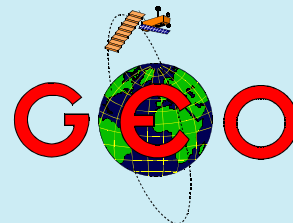


# The **GEO** Quarterly

Group for Earth Observation



www.geo-web.org.uk

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

*Number 5*

*March 2005*



*Inside this issue . . .*

*'The Union County Glacier'  
Read about the day when a  
glacier developed in New  
Mexico, USA*

*Upgrade your RX2 with  
GEO's customised PIC for  
the new NOAA-18  
frequencies ...*



*... read about it in the  
article on page 16*

*Rob Alblas describes his  
XRIT2PIC software for  
translating Meteosat-8  
transmissions on page 28*

*'Farewell Meteosat -  
Welcome Meteosat'. John  
Tellick reviews 25 years of  
the Meteosat programme*

*Create superb HRPT  
images using telemetry files  
from NOAA's Satellite  
Active Archive*

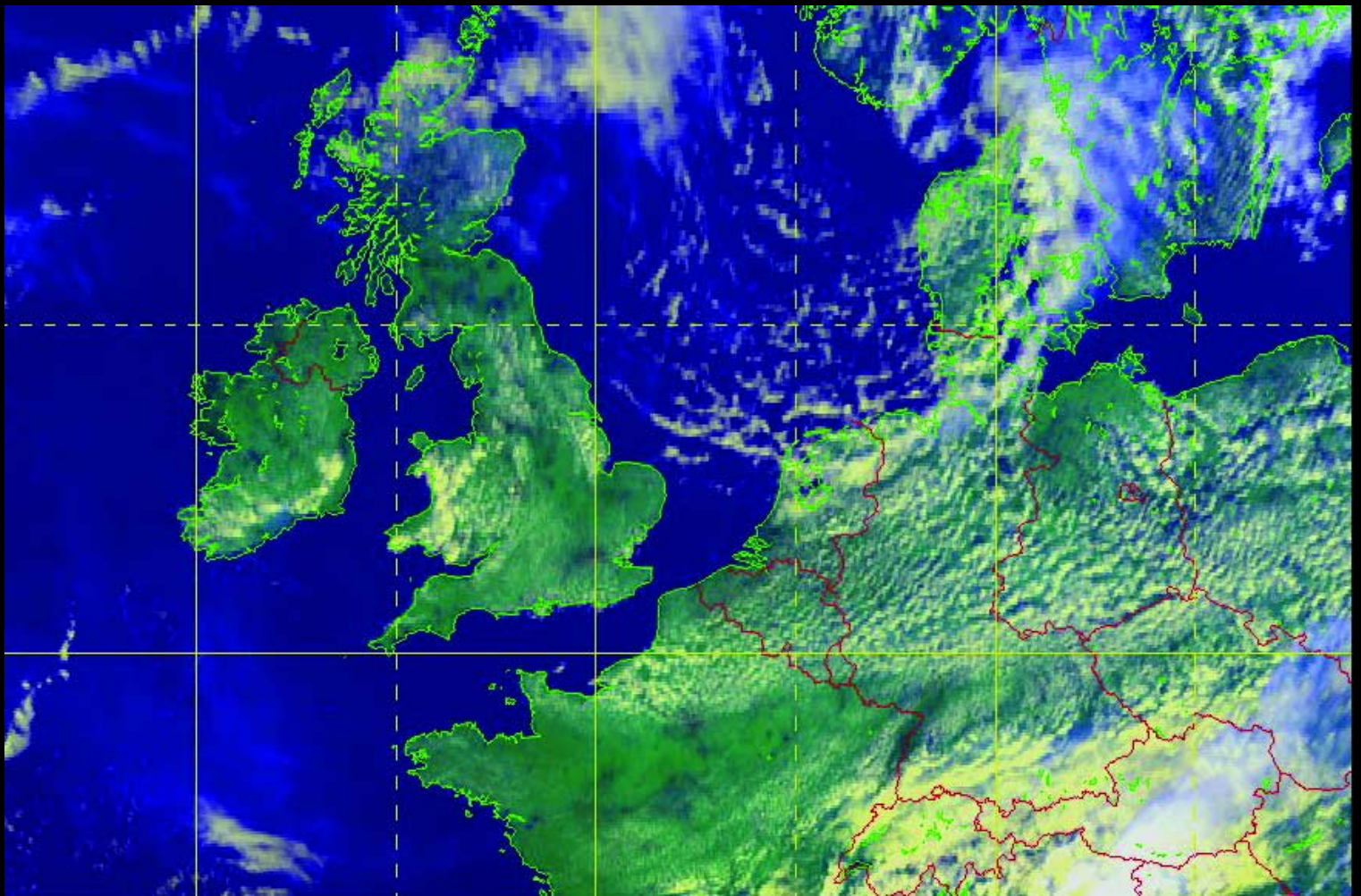
*More on setting up an MSG  
system from Fred van den  
Bosch*

*How LIDAR is used to  
monitor Mount St Helens*

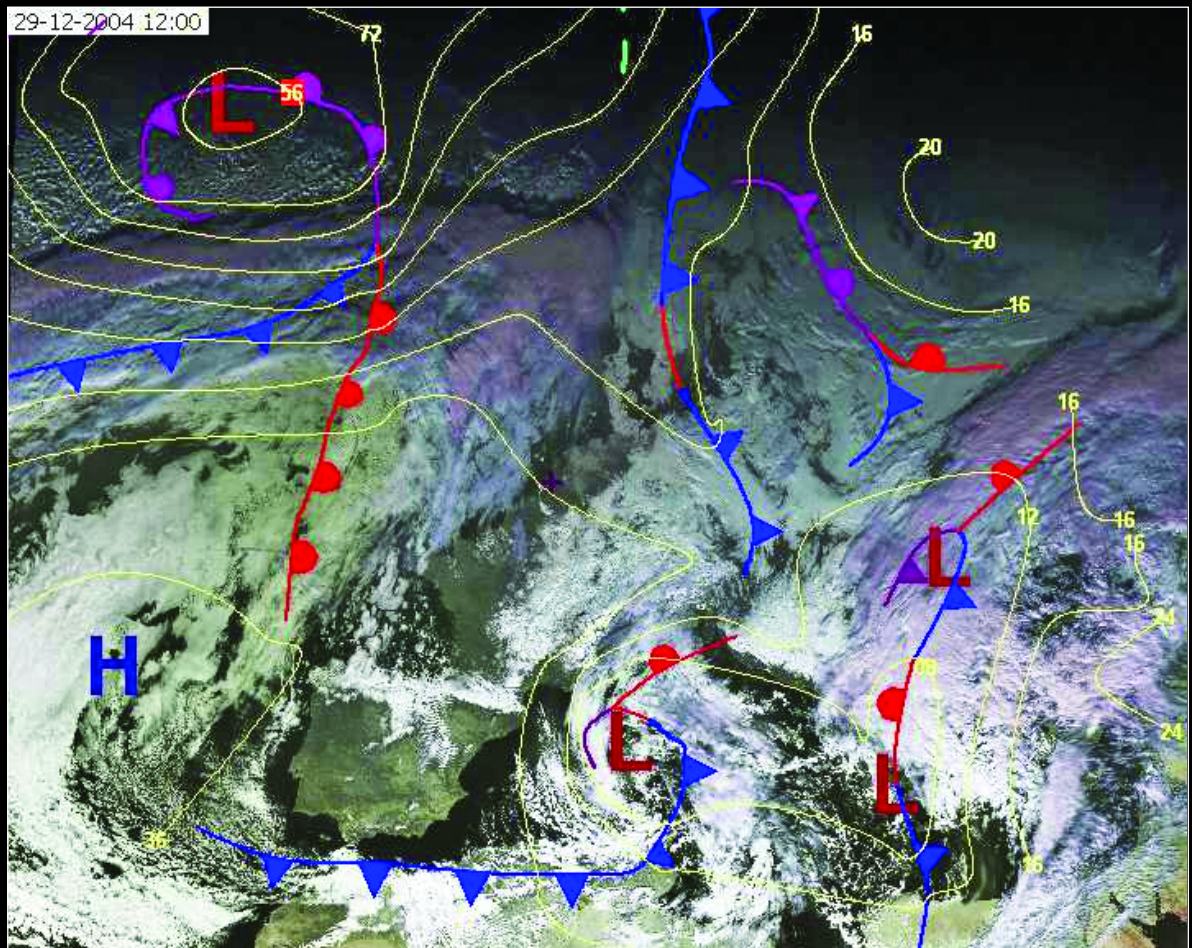
*Plus all the regular  
features ...*

**The 2nd GEO Symposium takes place in the  
National Space Centre, Leicester  
on April 30, 2005. Full details inside.**



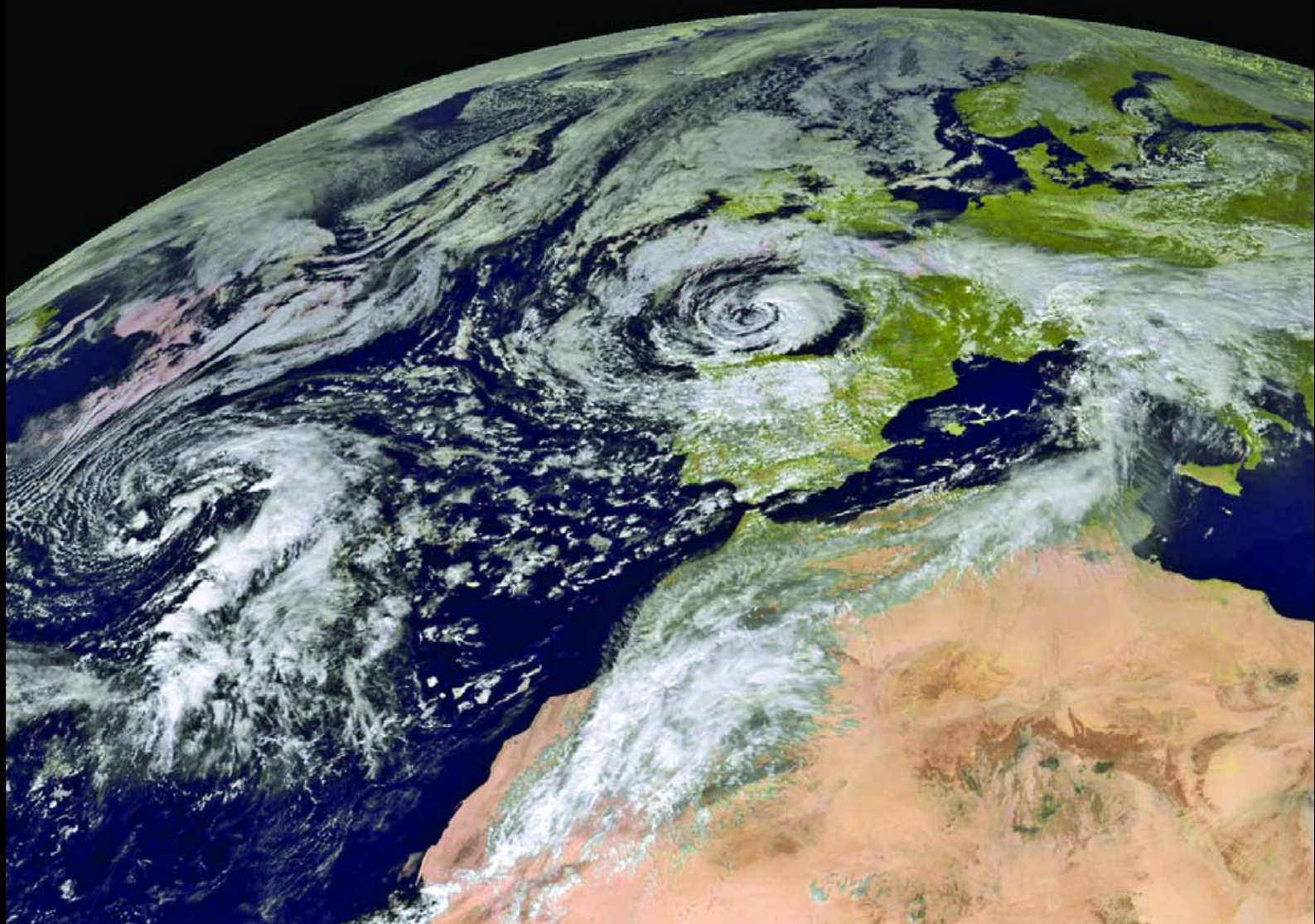


This image of Europe was taken from the 10:15 UT Meteosat-8 transmission on May 22, 2004 by Cedric Roberts. The final image has been corrected to Mercator projection to give a more realistic view of NW Europe by the latest Dartcom software



The noon Meteosat-8 image from December 29 last year, overlain with synoptic data using *Digital Atmosphere*. You can learn how to achieve this in Fred van den Bosch's article on page 44.





Heinz Fischer from Imberg in Germany sent us this 12:30 UT Meteosat-8 image from October 10, 2004, showing two impressive depressions on the same image, one over the Bay of Biscay, the other approaching over the Atlantic.

Image © EUMETSAT 2004



The main board of the RX2 receiver showing the new PIC in place at upper right.



This photograph of a built RX2 kit in a customised case was submitted by Norbert Puetz from Erding in Germany.









As this issue of GEO Quarterly goes to press, the world is still struggling to come to terms with the greatest natural disaster in living memory: the Indian Ocean earthquake and resulting tsunamis which devastated southeast Asia, Sri Lanka and India. The high-resolution IKONOS satellite images on page 17 can only hint at the devastation on the ground. Our thoughts go out to everyone who has been touched by this event.

GEO readers will be saddened to learn of the death of Cedric Roberts MBE, who contributed articles and weather satellite images to a number of periodicals, including GEO Quarterly. Cedric was a mine of information on all aspects of weather and satellite observations, and was always delighted to share his knowledge and experience with others. We are all very much the poorer for his passing. Dave Wright and Alan Davies have compiled an appreciation of Cedric which you can read on page 6. A selection from the final set of images Cedric submitted to us is also published in this issue.

As you will discover on page 45, a number of GEO readers have volunteered to add their names to the *GEO Helplines* section. The GEO Management Team would like to take this opportunity to express their thanks to all involved.

This issue sees the opening of the *GEO Shop*, managed by Clive Finnis. We have just two items available this quarter, but hope to increase our range during the months ahead. RX2 users wishing to access the new NOAA-18 frequency may be interested in our inexpensive new PIC whilst new overseas readers can save on back-issue costs with our CD offering the four 2004 GEO Quarterlies in PDF format. You can find the GEO Shop section on page 46.

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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



People who have sat around a committee table with me at meetings know I often say that I am aware of yesterday but I'm more interested in tomorrow. GEO is now a little over a year old and it would be easy to go back over our achievements in that first year. I will not try to do that beyond one sentence. Membership is running at over 500 in 30+ countries, we have published four quality magazines, held a symposium at Leicester, spent three days demonstrating at AMSAT in Guildford, attended rallies at home and in Utrecht and finally participated in four days with NOAA in Miami, all supported by a talented management team. We must look to the future.



Francis Bell pictured welcoming a delegate to the GEO stand in Miami

## New Satellites

If I have this correctly, two new satellites will become available in 2005, MSG-2 and NOAA N (18); others I just don't know about, for example the latest Sich. One thing I do know is that our interest group, many of us as direct readout users with a curiosity for experimentation, have a wealth of information for receiving weather satellite signals and can perhaps make contributions that commercial organisations and national meteorological offices could not support.

## New Services

This philosophy is supported by our policy for the coming year when GEO will be developing further services to members in the form of availability of reception hardware and software. Clive Finnis will be running this for GEO together with the established services run by Douglas Deans. Our first GEO Shop page can be viewed on page 46.

## Symposium 2005

Again, looking at the coming year, our

symposium at Leicester is booked and you can learn full details on the next page. Please support it if you can.

I think we enjoy a good relationship with AMSAT-UK and I hope GEO will be invited back to Guildford this year. Attendance at UK rallies is still a matter of time for individuals and policy. I will certainly try to return to Utrecht for at least one of the Dutch *Werkgroep Kunstmanen* meetings.

## Education Coordinator

An aspect of GEO membership that I always find rewarding is the willingness of members to contribute to the group. If you have read previous issues of our Quarterly you will know that I have been asking for someone to look after the educational dimension of our group. I am an ex-teacher and feel a passion to share our skills and interests with the education sector. I was so pleased when David Painter offered to undertake this role. My personal thanks to David. Who knows what future developments there may be? All I know is that children are inquisitive. Here's a quote from my bright three year old grand-daughter a few days ago: 'Grandpa! Why does it get light and dark each day?' Children want to know these things.

## International Liaison

There is another role that I would like someone to fulfil. It's the international dimension. I was astonished to learn from Nigel, our membership secretary, that GEO has members in about 30 countries. That does indicate the international nature of our interests which transcends national boundaries—we are a group for 'Earth Observation'. I would like somebody to offer to take on an international role. I think this could be a rewarding job without any stress. Whoever does fulfil this role would identify technical publications or user groups in fields such as amateur radio, TV, meteorology, electronic construction etc. anywhere in the world and send them a GEO press release plus, perhaps, a copy of one of our Quarterlies. GEO could draft the press release and invite its publication in any technical or related journal in any part of the world. If you don't know about GEO then you can't join.

## Technical Matters

There are technical issues which our direct readout membership will need to address in the coming year. These include LRIT and, in the UK, possible RF pager transmissions within the 137 MHz band which may interfere with the reception of NOAA 18.

## Subscription Renewal

I know I am at risk of repeating myself but our first year cycle elapses with this issue and GEO subscriptions will shortly become due on a rolling programme. For GEO to remain financially viable we need your membership. Without it there is no point in continuing. If you don't wish to renew, that's fine, but to give us feedback please let me know why. E-mail or post to me—but better still, just renew. A renewal form can be found on page 47.

## Static

I have recently bought a new car (well it's secondhand but new to me). I'm very happy with the car but I have noticed that often, when I get out of it and close the door I get a static shock. I can sometimes hear a click and it always takes me by surprise. I now close the car door with my elbow on the driver's door window.

The issue is this. On GEO business I often take my computers to exhibitions rallies club meetings and other demonstrations. Can anybody tell me about the risk from static of loading and unloading a computer from a car. I do take static precautions when handling microchips; I touch metal water or gas pipes before handling microchips but I can't do that when getting out of a car. Are my computers at risk? Copy to the editor please. This is not a trivial question and I really would like to know if there are risks.

I know some cars are fitted at the back with a conductive trailing strip touching the ground. Do these work and should I have one fitted? I know they say such strips prevent travel sickness but I am totally dismissive of that analysis. Try travelling on a coach with 52 teenagers, bucket in hand, and tell the children the coach is static protected!

On behalf of GEO's management team: 'Best wishes for 2005'.



# GEO Symposium



## April 30 2005

**Francis Bell**

GEO's annual symposium has been booked at the National Space Centre (NSC) in Leicester on April 30, 2005. Those of you who have been before know that this is an outstanding venue with good facilities for a meeting such as ours, offering technical support for live satellite reception and our workshops as well as an exhibition area. In addition, there are the NSC's own extensive exhibition halls which could take a day to look around (registration for the symposium includes a complementary ticket to visit the NSC exhibition area).



The packed lecture area during Symposium 2004

The programme for the day has yet to be finalised but will be similar to last year. VIP guests have been invited but until definite replies have been received it is not appropriate to include them in the programme. However, I am hopeful that both *EUMETSAT* and the UK Met Office will be represented.

The day will of course include talks, presentations and demonstrations of live weather satellite reception. If the new NOAA satellite has been successfully orbited, we may be able to receive live reception of NOAA-18 using GEO's new PIC chip, and we will certainly be demonstrating live Meteosat 8 reception. We will also have workshops for beginners and experienced alike and opportunities for conversation and shared experiences with friends.

Towards the end of the day we will have a plenary session which will include GEO's AGM, where any issues relating to GEO can be raised and discussed. Reports and accounts will be available, together with the rules and legal structure of GEO which govern our responsibilities. Remember that GEO is a company in England and Wales, with corresponding legal responsibilities, which we fulfil.

I know that not all members will be able to come to Leicester so if there is any issue

or question that a member wishes to be raised or discussed on the day, please let me have it in writing ASAP and I will present it to the meeting. I promise that any correspondence I receive, whether critical or complimentary, will be read to the meeting and discussed as appropriate. Delegates may also raise any matter on the day.

You can contact me by e-mail at:

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

or by post at:

GEO  
Coturnix House, Rake Lane,  
Milford, Godalming,  
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Telephone ++ (0) 1483416897

### Registration

If you wish to attend our Leicester Symposium please register with **Francis Bell** either by e-mail, telephone or post (details above). The cost for the day will be £12.00 and this will also cover the entrance to the NSC's exhibition area (normally £8.50 anyway). I cannot think of a better value for money day.



A Meteosat-8 demonstration at Symposium 2004

Any problem will be one of time: fitting everything into one day. Costs of travel, food accommodation and other personal expenses are not included. I will use the *Ibis Hotel* for my accommodation on the night before our meeting. This hotel is close to the centre of Leicester and also close to the railway station. For the sake of planning I would like you to register with me via any of the above contact points: this is because there is an upper limit to the number of delegates we can accept. I don't expect a problem here but it helps to know how many people will be coming. It also allows me to prepare a delegate list. If you do register and are

subsequently uncertain about your attendance please let me know.

The day's events are open to all GEO members and their guests. **Please encourage non-members to attend** because this does help to promote GEO. Because the cost is quite small, please pay at the registration desk on the day.

### Presentations etc

If any GEO member would like to make any sort of presentation or equipment demonstration at Leicester this would be very welcome—no more than that, but definitely encouraged! I think that members' willingness to share skills and experiences is one of GEO's greatest strengths and was certainly in evidence at last year's symposium. Please do not be shy at offering: you will be talking to friends who share a common interest. Please contact me and I will ensure you have exhibition space or a slot within the programme.

### Information

For maps and details about the NSC please visit their web site at

**[www.spacecentre.co.uk](http://www.spacecentre.co.uk)**

Closer to the date, visit GEO's web site

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

for details of the day's programme.

The official start time is 10.00 am but setting up can begin at 9.00 am. We must finish by 6.00 pm. Our symposium rooms are below the NSC's offices and easy to find.

**Please come to Leicester if you can. Last year's experience indicates that it will be a worthwhile day but it needs membership support.**



Member participation during a break in proceedings at Symposium 2004



# How to find your way to the GEO Symposium

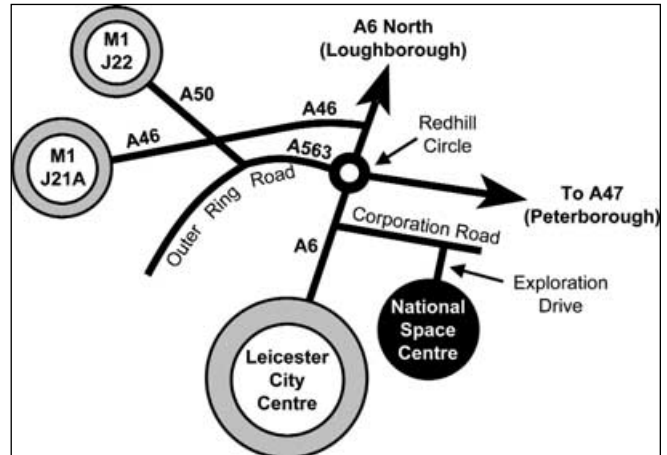


The National Space Centre is located just off the A6, two miles north of Leicester City Centre, and midway between the city's inner and outer ring roads.

Brown signs carrying a spaceship motif direct you from junctions 21, 21a and 22 on the M1 and all other arterial routes around Leicester. There is free parking for 400 vehicles at the Space Centre.

Midland Mainline and Central trains serve Leicester station. Bus route 54 serves Leicester Station, City Centre (Haymarket Bus Stop, Stand 14) and Abbey Lane, the latter just 5 minutes walk from the Space Centre.

You can find more information about shuttle buses serving the Space Centre by telephoning Leicester Tourist Information Centre on (0116) 299 8888.



Location of the National Space Centre (not to scale)

## QUARTERLY QUESTION

**Francis Bell**

There was a question in our last Quarterly, GEO Q4, relating to the sun and its distance from the Earth. Taking the mean distance from the sun to Earth as 150 million kilometres, how many solar diameters are we away from our sun? I had previously worked out the answer.

As promised I picked the winning entry on December 25, 2004. It came from Bert Harms from The Netherlands. He (or his nominee) wins a free entry to our Leicester symposium on April 30. His entry identified the sun as subtending an angle of 0.5 degrees as seen from the Earth. So the calculation is :-

$$\sin(0.5^\circ) \times 150 \text{ million equals } 1.305$$

$$\text{Therefore the solar diameter} = 1.305 \text{ million kilometres}$$

$$150 \text{ million divided by } 1.305 \text{ gives a distance of } \mathbf{115 \text{ solar diameters.}}$$

*[Strictly, this should use  $\tan(0.5^\circ)$  rather than  $\sin(0.5^\circ)$ , but for angles smaller than  $2^\circ$  the difference is negligible — Ed]*

I had previously cheated. I looked up the solar diameter in a reference book which said it was 1.4 million km. The answers are very close.

The reason behind this question related to my comprehension of distance and putting zeros on the end of a number. I can do the mathematics with exponents but with millions and billions I begin to lose reality within my brain. But I can cope with 115.

This was my next calculation. If the sun were the size of a tennis

ball (I measured one at 63 mm), could I fit it into my sitting room with me standing at one end of the room? The answer surprised me.

I will risk setting one more question and then invite GEO's membership to submit questions for publications. Questions to the editor or to Francis Bell please.

### The Question:

Assume that all Earth's oceans could be spread evenly over the planet's surface to an average depth of 6 km (which would be approximately true). If all the atmosphere were compressed to a volume at mean sea-level pressure, what would be the volume ratio of sea to atmosphere? Hint: 'What is the atmospheric pressure on the top of a 6,000 m high mountain?' Answers to Francis Bell please, by e-mail or post.

## Cover Colour Image Details

### Front

This splendid Moderate Imaging Spectroradiometer (MODIS) image of Scotland was acquired by NASA's *Terra* satellite on December 19, 2004 and shows snow covering most of the Scottish Highlands. The Great Glen, which includes Loch Ness, is visible as a dark diagonal line bisecting the region from lower left to upper right.

Credit: Jeff Schmalz, MODIS Land Rapid Response Team

### Back

A true-color (MODIS) image from NASA's *Terra* satellite showing Von Karman Vortices tracking southward from Jan Mayen Island, north of Iceland, on September 23, 2004.

Credit: MODIS Land Rapid Response System



# Known Meteosat Image Anomalies



Occasionally, certain images produced by Meteosat weather satellites display degradation due to the intrusion of sunlight into the radiometer. This phenomenon is dependent upon the sun-Earth-satellite geometry and is unavoidable at times. It generally occurs when the sun is not in complete eclipse behind the Earth—as viewed from the satellite—so that a portion of the sun’s disc is visible from the satellite, behind the Earth’s northern or southern limb.

This effect is observed particularly around midnight and especially during the time of the eclipses in spring and autumn. Visible light, infrared (IR) and water vapour (WV) images are all susceptible to degradation.

The light spots detected in visible images are caused by double reflections of stray light due to the optical design of the Meteosat radiometer. As direct sunlight reaches the satellite it is reflected and diffused by the mechanical structures within the radiometer. The consequence of this is that stray light enters the radiometer field of view, reaches the detectors and creates intense bright spots in some images (figure 1).

In the case of IR images, the degradation takes the form of a dark area (figure 2). When the radiance data are converted to temperature readings this gives excessively high values. Users analysing such images for those particular time periods should be aware of this anomaly.

Another manifestation of the anomaly is found in the WV images where 'dark spots' and 'bow-shaped structures' can be observed, both features being clearly evident in figure 3. If the effect is too severe, the acquired Meteosat image will not normally be disseminated; however, images displaying only minor defects are made available to users for the sake of completeness. An additional type of anomaly also sometimes detected on WV images is a 'striping pattern', as illustrated in figure 4.

