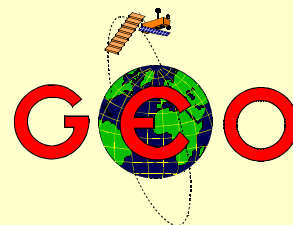


# The **GEO** Quarterly

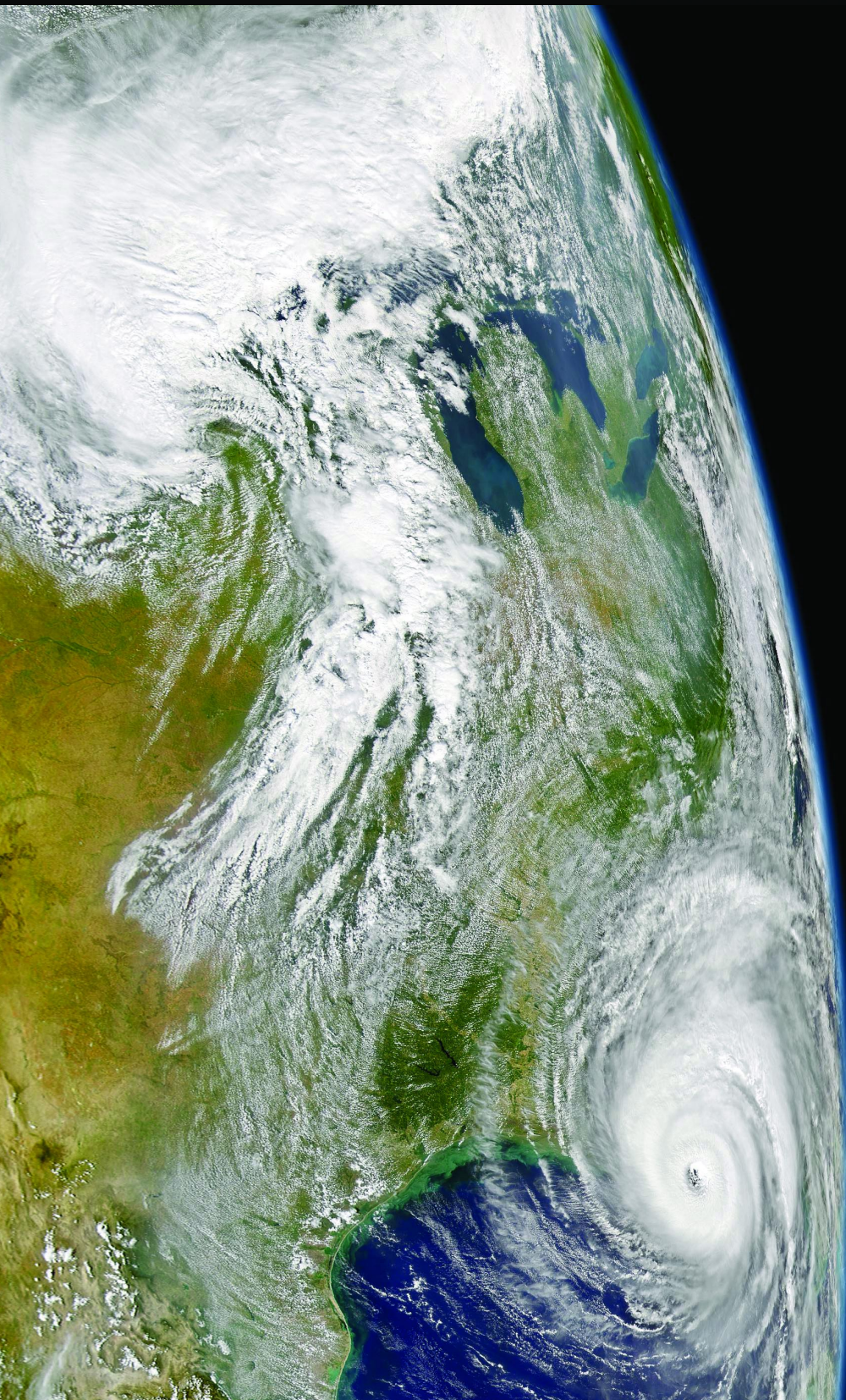
Group for Earth Observation



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

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

*Number 4  
November/December 2004*



## *Inside this issue . . .*

*Hendricus Lulofs describes his 'HJL' false-colouring process for NOAA APT images.*

*Download Meteosat-8 transmissions from Atlantic Bird-3 using C-Band - Kobus Botha explains the procedure.*

*Changes in the East African Glaciers and Ice Fields - personal reminiscences from Peter Bradley.*

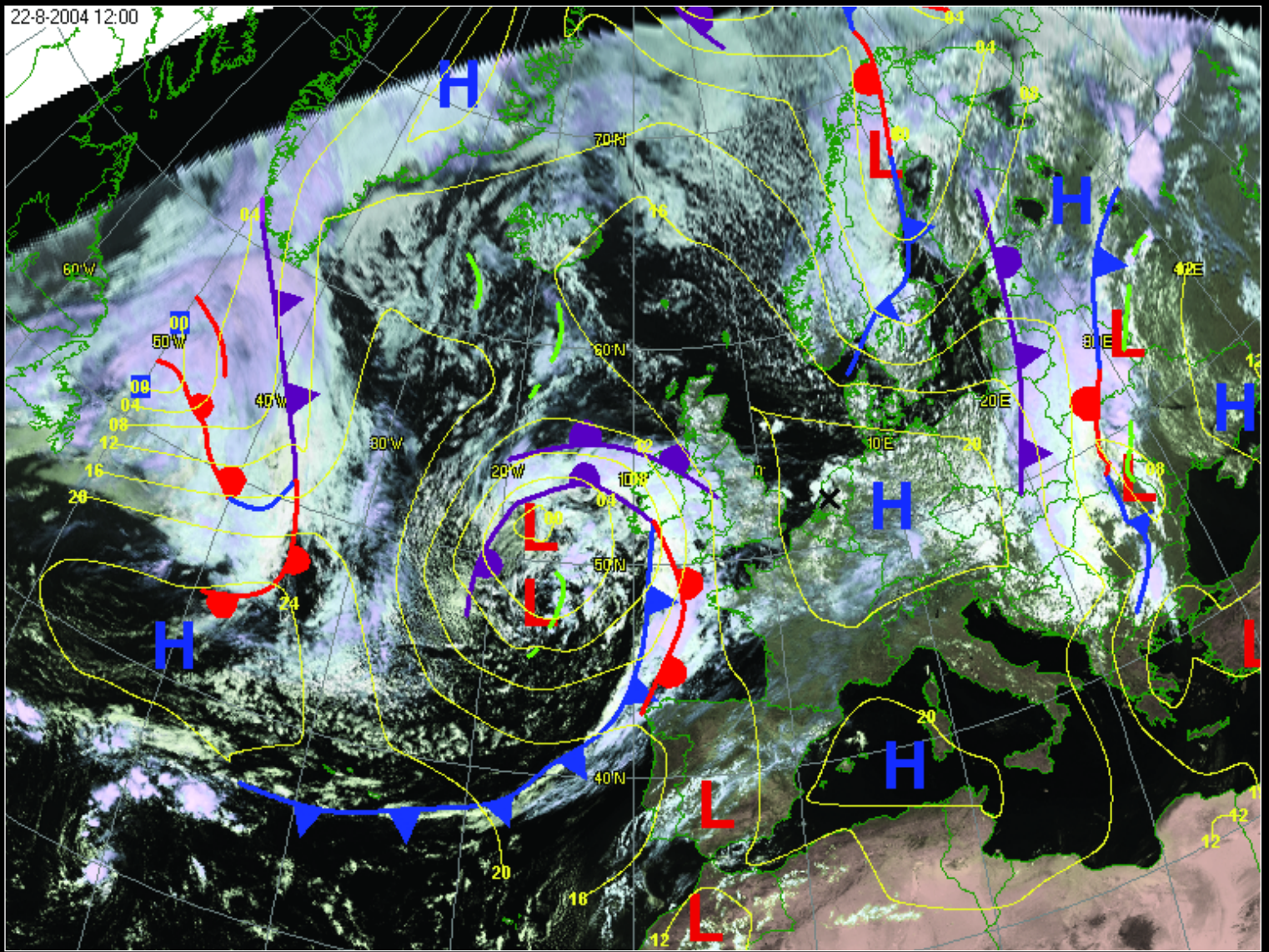
*David Taylor recalls his trip to Utrecht to join GEO's Dutch colleagues, and also extols the attractions of the Dutch city for a short tourist break.*

*For the Beginner—The Challenge of Meteosat-8. Mike Stevens explains in detail how he set up his system from scratch.*

*Ton Lindemann describes how he adds 'Fleetwood' Synoptic Data to his MSG images using the latest version of the 'Digital Atmosphere' Workstation*

*Plus all the news about GEO's activities in the Earth Imaging arena ...*

22-8-2004 12:00



Ton Lindemann prepared this surface chart using Digital Atmosphere Workstation v 1.1, GeoSatsignal, a Meteosat-8 false-colour image and a 'fleetcode' data file. Read how you can emulate Ton in his article on page 25



The scene at the Werkgroep Kunstmanen bijeenkomst, held in the 'Nimeto' on September 11, 2004. Read David Taylor's report on his trip to the Netherlands on page 16. You can learn more about the Dutch Weather Satellite Group by visiting <http://www.kunstmanen.nl>

Photo: Ruud Jansen



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Much has been written during the past year about the *EUMETCast* dissemination service for MSG imagery available to European enthusiasts via the *Hot Bird-6* geostationary satellite. But a parallel C-Band service, primarily intended for African countries and transmitted from the *Atlantic Bird-3* satellite, can also be received throughout Europe. *GEO* reader Kobus Botha, who lives in South Africa, is now receiving Meteosat-8 imagery via this route and describes how he set up his station in an article which begins on page 7. It certainly wasn't all plain sailing, and other *GEO* readers can benefit from his experiences.

*GEO*'s Dutch counterparts, *Werkgroep Kunstmanen*, hold regular meetings and workshops several times every year in the picturesque city of Utrecht. *GEO* was represented at the recent September meeting by Francis Bell and John Tellick, while David Taylor and his wife Cecilia also attended during the course of a long week-end break in the Netherlands. You can read the Taylors' account of their trip on page 16, accompanied by photographs taken both at the meeting and in and around Utrecht itself. By all accounts this is a venture that other *GEO* readers would find highly rewarding should they consider making such a trip themselves in future years.

Finally, as *GEO* reaches its first anniversary, a big 'thank-you' to everyone who backed us by subscribing to *GEO Quarterly*. As Francis Bell makes clear in his report on page 2, *GEO* has made great strides in just twelve months. Everyone on the *GEO* Team wishes all our readers a pleasant Christmas and New Year; we hope we can count on your continued support throughout the year ahead.

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# The **GEO Report**



**Francis Bell**

## Year of Achievement

It was on October 29, 2003 that our management team first formed *GEO*, and the company, with its legal structure, was established just weeks later on November 25. Somewhere in there is a birthday, although I'm not sure which date counts.



Wow! How much can you achieve in a year? *GEO* has issued four Quarterly publications; organised a successful symposium, with international visitors, at the National Space Centre; and participated during all three days of the AMSAT-UK colloquium at Guildford University, where we promoted our group with the help of the RSGB and their mobile ground station, *GB4 FUN*.

Some of *GEO*'s management team then paid a visit to Utrecht in the Netherlands to share our interests with the very talented *Werkgroep Kunstmanen* (you can visit their web site at [www.kunstmanen.nl](http://www.kunstmanen.nl)) and we recently received, and accepted, an invitation to contribute to the NOAA / NASA Direct Readout Conference in Miami, where I will try to represent our interests, and explain and illustrate our *GEO* user group's skills.

If anybody can tell me *GEO* could achieve more than that in a year I would be surprised. Of course there are practical things to be done, issues to be addressed and technical changes for the future: with our dynamic interest area this will always be the case. *GEO*'s management will always keep these issues under review.

## Members' Contributions

One feature of our group which impresses me is the willingness of contributors to send us copy and I must extend my sincere thanks to everyone who has contributed to our Quarterly publications. Without your efforts there would be scarcely anything to publish.

Another feature of our membership that pleases me is their willingness to respond to questions and issues raised in the Quarterly. I know the copy I write can sometimes appear naive, and is sometimes deliberately provocative. I'm always happy to give a kick in the groin to the establishment, especially when I believe I'm right! It is very rewarding to receive responses from these issues raised by myself and others in *GEO Quarterly*.

If you think you have anything to contribute please do not hesitate to send it to our editor, or even to myself. Remember, we are a friendly group with a common interest in weather satellites and their reception. We would like our membership to be able to share your experiences, technical skills, weather satellite images, anecdotes, photographs (of your 'shack', receiving station, antenna etc) and any designs and projects you are involved in. *Wouldn't you like to have something published in our GEO Quarterly?* Do please keep sending us your copy, responses, ideas and suggestions.

## The *GEO* Management Team

As you will see from the previous page, the *GEO* management team consists of seven people. We also have one consultant

plus a number of others whom we can rely on from time to time for advice and experience. We also have the names of several members who have volunteered to help us run *GEO*. My thanks to them all: these people will be contacted in due course.

It is still my ambition to promote the educational side of *GEO*'s activities and the invitation for someone to oversee this dimension is still on offer. Please contact me or any other member of the management team if you can contribute in this arena.

Equally I would like one person to take over the international promotion of *GEO*. This would involve identifying radio societies and other technical groups around the world and sending them a press release and a Quarterly publication. As I have said before, *GEO* are not looking at membership solely for membership's sake. But if people do not know about *GEO*, they cannot join us!

## Leicester 2005

I have confirmed *GEO*'s booking at the National Space Centre, Leicester, UK for our 2005 symposium. The date for your diary is April 30, 2005. Our first meeting there was, by consensus, judged a success and I will work on a programme for 2005 which I hope will be every bit as rewarding. However, this request must follow. We do need to share information and experiences so, if you have something to contribute, please do not be hesitant in coming forward. We will not be making a television programme for world wide reception—we will simply be a group of friends sharing experiences and information.

There will be more about Leicester in the next Quarterly, but meanwhile, if you would like to talk or make a display at *Leicester 2005*, please e-mail me (or write) with details. You can find my contact details on page 1. A zero response here will result in a boring day.

*GEO* will hold its first AGM on this day. There are important issues to discuss and, although we have absolute security within the company structure, I would like to adopt a more user-friendly set of day-to-day rules plus a statement of our *GEO* aims and objectives. I wish that the membership should feel a sense of ownership and have influence within *GEO*. All rules, aims and objectives will cover not more than two sides of A4.

## Dates for your Diary

You should have noticed text in *GEO Q3* by Darrell Robertson of NOAA relating to a meeting in Miami this December. I will be attending to represent *GEO* and hope to make a presentation illustrating our interests in weather satellites. You can read more information about the Conference in the notice on page 3 and, of course, on their official website. The conference lasts from the 6<sup>th</sup> to the 10<sup>th</sup> of December 2004.

*GEO* were very pleased to have been invited by *AMSAT-UK* to their colloquium at Guildford University last July and you can read about our demonstrations and presentations on page 4. I hope we will be invited again next year. I will certainly invite *AMSAT-UK* to *Leicester 2005* and will write some copy for their UK publication *Oscar-News*. If we are invited to *AMSAT*'s colloquium again it is likely to be held during the last few days

of July. *GEO* does not have a policy about amateur radio rallies: we will just have to be opportunistic about these. We have attended one so far. Perhaps we will publish our intentions on our web site.

### Membership

*GEO* can currently boast a growing international membership approaching the 500 mark and embracing 31 countries, which is very encouraging both in terms of numbers and international spread. However, it must be recognised that *GEO* has no income other than our membership subscriptions and that we have not yet started to break even financially; the subscriptions do not quite cover the cost of running *GEO*. Our hope and expectation is that, with our increasing membership over the next year, we will break even. In the meantime *GEO* is underwritten by its backers and *is* guaranteed.

There are two serious points to make following from the above comments. Firstly, do please renew your membership when it becomes due. Don't expect a reminder. Membership is on a rolling programme. The date of your subscription will cover you for exactly one year, which is four issues of our Quarterly plus the benefits that go with membership. If you don't want to renew, that's fine, but that should be an active decision, not forgetfulness. See also Nigel Evans' note on page 11.

The second point, which is related, is that membership subscriptions will have to increase. There is a balance point where Quarterly print run costs plus postage have to match membership subscriptions. Progress towards this situation is encouraging. Please recognise that the *GEO* management team have never received any expenses and I wish to acknowledge formally their commitment to the Group.

Membership renewal subscriptions for 2005 have not yet been fixed but it is likely to be above the current UK membership fee of £12. Please do not be distressed at this. Membership of *GEO* will still remain the best value-for-money subscription you can buy. You will receive the best quality Quarterly publication about weather satellites available anywhere. In this respect, I have in the past paid tribute to the efforts of our editor, but must now formally acknowledge the very high profile contribution made by Toptown Printers of Barnstaple, Devon. It is they who convert the editor's copy into the quality final product that drops through your letter-box. I think they do an outstanding job for *GEO*.

### Loose Ends

#### Quarterly No 1

Nobody has come back to me about my piece on the Cape Verde Islands although I did notice they had three competitors in the recent Olympic Games. I don't know if they won any medals.

The DNA sequence CGA on Mars transcribes to the alpha amino acid glycine.

I was delighted to discover that my interest in imaging and snow in Africa (*'The Snows of Kilimanjaro'*) had brought such a wonderful response from Peter Bradley. My thanks to Peter for his profusely illustrated contribution which starts on page 27 of this issue. These historical records are vital if we are to understand climate changes on our planet.

#### Quarterly No 2

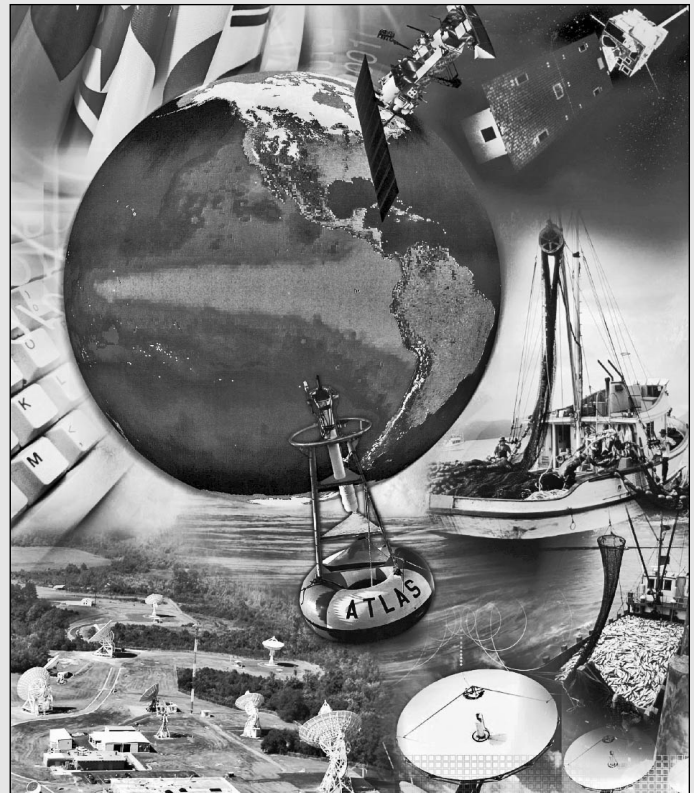
I wrote *Moonlight Sonata* 'in sea', the original composer wrote it in 'C sharp minor'. A rainbow in moonlight exists but the human eye cannot see it because the light levels are too low to see colour. Take this Quarterly outside under only bright moonlight and try to identify any colour!

*concluded on page 6 ...*

## The 2004 Satellite Direct Readout Conference 'A Decade in Transition'



NOAA invites Direct Readout users to its upcoming conference entitled 'A Decade in Transition', scheduled for December 6-10 at the Hilton Miami Airport and Towers Hotel, Blue Lagoon Drive in Miami, Florida.



It is anticipated that more than 250 participants from over 40 countries will attend. NOAA and NASA are co-operating in this conference with the aim of providing an information exchange forum for the L-Band and X-Band user community. The Conference will also provide a venue for vendors to display and discuss their products and services.

Full details can be found on the Internet at:

<http://DirectReadout.noaa.gov/miami04/>

During the next decade, the transition into new systems technologies will result in significant changes affecting all current and future users of NOAA satellites, particularly those who receive data directly from the satellites. As the next generations begin operating, all users will have to modify or replace current receiving equipment and processing software. This Direct Readout Conference is part of a continuing effort to prepare everyone for these changes.

*GEO is pleased to have been invited to this conference, where we will be making a presentation promoting the educational, amateur and self-training interests of our international membership.*



# GEO at AMSAT



**Francis Bell**

I was very pleased to receive, on behalf of GEO, an invitation from AMSAT-UK to attend their colloquium in Guildford from July 30 to August 1, 2004

I have been a member of AMSAT for many years. AMSAT's main interest is in amateur radio satellites and their worldwide membership has funded, built, launched and operated a number of amateur radio satellites: about 40 in all. I have listened to and used these satellites from my own home and as a retired science teacher encouraged some of my pupils to do the same.

AMSAT hold their colloquium at Surrey University in late July each year. The venue is not a coincidence as *Surrey Satellite Technology Limited* have their roots within the University of Surrey at Guildford. The strong amateur radio interest there gave birth to *UoSAT-1* and *UoSAT-2*, which laid the foundation for today's expertise and the subsequent development of other small satellites. Hence the attraction of Guildford as a venue.

The colloquium lasted for three days and consisted of a full programme of lectures, activities and social events. GEO promised to have on display live weather satellite reception for all three days and to provide speakers on direct readout weather satellite reception. GEO delivered on this.



Positioning the MSG dish antenna atop the RSGB's GB4 FUN vehicle  
Photo: David Taylor

Our task of establishing live reception of Meteosat-8 via Eutelsat's Hot Bird 6 did present some minor problems. There was a view of the southern sky at 167° but the 60 cm dish we were using had to be repositioned several times. A balance had to be achieved between signal strength, cable runs, trees, adjacent tall buildings and members of the public walking past. Resourcefully we achieved this and delivered a cable into the meeting room GEO used, adjacent to the main lecture theatre which

AMSAT was using. Thanks must go to David Simmons for establishing the satellite downlink for us and to Carlos Eavis for allowing us to position our dish on top of the RSGB's GB4 FUN vehicle for all three days. From this position we had a good view of the sky whereas, nearby at ground level we were compromised: we did get a signal but we represented a hazard to the public.

I thought we made good use of our room where we had two computers running live Meteosat-8 reception. A computer projector was provided by AMSAT and we displayed live animations on to a large screen. I thought it looked eye catching—perhaps even stunning. The other computer was also busy receiving un-animated 15-minute Meteosat-8 images.

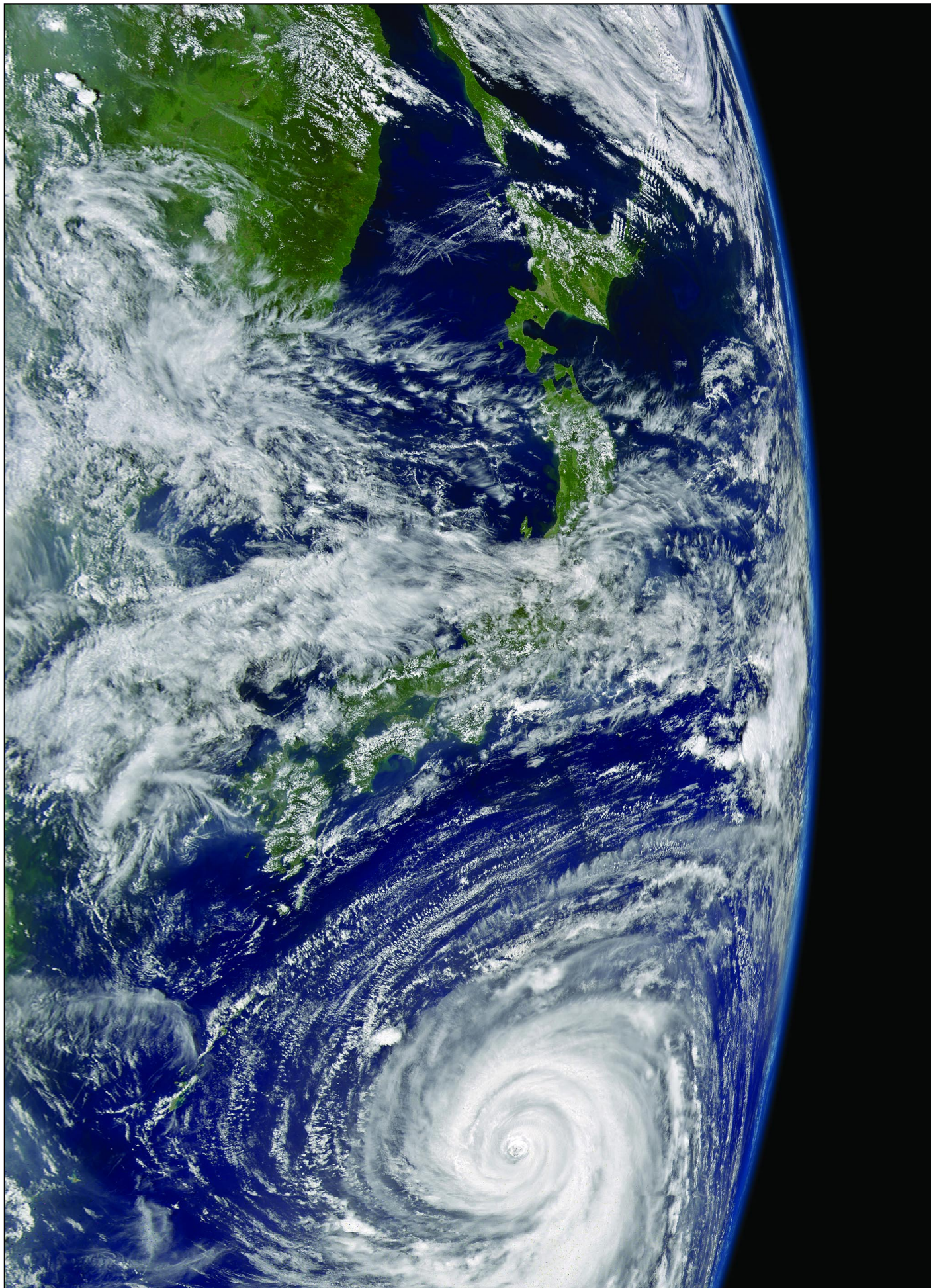
APT equipment on display included Miroslav Gola's receiver and Ray Godden's receiver with its reprogrammed PIC for an extended range of frequencies. The APT receivers and the turnstile antenna just outside the room did receive signals but these were not displayed because both the computers were otherwise occupied with Meteosat 8. However, live APT was there, backing up GEO's promise of live reception.

I must now express my thanks to EUMETSAT. They were very supportive of GEO's presence at Guildford in two ways. Firstly they provided us with informative booklets and posters covering their current and future satellite programmes, together with information about data dissemination. All these materials were appreciatively received by the delegates—except for one set which I kept for myself.



Francis Bell addressing delegates during the AMSAT Colloquium at Surrey University

Photo: David Taylor



The Orbview-2 satellite's SeaWiFS instrument imaged typhoon *Chaba* approaching Japan on August 26, 2004.

*Image: SeaWiFS Project, NASA Goddard Spaceflight Center, and Orbimage*

Secondly, and more importantly than their paper materials, *EUMETSAT* agreed for the presence at the colloquium of an outstanding speaker in Gordon Bridge. Gordon, who has been with *EUMETSAT* for many years, and is now a consultant on training, flew in from Frankfurt to be with us. His presentation gave an overview of *EUMETSAT*'s structure and both present and planned future programmes. As chairman of the sessions relating to weather satellite matters, I publicly thanked *EUMETSAT* for their support of GEO's activities. I do so now again formally in print.

Gordon made available the contents of his presentation on a small number of CD-ROMs which were quickly exhausted by the enthusiastic delegates. Gordon has offered to supply me with further copies, so if you would like one, either as an AMSAT member or as a GEO member, please write, supplying your name and address and enclosing four first class stamps or their equivalent, to 'GEO', Coturnix House, Rake Lane, Milford, Godalming, Surrey, GU8 5AB. UK .

The other outstanding speaker who contributed to the weather satellite theme during the middle day of the colloquium was David Taylor. David is a weather satellite software guru and is a good friend of GEO. His presentation to the delegates was spectacular. He demonstrated previously received images, their subsequent processing, remapping enhancing and animation using his *SatSignal* software. I wish I was that clever! David, who lives in Edinburgh, stayed at our home for four nights. Nadine and I enjoyed his company.

Again with David: thanks to him for looking after GEO's live displays. Although I provided the computers, receivers and other hardware it was David who made it work in real time thus fulfilling our promise to AMSAT.

I judged all three days to be time well spent sharing our interests in weather satellites with another amateur organisation. GEO just made a contribution to AMSAT's busy three day programme. They had other speakers and

arranged tours around the SSTL ground station, clean rooms and satellite assembly areas. Although I have been before I went on one of these tours. I was pleased when I saw a copy of the GEO Quarterly Launch issue outside Prof. Sir Martin Sweeting's office. I had to put my head around his office door and congratulate him in his taste of literature. I was flattered when he said: 'Oh yes we are GEO members'.

GEO was not courting new membership but of course I hope that any AMSAT member who took an interest in what GEO demonstrated will eventually join us. On a reciprocal note GEO members may wish to join AMSAT. Visit their web site at [www.uk.amsat.org](http://www.uk.amsat.org). I hope AMSAT will invite us again next year. If they do I will keep GEO's membership informed of dates. For the benefit of AMSAT members, GEO's web site can be found at [www.geo-web.org.uk](http://www.geo-web.org.uk). It is definitely worth a visit.

Thanks must go to GEO's team at Guildford. John Tellick who was there every day organising and answering questions, David Simmons for technical help and our two principal speakers Gordon Bridge and David Taylor.

### ***A Postscript***

Now all of the above describes the events of Guildford. I hope it acknowledges and thanks the people and organisations concerned. What it doesn't say is how much fun it was. At home I pulled two satellite systems to pieces, put them in the car with cables, connectors and dishes not knowing exactly how these were to be recommissioned in Guildford. But when it all worked at a good venue with appreciative delegates, it was very satisfying and in the best tradition of our hobby. It was a lot of fun!

My intention now is to represent GEO at the NOAA Direct Readout Conference at Miami in December 2004. This is high on my priority list as a means of promoting the educational, amateur and self-training interests of our group. I will keep the GEO membership informed and report back in due course.

... continued from page 3

I have had responses to my mild rebuke to physicists and my question about water ascending to the tops of trees. Thank you for reading the text. Liquid water is a polymer and is pulled to the top of a tree like a fine thread of nylon. The energy for this process comes from the evaporation of water from the leaves.

Biologists call this gradient 'water potential'. You may think: 'What has this to do with GEO?' The answer is that, without the unique chemistry of water there wouldn't be any life here. Hence the preoccupation of weather satellites looking at water using multiple spectral channels.

