

The **GEO** Quarterly

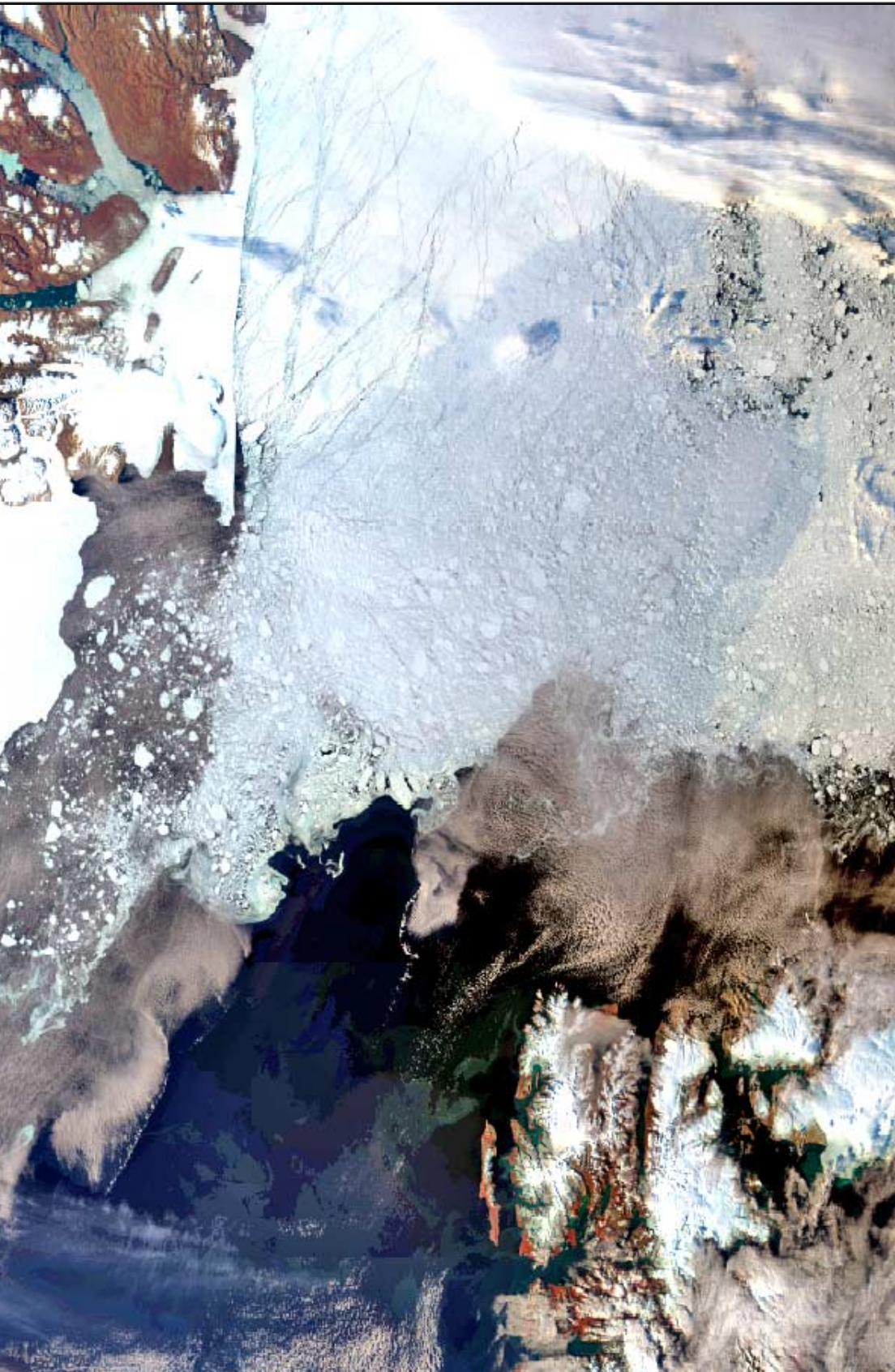
Group for Earth Observation



www.geo-web.org.uk

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

*Number 12
December 2006*



Inside this issue . . .

The European Space Agency's new MetOp satellite is now in orbit. Read our features on MetOp and its instrumentation.

If you own one of the German R2FX APT receivers, you can operate it under computer control. Clive Finnis explains how.

With the dark winter nights now upon us, what better time to construct a high-linearity LNA for your APT set-up. John Silver reveals his latest design project.

Werkgroep Kunstmanen held a workshop last September. Read Les Hamilton's report on his visit to GEO's Dutch counterparts inside.

Did you know that you can monitor current lightning activity over Europe via the Internet? Peter Bartlett introduces us to Blitzortung.org.

Following the feature on sunglint last issue, Marciano Righini sent us a selection of excellent examples from his image archives.

Plus all the usual features and satellite images ...



A high-resolution Mars Reconnaissance orbiter image showing gullies in a crater in the Terra Sirenum region of Mars.
Read more on page 10,

Image NASA/JPL

Keep up with the latest WXsat News every Month

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

Recently, our September issue carried an additional article reviewing the R2FX APT weather satellite receiver, while in the October issue, Clive Hardy described how you can build a copper pipe QFH antenna for VHF satellite monitoring.

'We are pleased to serve all the specialist areas of the hobby', commented Editor Kevin Nice. 'I am pleased to say that all of our regular columns provide more information than any current or former alternative.'

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www.monitoringmonthly.co.uk





Our front cover image this month was taken by the MERIS instrument aboard ESA's *Envisat* and provides continuing evidence for the influence of climate change on our planet. The scene confirms the existence of unprecedentedly large stretches of open water and broken ice in the Arctic Ocean north of Svalbard. Read more on page 7.

At last the waiting is over. Europe's *MetOp* satellite is safely in orbit and undergoing its commissioning trials. Although it will probably be early 2007 before regular images come on stream, you can read about the successful launch of the new satellite in articles by John Tellick and Peter Wakelin.

As GEO looks boldly forward to embarking on its 4th year, we bid farewell to Nigel Evans in his capacity as Membership Secretary. Nigel now spends much of his time working in France and no longer feels he has sufficient time to do this important task effectively. He does, however, intend to remain on the GEO Management Team and help out where possible. You can read Nigel's reminiscences on page 15.

With no candidate yet identified to take over as editor, Les Hamilton has agreed to continue in a *caretaker role* for the next few issues. Les notes that just a small nucleus among the GEO membership is providing nearly all the articles. If more readers were prepared to provide copy and share their images and experiences with us, either in the form of articles or 'Letters to the Editor', it would make his task of filling all the Quarterly pages very much easier.

When winter starts to bite and the nights become cold and frosty, remember to look out for some spectacular infrared NOAA images. We have a selection on pages 31 and 33. Do give this a try, and don't forget to send us your most interesting ones for publication.

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Responsibility for Constructional Projects and Software

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The GEO Report



Francis Bell

My first comment must be one of congratulations to EUMETSAT for the successful launch into the planned orbit of their satellite *MetOp-A*. This launch marks a milestone for the European programme of polar orbiting weather satellites. It complements the American NOAA series of polar orbiting weather satellites with which many of GEO's members are familiar. Now both NOAA and EUMETSAT satellites can monitor the Earth's atmosphere and weather systems from a distance of only 800 km.

I did follow the launch of *MetOp-A* and searched, but to no avail, for a TV channel covering it. However, I understand that John Tellick may have a video recording of the event which he may show at our Leicester Symposium next May.

The *MetOp* programme has taken many years of planning and implementation. A very expensive programme of course, with the costs being shared by the governments of EUMETSAT's 19 member states. The freely disseminated data which direct users anticipate will be a major contribution to observing and trying to understand our planet's weather.

On behalf of GEO, our congratulations to EUMETSAT for the launch of *MetOp-A* and our best wishes for the subsequent programme.

Now for a disappointment

Our repeated requests via this Quarterly publication for help with the editorial role and membership secretary's work-load has met with a near zero response from the membership. It is quite unreasonable to expect already busy and dedicated people to continue indefinitely with their services to our group without the support of others.

I know that, within our membership, there are many talented people and I hope we can call on this background resource, thus spreading the work-load of running our respected international Group. If you can help, or are offering some of your skills and time, please get in touch with myself, the GEO Quarterly Editor or the Membership Secretary. If this is the last GEO Quarterly you ever receive don't say you haven't been warned. There are no payments involved; the reward is contributing to our Groups success. This should be reward enough. An alternative may be to double the membership fee and pay somebody to do these jobs but that is not quite in the

spirit of an amateur organisation where there should be a willingness to help each other.

Meetings

Our membership is geographically dispersed both within the UK and more thinly throughout the rest of the world. To organise an annual meeting suitable for everybody is almost impossible. In the past we have met at the National Space Centre in Leicester, a city that is geographically almost at the centre of the UK. Alternative meeting venues have been examined but for 2007 our annual meeting will once more be at the NSC, Leicester, which is booked for May 19, 2007. Please note this is **not** a bank holiday weekend. A guest speaker from EUMETSAT has been invited: the rest of the day, to be planned request, will be mainly devoted to workshops, self-help groups and other practical sessions.

Although the Symposium is still over five months away, **now** is the time to contact us with ideas that **you** would like to see implemented on the day.

Please contact me, Francis Bell at

francis@geo-web.org.uk

or by post or telephone (details on page 1). Further details will appear in our next Quarterly but, in the meantime, the date for your diary is May 19, 2007 in Leicester, where I look forward to renewing the many friendships enjoyed in previous years.

Chichester

It has been suggested that GEO should experiment with regional meetings. I visited the planetarium at Chichester a few weeks ago. They have just installed an MSG receiving station which I was very pleased to see during its commissioning phase. With so many school children passing through their planetarium's doors there can be few better locations for a live MSG station. For those living in the southeast of England it looks like an attractive venue for a GEO regional single day meeting. Details of any meeting at Chichester will be published as soon as there are definitive plans.

Werkgroep Kunstmanen

I know that our Dutch friends in *Werkgroep Kunstmanen* are still very active with the reception and processing of weather satellite data. I am a member of their Group and receive their publication

De Kunstmaan. I cannot pretend I can read everything but I do my best. In my judgment they are a very talented organisation and they are also very supportive of GEO. I have been to two of their meetings in Utrecht and I know that three members of GEO's management team visited Utrecht in September for one of their regular meetings.

Our Dutch friends meet in Utrecht five times per year. Their meeting dates for 2007 are January 13, March 10, May 12, September 8 and November 10. I believe non-members are welcome to attend, but check with me by email and I will forward contact details for their Group.

You can learn more about *Werkgroep Kunstmanen* by visiting their website and clicking on 'English version' in the sidebar.

<http://www.kunstmanen.nl>

Dates for your Diary

Saturday May 19, 2007 - GEO's annual symposium at NSC Leicester.

July 6, 2007 - A visit to Darmstadt. EUMETSAT have generously agreed to host GEO for a day at their headquarters, with a potential visit to Usingen. This will provide an opportunity for our membership to meet EUMETSAT staff and see their operations. It will also enable our continental friends to meet some of GEO's members who are normally only to be found in the UK. Further details, when confirmed, will be published in our next Quarterly but do put the date in your diary now if you are interested.

July 27-29, 2007 - I hope GEO will be invited to AMSAT's annual colloquium in Guildford. GEO has attended this event for the past three years and hope to be there again.



GEO's extensive display at AMSAT 2006
Photo: David Taylor

September 24-28, 2007 - EUMETSAT / AMS conference in Amsterdam. I hope GEO will be there representing and describing our widespread membership base and our use of weather satellite data - educational, amateur, self-training interests and non commercial applications.

September / October 2007 - The Leicester Amateur Radio Rally (LARS). GEO hopes to have a stand there.

November 2007 - The Kempton Amateur Radio and Computer rally. GEO will try to be there.

There may be a NOAA conference in 2007 but I have no details of dates or venue. If the conference takes place I will try to represent GEO

QUARTERLY? QUESTION

This question is almost automatic. On which date and at what time was EUMETSAT's latest satellite MetOp-A launched? For an answer I will accept the time plus or minus a few minutes but please specify the time zone. I favour UTC but any specified time zone will be acceptable. Email your entry to me at

francis@geo-web.org.uk

As usual the prize will be a free entry to our annual symposium for the winner or their nominee. I will pick at random a winner on December 25, 2006.

And finally ...

Without hesitation I finish by offering on behalf of all the membership my thanks to those who contribute to our Quarterly publication. But I also encourage others to share photographs, satellite images, text, technical skills, experiences or any other aspect of our hobby which can be shared with the rest of GEO's worldwide membership.

GEO is on the lookout for regular

Feature Writers

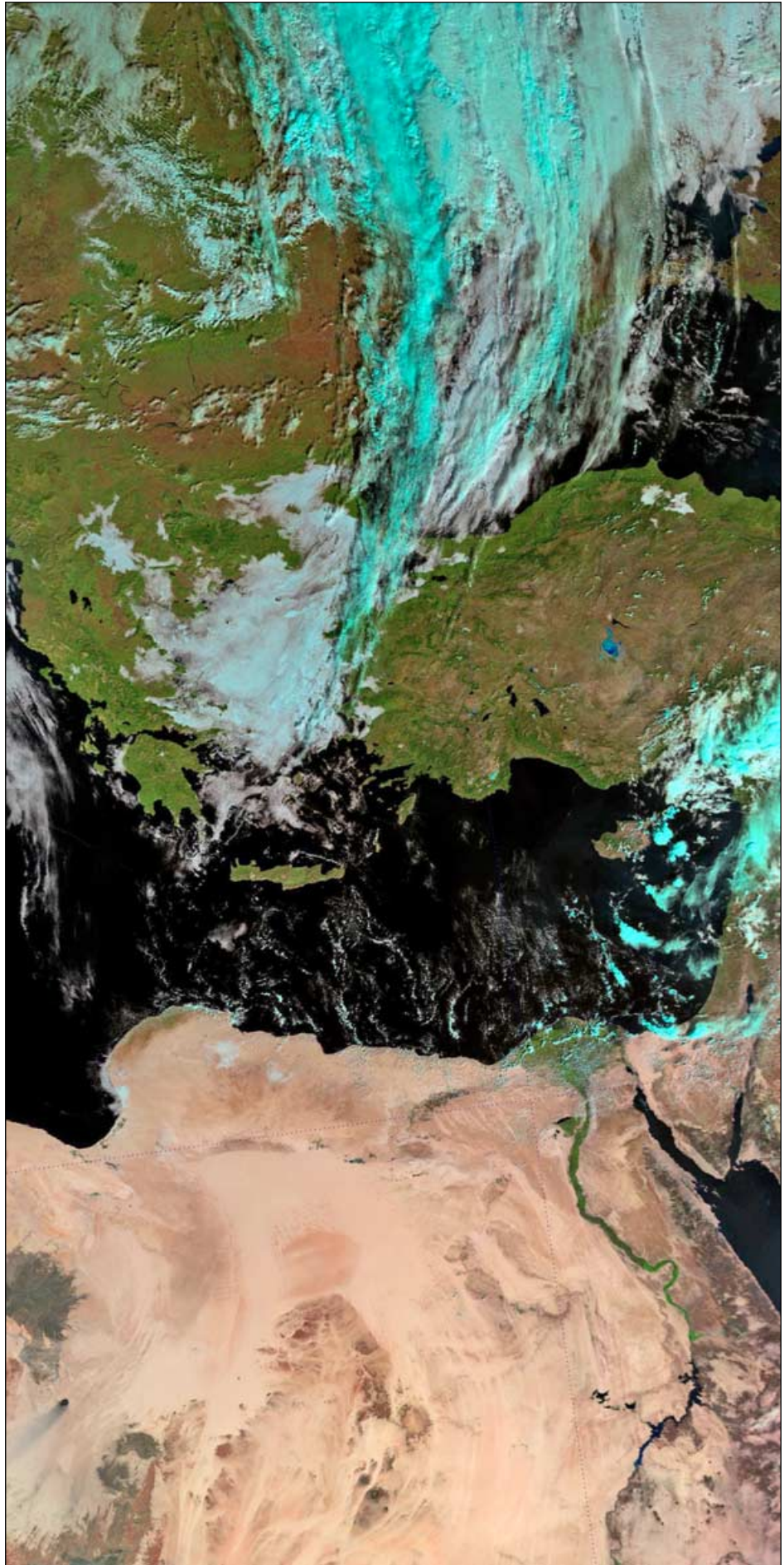
an

Editor

and a

Membership Secretary

If you believe you can help your Group, do please get in touch



Detail from the first high-resolution AVHRR image acquired by MetOp-A as it flew over Turkey and Egypt during its first orbit on October 25, 2006
Image © EUMETSAT 2006, rendered at the CalVal Facility

The Strait of Dover ...

... a personal view

John Tellick

An image from the ASTER instrument aboard NASA's Terra satellite, showing the English Channel and its environs in high resolution was published recently, prompting John Tellick to scan it for features of interest.

The image, which was originally acquired on March 14, 2001, is far too large to reproduce in its entirety, but interested readers can locate it at:

<http://asterweb.jpl.nasa.gov/gallery-detail.asp?name=tunnel>

Credit: NASA/GSFC/METI/ERSDAC/JAROS and U.S./Japan ASTER Science Team

The image opposite shows the coastline on the Kent side of the Channel. Insets at 67% resolution show Ramsgate harbour and Pegwell Bay (upper) and Dover harbour with its environs (lower).

The Strait of Dover or, as the French would have it 'Le Pas de Calais', and the White Cliffs have a place in many an Englishman's heart and psyche.

That mere 20 mile stretch of water is a big part of our history in keeping our country secure for centuries—except that is, for the Romans and William the Conqueror. And still to this day this 20 mile stretch of water, for some, 'protects us from Europe.'

Even though the physical barrier has been breached by the Channel Tunnel, for many, alas, there still seems to be a mental barrier. England, the home of fish and chips, HP sauce, cricket on a village green, afternoon tea and warm beer: France the home of wine, gourmet food, the smell of Gauloises, pungent cheeses and garlic, the TGV and haute couture. Will the English and the French ever learn to love one another?

I really enjoy sitting on the cliffs at Dover on a clear day, watching the shipping in the Channel and the views across to Calais, the French cliffs and down to Boulogne. With a pair of binoculars you can see the clock tower of Calais town hall and the dome of Boulogne cathedral.

So, I was interested to see this image from NASA taken by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on NASA's Terra satellite on March 14th 2001, showing in great detail the Strait of Dover and the adjacent parts of England and France.

May I take you on a tour and point out some of the features shown?

Starting at the end of the north Kent coast is the town of Margate, a bustling 'kiss me quick' holiday resort in the early 60's and 70's with its once-famous amusement park 'Dreamland'. Also famous in the early 60's for 'Mods and Rockers': remember them? I do!

Following the coastline southwards is the town of Ramsgate with its harbour wall. From here car ferries cross to Ostend in Belgium. The first cross channel hovercraft services by HoverLloyd (1969) departed from a concrete apron built out into Pegwell Bay, just west of Ramsgate. HoverLloyd merged with SeaSpeed to form HoverSpeed and moved to Dover docks. These services no longer operate.

This low-tide image shows up the cliffs, stretching from Margate all the way to sandy Pegwell Bay, just south of Ramsgate, well. This bay was the site of the Roman invasion and is now an important nature reserve. And at the extreme left of the image, slightly north of the bay, Manston International Airport (an ex-WW2 airfield) stands out well.

Off the shallow coast, the Goodwin Sands are visible. These shifting sands are very treacherous—still a danger to shipping and a graveyard for many wrecks over the centuries. The sands become exposed for several hours twice a day at low tide. In the late 50s, my brother and fellow members of the Royal Marines School of Music in Deal (the town opposite with a pier) used to hold cricket matches on the Goodwin Sands in summer.

South of Deal, the North Downs finally reach the coast and become tall cliffs, showing up as the white edging all along the coastline, past Dover and as far as Folkestone. Dover is the major cross-channel port, with its large sea-wall enclosing the eastern and western docks. Behind the eastern docks, on top of the cliffs, stands Dover Castle, a centuries-old look-out with substantial remains of a Roman lighthouse.

Slightly west of Dover a long oblong of land juts out slightly into the sea in front of the famous White Cliffs. This is Samphire Hoe, a man-made extension to England where 4.9 million cubic metres of chalk marl excavated from the English

side of the Channel Tunnel was dumped. It is now a very interesting and valuable nature reserve and a wonderful place to enjoy the White Cliffs.

Half of the virgin soil was planted with wild flower seed and the remainder with rye grass. The rye grass soon died out and has now been colonised by local flora. The whole area abounds with flowering plants, insects, birds and even lizards and snakes, including adders. At certain times of the year the air is heavy with the scent of the many wild flowering plants.

The Strait of Dover. Vive la difference, I say—that's what makes living in Europe so fascinating.

Join me next time for Part 2 when we'll cross the Channel to look at the landscape and some of the interesting features on the French side of 'La Manche'.

A Snowy Tale

It was reported in early October that, for only the fourth time in a hundred years, Scotland had become a snow-free zone. Other parts of the world were not so fortunate.

Johannesburg, **South Africa** experienced its first snowfall for 25 years on August 2 as much of the nation fell into the grip of icy temperatures. And just two weeks later, three people were discovered frozen to death on Mount Fletcher in the Eastern Cape.

Heavy snow fell over most of **New Zealand** on August 22, hilly suburbs being the worst affected as schools closed and transport was disrupted. While farmers and parents had their lives disrupted by the snow, skiers were said to be appreciating the snowfall.

Late-season snowfall caused traffic chaos in **Tasmania**, Australia on September 25 when it hit suburban areas of the city of Hobart, closing roads.

The Mount Evans Scenic Byway, which claims to be the highest paved road in **North America**, was closed by heavy snowfall on September 27. It is not expected to reopen again till Mid-May next year!

It proved to be unlucky October 13 for western **New York** state when an early snow storm caused havoc, leaving roads blocked, power lines down and some 250 000 consumers without electricity. The heaviest falls, some approaching 100 centimetres, occurred in the Buffalo area near the Canadian border, which experienced its heaviest snowfall for a single October day since records began in 1870.



EUMETSAT's

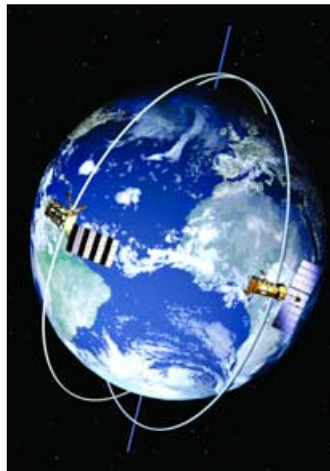
METOP-A

Onboard Instrument Overview

European Space Agency

Starting with the launch of Meteosat-1 in 1977, European geostationary weather satellites have contributed hugely to climate studies and towards making accurate weather forecasts. The successful launch of EUMETSAT's MetOp-A on October 7 2006 marks a new dimension in European weather satellites. MetOp is the first in a series of European polar orbiting spacecraft and flies in an 817 kilometre sun-synchronous polar orbit with an inclination of 98.7° to the equator. MetOp takes about 100 minutes to complete each orbit and during this interval, the Earth will have rotated some 25°, allowing observations to be made over adjacent strips of the planet on successive passes.

Polar satellites orbit at a lower altitude than geostationary ones—typically around 800 km compared with 36 000 km—and can thus observe our planet in greater detail. As its contribution to this arena, Europe has entered into a cooperative venture with America, whereby it provides the 'morning' satellite (MetOp) which crosses the equator at 09.30 local time, while the Americans provide the 'afternoon' satellite (NOAA) whose orbit passes over the equator at 14.30 local time. Together, these two orbits will maximise the coverage over which observations are made and provide the inputs needed for the computer numerical models on which our weather forecasts depend.

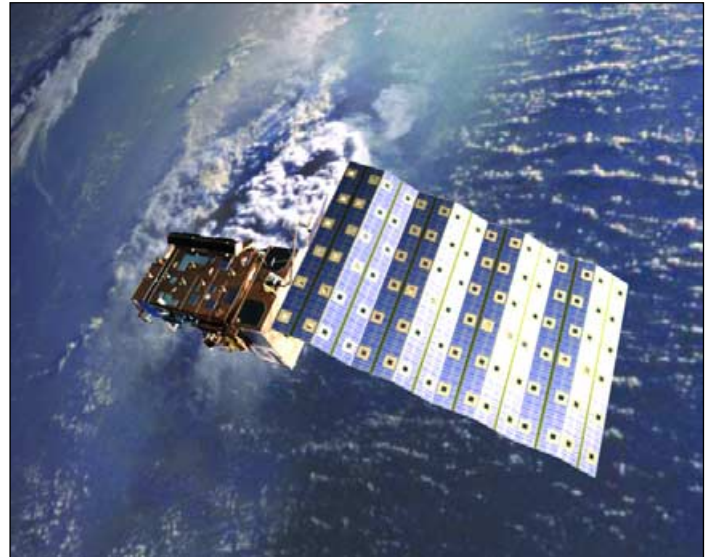


MetOp and NOAA orbits
Credits: ESA - AOES Medialab

The European contribution from the EUMETSAT Polar System (EPS) will provide ever more precise observations aimed towards the improvement of weather and climate forecasts. The field of satellite meteorology is about to enter a new era with the launch of MetOp-A, the first in a series of three new polar-orbiting MetOp (Meteorological Operational) satellites which form the space segment of the EPS

Why do we Need MetOp?

Weather has a major impact on many facets of daily life: agriculture, business, industry, transport, tourism etc: heavy snow brings transport to a standstill; a heat wave increases demand for water; a hurricane can bring widespread devastation. The economic and social benefits of accurate weather forecasts are huge, allowing breathing space to make important decisions and prepare plans of action. Typical examples would be advancing crop harvesting to avoid rains, gritting roads prior to frost or snowfall and re-routing air traffic and shipping to avoid severe weather. Knowing that hazardous weather conditions are on the way can save human life and property.



MetOp-A, due for launch in July 2006, is the first in a series of three EUMETSAT Polar System (EPS) satellites developed by the European Space Agency (ESA) for EUMETSAT, the European Organisation for the Exploitation of Meteorological Satellites. This artist's impression shows the deployment of the solar array.

Credits: ESA - AOES Medialab

In fact, severe weather poses one of today's biggest challenges as the damage caused by weather-related natural disasters is becoming increasingly significant. It is crucial, therefore, that we continue to further our understanding of Earth's atmosphere and its processes to enable better predictions on our ever-changing climate.

MetOp's Suite of Instruments

MetOp-A will carry a set of seven 'heritage' instruments provided by the United States' National Oceanic and Atmospheric Administration (NOAA) and the French Space Agency (CNES) plus a new generation of five European instruments offering improved sensing capabilities to both meteorologists and climatologists.

Several of the instruments measure similar aspects of the atmosphere, namely temperature and humidity, but use a variety of measuring techniques to acquire their data. This approach is crucial for numerical weather prediction, which not only requires high-quality observations but also needs huge amounts of data from different sources to feed into the models.

With its sophisticated array of instruments and diverse measuring techniques MetOp-A promises to provide outstanding data sets to advance the field of meteorology, which will ultimately improve the accuracy of weather forecasting and our understanding of climate change.

The European Instruments

The *Infrared Atmospheric Sounding Interferometer* (IASI) is one of the most advanced onboard instruments measuring infrared radiation emitted from the surface of the Earth to derive data of unprecedented accuracy and resolution on humidity and atmospheric temperature profiles in the troposphere and lower stratosphere, as well as some of the chemical components playing a key role in climate monitoring, global change and atmospheric chemistry.

The *Microwave Humidity Sounder* (MHS) acquires measurements at various altitudes of atmospheric humidity, including rain, snow, hail and sleet, and temperature by measuring microwave radiation emitted from the surface of the Earth.

