

# The **GEO** Quarterly

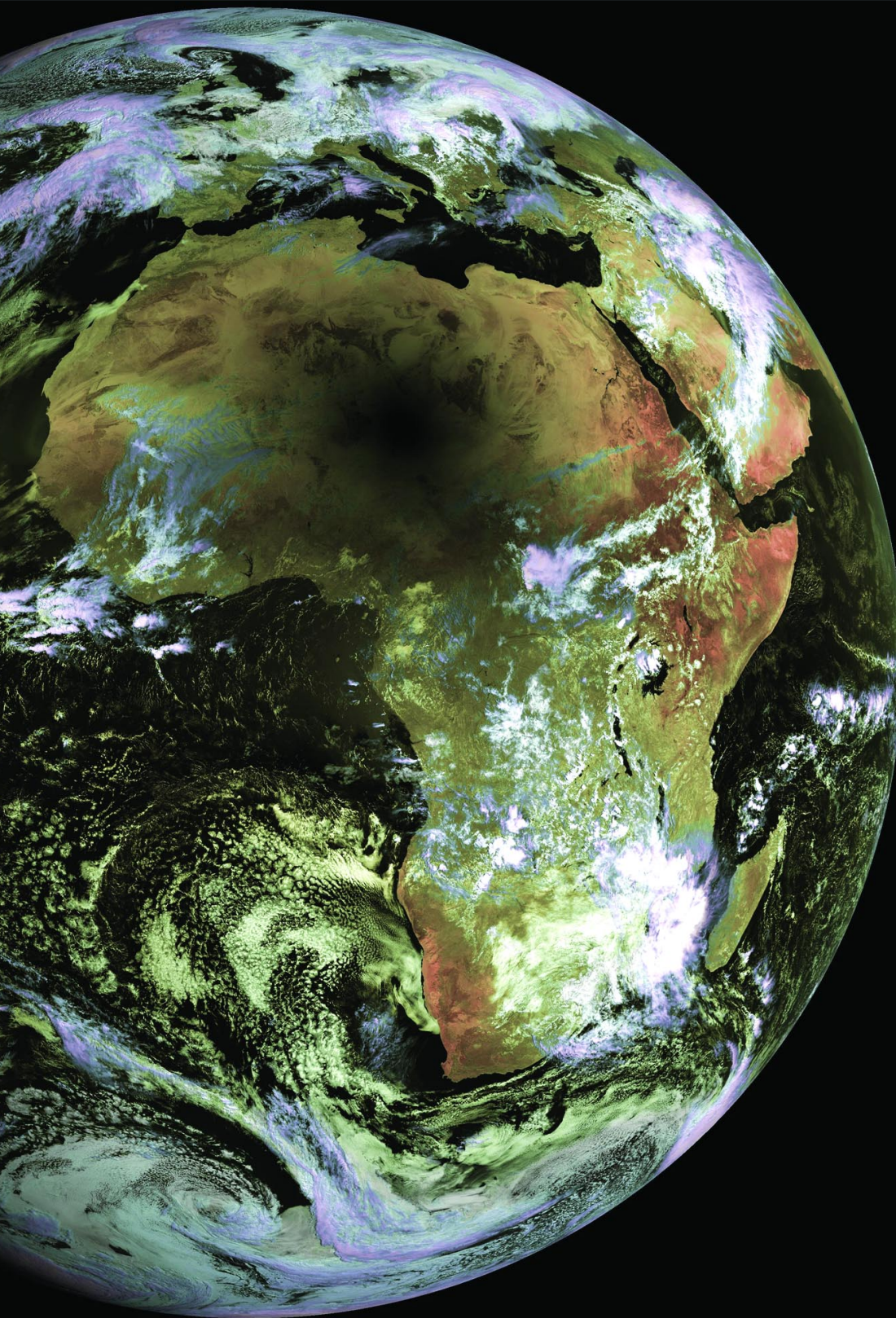
Group for Earth Observation



[www.geo-web.org.uk](http://www.geo-web.org.uk)

*The Independent Amateur Quarterly Publication for  
Earth Observation and Weather Satellite Enthusiasts*

*Number 10  
June 2006*



## *DVB-S Special Issue*

*David Lee describes the new EUMETCast AVHRR service which recently started to disseminate NOAA high resolution images to end users*

*We also explain how to register for this new service and describe the new software from David Taylor that you require to process the raw data*

*NOAAPORT is a similar DVB system available in the United States. We summarise a seminal article from José Nieves on setting up a NOAAPORT station. The full article can be downloaded from the GEO website.*

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*Constructing the PADAT 137 QFH antenna: Ruud Jansen leads readers through the final construction phase.*

*Rob Alblas explains how you can improve the resolution of colour MSG images using his software.*

*Reflections: Peter J Bradley explains how reflections in satellite images can be related to the terrain below*



Construct the PADAT 137 QFH Antenna  
See Ruud Jansen's article on page 12

## Keep up with the latest WXsat News every Month

Radio and Communications Monitoring Monthly provides a regular 4-page Weather Satellite column, "Satellites' View", by Lawrence Harris. In addition, there is an annual 'special' issue covering WXsats (illustrated) containing additional features and reviews, also written by Lawrence.


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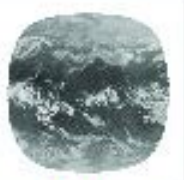
The May 2006 WXSAT Special edition


### GeoSatSignal - World View

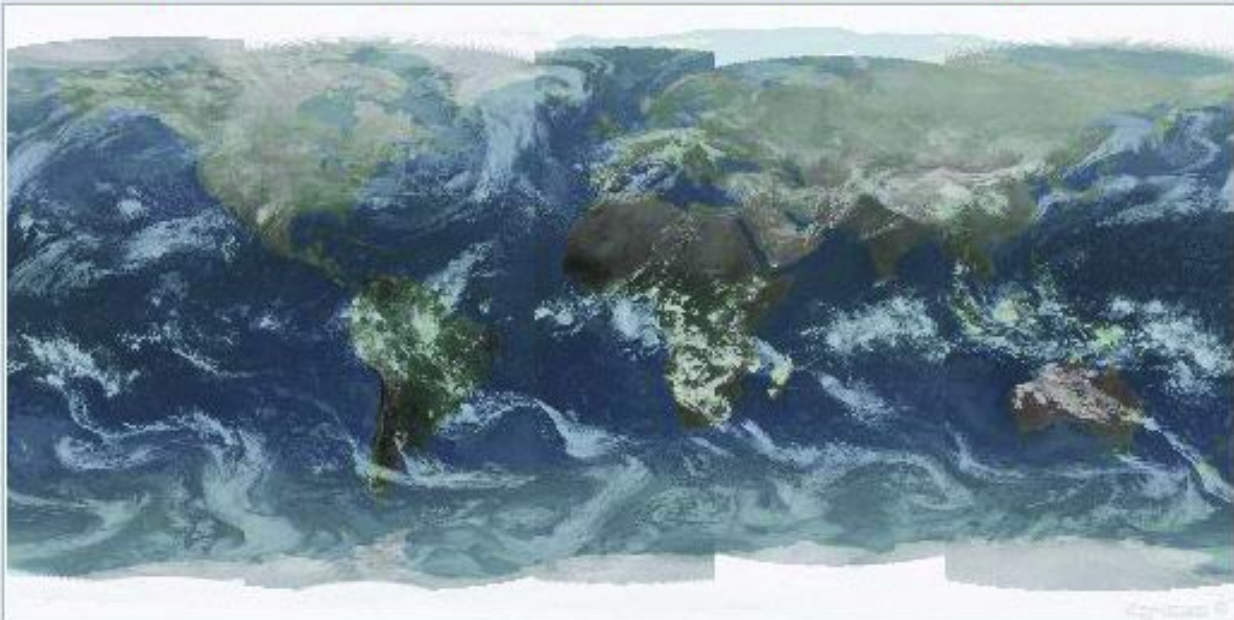
  
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Who could have foreseen the developments that have taken place in the field of weather satellite imaging since *GEO Quarterly* first appeared on the scene just two and a half years ago. Our first issue heralded *EUMETCast*, a hastily contrived stop-gap alternative to direct reception of HRIT and LRIT from the crippled MSG-1 satellite. Using DVB-S (Digital Video Broadcast by Satellite) relayed from the *Hot Bird-6* satellite, *EUMETCast* has become so successful that it is now accepted as the acknowledged standard for direct reception of MSG satellite images. The EARS-AVHRR service, albeit still on a trial basis, has already been added to the *EUMETCast* stream to provide NOAA HRPT imagery, and should gain operational status later in the year. This will be followed by a test period with AVHRR imagery from EUMETSAT's MetOp-A polar satellite which should become operational early in 2007. All this new material comes under the umbrella of 'essential data', and as such is free and unrestricted to users.

DVB-S is evolving across the Atlantic too. With the demise of DWEFAX, *NOAAPORT* has become the only means by which amateurs can now achieve direct access to images from the GOES geostationary satellites. Last November *NOAAPORT* switched to a DVB-S transmission format too; and like *EUMETCast*, *NOAAPORT* will soon be making NOAA HRPT available as well. Inside this issue, you will find a number of articles relating to both systems.

Finally, a stark reminder to all WEFAX and PDUS aficionados among the GEO readership: the direct dissemination service will definitely cease at 09:00 UT on June 14, 2006. There have been a number of extensions during the past year or so, but if you have not taken steps to set up a *EUMETCast* station for Meteosat-8 by that date, your screen is going to go blank. After quarter of a century of dedicated service, the lights go out on Meteosat First Generation as far as Europe is concerned.

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### Responsibility for Constructional Projects and Software

Every effort is made to ensure that the technical and constructional articles published in this Quarterly are correct. However, the ultimate responsibility is with the reader to ensure the safety of constructions and for any interfacing with other equipment. GEO cannot accept liability for shortcomings in any published design or any constructions carried out by members or other third parties.

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# The GEO Report

Francis Bell



I have just returned home from Leicester and I am trying to recover from a busy but rewarding weekend. The feedback I have already received about our Symposium has been positive and the day judged a great success. I must offer my thanks to all concerned: the delegates, about 60+, the speakers, GEO's management team and to our hosts at the NSC who are always helpful and supportive. I hope a full report with photographs will appear in our next GEO Quarterly.

All the speakers during the day were outstanding. We enjoyed speakers representing EUMETSAT, the UK Met Office, our software consultant, our astronomer member who also delivered a message from NOAA and our good friends from The Netherlands. They all made interesting and informative presentations.



Douglas Mansfield at Leicester

Photo: David Taylor

Sally Wannop's presentation relating to EUMETSAT contained up-to-date details of their satellite programmes, data dissemination policy and their interaction with other agencies, particularly NOAA.

A similar meeting for GEO's membership next year is under discussion: either the same venue with an adjustment of date to avoid the Bank Holiday weekend, or a meeting in Darmstadt if we can secure the invitation from EUMETSAT. Darmstadt may be attractive for our European members. Please let us know what you think!

## Management Team

I would like to turn to GEO's Management Team, who have looked after the affairs of our organisation for almost three years. They have done an outstanding job, producing a successful Group with a respected and talented membership numbering about 600, located in 30 countries. This has been achieved with a

management team who are voluntary and unpaid.

It is important that you read the notices on pages 6 and 10 which relate to the *Editor* of GEO's Quarterly publication and our *Membership Secretary*. You must read these notices and respond to them if you are willing. In short, GEO is looking for new blood to take on these roles. These positions have been filled for almost three years by two dedicated Management Team members who, quite understandably, wish to carry a reduced burden in the future. I think this is expected and understandable. The bonus is that it offers to others an opportunity to contribute to our distinguished amateur educational and non-commercial group. Please read the notices and consider whether you wish to offer your skills and time to GEO's future.

Just a reminder here may be appropriate. GEO has a corporate structure with a defined memorandum and articles of association. This document is available from me on request as a PDF file. Each year returns are made to Companies House, containing details of our accounts and directorships. This information is in place and is in the public domain. Remember there are no shareholders: the company belongs to its members!

## Dates for your Diary

GEO will be attending the German Hamtronic rally at Friedrichshafen on June 23-25, 2006. You can find details at

[www.messe-friedrichshafen.de](http://www.messe-friedrichshafen.de)

Also, GEO have been invited to attend AMSAT-UK's colloquium in Guildford this year on July 29-31, details at

[www.uk.amsat.org](http://www.uk.amsat.org)

The location at Guildford may be an opportunity for some of our members who could not attend our meeting at Leicester to come and exchange weather satellite experiences.

## Thanks

My final comment as usual is a sincere thanks to our supportive membership and the contributors to GEO Quarterly. If you have not contributed anything so far, do not be shy in coming forward. Experiences, equipment, location, images: we all wish to share these with each other.

# Symposium 2006

Preliminary Report

Peter Green

What a great day!

The sun shone on the 3rd annual GEO Symposium held at the National Space Centre in Leicester on April 28 when upwards of 70 delegates enjoyed a packed day.

Douglas Mansfield, a senior forecaster at the UK Met Office, explained how they use satellite images in conjunction with numerical models. Sally Wannop, the User Support Manager for EUMETSAT, described what we could expect from EUMETSAT in the way of upcoming launches and how these are going to provide more products that we and the wider user community can take advantage of. There are now 850 registered amateur users of their services.



The packed lecture theatre at the Symposium

Photo: Arne van Belle

An extended lunch break gave some time to visit the GEO Shop and demonstrations of hardware and software by our Dutch and Finnish friends, and to visit the newly installed MSG station in the Space Centre.

In the afternoon, David Taylor told us about the new data types coming from EUMETSAT and announced the launch of MSG Data Manager 2.5, software which would deal not only with MSG1 data but MSG2 data at the same time. David also announced GeoSatSignal-6 which has many enhancements and improvements and demonstrated AVHRR Manager. The quality and definition from this data type, displayed with HRPT Reader, is amazing.

We were then treated to an excellent presentation from Ferdinand Valk on hurricanes, followed by Arne van Belle who, with his usual enthusiasm and good humour, described how to set up a twin PC system to capture both MSG and MetOp data to maximum effect. He completed his presentation with some advice on keeping your computer clean and some novel approaches to keeping it running cool.

The final presentation came from Lawrence Harris who came to be interested in weather and weather satellites through his love of astronomy. Frustrated when going to his observatory at night only to find it too cloudy to observe, Lawrence discovered weather satellites, which showed him when he could expect clear views of the stars.

A more detailed, illustrated report on Symposium 2006 will appear in GEO Quarterly No 11, issued in September. Any reader who took interesting photographs on the day is welcome to send them to the editor for possible inclusion.

# AVHRR Imagery on EUMETCast

EUMETSAT are preparing to distribute regional AVHRR data via EUMETCast

David Lee

Many GEO members are already experienced in receiving the wonderful images produced by the AVHRR instrument of the NOAA series of satellites. The equipment for receiving the APT real-time transmission of the NOAA satellites is readily available and is relatively inexpensive. The informative and beautiful results that can be obtained illustrate many of the pages of GEO and attest to the great possibilities of studying the Earth and her weather from space.

### Local Real-Time Data on your Computer

Receiving APT transmissions allows you to instantly see exactly what a satellite is viewing when it is above the horizon at your particular receiving location. This means not only being able to see weather in your immediate surroundings, but also many hundreds of kilometres around, and gives the opportunity to view the approaching weather systems.

The same ability is used by professional weather agencies and national meteorological services in their provision of weather forecasts. However, these organisations are typically receiving another real-time transmission from the spacecraft, namely HRPT. As this is a digital transmission, it can be readily be utilised by computers. Reception of HRPT is more expensive in terms of hardware as it requires a tracking antenna system.

Reception of real-time APT and HRPT gives a wonderful ability to obtain images from around the receiving antenna site as the spacecraft is actually making its observations. However, these images are only available if the satellite is in direct line-of-sight with the antenna. Observations from further afield, made while the satellite is below the horizon, cannot be obtained. For this reason the data is stored onboard the spacecraft then dumped to a NOAA acquisition station once per orbit. From here the data is processed and archived so that it can be made available to users. While this gives access to all of the observations taken by the satellite over the whole globe, there is a penalty to be paid in that the data can be quite old by the time a user is able to retrieve it. This is a significant problem for agencies trying to produce large scale, timely and accurate weather forecasts.

### Regional Weather Forecasting

In the last few years this situation has, in part, been overcome for many European weather services due to the development of a system from EUMETSAT called EARS. EARS originally stood for EUMETSAT ATOVS Retransmission Service. ATOVS (which is itself

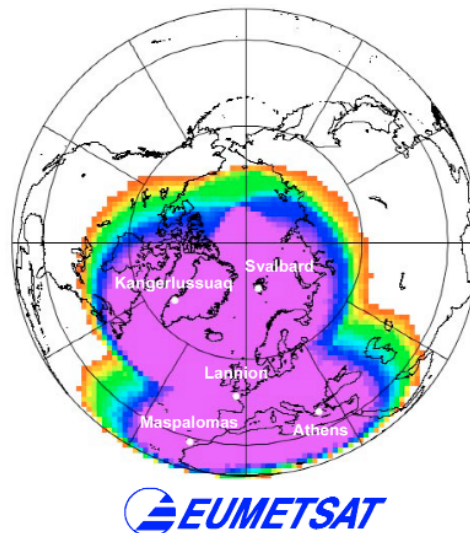


Figure 1 - Geographical coverage of EARS-AVHRR service from five HRPT stations. Coverage is indicated as a percentage of the total 'global' coverage of the AVHRR instrument.

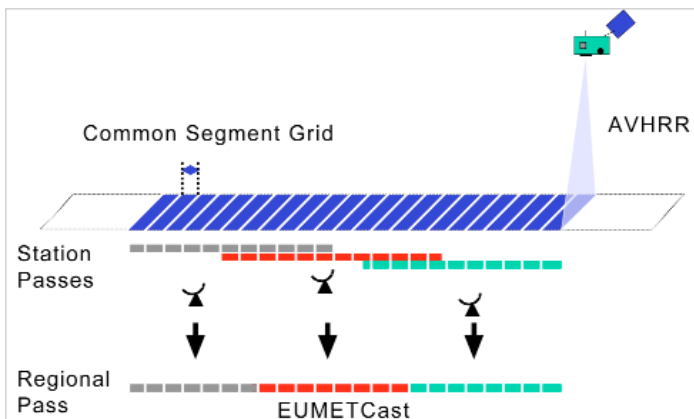


Figure 2 - Segments of data from stations with overlapping coverage are selected for dissemination to users as a regional pass.

another acronym for Advanced TIROS Operational Vertical Sounders) is the name for another set of instruments carried by the NOAA satellites.

Measurements from these instruments can be used to obtain information about the vertical profiles of temperature and humidity in the atmosphere. The radiation measurements from the ATOVS instruments can be assimilated directly into numerical atmospheric models using advanced computing techniques developed over the last decade. As the temperature and humidity measurements are obtained at many altitudes throughout the atmosphere, and at many points over the globe, they are incredibly useful for weather forecasting.

EARS offers a larger geographical coverage than can be obtained by a single HRPT receiving station. This is done by establishing a network of nine HRPT stations around the Atlantic and Arctic Oceans. These stations are listed in Table 1. This enables EUMETSAT to take advantage of the inherent real-time nature of HRPT reception and rapidly distribute the collected instrument data

HRPT station owner	HRPT station location
Danish Meteorological Institute (DMI)	Kangerlussuaq, Greenland
Hellenic National Meteorological Service (HNMS)	Athens, Greece
Kongsberg Satellite Services (KSAT)	Tromsø, Norway Svalbard to be added in the future
National Institute for Aerospace Technologies (INTA)	Maspalomas, Canary Islands, Spain
National Oceanic and Atmospheric Administration (NOAA)	Gilmore Creek, Alaska, USA Wallops, East Coast, USA Monterey, California, USA
Meteo France, Centre de Météorologie Spatiale (CMS)	Lannion, France (to be added in the future)
Meteorological Service of Canada (MSC), Canadian Meteorological Centre (CMC)	Bedford, East Canada Edmonton, West Canada

Table 1: HRPT stations contributing to EARS.

to end-users, typically within 30 minutes of the observation being taken by the spacecraft itself.

The data obtained during a satellite pass over each of the EARS reception stations is processed and distributed to users via the *EUMETCast* system familiar to GEO readers. In fact it was for the rapid dissemination of ATOVS data that *EUMETCast* was originally developed! It has subsequently been greatly expanded to carry a wide range of satellite imagery and other meteorological data and products.

The objective of the system is to provide data quickly. For this reason the products from each pass over a station (which has a maximum duration of about 15 minutes) are distributed rapidly through the system without combining them into longer stretches of data or into merged mosaics of a region. These types of products require data from longer time periods to be available and would therefore delay the delivery of data to users. The activity of collecting together the required set of measurement is left to the numerical forecasting model systems.

The ATOVS service has been operating since 2002 and has provided benefits to the meteorological community. Now EUMETSAT is working on extending the services provided by this system to include the more familiar AVHRR data, which is in fact the major component of the data making up the HRPT transmission from the spacecraft. The extended set of services is called the EUMETSAT Advanced Retransmission Service (EARS).

#### Regional AVHRR Imagery

Five stations that are providing data to EARS will contribute to the AVHRR service and provide a combined European and north Atlantic coverage (figure 1). To ensure the efficient and timely delivery, the received HRPT data is handled in small chunks, or segments, of one minute duration. This means that a more continuous flow of information can be passed through the communications network and *EUMETCast* dissemination system without significantly delaying it. The use of segments also allows the system to monitor the data provided from the various stations and select which is to be disseminated on the basis of quality. This avoids unnecessary duplication of data that may have been acquired for those regions where more than one station was able to see the spacecraft (figure 2). This use of segments is similar to the approach utilised in the dissemination of image data from Meteosat-8.

Users receiving the AVHRR segments will easily be able to combine them into

longer sequences of data by concatenating them together. The format of the data is such that it can be readily displayed and manipulated using existing and readily available software.

Receiving AVHRR data through *EUMETCast* will allow users to get access to this incredibly rich data with the inexpensive equipment required for *EUMETCast*. There is no need to purchase the significantly more expensive HRPT system hardware.

Further, as the AVHRR service expands, the geographical area from which data can be received will be significantly greater than can be received from a single station. Satellite data enthusiasts will be able to see lands and weather systems much further from home than before.

#### AVHRR on Metop too!

AVHRR has been flying on the US NOAA satellites for many years and is still a great work-horse for meteorological and Earth-resources studies.

Europe and the US are working together to ensure the continuation of the polar satellite system. Starting with MetOp-A, to be launched in July 2006, EUMETSAT will have the operational responsibility for the morning (local time) orbit with the MetOp satellites, while NOAA will cover the afternoon orbits. The European and American satellites will carry a set of identical AVHRR and ATOVS instruments.

The MetOp satellite will make HRPT transmissions using a new generation of digital technology, very different from the long-running NOAA satellites. This will mean that users wanting to receive HRPT data directly would need to purchase new hardware and software systems. The stations within the EARS network are currently being upgraded to receive these new MetOp transmissions and process the AVHRR and ATOVS data. These will be disseminated over *EUMETCast*. While the format of the AVHRR data sent out to users will be different for MetOp, this is only a matter of product format; this can be handled by software without the need for a complete new hardware installation.

All of this means that wonderful satellite imagery will soon be available to enthusiasts via a simple 'home' system that can produce many wonderful images of Earth from space.

*The author, David Lee (Moltek Consultants Limited), works at EUMETSAT for the EARS project.*

**Acknowledgements** to EUMETSAT, Anders Meier Sørensen and Christell Ponsard.



**Robert Denton G4YRZ**

### *Emergency Power for Radio Communications*

Don't be fooled by the title. This book does not just deal with radio communications; it can be applied to many subjects, weather satellites and home use included. Would you like to run your weather station for free? This book will show you how to make enough power to do so. You will not only be learning about the weather but about how to harness it to further your hobby as well as helping the environment.

I knew this book was going to be a riveting read right from the start because I burned my dinner reading the first few pages, it was so interesting. This is an easy to follow, no nonsense book which deals with all aspects of emergency power sources: solar, wind, water and gas. There is much information available on the subject of solar power in particular. What would you do in an emergency if you lost all power to your house? Have you thought about the consequences? No light, no heat, no water! Are you prepared for such an event? This book will prepare you for major power outages and explain how to deal not only with the power side of things but also surviving such an event. There are also several projects at the back of the book, one of which I have already started myself.

This book is very educational and explains how you can experiment and understand how things work, as well as allowing the satisfaction of free energy and the knowledge you built something yourself. A whole chapter has been allocated to covering safety issues. Subjects covered include charge controllers, inverters, batteries, power supplies, generators, torches etc.

I bought my copy of this book from the RSGB bookshop; it was the best value and most absorbing book I have ever bought and will pay for itself over and over again with the savings I will make on the solar power projects.

In my opinion this book is a life-saver. The only downside to it is that some issues relate to the 120-volt American supply—but it is easy to convert and apply to UK voltages. 12-volt supplies are also covered. As energy supplies to the world dwindle, what will you do to be prepared and survive?

*Emergency Power for Radio Communications* (ARRL), by Michael Bryce, is available in soft cover from

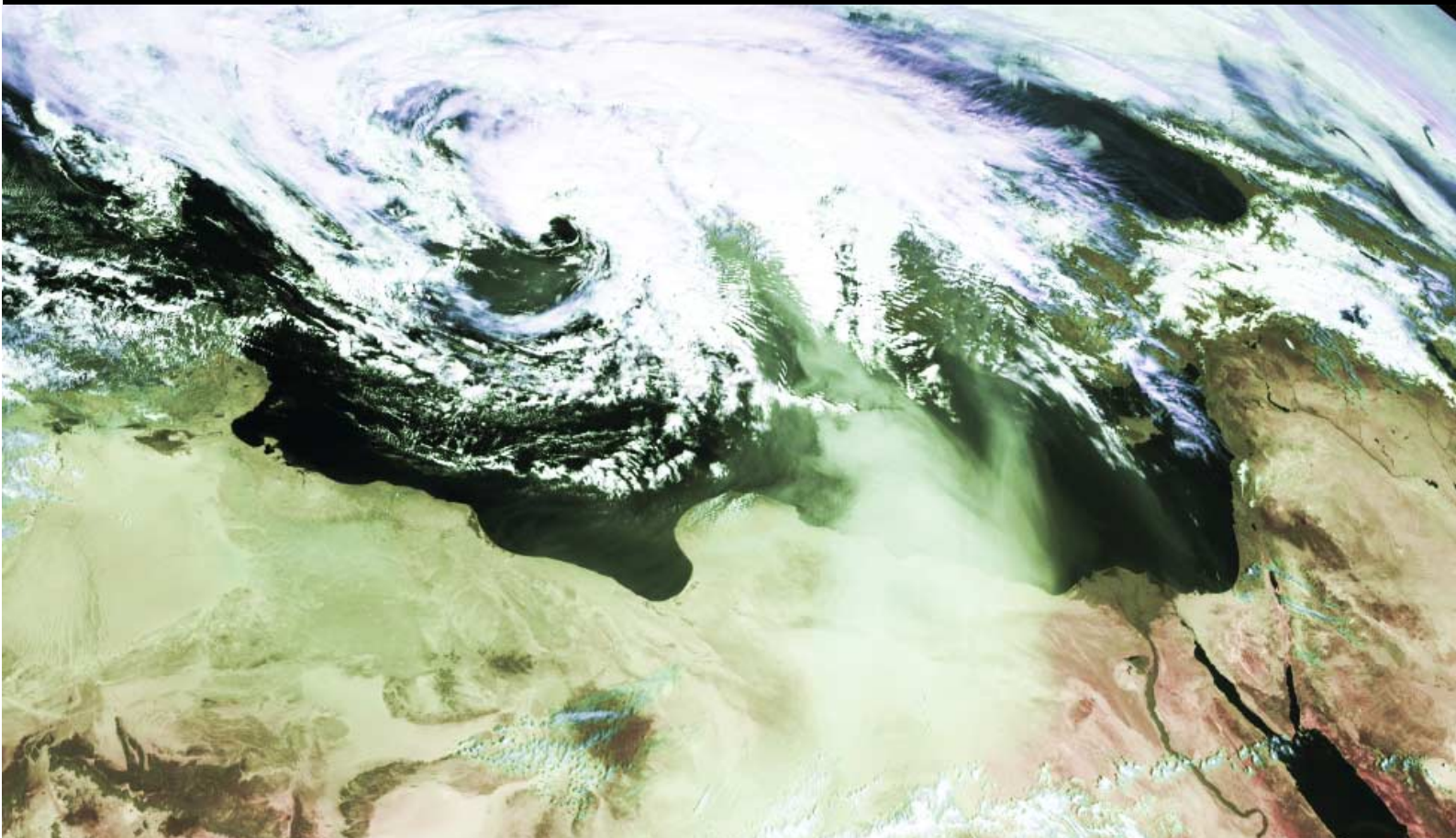
[www.rsgb.org.uk/shop](http://www.rsgb.org.uk/shop)

Members price £12.74 + p&p (non-members price £14.99 + p&p)



John Spacey spotted this spectacular sandstorm blowing out over the Gulf of Sidra on the north African coast towards Malta (above). The Meteosat-8 image was processed using David Taylor's *GeoSatSignal* software from an image captured on February 23. John also sent us an image acquired 24 hours later (below) which shows that the sandstorm had moved out of Libya and into Egypt while the winds had swung round, blowing the sand towards Turkey and Cyprus.

*Image © EUMETSAT 2006*



# QUARTERLY? QUESTION

Francis Bell

The last *Quarterly Question* related to the location of the hottest air mass in the world between May and July each year and its consequent effect on the monsoon seasons in Asia. There was a photograph of the area in question together with attached notes which I read on page 75 of the book '*Global Earth Observation System of Systems GEOSS a 10-Year Implementation Plan Reference Document*'. The question posed was: 'Where is this area?' The answer is the Tibetan Plateau.

Thanks to all readers who submitted answers. I selected Hann Redwin from London as the winner. From our e-mail exchanges I learned that Hann went to some trouble to secure the correct copy of the book referred to in the question. His first request to the publisher generated the abbreviated booklet rather than the full publication.

If this has happened to others, the full book is, I believe, still available from ESA Publication Division, ESTEC, PO Box 299, 2200 AG Noordwijk, The Netherlands. I suggest you write to the publishers and ask for a free copy but quote ISBN No 9290929863 to ensure you receive the full edition.

I chose the question because the answer surprised me. I thought the Indian monsoons were controlled by the heating of the central land mass of India but the book, which I'm sure is

correct, said it was controlled by the Tibetan Plateau.

## The Question

The Quarterly Question this time may have a less definitive answer; it is: '*How many complete country outlines can you see from weather satellites?*'

The area I am considering in this context includes Europe, north Africa and the Middle East. This represents the areas that can be imaged by satellite reception from Europe (from polar orbiting satellites and the 'European' images from Meteosat-8.

I have long been curious about countries and how they are established within their recognised boundaries. There seem to be the ephemeral elements of military strength and perhaps a local consensus, plus the more permanent natural geographical boundaries between different nations. I'm not even sure what constitutes a country: a permanent seat in the UN General Assembly? I'm just not sure.

With these thoughts in the back of my mind I often look at my satellite images of Europe and ask myself how many countries I can see, from the image, which have a definitive outline?

I came up with an answer of just two. Yes, I know Europe has about 20 to 30 countries. But can you see their outlines from space? For me the answer

in most cases was 'no'. You may say: 'What about Spain and Italy—they show up clearly enough'? I concluded this was not the case. I cannot see the boundary between Spain and Portugal nor those separating Italy from France, Switzerland and Austria. So how many countries with a definitive boundary can be seen from a weather satellite?