### **A 'Quarterly Question'**

I have recently taken an interest in the sun and have written a few paragraphs for GEO Q5. In anticipation of this, here is a question: 'How many solar diameters is the Earth away from the sun?' Take the distance from the sun to Earth as 150 million kilometers and the diameter of the sun to be its radiating surface, the photosphere at 5770 K. The answer surprised me.

The winning answer will receive a free admission to our Leicester symposium in any year. Answers to me by post or e-mail. I will pick a winner at random on Christmas day 2004, and also publish the names of all correct entries in GEO Q5.

## ***Cover Images***

### ***Front***

The SeaWiFS sensor aboard the *Orbview-2* spacecraft captured this spectacular true-color image of hurricane Ivan on September 15, 2004

*Image: SeaWiFS Project, NASA/Goddard Spaceflight Center, and ORBIMAGE*

### ***Back***

A true-color MODIS image from NASA's *Aqua* satellite showing hurricane 'Alex' in its prime over the Caribbean on August 4.

*Image: Jacques Desclotres, MODIS Land Rapid Response Team, NASA GSFC*



# My MSG Experience from South Africa using C-Band from the Atlantic Bird-3 Satellite



Kobus Botha (ZS6KOB)

During February this year I decided to go for MSG and gave myself five months to receive my first pictures—but what an experience it was! Very soon I realised that there was nobody in the whole of Africa to help me. Nor was there anyone abroad either, because so far, everyone was using Hot Bird and using different hardware from myself. I made an intensive study of all the documentation from *EUMETSAT* and read every article on the topic that I could get hold of—these really helped me a lot.

## Making a Start

Firstly I registered with *EUMETSAT*—very nice people there. I then bought the hardware, a 1.8-metre solid dish, a *Zintech* C-band LNB (uplink 3.4 - 4.2 GHz, downlink 950 - 1750 MHz, polarisation is *dualpol* and noise temperature is 17 K) and a computer. I had the computer specially built for me, a Pentium-4 with 2.8 GHz processor, 1 Gb RAM and 80 Gb hard drive. The graphics card has 128 Mb built-in RAM.

## Locating Atlantic Bird-3

It was not too difficult to locate *Atlantic Bird-3*. I used the computer program *Satco DX* (see <http://www.satcodx.info> for more information) to work out the details for me. After you have input your coordinates into the program it will graphically show your position on a nice map, as well as indicating the dish size needed and its azimuth and elevation (figure 4). In my case the azimuth was 304° and the elevation 43°. Finally, with the cable already connected to the *Vbox* card in my computer, I manually turned the dish to more or less the correct position. A map showing the Atlantic Bird-3 coverage area appears on page 19.

## Configuring the Vbox Card

At this stage you must configure your *Vbox* card before making the final positioning adjustments to the dish. I really suffered with the receiving card. Firstly I used an 'ordinary' TV card but after many hours realised that the software supplied with it was not compatible with the *Telique* software provided by *EUMETSAT*. So I bought the unit which *EUMETSAT* had tested, the *Broadlogic Vbox 2030* PCI card. It is very important that the software supplied with this card makes provision for TCP-IP settings.

But my troubles still weren't over as I couldn't get the *Broadlogic* control application software to load. I got the help of a software expert who discovered that my brand new Windows 2000 professional PC had decided that enough was enough: the operating system had to be reinstalled, with the loss of most of my programs! Please remove any firewalls on your computer before installation of the card software—if not you will have major software problems

I was now able to run the *Broadlogic* control software and make the following settings in the 'Tuner' tab (figure 1):

- Frequency - 3.7318 GHz
- Symbol Rate - 11963 kSym/s
- Polarisation - Left

Finally, I clicked the 'Tune' button to confirm these.

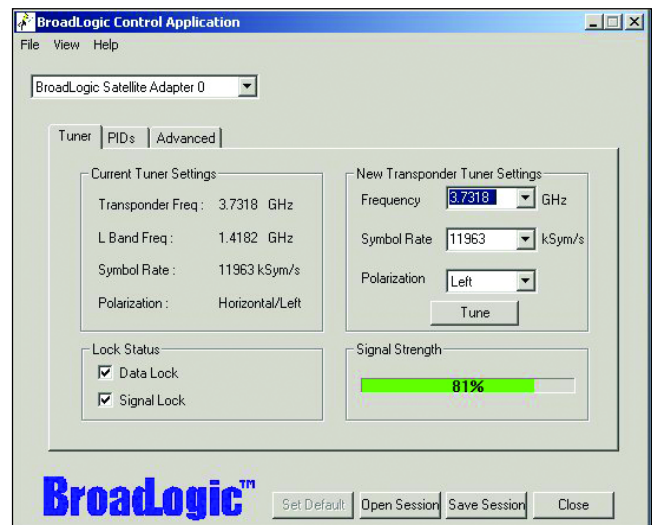


Figure 1 - Settings in the 'Tuner' tab of the *Vbox* TV card

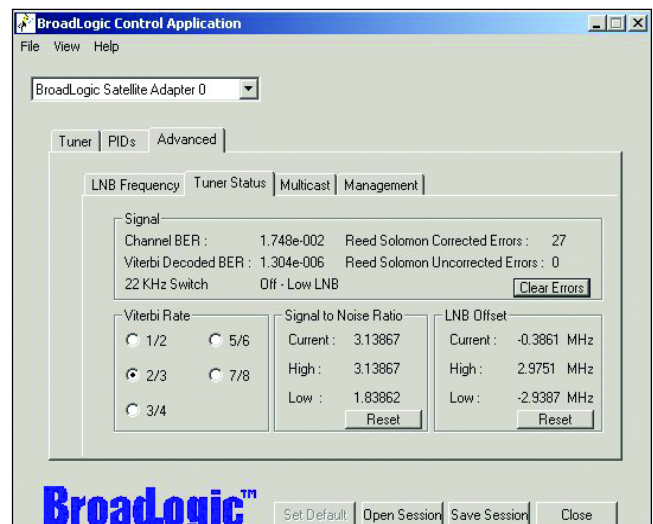


Figure 2 - Setting the LNB parameters in the 'Advanced' tab

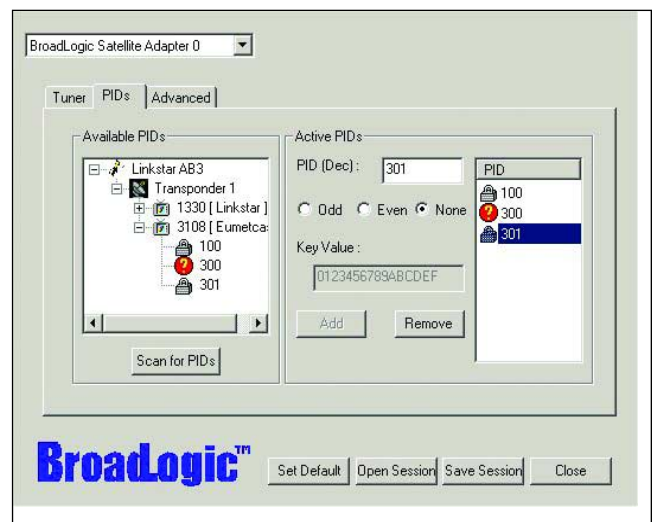


Figure 3 - Settings in the 'Viterbi Rate' for the *Vbox* TV card

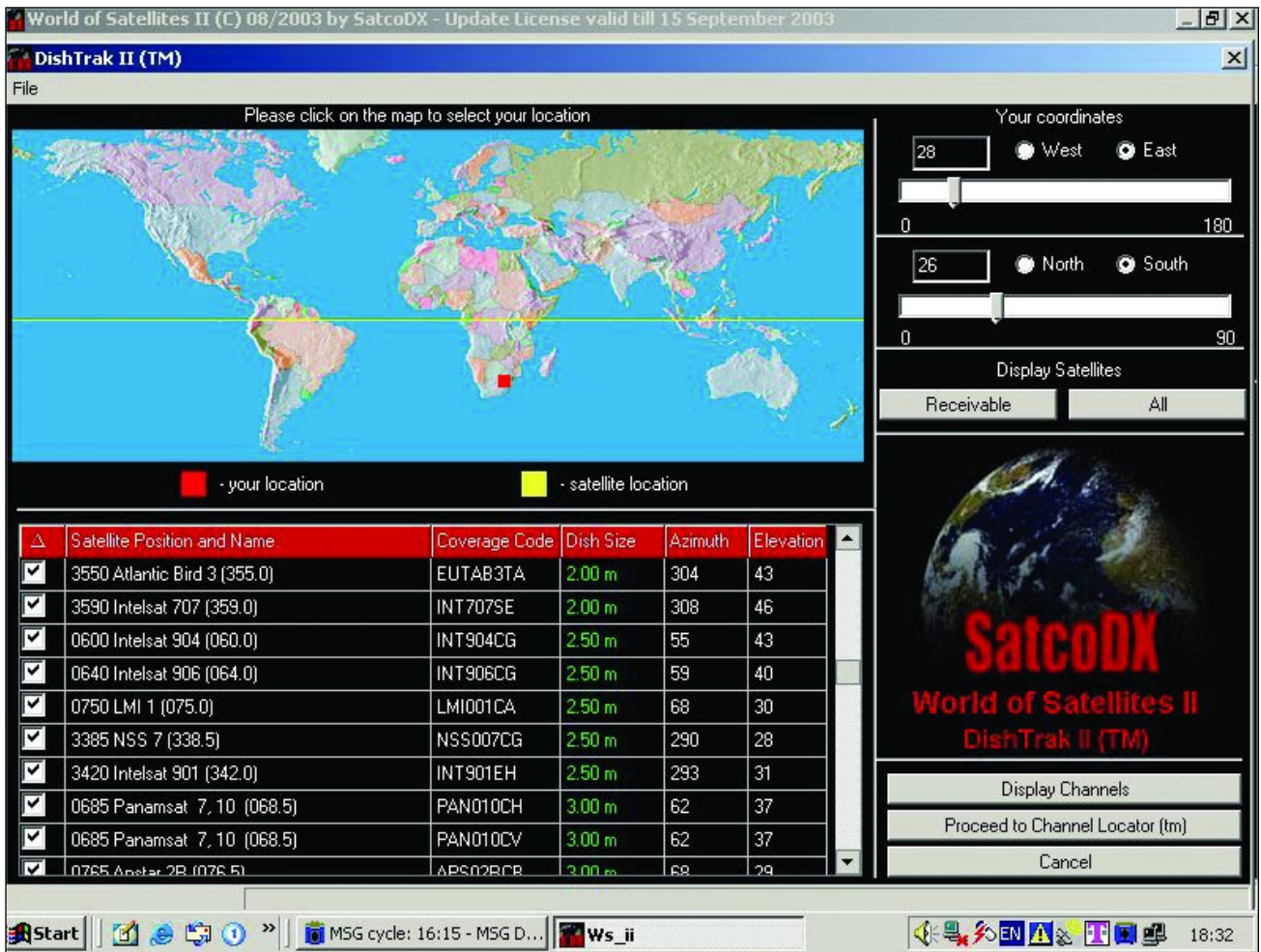
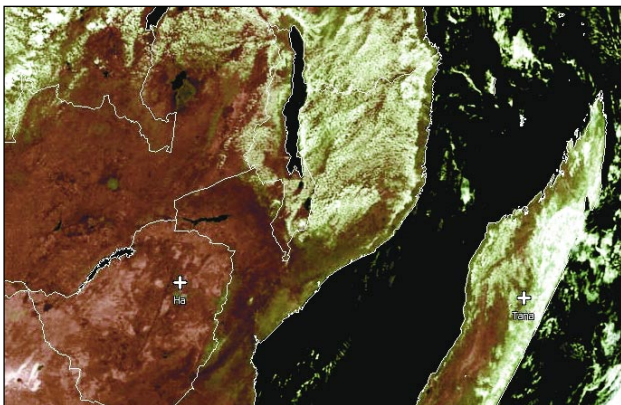
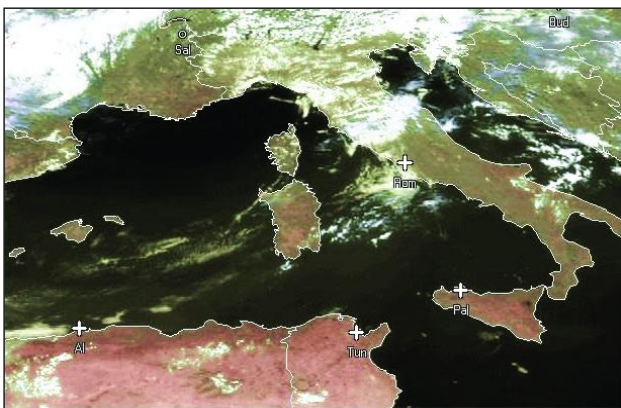


Figure 4 - Calculate the satellite coordinates with Satco DX



Figures 5 (top) - Italy Figure 6 (foot) - Central Africa  
Received via C-Band - September 15, 2004  
Image © EUMETSAT 2004



Figure 7 - The 1.8-metre solid dish required to receive C-Band

Setup continued by opening the 'Advanced' tab. First select 'LNB Frequency' (figure 2) and select 'single' under 'LNB Frequency' (to indicate that you will use only one LNB). Then, under 'Low Frequency', select 5.150 GHz. Now select 'Tuner Status' (figure 3), which displays values automatically derived during the demodulation and detection process. You cannot change these values.

- 22 kHz switch - Off
- Low LNB (meaning 5.150 GHz)
- Signal to Noise Ratio (This window displays the high and low values over a period of time. Click 'Reset' to set all the values to the current value.)
- LNB offset

One item you can select is

- Viterbi Rate - 2/3

For more detailed information on the parameters displayed under 'Tuner Status', please see the Help File.

Finally, I opened the 'PIDS' tab (figure 8) and pressed the 'Scan for PIDs' button—be prepared to wait a couple of minutes until this process is completed. Then, in the 'Available PIDs' window, I selected 'Transponder 1-3108 (Eumetcast)'. I added PIDs 100, 300 and 301 to the 'PID' box in turn, followed by a click on the 'Add' button each time. If there are other PIDs in the 'PID' window, remove them. Note that you will only get correct PIDs once your dish is finally adjusted.

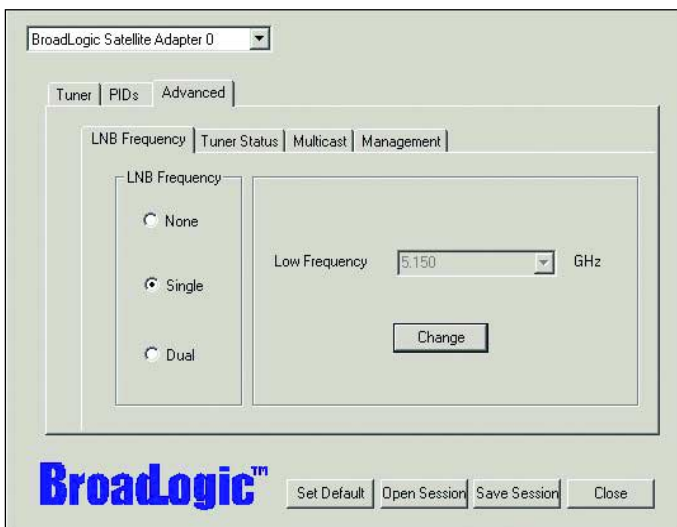


Figure 8 - Settings in the 'PIDS' tab of the Vbox TV card

### The Dish - Final Adjustments

With the software successfully installed, it was time to complete the positioning of the dish with the help of a signal-strength meter. There are many types of these meters on the market. The one I used was the *Satfinder*, which is available at most dealers in satellite dishes.

I cut the cable about two metres from the dish, inserted the *Satfinder*, then turned the dish manually until I received the strongest signal (indicated on a scale of 1-8 on the meter). This accomplished, the meter was removed and replaced by a barrel connector.

Back at my computer the signal strength was 82% as

indicated by the *Vbox* software. My cable length is about 40 metres, so I fitted an in-line amplifier (at the position where the cable was cut) but found that the signal was better without it!

Now came the final adjustments to the dish. I spent many hours on this, specifically to get the best position of the polarisation of the LNB. LNB polarisation is very important. The plane of the receiving part of the LNB must be the same as that of the transponder on the satellite: in the case of *Atlantic Bird-3* this is left-hand circular.

To get the LNB into the best position it must be rotated. The signal-strength meter is not sensitive enough for this task so you have to rely on the *Vbox* software, which shows the signal-to-noise ratio under 'Tuner status' (figure 3). You need two people for this—one to turn the LNB and the other to check the signal-to-noise ratio on the computer. It is useful if you have a two-way radio to facilitate communication. Rotate the LNB to get the highest figure you can—if possible 3 or greater. This figure does change continuously, and may even go negative at times, but don't worry. On average it should be between 2 and 3 most of the time.

You are now ready to receive your first pictures—enjoy it!

### And Finally ...

Always remember that you will have between 13 and 18 volts in your cable to the LNB, so be very careful to avoid a short-circuit, especially when you connect the signal meter, etc. To play safe disconnect the cable from the computer when making dish adjustments (the current is supplied by the computer via the receiver card to the cable connector).

I use only one computer and now have absolutely no problems. I do everything at the same time: receiving, decoding, saving, animating and all the other options. You really do not need two computers. I use the excellent software of David Taylor, and really enjoy the animator program.

All the problems I experienced are now history. The compensation of the stunning pictures which I receive is fantastic. Figures 5 and 6 illustrate segments from the colour composite images I am now obtaining. Figure 7 is a photograph of my 1.8 metre C-Band dish. I really enjoy MSG, and my system runs 24 hours every day. I hope that this article will help other people interested in MSG who have to make use of the *Atlantic Bird-3* downlink.

Where there is a will there is a way- go for it!

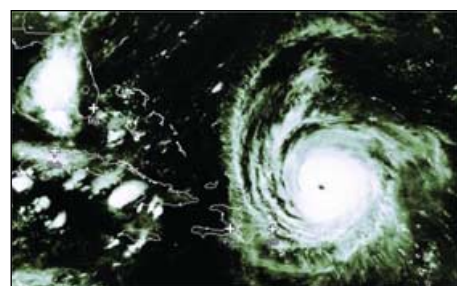


Figure 9 - Hurricane 'Frances' on its way to Florida - September 1

Image © EUMETSAT 2004

# Lightning Strike

Bill Johnston

Bill Johnston, K5ZI, has been an amateur radio operator for 45 years, and a weather enthusiast for even longer. With his experience as an engineer on the professional level, and ham on the hobby side, he has published several articles in weather and ham radio journals over the years regarding the effects of lightning and its potential to damage electronic equipment. His articles have detailed methods by which one can prevent, or at least minimise the damage that lightning might cause. Whether your concern is for computers, weather satellite equipment, ham gear, or any other sensitive electronic device, his advice in general is as follows:

'If a thunderstorm is approaching, turn off your equipment and completely disconnect it from the mains, antenna cables, rotator cables, and from all telephone modem lines. For added protection, reconnect antenna and rotator cables to a substantial earth ground. The latter step ensures that any lightning-induced currents in the disconnected cables are shunted to ground, and do not arc over to other equipment in the house. Though not one hundred percent fail-safe, these measures greatly reduce the risk of damage to equipment inside your house.'

As a strict adherent to his own advice, Bill has never experienced lightning damage to any of his ham or weather satellite equipment. At least, not until the night of August 1, 2004, when his house in southern New Mexico took a direct strike during a particularly severe thunderstorm which dropped 1.71 inches of rain in a little over two hours. This is considered a substantial rainfall in a state where most areas receive no more than 8 inches in an entire year! Bill takes up his story ...

Following the lightning strike, my immediate concern was fire, since much of the house immediately filled with acrid smoke. Fortunately (?), the smoke proved to have emanated from the many pieces of scorched electronic equipment, rather than from the house itself. A more thorough investigation the following morning revealed the sequence of events, and the full extent of the damage.

The lightning appears to have struck a large antenna tower just outside the house. The tower is exceptionally well grounded through a steel framework in a concrete foundation, plus several additional copper ground rods which extend downward to a depth of 8 feet. Nonetheless, a portion of the lightning's current followed the several antenna and rotator cables which come off the tower, and are draped through a series of U-bolts hanging from the rafter tails under the eaves of the house.

One of the wooden rafter tails was burned and blown apart. The cables drop down from the eaves to a 4-inch diameter PVC pipe which penetrates the side of the house to provide a path for the cables to enter the house. At this point the lightning split the PVC pipe, cracked the stucco on the outside of the house, and blew the plaster off the

wall on the inside of the house. As usual, I had followed my own advice—up to a point. Not a single piece of equipment in the ham shack was connected to the mains, the antennas, or telephone lines. However, the antenna cables from outdoors *had* been left lying loose, without being reconnected to a solid earth ground.

***As a result, the lightning-induced current flowing in them had arced to virtually every piece of equipment in the room, leaving burn marks and melted spots throughout.***

As I write this the damage assessment is still under way. However, this much is already known: my entire GOES, APT and HRPT weather satellite systems are a total loss, including the receivers, decoders, azimuth and elevation antenna rotators, rotator controllers, and preamps. Three state-of-the-art computer systems were totally destroyed (except for a single PCI parallel port accessory board which miraculously survived in one system). The laser printer was fried although the inkjet right next to it survived.



The antennas on Bill Johnston's roof

On the amateur radio side of the room, the majority of the ham equipment is a write-off. This includes several HF, VHF, and UHF transceivers, as well as a state-of-the-art receiver which tunes (or, more accurately, *used to tune*) from 100 kHz to 2 GHz. The assessment is ongoing to determine whether the few pieces which appear to have only light damage can be economically repaired. A couple of hand-held transceivers ('handie-talkies') in a desk drawer survived, but a small GPS receiver next to them did not.

There was additional damage in other parts of the house, though not extensive. One burner on the electric stove in the kitchen was destroyed, as was a surge protector power strip in another room. Surprisingly, the television set and VCR (which are on a separate outside antenna not far from the ham radio tower) suffered no damage other than having their program memories scrambled.

*concluded on page 11, column 2 ...*

## ***Rolling Subscriptions and Renewal Information***

**Nigel Evans**

GEO plans to issue four quarterly magazines each year. The first issue, which was free (GEO Q1), is issued to every new subscriber. In order to spread out the renewals it was decided at launch that these would become due on the anniversary of the date of subscription.

Thus, someone who subscribed in January 2004 will have received Q1 2004, Q2 2004, and Q3 2004 with Q4 2004 and Q1 2005 to come. Renewal will be required to receive the next four issues commencing with Q2, 2005.

In order to let you know **when** you should make your next payment to GEO we have decided to use the same reminder method employed by other similar publications such as *SPRAT* the QRP journal. From the next issue of *GEO Quarterly*, your **address label** will indicate when your subscription **expires**.

For example, the sample label opposite (which features my own details) indicates that this subscription runs out **following** the issue of Q1 2005 (March).

**Paid to Q1-2005**

Nigel Evans  
7 Gloster Ropewalk  
Dover  
Kent CT17 9ES  
England

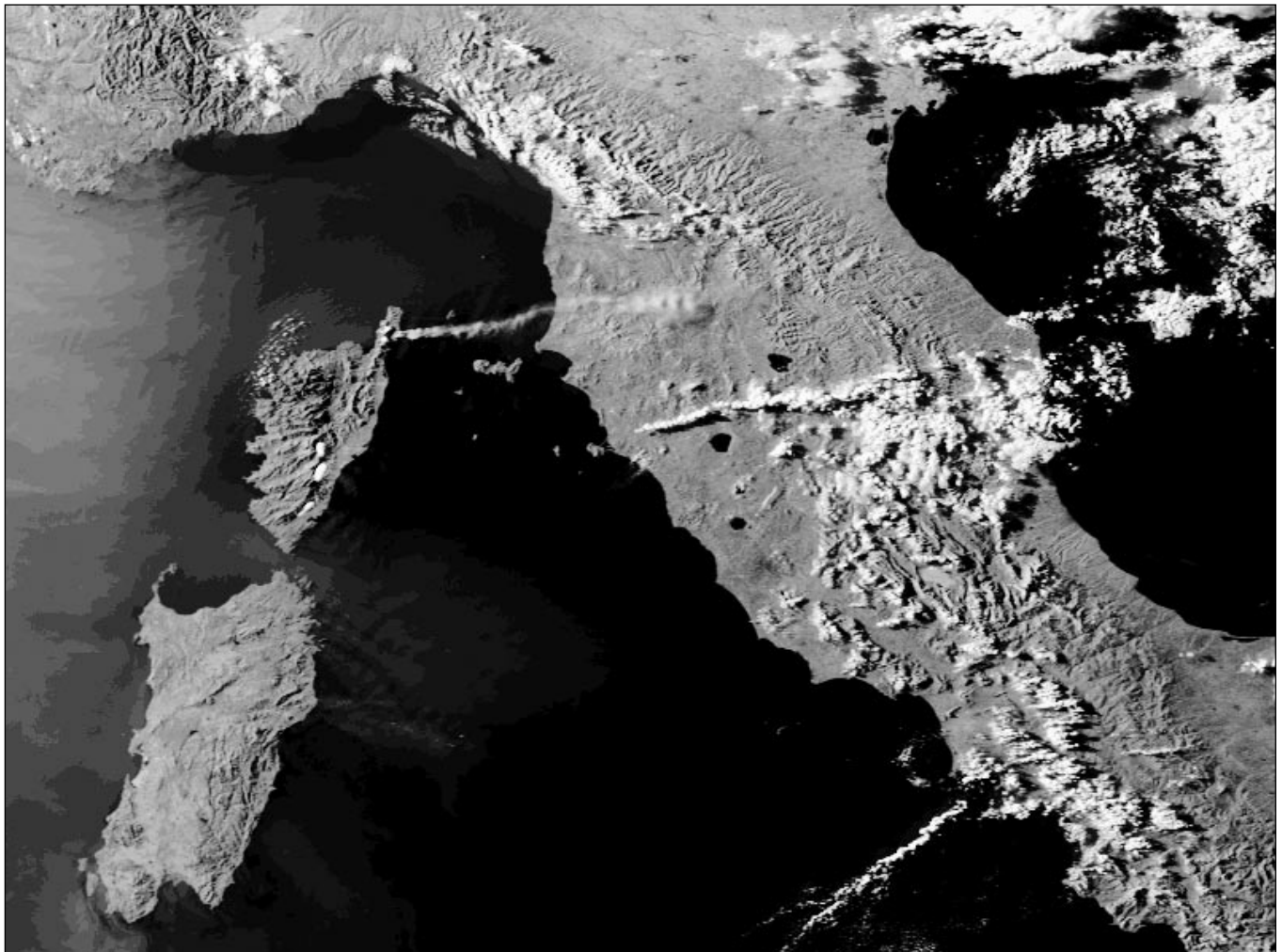
Please send any subscription queries to

***members@geo-web.org.uk.***

*... continued from page 10*

These losses are covered by my homeowner's insurance, except for a deductible excess which I must pay out of my own pocket. Since I had never had an insurance claim in the 40 years that my policy has been in force, I just recently increased the excess from \$500 to \$2,000 in order to save money on the annual premium. This makes me feel that the lightning has struck not once, but twice!

The moral of the story is that you can never be too safe when it comes to lightning protection. And just knowing the rules isn't enough—you have to follow them too. It will take many months to rebuild my weather satellite and ham station, but you can be assured that the rebuilt station will have provisions to ground all those loose antenna and rotator cables!



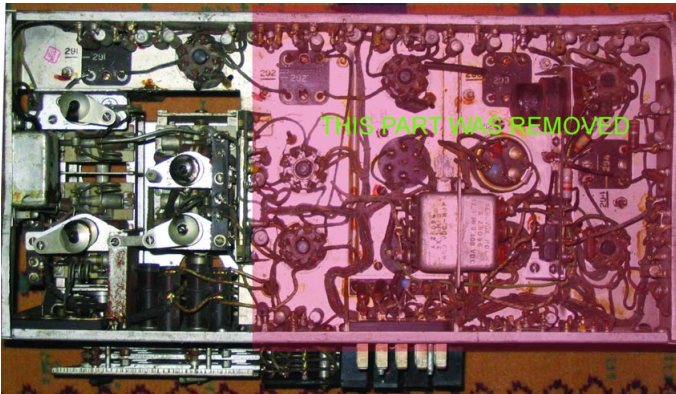
Marciano Righini, I4MY, from Italy sent this late afternoon NOAA-15 HRPT image acquired on August 13, 2004. The low angle of the lighting accentuates the smoke plume from a fire in the 'finger' of Corsica (France) as it crosses the Tyrrhenian Sea and reaches Tuscany (Italy).

# Reception of WXsats in the Early Years

*François Verstraelen*

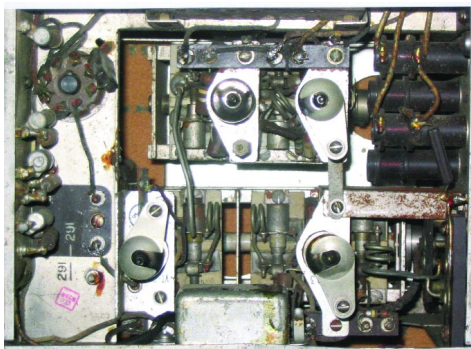
Some thirty years ago, amateurs who were interested in the reception of weather satellites had only one way to go: they had to build their own reception station because it was very expensive to buy a ready-built receiver. But then, in the year 1973 there came out a very good book on the Dutch market. It was called *Weersatelieten* and it helped you on your way to build your own station with surplus equipment that was left over from WW II.

You needed a VHF set and an HF set. The VHF set was the *BC 624* which was used in the famous Spitfires and Hurricanes, the well known airplanes from the Battle of Britain. The HF set was the *BC 603*, which was the receiver used in the American Sherman and Patton tanks. These receivers were not hard to find in the late 70's and early 80's and were certainly not expensive. You had to pay around £7.50 for a *BC 603* and £10.00 for the *BC 624* in those days. But once you had the two receivers then the construction work could be started.



The complete BC 624 VHF radio

The best results were obtained when you used the *BC 624* only as a converter, so you could remove all the IF and LF sections as well as the chassis. This was quickly done with a saw, leaving you with a nice robust converter with the dimensions of 14,5 x 14 x 5 x 19 cm. After this work was done you had to make alterations to the VFO section.

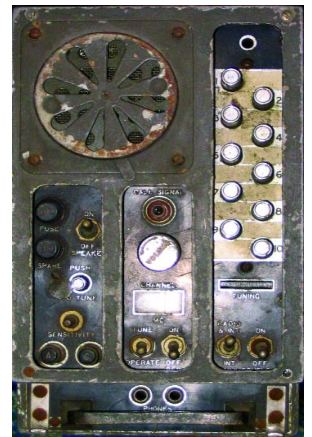


The BC 624, minus chassis, after removal of the IF and LF stages

Some rotor plates had to be removed from the variable condenser. This had to be done with great care because the axle of the condenser was made from high-quality porcelain which could easily be broken. Removal of the rotor plates was necessary because the range of the original receiver was from 100 to 156 Mc/s (MHz) and tuning was not accurate.

When this was done, then came the oscillator section and alterations to the HF section and mixer stage, followed by coupling to the *BC 603*, which was very easy to realise.

Now what about the *BC 603*? In the case of its use for WX sats, this unit was used only as an IF amplifier and FM demodulator. The original range of this rx was 20 -28 MHz and it was very easy to modify it for AM signals also. The receiver was continually tunable but also had some preset channels, though these were not very useful for amateur use. It was available with or without a dynamo for the electrical supply. I found it was best to build my own simple power supply for 220 V and 12 V which worked very well.



