

The **GEO** Quarterly

Group for Earth Observation



www.geo-web.org.uk

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

*Number 16
December 2007*



Inside this issue . . .

The image opposite depicts how desertification has befallen the Aral Sea basin in recent years. Les Hamilton investigates the origins of this problem and explains how, at last, measures are being taken to reverse its decline

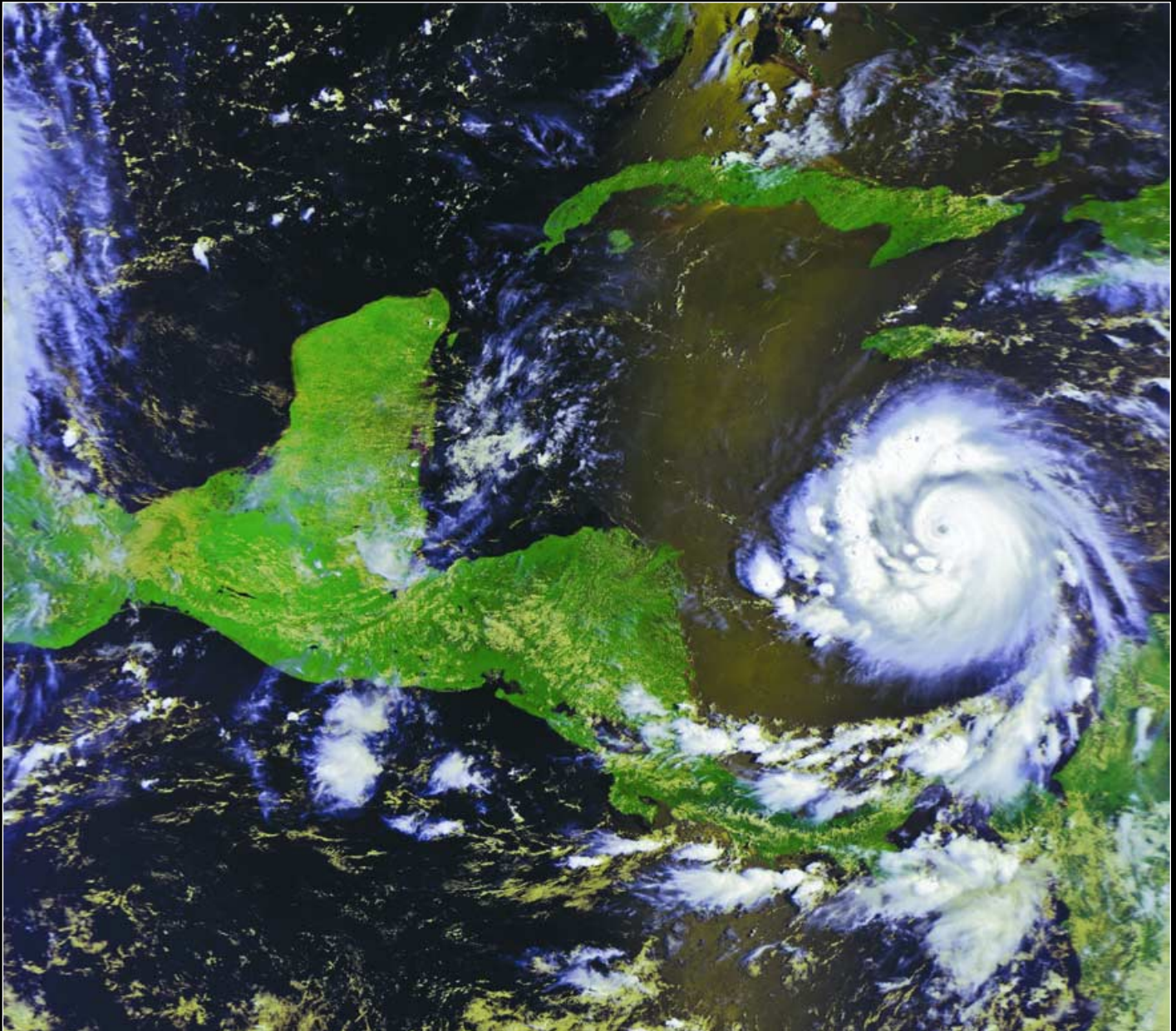
Ed Murashie examines the history of low-resolution weather satellite imaging and explains how LRIT has developed into the present-day standard

With more and more users involving themselves with automatic download of imagery to their websites, Giuseppe Cico unlocks the secrets of using command files for automatic-FTP

Rob Hollander details a recent experimental project conducted in the Netherlands to compare different types of APT antennas

Arne van Belle looks back to last summer's fires in Greece through a variety of false-colour Meteosat images

Plus many more features ...



Keep up with the latest WXsat News every Month

Radio and Communications Monitoring Monthly (ISSN 1749-7809) aims to be the magazine of choice for all serious radio enthusiasts and to serve all the specialist areas of the hobby. 'I am pleased to say that all our regular columns provide more information than any current or former alternative', commented Editor Kevin Nice.

The magazine provides a regular 4-page Weather Satellite column, *Satellites' View*, by Lawrence Harris. In addition, the May issue is normally a 'wxsat special' which includes additional features concentrating on specific aspects of weather satellite imaging and monitoring.

Radio and Communications Monitoring Monthly is available from most good newsagents as well as direct from its publishers.

Subscriptions are available world-wide. For more information contact Nice One Publishing Ltd, Tel: +44 (0)1202 862690 or visit the website.

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Our cover image should certainly have caught your eye as soon as you picked up this issue of *GEO Quarterly*. It provides a highly graphic illustration of how the hand of Man has, during the past half-century, slowly but surely turned the Aral Sea basin into a dustbowl of sand, salt and toxic chemicals. The last few years have seen developments which may be the beginnings of a recovery. You can read the story of the Aral Sea in our flagship article, starting on page 25.

GEO Readers will be interested to learn that, over in the States, Ed Murashie has put together a home-built, fully functional prototype LRIT Ground Station which has been fully operational since August. GOES WEFAX transmissions came to an end a couple of years ago, depriving many enthusiasts in the States of easy access to geostationary weather imagery. Inside this issue, in the first of a series of articles, Ed details the history of weather satellite imagery and outlines the path whereby LRIT has become today's standard low-resolution access mode to geostationary imaging. Future issues of the *Quarterly* will describe the hardware requirements to receive LRIT transmissions from the GOES satellites, followed by an exposé of LRIT structure and processing. Ed is also currently developing software that will allow the same hardware to process the high resolution GVAR signals. For those of you who can't wait to learn more, have a peek at Ed's webpages at <http://home.att.net/~emurashie/>

Ed's first article begins on page 15 and includes some superb LRIT GOES images to whet your appetite. As a taster, a colour composite LRIT image from GOES-11 is reproduced inside the back cover.

Dynamically maintaining a website is becoming ever more popular these days as enthusiasts strive to present the most up-to-date images on-line as rapidly as possible. Giuseppe Cico explains how the use of command files can be a boon in achieving this aim.

Finally, as a pictorial treat, we present a spectacular image from the European Space Agency's *Mars Express* orbiter (page 20). This colour image of the shallow 90 kilometre wide *Maunder* crater, just 900 metres in depth, was taken at an amazing resolution of 15 metres per pixel and shows staggering detail of irregular hummocky hills and valleys, the legacy of a landslide long aeons ago.

Contents

GEO Report	Francis Bell	2
GEO Symposium - 2008		3
Cover and Full Page Images		4
Beware Wildlife!	Alan Banks	4
News in Brief		5
It's a CLASS Act - Metop imagery from NOAA	Les Hamilton	6
Kamchatka	Robert Moore	10
Comparison of Antennas for 137 MHz	Rob Hollander	11
LRIT - Part1: History	Ed Murashie	15
Earth Imaging News	Peter Wakelin	21
<i>GEO Shop</i>		<i>i</i>
<i>NOAA Satellite Predictions for the UK and Western Europe</i>		<i>ii</i>
<i>Helplines and Internet Discussion Groups</i>		<i>iii</i>
Copy Deadline for January issue		<i>iii</i>
<i>GEO Membership Renewal Form</i>		<i>iv</i>
Auto-FTP: Upload images to your website in real-time	Giuseppe Cico	23
Aral Sea	Les Hamilton	25
EUMETCast without RAM Disk - Update	Mike Stevens	30
SeaWiFS	Peter Wakelin	32
Imaging the Greek Fires	Arne van Belle	36
New Software - 'DownloadPrograms'	Fred van den Bosch	38
Customised Icons for your Desktop	Robert Moore	39
Tips on installing RAMDisk for EUMETCast	Rob Denton	40
Weather Days	Peter Green	40
Software Showcase	Douglas Deans	41
EUMETSAT adds NOAA-18 Data to its Polar System	David Taylor	42
Hurricane? . . . What Hurricane?	John Tellick	43
Script Snippets	David Taylor	44

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The **GEO Report**



Francis Bell

At the time of writing I notice that GEO is within a few days of its fourth birthday. Our certificate of incorporation is dated November 25, 2003. Established members will know that we have a company structure which provides some formalities but, by guarantee, limits individual liabilities should there be unforeseen problems.

I know that for some of our membership this will be the first Quarterly to be received through the post. A sincere welcome to new members. Please let GEO's management team have any feedback relating to your ideas for the future. This invitation is also directed towards the existing membership.

A note here must be a request for the membership to contribute to the Group's activities. Articles for publication in the Quarterly, ideas for the website and discussions on our Internet forum all need membership participation and ideas. It places an extra burden on GEO's management unless the membership help with their own contributions and ideas.

As usual, a plea not to forget to renew your membership when it becomes due. I'm always happy to process renewals at rallies and exhibitions but if I do it generally means that the member in question has not responded to the renewal reminder enclosed with their last Quarterly. It just makes work and incurs expense when members fail to renew on time. Of course interests change, and individuals may actively decide not to renew their membership, and I understand this: but otherwise please renew on time.

Spreading the Word about GEO

I was sensitive to a comment made by Dr Lars Prahm, Director General of EUMETSAT, during a conversation I had with him during GEO's visit to Damstadt last summer. When I showed him a list of GEO's membership by country, he expressed mild surprise that we did not have more European members. I agreed, stating that this was an area we should research for new membership.

I note the figure of about 1500 users who are privately registered to receive EUMETCast and my feeling is that many of these would benefit by being members of GEO. I feel the same is true for North America, where there are potential members who do not know about GEO, and could also benefit by joining us..

GEO requires more members, particularly in continental Europe and the United States. If you are acquainted with individuals or organisations in the UK, Europe or North America who share our interests, then do please invite them to join GEO. An increase in our membership numbers would secure more financial security for GEO.

My thanks to GEO's management team who have promoted our group for four years with distinction, and thanks to the membership who are the contributors to our Quarterly publication which I believe, along with other facets, plays a vital role in our activities.

LARS

This year GEO attended the two-day Leicester Amateur Radio Rally (LARS) for the first time. The location was Donington in Leicestershire, adjacent to the popular motor racing circuit.



GEO's Stand at LARS last September

The rally was based in an exhibition area rather like an aircraft hanger, and with similar acoustics. The GEO team arrived a day early to establish our stand as we wished to run live satellite signals to it on both days. We requisitioned extra display tables and turned what was pre-booked as a modest stand into something more worthy of our efforts. With the aid of extending ladders, helpful electricians provided us with electricity from a pillar adjacent to our stand and fed co-ax from our satellite dish in the nearby car-park, through the rafters to the stand.

We had our new banner advertising GEO, and which contains two images received by our own members, on display along with three computers; lots of literature provided by EUMETSAT and BNSC; and some back issues of GEO Quarterly.

On the first day we were rewardingly busy.



GEO's EUMETCast Display at the AMSAT-UK Colloquium last July

It's difficult to judge numbers but perhaps 1000 visitors stopped to look at the displays on our stand. I have never seen so much literature disappear so quickly. I just hope everyone appreciated what they had taken away.

The second day was less busy following major traffic congestion due to the crowds attending the motor racing event and the organisers say they will avoid such a clash of events next year.

I can't conclude without a formal thanks to David Anderson, John Tellick, Peter Green, David Taylor and Cecilia Taylor—none of whom received expenses for their time, travel, or hotels—for their time establishing and running our stand over the two days.

UK Periodicals

Visiting a UK High Street newsagent recently, I found myself with a few minutes to spare. Out of curiosity, I looked at the radio related magazines which were on sale. There were five titles, one of which was *Monitoring Monthly*. I subscribe to this publication, so do not have to go into the shop each month. *Monitoring Monthly* is an interesting publication and each month devotes a few pages to weather satellites, plus other regular features about satellite reception. I would certainly recommend buying a copy so that you can judge whether or not you would like to subscribe on a regular basis. There is an advertisement for *Monitoring Monthly* inside the front cover of this Quarterly.

ESA Bulletin

I recently received my copy of *ESA Bulletin No 131*, a quarterly publication which covers all aspects of ESA's space programmes. The feature content varies in each issue but sometimes concentrates on

one aspect of their space programme. *Bulletin 131* features the 'Sentinel' programme and Earth observation, which I found particularly interesting. The Sentinels will be the first in a series of operational satellites to meet the Earth observation needs of the 'European Union ESA Global Monitoring for Environment and Security' (GMES) programme. The *Sentinel-1* satellite will image with synthetic aperture radar (launch date 2011), *Sentinel-2* will be for high resolution optical imaging (launch date 2012) while *Sentinel-3* will provide ocean ice and land observations (launch date 2011/2012).

Bulletin 131 also has a beautiful image of the Caspian Sea, which was the subject of a GEO quarterly question in one of last year's issues. It is tempting to think that the levels of all large inland water masses are in equilibrium. However, this is far from true: Lake Chad in Africa, Lake Eyre in Australia and, I have just discovered, Lake Titicaca in South America are all dynamic with respect to level and area.

The Dead Sea is an interesting case. I have recently read about a plan to fill it up with water from the Red Sea. The special case the Aral Sea is the subject of a feature in this issue of GEO Quarterly.

The *ESA Bulletin* is an interesting publication and it is most worthwhile having your name on their mailing list. The publication is free of charge. If you are interested, I suggest you write to

ESA Communication Publication Office
PO Box 299
2200 AG
Noordwijk
The Netherlands

Give your full postal address, ask for a copy of *Bulletin 131*, and request your name to go on their mailing list.

Image

EUMETSAT's regular in-house publication is *Image* and this is available on their web site. As usual I like a printed copy so I am on their mailing list. Interestingly the current issue of *Image* briefly reports GEO's visit to their Darmstadt and Usingen facilities.

The get on the mailing list write to

EUMETSAT User services
Am Kavallerisand 31
64295 Damstadt
Germany

or email ops@eumetsat.int

Alternatively, you can download the 8-page publication in PDF format from their web site at www.eumetsat.int.

GEO has published these contact details before but for new members it should be new worthwhile information.

QUARTERLY QUESTION

The Quarterly Question I set last issue was certainly more of a challenge than usual, and did not elicit many correct answers. I am indebted to Peter Wakelin for the following in-depth answer and explanation.

"The point on Earth which comes closest to the sun in its annual cycle must be the place where the sun is overhead at the time of Earth's closest approach to the sun. As this occurs on January 3, 4 or 5 (this depends on the phase of the moon) it must lie near latitude 22.7°S.

"The longitude will vary from year to year but, as no specific year is mentioned in the question, the answer is the highest point at latitude 22.7°S. This is the volcano Licancabur in the Andes which reaches an altitude of 5,921 metres.

"There's another peak 129 m higher some 50 km to the south but it would need to be about 80 m higher still to come closer to the sun."

This Quarter's Question

The Quarterly Question this time should prove a little more straightforward. It was prompted by reading *ESA Bulletin 131*.

The *Sentinel-1* satellite will carry Synthetic Aperture Radar (SAR), hence the satellite has to illuminate the Earth's surface with C-band radar and detect the reflected signal. This requires considerable electrical power.

The question is: 'how much power, on average, will be generated by *Sentinel-1*'s solar array.'

The answer is contained within the article in *Bulletin 131*. A clue might be that I could run my home indefinitely, summer or winter, on this level of power availability, even with all my home electrical equipment.

Answers to Francis Bell at

francis@geo-web.org.uk

or by mail to the address on page 1.

A winning entry will be chosen on December 25, 2007, and the winner will with receive an illustrated space calendar.



GEO Symposium

Saturday, May 10, 2008

GEO's annual Symposium is a long way ahead yet, but preparations are already in motion. The NSC Leicester has been booked for Symposium 2008 on Saturday, May 10. This date has been chosen in anticipation of avoiding the Bank Holiday weekend and other events such as major sporting fixtures.

Invitations have been issued to speakers but the day's programme is not yet fixed. It is hoped to have representatives from our own British National Space Centre and EUMETSAT in attendance.

Members who attended last time very much appreciated the more informal approach which offered more time for discussions and workshops.

We would like our members to have a say in developing the programme for Symposium 2008. If there are any specific topics or workshops you would like to see placed on the agenda, or if you would like to make a presentation or demonstration yourself, please get in touch with Francis Bell at

francis@geo-web.org.uk

or by mail or telephone (details on page 1).

A more detailed programme will be published in our March 2008 Quarterly. In the meantime, please put the date in your 2008 diary.

Other Dates for 2008

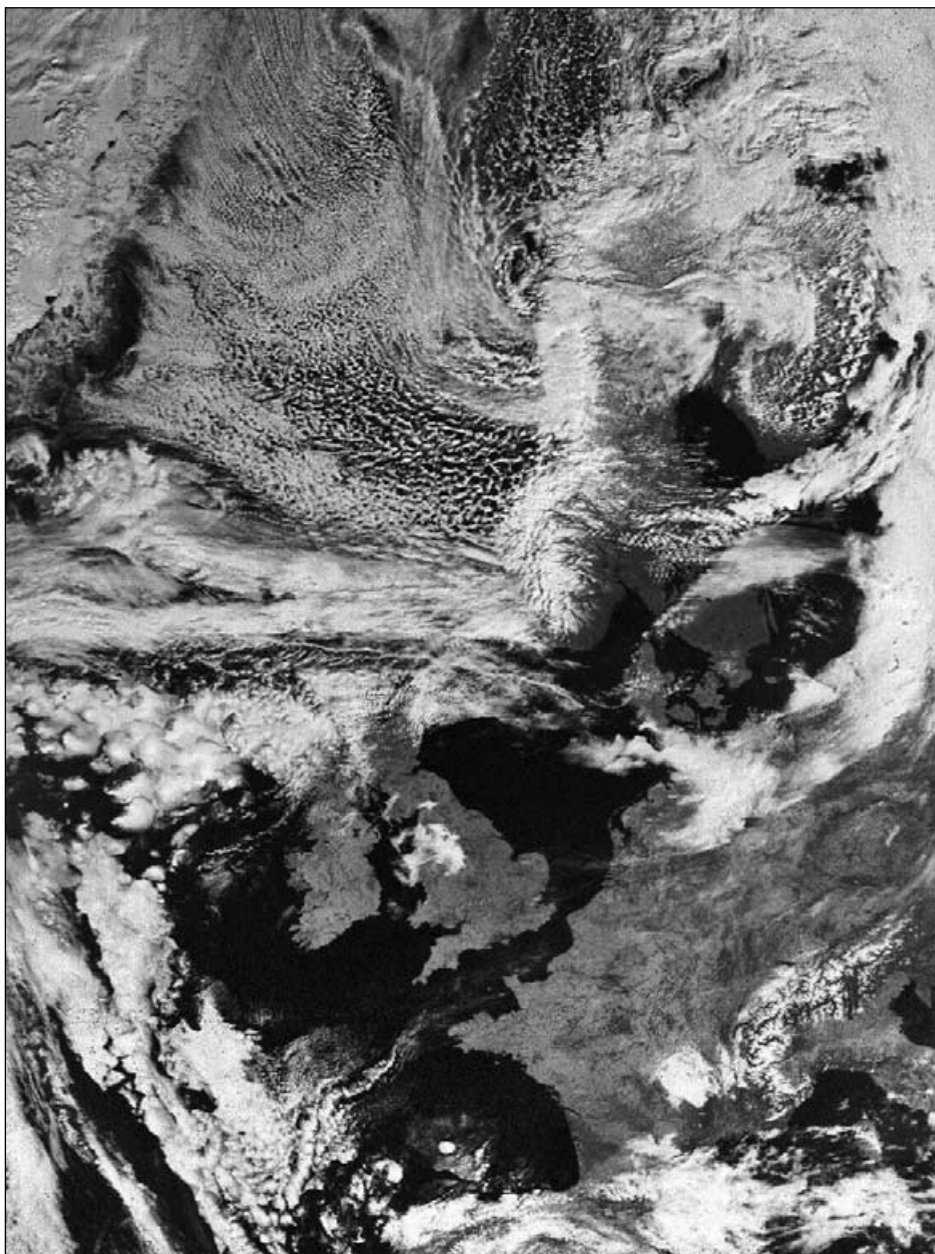
GEO will be represented in some form at the *Radio-Active Rally* in Nantwich on Sunday, February 3, 2008.

GEO are planning to attend the *West London Radio & Electronics Show* at Kempton. The date is usually mid-March. This is a busy, well attended show.

I hope GEO will be invited to *AMSAT-UK's* annual colloquium in Guildford. The dates should be July 25-27, 2008; however the invitation and dates need to be confirmed.

GEO will also be at the *LARS* rally at Donington in September. This is a well attended two day show.

GEO may, additionally, be present at other events. Check the March issue of GEO Quarterly for the latest news.



Anders Hook from Vallentuna in Sweden sent us this attractive image acquired from NOAA-17 on April 5, 2007. Cloud streets are conspicuous flowing off northeast Greenland and a prominent rope cloud can be seen stretching from Denmark and arcing north of the British Isles

Beware Wildlife!

Alan Banks

One morning recently, at 8.00 am, I noticed that my *EUMETCast* signal quality had suddenly fallen. My wife had seen a couple of squirrels collecting berries and nuts in the front garden and at about 9.30 am, as I went out to do a bit of shopping, I noted that there were muddy pawprints on the dish, which is only a couple of feet from the ground. Closer inspection showed mud on the LNB and support arm. The cable seemed intact and I wiped everything down and went on my way. On returning home I found the signal was even worse!

Further inspection showed that the cable had been partly pulled out of the LNB.

The squirrels must be suspects but I had probably made it worse when giving the dish its quick wipe down. Remaking the connection improved matters.

Wildlife can impact on our hobby! It reminded me of when I had a garden railway—hedgehogs and cats in the tunnels, ants along the rails, wasp nests under the track, frogs and toads in the retaining walls. Once, I even found a newt and worst of all were the thrushes which used the rail-head to smash their snails, leaving a neat pile for my small-scale locos to trip over.

Moral: beware squirrels collecting nuts in autumn (or any wildlife for that matter).

I'm glad I have nothing bigger than squirrels to contend with.

Cover and Full-Page Images

Front Cover

This striking MODIS image of the Aral Sea was acquired by NASA's Terra satellite on April 8, 2007. You can read our major feature on the Aral Sea on page 25. Image: MODIS Rapid Response Team at NASA/GSFC

Inside Front Cover

Graham Whitehead sent in this evocative Metop-A image of Hurricane Felix as it cartwheeled towards Yucatan on September 3.

Image © EUMETCAST 2007

Inside Back Cover

The upper image is a colour composite produced from the visible and infrared full-disc images transmitted from GOES-11 at 21:00 UT on September 2 this year. The LRIT images were acquired by Ed Murashi on his recently completed homebrew hardware.

Image processing: David Taylor

At lower left is a section from a MODIS image showing the Kamchatka peninsula and its volcanoes.

Image: MODIS Rapid Response Team at NASA/GSFC

At lower right is a MODIS image from Terra which shows the course of the River Volga as it enters the Caspian Sea particularly well.

Image: MODIS Rapid Response Team at NASA/GSFC

Back Cover

This August 26, 2007 Envisat image highlights Japan, an archipelago of over 3000 islands stretching some 2400 km across the western Pacific Ocean. The four principal islands are, from north to south, Hokkaido (top right corner), Honshu (the long island stretching in a northeast-southwest arc), Shikoku (visible just beneath the lower part of Honshu) and Kyushu (hidden by clouds).

This image was acquired by Envisat's Medium Resolution Imaging Spectrometer (MERIS) instrument, working in Full Resolution mode to provide a spatial resolution of 300 metres.

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Page 35

This October 2, channel-4 Metop-A image from Mike Stevens shows a predominantly cloud-free view of Sakhalin Island, Japan and part of the Russian region of Khabarovsk Krai. Note in particular the course of the Amur river (the world's ninth longest 4444 km in length) which defines the border between China and Russia's Far East.

Image © EUMETSAT 2007

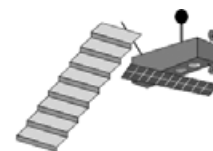
Page 37

Mike Stevens sent in this striking channel-3 mid-IR AVHRR image of the UK, France and Spain as seen from Metop-A on October 20 this year.

Image © EUMETSAT 2007



News in Brief



NOAA-18 Frequency Change

Readers in pager-prone parts of the UK will be delighted to learn that, following EUMETSAT's decision to abandon the dissemination of Metop-A LRIT in the 137.1 MHz band, NOAA-18 switched its frequency from 137.91 MHz to 137.1 MHz on August 18, 2007, a change that will continue for the foreseeable future (until it is required for Metop-B).

NOAA-12 Decommissioned

Following increasing problems with power regulation aboard NOAA-12, this weather satellite was decommissioned on August 10 this year following more than 16 years of service.

Reunion

Cementing a friendship made during the GEO visit to EUMETSAT's Headquarters in Darmstadt earlier this year, Giuseppe Cico took time out from his visit to Bath and Stonehenge to spend the August Bank Holiday Monday in Exeter, to meet up with Peter Bradley and Pete Green.

Giuseppe was met at St David's station and shown around the historic Exeter Cathedral, the Quay where the Onedin Line was filmed, the 'House that moved' and the very historic, original Exe Bridges, as well as other interesting historic sites that the city has to offer. Giuseppe is a very keen photographer and took many pictures during his visit to the West Country. The day was drawn to a close with a visit to Peter Bradley's house following a pub lunch in the Devon countryside.

If you are planning a day trip in the future I would suggest you consult Giuseppe! When his trip was originally confirmed England was having the worst summer weather for years. Devon always seems to have bad weather on Bank Holidays but Giuseppe was able to forecast some six weeks in advance that we would have a beautiful day—and we did. In fact he had a beautiful week!

Obscured

Our apologies to Roger Jones from Bishop Auckland for failing to identify him in the GEO photograph taken at Darmstadt. The



Pete Smith, Giuseppe Cico and Peter Bradley pictured in front one of Peter's reception dishes

meeting was a great chance for GEO members to make new friends, and Roger tells us that Carsten Arnheiter is planning to visit him for a few days before the end of the year.

California Forest Fires

This MODIS image from NASA's Terra satellite shows the massive plume of smoke spilling over the Pacific Ocean in the wake of severe wildfires which ravaged some 2000 square kilometres of southern California stretching from Santa Barbara down to the Mexican border. At the height of the conflagration, than a million people were evacuated from their homes. In all, at least 1,600 properties were totally destroyed, almost a hundred people were injured and there were fourteen fatalities..



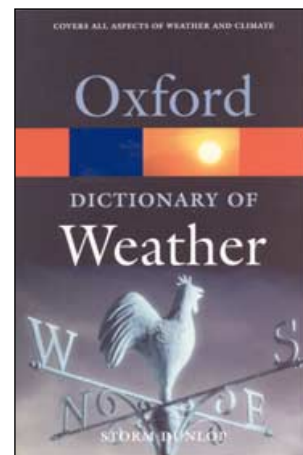
Fires in Southern California spws smoke over the Pacific Ocean

Image: MODIS Rapid Response Team at NASA/GSFC

Storm Dunlop's Dictionary of Weather

Following Storm Dunlop's talk at the May 2008 GEO Symposium in Leicester, Oxford University Press are offering GEO members copies of Storm's *Dictionary of Weather*, with a price of £8.75 (including P&P). The Dictionary has been described as 'the definitive reference for all things meteorological' and 'a welcome and important contribution'

Copies may be obtained directly from Storm (140 Stocks Lane, East Wittering, Chichester, West Sussex PO20 8NT), to whom cheques should be made payable. Storm will be happy to sign copies for you if you wish, but please indicate clearly if you require a copy to be dedicated to a specific person as a gift.



It's a CLASS Act



Download and process Metop HRPT data from the NOAA archive

Les Hamilton

It's now over two years since we first explained how you can obtain raw HRPT data files from the NOAA archives and process them yourself using David Taylor's *HRPT Reader* and *GroundMap* software [1]. The *Satellite Active Archive* (SAA) as it was then known has continued to develop and now provides high-resolution data from Europe's Metop satellite in addition to the American NOAA orbiters. The upgraded Internet site, now termed the *Comprehensive Large Array-data Stewardship System* (CLASS), is a valuable resource, specially for readers who would wish to enjoy the delights of HRPT imaging but for whom a dedicated *EUMETCast* system is not an option.

Uniquely, Metop provides full world coverage, 24 hours a day, unlike the restricted regions of 'HRP' or 'LAC' data provided from the NOAA satellites. Due to this enhanced recording capability, data from each full pass is dumped every orbit over Svalbard. This means that you are no longer restricted to data from fixed receiving stations (HRP) or recorded from predefined regions (LAC) as you are with the NOAA satellites. This new format is denoted 'FRAC' data.

Additionally, while the NOAA HRPT data is provided already segmented into chunks of varying duration (generally between 8 and 15 minutes), Metop *Full Resolution Area Coverage* (FRAC) data can be ordered to cover the maximum permitted 80° latitude span (about 23 minutes duration). Additionally, provided you do not select a specific region from the map (figure 4), you can download a complete orbit dump (around 560 MB).

Registration with CLASS

Although anyone can browse freely through the CLASS website by directing an Internet browser to

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

it is not possible to actually download any data until you have registered a few basic details with them. Registration is *free* and immediate, and is required principally to allow NOAA to email you links from which your requested data may be downloaded.

Click 'Register' on the black menu-bar at the top of the page and add your surname, forename and email address in

the appropriate fields. Finally, provide a password (of your own choosing) and click the 'Register' button at the foot of the page. You may now click the 'login' link then enter your *User name* (forename) and *Password* to gain full access to the site (figure 1).

Figure 1 - Entering Username and Password

Finding Metop HRPT Data

Once safely into the CLASS website, open the drop-down menu at the top of the page and select the second item in the list, *Advanced Very High Resolution Radiometer* (AVHRR), then click the 'Go' icon beside the menu. This brings up the *Search-AVHRR* options displayed in figure 4, opposite.

It is here that you define your search, your first task normally being to outline the **region of the world map** for which you require a Metop image. There are restrictions—80° longitude and latitude ranges—and you will be warned if you overstep these. Select your area by dragging a rectangle across the map with the mouse. If need be you can define the area precisely by adjusting the input fields to the right of the map.

Select a **time interval** for your search using the *Start Date* and *End Date* calendars. The maximum interval allowed is 160 days. More usually you will search just a single day, in which case choose the same date for both. The search can be fine-tuned by amending the *Start Time* and *End Time* fields.