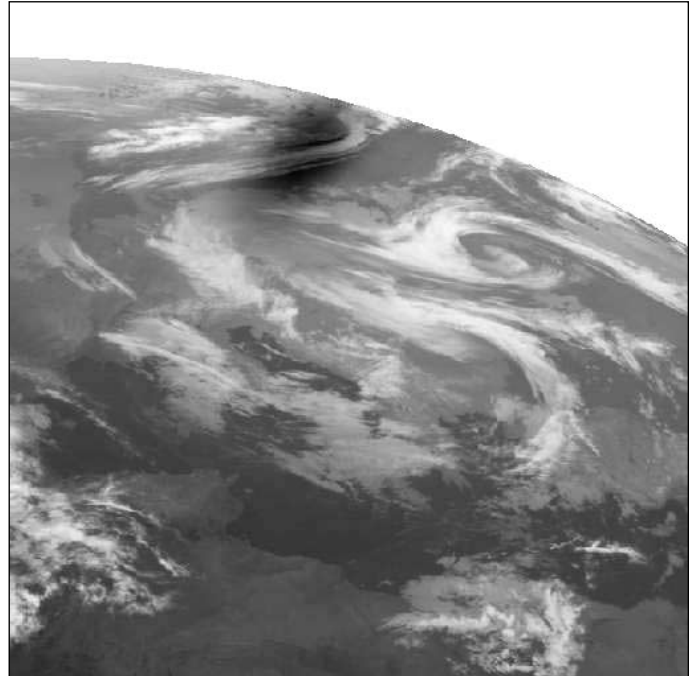


Figure 2 - A dark area can be seen over the Baltic Sea at upper centre in this IR image taken at midnight on April 16, 1997

### Acknowledgement

This article summarises information provided on the EUMETSAT website at:

<http://www.eumetsat.de/en/area5/anomalies/anomalies.htm>

This web page also features a number of interesting loop sequences that illustrate the effects rather well.



Figure 1 - A Visible light image taken near midnight on August 25-6, 1997

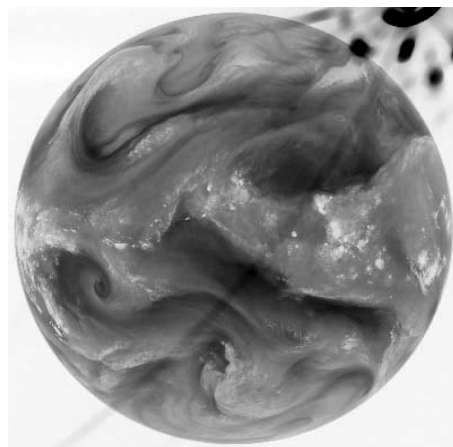


Figure 3 - A WV image showing 'spots' and 'bows'

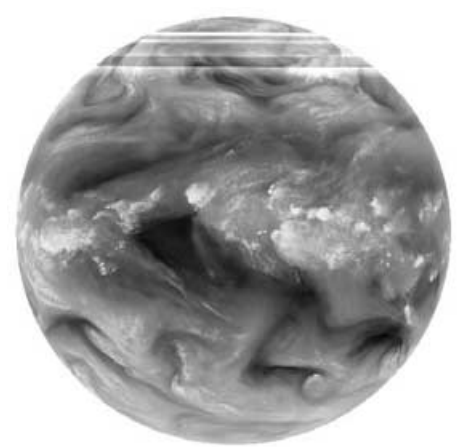


Figure 4 - A WV image showing 'stripes'



# ***Cedric Roberts MBE***

***Compiled by Dave Wright from information provided by Alan Davies, a close friend of Cedric Roberts MBE.***

It is with much regret and sadness that we learned of the death of Cedric Roberts MBE, who passed away peacefully in Mary Stevens Hospice, Stourbridge, West Midlands on November 27 last year. Unfortunately, while he was undergoing a pain management program in the Hospice, Cedric became very ill and lost his valiant fight against the slowly progressive cancer which he had endured for several years.

Cedric was born in 1931 in Halesowen, West Midlands and, apart from National Service in the RAF, lived all his life in Halesowen. After entering the Forces he did his basic training at RAF Locking then spent his two years of National Service at RAF Scampton, Lincolnshire, where he worked as a Radio/Radar technician, mainly on Lancasters.



Cedric Roberts pictured taking a rain-gauge reading in May 1997

Cedric was not involved directly with meteorology while at RAF Scampton but the Met Man did want to be a radio man, and Cedric wanted to be the Met Man: they did try to swap but the RAF would not agree!

After completing his National Service in the RAF Cedric took up his chosen career in education and taught physics and mathematics at Three Dwelling's School, Halesowen and latterly at Windsor High School, Halesowen up until 1986 when he retired as Deputy Head Teacher at the age of 55.

Cedric became intensely interested in all aspects of meteorology from an early age and at the time of his death had maintained continuous weather records for a period of 57 years. He had been involved with computers since the introduction of the first BBC Micro and once spent twelve months transferring forty years of written hard-copy data on to spreadsheets. As technology advanced he became particularly interested in weather satellite systems.



Taking temperature readings at Halesowen - May 1997

Before his illness took a real hold, Cedric used to go about giving 'talks' to local groups on the weather; these were complemented by excellent slide presentations. He was a keen photographer, particularly of cloud formations, and these photos were all taken by himself.

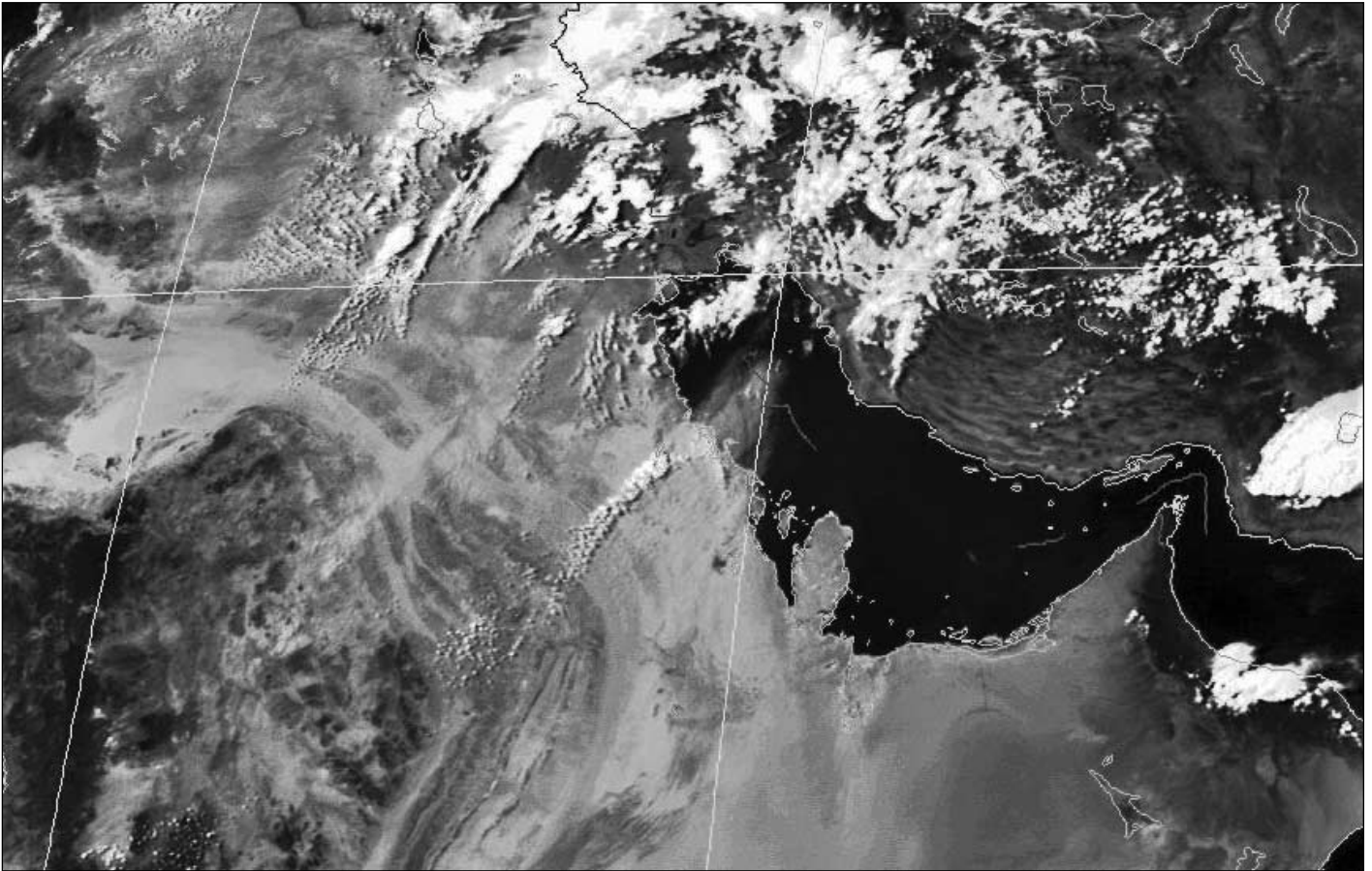
Cedric was awarded the MBE for 'Services to Meteorology' in March 1998.

Over the years Cedric contributed numerous interesting articles on both weather and weather satellite imaging to a variety of publications. He was a contributor to the Launch Issue of GEO Quarterly and provided the striking Meteosat-8 image for the cover of issue no 2.

The Halesowen Climatological Station (DCNN 4839) operated by Cedric was a Volunteer Observer Station for the Met. Office and provided daily observations to them for many years. BBC Midlands TV frequently used his site for live interviews if any extremes of weather had occurred.

The weather observations were Cedric's life and took precedence over everything else. It is amazing that he managed to continue this work throughout a long illness, right up until three weeks before his death.

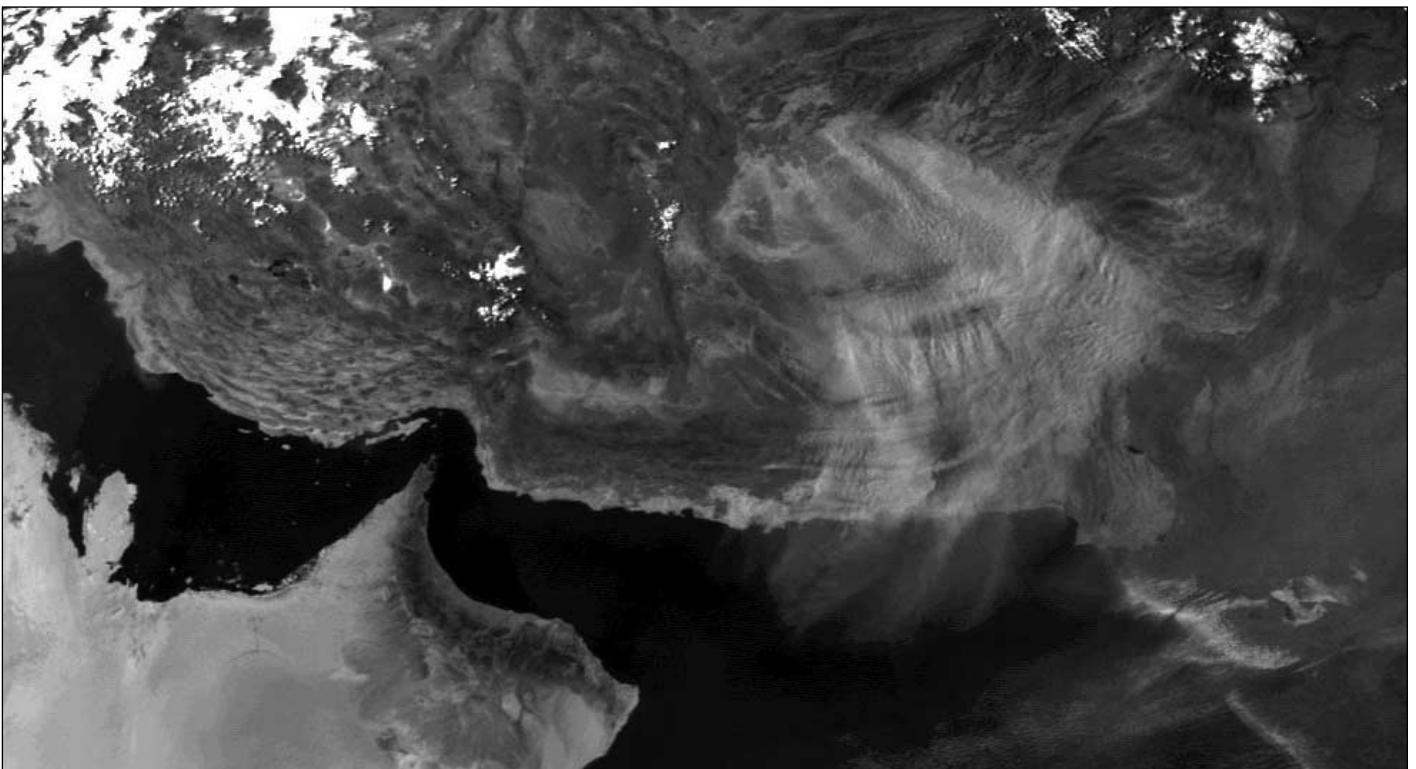




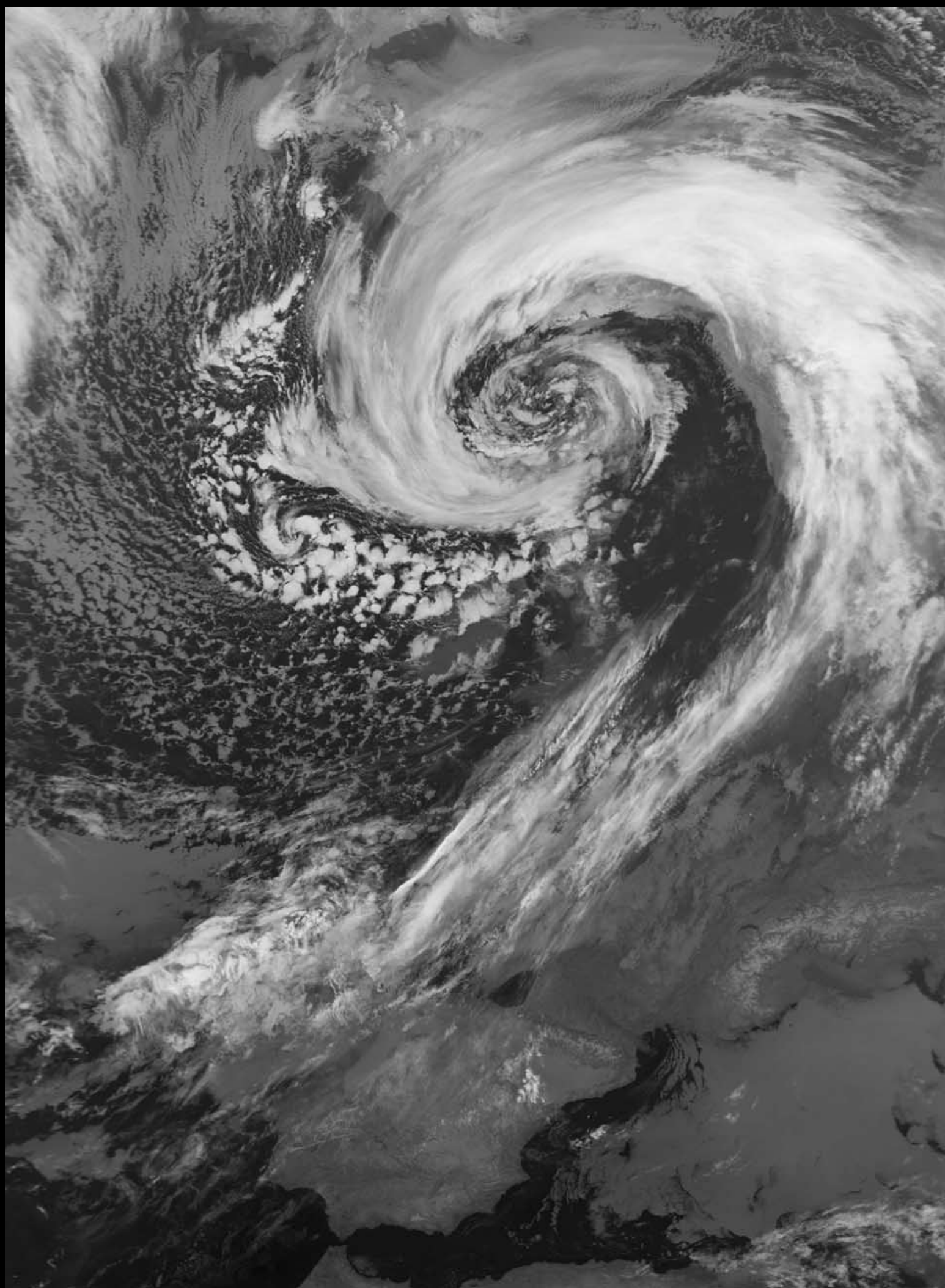
Cedric Roberts regularly submitted collections of his weather satellite images to GEO, always accompanied by interesting observations. The two images on this page are typical, and were selected from the most recent batch he sent us. Cedric wrote: 'This rather nice image featuring the Straits of Hormuz (above) was obtained from Meteosat-8 at 13:30 UT on May 28, 2004. This image shows up the convective activity very well. Whilst experimenting with a beta version of new software I

happened upon this rather unusual image of a sandstorm blowing from the southern tip of Saudi Arabia into the Indian Ocean (below). It was taken from the 12:00 noon Meteosat-8 image on May 23, 2004 and was processed with *Dartcom* software. I think you will agree that it is rather an unusual image, diverging from the usual pattern of images coming from this satellite, with its astonishing definition.'

Images: © EUMETSAT 2004







The 'Great Storm' that assailed parts of Great Britain with 200 kph winds on January 11, as seen through the sensors of NOAA-17 at 22:01 UT.  
Channel-2 infrared image created using *HRPT Reader* software from telemetry data supplied by David Taylor



# Add Cloud-Top Temperatures to your Satsignal Images

Mike Rowe



August 16, 2004 was the day that an unprecedented flash flood brought disaster to the small Cornish village of Boscastle. In just two hours the total August rainfall of 75 mm fell over the area, causing two nearby rivers to burst their banks sending a torrent of water through the centre of the village. Several homes were destroyed, over 50 vehicles carried off by the floodwater were written off, and in all the damage was estimated to be many millions of pounds.

Mike Rowe sent in two NOAA-12 satellite images of the event, one of them with an overlay of cloud-top temperatures, which show more clearly the extent of the rain cloud. GEO invited Mike to describe his technique for the benefit of readers.

**Mike writes:**

I use a registered version of *Satsignal* and loaded the additional colour look-up tables (LUTs) available from David Taylor's website [1]. When *Satsignal* is run you now get a new option in the NOAA colour section, HLS\_CT. This option, together with the normal HLS one, were used to obtain these pictures, acquired from NOAA-12 at 15:25 UT, close to the time of the storm

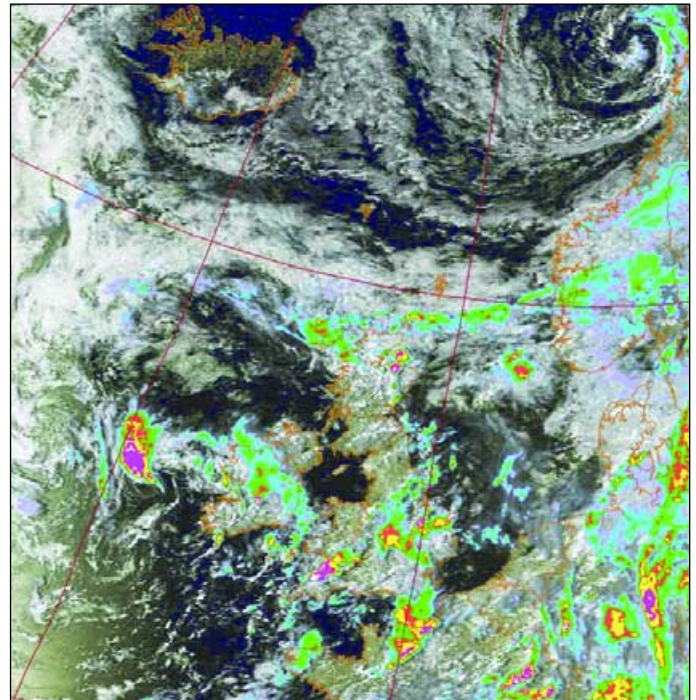


Figure 2 - The same image, processed using the 'HLS\_CT' LUT

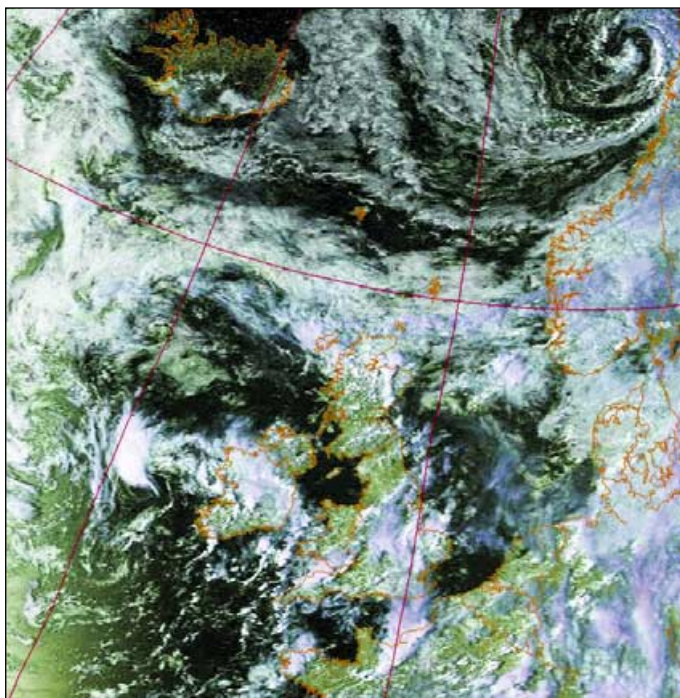


Figure 1 - Image processed using the normal 'HLS' LUT

Although the HLS image above shows the heavy cloud in the area, the cloud-top LUT shows the extent of the rainfall. As in the BBC weather maps, the brighter the colours the heavier the rain (yellow, red, purple, white). The lowest cloud-top temperatures are shown as white.

For the record, I am located near Worthing in West Sussex. My receiver is an RX2 and the antenna is a QFH mounted on a pole in the back garden, approximately 6 metre above ground and about 20 metres away from the receiver.

**Reference**

1. The additional LUTs for Satsignal can be downloaded from:

[www.satsignal.net](http://www.satsignal.net)

by opening the 'Satellite Tools' page, clicking 'Satsignal' then clicking the 'Colour look-up table' link under 'Downloads'.



Figure 3

This scene comes from the HRPT version of the same NOAA-12 pass  
Image: David Taylor - Processing Satsignal (vegetation mode)



# LIDAR

## How NASA is monitoring changes in Mount St Helens

NASA/USGS

Mount St Helens is undoubtedly the best known of North America's Cascade Range volcanos, following the historic 1980 eruption which devastated over 200 square miles of forest. The mountain rumbled back into life in late September 2004 as a new lava dome began to rise from its crater and on October 1 a spectacular cloud of ash and steam erupted from the mountain as illustrated in the photographs opposite.

Scientists from NASA and the United States Geological Survey (USGS) have joined forces to study Mount St Helens using a high-tech laser scanning technique known as LIDAR. This analyses changes in the surface elevation of the crater, which began deforming in late September 2004. The data derived from LIDAR enables the scientists to make accurate comparisons of the topography before and after a volcanic event and to map the dimensions of any uplift—often in exquisite detail—and thus create better models for forecasting future volcanic events.

### What is LIDAR?

Airborne LIDAR was pioneered by NASA scientists and engineers during the 1980s and 1990s. LIDAR can be used to create digital elevation models and, because of its very high vertical accuracy (as good as 10 cm), it is rapidly becoming the preferred method for detailed topographic mapping.

LIDAR (Light Detection and Ranging) is a remote sensing system, technologically very similar to RADAR (Radio Detection and Ranging), that can be used to collect topographic data. The key difference in LIDAR is that light rays are used instead of radio waves. The LIDAR equipment is carried aboard a light aircraft such as a Cessna-310 and comprises a scanning laser rangefinder, a Global Positioning System (GPS), and an Inertial Navigation System (INS).

During its flight above the terrain to be mapped, the aircraft travels at approximately 60 meters per second while the LIDAR instrument pulses a narrow laser beam toward the Earth through a port in the underside of the plane's fuselage. LIDAR lasers generally operate in the near-infrared so that the radiation reaching the ground will not cause eye damage to any humans who are in the target area as the plane flies overhead. The laser directs up to 5000 brief pulses of radiation per second towards the ground which reflects or scatters them back to the laser scanner (figure 3).

Data are collected by measuring the distance between the plane and the Earth beneath by accurately timing how long it takes for each reflected pulse to return to the plane. These reflected pulses are received through a small telescope which focuses them on to a detector. The time intervals are then used to calculate a set of distance values over the flight corridor.

The distance measurements obtained from each laser pulse are converted into map coordinates and elevations by combining them with information about the position of the plane (from the GPS) and the direction of the laser pulse (from the orientation of the plane as determined by the INS) at the precise instant that each pulse was fired. A large area can be mapped by flying



Figure 1 - Mount St Helens October 1 eruption plume photographed from Johnston Ridge Observatory  
Photo: Gene Iwatsubo, USGS



Figure 2 - Mount St Helens erupting on October 1, with renewed activity within the mountain's old 1980 eruption crater.  
Credit: John Pallister, USGS

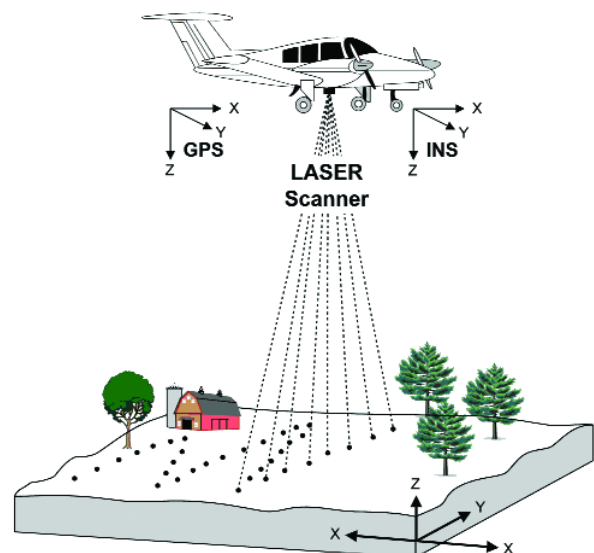


Figure 3 - Airborne LIDAR scanning



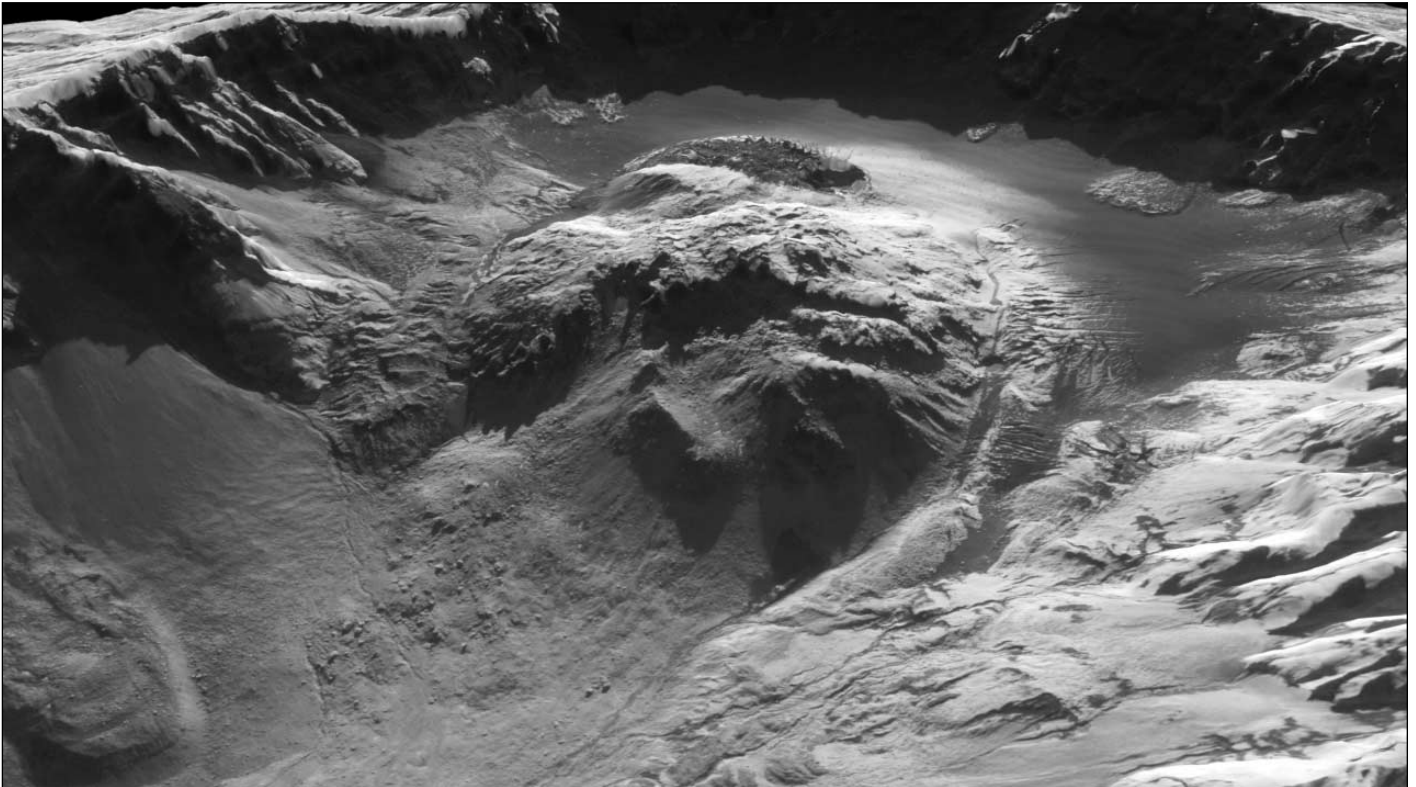


Figure 4 - This stunning image of Mount St Helens was produced by draping a 1-km/pixel IKONOS satellite image over an elevation map created from the October 4, 2004 aerial LIDAR survey. The new lava dome can clearly be seen rising behind the old one that formed between 1980 and 1986. To its right, a dark slit shows where a new vent opened as the volcano erupted.