The BC 603

The modifications required to this RX were easy to do and were followed by the job of realignment. This could be time consuming and required alignment equipment. I did not possess these, and was fortunate that a good friend, was able to do this for me.

The satellites I have **heard** with this equipment were NOAA-6 (launched 1979) and NOAA-8 (launched 1983). Unfortunately, I had no equipment to copy the satellite images on to paper nor to save them electronically. But I did see pictures that other amateurs produced from these satellites using very similar home-made equipment!

Let me say just a few words about how difficult it was to get on the information for the APT satellites in those days. It was really a 'must' that you had an other shortwave receiver and a telex printer to obtain information sent out from meteorological stations: Bracknell, Moscow, Offenbach etc..

As an antenna I used the 5 element Yagi as described in GEO Q2 and indeed, still use it to this day.

# News from Brazil

Raul Fritz  
Teixeira  
fritz@funceme.br



At the end of last March an intense and very rare South Atlantic cyclonic system, unofficially dubbed *Catarina* by the people of Brazil, evolved, according to the U.S. National Hurricane Center, into a Category-1 hurricane (figure 1). As it moved westward towards the Brazilian coast it caused death and destruction over both sea and land and was an object of great debate amongst meteorology experts in Brazil. The storm, reported in the previous issue [1], was considered to be the first hurricane in the South Atlantic in recorded history.

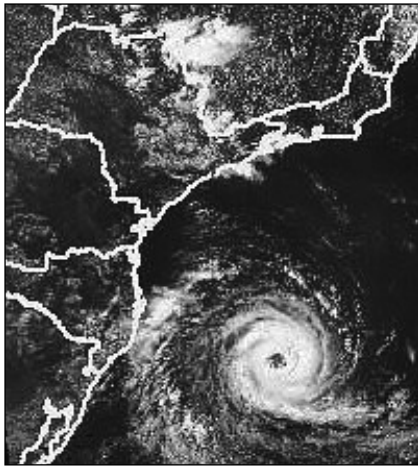


Fig. 1 - Hurricane Catarina near the coast of southern Brazil. NOAA-16 channel 1 (visible) image acquired on March 26, 2004, 17 UT.

Curiously, climate change scientists working in the Met Office Hadley Centre for Climate Prediction and Research in the UK, recognised that the region where *Catarina* has been formed was coincident with one of the areas where their climate model predicted that tropical storms in the South Atlantic could appear in the future [2].

Also very curiously, on January 19, 2004, a cyclonic circulation with scatterometer winds (from the QuikSCAT data) indicating tropical storm strength developed in the South Atlantic Ocean just east of the Brazilian state of Bahia [3] (figure 2).

This, however, can not be compared with *Catarina*, which was really a mixed system. From a baroclinic structure, *Catarina* acquired barotropic (tropical) characteristics like a hurricane. However, new studies and computer simulations will be made to better understand the phenomenon.

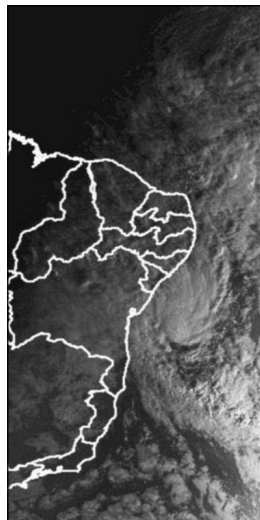


Figure 2  
A cyclonic circulation in the South Atlantic Ocean near the coast of northeast Brazil.

NOAA-15 visible image acquired on January 19, 2004, 08:45 UT.

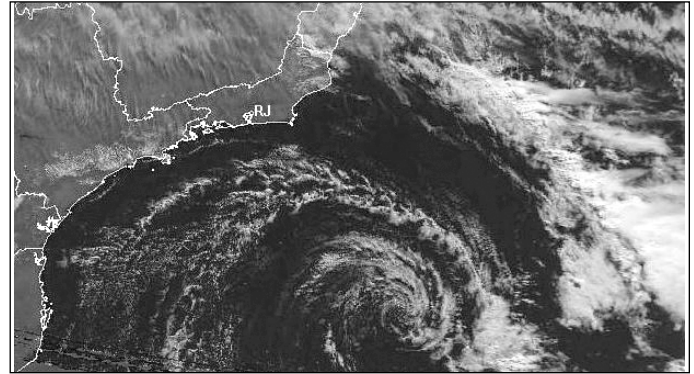


Figure 3 - A cyclonic system near the coast of southern Brazil, observed by NOAA 17 at 12:52 UT on May 9, 2004 .

Following this unusual event, some other cyclonic systems, much weaker, were identified in the same oceanic area (figure 3).

The May 9 cyclone, unlike *Catarina*, moved eastward, away from the coast. By the following day it was much less intense and in process of dissipation.

Images from polar orbiters are specially good to view the structure of clouds, mainly in the visible channels, and can be used to visualise and analyse the occurrence of varied kinds of mesoscale atmospheric phenomena (ranging from a few to several hundred kilometers) such as the squall lines resulting from convergence lines (boundaries). These are generally accompanied by heavy rain. Continuous and broken squall lines are groups of individual cumulonimbus organised around long convergence lines. Gust fronts with moderate or intense winds can precede these lines. An example of a tropical

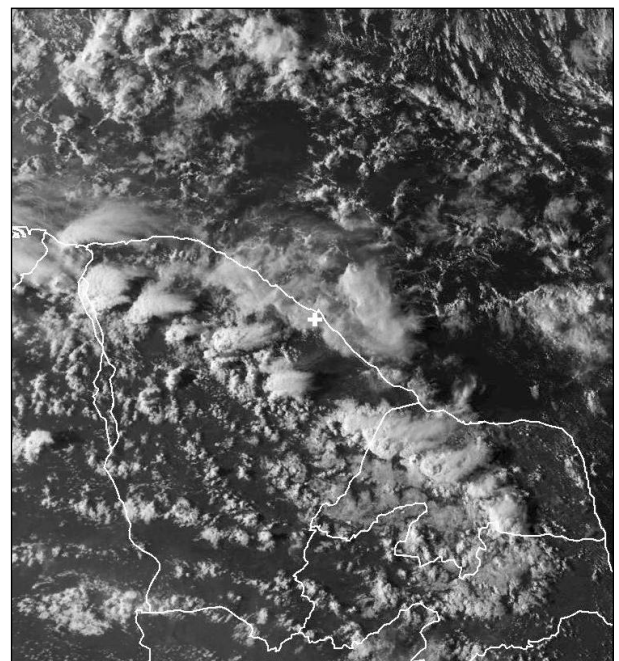


Figure 4 - A squall line acting over part of north-northeastern Brazil (the receiving site is represented by a small white cross). Channel-1 NOAA-12 image acquired at 19:00 UT on March 25, 2003.

squall line can be seen in figure 4, where extensive anvil clouds can be observed. They are so named due to their shapes, similar to blacksmith's anvils, that spread outwards from the upper parts of mature cumulonimbus.

Squall lines can develop in active areas of the Intertropical Convergence Zone (ITCZ), the region where the trade winds converge and where precipitation girdles the globe near the equator. Figure 5 shows a squall line associated with the ITCZ and penetrating inland. The squall line is more pronounced in figure 6, where it depicts many groups of well developed shower clouds.



Figure 5

A squall line associated with the ITCZ and penetrating into north-northeastern Brazil. NOAA-16 channel-1, April 9, 2003, 16:15 UT.

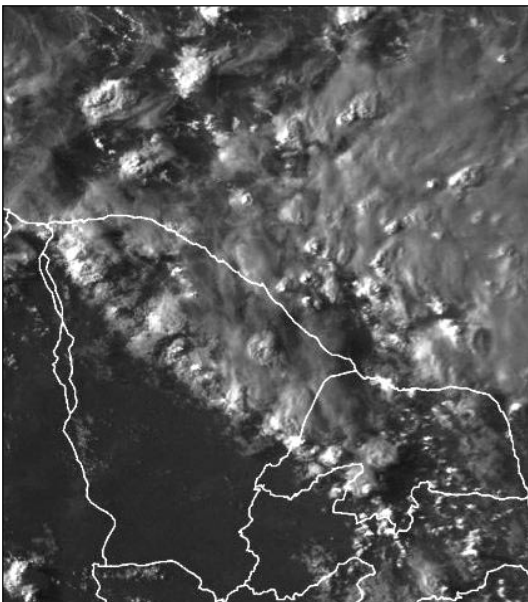


Figure 6 - The squall line has penetrated farther inland. NOAA-12 channel-1, April 9, 2003, 19:40 UT.

### **Funceme**

The images presented here were received by the Foundation for Meteorology and Water Resources of the State of Ceará (FUNCEME), a non-profit state bureau located in the northeast region of Brazil and working with

meteorology, land and water resources. In this institution meteorological images are used mainly for analysis and weather forecasting. Meteorological and land-use products are also generated from the various satellite channels. The site also receives images each 30 minutes from the geostationary Meteosat-7. A special software package was developed to work with the images in the visible, infrared and water vapour channels. This allows us to view the complete image or a sector remapped for northeast Brazil. It also allows us to produce image animations and colour-enhanced cloud top temperature



Fig. 7 - A Meteosat-7 visible image - 17:00 UT on May 20, 2004.

products. Figure 7 shows an example of Meteosat-7 visible imagery acquired at Funceme. Note the sunglint on the waters of the tropical North Atlantic Ocean immediately above of a line of clouds associated to the ITCZ. Note also the great convective complexes of clouds over Liberia and Sierra Leone in western Africa.

Visible images from geostationary meteorological satellites are very useful to identify and monitor weather systems and execute short-term weather forecasts ('nowcasts') focused on a 6-hour time frame. This is specially true due to the high frequency of the images (30 or 15 minutes). As an example, the sequence of images in figure 8 shows a gust front originating from a gigantic mass of cumulonimbus in process of dissipation over the ocean.

In the first image the cumulonimbus is visible as a white dot surrounded by lines of clouds forming arcs. In the second and third images the cumulonimbus is disappearing and the line arcs of clouds approach and touch the coast. In the final image a black dot (cloud free area) appears where the cumulonimbus was located and a line arc of clouds (cumulus and stratus) advances inland. The strong descending air (downdraught) from the cumulonimbus has given rise to clouds in long arcs accompanied by gusting winds.

*continued on page 19 ...*



# Earth Imaging News

Peter Wakelin

## ***Tropical Rainfall Measuring Mission to End***

After being granted a short reprieve to monitor the 2004 hurricane season, TRMM is to be de-orbited by a controlled descent into the Pacific Ocean. The spacecraft, launched in 1997, has been highly successful in measuring tropical rainfall for more than double its designed lifetime. The joint US/Japanese mission carries microwave and near-infrared sensors as well as a unique rain radar.

The spacecraft's altitude was raised by 50 km during August 2001 to extend its orbital lifetime, and natural decay is still some way off, but it was financial constraints that led to the decision to end the mission although all systems are still working. It will be replaced by an advanced Global Precipitation Measurement mission in about five years' time.

## ***TLE Continuation Assured - For the Time Being***

For many years, the source to the public of Two-Line Elements (TLE) has been NASA's Orbit Information Group (OIG), who distribute the orbital data derived from the radar and optical sensors operated by the US Military. This is changing and NASA's role will be taken over by US Air Force Space Command. Those who obtain orbital data directly from OIG should make the changes indicated on the OIG website. It is probable that restrictions will be placed on the redistribution of data so, as most readers get their data from secondary sources such as Dr Kelso's *Celestrak* site, some changes may be needed to get the data. The implementation of the changes has been delayed slightly but it seems inconceivable that weather satellite orbit data would be withheld although it is known that there is much internal squabbling within the US Air Force about continuing to make public the TLEs long provided by NASA.

## ***Farewell to Two Old Friends***

GOES 8 operations have been terminated and its residual propellant was used to boost the spacecraft well above the geostationary orbit where it will continue to encircle Earth for millions of years.

NOAA 11 has been deactivated and its batteries have been isolated to reduce the risk of a pressure build-up causing an explosion. A battery explosion may have been the cause of a recent DMSP spacecraft fragmentation which created numerous debris pieces in an already cluttered 800 km sun-synchronous orbit. The tenuous atmosphere at 800 km ensures that dead satellites and debris at this height do eventually burn up but it takes about 300 years.

## ***TIROS-N Still Transmitting***

Mike Kenny of the Bureau of Meteorology in Melbourne, Australia, reports that TIROS-N, the prototype of the present generation of NOAA polar-orbiters launched in October 1978, is transmitting CW on 136.77 MHz and 137.50 MHz when in sunlight and is interfering with NOAA 12 which uses the same frequencies.

There have been several instances in the past of old spacecraft resuming transmissions after years of silence but usually only when the entire orbit is sunlit. However, Mike says TIROS-N has now been transmitting for two months.

## ***India Back on Track after Explosion***

Just seven months after a major fire killed six workers at the Solid Propellant Space Booster Plant near the Shiharikota launch site in eastern India, the Indian Space Research Organisation successfully launched the first commercial flight of the GSLV (Geostationary Satellite Launch Vehicle) on September 20. It carried the Indian-built EDUSAT into a precise geostationary transfer orbit from where the satellite's own propulsion system took it to a geostationary position at 74 degrees east longitude alongside Kalpana 1 and INSAT 3A.

## ***Feng Yun 2C Launched***

China launched its third geostationary weather satellite on October 19 from the Xichang launch site in Sichuan Province of southwest China.

Feng Yun 2C is destined to operate above longitude 105 degrees east. At the time of writing, on the day following launch, the payload is in a geostationary transfer orbit with an apogee well short of geostationary altitude, according to the first two-line orbital elements.



Launch of Feng Yun 2C  
Photo: Xinhua.

## ***NOAA N-Prime to be Repaired after Accident***

The NOAA N-Prime spacecraft was badly damaged in an accident at Lockheed Martin's Sunnyvale, California factory in September 2003 when it fell off a 'turnover cart' used to rotate the satellite from a vertical to horizontal position, because securing bolts were missing.

NASA, who buy and launch satellites for NOAA, investigated the incident and published its final report on October 4, following which Lockheed Martin have agreed to forfeit all profits on the contract to help offset the \$135 million repair bill according to *Space News*.

Although the spacecraft chassis suffered most damage, many of the components will have to be replaced and both the high resolution infrared radiation sounder and solar backscatter ultraviolet radiometer will have to be either rebuilt or replaced. The planned early 2008 launch date is still expected to be achieved.

The report states that the cause of the accident was Lockheed Martin personnel's failure to follow proper procedures but also cites ineffective government oversight as a contributing factor. The report is available at

[http://www.nasa.gov/pdf/65776main\\_noaa\\_np\\_mishap.pdf](http://www.nasa.gov/pdf/65776main_noaa_np_mishap.pdf)

# A Visit to the Werkgroep Kunstmanen 'Bijeenkomst'

Utrecht, September 11, 2004

David and Cecilia Taylor

As a result of a chance remark made by Arne van Belle at the Leicester GEO Symposium in May—'Utrecht is a really nice city'—we decided to attend the September Werkgroep Kunstmanen meeting both to support the Dutch Group, as they had supported GEO in Leicester, and to see the sights of Utrecht and perhaps some other places in The Netherlands. Checking the flight times from Edinburgh showed that at least an overnight stay on the Friday was required in order to arrive early enough for the meeting: so we decided to extend by one day either side, travelling on the Thursday and returning on the Sunday. A bit of research on the Internet led to our finding a hotel in Utrecht which was only a short walk from the meeting at Nimeto College, and just about 20 minutes walk from the town centre.

Cars can be a burden in Dutch towns, so public transport is best. Not wanting to put anyone out by accepting offers of accommodation in the forest or lifts to and from Utrecht, we looked to see what public transport was available and found a fast and frequent train service from Schiphol Airport to Utrecht, taking either 50 minutes (with one change) or 60 minutes (direct stopping service). Looking on the map it seemed that Hilversum was almost on the route, so thoughts of visiting the Broadcast Museum there passed through our minds, or perhaps viewing the architecturally renowned Town Hall. It also emerged that the International Broadcasting Convention was on in Amsterdam on the Friday afternoon, so if it were wet there would be something to do!

We were blessed with excellent weather on the Thursday and Friday, and even a three hour delay at Edinburgh airport while a faulty aircraft was replaced did not dampen our delight with Utrecht. As we were late, and as the weather was excellent, our train diversion to Hilversum did not materialise, and we took the quicker train to Utrecht. Not knowing the town, and having a heavy portable to lug around, we took a taxi to the hotel, although we could probably have managed without. The train ticket could be bought with cash or credit card at the airport, but if you use a credit card make sure you have one with a PIN.

We wanted to go up the Cathedral Tower, but we were too late for that day and could instead book for Friday morning. We were able to get an excellent DVD telling us of the Cathedral's history, though. Our gentle wanderings on Thursday afternoon led us to discover the Oudegracht (Old Canal) which has a stretch devoted to restaurants of all cuisines, combining indoor and outdoor seating at the water's edge. This local knowledge proved useful when we dined out with our Dutch and Italian/Belgian friends from the meeting, on both the Friday and Saturday evenings!

Back at the hotel, we were able to play the DVD about the Cathedral, and discovered that half of the Cathedral had actually been blown down by a hurricane in the seventeenth century. Oh for nowcasting from satellites to be able to get out of the way! The separate tower had survived, although we now doubted the wisdom of booking a Tower visit the next day! Another of the delights of the Hotel Ouwi was a free WiFi connection to the Internet so we were able to confirm our safe arrival in Utrecht.

Friday arrived, and no change in the weather (confirming our satellite downloads of the night before). First thing on the schedule was the Cathedral Tower. Well, it actually feels quite solid inside, to be honest! The guided portion of the tour stops short of the open bell part of the tower, but those who are very brave (and still have some energy left) can proceed to the top of the tower from where there are some wonderful views to be had. We tried to locate Nimeto College, and succeeded (I think!). What was much more surprising was being able to see the Ajax football stadium in Amsterdam from Utrecht! We'd noticed both the stadium and the CISCO offices as 'noticeable buildings' as we passed them on the train.

We spent so much time up the tower that it was time for lunch when we returned to ground level (and remembered to collect our bags—not allowed up the tower). We had a snack in one of the cafes in the Dom Plein—the square surrounding the Cathedral. Our stroll continued in the afternoon—it was really too sunny to visit inside the many museums we had looked up on the Internet! Dinner on Friday evening was a chance to meet up with

another 'DX' visitor to Utrecht—Luca Bertagnolio from Brussels—and (in theory) John Tellick and Francis Bell. As it happened, we didn't know where Francis was staying, and though John tried hard to get to the meal, he didn't make it. Sardinian food was Thursday's choice.

At the meeting itself, after the short formal business section was completed, many people in the group gave informal reports on the status of their projects. These included hardware projects like QFH antennas and a novel 1.7 GHz dish feed, and software projects. Arne van Belle described MSG-1 reception, processing and animation using just a single 400 MHz PC, albeit with some very careful optimisation! John Tellick briefed us on the latest from EUMETSAT, and Francis Bell spoke about the GEO group and its progress so far. David Taylor described some of the newest data from EUMETCast – the Sea-Ice and Sea-Surface temperature data. After lunch, there was the chance to chat informally to everyone in the group, and to demonstrate some of the finer points of software which needed a one-on-one discussion. There was RF work on tuning the novel 1.7GHz feed.

After the meeting a group went out for an informal dinner, choosing an Indian and Sri Lankan restaurant from one of the many in the "restaurant arc" of the Oudegracht. Although the weather was not as good as on the days before, the rain held off throughout the meal. Indeed, the major hazard of dining so near the canal must be the chance of falling in if one's step is the least unstable (so not too much to drink!). Service was a little slow, but we all got what we ordered in the end, including various hot and cold sweets.

We spent the Sunday visiting Gouda – a smaller town than Utrecht but one showing the influence of trading, windmills and canals on the Dutch way of life. Having a Dutchman (Arne van Belle) as our guide was a valuable asset, and many thanks to him for taking the time to show us round. I don't think we even talked about weather satellites during the day!

Many thanks as well to the members of the Werkgroep Kunstmanen for making us so welcome, and allowing the intrusion of the English language into their meeting.



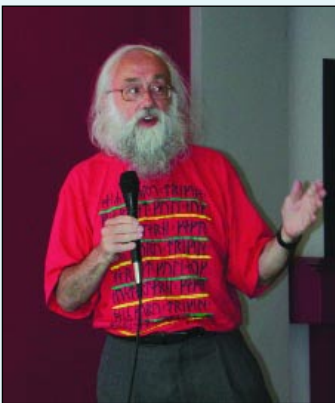
Arne van Belle setting up his 35 cm dish for MSG reception



Arne van Belle demonstrating MSG-1 reception



Canal-side Restaurants in Utrecht



David Taylor describing new EUMETCast facilities



Receiving and processing MSG-1 on a 400 MHz PC



View from Utrecht Cathedral Tower



This delightful miniaturised Meteosat-7 receiver was built by Jaap Rusticus, one of the Group's members



Testing a novel 1.7GHz dish feed



View towards Utrecht Cathedral Tower



Some Werkgroep Kunstmanen committee members



Francis Bell addressing the meeting on GEO's behalf



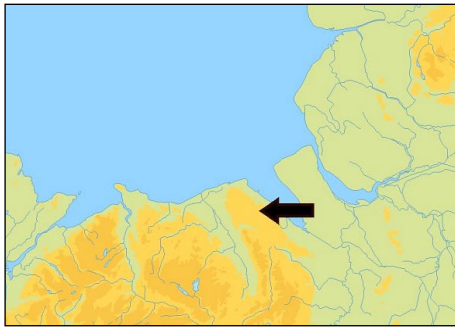
David Taylor demonstrating his software



Gouda Town Hall

# Summer 2004 in the Five Villages

Robert Moore



Whitford Community Council in North Wales has a quarterly journal, *The Five Villages Chronicle*. For some years I have written a weather report for each season. These are based upon the observations at my weather station in the village of Carmel and are usually illustrated with satellite data. The editor of *The Five Villages Chronicle* tells me that the weather reports are well received and of considerable interest to readers. Here is the ‘Summer 2004’ report.

‘What summer?’ you might be tempted to ask. June and July were cooler than last year, but August was warmer, and *very* much wetter. Grey skies and rain seemed to characterise August 2004—but it was a warm month nevertheless. The ground temperature went up to the highest I have recorded since 2000, 17.6°C on the 12th, but it has been falling ever since and was 15.5°C at the end of the month.

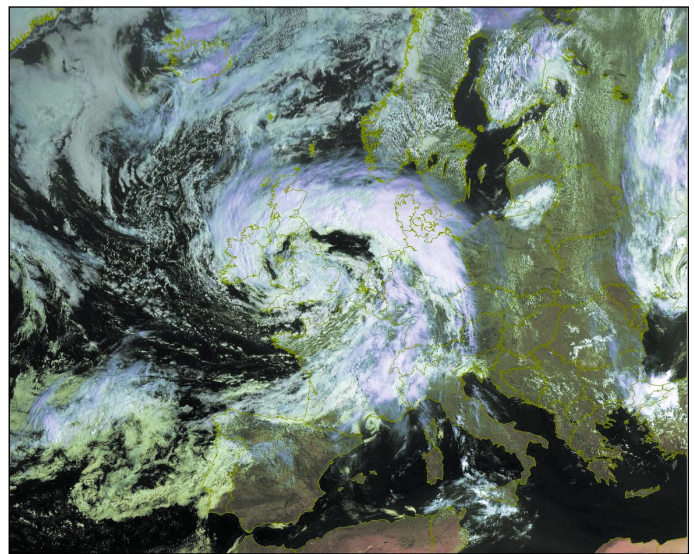


Figure 1 - Depression - 09:00 UT, June 23, 2004

Image: Copyright © EUMETSAT 2004

Processing: David Taylor's GeoSatsignal

Weather in the Five Villages Summer 2004 (2003 in brackets)				
	Temperatures (°C)			Total rainfall (mm)
	Average	Maximum	Minimum	
June	16.0 (17.5)	23.5 (25.2)	7.1 (8.5)	100.8 (40.6)
July	15.9 (18.4)	23.6 (30.5)	8.5 (10.6)	77.0 (99.5)
August	17.3 (17.9)	26.7 (32.8)	9.5 (7.9)	157.5 (14.6)

Our weather mainly comes to us across the Atlantic. At the edge of the atmosphere, at altitudes of around 10 to 15 kilometres, there exist *jet streams*, whose presence was confirmed by high-flying aircraft during the Second World War. These very strong winds act as conveyor belts that carry our weather from west to east. Depressions tend to form along the line of the jet stream but in the summer months we are normally well to the south of the jet stream, enjoying high pressure and warm air from the south. This year we have remained firmly to the north and even right under the jet stream and therefore subjected to a whole string of Atlantic depressions.

Figure 1 shows an image received from the Meteosat-8 satellite at 09:00 on June 23 at the Carmel weather station, showing the depression that brought 29.5 mm (over an inch) of rain to Carmel on that day. Figure 2 is part of the Admiralty weather chart for 06:00 on the same day—the isobars are close together and the depression is shown firmly centred over the UK. These are not the kind of pictures we expect to see in midsummer.

Summer 2003 was an exceptionally warm one and it has generated a lot of discussion in the technical literature. The August 2004 issue of the Royal Meteorological Society's journal *Weather* was a special issue devoted to the 2003 heatwave and drought. I was glad to see that my

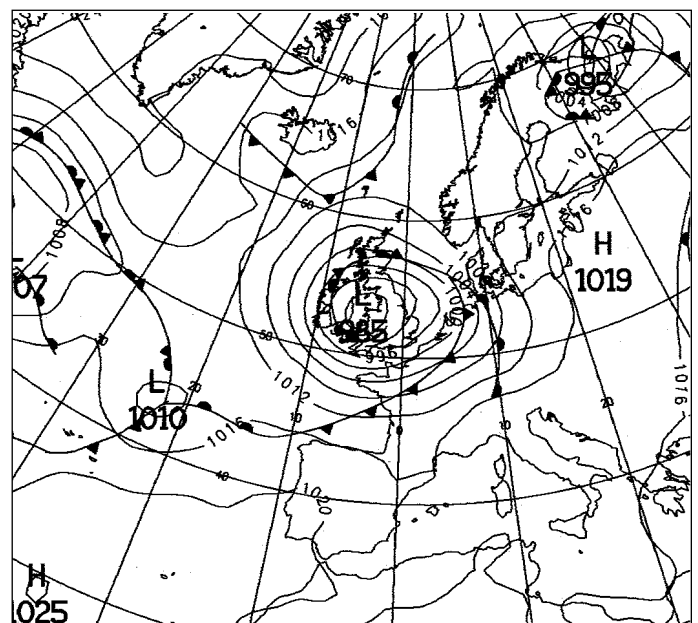


Figure 2 - The Admiralty weather chart for 06:00 UT on June 23

Image courtesy Fleet Weather and Oceanographic Centre

observations in Carmel tracked those shown in the charts published in *Weather*. Although, by contrast, this summer's rainfall has been very high, temperatures are in line with 2000 and 2002, and in-between those for June and August 2001, (when June was hot and August cool)—remember? So this summer's temperatures in Carmel were not exceptional. It was last year that was out of line.

Taken all in all it has been a pretty average summer—i.e. variable around the average temperatures, with alternate sunshine and rain. If you include May in your summer, it has not been at all bad.

But what about that rain? Low cloud, grey skies and rain seem to have been a feature of this summer but in fact the total June/July summer rainfall was roughly similar to previous years and virtually the same as 2000. 2003 was the exception again. Last year June and August were much drier than July. This year June and July were wetter than last year and August exceptionally so, with more than ten times as much rain falling as in August

2003. Nationally, summer was the wettest since 1956 and the twelfth wettest since records began in 1766. *When the rain falls is, of course, vitally important also, and arable farmers will not have welcomed so much rain in August, when they would have hoped to get in their harvest.*

In August we had severe flooding events in Boscastle and Lochearnhead: on radio and TV people asked if this was because of global warming. Global warming and cooling are long-term cyclical changes; specific events in particular places at particular times simply can not be directly attributed to these long-term changes. One of the main contributory factors in Cornwall was the confluence of sea breezes from the north and south coasts over Boscastle. I was watching the satellite imagery of the sea breezes along the south coasts of England and Wales and later the radar imagery of the rainfall (via the Internet). No forecaster could have predicted exactly what was going to happen. It was immediate and it was local circumstances that created these two weather events, not global warming.

## News from Brazil

... continued from page 14

These winds and light precipitation have reached the City of Fortaleza causing slight damage within the city and a brief disruption of power supply in some areas.

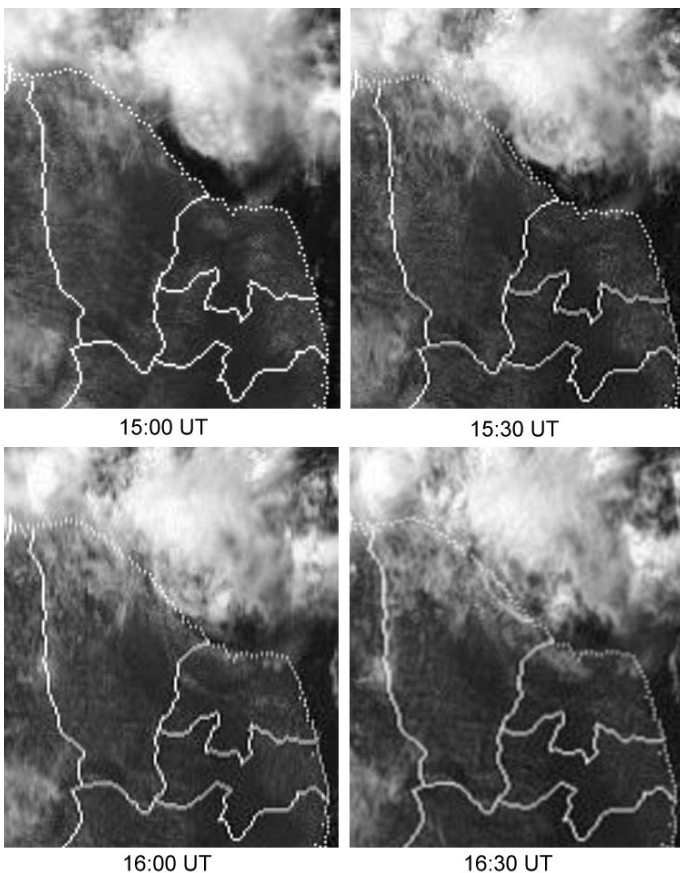


Figure 8

A sequence of Meteosat-7 visible images from March 27, 2004 showing a gust front identified by clouds embedded into lines in the form of arcs.

