The GEO Quarterly

Group for Earth Observation

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

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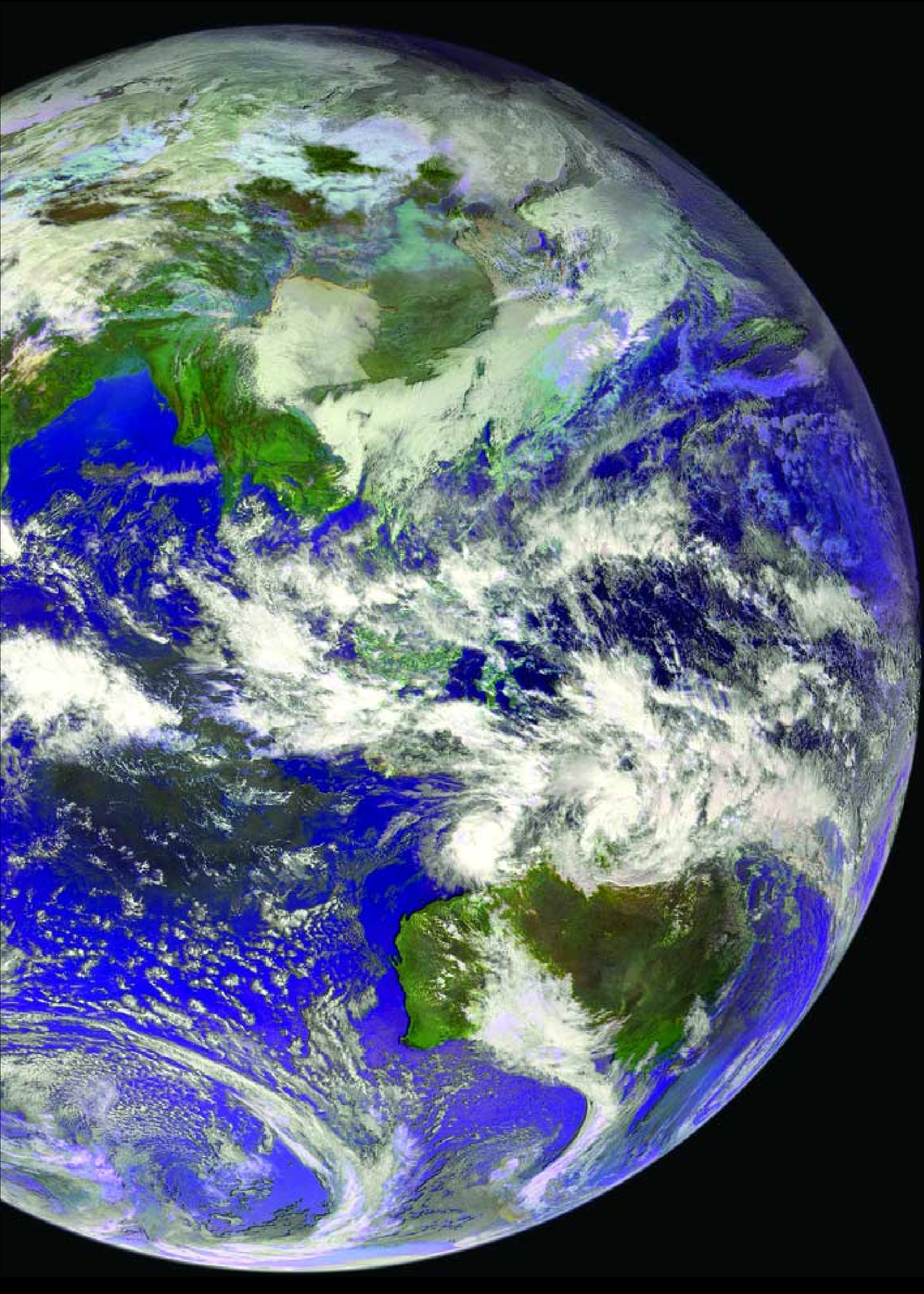

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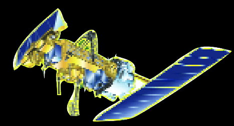
NOAA-18 now in orbit



Are you experiencing pager problems with this new WXsat? John Beanland explains that there is a great deal you can do to minimise their effect.

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Fred van den Bosch explains how to take advantage of Digital Atmosphere's new scripting language

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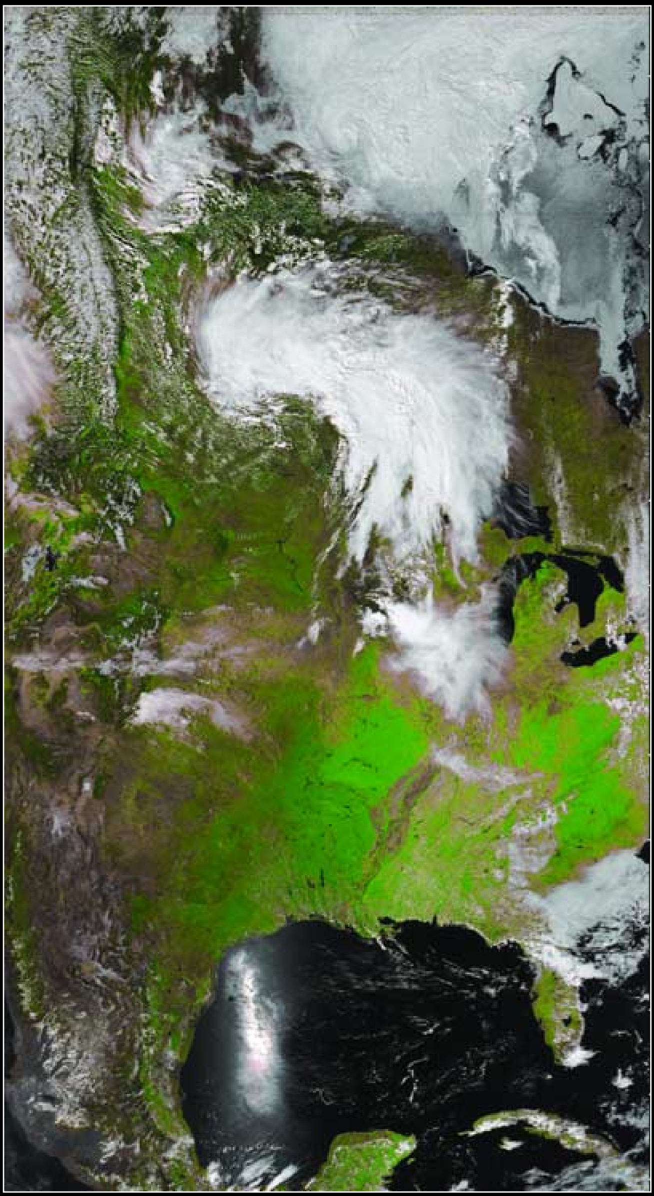

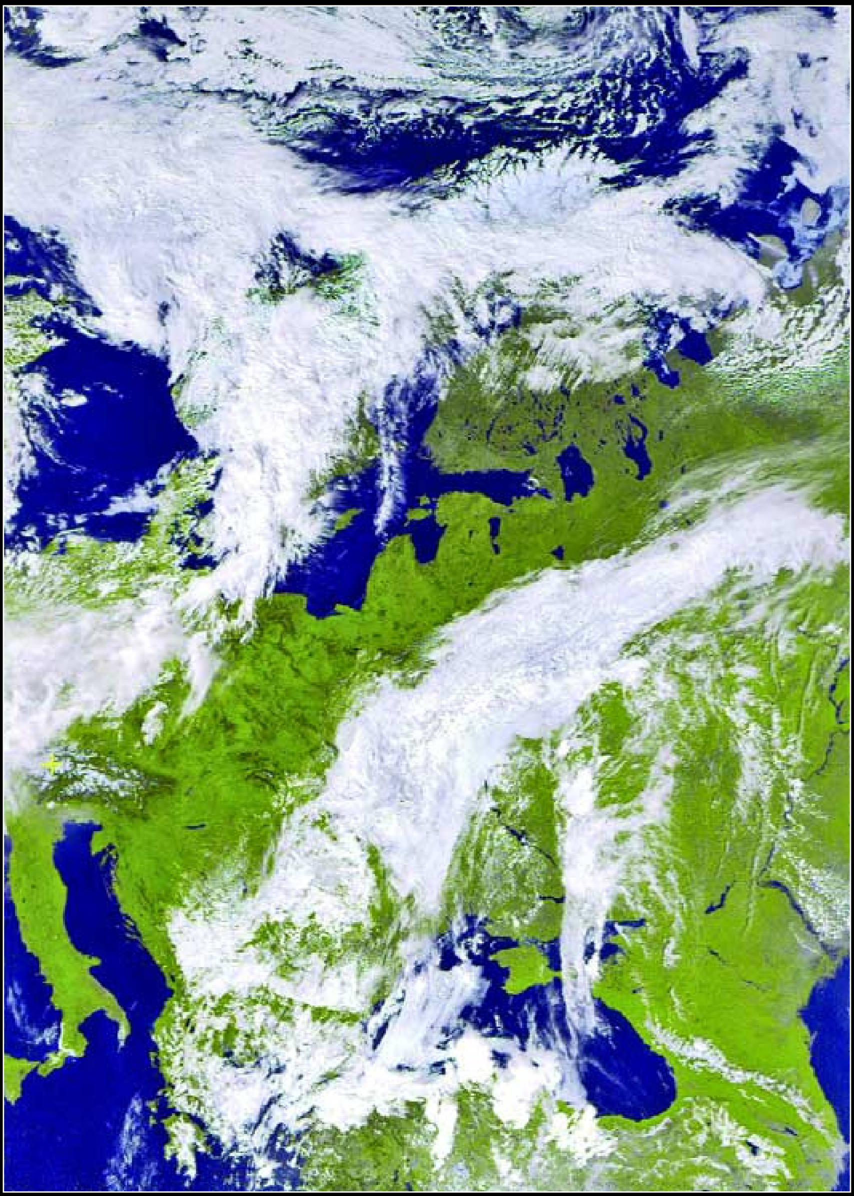

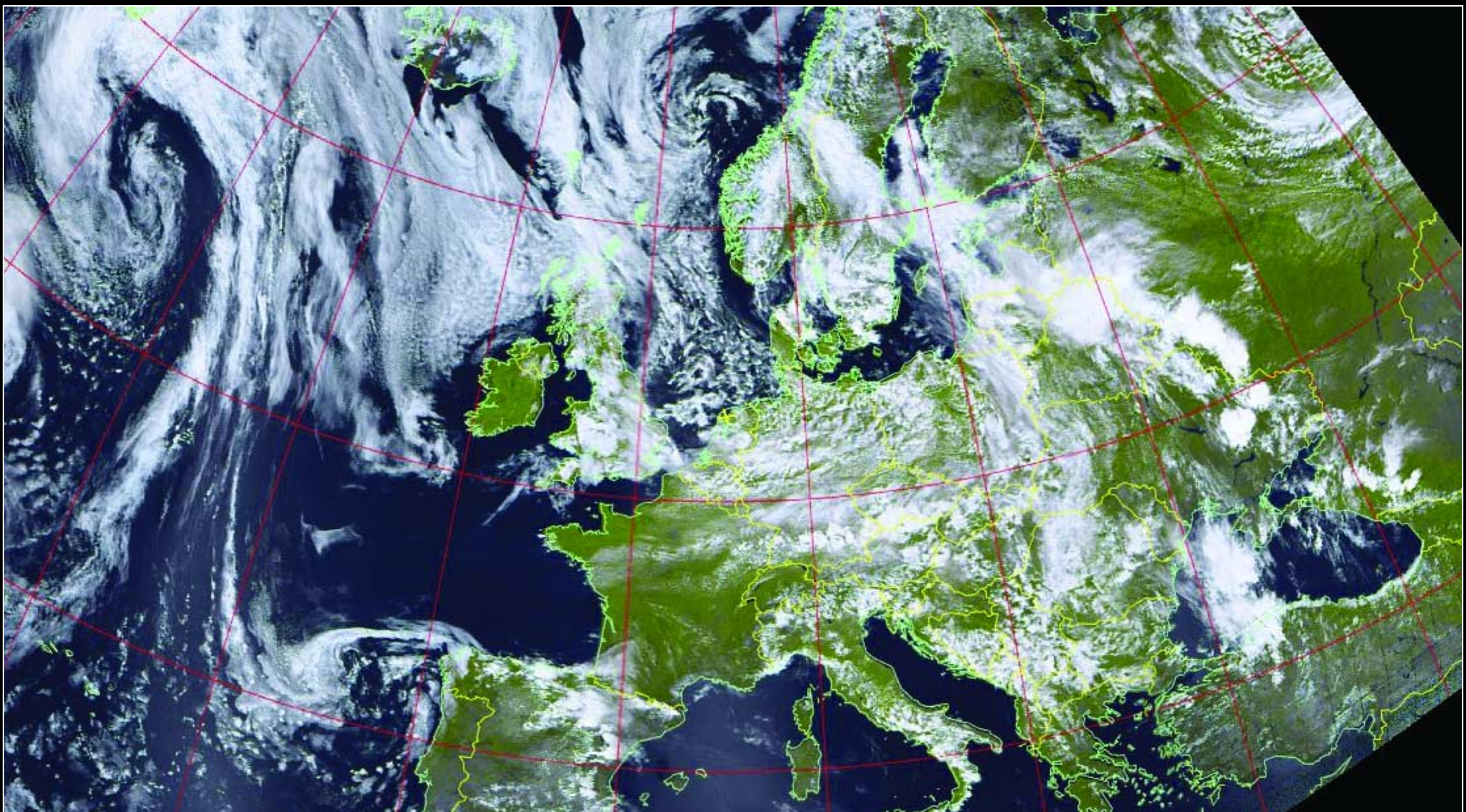

After several delays due to inclement weather conditions, NOAA-N finally made it into orbit on May 20. The new satellite, NOAA-18, fills the important early afternoon APT niche that had remained vacant since NOAA-16's APT VHF downlink failed in November 2000. Several early images from the new wxsat are reproduced opposite (see details on page 18) as well as on some of our inside colour pages.

NOAA-18 operates on a new frequency, 137.91 MHz, which has caused many GEO readers problems because of the proximity of pager transmitters. The scale and scope of this interference were established in an Internet survey conducted by Nick Hewgil and Lawrence Harris; you can read about their findings on page 11. We also have an article from John Beanland, who explains simple precautions we can all take to minimise the effects of pagers on our NOAA-18 images.

It is perhaps timely to yet again remind those our readers who enjoy the WEFAX and PDUS data transmitted from Meteosat-7 that these services are due to end in just a few months time. To continue enjoying geostationary images of Europe you will soon have to upgrade both hardware and software to capture the Hot Bird-6 DVB transmissions that carry the MSG imagery from Meteosat-8. You can read more about the impending changeover on page 3.

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Responsibility for Constructional Projects and Software
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The GEO Report

Francis Bell

I have just returned from three GEO events so include very brief reports of these and other matters; two field expeditions and the AMSAT-UK colloquium held in Guildford.

The last three days of July saw GEO at the AMSAT-UK colloquium in Guildford. This is a three day event and GEO ran live demonstrations of Meteosat-8 projected on to a large screen in a room adjacent to the main lecture theatre. The 60 cm receiving dish, for safety, was positioned in a garden behind metal railings but still received perfect images. We also ran live reception of polar orbiting satellites. We had two stands with literature supplied by EUMETSAT and BNSC as well as our own *GEO Quarterlies* on display. As best I can judge the literature fell into good hands because, by the end of the third day, most of it had disappeared. John Tellick was there displaying receiving hardware while David Taylor was supervising our live imaging. David gave a presentation in the main lecture. I'm not sure of the exact delegate numbers, my estimate was about 100+ from many different countries. On the third day we were joined by Clive and Carol Finnis plus Peter Green. Having dismantled our stands we then had an informal meeting in the evening to discuss current GEO issues.

GEO at AMSAT
L to R: Peter Green, Francis Bell, Clive and Carol Finnis

Photo: David Taylor

Thanks must go to AMSAT-UK for inviting us to their colloquium. I hope GEO made a worthwhile contribution and also hope we will be invited again in 2006.

A note about GEO's management team's wives. I am attentive to the support that they give to GEO. There were three wives in Guildford. Whether they are supporting GEO, their husbands or both I cannot judge but my thanks to them anyway, and of course to those others who support us.

The GEO stand at the AMSAT colloquium last July

Photo: David Taylor

Meetings

On the subject of meetings, GEO has now booked the NSC in Leicester for our next symposium and AGM. The date is April 29, 2006. Please put this date in your diary now. The 2005 symposium was judged to be a success but rather a busy day. For Leicester 2006 I would like to have presentations about the interpretation of the weather satellite images we receive. Previously we have tended to concentrate on the technical side of signal reception and display; if we want to know what this information means we must be able to interpret it correctly. I know Peter Wakelin contributes regularly to the Quarterly on this subject but if anybody knows of an additional person suitable to come to Leicester next year, please let me know.

NOAA-18 - Field Experiments

NOAA 18 is now in orbit and I receive beautiful APT visible images from this satellite on 137.9125 MHz from where I live in SW Surrey. I know that in the UK the pager frequency allocation overlaps with the weather satellite band of 137-138 MHz. My judgment is that this will not change for many years so the adjacent pager frequencies and use will have to be endured.

I have five receivers which can receive on 137.91 and have been experimenting with NOAA-18 reception. I also have three antenna systems. With some receiver and antenna configurations I can receive perfect NOAA-18 images whilst simultaneously listening to the background pagers on my scanner. However, I am sensitive to the fact that in other locations this is not the case and pager interference is severe.

I have been continuing my experiments in the field and, at the TCARC rally four miles west of Petersfield, Hampshire, I set up a station, literally in a field, and received perfect reception. The same was true at the AMSAT-UK colloquium site. My most recent field expedition was at the Wimbledon Amateur Radio Society's week-long expedition on top of the South Downs, three miles north of Reigate Surrey. This location is in line-of-site with Gatwick airport as well as two nearby pager transmitters plus many other RF transmissions in the area. The interference was overwhelming, with no chance of realistic NOAA-18 images. Five seconds of perfect reception then 20 seconds of noise. *I even received voice audio on a weather satellite channel.* If I lived close to this site I would be very frustrated. I know that many GEO members are experimenting and sharing experiences. Some locations seem okay (thank you at my QTH) while others experience more difficult reception. I subsequently learned that there may be up to 1000 users of the radio services close to where I had set up my NOAA-18 station on the South Downs.

On the subject of NOAA 18, I will take my portable station to the USA next time I visit. My son and his family have moved to North Carolina and we visit them there intermittently. It will be interesting to try NOAA-18 reception in the USA and listen for background interference there.

Subscription to GEO Membership

I reported to our membership at Leicester the financial position of our group. We do have money in the bank but we also have liabilities and responsibilities, so must look at the year ahead. Over the past two years our income has consisted of membership subscriptions, generous sponsorship from some individuals and now income from the GEO Shop. Our main expenses are the printing and distribution of our Quarterly publication. Nobody within GEO management has received expenses (for example travel, hotels, communication costs and many other expenses); these have been supported by our management team, with no regrets. However, to secure GEO's future we must be realistic about our finances. With this in mind a decision has been taken to increase our membership subscription from £16 to £18 for our existing and new memberships. This will take effect when subscriptions come up for renewal. There will be an equivalent increase for Europe and the rest of the world.

Please do not decline to renew your membership on the basis of this modest increase in subscription—it still represents outstanding value for money.

What do you get for your subscription? Our Quarterly publication of course, but also, importantly, shared experiences with other members and the benefits of an active management team promoting the interests of our membership to important national and international agencies. All for £18 a year! Perhaps I shouldn't write this but I believe it to be true. We are fortunate in this country to have a group such a GEO to successfully lobby for free and easy access to weather satellite data on behalf of the amateur, educational and self-training users. Other countries are not so fortunate.

If you wish, you can add on any amount to your annual subscription. There is no obligation here just an invitation if you wish.

WEFAX

Many of us will have been receiving WEFAX transmissions from Meteosats -1 to -7 for many years. This includes me with accumulated dishes down-converters and receivers for WEFAX reception. All users should note that this Meteosat service will soon end (see article on right). WEFAX is also being phased out on NOAA's GOES geostationary satellites in favour of LRIT. I was at the Miami conference in December 2004 where this was discussed. Although much of this discussion was highly technical, I noted the background suggestion by a small group of delegates that these satellites continue with WEFAX because of the many existing users of the service.

The response from NOAA and their consultants was unambiguous. *'To continue with WEFAX is not an option'*.

It is clear that image resolution and data rates are improved by moving to new formats. WEFAX is on its way out.

The GEO Shop

Any GEO member who wishes to receive live images from Meteosat satellites has to face this reality: if you have not already done so, take action now. The GEO Shop has all the hardware you need to receive the Meteosat-8 *EUMETcast* data format via Hot Bird-6. If you use the Shop to buy a new system or to put a new chip into your receiver for NOAA-18 you benefit the group—because of course, there is a small margin in sales for GEO. The Shop helps our finances and also offers the tremendous benefits of help and advice for our members.

Our thanks to Carol and Clive Finnis and also John Tellick for establishing the Shop. Everybody comes out a winner but I understand the time and commitment it takes to run the shop.

I will try to go to Utrecht for the next meeting of *Werkgroep Kunstmanen*, our friends in the Netherlands. I have just received my copy of their publication 'De Kunstmaan' with two pages devoted to a report on our Leicester symposium, which they supported.

Every Seventh Wave

I have mentioned above that my son and his family now live in the USA and we visit them from time to time. There is a small children's park just opposite their house which has a stream running next to it.

My grand-daughter Caroline—three and a half years old—likes me to take here there to play. One afternoon we went to this park and Caroline threw a few stones into the stream, which of course created waves. I said to her: "it's always the

... continued on page 10

The End Draws Nigh for WEFAX and PDUS

John Tellick

At the time of writing (early August), Meteosat-7 PDUS and WEFAX services from 0° are due to be terminated on February 1, 2006 owing to the delay in launching MSG-2. After that time there will be no more PDUS/WEFAX services from 0°.

Meteosat-8 (MSG-1) has been providing *EUMETSAT's* prime location dissemination in HRIT/LRIT format for well over a year now via *EUMETCast,* which is transmitted by the Hot Bird-6 satellite located at 13°E. HRIT imaging provides a set of 11 whole globe images in different spectral channels plus a twelfth channel which provides a selected area of high resolution visible imagery. All channels are updated every 15 minutes to provide round-the-clock coverage of stunning quality.

EUMETCast, which also includes relays of foreign satellite data, other meteorological data and NOAA ATOVS sounding data can be received using easy-to-install domestic type satellite TV equipment, all available from the GEO shop—see our advertisement and price list in the centrefold of this Quarterly.

EUMETCast is a multi service broadcast system and is the future *EUMETSAT* dissemination system for geostationary, polar orbiting and environmental data services.

This is an exciting development and if you wish to continue to receive Meteosat data, now at greatly improved resolution, plus future polar orbiting imagery over an extended area, you need to make the transition soon.

You need to register with *EUMETSAT* in order to obtain a license from your national Met. Office and the reception software.

This can take several weeks.

You will also require a suite of display software such as David Taylor's Meteosat Data Manager to process and display/animate the images.

The EUMETCast registration form is available on the GEO website at

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

You will also find a guide to help you to fill in the registration form plus further information on our website.

Don't delay - the future is here—now.

Symposium 2005

Les Hamilton

Following the acclaimed success of GEO's inaugural symposium in 2004 there was always that niggling doubt as to whether a repeat venture just one year later would be a wise move. Was it too soon to expect so many of our members to return? Could we provide a suitably varied program without simply duplicating what had already been done previously? Was it wise to return to the same venue at the National Space Centre for a second successive year?

On April 30 all our doubts evaporated as GEO members (and one dog) turned up in force for *Symposium 2005*. For most of the day the lecture theatre bulged at the seams with seating very much at a premium; if you were the least bit late for the start of any of the presentations you had to stand! We were particularly delighted to welcome several members of our sister organisation in the Netherlands, *Werkgroep Kunstmanen* [1]. Not only did they make a big impact by providing three presentations during the day, but Arne van Belle and Rob Alblas each set up and demonstrated his MSG ground station hardware throughout the meeting.

Proceedings opened with a brief welcome from Francis Bell after which Peter Green and Cecilia Taylor chaired the morning and afternoon sessions respectively. What follows is a necessarily brief overview of the day.

Mike Grocott

The morning's first presentation came from Mike Grocott, who described various facets of the work of the Callington Space Centre [2]. Mike explained how his personal career outlook had been changed following a visit to Florida to view a Space Shuttle launch and how he has since devoted himself to 'inspiring and motivating' the next generation of students. At Callington this has been achieved with the aid of telescopes and astrophotography and, more recently, by the introduction of digital satellite imaging from two Meteosat-8 ground stations installed with support from *Dartcom.*

Callington is currently developing a weather satellite module for junior students from 9 to 13 years of age, which emphasises the influence of satellites on everyday life. The students are involved primarily with image processing rather than under-standing how the hardware operates and they are encouraged to learn to interpret what the images actually show.

Many students at Callington perform particularly well because they are inspired by the activities that are available to them outside the formal classroom, and a group of 6th form students recently enjoyed a trip to NASA in the USA.

Gordon Bridge

Gordon opened with a brief overview of the theory of cloud reflectivity and how this energy may be harnessed for interpret-ative purposes. The 12 channels of radiation detected by Meteosat-8 provide unparalleled opportunities for detecting cyclones, weather fronts, fog etc. and all these phenomena were illustrated on the big screen with appropriate movie loops. In particular, Gordon pointed out how the different reflectances from snow crystals compared with water droplets—exhibited in the 1.6 µm infrared (channel-3)—enabled excellent discrimination between fog and snow. We were also shown how the 8.7 µm IR channel was particularly suitable for the detection of sulphurous fumes from factories and volcanos.

Gordon continued by describing some novel channel subtraction techniques which were paving the way to a more accurate means of identifying severe convection in clouds; this was proving a most valuable 'nowcasting' tool in aiding storm prediction. Varying the colours used can emphasise where the clouds are at their most active and makes it possible to follow the growth and decay stages of hurricanes—and may eventually prove useful for tornado forecasting.

Difference techniques were also proving useful to discriminate clearly between dust storms and true clouds, even during the night, and a 24-hour movie sequence showing dust blowing off the Sahara emphasised the point. Vegetation shows different reflectance signatures at different wavelengths, and combining Meteosat-8 channels can be used for the identification of specific crops—for instance rice paddies—as well as phytoplankton blooms in the Earth's oceans.

David Taylor

David Taylor first described developments in his own software for Meteosat-8 and the other data streams available over *EUMETCast*. Sea-surface temperature data has already been extended to a number of regional areas and is expected to be further increased to include full northern-hemisphere and Antarctic coverage. The culmination of the past year's software development has been *GeoSatSignal-5* which provides novel RGB combinations for the 12 channels of Meteosat-8 data.

David continued by detailing how the *EUMETCast* service was to be extended to carry data from *Metop*, the forthcoming European polar orbiting satellite. There are some exciting new instruments aboard Metop, including a very high-resolution infrared spectrometer and a radio occultation instrument; these will provide us with new ways to understand the atmosphere.

David showed us some presentation material provided by *EUMETSAT* which described how the existing *EARS* service is to be extended to cover AVHRR (HRPT) high-resolution image data from the existing NOAA satellites, and to provide pan-European HRPT data without the need for a complex receiving system or tracking antenna.

All this data will become available over *EUMETCast*, resulting in a much higher data rate, but David described how a new configuration (based on suggestions from Arne van Belle) had been tested by *EUMETSAT, which* showed that both the higher data rate and co-existence with existing data were quite feasible.

Ed Murashie

The weather satellite scene in the USA provided the subject of Ed Murashie's eagerly awaited afternoon presentation. Ed started with an overview of the TIROS program, originally conceived as far back as 1951, but which did not come to fruition until TIROS I was launched seven years later. Much of the delay had been the result of shifts in responsibility. The US army was originally in charge of the project, but this was later handed over to the air force before finally ending up as the province of NASA.

Ed also described in detail the history of the current NOAA fleet of both polar orbiting and geostationary weather satellites, including an animated appraisal

A packed lecture area listens attentively as Ed Murashie from the USA delivers his presentation

Photo: David Taylor

Ed Murashie in expansive vein during his talk

Photo: David Taylor

David Taylor (left) with Gordon Bridge

Photo: Les Hamilton

Demonstration of RGB colour combination

Image: Gordon Bridge

Nigel Evans (left) and Peter Bradley

Photo: Les Hamilton

David Simmons' setting up the Tellique suite

Photo: David Taylor

Tellique setup on the big screen

Photo: Les Hamilton

Tellique software installed—success!

Photo: Les Hamilton

Demonstrating the satellite signal meter

Photo: David Taylor

The RSGB *FUN* vehicle outside the NSC

Photo: Cecilia Taylor

Rob Alblas demonstrating his XRIT software

Photo: Les Hamilton

Pointing a Dish towards Hot Bird-6

Photo: David Taylor

Customers at the GEO Shop stand

Photo: Les Hamilton

Antenna discussion with Arne van Belle

Photo: David Taylor

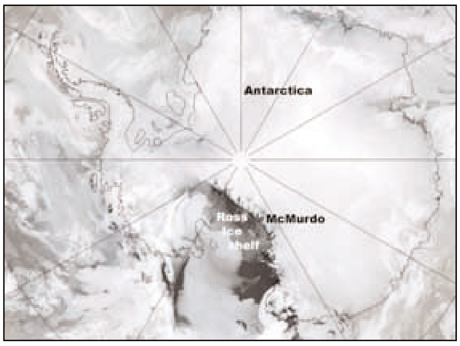
of the 'NOAA N-prime debacle', before detailing with how the civilian (NOAA) and military (DMSP) programmes are soon set to merge under the NPOESS banner.

'Is it still worth investing in APT' asked Ed. Given that NOAA N (now in orbit as NOAA-18) and NOAA N-prime (currently being rebuilt following its accident) each has a minimum design life of two years, there should be an absolute *minimum* of four years of APT ahead of us. So, yes, it is definitely worth investing in APT—it will probably be with us much longer than just those four years if NOAA-12's continuing 12-year lifespan is anything to go by.

Ed concluded with a look towards the new dissemination modes and the equipment required to receive them. It may well be that the development of software receivers could be the way forward—specially in view of the UK's pager problem. One approach could be to employ an analog front-end to convert the signal down to a lower base-band frequency and then digitise it with an Analog to Digital Converter (ADC). This in turn could feed a Digital Signal Processor (DSP) or Field Programmable Gate Array (FPGA) which would contain a 'brick-wall' filter to reduce the interfering signals by 60-70 dB. With all the FM and analogue demodulation done in the PC it would be much easier to execute filters. What about forming a group to develop this as a challenge?

Ferdinand Valk

We were delighted to welcome, from the Netherlands, Ferdinand Valk, who entertained us with a brief illustrated talk detailing the history of the B15 iceberg from its formation up till the present day.



Antarctica composite

After setting the scene with this composite satellite image of the continent (below), Ferdinand described events from the initial calving of the iceberg in 2001 through various phases of movement and grounding. All this was illustrated by fascinating movies he had created from MODIS imagery, which clearly showed the fracturing of the 'berg in 2003 and its collision with the Drygalski ice tongue in 2005.

Fred van den Bosch

Another of our Dutch members, Fred started with the assertion that 'basically I am lazy', then went on to explain how he has fully automated his weather satellite activities by means of batch files. By setting up an appropriate folder structure on the single PC used for the task he has fully linked products from *MSG Data Manager*, *MSG Animator*, *GeoSatsignal* and *Digital Atmosphere*. Images and synoptic files are all retrieved and processed completely automatically to produce satellite images overlain with fronts, isobars and so forth.