Recently I was looking back at some images from Earth observation satellites such as *SPOT* and *Landsat*. I did notice two images showing distinct political land boundaries. These did not cover the whole countries in question but it interested me that in some cases you can see land boundaries. One was between Israel and Egypt, bordering the Sinai peninsula. The other was along the 49<sup>th</sup> parallel between the USA and Canada. In both cases it was the differing agricultural practices which showed up. The traditional arable field sizes in the USA are different to those in Canada and this shows up clearly on a satellite image. On the Israeli side of the Sinai border there is agriculture whereas the Egyptian side is just left as desert—again these show up on satellite images.

I have said that my answer to the question is just two countries but I'm willing to be persuaded otherwise if anybody thinks differently. E-mail me, or contact me by post, with your answer, giving the names of the

countries you can identify. Interestingly, the software I am using for *EUMETCast* images provides an overlay of most country boundaries but only one of my two qualifying countries is included in the overlay. On an arbitrary basis I am excluding UK Crown Dependencies in an answer because I'm not sure whether they qualify as countries—in spite of some of them being recently represented in the Melbourne Commonwealth Games.

We will debate the winner in due course: but the usual prize of a complementary entry to GEO's next symposium is offered to the winner or their nominee.

**Here's another challenge**—not part of the Quarterly Question, but you may wish to try. Can you see, on *any* satellite image, the land boundary between Norway and Russia?

Yes! A land border does exist but you may have to look it up on a map. Any satellite image will qualify here. However, be warned that this border is so difficult to identify that, during the Cold War years when NATO and the Warsaw Pact were closely monitoring it, patrols would often stray on to each other's territory. I don't think there was ever a serious incident. An unintentional incursion was met by the other side politely escorting the offending patrol back to its own side of the border, thus avoiding World War Three.

## GEO requires new Feature Writers

GEO is on the lookout for members prepared to research topics with the aim of creating new articles for GEO Quarterly.

See page i of the centrefold for more details.

## GEO will be requiring a New Membership Secretary commencing early 2007

After 3 years in post, Nigel Evans plans to retire as GEO Membership Secretary at the end of this year.

Turn to page i of the centrefold for further information.



## Broaden your Horizons with the new



# EARS-AVHRR Service

Les Hamilton

Many GEO readers have been thoroughly enjoying the MSG imagery disseminated over the *EUMETCast* service during the past three years or so. It seems certain that last December's launch of MSG-2, coupled with the termination of the WEFAX and PDUS services on June 14, will encourage many more enthusiasts to register for *EUMETCast*. But did you realise that the EARS-AVHRR HRPT [1], which launched as a trial service last March, now allows you to access NOAA HRPT images via *EUMETCast* too?

EARS [2] has been designed to provide high resolution images from the AVHRR/3 [3] scanning radiometers aboard both the current American NOAA and the forthcoming European MetOp polar orbiting satellites via its *EUMETCast* service. The AVHRR is a six-channel device which detects energy in the visible and infrared regions of the electromagnetic spectrum and provides a maximum ground resolution of 1.1 km/pixel. These data have been available to readers possessing an HRPT reception system (and a reduced resolution subset is available as the familiar NOAA APT in the 137 MHz band).

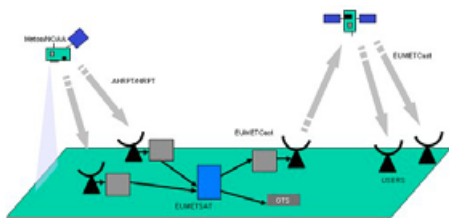


Figure 1 - EARS dissemination

NOAA themselves have the capability to record data from distant parts of the globe on board their satellites, dumping this once per orbit to their central ground stations, thus giving them global coverage. EARS will at last provide the amateur enthusiast with the opportunity to share in this global coverage via the EUMETSAT [4] network of HRPT stations ranged around the Atlantic and Arctic Oceans (figure 1).

The geographical coverage of EARS is primarily over data-sparse seas and oceans around Europe (figure 2). Hitherto, amateurs could only receive HRPT data transmitted from the NOAA satellites while they were actually flying above their ground stations and the images were necessarily restricted to a limited geographical area.

EARS provides NOAA HRPT data in two modes:

- By direct transmission from the satellite to one of EUMETSAT's HRPT ground stations. This provides the data at close to real-time but is limited to the region around the station. However, this mode does make use of multiple stations, i.e. those shown in figure 2. It is referred to as 'NRT' (near real-time), currently disseminates ATOVS data, and is being extended to include AVHRR data. In the short term, the Tromsø station will provide coverage while the one at Svalbard is finalised.
- by once-per-orbit data dumps sent to the central NOAA ground station. This provides global data coverage but with delays of up to 2 hours before it reaches the user. This mode will be used with MetOp—not NOAA-17 and NOAA-18. Current understanding is that NOAA-17 and NOAA-18 will only be utilised to provide the limited resolution GAC data for the full orbit.

EARS will be provided until at least the end of 2008. An extension of the service beyond this date requires approval from the EUMETSAT Council.

### Access and Registration

The great news for everyone is that this wealth of HRPT data comes absolutely **free**, although you must register with EUMETSAT to receive it. The EARS-AVHRR service is considered 'essential data' so does *not* require a licence. This also means that there are no restrictions on sharing data with other enthusiasts.

Anyone **already registered** for MSG HRIT etc., and therefore already a licensed user in possession of a *EUMETCast* Key Unit (EKU) and client software, need only send an email to [ops@eumetsat.int](mailto:ops@eumetsat.int) to request that their existing EKU be activated for the EARS-AVHRR service.

If you are **not registered** for any *EUMETCast* service, you must complete the new *EUMETCast* registration form (December 2005), indicating on it the service(s) you wish to receive. A copy of this form can be downloaded from the GEO website where you will also find a handy guide to filling it in. The address is:

<http://www.geo-web.org.uk/eumreg.html>

You will have to take the following steps:

- 1 Return your completed *EUMETCast* registration form to EUMETSAT.
- 2 EUMETSAT will contact you regarding the purchase of the *EUMETCast* client software and EKU, which is required, for all services, including the unlicensed EARS-AVHRR stream.
- 3 If you have requested access to one of the 'licensed' services such as MSG data, EUMETSAT will forward your registration form to the relevant Licensing Agent so that the licensing procedure can begin. This agent is the Met Office for UK users. If you request *only* the NOAA AVHRR data, a Met Office licence is not required.
- 4 Once any required licensing procedure is complete and you have paid for the *EUMETCast* client software and EKU, access to the services on *EUMETCast* will be granted. You will be sent a copy of the *EUMETCast* client software, an EKU and the username and password required for the installation process.
- 5 Above all, **read the explanatory notes** at the end of the *EUMETCast* registration form.

The current understanding is that only registrations for NOAA HRPT are possible. Once the MetOp AHRPT data service becomes available, probably in early 2007, you will have to register again, specifically for this data.

### Pass Scheduling

The actual HRPT data available will be based on a prioritisation scheme related to the status and performance of the operational polar orbiting satellites. This will be revised in response to events and also when a new satellite enters service. In particular, over the European region, the aim is to give first priority to reception from the primary morning satellite (currently NOAA-17) during the local morning and evening periods and to the primary afternoon satellite (currently NOAA-18) during the local afternoon and overnight.

**Following the start of Metop operations, MetOp-A will replace NOAA-17 as the primary morning satellite.**

The regional geographical coverage afforded by the service (figure 2) is based on EUMETSAT's Atlantic network of HRPT stations. The colour coding indicates the fraction of the actual AVHRR observations that the EARS network is capable of receiving under ideal conditions. Normally, only satellite passes lasting 7 minutes and more are included.

### The EARS-AVHRR Transmission Format

In much the same way as with *EUMETCast* MSG imagery, the EARS-AVHRR data will be transmitted in *segments*. These will be compressed files, each one representing one minute's worth of HRPT data. There will be occasions when the same 1-minute segment will be available from more than one station: for example, from the end of

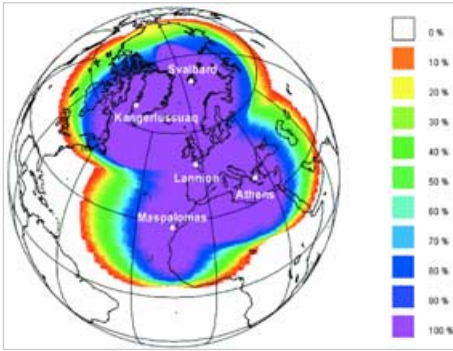


Figure 1 - EARS AVHRR coverage  
Image: EUMETSAT

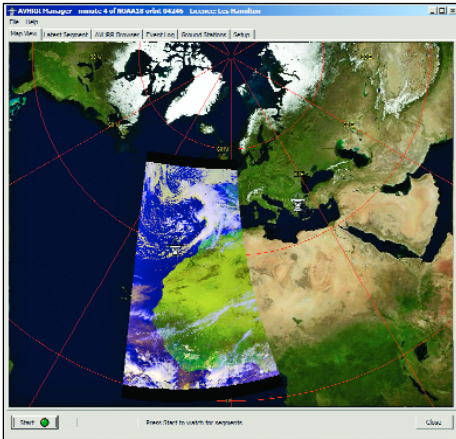


Figure 3 - AVHRR Reader



Figure 4 - NOAA-17 pass on March 14, 2006  
Image: EUMETCast EARS-AVHRR service

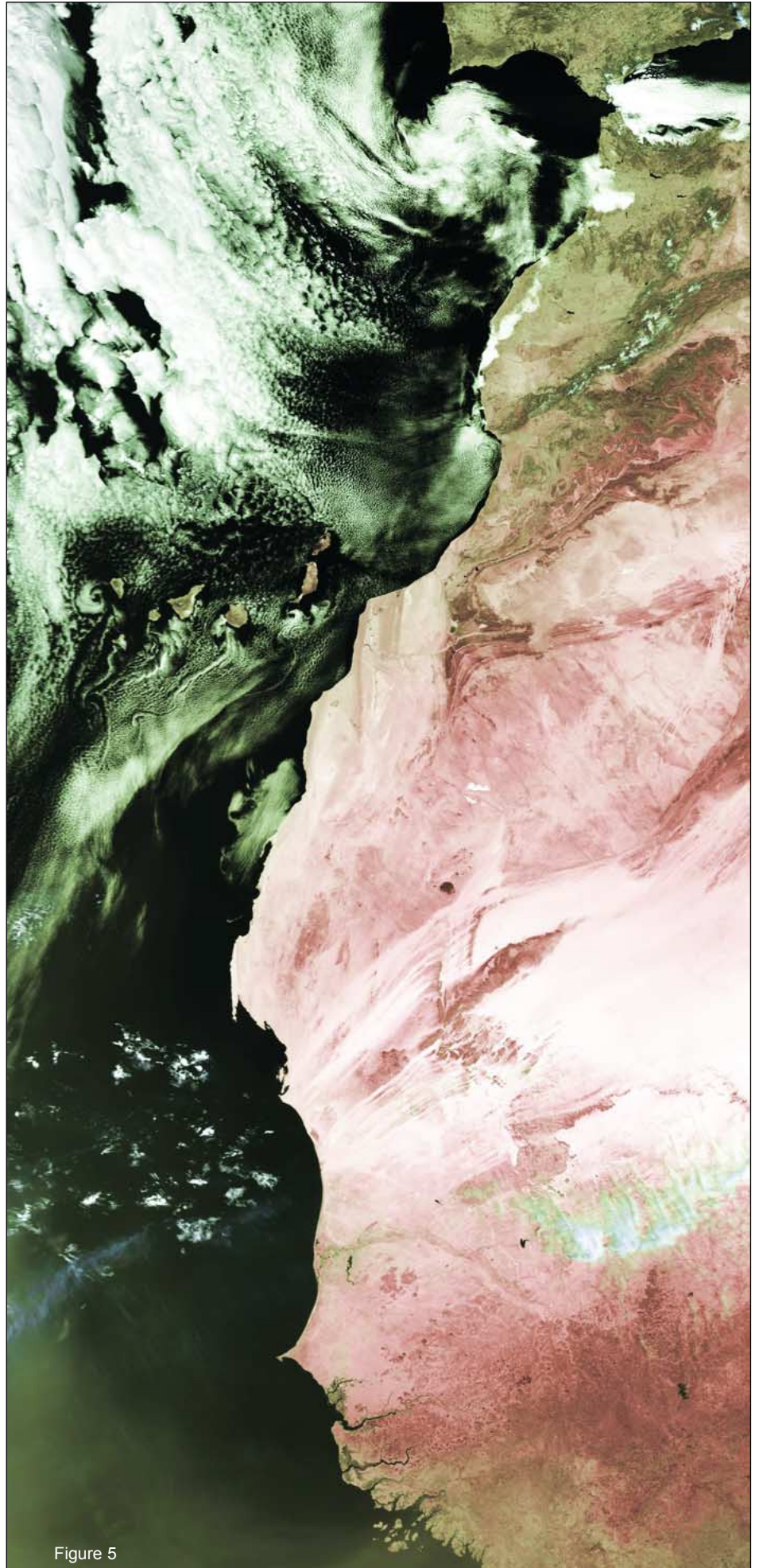


Figure 5

the Tromsø pass and from the beginning of the Maspalomas pass. In such cases the 1-minute segment with the best quality will be disseminated via EUMETCast.

When the first **MetOp** starts transmitting data later this year, the EARS network will again provide data in segments. As provided by the satellite, these will initially be of 3-minutes duration, starting from the commencement of each pass; but they will be converted into 1-minute segments aligned to minute boundaries before being sent to end-users via the *EUMETCast* uplink.

## The Decoding Software

# AVHRR Manager

Once you are a registered user and EARS-AVHRR data is streaming into your *EUMETCast* station you will require software to combine the segmented data into HRPT files and further, convert the raw data into images. A new program from *SatSignal Software*, **AVHRR Manager** does just this, then interfaces seamlessly with **HRPT Reader** to create the final images.

Both items may be downloaded from their dedicated pages on the SatSignal website at:

<http://www.satsignal.net>

by clicking its link in the 'Satellite Tools' section.

### Installing AVHRR Manager

To install *AVHRR Manager* on to your computer, create a new folder called AVHRR and extract the 'zip' archive into this. It is useful to create a short-cut to the file *AVHRRmanager.exe* by right-clicking on the file and dragging it to your *Desktop* or *Start* menu.

If, when you first run *AVHRR Manager*, you obtain a message about missing DLLs, you need to install the *Runtime Library Bundle*. This can be downloaded from a link on the *SatSignal* page of the website.

There is a choice of two background displays for the main screen: an outline map as reproduced on the inside front cover of GEO Quarterly No 8 or a NASA *Blue Marble* image (figure 3). You can select between these backgrounds on the program's 'Setup' tab.

You require the file *countries.dat* to produce the outline map background display. If this already exists in your *WXtrack* folder, AVHRR Manager will find it and make use of it. If need be, *countries.dat* can be downloaded from a link on the *HRPT Reader* page of the website and extracted into the *AVHRR Manager* folder.

### Installing HRPT Reader

HRPT Reader comes as a 'zip' archive. Create a new folder on your hard drive

called 'HRPT Reader' and unzip all the contents into this. It is also important to create a sub-folder called 'Keps' to hold files of current and historical NASA 2-line element data. Typically, a current 2-line data file will be called *noaa-12.txt*, *noaa-15.txt* and so on, and contains just the two lines of data elements. Consult the *HRPT Reader* documentation for fuller details.

### Getting Started

When you run AVHRR Manager for the first time you are presented with a window reminding you that you only have a 30-day evaluation period before registration is required. After a 4-second delay the 'OK' button is enabled allowing access to the program. To register the software you must click the 'Enter key' button and note the reported 'Hardware fingerprint' for your computer. You must include your hardware fingerprint in the 'Comments' section of your registration form.

### Program Setup

Before you can use AVHRR Manager you must first define various paths so that the program 'knows' how to access all the data it requires. Run AVHRR Manager and click the 'Setup' tab to reveal the 'File controls' input panel.

#### Kepler Path

Current Keplerian 2-line elements are needed to operate AVHRR Manager. If you already have a multisatellite 3-line element file such as *noaa.txt* or *weather.txt* inside your *WXtrack* folder, or a standard 'Keps' folder inside your *HRPT Reader* folder, AVHRR will find and make use of these when you click the 'Auto' button.

#### Tellicast Received Files Location

Use the 'Browse' button to navigate to the folder where *EUMETCast* raw data is downloaded on your computer, e.g.

**C:\Telligence\Received\**

#### Processed Combined Data Location

Use the 'Browse' button to navigate to the folder where the reassembled 1-minute segments are saved, e.g.

**C:\MSG-1\images\AVHRR\**

The program can delete data older than a certain number of days. If you wish to use this facility, set the '*Combined data retention period*' to a non-zero value.

As a single combined HRPT file can occupy in excess of 100 MB, you will soon have problems if you allow the data to accumulate for too long.

#### Saved Segment Files Location

Should you wish to retain the original HRPT 1-minute segments, use the 'Browse' button to navigate to a suitable folder you have created for this purpose.

#### File Options

Files are normally stored in dated folders to

make the data more manageable (just like MSG data). This feature can be disabled if desired.

The source data will normally be deleted after processing by the program. Unchecking '*Delete files from RX*' will prevent this from happening.

### Running AVHRR Manager

Once you have set up AVHRR Manager to your specification and ensured that your Kepler element files are up-to-date, you are ready to start. Click the 'Map view' tab to reveal the main screen (figure 3) and click the green LED-type button at lower left to start. The message 'Waiting for segments' should appear and the program will automatically read in and recombine HRPT segments as they are downloaded on to your machine by *EUMETCast*. Figure 3 shows a set of HRPT segments superimposed over the *Blue Marble* background map.

To view the image open the 'AVHRR Browser' tab (figure 6) where you can navigate through a menu of the day's downloads and select an image of your choice. If you checked the 'Save thumbnails' box during setup, a single click on a file will display this in the right-hand pane. A double-click on any thumbnail or its associated 'raw16' HRPT file opens HRPT Reader (which you must have installed to produce the HRPT images). A single click on the 'Open AVHRR' button has the same effect. The filename is automatically transferred to HRPT Reader; all you need to do now is select the 'Northbound' or 'Southbound' button to generate the image.

The creation of images using HRPT Reader was detailed in an article in GEO Quarterly No 5, page 18.

### Available AVHRR Images

The 'Ground Stations' tab compiles a list of passes from relevant satellites (currently NOAA-17 and NOAA-18) for the subsequent 24-hour period for each of the six EUMETSAT HRPT ground stations. This will help you to decide on your data requirements. Even during the current trial period with just the Maspalomas station (Canary Islands) active, saved data will amount to about 1GB per day.

On March 14, AVHRR imager telemetry from the 11:09 UT NOAA-17 pass was received at the Maspalomas station and sent on to EUMETSAT in Darmstadt to become the very first official HRPT data to be added to the *EUMETCast* stream (which can be received via the Hot Bird-6 satellite). Figure 4 shows the entire span of the pass at reduced resolution while figure 5 is a higher resolution section showing detail of Van Kármán vortices over the Canary Islands and river estuaries and the offshore archipelago of Dos Buagos in Guinea-Bissau. The HRPT pass was received by David Taylor in Edinburgh and processed using AVHRR Manager and HRPT Reader.

**PC Requirements**

This software is intended for use on a 500 MHz or better PC with at least 512 MB of memory. Windows 95, 98, 98 SE and ME are **not** supported; whilst the program *may* work on these platforms, correct operation is not guaranteed.

**Appendix -Keplerian Elements**

An alternative way of handling Keplerian element sets is to create a subfolder called 'Keps' anywhere you like—even directly on your 'C:' drive. Just save 2-line files for each individual satellite (noaa-*nn*.txt) into it.

But you will have to type the path leading to this folder into the 'Kepler path' field of *AVHRR Manager* **by hand**, and with an added trailing backslash thus: 'C:\'.

Notes

- A *noaa.txt* 3-line multi-element file stored in the *AVHRR Manager* folder is not recognised: *noaa.txt* and *weather.txt* multi-element files are only recognised when they reside in the *WXtrack* folder.
- A 'Keps' folder within *WXtrack* is not recognised under any circumstances.

**Acknowledgements**

Our thanks to are due to EUMETSAT and NOAA for making so much information available on their respective websites, and for allowing amateurs free access to AVHRR data from both NOAA and MetOp satellites.

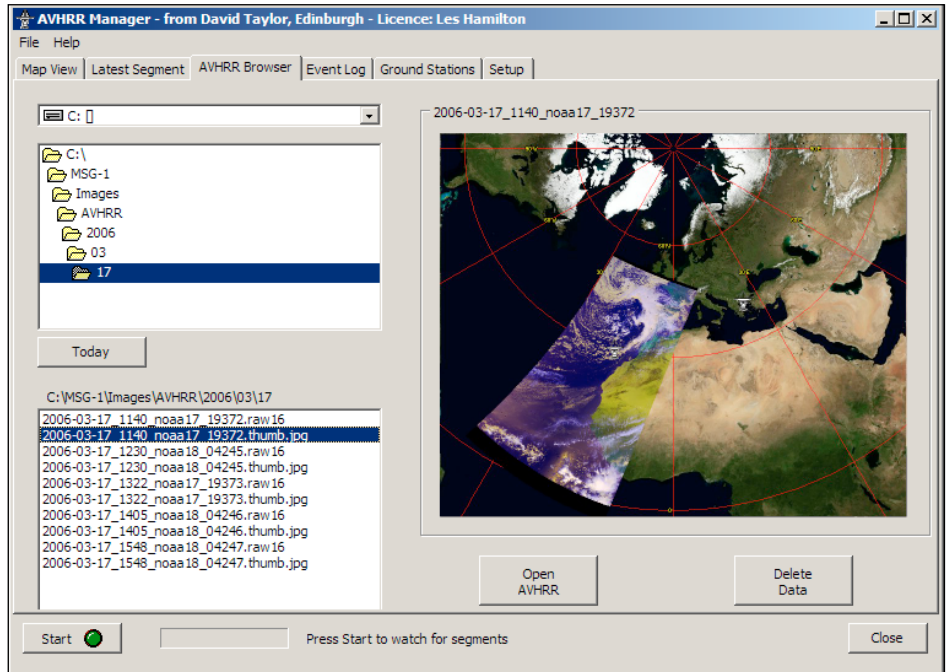


Figure 6 - The AVHRR Manager image browser tab

**Abbreviations**

1. High Resolution Picture Transmission
2. EUMETSAT Advanced Retransmission Service
3. Advanced Very High Resolution Radiometer
4. European Organisation for the Exploitation of Meteorological Satellites

**User Service Helpdesk**

For further information, please contact the EUMETSAT User Service Helpdesk:  
 EUMETSAT User Service  
 Am Kavalleriesand 31  
 D - 64295 Darmstadt, Germany  
 Telephone: +49 (0) 6151 807 366 / 377  
 E-mail: ops@eumetsat.int  
 Web Site: http://www.eumetsat.int

**GEO Auction**

for a

**Trimble Lassen SKII GPS receiver module**

GEO has been donated two *Trimble Lassen SKII GPS receiver modules*, complete with compact active micropatch *Magmount* antenna, five metres of cable and CDs containing the technical manual, to help raise funds. The first of these was raffled at our 2006 Symposium.



To allow the full membership of GEO to benefit from this opportunity we have decided to hold an auction for the second of these units. This is a great opportunity for an enthusiastic and knowledgeable home constructor to build their own time-standard or navigation system!

These modules are used a lot in car *SatNav* systems, and you can find more information on the Web at:

<http://www.trimble.com/lassensk2.shtml>

Should you wish to bid for this exciting product, please send your maximum bid to Peter Green by 18:00 GMT on Saturday, July 8, 2006.

Bids can be sent by e-mail to: [international@geo-web.org.uk](mailto:international@geo-web.org.uk) or by snail mail (details on page 1)

The highest bidder will then win the auction. Please do not bid unless you are serious as this will waste time and may prevent a member with a genuine interest from owning this unit.

The winning bid will include the cost of postage and **all** funds raised will go to GEO. This auction is open to all members of GEO regardless of country of residence.

**GEO requires a  
 New Editor  
 commencing early 2007**

Les Hamilton has combined the roles of Principal Feature Writer with both Editor and Make-up Editor since GEO first appeared. He now looks to take a well-earned break.

**Full details on page i of the centrefold.**

# Pushing the Limits

## ... of MSG reception through solid materials



Francis Ball

### Introduction

During frequent conversations I have with GEO members, questions are quite often raised which I cannot answer. However, one of the strengths of our membership is that it is highly likely that someone within the Group will have the answer, or at least sufficient experience to offer guidance or help.

Recently, a member telephoned me and said he was thinking of installing a satellite dish for Hot Bird-6 and EUMETCast reception *in his loft*. I was unsure about the viability of this plan but encouraged him to try if he had no other option. During the same conversation we also spoke about locating a dish inside a room but looking through a suitable sized window facing the correct direction. We left that conversation there.

I was a little uneasy about what I had said. I usually take an empirical approach in these matters because I do not have the necessary technical and theoretical skills to calculate RF signal path losses and gains with different sizes of dish: however, I know others have these skills. I was left with the empirical approach.

### EUMETCast Reception through Glass

I tried the window experiment first but immediately faced a problem because my house does not have a suitable window to conduct such an experiment. My main patio windows, which otherwise would have been ideal, face the wrong way and my south facing windows are too small and have leaded glazing. As an alternative, I set up a 45 × 35 cm receiving dish—one I often use for experiments—in the front garden. As usual, I connected it to my main receiving computer. The S-meter in the circuit read 98 units while the *TechniSat* software on the computer showed a good satellite signal strength of 50% and indicated that it was locked on to the satellite.

Now for the the experiment. I introduced a large pane of clear 2 mm glass (a spare pane for my greenhouse) in front of the dish to simulate reception through a window. The S-meter dropped to 46 units while the computer now gave a reading of just 10%: in the red and no lock!

I did not experiment further but it seems to me there are a number of variables that could contribute to this effect:

- the distance of the glass from the dish
- the thickness of the glass (what about double glazing?)
- the chemical composition of the glass. (Is plastic more transparent to RF than glass? Try glazing one of your windows with polycarbonate and evaluate the difference!)
- the angle of incidence of the incoming signal to the glass
- the size of the receiving dish
- perhaps other variables ...

I was not discouraged by my results because the introduction of the glass did not reduce the signal strength to zero, thus leaving scope for a different sized dish with a different orientation resulting in possible success.

I know reception through a window can be achieved at 1.7 GHz. A meteorologist friend of mine at Cambridge University had a room in one of the central college buildings. Now the beautiful and architectural nature of the colleges, not to mention their tourist attraction, do not lend themselves to having satellite

dishes bolted to their ancient external stone walls—this is more the province of a research facility or a radio telescope outstation. But my friend did have a room with a suitable window, so he arranged for his 1-metre dish to be located in his office 'looking' out of his window. His setup successfully received Meteosat WEFAX transmissions and the last time I visited him all seemed to be working well.

What happens if you move up from 1.7 GHz to 11 GHz ? I don't know.

### Loft Experiments

I did try the loft experiment as well. The upper limits on the size of dish I could use were defined by the hatch opening into the loft. Trying to increase the size of the hatch might have led to a domestic dispute, so this was avoided. I settled for using the same dish as for the window experiment and checked readings with the dish in the clear: the S-meter and computer readings were the same as before. I then moved the dish into my loft and adjusted its azimuth and elevation for Hot Bird-6. This time my S-meter reading was zero and the computer reading was consistently out of lock. No adjustments to the dish orientation could improve these poor readings. Again there must be variables to consider here.

- the type of roof tiles (Mine were 270 × 170 × 12 mm. As they were laid, I expect there were two tile thicknesses covering the roof making them effectively 24mm thick.)
- the distance of roof surface to the dish
- the wooden joists within the roof space
- roof tiles wet or dry
- other possible variables ...

If anybody asked me for an opinion I would say: 'experiment with reception behind glass but a loft-located dish may prove to be a challenge'. I know many people do receive 137 MHz APT using an aerial located in their loft. I have done this myself but with Hot Bird-6 we are dealing with 11 GHz.

*These issues are significant because, for many reasons, not all our members can locate external dishes on their homes. Positioning a dish behind a window or in a loft may be a viable alternative. It would be great to share your experiences, whether successful or otherwise.*

### The Invitation

Please, will any reader who has experience of Ku band reception behind glass or in a loft please write a few paragraphs for *GEO Quarterly* and if possible attach a photograph. Some members may wish to understand the theory behind the signal loss and submissions on this aspect of the problem are also welcome. Are the losses due to reflection, refraction or signal absorption?

Please somebody explain. Experiences of 137 MHz APT reception inside a loft would also be interesting.

Submissions to the editor please.

# Developing the PADAT 137

## A new, rugged, aluminium strip RQH Antenna Part 2 - Construction

Ruud Jansen

Last issue I explained the design process that led to the development of the PADAT137 RQHA. Now it's time to describe how you can actually build such an antenna yourself.

### The Headpiece

The most difficult part of this antenna is the headpiece, which should be constructed from polyoxymethylene (POM), a plastic with excellent HF properties. POM is water resistant, wear-resistant, very strong and easy to machine. It is supplied under the brand name *Delrin*.

Starting with a 55 mm length of 70 mm diameter solid POM rod, use a lathe to cut a 32 mm diameter hole the full length of its axis. This will accommodate the vertical length of PVC piping which functions as both mast and loop support. At the top, expand the hole to 42 mm diameter for a depth of 23 mm (figure 1).



Figure 1 - The headpiece mounting block

Next, drill the four 12 mm horizontal holes needed to accommodate the aluminium rods of the antenna elements. This is **very** precise work because these rods **must** be mounted perfectly horizontally. A deviation of only a few millimetres at the end of a length of rod results in a change of a few centimetres in the diameter of the antenna—and hence the impedance, as well as the phase shift between the two loops and the radiation pattern.

Another four holes (5 mm) must be drilled from the top to allow fixing of the lengths of rod with M5 bolts, along with eight 2.4 mm holes which should be tapped with M3 thread and used to secure the lid (figure 2 - opposite page).

The lid itself is just a simple disc of POM or *Lexane*, anything from 3 to 8 mm thick: and of course this lid must also be drilled with eight 3 mm holes to secure it to the headpiece.

### The Rod Components

For the upper cross-members, cut two 127 mm and two 132 mm lengths from 12 mm aluminium rod using a hacksaw. Drill a 4 mm hole with a depth of 25 mm or a little longer into one end of each. You will also need to drill a second 4 mm hole through each rod, 15 mm from the opposite end. Finally, a 2.4 mm hole must be drilled, at right angles to this 4 mm hole, just 4 mm from the end of the rod (figure 3). The eight 4 mm holes must be tapped for M5 thread and the four 2.4 mm holes for M3 thread as shown in figure 4.



Figure 3

For the lower cross-members, cut one 278 mm and one 288 mm length of the same aluminium rod and drill a 4 mm diameter hole, 25 mm deep, into both ends of each. A 3.2 mm hole then has to be drilled at right angles through the mid-point of each piece of rod. Tap M5 thread into the 5 mm holes and M4 thread into the 3.2 mm holes (figure 5).

### The Mast

The mast consists of a length of 32 mm outside diameter PVC pipe. You have to bore two 12 mm holes where the two lower aluminium rods must be pushed through the mast and secured. To make

this assembly sturdier, two PVC sockets can be mounted over the pipe at these points (the ridge which occurs halfway down the inside of each socket can be removed with a file or rasp).

The vertical distance between the centres of these two holes amounts to 40 mm and they must be drilled at 90 degrees to each other. The respective distances between the centres of the upper and lower of these two rods and the centres of the corresponding rods immediately above on the headpiece are 845 mm and 885 mm (figure 7, opposite page).

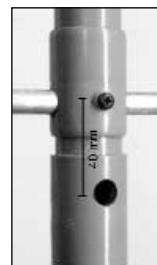


Figure 6

Finally, bore two 4 mm holes through both the PVC sockets and the mast in order to secure the two lower rods using 4 mm bolts (figure 6)

### The Vertical Aluminium Strips

Now it's time to deal with the aluminium strips. Cut four strips, two 900 mm long and two 940 mm in length then drill a 5 mm hole 10 mm from both ends of each. Now you have to create a 90° twist in each strip in order that it can be fitted correctly to the cross-pieces. Here's how I do it.