The *Global Navigation Satellite System Receiver for Atmospheric Sounding* (GRAS) is a Global Positioning Satellite (GPS) receiver that operates as an atmospheric-sounding instrument, providing a minimum of 500 atmospheric profiles per day through a process of GPS radio occultation. GRAS will supply atmospheric soundings of the temperature and humidity of the Earth's atmosphere.

The *Advanced Scatterometer* (ASCAT), an enhanced follow-on instrument to the highly successful scatterometers flown on ESA's ERS-1 and ERS-2 satellites, measures wind speed and direction over the ocean. Its six antennas allow for simultaneous coverage of two swaths on either side of the satellite ground track, providing twice the information of the earlier instruments. ASCAT also contributes to activities in areas as diverse as land and sea ice monitoring, soil moisture, snow properties and soil thawing.

The *Global Ozone Monitoring Experiment-2* (GOME-2) is a spectrometer that collects light arriving from the sun-illuminated Earth's atmosphere or a direct view to the Sun and decomposes it into its spectral components. The recorded spectra are used to derive a detailed picture of the atmospheric content and profile of ozone, nitrogen dioxide, water vapour, oxygen, bromine oxide and other gases.

The Heritage Instruments

(These are the components common to both MetOp-A and NOAA satellite payloads)

Meteorological Instruments

The *Advanced Microwave Sounding Units*, AMSU-A1 and AMSU-A2, measure scene radiance in the microwave spectrum. The data from these instruments are used in conjunction with the High-resolution Infrared Sounder (HIRS) instrument to calculate the global atmospheric temperature and humidity profiles from the Earth's surface to the upper stratosphere. The data are also used to provide precipitation and surface measurements including snow cover, sea ice concentration and soil moisture.

The *High-resolution Infrared Radiation Sounder* (HIRS/4) is a 20-channel radiometric sounder measuring radiance in the infrared (IR) spectrum. Data from HIRS/4 are used in conjunction with data from the AMSU instruments to calculate the atmosphere's vertical temperature profile and pressure from the Earth's surface to about 40 km altitude. HIRS/4 data are also used to determine ocean surface temperatures, total atmospheric ozone levels, precipitable water, cloud height and coverage and surface radiance.

The *Advanced Very High Resolution Radiometer* (AVHRR/3) provides day and night imaging of land, water and clouds and measures sea surface temperature, ice, snow and vegetation cover by scanning

the Earth's surface in six spectral bands in the range 0.58 - 12.5 microns.

Data Collection Instrument

The *Advanced Data Collection System* (A-DCS), provided by CNES, will provide worldwide in-situ environmental data collection and Doppler-derived location services with the basic objective of studying and protecting the Earth's environment. A-DCS, also known as Argos, is an advanced version of the system presently operated jointly by NOAA and CNES.

Space Weather Instrument

The *Space Environment Monitor* (SEM-2), provided by NOAA, is a spectrometer that provides measurements to determine the intensity of the Earth's radiation belts and the flux of charged particles at the satellite altitude. It also supplies knowledge of solar terrestrial phenomena and warnings of solar wind occurrences that may impair long-range communication, high-altitude operations, damage to satellite circuits and solar panels, or cause changes in drag and magnetic torque on satellites.

Search and Rescue Instruments

The *Search And Rescue Processor* (SARP-3), provided by CNES, receives and processes emergency signals from aircraft and ships in distress and determines the name, frequency and time of the signal. These pre-processed data are then fed into the Search And Rescue Repeater (SARR) instrument for immediate transmission to Search and Rescue Satellite (SARSAT) distress terminals on the ground.

The *Search And Rescue Repeater* (SARR), provided by the Canadian Department of Defence through NOAA, receives and down-links emergency signals from aircraft and ships in distress and provides a down-link for data received by the Search and Rescue Processor (SARP-3). SARR receives distress beacon signals on three separate frequencies, translates them and retransmits them to Local User Terminals (LUTs) on the ground. These terminals process the signals, determine the location of the beacons and forward the information to a rescue mission control centre.

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Arctic Summer Ice Anomaly

European Space Agency

Satellite images acquired during the latter part of August 2006 have shown, for the first time, dramatic openings in the Arctic's perennial sea ice pack north of Svalbard. These extended far into the Russian Arctic, all the way to the North Pole, and occupied a geographic area larger than the British Isles.

Our front cover image of the region, acquired by the Medium Resolution Imaging Spectrometer (MERIS) instrument aboard ESA's *Envisat* on August 29, clearly illustrates the large areas of open water and brash ice north of Svalbard.

In addition, data from *Envisat's* Advanced Synthetic Aperture Radar (ASAR) instrument and the AMSR-E instrument aboard the EOS *Aqua* satellite have enabled scientists to determine that between 5% and 10% of the Arctic's perennial sea ice (which had survived the recent summer melt season) had been fragmented by late summer storms.

The area between Spitzbergen, the North Pole and Severnaya Zemlya is confirmed by AMSR-E to have had much lower ice concentrations than witnessed during earlier years.

Mark Drinkwater of ESA's Oceans/Ice Unit said: 'This situation is unlike anything observed in previous record low ice seasons. It is highly imaginable that a ship could have passed from Spitzbergen or Northern Siberia through what is normally pack ice to reach the North Pole without difficulty.'

'If this anomaly trend continues, the North-East Passage or 'Northern Sea Route' between Europe and Asia will be open over longer intervals of time, and it is conceivable that we might see attempts at sailing around the world directly across the summer Arctic Ocean within the next 10-20 years.'

During the last 25 years, satellites observing the Arctic have witnessed reductions in the minimum ice extent at the end of summer from around 8 million km² in the early 1980s to the historic minimum of under 5.5 million km² in 2005—changes widely viewed as a consequence of greenhouse warming.

Satellite observations during the past two years have also shown that the extent of perennial ice is rapidly declining, but this strange condition in late August marks the first time the perennial ice-pack appears to exhibit thinner and more mobile conditions in the European sector of the central Arctic than in earlier years.

Though the reason for the considerable change in the ice pack configuration is still unknown, it is likely to have been due to the particularly stormy weather conditions that prevailed during much of August.

Reference

The Disappearing Perennial Arctic Sea Ice, GEO Quarterly No 1 (Launch Issue) page 5, March 2004.

Contrails

Francis Bell



The following text has been prompted by my own observations and also from articles in GEO Quarterly which have commented on the visibility of contrails from weather satellites.

I live in southwest Surrey, about 30 miles equidistant from the busy Heathrow and Gatwick airports. Of course, this results in many aircraft movements in the sky, which I can see from my house and garden. Although I can see and hear many aircraft, fortunately they are seldom low enough to be a nuisance. After take-off, I guess 30 miles gives the aircraft time to climb high enough for the noise at ground level not to be too distracting.

However, as well as aircraft using the local airports, there are many aircraft in transit over this area. I expect these are European, transatlantic and other long-distance flights being directed and regulated by London air-traffic control.

The point of the above comments is that sometimes the high flying aircraft are almost transparent to me on the ground unless I get sun glint from the aircraft: at other times they are very conspicuous because of the contrails they leave behind.

The photograph shows the sky above my house, looking north, approximately mid-way between Heathrow and Gatwick in June 2006, and shows contrails crisscrossing the sky. Sometimes I note these trails last for over an hour. In other

instances a contrail may last only a few seconds. On other days when the weather and sky look the same there are no contrails at all.

What I do not understand is the variation in the occurrence and persistence of contrails. At cruising altitude aircraft are likely to be somewhere between 35 and 40 thousand feet. At this altitude the pressure is about one third of sea level pressure and the temperature somewhere between -40 and -60°C . But what I don't understand is the variation in the critical factors which control whether or not a contrail is left behind a high flying aircraft.

Could somebody please write to the editor with an explanation of this effect. Are there diurnal and seasonal factors, or is it just controlled by weather patterns and water vapour in the atmosphere at these altitudes.

I understand temperature and pressure phase diagrams and triple points, but they do not offer me an explanation of the dynamics of what must be occurring. Efficiently burning a hydrocarbon fuel in air will generate large quantities of carbon dioxide and water vapour. My phase diagrams tell me that contrails are not due to carbon dioxide. Although the temperature is very low so is the pressure, hence carbon dioxide will be a gas under these conditions; large quantities perhaps but not visible to my eyes. So the contrails

must be trails of condensed water lasting for a few seconds or a period of hours and it is this aspect of the phenomenon that I do not understand. Perhaps somebody could explain these effects to GEO's membership.

As a slight digression I note that five of the contrails in the photograph show a distinctive spiral edge which is caused by vortex shedding from the aircraft's wing-tips. It is quite possible to see the same effect on weather satellite images where the atmosphere is induced into vortices after passing around islands. The induced cloud patterns show this effect very clearly. See GEO Q10 page 8 for an example.

A footnote. If I have my chemistry correct, I think that for every two molecules of water that come out of an aircraft engine exhaust there is one molecule of carbon dioxide. The photograph shows visually how much water vapour aircraft are putting into the high atmosphere, but if you divided it by two you could call it carbon dioxide. I will leave the discussion at this point because I'm an established heretic on the effects of carbon dioxide emissions. But still: if the photograph showed carbon dioxide instead of water it would still be an impressive image.

Birds



Mike Stevens (G4CFZ) recently sent us this image: Mike wrote:

"I thought I would send you this picture. I know its only a bit of fun, but it all helps the hobby along.

"Its my APT Antenna taken in the late afternoon. As we are bird lovers we feed them in the garden and they usually congregate on my antenna. This is the most I have seen so far this season."

A Successful Launch for **MetOp-A**



John Tellick

Finally, after numerous nail-biting delays and disappointments, *MetOp-2* roared into the night sky above Baikonur Cosmodrome in Kazakhstan at 16:28 UT atop a *Soyuz2-Fregat* launcher.

The launch, originally scheduled for July 17, was aborted during the final countdown owing to software problems with the rocket and a re-scheduled launch the next day was also aborted owing to 'automated check-out routines unable to deal with the partially-fuelled launcher configuration, which had resulted from investigations into the previous abort.' A third launch attempt on the 19th also proved fruitless when the ground system stopped the clock owing to operator error.

By this time, the Soyuz rocket had exceeded its 'fuelled time on the ground' and had to be returned to 'the factory' for refurbishment. Its cargo, MetOp, had to be transported back to the integration facility to be released from its fairing to undergo checks, testing and readying for a future launch.

Baikonur is a very busy launch facility, also serving the ISS and several ISS supply launches, as well as other satellite launches, were planned before the end of the year—so would it be possible to slot in the delayed MetOp launch?

Well, they did, and everything was going well until the integrated assembly of launcher and satellite was 'dropped' a few centimetres whilst it was being transported (horizontally) by rail to the launch facility. This caused a further short delay whilst everything was checked and verified.



MetOp on its way to the Launch Pad
Credit: ESA

The new launch was finally scheduled for 16:28 GMT on October 17 but with just a few seconds remaining before ignition, it was 'suspended.'

The clock in the ESOC control room showed '000:00:01 Hold'. The reason was a minor ground segment problem and launch was re-scheduled for the same time the following day. Unfortunately, high upper atmosphere winds prevented it taking place. But, after many disappointments, the October 19 launch went ahead on time and without a hitch.



MetOp on the launch pad awaiting take-off
Credit: Kurt Büchler, ESA

The Svalbard ground station picked up telemetry data from the satellite during its first orbit shortly after leaving Baikonur and reported that basic systems looked good.

The satellite was under the control of the ESA Space Operations Centre (ESOC) till Sunday October 22, during which period the solar panels were deployed and systems checking and various antenna deployments began.

MetOp-A, as the satellite is now known, is now under the control of *EUMETSAT* who are beginning several months of commissioning, sensor verification and calibration.

MetOp is a large satellite, the size of a double-decker bus, and at 4093 kilograms is the second largest polar orbiter built in Europe. The largest, Envisat, on which MetOp is based weighed in at slightly over 8 tonnes.

As MetOp is a highly complex satellite with many new and different sensors onboard, commissioning is going to take some time. A new ground facility has been built in Svalbard to receive MetOp data and this also requires validation with live data. Svalbard is a particularly important receiving station since, being so close to the North Pole, it receives part of every pass polar orbiting satellites make. Svalbard will also be used for downlinking stored global data. And as EUMETCast users are already aware, Svalbard has been receiving and relaying HRPT data from NOAA-17 and NOAA-18 for some months now.



The EPS ground station, Svalbard, Norway
© 2006 EUMETSAT

I'm sure we are all eagerly looking forward to seeing the new high-resolution data from MetOp, but perhaps not the problem of handling such a vast amount of data.

Congratulations to ESA, EADS-Astrium, Starsem, CNES, NOAA, ESOC and *EUMETSAT*, who have combined to design, construct and orbit MetOp. At last Europe has placed its own advanced polar orbiting meteorological satellite in orbit. Together with the advanced European MSG geostationary satellites, *EUMETSAT* has made Europe one of the world leaders in the dissemination of advanced high resolution meteorological data.

Earth Imaging News

Peter Wakelin

GSLV Failure Investigation Completed

As reported in the last issue (page 43), an Indian GSLV rocket carrying the *Insat-4C* communications satellite failed shortly after launch. The Failure Analysis Committee (FAC) concluded that the cause of the failure was the loss of thrust in one of the four strap-on liquid-fuelled motors as a consequence of a pressure regulator failure just five seconds after ignition. A manufacturing error is believed to have permitted an excessive propellant flow which led to intolerable temperatures in the gas generator.

The FAC reported that, although the GSLV design is robust, a much stricter control on fabrication, inspection and acceptance procedures is needed. A long-duration hot test on one in every 20 engines built is also recommended to ensure that the production process is under control.

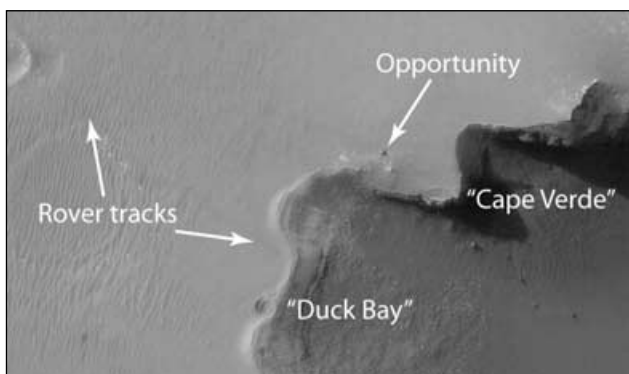
Immediate implementation of the FAC's recommendations ensures that the GSLV programme will soon be back on track and *Insat-3D*, a dedicated meteorological mission, should still go up in 2007 as planned.

Another Debris Hazard

Residual propellant in Japan's H-2A second stage rocket, which launched the *ALOS* remote-sensing satellite in January, 2006, was the likely cause of an explosion that blew the rocket to pieces. US sensors have detected more than 20 fragments but there will inevitably also be many smaller pieces, each capable of destroying a satellite in the orbits used by many Earth-observing spacecraft.

Mars Reconnaissance Orbiter Reaches Science Orbit

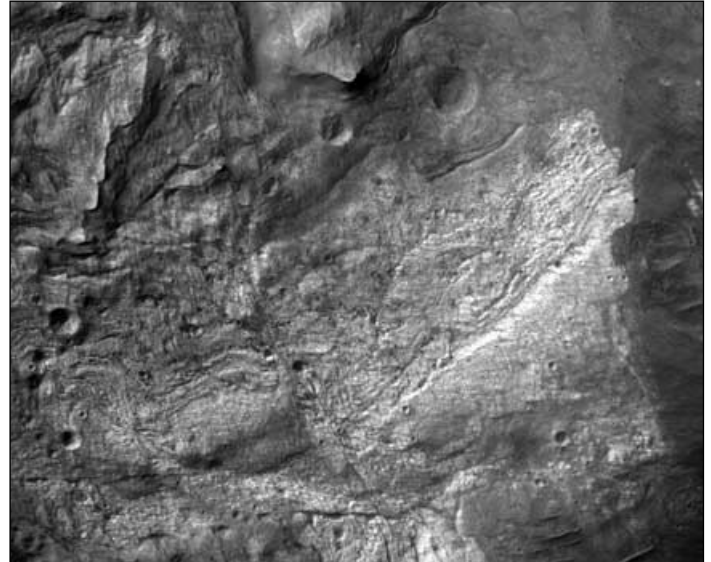
The Mars Reconnaissance Orbiter (MRO) arrived at the Red Planet on March 10, 2006 and its engine fired to reduce its speed just enough to enable the spacecraft to enter a Mars orbit varying between 425 and 43,000 kilometres above the surface. To conserve valuable fuel, aerobraking was then used to reduce the orbit. A small adjustment brought the lowest point down to just 105 km where, on every orbit, energy would be lost to atmospheric friction. After more than 6 months, the planned orbit has been achieved with very little further expenditure of fuel.



MRO images the rover Opportunity.
This image covers an area approximately 200 x 400 metres.

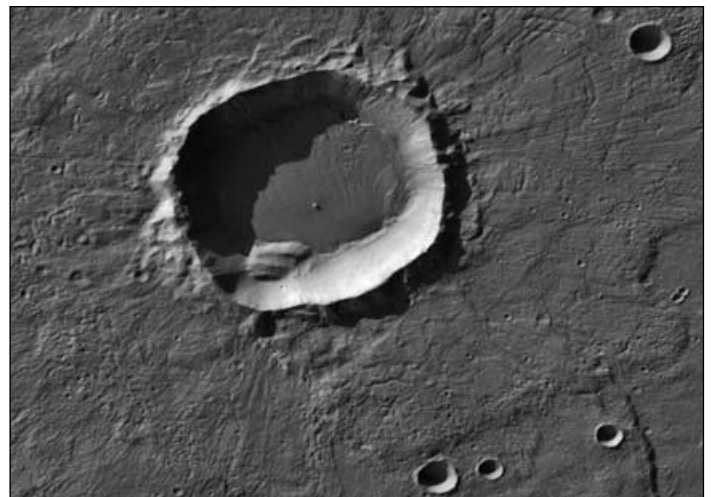
Credit: NASA/JPL

Some magnificent imagery has already been returned and plenty of science data should be streaming back to Earth for a long time to come. The resolution of the High Resolution Imaging Science Experiment (HiRISE) camera on MRO is about 80 cm from an altitude of 250 km, enabling it to easily spot the rover



This is the first high-resolution image of the Red Planet returned from NASA's Mars Reconnaissance Orbiter, on Sept. 29, 2006. The High Resolution Imaging Science Experiment (HiRISE) acquired this image from an altitude of 280 km at a resolution of 30 centimeters per pixel. The view shows a small portion of the floor of *Ius Chasma*, a branch of the giant *Valles Marineris* system of canyons and resolves rocks as small as 90 centimeters in diameter. At bottom right are a few dunes or ridges of windblown sand. If you were standing on this part of Mars, you would just barely be visible in this image.

Image: NASA/JPL



This image shows an unnamed crater in the *Terra Sirenum* region of Mars. An enhanced color view of gullies in the crater wall, taken by the High Resolution Imaging Science Experiment (HiRISE) camera aboard NASA's Mars Reconnaissance Orbiter, appears on the inside front cover of this issue.

The region receives very little sunlight during the southern Mars winter, when the image was taken (early October). The bluish areas consist of frost, which, at the latitude of this image (-39°), is most likely composed of water because the temperature is not low enough for carbon dioxide condensation. The reddish regions are locations where frost has been removed, most likely by sublimation. The dark, unfrosted regions represent the most recent activity in the gullies and are possibly a result of seasonal melting.

Image: NASA/JPL

Opportunity which has been roaming the surface of Mars for two years. More information and useful links can be found at

<http://www.nasa.gov/mro> and <http://HiRISE.lpl.arizona.edu>

Japanese Spy Satellite Launched

Japan's first pair of Information Gathering Satellites (IGS) was launched in March, 2003 and the second pair was destroyed in a launch failure later that year. The pair consists of one radar and one optical spacecraft in orbits precisely controlled by frequent small manoeuvres.

A new optical satellite was launched on September 11 and its radar companion will follow later. The reason for the separate launches is unclear but speculation that the dubious reliability of the H-2A launch vehicle prompted the decision not to risk two spacecraft in one launch may not be correct.

The US authorities acceded to Japan's request not to make orbital data on these satellites public but hobbyist visual observers soon found them and the latest one is in a 488 km near-circular sun-synchronous orbit.

MetOp Successfully Launched

After several delays, *MetOp-2* was eventually launched on October 19 from Baikonur on the first orbital flight of the new Starsem *Soyuz-2-1A*. This version made a sub-orbital test flight in November, 2004 without a *Fregat* upper stage. Although new, the *Soyuz-2-1A* still resembles the fifty-year-old *R7* ballistic missile from which it has evolved. The original plan was to launch *MetOp* on an *Ariane 5* vehicle but a suitable co-passenger destined for a similar orbit could not be found and a lone *MetOp* launch on the powerful Ariane could not be justified. Also, there were early concerns about possible vibration damage to *MetOp* on the *Ariane* but these have been overcome and it could be used for future *MetOp* launches.

Liftoff occurred at 1628UT. The Soyuz stages completed their tasks within 9 minutes and fell back to Earth leaving the *Fregat* to fire five seconds after separation to increase its speed by 1290 m/s enabling it to coast up to about 830 km. The *Fregat* then burned another 314 kg of fuel increasing its speed by a further 182 m/s to circularise the orbit. Having done its job, *Fregat* separated from the 4,093 kg *MetOp A* at 17:37 and, 38 minutes later, used its remaining fuel to reduce speed and fall towards the Pacific Ocean. To avoid confusion, orbiting *MetOp* satellites will be designated in launch order, A, B and C.



MetOp takes to the night sky

Credit: ESA

MetOp was born out of POEM, the European Space Agency's Polar Orbit Environmental Mission, which got under way in the late 1980s and was based on a large platform carrying both Earth observation instruments and an operational meteorological package. In 1992 it was decided to spread the instruments across two platforms: *Envisat*, for Earth observation and a dedicated *MetOp* for the operational meteorological instruments.

MetOp's payload module carries 13 instruments as well as housing the spacecraft's avionics. The instruments are provided by NOAA, ESA, EUMETSAT and the French space agency, CNES. Some instruments, such as the Advanced Very High Resolution Radiometer (AVHRR), the High Resolution Infrared

Sounder (HIRS) and the Advanced Microwave Sounder Unit (AMSU) are already in use on the NOAA polar-orbiting satellites but others are either instruments developed for *MetOp* or improved versions of instruments flown on other spacecraft such as GOME-2, an improved version of the Global Ozone Measuring Experiment flown on *ERS-2*. The Advanced Scatterometer, ASCAT, is an upgraded version of that flown on both *ERS-1* and *ERS-2*.

The Global navigation satellite system Receiver for Atmospheric Sounding (GRAS) is a new instrument utilising transmissions from the GPS constellation of satellites to derive atmospheric temperature and humidity profiles. Another new instrument is the Infrared Atmospheric Sounding Interferometer (IASI), a major element of the *MetOp* mission. It operates in over 8,000 spectral channels to provide temperature and humidity profiles to an unprecedented accuracy. It can also accurately measure quantities of trace gases in the atmosphere such as methane.

Following the successful launch, the Satellite In-Orbit Verification (SIOV) campaign is under way. As SIOV times vary for the different instruments, they will be progressively released to the next phase for system validation and calibration. It will be several months before *MetOp A* is fully operational.

Alaskan Dust Storm



The Moderate Resolution Imaging Spectroradiometer (MODIS) flying onboard NOAA's *Aqua* satellite imaged this dust storm derived from glacial sediments blowing off the Alaskan coast on November 1, 2006. The dust appears as a translucent plume, creating swirls over the ocean that vaguely mimic the shapes of nearby clouds.

Dust storms usually call to mind visions of hot, sandy deserts but they can also form at high latitudes. Alaskan glaciers grind the underlying rock into fine silt and winds blowing down the mountain valleys often carry this fine material with them. Because they blow primarily downward, these winds can actually change direction and follow the mountain valleys in which they travel. A close look at the image above shows the dust storm turning corners, following the Copper River Valley on its way to the sea.

Image: Jeff Schmaltz, MODIS Rapid Response Team, Goddard Space Flight Center

Run your R2FX Receiver under Computer Control



Clive Finnis

The R2FX receiver has proved to be a very popular item and many have been sold by the GEO Shop. Its popularity is well understood—it is very reasonably priced yet bristles with advanced features, some unique amongst the available APT receivers, such as its ‘antenna diversity’ function.

What makes the R2FX my receiver of choice is the ability to control it from a PC; thus I can leave it running, go to work, and when I return in the evening all the passes have been safely stored to my hard disk ready to be viewed at my leisure. During the day, the PC will have automatically switched the R2FX to the correct frequency for each satellite pass.

Setting up PC Control

Setting up the computer control is very simple. If you have purchased the R2FX accessories pack from the GEO Shop, you will have all the leads you require: if not, you will need a 9 pin to 9 pin PC serial cable, available from most UK PC stores, such as PC World or Maplins.

Unfortunately, there are several varieties of PC serial cable, all wired slightly differently. You will need a cable with a 9-pin D-type connector plug at one end and a 9-pin D-type connector socket at the other end. This must be wired ‘one to one’ (i.e. pin-1 on the plug is wired to pin-1 on the socket, pin-2 to pin-2 ... pin-9 to pin-9). The metal shield around the D-type connectors should also be connected to each other, for screening purposes.

The software to control the R2FX is built in to Craig Anderson’s *Wxtolmg* software. You can download the freeware version from

www.wxtoming.com

but I would like to describe the new R2FX control feature in the latest release of David Taylor’s excellent satellite tracking program *WXtrack*, which you can download from

www.satsignal.eu

David has generously included the R2FX control functions in the free download version but I would urge everyone who uses the program to register for the single user/educational licence at £24.50. Once you have used this program you will realise what excellent value this is, and registration enables David to expend time and effort on supporting and enhancing the program. David is a real ambassador of our hobby and deserves our support.

Having installed *WXtrack* and set it up (entered your geographical location, selected the satellites you would like to track and updated the Kepler elements) then it is time to connect the R2FX.

Connecting up the R2FX

The plug end of your serial cable connects to the D-socket on the rear panel of your R2FX (there is only one socket and the cable will only connect one way round, so no problems here). The other end of the cable connects to your PC serial port (sometimes known as a com or communications port). The only possible hiccup here is that some PC’s require a 25-pin D-type connector rather than the 9-pin one fitted on the cable. Moulded 25 pin to 9-pin converters are available, again from *Maplins*, *PC World*, *Tandy* (*Radioshack*) etc.

To ensure that both the R2FX and the PC can communicate, I would recommend running the *R2FX-Config.exe* program, which can be found on the CD supplied with the R2FX.

Select the number of the serial/com port on your PC (usually COM 1 or COM 2, unless you are using a USB to serial converter (more of which later), then click the ‘Load’ button (figure 1). All being well, the R2FX will report back its settings (figure 2).

Without disturbing the R2FX or the cable, click ‘Quit’ to exit the *R2FX-Config* program (unless you wish to change any of the parameters to suit your personal choice. Please refer to the R2FX manual if you need to do this) and run *WXtrack*.