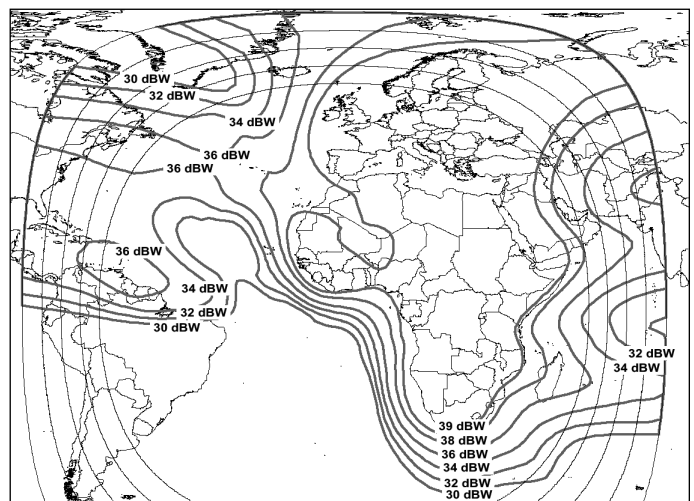
Therefore, imagery from meteorological satellites presents a great practical utility for the professionals in meteorology. Otherwise, amateurs not only can have a great delight observing them but can obtain a high knowledge about the atmospheric behaviour and then to venture to make good weather forecasts for the place where they live and also for other regions of the world.

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2. Catarina hits Brazil, Met Office, UK  
[www.metoffice.com/sec2/sec2cyclone/catarina.html](http://www.metoffice.com/sec2/sec2cyclone/catarina.html)
3. Tropical Cyclones Images and Movies, Met Office, UK  
[www.met-office.gov.uk/sec2/sec2cyclone/tcimages/Misc/](http://www.met-office.gov.uk/sec2/sec2cyclone/tcimages/Misc/)

Raul Fritz Teixeira has an informative website which you can visit at:

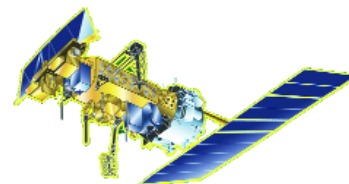
[www.geocities.com/raulfbt2003](http://www.geocities.com/raulfbt2003)



Footprint for Atlantic Bird-3 C-band transmission (see page 7)

# NOAA 12 Reborn

## The 'New' Afternoon APT Satellite



**Les Hamilton**

While preparing David Taylor's NOAA-12 images for the HRPT/APT comparison in GEO Quarterly 3, he and I enjoyed some interesting discussions on the appearance of this satellite's summertime afternoon images. David pointed out that the channel-2+4 composite NOAA-12 images produced by his *Satsignal* software exhibited an attractive colour quality which was quite distinct from images from the other current NOAA satellites. The two colour images on this page illustrate this comparison. They were acquired within a few hours of each other on June 25 this year, and the difference is significant. The NOAA-17 pass, close to midday, produced a crisp image with good contrast throughout. In its NOAA-12 counterpart from late afternoon, when the sun's elevation was much lower, land features in particular are clearly much more subdued.

Notwithstanding that differing lighting conditions throughout the day must impact on the appearance of satellite images, there exists a much more fundamental reason to anticipate differences in quality between NOAA-12 and NOAAs -15 and -17. NOAA-12 is an extremely ancient weather satellite—it was launched in 1991: indeed it is by far the longest-serving weather satellite currently active. It was also the last NOAA spacecraft for which the transmitted signal from the visible/near infrared image channel (channel-2), generally referred to as the 'visible channel', was modulated in direct proportion with the received reflectance from the terrain over which it flew.

Zero radiation was translated into zero signal modulation (full black on the resulting weather images) while 100% reflectance gave full modulation of the signal and produced the brightest white tones. Intermediate reflectance values were mapped on to proportionate shades of grey on the images. Unfortunately, while this provided excellent tonal differentiation in regions of high reflectance (cloud, snow and ice), land in general and vegetated terrain in particular were poorly discriminated in images from these earlier NOAA weather satellites.

### **Dual-Slope Gain Transfer**

Commencing with NOAA-15, launched in 1998, which carried a more advanced version of the imaging radiometer, a *dual-slope gain transfer characteristic* was applied to the mapping between received radiation and signal modulation (figure 3). Readers wishing more details should visit:

<http://www2.ncdc.noaa.gov/docs/klm/html/c7/sec7-1.htm#t7111-1>

The zero and 100% radiation values are still modulated as previously, to the extremes of a notional scale of 1000 points. But lower radiation intensities, in the range 0 to 25%, are mapped to digital values of 0...500 while intensities between 25% to 100% are mapped to values 501...1000. The effect is to provide increased gain for low reflectances, such as are encountered over land and sea, thus increasing the accuracy with which measurements can be made.

### **The Question**

David concluded our discussion by posing this question: 'Has anyone noticed the change between NOAA-12 and NOAA-15? The

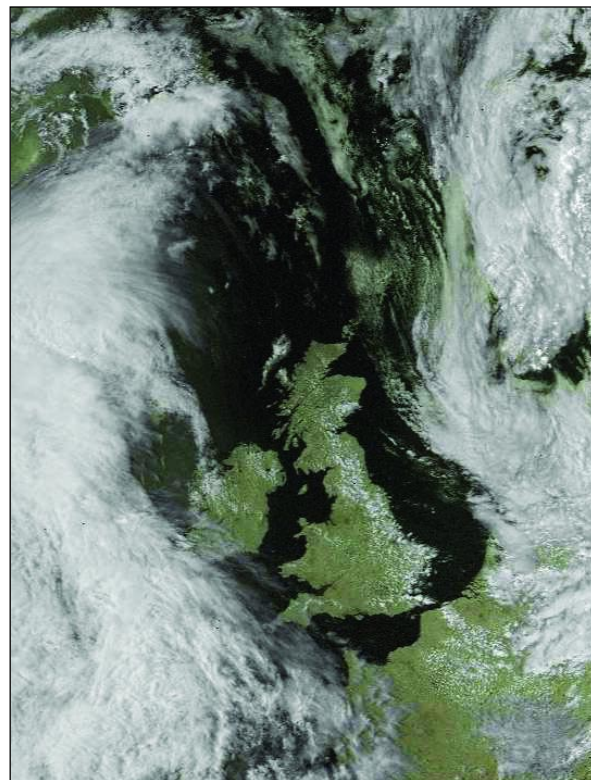


Figure 1 - NOAA 12 at 16:06 UT on June 25, 2004

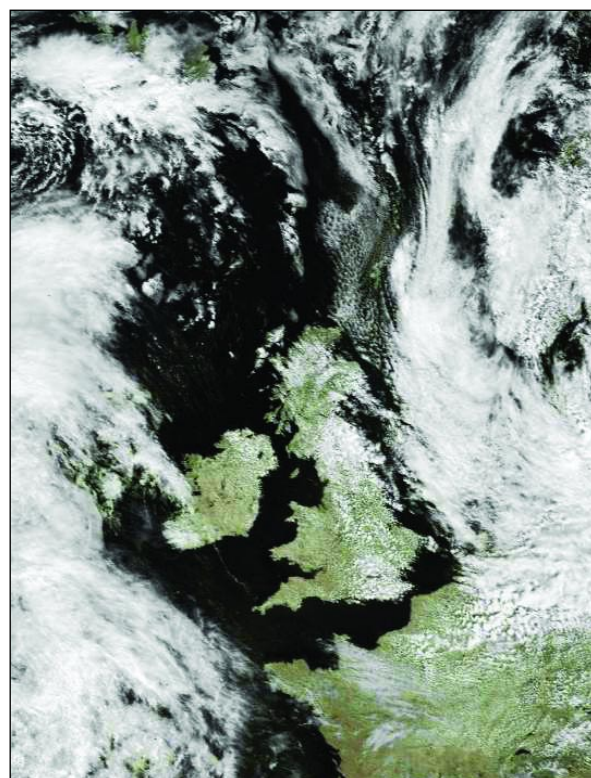
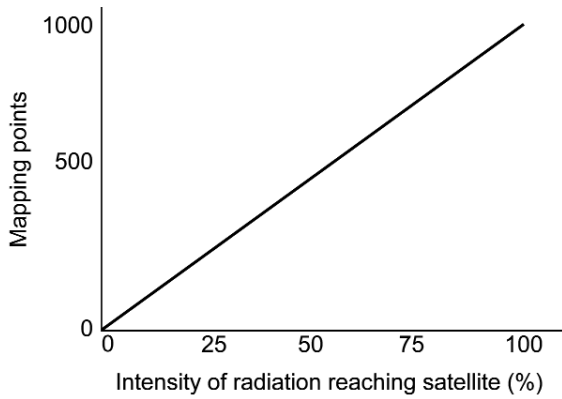
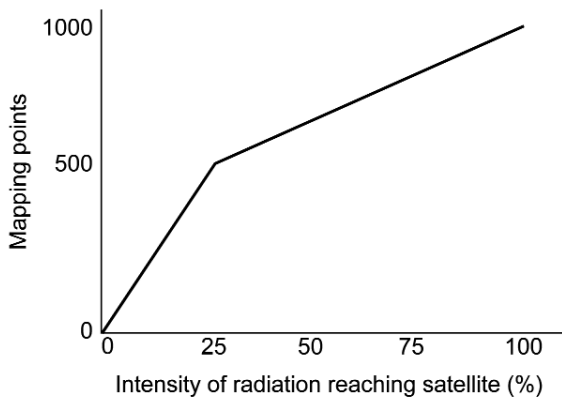


Figure 2 - NOAA 17 at 11:27 UT on June 25, 2004



**Proportional (single slope gain)**



**Dual slope gain transfer**

Figure 3

Illustration of single- and dual-slope gain transfer

ground areas should appear brighter in the APT signal, which should result in images that are more noise-free. Of course, that would only apply when the lighting conditions were the same (i.e. at the same local solar time) so you may not be able to compare NOAA-12 and NOAA-17.

**The Challenge**

The two colour-composite images opposite certainly show the NOAA-17 image to be brighter and crisper than that from NOAA-12. Taken on the same day, the former was acquired very close to noon and the latter four hours past noon. The comparison is clearly flawed because of this time differential. *What is required is a comparison between NOAA-17 and an old-style NOAA satellite under similar illumination conditions.*

A trawl through the archives turned up a number of equivalent transmissions, all received within two hours of noon during the month of June when solar illumination is at its strongest and illumination levels should be very similar. Figure 4 compares a NOAA-11 pass from 1989, the satellite's first summer aloft, with a NOAA-17 pass dating from June 13 this year. Figure 5 shows a NOAA-14 pass from 1997 showing Great Britain free of cloud and a similar NOAA-17 image obtained during that memorable sunny summer of 2003.

All four images are from channel-2 APT and were processed using *Satsignal*, with histogram equalisation and gamma correction switched off. While the cloud characteristics of the images are similar in their range of tones, it is obvious that the land rendition in those from NOAA-17 is considerably brighter than those from

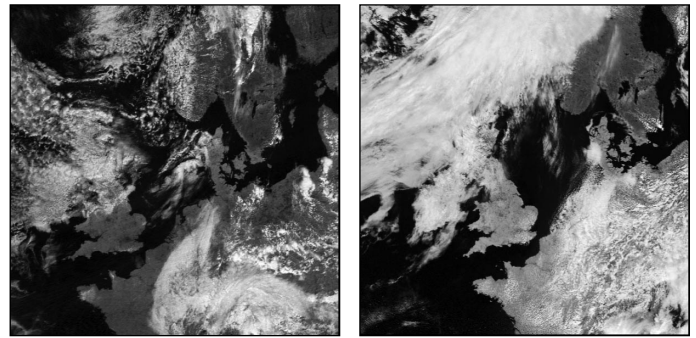


Figure 4 - NOAA 11 on June 23, 1989 (left) compared with NOAA 17 on June 13, 2004

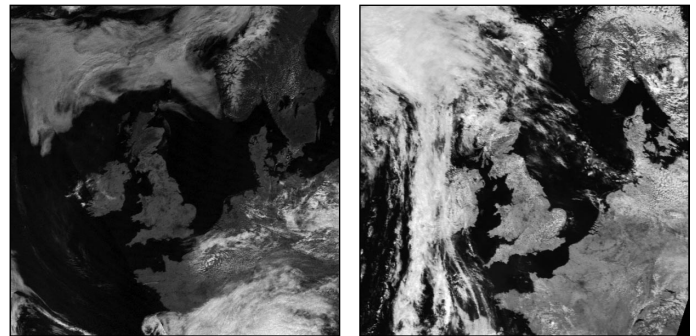


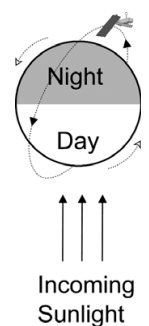
Figure 5 - NOAA 14 on June 1, 1997 (left) compared with NOAA 17 on June 16, 2003

NOAA-11 and NOAA-14. So it does seem conclusive that the dual-slope gain feature, implemented since NOAA-15, results in an improvement in the quality of channel-2 imagery from the NOAA satellites.

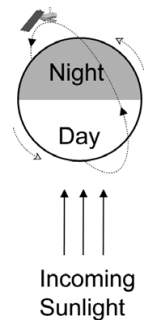
**Rebirth and Orbit Precession**

During NOAA-12's lifetime, a succession of *afternoon* APT satellites has come and gone. The APT aboard NOAAs -11, -13, -14 and -16 has ceased for a variety of reasons, leaving us without a 'true' afternoon APT satellite since late 2000. But, because of a phenomenon known as orbital precession, NOAA-12 has now come close to filling that void.

NOAA-12 was launched as a *morning* satellite. As such, it made its near-overhead southbound pass close to 8.30 am local time, over the illuminated hemisphere of the Earth, and provided well illuminated visible light images during the summer months. The ascending evening passes took place around 18.30 hours local time, but over the Earth's night-time hemisphere, where there was insufficient illumination to produce good visible light images. This situation is illustrated by the upper drawing at right.



As the years have passed by, perturbation effects caused by the Earth's atmosphere, the moon and the sun have conspired to rotate the plane of NOAA-12's orbit with respect to the sun—the phenomenon called precession. These days, overhead passes occur some three hours earlier than formerly, with the descending morning pass at around 05:30 am and the ascending one at 15:30 hours in the afternoon. Consequently it is now the northbound afternoon pass that



traverses Earth's illuminated hemisphere and which provides the better visible light imagery (see the lower drawing at the foot of page 21). Both views are taken from above the plane of Earth's orbit around the sun and very approximately over the north pole. The rotation of Earth about its axis is anticlockwise in these views.

### **Conclusion**

Following many years of orbital precession, visible light images from NOAA-12's morning orbit are no longer usable, even in midsummer when solar illumination is at its strongest. But by the same token the satellite's evening orbit has precessed into mid afternoon where it is now producing more than acceptable visible light images. Figure 6 shows a welcome sunny interlude in Great Britain's dull and damp summer. Note the rather attractive sun-glint reflecting from the waters of the Bay of Biscay

### **Some Personal Thoughts**

NOAA 12 holds a special affection in my memory as it was the first American weather satellite actually to be launched following my introduction to APT satellite imaging. My fascination with these weather satellites started in the spring of 1988 when the physics department at the academy where I taught acquired an early APT receiver, complete with an interface for the BBC microcomputer. In those days the active APT satellites were NOAAs-9 and -10, plus a succession of relatively short-lived and somewhat unreliable Russian *Meteor* satellites.

The satellite images produced using this equipment, albeit in just 16 shades of grey, proved utterly captivating and I resolved to set up my own ground station with minimum delay. This became a reality soon after the launch of NOAA 11 that September, and what an introduction to satellite imaging that proved to be! My very first NOAA-11 pass, on October 1, featured a major Atlantic storm, dubbed 'hurricane Helene' after the Atlantic hurricane whose dying remnants it was.

Obtaining this image was a real stroke of luck as I had just completed setting up my new hardware, including a dedicated tape-deck for recording. I switched on and immediately heard the NOAA-11 signal, strong and clear, through my speaker. Being so unprepared, almost half the satellite pass was already over, but the Atlantic storm, along with much of England and the Low Countries, was captured on tape for posterity. By playing the tape through my PC soundcard I was able to create a wave file and subsequently decode it using *Satsignal*. The result can be seen in figure 7.

But May 14, 1991 was the day of days as far as I was concerned. This was when a completely new NOAA satellite, NOAA-D, took to the skies, where, once safely in orbit, it became NOAA-12. At the time of its launch, the anticipated lifetime of the spacecraft was stated as 'not less than two years'. This has proved to be hugely pessimistic. NOAA-12 continues to operate after providing well over a decade of fascinating weather imagery—long may it continue to do so!

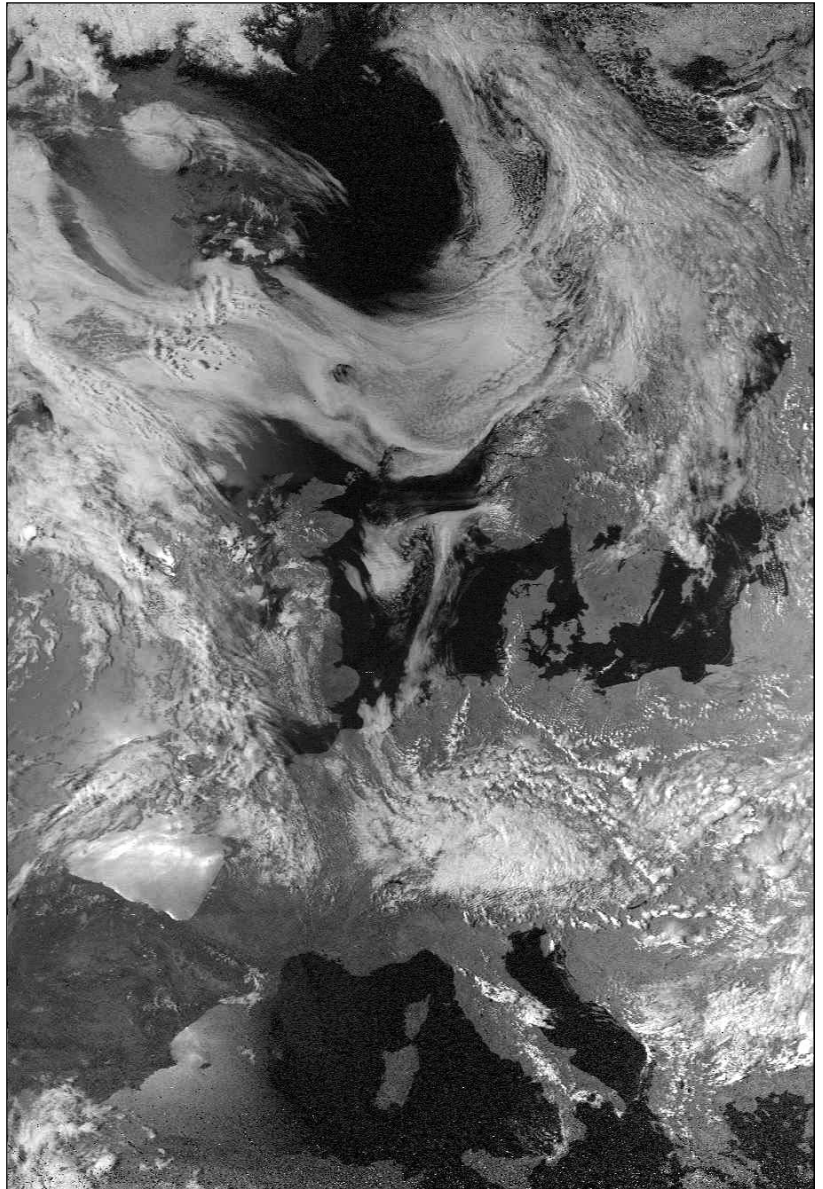


Figure 6 - NOAA 12 channel-2 image from the 15:36 UT pass on August 14, 2004

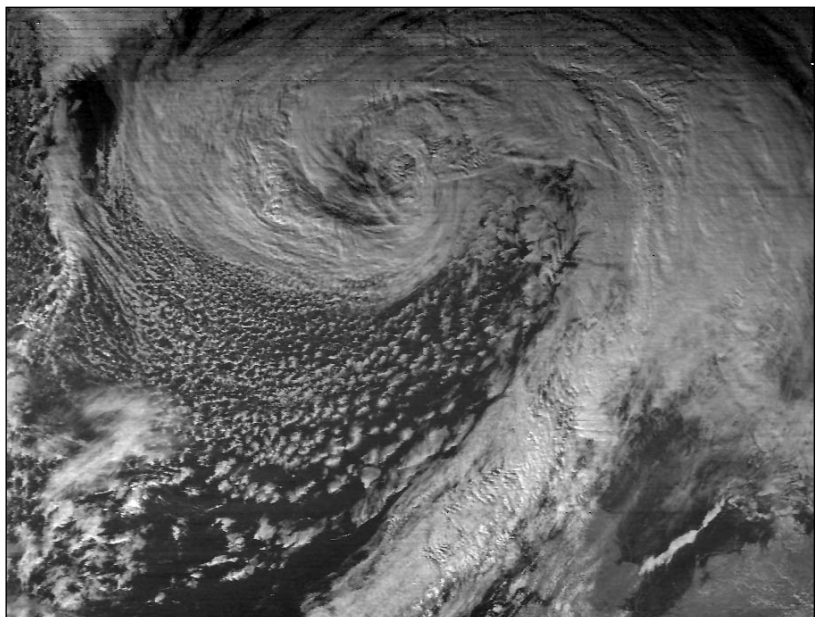


Figure 7 - Remnants of hurricane 'Helene' - NOAA 11 on October 1, 1988



# The Indian Space Programme

## Part 3

Peter Wakelin

The SLV-3 and the more advanced ASLV were experimental launch vehicles and the experience gained in their development, construction and launch led to the *Polar Satellite Launch Vehicle* (PSLV). The first launch attempt was in 1993 and PSLV soon proved to be a reliable, low-cost means of putting a significant payload into an 800-plus km sun-synchronous orbit. It has become the 'workhorse' of the Indian space programme.

### The Polar Satellite Launch Vehicle

The 44 metre tall PSLV is a four-stage vehicle using solid and liquid propulsion systems alternately. The 138 tonnes of HTPB (hydroxyl-terminated polybutadiene) in the first stage make it one of the largest solid-propellant boosters in the world, capable of developing a thrust of 3,500 kN at sea level. In addition, six strap-on boosters (derived from the earlier ASLV's first stage), each with a thrust of 440 kN, augment the first stage's thrust.

The second stage employs the *Vikas* engine which is built in India under license from a French company. It carries 40 tonnes of the liquid propellant UDMH (unsymmetrical dimethyl hydrazine) as fuel and nitrogen tetroxide as oxidiser and delivers a thrust of 724 kN.

Stage three uses 7 tonnes of HTPB cast in a Kevlar epoxy fibre case and generates a thrust of 324 kN. The fourth stage comprises two liquid-fuelled engines each utilising two tonnes of monomethyl hydrazine (MMH) fuel and mixed oxides of nitrogen as oxidiser. Each of these generates a thrust of up to 7.4 kN to accelerate the payload to orbital velocity.

PSLV incorporates a complex flight control system and an inertial navigation system (installed near the top of the fourth stage) which guides the vehicle from lift-off to spacecraft injection into orbit. A large number of stage auxiliary systems are incorporated for stage separation, heat shield separation and ejection etc.

The Vikram Sarabhai Space Centre, Thiruvananthapuram, designed and developed the PSLV. The inertial systems for the vehicle were developed by the *ISRO Inertia Systems Unit* and the liquid-propelled second and fourth stages were developed at the *Liquid Propulsion System Centre*, both of which are also located at Thiruvananthapuram. All launches take place from the

ranges at the Satish Dhawan Space Centre at Shiharikota, 100 km north of Chennai (Madras).

### The Launch Sequence

In theory, and in the absence of an atmosphere, the fuel-efficient way to launch a satellite would be to use maximum acceleration immediately after liftoff but, in practice, the launch profile is quite different. The lower atmosphere is dense and often very turbulent so, to minimise frictional heating and dynamic stresses on the vehicle and payload, a carefully controlled and complex launch sequence has to be followed. A typical launch profile for PSLV lifting a 1 000 kg payload into a sun-synchronous orbit might be as follows:

- Liftoff occurs after stage 1 and two of the strap-on boosters are ignited
- 30 seconds later at a height of 3 000m, the remaining four boosters are ignited
- The first two boosters burn out after 54 seconds (at 17 km) and fall away 19 s later
- The other four boosters burn until 79 s after launch (at 36 km) and then drop away
- Stage 1 burns out, drops off and stage 2 ignites 105 s after launch (at 48 km)
- Now well above the dense atmosphere, the payload's protective fairing is jettisoned after 152 s (at 105 km)
- After 260 s stage 2 is exhausted, drops away, and stage 3 is ignited at about 232 km altitude
- Stage 3 burns for about 70 s taking the vehicle to 400 km
- After coasting on a ballistic trajectory for a further 570 s to 700 km altitude, stage 4 ignites for about 7 minutes to reach orbital velocity

### The PSLV Development Flights

The first three launches, D1, D2 and D3 were designated developmental flights to test the systems and all carried Indian-built satellites in the IRS (Indian Remote Sensing) series.

PSLV-D1 was launched on September 20, 1993 carrying *IRS 1E* but was unsuccessful because of a software error in the guidance and control system. The other two were successfully launched in 1994 and 1996 and carried the more advanced *IRS P2* and *IRS P3* payloads respectively. The latter carried an X-ray astronomy payload as well as two remote sensing packages for vegetation and oceanic studies.

### PSLV Matures

The first 'commercial' flight, PSLV-C1, took place on September 29, 1997 and placed *IRS 1D* into a very precise orbit. As well as carrying a LISS camera (described in part two), the payload also included a steerable PAN camera which scans a swath of 70 km at the nadir with a



The PSLV Launch Vehicle

resolution of 5.8 m. It can tilt to scan off-track and also provide stereo pairs. Also included is WiFS, a wide-field, multispectral imager with a resolution of 188 m over an 810 km swath.

The next launch, on May 26, 1999, marked a milestone in that it was the first Indian launch to place three payloads into space. PSLV-C2's primary payload was *IRS P4* (also known as *Oceansat*) but the 107 kg Korean *KITSAT-3* and the 45 kg German *DLR-TUBSAT* were also orbited. *Oceansat* carries the Ocean Colour Monitor (OCM) and a Multifrequency Scanning Microwave Radiometer (MSMR). OCM operates in eight spectral bands and gathers data on chlorophyll concentration, phytoplankton blooms and suspended sediments.

PSLV-C3 also placed three satellites into orbit; a total of almost 1 300 kg went into 600 km sun-synchronous orbits on October 22, 2001. The primary payload was the India-built *TES* (Technology Experiment Satellite). The Belgian *PROBA* (Project for On Board Autonomy) and German *BIRD* (Bispectral and Infrared Remote Detection) were the secondary payloads.

### **Enhanced Capability of the PSLV**

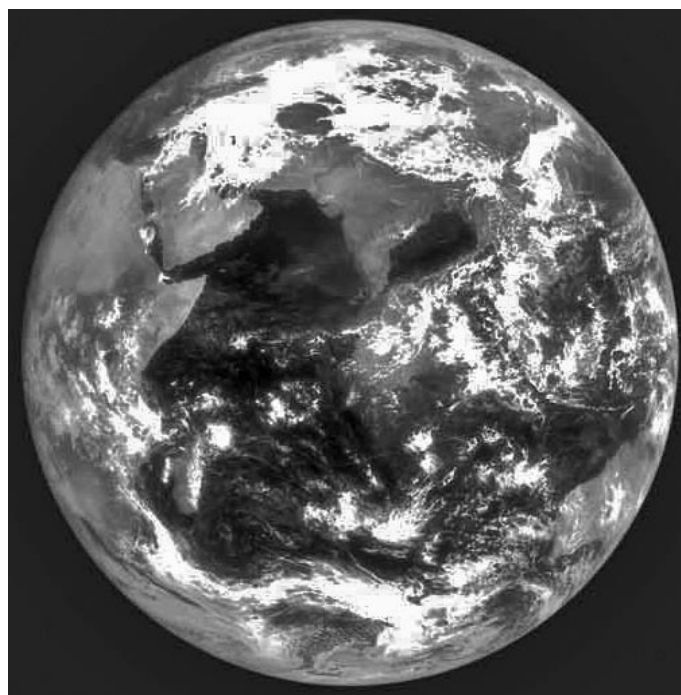
Improved performance from the third stage solid propellant motor was obtained by modifying the casing design and propellant loading. Also, the capacity of the fourth stage fuel tanks was increased which, together with the replacement of the metallic payload adaptor with a carbon composite one, resulted in a substantial payload advantage. PSLV could now place over two tonnes into a sun-synchronous orbit.



Resourcesat 1

This improved capability was put to a different use in the next launch; PSLV-C4 was launched eastwards and carried the 1 060 kg *Metsat* to a 250 x 36 000 km geostationary transfer orbit inclined at 18 degrees to the equator on September 12, 2002. *Metsat's* onboard motor circularised the orbit and reduced the inclination to near zero, making it India's first launch to geostationary orbit. In a solemn occasion at Parliament House on February 5, 2003, Indian Prime Minister Mr Atal Behari Vajpayee renamed *Metsat Kalpana 1* in memory of Dr Kalpana Chawla, the Indian-born American astronaut killed in the Columbia shuttle accident.

The most recent launch, that of PSLV-C5 on October 17 2003, placed *Resourcesat 1* in an 817 km circular sun-synchronous orbit. Not only does the 1 360 kg *Resourcesat 1* continue the remote sensing data services provided by *IRS 1C* and *IRS 1D*, both of which have operated well beyond their designed lifetimes, but also vastly enhances the data quality with its enhanced sensors. The spacecraft also carries a 120 gigabit solid-state recorder permitting global coverage.



Kalpana-1 visible image - 06:00 UT, March 26, 2003

### **Kalpana 1**

*Kalpana 1* is the first exclusively meteorological satellite built by ISRO and is the precursor to the future *INSAT* (Indian National Satellite) system that will have separate satellites for meteorology and telecommunications services. This will enable large capacity to be built into *INSAT* spacecraft, both in terms of transponders and their radiated power without the design constraints imposed by meteorological instruments.

*Kalpana 1* is located above 74 degrees east longitude and is a 3-axis stabilised platform carrying a 1-km resolution CCD camera imaging in three bands as well as a high resolution scanning radiometer with about 4-km resolution in the near and thermal IR bands. Imagery is transmitted to numerous receiving stations along with conventional meteorological data and facsimile charts through the Meteorological Data Distribution (MDD) system on *Kalpana 1*. Also on board is a data relay transponder which automatically collects readings from more than 300 unattended meteorological stations throughout India and sends them to the Meteorological Data Utilisation Centre at New Delhi.

Although PSLV is capable of putting a 1 000 kg payload into a geostationary transfer orbit, a more powerful vehicle has been developed to take heavy communications payloads to the geostationary orbit. The *GSLV* (Geostationary Satellite Launch Vehicle) will be the subject of part 4.

### **Acknowledgements.**

I am indebted to ISRO and the National Remote Sensing Agency for making so much information available on their websites:

<http://www.isro.org>

<http://www.nrsa.gov.in>

# Use 'Fleetwood' Data to add Synoptic Details to Meteosat Images

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The use of Bracknell synoptic charts as overlays on weather satellite images can cause problems because of Crown Copyright should you wish to publish these on your web pages. But there is now an alternative. The latest version of Digital Atmosphere WorkStation (DAWS), released in July 2004, supports fleetcode. Fleetcode is provided by the UK Met Office and comes free from copyright restrictions. This article explains how fleetcode data can be superimposed over your Meteosat weather images.