Start by clamping 30 mm at one end of a strip in a vice or fixed clamp. Next, clamp 30 mm at the opposite end of the strip between two pieces of hardwood, and secure them with a clamp (figure 8). Now turn this end about 120° in a **clockwise**

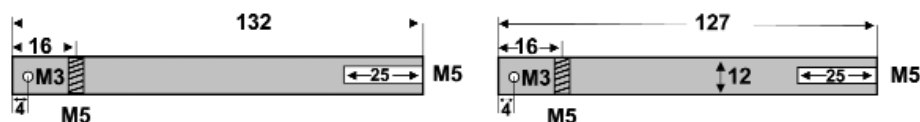


Figure 4 - The RQHA upper element rods

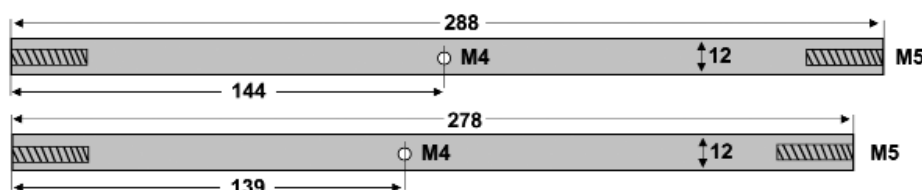


Figure 5 - The RQHA lower element rods

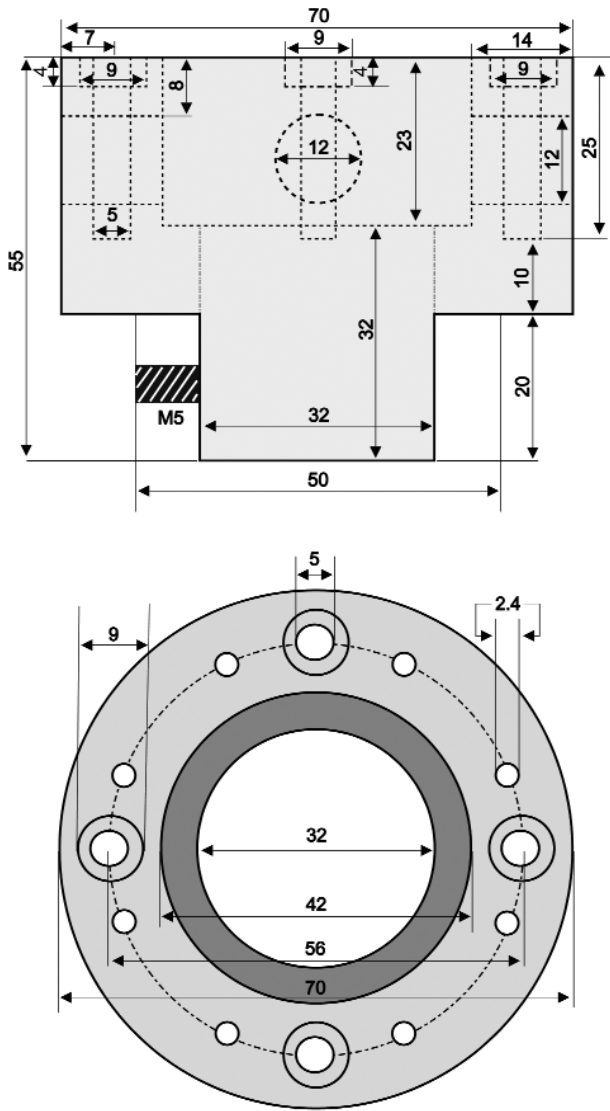


Figure 2 - Plan and elevation views of the upper block



Figure 8 - Twisting the aluminium strips

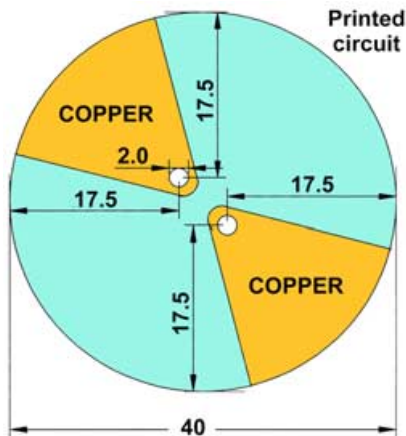


Figure 9 - The masthead PCB

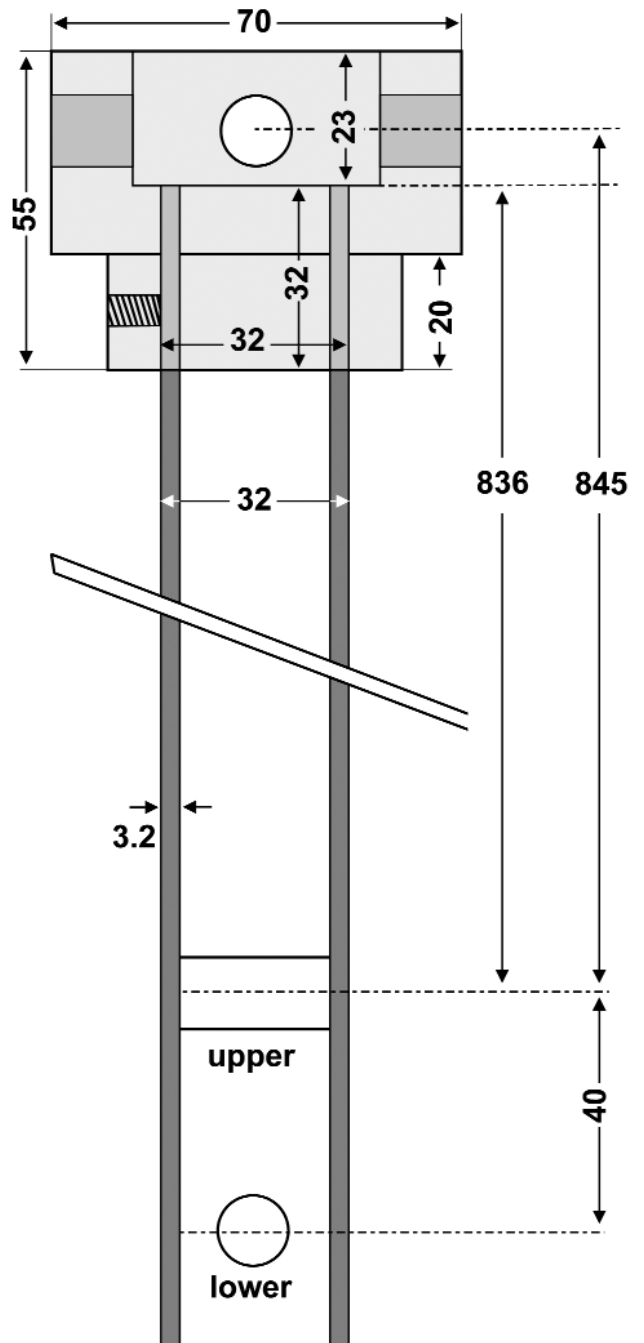


Figure 7 - Mast dimensions

direction, in a single movement. When you release it, the strip will return to about 90°.

If necessary, repeat this turning process a few times: do so as smoothly as possible to avoid tearing the aluminium. Repeat for the other three strips.

**The Printed Circuit Board**

When the the time comes to connect up the aluminium rods in the headpiece, this will be done using a small piece of printed-circuit board. To prepare this, take a piece of single-sided printed-circuit board and saw or file it to a circular disk; then etch or scrape away part of the copper in such a way that two

insulated copper segments remain (figure 9). Later, the upper rod components will be mounted on to these segments with solder lugs.

**Constructing the Balun**

Start with approximately 520 mm of 50 Ω RG58 co-axial cable and 150 mm of RG59 75 Ω co-ax. At one end of each, make a short slit in each side of the co-ax so that the outer insulation layer and braid can be folded back—but do not cut them off!

Solder the two inner conductors together in such a way that there is a minimum of space between the inner insulation layers of the two cables. Cut a short length of inner

insulation from a spare piece of co-ax, split it in half lengthwise, and mount it over the soldered inner conductor. Finally, fold both outer braids back so

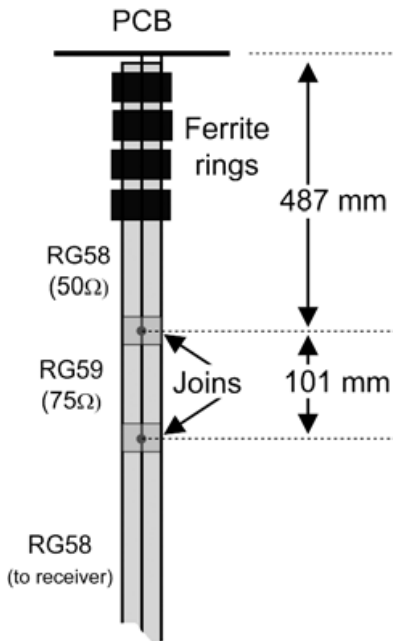


Figure 10 - Balun construction (not to scale)

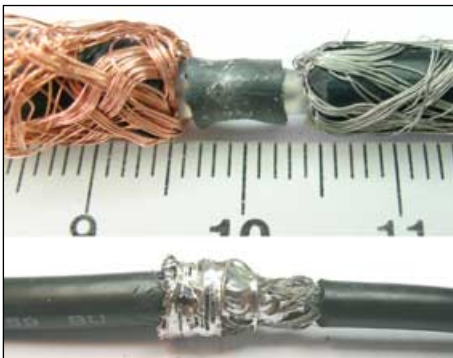


Figure 11 - Making the join

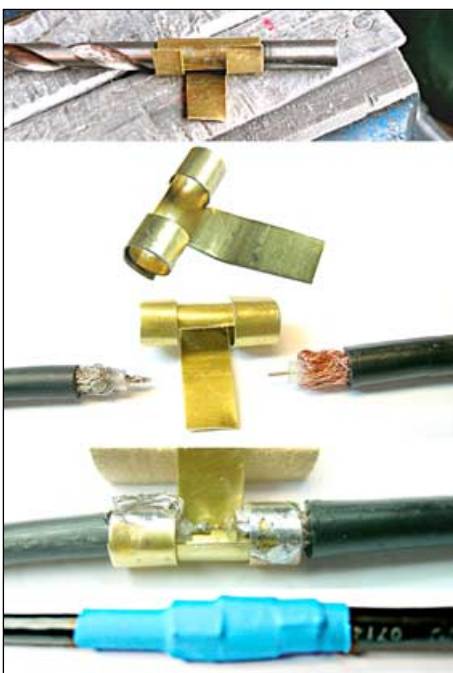


Figure 12 - The join: step by step

that they cover the join and solder them together. Finish these connections neatly with some shrink tubing. Trim both lengths of co-ax to their correct lengths then join the other end of the 75 Ω RG59 cable to the RG58 receiver downlead in a similar fashion. The correct dimensions for the lengths of co-ax are shown in figure 10 (though not to scale) and you can see photographs of the joining process in figure 11.

Another possibility for joining the lengths of co-ax cable is by making a special tool from a small piece of 0.3 mm thick brass or tin sheeting measuring about 25 × 20 mm (figure 12). Cut this piece half-way through in two places, 7 mm from each end then bend it around a 5 mm drill and fold the middle lip back. Now cut the co-ax as shown in the photos, push through both ends of the tube, and solder the braid of the cables to the tube. Use a hot soldering iron with a large tip to ensure that the shield is soldered to the tube quickly and make sure that the inner insulation does not melt away. Both inner conductors can now be soldered together and the protruding lip can be folded over to make a neat cylinder which may be finished with some shrink-tubing (figure 12).

If you find this approach too much trouble, it is of course also possible to use 50 Ω and 75 Ω *Teflon* co-axial cable. Take care however, because the velocity factor for *Teflon* co-ax is 0.695 rather than the 0.66 for RG58 and RG59. The length of the two upper co-ax pieces may be calculated with the *PASAN* software by entering this value in the 'Transmission line' field; both pieces will be slightly longer (512 mm and 105 mm). The use of *Teflon* cable prevents the inner insulation from melting away as a result of the extensive soldering activities.

Now slide the ferrite rings or tubular cores over the 487 mm length of RG58 (use *Type 43* cores with a narrow inner diameter to fit as tightly as possible over the co-ax cable). Should the inner



Figure 13 - Adding the ferrite rings



Figure 14 - Soldering to the PCB

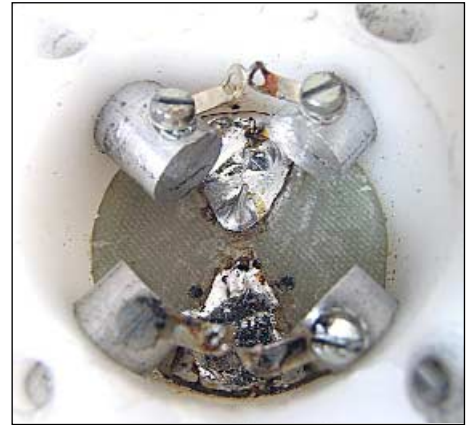


Figure 15 - The solder tags

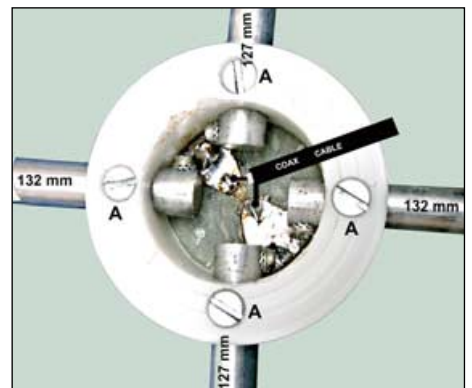


Figure 16 - Connections in the headpiece

diameter of these cores be just a little too tight, there is no problem in removing the outer insulation over the required length since ferrite cores are not themselves conductive (figure 13).

Finally, slide a piece of shrink tubing over the ferrite cores and crimp with a hot air source (hair dryer) to ensure that a rigid assembly is obtained. Complete the job by soldering the PCB to the balun (figure 14).

**Assembly**

Slide the assembled co-ax cable and PCB through the POM headpiece until the PCB stops on the ridge. Slide the four upper aluminium rod cross-pieces sideways into position as shown in figure 15. Take care: the two long pieces should be positioned opposite each other, as should the short ones. Screw solder lugs to the M3 holes at the end of each rod using a spring washer then bend the lugs in such a way that, when they are twisted by a quarter turn, their ends rest flat on the PCB. Secure the four rods from above by tightly screwing the four M5 bolts (labelled 'A') through the headpiece and into the threaded holes in each rod: then solder the four lugs to the PCB (figure 16).

*Note:* the short length of co-ax drawn in this figure serves only to illustrate how the balun co-ax, which runs down the mast, is attached to the PCB.

For the time being, slide the end of the



co-ax cable through the PVC mast and fit the headpiece on to it till it just touches the PCB.

Slide the longer rod through the lower 40 mm hole in the mast and the shorter length through upper one, taking care not to damage the co-ax cable running through the PVC tube. Now twist the headpiece so that the longer rods (132 mm) are perpendicularly above the short (278 mm) lower rod. The distance between the centres of these rods is now 845 mm. The perpendicular distance between the two short upper rods (127 mm) and the long lower rod (288 mm) is now 885 mm.

### Securing the Headpiece

You will need to drill two final holes near the top of the PVC mast in order to secure it to the headpiece. Screw the two M5 bolts near the base of the headpiece against the mast and then unscrew them again. This should leave a slight indentation in the mast. Now remove the headpiece and drill a hole through the mast, a little smaller than 5 mm, exactly where each M5 bolt left its impression. Take care not to drill into the co-ax cable or balun. Replace the head on the mast and screw in the M5 bolts so that approximately 5 mm protrudes through the hole in the mast. Bolts with a thread length of around 15 mm are quite suitable for this purpose. The head is now secure on the tube and cannot move.

### Mounting the Aluminium Strips

Mount the four aluminium strips using M5 bolts and washers. Bolt each short (900 mm) strip between one of the short (127 mm) upper rods and one end of the lower short (278 mm) rod, making a quarter turn anti-clockwise around the mast (see top-down view in figure 17). Each long (940 mm) strip should be connected similarly between one of the long (132 mm) upper rods and the long (288 mm) lower rod. All four strips will bow a little when tightened, and assuming that all measurements are correct, they will form an imaginary cylinder (figure 17). The cylindrical shape of both large and small loops may be checked by means of a ruler or a home-



Figure 17 - Mounting the aluminium strips

### Materials List

- 2 aluminium strips, 15 mm wide, 900 mm long and 3 mm thick. Hard or semi-hard
- 2 aluminium strips, 15 mm wide, 940 mm long and 3 mm thick. Hard or semi-hard
- 2 x 127 mm lengths of 12 mm aluminium rod
- 2 x 132 mm lengths of 12 mm aluminium rod
- 1 x 278 mm length of 12 mm aluminium rod
- 1 x 288 mm length of 12 mm aluminium rod
- 1 piece P.O.M. (Polyoxymethylene) 70 mm diameter and 55 mm long
- 1 piece P.O.M. or Lexane (Polycarbonate) 70 mm round and 3 to 8 mm thick (lid)

### Match construction

- 1 length of RG58 co-axial cable (520 mm)
- 1 length of RG59 co-axial cable (150 mm)
- 1 length of RG58 co-axial cable - length dependent on distance between antenna and receiver.

### Balun construction

- 25 pieces, Amidon FB-43-2401 (FP-43-2401, [www.amidon.de](http://www.amidon.de)) or
- 12 pieces, Amidon FB-43-6301 (FP-43-6301, [www.amidon.de](http://www.amidon.de)) or
- 15 pieces, Richcom RT11-050-090 ([www.conrad.nl](http://www.conrad.nl)) or
- 17 pieces, Richcom RT09-050-080 ([www.conrad.nl](http://www.conrad.nl))

*Display Electronics also stocks suitable Ferrite rings and tube cores; however I have not tested these.*

- Shrink tubing to put over the soldered connection and the soldered assembly of the shield and ferrite ring cores.

### Connecting the rods to the co-ax

- 1 piece single-sided printed circuit board, 40 mm diameter
- 4 solder lugs, 3 mm hole.
- 4 bolts, M3 cylinder head, 12 mm
- 4 washers with 3 mm hole
- 4 spring washers with 3 mm hole

### Securing the four upper rod pieces

- 4 bolts, M5 cylinder head, 20 mm
- 4 washers, 5 mm hole
- 8 spring washers, 5 mm hole

### Mounting strips on the rod pieces

- 8 bolts, M5 25 mm long
- 8 washers, M5
- 8 spring washers, M5 (above and below)

### Fixing loops and lower rods to mast

- 1 piece plastic pipe, 32 mm outer diameter (PVC), about 2 meter length (for mast)
- 2 sockets for 32 mm (PVC) pipe (refer foto).
- 2 bolts, M5 (thread length 15 mm) with washers, to secure upper piece to mast (refer photos).
- 2 bolts, M4 with washers (thread length around 25 mm) to secure the two lower rod pieces.
- 8 bolts, M3 (stainless steel or Nylon) with washers to secure lid.

### Please note

All bolts, washers etc. are stainless steel material. Galvanised bolts and washers would result in less galvanic corrosion, as compared to aluminium; however the ss - aluminium combination, covered with e.g. Tectyl is a usable alternative.

If required, a corrosion protecting agent, e.g. Tectyl.

<http://tectyl.valvolineurope.com/nl/>

Address details for suitable suppliers of the above mentioned materials may be obtained from the author.

made template, by measuring the distance between the mast and strips along the full length of the mast. If everything works well, use eight bolts to fasten the lid to the head. To make the assembly waterproof, a suitable rubber seal, obtainable from your local hardware store, may be added. You could also use a ring fashioned from a bicycle inner tube. Also, the use of a (thin) coating of a suitable sealing compound (**not** silicone) will keep moisture out. To protect the anchor points of the strips against corrosion, they may be treated with a suitable preserving compound such as Tectyl.

### Author's Footnote

Standard POM tubes with 30 mm inner diameter and 70 mm outer diameter are available at many hobby shops and shops specialising in plastics; you can also find suppliers on the Internet. Mostly they will sell this material in any desired length. I buy this material in 1000 mm lengths. If you have trouble finding a source, I can send you a 70 x 55 mm piece of POM. It is not expensive. Indeed, I can provide all the needed raw materials and send them anywhere

in the world for just the basic cost of the materials, postage and administration.

### Postscript

I have happily spent a lot of my time on this project and have tried to present a total picture, starting from conception to the point of publishing complete construction details. I would like to thank everyone who has assisted me in making this project a reality, in particular my wife Adri. During the multitude of 'garden' measurements, the required testing equipment was often parked in the living room waiting for a dry spell of weather. I would also like to thank her for the use of her sewing room, which I used to make dozens of drawings and photos of the various components—as well as bringing me snacks and drinks in the attic when there was no time to go downstairs.

Also thanks to **Chris van Lint** for the translation of this article. Without his knowledge of RQHAs, translation of my article would have been very difficult.

When planning construction of this antenna, do make sure that you read this article thoroughly first, and use the correct tools! If any errors have found their way into this article, please e-mail me at

[ruud@farbridges.net](mailto:ruud@farbridges.net)

so that I can quickly amend the article.

# GeoSatSignal 5



## Part 2 - Advanced Options

Douglas Deans - dsdeans@tiscali.co.uk

Readers who digested Part 1 of this article will now appreciate that *GeoSatSignal 5 (GSS5)* is a very comprehensive piece of software with just about every conceivable post image-processing option you could think up—and probably a few you had not. I am now going to look at a number of the more advanced features which the program has to offer. Perhaps the use of the word ‘advanced’ is misleading, as one or two of these functions are very likely to be used regularly, some of them perhaps on a daily basis. However, I consider those functions to be best tackled *after* you have become familiar with the more basic ones described in detail in *GEO Quarterly No 9*. In particular, I will specifically look at the use of remapping, manual and automatic animations (yes, automatic animations *are* possible with GSS5), the use of RGB mode and the rather impressive World View.

### Remapping

Think of remapping as a way of selecting an area to view from within a larger image such as a Meteosat or GOES full disc. The choice of settings (described later) will dictate the size of the area to view and, to some extent, how detailed the remapped image will be. Moreover, there are a number of very useful additional features which allow the selected area to be viewed with various forms of correction and overlays.

When a remapped image is formed it will appear under the ‘*Remapped*’ tab in the main *GSS5* window. Setting up a remapped image is done on a per-Job basis; select your chosen Job number then select the ‘*Remapping*’ tab in **<Options → Job setup>** (figure 1). As well as allowing you to select specific areas from within an image, such as a full-disc HRIT, remapping provides a range of options for image correction to compensate for such things as Earth’s curvature. This is a very powerful and useful tool and an example is seen in figure 2 where, despite featuring a region lying between 50° and 60° north of the equator, the UK appears undistorted in shape thanks to the orthographic setting—quite impressive when you consider how far away the UK is from the sub satellite point.

The settings for remapping are all available under the ‘*Remapping*’ tab (figure 1). The first and most obvious requirement is to tick ‘*Enable remapping*’, and indeed, all the other setting options are greyed out until this is done.

‘*Remapped image size*’ dictates the overall size of the completed image in pixels. This choice is partly dependant on your monitor resolution settings and how much you are prepared to tolerate scrolling. My own 19-inch flat screen monitor has a resolution of 1280 × 1024 but of course some of that is given up to the program taskbars and buttons. I find the setting of 1280 × 960 just about perfect with only minimal scrolling: the 1024 × 768 setting is smaller than the available space. Of course, if you prefer a smaller image, just pick an appropriate option. A little experimentation with this will very quickly give you the feel for it and help you find what best suits your own setup for the particular images you are making up. The key to where the image is centred, and how much you see within the overall size selected, comes in the settings for ‘*Meridian*’, ‘*Parallel*’ and ‘*Span*’. The ‘*Meridian*’ and ‘*Parallel*’ settings will define the coordinates of the centre point of the remapped image and are basically longitude and latitude; ‘*Span*’ (in degrees) dictates how far from the centre point your image will extend north, east, south and west.

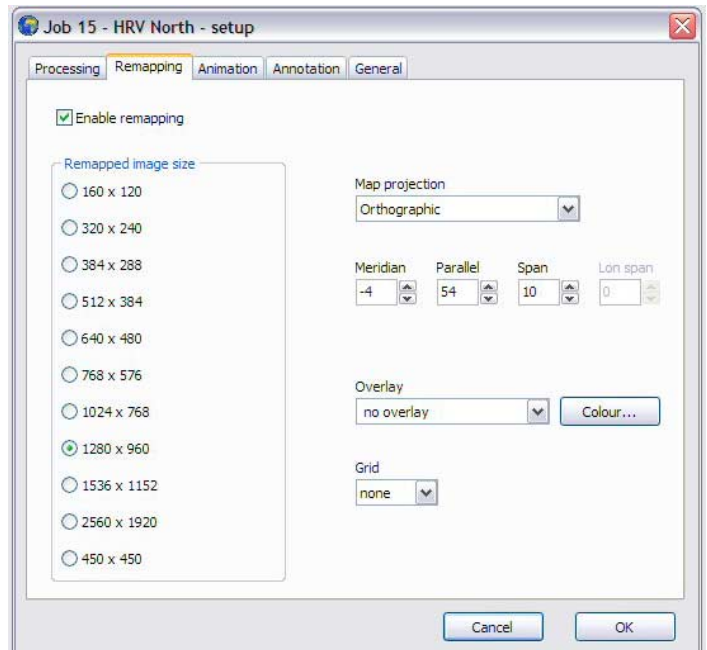


Figure 1 - the ‘Remapping’ tab

Let’s look at an example which positions a centred close-up of the UK in the image window. The settings described below extracted the image seen in figure 2 from a Meteosat-8 HRV channel-12 frame, using channel-9 to contribute the colour.

If you include the Channel Islands, the UK lies between approximately 49°N and 59°N. The centre of this is 54°N and that is the figure to use as the ‘*Parallel*’ setting. To include Ireland and some of the Atlantic (rather than Europe)—as that is often the more likely source of our weather—I have centred the longitude on 4°W. By convention west from 0° is negative, so ‘-4’ is entered as the ‘*Meridian*’ setting. In order to ensure that the remapped image does indeed stretch from 49°N to 59°N, centred on 54°N, we require a total span of 10° (i.e. 5° each side of the centre point). ‘10’ is therefore the setting that goes into the ‘*Span*’ box, a value that also dictates the E-W span.

Finally, decide if you want to add overlays or grids to your remapped image and whether it requires any form of correction. Figure 2 uses orthographic projection, which in my opinion is particularly suitable for a close-up of a country rather far from the sub-satellite point. I think you will agree that the result is very pleasing. Clearly, if you choose a larger span, it will cover a much larger area within your chosen window size and the detail will be reduced. However, the way remapping is designed allows the user infinite control over both the positioning and outcome of the final image. Do not be afraid to experiment with this; it will greatly help the learning curve.

There is also an option in the set-up to use overlays, and a large number are supported by GSS5. Of course it is for the user to download and save the relevant overlay data. For overlays to work they have to reside in the same folder as the image they are overlaying. This option allows you to overlay charts, synoptic



Figure 2 - Orthographic Meteosat-8 image of the UK

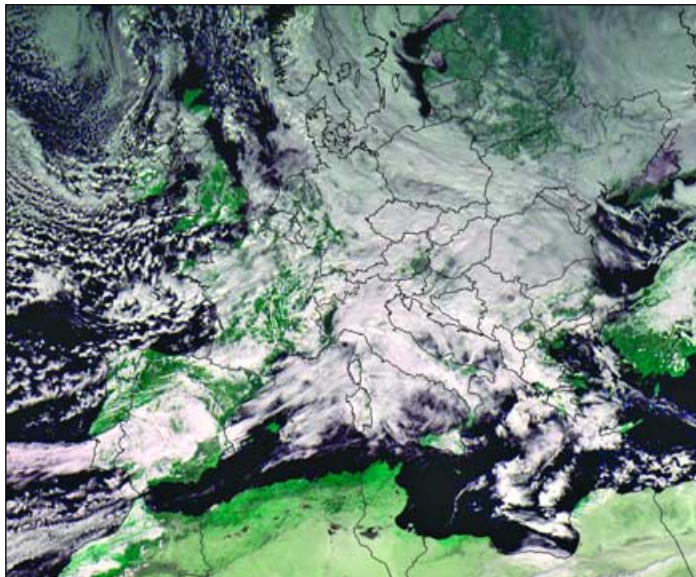


Figure 3 - RGB mode

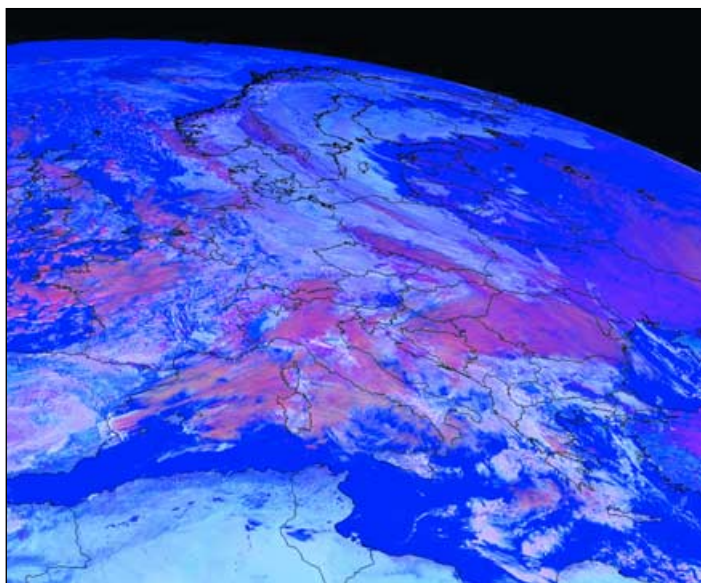


Figure 4 - Colours used to highlight snow over Turkey

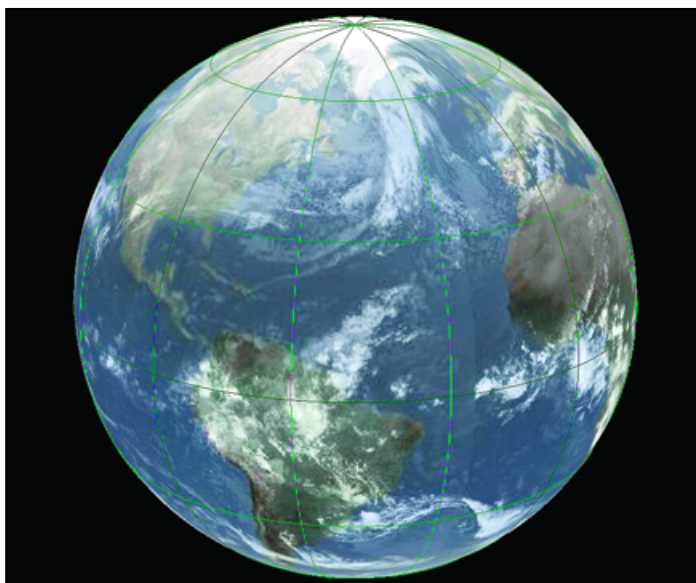


Figure 5 - A geostationary image composite in WxtrackGL

data, radar and many other useful features, and ensures that both the data and the remapped image are correctly aligned and overlain fully automatically. When an overlay is selected it overrides your usual 'Meridian', 'Parallel' and 'Span' settings and automatically crops and positions the Meteosat image to match its own area. This is in fact very handy, as it is then a simple matter to add an overlay to any remapped image you have previously set up: your original parameters are restored as soon as you decide to stop using the overlay. An example of this is shown in figure 7, where a Bracknell surface pressure chart has been overlain on a remapped channel-9 image from Meteosat-8. I think you will agree that this can be used as an excellent learning tool.