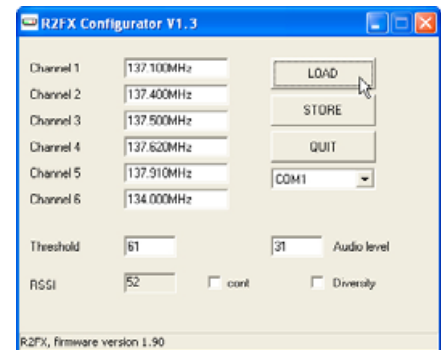
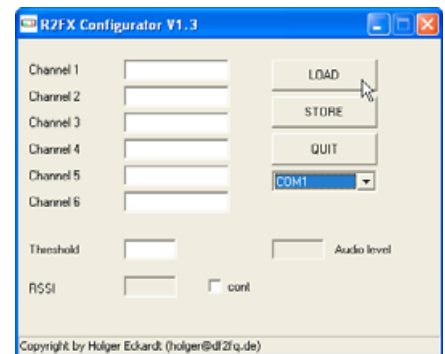


Figure 1 (upper) and Figure 2

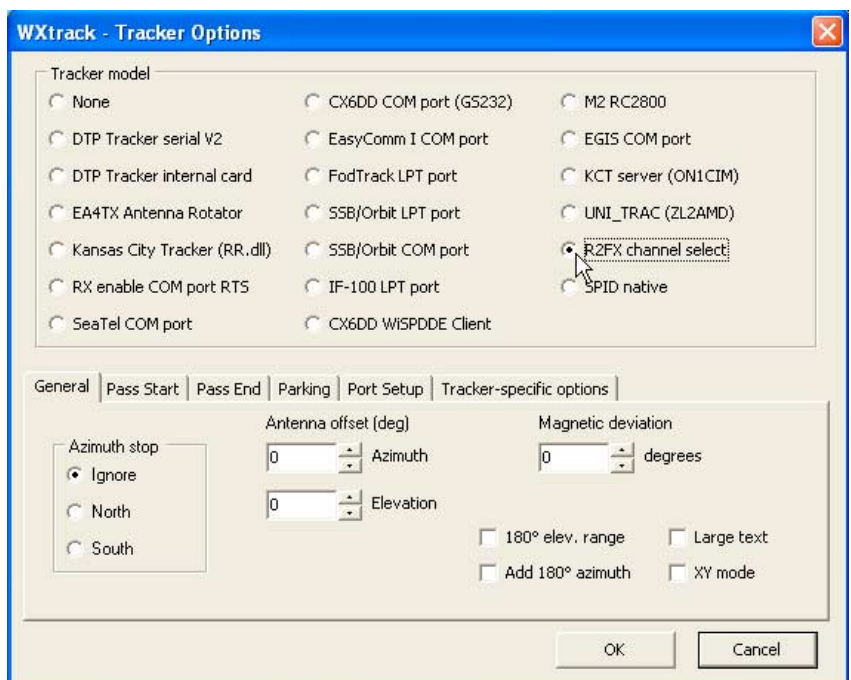


Figure 3 - The WXtrack ‘Tracker Options’ panel

WXtrack

To set up *WXtrack* for control of the R2FX you need to click on the 'Tracker' tab at the top of the screen and select 'Options'. The *WXtrack* 'Tracker Options' panel opens.

Click on 'R2FX channel select' as shown in figure 3 then click on the 'Port Setup' tab half-way down the window. Here, ensure that the COM port number is correct; i.e. the same as the one that you used in *R2FX-Config.exe* above.

Click 'OK' to exit from the Tracker Options window. It is recommended that you now exit *WXtrack* then restart the program in order to load the new settings correctly. All being well you will see 'R2FX' in the centre box at the bottom of the 'World Map' page.

WXtrack will send a 'change frequency' command to the R2FX one minute before the next satellite (and all subsequent satellites) comes into range. The R2FX shows that it has received this command by turning **off** all six front panel 'channel' LEDs, as shown in figure 4.



Figure 4 - The R2FX Receiver

Antenna Diversity

This useful feature, which allows you to switch between twin antennas or a single antenna, is now controlled through software, unlike the older model reviewed in *GEO Quarterly No 7*.

USB Problem

One *GEO* member contacted me recently to say that he could not enable the antenna diversity function using *R2FX-config.exe* because he did not have the necessary 'tick box' showing on screen. I assumed that he had somehow received an old or defective version of the software and sent him the latest version, but the problem persisted. After various e-mails it transpired that as his PC did not have a serial port; he was using a USB-to-serial converter to control the R2FX. I purchased one from my local *PC World* and, sure enough, encountered exactly the problem he had described (figure 5). Clearly this variety of USB-to-serial converter was only partly working—unfortunately only too common a problem with cheap 'Far Eastern' electronics, I have found (see figure) 6.

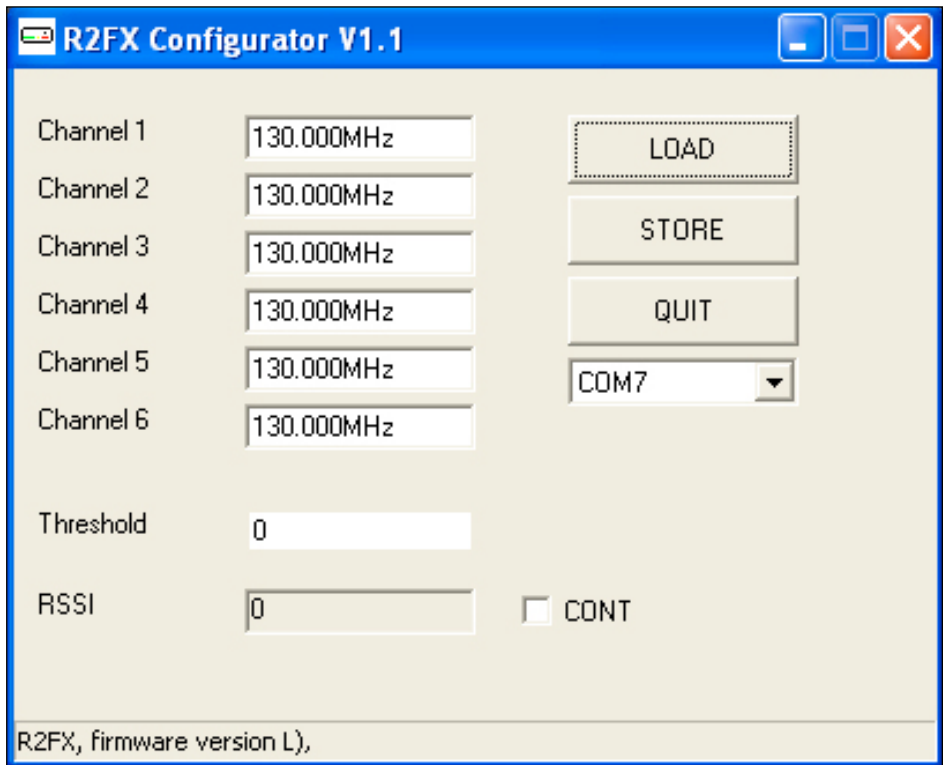


Figure 5 - Diversity check-box is absent when using a 'cheap' USB to serial converter

I then set about trying to find a reliable solution, and having heard good reports of FTDI chips 'through the trade', purchased one of their converters for £10.00.

At least it is made in Scotland, not Taiwan! It worked perfectly! I purchased the 'bare' system UC232R-10-NE 'chip'(figure 7), but for an additional 50p FTDI have one with a stylish white case.

So the motto is: cheap isn't always best.

If there is sufficient demand the *GEO Shop* will stock these converters. Otherwise please see the 'Chip Shop' at:

www.ftdichip.com.



Figure 6 - A 'cheap-and-nasty' USB converter



Figure 7 - A full-function USB converter

Apparent Anomaly in Midwinter NOAA-17 Channel-2 Images

Les Hamilton

Last January, I received a query concerning a phenomenon that appears uniquely in NOAA-17 channel-A images during the depths of winter. As we approach the end of yet another year it is anticipated that this will once more manifest itself, so now is a good time to explain what is happening.

Whilst passing over the Arctic, where there is insufficient illumination in the visible spectrum at this time of the year for imaging in visible light, NOAA-17 transmits channel-3B infrared images (centred on 3.75 μm). But once the craft encounters better illuminated terrain, imaging automatically switches to channel-2 (0.86 μm) to provide visible-light imagery. That, at any rate, is the theory, and is precisely what occurred with previous NOAA satellites that had implemented this frequency changeover.

In practice, the NOAA-17 frequently fails to make a sharp transition between the two channels: for as long as half a minute, a band of brighter imagery may be transmitted before the final switch to channel-2 is made. What, I was asked, was the reason for this anomalous effect which appears in so many NOAA-17 passes for several weeks during both December and January?

To understand what is happening here it is necessary first to delve into the operation of the AVHRR/2 (Advanced Very High Resolution Radiometer) imaging instrument flown aboard earlier NOAA satellites. This was originally developed to sense the Earth in five radiation bands, as detailed in Table I below.

| Channel | Frequency range (μm) | |
|---------|-----------------------------------|-----------------------|
| 1 | 0.58 - 0.68 | visible |
| 2 | 0.725 - 1.00 | visible/near infrared |
| 3 | 3.55 - 3.93 | mid infrared |
| 4 | 10.50 - 11.50 | far infrared |
| 5 | 11.40 - 12.40 | far infrared |

Table I - Frequencies in the AVHRR/2 (pre-NOAA-15)

All five channels were transmitted simultaneously, 24 hours per day, within the HRPT data stream but only two of them could be provided in the APT transmission. As a compromise, to prevent the transmission of completely blank frames during night-time (which does in fact occur for NOAA 12 and NOAA 18), channel-3 was activated during the hours of darkness. Throughout most of the year this switch-over occurs when NOAA 17 is out of radio range.

| Channel | Frequency range (μm) | Typical use |
|---------|-----------------------------------|--|
| 1 | 0.58 - 0.68 | Daytime cloud and surface mapping |
| 2 | 0.725 - 1.00 | Daytime detection of land/water boundaries |
| 3A | 1.58 - 1.64 | Daytime detection of snow and ice |
| 3B | 3.55 - 3.93 | Fire detection; night time cloud detection |
| 4 | 10.30 - 11.30 | Cloud mapping and sea-surface temperatures |
| 5 | 11.50 - 12.50 | Sea surface temperatures |

Table II - AVHRR/3 frequencies (NOAA-15 to the present day)

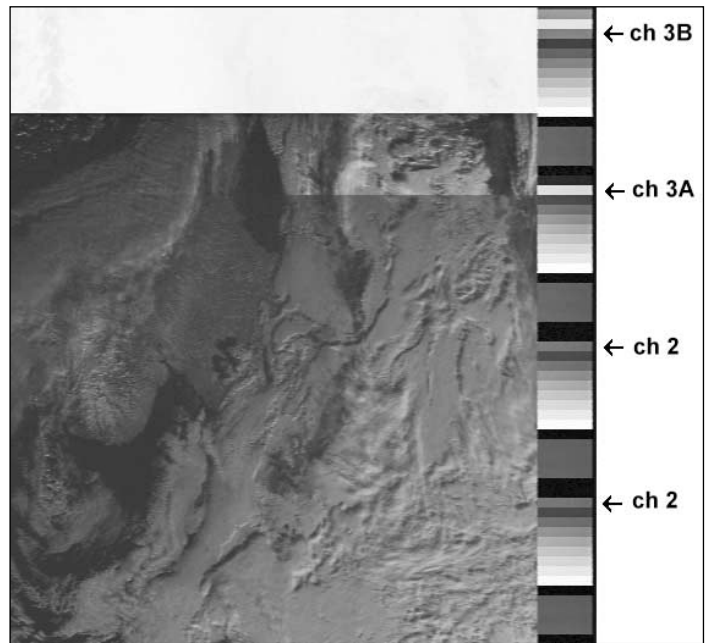


Figure 1 - Section from a NOAA-17 morning December visible image

The 6th Channel

Starting with NOAA-15, the improved AVHRR/3 radiometer was flown on the NOAA satellites. Amongst other improvements this instrument was now capable of imaging in six channels. The additional near-infrared frequency was given the assignation channel 3A while the 'old' channel-3 became channel-3B. Table II lists the six frequencies and their principal uses.

Channel Identification

A glance at figure 1 illustrates the situation when the NOAA-17 channel-A is switched. There are clearly three distinctly different image characteristics present: it appears very much as though we are viewing contributions from not two but three different AVHRR channels. So the first thing we require to do is identify which channels are operating.

Everyone who receives APT from the NOAA satellites will be familiar with the calibration bands flanking each image (figure 2; see also page 30). The 16 shaded boxes—which are repeated between each pair of minute markers—include, amongst other information, an 8-strip greyscale. This greyscale is readily identifiable; its strips being numbered 1 to 8 in order of increasing modulation index (brightness). Strip 9 is always black (zero modulation) and is a useful marker. The final strip (16) is the all-important Channel ID Wedge (arrowed at the foot of figure 2).

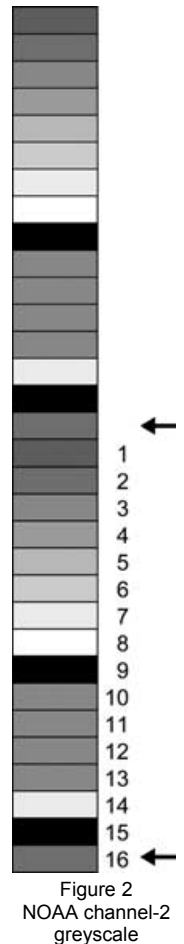


Figure 2 NOAA channel-2 greyscale

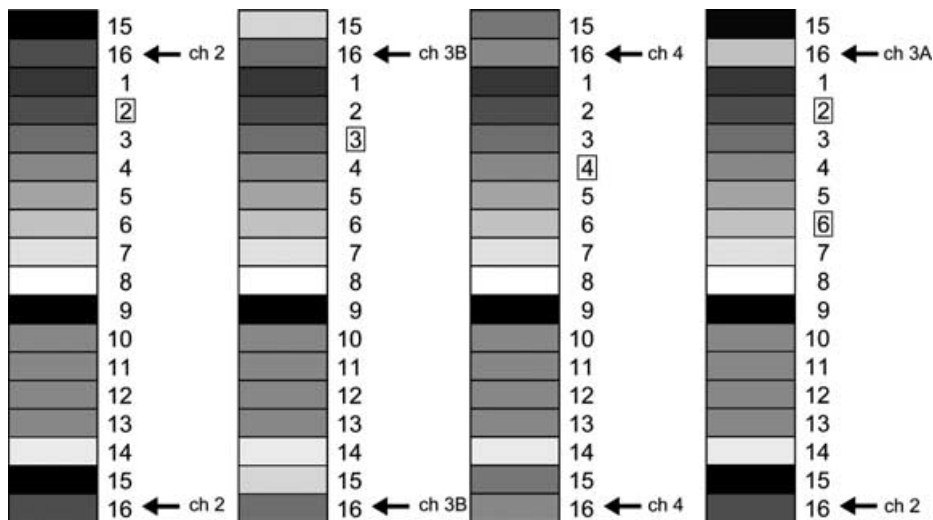


Figure 3 - NOAA APT edge calibration bands compared

The channel currently being transmitted in the APT frame is readily determined by reference to this ID wedge. If the ID wedge has the same shade of grey as strip 2 on the greyscale, channel-2 is active; if it has the same shade as strip 4 then channel-4 is active. Figure 2 shows two minutes worth of edge calibration band for channel-2. The best way to compare these strips is by importing an APT image into a paint program and determining the 8-bit greyscale code of each strip using its 'colour picker' tool.

Returning to figure 1 it is now readily apparent, in the region where the image switching takes place, that three different greyscale values occupy successive Channel ID Wedge strips (arrowed). Initially, when NOAA-17 first came within reception range, it was transmitting channel-3B, the overnight mid-infrared. Shortly before the switch-over to visible channel-2 imaging at the terminator, the channel-3 transmission itself switched from -3B to channel-3A, a near infrared frequency used for daytime discrimination of snow, ice and cloud features. This channel is not normally transmitted via APT—what we are seeing here is just a tiny glimpse of it.

However, one mystery remains. During channel-3A's brief appearance, the shade in the ID wedge matched that of step-6 on the greyscale! When the radiometer was upgraded to the AVHRR/3, a sixth channel was added. Since the first five steps in the greyscale wedge were already allocated to existing channels, the new channel was therefore matched with step-6. Because the original channel-3 and the 'new' channel-6 time-share the channel-3 AVHRR stream, they were both renamed, the 'old' version to channel-3B and the 'new' channel-6 becoming channel-3A. Figure 3 shows the appearance of the calibration margins for channels-2, -3B and -4 as well as the brief channel-3A/2 transition. In all cases the ID wedge rectangles are arrowed while the numbers for the calibration rectangles are outlined. Notice how strip 15, the 'Back scan' value, varies as transmission switches from one frequency to another.

Why Only NOAA-17?

At present there are four NOAA satellites actively transmitting APT imagery, yet NOAA 17 is the only one where this effect is apparent. To understand why, we need to consider the use made of the channel-3A frequency.

Although all current satellites except NOAA-12 have the capability of switching between channels 3A and 3B (in their HRPT transmissions) as the satellite moves from darkness into daylight, NOAA-17 is the only one that currently does so. This stems from a decision by NESDIS (NOAA's National Environmental Satellite, Data and Information Service) in May 2003 to rationalise the AVHRR Channel 3A/3B switching scheme. It was determined that channel-3A data was required from only one satellite, once per day. So although all satellites since NOAA-15 have channel-3A/B switching capability, NOAA-17 is currently the (sole) designated satellite which actually switches channels in this manner, with channel-3A active during daylight and channel-3B during the hours of darkness.

The AVHRR/3 instrument is pre-programmed to make its channel 3B to 3A switch close to the expected time that NOAA-17 crosses the terminator (the line separating darkness from daylight on the Earth's surface).

Increasing ground illumination below the satellite automatically triggers the channel-3 to channel-2 switch in the APT data stream once illumination is sufficient for imaging.

In reality, the times of these two events often differ by several seconds, allowing channel-3A to appear briefly in the APT data stream before channel-2 is active.

If you haven't observed this effect before, look out for it during December and January. Indeed, this year I have already noticed the effect as early as November 3.

It's been a Great 3 Years

Nigel Evans reminisces on his time as GEO Membership Secretary

As Francis Bell has mentioned I intend to stand down as Membership Secretary at the end of 2007. My work takes me to France every day, and my other hobbies which include playing keyboard in a local rock band and an active role in the local amateur radio community in Dover leaves me less and less time available for GEO, let alone family.

I am proud to have been associated with the launch of GEO. In the autumn of 2003 many of us had recently left RIG, and recognised a need for a new group, run by a more corporate rather than a committee/quasi political led management system.

We met in West London and over a few hours firmed up the format, which is GEO today. This included a management team, friendly approach, large A4 format full colour magazine, an official Internet Forum and a need to form links abroad, especially with our friends in Europe.

The offer of a free colour issue financed by some of the management teams' own funds quickly secured our place in the WX community. Sterling efforts by the GEO-Shop team cross-subsidise to keep our subscription costs down. I will also mention the work carried out by our editor Les Hamilton who also wishes to take a break this year. He has invested many hours to guarantee that GEO provides the best Weather Satellite periodical available, and which is read all around the globe by amateurs and professionals.

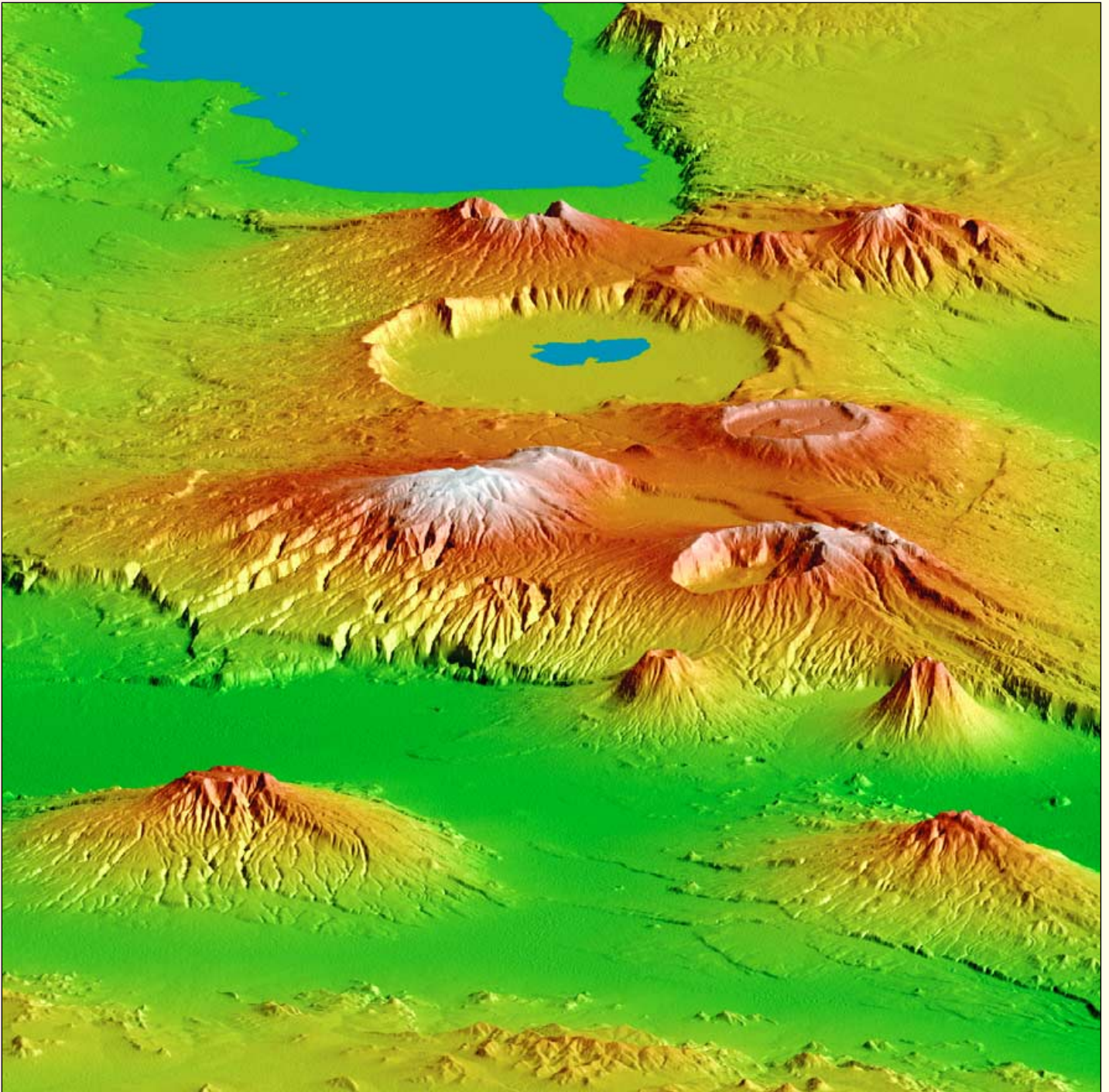
I would like to mention the special links we have forged with the Dutch Group *Werkgroep Kunstmanen*. Many of their members have become personal friends and have welcomed us into their homes and many club events.

I have seen the GEO membership swell to over 500 subscribers, and this looks likely to remain steady as long as everyone remembers to renew.

I shall of course continue to be part of the GEO management team and offer my help whenever possible.

Finally I would like to thank all the subscribers, the management team for their tireless efforts, and those members who have taken time to contact me personally with kind words and praise for GEO.

An SRTM view over Tanzania's Crater Highlands



During an 11-day mission during February 2000, Space Shuttle *Endeavour* flew the Shuttle Radar Topography Mission (SRTM), a specially modified radar system. The outcome was the most complete high-resolution digital topographic database of Earth (<http://www2.jpl.nasa.gov/srtm/>).

False colour and shading are frequently added to SRTM images to ease interpretation of features. This recently released image of the Crater

Highlands along the East African Rift in Tanzania shows a region where volcanism, landslides, erosion and deposition are all very evident.

In this image the lowest elevations are shown in green, uplands in brown and the highest elevations in white. Shading indicates the slope. The vertical relief has been exaggerated by a factor of two to reveal greater detail. The image is oriented as you would see it looking from the north toward the southwest.

The large blue feature at the top of the image is Lake Eyasi while the smaller one below it occupies the famed Ngorongoro Crater. The impressive white-capped upland beneath the crater is the 3,648 meter Mount Loolmalasin with Ela Naibori Crater to its right. At the very foot of the image two broad mountains, Kitumbeine (left) and Gelai (right) rise from the rift lowlands.

Image: NASA/JPL/NGA Shuttle Topography Radar Team

satellite transmission it may well cause the LNA to go into gain compression, with the result that the much weaker satellite signal will be 'suppressed', making it weaker still. The only way around these problems is to use a very linear but low-noise device in the LNA design and add some filtering after the LNA stage.

Which RF Device?

Numerous other LNA designs have used dual-gate MOSFETs such as the *GaAs NE25139* and *Silicon BF988* and, although these devices are capable of low noise (~1 dB), they have terrible linearity. An early design of mine (using a correctly biased BF988) yielded a 1 dB compression point of ~+8.5 dBm, with the resulting IM3 intercept point at ~18 dBm.

Therefore, manufacturers' data sheets were searched for better RF handling devices and several new GaAs MMICs, namely the *MGA-53543* and the *MGA-62563*, were found from *Avago Technologies* (formerly *Agilent*):

<http://www.avagotech.com>

Both devices have similar noise figure specifications but the IM3 linearity of the *MGA-53543* is quoted at 39 dBm. This is some 20 dB better than the dual-gate MOSFET. The only snag with this device is that it is conditionally stable below 500 MHz. The *MGA-62563* is unconditionally stable at low frequencies but, due to the internal feedback network, has a lower IM3 of 35 dBm. To ensure stability and ease of design and construction the *MGA-62563* was chosen for the LNA design.

Circuit Design

The circuit of the LNA is shown in figure 1. The device requires a bias current of ~60 mA at 3 V to give the best linearity performance but still maintains a creditable noise figure of under one decibel (1 dB). The main circuit is taken from the data sheet but a 5 V regulator is used to reduce the 12 V supply (from the weather satellite receiver, via the co-axial antenna download) to a more suitable level. The voltage regulator also provides some protection from power supply spikes and reduces low frequency noise. A drop-down resistor is used to set the bias to the device at the specified 3 V (assuming $I_{bias} = 60$ mA set by R5 at 220 ohm). The output of the LNA is fed to a 50 ohm band-pass filter (of standard design) comprising three lightly coupled resonators using miniature *Toko MC108* inductors. To isolate these inductors and ensure that the filter coupling is set with the coupling capacitors only, these inductors are screened.

The circuit (figure 1) was simulated to obtain the predicted noise figure and gain performance, with the resulting plots shown in figure 2 and figure 3. Following optimisation of the filter, several prototypes were constructed. The results of one of these are shown in Table 2 (below).

Construction

A small single-sided PCB (40 x 25 mm) was designed for the LNA, so that it could be sited inside the antenna at the start of the co-axial feed. Surface-mount components were used to miniaturise the PCB and also to ensure that the RF performance between different builds was very similar. Holes were drilled into the PCB to allow the miniature *MC108s* (and their associated screening cans) to be mounted on the non-copper side. The track side view of the PCB is shown in Figure 4.

The list of components used is shown in Table 1. The box listed is only a suggestion; some people may want to fit the LNA directly into the antenna at the start of the feed. Many of the components, including the active devices and SMT components, can be obtained from Farnell:

<http://uk.farnell.com/jsp/home/homepage.jsp>

The Toko coils and screens were obtained from JAB Electronic Components

<http://www.jabdog.com/index.htm>

The first thing to do when the PCB is etched and drilled is to fit

the SMT components, followed by the *MC108* inductors and their screening cans. A suggested sequence for fitting the SMT components is to start with the resistors, followed by the capacitors and inductors, with the active devices last.