Metop raw data is provided in the 'FRAC' datatype so only this item should be checked from the *Datatype* list. Finally, if you wish to restrict your search to morning (daylight) Metop passes, check the *Descending* radio button then select **Metop** from the *Satellite* drop-down list. It is as well to leave all the *Receiving Station* options ticked. These are needed for the NOAA HRPT data that is also available from CLASS and which you will probably wish to investigate too. Now start your search by clicking the **Search** button at the foot of the page. A listing

like the one shown in figure 5 will appear showing each pass, accompanied by its start and end times, and filename. To visualise your preferred image, tick it in the *Shopping Cart* column then click the numbered button in the *View Details* column. The following screen displays the precise area of the pass on a map of the world (figure 2) as well as providing thumbnail views of the channel-2 (visible) and channel-4 (infrared) images available from the dataset (figure 3).

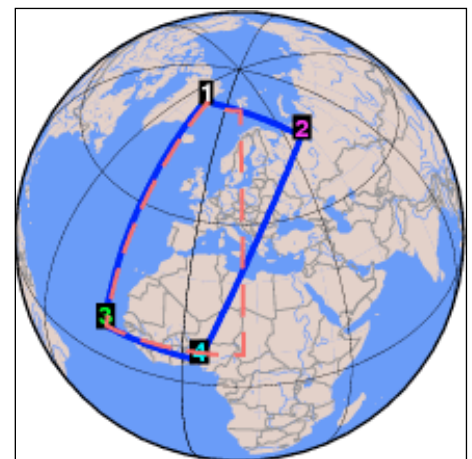


Figure 2 - Graphic showing the area selected

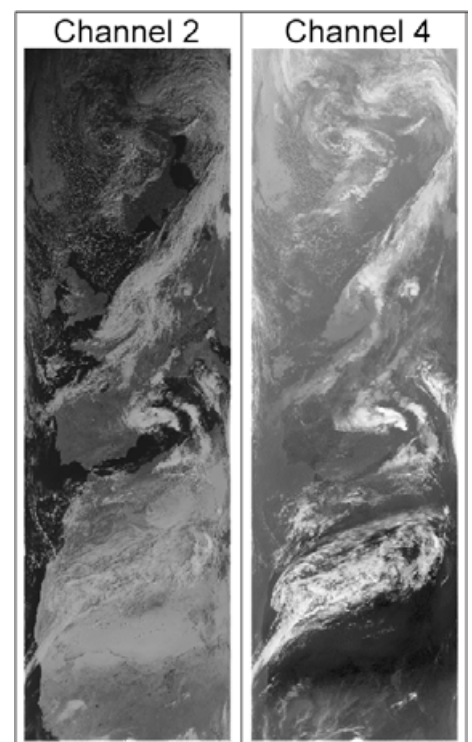
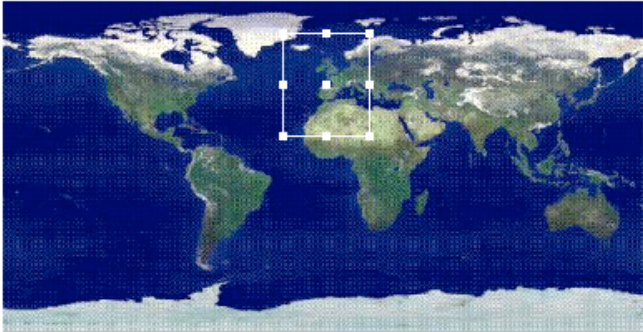


Figure 3 - Image thumbnails

Spatial




73.0
-28.0 18.0
17.0


Zoom In Zoom Out Max Area

Select Geometry: XY Plane

Note: XY Plane searches are resized to enforce a minimum lat/lon difference of 0.1 degrees.

Temporal

Start Date (format: YYYY-MM-DD) 2007-08-16  Start Time (format: HH:MM:SS) 00:08:00

End Date (format: YYYY-MM-DD) 2007-08-16  End Time (format: HH:MM:SS) 12:00:00

Specify the range of the times for: Each Day Or The Entire Range Of Days

Advanced Search

Datatype

- Full Resolution Area Coverage (FRAC) 1KM Level1B
- Global Area Coverage (GAC) 4KM Level 1B
- High Resolution Picture Transmission (HRPT) 1KM Level 1B
- Local Area Coverage (LAC) 1KM Level 1B

Receiving Station

- Cape Ferguson Australia
- Dundee Scotland UK
- Ewa Beach Hawaii
- Gilmore Creek AK
- Honolulu Hawaii
- Miami Florida
- Monterey CA
- Sioux Falls SD
- SOCC
- Svalbard
- Western Europe
- Wallops Island VA

Node

- Ascending
- Descending
- Either

Satellite

METOP-A
NOAA-18
NOAA-17
NOAA-16

Reset Search Save Criteria Load Criteria Dataset Name View

Figure 4 (above)

Shopping Cart:

View Details	Shopping Cart	Inventory ID	Datatype	Orbit	Start Time	End Time	Satellite	Dataset Name
1	<input type="checkbox"/>	9668843	AVHRR_FRAC	5152	2007-10-17 08:12:03.248	2007-10-17 09:53:40.249	M02	NSS.FRAC.M2.D07290.S0812.E0953.B0515253.SV
2	<input checked="" type="checkbox"/>	9669303	AVHRR_FRAC	5153	2007-10-17 09:53:02.249	2007-10-17 11:34:39.083	M02	NSS.FRAC.M2.D07290.S0953.E1134.B0515354.SV
3	<input type="checkbox"/>	9669643	AVHRR_FRAC	5154	2007-10-17 11:34:01.083	2007-10-17 13:14:21.424	M02	NSS.FRAC.M2.D07290.S1134.E1314.B0515455.SV
4	<input type="checkbox"/>	9670083	AVHRR_FRAC	5155	2007-10-17 13:13:43.256	2007-10-17 14:55:20.258	M02	NSS.FRAC.M2.D07290.S1313.E1455.B0515556.SV

Figure 5 (left)

If you are happy with this selection, rewind your browser to the previous page and click the *Go to Cart* button.

In this screen (figure 6), which confirms your selection, make sure that the *Include Archive Header* box beside your selection is ticked then click the *Place Order* button. A final screen will appear showing your order confirmation number. Press *Confirm* and the deed is done.

After a short interval, often just a couple of minutes, you will receive an email confirming your order. Shortly thereafter, a second email provides you with links to download the file either by FTP or using your Web browser.

I have discovered that a degree of patience is sometimes required when ordering Metop data. Whereas the NOAA satellite HRPT files become available within a few hours of a satellite pass, Metop HRPT data can on occasions take several days to appear. If you cannot find the pass/region you require, try again later.

Full Metop Orbit Dumps

If you are interested in examining several regions from the same Metop pass, it is often more convenient to download the FRAC file for the complete orbit. These files weigh in at 560 MB but, with modern broadband connections, can be downloaded in the background, while another task is being undertaken, in just 15 minutes or so.

To download such a file, follow the procedures described above but do not draw a rectangle on the map (don't even click on the map). When the list of passes appears, check the file you require and order it as described.

Splitting Orbit Dumps into Sections

Once you have your full orbit of Metop data available, one hurdle remains. Even with a high specification PC that can load the full file into *HRPT Reader* [2] you may be disappointed to discover that processing is slow and scrolling through the displayed image is like watching paint dry!

The answer is simple in concept—just split the file into more manageable segments. The question is: 'how?' I have written a small utility program that does this task for you: *Metop File Splitter* [3]. The program can be downloaded from my website as a self-installing archive. After selecting a Metop FRAC filename (figure 7), use the sliders to select the section you require, either by image lines or by duration (in minutes). On clicking 'OK', the splitting takes place and a new file, which includes the selection limits in its filename for reference, is automatically saved in the same folder as the original file.

Tests have proved successful when loading up to 40 minutes worth of Metop data into *HRPT Reader*. Though slower than normal, images process and display in a reasonable time (though this may depend on the specification of the PC used). Country outlines, if required, will plot correctly on these images. The first problem that emerges when excessively large segments are processed is that the country outline feature ceases working correctly, followed by a rapid slowing of all processing features. In reality, there should rarely be a need to use sections longer than 15 minutes duration.

HRPT Console

The final stage of processing images produced from Metop FRAC files generally involves selecting a map projection (Mercator, orthographic etc.) and correcting an image for the effects of the Earth's curvature using David Taylor's

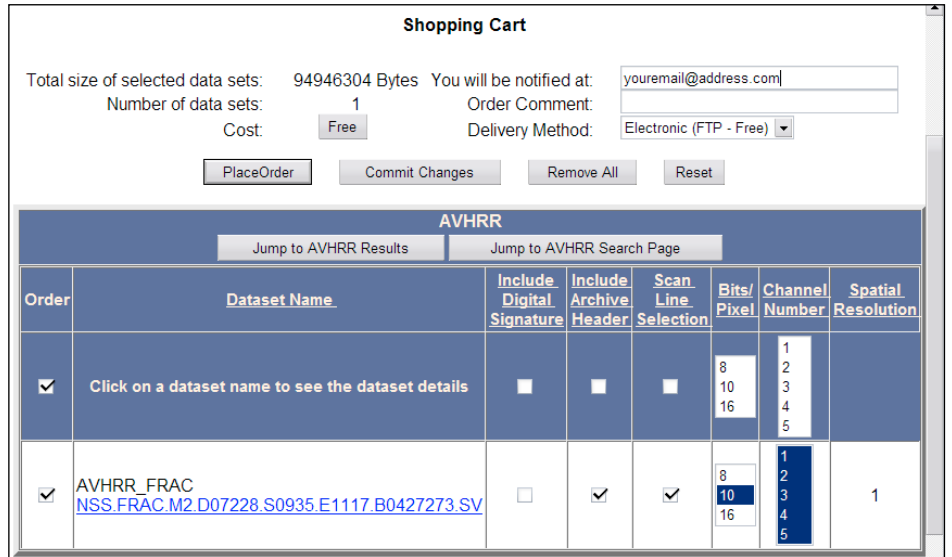


Figure 6 - The Shopping Cart

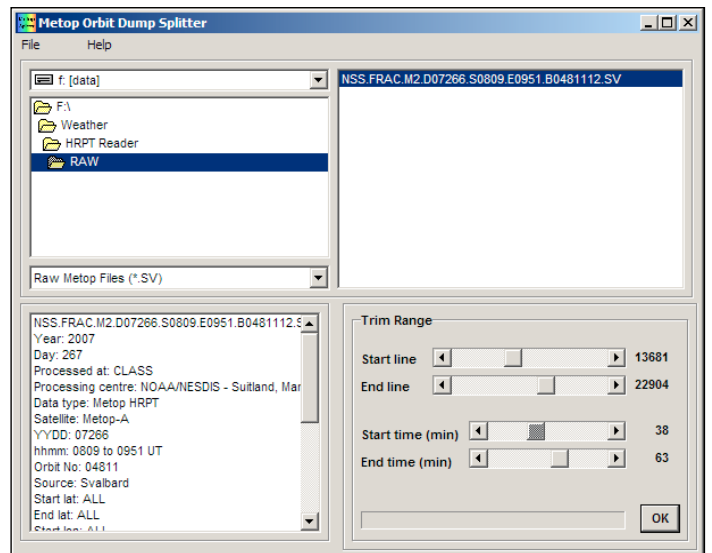
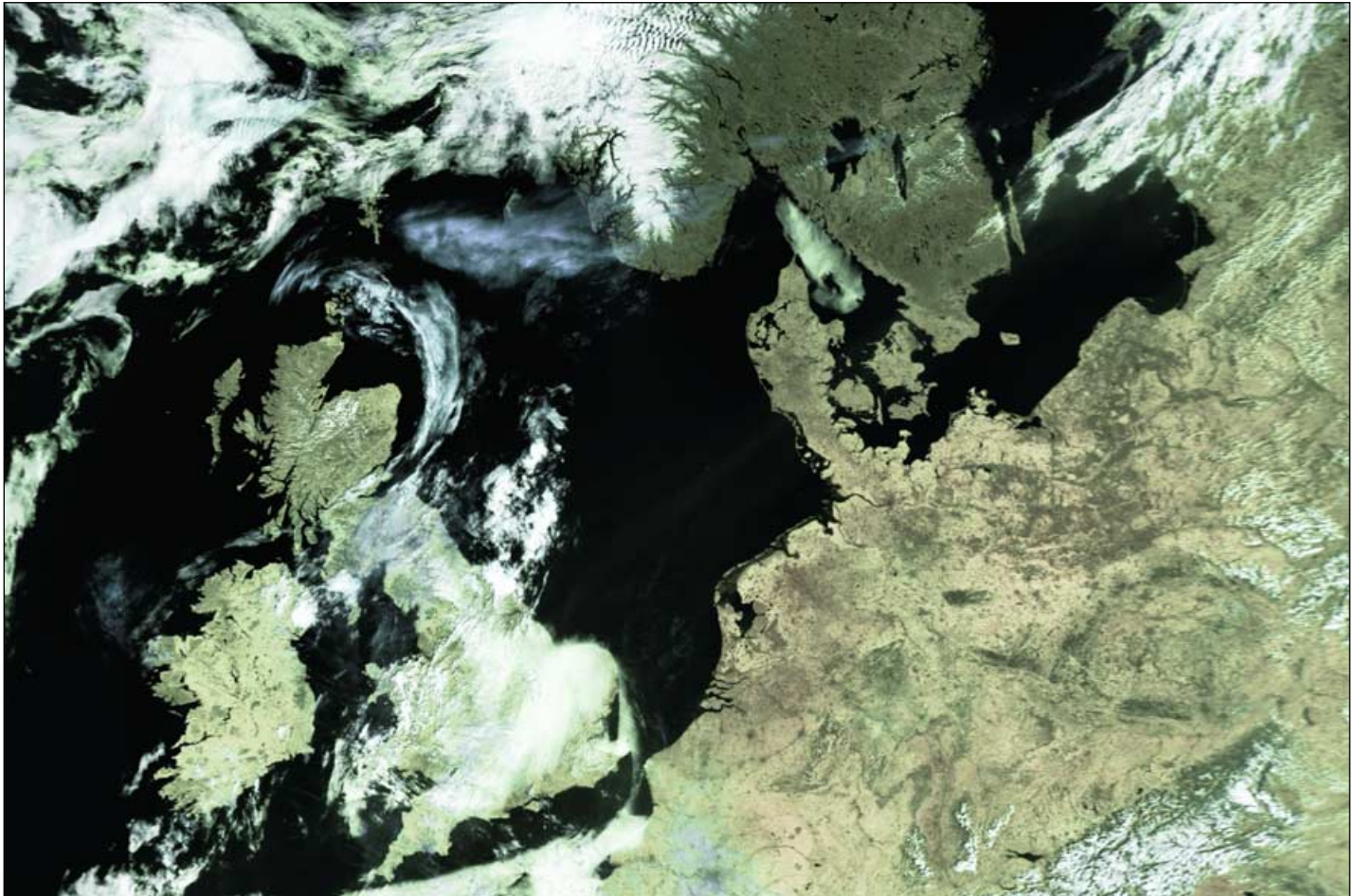


Figure 7 - Metop Splitter

GroundMap software [2]. With numerous sections from a full orbit of Metop data this means continually selecting a new region of the globe. There is also the question of which of the many output types from *HRPT Reader* you require. I have written *HRPT Console* as an interface program which allows the user to select command-line parameters for both *HRPT Reader* and *GroundMap*, and select a relevant area of the Earth's surface. Once these have been established on the program's configuration screen, a selected image output by *HRPT Reader* can be fed into *GroundMap* and rectified on the click of a button. The program comes with an extensive help file and should be intuitive in use. Note, however, that it only operates with registered versions of *HRPT Reader* and *GroundMap* (as the free versions are not responsive to command line parameters).

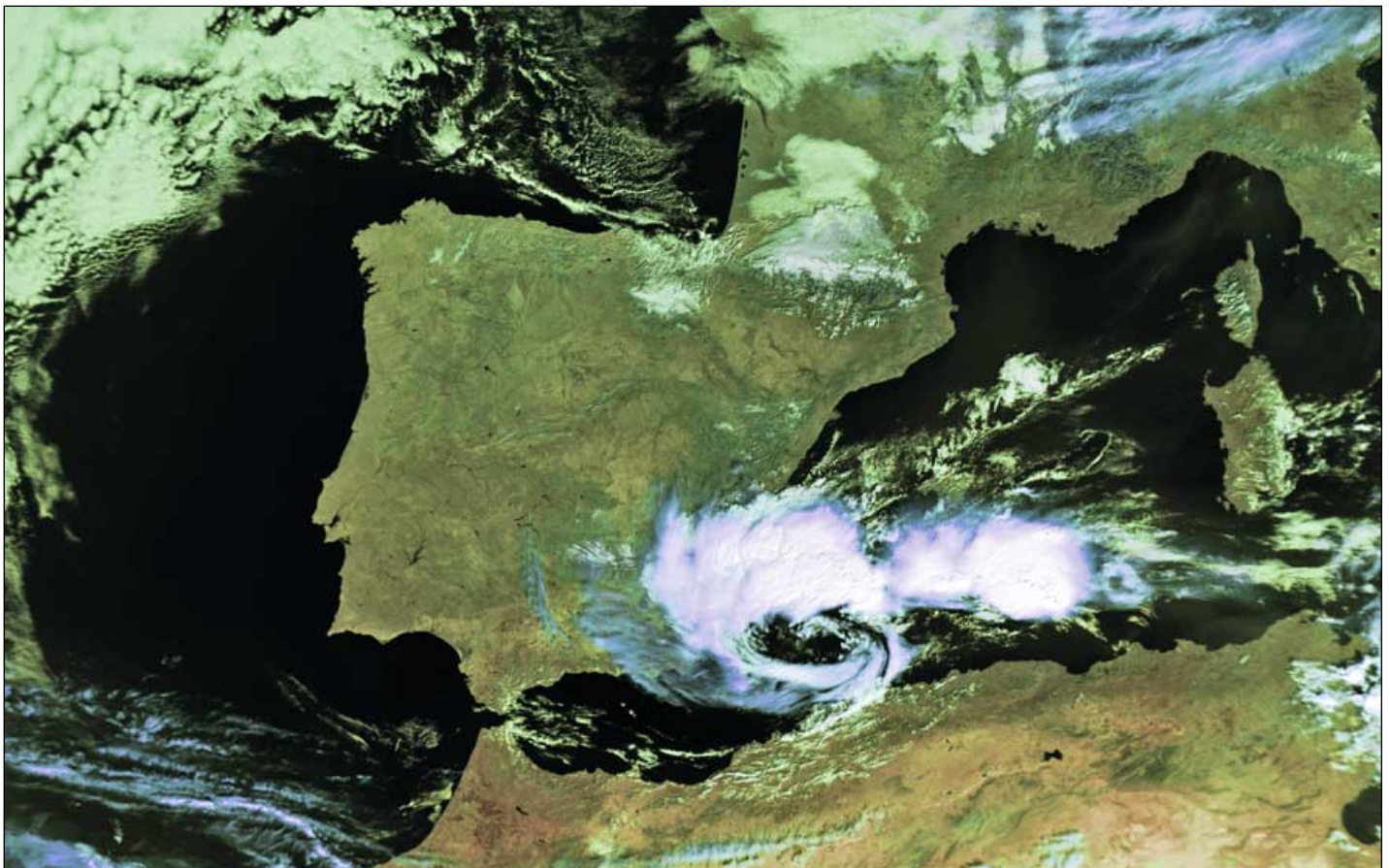
References

- 1 HRPT Images from the NOAA Archive, GEOQ 5, page 18, 2005
- 2 HRPT Reader and GroundMap can be downloaded from the link at <http://www.satsignal.eu>
- 3 Metop File Splitter may be downloaded from <http://myweb.tiscali.co.uk/software.htm>
- 4 HRPT Console may be downloaded from <http://myweb.tiscali.co.uk/software.htm>



The NOAA-17 image above, dating from April 27, 2007, shows high pressure over the UK during a spell of warm early summer weather—before the torrential rains of May, June and July descended, robbing the British Isles of its traditional summer.

Image: NOAA CLASS Archive (<http://www.class.noaa.gov/>)



Metop-A captured this cyclone over southeast Spain on October 12, 2007

Image: NOAA CLASS Archive (<http://www.class.noaa.gov/>)

КАМЧАТКА

One of the most Volcanic Regions on Earth

Robert Moore

My two professional careers have taken me right across the northern hemisphere and just into the southern one but one place I know I will never visit is the Kamchatka Peninsula, a wild and inaccessible part of the world on the far eastern edge of Russia. Yet this is the first part of the world we see every morning on the descending path of Metop-A. More often than not the region is covered in cloud. But sometimes the cloud structures themselves are worthy of closer examination, as in figure 1, a quite stupendous display of wave cloud in the Zaliv Selichova—the area of sea enclosed by the neck of the peninsula. The scene measures some 750 km from top to bottom. The peninsula itself is under the cloud to the right (east) of the image.

The Kamchatka Peninsula is part of the 'ring of fire' and a UNESCO World Heritage Site because of its volcanoes, renowned both for the great beauty of their almost perfect cones and for their deadly danger to climbers. When the clouds clear, some of the volcanoes may be seen in a line in Metop-A images (see colour image on the inside back cover). Recently there was an eruption of Kliuchevskoi volcano which was clearly visible in the ch4-ch5 imagery over several days (figure 2).

Events such as this may set us off on other observational paths; for example there were press reports of mudslides destroying parts of the geyser valley, one of the most spectacular features of the UNESCO site. There is also a webcam watching the volcano, which usually confirms it to be cloud-covered. But Kliuchevskoi sometimes clears, and its plume may then be seen rising into a blue sky. Some of the webcam images are spectacularly beautiful and a selection appears overleaf.

You can view these and real-time images of the volcano at:

<http://data.emsd.iks.ru/video/video.htm>

Once your interest has been stimulated by pictures from space and ground level you may be drawn to other sources of information—the World Wide Web, for example, will give you more images at:

http://volcano.und.edu/vwdocs/current_volcs/kliuchevskoi/kliuchevskoi.html

The Internet encyclopaedia *Wikipedia* will tell you more about the geology of the peninsula but you may find it hard to resist reading on about the history, language and folklore of the area as well.

Then, as in most parts of the world, there are links to follow to meteorological stations, geological surveys or university departments, to help you to gain even more information about observations taken, records kept and research conducted in the region.

Once you start exploring Kamchatka you might well find the Institute of Volcanic Geology and Geochemistry, Far East Division, Russian Academy of Sciences at:

http://www.wovo.org/0900_1000_IVGG.htm

and then the World Organization of Volcano Observatories at:

<http://www.wovo.org/index.htm>

and so on.

How the time slips by! But it is never a waste of time—learning something new every day is not only enjoyable and stimulating but very good for you. Also I can't see much point in a hobby where you spend time and effort in getting good images and then you don't actually look at the pictures!



Figure 1 - Wave cloud in the Zaliv Selichova
Metop-A image © EUMETSAT 2007



Figure 2 - Kliuchevskoi erupts
Metop-A image © EUMETSAT 2007

Comparison of Antennas for 137 MHz

R W Hollander

A team from the Dutch *Werkgroep Kunstmanen*, consisting of Arne van Belle, Harrie van Deursen, Ruud Jansen, Ben Schellekens and Rob Hollander decided in April 2006 to compare the performance of several types of 137 MHz antennas. After a series of test measurements, a setup was finally approved in October 2006 which allowed the performance of up to six antennas to be compared using the signal transmitted by a polar satellite. Satellite passes with different maximal elevation were used, to the west as well as to the east, to gain an overall impression of the performance of the antennas under test. This method was adopted because of the problems we had met with reflections in our previous measurements of radiation patterns of antennas [1].

Measurement Setup

One of the antennas was connected to a HRX-137 satellite receiver, designed by Harrie van Deursen. This particular receiver has a calibrated signal-strength output connected to a Conrad 12 bit ADC, controlled and read from via the serial port of a laptop. A coaxial relay, controlled via the parallel port of the laptop, was used to connect up to six antennas to the HRX-137 in a cyclical way. Finally a Dartcom-137 antenna amplifier with a gain of 11 dB was placed between the co-ax relays and the HRX-137 to boost the signal in order to achieve a better linear relationship between the signal strength output and the log of the input signal. The RF part of the measurement setup had an impedance of 50 ohm, including the input and output impedances of the HRX-137 and the Dartcom-137. Our measurements were controlled by software running on the laptop but before starting, the PC-clock was precisely set to DCF-77 time.

The time was recorded (PC-clock) and the first antenna connected then, after a 1 second interval to allow the receiver to settle, the signal strength of the first antenna was sampled 10 times and the mean value calculated and recorded. The other antennas were connected and measured in turn. Once the signal strength of all the antennas had been recorded, we constructed a single measurement record containing the start time for each series of measurements and the signal strength of each antenna. The result was shown on the screen of the laptop, both graphically and numerically.

This cycle was repeated, starting some minutes before the satellite was due to rise above the horizon until some minutes after the satellite had disappeared. This was done to allow us to determine the noise level of the setup for each different antenna. Once the measurements had been completed, the recorded time was used to calculate the azimuth (AZ) and elevation (EL) of the satellite using a satellite tracking program. Strictly speaking, we should have calculated AZ and EL individually for each antenna; however, the error that we made was negligible for the purpose of our measurements since an entire record only took 7.6 seconds!

It was important to calibrate the signal strength output of the HRX-137, in dB relative to an RF-input level of the HRX-137.

We used -50 dB at an input of 0.707 microvolt in 50 ohm. The relation between the signal strength output voltage and the logarithm of the RF-input voltage is almost linear in the range of input signals that were used. Only a small sinusoidal correction term was needed (due to the three log-converter stages in the NE604) to obtain a good fit between the calibration curve and the data. The deviation over the whole range was less than 0.2 dB.

Measurement Conditions

Harrie van Deursen decided that October 14, 2006 should be the day of the real comparison. On that day there were to be four useful satellite passes (table 1).

A.O.S.	Satellite	Direction	Maximum Elevation	Frequency (MHz)
12:42	NOAA-17	N → S	82° W	137.62
13:41	NOAA-18	S → N	42° E	137.91
14:21	NOAA-17	N → S	18° W	137.62
15:22	NOAA-18	S → N	39° W	137.91

Table 1 - The satellite passes used in the tests

The measurement location was a flat grassy field next to a small lake called the *Noord Aa* in Zoetermeer, which was within easy reach of Harrie's house by car. There is a free line of sight from horizon to horizon and the nearby lake allows a comparison of passes over land and over water. The location is shown by the red circle in figure 1. We set out to compare four types of 137 MHz antenna, using the horizontal open dipole antenna as a reference (table 2).

Type of Antenna	Owner	Height	Impedance	Centre Frequency	Cable Run	Attenuation
RQHA	Rob	3.0 m	51.3 - 53.5	138.5 MHz	8.9 m	2.5 dB
RQHA	Ruud	3.5 m	43.9 - 43.9	138.0 MHz	9.0 m	2.5 dB
RQHA	Ben	2.3 m	65.5 - 56.7	139.3 MHz	11.5 m	3.0 dB
Turnstile	Rob	2.0 m	43.1 - 45.2	137.0 MHz	8.2 m	2.8 dB *
Folded X-dipole	Arne	2.3 m	45.2 - 47.4	not clear	9.0 m	2.6 dB
Hor. open dipole	Rob	4.0 m	56.1 - 55.5	137.5 MHz	14.2 m	3.8 dB

* The attenuation is too high, probably due to a bad contact in one of the BNC-connectors.

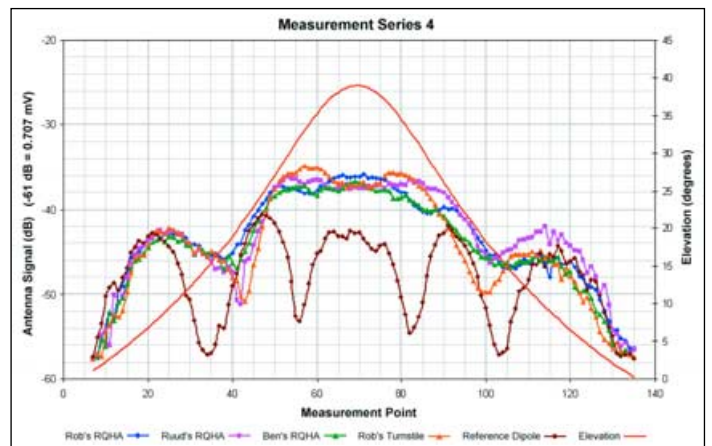
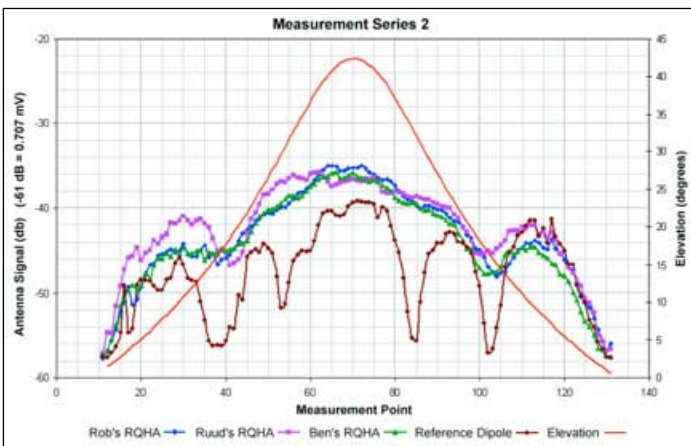
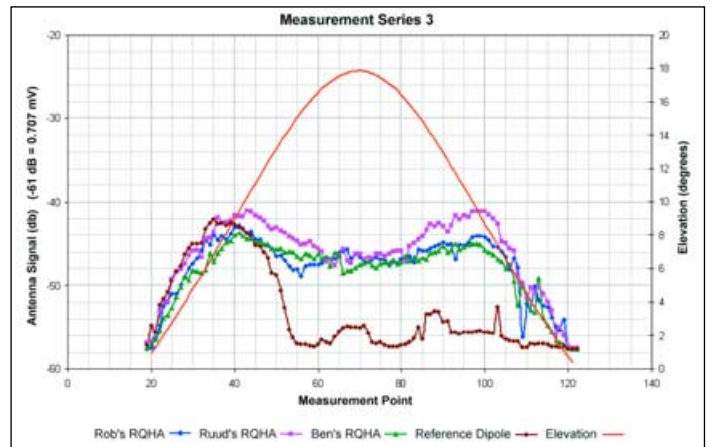
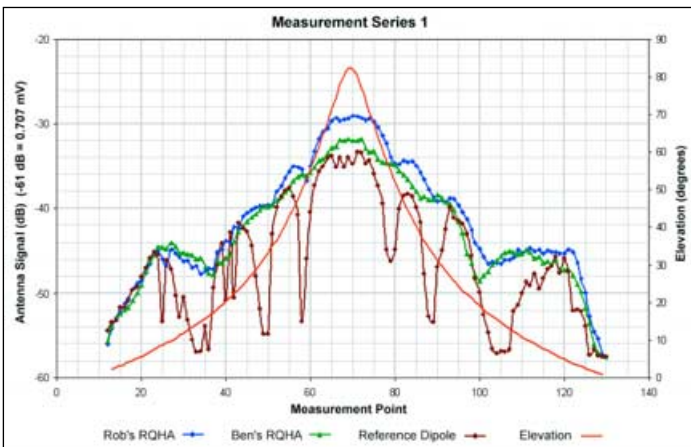
Table 2 - Antenna details

The heights listed in the table are those of the bottom of each mounted antenna. This means that it is the height of the reflector in the case of the turnstile and the folded cross dipole.