**Animations.**

One of the great joys of receiving images from geostationary weather satellites is making and running animation sequences. This is not just a fascinating exercise and visual experience but a great educational tool: all the more so when the satellite provides high resolution digital data with a repeat scan period of fifteen minutes. *GeoSatSignal* is able to produce animations, not just of basic received images, but of complex images made up using colour, RGB mode, remapping and many other options. In other words, anything you can produce from *GSS5* can be animated. But be warned; complex images may take some time to create, depending on your particular computer specification.

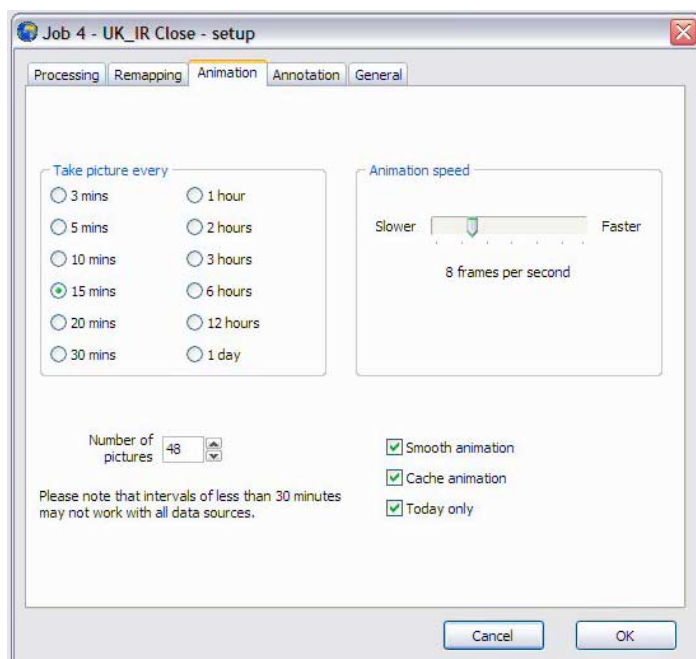


Figure 6 - the 'Animation' tab

To set up an animation for a specific Job, select it from the <Job> menu then open <Options → Job setup> and select the 'Animation' tab (figure 6). The procedure is very straightforward but one basic concept needs to be clearly understood first. You start with your currently loaded image (not necessarily the latest) and then work back for the number of hours required for the animation. GSS5 will look for similar files with the appropriate timestamps and can work with a variety of folder and file structures.

Let's examine the setup options shown above. The 'Take picture every' panel refers to the time gap between available images, or at least the gap you may want. For HRIT imagery from Meteosat-8 that would of course be 15 minutes whereas for the FSD relays from GOES through EUMETCast, 3 hours would be selected. Of course, if you wish, you could choose a 30 minute gap or more for the HRIT data, although I cannot think of any good reason why you would want to do this; but the point is that the setting should not be less than the frequency of your saved data.

If you want to animate the previous 12 hours from a Meteosat-8 channel (15 minute scan/4 images per hour) then you would set 'Number of pictures' to 48. 'Animation speed' can be set between 1 and 30 frames per second; this is really down to personal taste and, to some extent, experimentation based on the length of the animation and other settings. I find a setting of about 8 fps a nice compromise. 'Smooth Animation' uses a system called 'tweening' (apparently short for in-betweening), where intermediate frames are generated between images to help smoothing. You could be forgiven for thinking that with 15 minute scans from Meteosat-8 smoothing would be unnecessary but it does work well.

'Cache animation' is an option which can speed up the creation of animations. When unticked, all frames will be processed and included in the animation. With 'Cache Animation' ticked the frames will be saved and, if you come back a little later to update (extend) the animation, only the new frames need to be created and processing time is greatly reduced. However, you have to appreciate that caching will only commence after the number of frames selected has been reached. In other words if you are running an animation to show the latest 12 hours for a particular image then your frame number will be 48 (for Meteosat-8).

Once this animation has reached 48 frames it will start caching. As each new image is received, it will be added to the animation, while the oldest frame will be deleted. This means that you will always be able to view the most recent 12 hours of images. If you do not run your station overnight, and just run animations on a daily basis, caching will not work. It will just be reaching the required number of frames when you shutdown for the night! For the 24/7 enthusiasts this is a great processing and time saving setting.

To create your animation, once the image you wish to animate is on the screen, simply press the 'Animate' button. You will be offered a filename based on the Job title. You can alter this if you wish and you will also be warned if there is an existing file name in use and prompted whether you want to overwrite it. Animation controls are provided at the bottom of the image once the animation is formed and ready to run.

As I mentioned at the beginning of this article, there is a way to automate GSS5 animations. This is possible because David Taylor has provided batch-mode operation with the program, allowing it to be driven by command-line instructions. If you run such a batch file from a scheduling program such as 'Scheduled tasks' provided with Microsoft Windows, you can have a fully automated system. Of course, batch-mode can be used just to save images at any level in the processing chain, but it is particularly useful for automating animations. I do not intend to discuss batch commands as they are very well detailed in the help files. Suffice to say that the commands control where processing should stop for a given Job. You may only want to see the thermal image, or perhaps colour; or you may want to proceed as far as a remapped image. Again, you can animate at any stage but, if you specify the

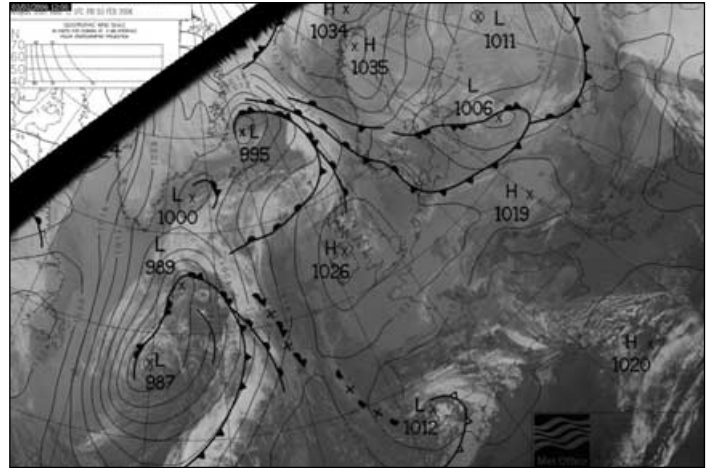


Figure 7 - A Bracknell mean sea level chart overlay

animation as 'Last', then the processing will be completed as per the settings in the Job setup.

A typical batch command example is shown below. To avoid difficulties and aid explanation, it is split over three lines but it must be entered as a continuous instruction.

**Note:** [ ] at the end of Line-1 represents a single 'space' character.

```
"C:\Program Files\David J Taylor\GeoSatSignal\GeoSatSignal.exe"[ ]
C:\MSG-1\Images\HRIT\*ch09.png -j4"-anim:
C:\Program Files\David J Taylor\GeoSatSignal\UK_IR_Close.avi" -close
```

Line-1 simply gives the location of the GSS5 program. Line-2 confirms the use of an HRIT channel-9 image to be processed in accordance with Job No 4. The final line confirms the location required for the output file. Notice the 'close' instruction at the end which removes the image from the screen.

This complete instruction can be used as the *run* command in a Windows scheduled task. If you are running *MSG Data Manager* and *MSG Animator*, then the computer processor is particularly busy on the hour, quarter past, half hour and quarter to, saving images and processing animations. One of the real benefits of running scheduled tasks is that you have control over when to schedule. If you are animating images every 15 minutes, then delay this so that it is processed at times other than the busy ones mentioned above. The system works well and allows you to automate some very complicated animations as well as a host of other things.

### RGB Mode

This mode is principally provided to allow the combination of arbitrary channels from Meteosat-8 and subsequent Meteosat Second Generation satellites by mapping the channels to either the red, green or blue component of the output image. Of course red, green and blue are the three colours of light which can be mixed to produce any other colour, and correspond to the colour receptors in the human eye. Perhaps in the future other countries will design and launch geostationary weather satellites with multiple wavelength channels but for the moment it seems that Europe is way ahead in this field.

RGB mode is not difficult to set up and can be used very easily. However the meteorological reasons for using it and the purposes and benefits of mapping and combining specific channels are much more complex. I do not intend to explore this in depth as there are many sources of excellent information already available. However a brief explanation is required along with the source of other useful reading.

The use of the RGB principle permits specific meteorological conditions to be highlighted. Knowing which channels and combinations aid clarification of particular meteorological

conditions is, of course, the skillful part. There are a number of useful guides available but by far the most comprehensive, and in my opinion the easiest to follow and understand, is the **MSG Interpretation Guide** produced by *EUMETSAT*. This is a huge guide on a whole range of interesting topics relating to MSG data, including the use of RGB, and is broken down into a series of PowerPoint presentations. There are nearly 50 presentations in the set and you can download just the ones you want. For more information and to download please go to :-

[http://oiswww.eumetsat.org/WEBOPS/msg\\_interpretation/index.html](http://oiswww.eumetsat.org/WEBOPS/msg_interpretation/index.html)

RGB mode can be accessed from **<Options → Job setup>** using the 'Processing' tab; the options become available when 'RGB' is selected under 'False Colour'. Simply select which channel you wish to be associated with each colour. There is also an option under 'RGB Xfer' which allows you to influence the output image by choosing a colour transfer table. Indeed, you can make up your own such table and choose different settings for each of the colours to influence the final image output. Believe you me: there are many hours of fun and experimentation to be had here!

RGB mode can also be used in an effort to develop pleasing colours for both land areas and cloud tops. Figure 3 is an example of this, where the land has been coloured but where clouds have retained their white appearance. The real benefit of the technique is to accentuate meteorological conditions and an example of this is shown in figure 4 where the 0.8 µm VIS channel is mapped to red, the 1.6 µm NIR channel to green and the 3.9 µm IR channel (set negative) is mapped to blue. The lilac/pale purple colour, seen over parts of Turkey, for example, highlights snow cover whereas clouds are shown in white through to orange for the highest and coldest. This mode can be fun to experiment with but is also a very useful mode for serious meteorological work.

Another feature which can be used in conjunction with RGB mode is the subtraction of MSG channels, also explored and explained in the *EUMETSAT* guide. I understand that David Taylor hopes to add this option to a future release of GSS.

**World View**

Because of the global sharing and availability of geostationary images, by direct dissemination from satellites, through the European *EUMETCast* service and from the Internet, weather imagery is readily available for all parts of the globe. The **<File → Open world view>** option in *GSS5* takes advantage of this to combine thermal data from satellites all round the planet and produce a composite image. This can also be overlain on a coloured map of the Earth.

A range of data can be used, including that from *EUMETCast*, PDUS and even WEFAX files. Setting up *World View* is very straightforward and the set-up window is shown on the inside front cover of this issue.

Without doubt the most important aspect of setting up is to ensure that you correctly specify the data location for the five geostationary satellites which contribute to the world view.

There are options included to have the combined image overlain on a coloured map of the world. A setting of 0 has no map and the remaining settings of 1 to 10 dictate the transparency/opacity of the underlying map. There is an option to save the combined image for viewing and perhaps further processing in another program but by far the most impressive option is to load the image into David's *WXtrackGL* program. This is a completely free program which provides a 3D display. The globe can be turned by means of a mouse so it is possible to view the entire world cloud cover just as it would be seen from space. An example of this can be seen in figure 5 but you have to try this out yourself to fully appreciate just how good it is.

**And finally ...**

I hope the two-part article has been of help to those new to the program and perhaps a refresher to others. It has certainly brushed up my knowledge of the software! Of course it is not possible in an article of this size to cover all aspects of the program, but I have tried to include those that I consider to be the most popular and useful as well as some others where additional explanation from a user may be helpful. The help files provided with the software are very comprehensive and some of the more difficult concepts such as CLUTS (colour lookup tables) and automation by batch files are given a very thorough airing. The help files should be your first port of call when an explanation is needed or a problem arises.

David Taylor has assured me that we can look forward to future developments for *GeoSatSignal* and perhaps some of these will already be available by the time this article goes to press. Just another reminder that the program can be downloaded from the 'Satellite Tools' section on David Taylor's web site at :-

<http://www.satsignal.net>

*GSS5* is also available on the GEO Software CD, GS1 along with many of David's other programs. Please remember that some of the options discussed in both articles are only available with the registered version.....another good reason to register.

All original Meteosat-8 images © EUMETSAT 2006



# Solar Degradation of Hot Bird-6 Transmissions



Twice a year, during the spring and autumn, the sun will appear to move immediately behind the satellite used for DVB transmission. As the sun comes within the beamwidth of the receiving dish, the noise energy from the sun at 11 GHz will affect the satellite signal, causing a reduction in the signal-to-noise ratio and hence a higher bit error rate.

Figure 1 shows the bit-error-rate (BER) due to solar interference when receiving Hot Bird-6 in Edinburgh. You can see the effect during one day, Thursday, March 2. As the data was sampled at 5 minute intervals the full structure of the sudden increase in BER is not really visible. The whole event takes about 15 minutes when the sun is closest to the satellite as viewed from the receiver.

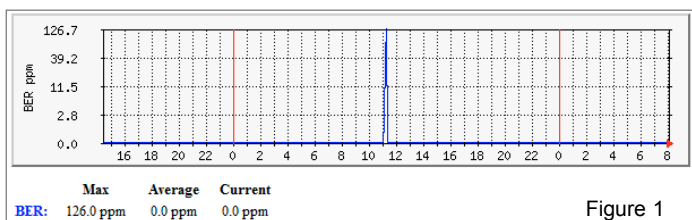


Figure 1

**David Taylor**

Figure 2 shows the BER averaged over a 30 minute period, and peaks due to solar interference can be seen from Sunday February 26 until Thursday March 2. As you would expect, as the sun moved nearer to the centre of the antenna beam, the interference worsened and the BER increased. Note that the 30 minute average is lower than the 5 minute average so, whilst the absolute numbers are meaningless, the pattern of the outage is clear.

For more information about collecting this data on your own PC, please refer to 'Monitoring *EUMETCast*' in GEO Quarterly number 8, page 5.

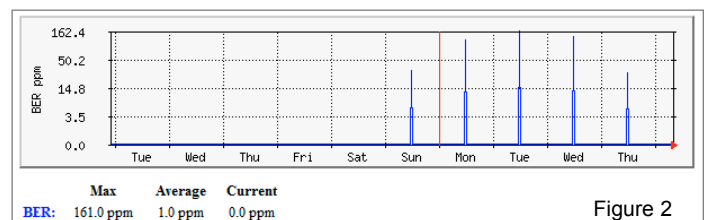
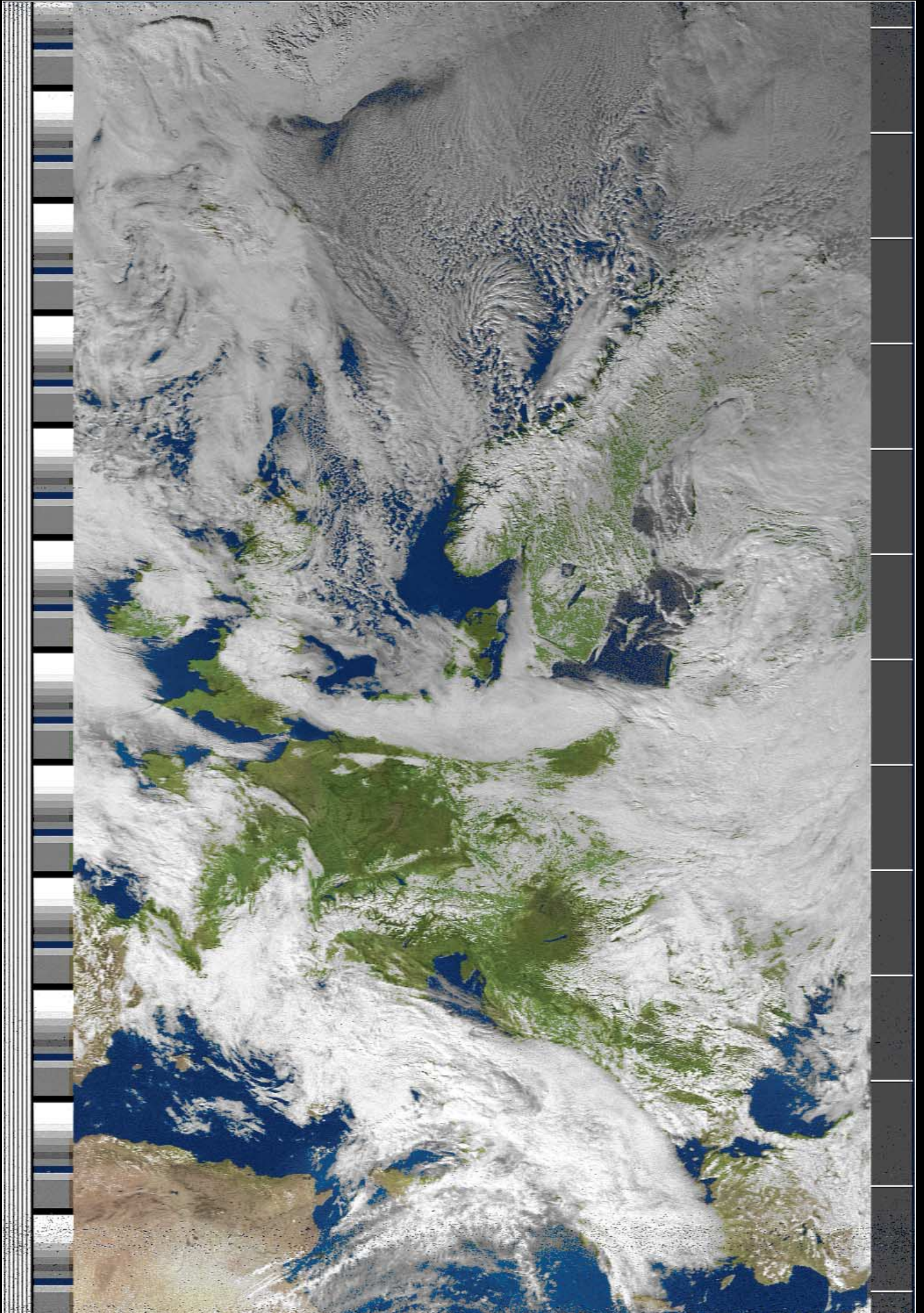


Figure 2



NOAA-18 at 12:11 UT on March 19, 2006, captured using the Wraase WRX-137 in conjunction with a Chris van Lint QFH antenna and processed with WXtoImg

# The Wraase WRX-137

## Possibly the best APT Receiver Money can buy

Les Hamilton

A few months ago, Hartmut Schaksmeier, one of GEO's German members, suggested that readers might be interested to learn about the Wraase WRX-137 APT weather satellite receiver that he uses for his APT imaging. Hartmut introduced me to Volker Wraase, of Wraase Electronic GmbH, Altenholz, Germany who kindly loaned a unit for evaluation. Hartmut has used this receiver for some time, and you can view some of his images in previous copies of *GEO Quarterly* [1].

### Background

The Wraase WRX-137 is a professional APT receiver which is used widely on the continent by airports, ships and military installations. Consequently, immunity against the strong VHF signals that can be experienced in such locations has been a major design criterion, though it was not designed for UK-specific pager problems.

### Receiver Overview

The WRX-137 is a rugged, weatherproof top-of-the-range receiver housed in a robust yet attractive metal case (figure 1). The front panel is uncluttered and supports all necessary controls apart from the power on/off switch which is located on the rear of the instrument. The rear panel carries BNC connectors for both an APT antenna and a (now obsolete) Meteosat downconverter, plus a phono output for audio output and an RS-232 serial port which doubles for computer control and output to *Prosat for Windows* and *JVcomm* imaging software. The receiver is powered from a 12-volt plug-top adaptor which connects into a standard 3.5 mm jack socket on the back of the receiver. You can use either the supplied continental PSU, via a suitable adaptor, or one of your own designed for the UK.

This receiver has been designed for use with Wraase turnstile antennas which are fitted with an intrinsic masthead pre-amplifier as standard, for which 12 V dc is permanently output from the receiver's *VHF-ANT* connector through the antenna co-ax and *cannot be switched off*.

### Setting Up

Connect the PSU to the WRX-137, the antenna to the *VHF-ANT* connector and fit an audio lead between the *AF-OUT* jack and your PC soundcard—then switch on. The WRX-137 announces itself on the LCD screen then displays the message *PC Control Yes/No* for 3 seconds. If you allow



Figure 1 - The Wraase WRX-137 APT weather satellite receiver

this message to time-out, PC control is selected automatically. The logic behind this is to enable you to power-up into PC-control mode by default when the receiver is located in an inaccessible remote location. Pressing the **Yes** button during this period also selects computer control.

If you wish to disable PC control you must press the **No** button before the message times out. Users who prefer to continue using their existing soundcard software should press the **No** button to select manual control.

### Manual Control of the WRX-137

There are three different control modes that can be called upon

- Auto Scan Mode
- Progressive Scan Mode
- Manual Mode

by simply pressing the **Mode** button repeatedly.

#### Auto Scan Mode

The WRX-137 enters this mode by default once manual operation has been selected. Just press the **Up** button to start the unit scanning through the five APT frequencies. As soon as a satellite signal is detected the receiver locks on to it for the duration of the pass.

#### Progressive Scan Mode

Similar to the above, this allows you to select specific frequencies which will be scanned then confines scanning to these alone. Press the **Mode** button to select *Progressive Scan Mode* then press the **Up** button once to display *'? 137,10 MHz ?'* on the LCD screen. If you wish to scan this frequency press **Yes**, otherwise **No**. As

soon as you have repeated this for the remaining four frequencies autoscanning commences, but only for the selected frequencies.

#### Manual Mode

Once you have opted to run the receiver manually, press the **Up** button repeatedly to cycle through the various channels, which are:

- Meteosat channel-1
- Meteosat channel-2
- 137.10 MHz
- 137.40 MHz
- 137.50 MHz
- 137.62 MHz
- 137.91 MHz

The first two options are now redundant and it remains to be seen whether they will be retained in new models. The remainder cover all the current and future NOAA frequencies as well as retaining 137.40 MHz that might conceivably yet come into use if another Okean or Sich satellite materialises.

Although you are unlikely to require the facility, you can, once you have selected your frequency, fine-tune it by firstly pressing the **Down** button; subsequently pressing either the **Up** (or **Down**) button



Figure 2 - The MX-137 antenna

will add (or subtract) 10 kHz from the base frequency; keeping a button depressed will scan continuously in 10 kHz steps. This function is disabled on pressing the **Mode** button once more.

### The Wraase Antennas

Wraase kindly supplied me with one of their MX-137 'Mobile' turnstile antennas (figure 2). This miniature antenna has been designed for use aboard ships where reducing bulk and minimising wind load in rough seas are important. It consists of a built-in preamplifier with ~17 dB gain, to which four stubby flexible elements clip by means of BNC connectors. These are 'internally electrically extended'; Wraase claim that low-loss direct coupling to the highly selective preamplifier ensures that the MX-137 is scarcely inferior to their full-sized KX-137 turnstile. All electrical components are protected from corrosion in a sturdy casing made from tough UV-resistant plastic. The download connection is made using a high-quality, waterproof N-type socket. There are no reflector elements.

### Antennas without a Preamplifier

If you wish to make use of an existing rooftop turnstile or QFH antenna (but which lacks a masthead preamp), you may have a problem. It will almost certainly short at the receiver input and make it 'howl' alarmingly.

### In this event, disconnect immediately to avoid possible damage to the unit.

*If you wish to use such an antenna of your own you **must** insert a blocking capacitor into the antenna feed. I used a 22 nF one, which proved very effective.*

### Capture Software

The WRX-137 receiver is an exceptionally sophisticated unit and contains a built-in microprocessor which provides the necessary interfacing hardware to enable the receiver to control both *Prosat for Windows* and *JVcomm* through its RS232 serial port (without the need of a dedicated external interface unit). The receiver can also interface with *WXtoImg* by the same method.

The WRX-137 can be used manually with any of the current soundcard recording programs. All that is required is an audio connection between its *AF-OUT* socket and a PC soundcard. I have successfully imaged using *WXtoImg*, *WXsat* and *APTD decoder* in this manner. With these programs now being so widely used, the built-in APT decoder is almost obsolete these days and could well be left out in a future redesign—which could lead to a more attractive price.

### Results using the MX-137 Turnstile

For my initial tests the MX-137 'Mobile' antenna was lashed to a washing pole at the foot of the garden in a situation

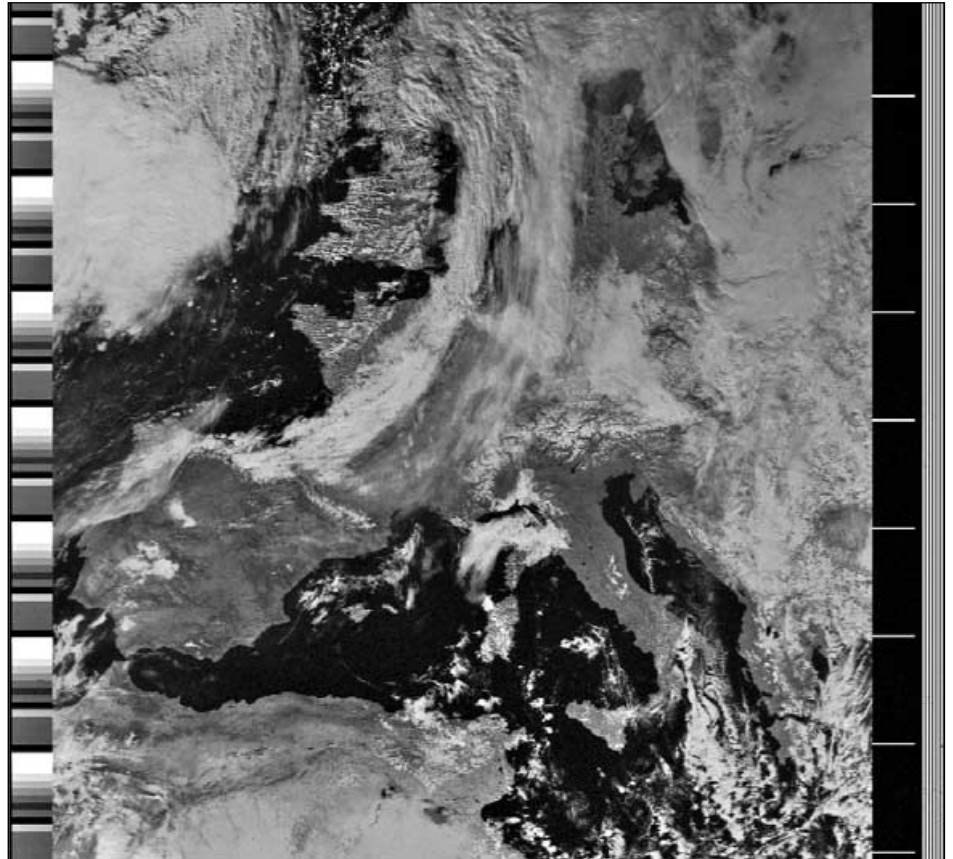


Figure 3 - A NOAA-18 channel-2 APT image acquired at 13:06 UT on February 22, 2006

providing good horizons in most directions. As would be anticipated for an expensive, top-of-the-range receiver like the WRX-137, results were excellent. Even transmissions from NOAA-18 when using its original frequency of 137.91 MHz showed no sign of pager interference.

Thus encouraged, I next mounted the MX-137 turnstile indoors under the eaves of my house. Results were truly dreadful, with pager banding over the entire length of each pass—far worse than I experience with my own loft-mounted QFH. I assume that this simply reflects the fact that the roof of the house attenuates the satellite APT signals much more than the powerful pager signals, and that the result is simply compounded by the mast-head pre-amplifier.

However, there is no doubt that, when mounted outdoors in a good situation, the MX-137 'Mobile' mini-turnstile is very much equal to its task and is the ideal companion to the WRX-137 receiver. Though I have not had the opportunity to test it, I am confident that the full-sized KX-137 turnstile (with reflectors and preamp) would be the perfect antenna to accompany the WRX-137 for the home user.

### Using Antennas without a Preamp

I already had both a turnstile and a QFH antenna permanently mounted for my APT activities and my next move was to test these with the WRX-137. As I had no wish to climb on to my roof in the middle

of winter to mount the MX-137 there, I decided to press my own antennas into service instead.

Neither of my antennas makes use of a preamplifier so the first hurdle was to insert a blocking capacitor into the download. I fitted the ends of a short length of co-ax with male and female BNC connectors then cut it in half. After stripping back the braid, the centre conductor at each end was shortened by about a centimetre. A 22 nF capacitor was then soldered across the break and wrapped in a few turns of PVC tape. Finally, the braid was reconnected and wrapped in a sleeve of aluminium foil then bound with more PVC tape. The entire unit was now used as a link between the WRX-137 and the antenna download.

Images continued to impress, and if anything were even better than those using the MX-137, where the extremities of passes tended to exhibit light speckling. Figure 3 is typical and, for my station in Aberdeen at 57°N, 2°W, exhibits fine detail well into northern Africa

### Summary

The Wraase WRX-137 APT receiver is a top-of-the range unit that can be guaranteed to produce the very best possible APT images. For the enthusiast for whom cost is not a consideration it is highly recommended for use, whether with one of the company's dedicated antennas or one of your own. Pricing for Wraase

*concluded on page 26 ...*



# Looking to the Future

## New GEO Management Team Members Required

If the many comments GEO has received since its inauguration are to be believed, the organisation has been an unqualified success. This of course stems in no small part to the dedication and enthusiasm of the current Management Team; but success brings increased demands on those working on GEO's behalf and can be time-consuming and restrictive for the individuals concerned. As in all organisations, there is inevitably a periodic turnover within the management structure, and GEO is no different.

GEO has now reached the stage where two of its stalwarts, Nigel Evans (Membership Secretary) and Les Hamilton (Editor) are looking, in the medium term, to retire from their posts. Both have chosen to relinquish office at the end of 2006, having helped to guide GEO through the first three years of its existence. Consequently, GEO is seeking new blood to fill these vacancies on its Management Team, that will arise at the end of this year.

### MEMBERSHIP SECRETARY

Nigel Evans has occupied this post since GEO was founded in late 2003 and, ably assisted by his wife Michele, has seen our membership rise from zero up to its current level of over 500. Unlike many of GEO's management team, Nigel has a full-time job and family commitments, and now wishes to be able to devote more time to these.

By identifying a successor in good time we hope to be able to ensure a smooth transition of responsibilities, so that the new incumbent will be able to take over completely transparently.

#### What does the Position Entail?

GEO membership is renewable on a rolling basis so renewals are spread over 12 months. The post would require about 3 to 4 hours a week at peak times (which is usually just after an issue of GEO Quarterly is published), but generally less.

The new Membership Secretary should have:

- a good working knowledge of a data base (MS Access is currently used)
- Production of mailing labels for each issue of GEO Quarterly
- access to a PC with a Broadband Internet connection (principally for banking)
- ready access to a Post Office
- an understanding spouse

Membership Secretary involves looking after GEO's most valuable asset—its membership. This is a highly rewarding experience which involves making regular contact with members and contributing to an organisation which has achieved international recognition and respect in just three short years.

As with all GEO posts, Membership Secretary is an honorary position; you are not paid for your time. Anyone interested and willing to undertake the role of GEO's Membership Secretary can obtain further information from

Nigel Evans at: [members@geo-web.org.uk](mailto:members@geo-web.org.uk) or

Francis Bell at: [francis@geo-web.org.uk](mailto:francis@geo-web.org.uk)

### GEO EDITOR

Les Hamilton, though nominally the GEO editor, has in fact been wearing three distinct hats. Not only has he edited all the content for ten GEO Quarterlies to date, he has also been responsible for researching and preparing, on average, three articles per issue (over 25% of the entire Quarterly content), as well creating the actual page make-up to send to the Printing House. Not surprisingly, Les finds this a considerable drain on his time, and is looking to stand down on the completion of three years' service. Ideally, the package of tasks he is currently handling could be better spread amongst a team which could include an Editor, a Make-up Editor and several Feature Writers.