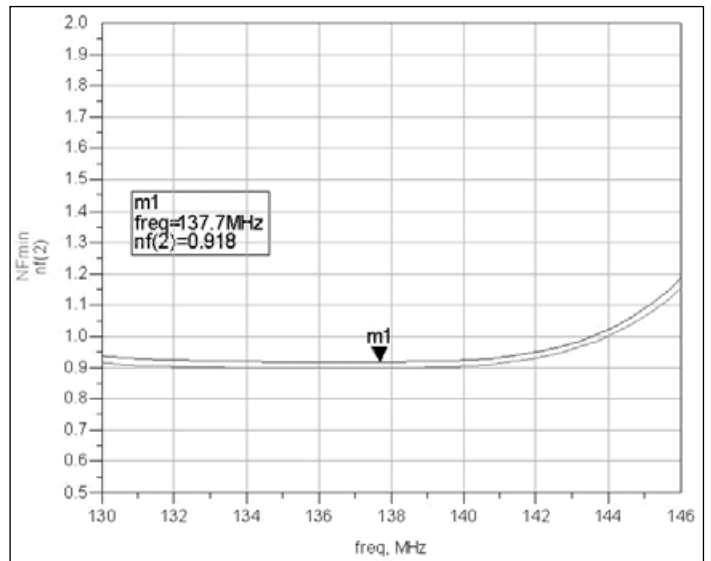


Figure 2 - Simulation of the LNA showing a plot of minimum noise figure (lower plot) and the simulated circuit noise figure (upper). The predicted noise figure of the LNA is 0.92 dB.

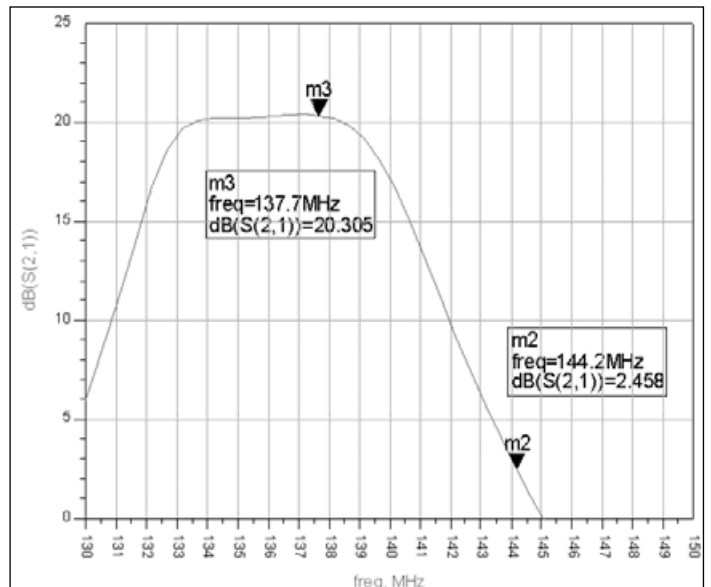


Figure 3 - Gain simulation results for the LNA showing about 16 dB rejection at 144 MHz.

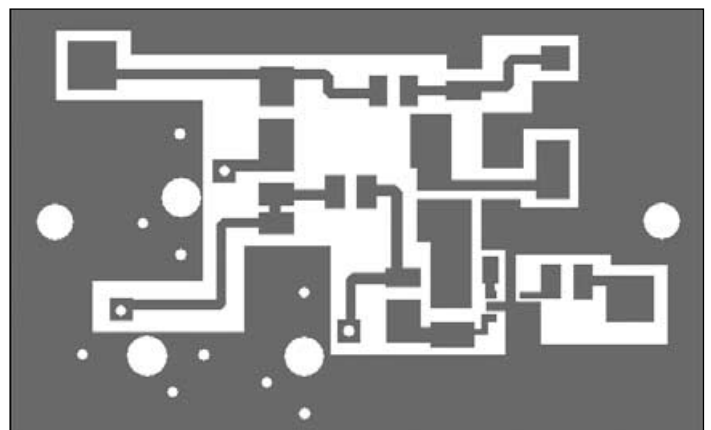


Figure 4 - The track-side view of the PCB

| Ident | Value | Type/Comment |
|------------|-----------|---|
| R1 | 33R | SMT 0805 chip resistor |
| R2 | 220R | SMT 0805 chip resistor |
| C1, C2 | 100 pF | SMT 0805 chip capacitor |
| C3 | 10 nF | SMT 0805 chip capacitor |
| C4 | 1 µF | SMT TANT 10V |
| C5, C6 | 1 nF | SMT 0805 chip capacitor |
| C7, C13 | 15 pF | SMT 0805 chip capacitor |
| C8, C12 | 82 pF | SMT 0805 chip capacitor |
| C10 | 12 pF | SMT 0805 chip capacitor |
| C9, C11 | 0.5 pF | SMT 0805 chip capacitor |
| L1 | 150 nH | SMT 0805 chip inductor |
| L2,L3, L4 | 0.105 µH | MC108 Green + Screening Can |
| L5 | 1µH | SMT 0805 chip inductor |
| IC1 | LM7805 | SO-8 5V voltage regulator Farnell code 9489436 |
| IC2 | MGA-62563 | SMT LNA - Farnell code 7820453 |
| Connectors | 2 off BNC | Screw BNC bulkhead |
| Box | See Text | Size 89 x 35 x 30 Farnell code 278889 |

Table 3-1 Components list for the FM LNA.

The box used in the prototype was a small 'Eddystone' type die-cast box (Farnell 278889 flanged or 301516 unflanged) with a screw-type BNC chassis socket fitted at opposite ends of the box.

The LNA was connected to the two BNC connectors using short lengths of miniature 50 ohm screened cable. On one prototype there were some stability problems (as the gain was particularly high on this unit) when the lid was fitted. This was cured by gluing a piece of electrically conductive foam to the underside of the box lid.

Figure 5 shows the position of the SMT components on this double-sided PCB. Note that twelve 0.6 mm diameter holes must be drilled through the PCB to allow mounting of the MC108 inductors and their associated screening cans.

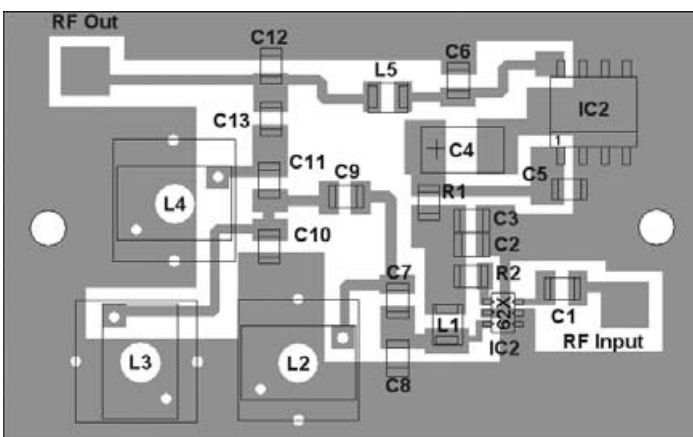


Figure 5 - Positioning of components on the PCB

A photograph of the completed LNA and circuit board is shown in figure 6, showing the completed LNA PCB inside a suitable die-cast box. 4-hole flanged BNC connectors are fitted at each end of the box. The PCB is normally secured using with two M 2.5 screws.

Figure 7 is a photograph showing the component side of the prototype PCB with the major components labelled. Note that the

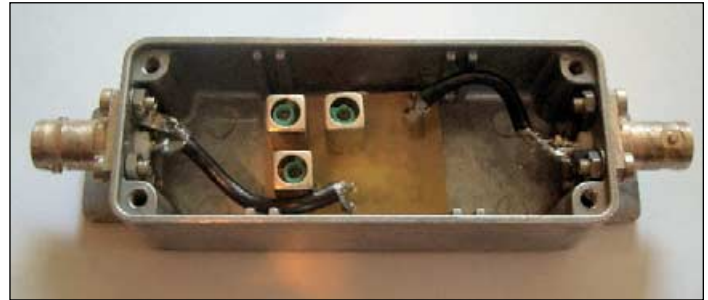


Figure 6 - This photograph shows the completed LNA PCB inside a diecast box. 4-hole flanged BNC connectors are fitted at each end of the box.

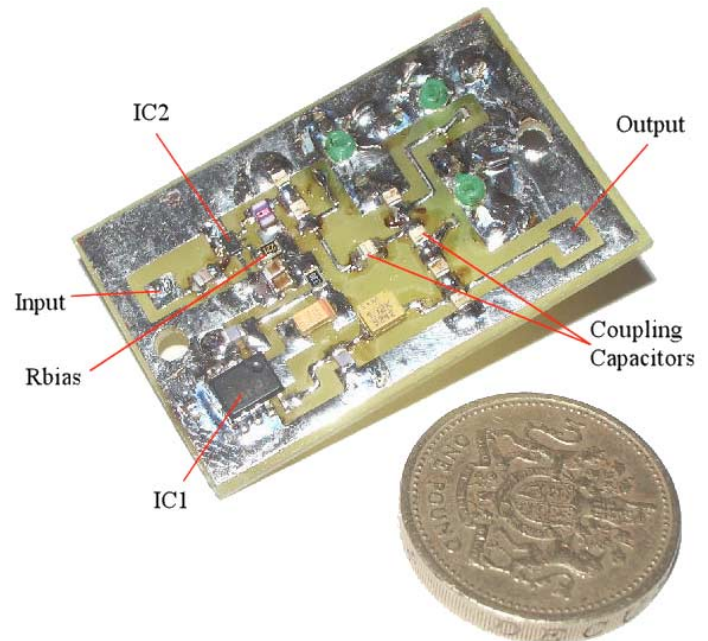


Figure 7 - The component side of the prototype PCB with the major components labelled.

inductors are attached to the PCB through 2.5 mm holes, by means of their securing pegs.

Testing

With the LNA connected to the weather satellite receiver download and being supplied with +12 V, the initial LNA tests consist of checking that the output of the voltage regulator is +5 V while that at L1 was approximately 3 V. If these values are correct, then it shows that the LNA is correctly biased. The next part of alignment required the passage of a polar satellite with high elevation. When the satellite is high in the sky, turn the ferrite core of each MFC108 inductor in turn to gradually increase the received signal to a maximum.

Note: use a special tool to adjust the ferrite cores, otherwise they will break.

Test Results

The prototype gain and noise figures were measured between 136 MHz and 144 MHz and are listed (in dB) in Table 2.

The gain response of the LNA was measured on a network analyser resulting in the gain response shown in figure 8. The rejection at 144 MHz could be increased by decreasing the value of the filter coupling

| Frequency (MHz) | Gain (dB) | N.F (dB) |
|-----------------|-----------|----------|
| 135 | 19.03 | 0.86 |
| 136 | 19.80 | 0.84 |
| 137 | 19.78 | 0.80 |
| 138 | 20.12 | 0.82 |
| 139 | 19.9 | 0.83 |
| 140 | 19.34 | 0.87 |
| 141 | 16.77 | 1.00 |
| 142 | 16.5 | 1.02 |
| 143 | 14.8 | 1.02 |
| 144 | 12.5 | 1.07 |

Table 2

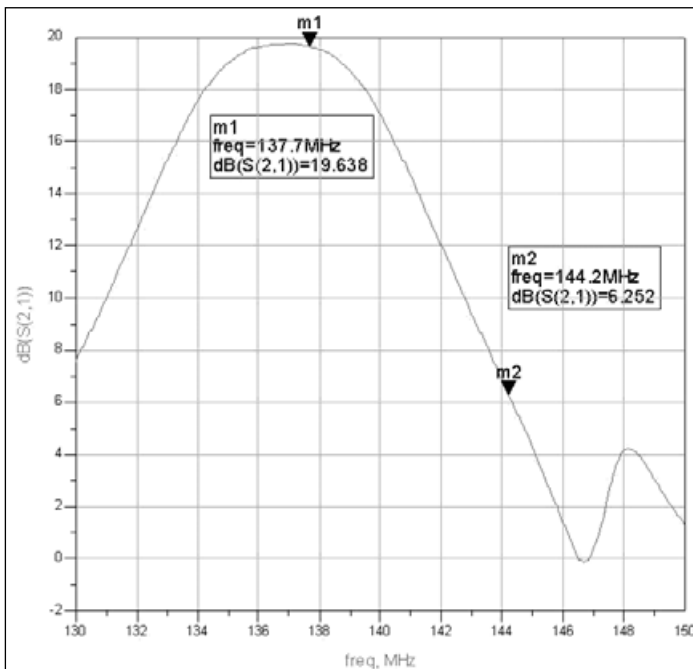


Figure 8 - Measured gain frequency response of the prototype LNA showing about 13.5 dB rejection at 144 MHz.

capacitors C9 and C11 but this led to a decrease in the gain of the LNA. Figure 8 plots the measured gain frequency response of the prototype LNA, indicating about 13.5 dB rejection at 144 MHz.

The linearity (two-intermodulation products) was measured and the intercept point found to be 33 dBm (specification for the device at 200 MHz is 35 dBm). This is still significantly higher than the silicon dual-gate MOSFETs used as the 'gold standard' in weather satellite receivers and preamplifiers.

Conclusion

The LNA described in this article provides low noise figure but has high linearity and sufficient gain to overcome cable losses on long antenna feeds. Although SMT components can be somewhat fiddly to use, they do produce a very compact design that could be housed within in an antenna.

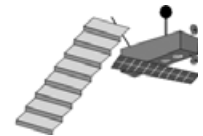
Further design iterations will consider using the even more linear *MGA-53543* device, although this is conditionally stable at low frequencies requiring a more complicated design to ensure it will not oscillate.

References

- 1 Data sheet for MGA-62563 - <http://www.avagotech.com/assets/downloadDocument.do?id=994>
- 2 Data sheet for MGA-53543- <http://www.avagotech.com/assets/downloadDocument.do?id=2604>



News in Brief



APT Recording Level

There was a minor error on the 'Mixer' article on page 25 of our previous issue. The command '*xwxtolmg.exe*' in the batch file must appear on a separate line.

Since the article was published, Giuseppe Cico came up with an improved procedure which makes it possible to initialise both *WXtolmg* and *SatLevel* in the same batch file, thus:

```
C:\Program Files\Mixer\Mixer.exe satellite
start xwxtolmg.exe
C:\Program Files\David Taylor\satlevel.exe
```

The 'start' command in line 2 causes the program to run in a new window, so the batch file will continue. As before, this batch file must reside in the *WXtolmg* folder.

Lightning Monitoring

Ken Barker was good enough to point out a minor but critical error in the address given in John Heath's article for the *Boltek* lightning display. The correct version is:

www.peterboroughvws.info/stormvue.html

with the correction underlined (it was previously scrambled as 'vws')

On the same topic, John Say contacted us to state that he also has a *Boltek* lightning detector in operation in Stanhope (Co. Durham) and a map using *Aninoquisi* software is uploaded to his site:

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

El Niño Slows Hurricane Season

Against all long-term predictions, data obtained by NASA's *Jason* satellite during September 2006 indicated that El Niño had returned to the tropical Pacific Ocean. Although the occurrence was much less intense than the last major episode during 1997-1998, there has been a noticeable reduction in Atlantic tropical storm activity this summer. Indeed, in the aftermath of 2005, which produced a record 28 tropical storms and hurricanes, Hurricane Season 2006 seems almost to have been a non-event with just nine storms, five of them hurricanes and only two of these classed as 'major'.

In truth, figures for this year are almost identical with the long-term average of 9.6 named storms, 5.9 hurricanes (2.3 major). But because all this season's hurricanes remained well out in the Atlantic, it gave the impression of lower activity than normal. This is in fact the first season for five years that the US coastline has avoided a 'hit' from an Atlantic hurricane.

El Niño typically acts to suppress hurricane activity by increasing the vertical wind shear over the Caribbean Sea region [1]. Years in which an El Niño develops tend to have fewer Atlantic hurricanes.

With the exception of Tropical Storm Ernesto, which briefly became a Category-1 hurricane over the Caribbean and impacted Haiti, Cuba and the Florida Keys, no other

storm made landfall, due to a persistent ridgeline of high pressure over the US east coast: this steered them into the North Atlantic, well away from the mainland, although Bermuda experienced strong winds, heavy rain, and storm surges from most of them.

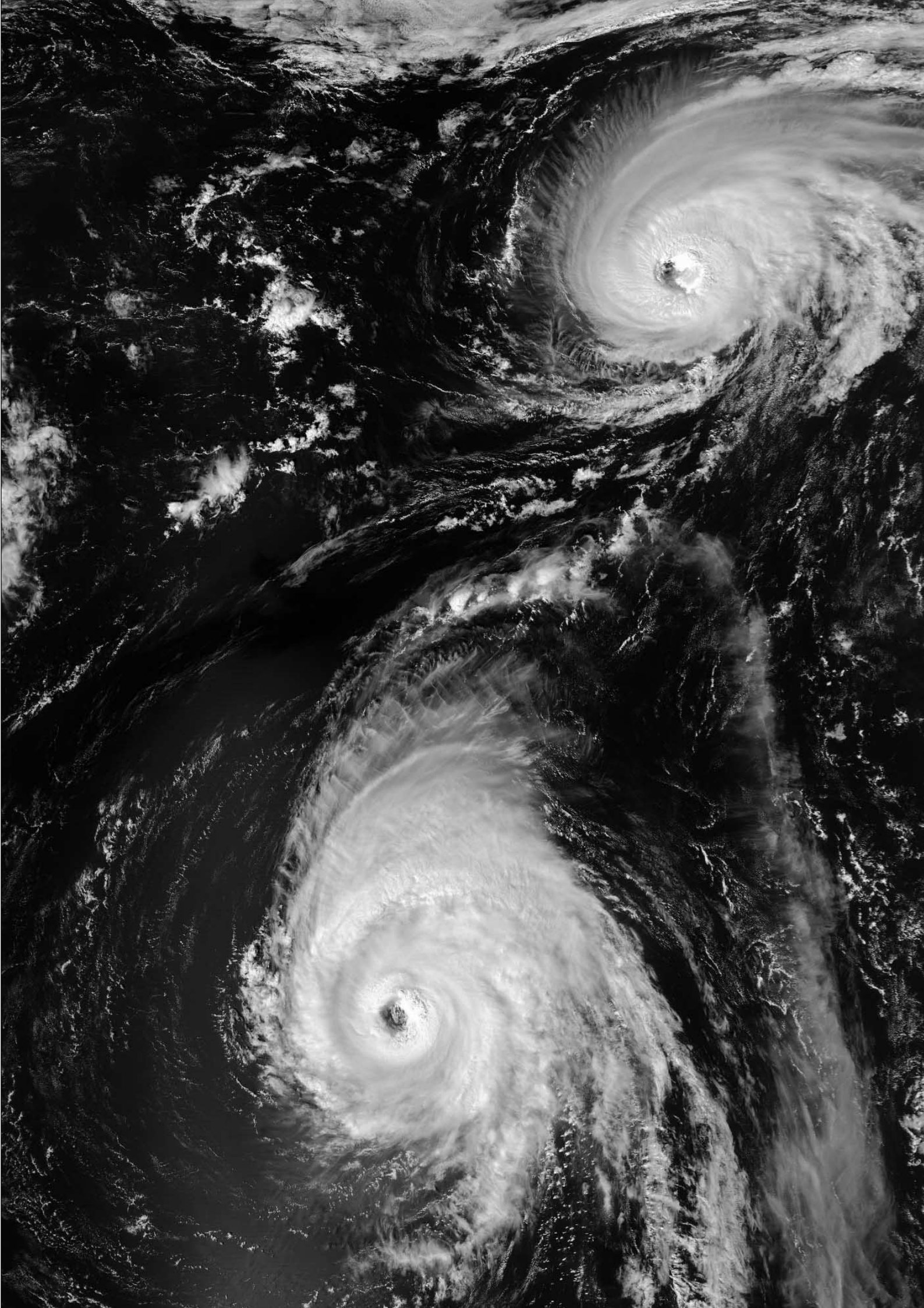
The image opposite, acquired by NASA's *Aqua* satellite at 16:45 UT on September 18, shows hurricanes Gordon and Helene which formed in quick succession in the north Atlantic Ocean during mid-September. Both storms display well-defined spirals with tightly wound central portions, complete eyewalls around their storm centres and well-defined cloud-filled eyes. At the time of this image Gordon had peak sustained winds of 160 kph, making it a Category-2 storm while Helene had sustained winds of 185 kph, making it a powerful Category-3 hurricane.

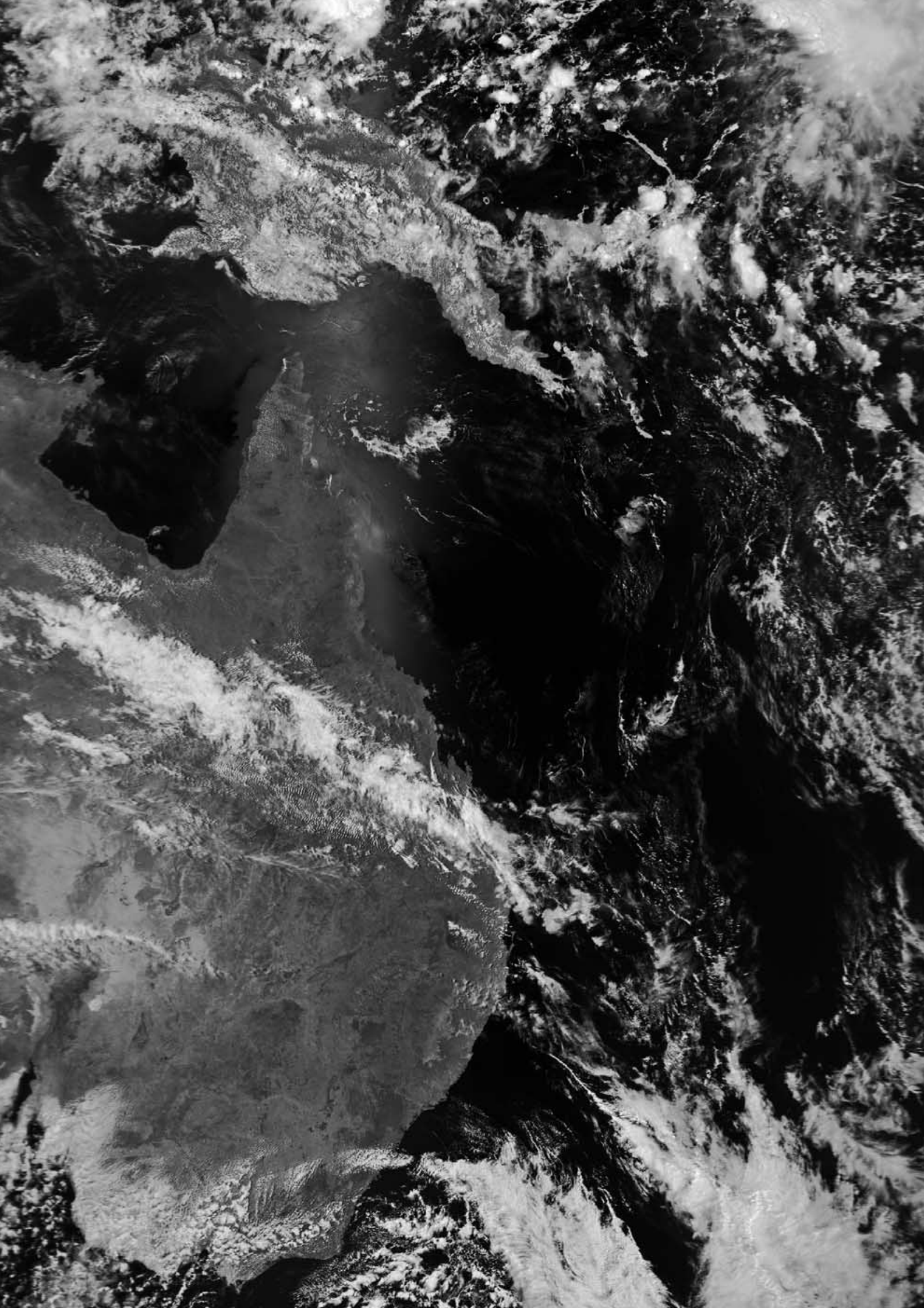
Image: Jesse Allen, MODIS Rapid Response Team.

Reference

1. Hurricane Season 2005 Update, GEOQ 11, page 26







GEO Shop



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



R2FX APT Weather Satellite Receiver

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

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

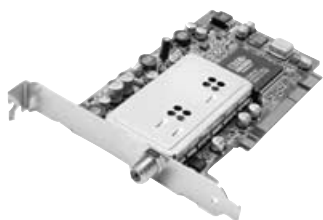
R2FX Accessory Pack

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

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

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

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



TechniSat SkyStar 2 PCI Card

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

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



TechniSat SatFinder Antenna Alignment Meter

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

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



TechniSat SkyStar 2 USB Box

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

UK - £94.50
 Continental Europe - £119.50



Telestar 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
 Continental Europe - £17.50



Telestar 80 cm dish and Universal 0.6 dB LNB

(or similar model)

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

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

GEO PIC 1.0 for the RX2

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



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

GEO/Dartcom EPROM v 1.3

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



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

Martelec MSR40 EPROM

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

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

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

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

GEO Members' PRICE LIST

| | Members Prices | | | Non Members | | |
|---|----------------|--------|--------|-------------|--------|--------|
| | UK | EU | RoW | UK | EU | RoW |
| APT Equipment | | | | | | |
| R2FX APT Receiver (no PSU) | 135.00 | - | 147.00 | 149.00 | - | 161.00 |
| R2FX Accessory Pack | 59.00 | - | - | 69.00 | - | - |
| Vierling Weatherman Complete Kit | 349.00 | - | - | 369.00 | - | - |
| Dartcom high quality QFH antenna | 259.00 | 279.00 | - | 279.00 | 299.00 | - |
| Turnstile APT antenna | 37.50 | - | - | 42.50 | - | - |
| GEO- PIC 1.0 | 7.00 | 7.80 | 8.40 | 7.00 | 7.80 | 8.40 |
| GEO/Dartcom EPROM v 1.3 | 10.00 | 10.75 | 11.25 | 10.00 | 10.75 | 11.25 |
| Martelec MSR40 EPROM | 10.00 | 10.75 | 11.25 | 10.00 | 10.75 | 11.25 |
| EUMETCast Equipment | | | | | | |
| TechniSat SkyStar 2 PCI Card | 53.50 | 55.00 | - | 59.50 | 61.00 | - |
| TechniSat Skystar USB box | 94.50 | 113.50 | - | 119.50 | 123.50 | - |
| Telestar 80 cm dish with LNB | 49.00 | - | - | 56.00 | - | - |
| Telestar Ku band universal LNB | 11.00 | 12.50 | - | 17.50 | 19.00 | - |
| TechniSat Satfinder alignment meter | 21.50 | 24.50 | - | 24.50 | 27.50 | - |
| 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 Membership (4 x GEO Quarterly) | 18.00 | 21.00 | 24.00 | 18.00 | 21.00 | 24.00 |

All prices are in £ sterling and include postage and packaging

NOAA Satellite Predictions

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

| | NOAA 12 137.50 MHz | NOAA 15 137.50 MHz | NOAA 17 137.62 MHz | NOAA 18 137.91 MHz | NOAA 12 137.50 MHz | NOAA 15 137.50 MHz | NOAA 17 137.62 MHz | NOAA 18 137.91 MHz | |
|--------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------|
| Dec 01 | 05:57 07:37 15:46 17:26 | 06:32 08:12 16:21 18:02 | 10:37 12:17 20:27 22:07 | 01:58 03:39 11:53 13:34 | Feb 01 | 05:25 07:05 15:14 16:54 | 05:17 06:57 15:07 16:46 | 10:08 11:48 19:59 21:38 | 01:24 03:05 11:20 12:59 |
| Dec 02 | 05:32 07:12 15:22 17:01 | 06:08 07:48 15:58 17:38 | 10:14 11:54 20:05 21:44 | 01:48 03:29 11:43 13:24 | Feb 02 | 05:00 06:40 14:50 16:29 | 04:53 06:33 16:22 18:03 | 09:45 11:25 21:15 22:56 | 01:13 02:54 11:09 12:49 |
| Dec 03 | 05:07 06:47 14:57 16:36 | 05:45 07:25 15:34 17:14 | 09:51 11:31 19:42 21:21 | 01:37 03:18 11:33 13:13 | Feb 03 | 06:15 07:55 16:04 17:45 | 06:09 07:49 15:58 17:39 | 11:02 12:42 20:52 22:33 | 01:03 02:44 04:25 12:39 |
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GEO Helplines

Douglas Deans, Dunblane, Perthshire, SCOTLAND

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

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

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

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

Useful Internet Discussion Groups

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

GEO-Subscribers

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

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

Satsignal

An end-user self help group for users of David Taylor's Satellite Software Tools including the orbit predictor WXtrack; the file decoders GeoSatSignal and SatSignal; the HRPT Reader and image creator program; the image remapper GroundMap; and software for the EUMETCast service—the MSG Data Manager, the 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 can share information about the EUMETCast reception hardware and software for the Meteosat geostationary satellites.