Fred also discussed several useful software packages he uses: *Digital Atmosphere*, *Photofiltre* and *Anaglyph Maker*. *Photofiltre* was particularly useful as it allowed both the addition and subtraction of MSG channel data, one case in point being to subtract channel-1 from channel-2 to enhance country outlines.

Rob Alblas

Rob Alblas is well known in the Netherlands as a weather satellite software author and his *XRIT* for MSG was featured in GEO Q5. Rob had intended to demonstrate using the LINUX platform, but his first major computer malfunction in 15 years occurred just before setting out for Leicester, so he demonstrated with the Windows version instead.

Rob took us through all the features of his software, which was used to decode live Meteosat-8 data throughout the day. He also explained how additional software could be used to convert MSG images into movies (as they were being received) and showed us a number of splendid animations.

Workshops

In addition to these speakers, a number of workshops operated throughout the day. One of the most popular was **John Tellick**'s demonstration of the use of a satellite signal meter to align a dish on Hot Bird-6 (see photographs on page 5). The whole process went flawlessly and took only two minutes.

In the demonstration room, another popular offering came from **David Simmons** who tackled the potentially problematic installation of the *Tellique* software on a PC. With each stage of the process projected on a large overhead screen, everything installed smoothly, culminating in a comforting audio signal which pulsed as the data was received from Hot Bird-6. David's secret here was the use of a set of radio headphones which allowed the dish to be pointed remotely from the PC by reference to the sound volume.

Once all the presentations were over, Francis Bell presided over a short AGM where he opened proceedings by reiterating, for the benefit of new members, the fact that GEO is a limited company which makes annual returns to Companies' House and the Inland Revenue. GEO represents its members' interests to international agencies, and has already made its mark.

GEO has recently expanded its management team, with David Painter (Education) and Peter Green (International Liaison) joining the Group's founders.

The meeting continued as a question-and-answer session where members posed a variety of queries from the floor, before David Painter wound up proceedings with a vote of thanks.

References

1 Werkgroep Kunstmanen
http://www.kunstmanen.nl

2 Callington Space Centre
http://www.callingtoncommunitycollege.co.uk/spacecentre

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
NOAA-18	137.91	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

VIEW HRPT IMAGES ON YOUR MAC

Sergei Ludanov - *kd6cji@mac.com*

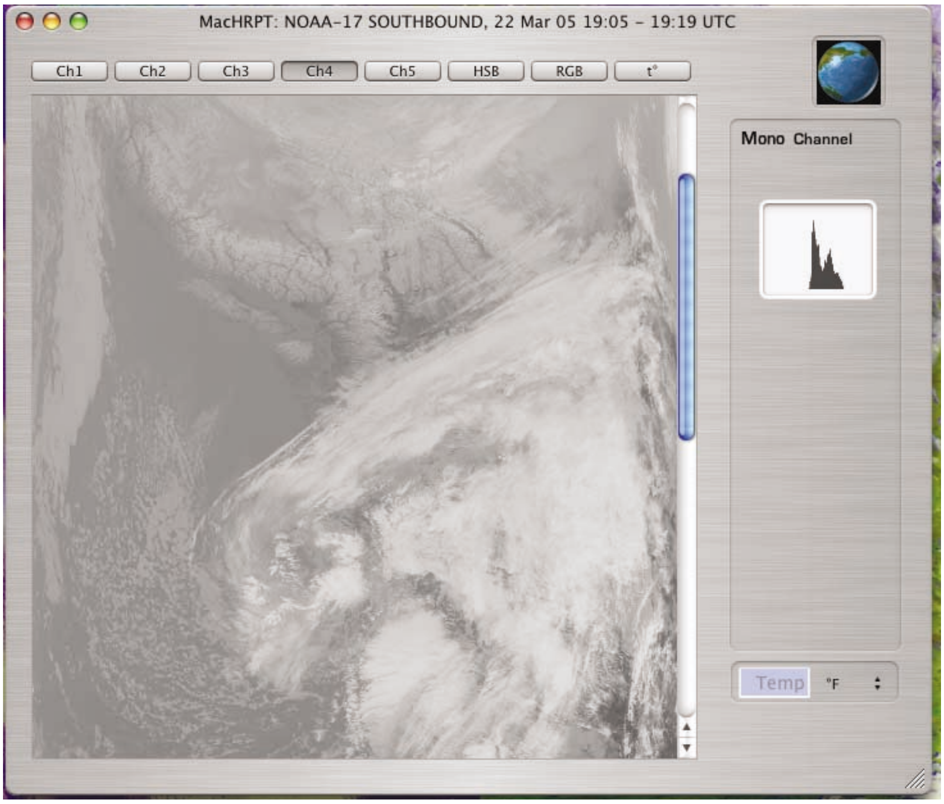


Figure 1 - MacHRPT displaying a NOAA channel-4 infrared image

Introduction

It was with great interest that I read Les Hamilton's article 'HRPT images from the NOAA Satellite Archive' in issue No 5 of *GEO Quarterly*. I almost rushed to the Internet to register with NOAA and request files to download but suddenly realised that I don't have HRPT Viewer on my *Mac PowerBook*. I went to *Google* to search for such a program that runs on Mac OS X but results were not very encouraging; in fact, I found none. Well, to be more exact, there is a multi-platform program called *GRASS* that runs on *Mac OS X* using *X11*, but it is very complicated to install and use. At any rate I have not figured out how to use it yet. However, I was so inspired by Les Hamilton's article that, by the time my search was over, I was on a roll and decided to try to write a program myself.

MacHRPT

At that point I had no clue about HRPT file formats or anything else related to them. Fortunately, the NOAA website contains a wealth of information, including the invaluable 'KLM Users Guide'. After details of the image format had become more or less clear, I fired up *XCode*—Apple's development tools and environment—and was on my way. A couple weeks of busy late nights at the computer and the first version of the program which, having no poetic talent I called *MacHRPT*, was ready.

MacHRPT is by no means a mature program yet and lacks many of the features that users of David Taylor's *HRPT Reader* are accustomed to: but I am planning to continue working on it, especially if there is significant interest expressed in it. I must admit that, before I started writing *MacHRPT*, I took a quick look at *HRPT Reader* to see what this was all about (I still have Windows PC at my work, collecting dust—but in this particular case it served a useful purpose).

At the time of writing I released version 1.1 but, by the time this magazine reaches you I hope there will be a newer and better version to explore.

Program Features

For the initial release I decided to implement only very basic features with a limited range of image processing capabilities. So the current version supports HRPT, LAC and GAC images for v2 datasets, but only HRPT for pre-NOAA 15 datasets . It can display any of the five satellite data channels (figure 1) as well as create false colour images using RGB and HSB models (figure 2). I found that the RGB model produces better, more vivid and colourful images from daytime passes. Overnight passes, where channels-1 and -2 are blank, don't produce anything interesting, and the HSB model is marginally better suited to these.

The only image processing tools that are implemented are 'Equalise Histogram' and 'Geometry Correction'. For RGB images, equalisation works on all three channels at the same time; with HSB model you can equalise both *Hue* and *Brightness* at the same time or separately, trying to create something viewable without too much effort. There is also *Saturation* adjustment for the HSB image (figure 3).

When the image for any individual channel is displayed its histogram is shown on the right panel of the window. An RGB image has three histograms, one for each component plus pop-up buttons to select the channel for each colour represent-ation. Displayed images can be saved in TIFF or PDF formats (at both full resolution and quarter resolution sizes) and printed. When printing, images are scaled to fit the page. In future I plan to add an option to choose multi-page printing so one can create a wall poster for displaying proudly in the shack!

While working on this project I ordered and downloaded a few files from NOAA and it was a somewhat annoying experience. As the main rule for writing software is to make it as user-friendly as possible, I decided to add a capability to download files from the NOAA ftp server from within the program. All that is required is to copy the filename from the e-mail you receive from NOAA, select *Download* from the *File* menu in *MacHRPT*, paste this filename into the *File Name* field and click the *Download* button (figure 4). Then just sit back, relax and watch the download byte counter flying (or crawling depending on your Internet connection speed). Actually there is no need to sit back as files are downloaded asynchronously on a separate thread, so it is possible to do image processing while new files are being downloaded in the background. When the download ends it will prompt you that the file is ready. For now this works only with the NOAA ftp server. As a final touch, just for fun and without any useful purpose, I added the little rotating globe icon at the upper right corner of the program window.

Performance

After I finished the program I could not resist measuring the performance and comparing with numbers given by Les for HRPT Reader on various Windows PCs. I don't have a bunch of Macs sitting around, but I was happy to see that MacHRPT's performance on my 1GHz G4 PowerBook with 512 Mb of RAM was on par with the data reported for a 2.8 GHz Pentium IV Windows machine running HRPT Reader.

For further development my plans are as follows: get ready for the HRPT v3 format change which will happen after the NOAA N launch and add support for the level 1f format used by Russian servers. I will also add more file formats for saving (JPEG, PNG, ?). After I run out of ideas I hope others will come up with more suggestions, criticism and so on.

Availability

Meanwhile, the program can be downloaded from:

http://homepage.mac.com/kd6cji

Once the download is completed *Mac OS X will* decompress the file automatically and you will end up with the *MacHRPT* icon on your desktop. Just drag and drop it to your favourite applications folder.

On the same web page there is also a download link for my *OrbitaX* program, a satellite-tracker for Mac OS X which may be useful for satellite enthusiasts as well. Admittedly, it is quite outdated but by no means obsolete. A new version will be released after I have completed MacHRPT.

Contacting the Author

Give these programs a try and let me know what you think. Both positive and negative comments are welcomed. I can be reached by e-mail at:

kd6cji@mac.com

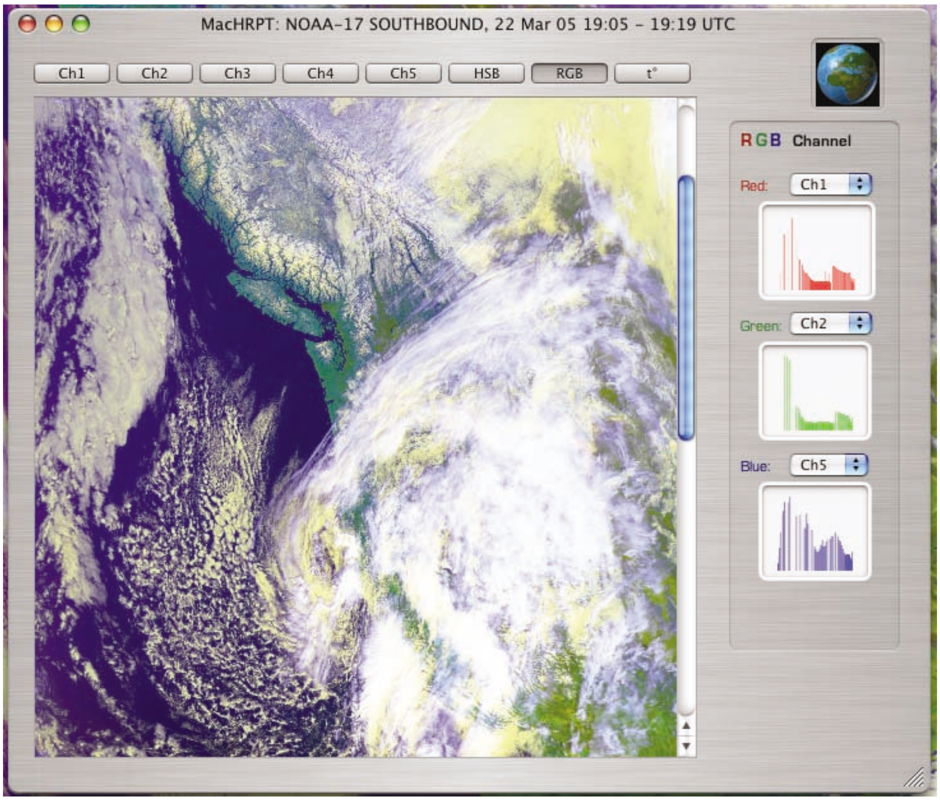


Figure 2 - An equalised and geometrically corrected false colour image

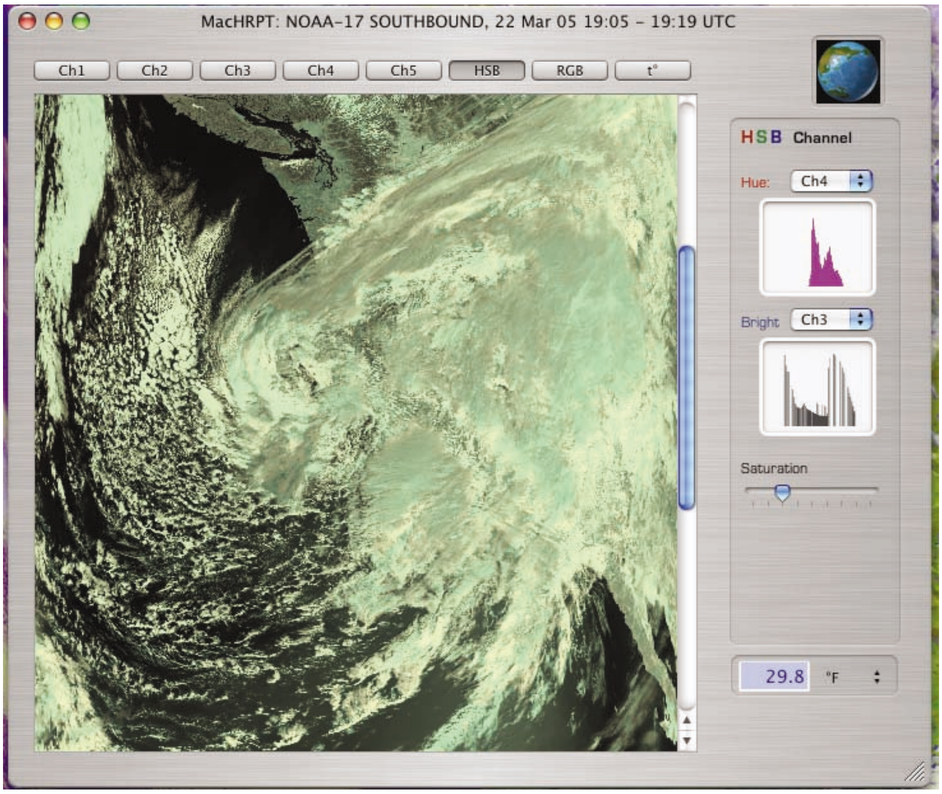


Figure 3 - The *Saturation* adjustment for an HSB image

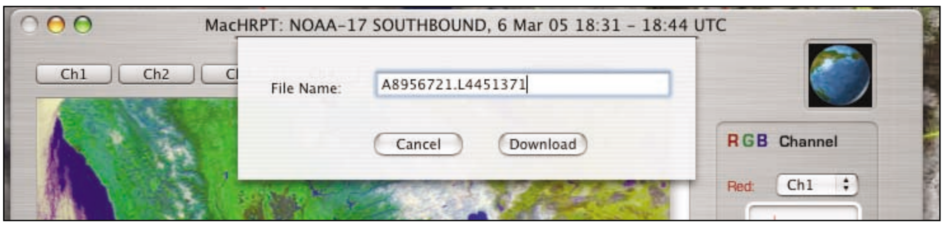


Figure 4 - The *Download* dialogue

Earth Imaging News

Peter Wakelin

NOAA-N Successfully Launched

Earlier NOAA satellites were launched by surplus Atlas E and Titan II missiles but these have now been retired so a Boeing Delta 7320 was used for this mission. The rocket lifted off from Space Launch Complex 2W at Vandenburg Air Force Base in California at 1022 UTC on May 20 and the 1442 kg spacecraft entred the planned 846 x 866 km orbit inclined at 98.8 degrees to the equator (measured from the east). The spacecraft was built by Lockheed Martin Space Systems and was launched on behalf of NASA's Goddard Space Flight Center's Polar Operational Environmental Satellite Program.

At the time of writing, in late July, NOAA 18 (renamed on achieving orbit) is being checked out and some anomalies are under investigation but it is believed that all instruments are either operating, or capable of operating, nominally.

NOAAs Galore

NOAA are obliged to keep just two polar-orbiting weather satellites in the NOAA series operational and two further craft in standby mode. With the recent unexpected resumption of imagery from NOAA 14's scanning radiometer there are no fewer than six spacecraft imaging, though one, NOAA 16, is capable of transmitting its data on the HRPT frequency only.

Because of perturbations to their orbits, the older craft no longer maintain precise sun-synchronism and have drifted away from their original orbital planes. In late July, the local times of northbound equator crossings were as follows:

NOAA 12 - 16:53
NOAA 14 - 20:49
NOAA 15 - 18:01
NOAA 16 - 14:48
NOAA 17 - 22:25
NOAA 18 - 13:57

Columbia's Last Flight Formed Clouds over Antarctica

A burst of high altitude cloud activity over Antarctica in January 2003 was caused by the exhaust plume of the Space Shuttle Columbia during its final flight, reports a team of scientists who studied ground-based and satellite data from three different experiments.

It had been suggested that the increases in brightness, occurrence and range of these high altitude clouds observed in recent years may be related to global climate change but it now seems likely that water released into the high atmosphere from rocket launches could be responsible.

These Polar Mesospheric Clouds (PMCs) are rare and form at around 84 km altitude when the temperature is colder than about -125°C. Such temperatures occur only at high latitudes in summer, hence the name. They are also known as noctilucent clouds as, because of their great height, they can be seen at night when all lower clouds are devoid of sunlight.

The Space Shuttle Columbia released about 400 tonnes of water (the product of its hydrogen fuel combustion) into the mesosphere at the time it was accelerating to orbital velocity whilst travelling almost horizontally near 110 km altitude. The resulting plume was about 3 km in diameter and about 1,000 km long and was detected and tracked by the Global Ultraviolet Imager on NASA's Thermosphere, Mesosphere, Energetics and Dynamics (TIMED) satellite. The images revealed rapid movement of the plume toward the South Pole.

More on this story, together with images, can be found at

http://www.nrl.navy.mil/pao/PressReleases/2005/36-05r

The writer witnessed a fine display of PMCs from southern England on the night of 22/23 June this year. They were visible low in the north throughout the short night and were probably over Scotland. Can these clouds be detected on weather satellite imagery? They may be too tenuous for the lower resolution IR sensors but would a suitably placed HRPT image show them, or perhaps the new high resolution visible imager on Meteosat 8?

NASA Opens New Hurricane Web Page

NASA now has a new Internet resource page highlighting the agency's diverse hurricane research. It was opened just in time for this year's North Atlantic hurricane season which has got off to a busy start with seven named storms before the end of July. The information is available on the web at:

http://www.nasa.gov/hurricane

Collision in Crowded Sun-Synchronous Orbit

The subjects of a collision which occurred on January 17, 2005 885 km above Antarctica have been identified by the US Space Surveillance Network. The rocket which launched the military weather satellite *DMSP-5* more than 31 years ago was struck by one of the several hundred catalogued pieces of debris which resulted from the explosive break-up of the Chinese CZ-4 rocket that launched the *CBERS-1* satellite in 1999.

The first recognised collision between objects from different missions occurred in July 1996 when the French *CERISE* spacecraft, also in a sun-synchronous orbit, was struck and damaged by a small fragment from an exploded Ariane rocket.

The sun-synchronous orbit between 600 and 1000 km is a popular destination for Earth-imaging spacecraft but, regrettably, several rockets and spacecraft in this region have exploded as a result of build-up of pressure from unused fuel or within batteries. Even very small fragments travelling at high speed are hazardous to satellites and it is only a matter of time before an operational spacecraft is destroyed by such a collision.

Japan's Next Earth-Imaging Satellite Delayed

Japan Aerospace Exploration Agency (JAXA) has announced that the launch of *ALOS* (Advanced Land Observing Satellite) has been delayed. Tests on another Japanese satellite, *ASTRO-F*, revealed a faulty transistor of a type that is also used on *ALOS*. Although the one on *ALOS* is working properly, JAXA have decided to replace it. Launch is still expected this year.

Cloudsat Arrives at Launch Site

NASA's *Cloudsat* spacecraft has arrived at the Vandenberg, California launch site and, after further testing, will be integrated on to a Boeing Delta II launch vehicle with its co-passenger *Calipso* (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation).

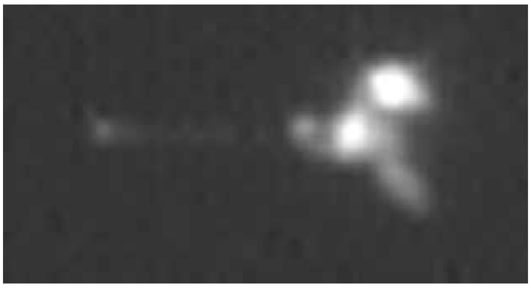
Cloudsat (Image: NASA)

Launch is now expected in late September and will take the two craft to a 705 km sun-synchronous orbit where they will fly about 100 km apart. Both satellites carry revolutionary measurement technologies that will probe Earth's atmosphere in new ways. A detailed account of these spacecraft will appear in this column after launch.

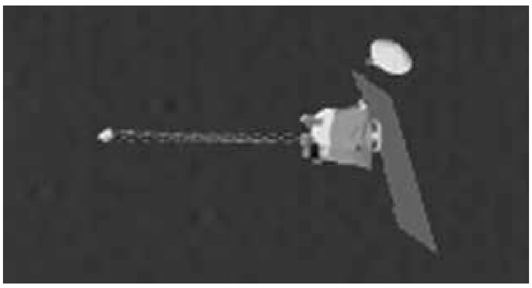
Martians Emulate Earthlings' Feat

From time to time it is claimed that strange streaks or spots on weather satellite images can be attributed to other spacecraft but the resolution, sensor characteristics and scanning methods employed make this extremely unlikely. However, other imaging spacecraft have observed satellites in Earth orbit and military spacecraft probably do it routinely. It is likely that the Space Shuttle Discovery, in orbit at the time of writing, has been extensively imaged by other satellites to check for damage.

Now, for the first time, this feat has been achieved by a spacecraft orbiting Mars. NASA's *Mars Global Surveyor* has successfully imaged the European Space Agency's *Mars Express* and NASA's *Mars Odyssey* both of which are also in orbit around the red planet.



Mars Odyssey imaged from Mars Global Surveyor



Computer drawing of Mars Odyssey

The Mars Orbiter Camera on *Mars Global Surveyor* captured this image of *Mars Odyssey* on April 21 when the spacecraft were about 100 km apart and travelling at more than 4 km/s in different orbits. At this range, the camera's field of view is about 800 m so a high pointing accuracy and precision timing are required to successfully image such a fast-moving target. An added complication is the time taken for commands to travel the constantly changing distance to Mars.

The image was obtained by the *Mars Global Surveyor* operations teams at Lockheed Martin Space Systems, Denver; California Institute of Technology's Jet Propulsion Laboratory and Malin Space Science Systems, the San Diego, California, company that built the camera.

Every Seventh Wave

... continued from page 3

big waves which come out first". She challenged me on this: "No, it's not like that. You get the small waves first". I then gave her a one minute lecture on waves: their interference with each other, the speed of propagation as a function of wave length and how important this is for the distribution of energy around our oceans. I was a little doubtful about her understanding of the concepts and mathematics involved. This doubt was confirmed when she smiled at me beguilingly, took me by the hand and said those magic words. "Can I go and play on the slide now please"?

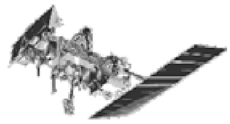
Quarterly Question

The last question related to the interference caused by Meteosat-8 to other satellite reception. The answer was on page 41 of ESA Bulletin No 121 (February 2005). The answer is the SOHO satellite which is studying the sun. I received three correct answers. The ESA Bulletin it is available on request, free of charge, from:

ESA Publications Division
c/o ESTEC
PO Box 299
2200 AG Noordwijk
The Netherlands.

I did say I wouldn't set another question myself but, since I haven't received one from anybody else, here's mine. **$E = mc^2$** is a famous equation. **E** stands for energy, **m** for mass and **c** the speed of light. The question is: Why pick a lower case letter 'c' for the speed of light? Answers to me by email or post: details on page 1.

NOAA 18 Reception and Pagers



Les Hamilton

Based on an Internet survey conducted by ***Lawrence Harris*** *and* ***Nick Hewgill***

It had been known for a long time prior to its successful launch on May 20 (for several years in fact) that NOAA-18 would transmit its APT on one of two new frequencies in the 137 MHz band. Which of these was finally to be used was not however established by NOAA until the satellite was actually in orbit and, as (bad) luck would have it, it was 137.91 MHz. Of course, for the World at large, this is of little consequence. But for APT enthusiasts in Great Britain this is worryingly adjacent to the pager frequencies which operate from 137.975 MHz and upward into the 138 MHz band. It was widely anticipated that this would cause problems—perhaps denying UK users access to the NOAA-18 satellite altogether.

In the event the great day arrived and almost at once conflicting reports started to flood in. Some members were experiencing perfect reception but by far the majority were reporting pager intrusions varying from 'mild banding' through their images to 'completely unusable'. Interestingly, these were not always in accord with the generally held belief that reception in urban areas would be impossible whilst the chances of success in rural locations would be much greater. Even within Greater London we received a few reports of 'perfect' reception, though most members found themselves in the 'unusable' category.

In an effort to place the matter on a more systematic footing, **Lawrence Harris** and **Nick Hewgill** set up an Internet survey on the problem. Nick produced a web page where members could input details of their receiver, antenna etc. and the degree of interference experienced with NOAA-18 while Lawrence summarised the results. Table 1 lists the main findings for the most popular equipment but a more detailed summary, accompanied by charts, can be viewed on Nick's website at:

www.weatherstation.org.uk/tabularresults.html

Lawrence Harris summed up the results thus:

'Almost without exception, non-UK monitors are not experiencing any interference. There is some preliminary evidence that one or two receivers might be relatively pager tolerant. It has to be said though that (1) the receiver concerned is very expensive and (2) those who have done the tests will not wish to buy a new receiver simply for NOAA-18 reception.

'These data should be interpreted carefully. A low-cost receiver in a radio-quiet environment would probably give better results than an expensive receiver next to a pager transmitter! The more receivers of one type that are in operation, the more the results can vary.... etc. etc.'

From my own location in Aberdeen I have tested three receivers with NOAA-18, an RX2, a Martelec MSR-50 and a German-built R2FX, all under identical conditions. Figure 1 comes from a NOAA-17 pass obtained on May 29 using the Martelec MSR50 tunable weather satellite receiver tuned to 137.50 MHz. The image is pager-free. Figure 2 was achieved with the same equipment some two hours later when the receiver was tuned to 137.90 MHz (*sic*) to capture NOAA-18. Moderate pager intrusions are visible (which are even stronger when operating the MSR50 at the satellite's nominal frequency of 137.91 MHz).

... concluded on page 13

	Interference Level			
Receiver	None	Mild	Moderate	Unusable
Dartcom	4	4	3	2
Martelec MSR50	1	0	2	2
Proscan	1	2	1	20
RX2	11	11	15	10
Others	0	1	1	5
Scanners (various)	1	1	3	5
Totals	**18**	**19**	**25**	**44**
Antennas				
Turnstile	7	6	9	23
QFH	11	12	15	24

Table 1
Summary of the main survey results

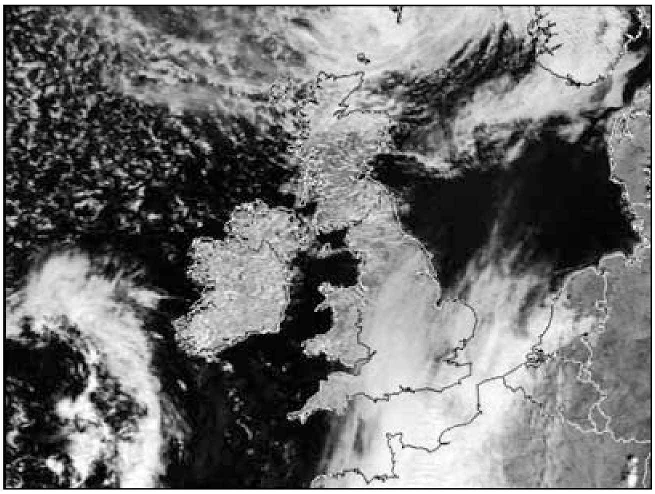


Figure 1 - No pager interference
NOAA 17 channel-2 APT image at 11:20 UT on May 29, 2005, received on 137.62 MHz using the MSR50 receiver
Image processing: Satsignal and GroundMap

Figure 2 - Moderate pager interference present
NOAA 18 channel-2 APT image at 13:24 UT on May 29, 2005, received on 137.91 MHz using the MSR50 receiver

Learning to Live with Pagers

How to minimise their impact

John Beanland G3BVU/W1

The arrival of NOAA-18 last May made almost every weather satellite enthusiast in Great Britain painfully aware of the existence of 'pager' transmissions. The new NOAA-18 frequency of 137.9125 MHz is uncomfortably close to these pagers, which transmit at 137.975 MHz and upward. In some areas the effects are minimal but many GEO members have reported the problem to be so severe as to render NOAA-18 imaging impossible.

Do we simply accept defeat, or can we actually do something to improve reception and eliminate or reduce the impact of the pagers? John Beanland certainly believes so, as explained below.

May I offer you some helpful comments in connection with the current, and future, RFI problems with 'pager Interference' on the reception of NOAA-18 transmissions at 137.9125 MHz.

The problem is due to the classical 'low cost' design of almost all weather satellite receivers. Without getting into details, two major problems are:

- The selectivity function (the ceramic IF filter) does not have sufficient skirt selectivity. More poles (and more cost) are needed.
- The major filtering is in the final IF (455 kHz in most receivers). This is too late in the receive chain. There is too much gain ahead of it.

Ideally the channel filtering should be at RF (which is not really practical without excessive expense). The alternative is in the first IF (10.7 MHz). But 10.7 MHz filters are more expensive than 455 kHz ones for the same number of poles. Huge production volume of 455 kHz filters has resulted in minimum cost.

Additionally most low-cost WX receivers use the inexpensive *Motorola* MC3359 'do everything' integrated circuit for the IF gain, IF filter location and detector functions. This is far from the best design for a robust receiver, but 'the price is right'.

The above comments are made to define the problem. I do not propose to offer a solution to the receiver design deficiencies in this article.

But I would like to offer a way to minimise the pager hazard encountered by many receivers. *The objective is to reduce the amplitude of the pager signal entering the receiver without reducing the amplitude of the NOAA-18 signal.*

Antennas

Many WX receive systems (note: I say *receive* systems) use a quadrifilar helix antenna (QFH) for reception of the weather satellite image signals. This is an excellent choice of antenna for general purpose use. By rejecting the LH polarised multipath signal and accepting only the RH polarised direct signal, the multitude of 'noise bars' across the image is eliminated. There is no multipath signal (180 degrees out of phase with the direct signal) to result in a zero amplitude vector addition of the direct and multipath signals to cause amplitude cancellation. In certain locations (like New York City) there are often 'double' reflections which place the multipath signal back in a RH polarised mode!

It is unfortunate that a QFH antenna responds very well to both horizontal and vertical linearly polarised signals. Hence the Quad Helix readily receives the Pager signal which is, without doubt ***a vertically polarised signal***, to suit their omni-directional coverage.

Fortunately there is a simple, low cost solution: a turnstile antenna! A turnstile antenna is circularly polarised only at the zenith. As we reduce the elevation angle, its response becomes elliptically polarised, of varying ratio, until at the horizon it is linear, ***horizontally*** polarised. Now the pager signal, as noted above, is vertically polarised; ***hence there is the potential for significant cross-polarised rejection of the pager signal without attenuation of the NOAA-18 signal***!

What are the requirements of the Turnstile design?

- It must be carefully constructed, observing symmetry about the axis.
- More importantly, the transmission line connection must be balanced.

Co-axial cables must have **baluns** installed at the feed point to present a balanced load to the dipoles. Ferrite beads on the co-axial cable provide a simple and effective solution. Similarly, ferrite beads on the co-ax at the receiver end attenuate (pager) signal energy that is induced on to the outside of the co-axial braid. '**Ground**' the receiver to an honest earth rod and keep the rod watered with 'conducting water' (train you hound dog to do this for you).