*Credits: IKONOS imagery provided courtesy of Space Imaging - LIDAR derived elevation map courtesy of USGS and NASA.*

many parallel lines, guided by the GPS, so that successive narrow corridors of data overlap along the edges. The data from all the corridors is then assembled to provide coverage over a large area.

**The Mount St Helens Survey**

The USGS first contracted a LIDAR survey of Mount St Helens in September 2003. In early September 2004, USGS and NASA scientists began detailed planning for a second survey, contracted by NASA, which would extend the area covered by the first survey. But when the mountain came back to life on September 23, these plans were fast-tracked, and the second survey was brought forward to October 4. Topographic changes resulting from the current activity at Mount St Helens are clearly evident in figures 5 and 6 below).

The results from the October 4 survey are shown in figure 4, where a one-meter-per-pixel image from Spaceimaging’s IKONOS satellite has been draped over the LIDAR elevation map for the area. The new lava dome rises behind the old one that formed between 1980 and 1986. LIDAR determinations showed that in the two weeks prior to the October 4 eruption, the new dome rose 110 meters—roughly the height of a 35 storey building—and covered an area of 130,000 square meters, equivalent to 5.3 million cubic meters of volume change in the area of uplift. To the right of the uplift a dark slit shows where a new vent opened as the volcano erupted.

And the dome wasn’t the only change that the LIDAR data recorded. Unrelated to the eruption, rock glaciers were seen to have moved downslope as new material fed into them. One such glacier can be seen on the left edge of figure 4. A comparison between this year’s topographic map and last year’s shows shrinking snow fields, growth in the crater glacier, and several rock slides.

**References**

- <http://vulcan.wr.usgs.gov/Monitoring/LIDAR/>
- [http://www.ghcc.msfc.nasa.gov/sparcle/sparcle\\_tutorial.html](http://www.ghcc.msfc.nasa.gov/sparcle/sparcle_tutorial.html)
- <http://www.sbgmaps.com/lidar.htm>
- <http://earthobservatory.nasa.gov/Study/Lidar/>

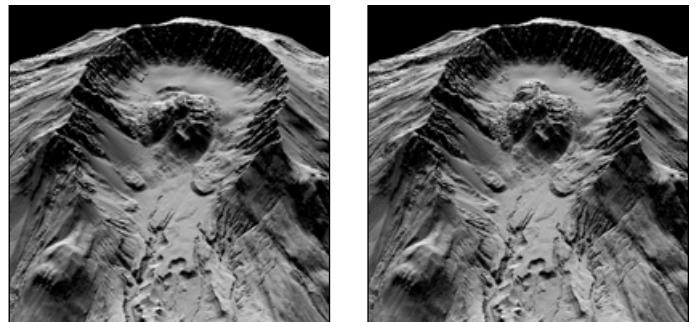


Figure 5 - LIDAR images (2003, left and 2004 right). The recent uplift is clearly visible in the right-hand image.

*Photo: NASA/USGS*

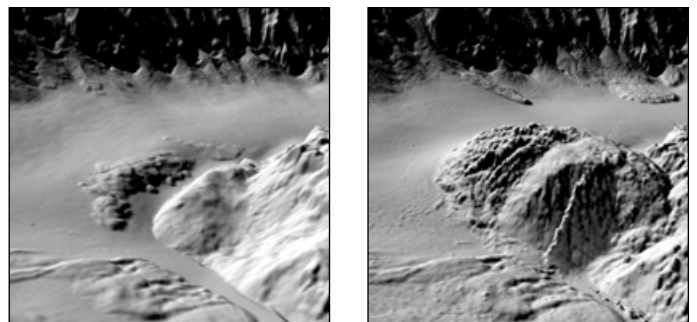
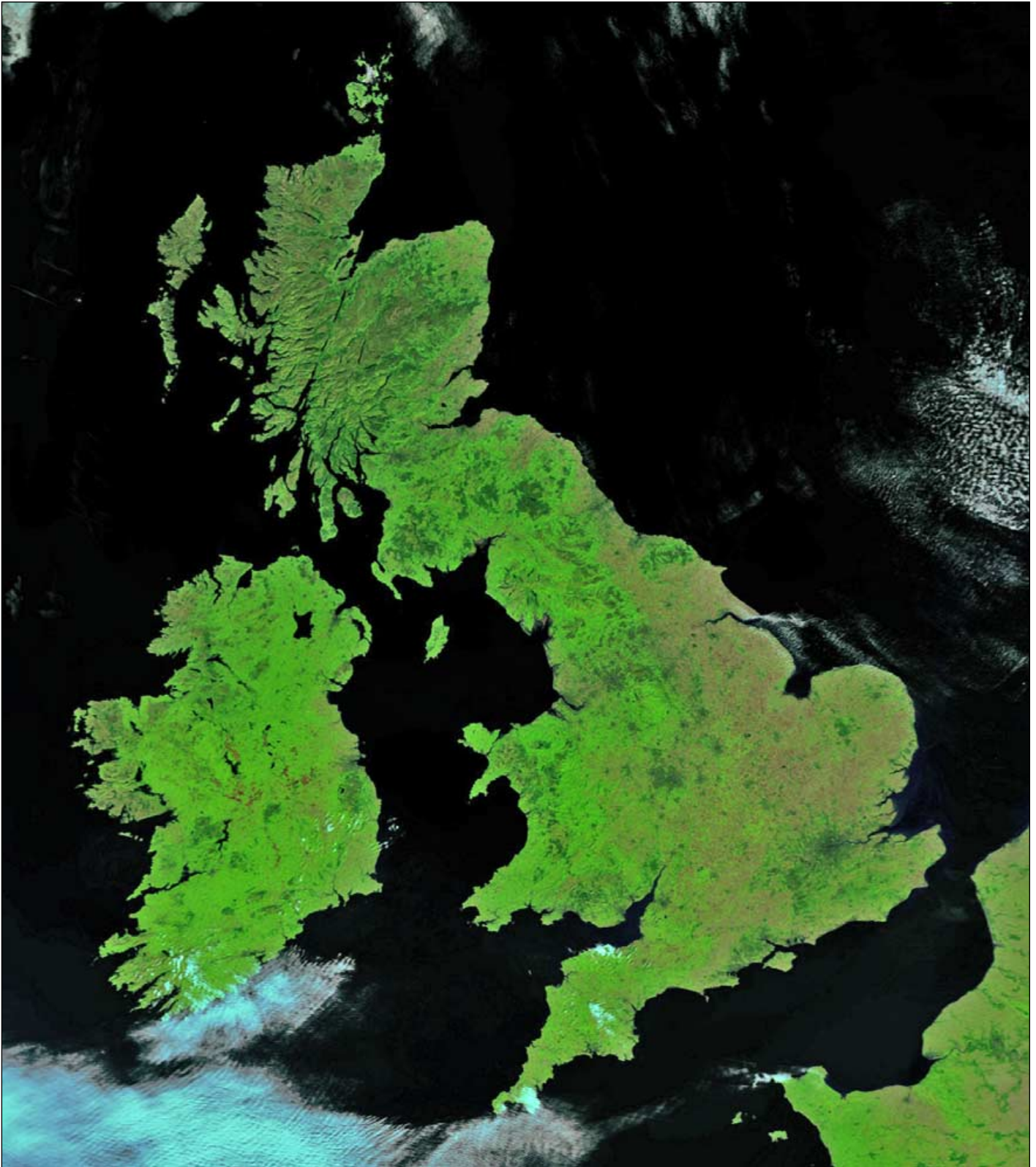


Figure 6 - Close-up LIDAR images (2003, left and 2004 right) clearly showing the new lava dome in the right-hand image.

*Photo: NASA/USGS*

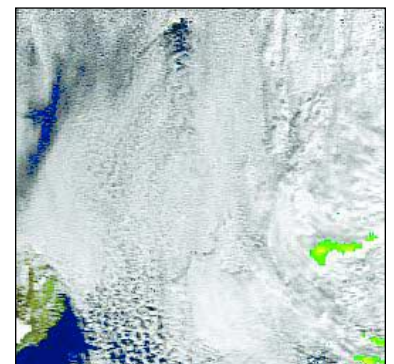


The 11:22 UT NOAA-17 HRPT image from September 8, 2004 pictured above was sent to GEO by **Mike Jupp** who commented: 'What a clear day—virtually the whole of the UK is cloud free—makes a change.' The image was processed using David Taylor's HRPT Reader software, using channels 3, 2 and 1 as the red, green and blue channels respectively.

The APT image segment at right was

provided by **Gerry Berg** (DK1RR) from Germany, who spotted an interesting wake of Von Kármán vortices south of Jan Mayen Island in the North Atlantic on September 23, 2004. The pass came from NOAA-12 at 16:04 UT on that day.

On the back cover of this Quarterly you will find the same vortex street as imaged by NASA's *Terra* satellite using its maximum ground resolution of 250 metres per pixel.





# Problems Making Antenna Measurements

## An Interim Report

Rob Hollander, Harrie van Deursen and Ruud Jansen

Our preliminary results on antenna measurements were presented in GEO Q3 in our article 'Antenna Theory and Measurement, part 1' and more results had been promised for part 2. However, the measurements on gain, radiation pattern and cross polarisation that we have completed so far revealed a fundamental problem with antenna measurements, one we had completely underestimated. We feel that we have to solve this problem first, or find a way to reduce its influence on the results, before part 2 can be launched.

In this article we describe the problem, one that is present not only in antenna measurements but also in any practical antenna geometry. It may well be that 'unexpected antenna performance' becomes less mysterious after reading this article. You may even find reasons to change your antenna position to get better satellite reception. After all, antenna performance under receiving conditions is what counts; antenna measurements are only interesting for those freaks who want to know whether their strange constructions (i.e. antennas) perform as expected or not.

The problem has nothing to do with poorly constructed antennas, measurement equipment, data-analysis or even with the skills of the person performing the measurements: it stems from the simple fact that electromagnetic waves are reflected from every interface between media with different dielectric properties, e.g. 'ground', walls, trees etc. Wave reflections are specular (as from a mirror) when the surface is flat but are more or less 'scattered' from rough surfaces. Moreover, waves 'bend' around edges (are 'diffracted'). This means that the waves that fall on to our antenna don't necessarily come straight from the satellite you want to receive or from the transmitting antenna during an antenna measurement. The geometry around transmitting and receiving antennas determines the reflections: how strong they are and from which direction they arrive. Also, due to the difference in path-length between the direct and the reflected waves, the phases of both waves are different. Moreover, the amplitude and phase of a wave change on reflection and these changes depend on the polarisation of the wave relative to the plane of incidence, on the angle of incidence and on the 'ground'-conditions (conductivity and dielectric constant). These are illustrated in figure 1. Ultimately, all these waves interfere—combine, taking into account the direction, amplitude and phase—to produce the antenna signal.

The combination of direct and reflected waves may result in a much larger signal than from the direct waves only (constructive interference) or the two waves may even completely cancel each other (destructive interference), depending on their relative phases. This latter effect is the reason for 'noise bands' in images from satellites near the horizon where, in each band, the direct and reflected waves are about equal in amplitude but 180 degrees out

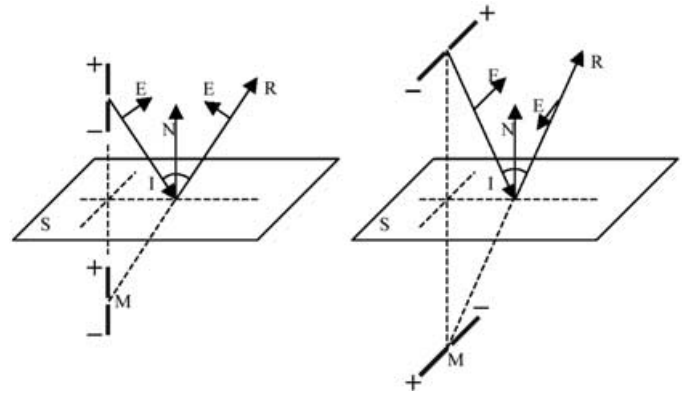


Figure 1

Waves from vertical antennas have their E-vector in the plane of incidence, formed by the incoming wave vector  $I$  and the normal  $N$  to the horizontal surface  $S$  shown on the left. After reflection the reflected wave  $R$  seems to come from the mirror antenna  $M$ . In case of a perfect (conducting) ground the phase does NOT change at reflection. Waves from horizontal antennas have their E-vector perpendicular to the plane of incidence as is shown at the right. In case of a perfect ground the phase changes 180 degrees at reflection, since the total E-field from the antenna and its image at the conducting ground plane should be zero.

of phase. The path difference between consecutive bands is just one wavelength! This effect is clearly visible in images that are received with an antenna that is linearly polarised at the horizon (like a turnstile antenna).

The 180° change in phase on reflection in only **one** of the two polarisation directions also means that circularly polarised waves change their sense of rotation on reflection; LCP becomes RCP and vice versa. If our antenna is circularly polarised at the horizon, e.g. RCP, we receive the direct waves which are RCP, but do **not** see the reflected waves which are LCP. Now we cannot get destructive interference! If our antenna, like the RQHA, is only 70% RCP (and 30% LCP) at the horizon, then *some* destructive interference *will* occur, but complete cancellation will not. Usually there is enough signal strength left to obtain a noise free image.

As soon as we realised what the cause of the strange results in our measurements was, we found many books with descriptions of the phenomenon [ARRL Antenna Book-20 with practical information, Jackson p.278 for EM-fields, and Schelkunoff p.201 on antenna theory].

*We felt as if we had just reinvented the wheel!*

In the ARRL Antenna Book (edition 20) you can find suggestions for antenna measurement set-ups. Some set-ups are rather good for antennas with a high directivity, like Yagis and parabolic antennas, because with such antennas it is often possible to arrange the geometry such that the reflections come from a direction in which the

AUT (antenna under test) is essentially 'blind'. For omnidirectional antennas like the RQHA or the turnstile antenna there are virtually no such prospects. In fact only two set-ups can be used: one in free space; the other a set-up in a reflection-free measurement room. For the first we had thought of using helium balloons. For the second we are still looking for an organisation that has a reflection-free room large enough for measurements at 137 MHz and who are willing to let us use that expensive facility for free. Good measuring conditions for 1.7 GHz are much more easily obtained since transmitter and receiver can be as close as 1 metre to each other to be in the *far field* region. It is easy to make a set-up with reflecting objects much farther away than this 1-meter separation.

It is fairly simple to measure, yourself, how serious reflections are, using just a transmitting dipole and a receiving dipole. For our measurements we used 'current' baluns comprising five large ferrite beads, resulting in an impedance of more than 1 k $\Omega$  for the outside of the copper braid to keep it free of radiating currents. Moreover, we used an impedance transformation from 61  $\Omega$  for our dipoles, nicely at resonance at 137.5 MHz, to the 50  $\Omega$  of our measuring system with two pieces of co-ax cable of 93  $\Omega$  and 75  $\Omega$ . For this first simple test the impedance transformation is not necessary, but we did so for our gain comparison with other antennas later on. You should realise that at the end we want to compare how different antennas behave in the same EM field. What we measure is the signal voltage. However, the electric field produces a current in our antenna proportional to the field strength and this current produces the signal voltage across the antenna impedance.

To avoid reflections in the cables we have to transform the antenna impedance to the input impedance of our measuring system, typically 50  $\Omega$ . Moreover, after transformation, we can use the signal voltages obtained with different antennas in gain comparisons. The baluns are necessary, otherwise you do not see only your dipoles transmitting, but the cable as well. For this test it is crucial that we make a pure dipole field in one polarisation only and measure this polarisation alone. We found that our measurements were almost free of cable geometry (the effect is much less than 1 dB).

The transmitter used for both the rotating dipole and reflection test measurements was a small battery operated oscillator, tuned at 137.5 MHz and fitted with a gain control, whose output level was continuously adjustable by means of a potentiometer. The feed cable was 50 cm of RG-174 running several times through a long ferrite bead. Both transmitter and balun are very compact and were placed directly at the antenna terminals.

The transmitting and receiving dipole antennas were mounted on poles about 3 m tall and some distance apart (use non-metallic pipe such as plastic drainpipe) and the 137 MHz output level was adjusted so that it did not overload the receiver. The signal strength was measured when both antennas were horizontal and again when both were vertical. If there are no reflections both measured signals should be equal whatever the distance between the antennas. If there are reflections the vertical set-up will usually give a lower signal than the horizontal one (Table I).

Antenna distance (m)	H-H minus V-V (dB)	H-H (dB)	H-H corrected	V-V (dB)	V-V corrected
2	1.5	75.5	80.6	74.0	77.6
10	3.2	65.2	66.6	62.0	63.6
13.1	3.0	<b>64.3</b>	<b>64.3</b>	<b>61.3</b>	<b>61.3</b>
17.5	2.8	61.5	61.8	58.7	58.8
~150	4.3	42.0	43.1	37.7	40.1

Table I - using a 13.1 m reference distance

In table I, columns H-H and V-V are the measured signals; columns H-H (corrected) and V-V (corrected) are the values that *should* have been measured assuming the measured values at 13.1 m and at the other distances corrected for the distance effect of  $1/r$  (valid in the *far field* approximation). It is clear that the  $1/r$  law applies for distances over 10 metres rather well.

The difference between H-H and V-V depends not only on the distance between the antennas but also on the heights of the mounting poles. The reflection coefficient of the ground and the phase-difference between the direct and reflected waves determine the measured signals at a given distance. We measured that, with a certain combination of distance and height, the difference H-H minus V-V was almost 6 dB!

To test the cross polarisation, we measured the combination H-V at a distance of 10 metres (H represents the transmitting dipole, V the receiving dipole). The signal is now -30 dB relative to the combination H-H at the same distance, indicating that the polarisation of the field is quite pure (i.e. no V-contribution from the vertical cable!).

What will happen when we replace our receiving dipole with an RQHA? When we place the RQHA with its axis towards the transmitter, then we expect that the received signal will be independent of the rotation angle around the axis. This has to be so, since the radiation pattern for horizontally as well as vertically polarised fields is axially symmetric. Moreover, the RQHA is circularly polarised, and thus signals from the H-field should be as strong as those from the V-field, provided that the H-field itself is as strong as the V-field. Since we have already seen with our dipole-dipole measurements that this is *not* the case, we can expect that the signal from a V-field will be smaller than that from an H-field. We tested this for three antenna distances (table II).

Antenna distance (m)	H minus V (dB)	H-transmit (dB)	H-transmit corrected	V-transmit (dB)	V-transmit corrected
3.4	1.1	73.1	75.2	72.0	71.4
17.4	3.8	<b>61.0</b>	<b>61.0</b>	57.2	57.2
~150	3.6	42.0	42.3	37.4	38.5

Table II - using a 17.4 m reference distance

The meanings of the columns are the same as in table I, except that the reference distance for the correction is 17.4 m. Rotation of the RQHA around its axis resulted in a variation of only  $\pm 0.1$  dB, which is about the measurement error.

The conclusion is that the fields from horizontal and vertical dipoles are pure H- and V-polarised fields respectively. The H-field and the V-field are not the same in total strength, mean direction and total phase due to different reflection properties of the two components.



Using a rotating dipole to measure the H-polarised and V-polarised radiation patterns in a single measurement introduces a complication. At first there is a modulation of the measured signal with twice the dipole rotation frequency. This modulation is also present when the receiving antenna is equally sensitive to an H- and a V-field, which should be the case for a circularly polarised antenna (apart from the phase relation). It is possible to measure first the difference in the produced fields with a dipole antenna then correct the measured H- and V-signals of the AUT. This is possible in a static measurement where you know the orientation of the transmitting antenna. With a rotating dipole you should measure the rotation angle at the same moment as the signal and the AZ- and EL-angles of the AUT. Correcting the measured H- and V- modulated radiation pattern obtained in a rotating dipole set-up, assuming that the larger signals come from the H-field and the smaller from the V-field, is tricky; you do not have that information. *This is the complication I mentioned earlier!*

You can assume that your AUT, like the RQHA pointing with its axis towards the transmitter, is equally sensitive to an H- and a V-field or measure the modulation of the signal of the AUT. For an RQHA with its axis pointing towards the transmitter this modulation should be the same as the difference in signal between the H- and V-fields from a static transmitting dipole, since we had already measured that the RQHA was equally sensitive to an H-field or a V-field independent of its rotation angle around its axis. Assuming that the outer envelope of the modulated pattern represents the H-field and the inner the V-field for all EL-angles may result in incorrect results since both patterns may cross at some EL-angle.



**Figure 2** -The team making measurements. From left to right: Arne van Belle, Rob Hollander and Harrie van Deursen. At the right is an interested passer-by.

*Photo: Ruud Jansen*

Measurements with circular fields are even more complicated. Due to the reflections, where RCP becomes LCP and vice versa, it is not possible to measure the RCP- and the LCP-radiation patterns separately. If we start with a pure RCP-field then the direct wave will have the correct polarisation and the expected direction. The reflected wave has the wrong polarisation and comes from some unknown direction. How should the single signal, the result of both the direct and reflected fields, be interpreted? The RQHA is not 100% RCP at all angles! In fact, this percentage is what we want to measure! Things mix up and cannot be disentangled.

Cross-polarisation measurements with circular fields require very pure RCP- and LCP-fields. Mixing of polarisation, e.g. due to reflections, immediately sets the

limit for the cross-polarisation that can be measured. You do not know which part of the measured cross-polarisation comes from the sensitivity of your antenna to the incorrect polarisation or from the field containing the incorrect polarisation. Reflections contribute up to 50% in the final field.

### Conclusions

It should be clear that, in antenna measurements, reflections should be avoided. In relative gain measurements, where the signal of an AUT is compared with the signal of a reference antenna, reflections enter into the result because the radiation patterns of AUT and reference antenna are not the same. The signal results in both cases from the same field, but the weighting of the reflections is different. Usually this is a small effect.

We already saw that the measurement of radiation patterns is fully influenced by reflections; we simply don't know where the reflected waves come from or, in other words, what angle of the pattern should be assigned to the measured signal strength? In radiation pattern measurements with circular polarisation, we also don't know what the degree of polarisation mixing we are looking at is—in other words, what pattern are we measuring: RCP or LCP? Measuring a horizontally polarised and a vertically polarised radiation pattern separately (in two static dipole measurements or in one rotating dipole measurement) is not the same as a radiation pattern measurement with a circularly polarised field. There is no information about the relative phase of the horizontally and vertically polarised components. If, as in the ideal case, the patterns (and the signal strengths) are identical, then circular polarisation is possible but linear polarisation cannot be ruled out.

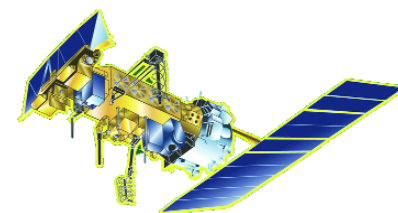
Cross-polarisation measurements are impossible in the presence of reflections. If we want to measure a -20 dB cross-polarisation (or even less) the field should be much purer than that 20 dB. The problem is not that we cannot produce such a field with a good transmitting antenna (although this is not trivial), but that the field is not pure at the time when the reflections show up. It seems that this type of measurement can only be performed at a large reflection-free EM-test facility, which is far beyond the scope of amateurs.

Our preliminary results already show that, despite the problems with reflections, it is possible to obtain radiation patterns that are not far from the expected ones. This gives hope for gain measurements as well. We still hope that we can find a geometry in which gain and pattern measurements can be performed with good accuracy. We have to test that geometry for reflections. Until now, we can only conclude that high mounting poles (10 m or more) and a small antenna distance (~10 m) are favourable. We have thought of using metal fences to screen ground reflections when the distance between transmitter and AUT is relatively large. This idea can be combined with a location where we can place the transmitter and the AUT on two hills in such a way that the surface where the reflections are produced is not visible from the AUT. We have already tried this (without fences) but the results were disappointing. We have to repeat these measurements now knowing better where to look. If nothing else helps, we may try a balloon experiment.

# GEO-PIC 1.0

## Upgrade your RX2 Receiver

to receive the new NOAA Frequencies



Clive Finnis

If all goes according to plan, a new NOAA weather satellite should start transmitting APT and HRPT imagery of the Earth this month. NOAA-N, the last-but-one satellite in the current *Polar Operational Environmental Satellite* (POES) series was listed for a March 19 launch and, once it reaches orbit, it will be renamed NOAA-18. Just one more NOAA satellite remains to be launched, the ill-fated NOAA-N prime, which is currently undergoing repair at the Lockheed Martin facility in California (see GEO Q3, page 19). Subject to successful restoration, this final APT-carrying satellite will launch in December 2007.

Looking to the future, the new all-digital *National Polar-orbiting Operational Environmental Satellite System* (POESS) kicks off in 2009. A feature of the new system is a change in the transmission frequencies: the familiar 137.50 MHz and 137.62 MHz will be no more. Two entirely new frequencies in the 137-138 MHz band have been allocated, and these will also be used with the final two NOAAs.

**Consequently, unless you possess a tunable weather satellite receiver, you will not be able to receive APT transmissions from NOAA-N and NOAA-N-prime!**

But there is good news for the hundreds of APT enthusiasts who use the ubiquitous RX2 receiver, designed by Ray Godden, to receive their images. The RX2 has given great service for many years but it cannot currently tune in to the new frequencies of 137.1 MHz and 137.925 MHz. The required frequencies in the RX2 are generated by means of control signals from the microcontroller PIC (IC6) to the frequency synthesiser TSA6057 (IC4). The solution to this problem is to provide a new PIC microcontroller which has been re-programmed to provide these new frequencies.



This PIC, called the **GEO-PIC version 1.0**, is available from the GEO Shop (see page 46) and will provide the following frequencies.

- Channel 1 - 137.100 MHz (new for NOAA-N)
- Channel 2 - 137.400 MHz (Okean/Sich)
- Channel 3 - 137.500 MHz (NOAA 12, 15)
- Channel 4 - 137.620 MHz (NOAA 17)
- Channel 5 - 137.910 MHz (new for NOAA-N)

**Note:** 137.91 MHz is as close as it is possible to program the RX2 to 137.9125 MHz

Thus channels 2, 3 and 4 will remain the same as the old PIC. Channels 1 and 5, which used to hold the 137.30 MHz and 137.85 MHz frequencies used by the Russian *Meteor* series of APT satellites have been re-allocated: as far as is known, these frequencies will not be used again.

Channel 't' the test channel, selected by holding down the front panel push button at power-up, remains as before at 137.970 MHz.

When in scan mode, the new PIC will scan channels 1 to 5 inclusive, as on the original device.

The new PIC also incorporates the code developed by Max Hadley for remote control of the RX2 from a PC serial port. See photographs of the PIC and RX2 inside the back cover.

### Installing the GEO-PIC

Fitting the new PIC is easy. It is the only IC in the RX2 that is fitted into a socket: so the old one can be carefully prised from the socket using a small jeweller's screwdriver. Be sure to observe anti-static precautions, as the new PIC, like most modern electronic components, can be damaged by a static electric discharge. The easiest precaution (if you do not have the conductive wrist bands used by professionals) is to touch an earthed object such as a metal radiator immediately prior to removing the new PIC from its protective black conductive foam. However do not worry if you are unsure of what to do—full installation and operating instructions are included.

### Check your Synthesiser Chip

Early RX2s were fitted with a different synthesiser chip in position IC4 (a TSA6060) and this requires different code in the PIC to 'drive' it correctly. Do check this out. If your RX2 has this chip fitted **please tell us** when you order so that we can ensure that you receive the correct PIC for your receiver.