<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 ATVOS data. With 40 sounder channels (20 microwave, 19 thermal and 1 visible), there is a vast amount of data available. 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://tech.groups.yahoo.com/group/wxtoimg/>

Copy Deadline for GEO Quarterly No 13 Saturday, January 27

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:

editor@geo-web.org.uk

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

editor.geo@gmail.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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Radar Satellites

Part 1 - The Russian Scene



Peter Wakelin

The Early Days

Plans for space-borne radars are almost as old as the 'Space Age' itself. Back in the 1960s, at the height of the Cold War, a vast amount of money was spent on developing reconnaissance satellites in both the USA and the USSR, and it is now known that as far back as 1961 the Russians had plans to put radars in space to monitor the fleets of US submarines and surface ships equipped with nuclear weapons.

The USSR took an early lead, not because their radar technology was more advanced, but because they had the launch vehicles capable of placing the necessarily large and power-hungry satellites into orbit. The cover-all *Cosmos* name was given to most USSR launches to hide their true nature but western analysts were able to deduce a possible role for some satellite classes based on their orbital parameters. Back then, orbital data on all objects tracked by US sensors, including data on their own classified missions, was freely available.

A Puzzle

Cosmos 198, launched on December 27, 1967, was the first of a series that had analysts puzzled; each flight started out in a circular orbit at around 270 km but later produced several objects, one of which climbed to an approximately 950 km circular orbit. *Cosmos 198*'s payload separated and a part was raised after just two days: the next satellite in the series, *Cosmos 209*, orbited for six days before part of it was raised. The trend over subsequent launches was to increase the time before separation to around two months.

In 1974, the Director of Naval Intelligence in Washington published *Understanding Soviet Naval Development*, which offered a few clues and things began to fall into place. In the same week, and quite independently, the American press and the late Geoff Perry, MBE, leader of the Kettering Group of analysts, came up with the same interpretations; the Russians were testing a surveillance satellite incorporating radar designed to seek out naval movements at sea anywhere in the world, regardless of the weather and even when ships were maintaining radio silence.

To ensure an adequate return radar signal, the satellites had to fly in a low orbit with occasional small boosts to overcome atmospheric drag. Furthermore, to power the radar an RTG (radioactive thermal generator) was used. As an RTG in low

Earth orbit poses a potentially serious pollution risk, the operating mode was to make the radar survey in low orbit and later, when telemetry indicated an imminent failure of the sensors or associated processing equipment, the RTG would be separated and raised to a higher long-life orbit.

Cosmos 954 was launched on September 18, 1977 and was expected to move up to the 'safe' orbit during November—but it failed to do so. Orbital decay caused it to burn up in the atmosphere on January 24 spreading 50 kg of radioactive uranium-235 over northern Canada. Following this catastrophe, there were no further launches in the series until April, 1980 by which time an alternative power source had been developed.

These radar satellites were designed and built at KB Arsenal in St Petersburg where the follow-on *Pirs* satellites were developed in the 1980s. With the end of the Cold War, KB Arsenal planned to commercialise their secret hardware with Project Obzor (Survey) but, due to lack of funds, Obzor never made it past the planning stage.

The Almaz Project

Meanwhile, at another design bureau, Vladimir Chelomei, who developed the USSR's cruise missile, was working on a high-resolution radar satellite named *Almaz* (Diamond) to be installed on a manned space vehicle. However, after a few scaled-down versions of *Almaz* flew in the 1970s, it was realised that manned reconnaissance from space was too expensive and inefficient as a high proportion of the crew's time was diverted to housekeeping and station maintenance. The programme was terminated in June, 1978.



Almaz T

Credit: Anatoly Zak

Some of the *Almaz* experiments were successful and, after political changes, the *Almaz* programme was revived as *Almaz-T*, an unmanned Earth resources spacecraft equipped with multiple sensors including a

new, large, synthetic aperture radar (SAR) *EKOR-A*, which is also known as *Mech-K* (Sword). A few days prior to the scheduled late-1981 launch, orders came from Moscow to kill the project as the money was needed to fund *Buran*, Russia's equivalent of the US's Space Shuttle. Later, new Chief Designer Gerbert Yefremov convinced Minister of Defence Sokolov, in April 1986, that the programme should be revived. After several years in storage the spacecraft was found to be in fairly good condition, unlike its fairing which had been used as a toilet. The launch took place on November 29, 1986 but was unsuccessful due to the failure of the Proton rocket's second stage to separate.

Success at Last

The next *Almaz-T*, with a mass of over 18,000 kg, was successfully launched on July 25, 1987 as *Cosmos 1870* and operated for two years until it was de-orbited from its 240 km orbit into the Pacific Ocean on July 29, 1989. Although classed as an Earth resources spacecraft, its high-resolution radar obviously had military applications too.



Almaz T1

Credit: Krunichev

An improved version was launched to a 270 km orbit on March 31, 1991 and announced by the Russians as *Almaz-1*. It had a better radar resolution of 12 m and real-time global data were returned to Earth via geostationary satellites. Unfortunately, one of its two SAR antennas failed to deploy correctly rendering that side inoperable. It was de-orbited after operating for 18 months.

Further improvements were planned for the next *Almaz* which included three radars as well as high resolution optical sensors but the project was terminated in 1992 due to lack of money.

Resurs

A system named *Resurs* (Resource) was announced in 1984. *Resurs* would provide regular, remotely-sensed data every five to seven days for 'monitoring all sorts of

natural phenomena important to man - atmospheric and ocean processes, possible changes in the Earth's geological structure and the like' said the announcer on Radio Moscow for North America at 2300 UT on January 27. There would be three sub-systems within *Resurs*: *Resurs-F* would be a high-resolution film-return system, *Resurs-O* a Landsat-type spacecraft with its imagery transmitted to Earth via radio and *Okean-O*, a system, familiar to many readers, for meteorological and ocean ice surveillance. *Okean-O* would carry a side-looking radar with a 1500 m resolution over a swath width of 460 km.

Okean-O disguised as Cosmos

Cosmos 1500 was launched on September 28, 1983 and Kettering Group observers soon picked up APT-compatible signals on 137.40 MHz. As the orbit was lower than the NOAA polar-orbiting weather satellites and the scan rate was 240 lines per minute, resolution of the visible imagery was good. On occasions, radar imagery was displayed over part of the scan.

The value of radar imagery for ocean ice monitoring became apparent when *Cosmos 1500* imagery rendered help to a caravan of ships icebound in the eastern Arctic Ocean near Pevek. Later, the icebreaker *Vladivostok* used *Cosmos 1500* imagery to reach the stricken research vessel *Michael Somov* icebound in the Antarctic.

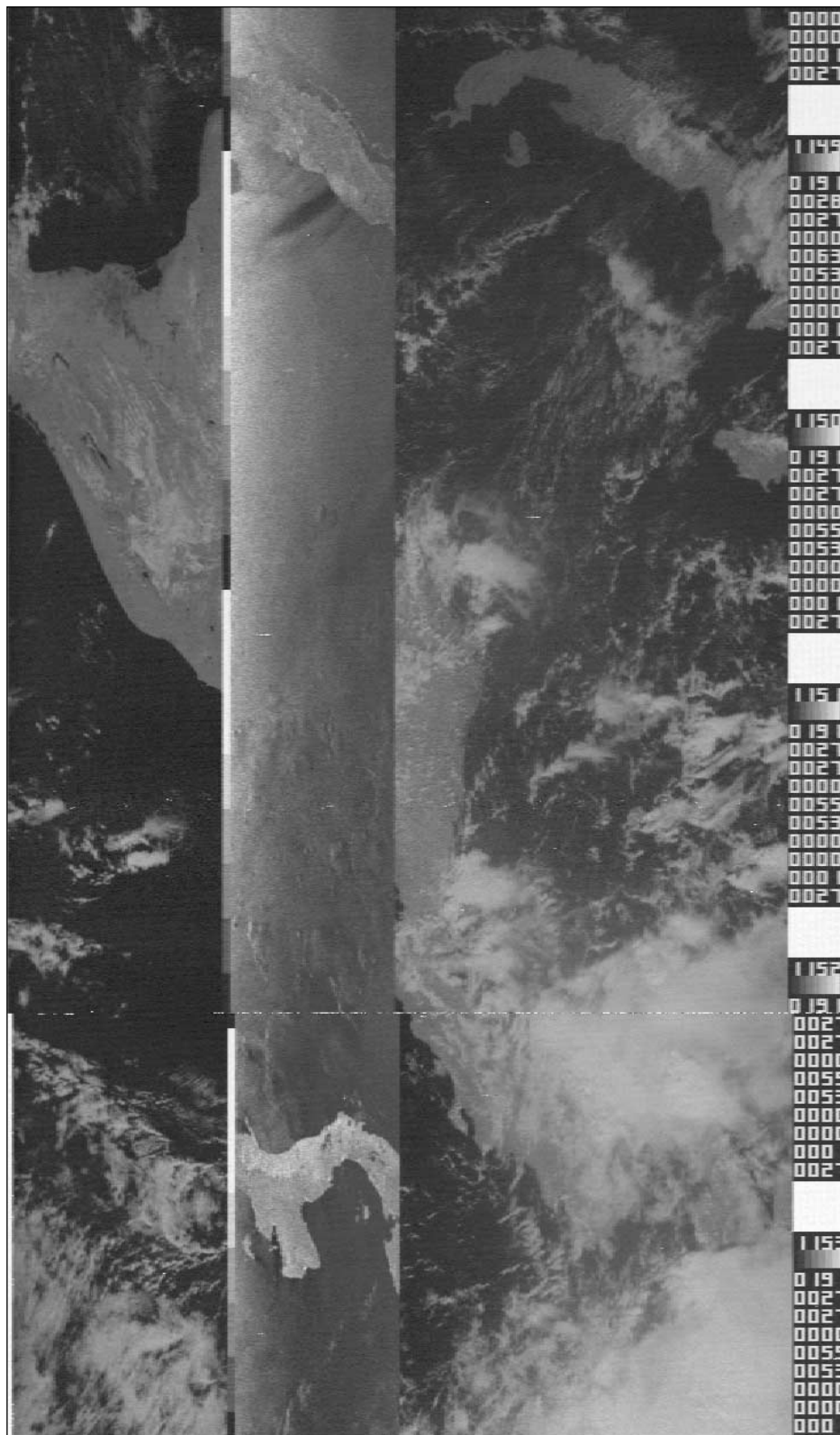
Cosmos 1602, launched exactly a year later, and *Cosmos 1766* launched on July 28, 1986 had similar imagery on 137.4 MHz. The data storage capability of *Cosmos 1602* was revealed when the author received a visible image of Japan in southern England on November 29, 1984 and stored radar imagery soon followed. Radar imagery was always limited to a maximum of seven minutes' duration, presumably because of power limitations.

Cosmos 1869, launched in July, 1987 was less successful as the radar antenna only partially deployed but other equipment functioned normally. It is thought that all these spacecraft were regarded as experimental as it was not until the next launch in the series, on July 5, 1981, that the *Okean* name was given to these craft in their launch announcements. To acknowledge the Ukrainian origin of these spacecraft, the name was changed to *Sich* for later launches.

The Future

Space activity in Russia has reduced dramatically since the break-up of the former USSR and political upheavals in the 1980s followed by economic problems. In 1982, 101 of the world total of 121 successful space launches were from the USSR.

By 1992 this had fallen to 54 Russian launches and in the first 10 months of 2006 the Russians have made only 16 launches,

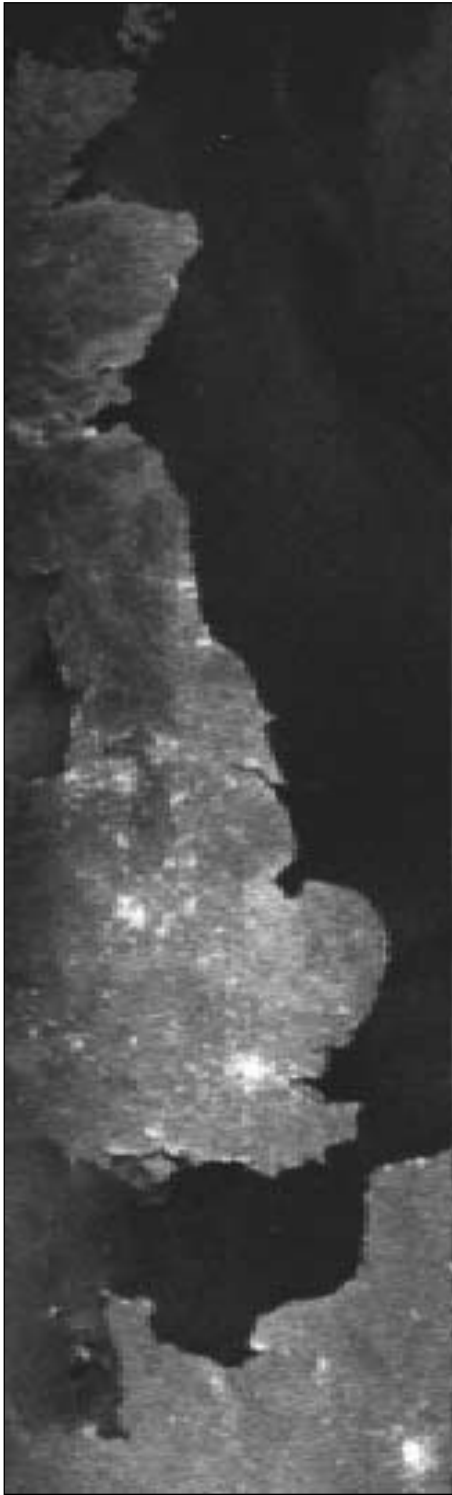


This *Sich-1* image was received by the author at 2207UT on November 17, 1995 but was recorded at 1450UT on the same day. It is a visible image of Central America with a narrow radar image superimposed down the centre. Nicaragua, Mexico, Cuba and Jamaica are readily discernible in the visible image whereas cloud-covered Panama is prominent on the radar image.

seven of which have been either ferry trips to the International Space Station or launches for other nations for which they are reimbursed most or all of the launch costs.

A new generation of weather satellites designated *Meteor-M* will carry a side-looking radar with two modes of

observation, one of which will have 400 m resolution, as well as advanced multispectral imaging and sounding radiometers. As recently as the last meeting of the Co-ordination Group for Meteorological Satellites held in November, 2005 the launch date was quoted as 'late 2006' but this now looks very improbable.



Denis Bonomo received this excellent Okean 4 image of the Bosphorus region on November 29, 1994

Acknowledgements:

I am grateful to the following for their valuable input: Anatoly Zak, Vladimir Agapov, Marcia Smith, the late Geoff Perry, MBE and Sven Grahn. Sven has had a deep interest in Russian space activities for more than 40 years and has an excellent website at

<http://www.svengrahn.pp.se>

Another valuable source of reliable information is Encyclopedia Astronautica at

<http://www.astronautix.com>

A valuable source of information, though not available on line, has been 'Soviet Space Programs: 1971-75' and the subsequent issues covering 1976-80 and 1981-87 prepared at the US Library of Congress for the Committee on Commerce, Science and Transportation of the US Senate.

Real-time imagery from Okean 4 as far west as the UK was rare but the author captured this image at 0902UT on September 15, 1995

Index to Satellite Images

Front Cover

Europe's Envisat imaged extensive brash ice stretching all the way from Svalbard to the North Pole in this MERIS image dating from August 29, 2006.

Image: ESA

Inside Front Cover

An enhanced colour view of gullies in a Martian crater wall, taken by the High Resolution Imaging Science Experiment (HiRISE) camera aboard NASA's Mars Reconnaissance Orbiter. See page 10.

Inside Back Cover

NOAA-14 will complete its 12th full year in orbit on December 12. This image, submitted by Lawrence Harris, illustrates the high quality of HRPT still available from this geriatric satellite. This image from the 09:28 UT pass on September 10 was processed with *ReadHRPT*.

Back Cover

Chuck Vaughn obtained this Feng Yun-1D image of Hurricane Ileana at 14:39 UT on August 23, 2006. The storm, located over the eastern Pacific Ocean just south of the tip of Baja California, had 190 kph peak winds.

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Hurricanes Gordon and Helene as seen by the NASA Aqua satellite on September 18.

Image: Jesse Allen, MODIS Rapid Response Team.

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This fine NOAA-18 channel-2 image dating from 03:48 UT on October 28, 2006 shows the eastern part of Australia plus an unusually cloud-free Papua New Guinea.

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

Page 27

This fine image from China's Feng Yun 1D was captured by Lawrence Harris from his home in Southampton at 07:45 UT on September 16 on a Timestep HRPT system and processed with David Taylor's HRPT Reader software. The oblique early morning sunlight highlights relief over Scotland and Cumbria as well as creating interesting cloud shadows.

Page 33

Winter's first icy blast hits western Europe in this NOAA-18 channel-4 IR image acquired at Russia's SMIS at 02:03 UT on November 1, 2006. The comma depression and the showers streaming southward ahead of it brought heavy snowfalls to coastal regions of Scandinavia.

Image: SMIS (<http://smis.iki.rssi.ru/>)

Meteosat Stamp

Rob Denton sent us a photograph of this postal First Day Cover from France, dated October 22, 1983 and commemorating 'Meteorology'.

The design includes both Meteosat-1 and an image of Europe transmitted from the satellite.



Alaskan Storm Shatters Antarctic Iceberg

Les Hamilton

Just over a year ago there occurred one of the best-ever examples of the so-called *Butterfly Effect*^[1]. On October 27, 2005, on a clear, calm Antarctic day, the 100 kilometre long iceberg B15A suddenly fragmented into half a dozen pieces. B15A was itself half of the original B15 iceberg which calved from the Ross Ice Shelf during March 2000. At that time, B15 was the largest iceberg ever known, measuring approximately 300 × 40 kilometres. It split in two in late 2003 ^[2].



Terra MODIS image of B15A on October 27, 2005, just prior to breaking up
Credit: MODIS Rapid Response System

Records from seismometers placed on the iceberg years earlier showed movement in B15A starting 12 hours before it broke up and continuing for three days thereafter. Despite prevailing calm conditions the iceberg was exhibiting a vertical oscillation of about a centimetre and a 10 cm movement from side to side.

Oceanographers have known since the early 1960s that ocean swells can travel half way around the planet and researchers suspected ocean swell to be the cause of this break up. They were able to calculate the origin of the swell from the seismometer data by comparing the arrival times of the faster-moving long-wavelength waves with the slower-moving short-wavelength ones. Amazingly, the swell proved to originate from 13,500 kilometers away—off the coast of Alaska!

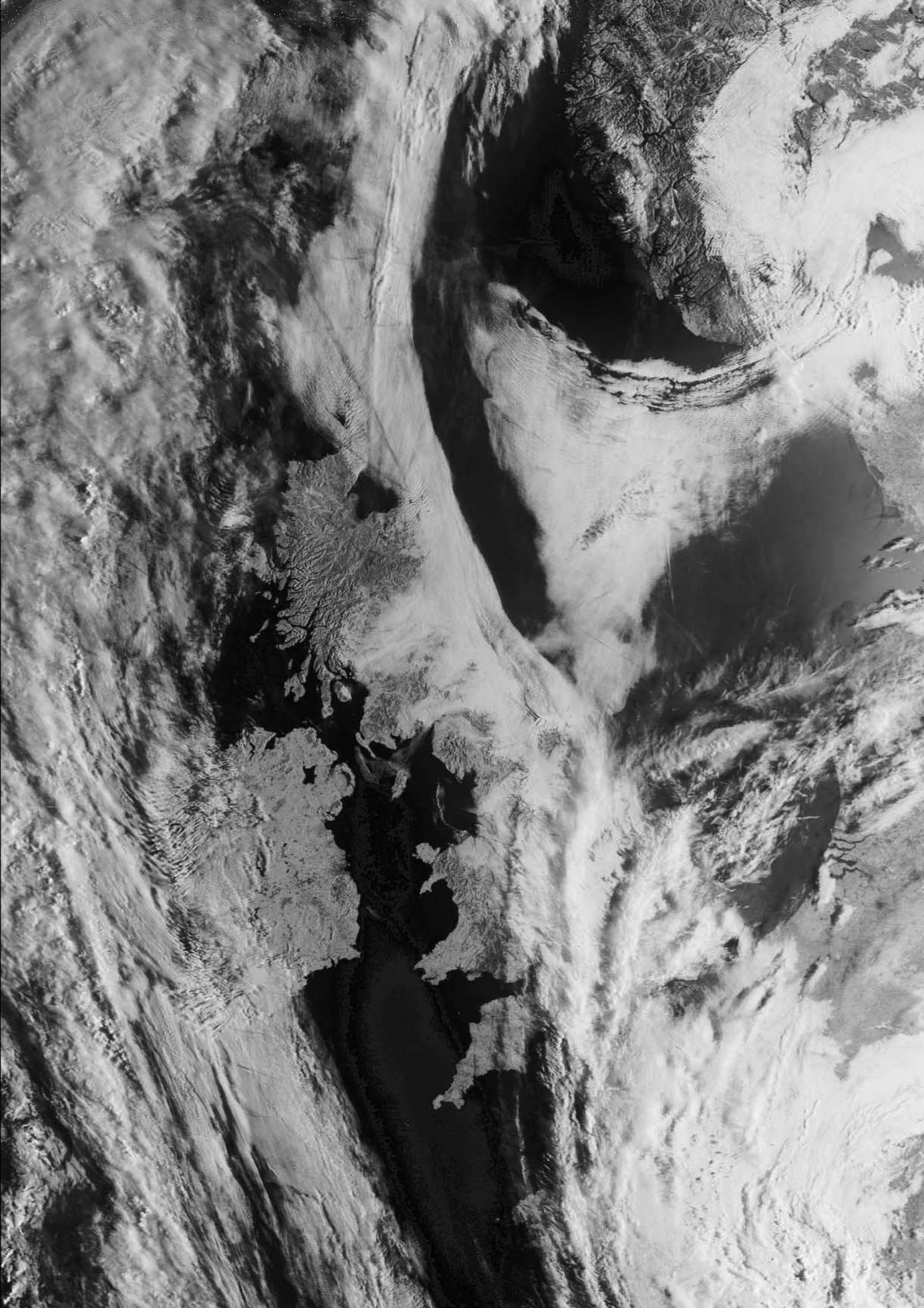


Terra MODIS image of B15A on November 1, 2005, shortly after the break-up
Credit: MODIS Rapid Response System

On October 21 there had been a powerful storm in the Gulf of Alaska which lasted a day and a half. A team of scientists led by Professors Emile Okal (Northwestern University) and Douglas MacAyeal (University of Chicago) presented evidence in the October issue of the journal *Geophysical Research Letters* which connected this storm with the B15A disintegration, .

Wave-buoy records showed that the original waves had been about twelve metres high in the Gulf of Alaska. Two days later, they had reached Hawaii at a reduced height of five metres and three days later still they were picked up by a sensitive seismometer on Pitcairn Island in the south Pacific. Ultimately, they reached Antarctica as little more than a swell at the site where B15A had run aground near Cape Adare. Continued pounding of the ice against the sea bed as the gentle swell repeatedly picked up the iceberg and then dumped it back down again is believed to have led to its demise.

1. The Butterfly Effect, more correctly 'sensitive dependence on initial conditions', is a concept of chaos theory developed by the meteorologist Edward Lorenz during the 1960s. The term derives from his lecture title, 'Predictability: *Does the flap of a Butterfly's wings in Brazil set off a Tornado in Texas?*' The implication was that even a very small disturbance in one part of the Earth could be the trigger for much a more serious meteorological event elsewhere.
2. Massive B15 Iceberg Splits in Two - GEOQ 1, page 34, March 2004



A Visit to the Werkgroep Kunstmanen 'Bijeenkomst'

September 9, 2006

Les Hamilton and David Taylor

GEO's Dutch counterparts *Werkgroep Kunstmanen* traditionally hold one of their five annual get-togethers on the second Saturday of September. This year John Tellick, David Taylor and Les Hamilton took the opportunity to pay them a visit. David and Les flew from Scotland for a four day visit while John motored from England and joined us for the Saturday.

The Netherlands had, so we were told, endured the most dreadful cool, cloudy and wet weather since the start of September, and although it would be stretching the imagination to suggest that we 'brought the fine weather with us', it is a fact that, within an hour of our arrival at Schiphol early on the Thursday, chinks of blue sky were already showing through the cloud. By mid-day it was gloriously sunny—and remained so throughout the entire four days of our visit.

During the days leading up to the meeting we were shown around Haarlem, IJmuiden and Amsterdam by Ruud Jansen (chairman of the *Werkgroep*) and Arne van Belle, both of whom spared no effort to show us around and make us at home in their country. And one evening, another member well known to GEO readers, Fred van den Bosch, invited us to his home for a speciality Vietnamese meal prepared by his wife Minh.

The Meeting

The general theme for this 'bijeenkomst' (meeting), held in the Nimeto building, Utrecht (figure 1), was the history of amateur weather satellite reception. Members had been encouraged to rummage in their attics and delve deep into their cellars to unearth items of hardware from the formative years of the hobby (figure 10). One of the most impressive of these was an X-Y drive antenna mount (figure 6). X-Y mounts have a much better performance near the zenith than a conventional azimuth-elevation mount which may require a very large azimuth change in a short time when the satellite is near overhead.

The first hour of the day proved totally informal, providing time for members with exhibits to set them up and chat with friends. As is usual these days, there was also the near-obligatory projection of live MSG imagery on a big screen throughout the meeting (figure 5). Soon, we were regaled with a display of receivers, fax copiers, antennas and historic images from satellites such as ESSA-8 and NOAA-4.

The formal part of the meeting was chaired by Ruud Jansen, who dealt with the usual formalities before handing over to Arne van Belle who brought us up to date with the latest developments regarding weather satellites, including the on-off saga relating to the launch of MetOp. If all goes to plan, the launch should, we were told, now take place on October 7. Official matters completed, the microphone was then passed around the hall, allowing members to describe the equipment they had brought for display.

Some of the early satellite images exhibited by Ruud Jansen were produced using a cathode ray oscilloscope as the image output device. The satellite signal was fed into the 'scope to produce a dot of varying intensity which scanned the screen while a camera, with its shutter open, recorded everything on film. Later, the film would be developed, and the satellite image printed.

A much superior if time-consuming method of creating images was demonstrated by Hans Scherhorn (figure 3). A recorded Meteosat-7 signal was played through a cassette tape deck. The output signal was electronically converted to a proportional high voltage charge and then fed to a needle positioned just above the surface of electrostatic paper. The paper itself was fitted around a rotating drum, spin-synchronised to the 2400 Hz satellite signal.

Afterwards, the paper, now bearing a latent electrostatic image, was placed in an agitated bath containing petroleum and toner particles which turned the charged areas of the paper black. After a couple of minutes drying, there was a high-resolution print in a full range of greyscales. Amazingly, this process could outperform all forms of printer until the photoquality inkjet appeared on the scene.