Of all the people complaining about pager interference, how many of them have an effective, or even a poor, ground system connected to their receiver?

Using the turnstile will result in some 'noise bars' because the elliptical polarisation will receive the LH polarised, multipath signal. This is a small price to pay for providing significant attenuation of the pager signal, which may now be of low enough amplitude for the 'low cost' APT receiver design to produce acceptable NOAA-18 images.

Co-axial Cable

Let us consider a typical 137 MHz APT WX station's RF installation.

1. There is an antenna installed 'high' in the air, probably 20-30 feet above ground in most installations.
2. A length of co-axial cable between the antenna and the receiver also reaches upward (nominally vertically) the same 20-30 feet.
3. A receiver, located indoors, with the co-axial cable connected to its input and a data decoder (either a dedicated hardware decoder or connection directly to the computer's soundcard) is connected to the receiver's output.
4. The only **ground** connection is through the mains power supply's green/yellow earth wire (which leads to earth). Basically the whole receiving system is usually floating way above ground, particularly as most units are powered by 12 volts provided by a transformer.
5. In general almost every receiver has poor selectivity and poor overload protection.

No wonder most people are in trouble!

Let us consider the co-axial cable. The braid is an excellent antenna for vertically polarised (pager) signals. RFI EMFs are induced in the braid (actually within 0.010 inch of the outer surface) and currents flow on the braid both towards the receiver and towards the antenna.

Let us assume that the receiver is built into a metal case and that it is effectively grounded (which I doubt). In this case the pager RFI currents will be shunted to earth and no (or little) harm will be done.

What about the induced pager currents flowing **up** to the antenna? When these currents reach the (antenna) end of the co-axial cable they will, in general, continue flowing on the inner surface of the braid, down to the receiver and ***right into it***! These two currents, **up** on the outside and **down** on the inside of the co-axial braid 'know' nothing of each other due to the 'skin effect'. 100% effective grounding of the co-axial cable's braid (and the receiver) at ground level as the cable enters the house, and at the input of the receiver, will not stop this pager current from entering the receiver! This pager current is being input to the receiver just like that from a satellite signal! It's what your receiving system is designed to do.

Connecting the co-axial cable to a turnstile antenna, in place of a QFH antenna, will reduce the amplitude of the pager signal received by the antenna but it will not change the amplitude of the pager signal received on the braid of the co-axial cable. So you get some reduction of the pager signal amplitude, but not as much as you expected, since the 'big, long and vertically polarised antenna' (the outer surface of the co-axial braid) is still doing what it is supposed to do.

What can we do to help ourselves?

1. **Stop** the pager currents that are flowing on the outer surface of the co-axial cable's braid from reaching the braid's inner surface. Fit ferrite chokes (ferrite toroids) to the braid at the antenna connection to attenuate the currents flowing on its outer surface as they attempt to reach the inner surface. This is a very good start and can be very effective.
2. Install an effective **balun** at the antenna terminals. Another important feature.
3. Bond the co-axial cable braid to an effective **ground** as the cable enters the house. Train your faithful hound dog to maintain the effectiveness of the **ground** rod.
4. In an extreme case, wrap your receiver in aluminium (kitchen) foil and connect the foil (and the receiver) to an effective GROUND.

All of the above have the potential to significantly reduce the amplitude of the pager signal entering the receiver. If you're suffering from 'pager interference', do something about it instead of complaining.

Further steps in reducing pager interference will require changes to the receiver's design and are probably not within the reach or technical competence of most WX enthusiasts. For those who are technically competent, consider adding a 'real' filter in the 10.7 MHz IF of your receiver. An 8-pole KVG crystal filter, model XF-107-E, is perfect for this job; it was designed for APT receiver applications. Don't forget to provide effective screening and decoupling between the input and output of the crystal filter. 'Stiffening' the design of the RF amplifier and the first mixer, to take advantage of a 10.7 MHz crystal filter, are other excellent attributes.

In Summary

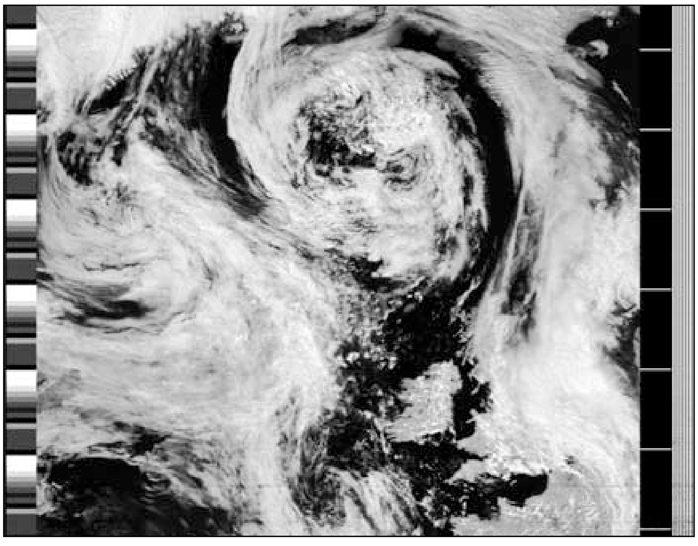
If you are currently using a QFH antenna, change to a turnstile. If you are already using a turnstile, pay attention to the feed's balance, etc.

NOAA-18 Reception and Pagers

... continued from page 11

The RX2 receiver provides virtually pager-free reception, the MSR-50 suffers moderate to severe interference (figure 2) while my R2FX is totally 'wiped out'. Figure 3 compares the RX2 and the R2FX on the *same* pass. It must however be stressed that all these receivers perform flawlessly on both of the 'old' NOAA frequencies. It is **only** on the NOAA-18 frequency that any problems with pagers are encountered.

Reference to Table 1 would suggest that the RX2 is distinctly superior to most other receivers. The figures also back up John Beanland's assertion (see article above) that the turnstile antenna is more likely to provide good results than the QFH. The survey includes over 100 responses from users across the entire length and breadth of Great Britain. Although these findings must be treated with caution they do nonetheless provide a most illuminating insight into the effect of pagers on NOAA 18 APT reception nationwide.



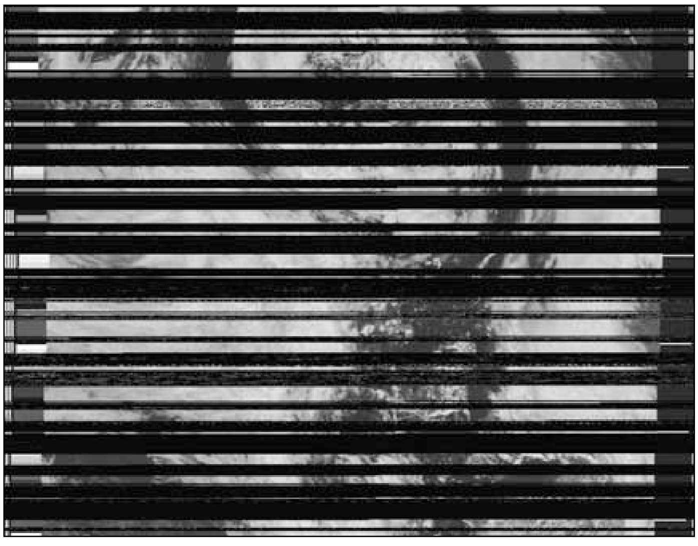
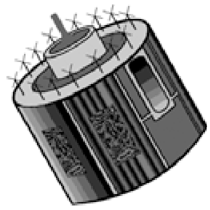


Figure 3 - NOAA-18 at 14:03 UT on July 5. Perfection with the RX2 (left) and wipeout with the R2FX (right)

The Twelve Channels of Meteosat-8



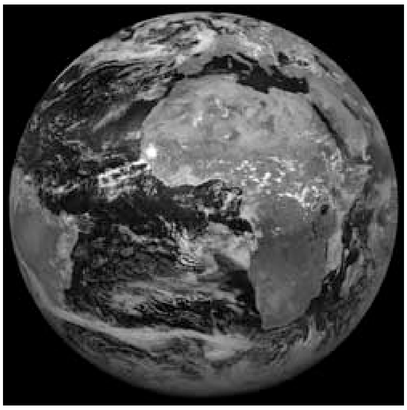
Meteosat-8 is the first of the *Meteosat Second Generation* (MSG) all-digital geostationary weather satellites and transmits twelve imaging channels every 15 minutes throughout the day. All this is accomplished by a single instrument known as the Spinning Enhanced Visible and InfraRed Imager (SEVIRI). Six of its channels (1, 2, 3, 4, 9 and 10) were specifically selected to correspond closely with the channels disseminated by the AVHRR-3 imager carried aboard the NOAA-KLM series of polar orbiting satellites. But what exactly do all these diverse imaging channels tell us?

The two visible channels centred on 0.6 and 0.8 micrometres (µm) provide cloud and land-surface imagery during daylight hours. These particular wavelengths permit discrimination between vegetated and non-vegetated land surfaces and also between the Earth's surface and different cloud types. These channels are also useful in helping to determine the atmospheric aerosol content.

The 1.6 µm infrared channel can be used to distinguish low-level clouds from snow surfaces and, in combination with the 3.9 µm and 8.7 µm channels, helps to differentiate between ice and water clouds. Additionally, when combined with the two visible channels, they also support the determination of soil moisture content and the optical depth of atmospheric aerosols.

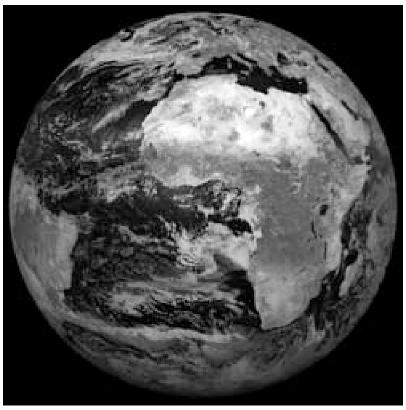
The 3.9 µm infrared channel can be used to detect fog and low-level clouds at night and to distinguish water clouds from ice surfaces during the hours of daylight. It also supports the 10.8 µm and 12.0 µm channels in making determinations of surface temperatures by estimating the tropospheric water-vapour absorption.

CHANNEL 1: Visible 0.6
(0.56 - 0.71 µm)



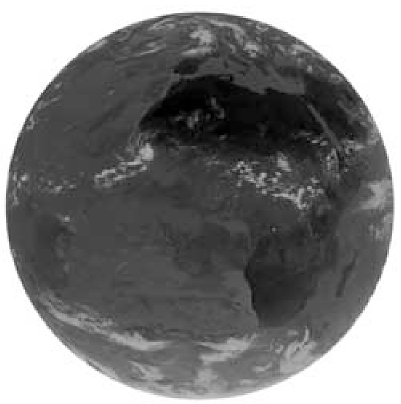
CHANNEL 2: Visible 0.8
(0.74 - 0.88 µm)

These channels are essential for cloud detection, cloud tracking, scene identification and the monitoring of land surfaces and aerosols. Together with channel 3 they can be used to generate vegetation indices.



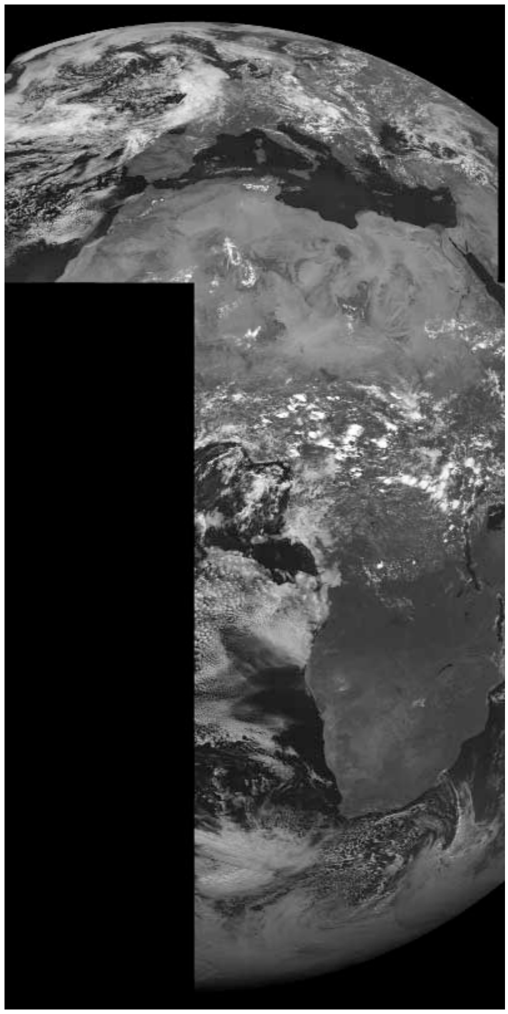
CHANNEL 3: NEAR-Infrared 1.6
(1.50 - 1.78 µm)

Helps to discriminate between snow and cloud, and between ice and water clouds. Also provides aerosol information.



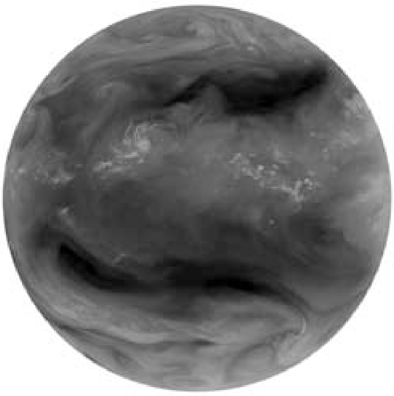
CHANNEL 4: Infrared 3.9
(3.48 - 4.36 µm)

Primarily for detection of low cloud and fog at night, but also useful for measurement of land and sea temperatures at night and the detection of forest fires.

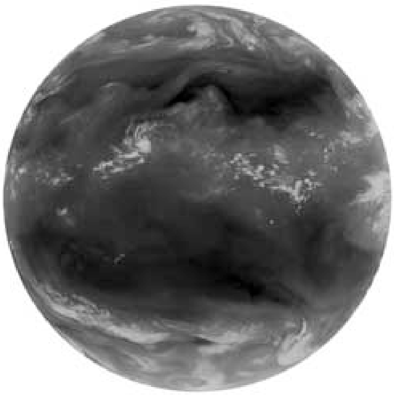


CHANNEL 12: High Resolution Visible
(0.6 - 0.9 µm)

The broadband visible channel, but with an improved sampling interval of just one kilometre.



CHANNEL 5: Water Vapour 6.2
(5.35 - 7.15 µm)

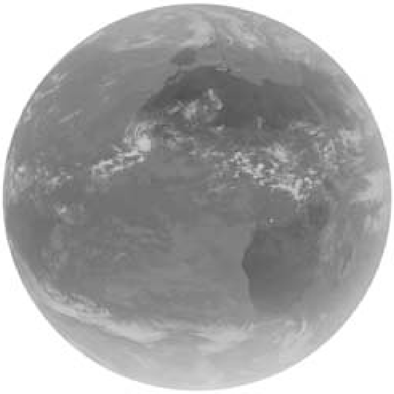


CHANNEL 6: Water Vapour 7.3
(6.85 - 7.85 µm)

Provides continuity of the Meteosat first generation broadband water vapour channel to measure mid-atmospheric water vapour and to produce tracers for atmospheric winds. Also supports height assignment for semi-transparent clouds. Two separate channels representing different atmospheric layers instead of the single channel on Meteosat.

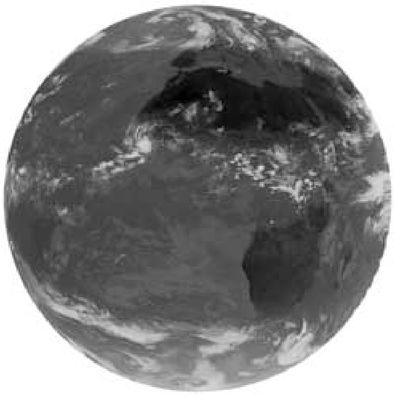
CHANNEL 7: Infrared 8.7
(8.3 - 9.1 µm)

Used mainly to provide quantitative information on thin cirrus clouds and to support the discrimination between ice and water clouds

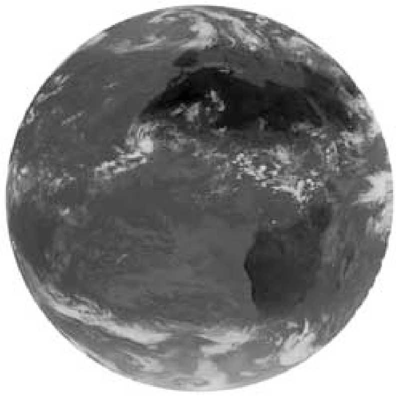


CHANNEL 8: Infrared 9.7
(9.38 - 9.94 µm)

Responsive to ozone concentration in the lower stratosphere. It will be used to monitor total ozone and assess diurnal variability. Potential for tracking ozone patterns as an indicator of wind fields at that level.



CHANNEL 9: Infrared 10.8
(9.8 - 11.8 µm)



CHANNEL 10: Infrared 12.1
(11 - 13 µm)

These two channels, termed the 'split window' infrared channels, both respond to the temperature of clouds and the surface. By splitting this part of the thermal infrared, each channel shows a slightly different response with respect to clouds and the Earth's surface. Combining them can help to reduce atmospheric effects when measuring surface and cloud top temperatures. They are also used for cloud tracking for atmospheric winds and for estimates of atmospheric instability.

CHANNEL 11: Infrared 13.4
(12.4 - 14.4 µm)

CO_2 absorption channel, to be used for the estimation of atmospheric instability, as well as contributing temperature information on the lower troposphere.

The two channels in the water-vapour absorption band, at 6.2 and 7.3 µm determine the water-vapour distribution for two distinct layers in the troposphere. These two channels can also be used to derive atmospheric motion vectors in cloud-free areas and will support the 10.8 µm and IR-12.0 µm channels in the altitude assignment of semi-transparent clouds.

The 8.7 µm channel may also be utilised for cloud detection and, in combination with the 1.6 µm and 3.9 µm channels, can help to discriminate between ice clouds and the Earth's surface. Moreover, the 8.7 µm channel may also be used in combination with the 10.8 µm and 12.0 µm channels to determine the cloud phase.

The SEVIRI channel that covers the very strong fundamental vibration band of ozone at 9.7 µm, will be used to determine the total ozone content of the atmosphere and may also be applied to monitor the altitude of the tropopause.

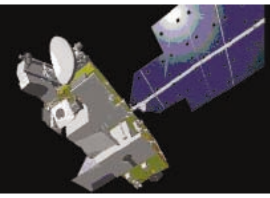
The two channels in the atmospheric window, 10.8 µm and 12.0 µm, will mainly be used together with the 3.9 µm channel to determine surface temperatures.

The 13.4 µm channel covers one wing of the fundamental vibration band of carbon dioxide centred at 15 µm, and will therefore be used primarily for atmospheric temperature sounding in support of air-mass instability estimations.

Acknowledgement

Much of the information used in the preparation of this article was obtained from '*Meteosat Second Generation Becomes Operational*' by W Schumann, R Oremus and S Rota, published in ESA Bulletin No 119, August 2004.

First Results from NASA's *Aura* Satellite 'A New Eye for Clean Air'



As we reported briefly in *GEO Q3*, '*Aura'* was launched from Vandenberg Air Force Base, California aboard a Delta II rocket on July 15, 2004 thus becoming the third and final satellite in NASA's current Earth Observing System. *Aura's* view of the atmosphere and its chemistry will complement the global data already being collected by its forebears, *Terra* and *Aqua*. Collectively, these three satellites allow scientists to study how life, land, water, and the atmosphere work together as a unit. *Aura's* four instruments will enable scientists to discern subtle chemical interactions to, and achieve a better understanding of how, Earth's atmosphere works: most specifically, whether the stratospheric ozone layer is showing signs of recovery, discerning the processes that control air quality and investigating exactly how the Earth's climate is changing.

Unlike *Terra* and *Aqua*, *Aura* is not an imaging satellite. Aura's objective is to probe the troposphere, that region of Earth's atmosphere, up to an altitude of approximately 10 km, which affects our daily lives the most. *Aura* will measure greenhouse gases such as methane, water vapour and ozone in the upper troposphere and lower stratosphere; *Aura* also will also measure both absorbing and reflecting aerosols in the lower stratosphere and lower troposphere, water vapour measurements inside high tropical clouds and high vertical resolution measurements of certain greenhouse gases in a broad swath (down to the clouds) across the tropical upwelling region. All of these measurements contribute key data for climate modelling and prediction.

OMI - the Ozone Monitoring Instrument

OMI is a nadir-viewing spectrometer that records total ozone (and other atmospheric parameters) related to atmospheric ozone chemistry and climate. The instrument measures reflected and backscattered solar radiation along the satellite track in no fewer than 740 wavelength bands across a selected range of the ultraviolet and visible spectrum. The spectrometer's 2600 km viewing swath-width is perpendicular to the satellite's orbit track and provides complete daily coverage of the sunlit portion of the atmosphere. OMI was contributed by the Netherlands Agency for Aerospace Programs in collaboration with the Finnish Meteorological Institute.

OMI is *Aura's* primary instrument for tracking global ozone change and will continue the high quality column ozone record begun in 1970 by *Nimbus-4 BUV*. However, OMI has a broader wavelength range and better spectral resolution and, additionally, measures column quantities of trace gases important to ozone chemistry and air quality. OMI can map aerosols and estimate the ultraviolet radiation reaching the Earth's surface. OMI's horizontal resolution is about four times greater than TOMS.

HIRDLS - the High Resolution Dynamics Limb Sounder

HIRDLS is an infrared limb-scanning radiometer designed to measure trace gases, temperature, and aerosols in the upper troposphere, stratosphere, and mesosphere to provide critical information on atmospheric chemistry and climate.

TES - the Tropospheric Emission Spectrometer

TES is an imaging Fourier Transform Spectrometer which can observe the thermal emission from the Earth's surface and atmosphere, by both night and day. TES measures tropospheric ozone and other gases important to tropospheric pollution with very high horizontal resolution. TES has a higher resolution than OMI, but monitors a swath of only 5.3 x 8.5 kilometres.

MLS - the Microwave Limb Sounder

MLS is a limb scanning emission microwave radiometer which measures radiation at millimetre and sub-millimetre wavelengths. MLS measures important ozone-destroying chemicals in the upper troposphere and stratosphere as well as trace gases in the presence of ice clouds and volcanic aerosols.

Early Results from the *Aura* Mission

Figure 1 shows the first publicly released product from the OMI. Acquired on September 22, 2004. It outlines the dramatically depleted levels of stratospheric ozone over the Antarctic. The lowest ozone concentration includes values of 100 Dobson units and under, and is shown in purple; the turquoise green and yellow regions indicate progressively higher concentrations of the gas.

Figure 2 displays data collected by OMI during the first ten days of March 2005, showing high concentrations of sulphur dioxide drifting northwest from Ambrym volcano on the island of the same name in the Pacific nation of Vanuatu. Indeed, at the time, this was the strongest point source of sulphur dioxide on Earth.

Ambrym Volcano is not erupting in the traditional sense but is constantly leaking sulphur dioxide gas from active lava lakes in ongoing *passive emissions*. These gas emissions present a serious hazard to the local population: the strongly smelling gas irritates the eyes and nose and makes breathing difficult. Higher in the atmosphere the sulphur dioxide combines with water to create acid rain which, on Ambrym, has destroyed staple crops and contaminated the water supply.

The Manam volcano erupted explosively overnight on January 27, 2005, spreading a cloud of ash and sulphur dioxide across New Guinea (***figure 3***). The following day Aura's OMI measured the cloud of sulphur dioxide drifting westward using the same Dobson scale as for ozone. Red pixels indicate the areas of highest concentration; the lowest concentrations are represented by pink pixels. A normal atmospheric column contains just 1 DU of sulphur dioxide. Following this eruption, the atmosphere over New Guinea contained up to 50 DU (red).

Measuring Total Ozone - the Dobson Unit (DU)

If all the atmospheric ozone on Earth could be concentrated evenly in a layer, at atmospheric pressure and 0°C, such a layer would be approximately 3.5 mm thick. This unusual approach forms the basis of the definition for the Dobson Unit (DU) which is used for ozone measurement. Put simply, one DU is defined as a notional layer of ozone, 0.01 mm thick, measured under these conditions.

So the total ozone concentration in Earth's atmospheric column is around 350 DU, a value that fluctuates from place to place but lies typically between 200 and 500 DU. The unit was named after G M B Dobson, one of the first scientists to investigate atmospheric ozone.

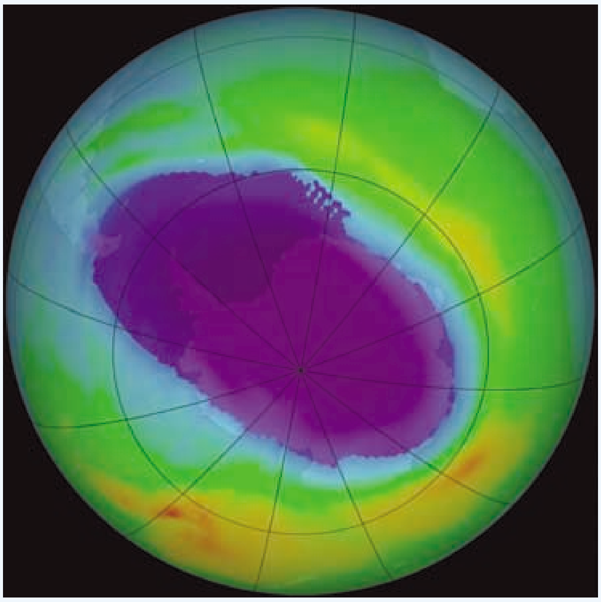


Figure 1
Aura image of the Antarctic 'ozone hole' during September 2004.

NASA image courtesy the Scientific Visualisation Studio at Goddard Space Flight Center.

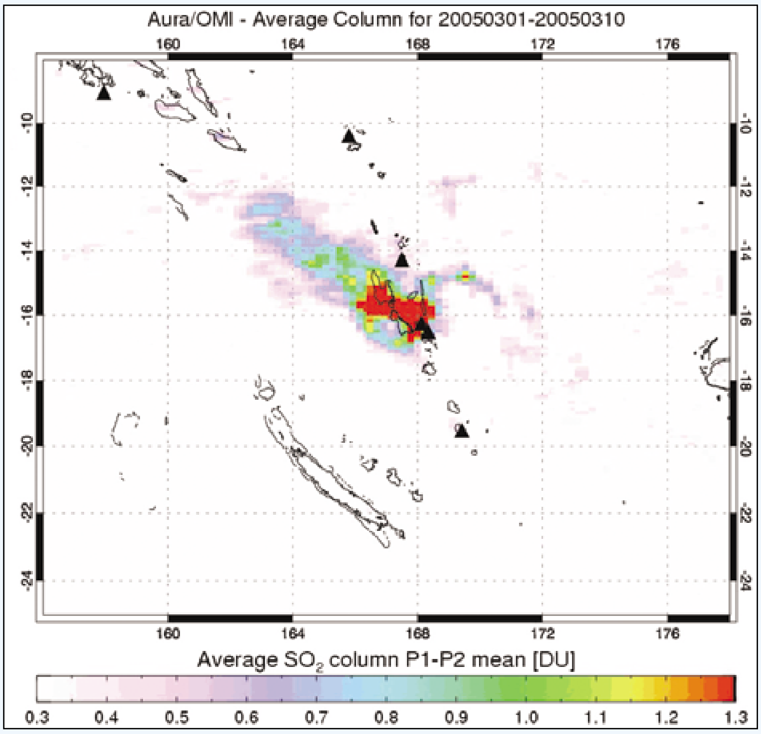


Figure 2

The ongoing passive emissions from Ambrym volcano on the Pacific Ocean island group of Vanuatu during early March 2005 released clouds of sulphur dioxide gas into the atmosphere. These were recorded by the OMI instrument aboard NASA's Aura satellite, and are shown on the map above.

NASA image and caption information courtesy Simon Carn, Joint Center for Earth Systems Technology (JCET), University of Maryland Baltimore County (UMBC).

Consequences

Once in the atmosphere, sulphur dioxide (SO_2) combines with water to create a highly reflective haze of sulphuric acid which reflects sunlight away from the Earth and back into space. Since less sunlight reaches the Earth, the haze has a cooling effect on the climate. If an eruption is sufficiently severe it can lead to cooler temperatures for several years until the sulphuric acid is washed out of the the atmosphere as rain. In 1991, Mount Pinatubo in the Philippines emitted millions of tons of SO_2 into the atmosphere and global temperatures, which had been expected to rise because of the greenhouse effect, actually levelled out. While large, Manam's eruption does not compare with Pinatubo's in magnitude, and it is not clear if, or how, the current eruption will impact regional climate.

This new view of passive volcanic emissions could lead to significant advances in understanding both volcanic eruptions and the impact of sulphur dioxide on climate. Passive emissions can be a precursor of explosive eruptions, and thus provide a warning signal that the volcano's activity may be changing. Scientists building computer models of the complicated interactions that make up Earth's climate need to understand how much sulphur dioxide enters the atmosphere and where it travels. Since most volcanic sulphur dioxide emissions come from passive degassing, OMI now allows scientists the means to assess the volcanic contribution to atmospheric sulphur dioxide concentrations with unprecedented accuracy. The data should help refine climate models.

Further Reading

A wealth of further information about Aura, its instrumentation and results can be found on NASA's Aura Mission website at:

http://aura.gsfc.nasa.gov/

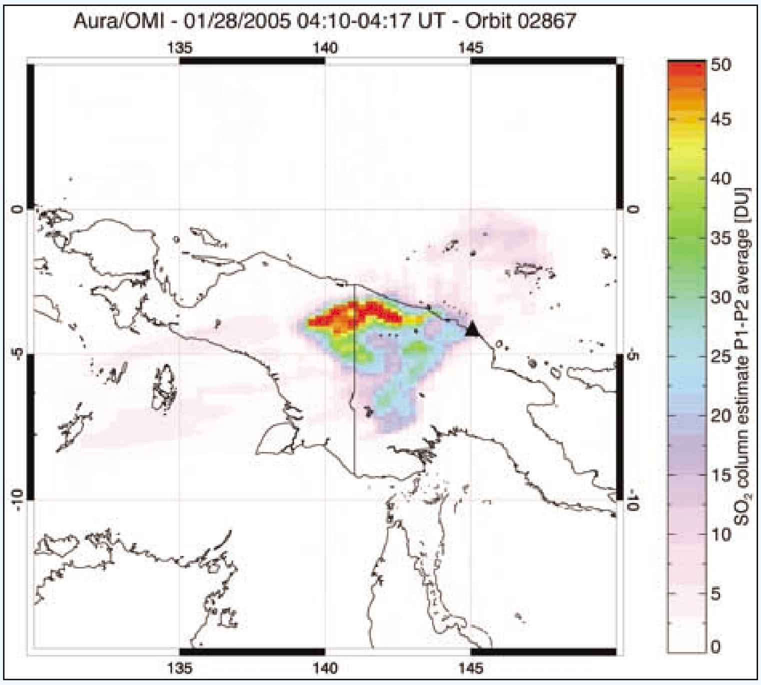


Figure 3

Manam volcano in New Guinea erupted explosively during the night of January 27, 2005, spreading a vast cloud of sulphur dioxide over the country. Concentrations were measured by the OMI aboard Aura and peaked at fifty times normal (red areas on map).

NASA image and caption information courtesy Simon Carn, Joint Center for Earth Systems Technology (JCET), University of Maryland Baltimore County (UMBC).