**If you do not mention this we will automatically assume you have the TSA6057 and send you a PIC to suit (the TSA6057 is fitted to the majority of RX2s).**

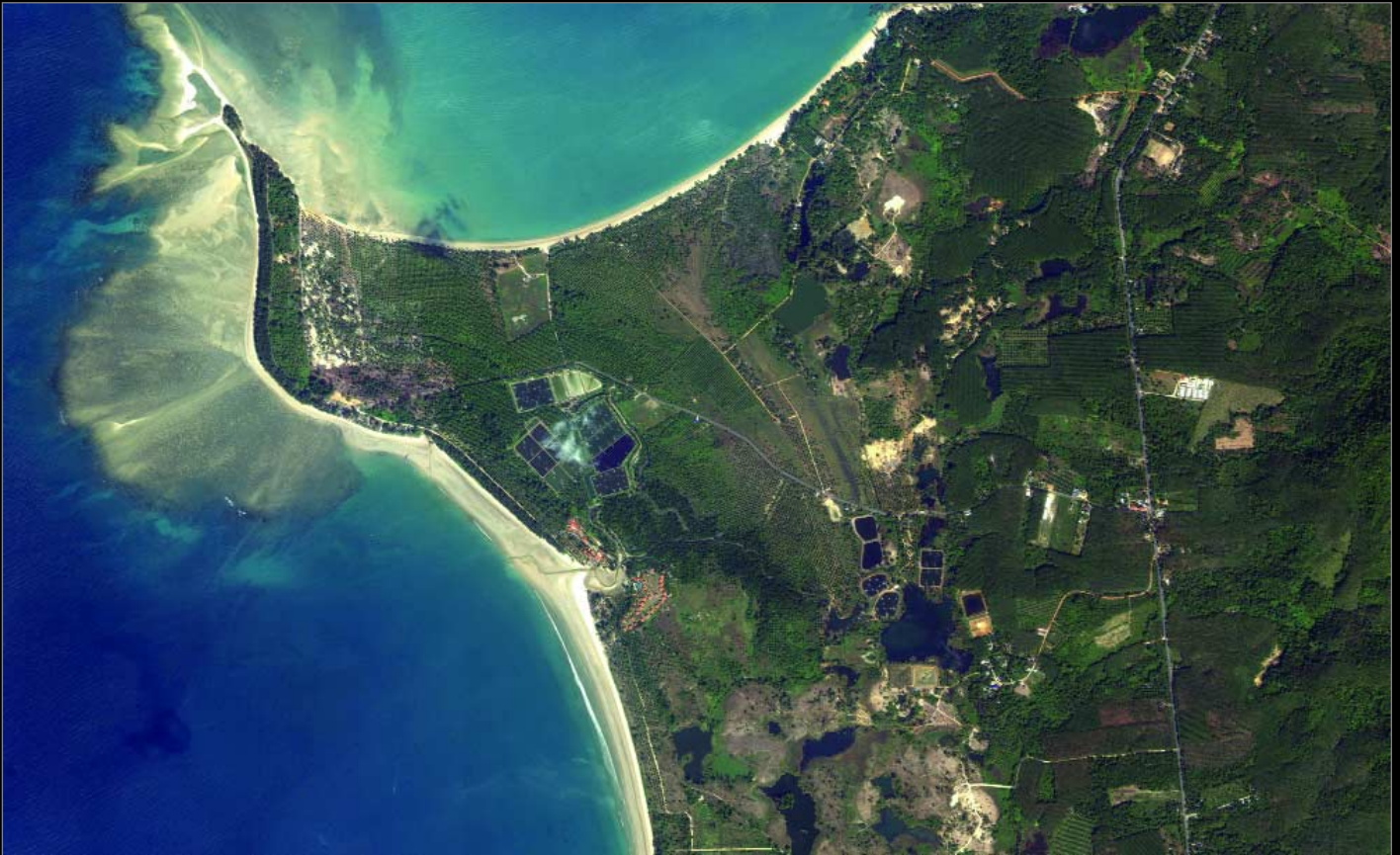
### What does this new PIC Cost?

For members residing in the UK the price is £7.00. The cost for members in continental Europe is £7.60 and for the Rest of the World it is £8.00. All these prices include carriage and packing.

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

*Items from the GEO shop are available only to paid up GEO members.*





**Thailand Tsunami Damage - December 29, 2004 .. the Greatest Human Disaster in Living Memory**

The beaches of **Khao Lak, Thailand** were struck by a tsunami 2-3 hours after a magnitude 9.0 Indian Ocean earthquake on December 26. Although some 500 kilometres distant from the epicentre, the waves were 10 meters high. The top image shows a coastline area popular with European tourists as it was on January 3, 2003. The lower image shows buildings and vegetation scoured by the tsunami, leaving only foundations and bare soil. Vast quantities of beach sand were also washed away. These high-resolution satellite images were acquired by Space Imaging's Ikonos satellite.

*Images: © Space Imaging.*



# Produce your own HRPT Images

## using data from the

# NOAA Satellite Active Archive



Les Hamilton

We know from comments we receive from GEO readers just how much you appreciate the high-resolution (HRPT) images from the American NOAA satellites. These can of course be acquired directly from the satellites themselves by anyone prepared to make the necessary outlay for a dedicated receiver and tracking antenna—but there is an easier way. The same raw HRPT data files transmitted by the NOAA satellites are available on the Internet and can be downloaded free from a number of sources, most notably from NOAA's own Satellite Active Archive (SAA). If you cannot afford to purchase a commercial HRPT system and lack the expertise to build your own from a kit this provides an alternative means of accessing the fascinating world of high-resolution satellite imagery.

### Registering with SAA

Although you must first register with SAA before they will permit you to download their products, this is just a formality—and there is no charge. Just direct your Internet browser to;

<http://www.saa.noaa.gov>

and click the 'Register' link at the top right-hand corner of the screen. The only information you have to supply are your first name, last name, e-mail address and password. The password is of your own choosing, and is required when you log-in to the site.

### Logging-in

Once registered, you can log-in to the SAA site and select files for download. Do this by clicking on the 'Login' link at the upper right-hand corner of the opening screen.

Type your first name into the 'Username' field and your chosen password into the 'Password' field. (figure 1) then click OK. Wait a few seconds until the screen refreshes (the 'Login' link will now have disappeared) and open the 'Please select a product to search' window, part of which is shown in figure 2. Click on the first item

in the list, 'Advanced Very High Resolution Radiometer', then on the link labelled 'Go'. You are now taken to the page where you can select the type of image you wish to search for, a specific satellite, and the start and end dates for your search. The relevant part of this page is shown in figure 3.

### Available Data Types

There are three types of data that you can select. The uppermost item, **GAC**, provides global coverage from satellites at a similar resolution to the familiar 137 MHz APT. These files produce images with a maximum ground resolution of just four kilometres per pixel. You are almost certain to be able to locate an image from anywhere on the planet in this file format. **HRPT** provides the full-resolution 1-km/pixel raw data stream received live from the satellites at ground stations in the USA, ideal if you require images of North America and the Caribbean. **LAC** also provides the HRPT data stream, but these files are recorded aboard the satellites whilst flying over regions out of direct range of US ground stations; the data are relayed to Earth during a subsequent orbit.

If you require HRPT data files for Europe, Asia or Australasia, then you should check the box beside LAC. Because of the recovery method for these data, you may often have to wait till the following day before LAC files become available for downloading.

### Selecting a Dataset

The options for **Receiving Station** and **Distribution Site** can safely be left untouched at their default settings. The **Node** options afford the opportunity of restricting your search to ascending or descending satellite passes: leaving all options unchecked has the same effect as checking the 'either' option. Should you wish to restrict your search to just one specific **Satellite**, click on its name to highlight it—otherwise passes for all satellites will be searched for and displayed.



Figure 1 - The Login window

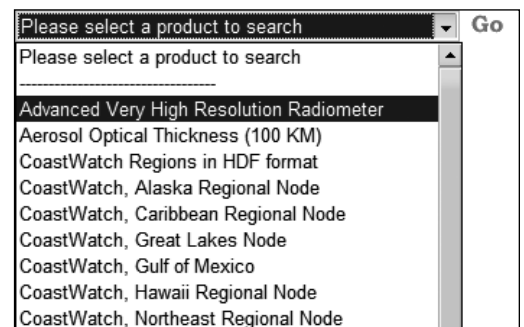


Figure 2 - Selecting NOAA data



Figure 3 - Selecting a Dataset



Figure 4 - Selecting a date from the calendar



The **Temporal** setting allows you to refine the search interval (one week prior to the current date by default). Either or both of two interactive calendars above the map at the foot of the page may be modified to increase the breadth of search, or to restrict it to a single day (figure 4). You can also restrict the hours searched by entering **Start Time** and **End Time** in the fields provided. Finally, you must define **Spatial** details for the area over which you wish to search for satellite data by dragging a rectangle over the map to outline the target region. You can zoom in for increased accuracy (figure 5).

**User Preferences**

The menu in the left-hand margin of each page contains the option 'User Preferences'. It is here that you can choose which of the five HRPT channels you require for the various file formats. Do this prior to ordering your first datafile from SAA. Be certain that you select 10 bits/pixel for each (figure 6). These preferences remain in force for future downloads until such time as you decide to change them.

**Ordering Datasets**

Once all the above has been completed, click on the **Search** button beneath the map and await a listing of all the appropriate satellite passes (figure 7). If you are searching over an extended time interval this may take a little time and present you with a large number of datasets in a paged list. Generally, it is helpful to restrict the search to a specified 24-hour period. You can view thumbnails of any image by clicking the button in the **View Details** column at the left of each line in the table (figure 8).

If you are happy with the image, return to the **Search results** screen, check the box in the **Shopping cart** column then click the **Go to cart** button at the top of the page. This takes you to the Shopping cart screen (figure 9) where all that remains to be done is to click the **Place order** button at upper left. Note: the 'Include Archive Header' box is always checked by default - **do not** alter this.

You should receive confirmation of your order almost immediately, and an e-mail (to the address you provided when you registered) confirming this is also sent out shortly thereafter.

The datasets that you order are placed in a folder on the SAA FTP server for you to download. There will be a delay

while this is set up for you, but you should receive a second e-mail confirming the address; this often arrives within minutes though it can take several hours during busy periods. Note, however, that if you request data that is more than a week old, it may sometimes be several days before it is made available for you. HRPT datasets can be large (some are of the order of 100 Mb). In general, a 10° spread in latitude equates to 16 Mb of data. As image processing can take a considerable time, particularly on low specification computers, it doesn't pay to order a file larger than you require! The whole point of HRPT, surely, is to investigate small regions in high detail.

Additionally, if you are using a dial-up Internet connection, it again pays to order the smallest datafile that suits your needs, as even a 16 Mb file as noted above will take the best part of an hour to download. You can reduce file size by ordering only channels 2+4 if all your interest is in producing false-colour images.

If you plan to download HRPT telemetry files on a regular basis, you should seriously consider switching to a broadband Internet account.

Once you receive notification that your file is available for download you have just 72 hours to retrieve it before it is cleared. You can retrieve your file with an ftp program of your choice or via your web browser. Note that when downloading via ftp you must select a 'binary' (or 'image') mode of transfer, not 'text' or 'ascii'.

**HRPT Imaging Software**

Once you have downloaded an HRPT or LAC datafile you have to process it into images. The software preferred by the majority of enthusiasts is the **HRPT Reader Program** [1] written by David Taylor. This program can be obtained in both free and registered versions. The free version is perfectly adequate for getting started but a number of more sophisticated image processing options are available upon registration. If you have not run any of David's software before, you will also require to install the **Runtime Library Bundle**.

HRPT Reader comes as a ZIP file. As it does not have an installer you must create a folder on your hard drive called 'HRPT Reader' and unzip all the contents into this. It is also advisable to create two sub-folders within it, **RAW** and **IMAGES**, the former to store your

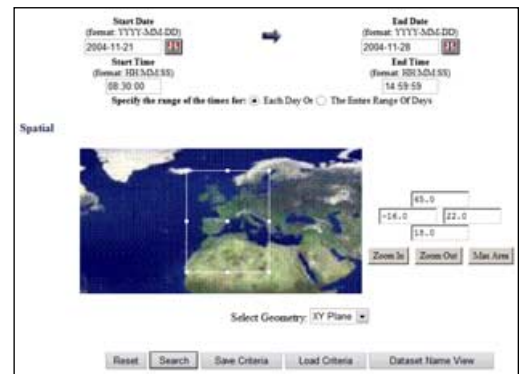


Figure 5 - Selecting the area (zoomed)

Data Type	Scan Line	Bits/Pixel			Channel Number					
		Selection	8	10	16	1	2	3	4	5
AVHRR_HRPT	<input checked="" type="checkbox"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AVHRR_GAC	<input checked="" type="checkbox"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AVHRR_LAC	<input checked="" type="checkbox"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AVHRR_FRAC	<input checked="" type="checkbox"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Figure 6 - User preferences

View Details	Shopping Cart	Inventory ID	Inventory Name	Orbit	Start Time	End Time	File ID	Default Name
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC
<input type="checkbox"/>	<input type="checkbox"/>	428121	AVHRR_HRPT	1205	2004-11-20 04:22:23.23	2004-11-20 04:33:40.0	5017	NSS_HRPT_NL_D04107.51149.E1155.B212606.GC

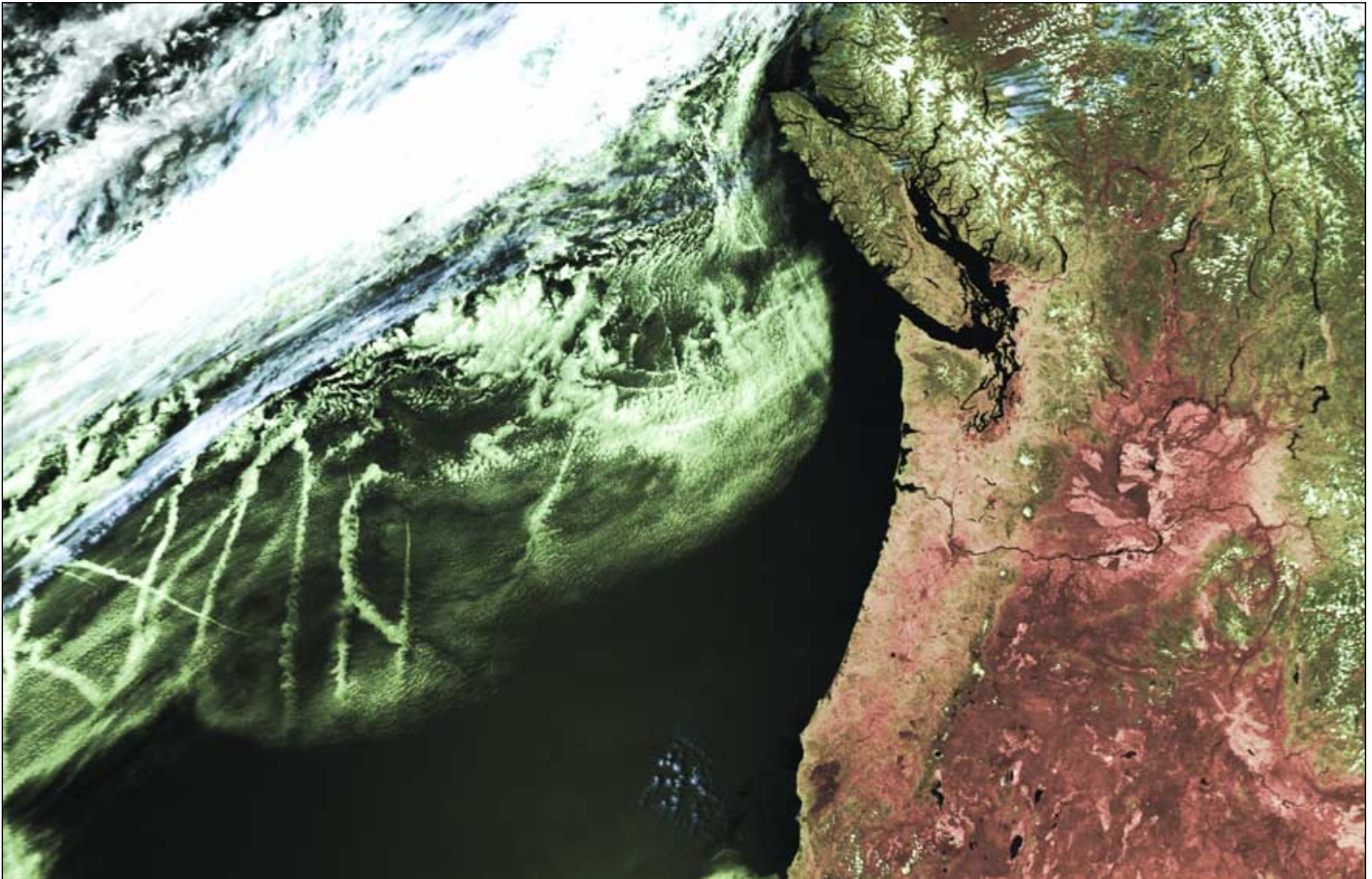
Figure 7 - Search results

Figure 8 - Dataset details

View Details	Order	Data Set Details	Default Archive Header	Scan Line Selection	Bits/Pixel	Channel Number
<input type="checkbox"/>	<input checked="" type="checkbox"/>	AVHRR_LAC NSS_HRPT_NL_D04107.51149.E1155.B212606.GC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10	1, 2, 3, 4
<input type="checkbox"/>	<input checked="" type="checkbox"/>	AVHRR_LAC NSS_HRPT_NL_D04107.51149.E1155.B212606.GC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10	1, 2, 3, 4

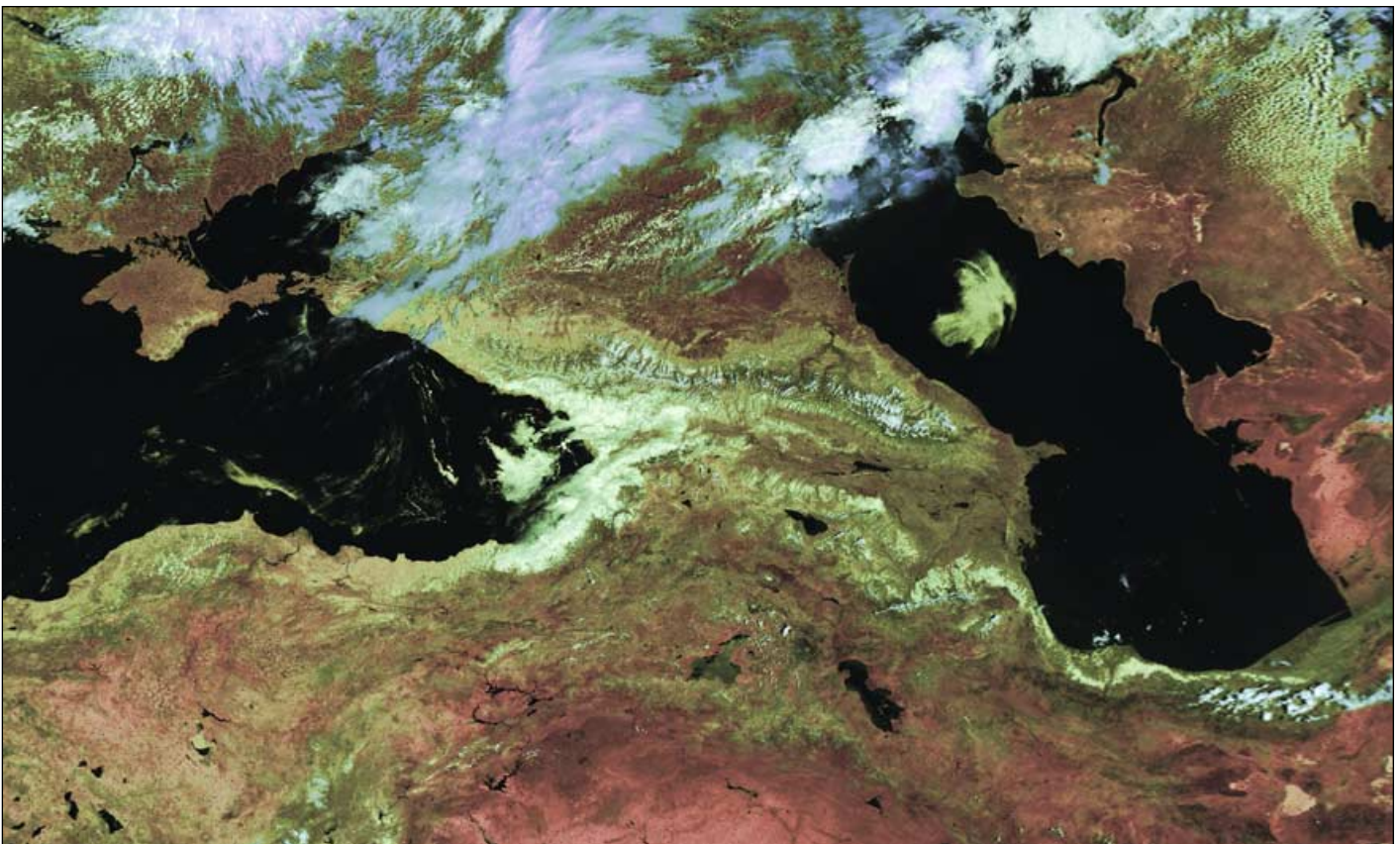
Figure 9 - Shopping cart





This splendid NOAA-16, false-colour image was prepared from an SAA 'HRP' datafile dating from 21:40 UT on June 28, 2003. The image displays a cluster of fascinating 'ship tracks' over the Pacific Ocean. Vancouver Island and the

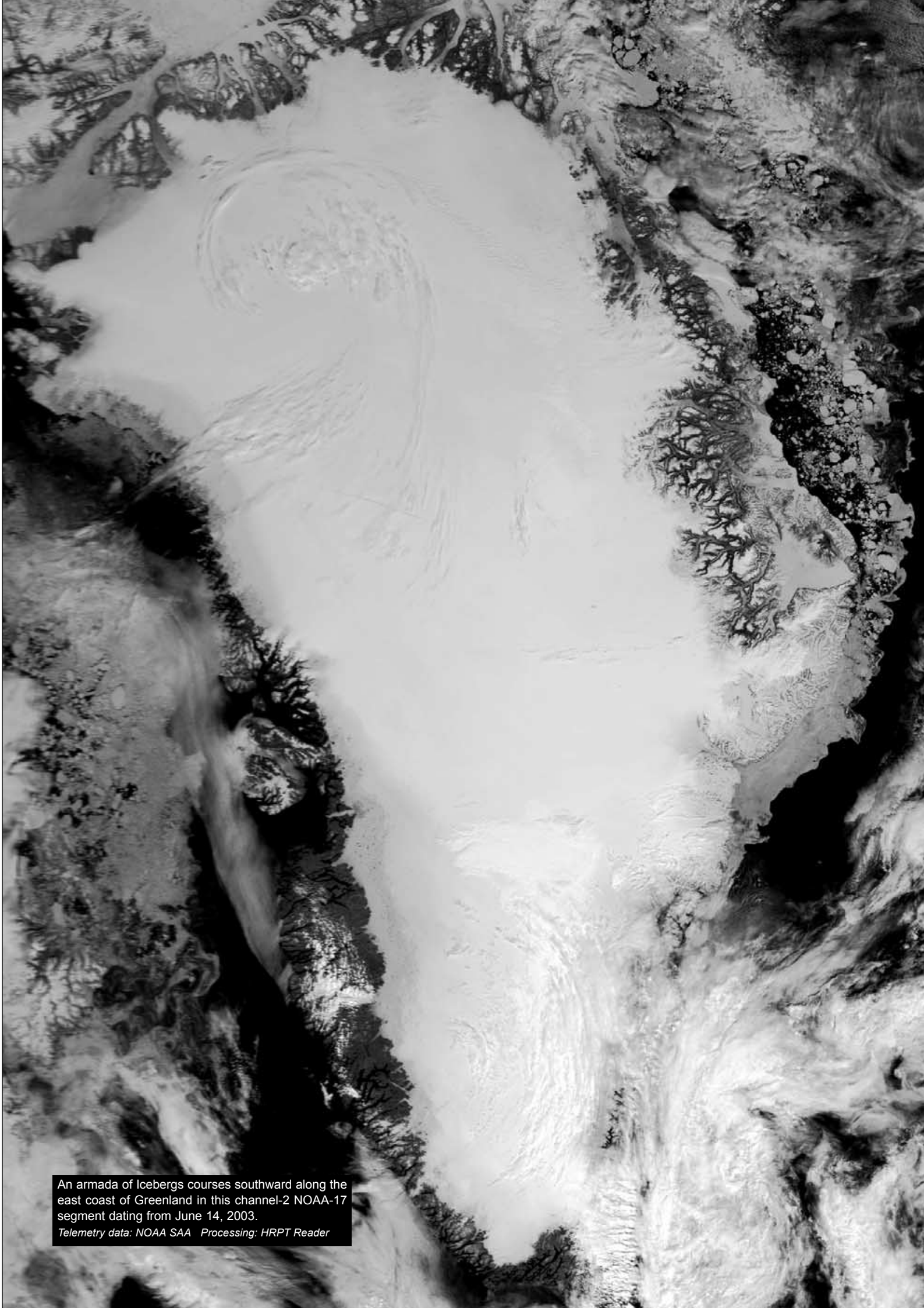
snow-capped Coast Range are prominent, as are the Columbia and Snake Rivers. The volcanic peaks of the Cascade Range stand out like a regiment of white beacons.  
*Telemetry data: NOAA SAA Processing: HRPT Reader*



This scene was observed by NOAA-17 at 03:11 UT on June 12, 2003. The raw datafile was acquired from Russia's SMIS server. The centre of the image is

dominated by the Caucasus Mountains stretching between the southern Caspian Sea and the Black Sea.  
*Telemetry data: SMIS Processing: HRPT Reader*





An armada of Icebergs courses southward along the east coast of Greenland in this channel-2 NOAA-17 segment dating from June 14, 2003.

*Telemetry data: NOAA SAA Processing: HRPT Reader*

downloaded datafiles, the latter to hold the images you prepare from them.

**Creating HRPT Images**

The files from SAA have meaningless automatically generated filenames: for example 'A4416181.L5629091'. This can be read by *HRPT Reader*, but it is best to edit the extension to 'GAC', 'HRP' or 'LAC' to give a filename like 'A4416181.HRP'. The stem of the filename can also be changed to a more meaningful name if you wish. Using these extensions ensures that the decoding software 'understands' the architecture of each specific datafile, and interprets it correctly.

Use the <File → Open> menu to navigate to your RAW folder and double-click on an HRPT datafile. If you have a relatively high-specification computer, HRPT Reader should display the image after just a few seconds. Figure 11 compares processing times for a variety of PCs, using raw datafiles of two different sizes. Although a faster processor bring benefits, the key to speed is having lots of RAM. As the table indicates, you can process small HRPT datafiles with as little as 32 Mb RAM—but it takes a long time: in the case of the 31 Mb test file, the Pentium-1 PC took a further three minutes just to write the image to the screen once initial processing had been completed!

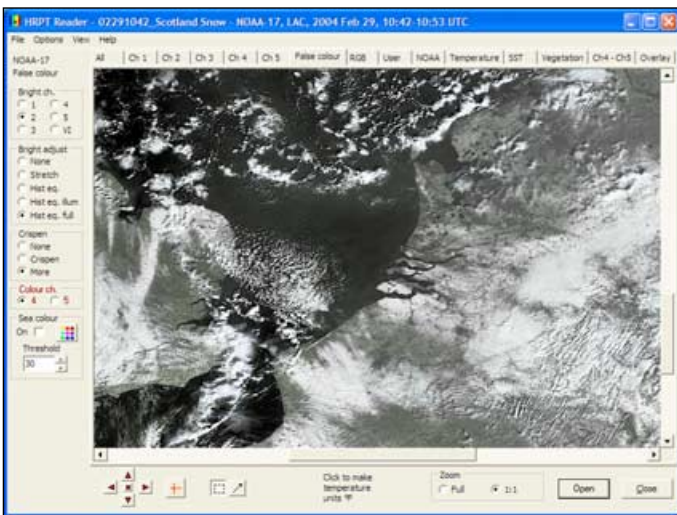


Figure 10 HRPT Reader screen displaying overnight snowfall in the Low Countries - NOAA 17, February 29, 2004

Processor	Speed (MHz)	RAM (Mb)	Processing (32 Mb file)	Processing (64 Mb file)
Pentium I	233	32	7 min 20 sec	-
Pentium II	366	192	18 sec	70 sec
Pentium III	500	256	12 sec	47 sec
Pentium IV	2800	1000	3 sec	7 sec

Figure 11 - Processing times on various PCs

The images from all five of the HRPT channels are available for inspection simply by clicking the appropriate channel tab at the top of the screen (figure 10). A number of specialised images produced by combining these channels in various ways can also be viewed on the other tabs (False colour, RGB, Sea surface temperature etc), but a detailed description of these is beyond the scope of this article.

**Saving Images**

Before saving an image for the first time it is necessary to 'tell' HRPT Reader the location of your 'IMAGES' folder. Select

<Options → Results location> from the menu-bar to navigate to this folder then click on it. Now any file saved using the options under the <File> menu will be placed in that folder. The particular image saved is always the one actually displaying at the time of the save; if you save while the false-colour image is displayed on the screen, it is that false-colour image that will be saved, and so on.