After a break for lunch, David Taylor made an illustrated presentation to the meeting in which he gave an overview of the state of the satellites operated by EUMETSAT. He explained how, this year, there are many satellite relocations as the new MSG satellites take over routine operation at the zero degree longitude station while the old Meteosat-6 and Meteosat-7 are relocated for the Indian Ocean Data Coverage service. David also detailed how EUMETCast has been considerably extended and is now attracting world-wide interest, and that the data now includes



Figure 1 - The Nimeto - venue for the meeting



Figure 2 - Heat radiators inside Arne's PC

high-resolution images from the NOAA-17 and NOAA-18 polar orbiters, while the new data provided once MetOp is launched will provide even more challenges and opportunities.

Other Matters

On the day following the meeting, Ferdinand Valk took us on a guided tour of Noord Holland, which included the hamlet of Zaanse Schans with its restored houses and working windmills, the coastal villages of Marken and Volendam, and a circuit of the Markermeer. The weather was flawless (figure 4) and Ferdinand pointed out how satellite images of the region clearly show up the reclaimed polders which have a very different colour from the original terrain. The image also shows a noticeable difference in colour between the IJsselmeer and the Markermeer, then two inland lakes created from the former Zuider Zee.

Our long week-end proved to be highly enjoyable, not solely because of the opportunity to attend the meeting in the Nimeto, but also for the friendship of everyone who shared the four days with us.

Photo Credits

Figures 6 and 8: David Taylor
Figures 1, 2, 5, 7, 9, 10, 11: Les Hamilton



Figure 3 - Hans Scherhorn (right) demonstrating his 'wet-paper electrostatic drum process' to Ferdinand Valk (left) and Ben Uiterwaal
 Photo: Ruud Jansen



Figure 4 - A MODIS image of The Netherlands, imaged by NASA's Aqua satellite on September 10.
 Image: MODIS Rapid Response System



Figure 5 - EUMETCast projected on a large screen



Figure 6 - X-Y drive antenna mount



Figure 7 - Rob Ablas (left) in conversation with David Taylor



Figure 8 - Fred van den Bosch (2nd left) demonstrating his software



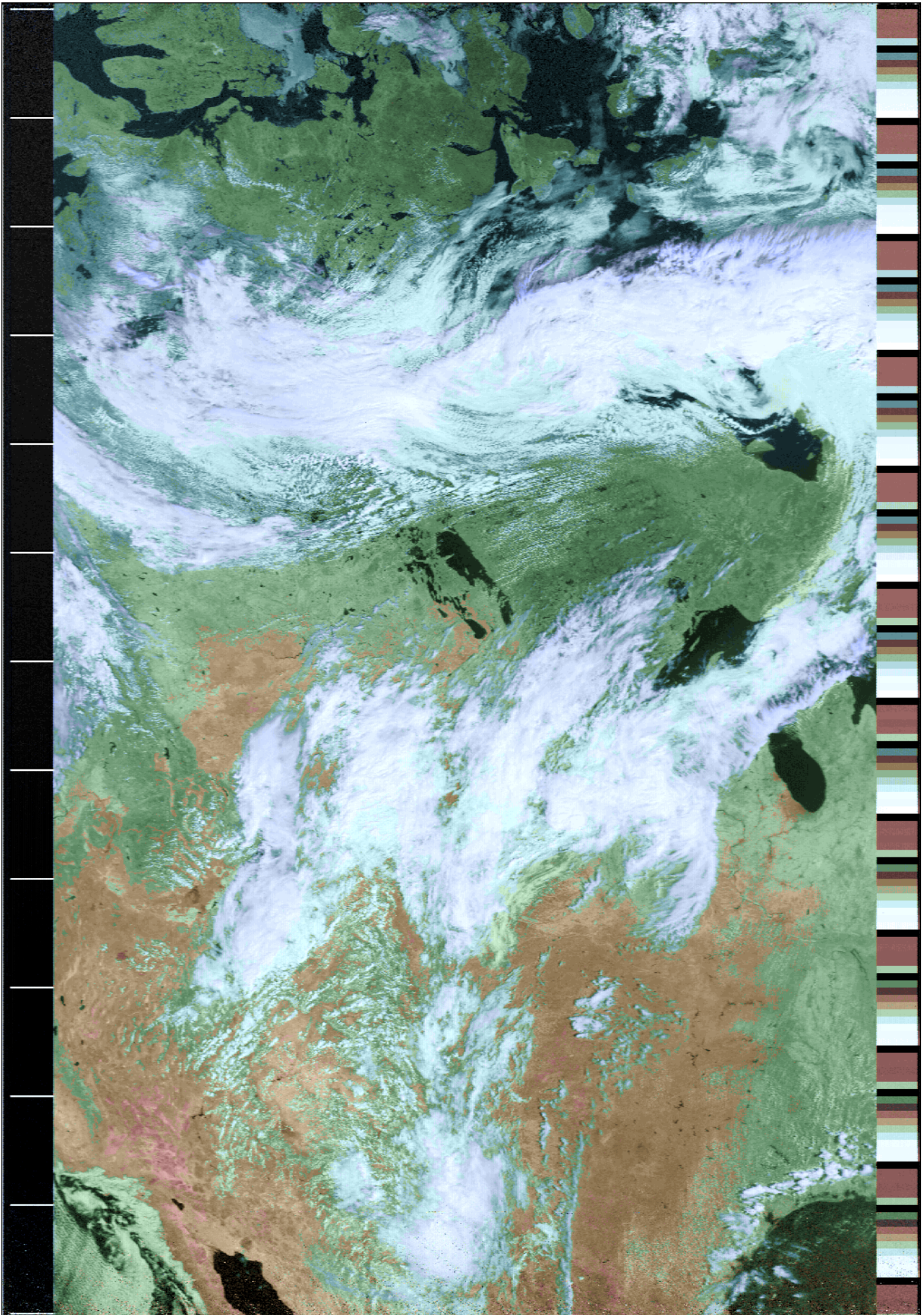
Figure 9 - Ruud Jansen, Arne van Belle and David Taylor enjoying a day in Amsterdam



Figure 10 - Some of the hardware on display at the Werkgroep meeting in Utrecht

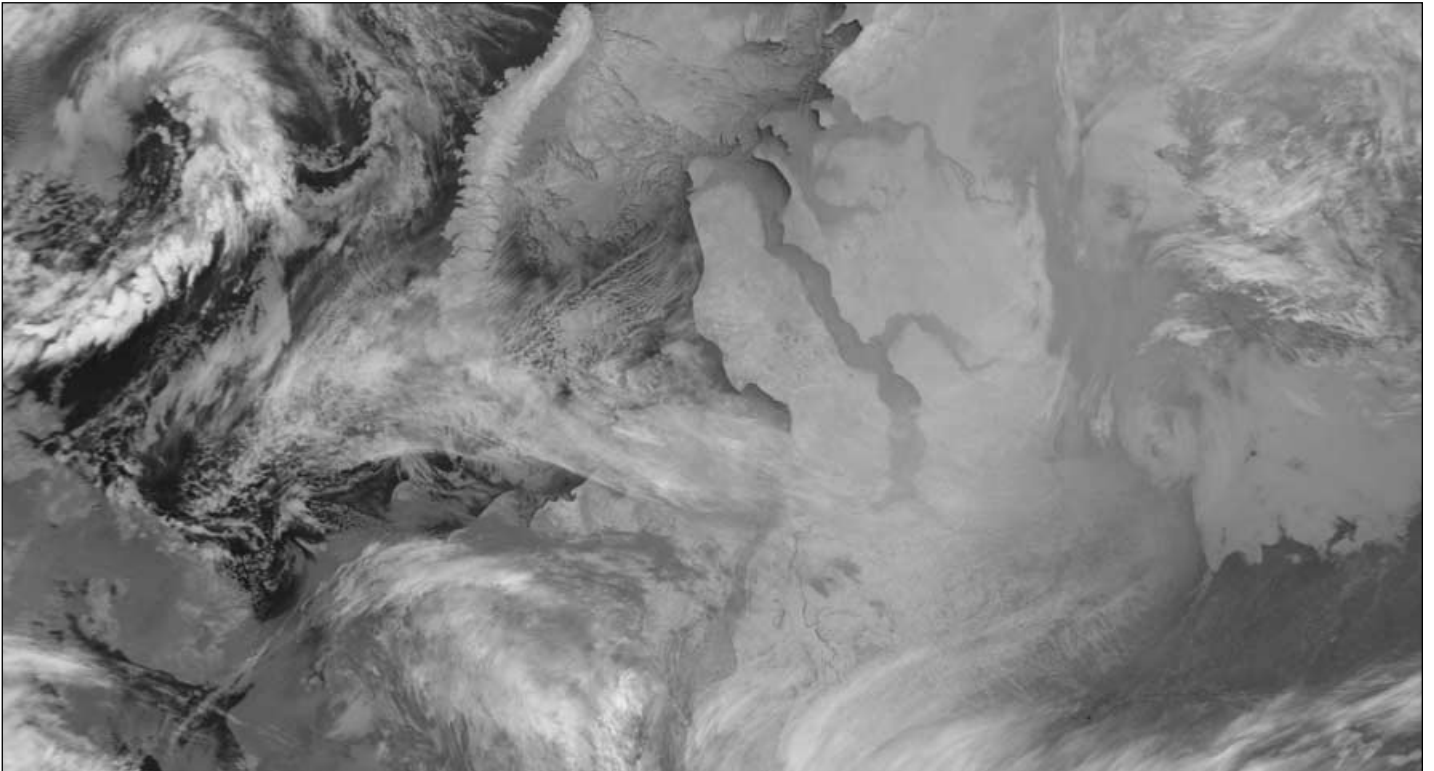


Figure 11 - Windmills at Zaanse Schans



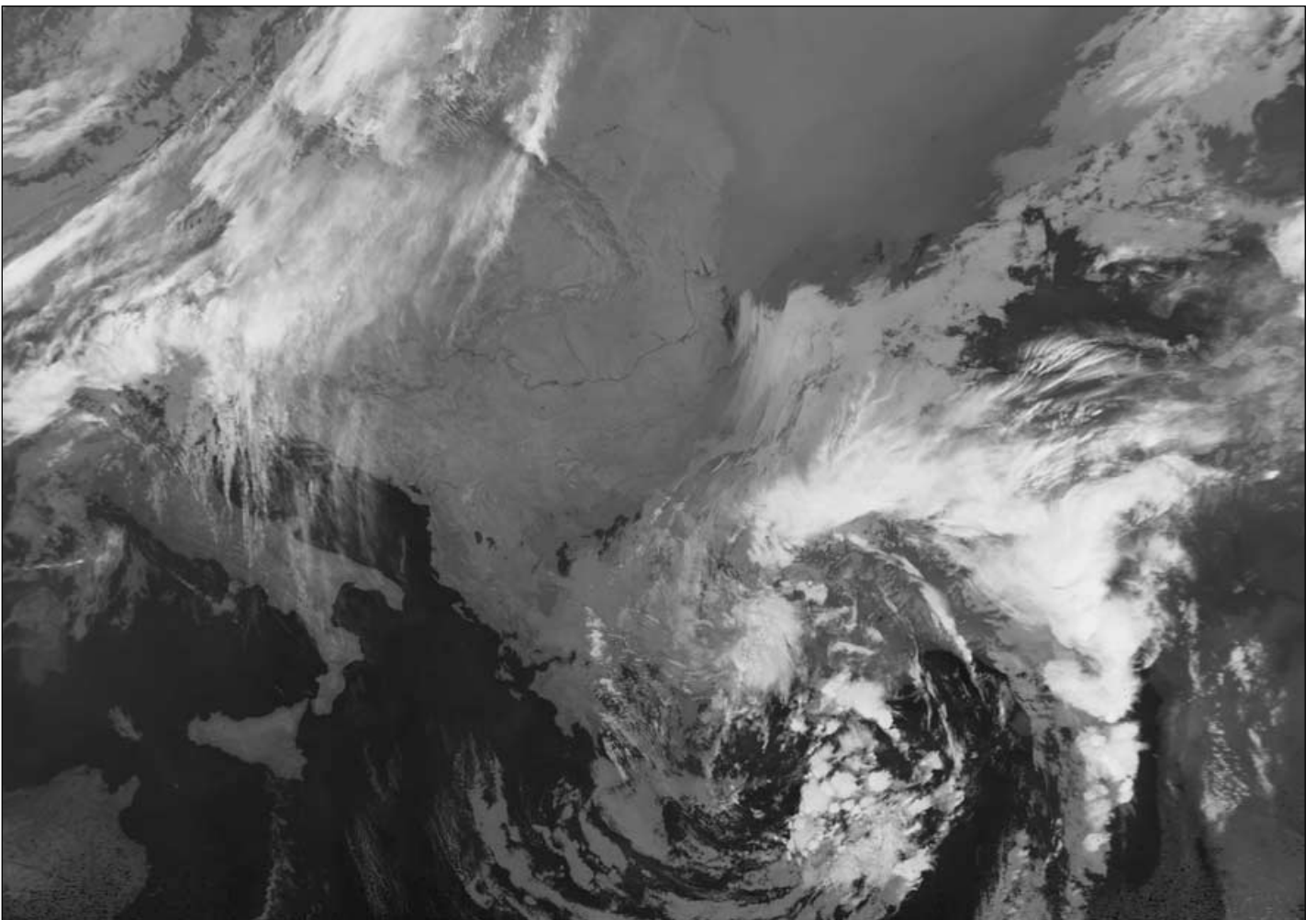
Keith Fraser KC2JC (ex GW3ZVA) of Amherst, New York has continued following the icemelt in Canada's Northwest Passage and sent us this NOAA-17 image from the 17:33 UT pass on August 1. Keith wrote: 'Following my previous image (GEO Q 11, page 40) the sea is now quite ice-free around the east coast of King William Island. This is

the route that Amundsen followed. The west coast, Victoria Strait, is still blocked with ice flowing down from the Beaufort Sea. This was where Franklin made his error and he foundered on this west side. Dolphin and Union Strait and Coronation Gulf are both open, as is the Great Bear Lake at the extreme left margin of the image.'



This overnight NOAA-18 channel-4 HRPT segment from 22:41:22 UT on October 31, 2006 shows striking detail of icepack forming in the Kara Sea to the east of Novaya Zemlya. The estuaries of the rivers Ob and Yenisey to the east of the Jamal peninsula are clearly already frozen over.

Image: SMIS (<http://smis.iki.rssi.ru/>)



As winter starts to bite over eastern Europe, this infrared segment from the 00:22 UT NOAA-18 channel-4 HRPT pass on November 1, 2006 picks out the course of the River Danube where it defines the border between Romania and Bulgaria as its waters journey towards the Black Sea.

Image: SMIS (<http://smis.iki.rssi.ru/>)

Tracking Lightning on the Web

Peter Bartlett MODLC

Following on from the interesting article concerning lightning strikes in GEO Quarterly 11, I too have been watching, on a regular basis, other sites that use the *Boltek LD-250 Lightning Detector* and *Stormvue* software. On August 13, I followed a storm over a couple of hours while it moved southwest from East Anglia until it arrived overhead in the London area, which proved to be very accurate. By entering 'Stormvue' into *Google*, I have also found a number of other sites using the same software and hardware setups [1,2].

Blitzortung.org

Of course, as John Heath explained, a *Boltek* system is not cheap. However, there is a network of over 80 amateur stations throughout Europe which feed Boltek lightning data to:

<http://www.blitzortung.org>

where you will find a map with current sferics plotted on it. The locations and websites of the participating stations can be found at:

<http://www.blitzortung.org/index.php?mode=5&map=5&lang=e>

If you prefer to monitor lightning directly on your own PC, you can generate the same maps using the *Lightning Viewer* software written by Edmund Korffmann. This is a simple freeware program for *Windows* which uses the Internet to automatically collect raw lightning data from *Blitzortung.org* then plots them on to a map (figure 1). The program gives the user control of which lightning data appears on screen, including alarms and city locations. You can download *Lightning Viewer*, currently in version 1.1, from:

<http://www.korffmann.de/>

by following the link to 'Lightning Viewer'.

Blitzortung.org is a free non-commercial service providing information about the location of lightning storms over central Europe. The data may only be

used for personal purposes, and any of the charts bearing the "© <http://www.Blitzortung.org>" overprint can be freely integrated into your own web pages. It is, however, emphasised that the data must not be used for the protection of life or property.

Lightning Viewer

This software consists of just a single executable file. You can enter the latitude and longitude of your home location in the right-hand panel when it appears on the map as a green dot with a red 100 kilometre range circle around it. A second range circle (green) can be added by entering a value in the 'Range/km' field and limits the statistical information to this radius around the home location.

The default map shows the whole of Europe but, by clicking the national flag buttons along the screen, enlarged maps of specific countries can be displayed.

Strike Visualisation

Clicking the 'Strikes' button cues this display. Lightning strikes are updated every minute and results for the previous hour are displayed on the map as coloured dots corresponding with the age of the strike. The right-hand panel of the display shows the local time, the number of strikes in the past hour as well as the number of strikes in the previous minute (figure 2).

Density/Area Visualisation

When you click the 'Areas' button, the display alters to show the lightning density as contour-filled areas. This allows one to determine where the most intense lightning activity is currently located. The colours represent the number of strikes within a radius of 20 km around each pixel position (figure 3).

Density Distribution

The figures additionally show, in the lower right-hand corner, a simple vertical bar graph which details the number of strikes relative to the time intervals

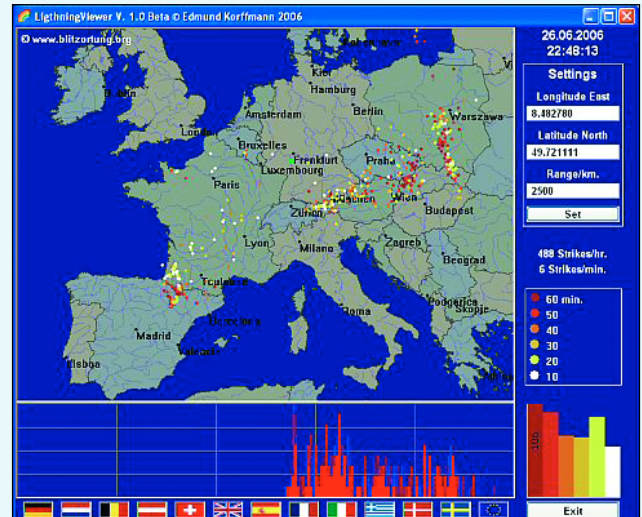


Figure 1 - European lightning strikes

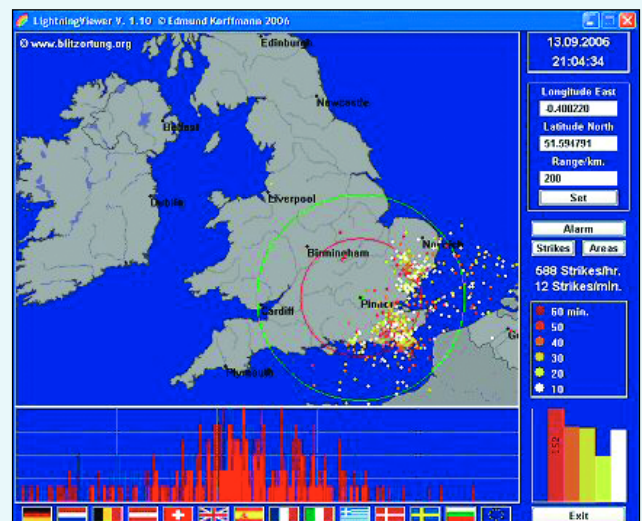


Figure 2 - Strike Visualisation

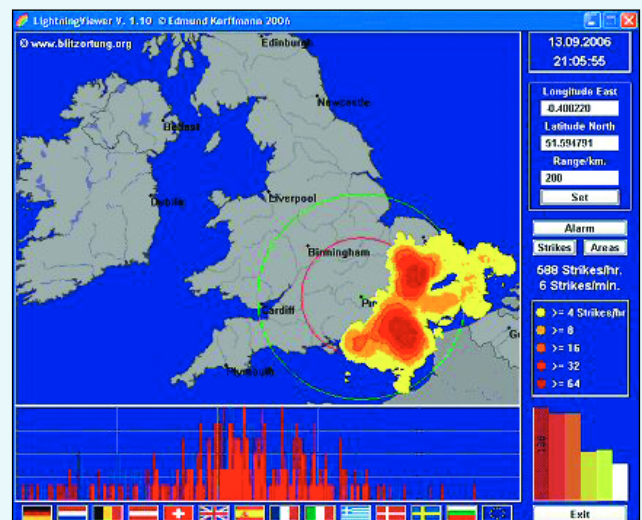
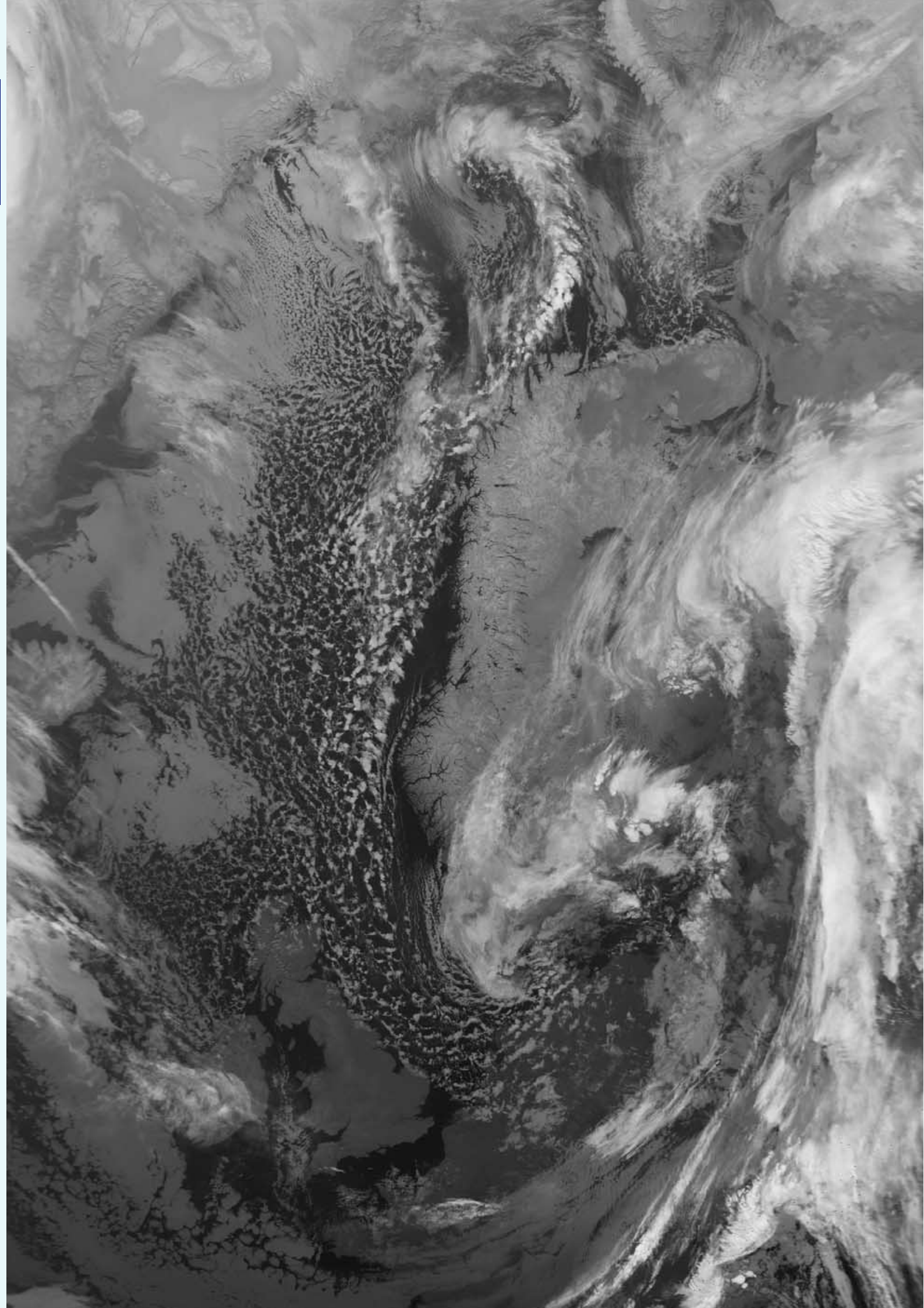
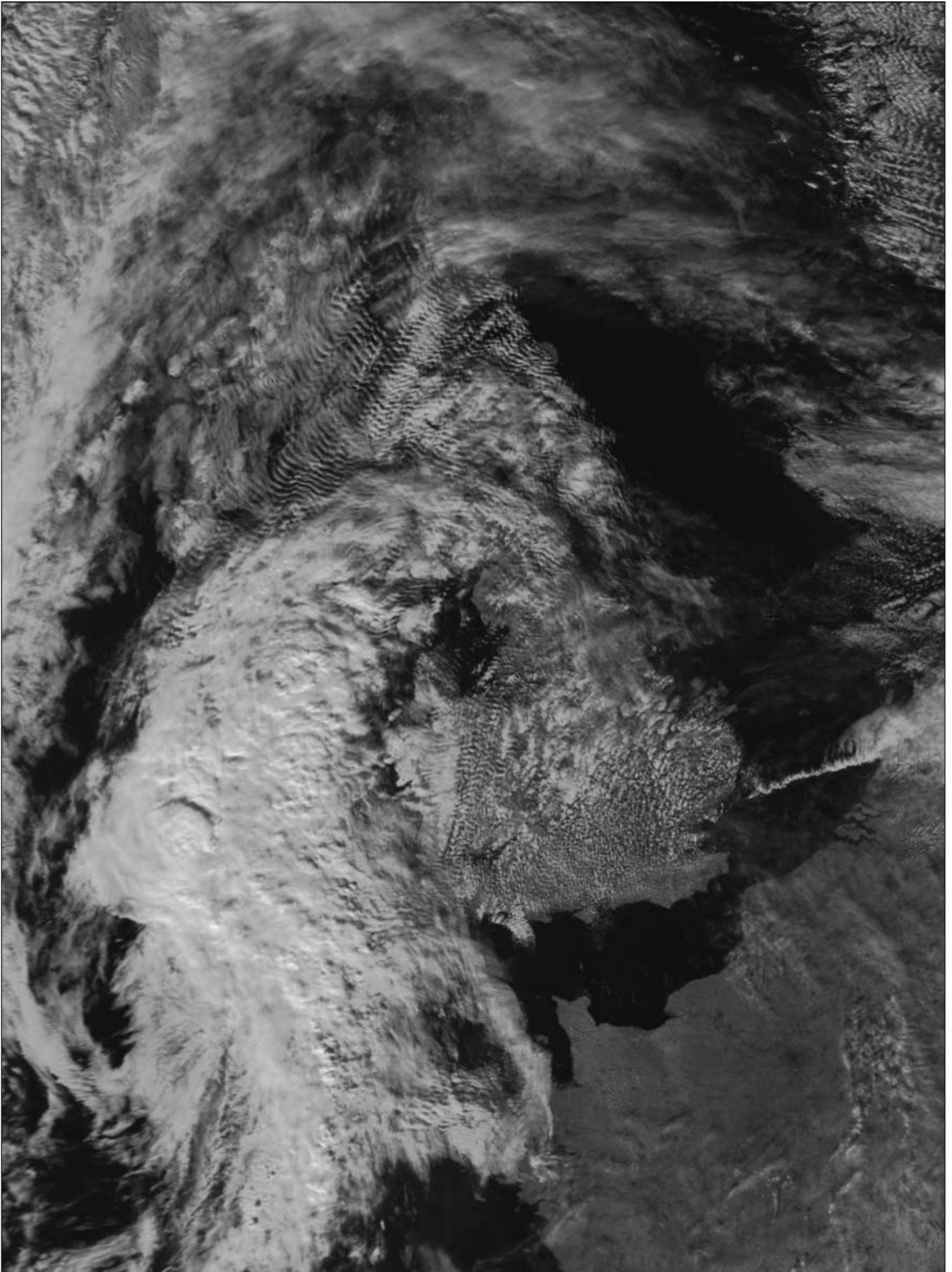