## Fleetcode

Fleetcode or IAC (International Analysis Code) is a method of providing detailed weather maps in a compact, encoded format. Files are very small—typically no more than three kilobytes—and in ASCII format. The name fleetcode derives from its major use, by offshore shipping. Developed after World War II when fax and the Internet weren't available, and there was a need for good weather maps for navigation on the open sea, fleetcode was broadcast by radio stations. Each fleetcode file contains, in coded format, a complete surface weather map, complete with the positions of highs, lows, troughs, all kind of fronts, isobars and more. For a long time this was the most efficient way to receive weather maps onboard ships. The forecaster then had to manually plot all the codes on to a weather map, draw in the lines and voila! He got his surface weather map.

In those days fleetcode was available for almost all important shipping routes and dangerous cyclone areas. But with the coming of fax and the Internet, fleetcode became less important as complete weather maps could be broadcast by fax (radiotransmitted) and by satellite systems. Almost all offshore weather services ceased broadcasting fleetcode. But the UK Met Office is offering fleetcode for the North Atlantic and Europe and the files are available on a Swiss yachting site. The US is offering its own dialect of fleetcode, but showing only the positions of highs, lows and fronts and in a different format.

Both forms of fleetcode are available on the Web and both can be used in *Digital Atmosphere WorkStation*. In this article, we will look only at the official fleetcodes from the UK Met Office.

## Software Requirements

To create your own surface charts from fleetcode files you require:

- GeoSatsignal4
- Digital Atmosphere Workstation v 1.1
- a source of Meteosat images
- a fleetcode analysis (or forecast) file

## Setting up Digital Atmosphere

It is necessary to customise some of the overlay colour

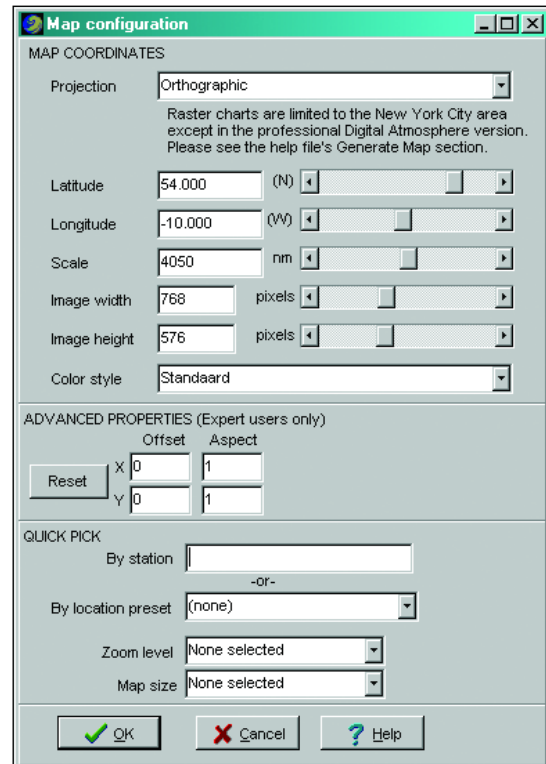


Figure 1 - Creating the base map in Digital Atmosphere

settings because the default black lines are hard to see when placed over false colour Meteosat images. Open Digital Atmosphere, click on <File → Preferences> then select the 'Styles' tab. We are going to change the colours for troughs and isobars to green and yellow respectively.

Scroll down the list and search the 'Parameter' column for 'Troughs'. Click on its default colour in the 'Colour' column to open the colour picker: select green then click 'OK'. Scroll down to the next item, 'General isopleths/labels' and change it into yellow in the same way. Click the 'Save changes' button, then 'OK' to exit.

The fleetcode charts relate to a *specific region* which includes the north Atlantic Ocean and western Europe. Select <Map → Generate base map...>, enter the parameters shown in figure 1 then click 'OK'. Use <Map → Save base map...> to save it as 'N-Atl\_Eur\_vis'. I have a special folder for *Digital Atmosphere* maps. Take a look into the folder where your map is saved: there should be a file named 'N-Atl\_Eur\_vis.dmf'. This is the setup file for the visual Meteosat images. Don't remove this file.

## Creating a Meteosat Image in GeoSatsignal

We must set up GeoSatSignal to create a remapped satellite image that exactly matches the base map created in *Digital Atmosphere*. First, create a new job using the parameters shown in figure 2. Be sure to use all the 'Remapping' settings shown on the right hand panel of

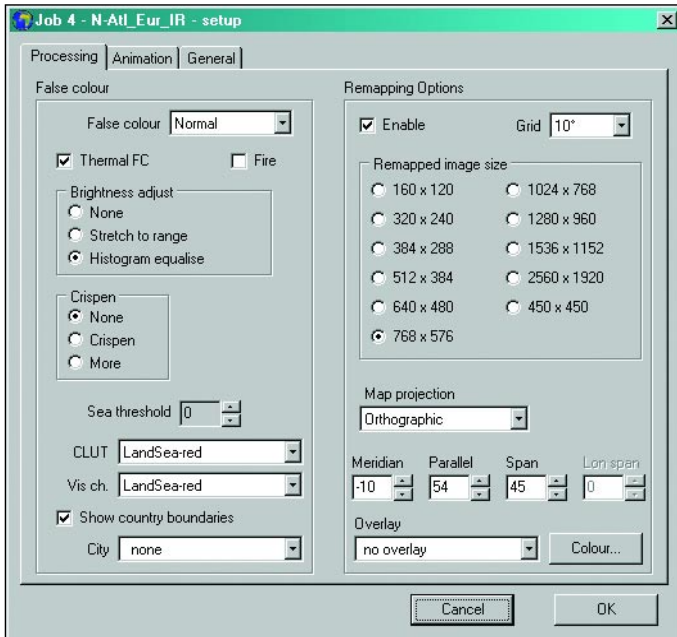


Figure 2 - Creating the job setup in GeoSatsignal4

this tab. Save the job as 'N-Atl\_Eur\_vis'. Using this job, load a set of Meteosat-6, -7 or -8 images. After processing, a false-colour remapped image, exactly matching the region covered by the *Digital Atmosphere* base map, will appear in the 'Remapped' tab. Save this image to a suitable folder.

#### Adding a Fleetcode Overlay to a Satellite Images

Open *Digital Atmosphere* (using the 'N-Atl\_Eur\_vis.dmf' base map) and open <Map → Import map> to load the image you just created with *GeoSatsignal*. If a warning message appears, just click 'OK'. The Meteosat image should now be displayed in *Digital Atmosphere*.

The next part of the story is easy. Download some fleetcode data files into the *Digital Atmosphere* 'Data' folder then click on 'Import file' in the <File> menu and load a fleetcode file. Click on <Data → Fleetcode → All annotations> and you're ready with an image like the upper illustration on the inside front cover.

More examples (IR and VIS) of these charts are published daily on my website (in Dutch):

[www.meteo-maarssen.nl/achtergrond/satelliet/satellietfoto.htm](http://www.meteo-maarssen.nl/achtergrond/satelliet/satellietfoto.htm)

There is an option to download fleetcode files directly from within *Digital Atmosphere* but at the time of writing this is not yet operational. For the present you can download the fleetcode files manually from:

<http://ftp.hb-yacht.ch/>

You will find that there are two kinds of file available, the ASXX series (analysis) and the FSXX series (forecast). The format of the files is ASXX21.ddhhmm and FSXX21.ddhhmm with 'ddhhmm' indicating the relevant date and time (UTC — dd - day; hh - hour; mm - minute)

The files are issued at six-hourly intervals, commencing with 00:00 UTC each day and become available around 5 hours after the synoptic main hour. There is a one month archive. Both types of file are accepted by *Digital Atmosphere*

The ASXX series are the current surface analyses while the FSXX are the forecast files. Keep in mind that each forecast file relates to 24 hours ahead of the date and time of issue (so you must add 24 hours to the forecast date and time in the filename. For example, FSXX21.221200, issued on the 22<sup>nd</sup> of the month contains the 12:00 forecast for the 23<sup>rd</sup> of the month).

#### References

GeoSatSignal is produced by *Satsignal Software* at

[www.satsignal.net](http://www.satsignal.net) ==> **Satellite Tools**

Registration costs £49.95

*Digital Atmosphere Workstation* is produced by *Weather Graphics* at:

<http://www.weathergraphics.com>

Registration costs \$89 for new users. If you are already a registered user, the upgrade fee is \$68.

## Termination of the Meteosat-7 Services from 0°



Subject to the successful launch and commissioning of MSG-2 (Meteosat-9), *EUMETSAT* will terminate the Meteosat-7 WEFAX and HRI services from 0° in December 2005. These will have been replaced by the new MSG services delivered via *EUMETCast*.

**Users currently operating Secondary Data User Stations (SDUS) should have migrated to MSG data via EUMETCast by this time.**

The production of meteorological products from the first generation of Meteosat satellite data at 0° will also end. The service will continue using MSG satellite data and will be disseminated via the Global Telecommunications System (GTS) and *EUMETCast*.

*EUMETSAT* plans to continue the Indian Ocean Data Coverage (IODC) service until the end of 2008 with Meteosat-7 taking over from the Meteosat-5 satellite at 63° East. The IODC service will continue to be made available to users via both *EUMETCast* and direct dissemination from the satellite providing the IODC service.

It is planned to continue the Rapid Scanning service provided by Meteosat-6 for some time beyond 2005.

The satellite will remain at its current position at 10°E. Delivery of this service will be via *EUMETCast* and FTP over the Internet.

# EAST AFRICAN GLACIERS AND ICE FIELDS

*Peter J Bradley*

## **Introduction**

I was interested to read Francis Bell's feature on the 'Snows of Kilimanjaro' in the Launch issue of GEO and the implications therein. I was living in East Africa in the fifties and sixties and, in my student days, I walked up a number of the East African mountains, usually with a small group of friends, and took many photos on the various expeditions. Francis Bell's article 'sparked off' the possibility of finding more recent photos which might be compared with those taken some forty years ago to give visual dimension to the proven fact that the tropical ice in Africa is disappearing. My formal studies (physics and geology) took me into some of the geology and glaciation of East Africa, and included elements of meteorology and

climatology. These connections seemed to give reasonable grounds for writing an article in response to Francis Bell's challenge. This article is written to give background to the situation and definitely not as a definitive monograph and, be there any, I apologise for inaccuracies in recall!

## **Geology and Glaciation**

The geology and glaciation of East Africa's mountains provide a good starting point, though I emphasise that the geology of the area is fascinating and very complex: to simplify it as I have attempted to do is certain to do it injustice. For readers unfamiliar with the area it might be useful to look at *figure 1*, which shows East Africa with text overlay for positional referencing of the mountains

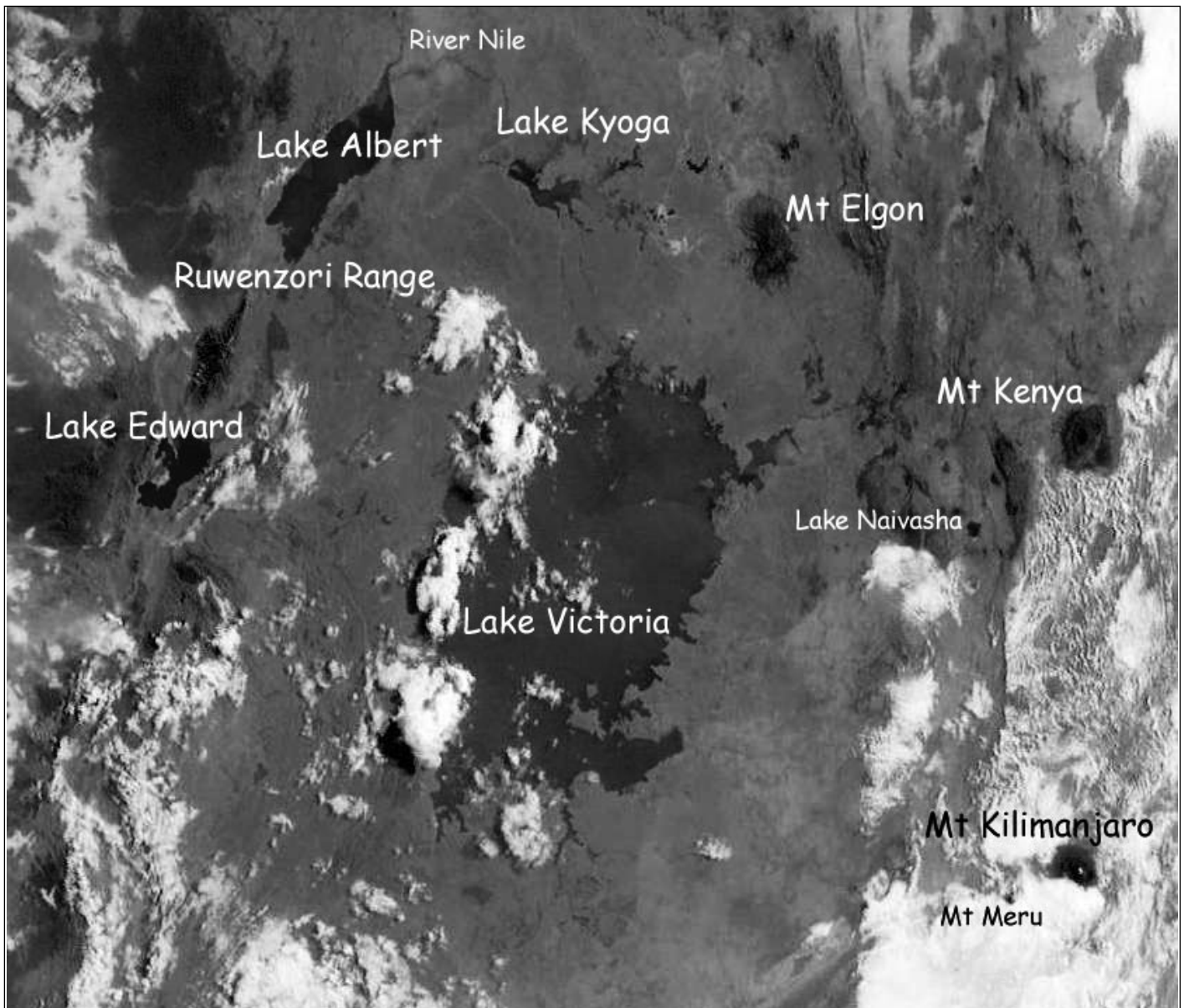


Figure 1 - A segment from the Meteosat-8 06:00 UT transmission on May 19, 2004, covering east Africa and showing the four mountain summits described in the text.

Image: © EUMETSAT 2004 Processing: David Taylor's software.

and lakes. This particular image was selected as it is relatively rare for all four of the mountain summits to appear free from cloud at the same time, though the foothills of Kilimanjaro are in cloud on this one.

Three of the four mountains to which I will refer are of volcanic origin, namely, the group of three called Kilimanjaro (Kibo, Mawenzi and Shira plateau), with Mount Kenya and Mount Elgon. The exception to the group is the Ruwenzori range which is a horst, a mountain range which has been formed by the uplifting or upthrusting of part of the landscape, and which formed at the same time as Africa's Great Rift Valley.

To simplify the picture, therefore, visualise a very old flat landscape—a peneplain of Archaean and Precambrian basement rock more than 600 million years old—that suddenly fractured with sideways pressure producing uplift to form the Ruwenzori while another part was forced apart and subsequently collapsed to form the Rift Valley. At the same time, volcanic activity was occurring in adjacent regions where the landscape was weakened, resulting in the many volcanic mountains, including those mentioned above. All of these mountains have had ice fields and glaciers at some stage during the last 300,000 years. The question is: 'How long has glacial change been going on and for how long will the remaining ice last?'

Geological studies suggest that the maximum glaciation in this region occurred between the lower and middle Pleistocene period. Studies show there have been periods of stability and retreat of the ice and arid (dry) and pluvial (rainy) periods. Very recent research by Professor Lonnie G Thompson and his team (2002) has shown, through the examination of cores from the ice fields of Kilimanjaro, that there have been three fairly abrupt climate changes during the past 11,000 years or so. So this is not the first time that the ice fields have been affected in geological history, but it is certainly the first to have been caused by mankind! I shall attempt to give a brief description of these four mountains and of their glacial history since they were 'officially' surveyed.

Observations of the lowest point to which ice descended were recorded on the Ruwenzori range at an altitude of approximately 2000 m. This has been determined by the position and altitude of terminal moraines, walls of rock debris that the glaciers dumped at the end of their travels. These moraines consist of material scoured from the bedrock and carried down the slopes with the flowing ice before the glaciers retreated, leaving U-shaped valleys and dams of rock behind which glacial lakes or tarns often form. The moraines on Mount Kenya suggest 3000 m as the lowest the ice descended. Mount Elgon only had permanent ice around the caldera and in several marginal glaciers down to 3400 m. In recent times, the past century or so has seen the most rapid ice melt and glacial retreat in the East African ice fields

It is perhaps worth mentioning here that, when photos are taken of these mountains (and particularly of Kilimanjaro), a daily or seasonal change in the snow line may be evident. This is very different from the longer term changes which have been observed over many years. Some photos, for example, taken early in the day, may show snow falls which disappear completely during the course of the same day but give the impression that there

is more average ice/snow than is truly the case. Compare *figure 2* with older photos and more recent ones later in the article.

### **Kilimanjaro - 'The Shining Mountain'**

Perhaps the most impressive of the East African mountains is the highest of the Kilimanjaro group, Kibo, though all of these mountains are impressive in their own ways. The white snow- and ice-capped volcanic peak of Kibo (5895 m), lying just three degrees south of the equator, has been the inspiration of many stories, articles and films. Anyone who has seen it from the Kenyan plains, in the clear, at dawn, when the sun turns it pink, will not easily forget it. The mountain looks very majestic. Kilimanjaro, as a mountain group, has six or seven distinct vegetation zones from the plains at 1200 m to the saddle between Kibo and Mawenzi (both Mt Kenya and Mount Elgon have similar zones. The Ruwenzori has a much more Alpine type of vegetation and all have some plant species unique to their respective regions).

Kibo, whose summit is now called Uhuru Point/Peak, was originally named Kaiser Wilhelm Spitze by Dr Hans Meyer, a professor of colonial geography, originally from Leipzig, Germany. He was, in 1889, the first European to reach the summit with a colleague Ludwig Purtscheller. At that time, Tanganyika—now Tanzania—was part of German East Africa. *Figure 3* shows clearly the ice field on the rim of the Kilimanjaro/Kibo taken from the Kenya side on the *Nalemoro Route* in August 1961. A few friends and I were relaxing for a couple of days to acclimatise at around 3900 m when this was taken.

Kibo is the youngest and highest mountain in the 45-50 km wide chain of three Kilimanjaro volcanoes which stretches for some 80 km from northwest to southeast along the Tanzanian side of the Kenya-Tanzania border and to the east of the Great Rift Valley. Kibo is dormant and was probably formed in the lower Pleistocene period (roughly 750,000 years ago). Mount Mawenzi (5151 m), the second highest of the group, lying to the southeast of Kibo, is the eroded plug of an extinct volcano which was formed about the same time as Mount Kenya (2.6-3.1 million years ago), during the Pliocene period (between 12 million and 1 million years ago).

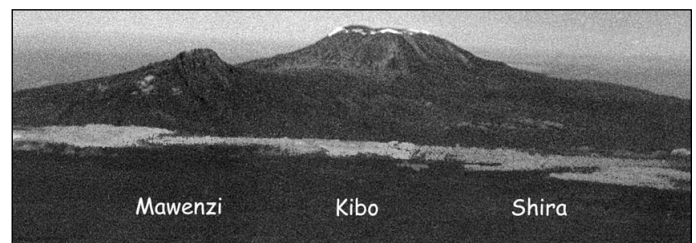


Figure 4 - Aerial view of Mawenzi, Kibo and Shira - March 1988

Finally, lying to the northwest of Kibo, comes the Shira Plateau (3962 m), the oldest of the trio of volcanoes, which has completely eroded away leaving, as its name suggests, a plateau above the plains into which the volcanoes were originally intruded. *Figure 4* is an aerial photo of the Kilimanjaro group which I took from the Kenya side in March 1988. The jagged mountain on the left is Mawenzi, the central mountain of Kilimanjaro is Kibo, and the



Figure 2 - Kilimanjaro: cloud and snow on crater rim - January 2004  
 Photo by kind permission of Dr Hartmut Bielefeldt



Figure 3 - Kilimanjaro with a group of friends - August 1961  
 Photo: P J Bradley



Figure 5a - The Furtwangler glacier, August 1961  
 Photo: P J Bradley

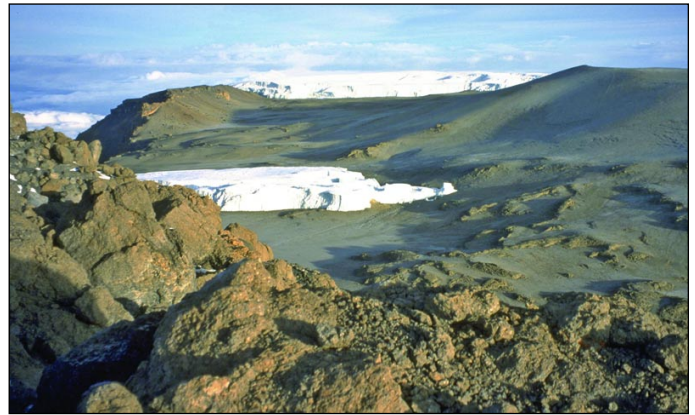


Figure 5b - The Furtwangler glacier, January 2004  
 Photo by kind permission of Dr Hartmut Bielefeldt

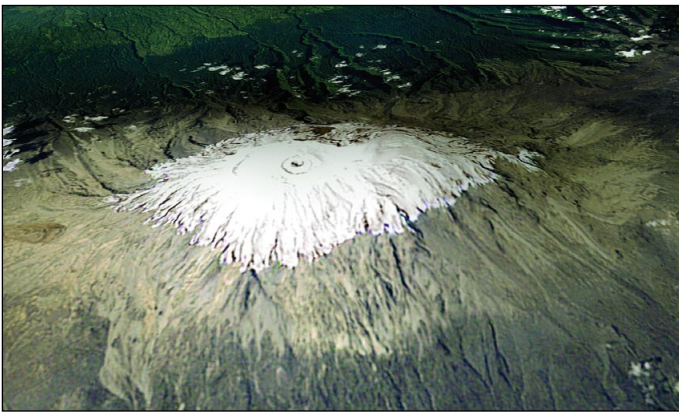


Figure 6a - Kibo, February 1993  
 Image: NASA Goddard Spaceflight Center/USGS

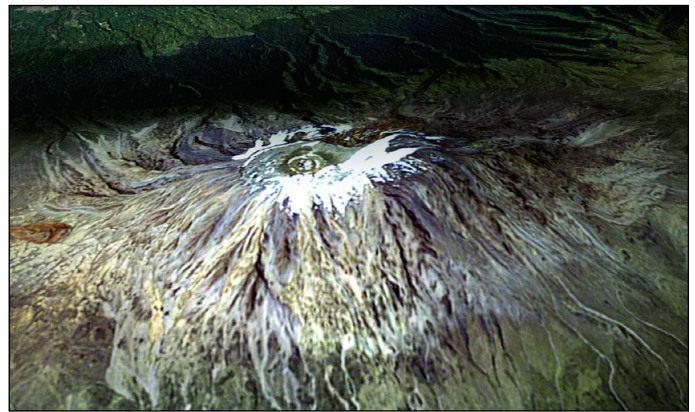


Figure 6b - Kibo, February 2000  
 Image: NASA Goddard Spaceflight Center/USGS



Figure 7a - The eastern icefield of Kibo, August 1961  
 Photo: P J Bradley



Figure 7b - The eastern icefield of Kibo, January 2004  
 Photo: Dr Hartmut Bielefeldt

Shira plateau is visible on the right. Another volcano, Mount Meru (4565 m), which is hidden behind Kilimanjaro, is just visible in *figure 1* (to the south of Kilimanjaro). Meru is yet another impressive dormant volcano and is situated well inside Tanzania but is too low to have any permanent ice.

Kilimanjaro is the highest of the freestanding volcanoes in the world with its base at approximately 1000 m above sea level. There are a number of ice fields and glaciers on Kibo, often named after German explorers and missionaries (the white patch seen on the summit of Kibo in *figure 1* is ice). My own photograph taken in August 1961 (*figure 5a*), and a second taken by Dr Hartmut Bielefeldt on his January 2004 expedition (*figure 5b*) show the Furtwangler glacier within the crater rim. Note that the ice field on the crater rim at the top of the first photo shows castle-like ice blocks which overhang part of the rim, but these have disappeared in the second photo where the ice field is much reduced. According to Professor Lonnie Thompson of Ohio State University, the Furtwangler Glacier seen in the photos as flowing through the breach in the crater rim had suffered a reduction to half its original area between 1974 and 2000.

The two images from NASA's Landsat satellites taken in February 17, 1993 (*figure 6a*) and February 21, 2000 (*figure 6b*) respectively, show an interesting comparison in the ice around the crater rim. The eastern and northern ice fields were originally joined (*figures 3, 8a*) but now there is a considerable gap between them.

*Figure 7a* shows the eastern part of the ice field as it appeared in August 1961 while *figure 7b*, taken from a slightly different position on the crater rim by Dr Hartmut Bielefeldt in January 2004 illustrates what remains today! The two evening photos taken from approximately the same point on the mountain, 43 years apart, show the visible reduction in ice. They were taken near the third caves on the *Nalemoru Route*, mine in August 1961 (*figure 8a*) and Dr Bielefeldt's in January 2004 (*figure 8b*).

An early morning photo taken standing on ice near Gilman's Point at approx 5685 m on the rim of Kibo in August 1961 (*figure 9*) shows that the flat section of ice is no longer there and the ice cliff is significantly reduced. Incidentally, it is reported that when the atmosphere is very clear, it is possible to see Mount Kenya due north from Kibo, a distance of 350 kilometres. Both peaks are sufficiently high for the Earth's curvature not to effect the line of vision and certainly both can be easily seen from an aircraft flying approximately equidistant between the two. It probably represents the longest view in the world.

Some of the statistics that relate to ice loss are staggering. Again, Professor Thompson points out that approximately 82% of the ice had been lost over a period of 88 years since the first surveys were carried out in 1912. Approximately one third of the ice had disappeared between 1989 and 2001, and since I climbed the mountain in 1961 approximately 45% of the ice has disappeared from the summit. At the present rate of desiccation (by sublimation) and melting, extrapolation indicates that little if any of the remaining ice cap on Kilimanjaro/Kibo will remain in 15 to 20 years from now!

### ***Mt. Kenya - 'Mountain of Light'***

Mount Kenya (5199 m) lies a mere 0.1° south of the equator (*figure 10*). The first 'official' records were started in the late 19<sup>th</sup> century and eighteen glaciers were recorded in 1893. The first European to climb Batián, the higher of the two summits—the other being Nelion—of Mount Kenya (known locally as Kirinyaga), was Sir Halford Mackinder, accompanied by Cesar Ollier and Joseph Brocherel in 1899. In 1903 Mackinder reported on fifteen glaciers and at that time they descended to an altitude of 4475 metres. By 1946, five of these glaciers had disappeared and at present those remaining are retreating as rapidly as those on Kilimanjaro. There was speculation at that time, for whatever reason, that the ice fields of the East African mountains might disappear within a century or so. It was a controversial notion then but was not related to the profligate fuel consumption activities of the human race! At present, apparently, only seven of the originally recorded eighteen glaciers exist.

### ***The Ruwenzori Range - 'Mountains of the Moon'***

The Ruwenzori Range, which includes no less than 25 peaks above 4500 m, is topped by Margherita (5109 m) and Alexandra (5091 m), the twin summits of Mount Stanley. These mountains lie approximately 0.4° north of the equator on the Uganda side of the Uganda-Congo border, between Lake Albert to the northeast (through which the Nile flows) and Lake Edward to the southwest (see *figure 1*).

The first Europeans to climb Margherita were the Duke of Abruzzi, along with Petigax, Ollier and Brocherel in 1906. The latter two also accompanied Mackinder on Mt. Kenya in 1899. The Ruwenzoris have six glacial complexes with over forty glaciers, the largest of which is on the Stanley plateau: in fact this is the largest glacier in Africa and it likewise is reported to be shrinking rapidly.

It is most likely that the Ruwenzori glaciers will be the last of those in the African tropics to disappear because these peaks are the wettest by far of the East African mountains. The prevailing winds are predominantly southeasterly or slightly northeasterly depending on the season and the moisture carried in them, partly from Lake Victoria, contributes significantly to the mountains' very damp climate. Although there are two wet seasons for this area, March to May and August to November, it rains almost daily regardless! Having watched the PDUS images of East Africa for a number of years and more recently those from Meteosat-8, the Ruwenzoris are seen to be nearly always shrouded in cloud, whereas Kibo more often has its summit above the clouds and is subject to more desiccation and melt as a result.

*This desiccation (drying out) is the loss of volume material through sublimation owing to 'evaporation' directly from the solid to the gaseous state without going through the liquid phase, i.e. ice to water vapour.*

### ***Mt. Elgon - 'Mountain of Mysteries'***

Mount Elgon, summit Wagagai (4321 m), lies 1.1° north of the equator on the Uganda side of the Kenya-Uganda border and is the lowest of the main East African mountains. Despite this, Elgon has the largest base of any freestanding volcano in the world with a diameter of some 85-90 km and an average slope of no greater than three to five degrees (*figure 11*).



Elgon is reportedly the oldest of these mountains though there has been controversy over its age. Estimates for its formation range from 24 million years ago (during the early Miocene period) to approximately 8 million years ago (mid Pliocene). It has also been suggested that Elgon was once much higher than it is at present as its crater, or more correctly caldera, is also very large, some eight by nine kilometres. The argument is that it could once have supported a much larger cone and that at some stage the main vent became blocked resulting in the mountain blowing its top off, much like Mount St Helens in 1980.

Elgon has no permanent ice now, though historically it had ice inside the caldera and around the margins of the caldera rim. *Figure 12* shows a view from the edge looking into the caldera where the surface temperature can change several tens of degrees in just a few minutes from full sun to the very cold misty conditions. The vegetation in the large sunken area is hardy: putting up with the diurnal temperature range has required a degree of adaptation. Until the early 1960s, Mount Elgon did experience some seasonal snow falls on the summit and these were observable from the base of the mountain. Nowadays, any snow is scarce, is usually limited to a dusting in and around the caldera, and only very rarely is any observable from the mountain's base.



Figure 12 - Mount Elgon, looking into the caldera (1958)

Photo: P J Bradley

An aside. I had walked up Mt. Elgon a number of times and on more than one occasion had been able to see Lake Victoria from the summit on a clear day. This is a long view of some 100-120 km and is most spectacular, but not as long as that from Kilimanjaro to Mount Kenya. Also, approximately 20 km from where I used to live on Mount Elgon, are the famous Kitum caves, where elephants and buffalo venture deep into the caves—a distance of 165 m or so—at night to lick salt minerals from the walls and the ceiling.