News in Brief

Dartcom APT Receiver

As you will read elsewhere in this issue, NOAA-18 reception in the UK has proved something of a hit-and-miss affair. However, one particular device, the Dartcom APT receiver, has proved particularly pager resistant. John Tellick, who gave up APT imaging many years ago because his location in Greater London was completely swamped by pager interference, discovered to his amazement that when using the Dartcom receiver tuned to 137.91 MHz he obtained perfect complete passes from NOAA-18. At the same location the popular Proscan receiver, fitted with a new crystal for the same frequency, was completely 'flattened' by the pagers. Reports from elsewhere in the country tend to support these findings. So if you have a Dartcom APT receiver gathering dust in the attic, bring it back into service—you may be in for a pleasant surprise.

New Dartcom Receiver EPROM

Several GEO Readers are still using the old Dartcom APT receiver (sadly now discontinued) and finding it to be particularly pager resistant at the NOAA-18 frequency of 137.91 MHz.

Although the receiver can of course be tuned manually to 137.91 MHz the original EPROM did not include the new frequencies in the scan list.

If you own one of these receivers and wish to include this frequency in its *automatic scan mode*, you require a new EPROM. GEO has been collaborating with Dave Wright at *Dartcom* to develop a new EPROM for the Dartcom APT receiver, which includes both 137.1 and 137.91 MHz in the scan frequency list. This EPROM is available exclusively from the GEO Shop as GEO/Dartcom EPROM v 1.3 (see details in our centre pages)

NOAA 17 APT Scare

APT enthusiasts suffered a major scare when NOAA-17 failed to transmit its 137.62 MHz telemetry on July 3. A report from Nigel Heasman indicated that the 08:04 UT pass was received as normal in Cyprus, but thereafter nothing. There were a few reports from around the world of intermittent transmissions, but often for only part of a pass. Fortunately it turned out to be a software problem whereby the APT was being erroneously commanded off and NOAA engineers restored normal service at 14:08 UT on July 5.

NOAA 14 Returns from the Dead

As many readers will recall, NOAA-14 ceased transmitting AVHRR imagery on April 14, 2004 when its scan motor seized up. It had been assumed that this spelled the end of imaging from this satellite yet, amazingly, more than a year later on July 16 this year, it unexpectedly sprang back to life and good quality HRPT images were once more transmitted from July 17. There is no sign of a regular resumption of APT imaging which will probably remain off due to the likelihood of frequent clashes with NOAA 17.

There are of course no guarantees as to how long NOAA-14's new lease of life will continue, but it is certainly worth looking out for if you are an HRPT user. The HRPT frequency for NOAA-14 is 1707.0 MHz.

This channel-2 visible image was taken from the 12:52 UT descending pass on July 17, the first full day of 'normalised' operation and shows Labrador and Nova Scotia in Canada.

Credit: NOAA CLASS Archive

In fact, NOAA did activate APT transmissions from NOAA-14 between July 28 and August 2 for test purposes. Unusually, these consisted not of the familiar visible/IR combination of channels 2+4, but an intriguing twin infrared APT combination of channel 3 with channel 4. Channel 3 (3.7µm mid IR) is the infrared channel that NOAA satellites normally switch in to replace the visible light channel overnight, while they are flying over the night side of Earth

Cover Colour Images

<u>Front cover</u> - One of the first colour composite images from the new Chinese Feng Yun 2C geostationary satellite, dating from 14:00 UT on December 31, 2004. Image courtesy NSMC, China.

<u>*Inside front cover*</u>

Milan Konecny from Canada provided us with a superb NOAA-18 channel 1+2 false colour image from the 19:48 UT pass on May 21 (upper left) . Milan used David Taylor's Satsignal to produce this image from a WAV file received by WxSat.

The 13:25 UT NOAA-18 image, also from March 21, is the earliest daylight image we received (upper right). It was sent in by **Ruud Jansen** who lives in Haarlem in the Netherlands. Ruud uses WXtoImg in conjunction with his home-built PITA137 receiver and an indoor home-built QFH antenna located in the roof-space of his house.

Joris Prosje, who lives in Harlingen at the very north of the Netherlands, sent in the APT image from NOAA-18 reproduced at the foot of the page. It is a composite of the 12:52 UT and 14:34 UT passes from June 11, 2005, which were acquired using an R2FX receiver (see page 19) fed from a turnstile antenna. Processing was achieved using Craig Anderson's *WxtoImg* software.

<u>*Back cover*</u>

Hartmut Schaksmeier from Remscheid, Germany sent in this superb NOAA-18 image captured from the 12:37 UT pass on July 22, 2005. The image was processed in vegetation mode using Craig Anderson's *WXtoImg* software.

The R2FX APT Receiver for Weather Satellites

Les Hamilton

New APT weather satellite receivers do not appear on the scene very often these days so, when I heard about the *R2FX* model manufactured by Holger Eckardt of Hohenbrunn, Germany, I just had to try one out.

This receiver has beautifully clean lines and is provided in an attractive aluminium case measuring just 113 x 85 x 31 mm. The front panel supports just a single 'select' button and 12 variously coloured LEDs (figure 1) while the rear panel boasts twin 50 Ω BNC antenna sockets, a power supply socket, audio-out jack socket and RS232 serial interface (figure 2).

Manufacturer's Specifications

The *R2FX* receiver is designed for the reception of polar orbiting weather satellites which transmit in the 137 MHz band. Matched IF filters and a highly linear demodulator provide optimum image quality, even with weak signals. An AFC circuit compensates for Doppler frequency shifts. A novel feature is the ability of the *R2FX* to utilise two antennas simultaneously: the receiver polls the antennas constantly and always selects the stronger signal to provide the cleanest possible image.

The *R2FX* Package

The *R2FX* comes complete with a power supply unit. Unfortunately it is of the continental '*Shuko*' 2-pin design so you will require a suitable adaptor if you plan to use it. I used a standard plug-top PSU designed for use in the UK without experiencing any problems. Also supplied was an audio lead to connect the *R2FX* to the soundcard of your computer and a CD bearing a copy of the *R2FX* manual, Craig Anderson's *WXtoImg* decoding software and some sample images and WAV files.

Power Supply for the *R2FX*

Without doubt the single most important aspect of preparing the *R2FX* for use is attaching the power supply. This receiver works well with an input of between 5 volts and 12 volts d.c. but you must take care with the supply's polarity.

The power jack feeding the *R2FX* must have a centre-positive supply (the jack tip must be positive) as the receiver is not protected against reverse polarity.

The lower limit of 5 volts permits the unit to be powered from a USB port on your PC. And although it would have been perfectly feasible to include polarity protection circuitry, this would raise the minimum voltage to 6 V and prevent USB operation.

The supplied PSU comes ready to use but UK members who substitute one their own must note the above carefully, specially as the *R2FX* does not possess a power switch: once the PSU is connected, the device is switched on. Check the voltage of the PSU—exceeding 15 V for even a short period can lead to damage. Personally, I always use a 6-volt supply and this has proved entirely satisfactory at all times. On the subject of PSU, I have found that a set of four rechargeable 2300 mAh NiMH 'AA' batteries also performs beautifully, providing a minimum of 36 hours supply—useful for trips to the countryside with a laptop.

Setting up the *R2FX*

Connecting up the *R2FX* could hardly be simpler. The PSU plugs into the rear of the unit, the audio lead connects between the audio-out socket and the line-in (or mic-in) of your PC soundcard while the antenna attaches to the 'Antenna 1' BNC position.

Should you require to adjust the audio output level of the *R2FX* there is a small trimming potentiometer inside the unit, close to the RS232 D-connector, labelled 'V' in figure 3. Turning this counter-clockwise decreases the output. But be careful, as the device does not have a 'stop' and rotates a full 360°—so you can inadvertently set the output back to 'high' by turning too far.

To switch on the *R2FX* you simply supply power—it does not have an on/off switch. The entire display of LEDs lights up for about two seconds, then all extinguish except for the the amber antenna LEDs and the red 137.50 MHz channel LED. You will probably notice the amber LEDs alternating on and off as the receiver polls between the two antenna BNC connectors.

Repeatedly pressing the 'Select' switch briefly steps the receiver through the six frequency channels. Holding this switch down for two seconds or more sets the receiver into scan mode and the six red LEDs start to flick on and off in turn as each channel is activated. The *R2FX* comes with the two new polar satellite frequencies already installed, and you can program new frequencies later should the need ever arise through the RS232 port, using your computer.

Frequencies currently provided are:

137.10 MHz -	Metop / NOAA 19 (future)
137.40 MHz -	Okean/Sich
137.50 MHz -	NOAA 12, 15
137.62 MHz -	NOAA 17
137.91 MHz -	NOAA 18
134.00 MHz -	WEFAX downconverter

Using the *R2FX*

Once set up the *R2FX* performed almost flawlessly and images and WAV files were produced using both *Wxsat* and *WxToImg* software packages. I found the audio output somewhat high for my notebook PC, so reduced this as explained above. My first image is reproduced in figure 5.

I was initially disappointed to note a stepped pattern of short, dark, horizontal lines marching diagonally across the image. As I was simultaneously decoding the same image with my *Proscan* receiver (which did not produce this effect), I initially feared that

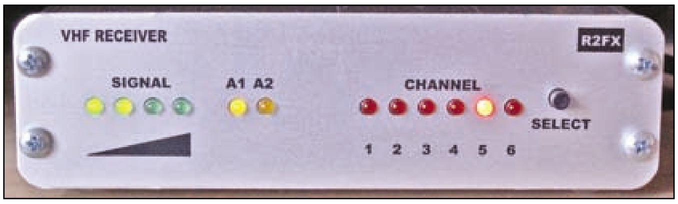


Figure 1
The front panel of the R2FX showing the various LEDs

Figure 2
The back panel of the R2FX, showing connectors

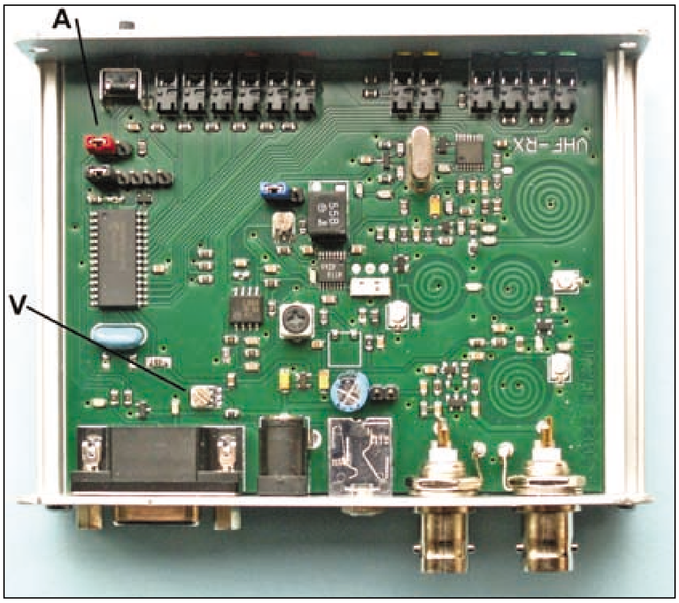


Figure 3
The interior of the R2FX showing the audio output adjust potentiometer (V) and the jumper switch (A) used to set/unset the dual antenna facility

Figure 4
My mobile weather satellite ground station, consisting of the R2FX receiver with 4 x AA battery pack and notebook PC.

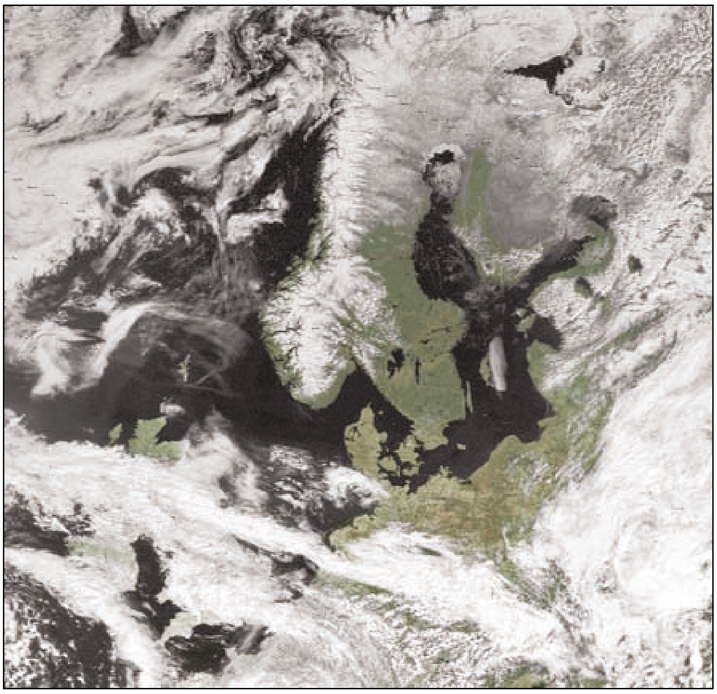


Figure 5
My first NOAA 17 image received at 10:34 UT on April 26, 2005 using the R2FX. A stepped pattern of short, dark, horizontal lines mars the image. The effect is most clearly evident over northern Scandinavia and over the mass of cloud at upper left. This effect is easily addressed by converting the R2FX from 'antenna diversity' to single-antenna mode.

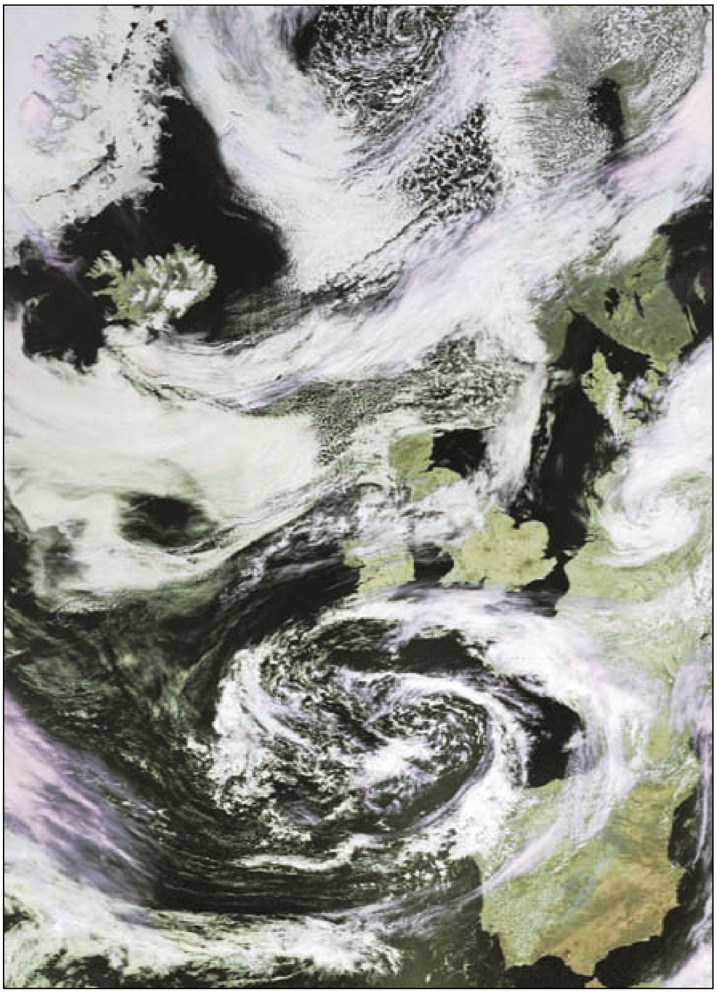


Figure 6
This image from NOAA 17 was acquired at 11:40 UT on May 15, 2005 after the R2FX had been adjusted for single-antenna operation.

Processing: both the above images were produced using Satsignal my *R2FX* might be faulty. However, an e-mail to Holger Eckardt soon solved this. The unit ships in twin-antenna mode (‘*antenna diversity*’ as the manual describes it) ... but I only had a single antenna connected. It turns out that, in this situation, the total lack of signal when the receiver attempts to access the second antenna results in a brief loss of signal, which places black pixels in the image. Switching the *R2FX* to single antenna mode removed the problem completely (figure 6).

Using Two Antennas

The idea of using twin antennas intrigued me, so I ran a test with two QFH antennas, deliberately positioned to the north and south of my house in such a manner that the structure prevented me obtaining a complete horizon to horizon pass from either (neither QFH was capable of receiving a complete pass because of the obstruction from my house). Nevertheless, results were superb: you would not have been able to guess that there was a problem as the *R2FX* seamlessly switched antennas at the appropriate point to maintain the strongest possible signal. For users who cannot position a single antenna in a location clear of obstructions this provides a novel way of extending the imaging range.

Changing to Single Antenna Mode

As my situation does not require me to make use of twin antennas I decided to switch modes. On opening the case of the *R2FX* you will see a red jumper next to the push-button on the front panel (labelled ‘A’ in figure 3). By default this is in the right-hand position (twin antenna mode). Just move the jumper to the left-hand position and the receiver is converted for single-antenna operation. You will find that only the amber antenna LED labelled ‘antenna 1’ now illuminates. Of course, the antenna must be connected to the ‘Antenna 1’ BNC connector otherwise you will not now receive any signal at all.

Performance

I received my *R2FX* in mid-April. Once the antenna ‘problem’ was understood, I ran a series of tests comparing the *R2FX* with my commercial *Proscan* and *Martelec MSR 50* receivers. The *R2FX* was tested <u>simultaneously</u> with either the *Proscan* or *MSR 50*, both test receivers being fed from QFH antennas in the loft; signals were decoded on laptop PCs using *WXtoImg* software.

Results were identical. Images were all well-nigh perfect, and any imperfections resulting from local interference showed identically on both. I had initially feared that the *R2FX*, being manufactured in Germany, might not possess sufficient filtering to eliminate pager intrusions but I need not have worried. There were absolutely no problems in this respect.

NOAA 18 Problems

However, the arrival of NOAA 18 in mid May, transmitting on the new frequency of 137.9125 MHz, did produce severe problems. Certainly, at my location in northeast Scotland, the *R2FX* was badly affected by pagers (some transmitting on 137.975 MHz), and images were simply awash with horizontal pager intrusions. But the same was true for the *MSR 50* (I cannot comment on the *Proscan* here, as mine is not upgraded for NOAA 18, although members elsewhere in Great Britain have found it impossible to image from NOAA 18 on the *Proscan* also)

The NOAA 18 situation does, however, vary a great deal across Great Britain. From some districts I have received reports that imaging is ‘impossible’ or ‘hopeless’ using both the *Proscan* and *R2FX;* from others, both receivers are performing perfectly. As expected, most members in the London area (a notorious pager hot-spot) cannot obtain NOAA 18 images—though even there, some readers have reported good reception using the *R2FX*. One final associated problem can arise when pager activity is particularly severe: if the R2FX is in scanning mode, it can lock on to 137.91 MHz for 30 minutes or more at a time, which means that passes of other satellites can be missed.

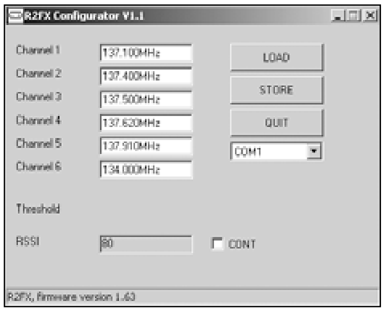
Satellite Imaging ‘On Location’

One of the delights of holidaying in remoter parts of Britain is taking along a mobile satellite ground station in order to check up on impending weather. This is something I do several times a year when visiting the Isle of Skye off the west coast of Scotland. The *R2FX* adds a new dimension to this pursuit because it can be operated with a power supply as low as 5 volts—you can even power it directly from a USB port on a laptop PC. It is the simplest task to purchase a set of four rechargeable AA batteries, a cell-holder and a 6 mm plug to fit the *R2FX*. Figure 4 shows my station shortly after decoding a satellite pass. The battery pack can be seen just behind the *R2FX* and the entire setup can be used ‘in the field’ without the need for mains electricity.

Reprogramming the R2FX Frequencies

If you purchased your R2FX earlier than May 2005 it will be set up with with the old Russian APT frequencies rather than the two new NOAA ones. This is easily rectified by downloading a simple program called *R2FX-config* from Holger Eckardt’s website (see below). All you require to do is connect the *R2FX* to the 9-pin serial port on your computer then run this program.

First select the correct port (normally COM1) and click ‘LOAD’. This recovers the frequencies held in the *R2FX* and displays them as illustrated. Just retype any of these then click ‘STORE’ and the new value will be programmed back into the receiver.



Conclusions

The *R2FX* is a modern, highly effective APT weather satellite receiver that performs well even in the UK with its notorious ‘pager’ problems. The only significant criticism concerned imaging from NOAA-18, but in fairness, the *R2FX* fared no worse than most other receivers.

I have received numerous reports from GEO members indicating that APT receivers of all types are being affected by pagers at the NOAA-18 frequency of 137.91 MHz. In some parts of the country the problem is so severe that imaging is impossible: yet there are locations where excellent images are being obtained with the R2FX.

The bottom line is this: if you are looking for a high quality receiver for APT then the *R2FX* is as good as any you will get. And its price of 179 euros (which includes post and packing) equates to just a shade over £120. When you consider that the UK-designed *RX2* receiver now costs £90 in kit form, this ready-built receiver from Germany, which works ‘straight out of the box’, becomes a very attractive proposition. As far as I can ascertain, it is the cheapest ready-built receiver currently on the market, as well as being one of the best.

... concluded on page 38

How to align a Dish on Hot Bird-6
for the reception of *EUMETCast*

John Tellick

Photograph 1

Many readers have probably set up a prime focus dish for *Meteosat-7* (the white dish in the photograph) and will know it points directly at the satellite in elevation as well as azimuth.

The three dishes pictured above are all pointing at satellites with fairly similar elevations: *EUTELSAT W1* at 10 °E (left), *Meteosat-7* at 0° (centre) and *Hot Bird-6* at 13°E (right). This last also has a second LNB for the reception of *Astra-1* at 19.2°E. Notice the shallow elevation angle of the offset dishes compared with the prime focus dish

Photograph 2

Use a compass to ascertain the direction where you need to point the dish and make sure your mounting point has a clear view of the sky at about 28 degrees elevation.

Exact pointing co-ordinates for your location can be found from EUMETSAT's antenna pointing calculator at:

http://www.eumetsat.int/cgi-bin/tools/antennaPointing

Photograph 3

Make sure that the vertical pole on your wall bracket or patio stand, on to which the dish is to be mounted, is truly vertical.

Photograph 4

Place the LNB in the LNB holder and give it a small twist off the horizontal, about 5° to the east, before tightening. This is to compensate for the satellite's increasing apparent twist the further east or west of south it is located in the geostationary arc (which twists – or 'skews' —the V/H transmitted signal). And of course, for a satellite positioned west of south, the LNB requires a westerly twist.

Photograph 5

Mount your dish on its pole and tighten the Az/El bolts sufficiently that the dish is secure and doesn't wobble—but can still be panned. Elevate the dish to about 8°. This, plus the approximate 20 degree offset of the LNB arm, will give a total elevation of around 28°.

Point the dish in the direction of your EUMETSAT calculation—or to between 15° and 20° east. Connecting a meter such as the *TechniSat* '*SatFinder'* or Arne van Belle's satellite meter between the LNB and your receiver will greatly assist in locating the signal.

Photographs 6 and 7

If you followed the above you may well already observe a signal indicating on the meter. You will find two very strong signals around the 15°E area (*Astra-1* at 19.2°E and *Hot Bird* at 13°E) by slowly panning the dish azimuth in this area.

Photograph 6
Dish aligned on Astra at 19.2°E

Photograph 7
Dish aligned on Hot Bird at 13°E

Photograph 7 shows the dish lined up on *Hot Bird-6*, the satellite position you want, having panned it westward of *Astra-1*. Notice the size of the horizontal angle through which the dish requires panning between these two high-level signals. **Note**: The camera position remained the same for photographs 6 and 7.

Peak the dish in both elevation and azimuth then confirm, via a satellite TV receiver or your *SkyStar* card, that you are indeed on Hot Bird-6 (via a pre-programmed channel) then make final peaking of the signal. First adjust the horizontal axis for maximum signal strength then tighten the azimuth bolts.

Now peak the elevation and tighten the elevation bolts. You may wish to go back and check both again, individually tightening each as you do so.

Photograph 8

Now that your dish is aligned and peaked on *Hot Bird-6*, and all the bolts have been tightened, you may wish to experiment with multi-satellite reception with one dish.

This is quite easy if you use a '*SatFinder*' meter. Connect the meter to a second LNB placed next to and to the west of your fixed one (as shown in the picture) and you will soon detect a strong signal. This should be *Astra-1* at 19.2°E. Owing to the size of the integrated feedhorn, extra LNBs can only be placed to receive satellites spaced 6 degrees or more apart.

... concluded on page 38

GEO Shop

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

PRICE LIST

	UK	EU	RoW
TechniSat SkyStar 2 PCI Card	49.50	51.00	-
Technisat Skystar USB box	109.50	121.50	-
Telestar 80 cm dish with LNB	49.00	-	-
Telestar Ku band universal LNB	11.00	12.50	-
Technisat *Satfinder* alignment meter	21.50	24.50	-
Dartcom high quality QFH antenna	259.00	279.00	-
Turnstile APT antenna	36.00	-	-
GEO-PIC 1.0	7.00	7.40	8.30
GEO/Dartcom EPROM v 1.3 *NEW*	10.00	10.75	11.25
GEO 2004 CD (back issues)	8.00	8.40	9.30
Printed Back Issues			
GEO Quarterly No 2	3.50	4.20	5.10
GEO Quarterly No 3	3.50	4.20	5.10
GEO Quarterly No 4	3.50	4.20	5.10
GEO Quarterly No 5	3.50	4.20	5.10

All prices are in £ sterling and include postage and packaging

HOW TO PLACE YOUR ORDER

Orders should clearly state your **name** and **address**, including **postcode**, and contact **telephone** number and **e-mail** address in case we need to contact you about your order. Items ordered should be **clearly described** and quantified.

It is preferred that you submit your order on a copy of the official **Shop Order Form**, which you can download from the GEO website at:

http://www.geo-web.org.uk/Orderform.pdf

(Of course, we will also accept handwritten or typed orders)

Please mail your orders to:

GEO Shop
PO Box 1375
Christchurch BH23 9AS
England

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

+44 (0) 1202 893 323

TERMS AND CONDITIONS

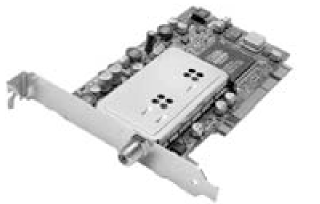
Payment Methods

Payments from **UK Members** can be accepted by *Personal Cheque, Postal Order, Credit Card* and *Debit Card*. Payments from **EU** and **Rest of World** members can be accepted by *Credit Card* or *Debit Card*.

Cheques and Postal Orders must be made payable to 'Group for Earth Observation'

VISA, Mastercard, Switch and Switch Solo are all accepted, but please note that you **must state**

- the cardholder's signature
- the type of card, card number and expiry date
- the issue number (for Switch and Switch Solo only)



TechniSat SkyStar 2 PCI Card

A 'free to air' DVB satellite TV and data receiver card as recommended by EUMETSAT. This card requires installing inside the computer and comes with comprehensive installation instructions and CD-ROM of driver software.

TechniSat SkyStar USB Box

If you do not feel confident about installing cards inside your computer you can use the external USB version.

Telestar 80 cm dish (or similar model) and **Ku-band LNB**

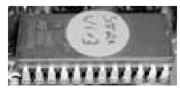
TechniSat SatFinder Alignment Meter

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

GEO PIC 1.0 for RX2

This PIC comes programmed with the two new frequencies to be utilised by the forthcoming NOAA-18 and NOAA-19 satellites.

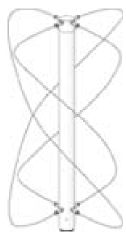
Note: Check your RX2 synthesiser chip before ordering (see GEO Quarterly No 5, page 16)



GEO/Dartcom EPROM v 1.3

Recent tests have shown the ***Dartcom APT receiver*** to be one of the best regards pager immunity in the UK. This NEW EPROM for the Dartcom APT receiver adds the two new NOAA frequencies to the scan list in memory page 0.

Turnstile APT antenna



Dartcom QFH antenna

GEO 2004 CD

Back issues in PDF format - so that new members can catch up on last year.

All credit cards are authorised before goods are despatched.

Please include your e-mail address or telephone number in case we need to contact you about your order. In the event of problems with items purchased from GEO-Shop, please contact Clive Finnis (contact details at top of page).

Ordering and Shipping

We will ship by post, so please allow 28 days for delivery although we hope UK and EU orders will take just a few days; orders to the Rest of the World may take a few weeks.