Figure 3 - Density Visualisation

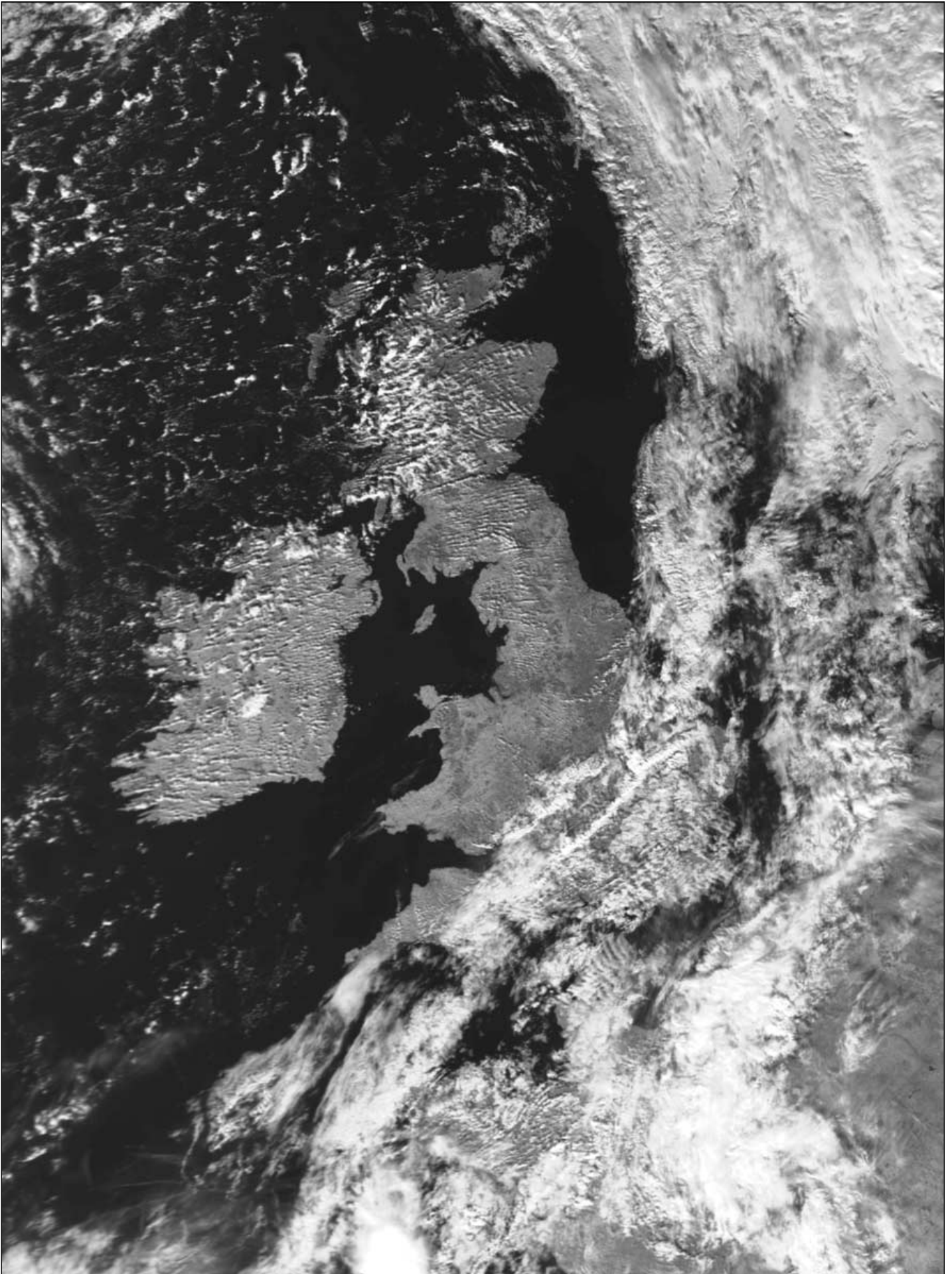
Concluded on page ...42





Almost the entire United Kingdom was covered by extensive lee wave cloud on October 8, 2006. Another interesting feature is a rope cloud, looking like an erupting volcano just off the coast of Suffolk. Any theories to the editor, please. The channel-2 HRPT image above was acquired by NOAA-18 around 12:45 UT

Image: NOAA CLASS archive at www.class.noaa.gov



What a difference a day makes! The entire United Kingdom is almost cloud-free in this NOAA-18 channel-2 image acquired around 12:35 UT on October 9, 2006. A wet night was swiftly replaced by a near summer-like day with temperatures approaching 20° in many places.
Image: NOAA CLASS archive at www.class.noaa.gov



Use *ProcessAVHRR* to generate multiple HRPT images in a single operation

Fred van den Bosch

Overview

There has been increasing interest of late in EUMETSAT's EARS-AVHRR service which collects high-resolution AVHRR data from a network of acquisition stations and disseminates it via EUMETCast [1]. The data files are sent in small segments which can be combined into a single file using either David Taylor's AVHRR-Manager [2] or XRIT2PIC from Rob Alblas [3]. My system uses the former, which outputs a high-resolution data file (HPT) and a corresponding thumbnail image (JPG).

The HPT data can be converted into images by means of HRPTReader [2], which can output a variety of single-channel images as well as composites and enhancements. Normally, each of these must be saved separately. If desired, the images can be converted to a different projection by the program GroundMap.

My situation

Just like the majority of the programs on my system, the reception of AVHRR telemetry received via EUMETCast, saving it to HPT files and its conversion into images using the HRPT Reader has been automated [4]. In principle, I make four images from every HPT file: corrected false colour, vegetation and RGB images, and in addition the uncorrected false-colour image required for use with GroundMap.

Occasionally things go wrong and an HPT file is not decoded. This might occur if the system had briefly become overloaded or because data from several satellites had arrived nearly simultaneously. The result is that some HRPT images are missing. To take the hard work out of having to create each of the missing images individually later on, I have written the ProcessAVHRR software. Using this program, I can easily start HRPTReader in batch mode and for every HPT file that has not been executed create all four images I require in a single operation, reaching the same result that should have happened automatically.

General Operation

ProcessAVHRR allows several images to be very easily generated at one go. Before the program is run for the first time a number of parameters must be defined. Thereafter, you can run ProcessAVHRR, select an AVHRR file (HPT) and, by clicking a button, start either the HRPT Reader or GroundMap (or both) to generate all the required images. If the exported image already exists, a warning is given and the image is displayed.

Installation

Create a suitable folder (called POVIM in this note) and extract the program ProcessAVHRR into it. This folder can be anywhere you wish:

E.g. 'C:\POVIM' or 'C:\Program Files\POVIM'

HRPT Reader Configuration

Because ProcessAVHRR also makes use of GroundMap to scale images produced by HRPT Reader, extra care is needed in deciding where the output images from HRPT Reader will be stored. Define a folder using <Options→Result location>. It is also important under <Options→Image filename format> to edit the 'format' string to 'yyyyymmddhhnn' (i.e. no hyphens) and make sure all three check boxes on that page are ticked. Click 'OK' to confirm (figure 2)

ProcessAVHRR Configuration

The POVIM folder contains the file ProcessAVHRR.cfg, which consists of six lines of data. These must be adapted to your own requirements. Open the file using Notepad. The first part, in my case, is as follows:

```
D:\DATA\AVHRR\
C:\Program Files\David Taylor\HRPTReader\ReadHRPT.exe
-fc:corr.jpg -ndvi:corr.jpg -rgb:R3G3B5:corr.jpg -fc:.JPG -close
-min
D:\MSG\AVHRR\
C:\Program Files\David Taylor\Groundmap\Groundmap.exe
-lat1:40 -lat2:60 -lon1:-10 -lon2:30 -width:1000 -height:500
-proj:Polar
```

The significance of the rows is as follows:

- 1 This is the folder where the output files (HPT) from AVHRR Manager are stored. It can be located anywhere on your PC. Remember the '\ ' character at the end of the line.
- 2 This is the complete pathname for the HRPT Reader
- 3 This is the parameter string for the HRPT Reader. In the above example a total of four images are generated. If you also wish to generate images using GroundMap, the 4th parameter, '-fc:JPG' must be present.
- 4 This is the folder, already defined within HRPT Reader, where its image files are stored (here again, do not forget the final '\')
- 5 This is the complete pathname of GroundMap
- 6 This is the parameter string for GroundMap. This particular example is from the GroundMap guide.

Execution

Start ProcessAVHRR. If there are already HPT files for the current day in the folder, these will be displayed directly on the screen, otherwise the contents of the DATA folder are shown.

Next, choose a file by clicking on the filename (HPT) or on the thumbnail (JPG). The thumbnail will be displayed. If an HRPT image for this file already exists this is shown, and one of the following two reports given:

- File made and renamed
This means that files have been created and that the name has already been adapted by my program RenameAVHRR. I use this program in order to make the filename appropriate to the system of POVIM Presentation Manager. I will describe that process later in a separate article about the Presentation Manager.
- File generated
In this case the image has been generated but still has the same name. If you do not use the RenameAVHRR program this allows a control to take place.

The advantage is that you can check directly if there is a difference between the generated image and the thumbnail. Unfortunately, displaying the image costs quite some time because the files are frequently large (figure 1).

When is this program useful?

The simplest option is to allow HRPT Reader to run automatically in batch mode. In that case ProcessAVHRR makes it is easy to check afterwards whether all the files have been processed. That is particularly useful if the program RenameAVHRR is also used. This

program rounds the time element of each filename to a multiple of 15 minutes, thus converting the output of *HRPT Reader* into a form which can be read by *POVIM Presentation Manager*. Because of this, it is possible that files which are within the 15-minute span are not correctly processed.

If *HRPT Reader* is not used in batch mode, *ProcessAVHRR* makes it very easy to generate several images, each with a different enhancement, from the same HPT file in a single operation.

If you regularly have a need to produce several enhanced images from *HRPT Reader*, working interactively via *ProcessAVHRR* is much more efficient.

As an example, if you wished to create a corrected channel-2 image and save it in BMP format, all you need do is edit line 3 of the *ProcessAVHRR.cfg* file by the insertion of '-ch2:corr.bmp' into the parameter string as follows:

```
-fc:corr.jpg -ndvi:corr.jpg
-rgb:R3G3B5:corr.jpg -fc:jpg
-ch2:corr.bmp -close -min.
```

ProcessAVHRR can be found on my Internet site:

<http://www.fredvandenbosch.nl/downloads.html>

Restrictions

In the *HRPT Reader*, the naming convention of the exported files is established. It is not feasible to incorporate all possible naming combinations in my program. I have therefore, for this reason, chosen to assume one naming system:

yyymmddhhnn

The checkmark against 'Add image-dependent suffix' is essential (figure 2). Otherwise, when you use *HRPT Reader* interactively, and an output file already exists, a new file would be made with a suffix 1, 2 etc.

This option is switched off in batch mode. This means that without the mark only one image is generated no matter how many parameters you have defined.

For all other combinations it can happen that existing filenames are not shown and that *GroundMap* does not work. Generating with *HRPT Reader* always works, of course, however.

References

- 1 EUMETSAT, www.eumetsat.int
Follow these menus:
WHAT WE DO→Satellites→EARS System→EARS-AVHRR
- 2 David Taylor
<http://www.satsignal.eu/>
- 3 Rob Alblas, <http://www.alblas.demon.nl/wsat/>
- 4 POVIM (2): Automating all processes
GEO Quarterly 11, September 2006, p 23

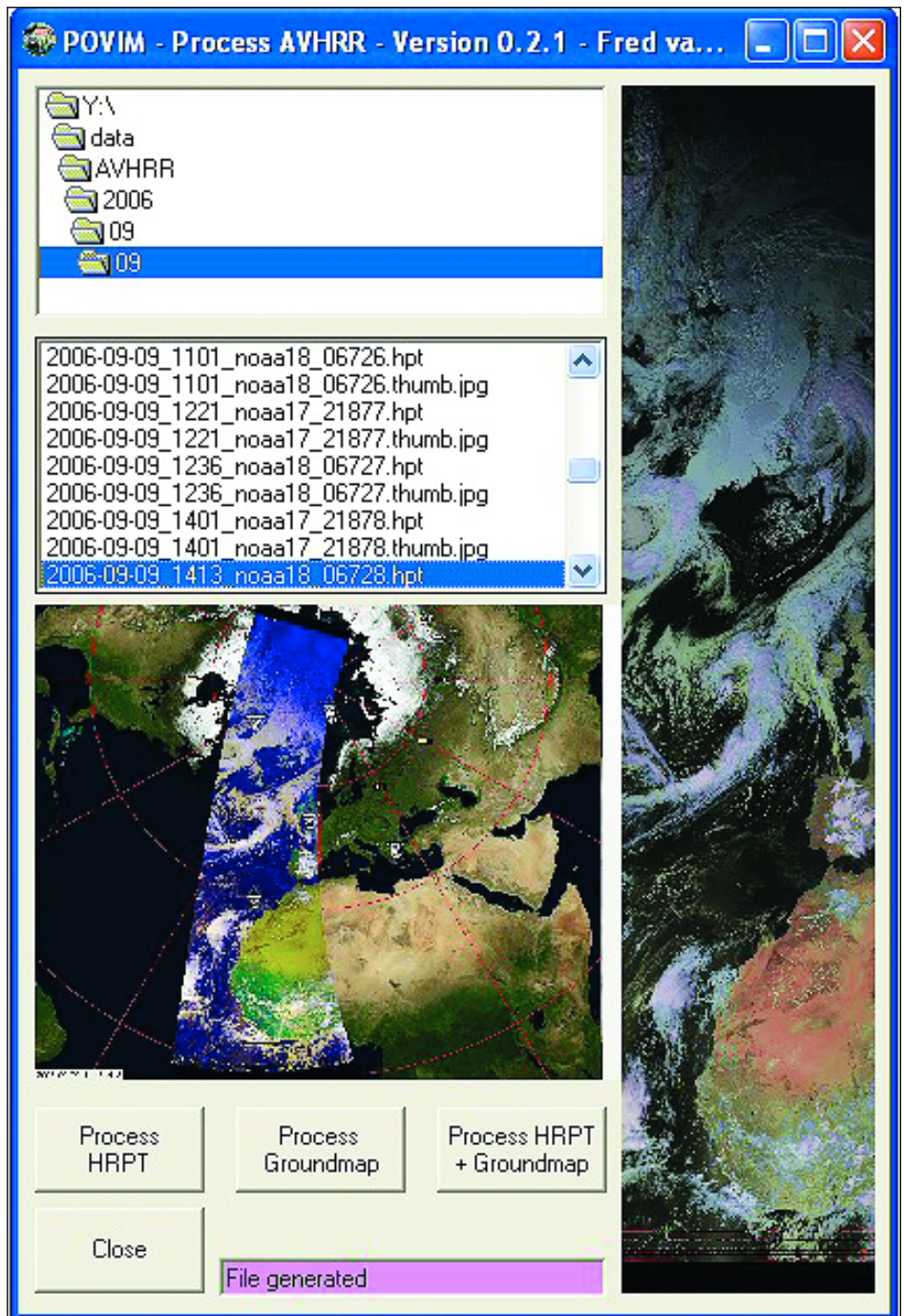


Figure 1 - The ProcessAVHRR display

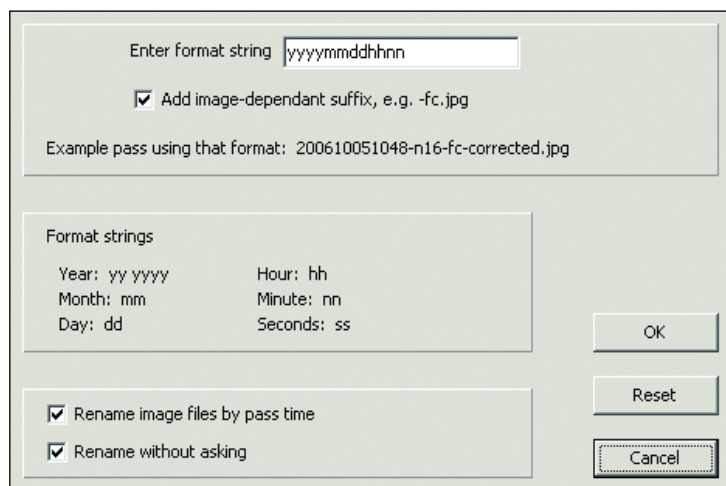


Figure 2 - Configuring filename style in HRPT Reader

IN TRAY

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

Hi Les,

Having read Rob Denton's challenge in the March 2006 Geo Quarterly, I thought someone should take it up. Throughout the past few months I have been capturing numerous passes with just the aim of getting further east. The enclosed image is not the greatest, but rather than leave Rob feeling nobody has taken up his challenge: there may be better to come.

The image was captured from NOAA-18 using an RX2 receiver and a homemade co-ax style QFH antenna, roughly 20 feet above ground level, from my home location in Pinner, Middlesex, England.

The theory is trying to capture the right pass when the satellite crosses over the Black Sea. If the satellite is too far east, then the signal is weak and noise bars spoil it: too far west and the image does not include much of the Caspian Sea.

If anybody has already submitted entries, perhaps you might publish the results to-date so that members can check out the competition so far.

As I have said in the past, the Geo Quarterly is excellent and a credit to you and the Management Team.

Peter Bartlett
Pinner, Middlesex, England.

[No list of results I'm afraid, Peter. Your entry was the only one received. The total apathy of GEO members towards this challenge has left me totally flabbergasted - Ed]

Dear Les,

May I take this opportunity to thank you for all your efforts of the last few years as editor of GEO. You have done a wonderful job and I am sure you will be sorely missed.

Regarding No 11, page 29: the Boltek LD-250 story. Just to clear a few things that may confuse some readers. The map showing the strikes is not the program from the LD-250 but is software from another firm, *NexStorm*. If any readers wish to learn more about the *Boltek* LD-250 they can contact *Skyview* at

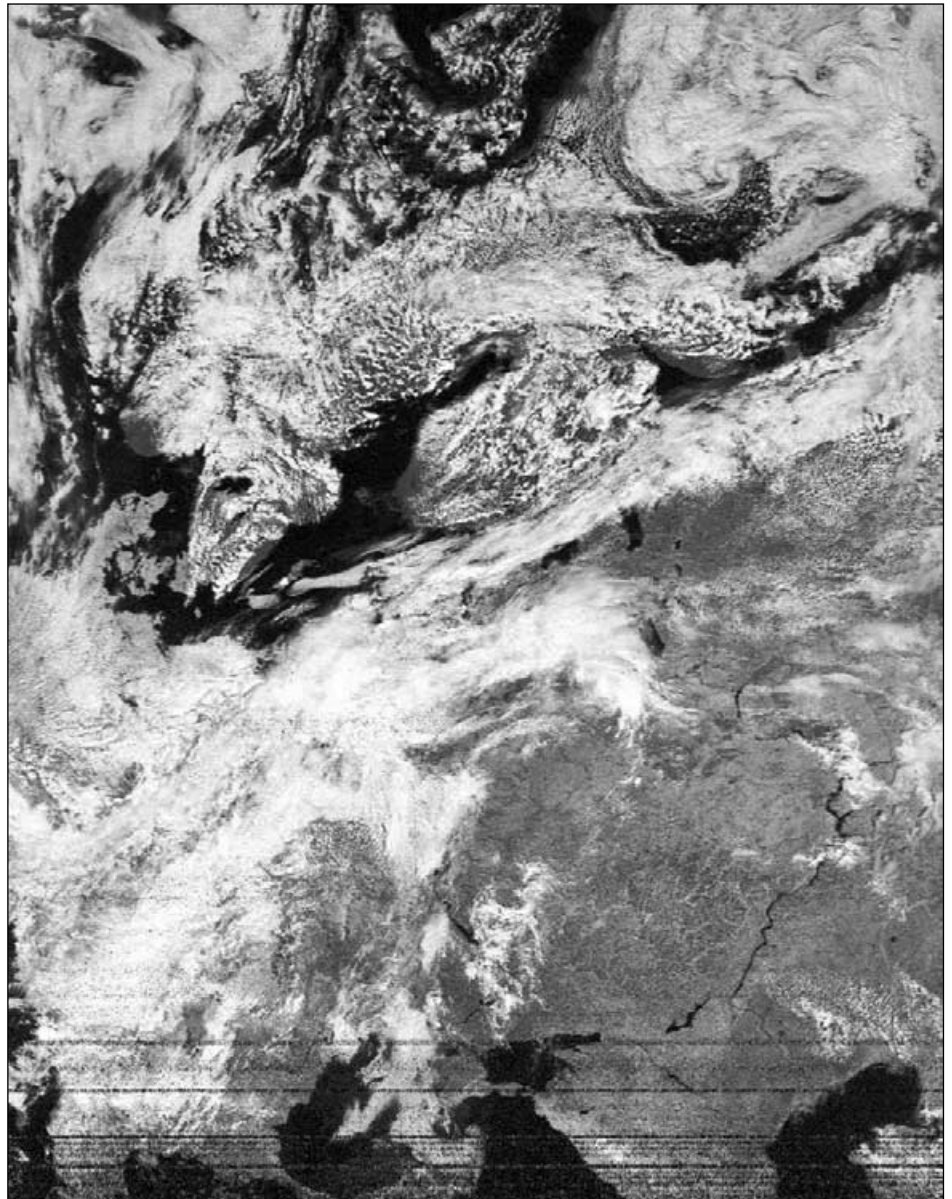
www.skyview.co.uk

by telephone at (01787) 883138 or by writing to Skyview Systems, 9 Church Field Road, Chilton Industrial Estate, Sudbury, Suffolk.

The two young ladies, Reanna and Janice, are always helpful and will supply catalogues of all the weather equipment they supply plus the catalogue of *Davis Instruments*, if requested. This information may help some readers who want to increase their weather knowledge but aren't sure where to start.

As I said before, I hope you enjoy your rest from the editorship and sincerely hope it is not the last we hear from, and of, you.

Best wishes,
Brian Bainton, Newport.



Peter Bartlett's NOAA-18 image showing part of the Caspian Sea.
Rob Denton awarded his prize of the *Pocket Guide to Weather and Forecasting* to Peter.

Dear Les,

In GEO Quarterly No 11, September 2006, page 44, Robert Moore published an interesting image of an unusual dark pattern surrounding Ireland and the south-eastern regions of Great Britain. He ends his article wondering if any readers have any ideas about the odd event.

I am a GEO reader with no ideas and no explanation to give him, but I have always been struck by the dark areas in the expanse of water made bright by the reflection of sunlight.

At the same time, I have always thought that, when the VIS or near IR sensors of the satellites show a dark water area, this implies a smooth surface. Dealing with Underwater

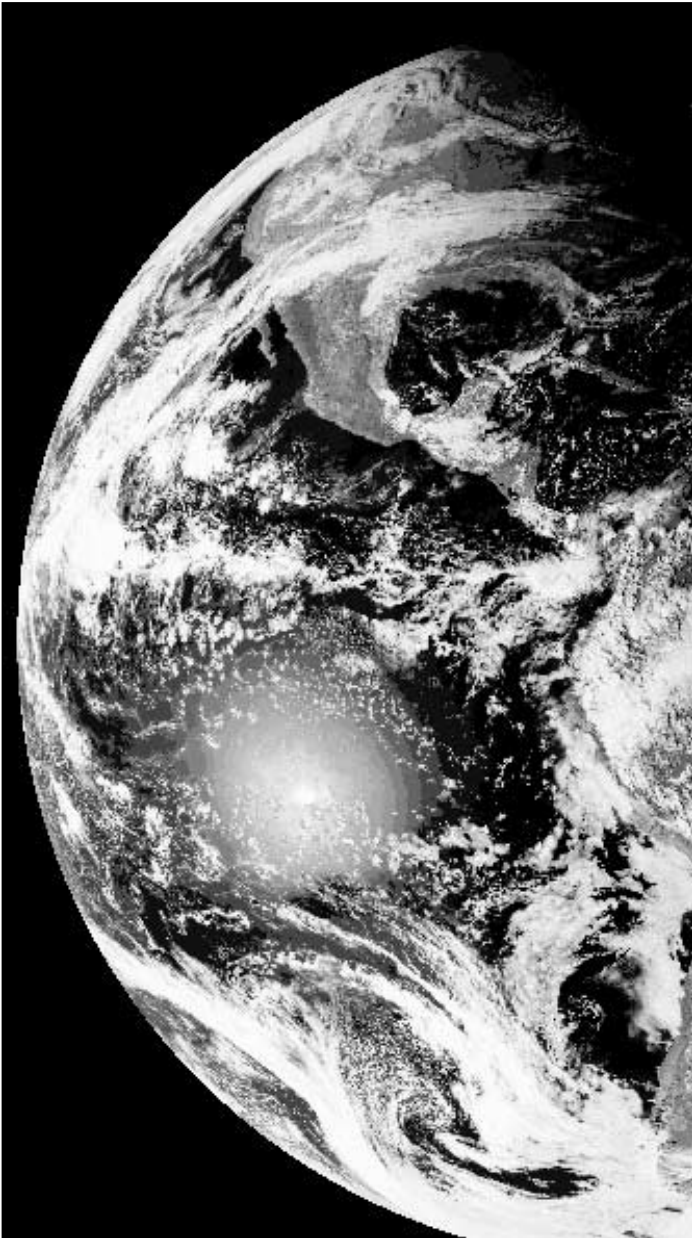
Waves, a NASA note states: 'Where these currents converge, the sea surface is more turbulent and therefore brighter. Where the currents diverge, the surface is smoother and darker, creating zones called slicks.'

Interpreting polar orbiting satellite imagery, Peter Wakelin wrote in 2002: 'The roughness of the sea usually means that sun-glint can be seen over at least a 10 degrees range of latitude and often much more.'

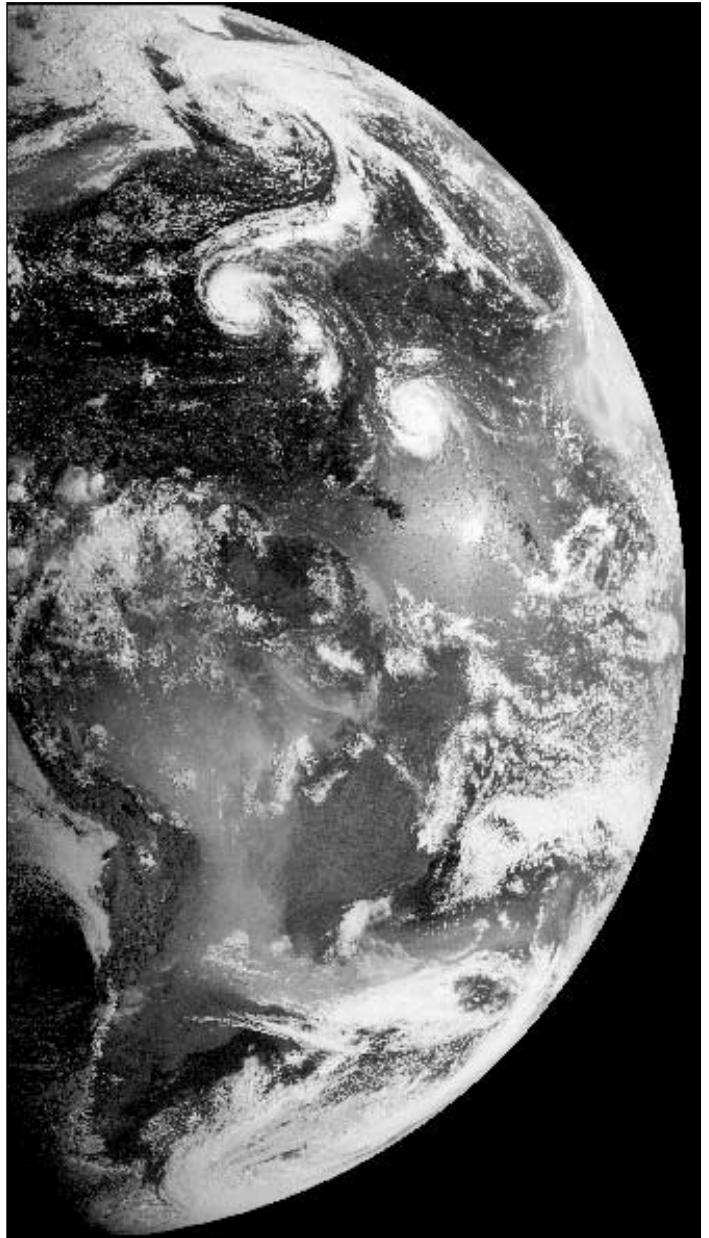
I have selected some high-albedo images from my archive which you may include in GEO Quarterly (see four of Marciano's images on the opposite page).