#### **Additional Notes and Comments.**

In the late fifties and early sixties, usually with a group of like-minded people, I climbed Kilimanjaro and several other East African mountains in the days when it was necessary to carry all your own gear and when there were no guides! As Francis Bell pointed out, Kilimanjaro, like most mountains, needs to be approached with respect. Several people die every year attempting to climb Kibo, either from altitude sickness related problems or some other mishap. The authorities are particularly unimpressed with 'go-it-aloners' these days, however well

organised: it gives the tourism industry a bad name when there are accidents. Apparently less than 40% of the 25,000 or so people who attempt to climb Kilimanjaro every year succeed; the remainder fail owing primarily to altitude sickness. The scree is particularly dangerous on descent as most people retreat from the mountain during the daylight hours when the ice which binds the scree together at night has melted. There is a tendency to want to run down the scree, a very hazardous pursuit.

There are some serious ascents, on both ice and rock, for the experienced climber but, because the rock is of poor quality, Mawenzi (*figure 13*) does need a deal of skill for its ascent, as does Mount Kenya. This photo shows clearly the scree that have developed between the ridges and valleys as a result of erosion, the primary cause of which is the daily freeze-melt cycle on the rock surface. Most of the mountains of East Africa with summits above approximately 3000 m suffer from this significant day-night change in temperature. Diurnal change is the difference between the minimum night time temperature and the maximum day time temperature. The constant change from well below freezing to significantly above freezing contributes to the break-up of the rock surface and produces rapid erosion of the mountain. Water gets right into the rock vesicles and freezes, forcing the structure to weaken and crack; the sun's heat expands the outer surface of the rock forcing it break away from the subsurface owing to differential expansion, a process called exfoliation.

This breaking up into smaller fragments creates the scree and also tends to make the rock surface very friable and bad for climbing. As mentioned earlier, both Mount Mawenzi and Mount Kenya were formed at approximately the same time. Both had sizable craters whose sides eroded as described leaving the plug, the solidified core or neck of the original volcano. Both have quite similar rugged profiles owing to the high level of erosion. Notice also the cloud creeping on to the saddle from the Tanzanian side in *figure 13*. If one looks at satellite images of Kilimanjaro the summit can often be seen when the surrounding approaches are smothered in cloud (see again *figure 1*). If walkers and climbers in the tropics become engulfed in this mist the temperature can drop very dramatically from comfortable thin shirt weather to thick winter 'trekking gear' weather.

#### **What next ?**

Although I was very interested in climate and weather in the early sixties I was never aware of any serious threat to the world owing to global warming or, more correctly, climate change. Along with the usual equipment required for meteorological measurements and the fascination of the weather patterns of the tropics, with the long and short rains, the regular-as-clockwork afternoon thunder storms and the ITCZ (Inter Tropical Convergence Zone), my interest in the weather has never waned. The thought that the white crown of Kilimanjaro might disappear from Africa's highest mountain was not a notion that had crossed my mind, nor anyone else known to me at that time. Yet, even in those days, more than 35% of the ice fields had disappeared from Kibo since the original German survey in 1912 and more than an additional 45% has disappeared since then.

What is curious is: 'How long have we been contributing



Figure 8a - Kibo Evening camp, August 1961  
 Photo: P J Bradley



Figure 8b - Kibo Evening camp, January 2004  
 Photo: Dr Hartmut Bielefeldt



Figure 9 - Author on the ice field near Gilman's Point, Kibo in 1961  
 Photo: P J Bradley



Figure 10 - Mount Kenya from Nyeri, showing glaciers (1958)  
 Photo: P J Bradley



Figure 11 - Mount Elgon taken from 1700 m at Lugulu (1958)  
 Photo: P J Bradley



Figure 13 - Mount Mawenzi, from the Kibo side of the saddle (1961)  
 Photo: P J Bradley

to this warming of the atmosphere? Had the man-made warming effect started as early as the beginning of the 20<sup>th</sup> century or even much earlier? Was there sufficient burning of fossil fuels globally, at that time or from the beginning of the Industrial Revolution, to have initiated this rise in atmospheric temperature? In any event, the tragedy is that very little can be done about this glacial recession. There is a very reasonable school of thought that suggests that, if there were a significant reduction of

forest/wood burning around the mountains and a program of re-forestation set in train to help increase precipitation, then there might be a chance of reducing the rate of ice recession. This is of course only local to the specific mountains. Another reasonable theory is that, as more of the dark volcanic rock is exposed to the sun as a result of melting ice, the increased heat absorbed increases the melting of the ice even more.

Undeniably it is for governments to tackle the major issues of climate change but it appears questionable whether many will recognise the true urgency of the problem or, if they do, will they wish to tackle it robustly and with conviction. Tokenism is probably all that can be said for many. One cannot seriously think of the constantly increasing air traffic and believe that more efficient engines will be developed to counteract the increased fuel consumption! In practice there are considerable doubts as to whether this general change can be reversed, except perhaps over an even longer period than it has taken to get where we are today. It will be a very sad day when the *Shining Mountain* no longer shines.

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### Acknowledgement

I should like to thank Dr Hartmut Bielefeldt for kindly allowing me to include some of his photos in this article. I should also point out that he has an excellent website which shows a number of mountains he has climbed in various parts of the world including Mount Everest

<http://www.bielefeldt.de/titele.htm>

I will also mention the recent research literature of Professor Lonnie Thompson and his team. Although one paper is mentioned here, others well worth reading, from

source, are available on-line from the Ohio State University site. For those interested in following this subject further, there is a colossal amount of material under countless references on the Internet.

A few of the most interesting of these are listed below.

- <http://eol.jsc.nasa.gov>
- <http://earthobservatory.nasa.gov/Newsroom/Headlines/>
- <http://www.acs.ohio-state.edu/units/reasearch/archiev/glagone.htm>
- <http://www.scienceblog.com/community/article158.html>
- <http://www.Kilimanjaro.cc/EAM/index>

Various government and tourist websites also give useful information and advice.

### Editor's Notes

*The author, Peter Bradley, grew up in Kenya, on the foothills of Mount Elgon, and has returned many times to the country. Although his early studies involved geology, physics and electronics, he has spent the last thirty years in teaching and audiology.*

*Peter built his first weather satellite receiver in 1969 and produced his first APT satellite images in 1971. He has since used most of the methods and modes of reception and display with much home-made equipment plus some commercial hardware, and is still receiving remote images thanks to NASA, EUMETSAT and David Taylor's excellent software.*

*Peter has a continuing interest in East African weather and climate patterns. He has held a radio amateur licence since 1968 (G8DUG and G4BZE). Now retired, he plays jazz and grows over 30 varieties of bougainvillea amongst his other activities.*

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## Copy Deadline for GEO Q5 - Friday, December 31, 2004

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/drawing which are **not embedded** within the article, for make-up purposes.

### Submission of Copy

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

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

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

# Meteosat 8 - The Challenge



Mike Stevens G4CFZ - [mikeg4cfz@tiscali.co.uk](mailto:mikeg4cfz@tiscali.co.uk)

I have been involved with the reception of APT images from polar orbiting satellites and wifax from Meteosat-7 for two years now. But mindful that the latter ceases operation in just over a year from now and new digital polar orbiters will be with us in the near future, I made the decision earlier this year to take the plunge and prepare myself for Meteosat-8 reception.

Let me start by saying that I am not a computer expert. I 'use them and abuse them', as the saying goes. Little did I know what lay before me, but as everyone who was receiving Meteosat-8 pictures said how spectacular they were, this was a challenge I could not put aside.

## The Computers

The first thing was to sort out computers. I already had an Acer Travelmate 233 laptop with a 2.0 GHz Celeron processor, 400 Mb DDR SDRAM and 40 Gb hard drive which I was already using for satellite reception. A friend of mine was ready to sell a second-hand Packard Bell PC, so I made an offer which he accepted. In the event, this was to prove a bad decision; when I tried to update the software from Windows Millennium Edition to XP the unit did a nose dive into the deck and crashed most spectacularly. I quickly got rid of this as it was obviously going to be a source of trouble. A workmate who likes sorting out PC problems took it off my hands. I later found out the hard drive and processor both had to be replaced before it would function satisfactorily.

This still left me with the problem of a second computer. Having read 'MSG Update' by David Taylor and John Tellick in the launch issue of *GEO*, which provided useful background information about the computers to use, I decided that a visit to the PC Supermarket was the best way forward: so off I went with cheque in hand and a budget in mind. After a great deal of looking and thinking I purchased an excellent piece of kit, an E-Machine 2.8 GHz with Intel Celeron, 512 Mb RAM, 80 Gb Hard Drive and DVD-CD Read/Write. So with luck no upgrades should be required, and it fell within my budget.

## Networking

Time now to sort out networking. It was a good thing that both computers had *Windows XP* so the problem should be easy. After fitting the crossover network lead I had to decide which unit was to be the master. I decided on the Acer Laptop. Each PC is configured separately using its own *Network Wizard*. If you have ever carried out networking then you will know all the tricks to look out for. But if not, follow the Network Wizards which will guide you through the set-up. One thing: you will be asked if you wish to make a set-up disk and I would advise you to do this. It will come in handy if you need to reset in the future.

Start off by making the second PC access the Internet through the master computer. Once that has been set up open all the files that you need to share from the master

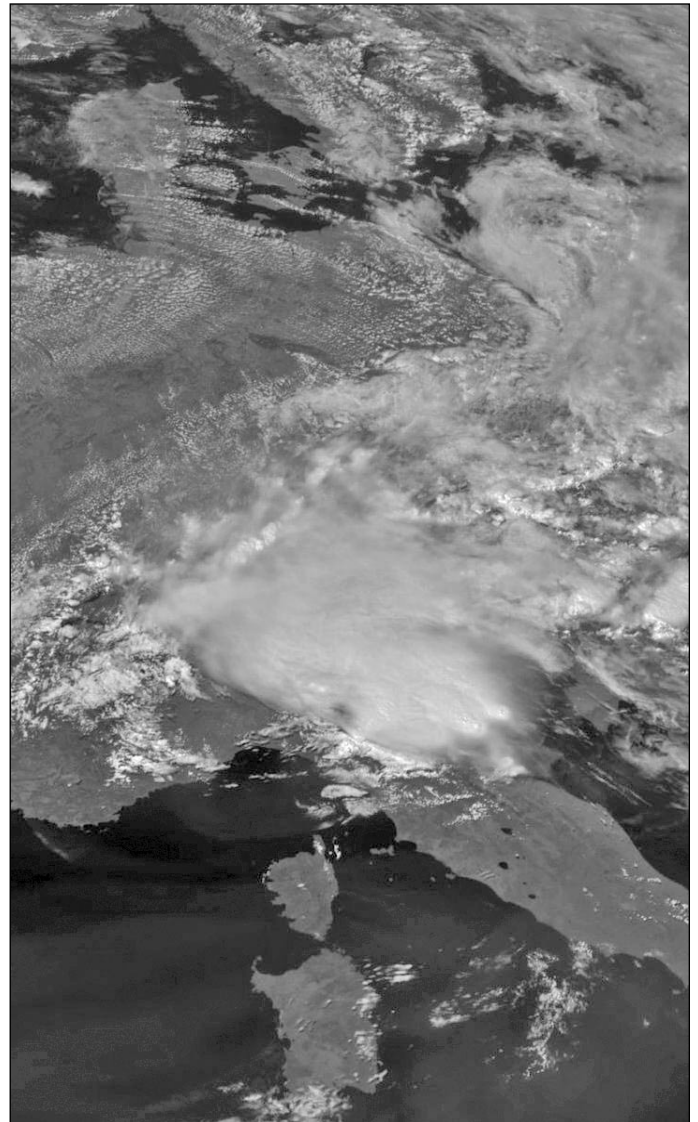


Figure 1 - Segment from Meteosat-8 at 13:00 UT on July 24, 2004  
© EUMETSAT 2004

computer (Acer). Having set up the network I tried a few things from each PC to check if all was working— behold it did. I could access the Internet from the second PC and access the files both ways from each PC.

## Licence

Once my network was set up it was time to order all the items of equipment. I had already sent off for the *EUMETSAT* application form several weeks earlier and while I was setting up my network my licence arrived. I duly signed and returned a copy, and within a week was contacted by *EUMETSAT* regarding the purchase of my software and *eToken* (EKU or EUMETCast Key Unit). This I did immediately, paying by credit card. According to my statement the cost worked out at just over £62. The software and *eToken* arrived within four days by DHL, which I thought was excellent.

## Hardware and Software

As I had decided to use the laptop as the receiver PC, I had to order the USB version of the Technisat receiver. Should I decide on changing PCs in the future I have the flexibility of being able to move this unit as well. I also required the LNB and the satellite meter which I was sure would come in very handy. The equipment was duly ordered from *Timestep*<sup>[1]</sup> and arrived safe and undamaged within five working days

### Assembly

My first task was to rebuild my existing satellite dish. I had to remove the LNB previously used for the reception of Meteosat-7 and fit the new LNB for *Hot Bird-6*—easy enough—but do take care not to clamp everything up tightly yet as you will need to move things around a bit to obtain maximum signal when setting up the dish.

I then installed the *Technisat* DVB receiver complete with software: follow the instructions to the letter or it can get confusing. My software loaded all right and within a few minutes *BBC World Service* was on screen. But my signal level was low with some of the pictures breaking up. When I looked at the satellite dish I realised it would have to be relocated for maximum signal as it was aiming through the roof of the garage at this point!

Now here in Portland we get a lot of storms during the winter season. The wind can be very extreme, the worst storms producing gusts in excess of 100 mph, so locating the dish higher to avoid the roof top would need a lot of consideration to avoid it being blown down or vibrating during high winds. But necessity can be the mother of invention. I designed and built a small bracket and mast on to which to fit the dish, whereby it could rest on the slant of the roof, so helping to add extra stability during gale conditions.

### Aligning the Dish

My dish is a 60 cm offset model mounted approximately 3 metres above the ground. I am using CT100 satellite cable with braided copper and aluminium foil screen and single-strand copper inner conductor. All connections are by F-connectors with shrink-tubing as extra protection.

*WXtrack* was used to determine the accurate azimuth and elevation of *Hot Bird-6* and then a compass was used to find the directions (but remember to add the magnetic variation, which is just over 3°). I calculated that the angles from my home to *Hot Bird-6* were 160.12° azimuth and 30.30° elevation (though obviously those figures change from differing locations around the UK).

So with compass in hand, the receiver switched on and the sat-meter in circuit I proceeded to set up the dish in its higher location. There are a lot of satellites in that region of the sky and it is very easy to miss *Hot Bird 6* and locate *Astra* instead (there are only 6° between them and that amount of movement on a satellite dish is very small indeed). This is where the compass comes in very handy and used in conjunction with the sat-meter I found *Hot Bird 6* very quickly.

The elevation of the dish is not as one might expect. It explains in some magazines that the angle should be shallower (flatter) towards the horizon owing to the offset feed configuration, but in my case the dish is angled up

slightly, between 5° to 10° from vertical. Now this will vary at different locations around the U.K—the further north you are located the shallower the angle of the dish. This is all to do with elevation angles from the Earth's surface to the satellite.

### Software

With the dish permanently mounted I noticed an immediate difference in the sat-meter reading, which leapt to full scale deflection. I returned to the PC and opened up *Setup4PC*. When I activated the 'status' box the 'signal quality' was 55%. That would certainly do to start with, but further adjustments would be required later.

I selected the DVB 'viewer' mode and located the BBC World Service. The picture was stable and clear. Another check you can carry out is to see if you are receiving Italian stations: if so then you are aligned to *Hot Bird-6* but, if you are receiving a lot of German stations you are likely on *Astra*.

So to recap, the dish is now aligned (but may need some final adjustments), the DVB viewer is working and we are receiving a good signal with stable pictures.

### Installing the Tellicast Software

My laptop has only two USB sockets. Into one of these I plugged the DVB viewer cable and into the other the USB *eToken*. Before loading the *Tellicast* software you are strongly advised to read *EUMETSAT's* 'Broadcast System for Environmental Data', EUM TD 15 [2], or you could have lots of problems.

First load the software for the *eToken* then, after that has loaded successfully, load the *Tellicast* reception software. **Note the following carefully:** during the process you will be asked for your *username* and *password*. These items will have been e-mailed to you from *EUMETSAT*, but when asked for them **do not type them in**. You **must** use copy and paste from the actual e-mail into the *username* and *password* boxes (these letters and numbers are case sensitive).

I made the mistake of trying to type these in by hand and it was only after several hours of concentration and help from David Taylor that we discovered what I had done wrong.

Once all the software had loaded I immediately opened the *Tellicast* program and was confronted with the words '*Configuration Error*'. Built within this program are several help utilities, one of which is the '*Log File*'. You can open this log file and locate the fault—it will be listed. Mine was listed as:

'incorrect interface address' 192.168.238.238

The program was looking for the DVB Adaptor, which of course I was not using. I had to locate the correct IP address of the TechniSat USB device (which was plugged into a USB socket).

As I stated in the beginning I am not a computer expert. But there are certain things that we pick up as we go along and I realised that if I could locate a DOS box within Windows XP I could find its location. I aired my

problem on the GEO-Subscribers Internet Group and about an hour later had an e-mail from Douglas Deans with an attachment from an article written by Arne van Belle, which read as follows:

Go to the start icon, click on 'Run'. In the box marked 'Open' write 'cmd' then click 'OK'. This will open the DOS box. Type 'ipconfig /all' at the prompt then press 'enter'. You will now be shown a display listing each item of your fitted hardware, each complete with its *Interface Address*. Mine was noted as 169.254.212.2, totally different from the one quoted above.



Figure 2 - The DOS box with prompt

I now went into the *T-Systems* folder and located the *recv.ini* files within which I located the incorrect interface address. This was edited to the new one and, immediately the new address was entered, the *'T' Icon* displayed in the system tray at the lower right of the PC display changed from red to green—at last my PC was connecting to the DVB receiver and on returning to the system I discovered that the *Announcement Channel* was active but that the *Data Channels* were not. (See also *Appendix II*)

Again I cannot over-emphasise: do read EUM TD 15 and follow the 'DVB Software Startup' section from page 27. It is vital that you follow this through exactly as per instructions **or you will not obtain a working system**.

It was at this stage I have to admit that I nearly gave up because, having followed the procedures to the letter, my system still did not function. It was then that I contacted the *MSG-1 Yahoo!Group* and posted a message. The following evening there was a message from David Taylor stating 'I think there is something wrong with your password'. And then it clicked—I had typed in my *password* and *username* instead of using the *copy and paste* method.

I re-entered my name and password straight away, using copy/paste, and the effect was immediate. All the *Data Channels* came alive and the 'Input graph' box was filling up with data.

At last the system was working.

### **Resetting the Dish for Maximum Signal**

I was now ready to reset the satellite dish for maximum signal using the 'Signal Strength' meter in *Setup4PC* (not the Sat-meter). First I adjusted elevation by moving the dish up and down to find the highest reading and then repeated for azimuth by moving it from side to side. When I had found the highest readings I started to move the LNB in towards the dish then slowly back out again.

Every move was monitored using the *Setup4PC* meter until I finally found the peak signal strength. The final adjustment was to rotate the LNB in a clockwise direction by about 10°, which showed my maximum signal to be 71%, fluctuating down to 69%, a mean of 70%.

At this point I proceeded to lock the dish at those settings and secured the brackets. Finally I sprayed the dish (only) with a black anti-rust spray because of its hostile environment (salt spray etc.)

I immediately contacted David Taylor for a time-limited edition of *MSG Data Manager* and *Geosatsignal* [3] which he returned to me the following day. These were loaded on to my processing PC (the E-Machine) and everything switched on.

### **Making Images**

Creating images with *MSG Data Manager* is simplicity itself. Install the program, enter your registration code, click the 'setup' tab (*figure 3*), and check the images you require. Then open the 'MSG-1 HRIT' tab, click the *Start* button, and sit back to watch the images build up (*figure 4*). The Meteosat-8 HRIT images are updated every 15 minutes. You can also receive images from other geostationary satellites around the world through the 'World' tab (*figure 5*). Monochrome images from several channels can be combined using *GeoSatsignal* to produce coloured images (*figures 6,7*).

### **Conclusions**

To say the results were stunning is an understatement! The pictures continued to build before me. The quality and detail are unbelievable. I remember sitting and looking in awe at what I was seeing.

The total time taken from start to finish of this project was seven weeks. The total cost of all the equipment including the new PC had been just under £1000, so all in all its not really cheap. But not too expensive either: achievable if you are careful and plan your way through it, starting with what you can afford and building up your equipment as you go along. See *Appendix I*

I have now purchased the full registered copy of both *MSG Data Manager* and *Geosatsignal4* as well as *MSG Animator*. I can thoroughly recommend all these excellent software packages from David Taylor. I also have to say a special thank-you to David for giving me a lot of support when I needed it, to Les Hamilton for his help in finding contacts and to Douglas Deans for passing information on to me. I'm also indebted to Arne van Belle for that little tip about the DOS box and to all the members of the *MSG-1 Yahoo!Group* for their input. I could not have done it without you.

For me this has been a huge learning curve and an experience I will remember for a long time. It is all about the amateur spirit of trying things that you are not sure will work, then finding that they do—fantastic! Finally a special thank you to my wife for her patience and encouragement to keep going when all seemed impossible.

I will just conclude by saying this:

'If I can do it so can you!'

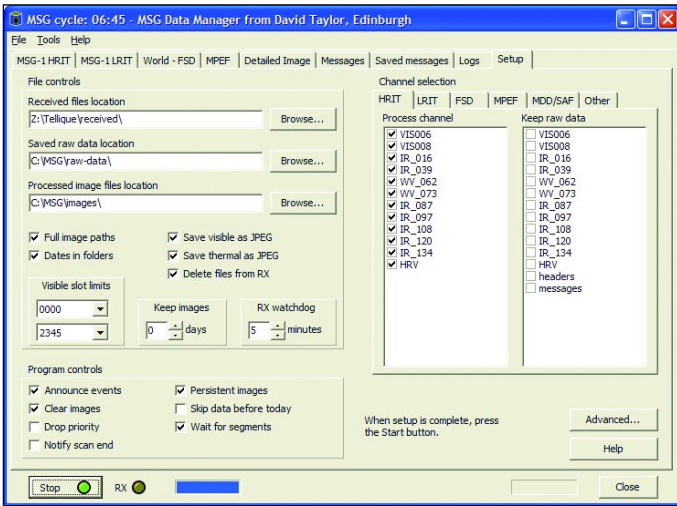


Figure 3

The MSG Data Manager 'Setup' tab

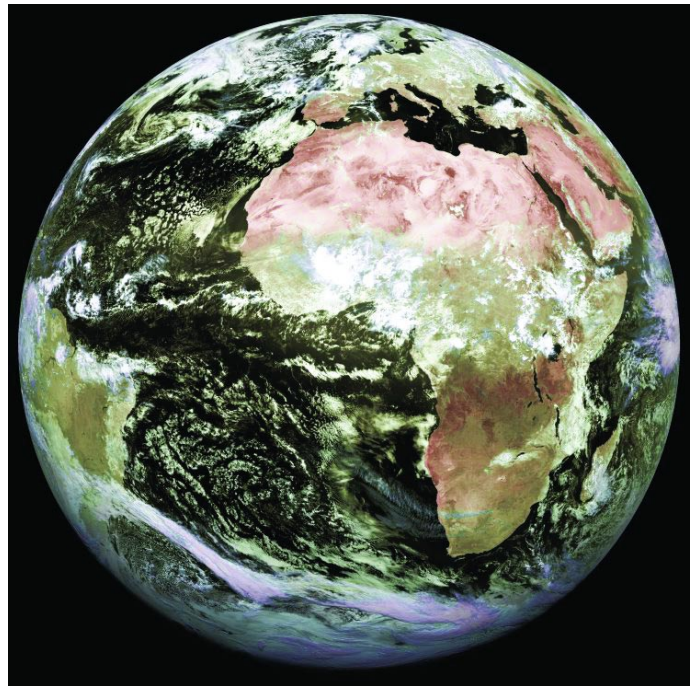


Figure 6

The equipment described in this article allows the user to download an updated full-Earth Meteosat-8 image every 30 minutes.

Above, Meteosat-8 image dates from July 17, 2004  
 Image © EUMETSAT 2004

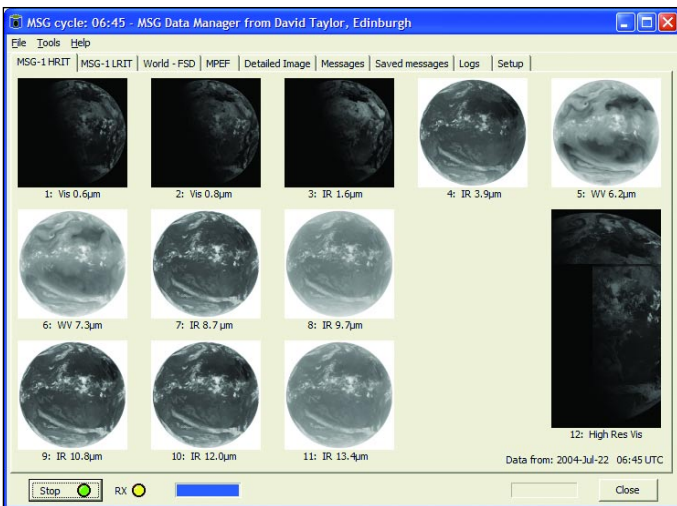


Figure 4

Thumbnail images displaying in the 'HRIT' tab during live reception of Meteosat-8 via the Hot Bird-6 DVB transmission

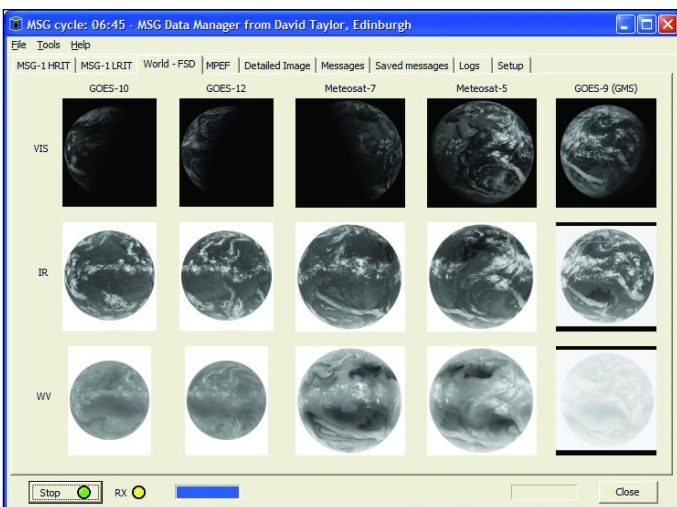


Figure 5

The 'World' tab during reception of 'foreign' satellites via the Hot Bird-6 DVB transmission

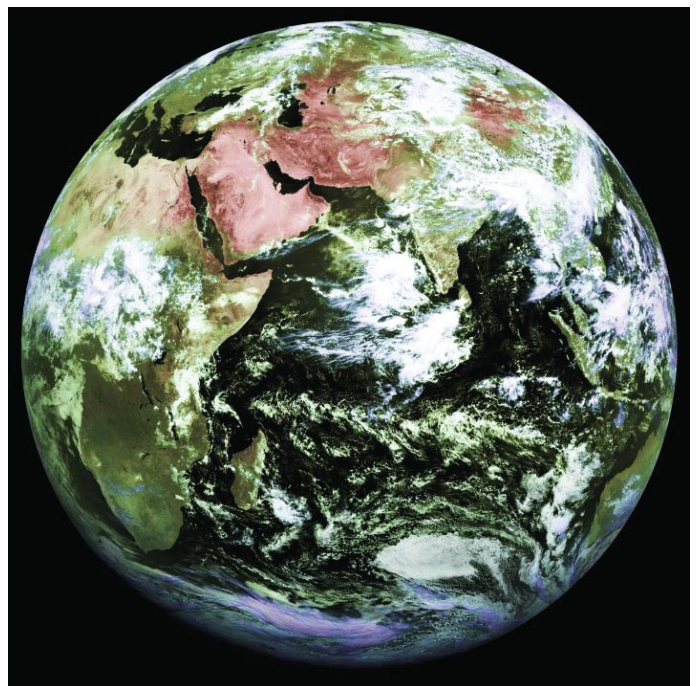


Figure 7

Once you are set up for reception of Meteosat-8, you can also receive periodic images from the so-called 'foreign' geostationary satellites. These include the European Meteosat-5 and Meteosat-7, the two American GOES satellites and Japan's GMS (currently relays from the ageing GOES-9).

Above is shown a full disc Meteosat-5 image dating from July 17, 2004  
 Image © EUMETSAT 2004

### Appendix I - PC Cost and Specification

While a new, high-specification PC like Mike's is ideal, readers who cannot match his price outlay should not be put off. I think that many readers will be able to acquire perfectly adequate second-hand PCs (e.g. a Pentium III, 500 MHz, 256Mb) for reception much more cheaply, and use their existing main PC for processing (perhaps with a memory top-up). I would suggest making use of what you already have and only resort to purchasing a new PC if absolutely essential.

### Appendix II - IP Address

Mike chose to use the IP address which had been assigned to his USB adaptor and alter the *recv.ini* file to match that address. For consistency with everyone else, I would suggest leaving the *recv.ini* file alone and altering the IP address of the USB adaptor to the usual 192.168.238.238.

- Start, Settings, Network and dial-up connections (Win 2000) or Start, Settings, Control Panel, Network connections (XP)
- Right-click on the required connection (e.g. B2C2 Broadband receiver...) then select 'Properties'
- Select the 'Networking' tab
- Select Internet Protocol (TCP/IP) from the drop-down list
- Click Properties
- Check 'Use the following IP address'
- Enter IP address: 192.168.238.238, subnet mask: 255 255 255.0

### References

- 1 Timestep Electronics - <http://www.time-step.com>
- 2 <http://www.eumetsat.de/en/area2/publications/td15.pdf>
- 3 Satsignal Software - <http://www.satsignal.net>

### Acknowledgements

Thanks to David Taylor for appendices I and II.