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

NOAA Satellite Predictions

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

	NOAA 12	NOAA 15	NOAA 17	NOAA 18
Sep 01	05:13 06:53 15:00 16:39	05:31 07:10 16:57 18:38	10:09 11:49 21:36 23:17	02:33 04:14 12:26 14:06
Sep 02	04:48 06:28 14:36 16:14	06:47 08:27 16:34 18:14	09:46 11:26 21:13 22:54	02:23 04:04 12:16 13:56
Sep 03	04:24 06:03 15:50 17:30	06:23 08:03 16:10 17:50	11:03 12:43 20:50 22:30	02:13 03:54 12:06 13:46
Sep 04	05:39 07:19 15:25 17:05	05:59 07:39 15:47 17:26	10:40 12:20 20:28 22:07	02:02 03:43 11:56 13:36
Sep 05	05:14 06:54 15:01 16:40	05:36 07:16 17:02 18:43	10:17 11:57 20:06 21:44	01:52 03:33 11:46 13:25
Sep 06	04:50 06:29 14:37 16:15	05:12 06:52 16:39 18:19	09:55 11:34 21:21 23:02	01:42 03:23 11:36 13:15
Sep 07	04:25 06:05 15:51 17:32	06:28 08:08 16:15 17:55	11:12 12:52 20:59 22:39	01:32 03:13 11:26 13:05
Sep 08	05:40 07:20 15:26 17:06	06:04 07:45 15:52 17:31	10:49 12:29 20:36 22:16	01:22 03:03 12:55 14:37
Sep 09	05:15 06:56 15:02 16:41	05:41 07:21 17:07 18:49	10:26 12:06 20:14 21:53	01:12 02:52 12:45 14:26
Sep 10	04:51 06:31 14:38 16:17	05:17 06:57 16:44 18:24	10:03 11:43 21:30 23:11	02:42 04:23 12:35 14:16
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Sep 12	05:41 07:22 15:28 17:08	06:09 07:50 15:57 17:36	10:57 12:37 20:45 22:24	02:22 04:03 12:14 13:55
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Sep 14	04:52 06:32 14:40 16:18	05:22 07:02 16:49 18:29	10:11 11:51 20:00 21:38	02:01 03:42 11:55 13:34
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Sep 16	05:43 07:23 15:29 17:09	06:15 07:55 16:02 17:41	11:06 12:46 20:53 22:33	01:41 03:22 11:35 13:14
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Nov 24	05:38 07:19 15:25 17:05	05:37 07:17 17:04 18:45	09:47 11:26 21:13 22:54	01:43 03:24 11:37 13:16
Nov 25	05:14 06:54 15:01 16:40	05:14 06:54 16:40 18:21	11:04 12:44 20:51 22:31	01:33 03:14 11:27 13:06
Nov 26	04:49 06:29 14:37 16:15	06:30 08:10 16:17 17:57	10:41 12:21 20:29 22:08	01:23 03:03 12:56 14:38
Nov 27	04:25 06:04 15:51 17:31	06:06 07:46 15:54 17:33	10:18 11:58 20:06 21:45	01:13 02:53 12:45 14:27
Nov 28	05:40 07:20 15:26 17:06	05:42 07:22 15:31 17:09	09:55 11:35 21:22 23:03	02:43 04:24 12:35 14:17
Nov 29	05:15 06:55 15:02 16:41	05:19 06:59 16:45 18:26	11:12 12:52 20:59 22:39	02:33 04:14 12:25 14:06
Nov 30	04:50 06:30 14:38 16:16	06:35 08:15 16:22 18:02	10:49 12:29 20:37 22:16	02:22 04:04 12:15 13:56
Dec 01	04:26 06:05 15:52 17:32	06:11 07:51 15:59 17:38	10:26 12:06 20:14 21:53	02:12 03:53 12:05 13:46
Dec 02	05:41 07:21 15:27 17:07	05:47 07:27 15:36 17:14	10:03 11:43 21:30 23:12	02:02 03:43 11:55 13:35
Dec 03	05:16 06:56 15:03 16:42	05:24 07:04 16:50 18:31	09:41 11:20 21:08 22:48	01:52 03:33 11:45 13:25
Dec 04	04:51 06:31 14:39 16:17	06:40 08:20 16:27 18:07	10:58 12:38 20:45 22:25	01:42 03:23 11:35 13:15
Dec 05	04:27 06:07 15:53 17:34	06:16 07:56 16:04 17:43	10:35 12:15 20:23 22:02	01:31 03:12 11:25 13:04
Dec 06	05:42 07:22 15:28 17:08	05:53 07:33 15:40 17:19	10:12 11:52 20:01 21:39	01:21 03:02 12:54 14:36
Dec 07	05:17 06:57 15:04 16:43	05:29 07:09 16:55 18:36	09:49 11:29 21:16 22:57	01:11 02:52 12:44 14:26
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Dec 16	04:55 06:35 14:42 16:21	05:15 06:55 16:42 18:22	09:43 11:23 21:10 22:51	01:20 03:01 12:53 14:35
Dec 17	04:30 06:10 15:56 17:37	06:31 08:12 16:18 17:58	11:00 12:40 20:47 22:27	01:10 02:50 12:43 14:24
Dec 18	05:45 07:25 15:32 17:12	06:08 07:48 15:55 17:34	10:37 12:17 20:25 22:04	02:40 04:21 12:32 14:14
Dec 19	05:21 07:01 15:07 16:47	05:44 07:24 15:32 17:10	10:14 11:54 20:03 21:41	02:30 04:11 12:22 14:03
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Dec 21	04:31 06:11 15:57 17:38	06:36 08:17 16:23 18:03	11:09 12:49 20:56 22:36	02:09 03:50 12:02 13:43
Dec 22	05:46 07:27 15:33 17:13	06:13 07:53 16:00 17:39	10:46 12:26 20:33 22:13	01:59 03:40 11:52 13:32
Dec 23	05:22 07:02 15:09 16:48	05:49 07:29 15:37 17:15	10:23 12:03 20:11 21:50	01:49 03:30 11:42 13:22
Dec 24	04:57 06:37 14:44 16:23	05:25 07:05 16:52 18:33	10:00 11:40 21:27 23:08	01:39 03:20 11:32 13:12
Dec 25	04:32 06:12 15:58 17:39	06:41 08:22 16:28 18:08	09:37 11:17 21:04 22:44	01:29 03:09 11:23 13:01
Dec 26	05:47 07:28 15:34 17:14	06:18 07:58 16:05 17:44	10:54 12:34 20:42 22:21	01:18 02:59 12:51 14:33
Dec 27	05:23 07:03 15:10 16:49	05:54 07:34 15:42 17:20	10:31 12:11 20:19 21:58	01:08 02:49 12:41 14:23
Dec 28	04:58 06:38 14:46 16:24	05:30 07:10 16:57 18:38	10:08 11:48 21:35 23:17	02:39 04:20 12:31 14:12
Dec 29	04:34 06:13 15:59 17:40	05:07 06:47 16:33 18:14	09:46 11:25 21:12 22:53	02:28 04:10 12:21 14:02
Dec 30	05:48 07:29 15:35 17:15	06:23 08:03 16:10 17:49	11:03 12:43 20:50 22:30	02:18 03:59 12:11 13:51
Dec 31	05:24 07:04 15:11 16:50	05:59 07:39 15:47 17:26	10:40 12:20 20:27 22:07	02:08 03:49 12:01 13:41

You can download a PDF version of these predictions from: ***http://www.geo-web.org.uk/predictions.pdf***

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.freeserve.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

Keith Holland, London, ENGLAND

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

- e-mail: 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

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

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

Hector Cintron, San Juan, Puerto Rico, USA

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

- Phone: 787-774-8657
- e-mail: n1tkk@hwic.net

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.

Useful Internet Discussion 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

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

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

Weather Satellite Reports

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

e-mail: 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: wxtoimg-subscribe@yahoogroups.com

Copy Deadline
for GEO Quarterly No 8
Monday, October 31, 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

Large attachments (1 Mb or greater) can be sent to:

lesw.hamilton@gmail.com

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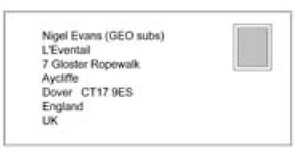

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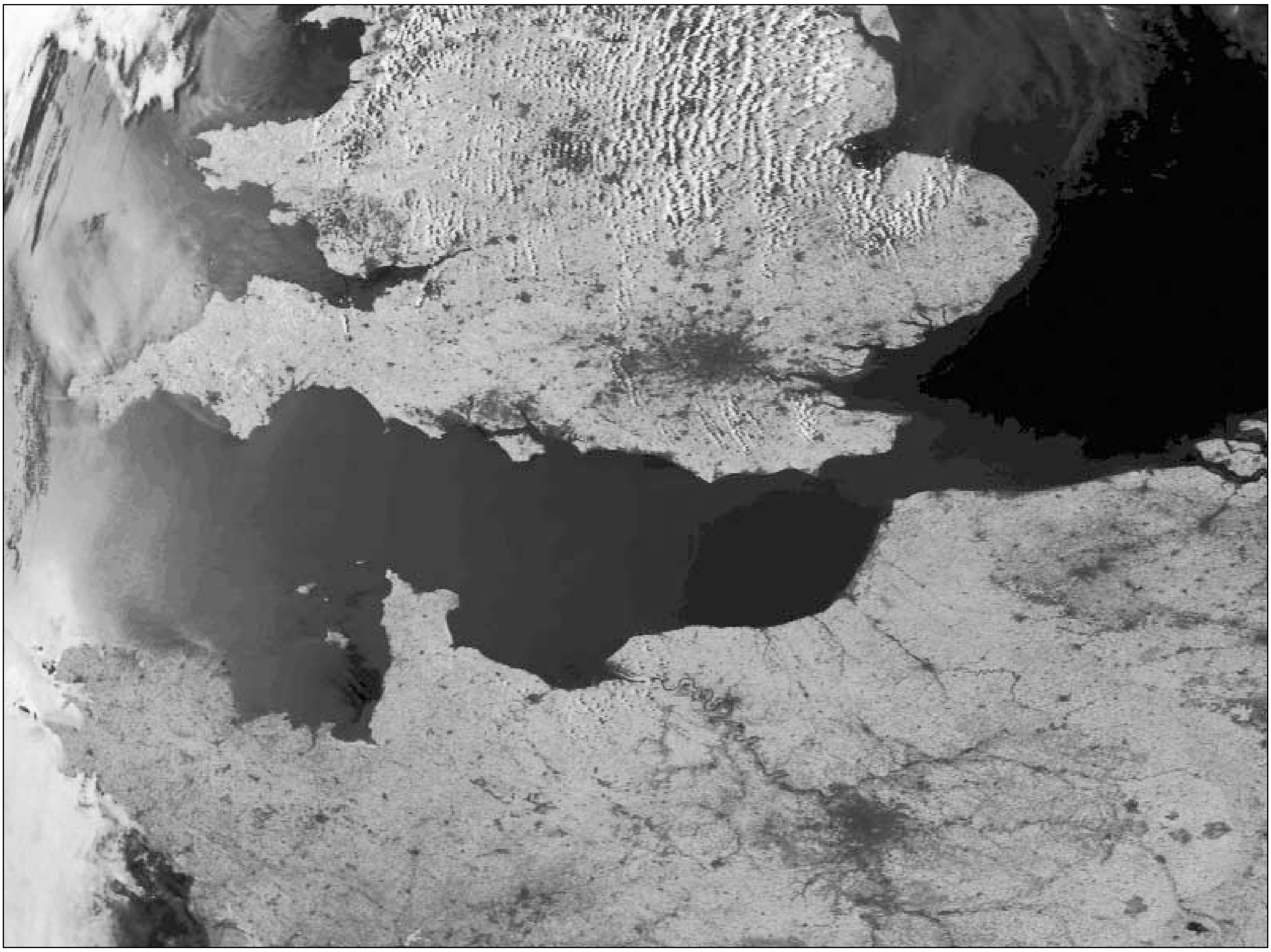
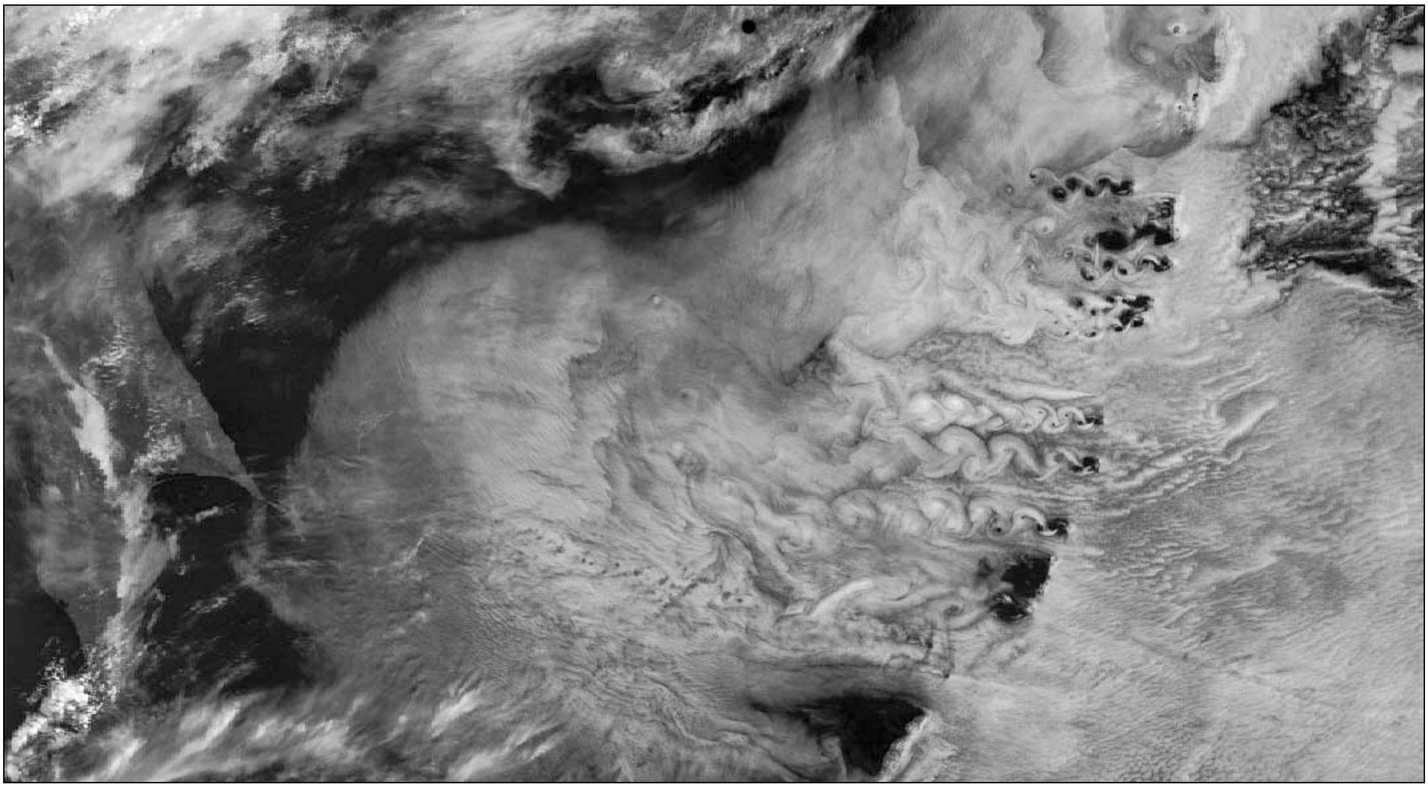


'**A Tale of Two Cities**': This superb NOAA 12 channel-2 visible image submitted by **Marciano Righini** form Ravenna, Italy clearly shows the cities of London, England and Paris, France in this near-cloudless view captured at 15:45 UT on June 18, 2005.



Von Karman vortex streets shed by the Kuril Islands drift across the Sea of Okhotsk in this ***ENVISAT*** 'MERIS' image taken on June 3, 2005.

Image: European Space Agency (ESA) - produced from ESA remote sensing data by Brockmann Consult (http://www.brockmann-consult.de/)

Weather Down Under

Doug Thwaites

Australia is a vast and beautiful country. It is the world's largest island with an area of 7,618,493 square kilometers, yet it is only thinly populated. Water, or lack of it, is the reason.

The Great Artesian Basin

The only source of potable water is from rain, although there is a water source underground: the Great Artesian Basin, which has an area of 1,711,000 square kilometres and consists of layers of water-bearing sandstone aquifers. At its deepest point, the Basin, which contains about 64.9 quadrillion (6.49×10^{16}) litres of water, is 3,000 metres below ground. It is estimated to have been formed about 200 million years ago. More than 1,500 bores use it, with a flow rate of about 1.5 billion litres a day per bore. The Basin is replenished from rainwater falling on the western side of the great dividing ranges in the east of Australia, but not enough to maintain the original quantity. The pH of the water is high and it contains a high sodium level which makes it unsuitable for irrigation, but stock drink it and survive.

Rainfall

To obtain potable water we need rain, which is produced by evaporation from the saltwater which surrounds Australia. To get this over land needs onshore winds to start with followed by conditions which cause precipitation. On the east of Australia is a range of mountains called the Great Dividing Range, which causes a division in the rainfall, though most falls to the seaward side. So we have a fertile green belt running all down the east coast and drier regions inland.

A coastal belt of fertile land runs all around the coasts of Australia due to onshore winds. This is where the majority of people live and where all the big cities lie. Weather systems move slowly across the continent from west to east, alternate lows and highs producing changes in the wind direction and thus to the chances of rain. During the year the weather systems move slowly up and down the country, causing the north to have wet summers and the south to have wet winters. You can see this effect in the summer (figure 1) and winter (figure 2) rain record maps.

Because the rain-bearing winds do not reach far inland there are deserts in the interior of Australia. But there are other ways that rain can find its way inland. A warm stream of water, rather like the Gulf Stream in the Atlantic, flows down the northern West Australian coast. During the summer months this breeds cyclones which cross the coast to become depressions. Due to the prevailing west to east movement, heavy rain is carried inland, sometimes all the way to the east coast.

Occasionally cyclones also form in the Coral Sea, to the northeast of Australia. These normally travel southwards over the ocean where they weaken and disperse; but if they cross the coast there are floods and the farmers are happy. For some reason Coral Sea cyclones are very rare nowadays, although ten years ago they were quite common.

Australia

Map provided by www.worldatlas.com

The Oceans

Scientists are sure that our weather is affected by the two massive oceans on either side of Australia. During the summer months two pools of warm water exist—in the western Pacific and the eastern Indian Oceans. Because of different tide times, water flows between the oceans through the Torres Strait to the north of Australia. Five countries have banded together to research the effects of this flow of warm, low salinity water between the two oceans. In order to do this, sub-surface monitors have been placed at strategic points throughout the Lombok, Ombai, and Timor passages through which this water flows.

Over the next few years, data will be collected by these instruments and, by comparing these with the weather at the time, we hope to learn more about how our weather is affected and what causes the changes.

The Southern Oscillation Index

Is the current lower rainfall going to continue? Where have our wet seasons with the accompanying floods gone? There is yet another reason why the rain patterns vary. Sometimes our television weather forecast mentions the Southern Oscillation Index (SOI), which is calculated from the monthly variations in the mean sea level pressure difference between Tahiti and Darwin. The index, which has a range from -35 to +35, is expressed by a formula used by the Australian Bureau of Metrology.

Sustained negative values of the SOI often indicate what is called an El Niño event. Such an event is accompanied by warming of the central and eastern tropical Pacific Ocean. This causes the Trade winds to weaken bringing reduced rainfall to eastern and northern Australia. The last bad El Niño was in 1997-1998. With drought all over the central and eastern areas at the present time we are possibly heading for another an El Niño period.

If, however the SOI becomes positive, the opposite applies. The waters of the eastern and central Pacific Ocean become cooler and eastern and northern Australia will become wetter. This is called 'La Nina' and results in stronger trade winds during our summer months. Our last La Nina was in 1999 and carried over to the southern autumn of 2000.

I live in the SE of Queensland, an area much favoured by retirees because of its lovely weather. The summers are not as hot and humid as further north, and its winters are not cold or wet like the southern states. Because of this people are flocking north putting the services at risk

We are now in a water crisis. We have several large dams, but the evaporation each week is much higher than the rainfall. The dams are at 40% capacity and water restrictions are in force. To refill them we need a cyclone, and it is winter here, so there is no hope at present (figure 3).

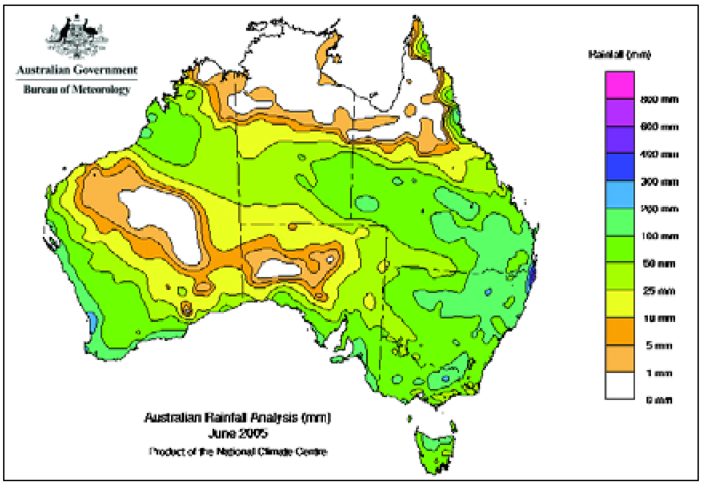


Figure 1 - Rainfall analysis for winter (June 2005)

Credit: Australian Bureau of Meteorology (www.bom.gov.au)

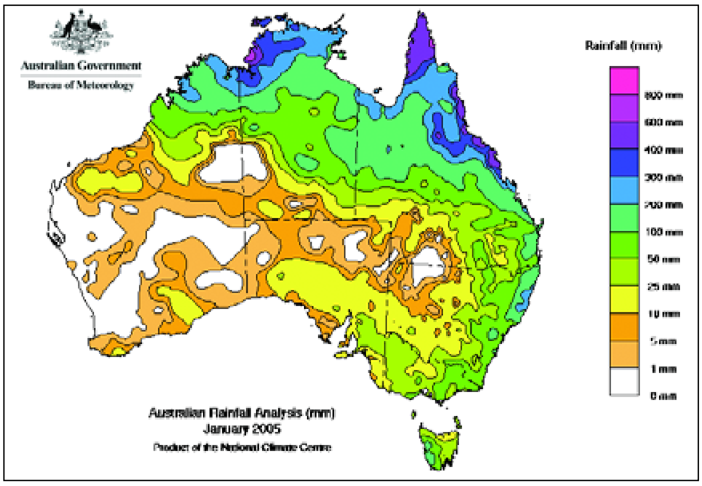


Figure 2 - Rainfall analysis for summer (January 2005)

Credit: Australian Bureau of Meteorology (www.bom.gov.au)

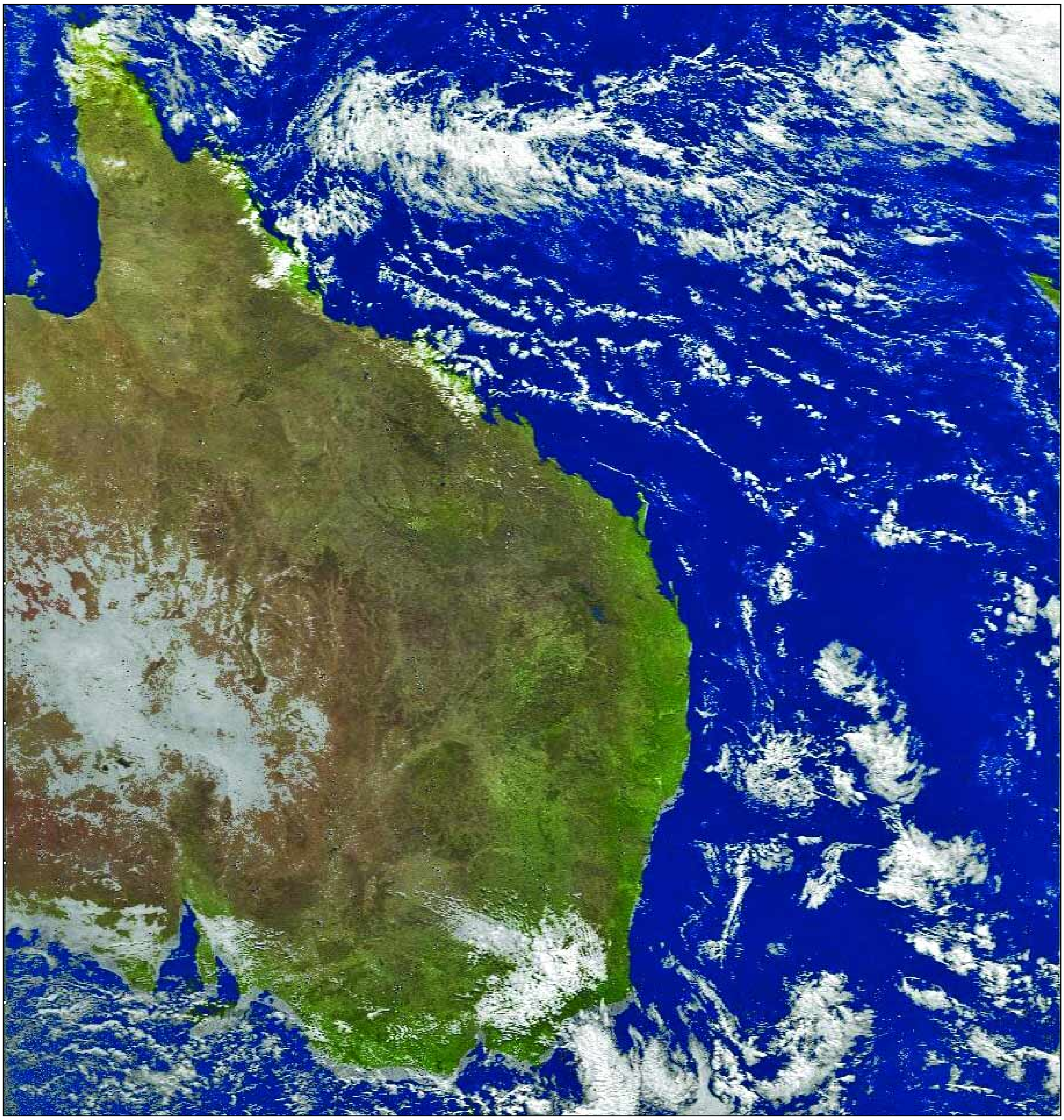


Figure 3 - Drought in Australia - NOAA 17 at 00:03 UT on July 29, 2005, processed using *WXtoImg*

Process your own Images from Feng Yun-2C

国家卫星气象中心
National Satellite Meteorological Center

Les Hamilton

China's Feng Yun 2C (FY2C) geo-stationary satellite is now in service and producing hourly images in five frequency channels, including visible, infrared and water-vapour. The website of China's National Satellite Meteorological Centre (NMSC) [1] makes available both 185 kb infrared images measuring 572 x 592 pixels as well as full 5-channel datasets in the form of HDF files which weigh in at a hefty 133 Mb apiece. The embedded images are all 2280 pixels square. The front cover of this Quarterly displays the first colour composite image from FY2C released by NSMC.

If you wish to view the entire range of images at full resolution you must first download an HDF file [2]: and therein lies a problem. Download speeds from the NSMC server vary enormously. On a good day my 512 kb/s Broadband retrieves a file in just under 40 minutes. But the rate can wither to almost zero—considerably slower than a standard dial-up connection—so you just have to keep trying (7am is often a good time to try).

The HDF File Viewer

HDF files contain huge quantities of data in addition to the images, and specialised software is required for their retrieval. Fortunately, the National Center for Supercomputing Applications (NCSA) at the University of Illinois, provides *HDF View* [3], a visual tool for browsing HDF files. This is available free of charge as a 15 Mb download.

After you load an HDF file into the viewer a list of its contents appears in a panel at the left-hand side (figure 1). The only items that concern us are the five entries 'NOMChannelIR1' ... 'NOMChannelVIS', which contain the image data.

Producing an image is not at all intuitive, but is straightforward enough *once you know how*!

- Load an HDF file
- **Right-click** on any one of the five image entries to highlight it and open the sub-menu (figure 1)
- Select 'Open As' from this menu to reveal the dataset selection window (figure 2)
- Click on the 'Image' button at the upper right of this screen
- Click the 'OK' button

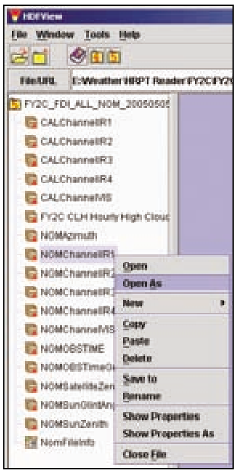


Figure 1
HDF View menu tree

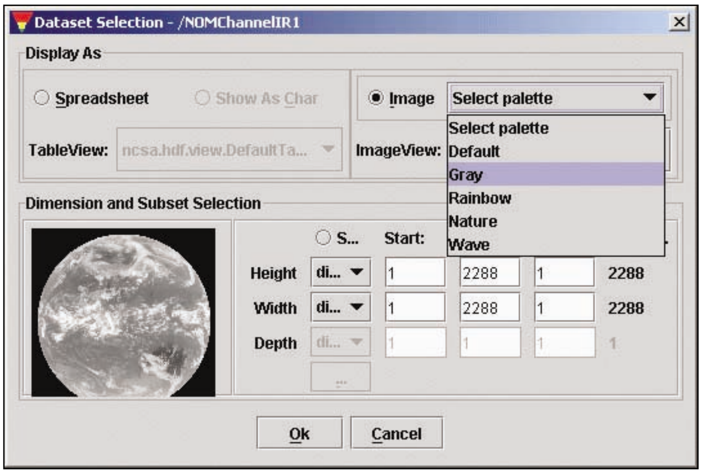


Figure 2
Dataset selection window

The image now appears in the main window (figure 3). You can zoom in and out of the image using the +/- buttons at the top left of the window.

Note 1: The visible image is only 6-bits deep and appears very dark indeed. It can be brightened by clicking the 'Image' button at upper left on the window, selecting 'brightness' from the fly-out menu, then inserting a suitable value (e.g. 100).

Note 2: Members who use David Taylor's *GeoSatsignal* have an alternative way of viewing HDF images from FY2C. Provided you have upgraded to the new version, *GeoSatsignal5*, you can extract FY2C images from HDF files and produce monochrome, false-colour, thermal false-colour and remapped products (see opposite).

References

1 National Satellite Meteorological Centre

http://nsmc.cma.gov.cn/indexe.html

2 HDF and JPG Image download site

http://nsmc.cma.gov.cn/SCB/F2C

3 HDF Viewer

http://hdf.ncsa.uiuc.edu/hdf-java-html

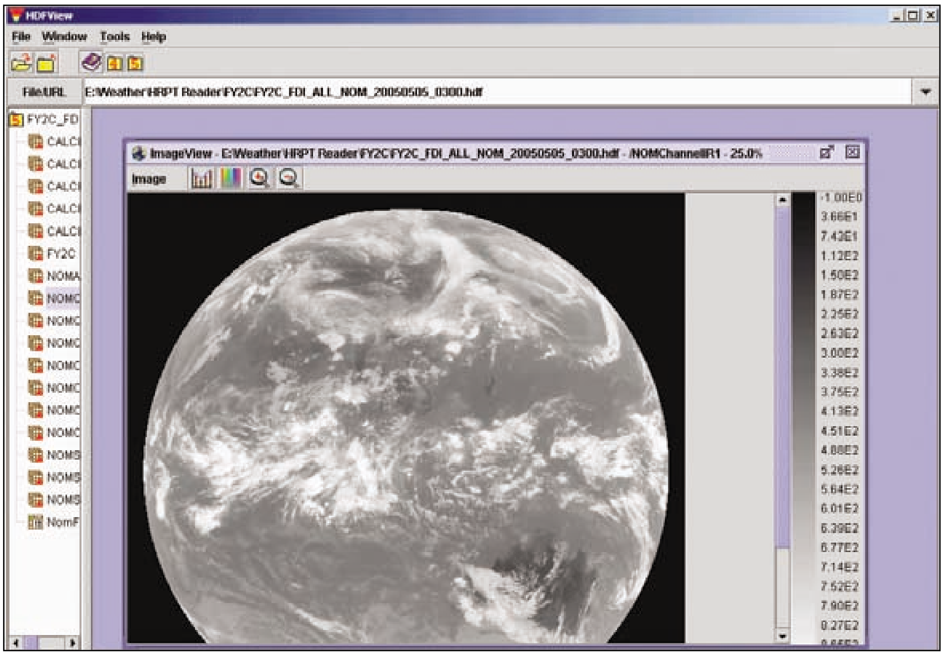
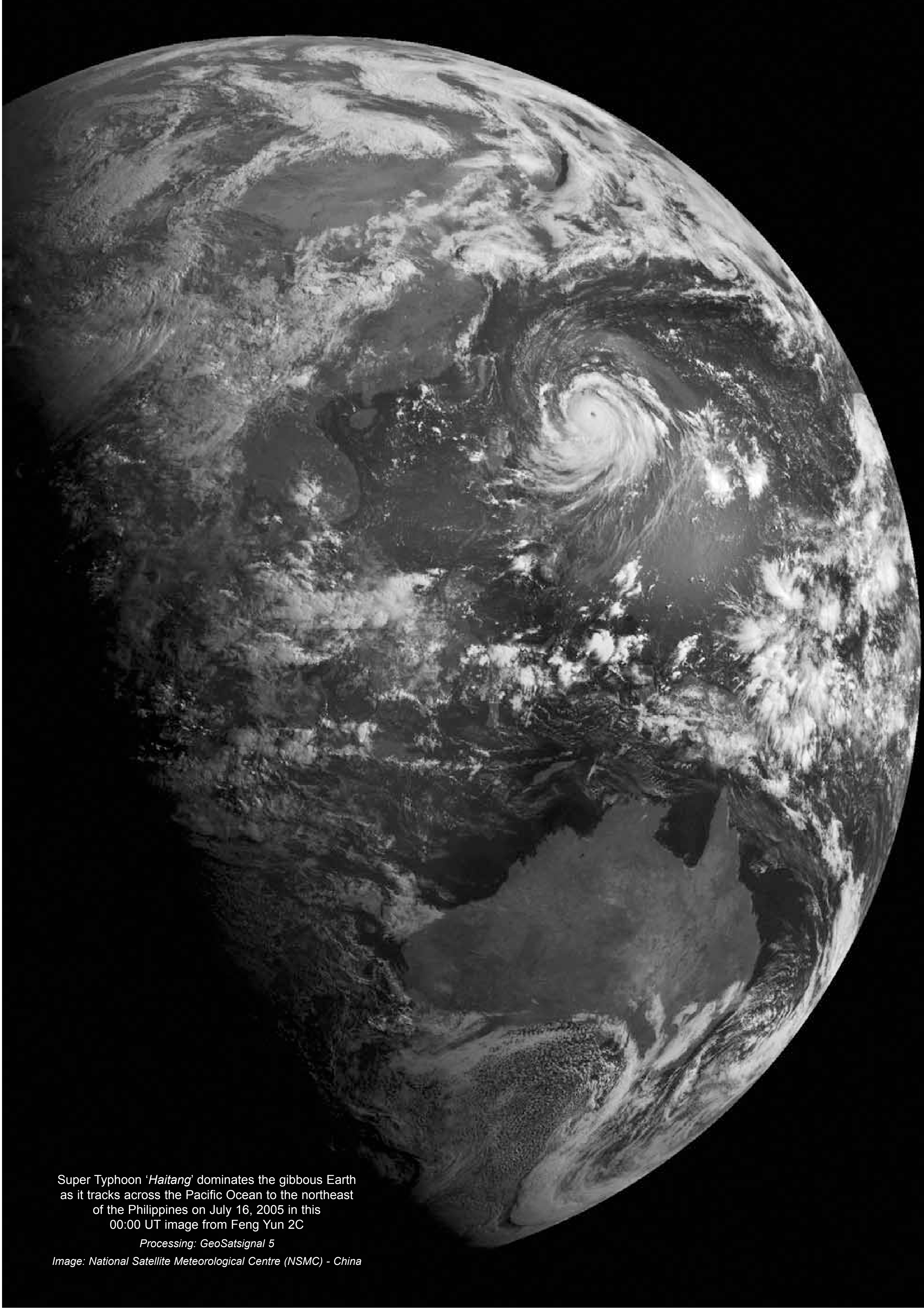


Figure 3 - Displaying an FY2C image using *HDF View*



Super Typhoon '*Haitang*' dominates the gibbous Earth as it tracks across the Pacific Ocean to the northeast of the Philippines on July 16, 2005 in this 00:00 UT image from Feng Yun 2C

Processing: GeoSatsignal 5

Image: National Satellite Meteorological Centre (NSMC) - China

GEO Member **Hartmut Schaksmeier** from Remschied, Germany sent us these images relating to NOAA-N. Above is a detail of the Great Lakes region from the 18:55 UT pass on July 15, 2005, prepared using David Taylor's HRPT Reader software.