The impedances in the table are the absolute values of Z (at 137.48 MHz and 137.9 MHz respectively) for each antenna. The phase of Z was not measured. The centre frequency value is that for which the impedance of the antenna showed a kind of symmetry. Ideally, this value should be 137.5 MHz while the impedance (which should be real) should be 50 ohm. The attenuation caused by the connecting cables was measured to allow for a precise comparison of the antennas. The differences, however, were small, and were not included in our analyses.



Figure 1 - Noord Aa (red circle), the measurement location near Zoetermeer in the Netherlands.



Figures 2-5

In each measurement series, the signal strength is read from the scale on the left-hand axis and the elevation of the satellite is read from the scale on the right-hand axis, using the red curve. The azimuth information is not used in these comparisons.

The *Dartcom-137* antenna amplifier was used in all measurements in this series. Input and output impedance were precisely adjusted to 50 ohm.

Measurement Series 1

- In the first measurement series, NOAA-17 rose over land and set over water.
- **Ruud's RQHA** performed extremely poorly in this series. Following this result Ruud checked the mounting of his antenna, discovered an error, and corrected it.
- The **turnstile** was connected by means of a cable with a faulty BNC-connector, as we found out later. So the turnstile antenna was omitted from this series.
- **Arne's folded dipole antenna** (the only 'professional' antenna in this comparison) produced such weak signals that, probably, something was wrong with the connections; we could not find what this was, however. This type of antenna can be connected with the wrong phase between both dipoles too. So the folded dipole antenna was not included in figure 2.

From the variations in signal strength of **Rob's horizontal open dipole** (reference), it was clear that this type of dipole suffered from destructive interference due to reflections. At the elevation angles where this dipole showed dips in the signal strength, the other antennas also had problems with interference, though less severely. A closer look at the curves reveals that the dips do not occur at exactly the same EL-angles! This is due to the difference in height of the different antennas.

The dips for the open dipole were at 15°, 32° and 55° elevation, angles which corresponded with exactly 1, 2 and 3 wavelengths (218 cm) of path length between the direct and the reflected wave.

The height was exactly 4.0 m. The phase shift on reflection of horizontally polarised waves is 180° [1]. Since this phase shift was also 180° at the 15° point, it meant that the Brewster angle was smaller than 15 degrees—and therefore that the ground at the measurement location was behaving better than a 'mean' ground (showing higher conductivity). The ground near the lake was rather wet!

Rob and Ben's RQHAs look the same, both in their construction and their performance.

Reconstructing Radiation Patterns

It is possible to reconstruct the radiation pattern of an antenna by measuring many passes of the same satellite at different maximal elevation angles. When we restrict ourselves to the elevation, it is clear that the sensitivity of an RQHA is good enough to receive the signal above noise level immediately the satellite reaches the horizon.

The sensitivity at angles greater than 30° may be designed to be smaller. This can be accomplished by designing the RQHA slimmer and taller. This is the case with Ruud's design, which uses a quarter-turn rather than half-turn design. In the next series it will become clear that the sensitivity of Ruud's RQHA at the horizon is indeed higher than Rob's RQHA but less sensitive at high elevation angles.

These measurements demonstrate that interference cannot be avoided nor can it be neglected. Some days after this series of measurements, Harrie wanted to be sure that we saw reflections and not something else. At the same location, he measured the signal strength of an open horizontal dipole about one metre above the wet ground and indeed the dips were not present. Moreover, he found that an RQHA 64 cm above the ground produced an almost ideal sensitivity curve as a function of its elevation. The message is that it is possible to exploit the reflections to enhance the radiation pattern, by making a proper

choice of the antenna height. To be fair; this only works when the reflecting plane is large and flat and rather conductive.

Measurement series 2 (figure 3)

- In the second measurement series, NOAA-18 both rose and set over land.
- Ruud's RQHA seemed healthy again and was included in the comparison.
- Rob's turnstile still seems to suffer from the bad cable connector.
- Arne's folded dipole was withdrawn from the contest.

The horizontal dipole again shows dips in signal strength at 15° and 32°. The dip at 55° is absent because the maximal elevation in this series was only 42°.

All three RQHAs performed more or less equally. The higher sensitivity of Ruud's design at low elevations was clearly demonstrated. The sensitivity at maximal elevation of Rob and Ben's RQHAs was slightly higher than Ruud's RQHA but the difference was marginal.

Signal strength dropped sharply for all antennas when the satellite sets to the north. The drop was 10 dB over only 4° difference in elevation! The increase in signal strength when the satellite rose above the horizon to the south was also rather sharp, but the dipole showed a dip while the other antennas showed irregularity (maybe because of a reflection from that direction that we had overlooked?).

Measurement series 3 (figure 4)

- In the third measurement series NOAA-17 rose over land and set over the boundary between water and land.
- At the end of this series it was clear that the turnstile had recovered from the bad BNC connector problem but we have not included it in this measurement series.

The maximum elevation for this satellite pass was very low to the west. The open dipole antenna, directed E-W for maximal sensitivity in the N-S direction, was unable to receive signals during the whole pass. All three RQHAs, however, showed excellent reception during the entire period that the satellite was more than 3° above the horizon. Ruud's RQHA performed a little better near the horizon. Above 17° elevation, all three RQHAs performed equally well.

Measurement series 4 (figure 5)

- In this measurement series NOAA-18 rose over water and set over the boundary between water and land.

In figure 5, all antennas are included, except for Arne's folded dipole, which again showed deep dips due to destructive interference at the well known elevation angles.

The turnstile antenna performed remarkably well, its sensitivity pattern showing the same reduced sensitivity for high elevation angles as Ruud's RQHA but shows an even higher sensitivity between 30° and 35°! The relatively deep dip in the turnstile's pattern at 19° corresponds with that for the open dipole at 15°, due to the much lower height that was used for the turnstile.

The turnstile suffers more from interference at low elevation angles than the RQHAs. Its polarisation is perfectly circular at the zenith but becomes linear (horizontal) at the horizon. The polarisation of an RQHA at the horizon is still quite close to circular! The sense of circular polarisation is reversed when EM-waves are reflected at angles larger than the Brewster angle. The RHCP (right handed circular polarised) RQHAs are almost blind to reflected LHCP-waves. The remaining destructive interference (the RHCP of an RQHA at the horizon is not 100%), however, is small and the signal strength remains well above noise level.

Conclusions

- The first lesson is to invest in good cables and connectors.
- Secondly, it is clear that a good antenna design (with circular polarisation and radiation pattern) is important; but a good antenna location (to minimise reflections) is even more so.
- Connecting an antenna is not simple! Arne's folded dipole was apparently not connected properly and even Ruud's RQHA had problems in the first measurement series (an error in connecting the loops, creating a phase mismatch).
- The open dipole antenna was included as a reference antenna but, as we already knew, was clearly not a good choice for satellite reception. However, an E-W oriented dipole positioned about one metre above a good conducting ground does perform very well for high elevation passes and might be a good choice for the reception of polar satellites during holidays.
- The differences in performance of the other antennas is important only at low elevation angles. At high elevation angles all the antennas performed more than satisfactorily.
- RQHAs perform better at low elevation angles than turnstiles, but not dramatically so.
- Ruud's slim, tall RQHA design, with more sensitivity at the horizon, is a good choice. However, this design also has a higher sensitivity below the horizon, which makes it theoretically more sensitive for destructive interference at low elevation angles. Moreover, the RHCP of Ruud's quarter-turn RQHA design at the horizon is 69% while

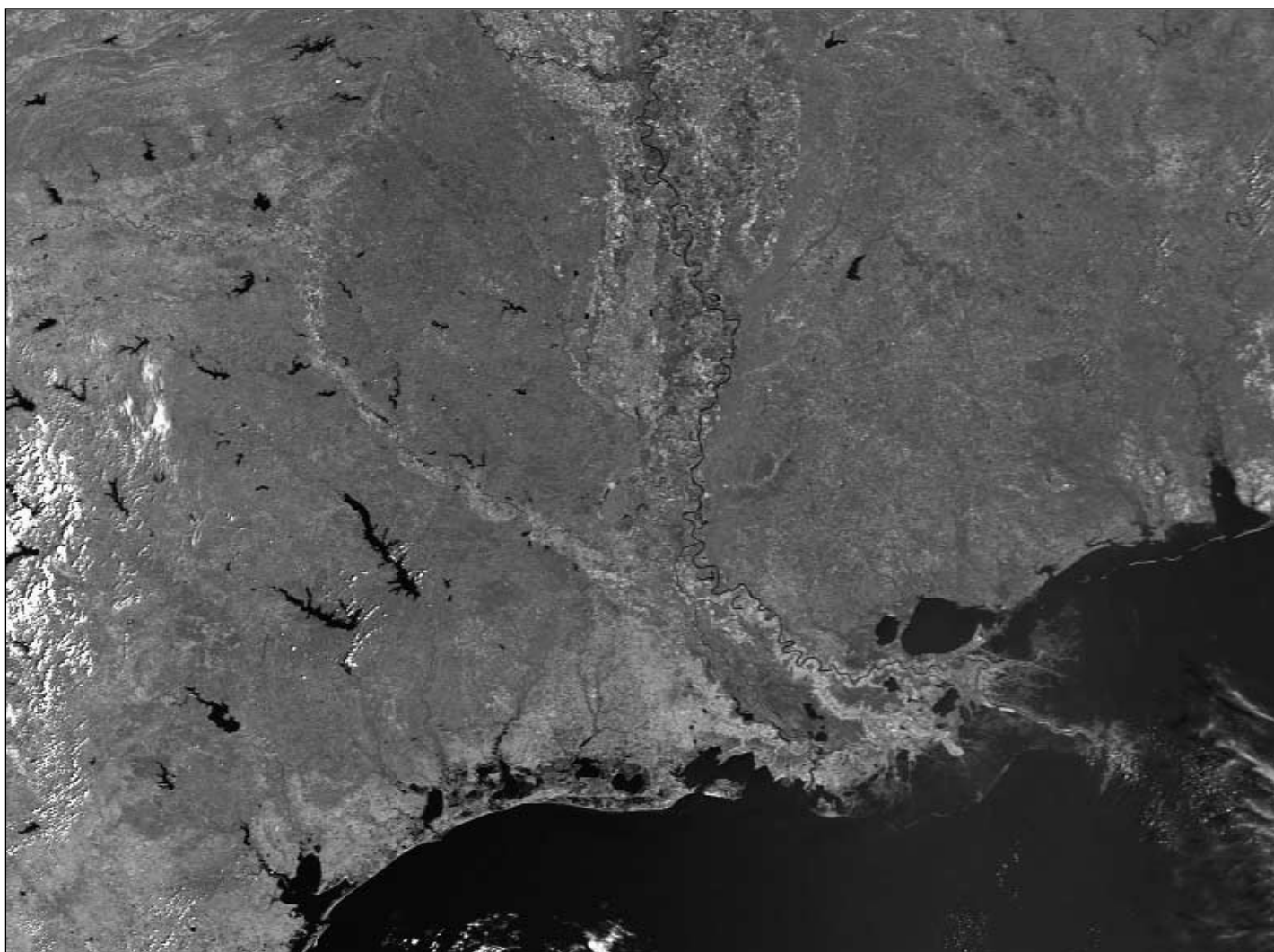
Rob's half-turn RQHA shows 82% RHCP at the horizon. The radiation patterns of RQHA antennas have also been described elsewhere ^{2,3}.

The reflection problem varies with the antenna location. An antenna on a roof in a city 'sees' a totally different reflecting environment than an antenna in an open field. In an open field it is advisable to position the antenna 60-100 cm above the reflecting ground to avoid signal dips due to destructive interference. The area around the antenna location that is important in this regard is relatively small; even for an antenna on a 4-metre pole, the radius of that area is only 16 metres.

In a city there are many reflecting objects and there, it is not possible to give general rules to avoid reflections. In a city it is more important to avoid the effect of multiple reflections. An antenna that is 'blind' for the reflected LHCP waves that arrive from all directions, like an RQHA, is a good choice. Moreover, an RQHA that is only sensitive in the upper hemisphere will have little problems with interference sources like computers etc., from which the radiation will reach the antenna from below its own 'horizon'.

References

- 1 Reflections of EM Waves, R W Hollander, GEO Q15, 2007
- 2 Antenna Theory and Measurement, R W Hollander, GEO Q3, 2004
- 3 Tech Note 2004-1
www.kunstmanen.nl



Striking details of meanders in the lower course of the Mississippi river are captured in this September 20 Metop-A image sent in by Alan Banks.

Image © EUMETSAT 2007

LRIT

(Low Resolution Image Transmission)

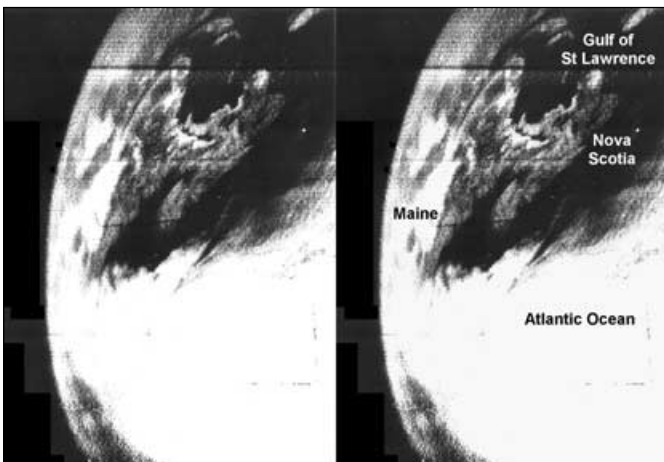
Part 1 - Historical Background

Ed Murashie

When you say LRIT, some people will cringe and then give you an earfull; others will smile and talk about the wonderful improved images; yet more will look puzzled and ask what you're talking about. I have the first one down well and sometimes have been found doing the second one. As for the third, that's why I am writing this article. Let's see *your* reaction after you have read it..

Before I get started describing the LRIT format, I want to describe the evolution of the weather satellite image formats that lead to LRIT. This includes the Weather Facsimile (WEFAX) format, the immediate predecessor of LRIT.

The first weather satellite to image the Earth was *TIROS 1*, on the day of its launch, April 1, 1960. *TIROS 1* had two vidicon cameras mounted on the base of the satellite, one with a wide angle lens and the other a narrow angle lens. The vidicon tube would be charged, a shutter would expose it to the Earth view for 0.0015 seconds and then an electron beam would scan the stored image for 2 seconds creating a 500 line image. The slow scan rate meant a narrow transmission bandwidth. The highest ground resolution was between 2 and 3 miles. The video signal would frequency modulate (FM) an 85 kHz sub carrier which then FM modulated a 2 watt 235 MHz carrier. The pictures were sent to either Command and Data Acquisition (CDA) stations within range or recorded on tape for later transmission.



The first ever TIROS-1 image, of New England and the Gulf of St Lawrence
Image: NOAA

CDA stations recorded the pictures onto 35 mm film, which were processed into photographs then combined into a single map, annotated and gridded. These nephanalyses were then facsimiled (faxed) to the National Weather Satellite Center where more information was added and rechecked before being faxed to local and foreign weather services and the military.

Different camera positions, camera lens and transmission methods were tested during the TIROS program. One of the most significant advances was *Automatic Pictures Transmission* (APT). The weather service realised that large atmospheric events like hurricanes lasted for days but thunderstorms only lasted for hours. The need to deliver the satellite pictures

quickly to the end user without having to wait for the satellite to pass over a CDA station be processed was critical. The APT system used a new type of vidicon tube which contained a secondary surface where the image would last longer before fading and thus could be scanned more slowly. This slower scanning meant an even lower transmission bandwidth, that could be received on relatively inexpensive equipment (around \$30,000 US in those days), therefore enabling more receiving stations to be built. The vidicon tube was charged, exposed to the Earth view, and the image transferred to the storage layer, taking about 8 seconds. During the next 200 seconds, the image was scanned at 4 lines per second and the video signal amplitude modulated (AM) on to a 2400 Hz sub carrier. The brighter the scene, the stronger the sub-carrier signal. Finally, this sub-carrier signal was FM modulated on to a 136.234 MHz carrier wave. Each image covered 1000 miles on a side and had a resolution of about 1 mile. Thus APT's roots derived from FAX technology that had been around for years.

The First GeoStationary Satellite

The first geostationary satellite with cameras to orbit the Earth was Application Technology Satellites' *ATS-1* on December 6, 1966. Interestingly, the primary mission of the ATS satellites involved experimental communication technologies, one of which was WEFAX. The National Environmental Satellite Center transmitted weather satellite pictures from *Nimbus* and *ESSA* satellites to the ATS Mojave California station which then sent them up to *ATS-1* on 149.22 MHz. *ATS-1* would then retransmit these down to APT receiving stations on 135.60 MHz. *ATS-1* was a transponder in space, with APT characteristics similar to those for TIROS—so the same equipment could be used for reception. Later, ATS satellites were even larger and transmitted at higher power levels, allowing inexpensive ground stations to receive their images.



An ATS-1 Image
Image: NOAA

Indeed, *ATS-6* was powerful enough to be able to transmit educational programs to remote areas of India and the United States using these same inexpensive ground stations.

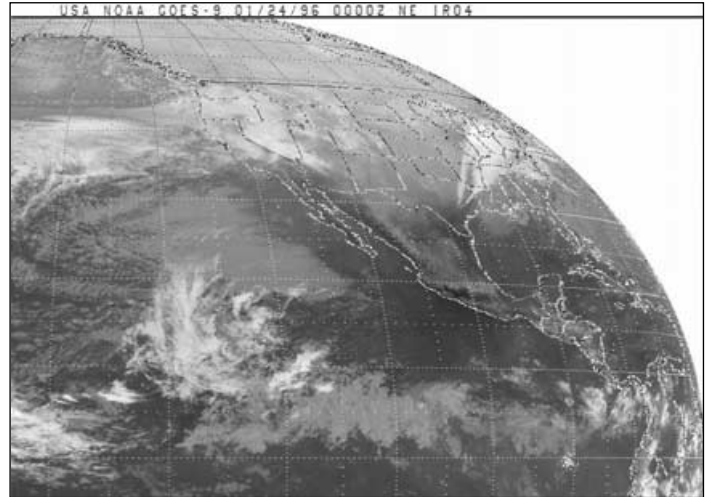
One of the secondary missions of the *ATS* satellites was to image the Earth from a geostationary orbit. The advantage of a geostationary satellite is that it remains over a fixed point on the Earth since its orbit matches the Earth's rotation. Another is that this orbit, some 22,000 miles above the Earth, is high enough that the camera sees the entire planet in a single frame. Combining these two advantages allowed a series of images to be animated, showing the flow of cloud patterns over time. *ATS-1* used a spin-scan cloud camera (SSCC) that utilised the satellite's 100 rpm spin rate, with a scanning mirror, to produce a 2000 line image in 20 minutes. *ATS-3* contained a colour version of the SSCC which took the first colour pictures of the full Earth (page 17).

The first satellites having a primary mission of weather observation were the Geostationary Operational Environmental Satellite (GOES) series. The prototype for the GOES satellite was the Synchronous Meteorological Satellite (SMS), and SMS-1 was launched on May 17, 1974. The SMS 1, 2 and GOES 1-3 satellites were almost identical and contained an improved SSCC called the Visible and Infrared Spin Scan Radiometer (VISSR) that could scan grayscale images at visible and infrared frequencies. These satellites carried eight visible sensors and one infrared sensor and a full Earth picture was completed in 1821 rotations, taking about 18 minutes. This provided a 14,568 line visible image with half mile resolution and an 1821 line infrared image with 5 mile resolution.



This GOES-1 visible image dates from October 1975
Image: NOAA

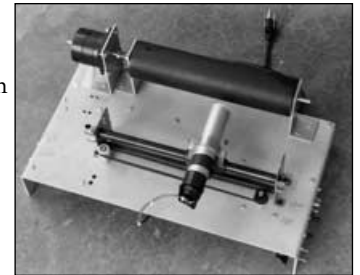
The Raw VISSR data (digital 14 megabit per second - Mbps) was sent down to the CDA station, reformed and gridded forming the lower data rate signal *Stretched VISSR* (digital 1.75 Mbps). The CDA station then sent this signal back to the satellite where it was retransmitted on a different frequency to receiving stations including the National Environmental



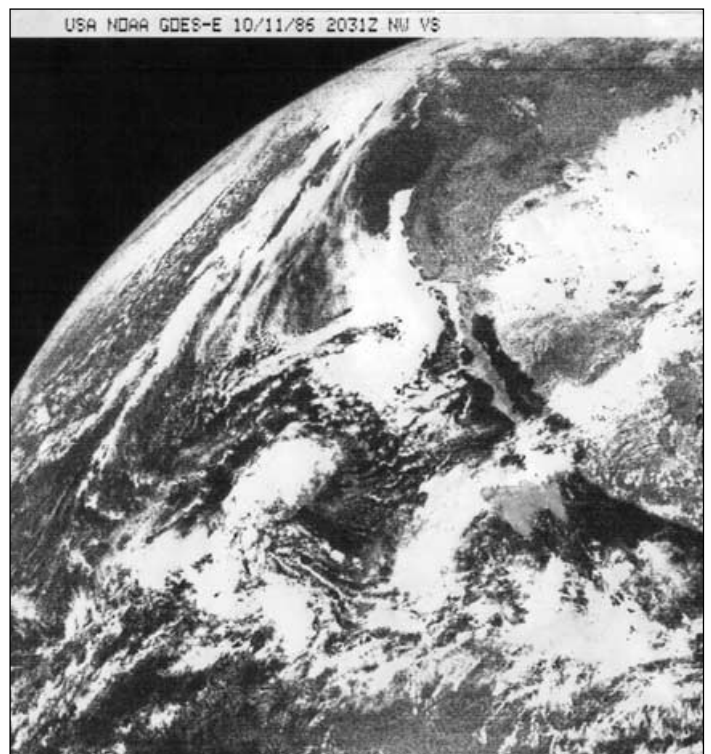
GOES-9 NE IR image from January 1996
Image: NOAA

Satellite Services (NESS). NESS reformatted the data by sectoring it and adding header information. The data was finally returned to the CDA who transmitted it to the satellite as an analog WEFAX signal on 2033 MHz. The satellite then shifted the signal frequency, amplified it and sent it back down to WEFAX ground stations on 1691 MHz.

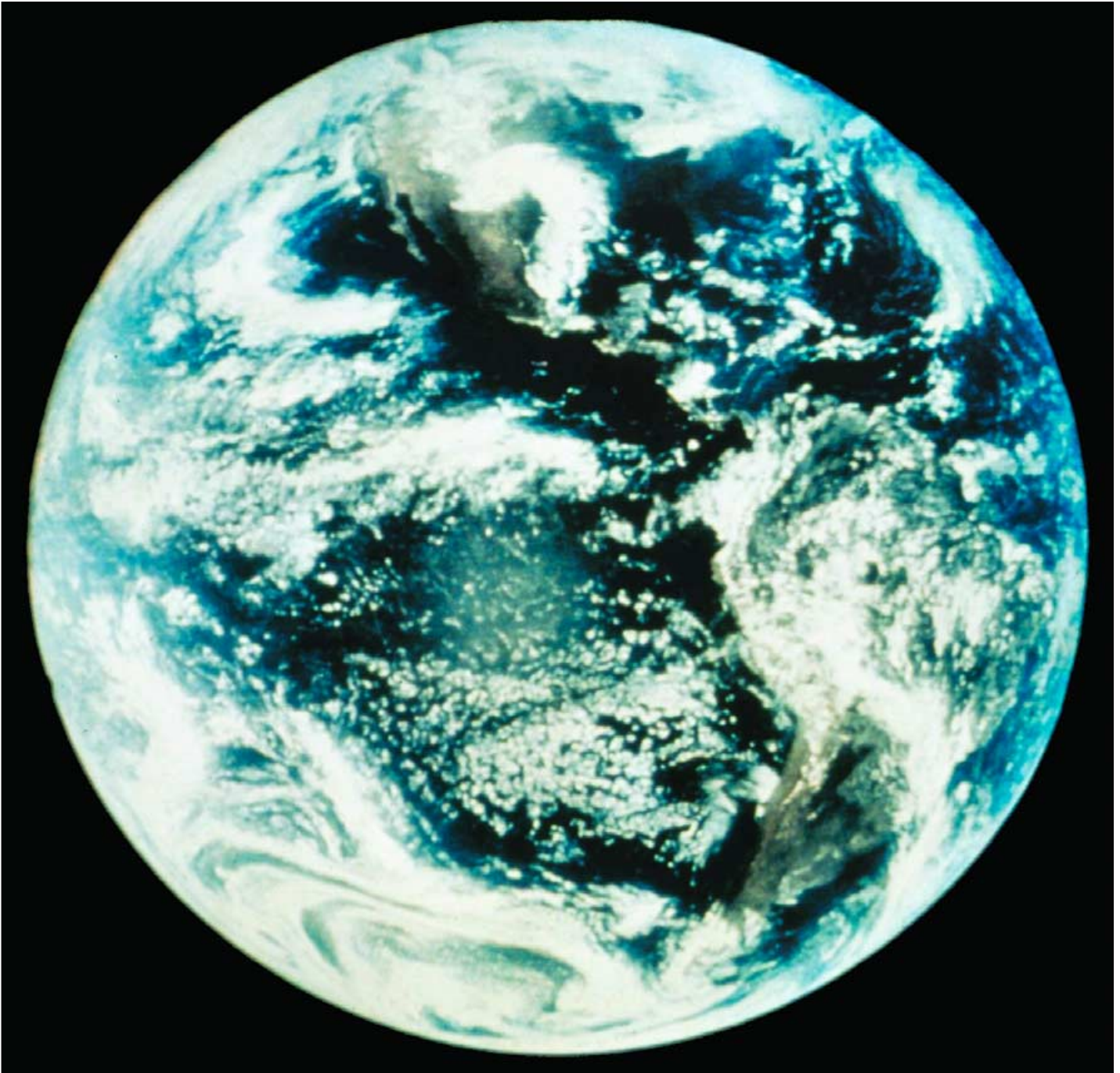
SMS and GOES also maintained the *ATS* WEFAX capability so that current facsimile equipment could be used, but changed the radio frequency from the VHF band (137 MHz) to S-band (1691 MHz). NASA and NOAA helped in the WEFAX transition by publishing papers like the 'SMS GOES WEFAX Users Guide' and promoted the use of S-band to VHF frequency downconverters. The European Meteosat-1 satellite was based on the SMS/GOES satellite series and also carried the WEFAX service.



The author's home-built photo fax



A GOES-E VS image produced on the author's photo fax



The first ever colour weather satellite image, from ATS-3, received at 18:00 UT on January 21, 1968

Image: NOAA

GOES 8 was the first 3-axis stabilised satellite, unlike the previous spin-stabilised ones. Being 3-axis stabilised, the imager is always facing the Earth, allowing for more imaging time and greater flexibility. It could, for instance, image thunderstorms in the southwest United States every 15 minutes. The higher resolution *Stretched VISSR* data format was replaced by GOES Variable (GVAR) format to accommodate the imaging flexibility. The same kind of flexibility is used in the LRIT transmissions. The WEFAX capability remained the same as in the previous series of satellites.

The GOES satellites, being transponders in space, would relay images from other satellites, as well as charts and schedules. A typical *GOES West* schedule included full disk and sectorised images from the Japanese GMS satellite, the GOES West satellite, the GOES East satellite, Meteosat and the polar orbiting NOAA satellites. There were also aviation charts, significant weather charts, TBUS satellite status reports and transmission schedules.

GOES-12 and GOES-10 WEFAX transmissions were discontinued and replaced by LRIT on March 1, 2005 and October 3, 2005 respectively, ending the long legacy of GOES WEFAX. On June 14, 2006, Meteosat-7 direct broadcasts were terminated ending WEFAX service for the European community. The only satellite still broadcasting WEFAX service is MTSAT-IR covering the Japanese region and this service is due to be discontinued on March 12, 2008.

A typical GOES WEFAX amateur station, as described in Dr Ralph Taggart's *New Weather Satellite Handbook* (1981), consisted of a 4-foot surplus parabolic dish with a 2-lb coffee can feedhorn connected to either a commercial S-band downconverter like *Microcomm's* or a homebrew one as described by Emilani and Rhighini's QST (November 1980). The output from the downconverter was connected to either a commercial VHF receiver like the *Vanguard*, a scanner such as the *Radio Shack PRO-2008* or a kit built unit like the *Hamtronic R75A*. The output of the VHF receiver was the

speaker and was a 2.4 kHz signal that varied in loudness as the signal was received. This output signal was tape-recorded for storage, fed to a modified fax machine like the *Western Union Telefax Transceiver* or displayed on an oscilloscope and the screen photographed. Some people, including myself, built their own photo fax machine. If you wanted to receive the polar orbiting weather satellite signal, you attached an antenna to the VHF receiver and you were ready to go.

An Earfull

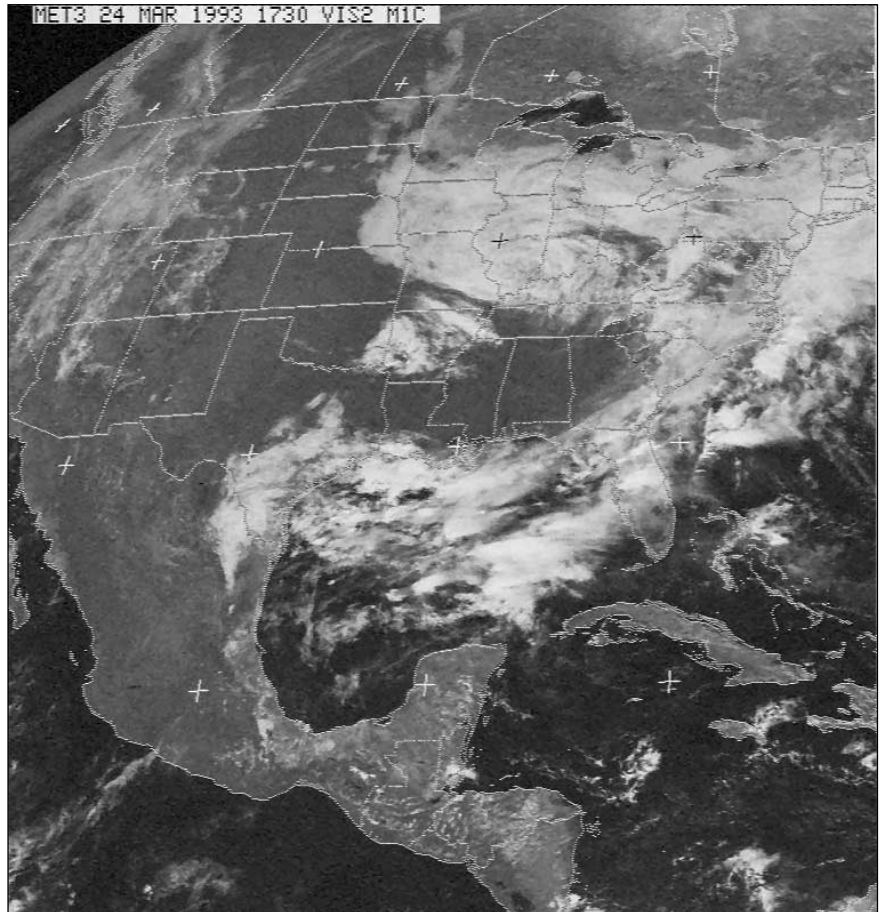
For myself and others who are hardware oriented, those were the good old days! You could get up and running on APT for as little as a few hundred dollars using surplus equipment. You could *hear* the signal and see it on an oscilloscope. How many of you still enjoy hearing that static as a NOAA satellite comes up over the horizon, the signal building to a strong tick-tock sound and then disappearing back into static as it slips over the opposite horizon? You could add the WEFAX capability later as your allowance would permit (about \$500) and could experiment with just wires, transistors (or tubes for those as old as myself) and a soldering iron. As the digital age dawned, everyone wanted to build that *YU3UMV* digital frame store for greater convenience and improved picture quality. With the appearance of computers you could build that *CoCo* (*Tandy* colour computer) or *Amiga* interface so that pictures could be electronically saved and shared. The point was that you could do as little or as much as you wanted and were capable of, and had more options and areas to experiment in.