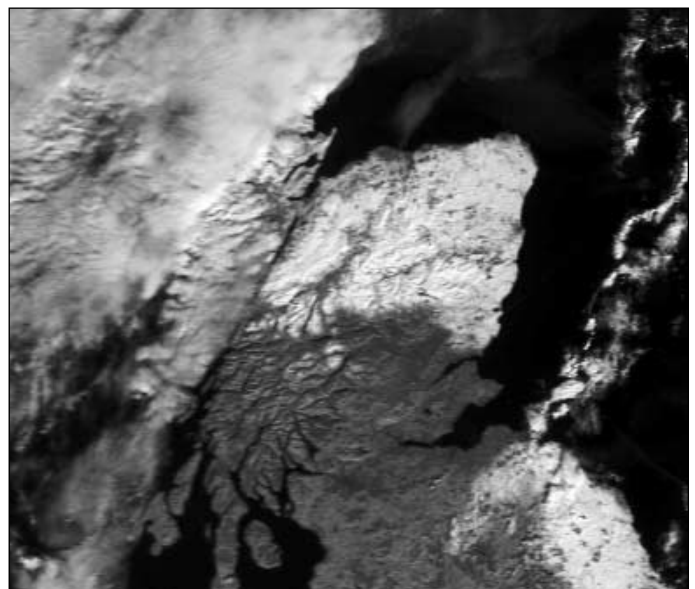
Images can be stored in a variety of formats. <File → Save displayed image> saves the geometrically uncorrected HRPT image (exactly as it appears on screen) in lossless BMP format at 1.1 km/pixel resolution. The <File → Save with correction> option applies geometric correction to counteract perspective effects caused by Earth's curvature, which occur at the edges of the images. <File → Save as APT> produces a corrected but subsampled version of the latter, with a resolution of 4-km/pixel. There are also options to save in the compressed JPEG format.

**Other Sources for HRPT Files**

HRPT data from the NOAA satellites is downloaded daily by the Space Monitoring Information Support Laboratory (SMIS) in Moscow, Russia [2]. There is a wealth of material available on the 'Satellite Data Page' [3]. The link 'Telemetry Active Archive' allows you to download datafiles collected during the previous 28 days and files for the previous 24 hours are available from the 'Last telemetry files' link. HRPT files are also available from the ZS RCPOD, Novosibirsk server [4]. This has the advantage of access to NOAA passes farther east than Moscow.

**References**

1. HRPT Reader is available from Software Showcase. You can also download it yourself from <http://www.satsignal.net> on David Taylor's website. You will find the link to HRPT Reader under the 'Satellite Tools' section. The link to the runtime library bundle is on the HRPT Reader page under the section headed 'System Requirements'.
2. SMIS  
<http://smis.iki.rssi.ru> (or <http://d902.iki.rssi.ru>)
3. SMIS Satellite Data Page  
[http://smis.iki.rssi.ru/dataserv/engl/data\\_s\\_e.htm](http://smis.iki.rssi.ru/dataserv/engl/data_s_e.htm)
4. ZS RCPOD, Novosibirsk  
[http://212.17.0.65/tlm\\_cat/tlm\\_cat\\_e.sht](http://212.17.0.65/tlm_cat/tlm_cat_e.sht)



A channel-2 NOAA-17 HRPT segment from February 29, 2004, when much of Scotland and northern England were blanketed in snow.



# Earth Imaging News

**Peter Wakelin**

## **TRMM Mission Extended Again**

Launched in 1997, the Tropical Rainfall Measuring Mission spacecraft was designed to operate as a three-year research mission. After four years of extending TRMM, which is now low enough to experience significant atmospheric drag, NASA and its mission partner, JAXA (Japan Aerospace Exploration Agency) planned to decommission TRMM and proceed with a safe, controlled deorbit.

However, in view of the high value of the data being returned, for both research and use in operational weather forecasting, the National Academy of Science's Committee on the future of TRMM 'strongly recommended continued operation of TRMM, at least until such a time as a decision on controlled reentry becomes unavoidable.' Destined to end up as a charred wreck on the floor of the Pacific Ocean, TRMM has been granted a few months' reprieve.

## **NOAA N Launch Preparations Under Way**

At the time of writing in mid-January, a Boeing Delta II rocket stands at Space Launch Complex-2 on the Western Range at Vandenberg AFB in California. The solid rocket boosters have been attached and the second stage is due to be added shortly.



Meanwhile, in a NASA payload processing facility nearby, the spacecraft has been mated to the Delta II payload attach fitting and placed on a test stand. Checks will continue right up to the launch which is expected on March 19.

## **GOES-R Development Continues Apace**

Although the launch is still more than seven years away, development of the next-generation GOES geostationary satellites is accelerating. The first, GOES-R, is planned to be orbited in 2012 and will have a greater capability than the imminent GOES-N spacecraft.

The new Advanced Baseline Imager will have about 16 channels which will have similar characteristics to those on the SEVIRI instrument on EUMETSAT's second-generation Meteosats. The GOES-R series will also carry a Hyperspectral Environmental Suite (HES), a multi-purpose sounder/imager. One of its capabilities will be to better monitor and study coastal waters, a task which has largely been carried out by lower polar-orbiting spacecraft. With the high resolution of HES, coastal monitoring can be continuous from a 'stationary' platform and scientists from NOAA, NASA, and the Office of Naval Research met recently to discuss how to maximise the benefits of this new capability.

Another recent development is the selection by NASA, on NOAA's behalf, of contractors to work on aspects of the Space Environment In-Situ Suite (SEISS) of instruments which comprises three instruments to provide data essential to NOAA's Space Weather Operations.

## **Sich 1M Fails to Reach Planned Orbit**

Sich 1M is in a useless orbit due to a shortfall in the orbit circularisation burn. The first burn of the third stage rocket carried the spacecraft (together with the MK-1TS subsatellite) to near the planned 650 km apogee where the third stage fired again but failed to impart sufficient velocity increase to circularise the orbit. The shortfall was about 100 m/s resulting in a perigee well below 300 km.



Two-line elements show that the mean motion increased from 15.352 to 15.381 in the four weeks following launch and the rate of increase will accelerate over the coming months as apogee falls. A fiery end seems inevitable in a few months' time as reports that on-board thrusters can compensate for the third stage underperformance are probably incorrect.

## **Tsunami Wave Heights Measured from Space**

NOAA scientists were able to utilise satellites to measure the height of the devastating tsunami waves that followed the Sumatran earthquake in December (see images on page 17). Scientists at NOAA's Laboratory for Satellite Altimetry (LSA) in Silver Spring, MD, examined data from the four satellites, *TOPEX/Poseidon*, *Jason 1*, *Envisat* and the US Navy's *Geosat Follow-On*. They deduced that two hours after the 'quake the wave height was 60 cm and had reduced to 40 cm after a further 75 minutes. After almost 9 hours the wave had covered most of the Indian Ocean and was 5-10 cm, except in the Bay of Bengal where 25 cm high waves were still bouncing around.

These figures may seem small, and in the open ocean such waves are harmless, but the wavelength is of the order of 100 km so the volume of water in a wave is colossal. It is not until the front of the wave reaches shallow water and slows down that the back of the wave catches it up and increases the amplitude to such an extent that massive devastation is inevitable.

*Concluded on page 27 ...*



# Miami Conference Report



**Francis Bell**

I was delighted to receive, on behalf of GEO, an invitation from NOAA to attend the Satellite Direct Readout Conference: 'A Decade in Transition' organised by NOAA Miami, in December 2004. The conference lasted five busy days and several evenings.

Although I paid my own expenses for hotel, flight and registration the organisers did provide GEO with a display area at no cost to us. I hope there was a suitable trade-off with GEO putting on an interesting display and distributing a copy of our Quarterly publication to almost all the conference delegates. In our display area, GEO ran four and a half days of computer presentation about our group. On the stand we also had three APT receivers and two Hot Bird-6 receivers plus relevant literature.

I don't know the exact numbers attending the conference because delegates tended to come and go over the five days. I think 190 delegates from 30 countries would be a close approximation for those present on each of the five days.

GEO was included in the conference programme and I made a presentation giving some details of GEO's background, skills, our membership numbers and geographical distribution. I also explained our interests in weather satellites. I was also a panel member during one of the conference sessions—an open discussion concerning the global co-ordination of environmental satellite data. My best contribution here was to comment on the growing and worldwide membership of GEO.

The conference organisers kindly presented me with an award after these



GEO's team at Miami  
Nadine and Francis Bell



Darrell Robertson (left) pictured presenting Francis Bell with the award for GEO's presentation.

two sessions. I will ensure that this award travels with me to be displayed at any future GEO events.

The conference programme was detailed and extensive. I cannot possibly cover it here except in the broadest terms.

- Day 1 - NOAA programmes, World Meteorological Organisation (WMO), NOAA geostationary and polar satellites, European satellites.
- Day 2 - International co-operation, WMO, NOAA, international use of data.
- Day 3 - Current polar systems, international co-operation, EUMETSAT and polar systems, future polar orbiting systems, NPOESS.
- Day 4 - GEO systems, current status, performance, LRIT, GOES R, EUMETSAT services.
- Day 5 - Global perspective, data dissemination, open discussion.

The text and visual materials which accompanied most of the presentations were projected from CD-ROMs using a computer system and the conference organisers will shortly be making all these presentations available on a single compilation CD-ROM. I will try to make these available to any GEO member who would like one. The CD will be free but there must be a modest handling charge.

UK members should send me their request by post, enclosing four first class stamps. Members who live outside the UK

can contact me by post or e-mail—there will be no charge. I undertake to fulfil requests but with copying and subsequent distribution the timescale is uncertain. My contact details can be found on page 1.

I enjoyed my time in Miami but it was not as glamorous as you might think being buried in conference rooms at the bottom of a large hotel for most of the time. Without a doubt the most interesting, valuable and pleasurable times were when meeting and talking to those people involved in the design, construction, operation and use of weather satellites. I learned about the weather satellite community and I hope they learned about GEO.

## Acknowledgements

I must thank all the following for their contributions to the success of the conference.

I'm not sure who all the organisers were, but special thanks to Darrell Robertson, Ken Ashworth, Eric Madsen and Valerie Thompson for supporting GEO's presence at the conference and of course to NOAA for its administrative structure which provided a smooth running five days.

I am also grateful to NOAA and NASA for providing GEO with a display area and to Les Hamilton for preparing the GEO 'Powerpoint' presentation.

Finally, I cannot end without thanking my wife, Nadine, who helped me with everything, including looking after GEO's stand while I was attending the conference presentations. Try weighing a GEO Quarterly, then multiply it by 250 and take the lot on a transatlantic flight with the rest of your luggage: You need help! Thanks to Nadine. She is unpaid but very supportive within GEO.



The GEO stand at Miami



## Useful Internet Discussion Forums on YAHOO!® Groups

There are a number of Internet-based discussion groups available to weather satellite enthusiasts. You can join any of these by sending an e-mail to the appropriate address, with a request to subscribe. Indeed, a blank e-mail containing the word 'subscribe' in its *Subject* line is all that is required. Some of the more useful groups and their contact addresses are listed below.

### *GEO-Subscribers*

This is a group where GEO members can exchange information relating to either GEO itself or Earth observation satellites and related matters.

**e-mail: [GEO-Subscribers-subscribe@yahoogroups.com](mailto:GEO-Subscribers-subscribe@yahoogroups.com)**

### *Satsignal*

An end-user self help group for users of David Taylor's Satellite Software Tools including the orbit predictor WXtrack, the file decoders GeoSatSignal and SatSignal, the ATOVS and HRPT Reader programs, the remapper GroundMap, and the MSG Data Manager

**e-mail: [SatSignal-subscribe@yahoogroups.com](mailto:SatSignal-subscribe@yahoogroups.com)**

### *MSG-1*

A forum dedicated to Meteosat-8 (formerly MSG-1), where members can share information about the reception hardware and software.

**e-mail: [MSG-1-subscribe@yahoogroups.com](mailto:MSG-1-subscribe@yahoogroups.com)**

### *Weather Satellite Reports*

A group providing reports, updates and news on operational aspects of weather satellites.

**e-mail: [weather-satellite-reports-subscribe@yahoogroups.com](mailto:weather-satellite-reports-subscribe@yahoogroups.com)**

### *WXtoImg*

Users of the WXtoImg software package for capturing and imaging NOAA APT can air their problems, discuss its features and ask questions about it.

**e-mail: [wxtomg-subscribe@yahoogroups.com](mailto:wxtomg-subscribe@yahoogroups.com)**

### Member's Advertisement

Does anybody have any receiving equipment for **C-Band**: that is, 4.0 GHz? I have a 2-metre dish and receivers but lack a feed horn LNB. I would like to gain experience with C-Band for members of our GEO group who are outside the footprint of Hot Bird-6 (which operates in the 11 GHz Ku Band). Reception will not be easy within the UK but it should be possible. Help on behalf of our group would be appreciated. Or, if this is a waste of time, I would appreciate it if somebody could tell me please.

Francis Bell (contact details on page 1)

## Copy Deadline

for the next GEO Quarterly

# Saturday April 30, 2005

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

- Technical articles concerning relevant hardware
- Construction projects
- Weather satellite images
- Reports on weather phenomena
- Description of readers' satellite imaging stations
- Activities from overseas
- 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, CD or e-mail attachment). But 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 **well before this date** 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.

If your article submission contains embedded images and diagrams, please note that we do also require, **in addition**, individual copies of each image or drawing which is **not embedded** within the article, for 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)**

### Contract for MSG-4 Signed

The €135 million contract for a the fourth Meteosat Second Generation spacecraft was signed at ESA Headquarters in Paris on November 3, 2004 to ensure continuity of European meteorological satellite services for many years to come.

French firm Alcatel Space is the prime contractor while EUMETSAT will finance, launch and operate the satellite. Delivery is expected in 2007.

MSG-2 is scheduled for launch in June 2005 and will be placed in a parking orbit until required to take over from Meteosat-8. Collectively MSG-1 to -3 are projected to provide up to 15 years of meteorologic coverage, and MSG-4 should extend this significantly.

# NASA's Other Earth Observing Spacecraft

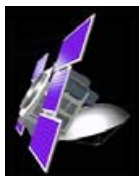
## Part 2 - Future Spacecraft

Peter Wakelin

Part 1 briefly described some of NASA's orbiting spacecraft other than those weather satellites we are familiar with. Part 2 describes some forthcoming satellites (together with Aura which has been launched recently) which may be of interest to readers. NASA's two papers presented to the 32<sup>nd</sup> meeting of the Coordination Group for Meteorological Satellites held in Sochi, Russia, in May 2004 form the basis for this article and I am indebted to the CGMS Secretariat for making them available.

### CloudSAT (*Measurements of global cloud properties*)

This cooperative mission with Canada will use a novel radar technique to examine the vertical structure of clouds in great detail and provide a new observational capability from space. It will be launched later this year to a 700 km sun-synchronous orbit allowing global coverage.



### Aura (*Measures Earth's ozone, air quality and climate*)

This spacecraft was launched several months ago into a 700 km sun-synchronous orbit with its ground track repeating every 16 days: it carries a suite of instruments to make comprehensive measurements of the trace gases in the atmosphere. The UK and the Netherlands provided some of the instruments which measure ozone, aerosols and several key atmospheric constituents that play an important role in atmospheric chemistry, air quality and climate.

### CALIPSO (*Cloud-Aerosol and Infrared Pathfinder Satellite Observations*)

CALIPSO will fly in formation with CloudSAT and Aqua (see part 1) to provide a comprehensive characterisation of the structure and composition of clouds globally and in all weather conditions. CALIPSO, which is expected to be launched later in 2005 with CloudSAT, is a cooperative mission with France and carries a high-resolution wide-field camera, a polarisation-sensitive LIDAR (read more about LIDAR on page 10) and an imaging infrared radiometer.



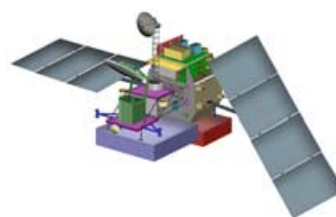
### OCO (*Orbiting Carbon Observatory*)

Expected up in late 2007, OCO will carry three grating infrared



spectrometers to measure carbon dioxide concentrations accurately over the entire globe for a period of at least two years.

### GPM (*Global Precipitation Measurement*)



Although not due up for three years, GPM is being designed and built on the success of the *Tropical Rainfall Measuring Mission* (TRMM) which is currently operational. GPM, like TRMM is a joint mission with JAXA (Japan Aerospace Exploration Agency) but will enter a higher inclination orbit than TRMM's, permitting observations over most of the globe.

GPM's instruments are a dual-frequency precipitation radar, a microwave imager plus a constellation of passive microwave radiometers which will help to improve water management, agricultural efficiency and disaster management.

### HYDROS (*The Hydrosphere State Mission*)

Planned for launch into a 6 am/6 pm sun-synchronous orbit late in 2006, HYDROS will provide the first global views of Earth's changing soil moisture and land surface freeze/thaw conditions. Its radar and radiometer data are expected to lead to a better understanding of the processes linking water, energy and carbon cycles.

### Aquarius (*Global maps of salt concentration of the ocean surface*)

Scheduled for a late 2008 launch, Aquarius will measure global sea surface salinity from its 600 km sun-synchronous orbit. Its radiometer will measure seawater emissivity at a wavelength sensitive to salinity with the aim of modelling the processes that relate salinity variations to climatic changes and to understand how these variations influence the general ocean circulation.



### NPP (*NPOESS Preparatory Project*)

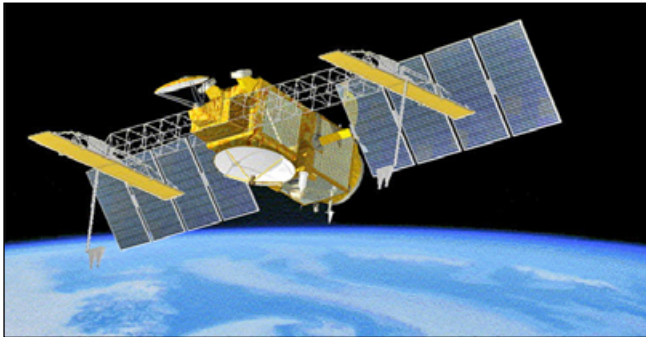
This spacecraft, scheduled for launch late next year, will extend the series of observations started by the *Aqua* and *Terra* satellites in NASA's Earth Observation System, thus bridging the gap between EOS and the next generation National Polar-orbiting Operational Environmental Satellite System (NPOESS) which will not become operational before 2010. A more detailed description of this spacecraft will appear in a future issue of GEO Quarterly.



**LDCM (Landsat Data Continuity Mission)**

Many readers will be familiar with the *Landsat* programme which began with the launch of Landsat 1 in 1972. LDCM will continue the 30 m resolution global land surface imagery of its predecessors but will be commercially owned and operated. The launch date has yet to be determined.

**OSTM (Ocean Surface Topography Mission)**



OSTM is a cooperative effort between NASA, NOAA, EUMETSAT and the Space Agency of France (CNES) and will be a follow-on to the *Jason 1* mission (see Part 1). With improved instrumentation and a greater swath width, sea surface topography measurements will become more precise. OSTM will operate from a circular 1336 km orbit and the launch is scheduled for late 2007.

*Further information on all the above spacecraft can be found by entering the satellite's name in any Internet search engine.*

... Continued from page 23

**India's Launch Site Escapes Tsunami Damage**

Although lying on the east coast of India, the Indian Space Research Organisation's satellite launch facility at Shiharikota, north of Chennai (Madras), escaped serious tsunami damage on December 26. Most damage and loss of life occurred further south. The Indian authorities remain very secretive about their facilities on the Indian-administered Andaman and Nicobar Islands, which suffered great damage and loss of life, so it is not known if their tracking station at Port Blair was affected.

**China Launches Remote Sensing Satellite**

The 300 kg Shiyang 2 remote-sensing satellite, developed by DFH Satellite Co, was launched on a Long-March 4 rocket on November 6 from the Tai Yuan Satellite Launch Centre in China's Shanxi Province. It achieved the planned 700 km sun-synchronous orbit and will be used for land resource surveying, environmental monitoring and protection, city planning and disaster monitoring. This was China's eighth successful launch in 2004 which is a record for that country.

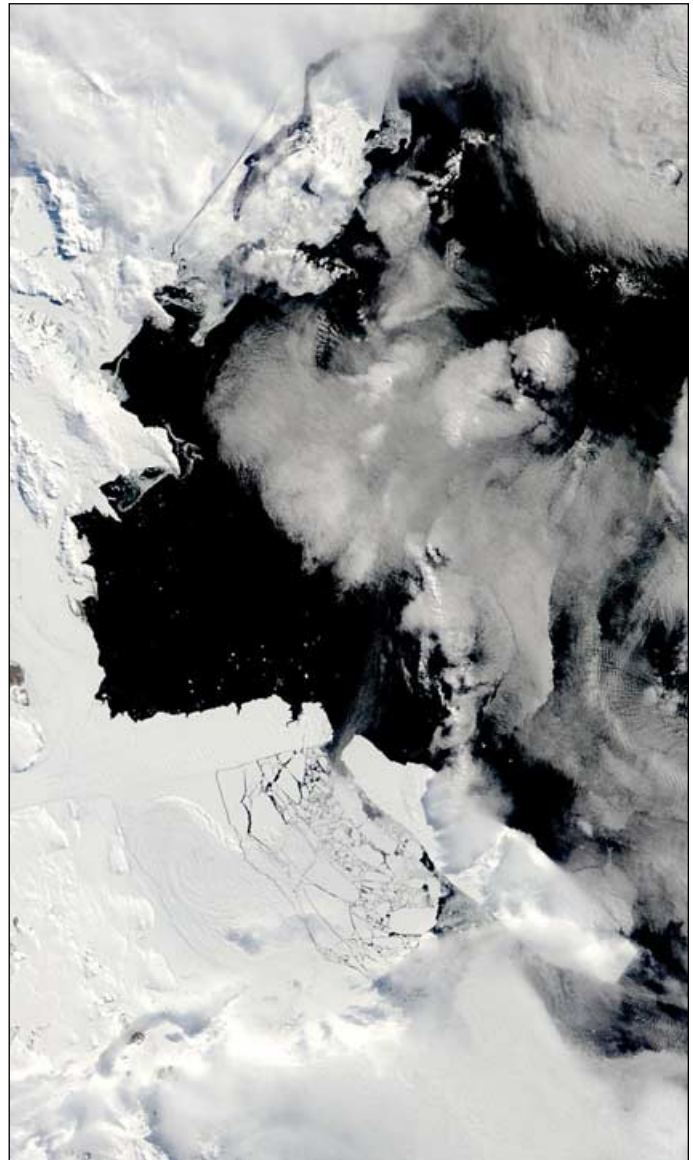
**Several Weather Satellite Launches Expected in 2005**

Although further slippages are likely, it seems that 2005 will be a good year for weather satellite launches. Hopefully, they will all do better than Sich 1M. The expected month of launch for several satellites is listed below.

MTSAT 1R	February
NOAA N	March
GOES N	May
CloudSAT/Calipso	May
MSG-2	June
Monitor E	June
DMSP 17	June

The first METOP was expected to be launched later this year but has been delayed until early 2006.

# B-15A Iceberg Blocks McMurdo Sound



After remaining a solid mass throughout Southern Hemisphere spring and the first part of summer, sea ice in McMurdo Sound finally began to break up during January 2005. In an annual cycle, thick ice freezes on the water during Antarctica's frigid winter then breaks and drifts into the Ross Sea during the summer. This year the process has been disrupted by the giant 80 mile long B-15A iceberg which blocked the currents that usually clear out the Sound, where, as late as the first week of January, the ice remained intact.

In early January, temperatures increased and a powerful storm moved over Antarctica. Strong winds churned the ocean, and, along with the warmer temperatures, may have contributed to the break-up of the ice. When the clouds cleared on January 13, the Moderate Resolution Imaging Spectroradiometer (MODIS) flying onboard NASA's *Terra* satellite revealed that the formerly solid ice had been broken into chunks.

*Image: MODIS Rapid Response Team, NASA-Goddard Space Flight Center*

# XRIT2PIC



## A tool to translate MSG-data into pictures

Rob Alblas

### Introduction

During the past decade I have written several programs for decoding high-resolution transmissions from weather satellites. These included both HRPT and CHRPT from polar orbiting satellites as well as HRI, the high-resolution broadcast format of Meteosat-7 and earlier European geostationary satellites (better known as PDUS).

With the launch of Meteosat-8, the first of the new generation of all-digital geostationary weather satellites, a new data format has come into the picture. The broadcasted formats are called LRIT and HRIT which I jointly refer to as XRIT. The main task is the translation of the XRIT formats into pictures. I have created a new program, XRIT2PIC, for the purpose.

Almost everything XRIT2PIC does is also possible with David Taylor's *MSG Data Manager*. XRIT2PIC also duplicates a few of the features of *GeoSatsignal* and *MSG Animator*. Still, there are a number of reasons why you might also wish to consider using XRIT2PIC.

- You do not need a powerful computer; XRIT2PIC runs fine on a PC containing just 256 Mb RAM (in a special mode just 64 Mb; in non-GUI mode even less).
- Non-GUI mode is possible, where XRIT2PIC can work in batch mode to translate XRIT pictures.
- There are executables not only for Windows but also for Linux (no 'Wine' tricks!)
- It is free software. The source code is available and it may be compiled for SUN/Solaris and Mac computers. (If you require the source code of the Wavelet translation part, a license is required, though. Contact EUMETSAT at [OPS@eumetsat.de](mailto:OPS@eumetsat.de) if you need it. No license is required to use the actual Wavelet library)

### Program Features

- LRIT/HRIT files received via the *Skystar-2* hardware are dumped on to the hard disc by the *Tellique* software.
- XRIT2PIC can process the following picture formats embedded within these files: JPEG 8-bit, JPEG 12-bit, Wavelet (8 and 10 bit) as well as some uncompressed formats.
- The Images you create can be output

as JPEG 8-bit, PGM 8-bit, PGM 16-bit and PPM 24-bit (colour).

- You can overlay coastlines and country boundaries
- Extraction of messages
- Movie generation is possible using the external program *Mencoder* (freely available for Linux and Windows) and executed by XRIT2PIC
- 'Live' display of selected channel(s)
- Immediate deletion of unwanted channels during reception
- Built-in viewer
- Automatic launch of your favourite viewer after translation of a picture

More features will be added in the future.

Figure 1 shows a functional overview of a receiving station using XRIT2PIC as its HRIT/LRIT translator.

### Files and Pictures

Table 1 provides an overview of the files dumped in your 'Received' directory by the *Tellique* software. These include data from some foreign satellites, also broadcast by *EUMETCast*.