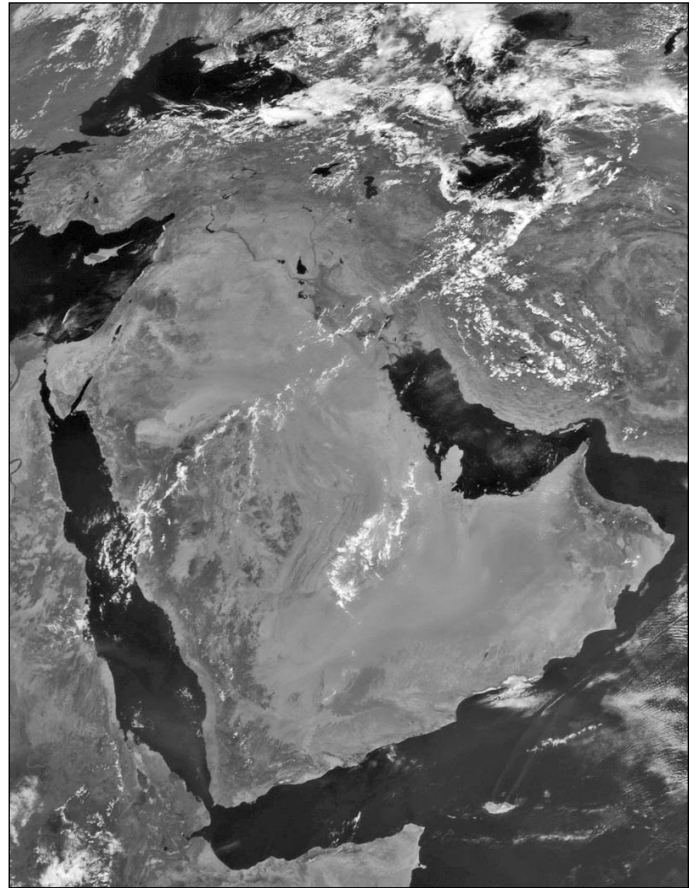


Figure 8 - Segment from Meteosat-5 at 08:30 UT on July 23, 2004  
© EUMETSAT 2004

## **NASA's Cassini Mission to Saturn provides the first high-resolution images of Phoebe**

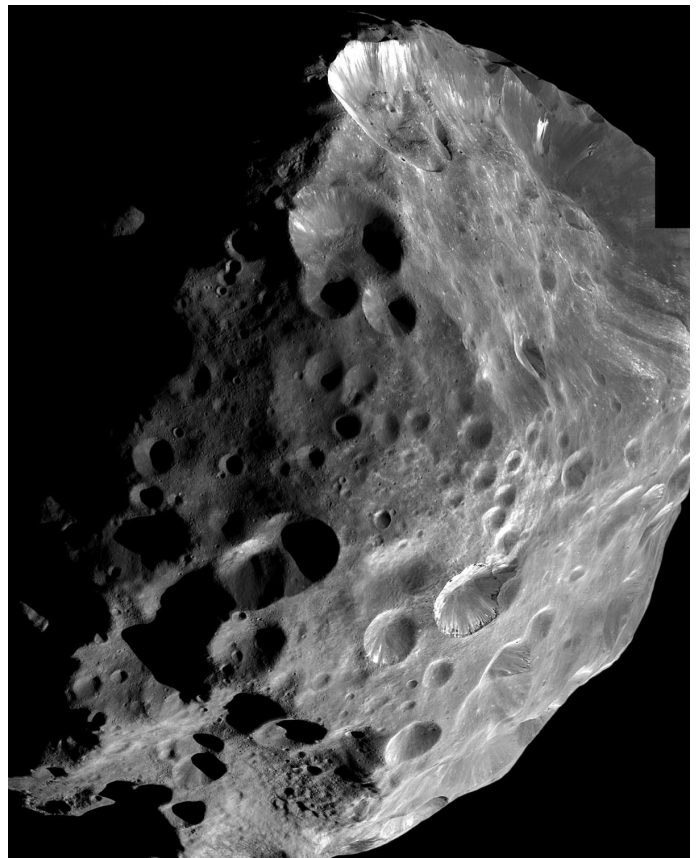
Last June, NASA's *Cassini* spacecraft captured the first ever high-resolution images of Saturn's small outer moon Phoebe and six of these, acquired in visible light through the narrow-angle camera, were used to create this mosaic. Image scale is 74 meters per pixel.

Phoebe shows unusual variation in brightness over its surface due to the existence on some crater slopes and floors of bright material—thought to contain ice—on what is otherwise one of the darkest known bodies in the Solar System. Bright streaks on the rim of the large crater at the top of this image may have been revealed by the collapse of overlying darker material from the crater wall. The large crater below right-center shows evidence of alternating bright and dark layered deposits.

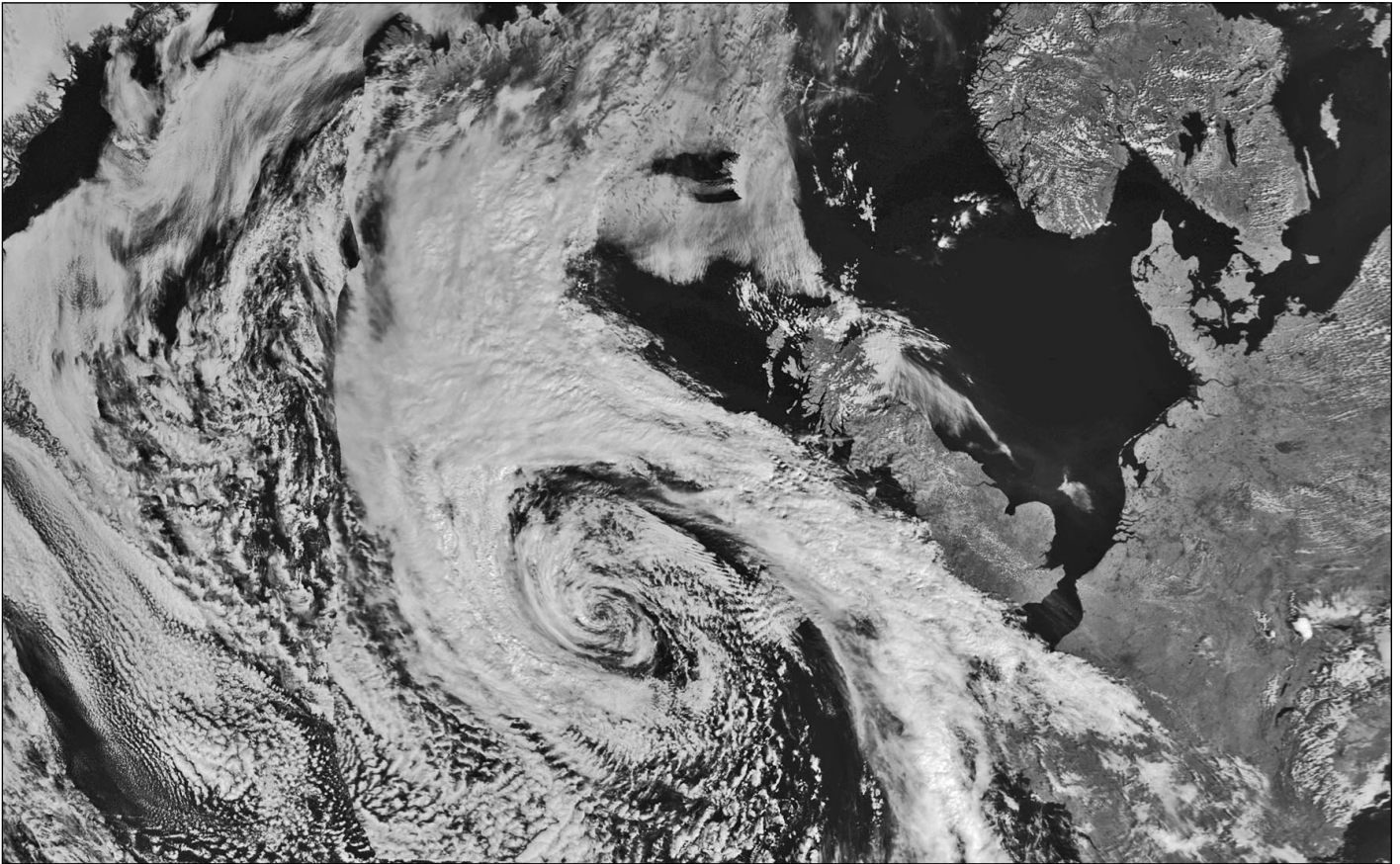
Hints of Phoebe's irregular topography can be seen peeking out from the shadows near the terminator to the left of the image. These are real features, possibly the rims of craters or mountain peaks just catching the first light of sunrise on Phoebe.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency.

Image Credit: NASA/JPL/Space Science Institute







This composite of two NOAA-17 channel-2 images from the 11:24 and 13:05 UT passes on August 8 shows the remnant of hurricane 'Alex' about to bring flooding to much of Great Britain.  
 HRPT data: NOAA Satellite Active Archive (<http://www.saa.noaa.gov>) Processing: Satsignal and Photoshop

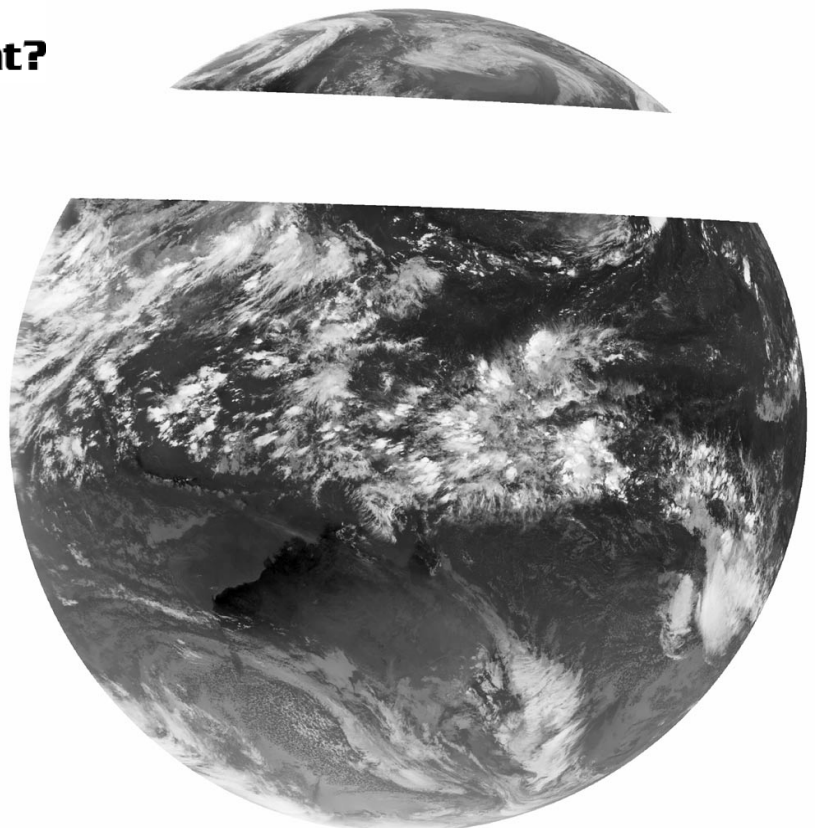
## Mystery Image

### Censorship or Missing Segment?

On September 9, a massive explosion near North Korea's northern border with China produced a mushroom-shaped cloud more than two miles in diameter. The smoke cloud was observed by satellites, fuelling speculation in the media that it might have resulted from a nuclear detonation. In the event, it was later established that the explosion was in fact related to work on a hydro-electric project.

**Peter Bradley** was surprised to receive the accompanying GOES-9/GMS image, acquired at 09:00 UT on that very day, via the Meteosat-8 FSD stream. Peter comments:

'My friend Peter Thompson, who is an avid weather watcher, asked me to check that the image was not simply suffering from missing segments. It coincides with the time of the North Korea explosion, we believe. The missing region of the image is clearly not the result of missing segments as the white band slants across the horizontal segments—possibly indicative of cutting! We believe the image may have suffered from censoring'.



Superb! Brilliant! Outstanding Impressive!  
**GEO Readers' Survey**  
 Great! Excellent! Well done! 1st class! Wow!

Now that the *GEO Quarterly* is firmly on the map and the Leicester Symposium is done and dusted, we have at last found the time to read through the information so many of you kindly provided when completing the short questionnaire included with the Membership Form in our Launch Issue. A large proportion of these forms were completed, providing the *GEO Team* with invaluable help to improve the service we offer you.

And what a welcome you have given us! Many of the most frequent comments appear in the title banner above. Other comments included 'promising start', 'nice surprise', 'fabulous', 'very well presented' ... needless to say, everyone on the *GEO Team* thanks you for your good wishes and encouragement.

#### **GEO Quarterly Format**

With very few exceptions, the A4 format was widely praised as being easy on the eyes and many readers were very much taken by the full page colour images: only one reply favoured the smaller A5 format. The overall quality of the magazine and its images was commented upon time and time again. Our suggestion of possibly distributing *GEO Quarterly* on CD-ROM did not meet with approval at all. Several readers made the point that much of the magazine's appeal lay in the fact that it could be enjoyed away from the computer screen in the comfort of an armchair. A few readers stated they would be prepared to pay more to ensure that we continued the printed format: one reader went so far as to state he would not renew his subscription if he could only receive his *Quarterlies* on CD. In fact, only one reader favoured the electronic format.

#### **Content**

By and large most of you felt that *GEO Quarterly* was well balanced and that the content provided a good mix of topics which were easy to read. From some quarters we were reminded to 'keep it simple', 'remember that all readers are not experts', and that 'everyone is not computer literate'. But we also received several requests for more articles of a technical nature.

The QFH construction article went down well, and there were requests for more articles on antennas in general, as well as antenna-building projects. There was a recurring theme requesting more 'hands-on' topics, articles covering receivers, and construction projects of various kinds. Two readers were keen to learn more about actually connecting their antenna to the receiver. Which is the best type of co-ax to use? Which connectors are most suitable etc? Hopefully, Arne van Belle's article in *GEO Q2* has already addressed these issues.

'What about running readers' competitions from time to time?' was one request.

#### **Sourcing from the Internet**

There were also a few reservations. It was suggested that too many items were 'reprinted from website material' and that more weight should be given to images that amateurs can receive themselves.

Well, as a new organisation, *GEO* will take time to build up a regular panel of authors—resourcing from the Internet provided us with the opportunity to find our feet. *GEO* also has a duty to meet the needs of those readers who are not themselves Internet-connected. Many subscribers in fact commented very favourably on these articles and images.

The current polar orbiting satellites (which amateurs can receive) are now in their twilight years, so we must look forward to the imagery of the likes of *Terra* and *Aqua*. At present images from these satellites are only available online, but direct reception from these craft may well be the next great challenge for the amateur: at present the Internet is the only source of data products from these satellites and we must raise awareness regarding what may lie ahead.

But meantime, do please select your best weather satellite images and send them to the editor for possible inclusion in future *GEO Quarterlies*.

#### **Which Satellites are GEO Readers Receiving?**

It was interesting to note that NOAA APT on 137 MHz is still by a long way the most popular satellite acquisition mode—almost  $\frac{2}{3}$  of those responding are actively receiving APT from the NOAA satellites. The accompanying table summarises the returns from the first 200 survey forms.

Meteosat-7	19%
Meteosat-7 PDUS	3.5%
Meteosat-8 (MSG)	29%
NOAA APT	64%
NOAA HRPT	12%
Feng Yun C/HRPT	2%

#### **Earth and Planetary Imaging**

The final question we asked was whether *GEO* should devote itself exclusively to planet Earth. A resounding 62% of you wished also to include some coverage of planetary missions, though it was emphasised that the main focus of *GEO* should remain the Earth itself.

Two of GEO's German readers, **Hartmut Schaksmeier** and **Gerry Berg**, sent in this self-same APT image from NOAA-12 showing the remains of hurricane 'Alex' passing over Europe on August 12, 2004. This HVCT false-colour image was created in *Wxtolmg*, with added precipitation colouring, and clearly shows the torrential rainfall over parts of western Europe, the Low Countries and Germany taking the brunt of the battering.

Just over a week earlier Alex, at the time a category-2 hurricane, had made glancing contact with North Carolina on the eastern seaboard of the USA, but scarcely made landfall, and did little damage.

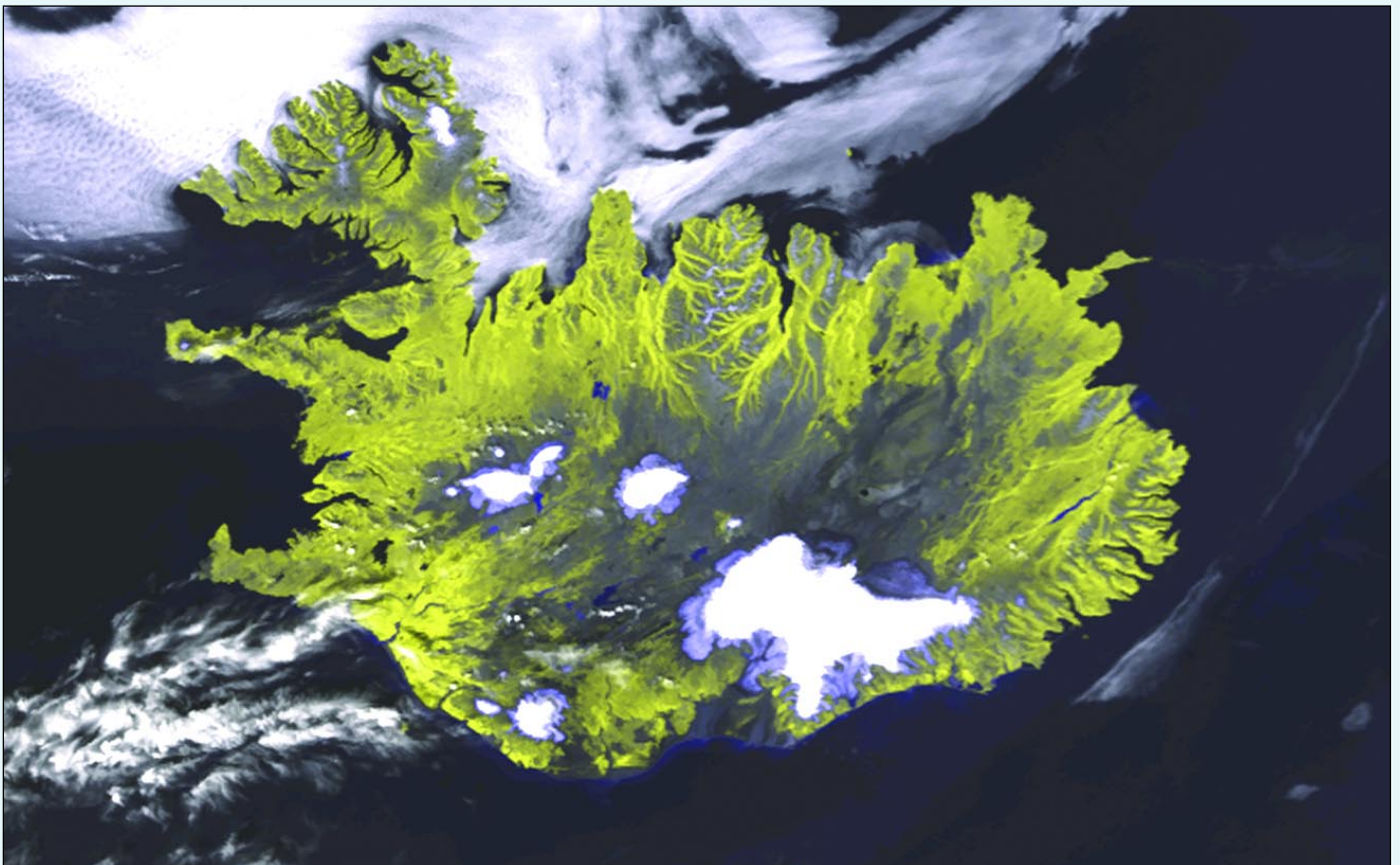
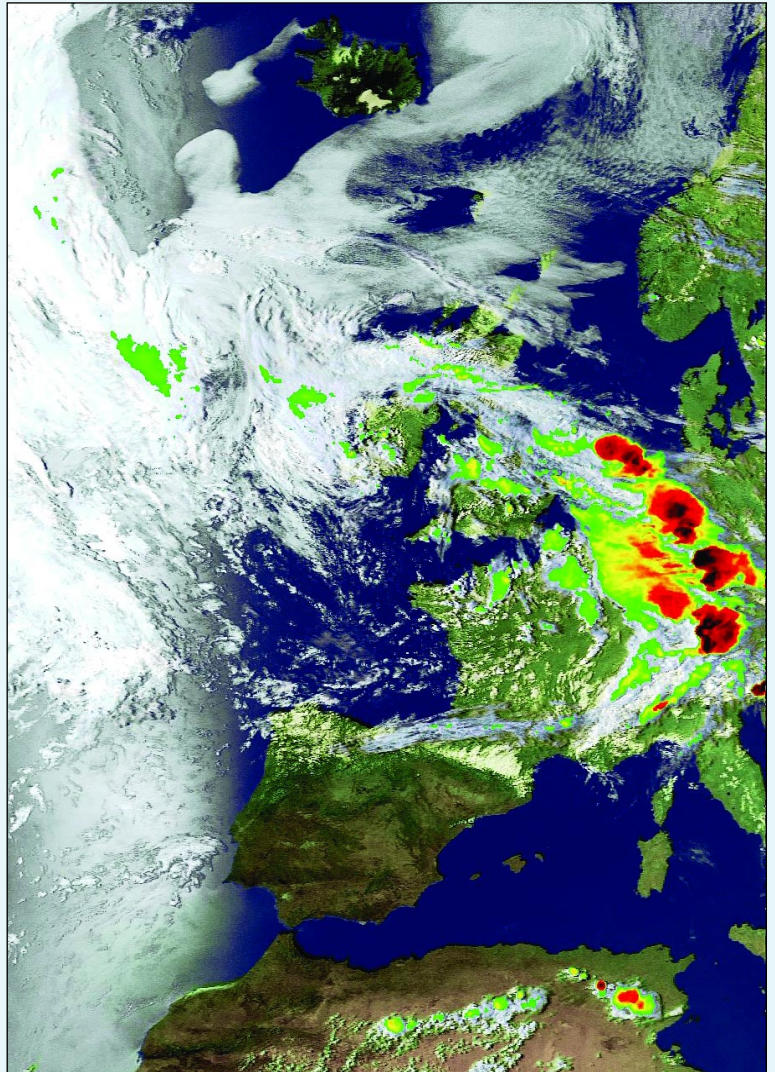
The most notable feature of Alex was how late this first storm of the 2004 Hurricane Season appeared; it was the fifth-latest 'first hurricane' recorded over the Atlantic during the past half century.

The previous latest was the infamous hurricane Andrew, which reached hurricane strength on August 22, 1992 and proved one of the costliest and most damaging ever. In 2003, by contrast, hurricane Ana arrived on April 22, before the official start of Hurricane Season, which is June 1.

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**Dr E G Duncan** from St Andrews in Fife, Scotland wrote in to say how impressed he was with the image of Iceland in GEO Q2.

*'Iceland is one of my favourite subjects, both in APT and HRPT, specially in late summer when the four permanent glaciers may be seen. Note the colour of the underlying rock (lava) showing through the thinning ice at the periphery of the glaciers. Indeed, summer 2004 has been exceptionally warm in Iceland and in some areas glaciers have lost three metres of ice. The image below came from NOAA-16 on August 11, and was processed on a Timestep system. It is a colour composite with the red and green applied to channel-2 and blue to channel-1.'*



# Use the 'HJL' False Colorization Technique to get the most out of your APT images

Hendricus J. Lulofs - Blacksburg, Virginia USA

As a meteorologist for NOAA's National Weather Service I have had the good fortune to have access to some of the most advanced meteorological technology in the World. Yet, there is a special feeling of satisfaction when receiving and processing one's own satellite images through a home polar orbiter reception site. Like many of you, I have for many years enjoyed the hobby of polar orbiter reception.

Soon after being able to reliably receive quality images, I became as you might say 'obsessed' with creating images with false colourization. I have divided this article into two sections. The first describes my personal journey through the learning process of image colourization—which led me to the development of the HJL technique; the second describes in detail how you can use this technique to generate high quality false colour images. 'HJL' by the way stands for my initials.

## My APT False Colourization Journey

Early on I tried false colouring APT images by the use of off-the-shelf software, first with a simple DOS program from *Weather Dynamics* before moving up to David Taylor's *Satsignal* software. The benefit of off-the-shelf software is that it is automated and can consistently give you good results from APT images. But my quest was for great results!

One day, while visiting the *Multifax* website, I spotted a write up about using programs such as *Paintshop* and *Photoshop* to add false colour to images. This was my first endeavour into manually intervening in the false-colour process. The technique resulted in superb cloud images but land and water colourization were not what I wanted. This was, however, a step in the right direction! Thanks go to *Multifax* for posting their article; some of the steps outlined below are a direct development of their techniques.

A year or so later I came across the *WTOC-11* website of Patrick Prokop from Savannah, Georgia, USA. Patrick appeared to be using a technique similar to the *Multifax* one but he had much nicer looking water and land colours. I started corresponding with Patrick and he walked me through his technique: this used David Taylor's *WXtrack* program to generate a coloured background image and then merged it with the visible and infrared images from the NOAA polar orbiters. This proved to be a huge step in the right direction and I am most grateful to Patrick for his help.

I felt I was getting closer to where I wanted to be, yet still desired more. Specifically I wanted to be able to include topographical information into the background of the image. My first step in this direction was to use *Photoshop*

to blend the NOAA image with the background map. The benefit of this was that clear land areas in the images now displayed some terrain and lake details that enhanced the background map from *WXtrack*. Next, after learning from David Taylor that I could substitute higher resolution maps into *WXtrack*, I searched for the highest resolution topographical map my PC could handle. The file I ended up using was almost 100 megabytes in size! Using this map as a source for my background images was a major step forward.

I next wanted to work on the overall clarity of the images. I felt that the way I was blending the images was washing out the image to a certain extent. By experimenting in *Photoshop* I discovered that the blending options feature produced positive results. I also wanted to work on the overall sharpness of the images and to do this I purchased a *Photoshop* plug-in called '*Mystical Tint Tone*'. This software really lets the advanced user put the finishing touches to a false-colour image.

When reading the detailed instructions below, one might say: 'This is nice but won't it take long to do?' It originally took me about 10 to 15 minutes to add false colour to each image. One time-consuming step was breaking up the IR and VIS images into identical sizes so that they could be overlaid. Fortunately Craig Anderson's *Wxtoimg* program does this for you and cleans up the images as well, saving time and increasing the quality. (One of the things I really like about this technique is that it still uses software from two of our most respected developers, David Taylor and Craig Anderson, and gives us the opportunity to support them by registering their products.)

It also dawned on me that *Photoshop* lets you record macros. I thus broke the process up into three macros and now I can complete the entire process in just three to five minutes. I had finally reached APT nirvana! The results of the HJL technique can be seen on my WEB site at:

<http://users.adelphia.net/~hlulofs/>

## The HJL Technique: A Step-by-Step 'How-to' Guide

My raw NOAA images are initially captured using *Q-fax* software from *Quorum Communications*. Most capture software available today, such as *Wxsat* and *WXtoImg*, work equally well and will produce a raw image consisting of two greyscale satellite images side by side, one showing the scene in visible light, the other in infrared. (figure 1).

David Taylor's *WXtrack* software is now used to generate the topographic background for the pass. My first step was to replace the background image file (*UserMap.jpg*) with one of much higher resolution<sup>[1]</sup>. In *WXtrack*'s 'Setup' tab, double-click on the required pass for the satellite you require. This takes you to the 'Ground Path'

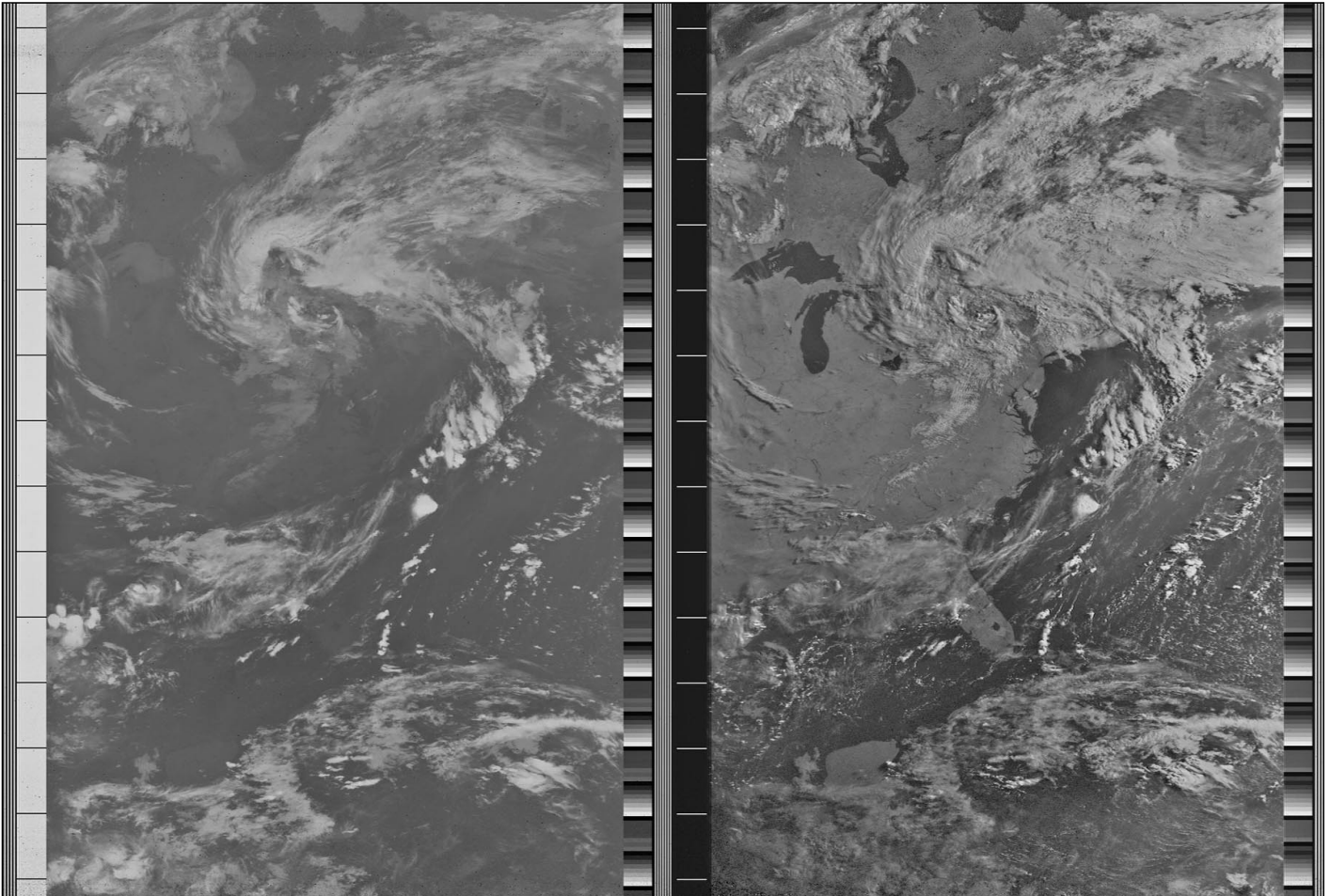


Figure 1 - A raw APT image as captured by *Quorum Communications Q-Fax* software

tab where a click on the 'Make picture' button generates the required background image. This is automatically saved under the name 'result.bmp'. The higher the quality of the 'UserMap' the better will be that of the 'result.bmp' file saved in the *WXtrack* folder (figure 2, page 44)

For the next step, I use *WXtoImg* to prepare separate visible and IR images. I load the raw image I want to work on (figure 1) and check <Options → Disable Map Overlay>. Under <Enhancements> I select 'Contrast Enhance (NOAA channel A only)'—this is the visible channel—then save this image (figure 3). I repeat for the IR image by selecting 'Contrast Enhance (NOAA channel B only)' then save this also.

### Adding the Colour

The remaining steps of the technique are all carried out using Adobe Photoshop. The *result.bmp* file (figure 2) and the two files generated by *WXtoImg* (figure 3) are all opened together in *Photoshop*. Select each of the latter two images in turn and change its image mode to RGB by selecting 'RGB colour' from the <Image> menu.

Now you need to create two image curves (one for the visible and one for the IR). You only need to do this once because once you have created them you can save the curves and then recall them every time you need them.