By the mid 80's, schools were installing weather satellite equipment so that students could learn about electronics, satellite technology, tracking satellites, image processing and weather. This was promoted by NASA issuing educator's guides and inviting them to satellite launches. By the end of the 90s the size of the WEFAX antenna and electronics had shrunk enough to fit in a suitcase! Many times I took my equipment to share with teachers at the NOAA satellite launches and to Ham Radio club meetings. I even sneaked the equipment up on the roof of where I worked so I could capture images.

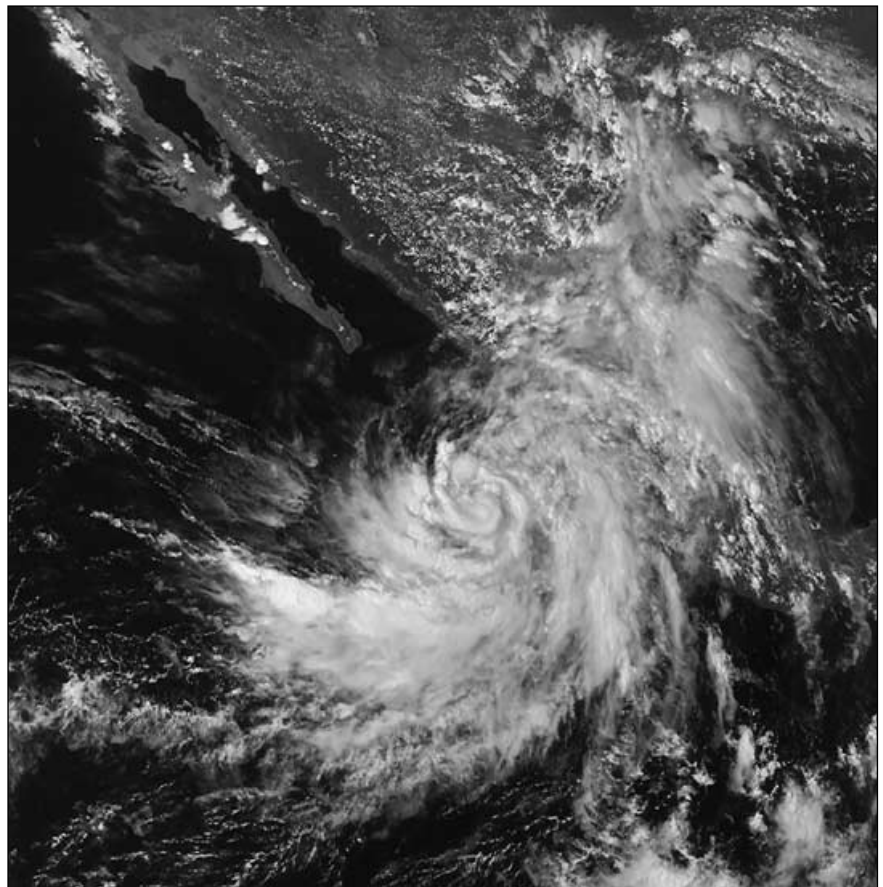
Now that LRIT has replaced WEFAX, all that has disappeared and you have to be a computer programmer to experiment with the limited hardware. Unfortunately, we don't have the fun of pointing the small dish or loop Yagi at a GOES satellite and switching on the receiver to hear the buzzing of the header followed by the strange sounds of the image and the zipping sound of the grids. We can no longer view a notebook PC displaying the steady advancement of images across its display and see newcomers amazed at how we are picking up a satellite image with such simple equipment. Luckily we still have NOAA APT transmissions for a few more years before they are also replaced by digital counterparts.

References

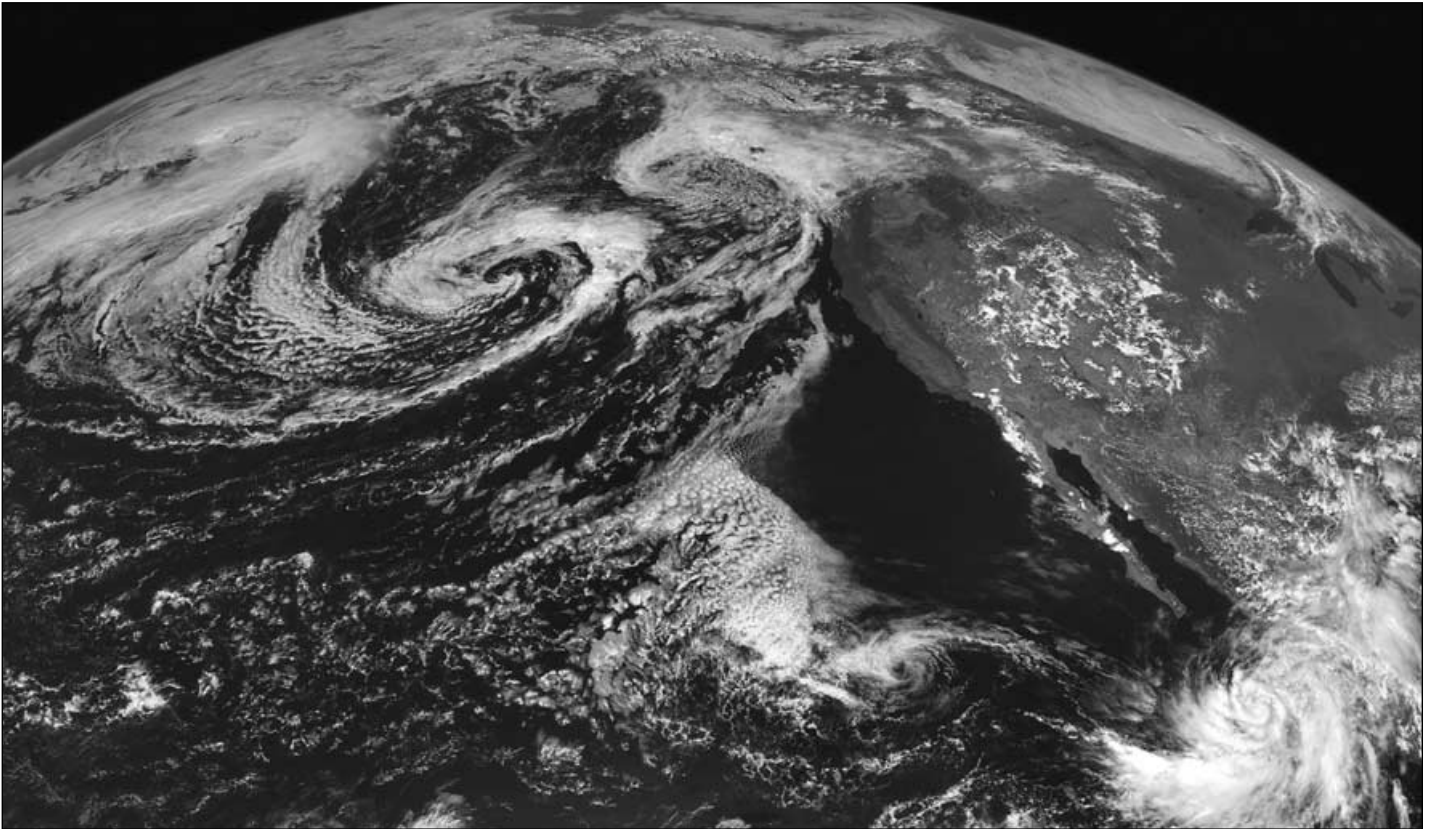
- William K Widger, Jr., 1966: "Meteorological Satellites"
 John Jakes, 1966: "TIROS Weather Eye in Space"
 Janice Hill, 1991: "Weather from Above"



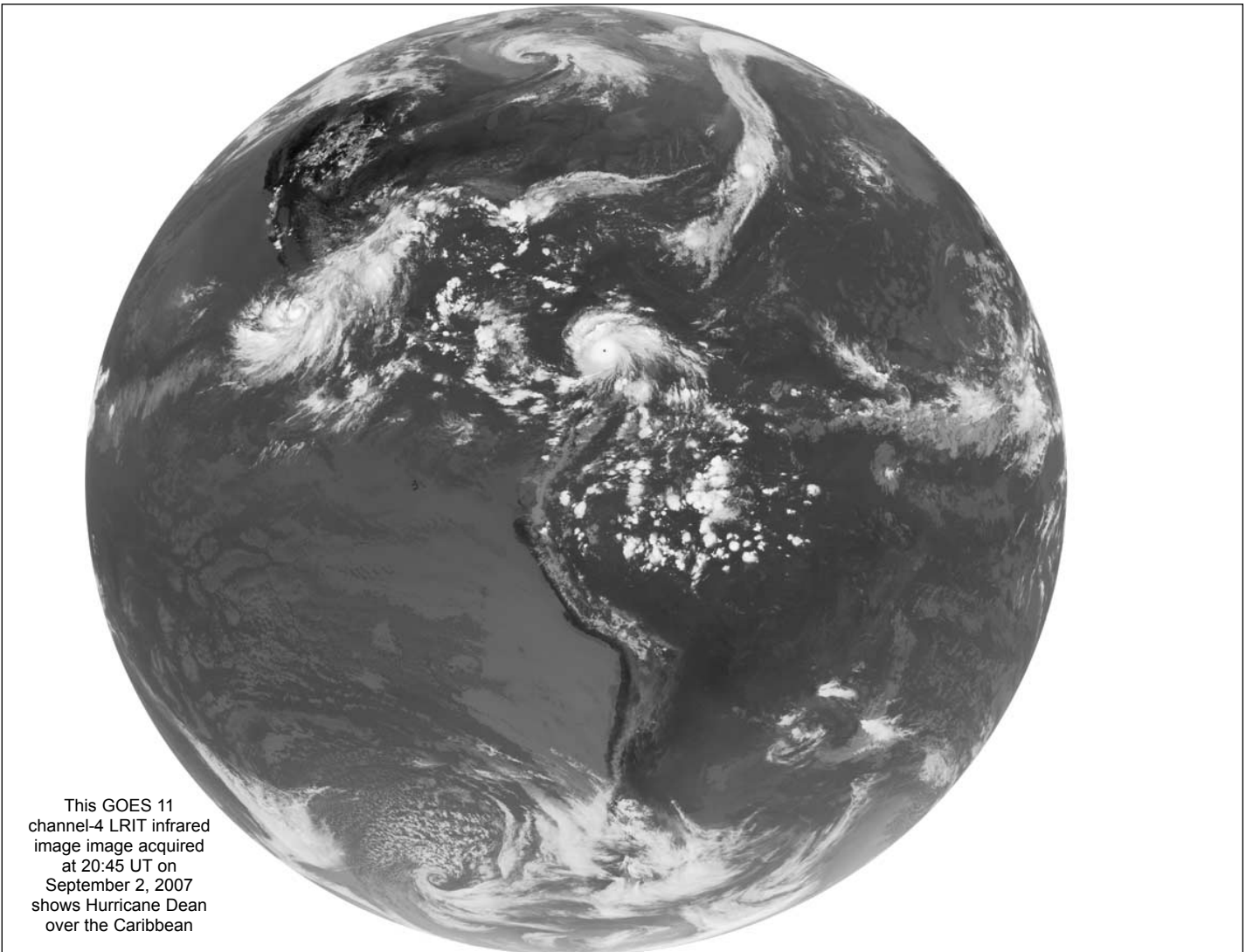
Following the failure of GOES -6 in 1989, EUMETSAT loaned their redundant Meteosat-3 to NOAA. Meteosat-3 was drifted from 0°W to a new station at 75°W over the Atlantic Ocean. This WEFAX image from Meteosat 3 was obtained during March 1993.



Judge the resolution and quality of LRIT from this visible image clip from GOES 11. Hurricane Henrietta shows south of Baja, yet the image above is shown at only 31% of its full resolution.



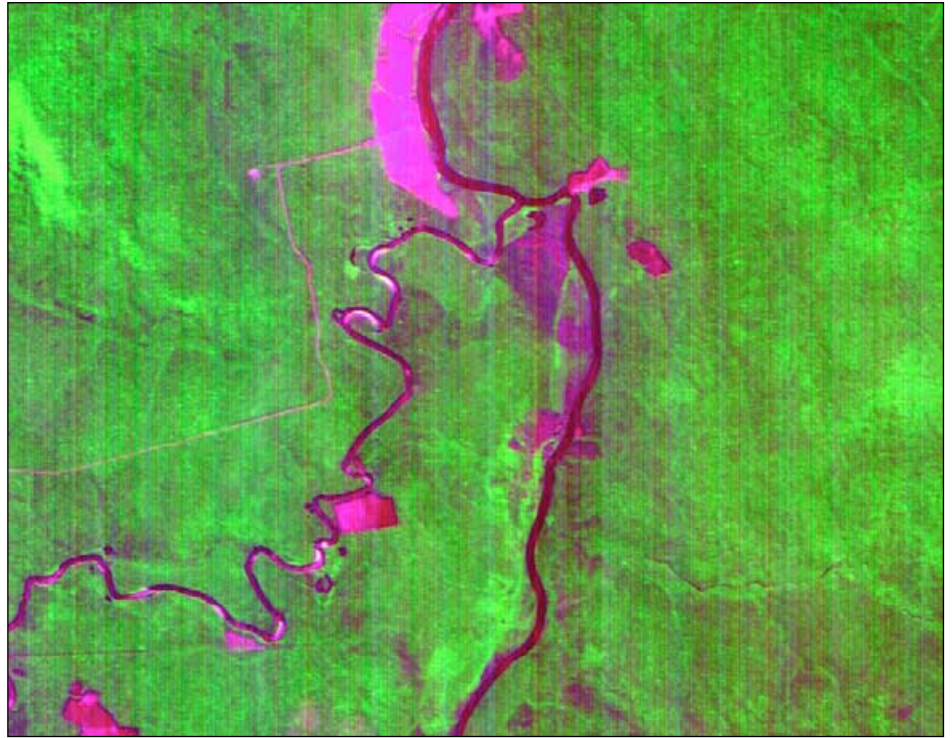
Above, a GOES 11 channel-1 LRIT visible image acquired at 20:46 UT on September 2, 2007 showing Hurricane Henrietta south of the Baja peninsula



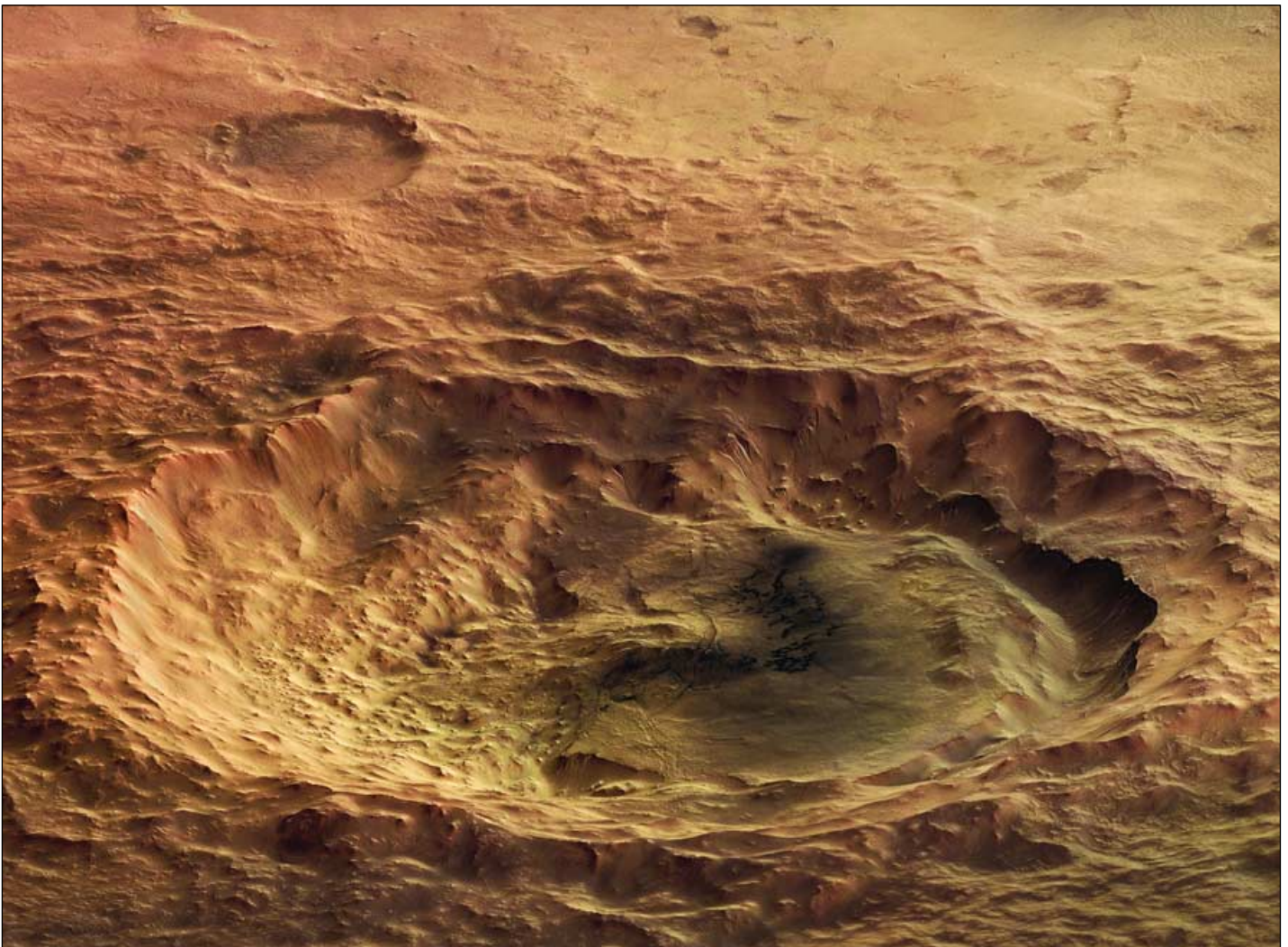
This GOES 11 channel-4 LRIT infrared image image acquired at 20:45 UT on September 2, 2007 shows Hurricane Dean over the Caribbean



Kaguya images the crescent Earth from a distance of 110 000 km
Image: JAXA/NHK



A high-resolution CCD image taken over Brazil's Matto Grosso by the *CBERS-2B* satellite
Image: INPE



This image shows the striking *Maunder* crater located in the region of *Noachis Terra* on **Mars**. The High Resolution Stereo Camera (HRSC) on ESA's *Mars Express* orbiter imaged the *Noachis*

Terra region during December 2005, with a ground resolution of approximately 15 metres per pixel. Named after the British astronomer Edward W Maunder, the crater is located mid way between

Argyre Planitia and *Hellas Planitia* on the southern Highlands of Mars. This perspective view has been calculated from the digital terrain model derived from the HRSC stereo channels.

Credits: ESA/DLR/FU Berlin (G. Neukum) - Copyright 2000 - 2007 © European Space Agency. All rights reserved.

Earth Imaging News

Peter Wakelin

Japanese Spacecraft Heading for Moon Images Earth

The Japan Aerospace Exploration Agency (JAXA) and the Japan Broadcasting Corporation (NHK) have successfully taken moving images from the *Kaguya* (also known as Selene) spacecraft which was launched towards the moon from the Tanegashima Space Center on September 14.

The High Definition Television (HDTV) camera used was developed especially for space use by NHK and operates at eight times the normal frame rate. The image at far left was processed by NHK from data obtained when *Kaguya* was approximately 110,000 km from Earth, which is nearly three times the distance of geostationary satellites, on September 29.

Kaguya has successfully entered orbit around the moon from where radio amateurs report a surprisingly strong S-band signal which can be detected using just a 3.5 turn helical antenna and no dish.

WorldView-1 Successfully Launched

DigitalGlobe's *WorldView-1* spacecraft was successfully launched by a Boeing Delta-2 vehicle to a 494 km sun-synchronous orbit from Vandenberg Air Force Base, California, on September 18. This was the 75th consecutive successful launch of the Delta-2 rocket since May 1997 and 25 remain to be flown. Built by Ball Aerospace and Technologies Corporation, with the imaging sensor provided by ITT Corporation,

WorldView-1's 60 cm aperture telescope/camera system produces 50 cm-resolution panchromatic images. The advanced, high-capacity system is capable of imaging up to 750,000 square kilometres of half-metre imagery every day.

The anticipated quality has the US government signed up as a customer to receive *WorldView*'s images of specific global hotspots and areas for intelligence-gathering. Although the US National Geospatial-Intelligence Agency contributed \$500 million towards the project, most of the imagery will go to the relatively young commercial Earth-imaging industry where demand for high-resolution imagery is soaring.

DigitalGlobe's other operating satellite, *QuickBird*, is expected to operate for another two years by which time *WorldView-2*, now under construction, should be in orbit.

DigitalGlobe have already released high-resolution images of Yokohama, Japan, Addis Ababa, Ethiopia and Houston, Texas, and a part of the latter is reproduced on page 23. The images can be found at

http://www.digitalglobe.com/worldview-1_images.html

Landsat-5 Develops Battery Problems

Although *Landsat-5* has now lost redundancy in some onboard systems, it has continued to return high-quality global data since its launch more than 22 years ago. On October 6, the Landsat Flight Operations Team (FOT) noticed that battery No. 2 had been automatically taken off-line and imaging was stopped to conserve power. Battery power is needed to supply the satellite's power needs whilst in the non-sunlit part of each orbit, and one of the three 22-cell nickel-cadmium batteries has already failed. With the loss of another battery, the remaining battery may have sufficient capacity to maintain a healthy spacecraft and continue with some daytime imaging operations.

At the time of writing, in late October, *Landsat-5* is not imaging but the FOT have a better understanding of the problem and are confident that imaging can resume even if No. 2 battery cannot be brought back on-line. This is quite an achievement for an imager that has already made well over 100,000 daytime passes across the world.

China Launches Another Brazilian Satellite

CBERS-2B, the third China-Brazil Environmental Research Satellite, was launched from China's Taiyuan space centre on September 19 into a 736 x 741 km sun-synchronous orbit. It has since manoeuvred to the usual 778 km circular orbit for *CBERS* spacecraft, which enables complete global coverage every 26 days for the narrow field-of-view sensor and every five days for the wider field-of-view sensor.

CBERS-1 was launched in 1999 and operated for almost 4 years. *CBERS-2* was launched in October, 2003 and is still operational but is not expected to survive until the more advanced *CBERS-3* is available for launch in 2009, so *CBERS-2B* was built as an interim measure. It is very similar to *CBERS-2* but has some enhanced instrumentation and is expected to operate for at least two years. The Infrared Multispectral Scanner (IRMS) on the earlier craft has been replaced by a panchromatic CCD camera with a resolution of just 2.7 metre/pixel. The spacecraft also has a new GPS (Global Positioning System) and a star tracker in its attitude and orbit control system. *CBERS-2B* has a total mass of 1,450 kg and is of cubic shape with dimensions of 1.8 x 2.0 x 2.2 metres and a solar panel 6.3 x 2.6 metres continuously oriented towards the sun using an automatic control system.

CBERS-2B was built by Brazil's National Institute of Space Research (INPE) and shipped to the Chinese Academy of Space Technology where twelve Brazilian technicians prepared it for launch. Integration with the CZ-4B launch vehicle took place on September 14 and without any further problems the successful launch occurred five days later.



CBERS-1
Image:INPE



Launch of CBERS-2
Image:Chinese Academy of Space technology

INPE have already made available some early images from the new spacecraft and the one at top right on page 20 shows an area in the Aripuanã region of Mato Grosso, Brazil. In this high resolution CCD image, rivers are shown as deep red whilst bare earth (tracks and deforested areas) are shown as a lighter red. One of the uses of this new satellite will be to monitor deforestation in the Amazon region.



Part of a *WorldView-1* image of Houston, Texas, at just 40% of its full resolution!
Image DigitalGlobe

GEO Shop



The 'Pager-Hardened' R2ZX APT Weather Satellite Receiver

This upgraded version of the German-built R2FX receiver has been developed specially for the UK market and is available solely from the GEO Shop. If you are in an area suffering from pager interference on the NOAA-18 frequency of 137.91 MHz, this receiver should be the answer to your problems - see the R2ZX review in GEO Quarterly No 14.

UK member's price - £159.00 UK non-member's price - £173.00

We still stock the original R2FX receiver which has proved itself to be a top-quality receiver throughout Europe and the world at large. Members in the UK find that the R2FX gives perfect reception of NOAAs 12-17, and in favourable locations (pager-free) of NOAA-18 also.

UK member's price - £140.00 UK non-member's price - £154.00

R2FX Accessory Pack

This contains everything required to implement a complete APT receiving system when used with either the R2FX or R2ZX receiver. It comprises:

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

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

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



The Bias-Tee allows a mast head preamplifier to be used with the 'Antenna 2' input of an R2FX or R2ZX. Only the 'Antenna 1' input normally feeds power to a preamp. The Bias-Tee now allows you to power twin preamps and maintain the receiver's Antenna Diversity feature.

UK members price - £15.00
UK non-members price - £19.00



John Silver's APT preamplifier was featured as a constructors' kit in GEO Quarterly No 12 (December 2006). Now we are able to offer this high-linearity LNA to GEO readers, ready built.

UK members price - £29.50
UK non-members price - £33.50



Telesat Universal Ku-band 0.6 dB Universal LNB (or similar model)

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

UK members price - £11.00
UK non-members price - £17.50



TechniSat SkyStar 2 PCI Card

This 'free-to-air' DVB satellite TV and data receiver card recommended by EUMETSAT must be installed *inside* your computer. It comes with comprehensive installation instructions and a CD-ROM of driver software.

UK members price - £55.00
UK non-members price - £61.00

GEO PIC 1.0 for the RX2

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



UK - £7.00
UK non-members price - £7.00

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



CURRENT PRICE LIST

	Members Prices			Non Members		
	UK	EU	RoW	UK	EU	RoW
APT Equipment						
R2ZX APT Receiver (no PSU)	159.00	163.00	171.00	173.00	177.00	185.00
R2FX APT Receiver (no PSU)	140.00	144.00	152.00	154.00	158.00	166.00
R2FX Accessory Pack	59.00	-	-	69.00	-	-
BNC Lead (0.25 metre)	4.50	5.25	5.75	6.50	7.25	7.75
UK Power Supply Unit (12 volt)	7.50	-	-	10.00	-	-
Dartcom High Quality QFH Antenna	259.00	279.00	-	279.00	299.00	-
Turnstile APT antenna	42.50	-	-	47.50	-	-
John Silver Preamplifier (built)	29.50	30.00	31.00	33.50	34.00	35.00
Bias Tee	15.00	15.50	16.00	19.00	19.50	20.00
GEO-PIC 1.0	7.00	7.80	8.40	7.00	7.80	8.40
GEO/Dartcom EPROM v 1.3	10.00	10.75	11.25	10.00	10.75	11.25
Martelec MSR40 EPROM	10.00	10.75	11.25	10.00	10.75	11.25
EUMETCast Equipment						
TechniSat SkyStar 2 PCI Card	55.00	56.50	-	61.00	62.50	-
Telesat 80 cm dish with LNB	54.00	-	-	61.00	-	-
Telesat Ku band universal LNB	11.00	12.50	-	17.50	19.00	-
TechniSat Satfinder Alignment Meter	21.50	24.50	-	24.50	27.50	-
Miscellaneous						
GEO Quarterly Back Issues (subject to availability)	3.50	4.20	5.10	n/a	n/a	n/a
GEO 2004 CD (PDF back issues)	8.00	8.80	9.30	n/a	n/a	n/a
GEO 2005 CD (PDF back issues)	8.00	8.80	9.30	n/a	n/a	n/a
GEO 2006 CD (PDF back issues)	8.00	8.80	9.30	n/a	n/a	n/a
GEO Membership (4 x GEO Quarterly)	20.00	24.00	28.00	20.00	24.00	28.00

All prices are in £ sterling and include postage and packaging

ORDERING AND SHIPPING

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

Orders should be sent to:

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

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

+44 (0) 1202 893 323

And remember, you can now order through the GEO Website using

PayPal.

NOT A GEO MEMBER?

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

Why not join GEO and take advantage of the discounted prices we can offer you as a member?

Subscription Rates (12 months/4 issues of GEO Quarterly) are just £20 (UK), £24 (EU) and £28 (rest of world).