Type	Source satellite	No of channels	Segments per channel (= Number of files)	Lines per segment	Total number of lines	Format
HRIT	MET-8	11	8	464	3712	Wavelet-10
HRIT	MET-8	1 (HRV)	24	464	11136	Wavelet-10
LRIT	MET-8	5	8	464	3712	JPEG-8
LRIT	MET5-7	3	5 or 10	500	2500 or 5000	Wavelet-8
LRIT	GOES9	3	6	464	2784	Wavelet-8
LRIT	GOES10	2	4 or 7	464	3248	Wavelet-10
LRIT	GOES12	3	4 or 7	464	1856 or 3248	Wavelet-10

Table 1 - Overview of file types

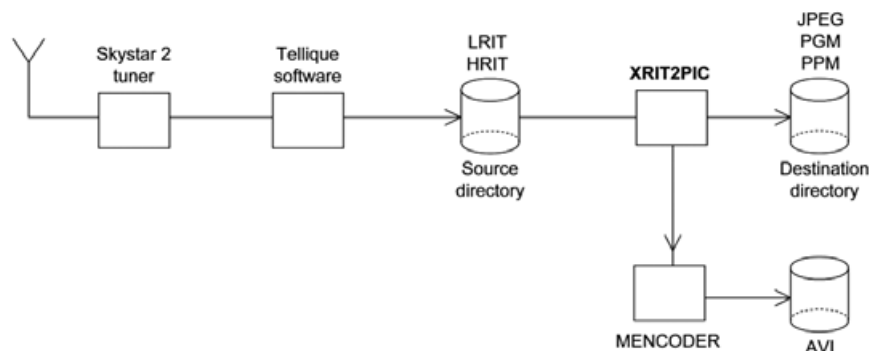


Figure 1 - Functional overview of XRIT2PIC



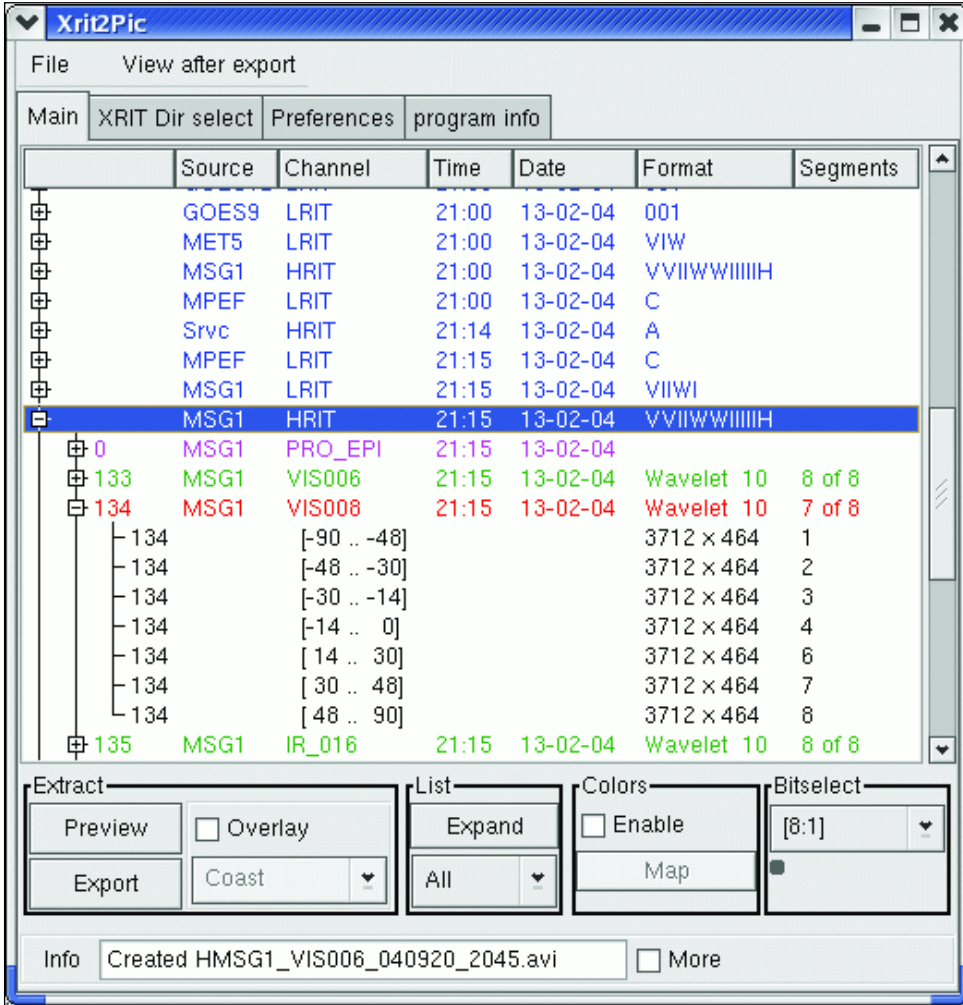


Figure 2 - Directory tree of MSG files

The zooming is achieved via keyboard hot-keys (e.g. 'i' = zoom in, 'o' = zoom out, 'f' = full size). If you place the mouse over the 'Help' button at the top right hand corner of the viewer window—without clicking—you see these in a drop-down list. You can also navigate around a zoomed image using the cursor keys.

To save an image, either press the <Export> button at the foot of the main screen or use the <File/Save> option on the image viewer itself: doing either will generate a JPEG or PGM file.

Alternatively, if you select two or more channels (green lines) or the full unexpanded dataset (blue line) before clicking the <Preview> button, the <Translate list> window will pop up (figure 3). Here you can select the channels you wish to translate: when you click <Do it> they will all be translated into images, each in its own viewer window.

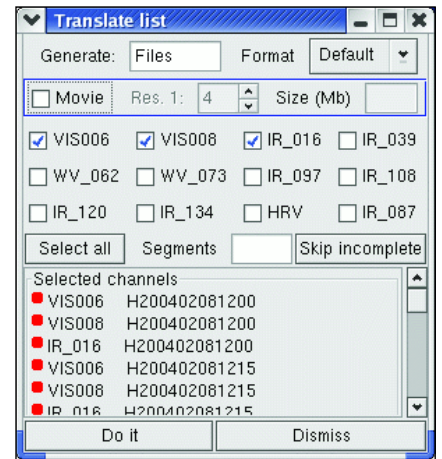


Figure 3 - Selecting multiple channels

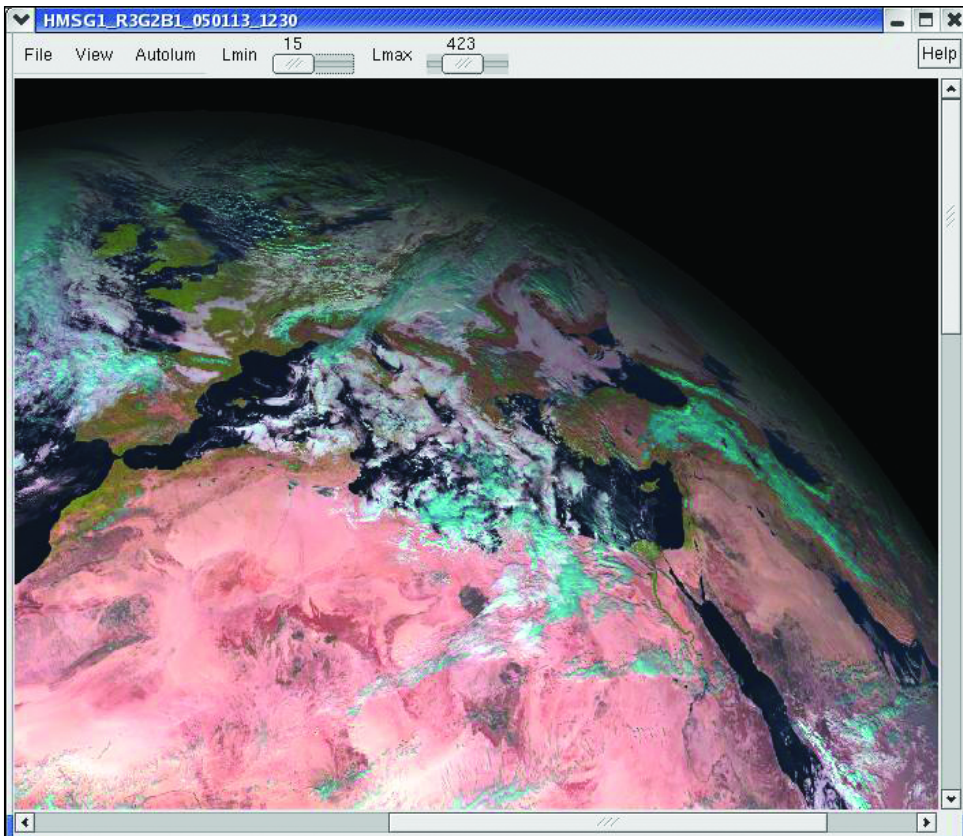


Figure 6 - A typical colour-composite Meteosat-8 image

By default, exporting is done without introducing extra loss: 10-bit Wavelet is translated into 16-bit PGM while JPEG is generated without decompressing or compressing the data. These methods have a few small drawbacks:

- PGM 16-bit does not seem to be a very well defined format—most viewers support it, but some viewers swap the LSByte and MSByte
- A PGM 16-bit image file is twice the size of a PGM-8 one
- Generating JPEG from LRIT without decompressing or compressing gives an upside-down picture

If a little information loss is acceptable, XRIT2PIC can also generate PGM 8-bit and uninverted JPEG from any source (JPEG 12-bit, used in early versions of the program for the HRV channel, isn't used any more although the program still supports this format).

For historical reasons, Meteosat-8 scans its images from south to north. In the 'old' days (Meteosat-7 and earlier) broadcasting a single picture at the highest resolution (AIV format) took nearly 30 minutes! So once the picture was complete, the southern part of the globe was already more or less 'out-of-date', while the Europe part that we are interested in was more up-to-date.

Scanning from south to north means upside-down pictures. To flip a picture format like JPEG it has first to be decompressed, then flipped, and finally compressed again. Because JPEG is a 'lossy' format, each compression generates extra image loss (each LRIT channel contains 8 segments, which means that 8 JPEG files have to be combined. This process is possible without doing an extra decompression and compression cycle).

The lossless Wavelet format is not supported by popular viewers and is therefore always translated into a more common format like PGM and JPEG.

### Colour Images and Boundaries

XRIT2PIC is also able to do some simple data processing. For example, it is possible to combine several channels into one colour picture. By default the VIS006, VIS008 and IR-016 channels are used, but other user-selected combinations are also possible.

Colour pictures are generated if a dataset (blue line, figure 2) is selected and the <Enable> button in the <Colors> panel is activated; both PPM and JPEG are supported as output formats.

It is also possible to overlay country boundaries and/or coast lines on your images. EUMETSAT provides GIF files with exactly the same size as the received pictures, in four different versions.

- just coast lines
- coast and country boundary lines
- longitude/latitude marks
- and all-in-one

XRIT2PIC can project these files on to the received pictures, both for preview and export.

### Movies

Last but not least, it is possible to generate movies by activating the <Film> button in the <Translate list> window (figure 3). If you experience viewer

problems when trying to generate movies at full resolution (3712 x 3712 pixels), the resolution may be lowered. Both monochrome and colour movies are possible. This feature uses an external program called *Mencoder*, which is freely available for both Linux and Windows.

XRIT2PIC first generates JPEG files for all selected items and stores these in a special directory. Then the program activates *Mencoder*. If the movie file is generated all the used JPEG files will be deleted.

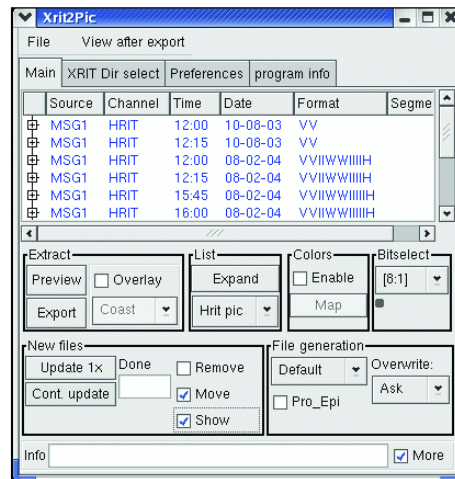


Figure 4 - Adding new files to the tree

### Processing During Reception

The features described above refer to data that has already been received and stored on your PC. There are a few extra features which make XRIT2PIC useful during 'live' data reception.

If the <Cont. update> button is pressed the program detects new files as they are downloaded by the *Tellique* software (figure 4). These will be added to the tree

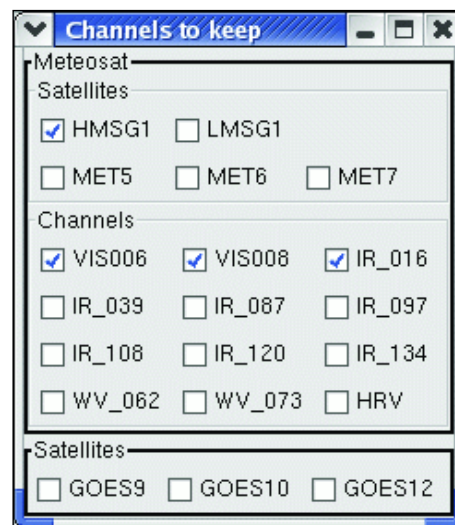


Figure 5 - Selecting which channels to keep

structure.

If the <Show> button is checked a viewer will pop-up, showing each picture as soon as it has been received. Currently just one channel can be shown properly at a time.

If the <Remove> button is checked a new window pops up in which the channels you want to save may be selected (figure 5). All other channels will be deleted a few seconds after *Tellique* has downloaded them. This can save a lot of disk space!

Detecting one new file in a directory which contains thousands may result in speed problems. If the <Move> button is checked XRIT2PIC moves all 'old' files into a 'Done' directory. The 'Received' directory is then empty, and it is easy to detect when *Tellique* adds a new file. This file will then be added into the XRIT2PIC tree structure and moved to the 'Done' directory. This whole procedure repeats itself every 3 seconds, provided the <Cont. update> button is active. You won't notice that the files are in a new directory; whenever XRIT2PIC is restarted, it always reads the files in both the 'Received' and the 'Done' directory. (The <File/manage files> menu opens a simple utility to move all files back to the original received directory, if desired).

### Non-GUI Mode

XRIT2PIC may be used in a non-GUI mode where raw XRIT datafiles are translated directly into JPEG/PGM files without generating and displaying the images, thereby saving greatly on memory usage. This mode is also suitable for automating translations.

Command line options are needed to tell XRIT2PIC what to do. Once the job is complete, the program will quit. A typical command line is shown in figure 7 at the foot of this page.

This will translate all HRIT files with a channel name starting with 'VIS' (e.g. VIS006 and VIS008), for every day in September 2004, with a time of 12:00. Each picture will contain only segments 7 and 8 (which is Europe). So, this single command will result in 30 x 2 = 60 picture files. (Movie files may also be generated this way.)

(The asterisk (\*) wildcard can be inserted in several of the fields. Whereas 'VIS006' could have been entered to decode that

```
XRIT2PIC -nogui -type H -chan VIS* -segm 7-8 -date 04-09-* -time 12:00
```

Figure 7 - A typical non-GUI command line



channel alone, 'VIS\*' decodes *all* visible channels. The date field expects the data to be entered in 'yy-mm-dd' format. The asterisk used in this example extends decoding to *every* day of the month. Full details of all non\_GUI options are listed in the XRIT2PIC Manual).

Now, if you place a non-GUI command (or several such commands) in a batch (.bat) file, together with the command:

```
del c:\telligence\received\*.*
```

(assuming that this is the directory in which *Telligence* dumps its files), you can run this .bat file periodically, each day, around midnight. You can do this under Windows with the 'Task Scheduler' utility (and under Linux using the 'Cron' utility). This entire process may run unattended for a year or longer if you want, saving only the images you want and leaving a clean hard disk.

### Settings

XRIT2PIC has default settings for everything, but in most cases a few settings have to be changed. The most important settings are:

- the directory where *Telligence* dumps the files ('Received'), and
- the directory in which you want to save the translated pictures. By default, this is the XRIT2PIC directory, but you can create your own 'Pictures' directory if desired.

These directories may be on different computers, if desired.

Also, the command to activate *Mencoder* with all its options may be altered.

Finally, the state of most buttons may be saved, so that the next time XRIT2PIC is started the state of these buttons will be restored.

### Installation

XRIT2PIC needs a few special library files:

- GTK libraries
- JPEG library
- Wavelet library

All these library files, together with the XRIT2PIC program itself, are available for both Linux and Windows. They can be downloaded from my website at:

<http://www.alblas.demon.nl/wsats/software>

On the same page you can also find a link to the *EUMETSAT* page with the overlay files, links to download the *MENCODER* program (needed for movie generation) and the XRIT2PIC manual containing all the program and installations details.

# A Miniaturised WEFAX Receiver for Meteosat-7

Jaap Rusticus

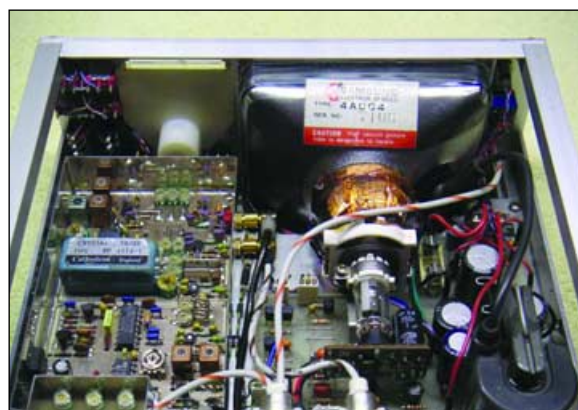
As part of David and Cecilia Taylors' report on the September 2004 meeting of Werkgroep Kunstmanen in Utrecht, Netherlands, we pictured a unique miniaturised receiver for Meteosat WEFAX, which featured a built-in display screen. The designer was Jaap Rusticus, and he provided the following details about it in a conversation with David Taylor.



The Jaap Rusticus WEFAX receiver, pictured beside a teacup

Most often, a Meteosat-7 receiving system consists of a 1700 MHz downconverter and a receiver, but because mine had to be small, I designed a two-channel one-board receiver. This means that the input to the PCB is 1700 MHz and the output is audio. It has a crystal filter and PLL-detector to give it a good performance.

The audio is fed into a signal demodulation board which is coupled to a 256 x 256 pixel frame storage board. These two boards were designed by a hobbyist friend of mine, Johan de Lange from Amsterdam. Although it is based on the idea of the old YU3UMV (1982) system, Johan gave it a completely new design and also developed the double-sided PCBs. The display uses an old 2 x 3 inch television tube. The small television set was built on *perlinax* and because I did not like that, I redesigned the television PCB on to a video PCB.



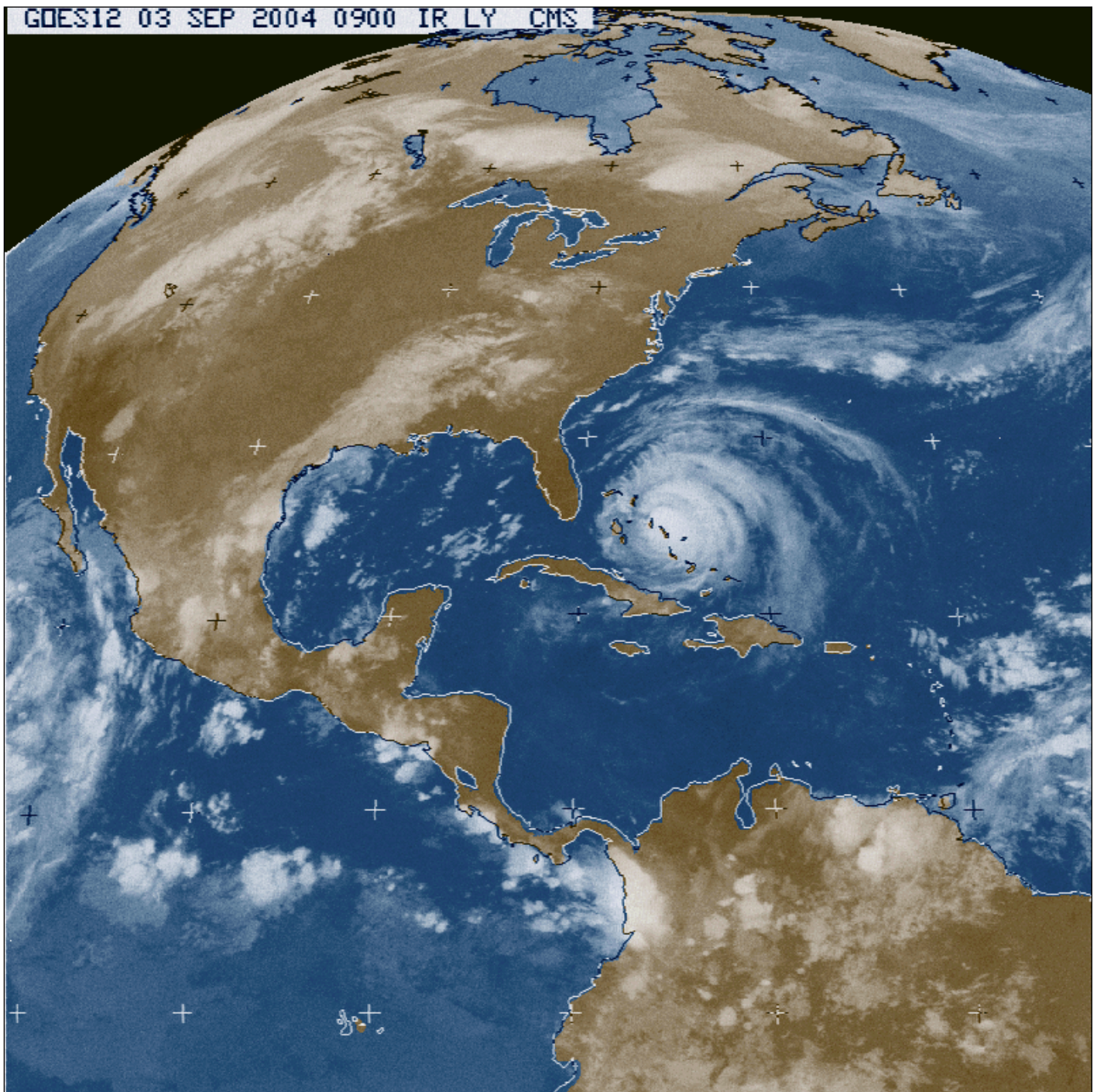
The interior of the receiver showing the miniature TV tube

The antenna is a 9-element Yagi, constructed according to the design of Gunter Hoch (DL6WU) in *UKW-Berichte*. Mounted on the antenna is a three stage preamplifier with a GaAsFET and two MAR-6's. This has a noise-figure of 0.7 dB. Normally this gives noise free pictures with the short Yagi but at Utrecht I used a too long a length of co-ax cable—I could not find a shorter one just before I took off for Utrecht.

The antenna signal passes through a 1700 MHz bandpass filter before entering the receiver board. This filter suppresses the strong GSM signals in both the 1800 MHz and the 900 MHz bands.



# Final Fling for Wefax



**Les Beeson** recently joined GEO and send us a selection of his WEFAX images. Les uses a 1-metre dish, with downconverter and an RX2 receiver to capture the signals, while the processing is accomplished by means of Eberhard Backeshoff's JVcomm32 software. The image above came from NOAA's GOES-12, via Meteosat-7. The image above, dating from September 3, 2004, shows hurricane *Frances* advancing on Florida.

Les collects images regularly, and uses them to create movies which, he states '.. are interesting in that they

show these hurricanes starting life on the equator, off the west coast of Africa, and then spiral northwest over the Atlantic. I have studied their movements for some years now, and find them quite fascinating ..'

However, as we announced on page 26 of GEO Quarterly No 4, all wefax from EUMETSAT, plus the high-resolution PDUS service will have ended forever by the end of 2005 (unless there is an unforeseen problem in commissioning MSG-2). In the article that follows, John Tellick take a nostalgic look back on a quarter of a century of Meteosat.



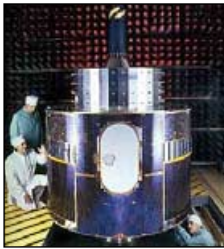
# Farewell Meteosat ..... Welcome Meteosat



**John Tellick**

If all goes well with this year's launch and commissioning of MSG-2 it will be farewell to all Meteosat-7 services from 0° at the end of December 2005. Meteosat-7 was the last of the so-called 'first series' of European geostationary meteorological satellites which have provided imaging coverage of Europe, Africa, the Atlantic and part of the Indian Ocean since the programme started in 1977.

Meteosat-1 was launched from Cape Canaveral on a Delta rocket in November 1977. Its radiometer failed prematurely in November 1979 and there was a gap in services until Meteosat-2 was launched from Kourou on an Ariane-1 launcher in June 1981. Since then there has been a continuous high quality imaging service without major breaks.



Meteosat-1 being prepared for service  
Photo: ESA

Meteosat-3, a refurbished P2 engineering prototype, was launched in June 1988 on the first flight of the Ariane-4 LP launcher (used to launch the rest of the series). This satellite quickly took over from Meteosat-2 whose on-board fuel supply was very low and which had developed a high orbital inclination (movement above and below the equator from its nominal position during each 24-hour period).



Launch of Meteosat-3  
Photo: ESA

Meteosat-4, launched in March 1989, was EUMETSAT's first operational satellite (see later), and signalled the beginning of the 'primary service'. Meteosat-5 followed in March 1991 and with two operational upgraded satellites in orbit high level of service could now be guaranteed.

In August 1991, in anticipation of a gap in GOES satellite coverage, Meteosat-3 was drifted to 50°W to begin the EUMETSAT Atlantic Data Coverage (ADC). In

February 1993 Meteosat-3 was moved again, to 75°W, and extended Atlantic Data Coverage (X-ADC) commenced owing to the failure of the GOES satellite.

Meteosat-6 was launched in November 1993 but showed imaging anomalies (which had also to some extent affected Meteosats -4 and -5). These anomalies were corrected by software during data processing operations at the Ground Segment and the images returned to the satellite for the direct read-out data transmission to users.

Meteosat-7 was launched in September 1997 and injected into geostationary orbit with such precision that considerable on-board fuel was saved. This has allowed longer station-keeping activities and extended the transition period between this final 'series one' satellite and Meteosat-8, the first of the 'series two' Meteosat Second Generation (MSG) satellites.

## Current Operations

Meteosat-7 remains stationed at 0° from where it is currently transmitting analogue WEFAX data, digital HRI (PDUS) data via direct read-out dissemination and other non imaging meteorological data services and products as well as being a platform for receiving and relaying environmental and meteorological data transmitted by ground- and ocean-based sensors, ships, aircraft and balloons. The satellite's radiometer scans the globe every half hour in visible light (VIS), Infrared (IR) and water vapour (WV) spectral channels. The raw data is received and processed by EUMETSAT before being sent back to the satellite and disseminated to end users via the direct read-out service 24 hours a day. The HRI data is also disseminated via the EUMETCast service.

Meteosat-6 is stationed at 10°E and provides the Rapid Scan Service (RSS), which provides a 10 minute scan of the European sector to track, and provide timely warnings of, severe weather across Europe. This service is disseminated via EUMETCast only.

Meteosat-5 was moved to 63°E between January and May 1998 and that July commenced the INDOEX multi-national experiment, studying atmospheric pol-

lution, solar radiation and the interaction of clouds over the Indian Ocean. This service (in the absence of a Russian GOMS satellite) was extended to become the EUMETSAT Indian Ocean Data Coverage (IODC) service. This coverage is due to last a few more years till a new GOMS satellite is operational in the area.

Meteosat-5 continues to provide high quality, vital imaging of the Indian Ocean area but is now running very low on on-board fuel. Its increasing orbital inclination has not been corrected for some years and it is due to be replaced by either Meteosat-6 or -7 once MSG-2 has been successfully commissioned.

Meteosat-5, now 14 years old, has only one direct read-out channel operational and transmits principally HRI (PDUS) data but also a single whole globe IR WEFAX ITOT frame during each 24 hour period.

## EUMETSAT and Meteosat Operations

EUMETSAT and its eventual control over the satellites evolved over several years, beginning in 1972, when an eight nation Meteosat development programme was initiated by the European Space Research Organisation (ESRO) which was a predecessor of the European Space Agency (ESA).

One satellite was provided for, with several spares. However, these spares and the refurbished engineering model enabled the launch of Meteosats 1, 2 and 3.



First Meteosat-1 image - December 9, 1977  
Image: © ESA

In December 1977 there was global geostationary coverage for the first time, from five geostationary weather satellites: three from the US, one European and one Japanese. A year long global weather experiment had started.

- January 1981 - An Intergovernmental Conference in Paris agreed to set up EUMETSAT to assure the continuity of meteorological satellites in Europe.
- March 1983 - ESA begins the Meteosat Operational Programme (MOP) in anticipation of the establishment of EUMETSAT. This guaranteed the construction and launch of Meteosats -4, -5 and -6.
- June 19, 1986 - EUMETSAT finally became a reality and at the first meeting of the EUMETSAT Council it was agreed that its headquarters would be in Darmstadt, Germany.
- August 1986 - The EUMETSAT Director arrives in Darmstadt to begin the recruitment of staff, to be housed in temporary accommodation which, it turned out, had to last for 9 years.
- May 1991 - Initiation of EUMETSAT's Meteosat Transitional Programme (MTP) and funding for the construction, launch and operation of Meteosat-7 until the year 2000 (though that has since been extended).
- November 1992 - The EUMETSAT Council agree on a networked configuration for future ground segments and a new ground segment for MTP with many facilities. This was to be located in the future EUMETSAT headquarters, with a new Primary Ground Station at Fucino in Italy.
- August 1993 - The foundations for the new EUMETSAT headquarters were begun.
- September 1994 - Staff preparing for the new EUMETSAT ground segment (see later) move into the Operations Wing whilst construction of the remaining parts of the building continued. The new headquarters were inaugurated in June 1995.
- November 1993 - Agreement on the start of reparatory programme for the EUMETSAT Polar System (EPS).
- June 1994 - Agreement was reached on the start of the full programme for MSG, with provision made for procurement of three new satellites of advanced design, their launch and operation for 12 years.
- October 1994 - Meteosat images received by the new EUMETSAT Primary Ground Station in Fucino are successfully relayed via a commercial satellite to the new operations centre in Darmstadt and used for test and development of the Mission Control Centre.
- September 1995 - Encryption of Meteosat HRI data is implemented to safeguard and control access to, and use of, the high resolution data.
- November 1995 - Full Meteosat operations controlling Meteosats -5 and -6 begin via the new facilities at EUMETSAT's Darmstadt headquarters and PGS at Fucino (operations had formerly been carried out by ESA's European Space Operations Centre (ESOC) in Darmstadt).
- December 1995 - Formal transfer of Meteosat operations from ESOC to EUMETSAT.
- June 1999 - Full unconditional approval for EPS.
- Sept-Nov 1999 - The stand-by satellite, Meteosat-6, is used for rapid scanning



Interior of the ESOC Control Centre. The Meteosat test card is visible at lower right

Image: © EUMETSAT

over the European Alpine region for the Mesoscale Alpine Programme (MAP) intensive observation phase.