Credit: NOAA CLASS Archive ()http://www.class.noaa.gov)

At upper left is a photograph of the early morning launch of NOAA-N from Vandenberg Air Force Base on May 20 while below is a photo of the Delta II launch vehicle on its launch pad.

Photos: NASA/NOAA

Road to Damascus

Francis Bell

My thanks to ***Wimbledon and District Radio Society*** for inviting me to their one-week field expedition in early August 2004. I could only stay one night but others from the society were there for the entire week. I admired the skills of the people there; operating amateur radio and contesting in different modes on various bands. Although I can do this, my main interest lies in satellite communication, particularly weather satellites.

I camped overnight on one of the highest locations on the North Downs, near Reigate, Surrey. Others more organised than myself had comfortable mobile homes but I was happy under canvas. Camping expeditions with the family in France have made me quite resourceful inside a tent.

My arrival was shortly after midday. I quickly set up my tent followed by the installation of a Meteosat-8 receiving station. I used my 60 cm dish and a small computer. It worked well and I demonstrated live Meteosat reception for 24 hours. My thanks to Graham Seale for providing me with 230 V from his generator.

I'm not sure how many people were there: 20 to 30 perhaps. Sitting around a table in the evening with some of the members I casually asked: 'Are there any satellites coming overhead soon?' With the aid of a computer somebody said yes: 'ECHO and NOAA-17 in a few minutes.' With my hand-held receiver, I demonstrated the live downlink audio from both satellites. I thought it was a good demonstration with only ten minutes notice.

The point of writing this article relates to 8.00 a.m. the following morning. Following my night under canvas I awoke to a beautiful sunny morning with a crystal clear sky. One of my friends said to me: 'One of our members has a telescope to look at the sun'. Just a few minutes later I was on the receiving end of a demonstration.

The next sentences should be read with care. This is not advice—it is an absolute instruction. NEVER look at the sun through any optical instrument unless you are 100% confident that you know what you are doing. Otherwise you may finish up blind. Don't do it!

I could scarcely believe what was happening! A WDARS member brought out his very special telescope with its very expensive filters and pointed it at the sun. 'There!' he said: 'Look at that' Being ultra cautious I had watched him. 'Are you sure this is okay?' I asked twice. 'Yes'... so I looked.

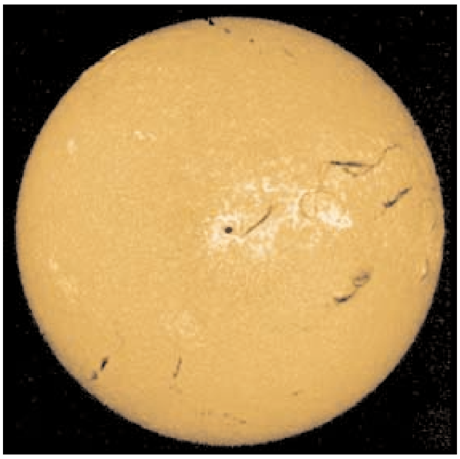
Wow! If there was ever a road to Damascus this was it for me. I could see our sun in real time using its hydrogen alpha emission line. No other radiation was being allowed through the telescope. The sun was visible as a dark red disc. The details were staggering. Not only could I see the sun's surface (with a distinctive granular appearance generated by convective cells): dark spots, prominences and great arching loops above the surface—like magnetic rainbows—were visible.

This was real time: not archive material. I was looking at our local star and in the 30 minutes of my observation I could see that it changed. Our sun is not a stable, friendly glowing ball of fire. It is dynamic ... a bubbling, heaving, pulsing, magnetically varying ball of fusion. If anybody thinks our sun is constant try observing it for 30 minutes (but ***not*** without a specialist instrument please). It changes minute by minute.

Of course I understand the intense scientific research that goes into the study of the sun. I have seen and respect the published papers and images from Earth-based observations and from the satellite SOHO (there is a clue here). But for me there is no substitute for seeing it myself in real time.

I guess that's why I'm interested in weather satellites. Live reception or live observation—that's what gives me a buzz. My eyeball on something new. That's what I like.

Our sun. A hot tennis ball in my sitting room. Constant? Certainly not! Science just does the best it can to explore what is ultimately our Earth's energy life support system.



A typical hydrogen-α image of our sun

Tenting on the North Downs

The Meteosat-8 station inside the tent

WADS meeting on the North Downs

Using Scripts with DIGITAL ATMOSPHERE WORKSTATION

Fred van den Bosch

Introduction

I am lazy! So I work very hard to automate as much as possible. For *GeoSatSignal* you can do that by using batch jobs. I do this to decode images in a format that I can use for *Digital Atmosphere Workstation* [1]. *Digital Atmosphere* (often called *DAWS*) can also be automated, by means of scripts [2]. A script is a combination of commands which are executed in sequence. A *DAWS* script is prepared with a simple text-editor like *Notepad*. *DAWS* has two types of script:

- **Scheduler scripting** is used for letting *DAWS* do various tasks while unattended.
- **Analysis scripting** is used to build products in a very flexible way.

In practice both types can be combined into a single script that runs at predefined times and gives predetermined products. Many people find scripting to be somewhat vague and difficult. In this introduction I will try to demystify it a bit.

Making a script takes three stages:

- designing
- coding
- testing

Each of these stages will now be described in detail.

Designing a Script

Before you make a script you must think of what you want to perform in it. You can do that thinking in *Notepad* in the form of comments. A comment is plain text with, in the first position, a '#' character. This line will be ignored when the script is read by *DAWS*. So open Notepad and start by keying in the first few lines describing the purpose of the script. Here is an example ...

```
#
# Show an MSG image with a fleetcode overlay
#
```

OK, this is the beginning. Now think of the different tasks that must be executed to achieve this. The main one is that I want to show the fleetcode so ...

```
# Show fleetcode
```

And I want to do that on the latest MSG image, so I must get that image ...

```
# Import image
```

And, oh yes, I want to display the latest data, so I add ...

```
# Retrieve data
```

Now give the comments a logical sequence. This results in ...

```
#
# Show an MSG-image with a fleetcode overlay
#
# Retrieve data
# Import image
# Show fleetcode
```

Coding the Script

The hardest part of the exercise, deciding what the script must do, is now behind us. Now we have to start with the coding: writing the separate commands. For this you often require to search through the scripting chapters in the manual to see which commands can be used (the file *manual.pdf* is inside your *DAWS* folder). And then it's often a matter of trial and error to see if your script will do what you intended. In the example below, the scripting commands are capitalised for clarity (but this is not essential).

The first comment line: 'Retrieve data'. Searching the manual under 'Scheduler scripting' we find the DOWNLOAD command ...

```
DOWNLOAD,http://ftp.hb-yacht.ch/ASXX21.@D@S00,C:\Data\fleet.dat
```

This is one of the most difficult commands to understand. It says: "Download the file 'ASXX21', with the latest day and time, from the internet address 'http://ftp.hb-yacht.ch/'."

Scripts use tokens like '@D' (for the day) and '@S' (for the synoptic hour). When the script is run by *DAWS*, the program will substitute the correct day and hour for these tokens and end the filename with '00'. So if you ran the script on March 27 at 12.00 hours, the file downloaded would be 'ASXX21.271200'.

The second part of the command means: "Write this file to the folder 'C:\Data' under the name 'fleet.dat'." This folder name is your own choice but it **must** exist—you have to create it yourself before running the script! I created the folder 'Data' on my 'C:\' drive specially for storing my scripts.

The first command wrote the fleetcode data file to the hard disc. But you need to load the information into *DAWS* itself, so you must now import it. This is done with ...

```
INGEST,C:\Data\fleet.dat
```

This means: "Retrieve the datafile 'fleet.dat' from 'C:\Data\' and load it into DAWS."

Next we must load a *DAWS* **base map** generated to have the same dimensions as the Meteosat-8 image to be used [5]. I called this map (*Map-Europa.dmf)* and stored it in the folder 'C:\Map'. This is loaded with the command ...

```
LOAD,C:\Map\Map-Europa.dmf
```

This will ensure that all the necessary georeferencing data needed by *DAWS* to position synoptic data correctly over the image are also loaded. After this we can import the Meteosat-8 image (*Image-Europa.jpg)* that I created in *GeoSatSignal* ...

```
IMPORT,C:\Map/Image-Europa.jpg
```

This command replaces the *DAWS* base map with the Meteosat-8 image from *GeoSatSignal*. If you want to see the country boundaries you can add the command ...

```
BASEMAP
```

to your script.

So the result up to now is that we have an image with country boundaries on the screen.

The final step is to show the fleetcode. Searching in the list of commands we find ...

```
FLEETF
```

This will display the fleetcode over the satellite image. And finally we add ...

```
STAMP
```

This adds a datestamp in the upper left corner of the image to indicate the date and time when you made this image.

The whole script now looks like this:

```
#
# Show MSG-image with Fleetcode
#
# Retrieve data
  DOWNLOAD,http://ftp.hb-yacht.ch/ASXX21.@D@S00,C:\Data\fleet.dat
  INGEST,C:\Data\fleet.dat
# Import image
  LOAD,C:\Map\Map-Europa.dmf
  IMPORT,C:\Map/Image-Europa.jpg
  BASEMAP
# Show fleetcode
  FLEETF
  STAMP
```

This completes the coding of the script. But is it OK? It's time for the final step.

Testing the script

Whole books are written about testing so I can give here just a few hints.

Test your scripts carefully!

And keep in mind: you often read what you *think* you have written. This means that if you cannot find the problem, explain it to someone else or let another person check the script.

Comment out Commands for Test Purposes

If you are not sure about a certain command you can add a '#' in front of it so that it is (temporarily) ignored so you can see what happens.

Check the Input Files

If your script is not giving the result you expect, check not only your script, but also the input files. When I was working on a script for fleetcode, no output was being generated. After some trials I checked the files on the Internet site.

Normally there exist 31 groups of 4 files (for a 31-day month), for 0000, 0600, 1200 and 1800 hours, e.g. 'ASXX21.271200' as explained above, where '27' is the day of the month.

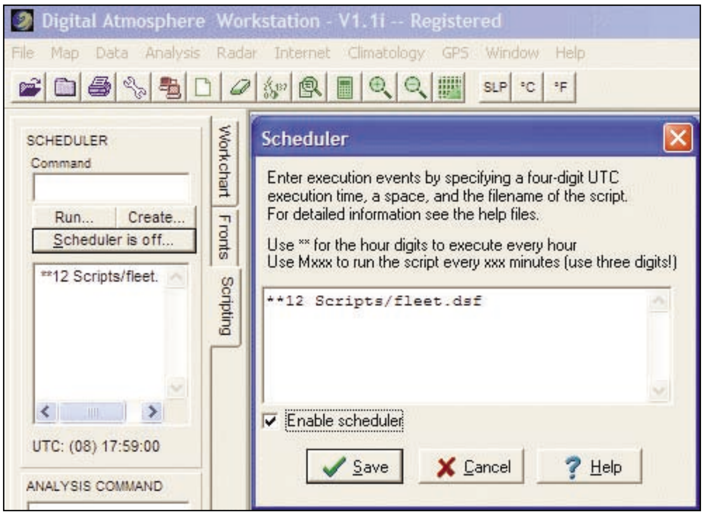
At the beginning of each day, or possibly later that day, each of the previous month's files for that day are cleared and 'no entry' is written into them. As soon as the synoptic information is available it is written into the file but this can be up to a couple of hours later than the time indicated by the filename. When *DAWS* reads a file with 'no entry' in it the script performs without errors. Only, it does not plot the fleetcode.

Save your Script

Once your script is working correctly, save it with a meaningful name, and the filename extension '.dsf'. The file described above could be called *fleet.dsf*. You can save this in the DAWS folder, or even better, a sub-folder called 'Scripts'.

Automatic Scheduling

Click the 'Scripting' tab at the upper left of the DAWS screen and then the 'Scheduler is off...' button. The following window appears.



In the right-hand panel, enter the time you wish to run the script in 4-digit UTC format (hhmm). By using '*' wildcards, I can make this script run automatically at 12 minutes past every hour, all day long. Finally, check the 'Enable scheduler' box and click 'Save'. The window closes and the scheduler button at upper left now says 'Scheduler is on'.

You can also make the scheduler run at a predefined interval (in minutes) by using 'M' followed by the minute interval expressed as three digits. For example, to run the script every 12 minutes use 'M012' as the time. A new interval begins immediately after the prior one has ended, rather than after the completion of any task at hand, so the time accuracy is reliable and predictable [3].

A Simple Temperature Script

Many of the overlay maps created in Digital Atmosphere can be improved by adding colour fills, for example, to areas with a particular temperature range. Figure 2 is a temperature chart for Europe. Isotherms are drawn every 5°C, and each 5° range is coloured differently. The script for this was ...

```
# Displaying temperature in 5-degree steps
ERASE
# Fill the temperature zones
ANALYZE,OVER FILL COLOUR=064:128:255 FILS=0 LSTN=0 TEMP
ANALYZE,OVER FILL COLOUR=064:160:192 FILS=0 GRTN=0 TEMP
ANALYZE,OVER FILL COLOUR=096:192:128 FILS=0 GRTN=5 TEMP
ANALYZE,OVER FILL COLOUR=128:160:000 FILS=0 GRTN=10 TEMP
ANALYZE,OVER FILL COLOUR=192:192:000 FILS=0 GRTN=15 TEMP
ANALYZE,OVER FILL COLOUR=224:160:000 FILS=0 GRTN=20 TEMP
ANALYZE,OVER FILL COLOUR=255:160:000 FILS=0 GRTN=25 TEMP
# Now draw the isotherms
ANALYZE,CONT CINT=5 COLOUR=100:100:100 LINE=1 TEMP
STAMP
```

Explanation

The first comment is ERASE, which clears the screen.

The 'ANALYZE' lines are more difficult, particularly as DAWS executes them from right to left. Let's take the first example one term at a time to explain what is happening.

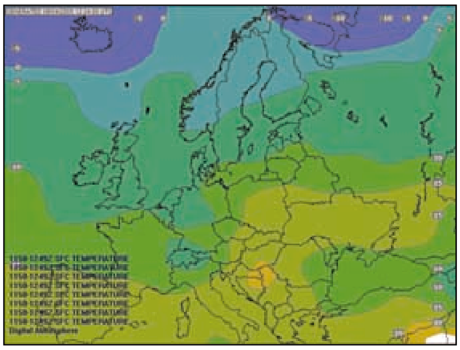


Figure 2 - Temperature zones - April 7

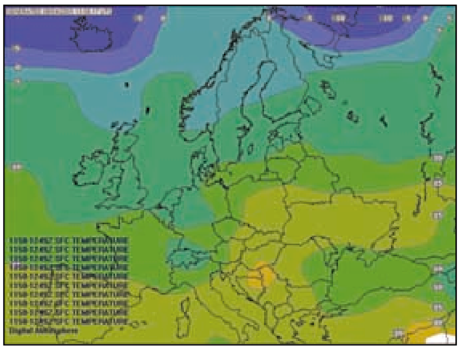


Figure 3 - Temperature zones - April 7

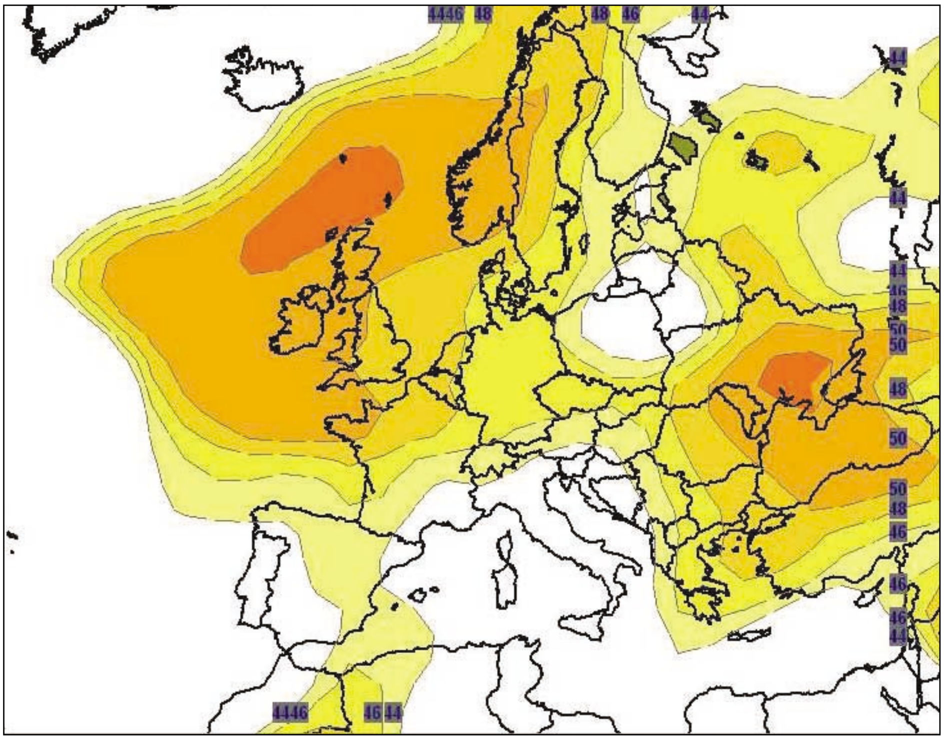


Figure 4 - TT chart created by the TT script opposite for May 22, 2005

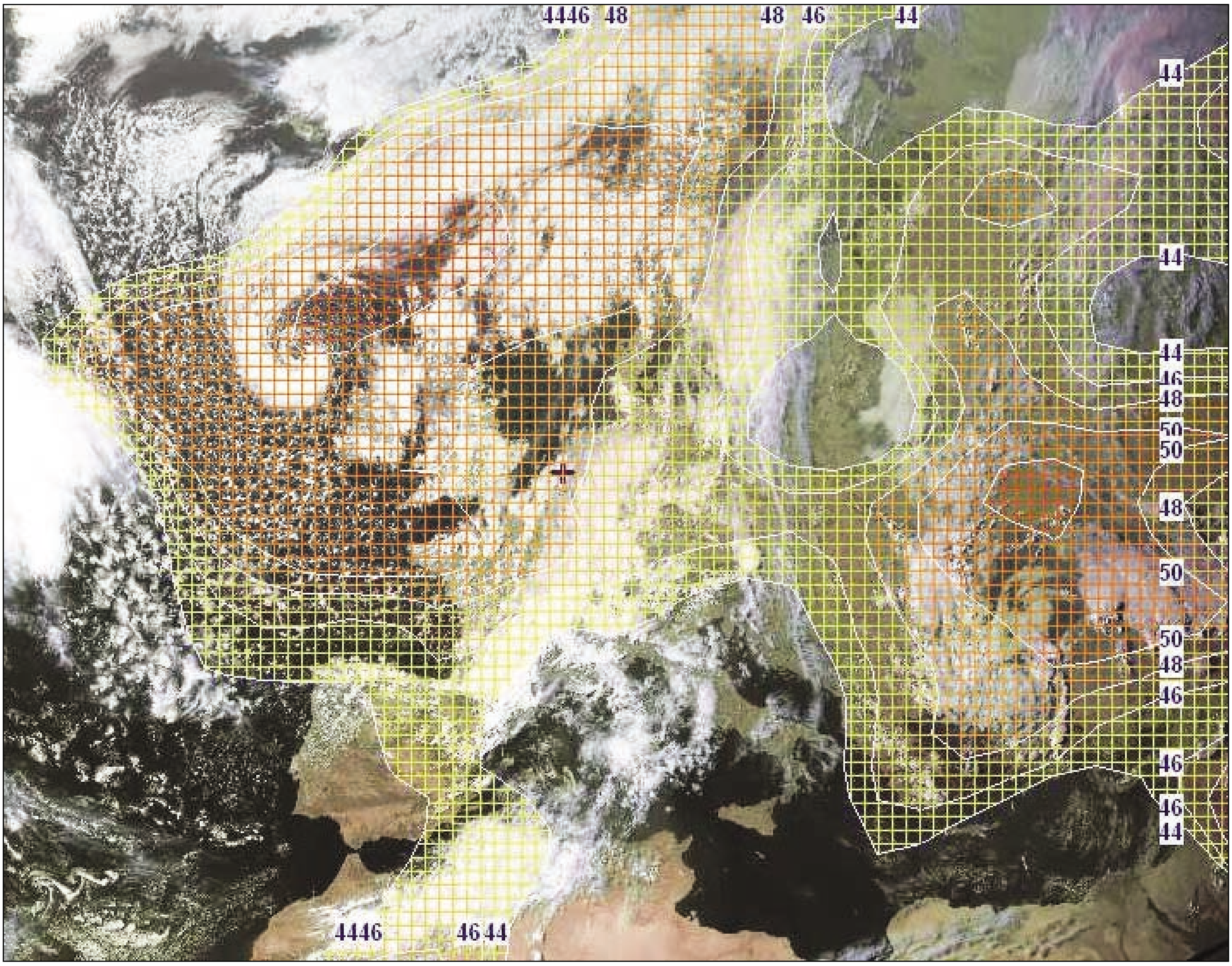


Figure 5 - The Meteosat-8 image from 16:00 UT on May 22, 2005 with a TT index script overlay (using a hatched fill)

Image: © EUMETSAT 2005

TEMP	take the temperature in °C
LSTN=0	if this temperature value is less then 0
FILS=0	use fill-style 0 (solid)
COLOUR=R:G:B	select colour red, green, blue
FILL	fill the entire area (temp<0) with this colour
OVER	overlay translucently on the basemap
ANALYZE	make all the above commands happen

The next six lines are similar except that they operate for temperature values greater than (GRTN) specified values.

The final 'ANALYZE' line draws the actual isotherms.

TEMP	take the temperature in °C
LINE=1	set the thickness of the lines (isotherms)
COLOUR R:G:B	select the line colour
CINT=5	select the contour (line) interval (5°C)
CONT	draw the contours (isotherms)
ANALYZE	make all the above commands happen

Finally, if you wish, you can add the 'STAMP' command to add a timestamp in the upper left corner of each image.

A Script to Handle Negative Temperatures

If you look carefully at figure 2, you will notice that all temperatures below zero are the same colour. This is because a *DAWS* script cannot (at present) handle negative numbers, so everything 'less than 0' is treated equally. But a little trickery can solve the problem, as in this script.

```
# Displaying temperature in 5-degree steps
ERASE
# Set a temperature offset of 15 degrees
ANALYZE,SADC=1:15 STOR=1 TEMP
# Apply fills in 5° steps
ANALYZE,OVER FILL COLOUR=000:064:255 FILS=0 GRTN=0
ANALYZE,OVER FILL COLOUR=000:096:255 FILS=0 GRTN=5
ANALYZE,OVER FILL COLOUR=064:128:255 FILS=0 GRTN=10
ANALYZE,OVER FILL COLOUR=064:160:192 FILS=0 GRTN=15
ANALYZE,OVER FILL COLOUR=096:192:128 FILS=0 GRTN=20
ANALYZE,OVER FILL COLOUR=128:160:000 FILS=0 GRTN=25
ANALYZE,OVER FILL COLOUR=192:192:000 FILS=0 GRTN=30
ANALYZE,OVER FILL COLOUR=224:160:000 FILS=0 GRTN=35
ANALYZE,OVER FILL COLOUR=255:160:000 FILS=0 GRTN=40
ANALYZE,CONT CINT=5 COLOUR=100:100:100 LINE=1 TEMP
STAMP
```

The first 'ANALYZE' process increases the values of all temperatures by 15. This ensures that -15°C is converted to 0°C (a positive number) and so on, so that it can be handled by *DAWS*. These terms are:

TEMP	take the temperature in °C
STOR=1	store this value (in storage slot No 1)
SADC=1:15	add 15 to the number stored in slot No 1

This calculated value (rather than the actual temperature) is next passed to each of the following statements in turn to determine the appropriate fill colour; everything else is the same as before. You can see the result in figure 3 where there are now additional 5-degree colour bands for negative temperatures.

There are numerous tricks that you learn as you create more scripts. One useful one is that once a parameter has been selected (e.g. TEMP), it applies to all following 'ANALYZE' commands until a new parameter is chosen. So in the example in the previous column, the 'TEMP' parameter could in fact be omitted from every 'ANALYZE' line *after* the first one. To run this script you must first load suitable synoptic data into *DAWS* using the **<Internet → Retrieve data>** menu and selecting 'SYNOP from Albany (worldwide)'.

A Script for the Total Totals Index (TT).

The so-called 'totals totals index' is an index of atmospheric instability and uses temperature parameters at two different levels in the atmosphere to determine the potential for thunderstorms. It is expressed by the formula

$$TT = (Td_{850} - T_{500}) + (T_{850} - T_{500})$$

where T_{850} and T_{500} are the temperatures at the 850 mb and 500 mb levels in the atmosphere and Td_{850} is the dewpoint temperature at the 850 millibar level.

The predicted risk of severe weather activity is as follows:

TT>30	Showers and thunderstorms become increasingly likely
44-45	Isolated moderate thunderstorms
46-47	Scattered moderate / few heavy thunderstorms
48-49	Scattered moderate / few heavy / isolated severe thunderstorms
50-51	Scattered heavy / few severe thunderstorms and isolated tornadoes
52-55	Scattered to numerous heavy / few to scattered severe thunderstorm / few tornadoes
TT>55	Numerous heavy / scattered severe thunderstorms and scattered tornadoes

In this script we will use different colours, lines and coloured areas. First the whole script is presented and then follows an explanation.

```
ERASE
STOR=1 DWPT H850
STOR=2 TEMP H500
STOR=3 SDIF=1:2
STOR=4 TEMP H850
STOR=5 TEMP H500
STOR=6 SDIF=4:5
ANALYZE,SSUM=3:6
ANALYZE,OVER FILL COLOUR=224:255:224 FILS=0 LSTN=44
ANALYZE,OVER FILL COLOUR=255:255:100 FILS=0 GRTN=44
ANALYZE,OVER FILL COLOUR=255:240:000 FILS=0 GRTN=46
ANALYZE,OVER FILL COLOUR=255:204:000 FILS=0 GRTN=48
ANALYZE,OVER FILL COLOUR=255:161:000 FILS=0 GRTN=50
ANALYZE,OVER FILL COLOUR=255:097:000 FILS=0 GRTN=52
ANALYZE,OVER FILL COLOUR=255:014:014 FILS=0 GRTN=55
ANALYZE,CONT CINT=2 LSTN=53 GRTN=44 DASH COLOUR=100:100:100
ANALYZE,CONT CINT=5 GRTN=55
```

The first lines introduce some new terms which are required to make the TT calculations.

H850	set the 850 mb level
DWPT	take the dewpoint (Td850, °C)
STOR=1	store in slot No 1
H500	set the 500 mb level
TEMP	take the temperature (T500, °C)
STOR=2	store in slot No 2
SDIF=1:2	subtract the values in slots 1 and 2
STOR=3	store the result in slot 3 (Td850 - T500)
H850	set the 850 mb level
TEMP	take the temperature (T850, °C)
STOR=3	store in slot No 3
H500	set the 500 mb level
TEMP	take the temperature (T500, °C)
STOR=4	store in slot No 4
SDIF=3:4	subtract the values in slots 1 and 2
STOR=5	store the result in slot 5 (T850 - T500)
ANALYZE,SSUM=3:6	Make an analysis based on the sum of the contents of slots 3 and 6

The next seven 'ANALYZE' lines are similar to those we met earlier and apply selected colour fills to areas.

Now we draw dashed contour lines at 2-TT intervals when the index is less than 53 but greater or equal to 44.

```
ANALYZE,CONT CINT=2 LSTN=53 GRTN=44 DASH COLOUR=100:100:100
```

COLOUR	set the line colour (see below)
DASH	draw a dashed line
CINT=2	do this with an interval of 2
GRTN=44	do this for every value greater than 44 ...
LSTN=53	... and less then 53
CONT	draw contour lines

Finally, we draw dashed contour lines at 5-TT intervals when the index is greater or equal to 55.

```
ANALYZE,CONT CINT=5 GRTN=55
```

To run the TT script you must first load suitable data into *DAWS* using the **<Internet → Retrieve data>** menu. 'Radiosonde from COD (worldwide)' is a good place to start. Figure 4 shows the *DAWS* chart produced using the noon data for May 22, 2005 while figure 5 displays it over a Meteosat-8 image. Note that, in the latter case, 'FILS=0' has been replaced by 'FILS=1' to produce a cross-hatched fill which allows the satellite image to show through better.

Note

The first time I did this I wrote 'CINT=2 GRTN=55' and to my surprise obtained a contour line at 54! After playing with the values it turned out that the starting point is the nearest, lower, multiple of 'CINT' (in this case 54). So asking 'GRTN=55' with 'CINT=5' starts at 55. In fact, using 'CINT=11' is perhaps a better solution as there will be no more lines until 66.

How to Produce Colours

Each colour is made by a combination of Red, Green and Blue (RGB). Each RGB triplet is defined by three numbers from the range 0 to 255. For example, red has an RGB-value of 255:0:0, green 0:255:0 and blue 0:0:255. A nice little program to find RGB-values is *Colour Cop*, which can be downloaded from:

http://www.datastic.com/tools/colorcop/download.php

When you start it, click on 'Custom' to open the colour palette. When you click the cursor on a colour, you see in the lower right corner the RGB-value of that colour. So for everything you want to plot you can look for a suitable colour in the palette, note the RGB-value and use it in your script. When you have decided on all your script colours, run it and see how it looks. If some colours are not exactly as you planned, you can return to Colorcop and change the values a little. This is definitely a matter of trial and error. But if you know how this works you can change every script to your own wishes.

At this moment it is perhaps a good idea to play a bit with this script: change the value of COLOUR and FILL to see what happens. And then it's time to make your own script.