#### How is the Quarterly Produced

Make-up is the crucial stage, where *GEO Quarterly* pages are actually created from members' contributions. This process is handled using *Quark Express*, a frame-based software package that is standard with most printing houses. If you have used Microsoft 'Word' or 'Publisher' with text and images, it should not take long to master *Quark Express*. Les assures us that he mastered this software (hitherto unseen) and produced his first magazine within the space of eight weeks. Additionally, a good image processing package such as *Photoshop* or *Paintshop Pro* is required for cropping and resizing images.

Editing skills are based on common-sense and the use of a spell-checker. Basically this involves 'streamlining' submissions, checking grammar, cutting out waffle and irrelevant material, and liaising with the author as to the finally agreed copy.

Les assures us that he is prepared to work with his successor over an extended period to ease the transition and to ensure that the quality of the *Quarterly* will be maintained.

### FEATURE WRITERS

Much of the burden of writing regularly for GEO Quarterly has so far fallen on Les Hamilton, Francis Bell, Peter Wakelin, John Tellick and several members of Werkgroep Kunstmanen. Over the years we have enjoyed a number of one-off submissions from readers; but sadly, less than 25% of the features you have read in *GEO Quarterly* were penned by its vast majority of UK members

GEO requires a panel of members who are prepared to research material and write it up in the form of feature articles for the *Quarterly* from time to time. If you feel you could do so for every issue this would be superb—but even if you feel able to research a topic and produce an article just once or twice a year, we would love to hear from you.

Any member who feels they can help GEO in this arena, or would like further information, is welcome to contact Les Hamilton at:

[editor@geo-web.org.uk](mailto:editor@geo-web.org.uk)

or Francis Bell at:

[francis@geo-web.org.uk](mailto:francis@geo-web.org.uk)

**Copy Deadline**  
for GEO Quarterly No 11  
Saturday, July 29, 2006

The Editor is always on the lookout for articles and images for inclusion in GEO Quarterly. These can relate to any aspect of Earth Imaging, especially:

- Technical articles concerning relevant hardware / software
- Construction projects
- Weather satellite images
- Reports on weather phenomena
- Descriptions of readers' satellite imaging stations
- Activities from overseas readers
- Letters to the Editor
- Problems and Queries for our experts to answer

Contributions should of course be original and, where possible, should be submitted to the editor in electronic format (floppy disc, e-mail attachment, CD). But of course we will also accept handwritten or typed copy should the need arise.

Please note, however, that **major articles** which contain large numbers of satellite images, photographs or other illustrations should be submitted **as early as possible** so that they can be prepared and made up into pages in time for publication.

#### Images and Diagrams

Images can be accepted in any of the major bitmap formats, e.g. JPG, BMP, GIF, TIFF etc. Images in both monochrome and colour are welcomed for inclusion. Line drawings and diagrams are preferred in Windows metafile and postscript formats. We can also scan original photographs, negatives and slides.

#### Gridding, Overlays and Captions

Please note that readers' satellite images should be provided **without** added gridlines, country outlines or captions **unless** these are considered essential to illustrate an article.

If your article submission contains embedded images and diagrams, please note that it is essential that you **also submit the individual images** in one of the formats described above: these are essential for page make-up purposes.

#### Submission of Copy

All materials for publication should be sent to the Editor, Les Hamilton, 8 Deeside Place, Aberdeen, AB15 7PW, Scotland.

Materials may also be sent as attachments to the following e-mail address:

[editor@geo-web.org.uk](mailto:editor@geo-web.org.uk)

Larger attachments (1 Mb to 10 Mb) are best sent to:

[editor.geo@googlemail.com](mailto:editor.geo@googlemail.com)

And finally . . . if you do have material ready for the next GEO Quarterly, please submit it as soon as it is ready—do not wait till the deadline before sending it in. This simply creates an editorial log-jam.

# GEO Shop

Manager: Clive Finnis  
 e-mail: [shop@geo-web.org.uk](mailto:shop@geo-web.org.uk)  
 FAX: +44 (0) 1202 893 323



### R2FX APT Weather Satellite Receiver

This diminutive German-built APT receiver is packed with features and is the ideal receiver for the newcomer to the hobby. May be affected by pagers on the upper NOAA frequency of 137.91 MHz.

UK member's price - £135.00  
 UK non-member's price - £149.00

### R2FX Accessory Pack

This contains everything required to implement a complete APT receiving system when used with the R2FX receiver. It comprises:

- 137 MHz Turnstile Antenna
- UK plug-in power supply
- PC audio lead + PC Serial 'computer control' lead
- Aerial lead (20 m with fitted connector)
- CD of PC shareware starter software
- Instructions

We do not normally ship outside the UK as this receiver should be available elsewhere more cheaply from the manufacturer. But contact the GEO Shop if you wish a quote.

UK member's price - £59.00  
 UK non-member's price - £69.00



### Vierling 'Weatherman' APT Weather Satellite Receiver

This professional receiver is German-built and designed by Vierling, to satisfy the most dedicated enthusiast. It features an LCD display and has proved to have excellent resistance to pager interference at all frequencies, including 137.91 MHz.

UK member's price - £239.00  
 UK non-member's price - £259.00

### Vierling 'Weatherman' QFH Antenna

This kit can be assembled into a rugged all-metal QFH antenna within 30 minutes.

UK member's price - £179.00  
 UK non-member's price - £189.00

### Complete 'Weatherman' System

This comprises the APT Receiver, QFH Antenna plus Windows-based computer control software.

UK member's price - £349.00  
 UK non-members price - £369.00



### TechniSat SkyStar 2 USB Box

This external 'free-to-air' DVB satellite TV and data receiver plugs into a USB port on your computer and comes complete with power supply, USB cable and a CD-ROM of driver software.

UK - £94.50  
 Continental Europe - £119.50



### TechniSat SkyStar 2 PCI Card

This 'free-to-air' DVB satellite TV and data receiver card recommended by EUMETSAT must be installed inside your computer. It comes with comprehensive installation instructions and a CD-ROM of driver software (if you do not feel confident about installing cards inside your computer, we recommend the USB version above)

UK members price - £53.50  
 UK non-members price - £59.50



### TechniSat SatFinder Antenna Alignment Meter

This sensitive meter is a great help in setting up and aligning the dish for maximum signal. The meter comes with full instructions.

UK members price - £21.50  
 UK non-member's price - £24.50



### Telestar Universal Ku-band 0.6 dB LNB

(or similar model)

Digital satellite TV Universal LNB for use with the SkyStar receivers above or any DVB satellite TV receiver.

UK members price - £11.00  
 Continental Europe - £17.50



### Telestar 80 cm dish and Universal 0.6 dB LNB

(or similar model)

A quality German made aluminium dish and LNB with an AZ/EL mount to fit onto a vertical pole. (Wall or patio mounts are available from local satellite TV dealers)

UK members price - £49.00  
 UK non-members price - £56.00

### Ordering and Shipping

We will ship by post, so please allow a few days for items to arrive in Europe and perhaps a few weeks for the Rest of the World.

### Orders should be sent to:

GEO Shop,  
 44 Disraeli Road  
 Christchurch BH23 3NB  
 Dorset, England

If you are paying by credit card, you can FAX us your order to:

**+44 (0) 1202 893 323**

### GEO PIC 1.0 for the RX2

Programmed with the new channel frequencies required for NOAA-18.



UK - £7.00  
 Continental Europe - £7.80  
 Rest of World - £8.40

### GEO/Dartcom EPROM v 1.3

This new EPROM for the Dartcom APT receiver is available exclusively from GEO.



UK - £10.00  
 Continental Europe - £10.75  
 Rest of World - £11.25

### Martelec MSR40 EPROM

UK - £10.00  
 Continental Europe - £10.75  
 Rest of World - £11.25

### If you are not a GEO Member?

GEO can provide most of the items advertised (with the exception of GEO Quarterly back-issues and CDs) to both members and non members. However, the latter cannot benefit from the discounted prices available to members.

**Why not join GEO and take advantage of the discounted prices we can offer members.**

Subscription Rates (12 months/4 issues of GEO Quarterly) are just £18 (UK), £21 (EU) and £24 (rest of world).

## GEO Members' PRICE LIST

	Members Prices			Non Members		
	UK	EU	RoW	UK	EU	RoW
<b>APT Equipment</b>						
R2FX APT Receiver (no PSU)	135.00	-	147.00	149.00	-	161.00
R2FX Accessory Pack	59.00	-	-	69.00	-	-
Vierling Weatherman APT Receiver	239.00	-	-	259.00	-	-
Vierling QFH Antenna	179.00	-	-	189.00	-	-
Vierling Weatherman Complete Kit	349.00	-	-	369.00	-	-
Dartcom high quality QFH antenna	259.00	279.00	-	279.99	299.99	-
Turnstile APT antenna	37.50	-	-	42.50	-	-
GEO- PIC 1.0	7.00	7.80	8.40	7.00	7.80	8.40
GEO/Dartcom EPROM v 1.3	10.00	10.75	11.25	10.00	10.75	11.25
Martelec MSR40 EPROM	10.00	10.75	11.25	10.00	10.75	11.25
<b>EUMETCast Equipment</b>						
TechniSat SkyStar 2 PCI Card	53.50	55.00	-	59.50	61.00	-
Technisat Skystar USB box	94.50	113.50	-	119.50	123.50	-
Telestar 80 cm dish with LNB	49.00	-	-	56.00	-	-
Telestar Ku band universal LNB	11.00	12.50	-	17.50	19.00	-
Technisat Satfinder alignment meter	21.50	24.50	-	24.50	27.50	-
<b>Miscellaneous</b>						
GEO Quarterly Back Issues (subject to availability)	3.50	4.20	5.10	n/a	n/a	n/a
GEO 2004 CD (PDF back issues)	8.00	8.80	9.30	n/a	n/a	n/a
GEO 2005 CD (PDF back issues)	8.00	8.80	9.30	n/a	n/a	n/a
GEO Membership (4 x GEO Quarterly)	18.00	21.00	24.00	18.00	21.00	24.00

**All prices are in £ sterling and include postage and packaging**





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Subscription is valid for a period of one year from your date of application, and will entitle you to all the privileges of membership of the Group for Earth Observation, including four issues of GEO Quarterly.

Please note that your subscription commences with the issue of GEO Quarterly current at the time of your application. Back issues, where available, are advertised in your copy of GEO Quarterly.

Current Subscription Rates	
United Kingdom	- £18
Europe	- £21
Rest of World	- £24

I enclose my payment of ..... £

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If you would like to renew your subscription automatically by credit card each year, please tick the box opposite →

I wish to join the Group for Earth Observation (GEO) for a period of one year

Name (please print clearly)

Address

Town/City

Postcode/ZIP

Callsign

Country

Telephone Number

FAX

E-mail Address (please print very clearly)

Website address (... if related to Earth Imaging etc.)

Declaration

I have no objection to GEO holding my membership details on its computer database. I understand that such information will be used exclusively for internal GEO administration purposes. Please sign and date below to confirm

Signature

Date

Please send your completed form to

Nigel Evans (GEO subs),  
'L'Eventail', 7 Gloster Ropewalk, Aycliffe,  
Dover CT17 9ES, England, UK.



If paying by credit card, you may FAX a copy of this form to (01304) 207 731

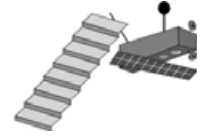
UK residents who wish send their remittance by cheque or postal order should make these payable to:  
**'Group for Earth Observation'**

If you prefer not to remove this page from your Quarterly, a **photocopy** or **scan** of this form is acceptable

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# News in Brief



## ***Metop Launch Confirmed***

The launch date of Europe's first polar-orbiting meteorological satellite has been confirmed for July 17, 2006. The first in the series of Metop satellites (to be called Metop-A once in orbit) will be launched on a Soyuz launcher from the Baikonur Cosmodrome in Kazakhstan into a polar orbit with an altitude of 837 km and a 09:30 equator local crossing time (descending node).

## ***Final Curtain for WEFAX***

The days of Meteosat-7 WEFAX and PDUS are drawing to a close. After a number of extensions as delays beset the launch of MSG-2, all services will end effective from June 14, 2006. GEO readers who have not made arrangements to set up a EUMETCast system by this date will find themselves without any access to live geostationary imagery.

**Raul Texeira**, who monitors Meteosat imagery from the Funceme meteorological station in Brazil (GEOQ No 6, page 24), sent us a Meteosat-7 image he acquired showing the umbra of the recent total solar eclipse over Egypt at at 10:30 UT on March 29.

## ***RARS or RATIOSOVSRS?***

Technical reports are full of acronyms and abbreviations these days. Recently, Peter Wakelin came across 'RARS' in the latest CGMS (Coordination Group for Meteorological Satellites) report. The glossary in appendix 7 to the report says:

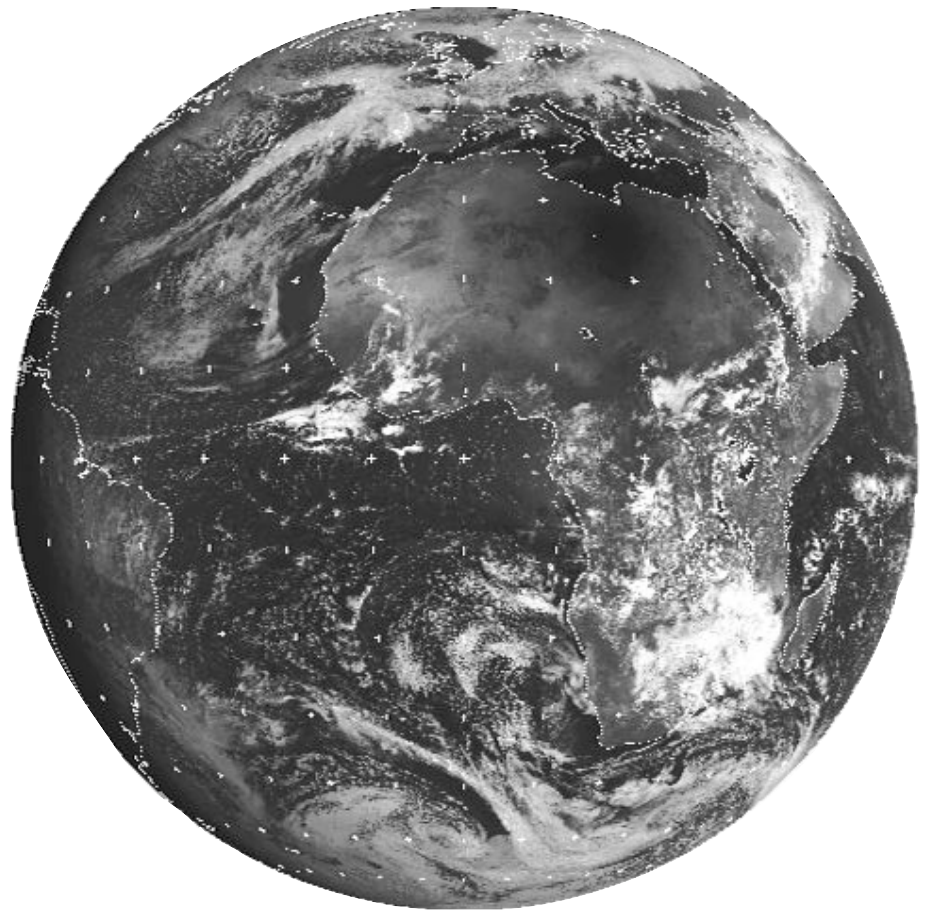
RARS is Regional ATOVS Retransmission Service and ATOVS is Advanced TOVS and TOVS is TIROS Operational Vertical Sounder and TIROS is Television Infrared Observation Satellite.

So RARS is Regional Advanced Television Infrared Observation Satellite Operational Vertical Sounder Retransmission Service.

## ***'Far East' Competition***

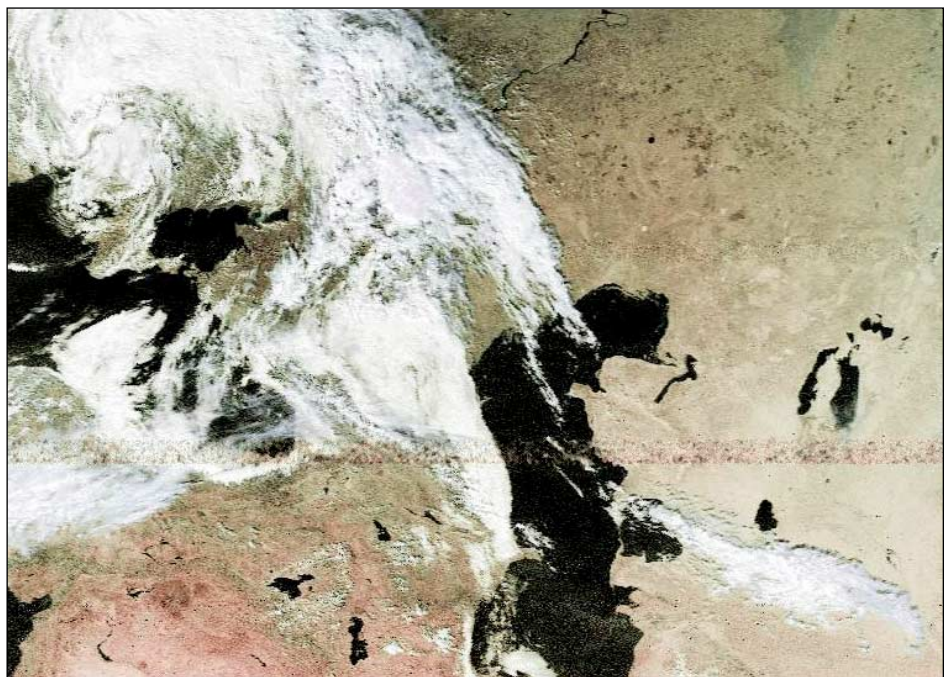
Despite Rob Denton's challenge, and offer of a prize, not a single entry has been received from GEO members resident in the UK to better his NOAA-17 image which displayed most of the Caspian Sea.

**Norbert Puetz** obtained an image containing both the Caspian and Aral seas from Munich, Germany. The image was received on an RX2 using a dipole (sic) antenna, recorded on minidisc and processed later using *SatSignal*.



Total solar eclipse of March 29, 2006. The umbral shadow is clearly evident centred over Egypt in this Meteosat-7 image acquired from Brazil at 10:30 UT on March 29.

Image © EUMETSAT 2006



The 12:20 UT NOAA-18 pass on October 13, 2005, received by Norbert Puetz from Munich.

# HIGH RESOLUTION MSG Images in Colour



Rob Alblas

I described *XRIT2PIC*, a program for handling MSG data, in an earlier issue of GEO Quarterly [1]. In this article I will discuss some new features which have been added since then, perhaps the most interesting being a method of showing the HRV channel images in full (false) colour. I will also discuss briefly options to create anaglyphs (3D weather images) and offering simplified movie generation.

### MSG Image Resolutions

It is important to understand that the space resolution of HRIT images is the same as for LRIT. The differences between comparable channels of HRIT and LRIT are in the number of bits per pixel (10 versus 8) and the compression method employed (lossless Wavelet for HRIT and lossy JPEG for LRIT). Note that the R in LRIT and HRIT stands for Rate, not for resolution! There is just one exception: the HRV channel of HRIT.

Channels 1 to 11 all have a nominal sub-satellite resolution of 3 km (at the 0° meridian on the equator); channel 12 (HRV) has a sub-satellite resolution of 1 km. However, at the latitude of England, the resolution is lower by a factor of 1.7 (cos 54°) as a consequence of geometric perspective, so that channels 1 to 11 actually have a resolution of about 5 km and channel 12 (HRV) of 1.7 km.

### HRV in Full Colour.

Coloured images are possible by mapping different HRIT channels to red, green and blue. These images will have the lower resolution because there is just a single HRV channel. A combination of HRV with lower resolution channels is possible, but of course, only that colour specifically assigned to the HRV channel will be in high resolution.

To get the impression of a high resolution image, chrominance (colour) differences may be shown with a lower resolution than for luminance (brightness) differences. This property of the human eye is used with colour TV to transmit red, green and blue via a channel with about the same bandwidth as for black-and-white TV, without drastic resolution reduction.

*The same can be done when composing MSG colour images: use HRV solely for the luminance and a combination of three of the remaining lower resolution channels for chrominance. The resulting image will show a lot more detail.*

There is one snag with this, however. The HRV channel has a spectrum ranging between 0.5 and 0.8 µm. The two visible channels have spectral ranges of 0.56-0.71 and 0.74-0.88 µm, which lie well within the HRV spectrum but the other channels have spectra outside the HRV range.

If a combination of channels is used to highlight a certain phenomenon, *but this phenomenon is not visible in the HRV channel*, then this aspect will not be visible in high resolution in the composite image. Moreover, if the contribution of HRV in this area is zero then the whole phenomenon will become invisible. Keeping this restriction in mind, it is still worthwhile composing images in this way; in particular, locations far from the equator look much better.

### Formulas

Every pixel in a low resolution channel overlaps nine pixels (3x3) of the HRV image. To calculate the high resolution red, green and blue contributions in a false-colour HRV image, the formulas shown opposite are used.

$$R_{hi} = \frac{LUM_{hi} \times R_{lo}}{LUM_{lo}}$$

$$G_{hi} = \frac{LUM_{hi} \times G_{lo}}{LUM_{lo}}$$

$$B_{hi} = \frac{LUM_{hi} \times B_{lo}}{LUM_{lo}}$$

$R_{lo}$ ,  $G_{lo}$  and  $B_{lo}$  represent the red, green and blue levels of a pixel from three of the low resolution channels while  $LUM_{hi}$  represents the value of one of the 3x3 HRV pixels that they overlap.

The luminance contribution for the low resolution channels is:

$$LUM_{lo} = R_{lo} + G_{lo} + B_{lo}$$

This value is used to normalise the colour values; as a result, the luminance contribution of the low resolution channels is removed.

$$R_{hi} + G_{hi} + B_{hi} = LUM_{hi} \times \left( \frac{R_{lo}}{LUM_{lo}} + \frac{G_{lo}}{LUM_{lo}} + \frac{B_{lo}}{LUM_{lo}} \right) = LUM_{hi}$$

So the HRV channel now provides the luminance and the low resolution channels only contribute to the chrominance of each pixel. This mapping method is implemented in *XRIT2PIC*.

### Results.

Figure 1a shows a normal colour composite image using  $B_{lo}$ =VIS006,  $G_{lo}$ =VIS008 and  $R_{lo}$ =IR-016. In figure 1b the same image is

shown using HRV for luminance and VIS006, VIS008 and IR-016 for chrominance, as described above. Clearly, a lot more detail is visible now.

In figures 2a and 2b, IR-016 is replaced by IR-039 to highlight the forest fires in Portugal last summer. This example also shows a big improvement in detail—with the exception for the fire spots themselves! This is because the HRV channel is not sensitive at 0.39 µm (so there is no high resolution information for this phenomenon). Moreover, the luminance near the fires is not very high in the HRV spectrum, so the fire spots don't pop-up that much. The lower resolution of the fire spots becomes clearer after zooming in (figures 2c and 2d).

The smoke plumes show a lot more detail because they show up well in the HRV visible channel. (All the images are from 12:00 UT on August 21, 2005). More examples are given in figure 3a/b and 4a/b (using the same colour mapping as in figure 1).

### Creating High Resolution Colour Images

Figure 5 shows how these images can be produced using *XRIT2PIC*. It is enough to check the 'Enable' and 'Hires' buttons in the 'Colours' box. By default VIS006, VIS008 and IR-016 are used but this may be changed in the 'Colour map' window which pops up after clicking on the 'Mapping' button (figure 6, page 26). Here any combinations of channels may be defined.

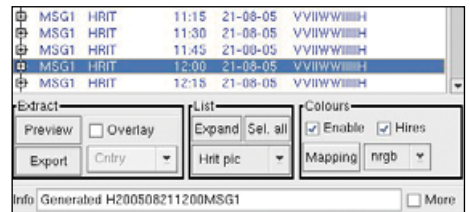


Figure 5

At the bottom of the 'Colour map' screen you can enter the percentage contribution for each channel; by specifying negative numbers, channels may be subtracted. (Note that in this window HRV is **not** checked, because this channel should only contribute to luminance, not to the actual colours!)

### HRV Earth Coverage

The HRV channel covers a smaller part of the Earth's disc than channels 1 to 11. Also, the upper part of the HRV channel covers a different spread between west and east compared with the lower part. As a result

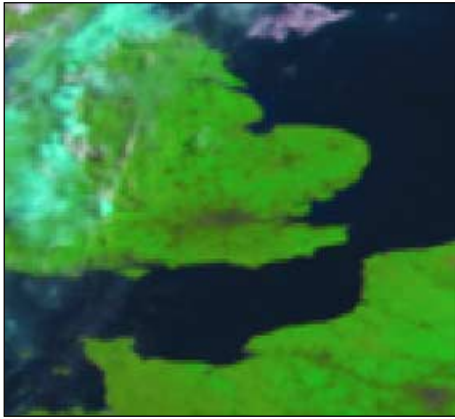


Figure 1a - The English Channel

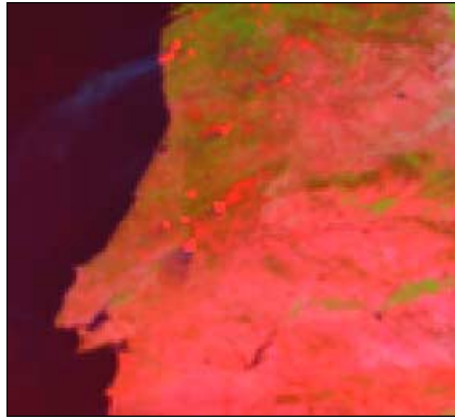


Figure 2a - Portugese forest fires

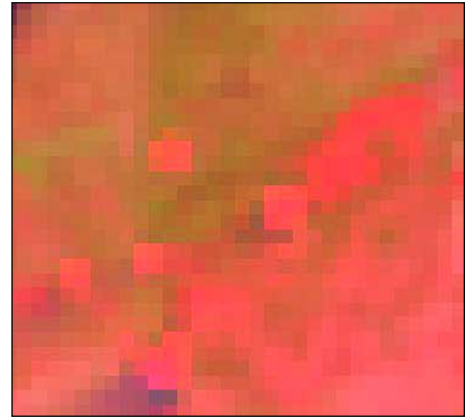


Figure 2c - Fire hotspots (zoom)



Figure 1b - The English Channel



Figure 2b - Portugese forest fires

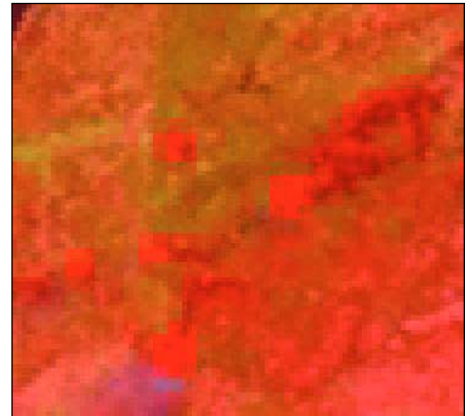


Figure 2d- Fire hotspots (zoom)

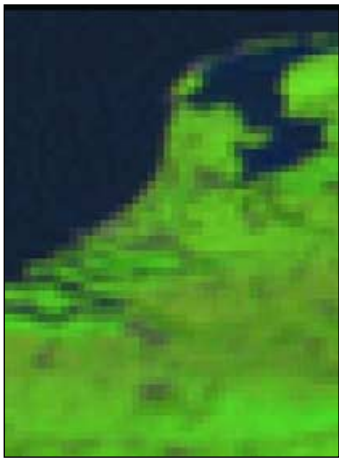


Figure 3a - Netherlands



Figure 4a - The Nile Delta

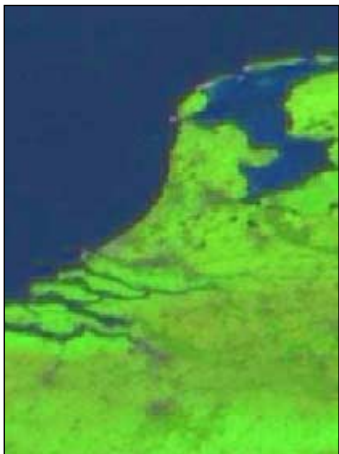


Figure 3b - Netherlands



Figure 4b - The Nile Delta

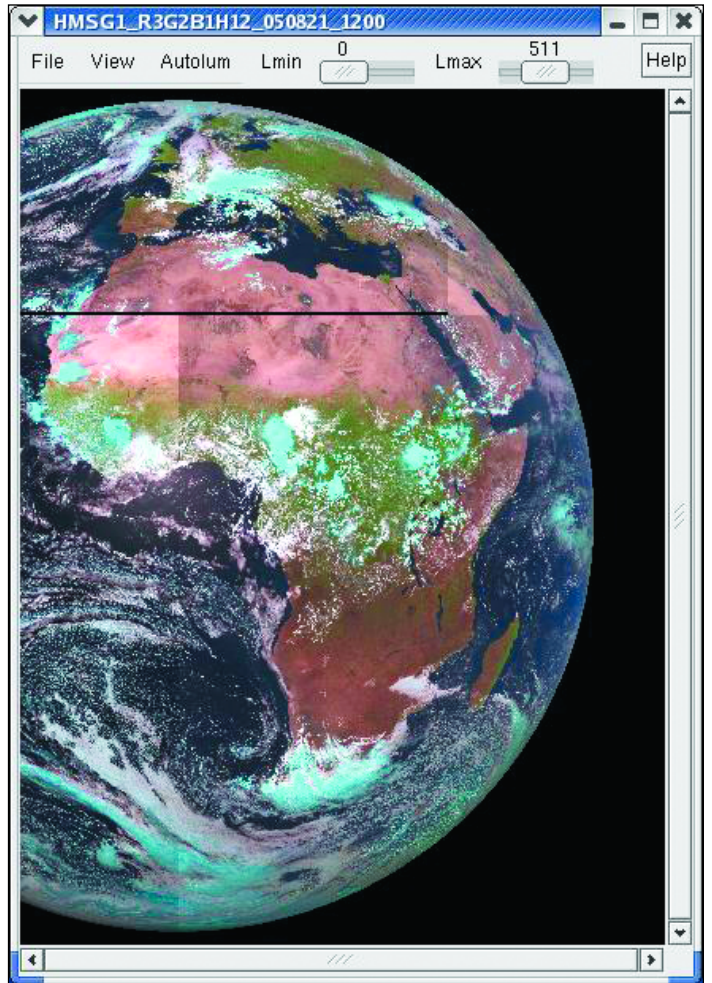


Figure 7 - An HRV colour composite

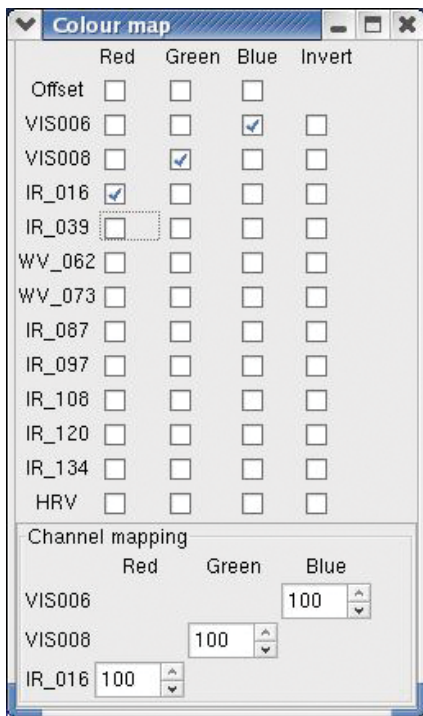


Figure 6

the HRV image is not square or rectangular shaped like the other channels.