TechniSat SatFinder Antenna Alignment Meter

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

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



Telesat 80 cm dish and Universal 0.6 dB LNB (or similar model)

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

UK members price - £54.00
UK non-members price - £61.00

NOAA Satellite Predictions

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

NOAA 15 137.50 MHz			NOAA 17 137.62 MHz			NOAA 18 137.10 MHz		
Dec 01	04:53 06:33 14:42 16:21	10:16 11:56 20:05 21:44	01:06 02:47 12:40 14:22					
Dec 02	04:30 06:09 15:57 17:38	09:53 11:33 19:42 21:21	00:56 02:36 12:29 14:11					
Dec 03	05:45 07:26 15:33 17:13	09:30 11:10 20:58 22:39	02:26 04:07 12:19 14:00					
Dec 04	05:22 07:02 15:10 16:49	10:47 12:27 20:35 22:15	02:15 03:56 12:09 13:50					
Dec 05	04:58 06:38 14:47 16:25	10:23 12:04 20:12 21:51	02:05 03:46 11:58 13:39					
Dec 06	04:34 06:14 16:01 17:42	10:00 11:40 19:49 21:28	01:54 03:35 11:48 13:29					
Dec 07	05:50 07:30 15:38 17:18	09:37 11:17 21:05 22:46	01:44 03:25 11:38 13:18					
Dec 08	05:26 07:06 15:14 16:54	10:54 12:34 20:42 22:23	01:34 03:14 11:28 13:07					
Dec 09	05:02 06:42 14:51 16:30	10:31 12:11 20:19 21:59	01:23 03:04 11:18 12:57					
Dec 10	04:39 06:18 16:06 17:47	10:08 11:48 19:57 21:36	01:13 02:54 11:07 12:47					
Dec 11	05:54 07:35 15:42 17:22	09:45 11:25 19:34 21:12	01:02 02:43 12:36 14:18					
Dec 12	05:31 07:11 15:19 16:58	09:22 11:01 20:49 22:30	02:33 04:14 12:26 14:08					
Dec 13	05:07 06:47 14:56 16:34	10:38 12:19 20:27 22:07	02:22 04:03 12:15 13:57					
Dec 14	04:43 06:23 16:10 17:52	10:15 11:55 20:04 21:43	02:12 03:53 12:05 13:46					
Dec 15	05:59 07:39 15:47 17:27	09:52 11:32 19:41 21:20	02:01 03:42 11:55 13:36					
Dec 16	05:35 07:15 15:23 17:03	09:29 11:09 20:57 22:38	01:51 03:32 11:45 13:25					
Dec 17	05:11 06:51 15:00 16:39	10:46 12:26 20:34 22:14	01:40 03:21 11:34 13:14					
Dec 18	04:48 06:27 16:15 17:56	10:23 12:03 20:11 21:51	01:30 03:11 11:24 13:04					
Dec 19	06:04 07:44 15:51 17:32	10:00 11:40 19:49 21:27	01:20 03:00 11:14 12:53					
Dec 20	05:40 07:20 15:28 17:07	09:37 11:16 21:04 22:46	01:09 02:50 12:43 14:25					
Dec 21	05:16 06:56 15:04 16:43	10:53 12:34 20:41 22:22	00:59 02:39 12:33 14:15					
Dec 22	04:52 06:32 14:41 16:19	10:30 12:10 20:18 21:58	02:29 04:10 12:22 14:04					
Dec 23	04:28 06:08 15:56 17:36	10:07 11:47 19:56 21:35	02:19 04:00 12:12 13:53					
Dec 24	05:44 07:25 15:32 17:12	09:44 11:24 19:33 21:12	02:08 03:49 12:02 13:42					
Dec 25	05:20 07:01 15:09 16:48	09:21 11:01 20:49 22:29	01:58 03:39 11:51 13:32					
Dec 26	04:57 06:37 14:46 16:24	10:38 12:18 20:26 22:06	01:47 03:28 11:41 13:21					
Dec 27	04:33 06:13 16:00 17:41	10:14 11:55 20:03 21:42	01:37 03:18 11:31 13:11					
Dec 28	05:49 07:29 15:37 17:17	09:51 11:31 19:41 21:19	01:26 03:07 11:21 13:00					
Dec 29	05:25 07:05 15:13 16:53	09:28 11:08 20:56 22:37	01:16 02:57 11:11 12:50					
Dec 30	05:01 06:41 14:50 16:29	10:45 12:25 20:33 22:13	01:06 02:46 12:39 14:22					
Dec 31	04:38 06:17 16:05 17:46	10:22 12:02 20:10 21:50	00:55 02:36 12:29 14:11					

NOAA 15 137.50 MHz			NOAA 17 137.62 MHz			NOAA 18 137.10 MHz		
Jan 01	05:53 07:34 15:41 17:21	09:59 11:39 19:48 21:26	02:25 04:06 12:19 14:00					
Jan 02	05:30 07:10 15:18 16:57	09:36 11:16 21:03 22:45	02:15 03:56 12:08 13:49					
Jan 03	05:06 06:46 14:55 16:33	10:52 12:33 20:40 22:21	02:04 03:45 11:58 13:39					
Jan 04	04:42 06:22 16:09 17:51	10:29 12:09 20:18 21:57	01:54 03:35 11:48 13:28					
Jan 05	05:58 07:38 15:46 17:26	10:06 11:46 19:55 21:34	01:43 03:24 11:37 13:18					
Jan 06	05:34 07:14 15:22 17:02	09:43 11:23 19:33 21:11	01:33 03:14 11:27 13:07					
Jan 07	05:10 06:50 14:59 16:38	09:20 11:00 20:48 22:28	01:23 03:03 11:17 12:57					
Jan 08	04:47 06:26 16:14 17:55	10:37 12:17 20:25 22:05	01:12 02:53 11:07 12:46					
Jan 09	06:03 07:43 15:50 17:31	10:14 11:54 20:02 21:41	01:02 02:42 12:36 14:18					
Jan 10	05:39 07:19 15:27 17:06	09:50 11:30 19:40 21:18	02:32 04:13 12:25 14:07					
Jan 11	05:15 06:55 15:03 16:42	09:27 11:07 20:55 22:36	02:22 04:03 12:15 13:56					
Jan 12	04:51 06:31 14:40 16:18	10:44 12:24 20:32 22:12	02:11 03:52 12:05 13:46					
Jan 13	04:27 06:07 15:55 17:35	10:21 12:01 20:09 21:49	02:01 03:42 11:54 13:35					
Jan 14	05:43 07:23 15:31 17:11	09:58 11:38 19:47 21:26	01:50 03:31 11:44 13:24					
Jan 15	05:19 06:59 15:08 16:47	09:35 11:15 21:02 22:44	01:40 03:21 11:34 13:14					
Jan 16	04:56 06:36 14:45 16:23	10:51 12:32 20:39 22:20	01:29 03:10 11:24 13:03					
Jan 17	04:32 06:12 15:59 17:40	10:28 12:09 20:17 21:56	01:19 03:00 11:13 12:53					
Jan 18	05:48 07:28 15:36 17:16	10:05 11:45 19:54 21:33	01:08 02:49 12:42 14:25					
Jan 19	05:24 07:04 15:12 16:51	09:42 11:22 21:10 22:51	00:58 02:39 12:32 14:14					
Jan 20	05:00 06:40 14:49 16:27	09:19 10:59 20:47 22:27	02:28 04:09 12:21 14:03					
Jan 21	04:36 06:16 16:04 17:45	10:36 12:16 20:24 22:04	02:18 03:59 12:11 13:52					
Jan 22	05:52 07:33 15:40 17:20	10:13 11:53 20:01 21:40	02:07 03:48 12:01 13:42					
Jan 23	05:28 07:09 15:17 16:56	09:49 11:29 19:39 21:17	01:57 03:38 11:50 13:31					
Jan 24	05:05 06:45 14:53 16:32	09:26 11:06 20:54 22:35	01:46 03:27 11:40 13:20					
Jan 25	04:41 06:21 16:08 17:49	10:43 12:23 20:31 22:11	01:36 03:17 11:30 13:10					
Jan 26	05:57 07:37 15:45 17:25	10:20 12:00 20:08 21:48	01:25 03:06 11:20 12:59					
Jan 27	05:33 07:13 15:21 17:01	09:57 11:37 19:46 21:25	01:15 02:56 11:10 12:49					
Jan 28	05:09 06:49 14:58 16:37	09:34 11:14 21:01 22:43	01:05 02:45 12:38 14:21					
Jan 29	04:45 06:25 16:13 17:54	10:50 12:31 20:38 22:19	00:54 02:35 12:28 14:10					
Jan 30	06:01 07:42 15:49 17:30	10:27 12:08 20:16 21:55	02:24 04:05 12:18 13:59					
Jan 31	05:37 07:18 15:26 17:05	10:04 11:44 19:53 21:32	02:14 03:55 12:07 13:48					

GEO Helplines

Douglas Deans

Dunblane, Perthshire, SCOTLAND

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

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

John Tellick

Surbiton, Surrey, ENGLAND

Meteosat-8 advice - registering for the various MSG services, hardware and software installation and troubleshooting. John will also field general queries about any aspect of receiving weather satellite transmissions.

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

Keith Holland

London, ENGLAND

Specifically, help for APT users (137 MHz band).

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

David Strickland

Truro, Cornwall, ENGLAND

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

- e-mail: David@Strickland.uk.com

Geoff Morris GW3ATZ

Shotton, Flintshire, NE WALES

Geoff has lots of experience with aerial, co-ax, connectors, mounting hardware etc. and has also done a lot of work with the orbiting satellites. Geoff has been a EUMETCast Meteosat-8 user for some time and is familiar with David Taylor's MSG software; he should be able to share his experiences with newcomers to this branch of the hobby.

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

Guy Martin G8NFU

Biggin Hill NW Kent, ENGLAND

Guy is prepared to advise anyone who wishes to receive MSG under Windows 2000.

- agm@tonbridge-school.org

Hector Cintron

San Juan, Puerto Rico, USA

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

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

Email contact can of course be made at any time, but we would ask you to respect privacy by restricting telephone contact to the period 7.00-9.00 pm in the evenings.

Internet News/Discussion Groups

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

APT Decoder

This is a group where users of Patrik Tast's APTDecoder can share information and problems.

<http://tech.groups.yahoo.com/group/APTDecoder/>

GEO-Subscribers

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

<http://tech.groups.yahoo.com/group/GEO-Subscribers/>

Satsignal

An end-user self help group for users of David Taylor's Satellite Software Tools (SatSignal, WXtrack, GeoSatSignal, HRPT Reader, GroundMap, MSG Data Manager, AVHRR Manager and the ATOVS Reader.

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

MSG-1

A forum dedicated to Meteosat Second Generation (MSG), where members share information about the EUMETCast reception hardware and software.

<http://tech.groups.yahoo.com/group/MSG-1/>

METOP

A forum for users of high-resolution AHRPT data from the MetOp satellite, available via EUMETCast.

<http://tech.groups.yahoo.com/group/METOP/>

AVHRR

A forum for users who download high-resolution EARS-AVHRR data from the NOAA polar orbiting weather satellites via EUMETCast.

<http://tech.groups.yahoo.com/group/AVHRR/>

ATOVS

A Group for discussions about using ATVOVS data. Data from the whole world is available from CLASS (www.class.noaa.gov) and for an extended Europe, via EUMETCast.

<http://tech.groups.yahoo.com/group/ATOVS/>

Weather Satellite Reports

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

<http://tech.groups.yahoo.com/group/weather-satellite-reports/>

WXtoImg

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

<http://groups.yahoo.com/group/wxtoimg-1/>

Websites

MODIS Real-Time Earth Images

Recent high-resolution imagery from NASA's Terra and Aqua satellites is posted here. There is also a gallery of near real-time current images.

<http://rapidfire.sci.gsfc.nasa.gov/gallery/>

Mars HiRISE Imagery

Ultra high-resolution colour images at 30 centimetres per pixel (and better) from the Mars Reconnaissance Orbiter.

<http://hirise.lpl.arizona.edu/>

<http://hirise.lpl.arizona.edu/nea.php>

Atmospheric Optics

Photographs and discussion on cloud phenomena, rainbows, halos, nacreous clouds, fogbows, glories and much more..

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

Cloud Structures

Protographs from orbit, with explanations, of many cloud structures: convective cells, vortexes, cyclones, cloud arcs, gravity waves and more.

<http://www.brockmann-consult.de/CloudStructures/>

The Copy Deadline for GEO Quarterly No 17 is Saturday, January 26

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

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

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

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

Images and Diagrams

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

Gridding, Overlays and Captions

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

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

Submission of Copy

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

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

geoeditor@geo-web.org.uk

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

editor.geo@googlemail.com

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

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Auto - FTP

Upload Satellite images to your website in real-time

Giuseppe Cico

When I started receiving EUMETCast digital services I found the images produced by David Taylor's software quite stunning. So much so that I was eager to find a way to look at them while working at my office. The problem was how to make regular automatic updates to my website, something I solved by scheduling *GeoSatSignal* sessions using batch files—like the one listed in figure 4. Note that text has been modified for the purposes of this article, removing customised paths and personal information to make the lines shorter.

At the very beginning, in *line 2* of the script, there is a strange command, **realdote**. *Realdote.com* is a useful DOS executable which allows the creation of dynamic time-related commands. It can be downloaded from

<http://www.huweb.hu/maques/realdote.htm>

and should be placed in the *C:\WINDOWS\system32* folder so that you have this new command available.

Data collected from EUMETCast are organised in folders with names related to date. In my script, CCYY means 'century and year', MM 'month' and DD 'day', in accordance with the command-line syntax explained on the web page. In the example shown, **realdote** creates, runs and then deletes a temporary batch file which sets the variable **today** to '2007/09/24/20070924'. I use this to solve the problem 'how do I get today's latest free 6-hour image?'

In line-6, **realdote** is used again, to extract the current hour in the variable **timeHH** and the loop from *lines 7 to 10* obtains the free image at 6 am. It is important to use the **today** variable here, otherwise, using the conventional '...*0600-msg...' time format gets data from the previous day. When the script uses **timeHH** it translates into

```
<GSS path>\GeoSatSignal.exe" <MSG data
path>\HRIT\2007\09\24\200709240600-msg-ch01.jpg -j37 -
colour:<public path>\MSG_VISIBLE.jpg -min ( wrapped line )
```

If the image *200709240600-msg-ch01.jpg* doesn't exist, nothing is done and the destination file *MSG_VISIBLE.jpg* is not modified.

This way, an *MSG_VISIBLE.jpg* file is generated at 06:00, 12:00 and 18:00 using only the current day's data, provided that valid data has been received. In my setup, the file *MSG_VISIBLE.jpg* is generated with job37 from GSS ('-j37' in line 8), and is a quarter-sized full disk image (figure 1). *MSG_REMAP.jpg*, a remapping of Europe (figure 2) is created with job5 ('-j5' in line 9).

The batch file continues, creating hourly IR images but limiting visible ones to between 6-17 hours (*lines 28,29 - 33*).

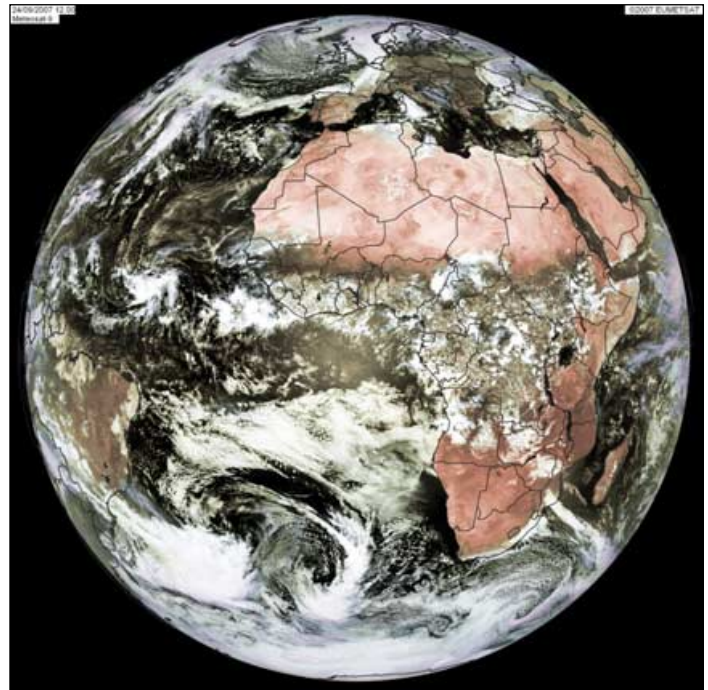


Figure 1 - Meteosat full disc image
Image © EUMETSAT 2007

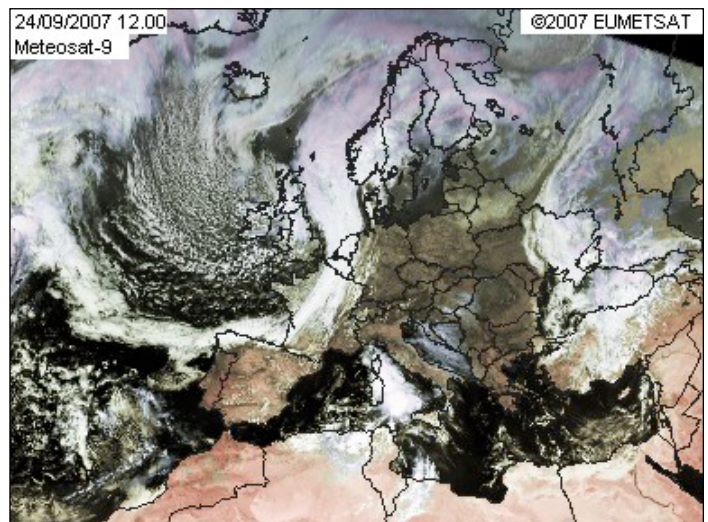


Figure 2 - Meteosat: Europe zoom
Image © EUMETSAT 2007

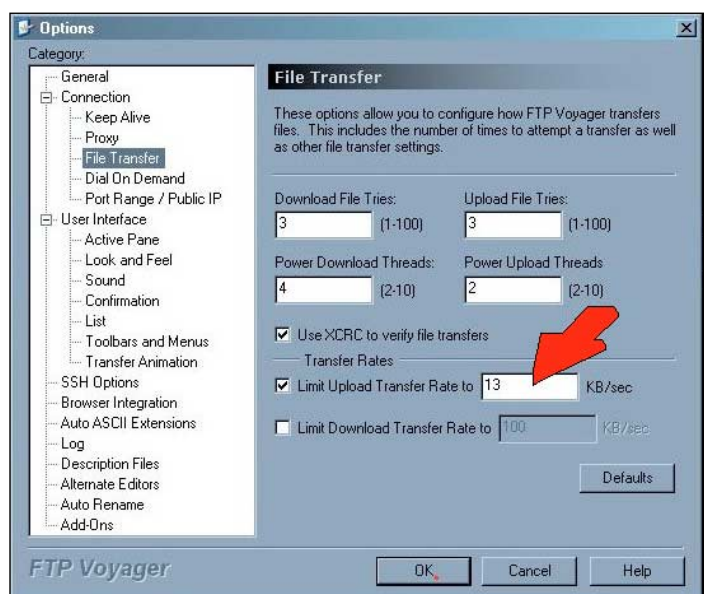


Figure 3 - FTP Voyager

```

1 title "MSG JPEG ( @ hh.15 )"
2 realsdate /f="set today=\CCYY\MM\DD\CCYYMMDD" >set_today.bat
3 call set_today.bat
4 del set_today.bat
5 rem *** 6-hourly public at 6
6 for /f %%i in ('realsdate.com /f="hh"') do (set timeHH=%%i)
7 if %timeHH% EQU 06 (
8 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\%today%0600-msg-ch01.jpg -j37 -colour:<public path>\MSG_VISIBLE.jpg -min
9 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\%today%0600-msg-ch01.jpg -j5 -remap:< public path>\MSG_REMAP.jpg -min
10 )
11 rem *** 6-hourly public at 12
12 for /f %%i in ('realsdate.com /f="hh"') do (set timeHH=%%i)
13 if %timeHH% EQU 12 (
14 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\%today%1200-msg-ch01.jpg -j37 -colour:<public path>\MSG_VISIBLE.jpg -min
15 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\%today%1200-msg-ch01.jpg -j5 -remap:<public path>\MSG_REMAP.jpg -min
16 )
17 rem *** 6-hourly public at 18
18 for /f %%i in ('realsdate.com /f="hh"') do (set timeHH=%%i)
19 if %timeHH% EQU 18 (
20 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\%today%1800-msg-ch01.jpg -j37 -colour:<public path>\MSG_VISIBLE.jpg -min
21 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\%today%1800-msg-ch01.jpg -j5 -remap:<public path>\MSG_REMAP.jpg -min
22 )
23 rem *** create hourly IR MSG
24 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\*-msg-ch07.jpg -j39 -remap:<private path>\MSG_THERMAL_1H.jpg -min
25 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\*-msg-ch07.jpg -j47 -remap:<private path>\MSG_NW_CH7_1H.jpg -min
26 rem *** create Vis MSG between 6-17 GMT hours
27 for /f %%i in ('realsdate.com /f="hh"') do (set timeHH=%%i)
28 if %timeHH% GEQ 06 (
29     if %timeHH% LEQ 17 (
30 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\*-msg-ch01.jpg -j40 -remap:<private path>\MSG_REMAP_1H.jpg -min
31 "<GSS path>\GeoSatSignal.exe" <MSG data path>\HRIT\*-msg-ch01.jpg -j35 -colour:<private path>\MSG_VISIBLE_1H.jpg -min
32     )
33 )
34 rem *** files upload
35 "<ftp path>\FTP Voyager\FTPVoyager.exe" host=<ftp host> user=<user> pass=<password> remote=<remote folder> local=<local folder>
    autoquit=1 autosync=1 syncoptions=2334 maxthreads=2 -nosplash
36 exit

```

Figure 4 - The complete batch file (the line numbers are **not** part of the file and are provided only for reference from the text)

The batch procedure ends with files uploading (*line 35*). Obviously, in respect of my EUMETSAT licensed data policy, licensed images are not available for public viewing.

FtpVoyager is a licensed ftp client which you can download from

www.ftpvoyager.com

I prefer using this client instead of native ftp because of certain features. You can **synchronise folders** (allowing you to mirror files and folders between a local PC and a remote server) and **limit bandwidth**. For example, I have a 256 kb/s upload ADSL, so use two sessions with approximately 100 kb/s (13 kByte/s) each to leave me around 50 kb/s available for email etc.

The syntax I use in *line 35* of my batch file means 'upload modified files, two at the same time, to the remote folder from my local folder', and is controlled by the options 'syncoptions=2334' and 'maxthreads=2'. Note that this is a long line which wraps around over two text lines.

Option 'syncoptions=<value>' states which synchronisation has to be made and <value> is the sum (0+2+4+8+16+256+2048 = 2334) of selected parameters from a table listed in the program's on-line help. The option 'maxthreads=2' means 'send two files at same time'. The bandwidth for each upload is set in the general configuration screen of the client (figure 3).

I have similar batch files which create FSD and other files which you can view in the public area of my web site

<http://www.giuseppiccico.eu>

by selecting 'viewing Earth from space'.

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Aral Sea



Can this man-made disaster be reversed?

Les Hamilton

Pick up any atlas more than 10 years old, flip to the page showing central Asia and home in on the border between Kazakhstan and Uzbekistan; straddling it is the characteristic 'inkblot' outline of the Aral Sea. But a glance at any recent weather satellite image shows a very different scene. As recently as 1960 the Aral was the world's fourth largest lake boasting a surface area of 60 000 km². But in what is now widely considered to be the greatest ecological disaster of modern times, the Aral had, by 2004, shrunk by an astonishing 70% to under 18 000 km² and its surface fallen from 53 metres above sea level to just 36 m a.s.l. Placed in perspective, this is equivalent to completely draining the Great Lakes Erie and Ontario in North America.

The two satellite views reproduced here graphically illustrate the magnitude of the changes that have taken place as recently as the past decade alone. Figure 1 is a 1996 NOAA-14 image showing that the Aral had already divided into two separate bodies of water, the *Small Aral Sea* and the *Large Aral Sea*. In figure 2, a Metop-A image acquired in August 2007, the recession of the Aral shoreline, particularly in its larger southern basin, is starkly revealed.

By way of illustration, the city of Aralsk stood on the northern shore of the Aral Sea as recently as 1970 (figure 4). Three decades later, the water level had fallen by over 16 metres and the sea had receded almost 100 kilometres from the former fishing port. Today, numerous fishing boats lie rusting on the exposed bed of the former sea (figure 5), shipyards where these vessels used to be built stand empty and the town's fish processing plant, once the largest in the former Soviet Union, has been abandoned.

Geographical Context

Millions of years ago, the region that nowadays comprises northwestern Uzbekistan and southern Kazakhstan was a large inland sea. Over the millennia this dried out, leaving behind broad plains of highly saline soil and the body of water that we now call the Aral Sea. Located in a low-lying near-desert region in the centre of the world's largest landmass, the Aral basin experiences a continental climate where summer temperatures can exceed

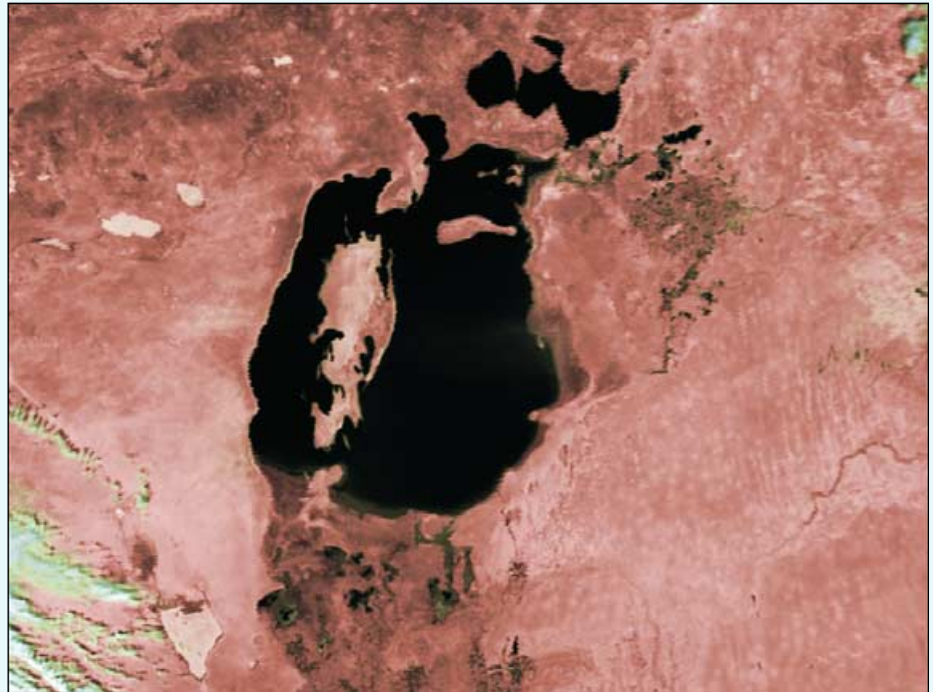


Figure 1 - NOAA 14 at 09:32 UT on June 3, 1996
Image: NOAA CLASS Archive (<http://www.class.noaa.gov>)

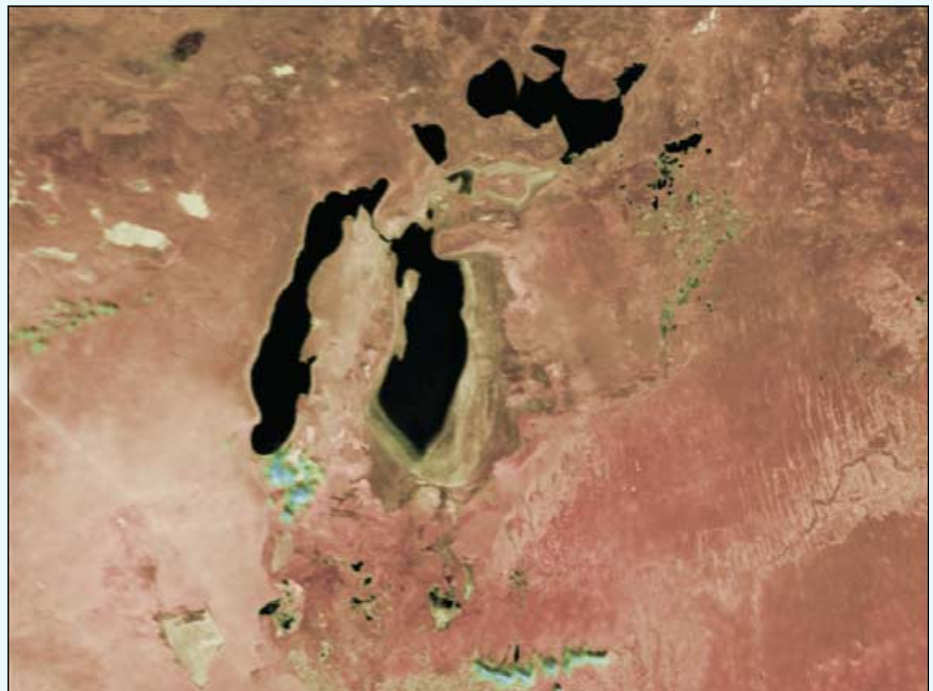


Figure 2 - Metop-A at 13:07 UT on August 23, 2007
Image: NOAA CLASS Archive (<http://www.class.noaa.gov>)

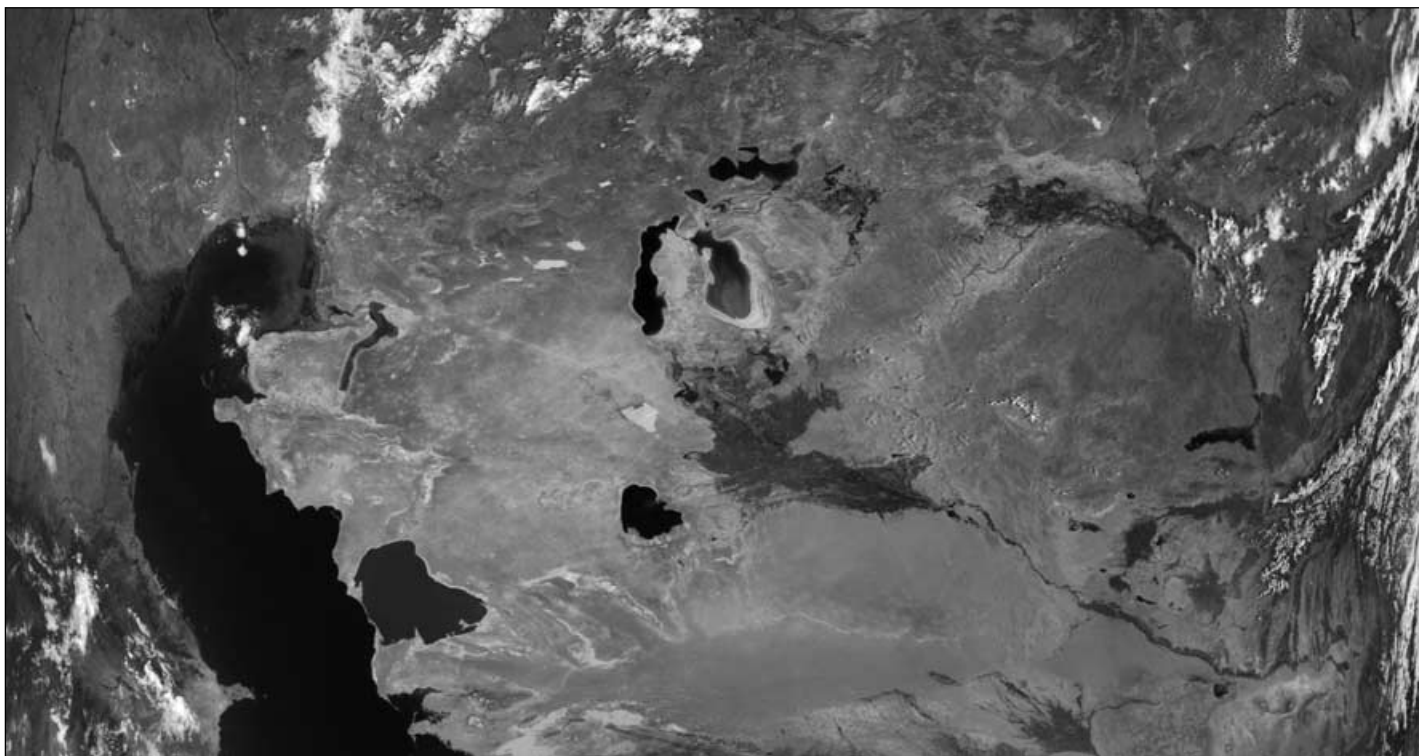


Figure 3 - The Caspian Sea and Aral Sea basin - Metop-A image from Eric Dean (© EUMETSAT 2007)

40°C while those in winter frequently plummet to -20°C and below. Since evaporation rates are high, the Aral's water balance depends almost entirely on the inflow from central Asia's two major rivers, the 2,580 km long Amu Darya which originates in the snow-capped Pamir Mountains and the 2,220 km Syr Darya which develops from tributaries rising in the snowy Tien Shan ranges of east Kyrgistan. Eric Dean's splendid Metop-A image (figure 3) details the courses of both rivers.