Tips and Tricks

- Practice, practice, practice. This is the most important tip. You can only learn scripting by doing! You can find some good script examples by following the link to 'Digital Atmosphere scripting' in the Digital Atmosphere on-line forum at:

  http://www.weathergraphics.com/forum/
- Try them and see what happens, then use the information for your own scripts. We have a Dutch proverb: 'beter goed gejat dan slecht verzonnen' which, translated, means 'better to copy well then invent badly'.
- When *DAWS* performs an analysis, it reports each activity in the 'Legend block' at the lower left side of the image. This can become very intrusive with complex scripts. Unfortunately, there is no way at present of disabling this feature. The best that can be done is to display it in the smallest style possible. Do this from **<File → Preferences → Styles>** by changing the entry under 'Legend block' to SIZE=1, FONT=Arial.
- If a command line is followed by one or more ***trailing spaces*** the command does not work.
- The command ***GRTN*** (greater than) in fact means 'greater than or equal to'.
- ***Negative*** values cannot be included in commands.
- Beware! At the time of writing this article the scripting language still has some bugs. If your script is not doing what you expect, the fault is not always yours!

Digatmos.mnu

Make a print of this file, which you can find in the *DAWS* folder. This file contains all the menu commands that drive the *DAWS* 'Analysis' drop-down menu, and you can use them in your scripts. Just add 'ANALYZE,' at the start of each line. You can make any line into a comment by making the first character the hash (#) symbol.

Write in Parts

Don't write a long and complex script in one try. Divide the problem into several parts, write and test them separately and finally combine them to one script.

One Script or Many Scripts

Think carefully about the way you want to make the scripts. You can write

- one big script with a lot of tasks in it, or
- many small scripts

The advantage of a big script is that it's easy to run. Run a single script and everything happens. The disadvantages are that it is difficult to maintain and you can never use the commands separately (for debugging) and view the result on the screen.

For a set of small scripts it is the opposite. They take longer to analyse and run but, since each executes just one task, debugging is easier (you can comment out commands easily to see their effect). This is my personal preference.

I hope that, in the future, there will be a possibility to combine small scripts in an easy way and I have already added this wish to the forum.

Comments

Write comment lines in the script. This will help you later if you want to change things. And believe me, if you don't, then after just a short time you will think when you look at a script: "What on Earth was my intention when I did this?'

Different Folders

In the folder where *DAWS* is installed make a new folder with the name 'Scripts' and put all the scripts in it. This prevents a lot of searching. If you want you can do the same with maps: all the different maps you are generating as base maps. And finally make another folder where you can store all the maps with overlays generated by your scripts (the place is not important).

Analysis commands

In the manual (manual.pdf) is a list of commands grouped by type. On the forum I have placed a list of analysis commands sorted by name. This is very useful if you look at scripts written by others.

KISS

And last but not least: Keep It Simple S..... For instance, you can combine a lot of commands into one statement of up to 255 characters. Although a script with a couple of these long lines performs a bit quicker, it is very difficult to read and understand. Personally I always write one command on one line. See the above example and some of my examples on the *DAWS*-forum.

Good luck with creating new scripts and, if you develop a nice script, please put it on the *DAWS* forum.

References

1. Digital Atmosphere Workstation
   http://www.weathergraphics.com
2. Digital Atmosphere User Manual, Tim Vasques and Shannon Key
3. Digital Atmosphere forum
   http://www.weathergraphics.com/forum/
4. Use 'Fleetwood' data to add synoptic details to Meteosat images, Ton Lindemann, GEO Q4, page 25 (2004)
5. My experiences setting up an MSG-1 System, Fred van den Bosch, GEO Q5, page 44 (2005).

In our Next Issue ...

- Fred van den Bosch demonstrates how easy it is to create 3D colour images from your APT (and HRPT) weather images.

- Fred has also kindly written up the talk he gave at Symposium 2005: '*POVIM - A Framework for Product Orientated Video, Images and Maps*'. This deals with the systematic organisation, on the PC, of all the files relating to a fully automated MSG data retrieval system.

- We will also be reviewing a new, complete, APT station called WEATHERMAN, produced by the German company *Vierling*. This consists of a computer controllable APT receiver, operating software and a QFH antenna.

  If you would like a sneak preview, go to:

  http://www.vierling.de/www_vierling/ weatherman-en_667_340_6_f.htm?query=

- We will also be evaluating *APTDecoder*, a new software offering that promises to rival current APT decoding favourites such as WXsat and WXtoImg.

  If you would like to try out this new package, it can be downloaded from:

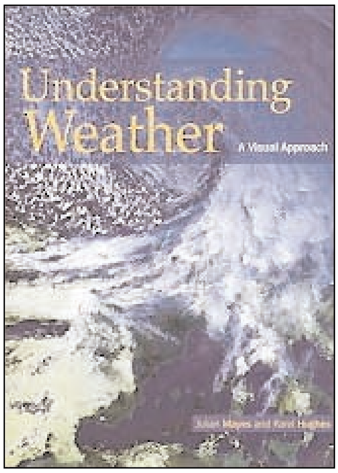
  http://www.ptast.com/apt/decoder

- Have you ever wished that you could power your weather satellite receiver from just 4 rechargeable 'AA' batteries so that you could image satellites when away from home? Richard Osborne describes a simple construction project that will help you do just that.

Understanding Weather

A visual approach

A book review by Robert Moore



This book is a very useful addition to the shelves of weather observers who make use of satellite data and for satellite hobbyists. The book is well in advance of the 'beginners guide' but you do not need a degree in physics or maths to learn a great deal from it. It fills an important gap in the literature available to support amateur earth-observers (see 'Some Useful Titles' at the end of Observing the Weather with MSG-1 in GEOQ 3). As soon as you turn the pages you will recognise familiar images—indeed you may have received the same images and have them stored in your archives.

In chapter 4 for example there is an extremely useful discussion of reflection, absorption and scatter accompanying a clear account of why particular frequencies are used for weather satellite operations. The authors force you to ask what exactly it is that you see in an image and why you see it. The discussion largely confines itself to the use of visible, infrared and water-vapour imagery, only mentioning briefly some of the more complex atmospheric soundings that are now becoming available. Discussion of the latter would have lengthened the book and detracted from the clarity of the discussion.

The book is copiously illustrated and includes boxes in which particular topics are expanded. Unfortunately, the illustrations become somewhat separated from the relevant text, requiring the use of fingers and thumbs to follow the argument. It is hard to avoid this happening in a book of this nature but the publishers really should have tried harder. There is also a slight tendency for the authors to repeat themselves in ways which may be useful for some readers but confusing to others.

One really nice feature of the book is that the authors discuss what we do not know: the uncertainties and controversies amongst scientists. No science is about Truth with a capital 'T' and this is no less the case in meteorology. Mayes and Hughes draw our attention to this rather than skirting around the issues.

Most books dealing with the analysis of satellite imagery discuss Northern American weather systems. *This volume concentrates on the UK and Europe*, with shorter discussions of the USA and other regions. So if you are not already a weather expert but wish to extend your understanding of the images you receive from NOAA satellites and Meteosat-8 then you need this volume for your book shelf. It will certainly make all readers look at their satellite imagery with even greater care and interest.

Understanding Weather : A visual approach *(188 pages)*
Authored by Julian Mayes and Karel Hughes
Published by Arnold (London), 2004
ISBN 0 340 80611 7

Hurricanes to Intensify

. . . as Earth warms?

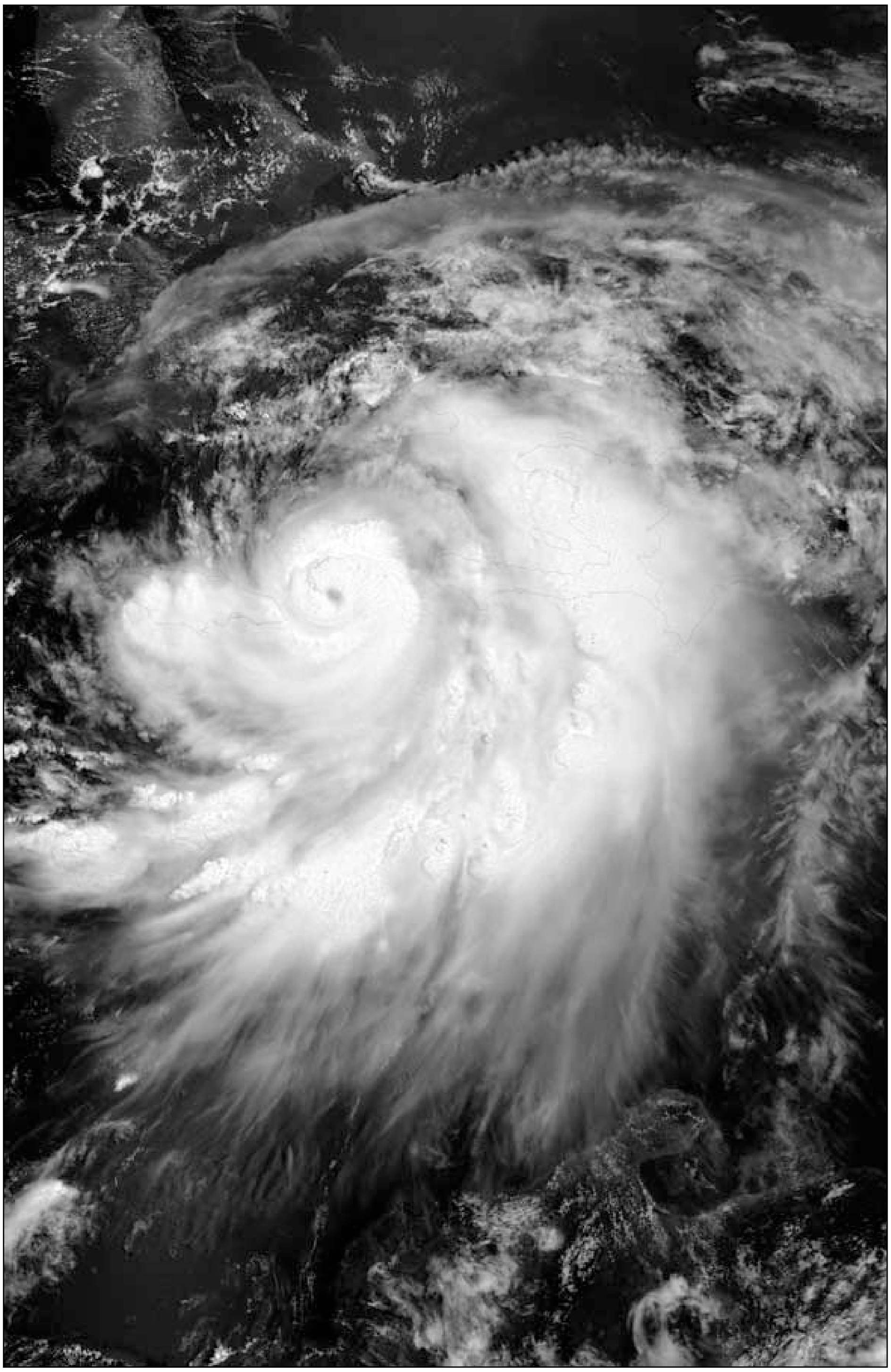
The sustained hurricane onslaught endured by North America's Atlantic coastline during 2004 has served to highlight recent arguments that human-influenced environmental changes may be increasing both the severity and frequency of such storms. Human activities are changing the composition of the atmosphere and global warming, which is manifested in unexpected ways, is one of the consequences.

World-wide sea surface temperatures have risen by approximately 0.5°C during the past 100 years and the quantity of water vapour over the oceans has increased by about 2% since 1988.

Most hurricanes that strike the U.S. coastline are born in the tropical North Atlantic Ocean, where sea-surface temperatures over the past decade have been the warmest on record. Increased ocean surface temperatures means that the environment in which hurricanes form is changing and one notable manifestation was the March 2004 hurricane in the South Atlantic, off the coast of Brazil—the first and only such hurricane to be recorded in that region. The warmer sea surface and moister atmosphere furnish potential energy for the showers and thunderstorms that fuel hurricanes: the additional water vapour will tend to produce heavier rains within the hurricanes and an increased risk of flooding at landfall. The evidence strongly suggests more intense storms and risk of greater flooding events for the future, so that the North Atlantic hurricane season of 2004 may well be a harbinger of things to come.

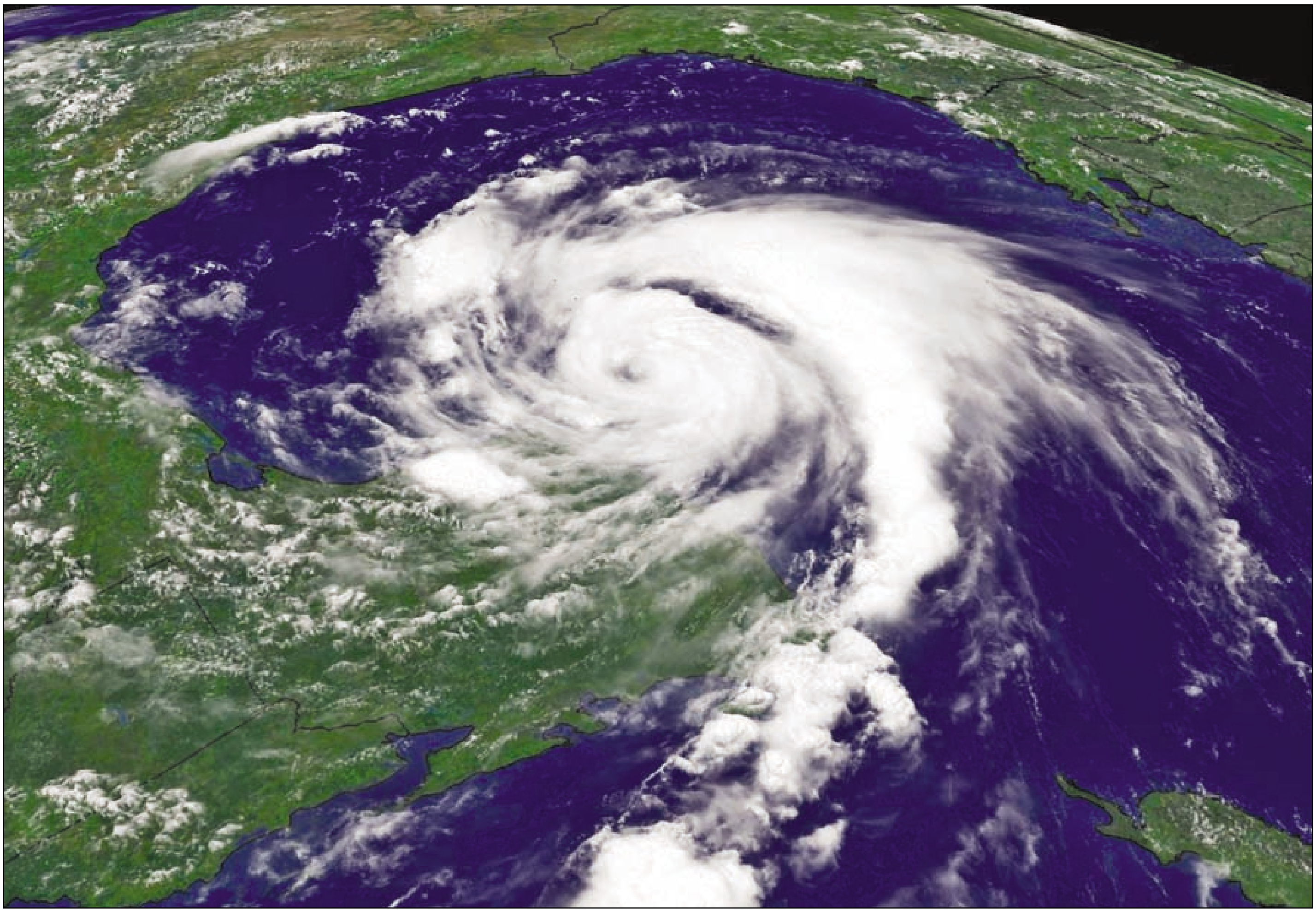
The effect on hurricane numbers is less certain as models disagree on how global warming might affect the wind shear that can either support or discourage hurricane formation.

Globally, the number of hurricanes and typhoons tends to hold relatively steady from year to year. When activity increases in the Atlantic, it often decreases in the Pacific and vice versa, based in part on the El Niño and La Niña phenomena. Because hurricane numbers vary so greatly on a regional level from year to year and also from decade to decade, it is difficult to use statistical techniques to extract longer-term trends in the number of hurricanes that form and where they move.



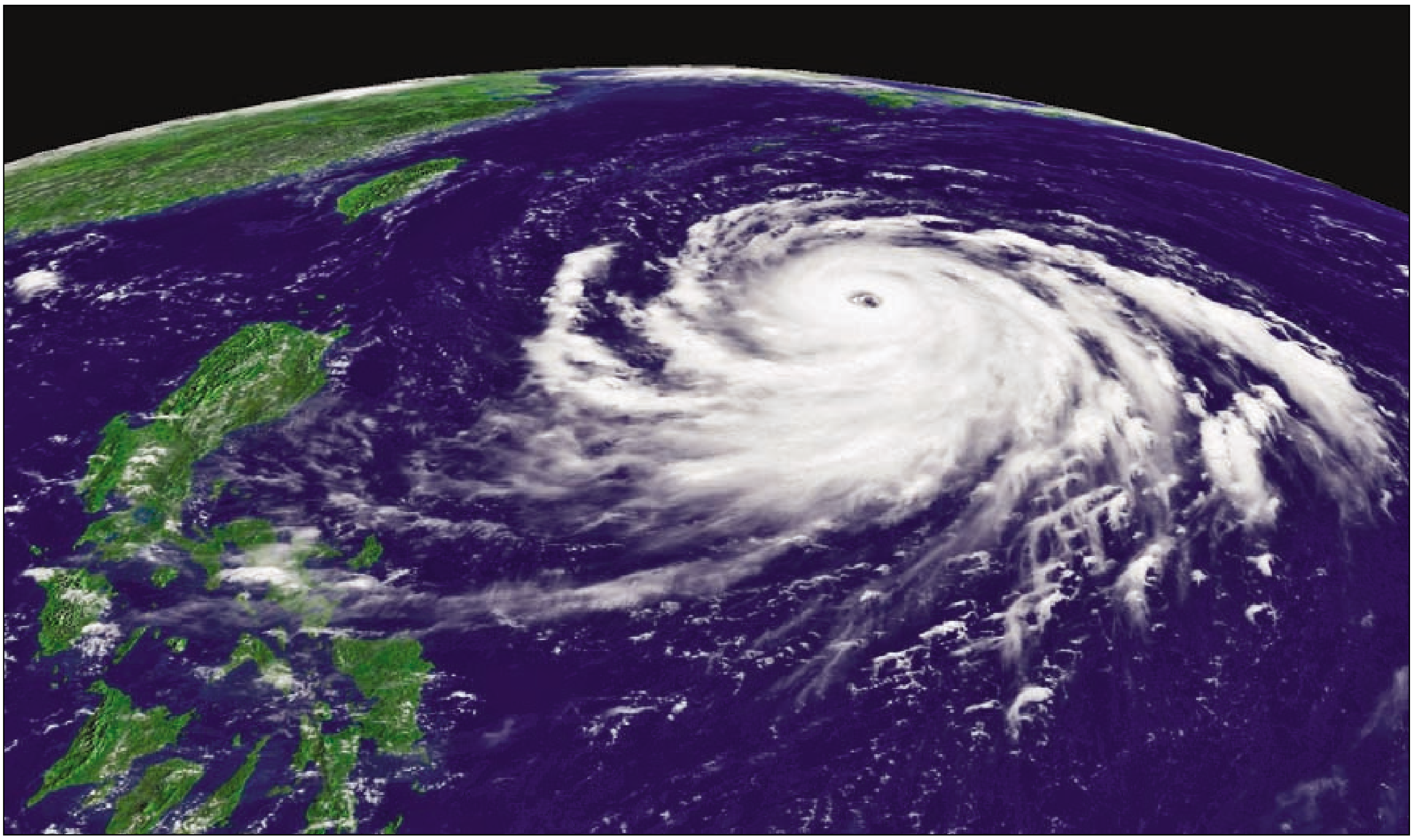
Hurricane ***Dennis***, imaged approaching Cuba by the MODIS instrument aboard NASA's Terra satellite on July 7, 2005

NASA Image courtesy Jeff Schmalz, MODIS Land Rapid Response Team at NASA GSFC



Hurricane Emily as imaged at 18:15 UT on July 18, 2005 by GOES 12

Image NOAA/NESDIS (http://www.nnvl.noaa.gov/)



Super Typhoon Haitang to the northeast of the Philippines, as seen by GOES 9 at 03:25 UT on July 16, 2005

Image NOAA/NESDIS

AFTERSHOCKS

A report on continuing earthquake activity in the Indian Ocean Basin

C S Loh

Following the 2004 Boxing Day tsunami in Southeast Asia, aftershocks have continued to propagate through the Indian Ocean basin as Earth's interior readjusts to the surface changes.

The Nias Quake

At 16:09 UT on March 28, 2005, a powerful magnitude 8.7 aftershock took place on the same fault line, 69 km to the southeast, and was felt in Sri Lanka, the Andamans, Thailand, Malaysia and Singapore. The epicentre lay 12 km deep between the islands of Nias and Simeulue off western Sumatra (Figure 1). A 3-metre high wave swept into Simeulue and at Nias the sea surged at least 400 m inland destroying 70% of the buildings in the town of Gunungsitoli. Farther away the waves were much smaller: just 25 cm in Colombo, Sri Lanka and 10 cm in the Cocos Islands. At Malé in the Maldives, the tide gauge measured a wave height of 20 cm, compared with a 2 m tsunami following the December quake.

As a result of this quake the coastline in Simuele was reported to have been uplifted by a metre; at Sarangbaung, an island 20 km north of Nias, there was about 1.7 m subsidence. At Nias itself, uplift exposed offshore coral as illustrated in Figure 2a/b.

The aftershock originated south of the December earthquake and was of shorter duration and lower magnitude, leading to smaller waves. Furthermore, the December earthquake had a higher average slip, ruptured a longer section of the interplate thrust fault and occurred under a greater depth of water (up to 4 km compared with just 1 km) than the March event. It was this greater depth that produced the tsunami that lashed the Indian Ocean shorelines last December.

Another factor is that there was a 5 m vertical sea-floor displacement in December compared with 3 m in March resulting in a greater overburden of water being pushed upwards. Finally, the waves from the March aftershock spread mainly to the southwest across the Indian Ocean, avoiding any landmass where they could have created a major tsunami.

The Padang Quakes

Between March 28 and April 10 the Meteorological Services Department, Malaysia recorded more than 190

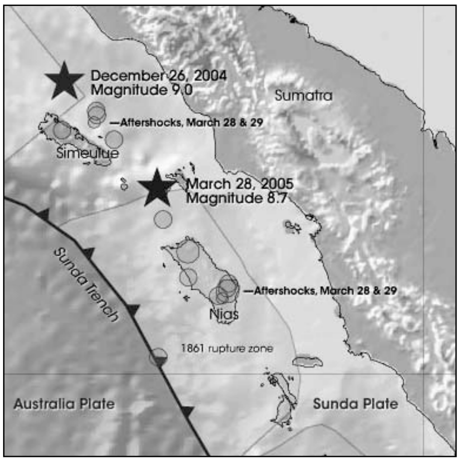


Figure 1 - Location of the March 28 quake

Credit: USGS

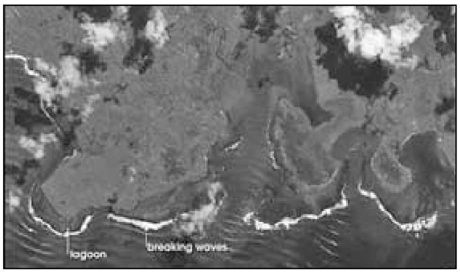


Figure 2a - Offshore coral - July 13, 2000

Terra ASTER Image courtesy NASA

Figure 2b - Offshore coral uplift - April 6, 2005

Terra ASTER Image courtesy NASA

aftershocks culminating in a magnitude 6.3 quake southwest of Padang in Sumatra. This was followed by increased activity in Gunung Talang, one of Sumatra many volcanoes as grey ash rose 250 m above its summit.

On May 14, another earthquake, of 6.9 on the Richter scale, was felt in Penang, Kuala Lumpur and Malacca during Saturday lunch hour, the epicentre reportedly 50 km northwest of Padang. Since the March tremor, seismological data indicate earth rupturing to have progressed southwards, accentuating future risks in other towns in Sumatra.

The R2FX APT Receiver

continued from page 21 ...

How to Obtain the *R2FX* Receiver

You can find full details concerning the *R2FX* receiver by visiting Holger Eckardt's website at:

http://www.df2fq.de

Although the site is in German, an *R2FX* manual in English can be downloaded as a PDF file from

http://www.df2fq.de/res/R2FX-Engl.PDF

To purchase an *R2FX* you must send 179 euros to:

Holger Eckardt
Kirchstockacherstrasse 33
D-85662 Hohenbrunn
Germany

Unfortunately, there is no facility for a credit card payment, so you have to either arrange a bank transfer or send cash. I sent euro banknotes in a jiffy-bag.

If you have any questions about the *R2FX*, do not hesitate to e-mail Holger Eckardt. Communication is not a problem as Holger speaks excellent English. Holger can be contacted at:

holger@df2fq.de

How to Align a Dish on Hot Bird

continued from page 22 ...

You can purchase 6° spacing LNB holders from satellite TV stockists but, as you will see, the position has quite a bit of 'play' and any DIY enthusiast could knock up a support arm from parts available at your local DIY store.

If you now place your LNB farther round to the west and pointed back into the dish you should find another strong signal. This is a combination of *Astra-2* at 28.2°E and EUTELSAT *EUROBIRD* at 28.5°E. This is the location for all the Sky TV services as well as FTA BBC-1 and BBC-2 national and regional opt-outs, BBC-3, BBC-4 and BBC interactive streams as well as several other English language services.

You could therefore mount two additional LNBs on to a DIY arm for extra FTO TV channels.

This will not interfere with your reception of *EUMETCast* via *Hot Bird-6* as your dish and primary LNB is already aligned to the *Hot Bird* 13°E location.

IN TRAY

The Column for Readers' Letters and Queries

e-mail: editor@geo-web.org.uk

Dear Editor,

I do agree with Peter Wakelin's nice conclusion on page 21 of the last issue of GEO Quarterly, but some of his statements are incorrect. His conclusion about the tightening of isobars shown in *Digital Atmosphere Workstation* (DAWS) is not the result of air moving around hills but a consequence of the internal calculation methods used in DAWS itself.

Readers should be warned not to use too small maps in DAWS. It would be better to use programs such as GrADS for in-depth analyses of the weather, or to use one of the on-line archived mapping sites/tools from NOAA.

Anyway, these hills are too small for this kind of effect. Air can move over hills to form mountain waves, or lengthwise (partly) along the hills to create eddies as on the images. In the latter case, it never results in pressure changes of several hPa. As we shall see, there was an inversion at 1700 m and the highest of the hills in question are around 400 m. Most of the air is just hopping over the tops.

Reports from weather stations are always in Mean Sea Level, meaning that they are reduced to 45° latitude at 0°C on sea level. This is resulting in a smoothed map where the effects of mountains and hills are faded out. I checked this with the on-line FNL archived analyses on the site of the Air Resources Laboratory/READY and there were no hill-tightening effects at all.

Peter suggests that there is a cloud layer with waves above the stratocumulus clouds. First: the cloud tops on the image are not stratocumulus, but just stratus in a varied density. Stratocumulus on satellite imagery looks like so-called 'closed cells': bright oval spots with a darker border. Stratus is smoother but can show a variation in thickness as darker and brighter lanes. Synoptic reports did indeed report stratocumulus cover on the cloudbase, but this was not visible by satellite as they are overlain by the stratus.

The types of the cloud layers can be checked by soundings. The nearest sounding, from Trappes (near Paris) at 12 UTC indicated a cloud layer from near surface up to 1.700 m. There were no clouds at higher levels (as Peter suggested) because of an inversion at 1700 m. At the inversion the relative humidity (RH) dropped down from around 95% to less as 10% at higher altitudes. Scattered clouds are possible if the air is more saturated than 70%, and it can become completely overcast if RH exceeds 90%. I made a double check with a hypothetical sounding calculated from the gridded FNL data for 50°N and 2°E, in the centre of the cloudmass, for 6 UTC, and found an identical inversion with a stratocumulus base with stratus on top and a cloud-free upper level up to 10 km.

About the waves: sometimes we can see them on the boundary layer of the stratus where wind is blowing over the cloud tops at the inversion level (like wind over water). This was the cause of the waves on these images.

Ton Lindemann, Meteo Maarssen
Netherlands

Hello Les,

Many thanks for the GEO June issue, I am enjoying it very much. Particularly the article of "*Introducing Digital Atmosphere Workstation*", which was very timely to me since I was just considering learning DAWS at that time.

I am including a NOAA-18 APT image of South East Asia (see page 40) dating from 04:55 UTC on July 17, which depicts Typhoon Haitang. The image was received by an RX2 receiver with a rotor controlled Yagi-Uda antenna and processed by *WxToImg* and *Photoshop Elements*.

Cheers,
Jiro JQ2LMG, Japan.

Hello Les,

Thank you for your great effort with the magazine—it is superb; and thank you in particular for your recent article on the production of HRPT Images from the 'NOAA Satellite Active Archive'.

Presently I'm preparing for the reception of NOAA 1.7 GHz signals (using Sam Elsdon's HRPT Receiver and hopefully Rob Alblas' Decoder.)

To help become familiar with David Taylor's Runtime Library Bundle and HRPT Reader Program, I could think of nothing better than the opportunity of downloading some NOAA passes over Australia: maybe the same passes that I already have in APT format. This would enable a direct comparison.

Ken Morgan
Brighton,
Victoria, Australia.

Tornado hits Birmingham

If you lived in the United States, a headline like this might not seem out of place. But Birmingham England?

On the afternoon of July 28 this year a freak mini tornado hit the Sparkbrook and Kings Heath districts of the UK's second largest city. The entire episode lasted no more than 10 minutes as the sudden storm cut a kilometre-long swathe through the city, blocking many roads by fallen trees and causing traffic chaos.

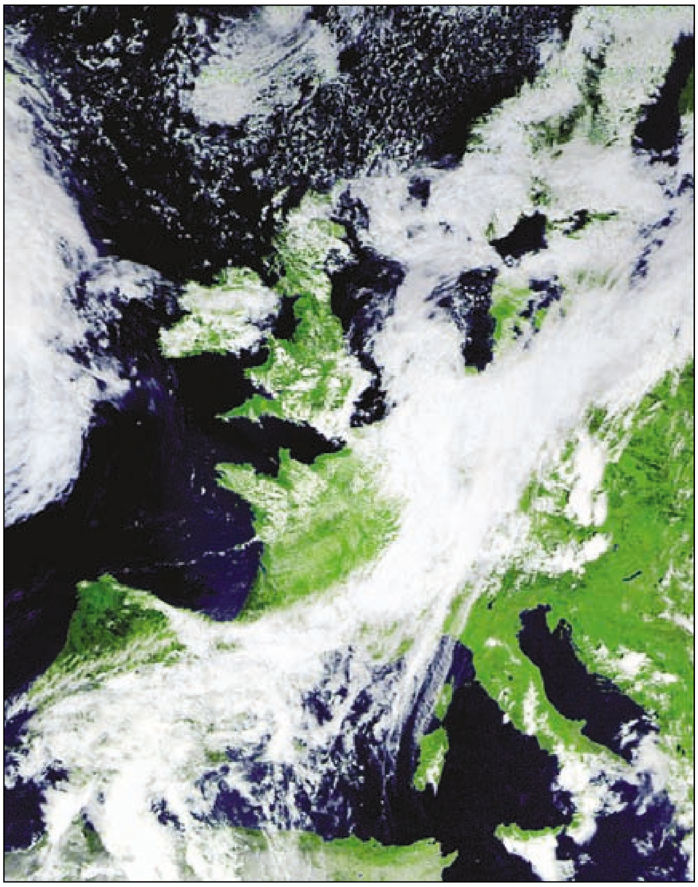
Following a spell of torrential rain it became very dark, the sky turned dull brown and powerful winds whipped up, felling hundreds of trees, overturning cars, toppling walls and stripping entire roofs from buildings. Rows of roofless houses were left with gaping windows. One observer noted '.. all of a sudden it got dark and the front door blew open.'