Instead of extracting parts of the high resolution image, *XRIT2PIC* makes the composite image rectangular by displaying the parts which lack an HRV contribution in the normal low-resolution way. At the boundary there is a difference in brightness (because of the different mappings), and after zooming in differences in resolutions become visible. See figure 7, where the lower left and upper right parts are in low resolution.

**Processing Considerations**

I use a PC with 512 MB of RAM and that works fine. Maybe 256 MB would just work, but I wouldn't recommend that; I think that may cause lots of disc swapping.

Note that four images have to be decoded, including the HRV, so processing is a bit slow; but once you have created the colour image in a preview window you can enable 'Fast' in the 'View' menu. After one redraw the whole processed pic is in memory, and then zooming/panning is much faster (depending on how much memory you have in your PC: as said, 512 MB works fine).

The latest version of *XRIT2PIC* has a new feature that allows you to save zoomed pictures from the 'Preview' menu.

**More New Features**

**Anaglyphs**

Fred van den Bosch described how to make 3D images from weather satellite images in the last issue. Unfortunately,

several manual steps have to be done for each image. *XRIT2PIC* can now generate anaglyphs directly from HRIT/LRIT images; it is enough to check the new 'Anaglyph' button (figure 8) on the toolbar at the top of the window then click 'Preview'—and put on your coloured glasses.

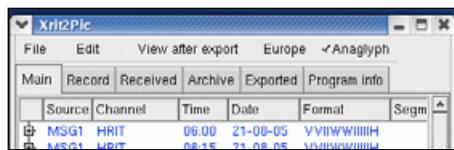


Figure 8

The methodology employed is very simple. Two shifted images are generated, one in red and the other in cyan, the amount of shift for each pixel depending on its brightness. The idea is that features nearer the observer (i.e. clouds) are brighter than far-away parts (land).

Currently the quality is not quite so good when compared with Fred's method, but the results can still be very attractive. Both black-and-white and coloured anaglyphs are possible, although black-and-white gives better 3D effects.

**Movies**

Up till now, *XRIT2PIC* needed an external program (e.g. *Mencoder*) to generate movies. The current version (2005.12 and later) has a built-in movie generator—no external program is needed any more.

It is also possible to generate 'live' movies; each time all required channels for a new image are received, a new frame is added. If desired *XRIT2PIC* can delete all raw data after each generated frame.

**In Conclusion**

All mentioned features may be combined: *XRIT2PIC* can generate high resolution colour anaglyph movies. It is questionable if this is useful. As I have already stated, the best 3D-effects are produced with black-and-white images. Also, the human eye needs some time to see the 3D effect, and this becomes a bit more difficult with moving images.

**References**

- 1 *XRIT2PIC*, a Tool to generate MSG Images  
Rob Alblas - GEO Q5, page 28
- 2 Create your own 3D Weather Images  
Fred van den Bosch - GEO Q8, page 24

The program *XRIT2PIC* can be downloaded, free, from Rob's website at:

<http://www.alblas.demon.nl/wsat>

Follow the link to 'Software' and download the following three files:

- xrit2pic.zip
- decompr.zip
- gtk\_dll.zip

You can also download an optional utility called *xrit2pic\_install.exe* which can automatically unzip all the files and install them in your C:/Program files folder.

**Cover Colour Images**

**Front Cover**

There was a total eclipse of the sun over north Africa on March 29 and Meteosat-8 captured this image showing the umbra poised between Niger and Chad at 09:45 UT. This false-colour HRIT image was processed by **David Taylor**.

Image © EUMETSAT 2006

**Back Cover**

**Norbert Puetz** captured this NOAA-18 APT image at 11:11 UT on March 6. The satellite had a maximum elevation of only 12 degrees from Norbert's location in Erding in Germany. If you look carefully you can detect the frozen rivers Volga and Ural in the snow-covered terrain to the north of the Caspian Sea.

**Erratum**

Due to an unforeseen problem, the fraction 'one quarter' was omitted from the final print of *Quarterly* No 9. The last paragraph on page 9 as well as the first on page 10 should have made reference to a 'quarter wavelength'. We hope this did not spoil your enjoyment and understanding of the article.

**The Wraase WRX-137 Receiver**

(continued from page 22)

equipment, with approximate equivalents in sterling are shown in the table below.

Unit	Price (euro)	Price (£)
WRX-137 Receiver	695.00	486.50
WRX-137 + Prosat for Windows software	785.00	549.50
KX-137 Turnstile	295.00	206.50
MX-137 'Mobile' Turnstile	355.00	248.50

You can learn more by visiting

<http://www.wraase.de>

**References**

1. Images produced on the Wraase WRX-137 weather satellite receiver by Hartmut Schaksmeier
  - GEO Q1, page 45
  - GEO Q2, page 17
  - GEO Q4, page 41
  - GEO Q7, back cover
2. APTDecoder, GEO Q8, page 15.



# The Oregon Scientific

## WMR-968 Cable-free Weather Station

Alan Swards

Oregon Scientific's WMR-968 cable-free weather station consists of five components:

- An indoor unit with temperature/humidity/barometer sensors (figure 1)
- an outdoor unit with temperature/humidity sensors (figure 2)
- a unit with wind speed and direction sensors (figure 3)
- a rain sensor (figure 5)
- a display console (figure 6)

These units are all linked by a 433 MHz radio link which has an effective range of about 30 metres in a masonry building. The antennas are visible in figures 3, 5 and 6. The kit comes with a simple starter manual but a more comprehensive one is available for downloading from *Ambient Weather*. Specifications for the system are presented in the panel at right.

I later added another component—a remote temperature sensor for my outdoor pool (figure 4); this has similar specifications to the outdoor thermo-hygrometer unit, except that it has no solar panel.

### Why I bought this System

I bought the WMR-968 a little over five years ago, direct from *Ambient Weather*. I chose it because, living in a masonry house, the running of cables was impracticable and the cable-free feature gives one a lot of latitude in selecting the right emplacement for the various sensors. At that time this was the only cable-free weather station on the market and there were no European suppliers. I suspect that the frequencies used for the cable-free wireless communications were not at the time allotted for this use in Europe, but no difficulties arose in shipment, and of course, I did not ask for permission to use them!

### Setting up the Station

Before setting up the station using the console, it is advisable to locate the various sensor units where you had planned to put them, to determine if communications are possible. The outdoor thermo/hygro unit should not, of course, be placed where it will be in sunlight and it is better to shelter it from rain, but, in the absence of a professional Stevenson screen (or, to make one, *Google*



Figure 1 - The indoor unit

'Stevenson screen'), I put mine under the eaves on the north side of the house. The anemometer should be located on the highest point available and away from trees if possible. The rain sensor should be placed well away from the house.

All the units require batteries, usually AAA but some AA. The sensor units (except for the indoor temperature/humidity/baro sensor and the outdoor temperature sensor with probe) have solar panels and capacitors to provide power during the day, so the batteries do last a long time. Once each unit is installed you must push the *reset* button using a ballpoint pen; then power up the display unit, set up the measurement units you wish to use, and press and hold the channel button (on the touch-sensitive screen) until it flashes. This causes the display to scan the various radio channels for the remote sensors and to acquire them. Once acquired, the values measured by the various sensors will be displayed. You can choose which units you want the station to use (degrees Fahrenheit or Celsius, mph or kph, inches or mm, and so on). The display unit normally resides indoors where it can conveniently be consulted. If one wants to use the backlit screen, its power transformer must be connected and plugged into the mains. It is also essential to use an external power supply if you want to connect the display unit to a computer via the RS232 serial port.

### Manufacturer's Specifications

for the Oregon Scientific's WMR-968 cable-free weather station

#### The Console

This features touchscreen desktop control with bright green HiGlo™ backlighting. The console is about 20 cm wide — perfect for desktop or wall-mount use anywhere. Console dimensions: 20 x 13.8 x 3.8 cm.

#### The Thermo-Hygrometer

The operating range of the outdoor thermo-hygrometer is  $-50^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  with resolution of  $0.1^{\circ}$ ; humidity range is 2% to 96% relative humidity (RH) with an accuracy resolution of 1%. Updating occurs every 37 seconds. The thermo-hygrometer is powered by a solar cell with battery backup.

#### The Anemometer

The anemometer measures wind speed and direction. The anemometer operating range is up to 125 miles per hour with accuracy resolution of  $\pm 0.4$  mph. Data transmission occurs every 14 seconds. The anemometer is powered by a solar cell with battery backup.

#### The Baro-Hygrometer

The baro-thermo-hygrometer measures indoor temperature and humidity, and barometric pressure. Its operating range is  $-5^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  with an accuracy resolution of  $0.1^{\circ}$ ; 2% to 96% RH with an accuracy resolution of 1%; 800 to 1050 mB with an accuracy resolution of 1 mB. The baro-thermo-hygrometer operates off four 'AAA' batteries.

#### The Rain Gauge

The rain gauge measures rainfall, reflecting current rainfall or accumulation of up to nine days' history using a self-emptying collection unit. The rainfall measurement range is 0 to 100 cm per hour with a cumulative operating range of 0 to 1000 cm with an accuracy resolution of 0.1 cm. Transmission occurs every 47 seconds. The rain gauge is powered by a solar cell with battery backup.

The entire kit has a 30-day return policy and a one-year factory warranty. Further information can be obtained from:

[www.ambientweather.com](http://www.ambientweather.com)



Figure 2 - Outdoor temperature/humidity sensor sheltered from the rain



Figure 5 - The rain sensor



Figure 3 - Windspeed and direction sensors

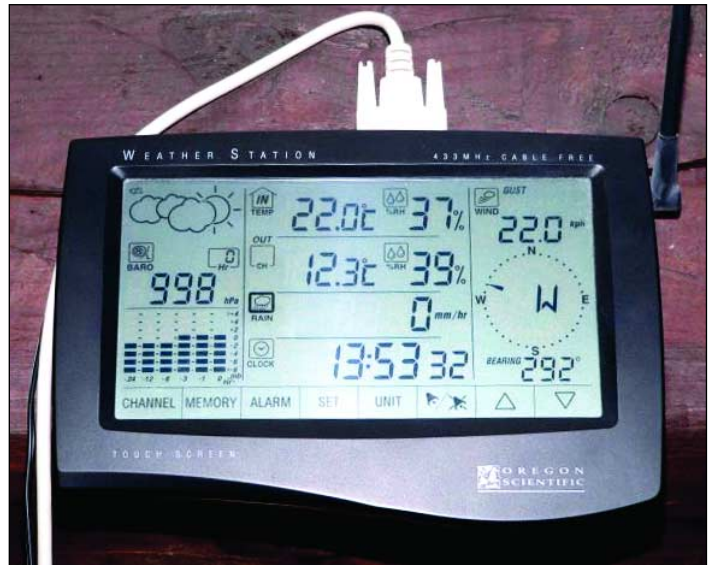


Figure 6 - Display console



Figure 4 - Outdoor pool sensor

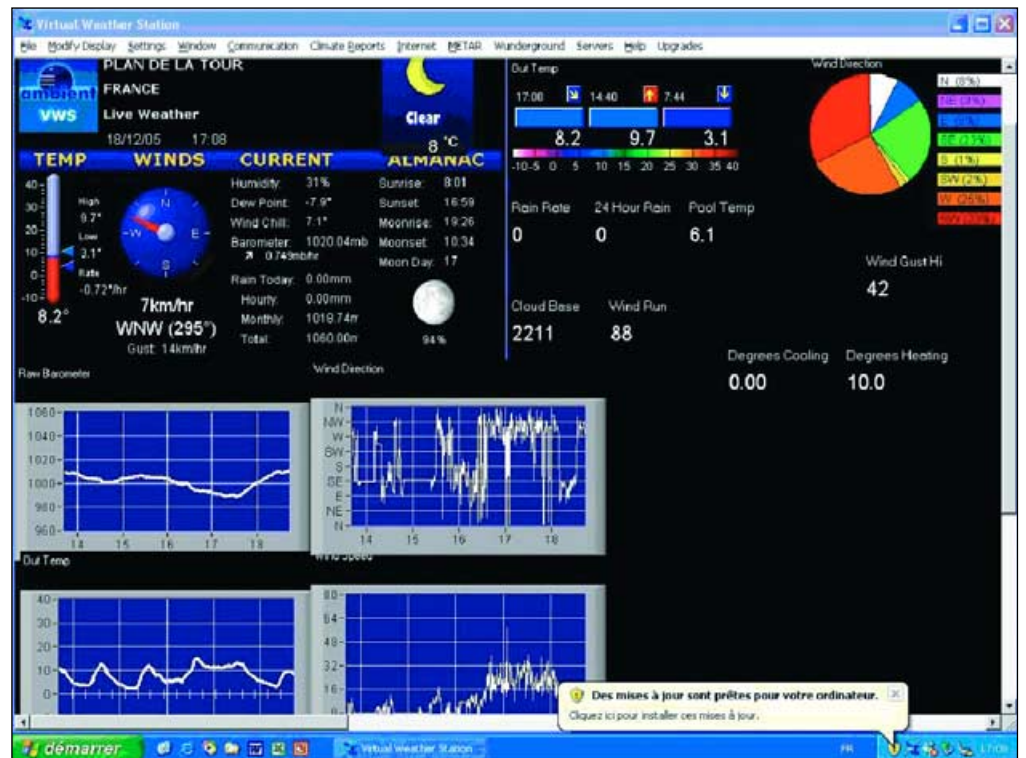


Figure 7 - The PC display of Virtual Weather Station

**Setting-up Problems**

If a sensor is not acquired, try moving the antennas on both the sensor and display. If this does not work, it may be necessary to try another location for the sensor unit. This is a trial and error process but with a little application suitable emplacements which allow communications can be found. I had the most difficulty with the rain sensor, which I wanted to keep as far away from the house as possible to avoid it being sheltered and thus giving incorrect readings. The add-on temperature sensor which I used for my pool also gave me a problem because of its depressed location; in this case placing the indoor display unit at a higher level enabled the signal from the outdoor unit to be received.

**Experiences with the WMR-968**

Over the five year period I have had the weather station it has performed well, although I have had to replace the wind direction/speed sensor unit and the indoor temp/humid/baro unit. In the former case, the sensor stopped indicating wind speed, in the latter, although the sensors continued to work well, the RF link would only work over a distance of a few centimetres! Both units failed after the one year warranty was up but within two years of purchase. The rest of the kit and the replacements have worked flawlessly.

**Software**

At the same time as I bought the weather station, I also bought the *Ambient Software* program *Virtual Weather Station* (VWS). This is a great piece of

software and is well worth its low price, especially as you get regular free upgrades. I originally purchased version 4 and it is now up to v 12.07, with all sorts of additional bells and whistles which weren't on the original. Recent versions have the capability to upload the weather station data to your website on a continuing basis, if that is what you need. The best thing about VWS is that it allows you to display the data from the weather station on your computer screen in a number of ways, including graphing it over the last few days, distribution of wind direction, etc. You can also display more data simultaneously than there is room for on the display unit (figure 7), and of course, the computer can store and retrieve the data. VWS also produces summaries each day, month and year in NOAA format, a sample of which is shown in the table below. I keep these summaries in a folder and find them very useful for comparing one year with another. The online database can be consulted at any time for any specified date of interest and, as the database is stored as a .csv file, it can be imported into an *EXCEL* spreadsheet and manipulated in whatever manner you wish. In this way you can keep years of weather data to the nearest two hours, all easily available at the click of a mouse.

I run the VWS software on an old IBM *ThinkPad T20* notebook computer via the serial link. The computer runs 24/7 and the battery back-up built into the machine is useful to carry me over short power outages. Outages longer than the

battery capacity result in the computer going into hibernation mode, but the weather station console stores a certain amount of data which is automatically uploaded when the computer comes back on again. Such computers are readily available second hand at very reasonable prices.

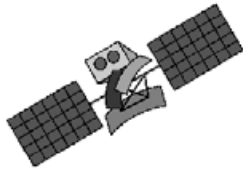
As mentioned above, VWS can be configured to upload weather data to your web site automatically. I have not used this function, as I don't feel that my data is of general interest, but if you are driven to publish all your data, this software allows you to do so.

**Summary**

After five years use of the station, it has become part of my life. I always check the readings first thing in the morning and last thing at night and frequently during the day. Being a receiver of weather satellite imagery (now MSG-1), I often compare what I see on the images with what the weather station is indicating and draw my own conclusions (which might be to turn on or off watering systems, add more cloth to vulnerable plants, and so on). The cable-free capability is very nice to have as the running of cabling around masonry houses is a very tedious business, so much so that it discourages you from installing systems or making changes to them. All in all, I can thoroughly recommend the WMR-968, but, as I mentioned, there may be other makes today which offer as good or better capability or reliability.

MONTHLY CLIMATOLOGICAL SUMMARY FOR 11/2005														
DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT COOL		RAIN	WIND SPEED			DOM DIR	MEAN BAROM	MEAN HUM
						DEG DAYS	DEG DAYS		AVG	HI	TIME			
1	18.0	20.4	1:02pm	15.9	10:18pm	1	0	2.00	2	19	10:38pm	SE1019.31	87	
2	16.8	19.6	2:19pm	14.2	8:15am	2	0	0.00	3	28	4:51am	SE1021.39	72	
3	16.9	19.3	2:30pm	16.0	12:28am	2	0	0.00	1	12	1:58pm	SE1021.98	90	
4	17.4	18.6	12:49pm	16.6	1:03am	2	0	1.00	3	19	12:54pm	SE1019.95	86	
5	16.7	18.0	1:31pm	14.7	10:35pm	2	0	1.00	1	17	6:14pm	SE1020.02	84	
6	14.9	19.5	2:49pm	11.8	7:35am	4	0	0.00	1	11	12:06pm	SE1021.85	77	
7	13.5	18.7	2:11pm	9.8	6:26am	5	0	0.00	1	12	2:17pm	SE1024.34	82	
8	14.1	18.3	1:39pm	11.4	12:29am	5	0	0.00	2	15	12:49pm	SE1026.18	84	
9	14.7	18.0	1:36pm	11.7	2:21am	4	0	0.00	2	19	1:45pm	SE1023.97	84	
10	15.0	19.2	1:29pm	11.3	11:40pm	4	0	0.00	1	17	1:18pm	SE1028.65	74	
11	12.7	18.4	2:34pm	9.0	7:44am	6	0	0.00	1	9	12:49pm	SE1029.01	72	
12	11.8	14.1	2:34pm	9.0	3:26am	7	0	40.00	1	17	7:57pm	ENE1021.53	89	
13	15.4	16.9	11:06am	12.3	1:26am	4	0	0.00	6	22	3:30pm	ENE1015.90	73	
14	16.2	17.0	10:45pm	14.7	3:33pm	3	0	12.00	6	21	12:53pm	NE1017.89	64	
15	15.0	17.2	2:57pm	11.5	11:37pm	4	0	1.00	4	35	8:36am	NE1012.24	73	
16	13.6	17.4	2:43pm	9.9	3:16am	5	0	0.00	12	43	11:11pm	WNW1002.77	67	
17	11.9	14.4	12:00am	9.2	11:57pm	7	0	0.00	15	48	9:19am	WNW1002.75	47	
18	10.6	14.9	1:37pm	6.7	7:13am	8	0	0.00	1	15	2:35pm	SE1012.21	63	
19	10.9	14.5	2:25pm	7.0	7:48am	8	0	0.00	2	15	12:05pm	SE1020.54	52	
20	8.3	13.1	3:03pm	4.7	7:06am	11	0	0.00	0	7	10:30pm	E1027.31	68	
21	9.7	13.7	1:34pm	6.7	11:56pm	9	0	0.00	3	21	1:35am	WNW1020.92	62	
22	9.7	12.8	1:01pm	5.9	7:11am	9	0	0.00	4	22	10:28am	NE1018.37	53	
23	7.6	9.8	2:48pm	3.9	11:59pm	11	0	0.00	1	14	10:47am	NW1017.52	54	
24	4.9	9.3	2:16pm	2.1	3:57am	14	0	0.00	5	31	7:07pm	WNW1012.17	57	
25	6.6	9.0	11:59am	4.0	12:00am	12	0	0.00	13	50	3:16am	WNW 999.21	59	
26	7.9	11.4	3:10pm	5.8	10:44pm	11	0	0.00	5	28	11:16pm	WNW 994.62	51	
27	6.6	9.4	2:51pm	4.7	8:15am	12	0	0.00	17	44	9:20am	WNW 997.32	42	
28	7.3	10.9	2:50pm	5.0	7:09am	11	0	0.00	16	45	8:35am	WNW1004.85	40	
29	7.2	11.6	2:37pm	3.7	1:38am	12	0	3.00	4	32	5:47pm	WNW1005.84	74	
30	6.6	10.6	2:57pm	4.2	7:33am	12	0	0.00	8	32	1:16am	WNW1007.65	61	
TOT	12.0	20.4	11/1/05	2.1	11/24/05	209	0	60.00	5	50	11/25/05	WNW1015.66	68	

HEAT BASE: 19.0  
COOL BASE: 24.0



# NOAAPORT



## A system for transmitting environmental data via C-band satellite

### Background

Imaging from geostationary Earth observation satellites has made great strides in recent years, most notably in implementing the transition from low-resolution WEFAX imagery to the much higher resolution digital LRIT. In the USA, the National Oceanic and Atmospheric Administration (NOAA) initiated a time-sharing phase commencing August 2003, during which WEFAX and LRIT images were disseminated alternately from its GOES platforms. GOES-E finally ceased transmitting WEFAX altogether on March 1, 2005, and when GOES-W followed suit on October 3 of the same year the transition to digital was complete, leaving thousands of enthusiasts without a low-cost option to access the data. Meteosat-7 will cease WEFAX transmission on June 14, signalling the end for WEFAX enthusiasts in Europe.

In Europe, a similar scenario at one time seemed likely when *EUMETSAT* commenced commissioning trials of their MSG-1 satellite (now named Meteosat-8) in late 2002. However, in one of the most bizarre strokes of bad/good luck, one of the power amplifiers concerned with transmitting the digital data from the satellite failed. This forced *EUMETSAT* to explore a new, and, in this context, hitherto unthought of transmission method, DVB-S (Digital Video Broadcasting from Satellite). The outcome was the *EUMETCast* system, where MSG data is transmitted to end users via the commercial *Hot Bird-6* satellite, whose primary function is the provision of satellite-TV.

For over three years now, ever since the *EUMETCast* service commenced in late April 2003, enthusiasts in Europe have been able to enjoy superb digital geostationary satellite imagery from around the globe. All that is required to achieve this are an 85 cm offset TV dish fitted with a standard digital TV LNB, an appropriate DVB receiver card or USB unit, twin computers for receiving and processing the data (or a single high-powered modern PC), plus appropriate acquisition and processing software, and a licensed hardware key. The total cost of all this (PC excepted) is unlikely to exceed £300 (\$550)

### NOAAPORT

Only a very few of our American readers are fortunate enough to have access to *EUMETCast* through its C-band service. This is transmitted via the *Atlantic Bird-3* satellite, whose footprint just touches the easternmost parts of the USA. For the majority of Americans, digital geostationary satellite images are now only available for direct download using the *NOAAPORT* service, which is operated by the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration (NOAA).

Superficially, there are many similarities between *NOAAPORT* and *EUMETCast*. *NOAAPORT* provides one-way broadcasting of NOAA environmental data and information, in near-real time to end-users, on C-band, using the commercial *GE Americom* GE-4 satellite (also known as *AMC-4*) located at 101°W (figure 1). Digital telemetry from both the GOES-E and GOES-W satellites, environmental sensor information from the GOES Data Collection System (DCS) [1], radar products, observations, forecasts, watches and

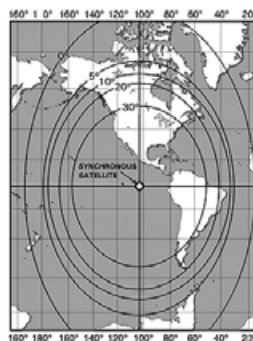


Figure 1 - AMC-4  
Credit: NOAA

warnings, plus other meteorological data from various NWS facilities are processed to create products. These are then sent to the Network Control Facility (NCF) which routes them to one of the four *NOAAPORT* channels for uplink and retransmission. And from June 7 this year, NOAA polar orbiter data will be added to the service on a pass by pass basis. The major operational components that feed data to *NOAAPORT* are shown in simplified form in figure 2.

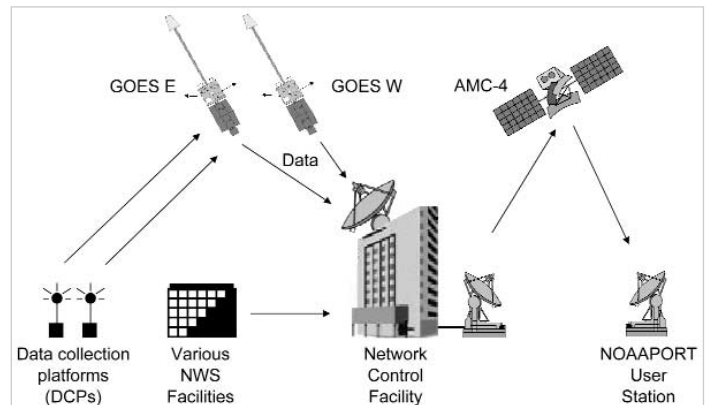


Figure 2 - Simplified *NOAAPORT* System Overview

### The *NOAAPORT* Receive System

In March 2005, the transmission mode for *NOAAPORT* data streams changed to Digital Video Broadcasting via Satellite (DVB-S), '... allowing inexpensive equipment to be used to demodulate the data ...', according to NOAA. 'Inexpensive' is obviously open to interpretation: at present there are only a handful of commercial vendors supplying *NOAAPORT* systems. These cost a minimum of \$10,000 and, depending on options, as much as \$20,000 or even more. Even if you are prepared to build your own system, as explained by José Nieves (see opposite), the cost is still likely to be several thousand dollars, many times the cost of a *EUMETCast* DVB system.

In order to receive *NOAAPORT*, end-users require to purchase a DVB-S receiver, a 10-foot (3-metre) dish and a second network interface card for their reception PC, as well as installing new software to read and process the received data. The requirement for the 10-foot dish is driven by the necessity to use C-band (with its lower susceptibility to rainfall attenuation) and by the close spacing of satellites in the American C-band belt: the large dish size is required to achieve a narrow beamwidth to minimise interference from adjacent satellites.

Inevitably, this forces up the cost in comparison with domestic satellite TV. The *NOAAPORT* satellite broadcast is operated by the US government and does allow users to enjoy unrestricted, royalty-free use of the data. The only cost is the one-time investment in the ground station. But the costs of the system, perhaps coupled with Internet access to much of the data, has undoubtedly resulted in much lower take-up of the system by the amateur community to date.

### *NOAAPORT* Product Dissemination

One feature that will surprise most GEO readers is the fact that *NOAAPORT* is data driven and there is no set schedule for any specific meteorological product. Rather, prevailing weather conditions determine what data is made available and which products are created and disseminated. When operating

continued on page 43 ...

# One Year with NOAAPORT

## A guide to reception equipment and processing software

Jose F Nieves

Department of Physics, University of Puerto Rico

GEO are delighted to have received this very comprehensive and detailed guide which covers everything a prospective user of NOAAPORT requires to know about setting up a system. GEO is mindful that NOAAPORT is not accessible to the vast majority of our readership, so just a synopsis is presented here. The entire article is available as a PDF download from the GEO website at

[www.geo-web.org.uk/sats.html](http://www.geo-web.org.uk/sats.html)

from the section headed 'The American NOAAPORT System'.

### Synopsis

Following a brief overview of the NOAAPORT system, focussing on the collection of meteorological data from various sources and the subsequent routing of products through the system, José explains how switching to the DVB-S transmission format and open specification now allows an end user to assemble a receiving station from off-the-shelf parts for a fraction of what it cost just a few years ago. Early in 2005 José learned that the NOAAPORT signal could be received from his location at San Juan in Puerto Rico. Very little was then known about it but, convinced that a usable signal could be received, José erected his own dish and embarked on a project to write the necessary software to receive and process the data. Since then, José has been constantly working on his system, which has now reached a mature level. The article continues by describing his experiences, the equipment that is required to receive NOAAPORT data, the necessary computer hardware and software needed to process it, and how these can be used.

### The Dish Antenna

To receive the signal, a C-band dish, with an associated LNB and an appropriate DVB-S receiver are required. There has been much discussion about the best dish to use and the consensus is that the smallest reliable one measures 10-feet; 7-foot dishes have been experimented with but these did not provide a signal that was strong nor stable enough. The LNB used with the dish is less critical. It is also explained how it can be useful to install an actuator (motorised arm) so that the dish may be aligned by remote control. José concludes this section by describing at length how he installed his dish.

### The Receiver

José recommends the Novra S-75 receiver which costs around \$350 and is available from satellite equipment dealers. He also discusses PCI receiver cards that can be installed inside your computer but stresses that it is advisable to use these in a separate dedicated receive PC because processing the NOAAPORT data is very resource-intensive. Trying to achieve both capture and processing on the same PC 'is a recipe for disaster'.



The Novra S75 receiver, under 12 cm wide

The receiver has two connectors on the back, one for the download from the dish and the other an ethernet port for communication with the computer. Configuration of the receiver, accomplished with the aid of software from an accompanying Windows CD is explained, followed by hints on how best to connect it to the processing computer. Two options are discussed: using a computer equipped with two ethernet ports and employing a crossover ethernet cable, or alternatively connecting both the computer and the receiver to an ethernet switch.

### Software

The choice of computer is very much dictated by the software it is planned to use, and José describes at length the NBSP (NOAAPORT Broadcast System Processor) software package which he has been developing. Previously the only software that had been available were LDM (Local Data Manager) and an associated decoding and display package from Unidata called *Gempak*. It is noted that LDM and *Gempak* run only on UNIX or Linux operating systems. In addition, *Gempak* constrains the user to store satellite images and other data files in particular formats that cannot be viewed or used immediately with other software, including Web browsers. As this was far from ideal, José designed NBSP, which is distributed free. NBSP is under constant development on a computer

running FreeBSD. Whenever a new version is ready, compiled binary packages for FreeBSD, the Fedora Core distribution of Linux and the *Cygnin* environment for Windows are made available. Both the software and the manual may be downloaded from:

<http://www.noaaport.net>

There follows a lengthy and somewhat high-powered description of NBSP's features and system configuration—hard to follow if you are unfamiliar with NOAAPORT but essential reading for anyone involved with setting up their own NOAAPORT system.

### System Configuration

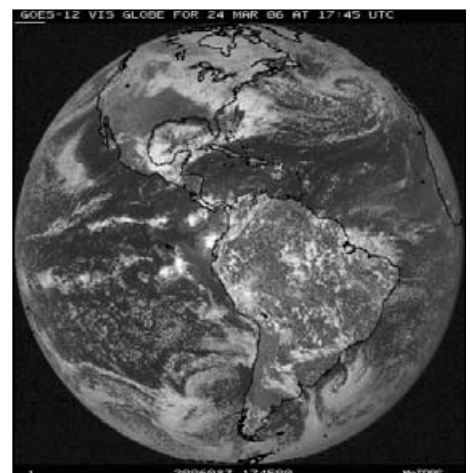
This section discusses a structure for default directories to store both downloaded and derived products; numerous screenshots and charts are provided to illustrate the types of product that can be achieved using the data downloaded via NOAAPORT. Much use is made of Digital Atmosphere Workstation in this respect, and the author concludes with a sample DAWS script for producing a colour temperature fill.

Finally, there is a unit describing the distribution of files over the Internet using an NNTP server.

The entire article is available as a PDF download from the GEO website at

[www.geo-web.org.uk/sats.html](http://www.geo-web.org.uk/sats.html)

from the section headed 'The American NOAAPORT System'.