Figure 4 - The Aral sea and its feeder rivers

The Situation 50 Years Ago

The word 'Aral' means 'island' in the Kazakh language, a reference to the fact that the sea used to be dotted by more than a thousand small islands. Half a century ago the Aral was a brackish lake with a salinity level of just 10 grams per litre, less than one third of that typically present in the planet's oceans. This supported a thriving fishing industry, principally of freshwater species. As

recently as 1960, half the combined annual discharge from the two rivers, some 56 cubic kilometres of fresh water, was reaching the Aral. But developments during the sixties and seventies were to radically change that.

The Aral Sea Plan

Irrigation of the fertile lands between the Amu Darya and the Syr Darya had been practised for many centuries, yet the Aral Sea had endured in a delicate balance with the needs of mankind. During the early 1960s, the Soviet Union undertook a major irrigation project, the 'Aral Sea Plan' designed to convert the surrounding plains into the nation's major crop producing region, with the emphasis on cereals, rice and in particular, cotton. But due to the arid climate of the region, almost 90% of cultivated land has to be irrigated.

A series of dams was constructed along the lengths of both rivers, creating 94 reservoirs from which a 40 000 km network of canals could distribute water to the surrounding lowlands. By 1990 the area of cultivated land had more than doubled in area to 7.5 million hectares. Cotton production in particular soared and Uzbekistan became one of the world's major cotton producers.

But this agricultural success came at a heavy cost to the Aral Sea itself. As abstraction continued to escalate the annual inflow of fresh water into the Aral dropped below one tenth of its former value. Indeed, during some summers, inflow would dry up altogether as the river's final trickles evaporated before even reaching the sea's shoreline.

Finally, the Amu Darya ceased supplying the Aral altogether, leaving the diminished Syr Darya with the impossible task of supplying the entire Aral basin with water. Figure 4 shows the Aral Sea coastline as it was pre-1960 with the remnant 2004 sea shaded. The Aral Sea had by now lost 80% of its volume in 30 years and salinity had increased fourfold.

Disaster Escalates

Although the reduced volume of river water debouching into the Aral was certainly a major player in the disaster that had befallen it, it was by no means the sole culprit. What water *did* succeed in reaching the Aral was becoming increasingly polluted by the chemical fertilisers and pesticides needed to sustain the crops, not to mention the inevitable industrial waste from the region. As the sea continued to shrink these pollutants became ever more concentrated, rendering the environment hostile to all its freshwater life. Many of the endemic plant and animal species died out and the local fishing industry collapsed completely. Commercial fishing



Figure 5a - Derelict Ships in the Aral Sea
Photo: David Swanson (IRIN)

came to an end in 1982 and entire fishing communities lost their livelihood.

In 1960, when the Aral Sea had been a rich source of fish, Muynak, located on its southern shore, had been a thriving fishing town where over 3000 fishermen plied their trade. In 1957, Muynak fishermen harvested 26,000 tonnes of fish, about half of the total year's catch from the entire Aral Sea. Today, Muynak finds itself in the middle of a desert and over 200 km from the nearest sea-shore. Only rusting fishing boats sitting on a parched desert of salt scrub, sand and broken sea shell now hint at its past prosperity. All twenty species of freshwater fish that used to inhabit the Large Aral Sea have become extinct, unable to survive in the toxic, saline soup that remains.



Figure 5b - A Derelict Ship on the Aral Sea Bed
Photo: © 2007 Buzznet Inc

As the Aral has continued to recede it deposited thousands of tonnes of salt laced with toxic chemicals over more than 36,000 km² of exposed sea bed. When the winds blow, these materials are whipped from the arid surface, carried off as dust clouds, and deposited over thousands of square kilometers of arable land.

Major dust storms rage on more than 90 days annually, redepositing most of these materials within a 300 km radius; but some travels thousands of kilometres and dust from the Aral basin has been detected as far away as Belarus, over 1,000 kilometres to the northwest.

Currently, winds carry an incredible 200,000 tonnes of salt and sand away from the Aral Sea region every day.

It has been estimated that every square kilometre of land receives over 40 tonnes of this dust annually, poisoning the soil, reducing the area available for agriculture, destroying pastures, and creating a shortage of forage for livestock. The dust has also seriously compromised the health of the local population amongst whom anaemia, allergies and cancer have all become more prevalent while tuberculosis has reached epidemic proportions. The city of Aral'sk suffers one of the highest infant mortality rates in the world.

Pesticides and fertilisers have also found their way into water and irrigation channels, poisoning the food and drinking water of some five million people. In some localities the water is so contaminated with fertilisers and chemicals that it is no longer suitable for either human consumption or agriculture. In general, drinking water throughout the region now contains four times more salt than the recommended WHO maximum, leading to increases in kidney disease, diarrhoea and other serious ailments. It is scarcely surprising that, over the past three decades, mean life expectancy has fallen from 64 years to just 51 years.

In former times the waters of the Aral Sea had provided a moderating influence on the climate of its hinterland, mitigating the effect of cold Siberian winters, providing a degree of cooling against the summer heat and humidifying the atmosphere. But with decreased surface area the climate of its surrounding region has become more continental: summers are shorter, hotter and almost rainless; winters are longer and relatively free from snow. Together, these effects have shortened the growing season to an average of just 170 days a year, leading to an inevitable reduction in crop yields.

Thus far the ecological disaster in the Aral basin has displaced more than 100,000 people and affected the health of more than five million throughout the region.

Recovery

It seems improbable that the Aral Sea will ever fully recover, not least because Russia and Uzbekistan are more interested in exploiting the southern *Large Aral Sea* for deposits of gas and oil rather than trying to reverse the environmental damage. Recent estimates suggest that over two billion tons of crude oil and two trillion cubic meters of natural gas lie below the sea bed, nearly double the reserves estimated for the Caspian Sea's Russian continental shelf [2].

But it is a different matter for the *Small Aral Sea* to the north where, following the collapse of the Soviet Union, local initiatives raised money to build a dam to prevent its waters draining into the southern basin. The first dam, little more than a barrier of sand, was built 1992 and lasted 9 months until rising sea levels washed it away. A replacement dyke 14 km long by 30 metres wide was erected in 1996 but was badly breached during a storm in 1999 when a 3-km section was washed away.

Nevertheless, the dam had already proved its worth by stabilising the level of the Small Aral and reducing its salinity by half (during which time the

Large Aral fell a further 20 metres), and in 2001 a US\$85 million initiative jointly financed between the Kazakh government and the World Bank embarked on the '*Syr Darya Control and Northern Aral Sea*' project. This began with the reconstruction of nearly 100 km of canals, sluices, and waterworks on the Syr Darya river. The old Soviet sluice gates had become badly rusted and were full of holes while most of the original canals, which had been poorly constructed, lacked a waterproof concrete lining. At least 40% of the waters extracted from the Syr Darya were simply being lost through leakage—if not more!. The remediation effort brought about a rapid improvement—doubling the flow in the river. Not only were the waters of the Syr Darya now irrigating the fields along its banks much more efficiently: it was at last providing an increased inflow of fresh water to the Small Aral Sea.

The next stage of the effort, completed in August 2005, was the construction of the Kokaral dam [3], physically separating the two parts of the Aral Sea. Although separation of the Aral had occurred naturally in 1989, water had continued to spill into the Large Aral via the narrow Berg Strait that linked the two regions of the sea. The new dam, this time constructed from a sand and limestone fill topped by a layer of concrete, effectively sealed this channel, trapping all the increased flow from the Syr Darya within the Small Aral Sea. The dam, more than 13 kilometers long with a foundation 300 metres wide, averages four metres in height (10 metres above the former channel) and is eight metres wide at its top.



Figure 6 - The Kokaral Dam
Photo: Brigitte Brefort / World Bank

It had been anticipated that it would be at least five years before the dam made a significant impact on the level of the Small Aral Sea but, as early as mid 2006, its effect had hugely exceeded expectations. The sea surface had risen four metres and increased in area by a third while salinity had dropped by more than 50%. Already, freshwater fish have started to return from the rivers and fishermen are working the waters again for the first time in a generation. It is planned to reintroduce sturgeon to the sea during late 2007 while some 30 000 fish native to the Aral are currently



Figure 7: MODIS Images from the NASA Terra satellite showing the Small Aral Sea on June 14, 2001
Images: MODIS Rapid response Team at NASA/GSFC



Figure 8: MODIS Images from the NASA Terra satellite showing the Small Aral Sea on May 9, 2007
Images: MODIS Rapid response Team at NASA/GSFC

being reared in hatcheries for a planned release into the sea during 2009. Additional remedial work on the Syr Darya delta is aimed at restoring fishing lakes which will be used as an additional resource for rearing fish for restocking the Aral.

The coastline is already beginning to return to some of the stranded fishing villages while Aralsk, once almost 100 km from the sea, now stands just 12 km from the current shoreline. Though the port still stands some distance from the sea it is already showing signs of revival and a new fish-processing plant handled 2000 tons of fish during 2006.

As of February 2007 [5], the northern sea's area has expanded by a third and water levels had risen over ten metres. Should this progress be maintained then prospects for rehabilitating fishing communities and restoring sustainability are highly promising.

Figures 7 and 8, MODIS images from NASA's *Terra* satellite, provide dramatic evidence of this progress, particularly in the north-eastern bay south of Aralsk. The lower image shows the line of the Kokaral Dam is an unmistakable sharp, angled line crossing the Berg Strait while the lower left-hand portion of the image is partly obscured by one of the frequent dust storms.

The next phase of the project, which may involve increasing the height of the dam itself, could bring water all the way back to Aralsk. Work could begin in 2009, but the design of the project and availability of all-important finance will be key in determining whether the Small Aral Sea can indeed become fully restored to its former depth and area.

A Possible Plan for Complete Recovery

When plans for the original canal system for the Syr Darya and Amu Darya rivers was drawn up it was already foreseen that the Aral Sea would be starved of water. It was originally intended that further canals could be built specifically to address this problem by diverting some of the flow from two major rivers outwith the Aral basin, the Volga and Ob, into the Aral Sea. Sadly, the cost proved prohibitive at the time and the plan was shelved. But as the Aral Sea disaster continues to escalate, particularly in the south of the basin, many prominent Russian political leaders and scientists are once more discussing this option to restore the Aral.

The river Volga flows into the Caspian Sea and has a flow rate three times that of the Syr Darya. Moreover, the Caspian Sea has risen 2.5 metres during the past three decades and coastal cities are at risk of flooding. Diverting perhaps 10% of the Volga's flow into the Aral basin would therefore be doubly advantageous. The plan would require the construction of a canal 800 km in length, 200 metres wide and five metres deep at a projected cost of US\$8Bn. This would drain in a southwesterly direction towards the Aral basin and require very little in the way of assisted pumping because much of the intervening terrain is relatively low-lying. There are no major physical barriers to be overcome and the flow of water could largely be maintained under the influence of gravity alone. The MODIS image on the inside back cover clearly shows the Volga entering the Caspian Sea.

The Ob is an even larger river, which flows north through already saturated terrain towards the Arctic Ocean. To carry its waters towards the Aral would require a canal of similar cross section but three times the length, running from the confluence of the Ob with the Irtysh river. This canal would have to negotiate the Turgay Plateau in northwest Kazakhstan, an upland region with an average elevation of about 300 metres. This plateau is bisected north-to-south by the 600 km long Turgay Depression, a former glacial meltwater channel containing a chain of lakes. This channel rises to a maximum elevation of 126 metres and would provide the line of least resistance. Nevertheless, large pumping stations requiring 2.5 GW of power would be needed to maintain the flow of water. Although the cost is estimated at US\$22Bn, this would almost

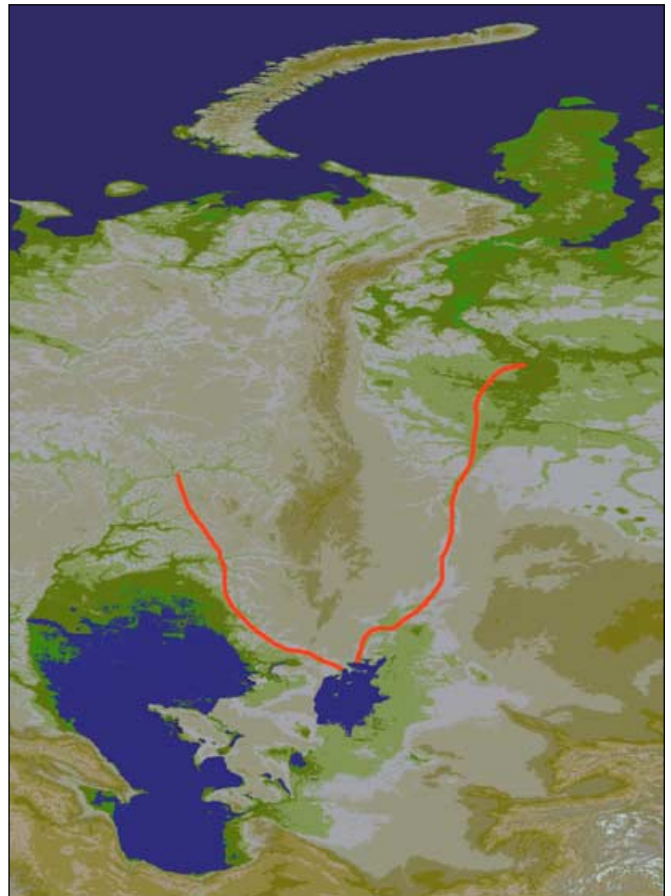


Figure 9
Possible courses for the projected canals linking the Volga and Ob rivers with the Aral Sea

certainly be recouped several times over by the region's eventual prosperity.

Such projects are eminently feasible and these canals would be similar in scale to existing modern systems already in existence in the Syr Darya/Amu Darya catchment area and elsewhere. Once these projected canals were operational, the Aral Sea could be completely refilled in around 20 years, major fisheries could be resurrected and there would be sufficient irrigation water to turn the surrounding region into one of the breadbaskets of the planet. The relief map shown in figure 9 has been mapped from the NOAA/NGDC one kilometre *GLOBE* dataset using proprietary software. The possible routes of these two canals are superimposed on it.

Acknowledgement

Thanks to Eric Dean for useful discussions during the preparation of this article.

Further Reading

The information contained in this article has been gleaned from dozens of sources on the Internet. Readers can learn more about the Aral Sea in the following references.

References

- 1 Aral Sea History
http://www.orexca.com/aral_sea.shtml
- 2 The Aral Sea's Buried Treasure
<http://www.mnweekly.ru/business/20070614/55257968.html>
- 3 Kazakhstan News Bulletin
<http://www.kazakhembus.com/030306.html>
- 4 Release the Rivers
<http://www.ecoworld.com/home/articles2.cfm?tid=354>
- 5 UNESCO Water Portal Weekly Update No.175: The Aral Sea
<http://www.unesco.org/water/news/newsletter/175.shtml>

EUMETCast Without RAMdisk ... an update

Mike Stevens (G4CFZ)

My previous article certainly seems to have produced a lot of interest, especially amongst our leading exponents. I will admit that they do have points of interest but they must appreciate that there are times when we—as amateurs—will experiment with different methods to solve a problem. They must respect the fact that in some cases alternative solutions may work perfectly well.

My system has now been running since early February this year without as much as a hiccup. It is normally active for approximately 8 to 10 hours per day, every day, except when there are storms around when I will run it for longer. I do not run the system 24/7, mainly because I am trying to reduce my carbon footprint at this location.

Memory Upgrade

Since the last article [1] I have upgraded the memory in the desktop PC to 1.5 GB of RAM which has made a considerable difference to its operation. Everything is much smarter and quicker; in fact *EUMETCast* is running in the back ground as I write this article. The external Hard-drive is a *Lacie 250GB/HDD USB 2.0, Porsche* running at 7200 rpm with an NTFS file system. It was manufactured in the USA and has now been operating on my system for just over two and a half years with no problems at all.



Hurricane Dean, captured by the author's EUMETCast system
Image © EUMETSAT 2007

The system is still as laid out as in the previous article and is producing excellent pictures to this day. I occasionally have a couple of chunks missing but nothing too serious. The messages in *Metop Manager* show that some orbits do have missing chunks, most of which seem to appear over the sea or on the dark side of the planet; but the main areas of vision over mainland Europe, the Middle East and the Americas are mostly intact with full runs of data chunks.

Software

The other item I have changed is the *Tellicast* software, reverting back to version 4.0 as version 5.0 gave me a few problems though, given time, I am sure it can be sorted out. I have come to the conclusion that, on certain PCs, Windows XP works fine while on others it can be a bit problematic, depending on what other software you are trying to use: *ARSoft RAMdisk* seems to be one of these, working better on some PCs than others, especially under Windows 2000. I have been informed that *ARSoft RAM Disk* was not designed for Windows XP, so therein lies a problem.

I had a similar problem when trying to load some Amateur Radio software on my Laptop: it just would not settle in with XP and I

expect we shall find the same with the new Vista systems. I for one will wait until the dust settles before going down that road.

Reliability

So, in conclusion, is my system reliable? Yes it is! Nothing has happened to make me say otherwise—there are no hard-drive or file issues, nor do I have problems with files filling up or having to reboot during operation as some people report. Sorting out the '*recv-channels.ini*' file should put that right. Also, there is no severe overheating of the USB hard drive at all. It runs at a reasonable temperature for an 8 to 10 hour session. It has been suggested that the external hard drive could possibly fail; well so could the internal one. And as for being a poorer solution, I can only say that time will tell. If a failure does occur, surely it will be easier to replace an external drive. As long as you keep all the files backed up this would not be a complete disaster.

Final Thoughts

Is a USB hard drive a viable alternative to RAMdisk? That is the big question. I believe it is but others must decide for themselves.

If you are unable to use RAMdisk you could purchase one of the commercially available RAM Drives: this would of course be supported but cost might prove prohibitive.

You can use the excellent *TQChanSel* software from Rob Alblas [2], which enables you to decide which transmissions you wish to receive, to avoid filling up your hard drive with unnecessary files. Nice one Rob!

So the final word is that it works for me and as long as it does so I shall continue to receive the excellent pictures being transmitted by *EUMETCast*.

This hobby of ours is a very exciting one. We just do not know what we are going to see next. With global warming now firmly fixed in our minds and the extreme weather we have experienced in the U.K this summer, we are all looking for the unexpected on our screens, plus experimenting with different procedures and software to see if we can get the very best from our systems. Its something I did for most of my career in the civil service: trial and error, the mother of invention.

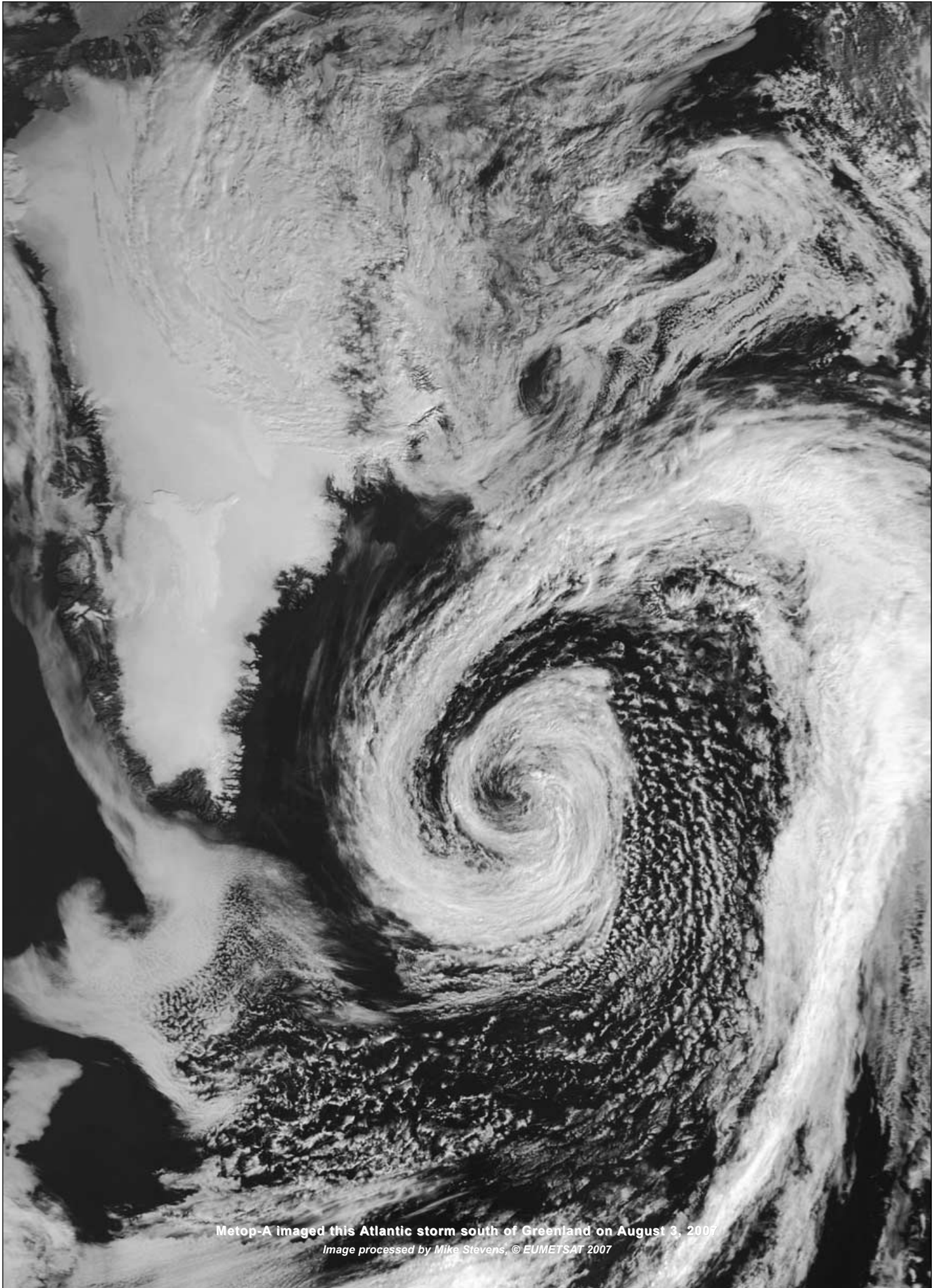
One other item I should mention is that having the satellite meter in circuit with the dish could be handy should you require to disconnect your system from the antenna due to severe electrical storms. I do this every time a storm is in the area for safety reasons. A friend of mine lost his satellite system due to a nearby lightning strike.

I hope that those of you who have RAMdisk are finding everything OK and I wish you well with it. For those of you who cannot get it to work there are alternatives; it's just a case of finding the one that works for you, so keep on trying and experimenting. If all else fails there is plenty of help available within GEO. After all, we all had to start some where at sometime.

I would like to thank those of you who contacted me regarding the previous article. Your comments were appreciated.

References

- 1 Receive EUMETCast without a RAMDisk
Mike Stevens, GEO Q14, page 11.
2. TQChanSel - Control EUMETCast Channels
Rob Alblas, GEO Q14, page 34



Metop-A imaged this Atlantic storm south of Greenland on August 3, 2007.
Image processed by Mike Stevens, © EUMETSAT 2007

Ten Years of SeaWiFS Data

Peter Wakelin

In late 1997, many hobbyists were busy modifying their HRPT equipment to receive the multi-spectral imagery from SeaWiFS following the announcement that during the testing and check-out phase, which was expected to last for 90 days, the data would be unencrypted. Despite the approaching winter and falling light levels, many amateurs in temperate northern latitudes, and elsewhere, did receive excellent imagery for several weeks before encryption began. I suspect the amateur community largely forgot about SeaWiFS following encryption but it continues in reasonably good health and has amassed a huge amount of valuable data as it begins its second decade of service.

Background

SeaWiFS (Sea-viewing Wide Field-of-view Sensor) was designed to significantly improve on the historical proof-of-concept successes of its predecessor, the Coastal Zone Color Scanner (CZCS) which was launched on the *Nimbus-7* weather research satellite in 1978 and operated for eight years.

SeaWiFS is a part of NASA's *Mission to Planet Earth* and was one of NASA's early attempts at a commercial partnership. *Orbital Sciences Corporation* (now called *GeoEye*) won the fixed-price contract. SeaWiFS is the only instrument on the *SeaStar* satellite (later renamed *OrbView-2*) and was launched into a low orbit by a Pegasus XL vehicle dropped from an aircraft off the coast of California on August 1, 1997. The spacecraft's thrusters later raised it to the operational 705 km near-noon sun-synchronous orbit.

The Instrument

There are four sensors for each of the eight spectral bands whose centre wavelengths range between 412 and 865 nanometres in the visible and near-infrared parts of the spectrum. Band 1, at the violet end of the spectrum, is best suited to detect dissolved organic matter whereas bands 2, 3 and 4 in the blue and blue-green zone are used for chlorophyll and pigment absorption. Band 5 is primarily for pigments, optical properties and sediments. The longer red and infrared bands are used mainly to determine atmospheric corrections but the infrared, in particular, is ideal for detecting aerosols. The sensors are mounted on a tilt mechanism permitting a $\pm 20^\circ$ offset to avoid sunglint from water surfaces. On May 31, 1998, an image was captured at Dundee University in Scotland, which showed a discontinuity caused by activation of this tilt mechanism. As the instrument operates largely in the visible part of the spectrum, it is switched off when the solar zenith angle is greater than 73° to conserve power.

Examples of applications include:

- providing information on the global cycles of carbon, oxygen and nitrogen into and out of the oceans
- helping scientists determine the contributions of phytoplankton in reducing global carbon dioxide
- showing the location of pollutants
- providing information on harmful organisms (e.g. the 'red tides' of the *Karenia brevis* species of phytoplankton)
- showing scientists where ocean currents provide plant nutrients
- providing information on the location of fish populations for the commercial fishing industry

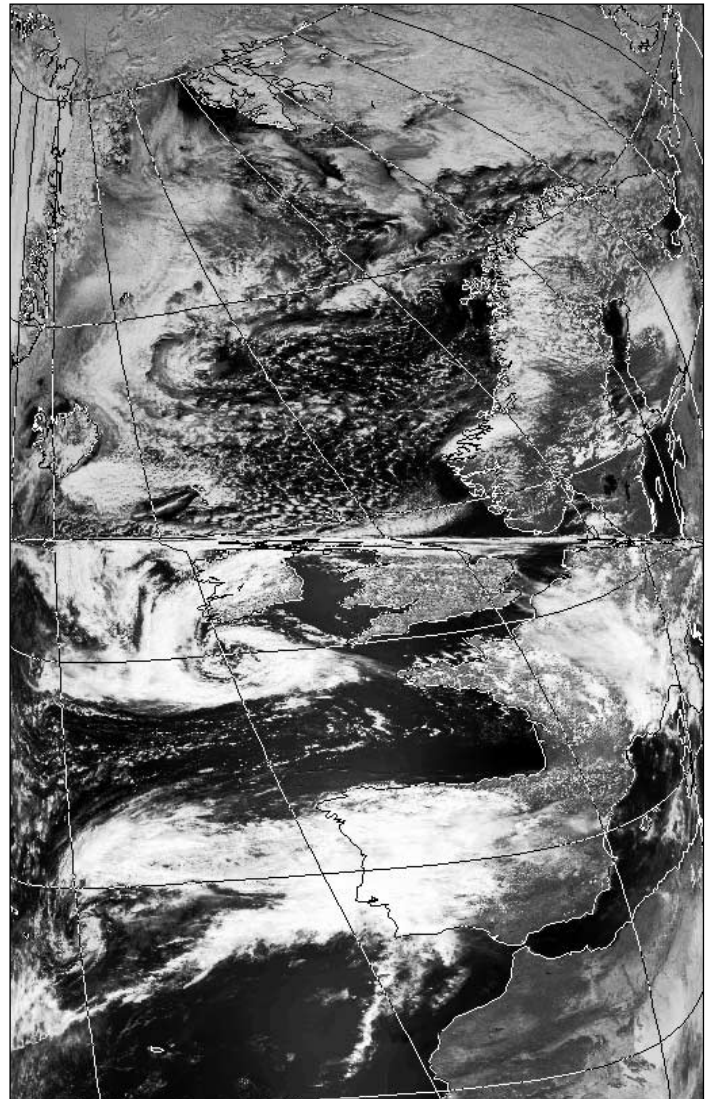


Figure 1 - The sensor tilt mechanism was activated during this pass

Credit: Dundee University

- knowledge of ocean currents for the shipping industry
- knowledge of ocean eddies and jets for oil drilling

Local area coverage data are transmitted in real time in the HRPT format on 1702.56 MHz whilst global data are stored on board and dumped to the Wallops Flight Facility on 2272.5 MHz as the spacecraft passes overhead.

More technical data on the SeaWiFS instrument and its uses can be found on the Internet; typing the keyword 'SeaWiFS' into any search engine will reveal many sources of information and show how widely the data have been used in research projects throughout the world.