- August 2002 - MSG-1 is launched and subsequently very accurately placed in geostationary orbit, thereby saving considerable on-board fuel (launch—ESA, orbit transfer—ESOC, operations following successful transfer to geostationary orbit—EUMETSAT).
- October 2002 - A solid state power amplifier (SSPA) fails during the commissioning tests on MSG-1. Commissioning is halted pending the outcome of an enquiry.
- April 2003 - Trials begin, disseminating MSG image data via the already operational EUMETSAT Multicast Distribution System being transmitted in the Ku-band by EUTELSAT's Hot Bird satellite system at 13°E. (This was later renamed EUMETCast following successful trials).
- January 2004 - MSG-1 fully operational imaging service begins (via EUMETCast).

Following normal convention, MSG-1 has been renamed as Meteosat-8: hence my title '*Farewell Meteosat – Welcome Meteosat*'. Construction, launch and



The Fucino ground station in Italy

Image: © EUMETSAT

operation of a further MSG satellite, MSG-4, has subsequently been agreed. MetOp, the first European polar orbiting satellite is due for launch in late 2005.

Discussions are already under way on the requirements for Meteosat Third Generation (MTG).

#### Remember.

- Meteosat-7 services are due to terminate at the end of December 2005—unless you swing your antenna round to Meteosat-5
- WEFAX users in Europe will have blank screens.
- You cannot use your Meteosat-7 receiving system for reception of Hot Bird-6 EUMETCast nor any direct read-out LRIT services from MSG-2, 3 or 4.

The Meteosat series has served the world well, on some occasions from three different locations, during its 27 years service—and continues to do so.

This mantle has now been taken on by MSG-1 which, as Meteosat-8 with its advanced SEVIRI radiometer, is producing much higher resolution imaging in 12 spectral channels every 1/4 hour, an enormous advance in the amount of vital meteorological data produced 24 hours a day by EUMETSAT.

#### Acknowledgement

I would like to thank and acknowledge the help and support I have received from EUMETSAT in preparing this article.

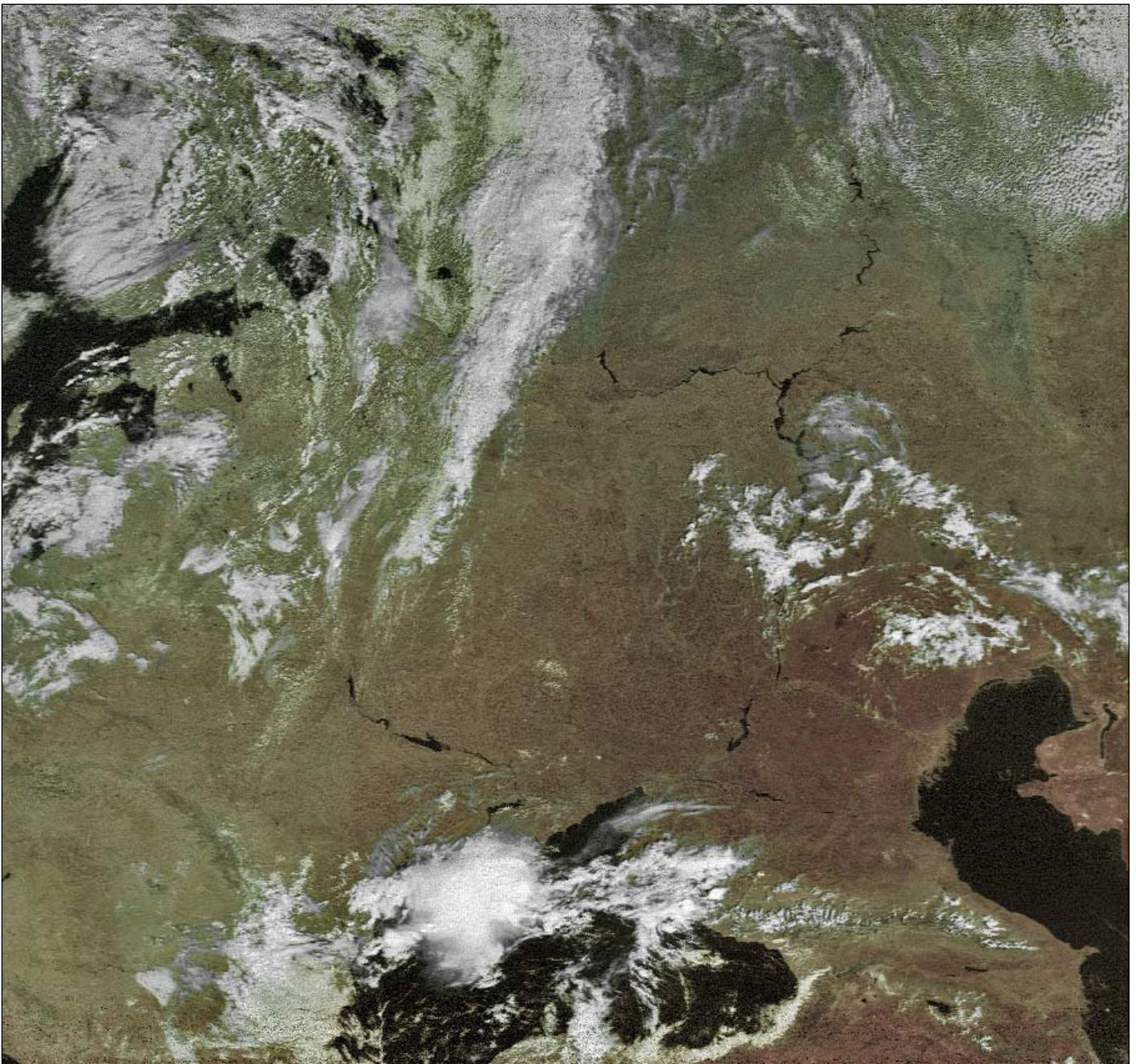


# How far East can you see?

**Rob Denton** G4YRZ, who lives in Worksop, Nottinghamshire, England, provided this NOAA-17 image showing excellent detail well to the east of the Black Sea, and including much of the Caspian Sea. Rob used the Wxsat capture software and a WIMO crossed dipole mounted on his chimney. No pre-amp used. Rob wonders if any other readers manage to image so far to the east using basic APT equipment.

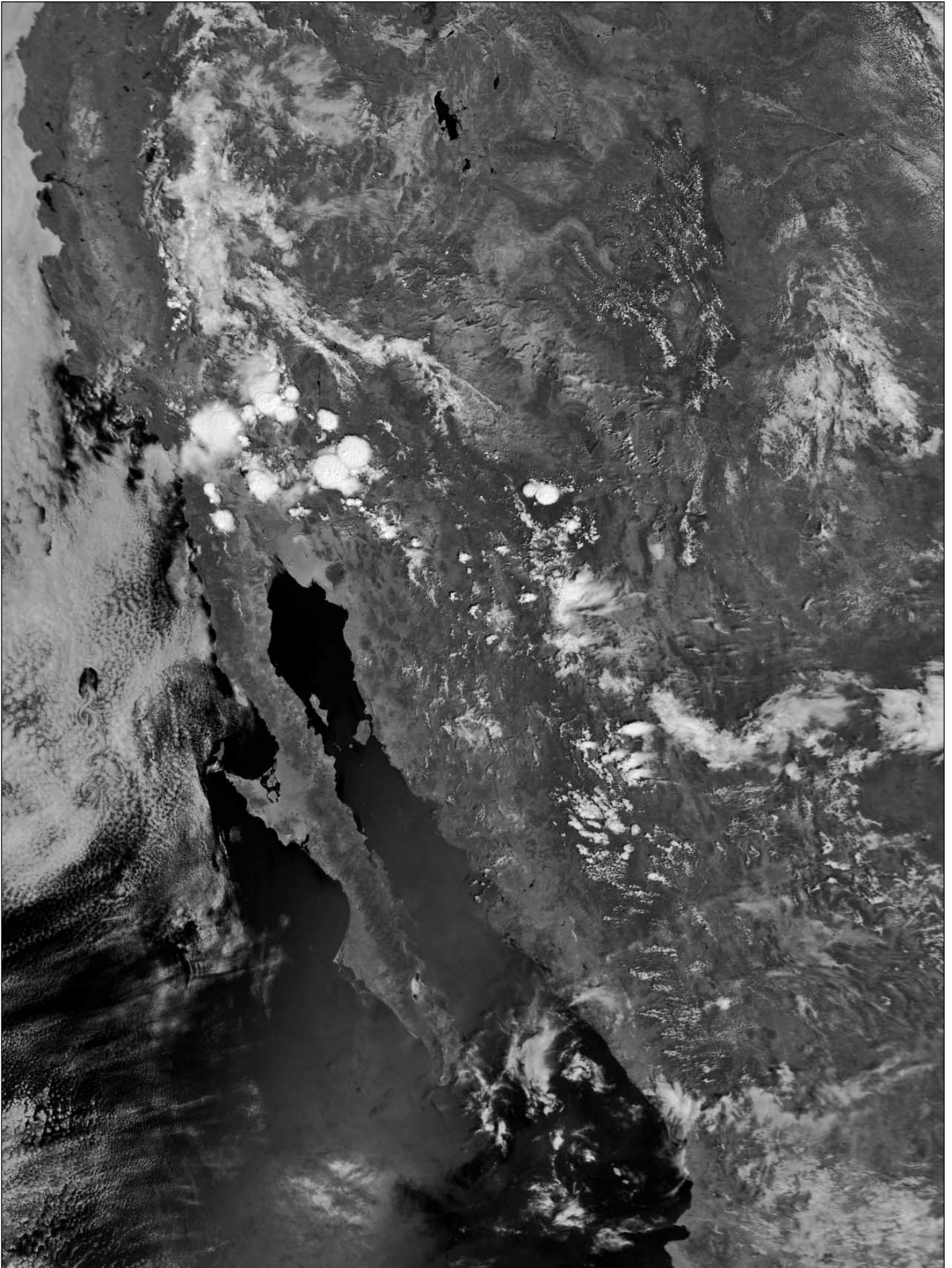
If you do, why not write in and let us hear about it?

Contact [editor@geo-web.org.uk](mailto:editor@geo-web.org.uk) with your experiences and images.



NOAA 17, 08:29 UT on August 29, 2004





This is the NOAA-17 channel-2 image from 18:04 UT on August 13, acquired approximately 12 hours prior to the Union County hailstorm. There is little activity over the Clayton area (marginal arrows), but thunderstorms can be seen brewing over Arizona and western New Mexico.

*Telemetry: NOAA SAA - Processing: HRPT Reader and Groundmap*



# THE UNION COUNTY GLACIER

Ask anyone where glaciers are to be found, and the most probable answer will surely be the name of one of the planet's highest mountain ranges: the Alps, Himalayas, Rockies. The more discerning reader might also add the names of some of the Earth's great polar land masses: Antarctica, Greenland, Baffin Island. But the State of New Mexico in the USA? Surely not!

Well, prepare for a surprise! During freak weather conditions last August, a unique and unexpected weather phenomenon resulted in the overnight appearance of New Mexico's very own 'glacier'. Here is the tale of that amazing occurrence.

The scene is Union County, often described as the 'Crossroads of the Southwest', nestling at the northeast corner of New Mexico, in an area bordered by the Colorado, Texas and the Oklahoma panhandle. The county capital is Clayton, a city with a population close on 2500, situated about 10 kilometres west of the Texas border at an elevation of 1538 metres. During winter, the minimum temperatures do certainly drop below freezing, but such conditions have never been recorded during August, when the average minimum overnight temperature is 15°C and the daily mean is 22°C. Definitely not conditions conducive to the formation of a glacier!

Abnormal weather conditions near Clayton around midnight on Friday August 13 resulted in millions of tiny hailstones combining into a mass of ice at least 5 metres thick that persisted for almost a month before finally melting away. Geologists and meteorologists dubbed this the 'Union County Glacier'.

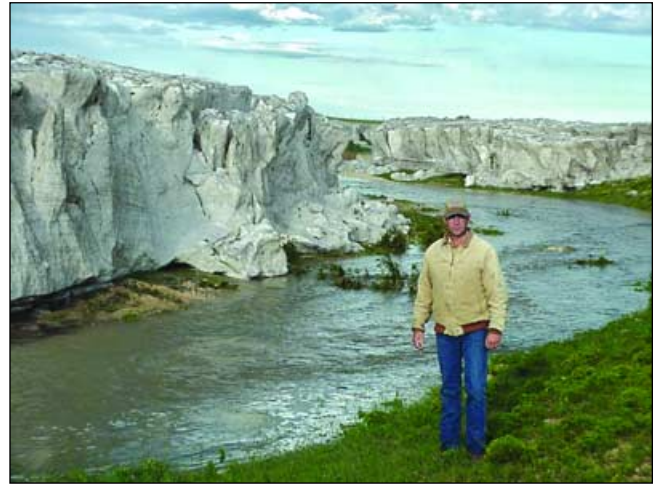


Figure 2 - Water flowing between ice cliffs 5 metres high



Figure 3 - View upstream from the same location



Figure 4 - An ice cave cut into the ice

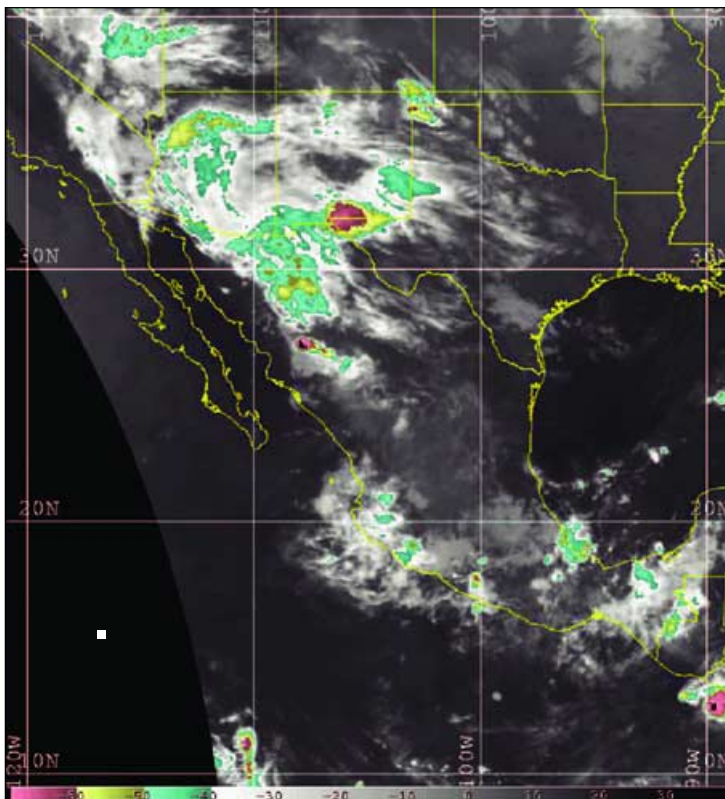


Figure 1 - A GOES-12 infrared satellite image of the storm NOAA/National Weather Service courtesy UCAR Joint Office for Science Support.

During early August a succession of four cold fronts moved down from the north, helped along by a high-pressure cell stalled over Alaska. These fronts met humid air moving up from the Gulfs of California and Mexico, each time resulting in elevation of the unstable humid air to form bands of intense thunderstorms across the Eastern Plains. On



August 11, a particularly strong cold front swept across the Eastern High Plains, lifting humid air laden with fresh moisture. Showers and many thunderstorms were reported across the State during the following three days. The most severe of these, which included falls of large hail, occurred between the 12th and the 14th.

Residents of Clayton, Sedan (another community about 20 miles to the south) and the areas in between will long remember one particular storm that hit around midnight on Friday August 13 and its spectacular aftermath. Figure 1 is a GOES-12 infrared satellite image acquired at 08:30 UT (around local midnight) on August 14, 2004, showing the southwestern United States and Mexico. Cloud-top temperatures are indicated by colour according to the scale at the foot of the image. Yellow and orange represent cloud tops colder than  $-50^{\circ}\text{C}$ . The tiny orange speck above and to the right of the large orange area on the image represents the top of the intense thunderstorm that affected the Clayton/Sedan area.



Figure 5 - Map showing the location of Clayton, Union County, New Mexico

What this storm lacked in size (it was estimated to be only some 12 square kilometres in area) it more than made up for in intensity. Hail accumulations reaching 30 cm were followed by as much as 7.5 cm of rain. Indeed, so much rain fell in such a short period of time that the pea- and marble-sized hail was carried along as sheetflood before ending up being concentrated in a small, normally dry, 5- to 7-metre deep drainage tributary to the gully known as Sand Draw. Approximately 13 km south of Clayton, this tributary runs beneath the road through a drainage culvert.

The hail was being driven along in such quantities by the deluge of rain that it piled up at the entrance to the culvert which was unable to handle the flow. Hail backed up along the gully, behind the culvert, as rain continued to flow across the fields, through the tons of ice, and on to the highway. Some time during the night the stream of flowing water cut a new, sheer-sided canyon through the heap of ice.

Early on the Saturday morning, Barbara Podzemny and her husband Randy were driving north from their home near Sedan—where they had experienced only about 2 cm of overnight rain, and no hail—towards Clayton when



Figure 6 - The normally dry tributary of Sand Draw

they encountered what for all the world looked like a glacier. Figure 2 shows Randy Podzemny standing near the bottom of the draw as water from the previous night's deluge and the melting ice flows between ice cliffs up to 5 metres high. Note the bedding patterns in the ice caused by varying amounts of debris and soil deposited with the hail. Figure 3 shows the view upstream from the same location while figure 4 depicts a cave cut into the ice by the torrent of runoff.

The overnight hail had filled the drainage tributary to a height of approximately 5 metres and vertical ice cliffs 8 metres wide and some 100 metres long framed the torrent of water flowing through the normally dry channel (figure 6).

Everyone who encountered the glacier on that Saturday morning, and for several days thereafter, were astonished by what they saw. By 6:30 a.m. that morning they could look out across what appeared to be a sheet of ice more than 100 metres long on the west side of the road with a stream, complete with new little waterfalls, flowing through a sheer-sided canyon cut by the water through the glacier. Later in the day the ice had compacted to the extent that people could walk across the top of the glacier without sinking in.

Although hail is commonly formed in thunderstorms, the dimensions of this accumulation are unique. The ice remained for nearly a month in spite of long sunny summer days and temperatures well above  $25^{\circ}\text{C}$ .

#### Acknowledgments

- to Barbara Podzemny for granting GEO use of her original photographs of the Union County Glacier to illustrate this article
- to Jane C Love, editor, for allowing us to draw extensively on her original article 'The Union County Glacier', printed in the November 2004 issue of the professional journal *New Mexico Geology* (vol. 26, no. 4, pp. 123-125), published quarterly by the New Mexico Bureau of Geology and Mineral Resources, a service and research division of New Mexico Institute of Mining and Technology

#### Internet Reference

- The Union County Glacier, Jane C Love,  
[http://www.srh.weather.gov/abq/feature/  
UnionCountyGlacier2004.pdf](http://www.srh.weather.gov/abq/feature/UnionCountyGlacier2004.pdf)



# IN TRAY

**The Column for Readers'  
Letters and Queries**  
e-mail: editor@geo-web.org.uk

**Dear Editor,**

Along with many others, I was deeply saddened to learn that Cedric Roberts MBE had passed away. I had the privilege of knowing Cedric for about 15 years, and have benefited enormously from his tremendous kindness and infectious enthusiasm. Whilst I was living locally to him in Halesowen he was very helpful when I first tried to establish a weather satellite station and despite me moving away around the globe we had stayed in periodic contact ever since. Others have written a fitting obituary for him, but perhaps you would allow me to share a couple of my own experiences.

One of the things that really amazed me about Cedric was his desire to use the latest technology to help him further his passion for weather recording and study. He was one of the first people that I knew to connect to the Internet from home (using the latest ultra-fast 28.8k modem if I remember correctly!) and operated a fully automated electronic weather monitoring and logging station alongside his tried and tested (manual) Met Office standard equipment. I understand he caused quite a stir at Met Office HQ when he spotted that their standard equipment was under-recording 'wind run' on days of light wind because the weight of their anemometer propeller was 'missing wind' that his smaller and lighter electronic acrylic version was recording.

One of my favourite memories of Cedric was walking around his local area with him carrying a dipole antenna and portable weather satellite receiver trying to locate the source of some interference that was causing a problem with his NOAA APT images! We weren't successful, but I remember the looks that we received from passing motorists!

The weather satellite community has lost an understated stalwart in Cedric. May he rest in peace.

*Ben Ramsden, Basingstoke, UK.*

**Dear Editor,**

I only got to know Cedric Roberts in recent years, through his use of my software, first for processing HRPT data and later for Meteosat-8. However, if I had been at a different school in the West Midlands during the 1960's I might have had Cedric as one of my teachers! As Cedric was from the same part of the UK as myself it was always a treat to hear his voice, and his articles brought back fond memories. We exchanged e-mails over recent years, but I never had the pleasure of meeting him.

I discovered that Cedric had taken a party of youngsters to Norway in 1965, 'well before Holidays Abroad had caught on' as he once wrote to me, and I gather that such visits were a frequent part of his mid-1960's teaching activities. He was very enthusiastic about updating his system to receive Meteosat-8 data, although his health latterly prevented him from having full-time enjoyment of the hobby. For many years he submitted regular weather reports to the UK Met Office, having started his Weather Station in 1956 and it was a real treat for me to get a copy of his Met Office report as an unexpected present one year! He was a Fellow of the Royal Meteorological Society and an MBE (Member of the British Empire). An enthusiast and gentleman like Cedric will be sorely missed.

*David Taylor, Edinburgh.*

**Dear sirs,**

With regard your item 'Mystery Image Censorship or Missing Segment?', I find it a pity that GEO is resorting to rumour-mongering and submitting of conspiracy theories. I do not think this type of item serves your readership in any way. The item takes a probable coincidence, attempts to create a rumour and implies a conspiracy. Where are the facts to substantiate this claim? Is there a known problem with the spacecraft that could account for such 'cutting'? What were the following images like?

I am very surprised that GEO would allow this type of item to be published.

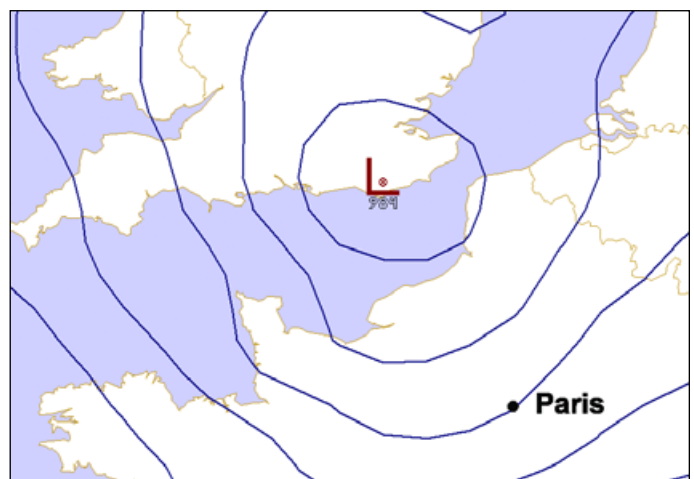
Best regards,  
David Lee

## Freak Storm Ravages Paris

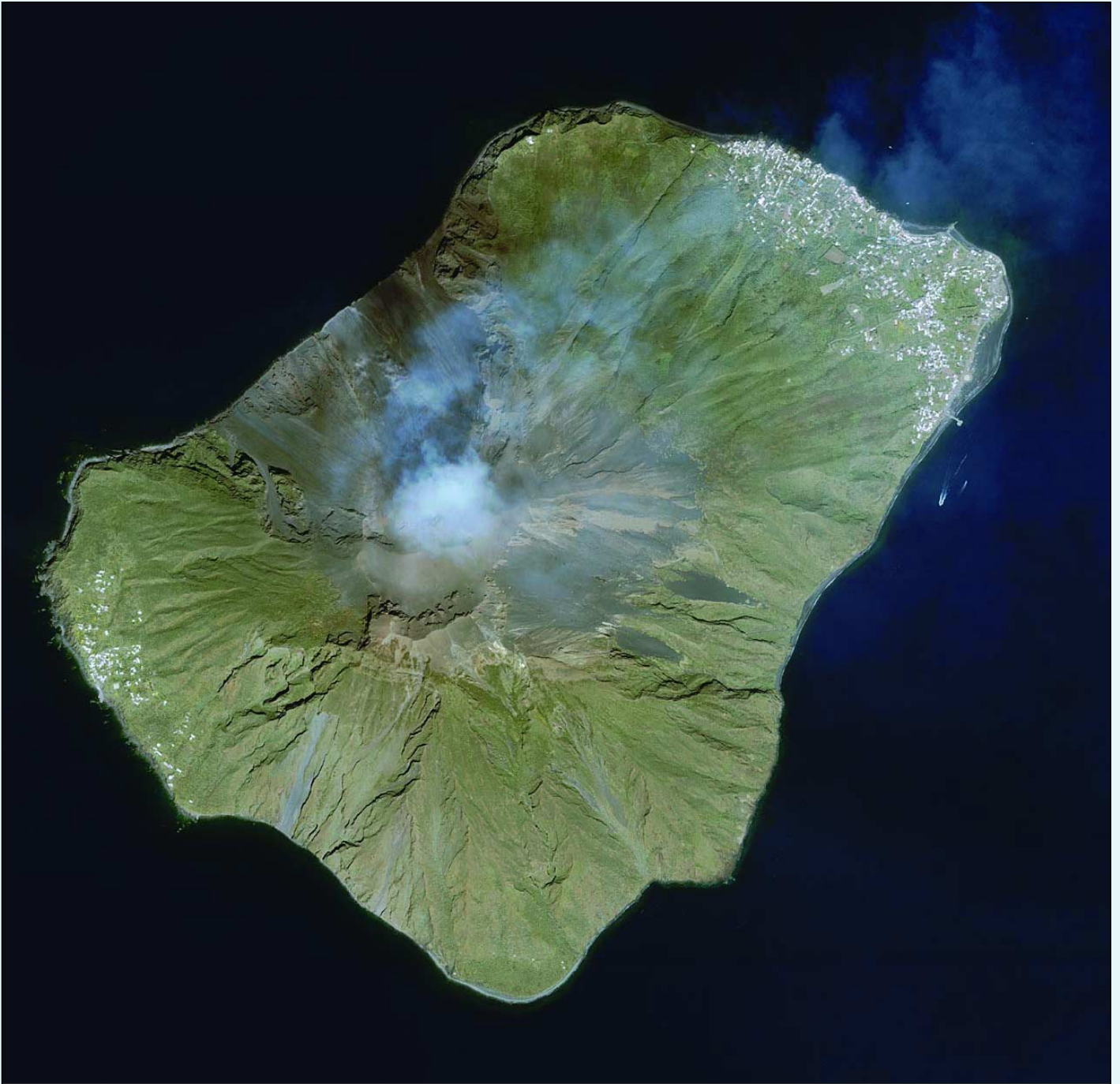
During the afternoon of December 17 last year, a brief but devastating storm producing hurricane-force gusts of up to 130 km per hour swept across northern France and battered the capital, Paris. One woman died when a tree was toppled on top of her car, many others were injured by flying debris and 385 000 homes were left without electricity. The storm also caused major disruption to air, rail and road traffic. In all, there were six fatalities, most caused by falling trees.

The storm hit Paris without warning and though it lasted only a few minutes it caused havoc. Trees were shaken violently and tiles were dislodged from rooftops. The Eiffel Tower, parks and other outdoor facilities were closed. The powerful gusting winds prompted Meteo France (the national weather service) to issue its second highest alert and warned people not to use their cars. The Paris fire service had to deal with thousands of calls for help, mainly as a result of falling tiles, branches and downed power lines.

At the Château de Versailles outside the capital, tourists were evacuated after nearby trees began to be uprooted. In Normandy, a high motorway bridge spanning the river Seine was closed.



The 12:49 UT synoptic chart, showing the storm centre as it starts its journey across northern France on December 17.



This one-meter resolution image of the Island of Stromboli, Italy near the Sicilian coast was taken by Space Imaging's IKONOS satellite on April 29, 2003.

The image shows impressively Stromboli, surrounded by the Tyrrhenian Sea.

The island of Stromboli belongs to the Aeolian Islands of Italy and rises up to 3,000 m above sea level. In the south west the port of Ginostra, and on the other side of the volcano the village of Stromboli, are visible.