A typical GOES-W full disc visible image downloaded via NOAAPORT

Credit: SSEC, University of Wisconsin-Madison

# C-16 Iceberg Smashes into Ice Shelf



Antarctic ice shelves periodically experience calving events which produce quantities of sizeable icebergs. One such event occurred in March 2000 when the Ross Ice Shelf in western Antarctica released a number of large fragments. These have been drifting around the Ross Sea ever since and include the large tabular B-15A iceberg (*GEO Q1, page 24, GEO Q5, page 27*) and a smaller 55 × 18.5 km fragment known as C-16.

Virtually immobile after grounding itself north of Ross Island, C-16 finally freed itself early this year, since when surface ocean currents have been carrying it north towards the floating Drygalski Ice Tongue (*GEO Q6, page 11*), an 80-kilometre protuberance from the David Glacier. Should this tongue break loose completely, scientists fear that major changes to

both ocean currents and local climate could ensue. Finally, on March 30, 2006, C-16 collided with the tip of this ice tongue, breaking off its easternmost corner and forming a new iceberg measuring 13 × 11 kilometres and now designated C-25.

The Advanced Aperture Synthetic Radar (ASAR) aboard ESA's **Envisat** satellite (*GEO Q1, page 22*) acquired this wide swath image of the March 30 collision, providing spatial resolution of 150 metres.

ASAR, which has the ability pierce through clouds and image even in total darkness, is capable of differentiating between different types of ice.

*Image: European Space Agency. All rights reserved*

# Earth Imaging News

*Peter Wakelin*

## MetOp-2 Shipped to Launch Site

Europe's first polar-orbiting weather satellite, **MetOp-2**, arrived at the Baikonur Cosmodrome in Kazakhstan on April 18 aboard an Antonov-124 transport aircraft flight from Toulouse, France. Launch is scheduled for 1626 UTC on July 17, on a *Soyuz ST / Fregat* vehicle operated by *Starsem*, to a planned 837 km sun-synchronous orbit. Spacecraft have been launched to sun-synchronous orbits from Baikonur before but always in a south-westerly direction; this will be the first to head out on a north-westerly trajectory taking it across Greenland and central USA on the initial orbit, a trajectory which, not so many years ago, might have had extremely undesirable consequences.

## Geostationary Lightning Mapper Contracts Awarded

Contracts for the formulation phase for a new instrument to be flown on the the next-generation **GOES** spacecraft have been awarded to Lockheed Martin Space Systems Company Advanced Technology Center of Palo Alto, California, Ball Aerospace & Technologies Corporation of Broomfield, Colorado and to ITT Industries Space Systems Division of Fort Wayne, Indiana.

The Global Lightning Mapper (GLM) comprises a high-speed optical detector and associated electronics to provide a real-time map of lightning activity over the full disk. The first GLM is scheduled to fly on **GOES-R** in six years' time.

## Sich-1M Burns Up

Sich-1M was launched in December 2004 but the engine burn to circularise the orbit was unsuccessful, leaving the spacecraft in an eccentric orbit with a perigee below 300 km. Atmospheric drag at this altitude was too great for the gravity-gradient stabilisation system to cope with and little or no useful imagery was received. *US SPACECOM* sensors predicted burn-up time at about 2050 UTC on April 15 which is in good agreement with the re-entry sighting by an observer in central France at 2054 UTC.

## Replacement CryoSat to be Built

The launch of CryoSat in October 2005 was unsuccessful due to the failure of its *Rockot* launcher but approval for a replacement, CryoSat-2, was announced in February by ESA's Earth Observation Programme Board.

**Cryosat-2**, expected to be launched in March 2009 on a three year mission, will carry SIRAL (SAR/Interferometric Radar Altimeter) to precisely measure changes in elevation and thickness of both land and sea ice to within about 200 km of both north and south poles. Precise measurements require knowing the spacecraft's orbital parameters to a very high accuracy and, to achieve this, a laser retro-reflecting system and an onboard ranging instrument called DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) will be incorporated into the payload. In addition, there will be three star trackers to maintain precise radar antenna orientation.

## Canada to Build Three More Radar Satellites

Canada's Radarsat-1 was launched in 1995 and **Radarsat-2**, with improved resolution, is being tested at the Canadian Space Agency's David Florida Laboratory in Ottawa prior to its shipment later this year to the Baikonur launch site in Kazakhstan.

Design and mission definition work has now started on a constellation of three small Earth-observation radar satellites to complement the Radarsat programme. They will provide more timely and comprehensive data than is currently available,

enhancing the tracking of ice in Canada's navigational waters and supporting safe shipping in the Great Lakes, the St Lawrence Seaway and along Canada's coastlines. The constellation will also support Canada's contribution to global disaster management and rescue efforts by detecting oil spills, monitoring floods, landslides and eruptions and aiding forest fire-fighting. The satellites will be capable of imaging day and night and in all weather conditions. More on this and other activities of the Canadian Space Agency can be found at:

<http://www.space.gc.ca/asc/index.html>



Canada's Radarsat-2 resolution will be better than that seen in this Radarsat-1 image of British Columbia

*Image credit: Canadian Space Agency.*

## First Meteor-M Spacecraft Launch Planned for August

The Meteor-M series of spacecraft is based on the proven Resurs-O1 series unified platform and the first may be launched as soon as August. As well as a low-resolution (1 km) six-channel

scanning radiometer, there will be an imager with 50 m or 100 m resolution at a swath width of 400 km or 900 km, a 29-channel atmosphere temperature and humidity sounder and an onboard radar complex.

Raw data will be transmitted at about 8 GHz but there will be direct readout in the new LRPT format on 137.1 MHz or 137.9 MHz and HRPT (not AHRPT) on 1700 MHz. The quoted 2 MHz bandwidth and 665kb/s data rate for HRPT are similar to those used by NOAA.

### Fifteen Years of Radar Altimetry

In March, oceanographers, glaciologists, hydrologists and geodesists gathered in Venice for the *15 Years of Progress in Radar Altimetry* symposium organised by ESA and the French Space Agency (CNES).

As it is now feasible to measure radar return pulse times to much better than nanosecond accuracy, it is possible to measure ocean surface levels to an accuracy of around two centimetres over vast oceans—a feat quite impossible by conventional sea-level measuring techniques. Meteorologists have long recognised the importance of knowing sea surface temperatures but, as there is a close correlation between atmospheric pressure and the height of the sea surface, a new tool has been added to their range to better predict such events as El Niño, for example, which can have such a huge impact over large parts of the Earth.

*Rossby waves* were first identified in the atmosphere in 1939 by Carl-Gustav Arvid Rossby and will be familiar to meteorologists as the large-scale meanderings of the polar jet-stream, whose restoring force is the variation in the Coriolis effect with latitude. Similar waves were theorised to exist in the oceans but, as their amplitude is only about 10 cm and their wavelength several hundred kilometres, their existence was not confirmed until the advent of radar altimetry from space.

In the ocean, Rossby waves are responsible for the asymmetry of circulatory vortices; an important effect for us in Western Europe is the resultant intensification of the western arm of the North Atlantic vortex that powers the Gulf Stream which keeps us warm in winter. It is possible that decreasing salinity in parts of the North Atlantic caused by the influx of fresh water from a warming Arctic region could influence the circulation in the North Atlantic, and radar altimetry satellites will help to detect any changes in this circulation.



Jason-2 will be similar to this artist's impression of Jason-1.

Image credit: NASA

Satellites launched in the 1970s proved that radar altimetry from space was possible but routine, precise measurements of ocean levels started in 1991 when ESA's ERS-1 satellite was launched. Further European radar satellites followed in 1995 (ERS-2) and Envisat was launched in 2002. TOPEX-Poseidon, a joint CNES/NASA project, carried an altimeter in 1992 with a follow-up mission, Jason-1, in 2001. An improved **Jason-2** is to be built for a planned launch in 2008. A good starting point for further information on radar altimetry is:

<http://sealevel.jpl.nasa.gov>

### MetOp Data Denial Implementation Plan Agreed

NOAA and EUMETSAT have signed a Data Denial Implementation Plan which secures the continued flow of real-time data from the NOAA-provided instruments on the MetOp spacecraft to public duty users in the US and EUMETSAT Member States during episodes that might otherwise require data denial. If, in a time of crisis or war, NOAA requests denial, then EUMETSAT will continue to provide real-time data to an agreed list of essential users.

### Satellites Help Detect Deep-Ocean Whirlpools

Researchers from NASA's Jet Propulsion Laboratory, the University of Delaware and Ocean University in Qingdao, China, have developed a method of detecting submerged, salty eddies called '*Meddies*' using data from several US and European satellites.

Meddies, first identified in 1978, are so named because they are formed by the flow out of the Mediterranean Sea through the Strait of Gibraltar. Due to its high salt content, the outflow through the Strait is more dense than the colder North Atlantic so this river of dense, salty water sinks to depths of more than 1000 m along the continental shelf and separates into clockwise-flowing eddies, typically a kilometre in depth and 100 km in diameter. These submerged meddies spin slowly westwards for many hundreds of kilometres and may last for more than two years before dissipating.

"Since Meddies play a significant role in carrying salty water from the Mediterranean into the North Atlantic, new knowledge about their trajectories, transport and life histories is important to understanding their mixing and interaction with North Atlantic water," said Professor Xiao-Hai Yan of the University of Delaware, reporting in the April issue of the American Meteorological Society's *Journal of Physical Oceanography*. "Ultimately, we hope this will lead to a better understanding of their impact on global ocean circulation and global climate change."

Radar altimeters flying aboard the NASA/CNES Topex/Poseidon spacecraft, NASA's *Jason-1* and ESA's *Envisat* measured the height of the sea surface compared to average sea level, revealing the difference in altitude where a Meddy entered the Atlantic. Specialised microwave radars called scatterometers on Japan's *Midori-1* and the SeaWinds instrument on NASA's *QuickScat* spacecraft, measured the surface wind over the ocean, providing the data needed to remove the surface variability 'noise' caused by the wind blowing over the ocean's surface.

While the technique is not yet 100 percent accurate, Yan and his colleagues are continuing to refine it and are exploring its application to other areas of the world. They are currently examining salinity variations in the East China Sea before and after construction of the Three Gorges Dam, the largest dam in the world.

### Improved Accuracy Sea Surface Temperatures now Available

Sea surface temperature (SST) is an important variable for weather and ocean forecasting and is increasingly seen as a key indicator of climate change. ESA's *Medspiration* project combines data from multiple satellite systems to produce a robust set of sea surface data for the waters around Europe and the Atlantic Ocean. These products are generated speedily for near-real time ingestion into forecasting models, and a high-resolution SST map focussed on the Mediterranean Sea with an accuracy better than 0.3°C is now produced daily.

Satellite instruments can only measure the temperature of the surface 'skin' of the water rather than the bulk SST beneath, which is what meteorologists and oceanographers want. However, especially in areas of light winds such as the Mediterranean Sea in summer, insolation can create a significant temperature gradient near the surface which dissipates at night with mixing.

*Medspiration* products now use SST measurements acquired only at night, and have recently improved the spatial resolution of SST maps by incorporating data from higher resolution sensors as well as data from the polar-orbiting and geostationary weather

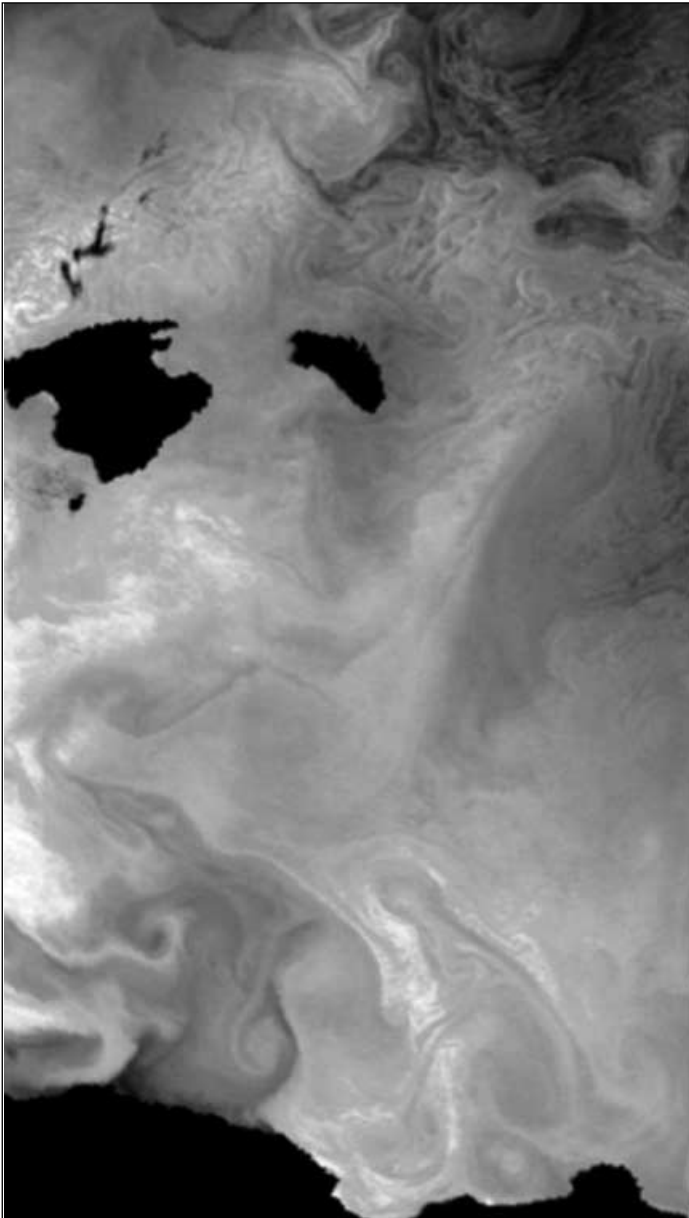


satellites. In addition to the Advanced Along Track Scanning Radiometer on ESA's Envisat, which can measure to 0.2°C, data are used from a pair of Japanese-built instruments, the Advanced Microwave Scanning Radiometer (AMSR) on NASA's *Aqua* satellite and the TRMM Microwave Imager (TMI) on the JAXA-NASA Tropical Rainfall Measuring Mission (TRMM) satellite.

These improved results from the *Medspiration* project also feed into an even more ambitious scheme to combine all available SST data into a worldwide high-resolution project known as the Global Ocean Data Assimilation Experiment (GODAE) High-Resolution Sea Surface Temperature Pilot Project (GHRSSST-PP).

More on the *Medspiration* project can be found at:

[http://www.esa.int/esaEO/SEM1XXNVGJE\\_index\\_0.html](http://www.esa.int/esaEO/SEM1XXNVGJE_index_0.html)



Amazing resolution of sea temperature variations near Spain's Balearic Islands  
Image credit: ESA

### Global EUMETCast-Style System Takes Shape

In view of the requirement for cost-optimised access to increasing volumes of data and products, access to satellite data will be through a composite system consisting of both Direct Broadcast (DB) and Advanced Dissemination Methods (ADM). As part of the Integrated Global Data Dissemination Service (IGDDS), ADM would be the baseline while DB reception would serve as a limited backup and for those without access to the ADM service.

It is envisaged that the data-dissemination satellites would be situated at five or six locations around the globe but, initially, commercial communications satellites near to the present five main DB weather satellites would be utilised.

At present, the most advanced implementation is EUMETSAT's *EUMETCast* system but India is making data from its *Metsat* spacecraft available to other countries in the area through a commercial satellite and China has quickly developed a retransmission service through the *ChinaStar-1* commercial satellite. China's *Shine Tek* system retransmits data not only from the Feng-Yun-1D, FY-2C, MTSAT and the NOAA polar-orbiters but also high-resolution imagery from the MODIS instruments on several other satellites. At present, this service is not available outside China.

The Study phase of NOAA's ADM system began in 2003 and has now progressed to the development phase, in which the primary concern is to demonstrate the viability of the system and to provide specific descriptions of what the ADM should consist. A partial operational service may begin in 2007. However, it is clear that NOAA will not be abandoning Direct Broadcast transmissions in the foreseeable future; a Multi-Constellation User Terminal (MCUT) is being developed to receive and process signals from a range of different polar-orbiting as well as geostationary satellites. The reception of high-resolution imagery from the forthcoming NPOESS polar-orbiters in X-band will require a precisely-steered antenna at least 2 m in aperture.

### Four Earth-Observing Spacecraft Launches in April

It is well known that radio signals are affected by passage through the atmosphere and **Formosat-3** was launched on April 15 by an Orbital Sciences Minotaur vehicle from Vandenberg, USA, specifically to measure the effect of the atmosphere on GPS satellite signals. The joint US/Taiwanese spacecraft, which is alternatively known as COSMIC (Constellation Observing System for Meteorology, Ionosphere and Climate), consists of six small 62 kg satellites each carrying a GPS receiver which, over a period of several months, will be moved to equally-spaced planes around the globe inclined at 72° to the equator.

Israel can launch satellites only in a westward direction over the Mediterranean Sea so the Russians put their latest imaging spacecraft, **EROS B**, into a polar, sun-synchronous orbit from their far eastern Svobodniy launch site in Amur region on April 25. The Israeli company, *ImageSat*, which is part-owned by the state-run Israel Aircraft Industries, said the 280 kg spacecraft has a resolution of 70 cm. The Russian news agency, ITAR-TASS, reported that the camera 'will permit Israeli intelligence to observe important Iranian targets in the most minute detail'.

China's 47<sup>th</sup> successful launch in a row since October 1996 placed the 2,700 kg **Yaogan** research satellite into the planned orbit. The Long March-4B rocket carried the payload—which will be used for surveying, crop yield estimates and disaster forecasts—from the launch site at T'ai Yuan on April 27.

The **CloudSat/CALIPSO** mission was to have been launched in 2005 but technical problems and the strike at Boeing, the makers of the Delta II launch vehicle, delayed the launch until April. Scheduled for lift-off during a one-minute launch window on April 21, the launch was aborted due to a technical problem. On successive days the launch was postponed due to technical problems, inclement weather or the non-availability of a support aircraft. The spectacular night-time launch from Vandenberg finally took place at 1002 UTC on April 28, and the two satellites are flying in formation in their planned sun-synchronous orbit. A more detailed account of this mission will appear in the next issue.



Night-time launch of CloudSat/CALIPSO  
Credit: Boeing / Thom Baur



**Ruud Jansen**

Translation by Chris van Lint

Following our visit to Brazil (*KM2005-1 and GEO Quarterly No 6*), my wife and I planned to revisit Goa, India's smallest state. Goa is a former Portuguese colony and enjoys special status within India: taxes are lower, beer is cheaper and the average standard of living is higher compared to the rest of India. This is mainly due to the presence of bauxite, which is used in aluminium production, and at the coast, on the river mouth near the township of Panjin, bulk carriers are loaded with this ore by means of a large number of small barges. The privileged position of Goa is responsible for the fact that on Sundays and other public holidays, dozens of buses from other provinces and from the city of Mumbai discharge their cargo of day visitors at various beach locations. The most popular of these is the village of Calangute, which boasts a beach approximately 20 kilometres wide, dozens of shops, big markets, small hotels and restaurants.

Although one sometimes nearly breaks one's neck tripping over stinking heaps of garbage and has to be careful not to step on the holy cows which roam free everywhere, a lot of resources are expended to ensure the streets and beaches are clean. On the part of the beach most frequented by tourists, a team of women ensures that the whole area is free from snippets of paper, empty bottles and other rubbish.

Even smoking is prohibited in the public areas of the beach. The shops recommend bringing your own plastic bags to carry your groceries, as the ones purchased from the shops are relatively expensive.

To put it in a nutshell, Goa is a nice holiday destination providing you are sensitive and aware of local culture. This means no topless appearances on the beach and no shopping in a bikini etc. Be

aware that, when you ask an Indian a question and he or she replies whilst shaking their head in a 'no' fashion, he or she means 'yes'. This will avoid quite a few problems when bartering in the market!

### Satellite Imaging

Although my wife and I had already visited Goa for two weeks last December, we went there again in February/March for a few weeks. This latest time I brought along my weather satellite gear,



The Arabian peninsula - NOAA-18 at 09:49 UT on March 2, 2006

consisting of the *KECIL137* receiver, the *PITA137* aerial and a minidisk recorder, together with a small *Sony* notebook computer.

The notebook was used to calculate the pass times of the NOAA-18 satellite, using David Taylor's *WXtrack* program, as well as for saving the minidisk sound recordings. This would also enable me to

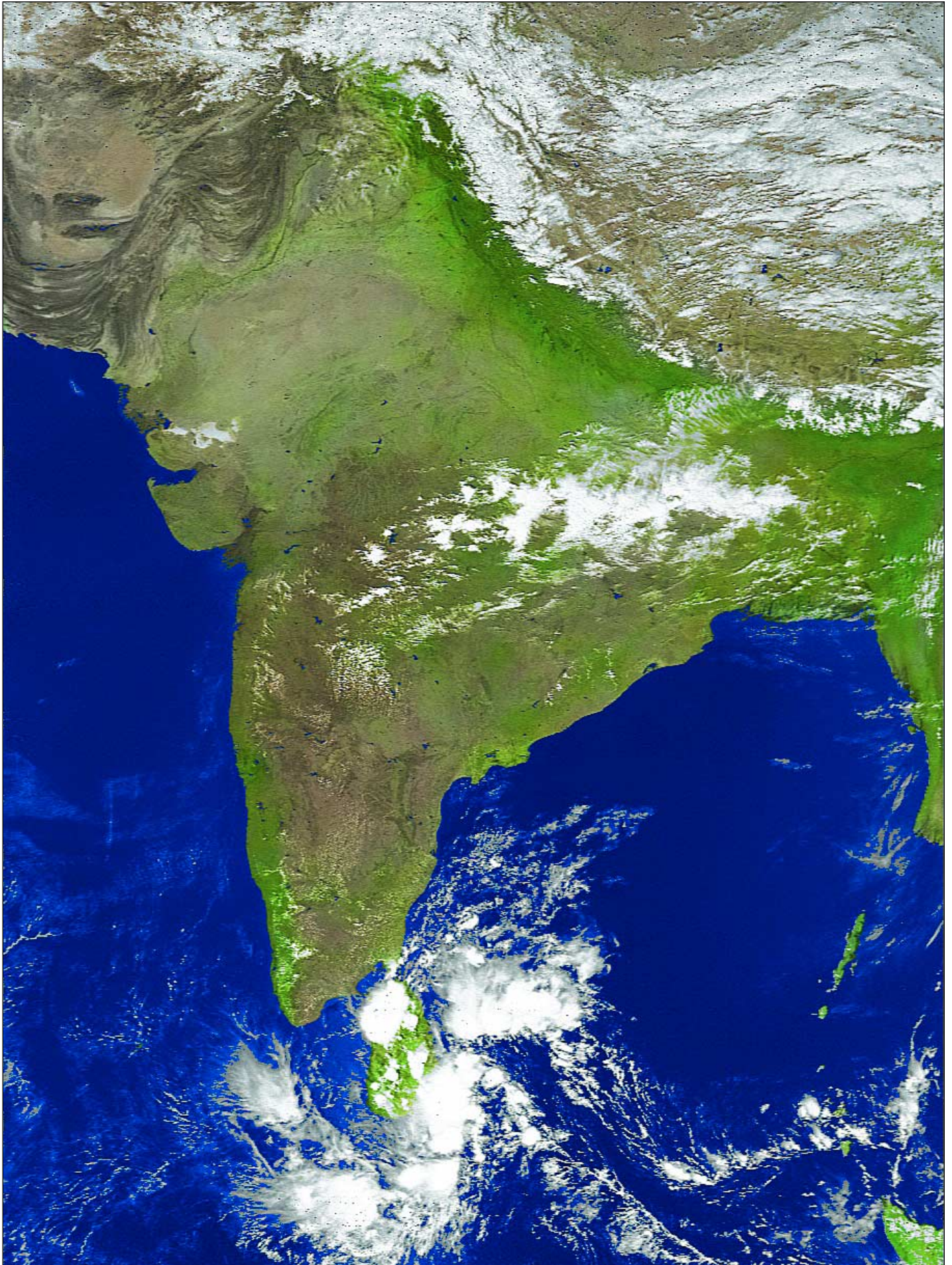
check whether or not the images were satisfactory. The final images were processed at home.

For both recording and imaging I used Craig Anderson's *WXtoImg* software. I chose the NOAA-18 satellite so that I would not have to get out of bed early, or have to wait at the beach until late in the evening. The aerial was partially hidden from sight and was hung under the roof of a so-called 'shack' (a beach tent with a straw and corrugated iron roof, situated close to the dunes). Notwithstanding this, I still attracted a large gathering of inquisitive locals. I had attached a piece of paper to my aerial on which I had written 'Danger - Radiation' in English in order to prevent touching, disassembly or distortion of my *PITA137*. I also had a visit from an angry shack owner who complained that I was scaring his customers away because of the radiation danger!

When the satellite was approaching, I would head for the aerial with my gear, connect it to my receiver, start the minidisk recorder and in the meantime drink a *Kingfisher* (local beer brand, named after one of the prevalent birds). By the time my bottle was empty, the satellite would have disappeared behind the dunes and I could disconnect my gear and return to my wife, followed by a cooling bath in the sea (28°C) as a fitting conclusion.

I have made a few images in this fashion. The most easterly pass (just behind the dunes) covered Thailand and the western point of Sumatra (Indonesia). The next pass was nearly overhead India and the following one produced images of the Arabian Peninsula. Unfortunately most of my images are marred by sun reflections (sun glint) on the sea surface. This is one of the unpleasant consequences of bright sunlight and almost no clouds (just a joke – the other consequences are a big thirst and a suntan).

By placing all the images I have made during my various holidays next to each other, I can cover an overlapping area from west Greenland to the south east coast of Australia. I also still have an image of part of South America (*GEO Q No 6*). In order for me to cover the whole world a few more holiday trips will be required, so there is still plenty to do in the future.



This splendid image of India was acquired by Ruud Jansen at 08:08 UT on March 2, 2006  
*KECIL137 receiver, PITA137 antenna and WXtolmg software*

# Reflections

## Relating features on the Earth's Surface to Satellite Images

Peter J Bradley G4BZE

Over many years of receiving weather satellite images I have marvelled at how certain lighting conditions can enhance their ability to detect features on the surface of the Earth. Given that the ground resolution at the sub-satellite point is approximately one kilometre for both the NOAA HRPT and MSG HRV, how is it possible that rivers, for example, which may be much narrower than 1 km, can be seen when the sun is in an appropriate position? Sun glint and shadows, particularly when the sun is at a low angle, can reveal structures, both on the Earth's surface and in clouds, that might otherwise not be discernable.

The concept of 'angle of incidence equals angle of reflection' explains very simply the reason for this happening. When a satellite is in such a position that rays of light from the sun reach the Earth's surface at the same angle as the reflected rays travel back to the satellite, especially from a still body of water (sea, lake, river), that surface acts like a mirror to produce an artefact in the satellite image that is generally described as *sun glint*. This situation is shown in figure 1.

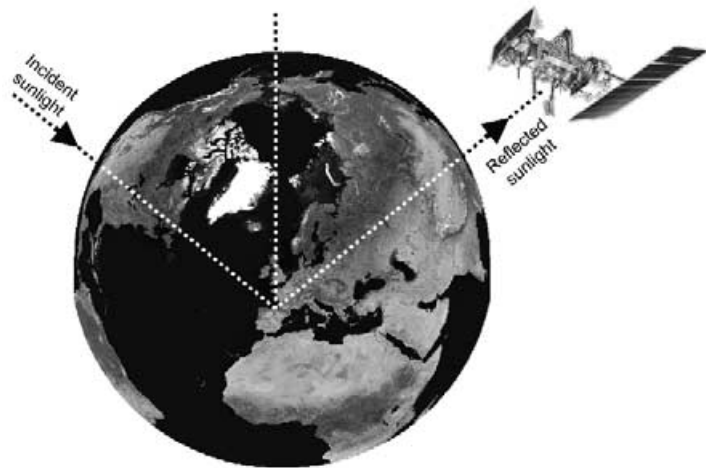


Figure 1 - The geometry of sun glint

Anyone who regularly collects weather satellite images will have seen examples of the larger manifestations of sun glint on APT, HRPT, the old PDUS and the new MSG-1 over the years. Figure 4 on the facing page is a prime example, a NOAA-14 channel-2 HRPT image received at 08:00 UT on April 17, 2003, which shows major sun glint over a large section of Europe east of the UK: note particularly the rivers Oder, Elbe and Rhine. It also shows a high pressure region centred over Britain with a more distant low pressure area on the southwestern side of the jet stream.

### Lake Victoria

Figures 2 and 3 show two Meteosat-8 segments from the same region of eastern Africa, centred on Lake Victoria. A close examination reveals some most interesting features from surprising sources. In figure 2, acquired at 06:00 UT, the first traces of sun glint make Lake Victoria prominent but otherwise the overall scene is a relatively flat and featureless landscape with the exception of a single mountain (Mt Elgon) to the north and the series of rift valley lakes to the east. 45 minutes later, with the sun at just the correct angle (figure 3), an amazing river system (which could be described as one of the sources of the Nile) is revealed; little evidence of it was apparent in the earlier image.