The Future

The successor to SeaWiFS is the MODIS (Moderate resolution Imaging Spectroradiometer) which incorporates many more spectral bands but the wavelengths used in SeaWiFS are also

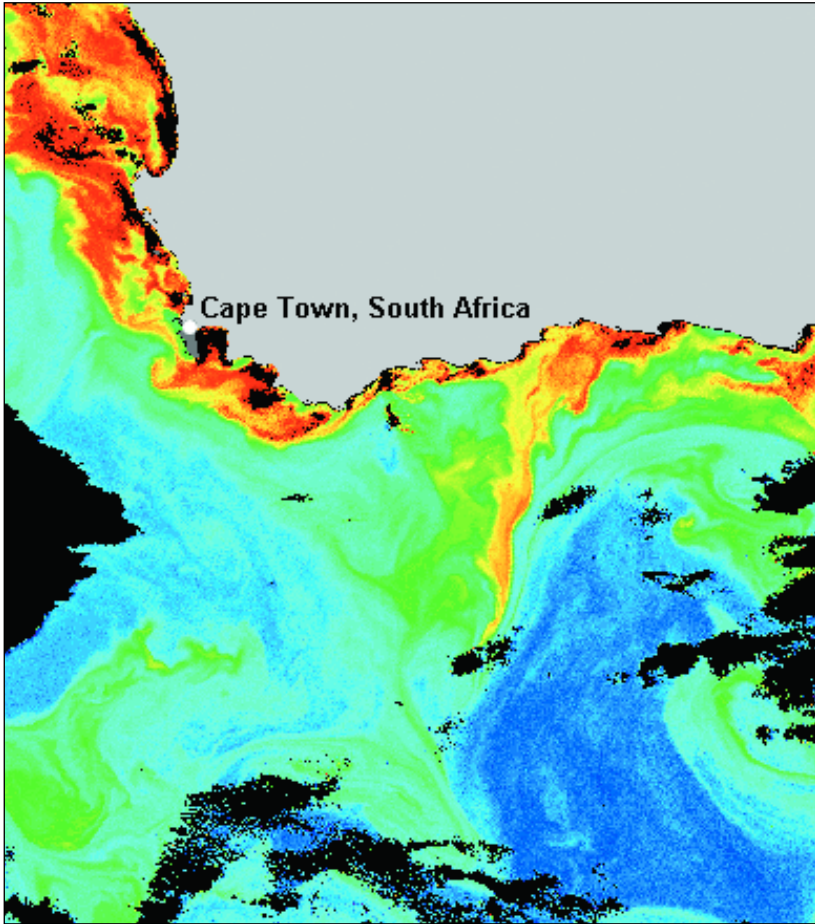


Figure 2 - Currents converge off Southern Africa

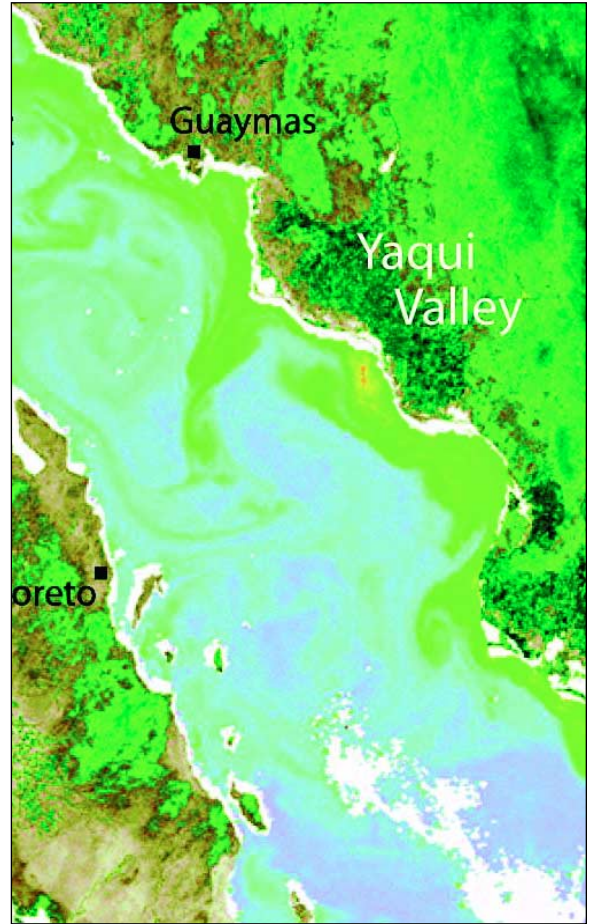


Figure 3 - Chlorophyll in the Gulf of California

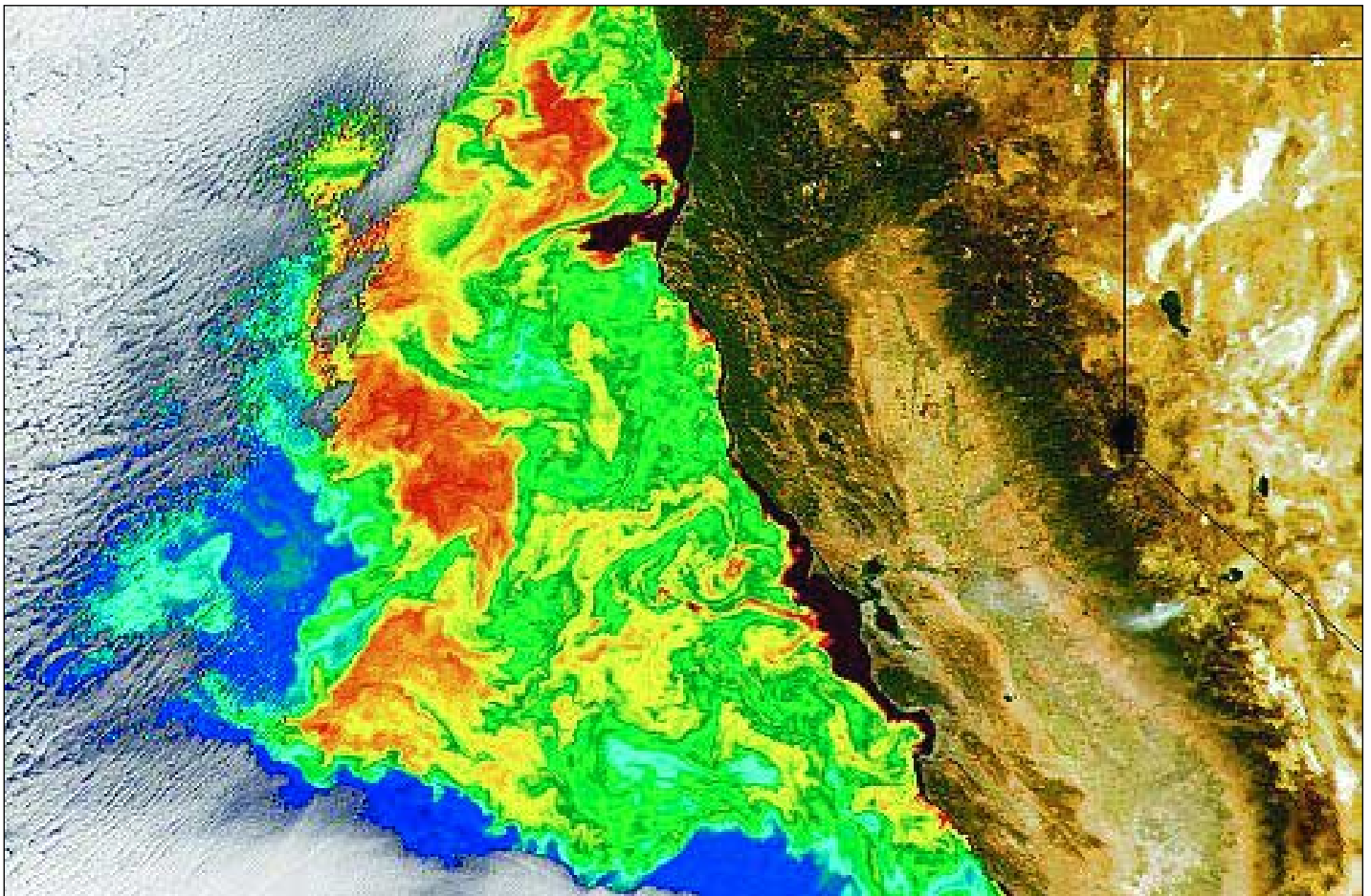


Figure 4 - A nutrient-rich upwelling off the coast of California

utilised in MODIS so that direct comparisons can be made. Although MODIS is now flying aboard several satellites, NASA are continuing to operate SeaWiFS nearly six years beyond its designed lifetime as the returned data are valuable and the operating costs are minimal. Deteriorating batteries will probably end the mission soon but for a low-cost, small satellite, the SeaWiFS mission has been a resounding success.



Figure 5 - The red and infrared bands on SeaWiFS readily detect these Namibian dust plumes but do strange things to the clouds in the lower left

Some SeaWiFS False-Colour Images

Figure 2 shows interesting features off the coast of South Africa on March 28, 1999. Here the warm Agulhas current of the western Indian Ocean converges with the cold Benguela current that originates off Antarctica and moves up the west coast of South Africa. The large, straight convergence zone is marked by high-productivity waters (the higher chlorophyll concentrations appear as red, orange and yellow in this false-colour image) where the Agulhas current is forced to make a sharp turn to the south. The strong dynamics of the area can be seen in the patterns of eddies near the convergence zone. Strong upwelling in the Benguela current brings nutrient-rich water to the surface where phytoplankton multiply rapidly leading to high chlorophyll levels. Marine life is rich and varied in this area.

Figure 3 shows a chlorophyll-rich area off the Mexican coast in the Sea of Cortez (also known as the Gulf of California) which scientists from Stanford University have shown to be caused by fertiliser run-off from the intensively farmed Yaqui Valley. Two crops of irrigated wheat are grown in an area in excess of 2,000 square kilometres each year requiring large quantities of artificial fertilisers. Excess water from irrigation carries nitrogen and other nutrients into the river and eventually to the sea resulting in greatly increased algal (phytoplankton) growth. Researchers at Stanford University, led by Pamela Matson, examined SeaWiFS images over a 5-year period and were able to show that these algal blooms consistently appeared within days of irrigation events. Although such blooms occur naturally, scientists have long suspected that blooms fuelled by fertiliser



Figure 6 - High turbidity is evident in the Sea of Azov compared with the Black Sea

run-off can lead to the harmful blooms known as 'red tides' which release toxins into the water that can poison molluscs and fish.

Figure 4 is part of a SeaWiFS image taken on 6 October, 2002 as the spacecraft was southbound off the coast of California. The southward moving shallow current off the Californian coast tends to move away from the coast in response to the Coriolis force resulting from the Earth's rotation. In so doing, cold, nutrient-rich water wells up from below to replace it. This upwelling fuels the growth of phytoplankton which, along with larger seaweeds, in turn nourish the incredible diversity of creatures found along the Californian coast. SeaWiFS can easily 'see' this upwelling and associated ocean turbulence by locating the chlorophyll-bearing phytoplankton. High chlorophyll levels are shown as red and orange in this false-colour image whereas land and clouds are depicted close to their natural colours.

Acknowledgement

Images are courtesy the NASA SeaWiFS team unless stated otherwise.

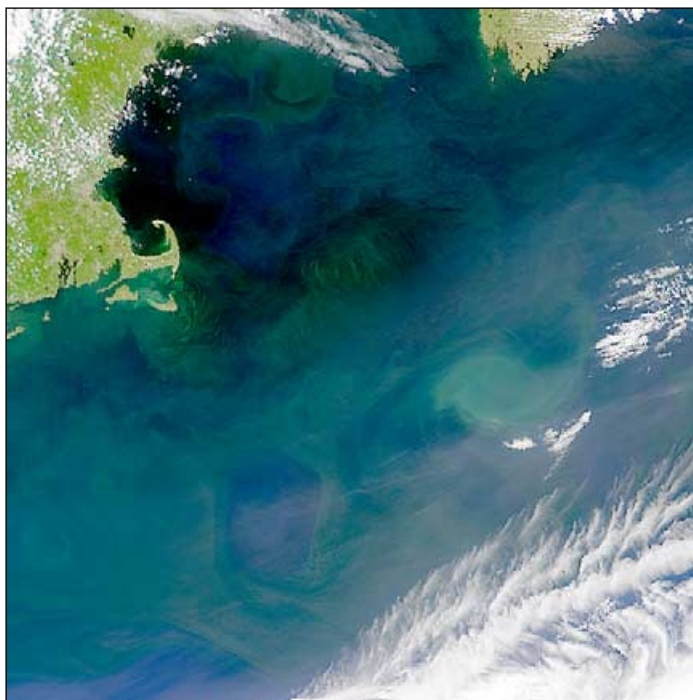
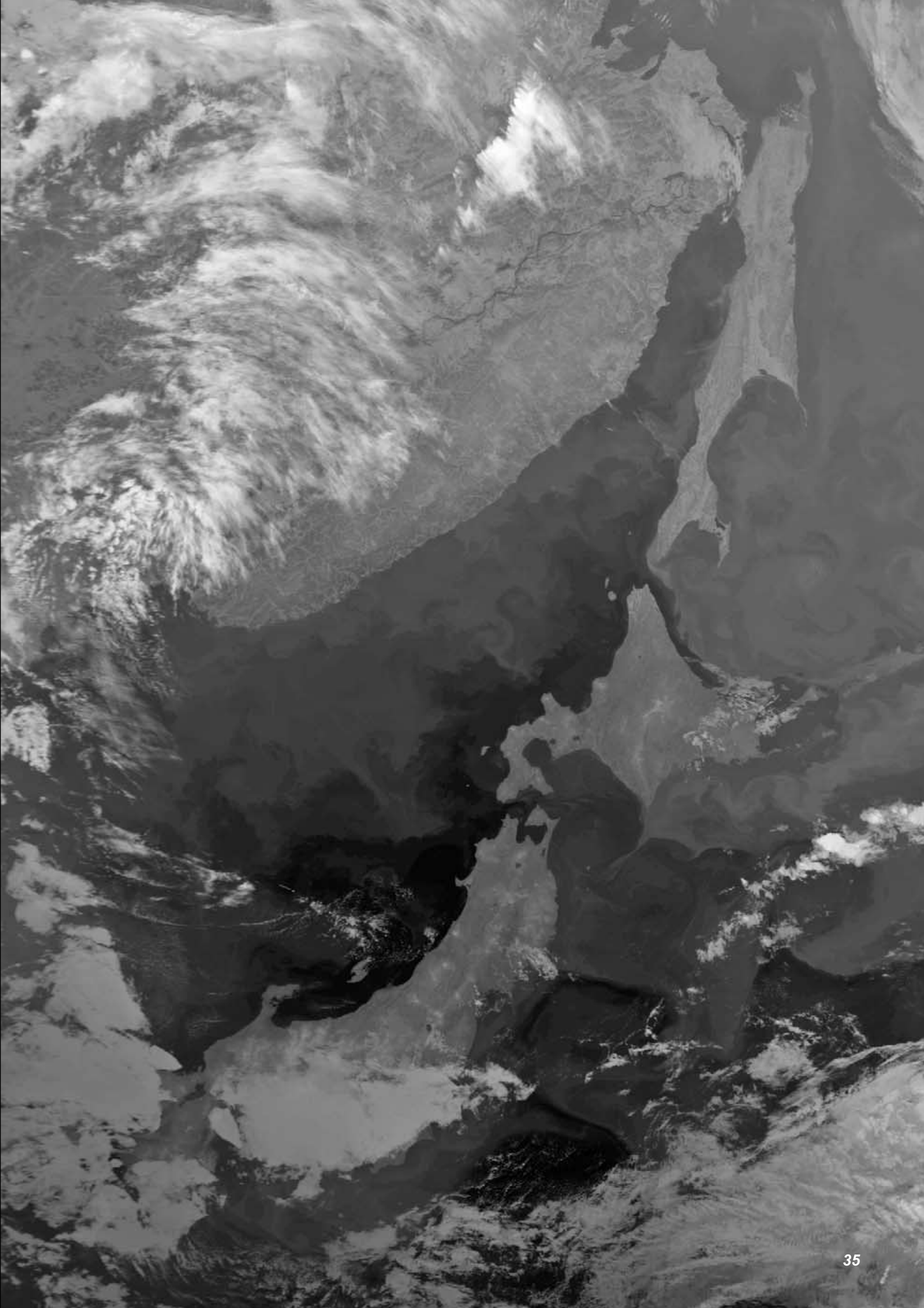


Figure 7 - This SeaWiFS view of the northeastern U.S. shows several eddies along the north edge of the Gulf Stream



Imaging the Greek Fires

Making the most of HRPT Reader's False-Colour Options

Arne van Belle

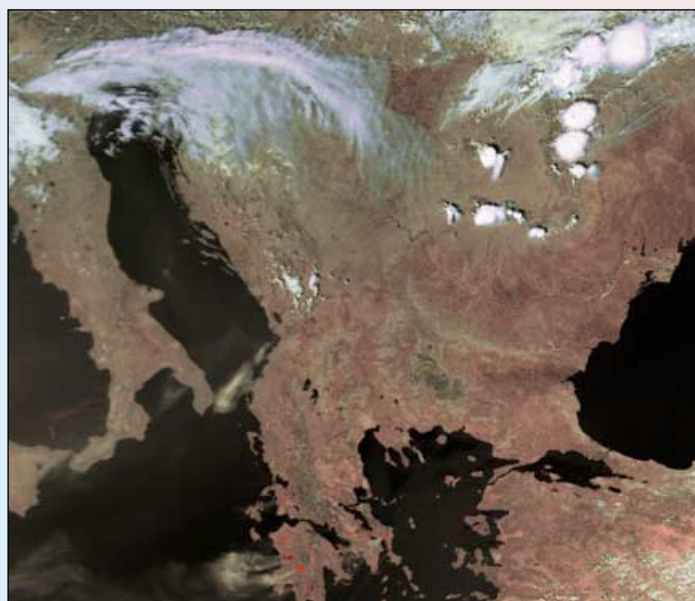
Like many GEO Quarterly readers, I followed the forest fires in Greece and elsewhere with interest on my EUMETCast images. It is often possible to highlight specific features by careful

manipulation of the colour channels in David Taylor's HRPT Reader program. I hope readers will find the selection of images presented below of interest.



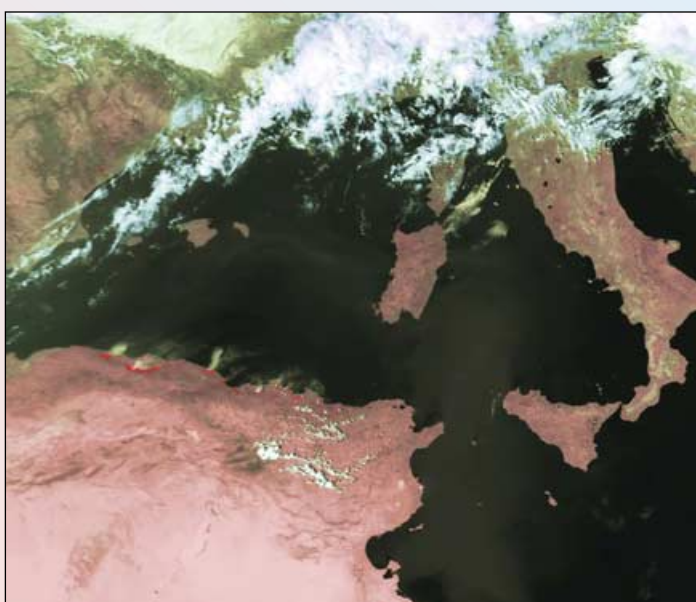
Metop-A image from August 25, 2007, processed in R3G2B1 mode, showing huge smoke trails from the wildfires in Greece.

Image: via EPS-Global on EUMETCast, © EUMETSAT 2007



This NOAA18 image from August 25, 2007 shows the Greek fires at their peak and was processed using HRPT Reader / FalseColour-FireDetection mode

Image received over EARS-AVHRR, © Eumetcast 2007

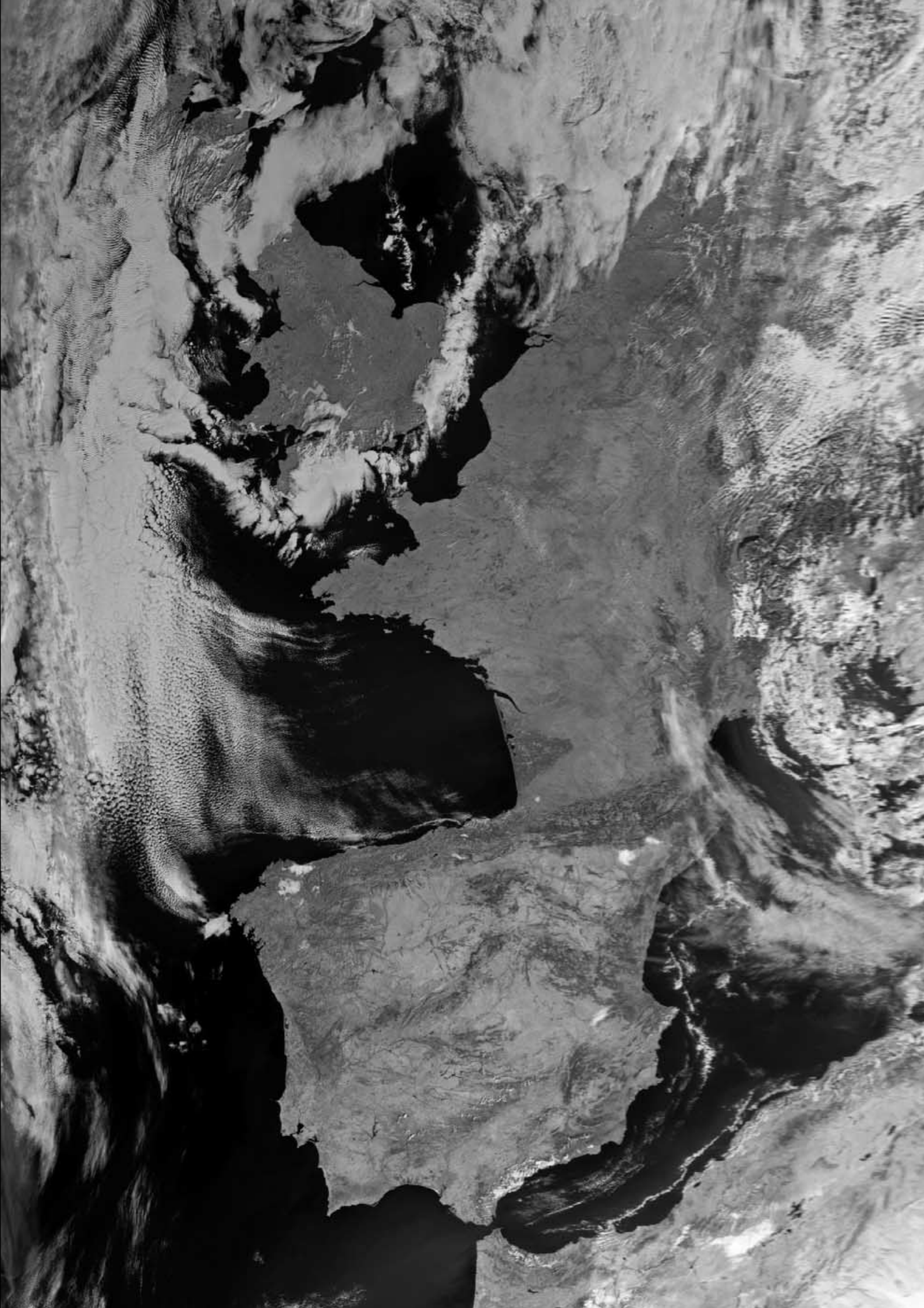


The two images above come from the same NOAA-18 image dating from August 29, 2007. The clip on the left, processed using HRPT Reader's false-colour/fire-detection mode, shows up the many small fires raging in Algeria. The right-hand clip shows that most of the Greek fires have at last been successfully extinguished. Processing in HRPT Reader used R3iG2B1 mode (where Red = channel-3 inverse, Green = channel-2 and Blue = channel-1).



NOAA18 images using channel 3B during daylight passes are particularly well suited for fire detection. Clearly visible are the huge scorched areas (dark red), while the still active fires colour a fierce orange/red. As you can see, other countries like Bosnia and Bulgaria were also hit by large fires.

Image received over EARS-AVHRR, © Eumetcast 2007



DownloadPrograms

New Software from Fred van den Bosch

This article describes new software called *DownloadPrograms* that checks various Internet sites for new versions of weather satellite related software and, if there is a newer version than the one installed on your own computer, automatically downloads it.

Motive and design

David Taylor [1] regularly brings out new versions of his programs. If there are new developments, or there is a beta version, several new updates of a program can appear during a single same day. If you have a large number of programs running on your system it can be difficult to remember which versions are installed and which ones you still have to download. If you are lazy as me that's a problem! So I grabbed my keyboard and keyed in this program. The design is as follows.

websites for Rob Alblas [2], myself [3] and Les Hamilton [4] to it. There is not a great selection of sites (unfortunately!). Nevertheless, anyone who has written software that they would like added, or who has other suggestions, can email me at:

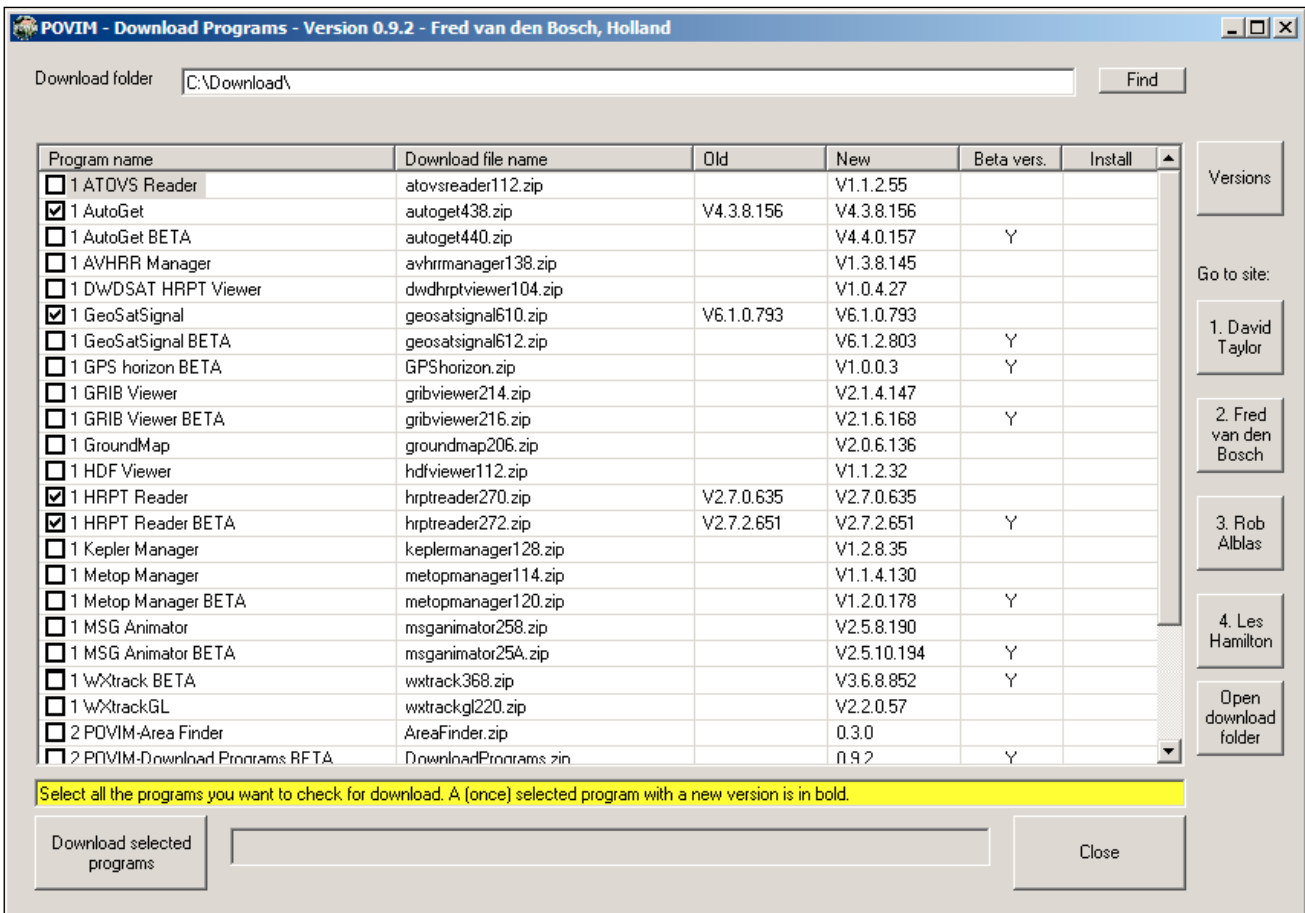
fred@vandenbosch.speedlinq.nl

How the Program Works

Download a copy of *DownloadPrograms* from <http://www.fredvandenbosch.nl/downloads.html>

and unzip it into an appropriate folder.

Run *DownloadPrograms.exe* to display the screen shown below. The contents of this screen are built up from the data on your PC



David's website contains a version file containing all the program names with associated version numbers. These are read in and stored by *DownloadPrograms*, then compared with a similar local file (on your own PC) containing the names of all the programs you have downloaded from his site, with their version number.

If a newer version is available on David's website, it is automatically downloaded and the version number in your local file is updated.

Once the program was working, I realised that there are several other websites with programs for satellites; so I added additional

(from the previous time *DownloadPrograms* was run) plus any new programs on the various Internet sites. The latter can be recognised by the empty field in the column headed 'Old'. The first time the program is started up, the 'Old' column is empty. Programs that are selected, and for which new version exists, are shown in bold, so that they can be easily recognised.

The Download Folder

Here you must enter the folder where files are to be stored after downloading. The name can be keyed in directly or you can browse for a suitable folder, which must already exist, using the <Find> button. Confirm the folder by means of the <Select> button.

Checking Programs

For each program to be checked you must tick the box beside its name. All ticked programs are checked, and if necessary downloaded. Select therefore only those programs that you actually use! If a new program appears, it is automatically incorporated into the list. A new program can be recognised by the lack of a version number in the 'Old' column. These must therefore, if required for downloading, be provided with a tick.

Download Selected Programs

Check first if there are new programs and tick these if necessary. If needed, the tick can be removed from emboldened lines if, for any reason, you do not require that program to be downloaded. Click on <Download selected programs> and all items where the 'new' version number is greater than the 'old' one will be downloaded. Because the 'Old' column is empty the first time the program is run, all ticked programs will be downloaded. If all programs are checked, a report is given if there are updates. If this is the case, a 'Y' in the 'Install' column indicates that the program concerned can be installed. The <Close> button quits the program.

The <Version> button displays a separate screen showing version details for DownloadPrograms as well as the date of the version files on the various websites. The <Go to site> buttons take you directly to the appropriate software website (this page is determined by the site owner). If you let the mouse hover over the buttons the date on which the site details were last updated is shown.

Batch Operation

What I've described so far is the interactive use of the *DownloadPrograms*. It is also possible to run this software in batch mode, executing the program during a Windows start-up or at a specific time via a task manager. To do so, the following steps must be followed:

- Create a shortcut by right-clicking the mouse on *DownloadPrograms.exe* and selecting 'Make Shortcut'.
- Right-click on this new shortcut and select 'Properties'.

- In the 'Target' field you will see the pathname to *DownloadPrograms*
- Here you must add '-Batch' to this path. In my case the line under 'Target' becomes

**C:\Program Files\POVIM\DownloadPrograms\
DownloadPrograms.exe -Batch**

Now, when you click the shortcut, the program will open in batch mode with the following consequences. If there are new versions available, the execution is the same as above: you see the screen illustrated and the new versions can be downloaded. When there are no new versions, the program immediately closes and the screen is not shown.

If you wish *DownloadPrograms* to run automatically when you switch on your PC, make a copy of the shortcut and place it in the startup folder e.g. 'C:\Document and Settings\All users\...'

If you wish to run *DownloadPrograms* at a specific time, place the address of the shortcut in a Task Manager.

Future Developments

I will be interested to receive observations and wishes for this program. As a new development I am thinking of a program which can automatically install downloaded files on one or more PC's. This will, hopefully, follow in the future.

Forum

There is an Internet forum where you can ask questions about my programs

<http://tech.groups.yahoo.com/group/POVIM-Software/>

References

- 1 David Taylor, <http://www.satsignal.net/>
- 2 Rob Alblas, <http://www.alblas.demon.nl/wsat/>
- 3 Fred van den Bosch, <http://www.fredvandenbosch.nl>
- 4 Les Hamilton, <http://myweb.tiscali.co.uk/wxsatellite/>

How to Identify Programs on your Desktop and Enhance Accessibility

Robert Moore

The default icons which reside as shortcuts on your PC's desktop are perfectly serviceable. However, you may tire of the icons which the program supplies by default, or you may prefer to distinguish between various programs with similar icons.

For my processing programs such as *ATOVSReader*, *GRIBViewer* and *GroundMap* I have always used icons based on typical, colourful, output images from the programs themselves. For MSG Data Manager I used an image of Meteosat-8 borrowed from a EUMETSAT website. You can also create icons from your own digital photographs.

Those of us who took photographs at Usingen now have images that can be converted to icons using any of the many icon-maker programs downloadable from the Internet. It only takes a minute to produce an icon from an image, although perhaps a little longer if you need to heighten the image contrast in a graphics



MSG Receiving Antenna and Microwave Tower

package in order to make the small icon image bolder.

Here are two as yet unassigned icons I have created from Usingen photographs, without any image enhancement. The left hand icon shows the MSG receiving antenna and the microwave tower linking to Darmstadt while the right hand one shows of the uplink antenna to *Hot Bird*.

I keep my home-made icons in an *Icon* folder in 'My Pictures'. By simply right-clicking any current shortcut on the



The *Hot Bird* Uplink Antenna

Desktop and selecting 'Properties', you can access the 'Change Icon' button and select a new icon (don't forget to hit 'Apply' before leaving 'Properties')

These icons are non-essential and entirely decorative, although I do find them useful for quickly identifying programs on my desktop.