*Image: spaceimaging.com*





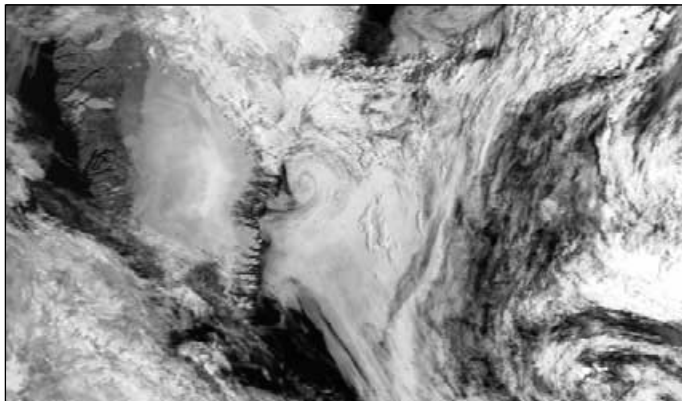
# Imaging Away from Home

**John Heath G7HIA**

Are you missing some very interesting images from the Polar Orbiters: NOAAs 12, 15 and 17? If you live in a built-up area the answer is probably 'yes'. For many of us, houses and tall buildings prevent reception from satellites at low elevations in the sky. Even in a rural location you may have trees, hills or mountains in just the wrong place.

Holidays can offer an opportunity to find an open space. A recent trip to the West Coast of Scotland gave me the chance to obtain images of the high latitudes of Greenland and the elusive Svalbard group of islands, often obscured by cloud.

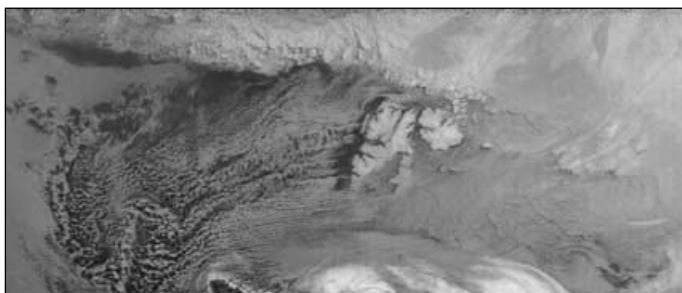
I find that a directional antenna which gives some gain is most suitable for this type of excursion. A three element Yagi works well and goes in the car fully assembled. It gives around 6 dB of gain and has a beam width of 50 degrees or more. Because of the beam width there is no need to track the satellite and for



Greenland in summer - NOAA 15 visible from August 1m 1999



The portable ground station, pictured on the West Coast of Scotland



Svalbard - NOAA 17 IR at 18:49 UT on November 24, 2004

these low elevation passes I just mount the antenna on a small tripod and point it north.

The illustration shows a commercial (*Arrow*) antenna made in the USA and purchased from AMSAT-UK. Designed for portable satellite work it has 2 m and 70 cm combined. Here only the elements for the 2 m band have been fitted. Although optimised for 146 MHz, this antenna still gives perfectly good reception results at the satellite frequencies of 137.50 and 137.62 MHz. With such a short cable run from the antenna to the receiver signal losses in the cable are negligible.

The receiver is my trusty RX2—battery powered. The laptop does not need to be high spec. I use an old model scrounged from work. It runs my favourite tracker and Wxsat for imaging. I suggest you take a print out of pass predictions for easy reference. You could possibly do away with the computer entirely and record the audio on a digital tape recorder or minidisc player for processing at home later. Something I have not tried as yet.

If you need convincing that there are some interesting images to be had at low elevations, I hope the ones shown here will change your mind—Happy Imaging

## ACTIVE DYNAMIC LOADING

*David Taylor*



RF attenuation by *Sturnus vulgaris*

(Common starlings photographed on David Taylor's turnstile antenna)

*Photo: Cecilia Taylor*

The above image illustrates an ADL (Active Dynamic Loading) experiment in progress on a turnstile antenna for the new NOAA-N frequencies. Variable flap-rate can compensate for Doppler shift during the pass but you are warned not to stand directly under the antenna for extended periods due to the danger of contamination.

N.B. - Please don't get your feathers ruffled about this!

# SOFTWARE SHOWCASE



Douglas Deans - [douglas@dsdeans.freemove.co.uk](mailto:douglas@dsdeans.freemove.co.uk)

As promised in my last GEO column, this quarter is dedicated to catching up with updates to some of the software on the GEO CDs. There are no major updates to report and most are for cosmetic or bug-fix reasons. May I remind readers that updates to software are incorporated into the CDs progressively as they appear. This ensures that when software is ordered and provided it will always contain the latest program versions available. Sometimes an update will be reviewed in the following quarter's magazine but often there is insufficient space to do this, or the update is so minor that it does not justify column space.

## Satscape v 2.02

Satscape is a well established satellite tracking program by Scott Hather. The recent update has a few minor fixes but this is a program with many useful features. It is possible to open multiple windows and have several 2D and/or 3D views on the screen tracking different satellites simultaneously. The program is able to track up to 500 satellites at a time with various map views, ground tracks and footprints provided. A wide range of interesting maps have been included with the GEO software.

There are too many options to mention in this brief outline but all in all this is a very well presented package which, to Scott Hather's credit, still remains freeware.

For more information or to download the program go to :-

<http://www.satscape.co.uk>

## Element Manager v 1.59

Element Manager is a 32-bit program designed to manipulate NASA and NORAD two line element sets. It will work with Windows 95 up to XP platforms. You can import files containing 2-line elements irrespective of accompanying text; the element sets are stripped of all extra text and only the two-line elements themselves are saved. The main update in v 1.59 adds further options—the Satellite Situation Report and in particular the ability to read the files and export them.

For more information or to download the program go to :-

<http://www.elementmanager.com>

## NeoPaint v 1.45

NeoPaint is a powerful graphics program which started life as a DOS paint program but is now a fully featured 32-bit tool suitable for Windows 95/98/ME/NT/2000 and XP platforms. Some of the many new features in the Windows version include: support for most popular image formats including JPEG, GIF, PCX, TIFF, BMP and PNG; integrated support for scanners and digital cameras; professional quality output to any Windows compatible black and white or colour printer; multiple undo levels; dozens of special effects and textures; custom paint brushes; photo retouch and colour correction tools; high quality colour and format conversion; masking; colour separation; Picture Browser with file management tools; built-in NeoGrab screen capture; and dozens of other tools and options.

The updates are too numerous to catalogue here but include a huge range of new tools providing red-eye removal and pencil and texture brush to mention just a few. Many new special effects have been added and there is an enhanced user interface with re-designed tool icons and many other options.

For more information or to download the program go to :-

<http://www.neosoftware.com>

All the above programs are available on GEO Software CD, GS2 but please note that NeoPaint is a 30 day trial version.

And finally a first for the GEO Showcase....a program removal. I have taken out the program **e-weatherman** from CD2 as it appears to be no longer supported by Metcheck.

## SOFTWARE CATALOGUE

<b>GS1</b>	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.	
	WXtrack	Satellite Tracking Program v 3.4.6
	SatSignal	Creates images from wave files v 4.1.0
	HRPT Reader	Converts raw HRPT data files into images v 2.5.4
	GeoSatsignal	Manipulates geostationary weather satellite images v 4.2.0
	GroundMap	Rescales satellite images v 1.3.8
	RX2 PassControl	Computer control program for the RX2 receiver v 2.2.8
<b>GS2</b>	A wide range of software for all aspects of weather satellite reception, including tracking, receiving, monitoring and image manipulation. Content is detailed below but many other extras are provided. Titles correspond with folder names. * implies a DOS program.	
	Collection D02	Recall (wave file recorder), Palette (modifies Wxsat colour palettes).
	Collection D03	Scanner recorder v 1.8 (wave file recorder), *NOAA95/*FENG99 (software for the NOAA 95 HRPT project)
	Collection D04	Wxsat v 2.59 (wave file recorder/decoder), Satmon (wave file recorder).
	AGSatTrack	Satellite tracking program v 1.33
	Cirkit	Documents for the Cirkit Wxsat receiver and the UOSat receiver (PDF format)
	Element Manager	2-line element manager v 1.59
	Footprint	Satellite tracking program v 2.10
	Ifan View	Image/slideshow viewer v 3.80
	JVcomm32	Evaluation version (APT/FAX/SSTV decoder)
	Macintosh Kepler editor	Edits verbose AMSAT format elements. Mac OS X and OS9 only.
	NeoPaint	Image processing program (30 day evaluation)
	Paintshop Pro	Image processing program (30-day evaluation)
	Satscape	Satellite tracker and wave file recorder v 2.02
	Splitter	Utility program for splitting and reuniting large files
	WXtoImg	WAV file recording and decoding program with many options. v 2.5.11



**GS3 3DEM Package for 3D Terrain Visualisation**  
This CD includes the full set of GLOBE Tiles to allow you to produce excellent images and flybys from HRPT images. Also included is a selection of Mars MOLA files, sample images and helpful guides by Ed Murashie.

**GS4 Image CD**  
A wide selection of high-resolution remote images from a range of satellites, including stunning imagery from the Space Shuttle missions. A full description and source if provided for each image.

**GS5 Mars Rover Panoramics**  
A chronological account, in panoramic images, of the NASA Mars Rovers' progress across the Martian Terrain

#### How to Purchase CDs

Simply 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 the CD, packaging and posting, a small donation towards the cost of overheads, the cost of overseas orders and the search for new or updated software. 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.

#### New Chinese Satellite

Feng Yun 2C, the first geostationary meteorological satellite wholly designed and built by the Peoples' Republic of China, was launched from the Xichang Launch Centre on October 19, 2004. FY-2C, whose name means 'winds and clouds' replaces FY-2B.



The satellite has been designed to monitor the temperature and the clouds above China and neighbouring areas and will provide meteorological information for the Asia-Pacific region.

This first visible light image was acquired on October 29.

#### Member's Advertisement

##### For Sale

Boxed and tested HRPT RX (Sam Elsdon design) with LNA (also boxed), working very well.

Never used, except for testing because I cannot install a suitably sized dish with AZ/EL at my location. Offers please to Dave Houlden, Portland, Dorset.

e-mail: [dave@g1ocn.com](mailto:dave@g1ocn.com)

## Weather Predicting Simplified

A Book Review by Peter Bartlett

I thought readers might be interested in the following book that I have recently acquired. Wanting a book that would further enhance the excellent 'Interpreting Weather Satellite Imagery' articles written by Peter Wakelin, I came across *Weather Predicting Simplified*, a book that also assists me with gaining a better understanding of basic meteorological charts and weather data, coupled with weather satellite images.

The 180-page book measures 190 x 240 mm and in my opinion will suit all readers who want to gain a better understanding of their satellite weather images. Having an interest also in *Digital Atmosphere*, I have found that the book has helped me gain a greater understanding of weather movements and events.

The book is laid out into eight chapters, following an introduction which states: 'This book is intended for everyone interested in the weather and is meant as a handbook to be used and referenced frequently. Although the book's main focus is on marine weather, it will help anyone interested in understanding, analysing and forecasting weather'.

The chapters covered are:

- 1 What Makes the Weather
- 2 How Weather Reports and Charts are Prepared
- 3 Marine Coastal and Offshore Weather Forecasts
- 4 Surface Charts
- 5 Upper Air Charts and Jet Stream Systems
- 6 Speciality Charts
- 7 Satellite Images
- 8 Integrating Satellite Images with Weather Charts

The book is filled with predominately monochrome drawings, charts and satellite images to assist in predicting the weather; almost every page has some kind of visual aid. Chapter 8 contains more than one hundred examples of weather systems and events portrayed through charts, text and satellite images. Although the majority of the diagrams feature the USA, there is also a reasonable number of examples from Europe. This does not effect the overall aim of the book: to provide the reader with a greater understanding of weather charts and images.

The book rounds off with appendices headed 'Radar', 'Weather check-list' and 'Resources' (two pages of various Internet weather-related sites).

Overall I have found this book to be very informative and a pleasure to both read and own. It is written by Michael William Carr and was published in 1999, in hardback, by *International Marine*. Price £15:00 (ISBN 0-07-012031-5)

#### Reference

Digital Atmosphere Software:

<http://www.weathergraphics.com>

# My Experiences setting up an MSG-1 System



Fred van den Bosch

Yes! I have managed to get my MSG-1 system up and running: and in fact it all turned out to be rather easy. Here are my experiences. Because Mike Stevens gave exact details of the software installation<sup>[1]</sup> in GEO Q4, I will only mention those points where I can add additional information.

## Installation

Installing the *Skystar* card did not cause any trouble. I placed the card in my PC, inserted the accompanying software CD and soon had everything working. The *Astra* satellite was found quickly and at first I played a bit with receiving TV stations. Then I tried to receive *Hot Bird-6* but could not pick up anything! It turned out that I had been using the position of *Meteosat-8* itself in *WXtrack* and this differs by about 30 degrees from *Hot Bird-6*. After a hint from one of our members I tried again. Starting from *Astra*, I moved the dish very carefully to the right (when you look in the direction of the satellite) and bingo—there it was! But do remember that *Hot Bird-6* is very close to *Astra*.

## Testing

Then came the most difficult part—waiting until the client software and Key Unit were delivered by *EUMETSAT*. The time spent waiting wasn't wasted however. I received copies of some raw MSG data files from one of our members (files received directly by the *EUMETCast* client software) and spent a couple of days decoding them using David Taylor's software. This allowed me to completely set up *MSG-DataManager*. The resulting MSG images were then used for testing *GeoSatSignal*, designing the jobs and adjusting the link with Digital Atmosphere. All this was thanks to trial licences<sup>[2]</sup> for *MSG-DataManager* and *GeoSatSignal* supplied by David Taylor

## Receiving

When finally the *EUMETCast* client software and Key Unit were delivered the remaining part was easy. Installation was quickly completed by following the accompanying manual. My only mistake was failing to add access to the *tqrecv.exe* program from *Zone Alarm*, the firewall that I use. This resulted in a yellow 'T' that obstinately refused to turn pink. When, after some searching around I switched off *Zone Alarm*, the data came streaming in. Because all the programs had already been set up correctly during the test period (while awaiting the arrival of the Key Unit etc.), everything worked immediately and well. All that now remained was a little fine-tuning.

## Linking with Digital Atmosphere

I explained in GEO Q2<sup>[3]</sup> a procedure to link APT weather satellite images with *Digital Atmosphere*: this is very easy. Linking *Digital Atmosphere* with MSG-1 images is even easier. Latitude and longitude in DA are exactly the

same as in *GeoSatSignal*—only the scale must be adjusted. A good starting point for the scale is: multiply the span by 90. So if the span in *GeoSatSignal* = 40 then the scale in DA = 40 x 90 = 3600. The map projection used in *GeoSatSignal* is orthographic. A selection of parameters matching *Geosatsignal* images with DA maps appears in figure 1.

The illustration inside the front cover of this issue shows a false colour HRV image from 29-12-04 12.00 UT, upon which isobars and fronts have been added using Digital Atmosphere.

Region	GeoSatSignal			Digital Atmosphere		
	Meridian	Parallel	Span	Lat	Lon	Scale
Europe	5	52	40	52	5	3600
Africa	2	20	75	20	2	6420
Netherlands	5	52	4	52	5	370
N America	-95	45	40	45	-95	3600

Figure 1 - Parameter sets for linking Geosatsignal images with DA



Figure 2 - Regions covered by the parameter sets in figure 1

## System

My system is a 2.6 GHz computer with 512 Mb RAM. At the moment, receiving and decoding are both done on one system. All my other computing is done on the same PC too, so I have 'somewhat poorer' response times: almost as slow as my old 266 MHz PC!

## Images

On the *EUMETSAT* home page at [www.eumetsat.de](http://www.eumetsat.de) you can click on the banner 'Meteosat-8: A New Service Dimension' where you will find a link to the 'MSG Channel Interpretation Guide' page. There you will find some PowerPoint presentations which describe how you can combine several images in to a new one. There are lots of ideas there.



You can also link directly to this page using:

[http://www.eumetsat.de/en/dps/msg/channel\\_interp/index.html](http://www.eumetsat.de/en/dps/msg/channel_interp/index.html)

You can find more help on this theme from Arne van Belle's 'MSG colour composites how-to' guide from:

<http://groups.yahoo.com/group/SatSignal/files>.

Finally for those who are still in doubt—I succeeded so it is not difficult!

Good luck!

### References

1. Meteosat-8: The Challenge - Mike Stevens, GEO Q4, page 34.
2. David Taylor is always pleased to provide trial licenses for his software. These are valid for about three weeks, and are to be recommended. ([davidtaylor@write.com](mailto:davidtaylor@write.com))
3. Using Wxtolmg Images in Digital Atmosphere - Fred van den Bosch, GEO Q2 page 9

### Appendix I - More on using Fleetwood Data Files

Last issue, Ton Lindemann explained how you can use Digital Atmosphere to add *Fleetwood* synoptic data to your Meteosat-8 images. Unfortunately, since Ton wrote his article, the Internet address given for downloading the *Fleetwood* files has become password protected. However, the files are still accessible by using the following (the final two characters are 'zero').

<http://ftp.hb-yacht.ch/ASXX21.@D@S00>

The '@D' token picks out the current day from your internal PC clock while '@S00' selects the 'synoptic hour' by rounding down the time on your PC clock to 00, 06, 12 or 18: so the address above will always load the most recent set of *Fleetwood* data.

### Appendix II - Analysis Scripting

Digital Atmosphere can read script files to automate complex procedures such as Ton's for adding *Fleetcode* overlays to current Meteosat-8 images.

The following file will collect the 12:00 *Fleetcode* file from the Internet and overlay it onto your current Meteosat-8 image. The file can be called '1200.dsf' and is a text file that can be created using any text editor. It is loaded into Digital Atmosphere using the 'Run' button on the 'Scheduler' part of the Scripting tab in the toolbox. Of course, you will have to substitute your own folder and filenames. You can create a file for any synoptic hour, and you can also use the tokenised address given above.

```
## download and store 12:00 UT Fleetcode data ##
download,http://ftp.hb-yacht.ch/ASXX21.@D1200,c:\Program
Files\DigitalAtmosphereWS\fleetdata\fleet.dat
## import the Fleetcode data into Digital Atmosphere ##
ingest,c:\Program Files\DigitalAtmosphereWS\fleetdata\fleet.dat
## load the correct Digital Atmosphere base map ##
load,c:\Program Files\DigitalAtmosphereWS\fleetwood.dmf
## import the Meteosat image made by GeoSatSignal ##
import,c:\Program Files\DigitalAtmosphereWS\msgmaps\met8.bmp
basemap
fleet
stamp
#
```

## GEO HelpLines

### Douglas Deans, Dunblane, Perthshire, SCOTLAND

All aspects of weather satellites from APT, HRPT to Meteosat-8 DVB/EUMETCast systems.

- telephone:(01786) 82 28 28
- e-mail: [douglas@dsdeans.freemove.co.uk](mailto:douglas@dsdeans.freemove.co.uk)

### John Tellick, Surbiton, Surrey, ENGLAND

Information about the hardware required to receive Meteosat-8 and advice about registering for the various MSG services. John will also 'field' any queries of a more general nature about any aspect of receiving weather satellite transmissions.

- telephone: (0208) 390 3315
- e-mail: [info@geo-web.org.uk](mailto:info@geo-web.org.uk)

### Keith Holland, London, ENGLAND

Specifically help for APT users (137 MHz band) and Meteosat-7 wefax.

- e-mail: [geo@koholland.plus.com](mailto:geo@koholland.plus.com)

### David Strickland, Truro, Cornwall, ENGLAND

David has set up his own wireless network system of three computers. He has interests in electronic design and prototyping, general computing, microchip processors with various facilities and of course MSG satellite imaging. He will be happy to discuss any of the above topics, and to help anyone local, including viewing his setup.

- e-mail: [David@Strickland.uk.com](mailto:David@Strickland.uk.com)

### Geoff Morris GW3ATZ, Shotton, Flintshire, NE WALES

Geoff has lots of experience aerial, coax,connectors, mounting hardware etc. Also done a lot of work with the orbiting satellites. Geoff is know his way with most of David Taylor's software. He has recently started with MSG, so should be able to share his experiences with other newcomers to this branch of the hobby.

- Tel: (01244) 818252
- e-mail: [gw3atz@btopenworld.com](mailto:gw3atz@btopenworld.com)

### Guy Martin G8NFU, Biggin Hill NW Kent, ENGLAND

Guy is prepared to advise anyone who wishes to receive MSG under Windows 2000. He also runs Meteosat-7 SDUS.

- [agm@tonbridge-school.org](mailto:agm@tonbridge-school.org)

### Hector Cintron, San Juan, Puerto Rico, USA

Hector is prepared to field enquiries on HRPT, APT, WEFAX, EMWIN and NOAAPORT

- Tel: 787-774-8657
- e-mail: [n1tkk@hwic.net](mailto:n1tkk@hwic.net)

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**E-mail contact can of course be made at any time, but we would ask you to restrict telephone contact to the period 7.00-9.00 pm in the evenings.**



**Manager: Clive Finnis**  
 e-mail: [shop@geo-web.org.uk](mailto:shop@geo-web.org.uk)  
 FAX: +44 (0) 1202 893323



GEO is pleased to offer members the opportunity to purchase **GEO-PIC 1.0**, a replacement PIC for the RX2 receiver. This will enable you to receive the two new NOAA APT frequencies that will be operated by the final satellites of the series, NOAA 18 and NOAA 19. NOAA 18 is due for launch in March this year, with NOAA 19 following in December 2007.



If you have recently joined GEO for the first time, we can offer a CD with PDF versions of the four 2004 issues of the GEO Quarterly to bring you up to date.

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GEO 2004 CD	8.00	8.40	9.30

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

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We still have free copies of the GEO Launch Issue available. If you have friends who might be interested in learning about GEO, please encourage them to send for their copy by completing the application form on the GEO website at:

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

**Weather Satellite Frequencies**

Polar Orbiting Satellites	Frequencies (MHz)	
	APT	HRPT
NOAA-12	137.50	1698.0
NOAA-14	-	1707.0
NOAA-15	137.50	1702.5
NOAA-16	-	1698.0
NOAA-17	137.62	1707.0
Feng Yun 1C, 1D	-	1700.4

Geostationary Satellites		Location	Frequencies WEFAX (MHz)
GOES-E	USA	75°W	1691.0
GOES-W	USA	135°W	1691.0
Meteosat-5	INDOEX	63°E	1691.0
Meteosat-6	Europe	10°E	1691.0
Meteosat-7	Europe	0°	1691.0, 1694.5
Meteosat-8	Europe	0°	DVB





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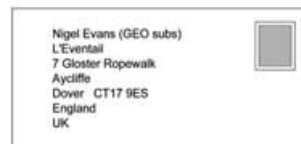
I have no objection to GEO holding my membership details on its computer database. I understand that such information will be used exclusively for internal GEO administration purposes.

Please sign and date below to confirm

**Signature**

**Date**

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'L'Eventail', 7 Gloster Ropewalk, Aycliffe,  
Dover CT17 9ES, England, UK.



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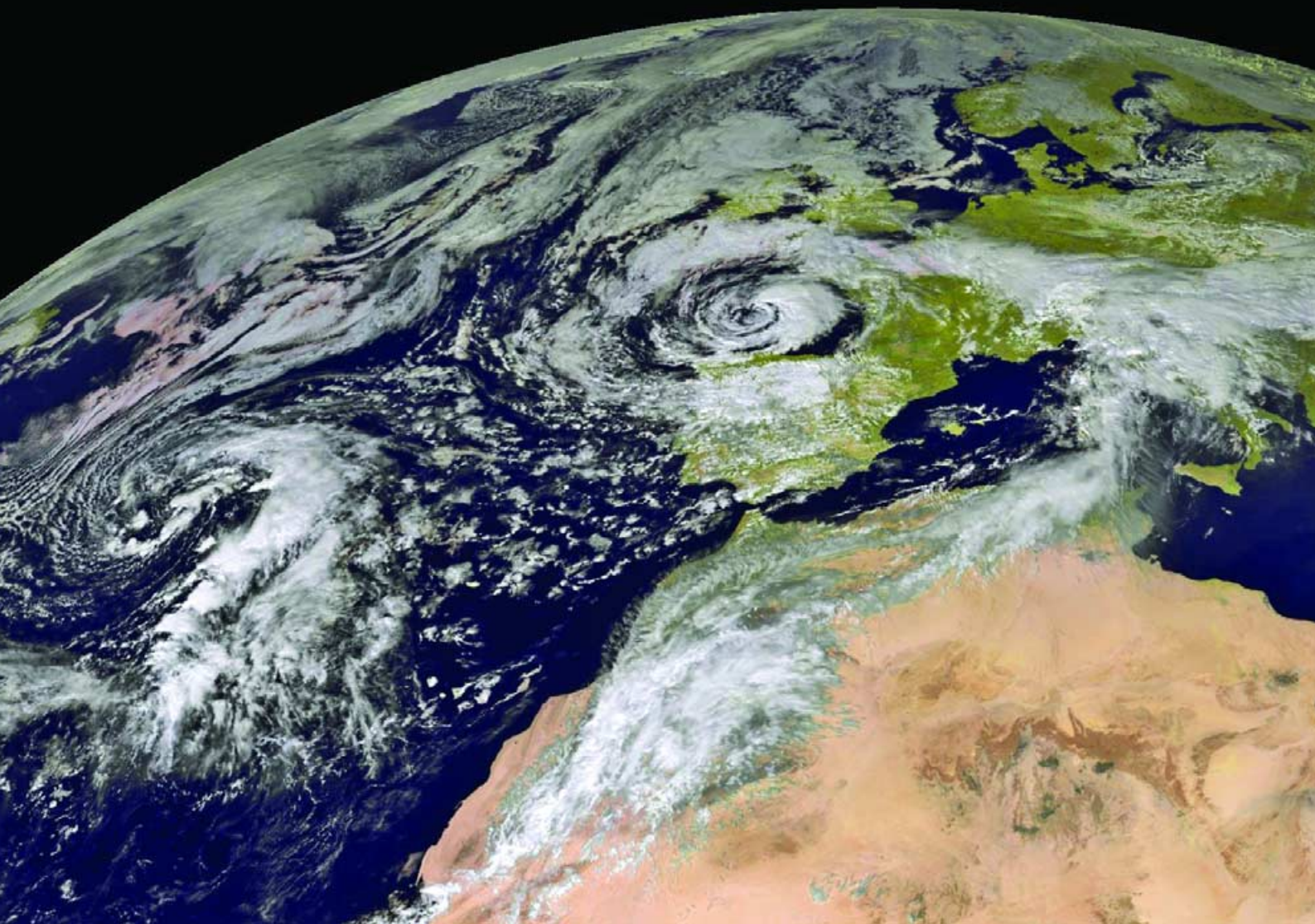
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# NOAA Satellite Predictions for the UK

(Based on Latitude 52°N, Longitude 2°W, times in UT / GMT)

NOAA 12			NOAA 15			NOAA 17			NOAA 12			NOAA 15			NOAA 17		
Mar 01	05:48 07:28 15:37 17:18	06:30 08:11 16:20 18:00	10:14 11:54 20:05 21:44	May 01	05:45 07:25 15:34 17:15	05:46 07:26 15:37 17:15	10:22 12:02 20:13 21:52										
Mar 02	05:23 07:03 15:13 16:53	06:07 07:47 15:57 17:36	09:51 11:31 21:21 23:02	May 02	05:20 07:00 15:10 16:49	07:02 08:42 16:52 18:32	09:59 11:39 19:50 21:29										
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Mar 04	04:34 06:14 14:24 16:03	06:59 08:40 16:49 18:29	10:46 12:26 20:36 22:16	May 04	04:31 06:11 14:21 16:00	06:15 07:55 16:05 17:44	10:54 12:34 20:44 22:24										
Mar 05	05:49 07:29 15:38 17:19	06:36 08:16 16:25 18:05	10:23 12:03 20:13 21:53	May 05	05:46 07:26 15:35 17:16	05:51 07:31 15:42 17:21	10:31 12:11 20:21 22:01										
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Mar 18	05:29 07:09 15:18 16:58	06:28 08:08 16:18 17:57	10:26 12:06 20:17 21:56	May 18	05:26 07:06 15:15 16:55	05:43 07:23 15:34 17:13	10:34 12:14 20:25 22:04										
Mar 19	05:04 06:44 14:54 16:34	06:04 07:44 15:55 17:34	10:03 11:43 19:54 21:33	May 19	05:01 06:41 14:51 16:30	07:00 08:40 16:49 18:30	10:11 11:51 20:02 21:41										
Mar 20	04:40 06:20 14:30 16:09	05:41 07:21 17:10 18:51	11:21 13:01 21:10 22:51	May 20	04:37 06:17 14:27 16:06	06:36 08:16 16:26 18:06	11:29 13:09 21:18 22:59										
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Heinz Fischer from Imberg in Germany sent us this 12:30 UT Meteosat-8 image from October 10, 2004, showing two impressive depressions on the same image, one over the Bay of Biscay, the other approaching over the Atlantic.

Image © EUMETSAT 2004



The main board of the RX2 receiver showing the new PIC in place at upper right.



This photograph of a built RX2 kit in a customised case was submitted by Norbert Puetz from Erding in Germany.