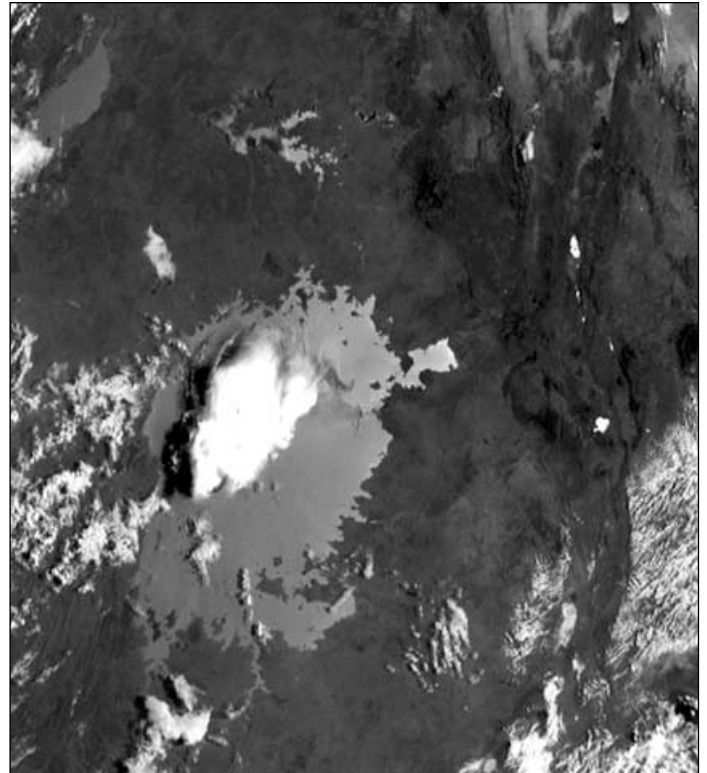


Figure 2 - Meteosat-8 at 06:00 UT on March 23, 2004  
Image © EUMETSAT 2004

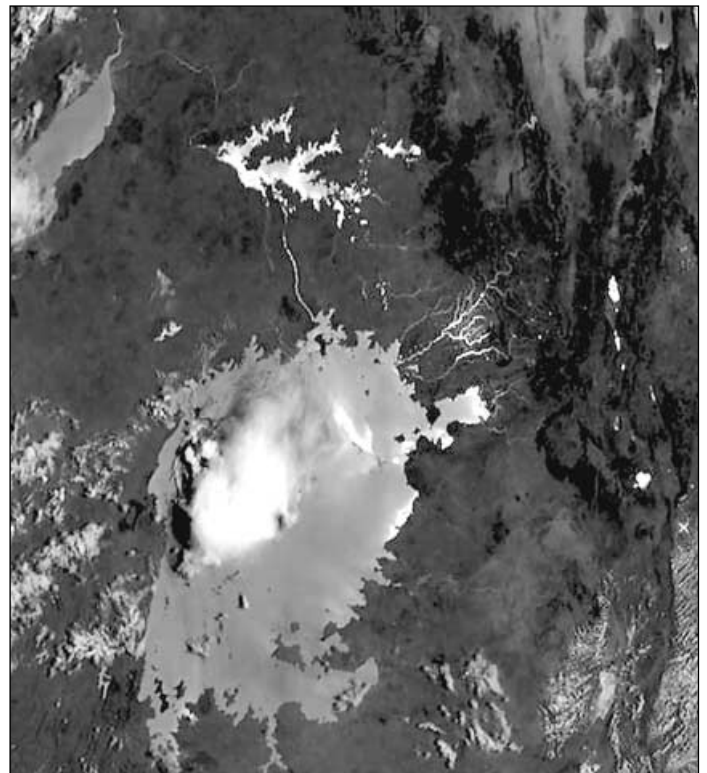


Figure 3 - 06:45 UT on March 23, 2004  
Image © EUMETSAT 2004

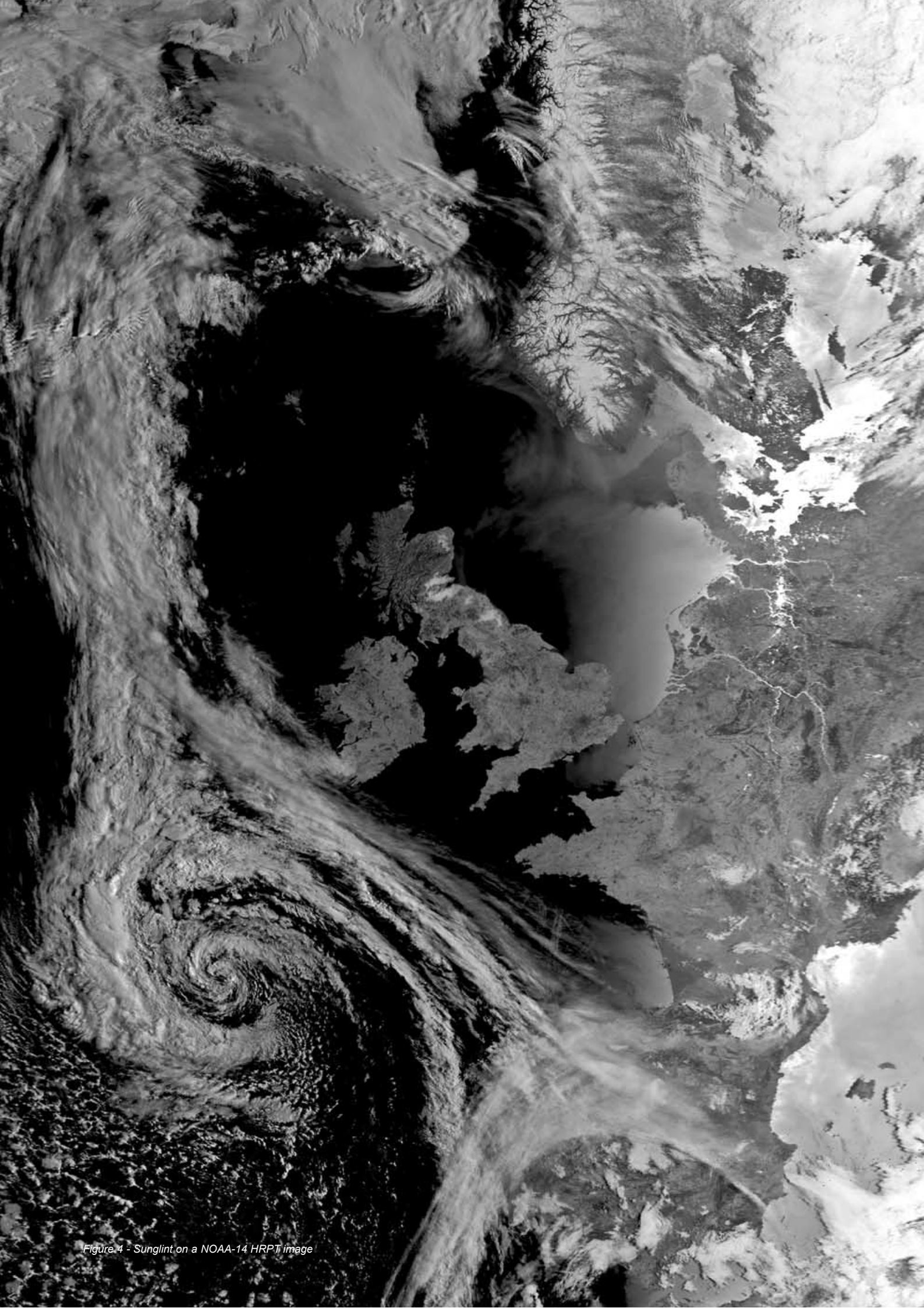


Figure 4 - Sunlint on a NOAA-14 HRPT image



Figure 5 - Mt Longonot



Figure 6 - The Webuye waterfall



Figure 7 - Cloud stretching north from the Pyrenees



Figure 8 - Pyrenees from France



Figure 9 - Pyrenees from Spain



Figure 10 - Steam plume from a French nuclear power station

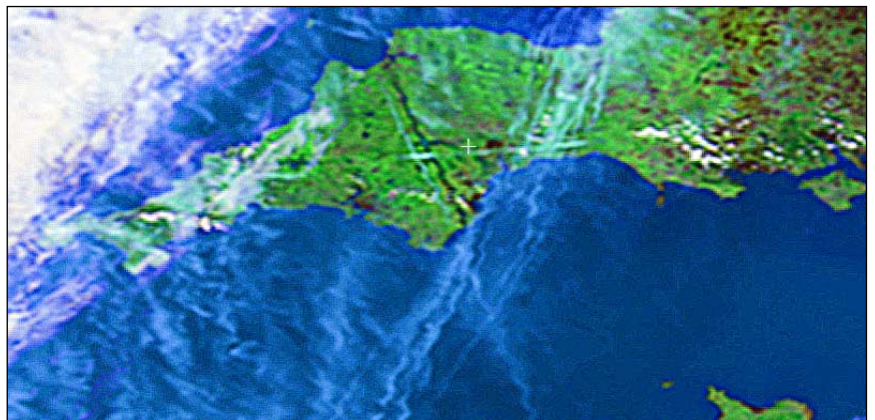


Figure 11 - NOAA 17 composite image showing contrails



Figure 12 - The same contrails, photographed by the author

Most of the rivers you see are considerably less than one kilometre across and therefore do not show up in the earlier image. When such sub-kilometre detail is revealed, the sun-Earth-satellite geometry is such as to mirror sunlight from the surface of the water directly towards the satellite and saturating some of its sensor elements, thus revealing the hitherto invisible river system. If one looks at an animated sequence of images it is very easy to see the sun glint crossing from east to west showing up many sub 1-km water course in the process.

Notice also, at lower right in the images, the apparent rows of cumulus humilis (fair weather clouds) which

come right up to the edge of the rift valley escarpment but not beyond. Also notice the huge storm cell developing over the western side of Lake Victoria itself, quite common during March.

When looking at some of these satellite images one might just wonder how early explorers would have felt had they known that, in the future, a few of these images could have shown them the total route of the Nile without the need for years of exploration in this vast and fascinating continent.

The White Nile flows from Lake Victoria through Lake Kyoga, a papyrus surrounded lake, then into Lake Albert, through a narrow gap

only seven metres wide in the surface rock at Kabelega Falls (Murchison Falls).

Figure 6 is a photograph showing another waterfall, at Webuye, which can be seen just above the glistening spot on one of the rivers (figure 13). From there, the Nile continues up through Uganda and southern Sudan, then the Sudd region (a vast papyrus swamp) and finally north to Khartoum where it meets the Blue Nile (from Lake Tana in Ethiopia) before flowing through Egypt to the Mediterranean.

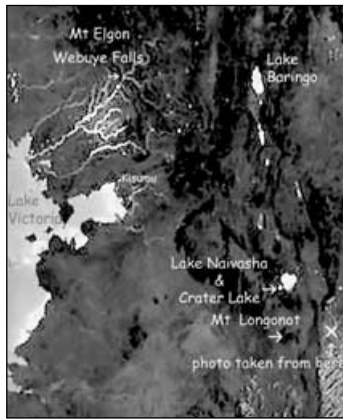


Figure 13 - Waterfall at Webuye

Mt Longonot (figure 5) is a dormant volcano, photographed from the position marked 'x' near the right-hand edge of figure 3. Mt Longonot was formed in the base of the rift valley and can be seen just south of Lake Naivasha. This lake is distinguished by having a small crater lake protruding from its southwestern shore.

Images acquired at weekly intervals as the sun moves north or south of the equator show different reflections. Figure 15 is an interesting example. The main region of sunglint encompasses the southern Red Sea and part of the Gulf of Aden; there are notably strong reflections around the Gulf of Tadjoura in Djibouti, and inland from Lake Tana, the largest lake in Ethiopia. Sunglint also makes it possible to see the small island in Lake Tana and the outflow of the infant Blue Nile. Though no mean river (it can extend to 400 metres in width when in flood), the Blue Nile is well below the normal resolution capability of Meteosat-8 HRV.

**Cloud Features**

Another example of how the satellite can image features that can be seen from the ground is that of the clouds to the north of the Pyrennes. The MSG image in figure 16 shows this phenomenon clearly; there is no cloud cover to the south of the mountains on the Spanish side but a considerable amount on the French side. Figure 7 was photographed while standing in bright sunshine just to the south of the clouds, from the top of one of the ridges on the Pyrennes and shows this cloud effect. These clouds hold a great deal of water which is deposited on the French side (figure 8) producing the lush vegetation whereas, on the Spanish side south of where the French photo was taken, there is very little rain (figure 9) and the landscape is very yellow and parched.

On one occasion, when in the Loire region, I was intrigued by a cloud which appeared to vary in size but stayed in exactly the same place every day (figure 10). It's shape changed depending on how strongly the wind was blowing and the air temperature, but always remained on station. When I enquired as to why the cloud remained there the response was something like 'nuage nuclear'. I was told that the cloud would sometimes rise

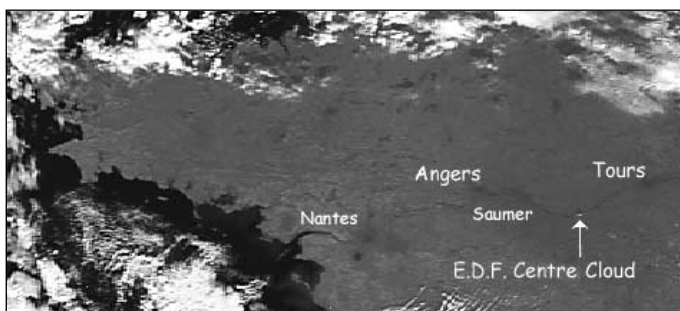


Figure 14 - NOAA 17 HRPT, 10:28 UT on December 12, 2005

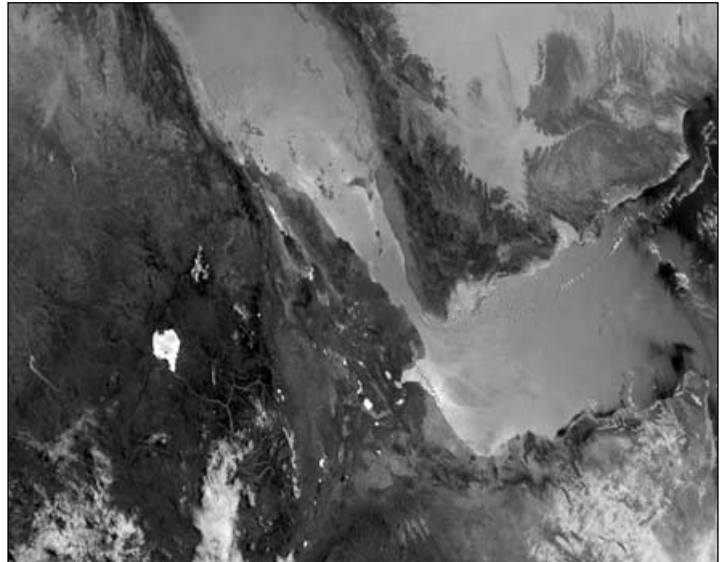


Figure 15 - Meteosat-8 HRV - 05:45 UT on April 5, 2004

Image © EUMETSAT 2004

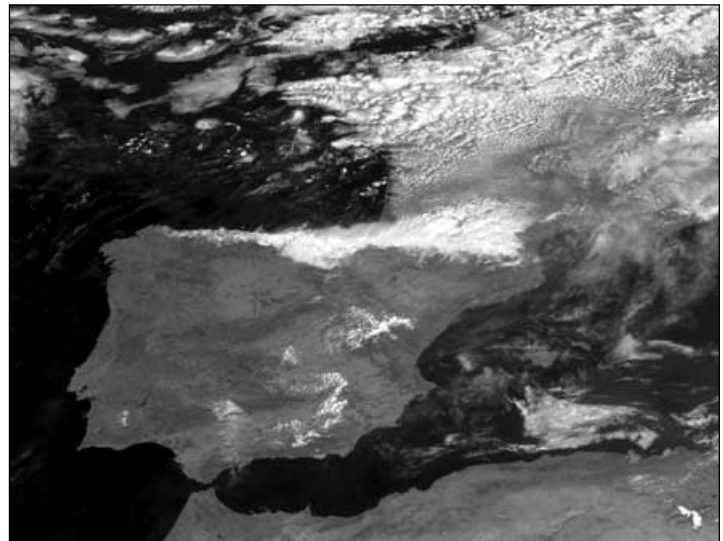


Figure 16 - Meteosat-8 HRV at 12:00 UT on June 4, 2005

Image © EUMETSAT 2005

hundreds of meters, particularly in the colder months of the year. It didn't take long to track down the cloud which was above the Nuclear Power station (EDF Centre Nucleaire) at the confluence of the Loire and the Visse just south of the small town of Bourgueil.

Curious to see whether this cloud was large enough to appear on any of the satellite images, I looked at some archived HRPT material. Figure 14 shows the cloud on a satellite image, very small but present. It is quite possible that similar images could be seen over Drax, Ferrybridge or similar power stations in the UK.

**Aeroplane Contrails**

My final example of what can be seen simultaneously from satellite and the ground is shown in figures 11 and 12. Two aeroplane contrails cross each other above the eastern edge of Dartmoor and they show up clearly in both the satellite image and the photograph. The contrail across the image can be seen above it's shadow which lies slightly to the east.

Figure 11 is a *Photoshop* composite of a NOAA-17 pass using channels 1,2 and 5, and was created in order to show both the vapour trails and the shadows—which do not show up well on any single channel. Channel-1, which showed the trail well, was assigned to the red image, channel-2, which showed the shadow well became the green image and channel-5 provided the blue component of the image. When combined, the composite gave an acceptable colour image.

# SOFTWARE SHOWCASE



Douglas Deans - dsdeans@tiscali.co.uk

The exciting news this quarter is the addition to the library of three new programs from David Taylor, whom many will know as the most prolific weather satellite program writer around. These are all programs associated with the reception and use of data from the *EUMETCast* system but will also work with data from others sources such as the Internet.

Whilst these programs have been about for some time they have never been available as Shareware; although David was often happy to allow new users a trial licence to evaluate the software, it was not appropriate to include them on the CD. However, the structure of the programs has now been changed and allows users a built in 30-day trial period. This means that software will now work straight from the CD for the evaluation period, making it an excellent candidate for the library. Registration is required for the software to work beyond the trial period.

Software charges are, in my opinion, very good value for money, especially with the unrivalled support that David provides. In addition there are some excellent composite packages with great savings, *MSG-1 Toolset Plus* being one that comes to mind.

The programs being added are *MSG Data Manager*, *MSG Animator* and *AVHRR Manager*. A brief outline of each of the programs is provided below and you can read more about *AVHRR Manager* on page 9 of this issue. I do hope that separate, more comprehensive reviews will be possible in future GEO publications. All the programs are now included on GS1. This CD is devoted exclusively to David Taylor's software and also contains lots of images and test data. You can find more information about these programs, and download them, from:

<http://www.satsignal.net>

## MSG Data Manager v 2.5

*MSG Data Manager* processes and manages the files received from the MSG satellites through the *EUMETCast* system, where data can be easily received using an inexpensive Digital Video Broadcasting (DVB) card and a domestic satellite dish. The program will, of course, also work with other sources of this data when they become available.

The huge amounts of high resolution digital imagery and meteorological data now available means that management is almost as important as reception. *Data Manager* not only processes the raw data

into images but gives the user control of what is to be processed: what should be kept and for how long. In addition, the program saves and manages lots of other meteorological images and data for subsequent viewing and processing in other programs. There is a vast array of user options and it would be difficult not to find a set-up suitable for everyone's use.

## MSG Animator v 2.5

*MSG Animator* is a fully automated program providing real-time animations of images processed and saved with *MSG Data Manager*, including *Meteosat 5* and *7* as well as all the foreign satellite feeds. Up to 30 different animations can be configured although automatic updating of all those might be rather onerous on the computer! The software provides lots of user-defined options, including number of frames, location of image within the full disc, full disc if required, palette choice and video processing options, smooth animations and many more—too numerous to mention here. For more complex animations with re-projections, weather chart overlays and many other combinations, *GeoSatSignal* should be used. However *Animator* is a must for quick, fully automated, up to date animations from MSG with no user input required after the initial set up.

## AVHRR Manager v 1.2.2

*AVHRR Manager* is a relatively new program (see page 9) and has been written to deal with an exciting new addition to the *EUMETCast* system known as *EARS-AVHRR*. As many of you will know, *HRPT* is the digital 6-channel 1-km resolution data from the NOAA satellites provided by the *AVHRR* instrument (from which *APT* is derived as a sub-product). There are already many stations in Europe and America feeding the *ATOVS* data to *EUMETSAT* for distribution via *EUMETCast*. *HRPT* is now being added from about five of those stations in Europe, Svalbard and Greenland.

When *MetOp* comes into service with similar data, *EUMETSAT* plans to distribute whole-world *AHRPT* data via *EUMETCast*. This will be a fabulous service although we may have to get bigger computers and hard drives! The data is sent in 1-minute segment files and the program, which is still under development, handles all the following functions and more.

- Decompresses and assembles the segmented data into composite *AVHRR* files ensuring that any out-of-order segments are correctly dealt with.
- Each completed pass is overlain on a quick-look map, and there are options to change the quality of the map.
- You can select audible warnings for new passes and new segments

- There is an option to view a list of passes for each receiving station and you can also add the location of those stations to the map.

The assembled file can be viewed in David's *HRPT Reader* program and there is a direct link to this (assuming you have it installed on your computer) via *AVHRR Manager*. The program is still under development and I expect that by the time you read this there will have been a number of new features added.

The only catalogue additions and changes this quarter are to CD GS-1, as listed below. The full catalogue appeared in *GEO Quarterly* No 9.

All David Taylor's weather satellite programs and libraries, including the current releases of *WXtrack*, *Satsignal*, *HRPT Reader*, *GeoSatsignal*, *GroundMap*, *RX2 PassControl* and many other program extras. This disc also contains a large quantity of sample files, many of high-resolution data, for use with these programs.

AVHRR Manager	Processes and manages the files for HRPT via EUMETCast	v 1.2.4
GeoSatSignal	Manipulates Geostationary weather satellite images	v 6.0.0
GroundMap	Rescales satellite images	v 2.0.0
HRPT Reader	Converts raw HRPT data files into images	v 2.6.4
MSG Animator	Automatic animation of MSG images following reception	v 2.5.0
MSG Data Manager	Processes and manages the files received from MSG satellites	v 2.5.0
RX2 PassControl	Computer control program for the RX2 receiver	v 3.0.8
SatSignal	Creates images from wave files	v 5.0.0
WXtrack	Satellite Tracking Program	v 3.5.4

### How to Purchase CDs

Write to the address below requesting GS1, GS2, GS3, GS4 or GS5. Prices are £5 for any single CD, 2 for £8, 3 for £11, 4 for £14 or all 5 for £17. Please enclose cash or cheque (made payable to Douglas Deans—not GEO) for the appropriate amount. Nothing else is required.

The cost includes CDs, packaging, posting and a small donation towards the cost of overheads. No fee is asked from overseas members although an exchange of software or interesting satellite images is always welcome. Orders are normally dispatched on the day of receipt.

### Order your CDs from:

Douglas Deans, 17 Montrose Way, Dunblane, Perthshire FK15 9JL, Scotland.



# Lowell Observatory, Arizona

Robert Moore

The 'Mars Express' article in GEO Q8 reminded me of my trip to Arizona. On my way to Grand Canyon at the end of October I had to stay overnight in the town of Flagstaff, the location of one of the world's most famous astronomical observatories. The location was chosen because Flagstaff is high up and very dry with no cities nearby, thus making it possible to observe all the year around. Whilst Flagstaff has grown since the late 19<sup>th</sup> century, its observatory still enjoys good conditions because the city has signed up to the *International Dark Skies Agreement*. Lighting in the city is carefully controlled; there is enough of it, but not too much, and no energy is wasted in lighting up the sky.

The founder and first Director, Percival Lowell (1855–1916), came from a wealthy family and took to astronomy only in his late 30s when, in 1894, he established the observatory in order to study Mars. Lowell was convinced that the patterns on the surface of Mars resulted from the activities of intelligent beings and he is forever linked in the popular imagination with life on Mars. However, he also searched for a *ninth planet*, which he believed must lie beyond the known planets in the solar system because of irregularities in the orbit of Neptune. Lowell made calculations of the size and orbit of this planet and, although he never saw Pluto (which was finally spotted in 1930), he started the search for it. Appropriately, Pluto was eventually identified at Flagstaff.



Over 33 000 light years distant and 120 light years across, M15 in Pegasus is one of the more conspicuous globular star clusters, on the threshold of naked eye visibility. This picture was made from CCD images taken at the KPNO 0.9-meter telescope in July and September of 1998.

Image: NOAA/AURA/NSF

The original observatory buildings, now an official National Monument, are mainly a museum and educational institution but both on site and at a centre a few miles away, serious research continues, mainly on the Kuiper Belt and the Moon. Lowell scientists collaborate with other institutions and have access to some of the world's largest telescopes.

I had the opportunity to look through two telescopes, although not Lowell's 24-inch Clark telescope (that would have been something—but it was not in use that night!). Through the McAllister 15-inch telescope I observed the star cluster M15 near the centre of the Milky Way. This is barely visible to the

naked eye but I saw it as thousands of stars, more and more densely packed towards the centre of the cluster. The image reproduced above will give you some idea of what I saw. It can be viewed, in colour, on the web page

[http://seds.lpl.arizona.edu/messier/more/m015\\_more.html](http://seds.lpl.arizona.edu/messier/more/m015_more.html)

where it is the seventh and final image.

Whatever its scientific importance, this cluster is a very beautiful object, whose light takes nearly 34,000 years to reach us. Through a ten-inch reflector I had a look at Mars (which was almost at its closest to Earth). The disc was very large and so dazzling that it was not possible to pick out surface details—the operator did not have an appropriate filter available. So I did not see Lowell's beloved 'canals'. Lowell would no doubt be as intrigued and amazed by the images from *Mars Express* as we are. Breathtaking seems too mild a description of the observations we can now make. Perhaps one day a GEO reader will write us a first hand description of a visit to Mars. I suspect rather few of today's readers will be here to enjoy that report.

There is lots to see and do at the Flagstaff Observatory; families with children are made very welcome and there appears to be an army of very expert 'amateur' astronomers around to guide visitors, answer questions and operate the telescopes. So if you happen to be passing that way – do drop in. Alternatively have a look at:

<http://www.lowell.edu/>

## Reference

Oliver Morton (2002) *Mapping Mars*, Fourth Estate (London and New York) ISBN 1-84115-669-8

... continued from page 30

## NOAAPORT

routinely, GOES does follow a standard scan pattern which creates certain products at approximate intervals, thus giving an appearance of 'scheduling'. But when particular weather conditions arise—hurricanes for example—NOAA will change the satellite's scan pattern and imaging rate to observe the event in greater detail. This changes the flow of data sent to the system for product creation: different products are now produced, disrupting the apparent 'schedule'.

Further information on all aspects of *NOAAPORT* can be found on the *NOAAPORT User Page* on the Internet [2].

## References

- 1 The GOES Data Collection System (DCS) is a relay system used to collect near real-time environmental data from earth-based platforms known as data collection platforms (DCPs) located in remote areas where normal monitoring is not practical. These platforms, which can be located on fixed sites on land as well as aircraft, ships, balloons and buoys, can be placed in remote locations and left to operate with minimal human intervention. They are used to monitor seismic events, volcanoes, tsunamis, snow conditions, rivers, lakes, reservoirs, ice cover, ocean data, forest fire control, meteorological and upper air parameters, and to provide ground truth information. Transponders aboard the satellites detect these signals and retransmit them to the Data Acquisition (CDA) station in Wallops Island, Virginia.
- 2 NOAAPORT Users' Page

<http://www.nws.noaa.gov/noaaport/html/noaaport.shtml>

# New Horizons



John Wills - email: veejay@uk2.net

In the last issue of *GEO Quarterly*, Francis Bell requested an image of the Caspian Sea area. Well, I thought I would send you some that I have received here in Cyprus over the last few months. At the same time, I'll take the opportunity of including a brief description of my setup.

I moved to Cyprus just over a year ago and am situated on the south coast, about 1000 feet above sea level, where I have unobstructed views all around: except to the south where a small hill just prevents me getting images stretching as far south as the Horn of Africa.

My aerial, illustrated opposite, is of the Sykes-Cobey QFH design, which works very well as can be seen from some of the low elevation images reproduced here. The receiver is from Dartcom, and has had a GEO/Dartcom EPROM fitted to enable me to receive NOAA-18. During last Summer I was using the Timestep *ProSat for Windows* software but have now installed *WXtoImg*. I have just completed building an *RX2c* which is now my standby receiver.

The images on this page were both captured from NOAA-17 last summer using the Prosat software. The upper one, which provided 11 minutes of almost perfect viewing from north of the Caspian Sea down to the Red Sea, started to fade out just before the Horn of Africa would have come into view. The satellite signal has been cut off, due to the small hill to the South of me. The lower image shows just about as far east as I can get, displaying the Indus River snaking back to the Hindu Kush. The maximum elevation for this pass was only 5.2 degrees.

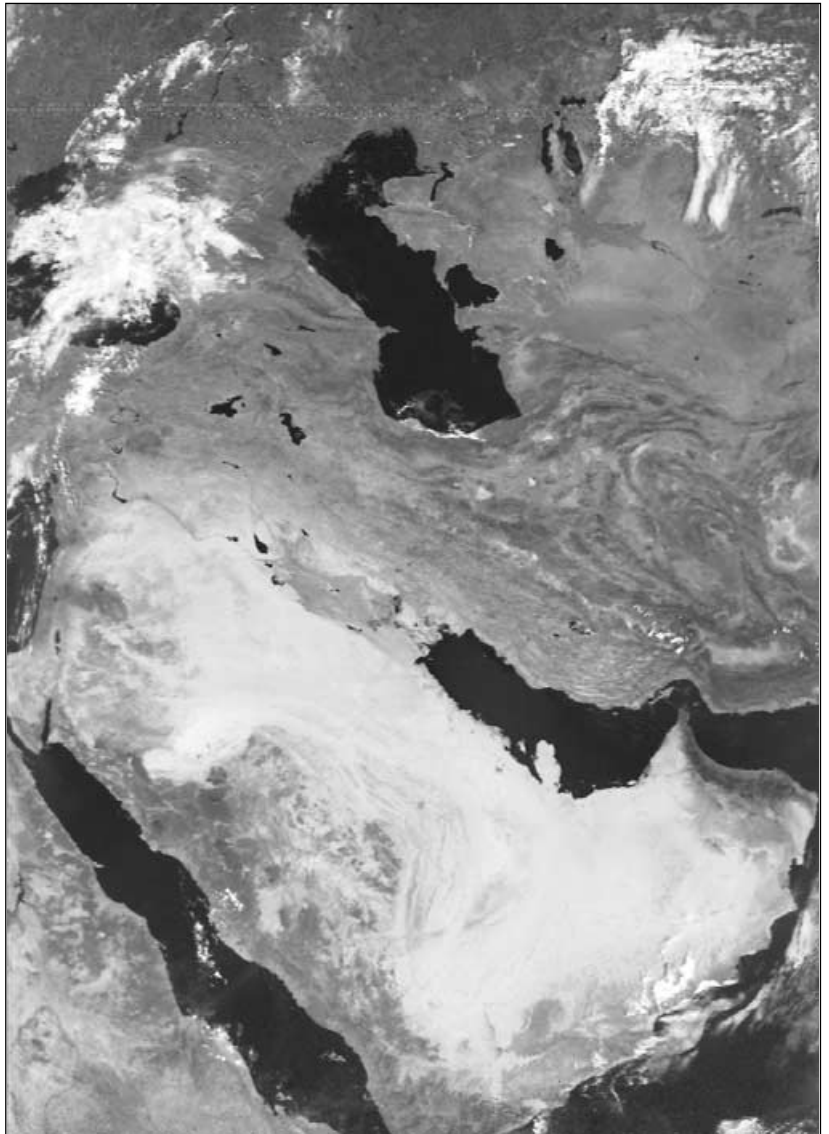
During late summer 2005 I transferred my activities to *WXtoImg* and the colour image opposite was produced from a NOAA-18 pass acquired at 10:29 UT on April 17, 2006.

## My Satellite Imaging Setup

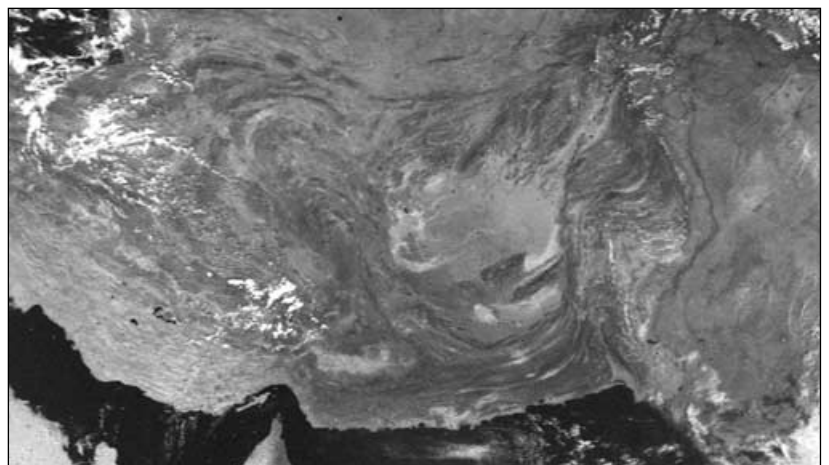
The uppermost colour image opposite shows my weather satellite equipment. At the extreme left, next to the oscilloscope, stands a home-made variable, double power supply, with, to its right, my *Proscan* Receiver sitting atop the *Dartcom* unit. A general coverage shortwave receiver can be seen on the desk, along with the computer; to the right of this again is a module which connects, via a dish, to a satellite for my Internet connection—we do not have a phone line here.

The uppermost small colour photograph shows my Sykes-Cobey QFH. Below, another shows it mounted on my roof in a wider view looking north that illustrates my vantage point nicely. The final photograph shows a beautiful sunset over my western horizon, across the Mediterranean Sea.

I do not suffer from any paging problems here in Cyprus. But now and again on 137.62 MHz I do get an occasional voice transmission. It seems to be a phone conversation between two ladies, all in Greek; they do seem to have a lot to say to each other!



NOAA-17 at 07:38 UT on September 17, 2005 showing not only the entire Caspian Sea but the Persian Gulf and Arabian Peninsula.



NOAA-17 at 06:45 UT on September 19, 2005 showing the Indus river snaking back to the Hindu Kush.