Weather experts judged the storm to have been a tornado with a rating of T3-T4, implying that windspeeds could have been as high as 200 km/hour.

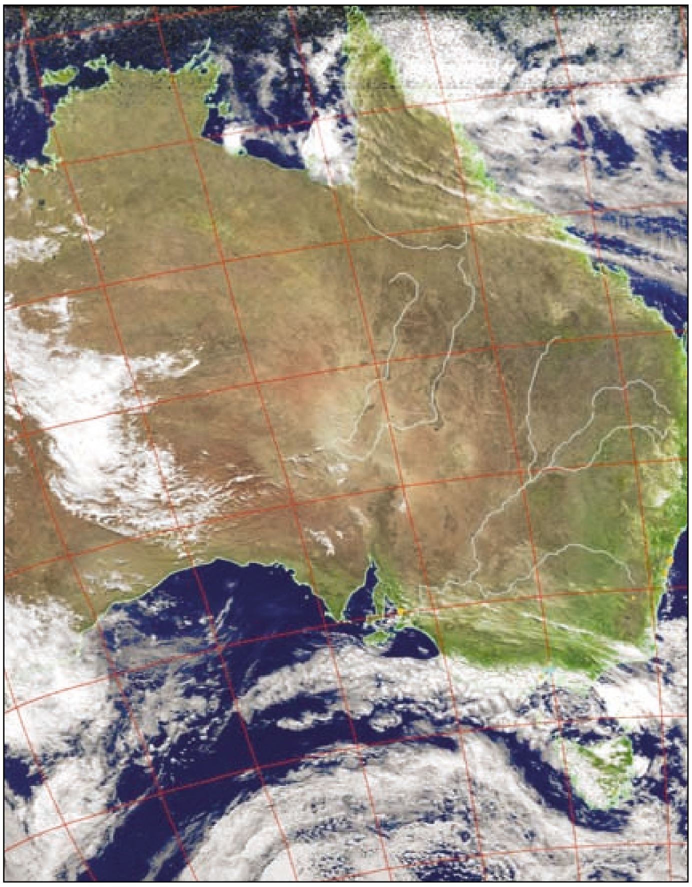
Twenty people were injured and required hospital treatment, three of the more serious cases involving fractures, while hundreds who were left temporarily homeless were forced to spend the following night in emergency shelters.

Although nowhere was affected for more than a minute or so the streets were rapidly littered with broken glass, bricks, roof tiles and furniture before the storm cleared as quickly as it had arrived, giving way to warm sunshine.

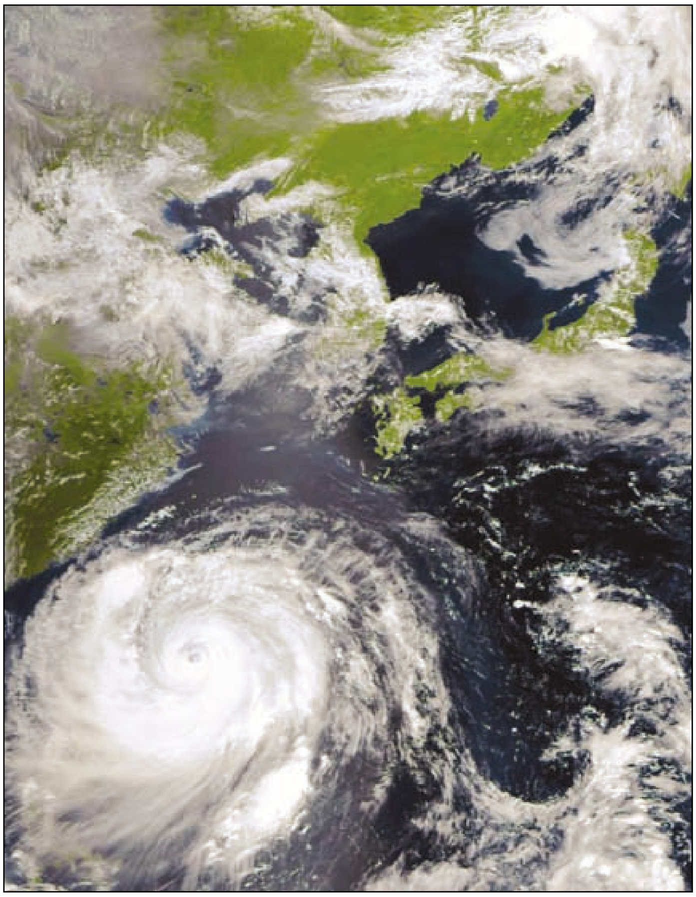
Although there are upward of 30 tornado reports annually in the UK, these rarely impact on built-up areas.



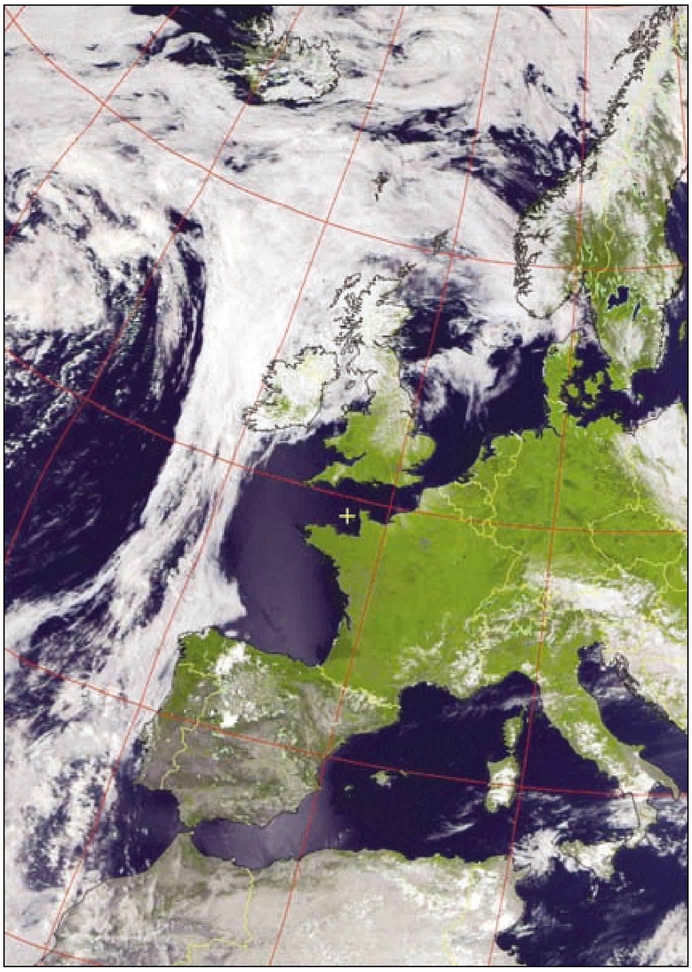
Alan Woodcock received this excellent NOAA-18 image at 13:12 UT on May 30 from Twickenham, west London using a Chris van Lint Quad Helix antenna feeding into a Dartcom pre amp and then into a slightly modified Cirkit receiver. The Image was processed with WxtoImg using the vegetation option (channels 1+2).



Ken Morgan from Brighton, Victoria, Australia sent us this NOAA-17 image dating from 00:49 UT on March 9. It shows Cyclone 'Ingrid' off the east coast of Cape York peninsula.



Jiro Yamamoto from Nishio City, Japan sent us this superb NOAA-18 APT image of South East Asia which includes Typhoon Haitang. It dates from 04:55 UT on July 17, 2005.



Tony Le Page sent us this NOAA-18 image received from St Peter Port, Guernsey at 13:21 UT on June 18. Tony uses a Dartcom receiver, Paul Hayes QFH antenna and *WXtoImg* software.

SOFTWARE SHOWCASE

Douglas Deans - *douglas@dsdeans.freeserve.co.uk*

Let me start this quarter with some news on updates to the Mars Rover Panoramics CD, GS5. The two Rovers, Spirit and Opportunity, have astounded everyone with their performance and, having completed their three month planned mission in April 2004, are still going strong in their second mission extension. So far, the two rovers have together covered an amazing total of 6.2 miles. GS5 is now filled to capacity with their panoramic images.

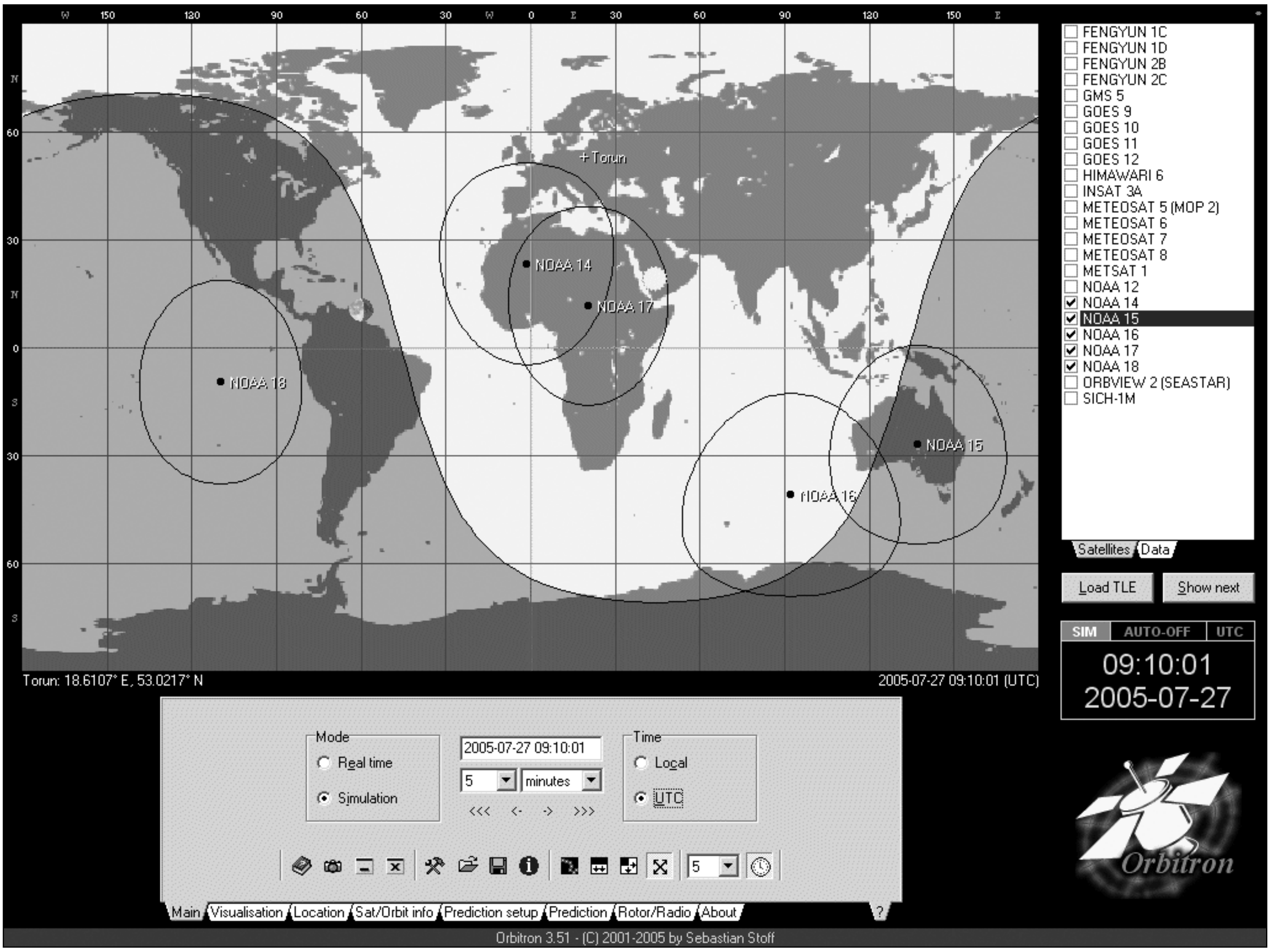
Despite the continued missions of the Rovers, it is not my intention to produce any further CDs for the GEO library, primarily because GS5 contains about every possible image topic you could expect from Mars and a few you would not anticipate: plains, views of craters some from inside, rocks of all types, views from hills, clouds—yes there are clouds on Mars, and even dust devils. Many are in full colour and there is a good selection of 3D. If you want to save yourself nearly 700 Mb of downloads and have an image description provided, then this is the CD for you.

Orbitron v 3.60

This is not a brand new tracking program but one that was brought to my attention by a GEO member. There are many tracking programs available to the radio ham and weather satellite enthusiast alike but that in itself does not constitute a valid reason for not reviewing new ones.

Although Orbitron is extremely comprehensive it does not offer much more than many of the other programs already on the market. However it has one very attractive feature in that it is completely free with no facilities held back for paying options. The author, Sebastian Stoff from Poland, has called his software 'Cardware', a new word for my computer vocabulary ! This means that you may use it free of charge but, if you have found it useful and think he has done a good job creating it, then you are encouraged to send a traditional (snail mail) postcard with your city/region view (Ham QSL cards are also accepted). Sebastian treats the sending of a postcard as a form of software registering and in turn provides a list of all users who have 'carded'.

Installation is very straightforward but do beware of a couple of choices which are incorporated into the installation window. One option is to run a screensaver, the other the to auto-update TLEs': both are selected by default. I missed this first time round (too hasty) and was most annoyed with both the screensaver (which I



normally do not use) and the dial-up connection box popping up every time I loaded the program.

The main screen, shown here, incorporates the usual cylindrical equidistant type map but an unusual touch is the ability to centre the map anywhere by simply pressing the mouse button and dragging it; and there is a further option to zoom into the map. The satellite list is provided at the right side of the map, with those available being dependent on which TLE group is loaded. To change the list just select 'Load TLE' and you are given the option to select another TLE group from the program files. All the usual tracking program options are provided and are too numerous to mention here. Orbitron is certainly worth a look and is probably the most comprehensive program of its type available free of charge. The program is still evolving.

Orbitron is available on GEO software CD GS2 or, for more information and to download the program go to :-

http://www.stoff.pl/

World Wind v 1.3

World Wind, produced by NASA, is an incredible program which allows the user to zoom from satellite altitude into any place on Earth, utilising high resolution LandSat imagery and SRTM elevation data to experience Earth in visually rich 3D, just as if you were really there. It has to be seen to be believed.

Particular focus was put into the ease of usability so people of all ages could enjoy World Wind. All that is needed to control the program is a two button mouse, with additional guides and features being accessed though a simplified menu. Navigation is automated with single clicks of a mouse as well as the ability to type in any location and automatically zoom into it.

I do not intend to review the program in this column as I am hopeful of a more detailed article, as merited by a program of this magnitude, in a future issue of GEO quarterly. However due it is large download size (over 180 MB) I have added it to CD GS2 to help those without a broadband connection.

For further information and to download the program go to :-

http://worldwind.arc.nasa.gov/

GS1	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 3.5.0
	SatSignal	Creates images from wave files	v 4.2.0
	HRPT Reader	Converts raw HRPT data files into images	v 2.6.0
	GroundMap	Rescales satellite images	v 1.3.8
	RX2 PassControl	Computer control program for the RX2 receiver	v 3.0.6

GS2	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 (wave file recorder/decoder), Satmon (wave file recorder).	v 2.59
	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
	Irfan 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)	
	Orbitron	Satellite Tracking Program	v 3.60
	Paintshop Pro	Image processing program (30-day evaluation)	
	Satscape	Satellite tracker and wave file recorder	v 2.02
	Space-Track TLE Retriever	Generates TLE files in 'Celestrak' style from data sets recovered from Space Track	
	Splitter	Utility program for splitting and reuniting large files	
	World Wind (NASA)	View anywhere on Earth from satellites	v 1.3
	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 inages. 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

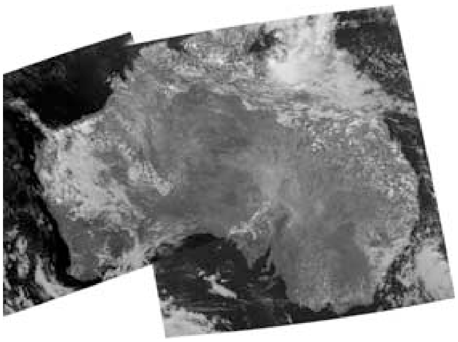
Merge HRPT Images

using Paint Shop Pro Part 2 - Filling in the Blanks

Les Hamilton

Last issue I explained how to combine two or more HRPT images to display a more extensive geographical area. This tends to be particularly straightforward for regions such as Europe and North America where the NOAA CLASS Library [1] makes all the necessary satellite passes available.

But what about more distant regions of the planet: Australia for example? Most days only a single HRPT file covering most of the central and eastern parts of the continent is made available. On those days when two successive passes over Australia can be downloaded the images are usually centred on the major land regions only. Extremities and surrounding oceans are 'clipped' and the resulting composite image, with its ragged outline, tends to be singularly unappealing, as illustrated below.



Composite of two NOAA-16 channel-2 HRPT images from March 19, 2005

LAC files: NOAA CLASS Library

The question is: 'can we do anything to improve the overall appearance of this image?'

GAC Images

While HRPT images may not always be available, it is almost certain that lower resolution GAC images for the region of interest will be. A quick check through the CLASS Library for March 19, 2005 revealed that three of these files (which covered Australia in its entirety) were available for downloading. Using the CLASS area selection tool [2], segments from each GAC file stretching from 20° north of Australia to 20° south were ordered. This selection ensured that sufficient of the surrounding oceans was included to provide an attractive background.

Composite of three NOAA-16 channel-2 GAC images from March 19, 2005

GAC files: NOAA CLASS Library

The resulting composite GAC image could be cropped neatly around Australia as shown above.

Of course, the downside is that this image provides a maximum ground resolution of just 4 kilometres per pixel—and often less as a result of the necessary rectification in *GroundMap*.

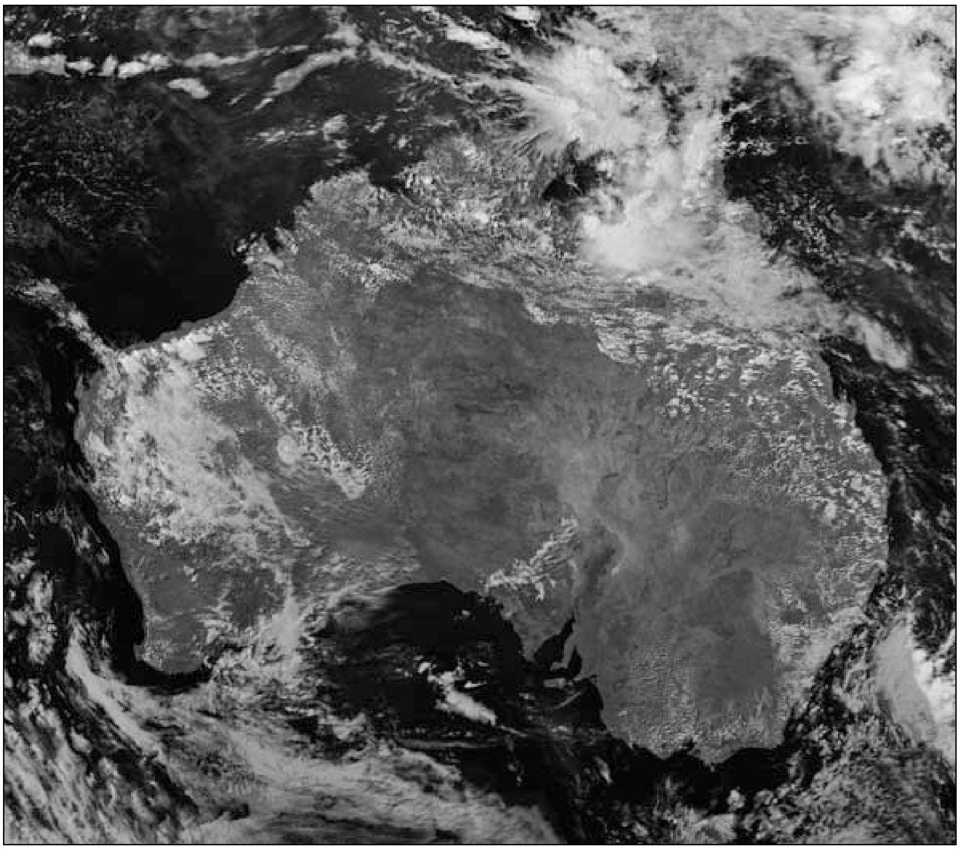
But of course, the two HRPT images covering most of Australia are also available. These can now be loaded into *Paint Shop Pro* as additional layers <u>above</u> the GAC ones (i.e. load them <u>after</u> the GAC images) so that they are displayed above the GAC 'background'. The result is a high resolution image of most of Australia with the 'missing' extremities and oceans rendered in somewhat lesser detail. Indeed, because the eye is drawn to the detail of the HRPT segments, you are scarcely aware that the margins of the image are somewhat less sharply defined.

References

1 NOAA CLASS Library

http://www.class.noaa.gov

2 The NOAA Satellite Active Archive GEO Quarterly No 5, page 19.



The final composite, with the two HRPT sections superimposed on a 'background' framed from the three GAC segments.

All original telemetry files: NOAA CLASS Library

An Affordable *RADAR* Service for the UK

Douglas Deans

Good quality radar imagery is difficult to come by, even in this modern day of Internet access. There are a number of sources but the imagery is usually of poor resolution and often time-lagged. Either one of those problems makes the data of little benefit for local nowcasting; both make it almost impossible. To receive a service of good value and one which can contribute positively to other meteorological data we (by which I mean *amateurs*) have to consider registering for a paying service. This need not be financially onerous.

There are a number of paying services but there is one I have found that offers excellent value for money whilst providing good resolution data of the whole UK, updated every fifteen minutes, and available within 15 minutes of actual time. I have now been using it for several years.

The service is provided by *AvBrief*.

http://www.avbrief.com/

AvBrief is as site primarily dedicated to offering a wide range of services for pilots, in particular for flight briefing. As you would expect, there is a large selection of data available including weather, Airfield Information, Route Briefing, NOTAMS and many other services. There are a number of different packages to suit everyone's needs but what I really liked about this site is the ability to register only for the 15 minute radar service. Full marks to *AvBrief* for recognising the interest of meteorology without having a pilot's licence !

Let me say from the outset that I have no association whatsoever with *AvBrief* other than I have been a registered user of their radar data for several years. I must say that the service has been excellent and any communication I have had has been dealt with promptly and courteously. As an example of that, there was one recent (and very rare) occasion when the service was down for nearly two days over a weekend. Everyone registered had a week added on to their registration period. At the moment a full year of 15 minute radar imagery can be obtained for £25.85.

What do you get for your money?

A typical radar image is shown opposite, alongside the corresponding Meteosat-8 segment showing the UK for comparison. Please note, however, that the coloured *Rainfall Radar Key*, normally accessed separately, has been added to the image by myself to save space. These images are updated every 15 minutes, with the latest and the previous ten available for access at the click of a mouse (more are available from archive). Whilst it would be a simple matter to make your own animations there are five preset animations available at a slightly lower resolution on the web page: quarter-hourly frames over a 2, 4, 6 and 8 hourly periods and half-hourly frames over an 8 hour period. I find those perfect for most of my purposes and only rarely make up an animation from my own individual frames.

The composite rainfall radar image uses colours to represent the approximate rainfall rate, with blue as lightest, through green, yellow, orange and reds which represent very heavy rainfall. Although it may not be clear from the article image, the full resolution radar image is bigger than my web page screen and my monitor is run at a resolution of 1280 x 1024.

I don't intend, nor am I able, to give an in-depth analysis of radar imagery. For those who may be interested there is an excellent book called *Images in Weather Forecasting* [1] which devotes a full chapter to radar imagery. I have had this book for some time and it contains a wealth of knowledge for those interested in weather satellite imagery and radar interpretation.

Can I also say that the *AvBrief* site itself provides some excellent help both in interpreting weather radar and detailing its usefulness although the latter is understandably aimed at pilots.

However, a word of caution as interpretation of radar imagery is not always straight forward. There are many things which can influence readings including topography local to the radar station partially blocking the beam and showing no return when in fact there may be rain.

Droplet size can affect the radar and in some cases give misleading precipitation rates. The angle of the radar beam is such that it is measuring precipitation closer to the ground in proximity to the device and progressively higher from the ground the further the beam travels. Consider the consequence of this in a condition of light rain falling and perhaps evaporating before hitting the ground. There may also be situations where very narrow bands of precipitation are missed due to the resolution of the radar.

Whilst it is possible to make some assessment of rainfall from interpretation of satellite images in different wavelengths, it is not an exact science. Access to 15 minute radar is extremely useful and, used in conjunction with satellite imagery and other meteorological data, can be an excellent learning tool.

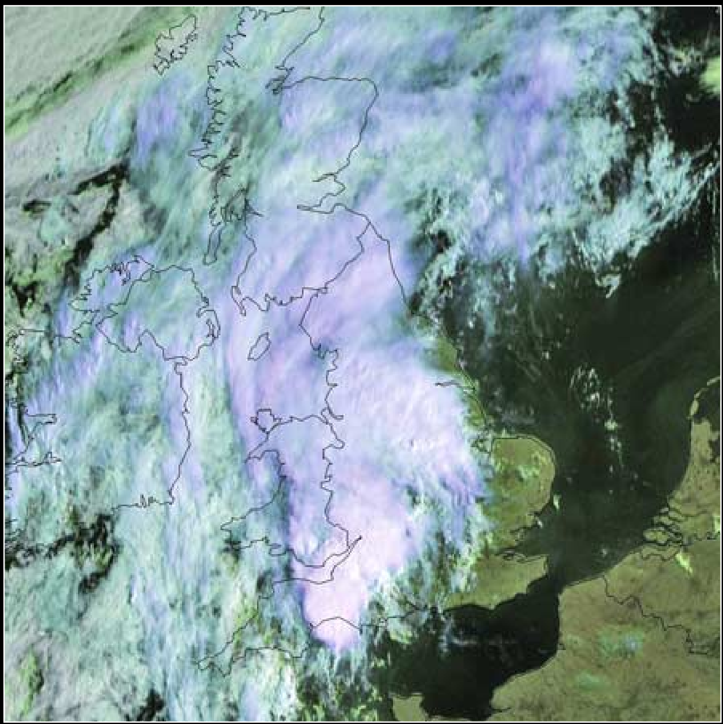
The Images

The images opposite date from Friday, June 24, 2005, when severe storms struck the West Country. Many minor roads were flooded, and there were major traffic delays on the M4 motorway in Wiltshire. At Poole in Dorset, a teenager was fortunate to survive after lightning blasted a hole through the roof of his home. He had been playing a video game, and was thrown across his bedroom by the strike, which also caused fire damage to the house.

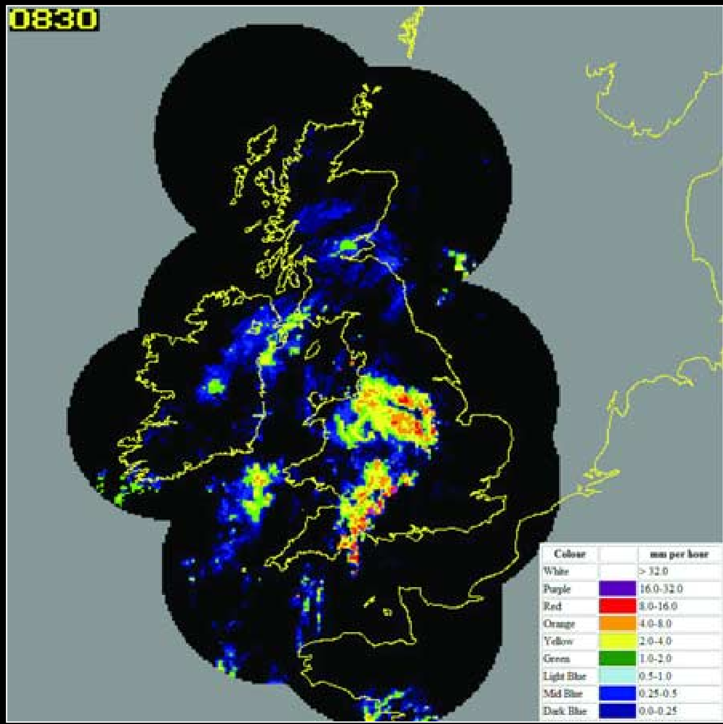
The opening day of the Glastonbury music festival was a spectacular washout. The 100 000 participants were wakened in the early hours of the morning by crashing thunder, lightning and torrential rain. Tents were flooded, stages were struck by lightning and nearby streams burst their banks, inundating parts of the site under knee-deep floodwater. Power to the stages had to be disconnected on safety grounds and all the morning's entertainments postponed.

Reference

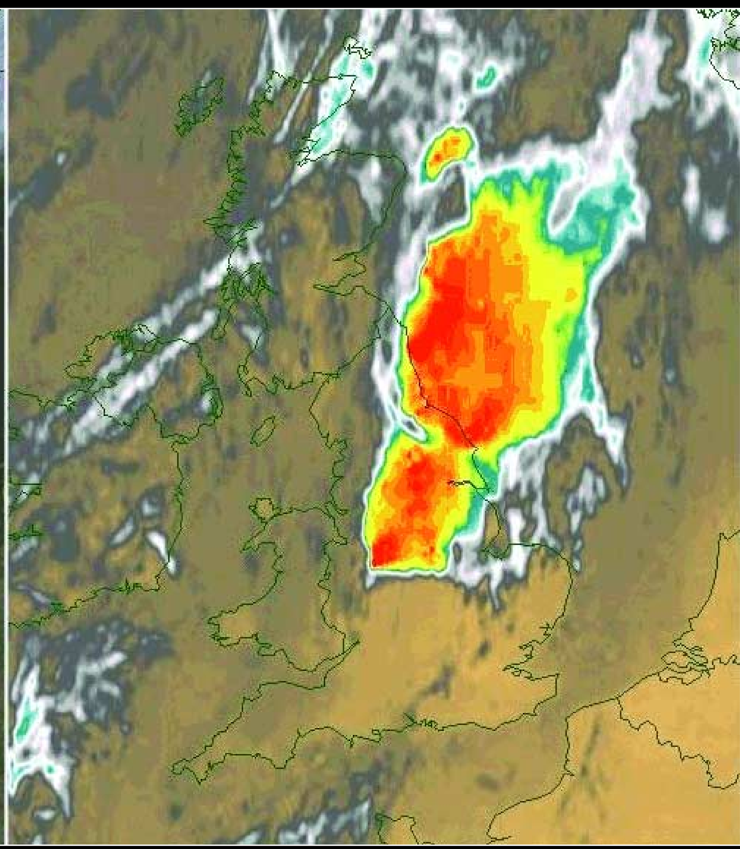
1 *Images in Weather Forecasting* by Bader, Forbes, Grant, Lilley and Waters, published by Cambridge University Press.



Severe storms course across England on June 24, 2005, caused widespread thunderstorms and flooding.
Image © EUMETSAT 2004



The morning radar map from *AvBrief* illustrates the extent of the storms, the colours indicating rainfall in millimetres per hour.
Chart courtesy AvBrief (http://www.avbrief.com/)



Just a few days prior to the thunderstorm event of June 24, another band of thunderstorms, accompanied by torrential rain, swept across England. Parts of Yorkshire experienced an entire month's rainfall in just three hours and helicopters had to rescue a number of people who had sought refuge from the floodwaters on roofs and in trees.

Robert Moore submitted these two Meteosat-8 images detailing the situation at 18:00 UT on June 19. The false-colour HRV image (left) displays the cloud mass positioned over northeast England while the false colour IR frame clearly picks out the coldest cloud tops, the areas most likely to experience the heaviest rainfall (red).

Images © EUMETSAT 2005