The resulting icons

Tips on Installing

RAM Disc for

EUMETCast

Rob Denton

On a recent overcast day I decided to take my first step towards streamlining my EUMETCast station, installing a RAM Disc and networking with a second PC.

Following the guidelines in GEO Quarterly and on the web, I decided to try RAM Disc for the first time. The fact that I had put it off till now gives some indication of how worried I was that this might upset my system. In truth, I hadn't even wanted to try it before. Following Instructions were obeyed to the letter, and though it was not as difficult as I had feared, deep down I was still thinking: 'is this machine going to run again?'

I waited ... and waited. Nothing! I was tempted to simply give up and re-install the back-up file I had made. But I wasn't going to let it beat me that easily. Just where had I gone wrong?

I carefully went through everything again and checked all the possibilities. For a start, there was no '*.fsy*' file in RAMDisk! I checked all the folders in 'T-Systems', and it was there that I finally spotted the error.

For some reason, in the *recv.ini* file, there was a hash (#) at the start of the line

```
linefile_database_directory=Z:\receiving
```

I promptly deleted the '#' and, sure enough, after restarting T-systems, the '*.fsy*' file appeared in the RAMDisk! Data started to flow again. Phew!

I thought I would share this with readers in case anyone else had the same problem on setting up.

I can't believe how quiet the PC is now, and the hard disk light hardly ever comes on. I have to keep checking that the software is still working—but it surely is.

Following this success, I just had to see if I could network the 2 PCs. Following Mark Edward's advice in GEO Q15, I took the plunge and everything went perfectly, without a glitch. I'm so delighted.

Thanks to all you GEO readers for sharing advice. I have now joined the 2-PC brigade and it wasn't nearly as difficult as I originally thought it would be.

'Weather Days'

Peter Green

Recently, I came across the UK Weather Shop, who run courses under the banner *Weather Days*; these offer participants an understanding and interpretation of weather charts and the implications of climate change, as well as instruction in setting up a weather station.

We see images of the weather daily from the systems available to us, but I have always wanted to learn more about the weather and forecasting. For £20 and a trip to Eastbourne I thought, why not?

Booking on-line by credit card was easy was confirmed by email. A couple of days prior to the event, Liz Bishop from the Weather Shop sent an email reminder giving directions etc—a nice touch I thought.

Very early on a Saturday morning I made the trip to Eastbourne, a bit of a hike for me at some four and a half hours. I arrived early at the marina where an arcade of shops is situated within the marina complex. The Weather Shop does not open until 10 am, however, so there was no chance to look around it before the course.

The course was held in Chart Room of the new yacht club, very nicely appointed and of course with great sea views.

We started with tea and coffee as the delegates getting to know each other informally. Fourteen of us were there for the day and what surprised me was the male/female mix, seven of each; normally with the GEO Symposium it is very much male dominated.

Following a short welcome from Weather Shop director Alistair Barron, it was down to business. The course was presented by Dave Wiseman, proprietor of *Wiseweather*. Dave has been involved with just about every aspect of the weather since he joined the Met Office almost thirty years ago. He outlined the day for us and presented everyone with the course schedule, notes and charts.

We started with a basic climate primer: discussing climate types and patterns before moving on to mapping our weather and learning how to interpret and use weather maps. The morning session concluded with an introduction to the development and process of weather systems, including the main modes of atmospheric circulation, case studies of depression types and air masses and a discussion of some 'extreme' weather events and why they occurred. All the time we had to use our notes and were encouraged to plot our own synoptic chart.

David made use of a large screen attached to his laptop, so that everyone in the room had a good view of his presentation before we finally broke for lunch.

There are many places to eat at Sovereign Harbour, from the yacht club restaurant itself to the many cafes, pubs and restaurants surrounding the marina. If you were quick, there was even time for a look around the Weather Shop.

The afternoon session covered setting up a weather station. Dave passed around basic thermometers and progressed on the more elaborate electronic instruments with explanations on the uses and usefulness for each.

We then covered the symbols used for plotting weather data, combining this with observations of cloud, temperature and wind made from the balcony of the yacht club. The course concluded with a short presentation on Climate Change and forecasting for the future.

There was time throughout for questions and discussion and I am sure we all came away with a better understanding of the basics of weather and what to look for in the sky on a daily basis.

I thought the course was good value for money although this is a huge subject to cover. Each of the areas that we explored would benefit from much more detail and you could spend a day at least on each of them. If anything, they tried to pack too much into the day. This is definitely a case of less is more.

Next year, the Weather Shop are hoping to take their 'Weather Days' on the road and, if there is sufficient interest, make them more specialised; so if you would like to have a 'Weather Day' close to you, and would like it to cover areas of specific interest to yourself, then an e-mail would not go amiss.

At the end of the day there was sufficient time for a leisurely look around the Weather Shop. This place has the lot! From a weather wristwatch to the latest electronic weather station from Davies; from a hand-held anemometer to beautiful hand made barometers; even a stunning Campbell Stokes Sunshine Recorder. A large selection of books and charts are also available.

The staff will even gift wrap these items for you should you wish to give someone that special present (or even get someone to buy you what you *really* want for Christmas).

References

- <http://www.ukweathershop.co.uk/index.html>
- http://www.ukweathershop.co.uk/acatalog/weather_days.html (weather days)
- <http://www.wiseweather.co.uk/>

SOFTWARE SHOWCASE



Douglas Deans - dsdeans@tiscali.co.uk

There's something of an unusual introduction to my column this quarter, as I would like to involve the membership in shaping the future of Software Showcase. I have been reviewing software and providing a CD library for GEO now for some three and half years. In that time, and despite the increasing use of the Internet and in particular the huge rise in fast broadband take-up, well over 200 CDs have been dispatched following 15 quarterly publications. Although the CDs are provided basically at cost and are inexpensive, this is nevertheless quite a surprising statistic given the immediacy and zero cost of the alternative Internet option.

However, and more importantly, there has so far this year only been one request for a CD. Clearly the Internet is now the favoured and most efficient route for obtaining software. I have always dispatched CDs on the same day as the order was received but I cannot compete with the few minutes required to download and its zero cost.

My own opinion is that it is time to move on and to seriously consider the need to keep a CD library, the updating of which constitutes the majority of my workload. It also uses valuable copy space which could perhaps be better used on other topics.

For this publication I will retain the status quo but I would very much welcome some input from the membership. Please feel free to contact me directly at the above e-mail address, although it might perhaps be better to use a public forum so that people's views can be seen and debated. Possible public forums are the GEO group,

<http://tech.groups.yahoo.com/group/GEO-Subscribers>

or you might even consider a letter to the Editor of the Quarterly—I would prefer not to work on the basis of 'nothing heard means the membership agree'.

So please, set apathy aside and make a positive contribution it is after all your organisation and your magazine. I will try and summarise the members' input in my column for the next issue.

In addition, if the library is to terminate, do readers feel that the column should continue highlighting upgrades or new software when the writer manages to spot it! There is still shareware about but, increasingly, it is a trial followed by a payment. Of course, if there is no library, then this is not so important, as a future

column need only identify the new or upgraded software and provide an Internet source for more information and downloading. Again your views would be much appreciated.

I would also like to advise members that I have removed the program '*Splitter and Merger v 4.0*' from CD2. I have been unable to trace this since the Internet URL

vanished. There is a myriad of splitter and merger programs available, many for free, some for a limited trial but most very inexpensive. Just try putting Splitter and Merger into a search engine. Under the circumstances there seems little point on picking one at random for the CD as even those still with 56k modem capability will be able to download such programs in little time.

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.	
	AVHRR Manager	Processes and manages the files for HRPT via EUMETCast v 1.3.8
	GeoSatSignal	Manipulates Geostationary weather satellite images v 6.1.0
	GRIB Viewer	Viewer for GRIB format files v 2.1.4
	GroundMap	Rescales satellite images v 2.0.6
	HRPT Reader	Converts raw HRPT data files into images v 2.7.0
	Kepler Manager	Organises files of 2-line element data v 1.2.8
	Metop Manager	Processes and manages AVHRR files from Metop satellites v 1.1.4
	MSG Animator	Automatic animation of MSG images following reception v 2.5.8
	MSG Data Manager	Processes and manages MSG data files v 2.5.8
	RX2 PassControl	Computer control program for the RX2 receiver v 3.1.0
	SatSignal	Creates images from wave files v 5.0.6
	WXtrack	Satellite Tracking Program v 3.6.6

GS2	A wide range of software for all aspects of weather satellite reception, including tracking, receiving, monitoring and image manipulation. Content is detailed below but many other extras are provided. Titles correspond with folder names. * implies a DOS program.	
	Collection D02	Recall (wave file recorder), Palette (modifies Wxsat colour palettes).
	Collection D03	Scanner recorder v 1.8 (wave file recorder), *NOAA95/*FENG99 (software for the NOAA 95 HRPT project)
	Collection D04	Wxsat (wave file recorder/decoder), Satmon (wave file recorder) v 2.59
	AGSatTrack	Satellite tracking program v 1.33
	APTDdecoder	Program for capturing APT audio and processing images v 2.0.4.76
	Cirkit	Documents for the Cirkit Wxsat receiver and the UOSat receiver (PDF)
	Element Manager	2-line element manager v 1.59
	Footprint	Satellite tracking program v 2.24
	Irfan View	Image/slideshow viewer v 3.80
	JVcomm32	Evaluation version (APT/FAX/SSTV decoder) v 1.40 pre
	Macintosh kepler editor	Edits verbose AMSAT format elements. Mac OS X and OS9 only.
	NeoPaint	Image processing program (30 day evaluation) v 4.60
	Orbitron	Satellite Tracking Program v 3.70
	Paintshop Pro	Image processing program (30-day evaluation)
	PhotoFiltre	Image retouching program with many extras v 6.2.7
	Satscape	Satellite tracker and wave file recorder v 2.02
	Space-Track TLE Retriever	Generates TLE files in 'Celestrak' style from 'Space Track' data sets
	Xrit2Pic	Processes MSG and Metop data v 2007.03
	WXtoImg	WAV file recorder/decoder program with many options. v 2.7.3

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.
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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
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PhotoFiltre v 6.2.7

Since last writing about this program there has been a number of updates. As a reminder to readers I suggest you have a look at my brief introduction to the software in GEO Quarterly 8, December 2005. One of the appealing features of the software was its ability to handle multiple channels/wavelengths. Perhaps there is less need given the very extensive facilities that David Taylor now provides within his own programs, in particular GeoSatSignal. There are, of course, some more sophisticated versions of PhotoFiltre available to purchase but Version 6 remains freeware.

PhotoFiltre v 6.2.7 is available on GEO software CD, GS2 For further information or to download the program go to :-

<http://www.photofiltre.com/>

How to Purchase CDs

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

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

Orders are normally dispatched on the day of receipt.

Order your CDs from:

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

Contacting the Editor

Please note the
new email address
for contacting the editor

geoeditor@geo-web.org.uk

EUMETSAT extends its Polar System by adding NOAA-18 Data

David Taylor

Towards the end of September 2007, a major new source of data was added to the *EUMETCast* data stream. As part of the European Polar System (EPS), the *Metop* satellite provides the morning coverage of any particular region, and a NOAA satellite provides the afternoon coverage. For about a year now, *EUMETCast* users have enjoyed a continuous stream of high-resolution data, 24-hours a day, from all round the world. As *Metop-A* orbits the planet, data is dumped at EUMETSAT's Svalbard ground station and then sent out to users over the duration of the next orbit. Actually, the data is sent slightly more quickly so that there is a little margin and, when watching the transmitted 3-minute data chunks in real-time, it almost looks as if *Metop* has halted over the pole!

This coverage has now been extended to include afternoon coverage from the

compared with the full 2048 pixels of the AVHRR. Only every one out of every three AVHRR lines is used, reducing the along-track sampling to about 4 km.

As ever, software to decode these transmissions has been available from the outset [1] as a free update to the *Metop Manager* software [2], which not only processes the GAC data into attractive images but also creates a composite world-view of it. This provides you with a continuously-updated pictorial view of weather across the whole world. Even better, the picture moves with the satellite, giving you the experience of travelling on the satellite and watching the Earth pass beneath your feet.

A full-sized, false-colour version of the above image (2.7 MB) from

<http://www.satsignal.eu> => *Metop Manager*



A typical GAC composite World View from the *Metop Manager*

Image © EUMETSAT 2007

NOAA-18 satellite. Data from *NOAA-18* is collected from various locations and, in order to include information from the full orbit, an on-board device records the instrument data from the Advanced Very High Resolution Radiometer (AVHRR). This is later dumped to the ground stations as *NOAA-18* flies over them. As the recording capacity on *NOAA-18* is limited compared with the more recent *Metop* satellite, only reduced resolution imagery is possible, comparable with that achieved by the Automatic Picture Transmission (APT) data from the same satellite. This data format is known as General Area Coverage (GAC) and is 409 pixels wide

To obtain this data, you need to register for the *NOAA-AVHRR* data on the GEO Web site at

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

Look for the section named '*Polar Data Services, Global Data Service (Level 1 data)*'.

References

- 1 SatSignal Software
<http://www.satsignal.eu>
- 2 *Metop Manager*
<http://www.satsignal.eu> => *Metop Manager*

HURRICANE ? ... WHAT HURRICANE ?

John Tellick

"Earlier on today apparently a woman rang the BBC and said she'd heard there was a hurricane on the way. Well, if you're watching – there isn't".

These few words turned out to be the most famous—or should that be infamous—words ever spoken by a British TV weather forecaster. The forecaster in question was Michael Fish, presenting the early evening forecast on October 15, 1987. What followed that night will never be forgotten by those who experienced it—nor by Michael Fish, who has suffered 'the blame' ever since.

To be fair to Michael Fish, his 'hurricane' remark, taken wholly out of context, actually referred to the likelihood that Hurricane Floyd (in the Caribbean) would hit Florida. Forecasters had in fact been predicting strong winds over England for several days, but the track of the depression was predicted to be further south than it turned out. Michael Fish added 'But having said that, the weather will become very windy, but most of the strong winds will be down over Spain and across into France—but there is a vicious-looking area of low pressure on our doorstep nevertheless.' His chart for 13:00 showed a deep depression of 974 mbar over the Bay of Biscay.



Michael Fish, pictured presenting a typical forecast in 1982

In the final forecast of the day, Bill Giles (with the centre of the depression now off Brittany at 959 mbar) said: 'It looks like most of the strong winds will stay away, although it's still going to be very breezy up through the Channel'.

A classic understatement one can say with hindsight! But it was always Michael Fish's comment that was remembered—and is to this day.

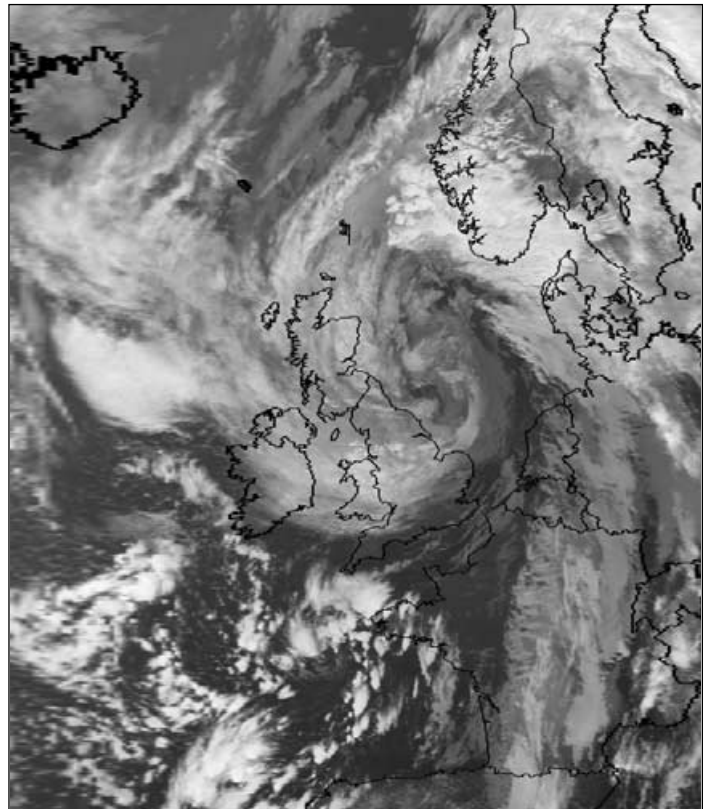
The storm over southern England wasn't a hurricane in meteorological terms; it was a 'bomb' [1], which produced hurricane force winds over land and is now remembered as The Great Storm. Moreover, born out of warm humid air meeting cold dry polar air, the system intensified rapidly and its centre, originally thought to be passing over France, instead tracked from the Bristol Channel across central England with particularly devastating winds on its southern edge.

When most people went to bed that night it was just windy, nothing out of the ordinary for southern England; but as the night progressed it became a terrifying experience of lashing rain and howling, roaring winds till you felt it couldn't get any worse. It seemed like the house itself was shaking, and nobody could sleep whilst trees, chimney pots, slates—indeed whole roofs—crashed to the ground all around.

Daylight revealed a changed landscape with 15 million trees felled and the forests of Surrey, Sussex and Kent destroyed. Nor did the towns and cities escape, with buildings, parks and gardens devastated. 18 people in the UK lost their lives and the toll would have been much worse had the storm occurred during daylight hours.

The Great Storm was the worst event of its kind since 1703 and one could well imagine being in the tropics during a hurricane: but this was England! Inland, sustained wind speeds of over 80 kph raged for four hours, frequently gusting to over 120 kph and occasionally 140 kph. Gusts along the East Sussex and Kent coasts reached 160 kph with the highest recorded gust of 195 kph being recorded at Gorleston in Suffolk. Parts of northern France and Belgium also suffered in the storm.

Our beloved countryside here in the southeast of England bore the scars for years—and still does in a few places. Many feared southern England would never be the same again. But, driving through these counties 20 years later, it is again a



The aftermath of the 'Great Storm', a NOAA-10 channel-4 IR image acquired at 8:00 am on October 16, 1987.

Image NOAA CLASS Archive (www.class.noaa.gov/)

green and pleasant land: Nature has regenerated its woodlands and the Downs are again covered in trees. You would hardly know the scale of the devastation wrought that night if you had not lived through it.

Nature, it seems, has such a propensity to destroy and regenerate? Well we wouldn't expect to have another storm like that for 300 years, would we? One might have thought not but that supposition didn't last long.

Large areas of Great Britain and northern Europe were again battered and devastated by storm force winds on January 25, 1990 in what has been called the Burns' Day Storm.

The meteorologists were much better prepared this time and severe gale warnings were issued four days in advance—though the eventual track across the UK was not known that early on. More precise forecasts were issued on January 24 as the storm intensified, its central pressure falling continuously as it approached Ireland. The lowest central pressure was estimated as 949 mbar as it passed to the east of Edinburgh at around 16:00 UT on January 25. Sustained winds reached 120 kph (comparable with a Category-1 hurricane) while gusts of up to 170 kph were responsible for most of the damage it inflicted.

This storm produced winds of comparable strength to the Great Storm but over a much wider area of northwestern Europe. At least 97 people lost their lives—half of those in the UK. The numbers of casualties were significantly higher than in 1987 because this storm struck during daytime; most of the fatalities resulted from falling masonry and wind-blown debris. Buildings were damaged, travel by road, rail, sea and air were all severely disrupted and an estimated three million trees were brought down in the UK alone.

- 1 Bomb: an extratropical cyclone in which the pressure drops more than a millibar per hour

Script Snippets 2

Maximising File Compression for Archiving

David Taylor

The Problem

I recently had a request for some Metop AVHRR data, so that a reader who did not have access to *EUMETCast* could test out my *Metop Manager* program. As you will have read in past issues of GEO Quarterly, Metop data does occupy rather a lot of disk space even though it is compressed during transmission over the *EUMETCast* system.

What I wanted to achieve was to compress a whole set of Metop files in order to write them on to a DVD. However, simply placing all the files into a Zip archive would still have resulted in a file over 4 GB in size. This would need something bigger than a single DVD to carry it (as I had more than a day's worth of Metop data to compress). My solution was to compress each individual 3-minute Metop data chunk automatically, looping through all the files in a directory. However, I wanted to be able to stop and start the process at will (it's quite CPU-intensive), and hence be able to detect if I had already Zipped a file and avoid Zipping it again.

The Solution

I achieved my objective by using the script below—looks quite simple, doesn't it?

```
FOR %%F IN (C:\EPS-AVHRR-raw\AVHR*) DO (
  IF NOT EXIST %%~nF.zip PKZIP25 -add -max %%~nF.zip %%F
)
```

Explanation

Essentially there are two parts to this script, a loop over all the files and, for each file, testing whether a Zip exists and, if not, creating it. I use an old version of the *PKZIP25* program from *PKware* (www.pkware.com) for compressing the actual data.

In developing a script like this, I tend to develop the loop first so that I can see if the files I am picking up are the correct ones. Although the loop can be written on a single line, splitting the loop over more than one line may make the operation clearer if you have a complex set of operations to perform on each file.

Here is how you might loop through all the *MS Word* documents in the current directory and do a directory listing of each:

```
FOR %%F IN (*.doc) DO DIR %%F
```

At the command prompt, you can type 'HELP FOR' to understand the syntax of the **FOR** command. In this case, for each file with a '.doc' extension in the current directory, the command after the **DO** is run, with the **%%F** being replaced by the file name for each file. Note that in a script, the **%F** which the HELP FOR refers to must be replaced with a double percent mark: **%%F**.

We can lay out the same **FOR** command over two lines using round brackets like this:

```
FOR %%F IN (*.doc) DO (
  DIR %%F
)
```

This has explained the **FOR** statement in the script—except for the fact that, rather than specifying all the files in the current directory, I choose in this script to specify a different directory, and to specify it completely:

```
FOR %%F IN (C:\EPS-AVHRR-raw\AVHR*) DO (
```

In this case, as stated earlier, should the Zip file already exist, I don't wish to create it again. To test for the existence of a file, scripting offers the **IF** command:

```
IF EXIST <filename> <command-to-run>
```

For my script, I want to create the Zip only if the Zip-file doesn't already exist:

```
IF NOT EXIST <filename> <command-to-run>
```

I now want to reply on another innovation of the more recent versions of Windows scripts, the ability to split a full filename down into components.

In this case, I want just the filename part, without the directory or file extension parts, and I can get this by using **%%~nF** command instead of **%%F**.

The basic syntax for the *PKZIP25* command is:

```
PKZIP25 -add <Zip-file-name> <file-to-add>
```

such as:

```
PKZIP25 -add Document.zip my-file.doc
```

In this case, I wanted to use the maximum compression, even at the expense of CPU time, so I used another parameter to *PKZIP*:

```
PKZIP25 -add -max Document.zip my-file.doc
```

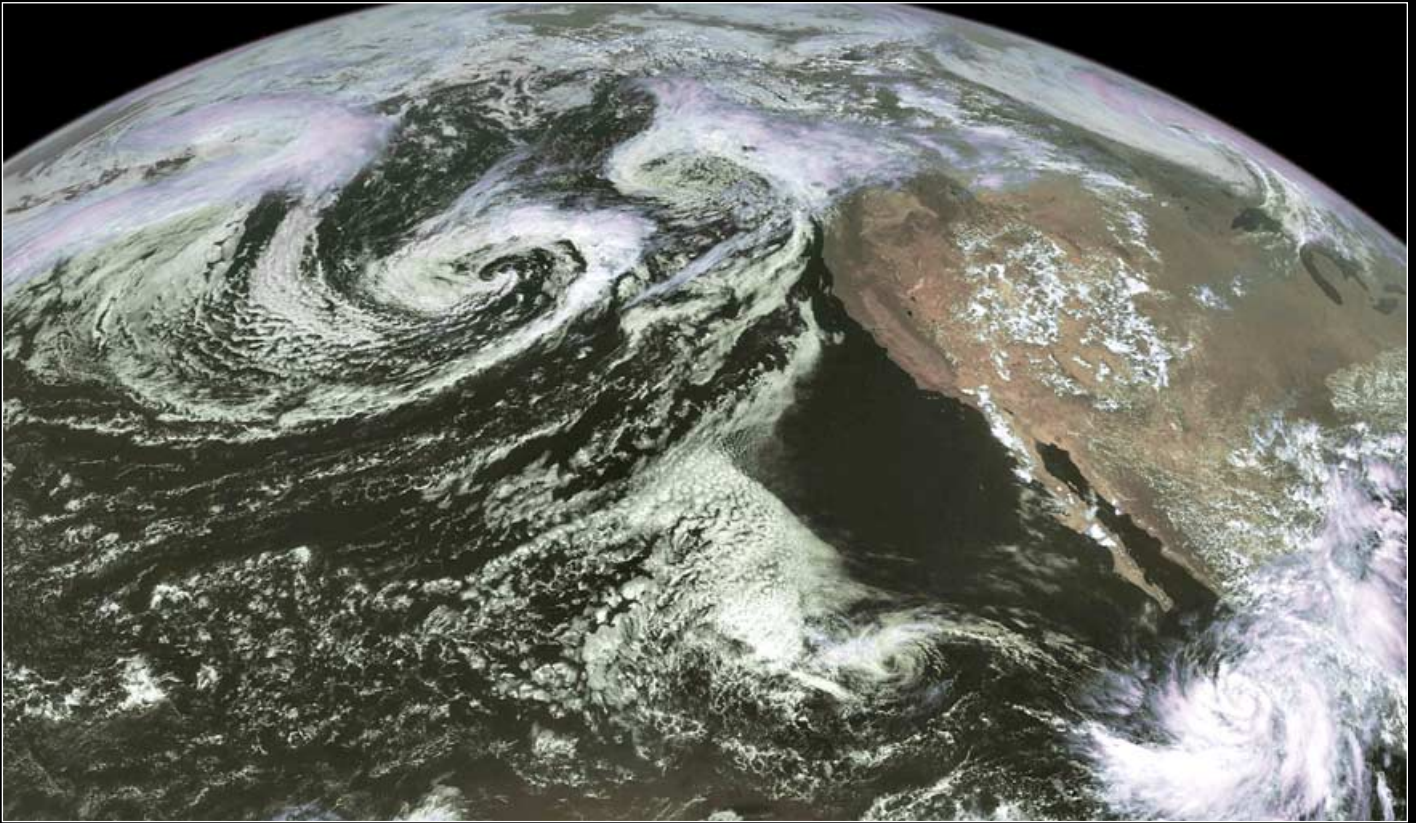
and of course, I wanted the filename of the Zip file to match the filename of the Metop AVHRR file, and use the full path to the Metop AVHRR file as the name of the file to compress. Hence my Zip command is, using the **FOR** variables:

```
PKZIP25 -add -max %%~nF.zip %%F
```

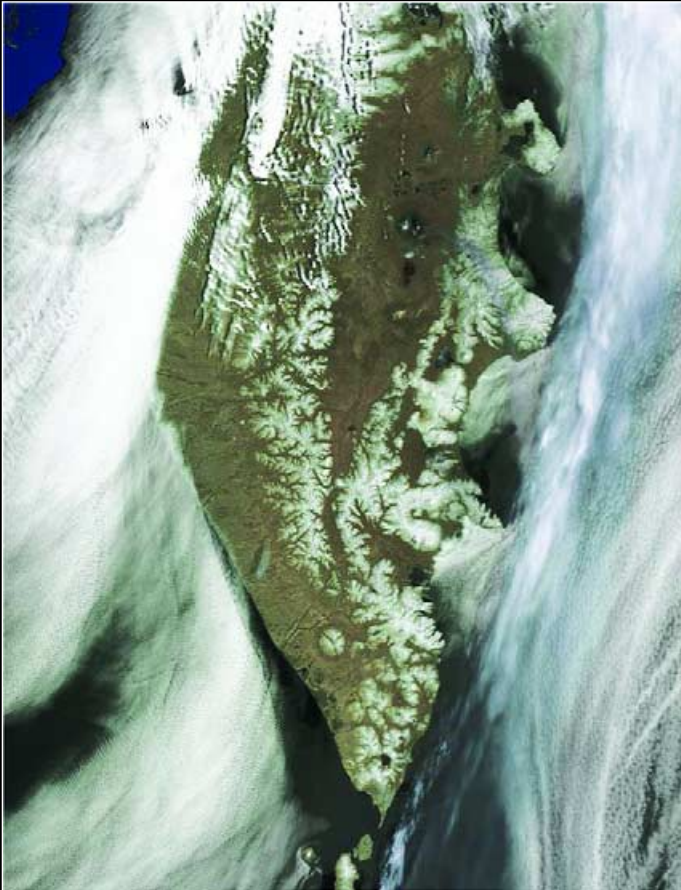
Of course, I don't want to invoke *PKZIP* if the Zip file already exists:

```
IF NOT EXIST %%~nF.Zip PKZIP25 -add -max %%~nF.zip %%F
```

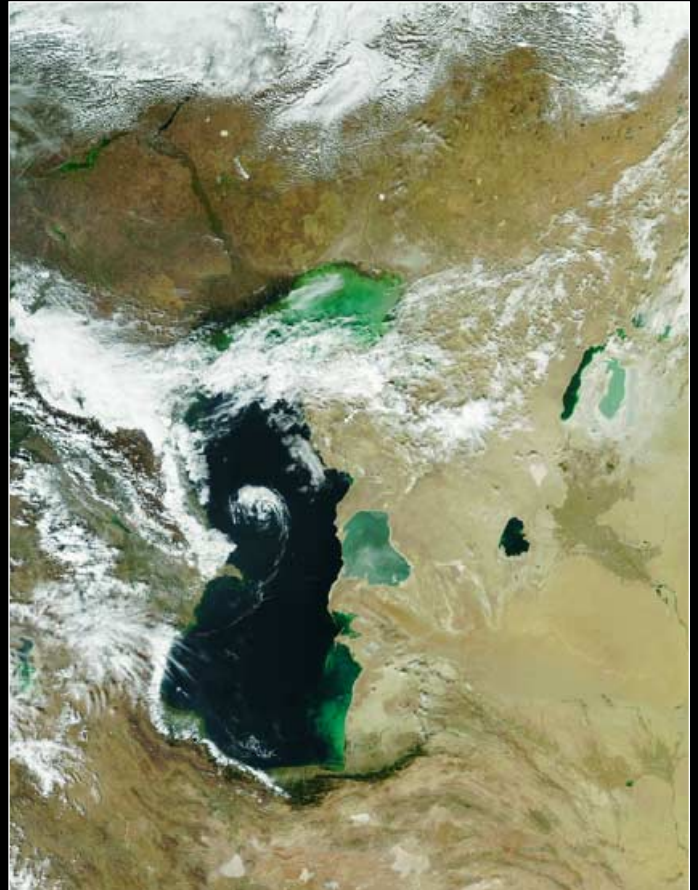
So what looks fairly simple actually turns out to be a little more involved, but nothing that any reader could not tackle.



This is a colour composite image, created by David Taylor with his *GeoSatSignal* software, from GOES-11 LRIT images received by Ed Murashie using his home-built LRIT receiving hardware.



Volcanos in Kamchatka - see article on page 10
image © EUMETSAT 2007



The Caspian and Aral seas imaged by *Terra* on October 11, 2007
See article on page 25
image: MODIS Rapid Response Team at NASA/GSFC