Lets start with the visual image. Click anywhere on the palette with the visible picture to make sure it is active then choose <Image → Adjustments → Curves> to reveal the 'Curves' palette. Use the drop-down menu in the



Figure 3 - A visible image split and optimised by *WXtoImg*

'Channel' box to select 'Blue'. Hold down the mouse on the point at the upper right of the graph and pull it straight down the right-hand axis until the 'Output' box reads zero (the image should now look yellow). Select 'Green' in the 'Channel' box but this time drag the upper right-hand point down to just 165. Leave the 'Red' channel at 255. Click the 'Save...' button, type in a suitable filename such as '*vis.acv*', save this curve for future use then click 'OK'.

Click anywhere over the IR image to make it active and create a curve for this image too. In the 'Curves' palette choose the 'Red' channel and set that point to zero (the image turns cyan). Choose the 'Green' channel and set

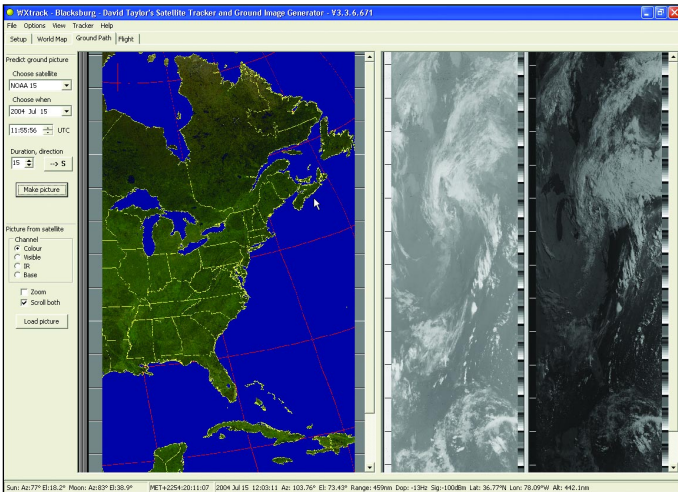


Figure 2 - A topographical map generated by WXtrack (left)

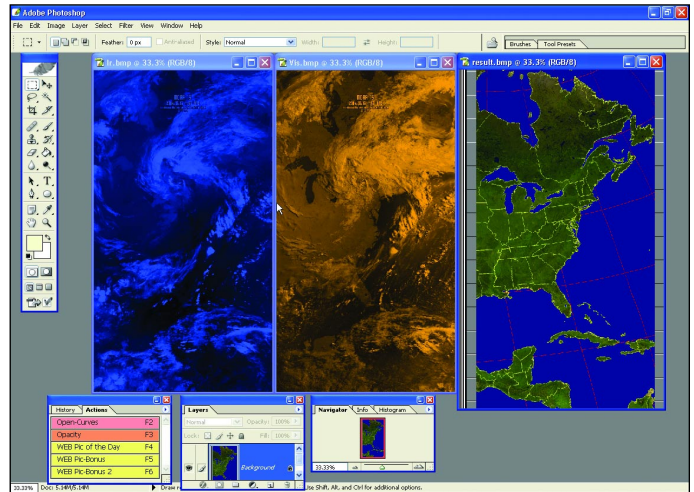


Figure 4 - Coloured infrared (blue, left) and visible (orange, middle) images with the background map (right)

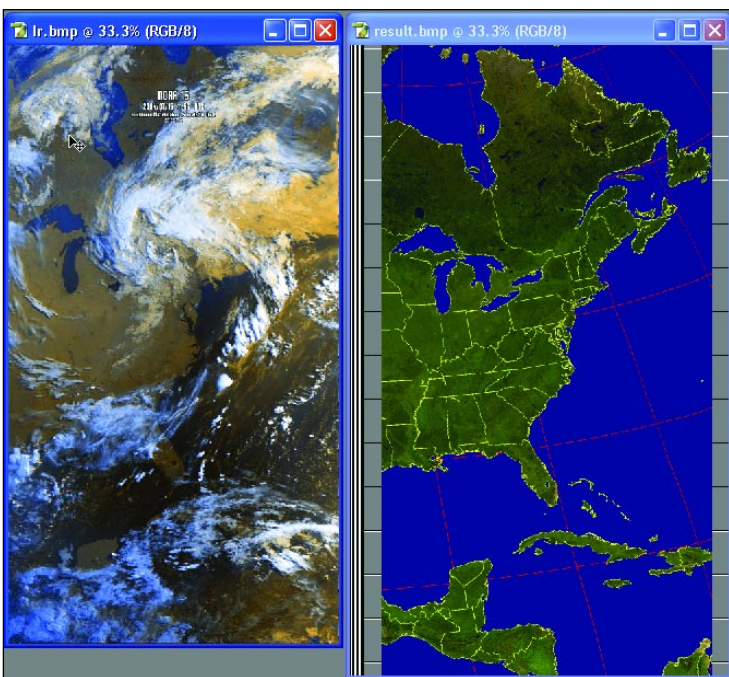


Figure 5 - Merged and optimised false-colour infrared and visible images (left). Background map generated by WXtrack (right)

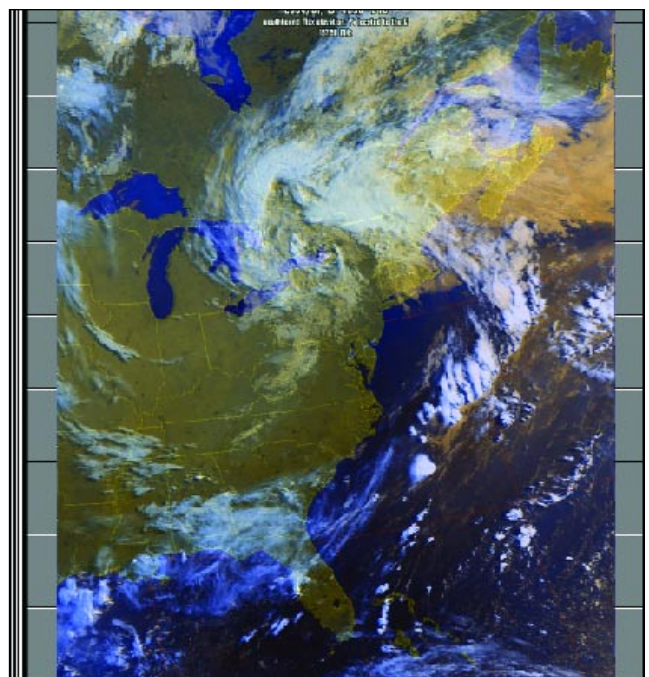


Figure 6 - Lining up the false-colour image with the background

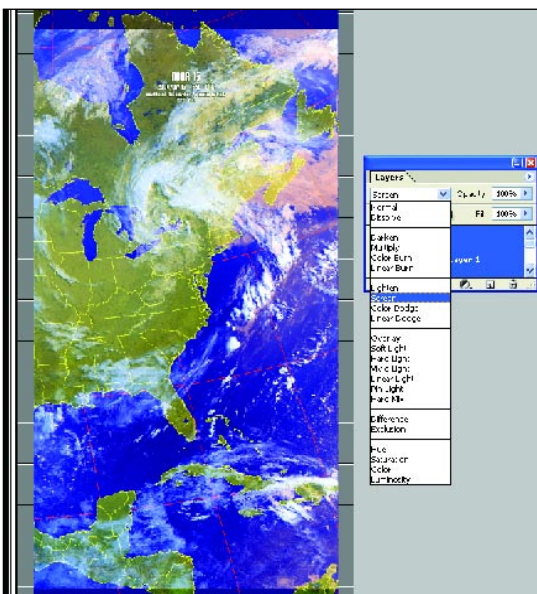


Figure 7 - Choosing a Photoshop blending mode

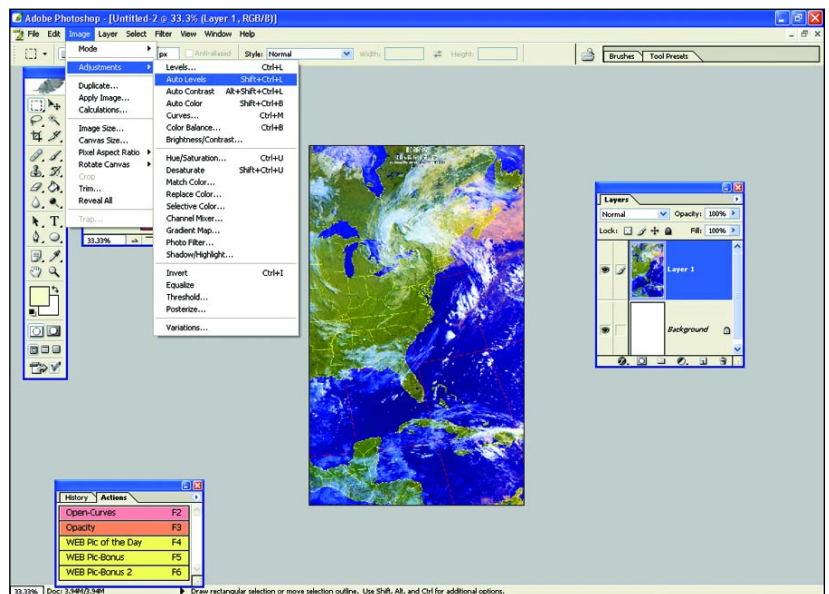


Figure 8 - Choosing Photoshop Auto Levels

that at 90. Leave the 'Blue' channel at 255. Save this curve for future use (as *ir.acv*) and hit 'OK' (figure 4).

### Combining the Images

The colourized visible and IR images must now be combined into one 'false colour' image. Make sure both images, with their curves applied, are loaded into *Photoshop* and that the 'Layers' palette is open (if not press f7). Click the **visible image** to make it active and you should see a thumbnail copy of it appear in the 'Layers' palette with the word 'background' next to it.

Place the mouse pointer over the word 'background', hold the left mouse button down and drag the small rectangle that appears over the centre of the **IR image**—then release the mouse. It will appear that you now have two images in the one window. In the 'Layers' palette, set the opacity to 50%, which should enable you to 'see through' the visible image and view the IR image underneath.

The images have now to be aligned exactly on top of each other. Since *WXtoImg* created the two images the exact same size, you should be able to align them so that they are perfectly stacked. Move the top image by clicking and holding down the left mouse button and dragging it into the desired position. Once you have the images aligned click the small triangle (▶) at the top right-hand corner of the 'Layers' palette and select 'Flatten' from the drop-down menu that appears. The IR and visible images will now be combined into a single normal image. Finally, if the resulting image is too dark, select <Image → Adjustments → Auto Levels> from the main menu-bar to obtain optimum lighting levels (figure 5).

### Adding the background

Now is the time to merge the false-colour image with the map background (*results.bmp*). To do this, make sure your

false colour image is the active window (click over it): you should now see a thumbnail copy of the false-colour image in the 'Layers' palette with the word 'background' next to it. Place the mouse pointer over the word 'background', hold the left mouse button down, drag the small rectangle and release it over the centre of the 'Results' image. In the 'Layers' palette, set the opacity to about 60%, zoom in to a cloud-free area of the image that shows recognisable features and line up the two images (figure 6). Once you are happy, set the opacity back to 100%.

Click the small triangle (▶) at the top right-hand corner of the 'Layers' palette and this time select 'Blending Options' (In *Photoshop CS* you can also select this option using <Layer → Layer Style → Blending Options> from the main menu-bar). Click on the drop down menu at the top centre called 'Blend Mode'. The two options I find to give the most satisfactory results are 'Lighten' and 'Screen' (figure 7).

### Finalising the image

Once you have applied the 'Blend Mode' you wish to use, flatten the image as before. If you wish you can crop as needed and use *Photoshop's* auto levels feature (figure 8) to add the finishing touch to your masterpiece. Now save this image and upload to your website. You are DONE!

Examples of finished images can be seen on the inside back cover of this issue (figures 9 and 10).

### References

1. Good sources for high resolution maps are:
  - NASA's Visible Earth Web Site:  
<http://visibleearth.nasa.gov/cgi-bin/viewrecord?11656>
  - GLOBE & XPLANET Maps may also work:  
<http://www.radczyberzine.com/xglobe/>

## Record Rainfall hits Eastern USA

According to NOAA, the battering from hurricanes Frances, Ivan and Jeanne broke September rainfall records throughout the south-east and east coast of the USA. Pennsylvania, Georgia and West Virginia all experienced a record wet September and the city of Birmingham, Alabama set a record with 21.9 cm of rain falling in one 24-hour period: breaking a record that had

stood since July 1916—also the result of a tropical storm. This year's three September hurricanes came ashore hard on the heels of five tropical systems that had already impacted on these states during August. Although wind damage was extensive with each of the storms, flooding was the major impact, with states from Florida to New York feeling the effects.

## Weather Satellite Frequencies

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

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

### Download NASA 2-line Elements

Satellite tracking programs require regular updates of the NASA 2-line element sets that are essential for calculating the positions of Earth-orbiting satellites. One of the best Internet sources for these files is Celestrak at: <http://www.celestrak.com>

Elements for many groups of satellites are updated daily. Particularly useful are:

<http://celestrak.com/NORAD/elements/weather.txt> (most weather sats)

<http://www.celestrak.com/NORAD/elements/stations.txt> (ISS)

# SOFTWARE SHOWCASE



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

This quarter sees the launch of a new CD for the Showcase library. A new CD is a rare occurrence so I am taking the opportunity, whilst software updates are in short supply, to provide some information on the content. To compensate the column for GEO Q5 will be dedicated to software updates.

There is still plenty of room on GS2, the general weather satellite program CD, so any new offerings of that nature will be added there. However, there are events from time to time which are of particular interest and where the production of a CD can greatly help those without fast broadband connections, while a prepared composite product can also be popular with others for time-saving reasons. The images being returned by the two NASA Mars Exploration Rovers, *Spirit* and *Opportunity*, are simply breathtaking and in my opinion fall into the above

that some people still run basic software, I have intentionally left the GS5 structure simple. The images are in jpg format, a file type recognised by all image viewing software.

There are four folders, comprising an image folder and a description folder for each of the two rovers. The image descriptions are in simple text format as all computers will have a copy of *Notepad*. The image and description file for each rover have the same number so cross-referencing is simplicity itself. Simply load a particular image file number from the image folder and then the corresponding number from the image description folder for a full explanation of the content.

GS5 is now available. For further information and how to order from the Showcase Library please see details below.



'Bonneville Crater' on Mars, imaged from the Spirit Rover

This is a **low** resolution image! The corresponding coloured image on the CD is at much higher resolution

category. Particularly stunning are the panoramic views, some in full colour, some as big as 30 Mb jpeg images, and all with unbelievable digital clarity and resolution. Many have been adapted for 3D viewing.

With that in mind, GS5 has been produced, providing a chronological account, to date, of the two rovers' progress across miles of Martian terrain. The CD will be kept up to date as the project continues to completion.

The rovers have an array of cameras, some for navigation and hazard avoidance etc., and an equally impressive set of science tools on the robotic arm carrying the sophisticated instrument package. However, it is the panoramic views that constitute the major downloads, so it is those that have been provided on the CD. In addition it would be impossible to include all camera images and science data on a single CD. To view the entire image suite and for vast amounts of additional technical and science information may I suggest you visit:

<http://marsrovers.jpl.nasa.gov/home/index.html>

Recognising the huge array of programs available, and

## **How to Purchase CDs**

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

The cost includes the CD, packaging and posting, a small donation towards the cost of overheads, the cost of overseas orders and the search for new or updated software. No fee is asked from overseas members although an exchange of software or interesting satellite images is always welcome.

**Orders are normally dispatched on the day of receipt.**

## **Order your CDs from:**

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



# Software Catalogue

## Hurricane Season - 2004

**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 3.4.4
SatSignal	Creates images from wave files	v 4.0.8
HRPT Reader	Converts raw HRPT data files into images	v 2.5.4
GeoSatsignal	Manipulates geostationary weather satellite images	v 4.1.0
GroundMap	Rescales satellite images	v 1.3.8
RX2 PassControl	Computer control program for the RX2 receiver	v 2.2.8

**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.

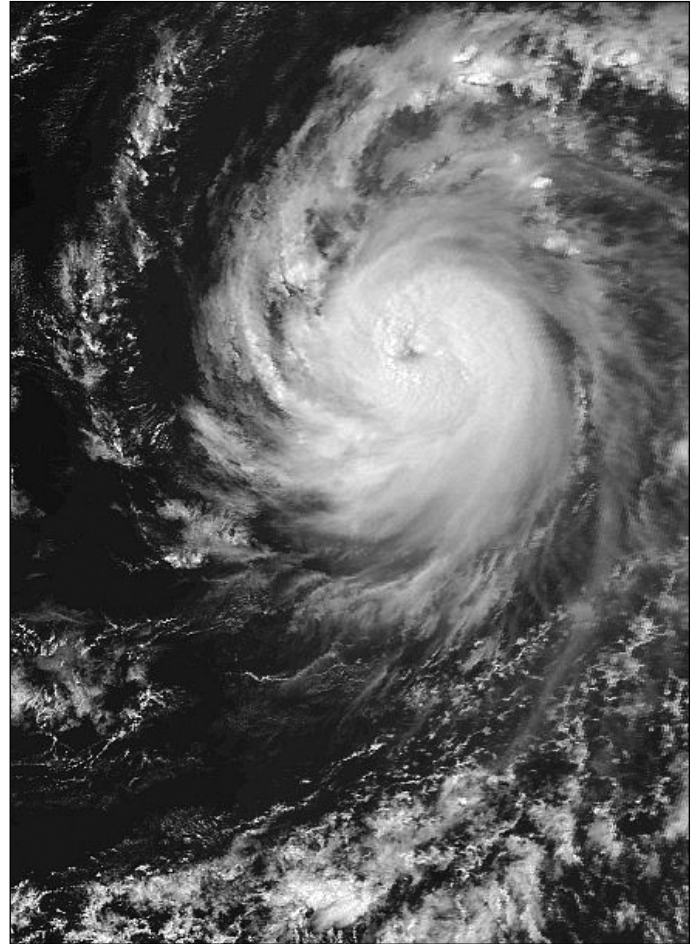
Collection D02	Recall (wave file recorder), Palette (modifies Wxsat colour palettes).
Collection D03	Scanner recorder v 1.8 (wave file recorder), *NOAA95/*FENG99 (software for the NOAA 95 HRPT project)
Collection D04	Wxsat v 2.59 (wave file recorder/decoder), Satmon (wave file recorder).
AGSatTrack	Satellite tracking program v 1.33
Circuit	Documents for the Circuit Wxsat receiver and the UOSat receiver (PDF format)
e-weatherman	Downloads current weather conditions from the Internet direct to your computer
Element Manager	2-line element manager v 1.58
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)
Paintshop Pro	Image processing program (30-day evaluation)
Satscape	Satellite tracker and wave file recorder v 2.00
Splitter	Utility program for splitting and reuniting large files
WXtolmg	WAV file recording and decoding program with many options. v 2.5.10

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

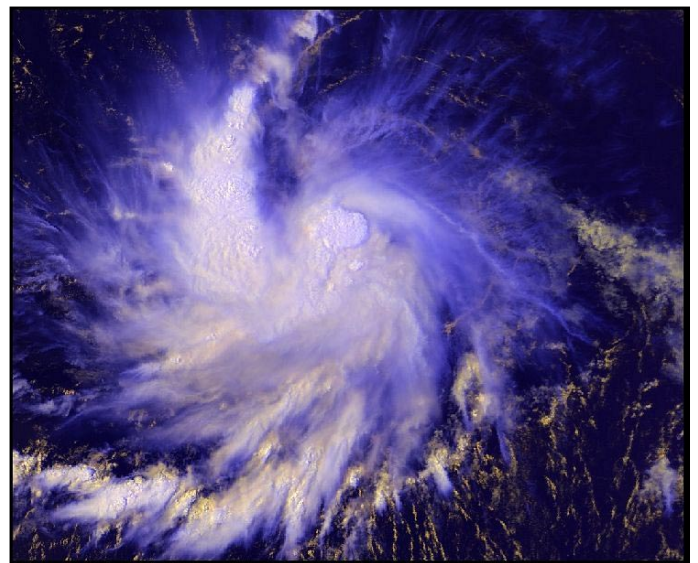
**GS4** **Image CD**  
A wide selection of high-resolution remote images from a range of satellites, including stunning imagery from the Space Shuttle missions. A full description and source if provided for each image.

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

The sunshine state of Florida, USA suffered an unprecedented battering during August and September this year when an unprecedented four hurricanes hit the region in just six weeks. Two of these are illustrated below in images captured at Cear State Department of Meteorology, Brazil.



Hurricane Danielle, a NOAA 16 HRPT image on August 17, 2004  
Image: Raul Fritx Teixeira, Funceme, Brazil



Hurricane Ivan, a NOAA 16 HRPT image acquired when the storm was in its infancy over the Atlantic Ocean on September 3, 2004  
Image: Raul Fritx Teixeira, Funceme, Brazil

# Join GEO-Subscribers

## Internet Discussion Group on YAHOO!®Groups

Nigel Evans organises this on-line discussion forum on *Yahoo!®Groups*. Called *GEO-Subscribers*, it provides a means whereby GEO subscribers can share their experiences and help each other with problems. And you do not have to be a GEO member to join *GEO-Subscribers*—any enthusiast with an interest in Earth Observation is welcome to subscribe to the forum.

Queries posted on *GEO-Subscribers* are often answered within just a few hours (sometimes minutes), making this undoubtedly the fastest way to keep up to date in the Earth Observation field. Many subscribers have already benefited from the service—so can you!

To sign up with *GEO-Subscribers*, visit the GEO website at:

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

and type your e-mail address into the YAHOO 'send' window at the foot of that page. Then click on the *Yahoo!Groups* logo to submit your request.

## GEO Helplines

### Douglas Deans

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

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

### John Tellick

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

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

- e-mail: geo@koholland.plus.com

**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.**

## NOAA 'N' Launch Imminent

NOAA has announced that, if all goes according to plan, their next APT satellite is scheduled for launch on **February 12, 2005**. This satellite, which will become NOAA-18 once in orbit, will transmit on a new frequency: either 137.10 MHz of 137.9125 MHz (which frequency will apply has yet to be announced).

# Weather-Satellite-Report

## Internet Mailing List on YAHOO!®Groups

Douglas Deans publishes a weekly weather satellite report on this Internet Mailing List, generally on Mondays.

The List will keep you up to date with any change in status, and with any irregularities in transmissions, both for the polar orbiting and geostationary satellites throughout the world.

The List will also include, when relevant, interim updates, details of unexpected problems and news items.

You can join this group at:

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

## Back Issues

If you are a recent recruit to GEO, you may be interested to learn that you can complete your collection of GEO Quarterly magazines by purchasing back-issues. These are available, **to GEO members only**, on a unit price basis as detailed below.

- |                 |                  |       |
|-----------------|------------------|-------|
| • UK            | (2nd class mail) | £3.50 |
| • Europe        | (printed paper)  | £4.20 |
| • N America     | (printed paper)  | £5.10 |
| • Rest of World | (printed paper)  | £5.10 |

### Back-Issues Currently Available

- |        |   |               |
|--------|---|---------------|
| GEO Q2 | - | May/June 2004 |
| GEO Q3 | - | Aug/Sept 2004 |

### Requests for back issues should be sent to:

Nigel Evans, GEO-SUBS, Eventail, 7 Gloster Ropewalk, Dover, Kent CT17 9ES, UK

Payment can be made by supplying your credit card details (card number + expiry data). UK readers can also pay by personal cheque or postal order. Enquiries for more information can be sent to

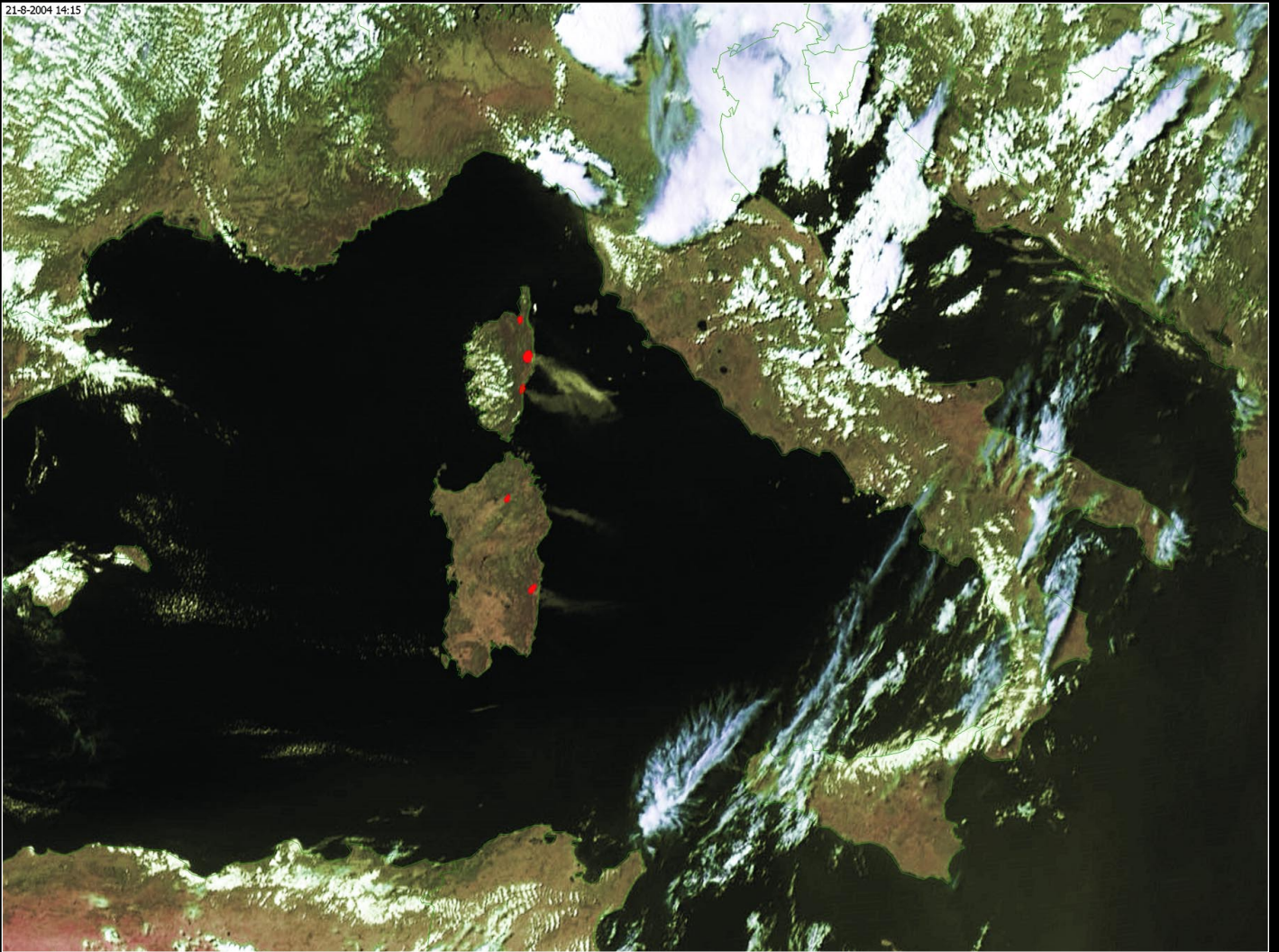
[members@geo-web.org.uk](mailto:members@geo-web.org.uk)

### Launch Issue

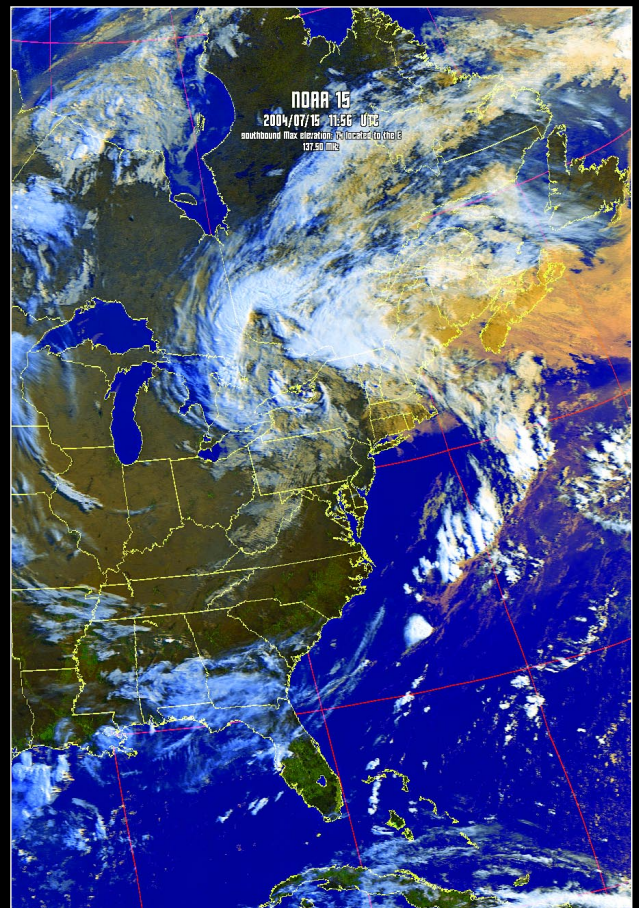
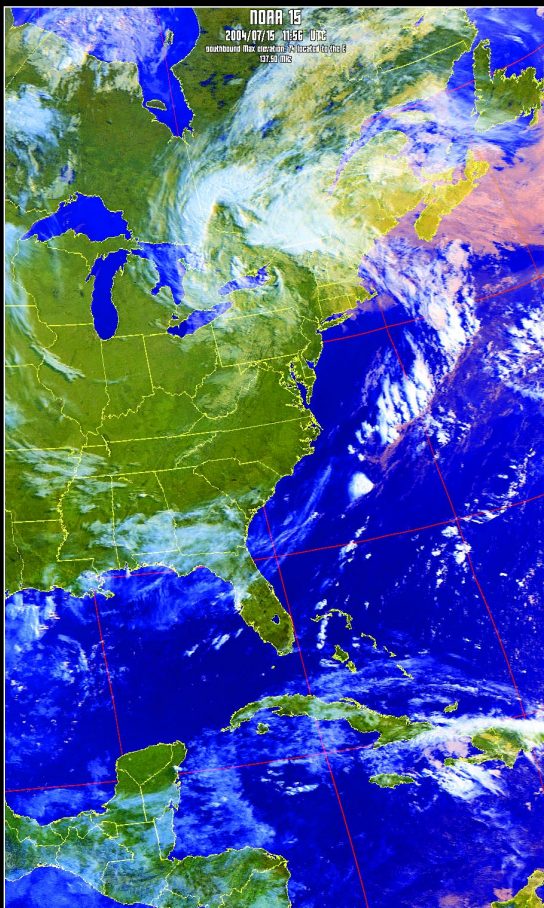
We still have free copies of the GEO Launch Issue available. If you have friends who might be interested in learning about GEO, please encourage them to send for their copy by completing the application form on the GEO website at:

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

21-8-2004 14:15



Fires in Corsica and Sardinia, captured by Arne van Belle from a Meteosat-8 HRV frame at 14:15 UT on August 21, 2004  
Image © EUMETSAT 2004



The final false-colour images created using the 'Screen' blending mode (figure 9, left) and the 'Lighten' blending mode (figure 10, right). Read Hendricus Lulofs' article on page 42 to discover how to produce APT images like these.