Thank you for all you are doing for our community. 73.

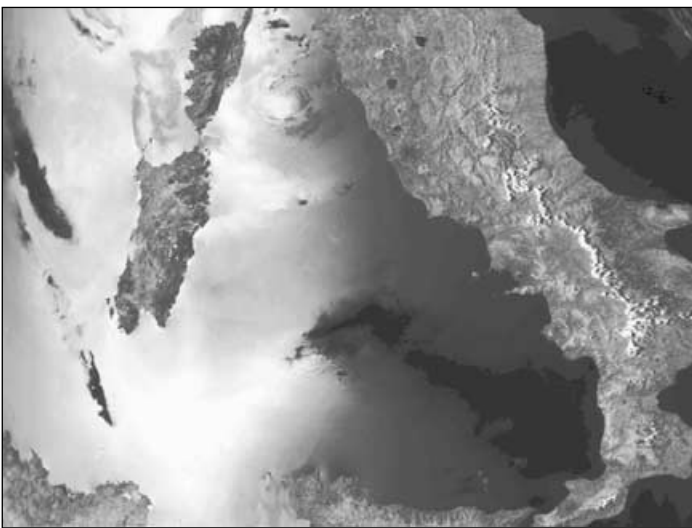
Marciano Righini, 14MY



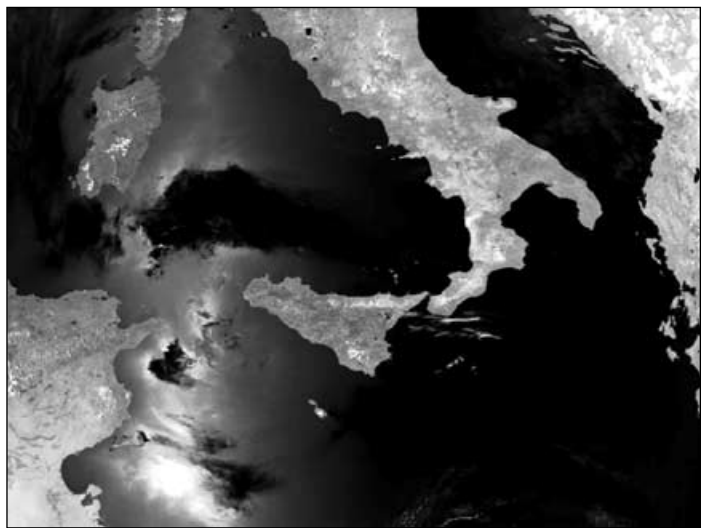
A GOES-E image relayed by **Meteosat-5** at 21:54 UT on November 22, 1994 showing sun glint on the Pacific Ocean. It was late spring in the southern hemisphere, one month before the summer solstice.



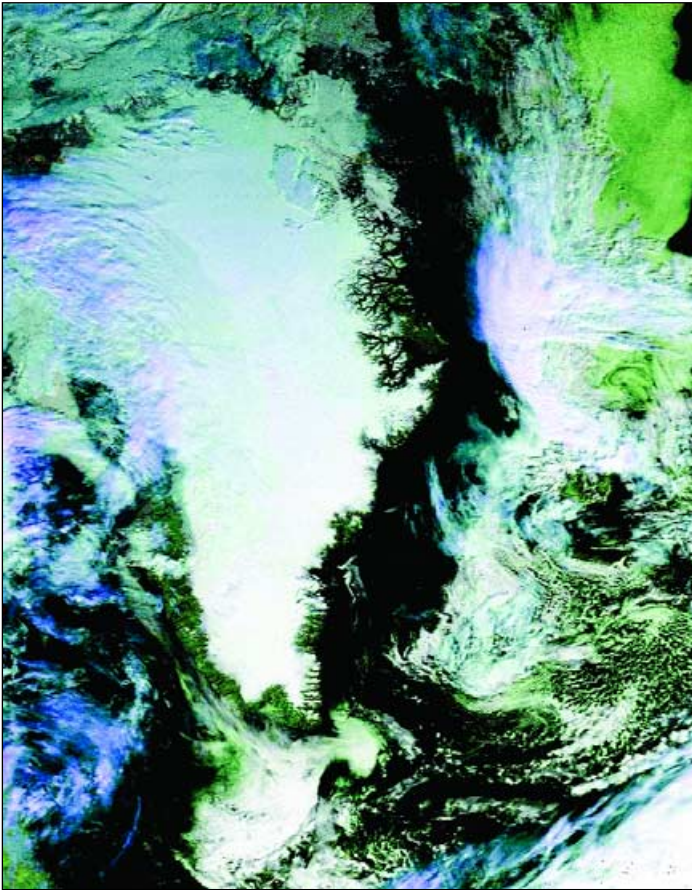
A GOES-E image relayed by **Meteosat-5** at 12:56 UT on September 1, 1995 showing two hurricanes and sun glint on the Atlantic Ocean. There were still three weeks to go before the autumnal equinox.



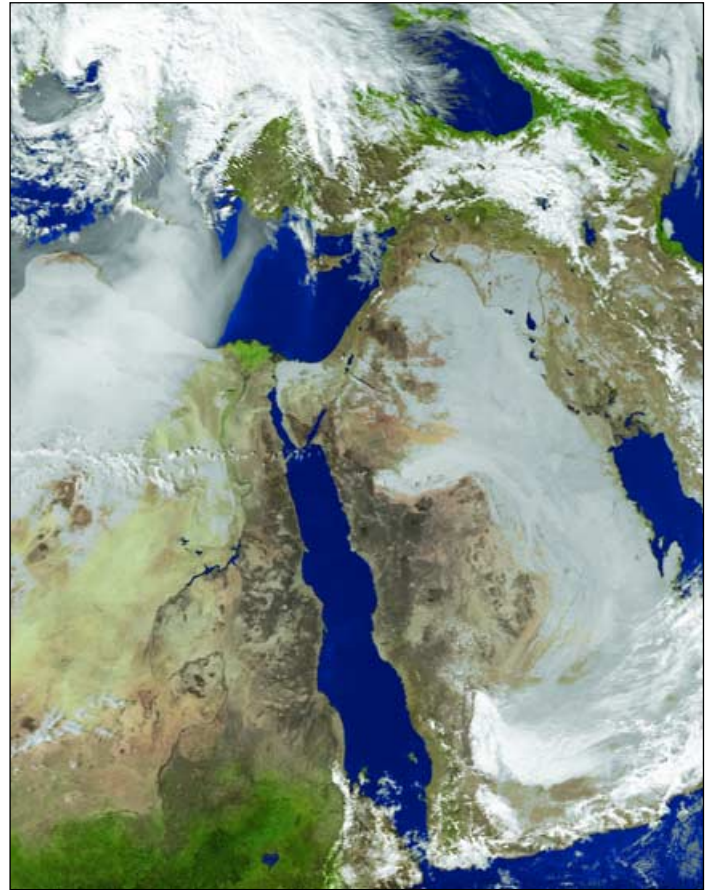
This channel-2 HRPT segment came from a **NOAA-11** pass between 14:11 and 4:26 UT on July 29, 1993. The image shows the islands of Sardinia (Italy) and Corsica (France) surrounded by sun glint. The variations in grey and the dark areas are due to variations in sea surface roughness.



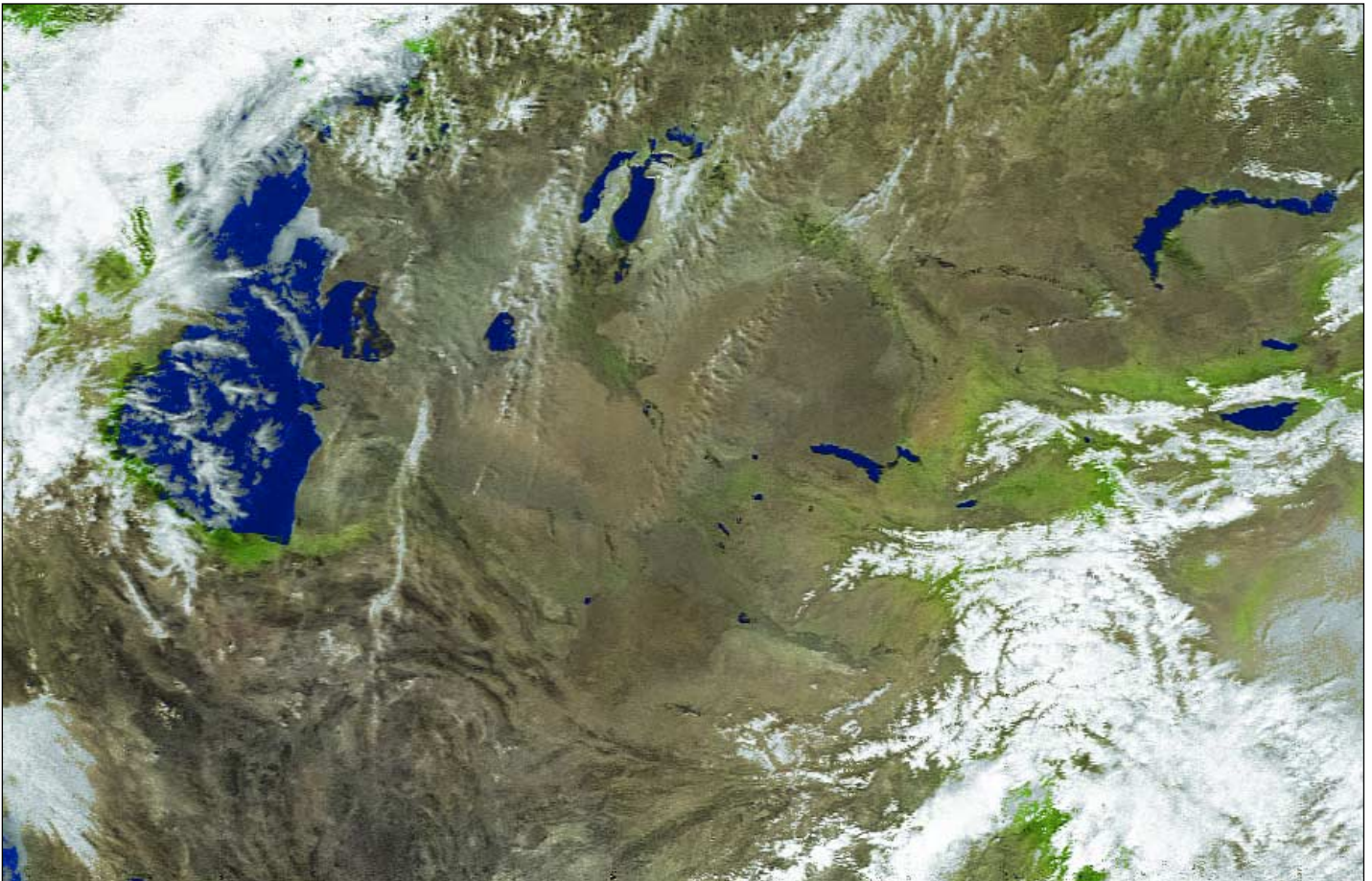
This channel-2 HRPT NOAA-18 image obtained between 12:27-12:42 UT on June 23, 2005 shows sun glint on the channel between Sicily and Tunisia with several brightness variations. The most apparent feature is an extensive dark area on the Tyrrhenian Sea between Sicily and Sardinia.



Alan Smith from Birkenhead, Merseyside captured this fine summer image of Greenland in an early afternoon NOAA-17 pass on August 28 this year using his Vierling 'Weatherman' system with a roof-mounted QFH antenna.



John Wills from Cyprus received this NOAA-18 image of the Middle-East at 11:14 UT on February 24, 2006, which includes a fierce dust storm blowing northward from Egypt over the Mediterranean Sea.



Another NOAA-18 image from **John Wills**, this one dating from 09:01 UT on April 16, 2006. From left to right, the southern Caspian Sea, Aral Sea and Lake

Balkhash all show prominently. At lower right, in Tajikistan, are the snow-covered Pamirs, several of which rise to over 7000 metres.

SOFTWARE SHOWCASE



Douglas Deans - dsdeans@tiscali.co.uk

After a number of false starts, Europe's first polar orbiting meteorological satellite has been launched. The MetOp-2 launch took place from Baikonur Cosmodrome in Kazakhstan on 19th October at 16.28 UTC. The successfully orbited satellite is now known as MetOp-A. This is the first of three satellites for the Eumetsat Polar System (EPS) and is the European contribution to the Initial Joint Polar Orbiting Operational Satellite System (IJPS). Eumetsat will provide the morning orbit satellites. MetOp-A has a huge range of instruments on-board and through the Eumetcast system it will be possible to receive global, yes worldwide, data of the highest resolution. Exciting times indeed.

It is expected that the first trial MetOp-A data through the Eumetcast system will start during December although this is subject to the progress of commissioning. What software can we look forward to for this data ? I had a chat with the one person who could help and here is what David Taylor had to say:

'MetOp-A offers unique opportunities for those with a EUMETCast system. Not only will there be near-real-time data like that presently available from NOAA-17 and NOAA-18, but a full data stream delayed by one orbit from all over the world. It will be rather like having the CLASS archive on your own hard disc.

'However, with the new satellite have come completely new transmission systems and data formats, and it is not yet completely clear how each of the data streams will be processed by EUMETSAT before being made available to the users. It may be possible to adapt some existing software for the new data while retaining the existing features and thermal calibration, although the world-wide data will require some sort of archive and

library system which will be a completely new requirement for HRPT users

'Software for MetOp has been under development for some time and is working well with test data kindly made available by EUMETSAT, and it is hoped that by the time real data is available upgrades and new programs to handle the new data formats will be available.'

So there it is straight from the horse's mouth (sorry David). By the time the next quarterly journal is due in March next year, I expect there may well be a number of important additions to the software library for me to report on. Time to get your list amended for Father Christmas !

Not much else to report this quarter. There are a number of program updates, but not of sufficient change to merit a write up. I have listed below the programs which have been updated and as always are available from the current CD library.

CD1

- GeoSatSignal v 6.0.2
- Kepler Manager v 1.2.8
- WXtrack v 3.5.8
- GroundMap v 2.0.4
- MSG Animator v 2.5.2
- AVHRR Manager v 1.2.6
- HRPT Reader v 2.6.6

CD2

- APTDecoder v 1.03.72

| | | | |
|------------|--|--|---------|
| 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 1.2.6 |
| | GeoSatSignal | Manipulates Geostationary weather satellite images | v 6.0.2 |
| | GRIB Viewer | Viewer for GRIB format files | v 2.0.8 |
| | GroundMap | Rescales satellite images | v 2.0.4 |
| | HRPT Reader | Converts raw HRPT data files into images | v 2.6.6 |
| | Kepler Manager | Organises files of 2-line element data | v 1.2.8 |
| | MSG Animator | Automatic animation of MSG images following reception | v 2.5.2 |
| | MSG Data Manager | Processes and manages the files received from MSG satellites | v 2.5.2 |
| | RX2 PassControl | Computer control program for the RX2 receiver | v 3.0.8 |

| | | | |
|------------|--|---|---------|
| GS2 | A wide range of software for all aspects of weather satellite reception, including tracking, receiving, monitoring and image manipulation. Content is detailed below but many other extras are provided. Titles correspond with folder names. * implies a DOS program. | | |
| | Collection D02 | Recall (wave file recorder), Palette (modifies Wxsat colour palettes). | |
| | Collection D03 | Scanner recorder v 1.8 (wave file recorder), *NOAA95/FENG99 (software for the NOAA 95 HRPT project) | |
| | Collection D04 | Wxsat (wave file recorder/decoder), Satmon (wave file recorder). | v 2.59 |
| | AGSatTrack | Satellite tracking program | |
| | APTDecoder | Program for capturing APT audio and processing images | |
| | Cirkit | Documents for the Cirkit Wxsat receiver and the UOSat receiver (PDF format) | |
| | Element Manager | 2-line element manager | v 1.59 |
| | Footprint | Satellite tracking program | |
| | Irfan View | Image/slideshow viewer | |
| | JVcomm32 | Evaluation version (APT/FAX/SSTV decoder) | |
| | Macintosh kepler editor | Edits verbose AMSAT format elements. Mac OS X and OS9 only. | |
| | NeoPaint | Image processing program (30 day evaluation) | |
| | Orbitron | Satellite Tracking Program | v 3.70 |
| | Paintshop Pro | Image processing program (30-day evaluation) | |
| | PhotoFiltre | Image retouching program with many extras | v 6.1.5 |
| | Satscape | Satellite tracker and wave file recorder | v 2.02 |
| | Space-Track TLE Retriever | Generates TLE files in 'Celestrak' style from data sets recovered from Space Track | |
| | Splitter | Utility program for splitting and reuniting large files | |
| | WXtoImg | WAV file recording and decoding 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. | | |

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

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

How to Purchase CDs

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.

Cleveland Volcano Erupts

Aleutian Islands, Alaska



On May 23, 2006, Flight Engineer Jeff Williams contacted the Alaska Volcano Observatory from the International Space Station to report that Cleveland Volcano was producing a plume of ash. Shortly after activity began he took this photograph showing the plume moving west-southwest from the volcano's summit at an altitude of some 6000 metres above sea level.

Cleveland Volcano, with a summit elevation of 1,730 metres, is situated on the western half of Chuginadak Island, and is one of the most active volcanoes in the Aleutian Islands. It is a stratovolcano, composed of alternating layers of hardened lava, compacted volcanic ash, and volcanic rocks. This volcano is the highest in the Islands of the Four Mountains group.

Magma that feeds eruptions of ash and lava from Cleveland Volcano is generated by the northwestward movement of the Pacific Plate beneath the North American Plate. As one tectonic plate moves beneath another, melting of materials above and within the lower plate produces magma that can eventually move to the surface and erupt through a volcanic vent. Cleveland Volcano claimed the only known eruption-related fatality in the Aleutian Islands, in 1944.

Astronaut photograph ISS013-E-24184 was acquired May 23, 2006, with a Kodak 760C digital camera using an 800 mm lens, and is provided by the ISS Crew Earth Observations experiment and the Image Science & Analysis Group, Johnson Space Center.

Tracking Lightning on the Web

Continued from page ...32

defined by the colours used for strike visualisation. The actual number of strikes per time interval is only written on to the highest bar.

Alarms and City Locations

Finally, if you wish, click the 'Alarm' button to activate audible alarms. By default, this is set to 'none', but you have the choice of using a PC loudspeaker alert or playing a favoured wave file through your soundcard and triggered by the number of lightning strikes and their range. City locations can be added/alterd by editing the text file *cities.txt* which resides in the program folder. Each line in this file consists of four

items, 'Location name', 'Latitude', 'Longitude' and 'Display'. The final item determines how the location is displayed:

- 0 not shown
- 1 shown on Europe overview map only
- 2 shown on the country maps

Conclusions

Having tried this software over the past few weeks, I find it an excellent program that works with very little setting up for your home location, and provides excellent results from the participating stations

References

- 1 http://www.isleofwightweather.co.uk/live_storm_data.htm
- 2 <http://441creative.com/weather/stormvue/>

ATLANTIC

Francis Bell

Some readers may remember my light hearted comments in a previous quarterly—GEO Quarterly No 8, page 2—about bad weather and natural disasters following Nadine and myself holidaying around the world. This time events caught up with us.

We both like to travel and occasionally enjoy a cruise, usually just for one or two weeks. However, this time we booked a transatlantic cruise lasting 24 days. Usually I find days at sea tiresome but what I do enjoy are the different ports of call, just treating the ship as a floating hotel. There was a trade-off this time, with days at sea being mitigated by visiting ports on the east coast of Canada and the USA, including New York. Also, our friends had booked the same cruise so the decision was made: we will go.

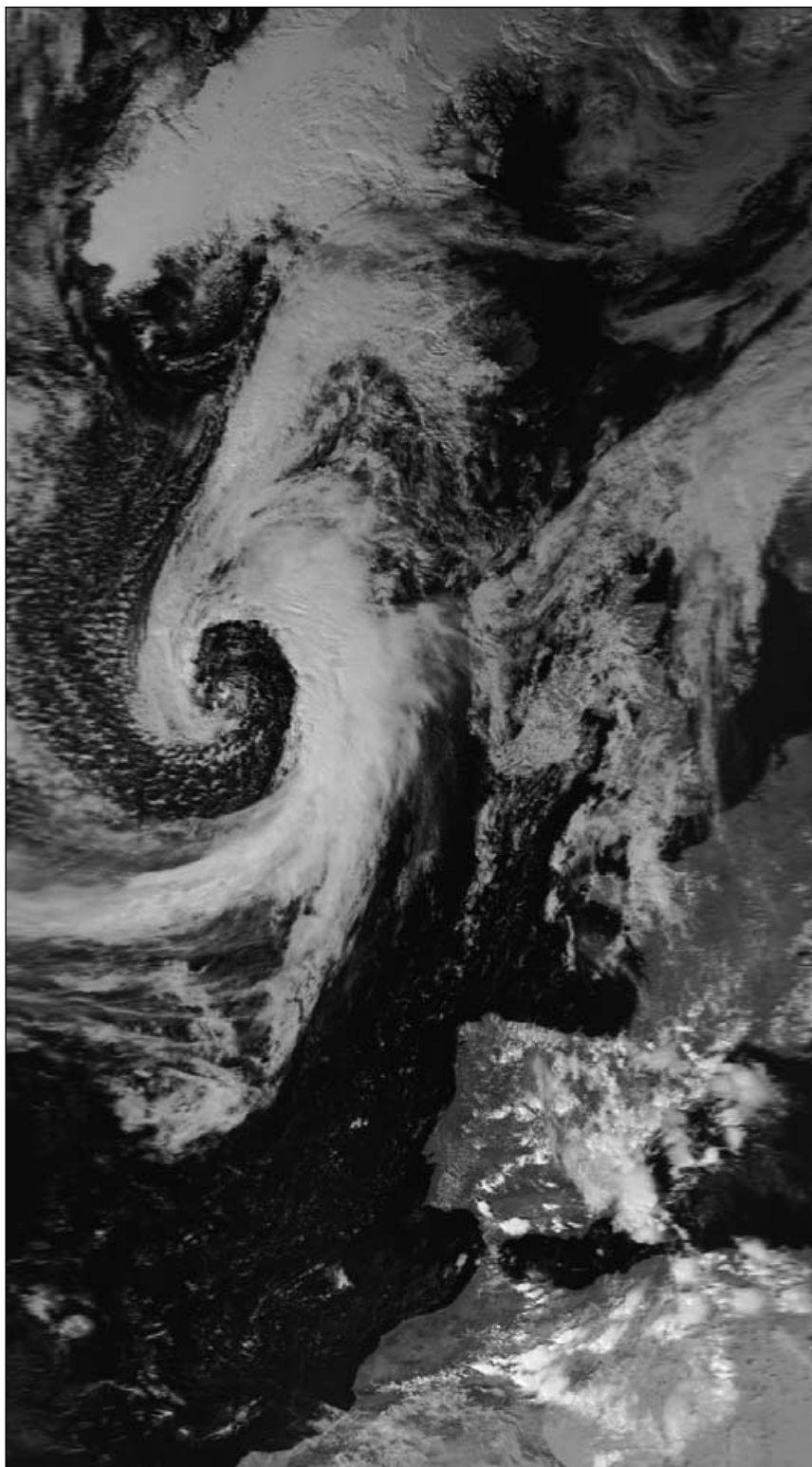
Now I know autumn weather in the north Atlantic can be a bit variable but I did not anticipate the stormy weather we actually encountered. This was compounded by the poor decision-making on behalf of the ship's operator to cope with this adverse weather.

A cruise ship's itinerary will usually be run on a tight schedule anticipating their pre-booked ports of call; hence there is little time for contingency plans or changes of course while at sea. This tends to lock the ship into an inflexible pre-planned course and time schedule. This was the downfall of our particular cruise.

Weather forecasting for the north Atlantic must be intense, backed by satellite data, ships relaying their data and fixed recording stations. The British, French, Canadians and Americans all provide detailed weather forecasts for this part of the Atlantic ocean. The important word here is forecast: not just giving the relevant parameters for the present but forecasting the pattern of expected changes for days into the future. Ships need this information. Immense resources and effort go into this process for the benefit of 'those in peril on the sea'.

Our outward cruise plan was to sail from Falmouth UK to St John's Newfoundland, with the ship following the great circle route defined almost exactly by the line of latitude 50°N. I didn't know this at the time but this course was to take us into the eye of two ferocious storms. This was folly on the part of the cruise operator because, in the short time scales with which we were dealing, weather forecasts would have identified the potential meteorological hazards. These forecasts were apparently ignored.

Two days out from Falmouth we encountered our first storm. This was an intense depression and



This NOAA-18 image shows the intense north Atlantic depression at 13:58 UT on September 12, 2006, when the ship's position was very close to 50°N, 20°W. Image: NOAA CLASS Archive (www.class.noaa.gov)

the ship sailed straight into its centre. I find it difficult to judge wave heights although I did hear a figure of 10 metres quoted: whatever their height they were frightening. As cruise ships go, our vessel the *MV Athena* is quite small, about 16,000 tonnes, hence those violent conditions generated dramatic and dangerous movement of the ship. In addition to the periodic movement of the ship, which after some time could be anticipated, there were occasions when unpredictable violent shocks were sent through the vessel. Anything on board that wasn't screwed down or otherwise secured went flying. I mean just that: furniture, bottles and table-tops all crashing through the lounge bars and public places. Unfortunately, this meant human beings as well. One passenger was catapulted through the air down a six step stairwell and killed while many others sustained lesser injuries. Many cabins were damaged and there was some ingress of sea water into our own cabin.

After passing through this storm some degree of normality was restored until, two days later, we ran into hurricane *Florence*. Technically it had by then been downgraded by the Americans to extratropical storm *Florence*. Wow! A rerun of the conditions experienced during the previous storm for another two days.

By now the whole cruise itinerary was wrecked because the storm delays had put us several days behind schedule; hence several ports in Canada and the USA were missed. On a brighter note, we did enjoy two and a half days in New York doing the typical tourist activities.

Now for the final act of folly. The cruise operators decided we would return to Falmouth using a route following closely the ship's outward course. The original itinerary should have taken us via the Azores. I expected this to be a relief from storms because the Azores high pressure area is well defined and predictable calm seas may be anticipated. This was not to be. For logistical reasons the cruise operators wanted to return using a more northerly route: never mind about the itinerary, just get back to Falmouth on time.

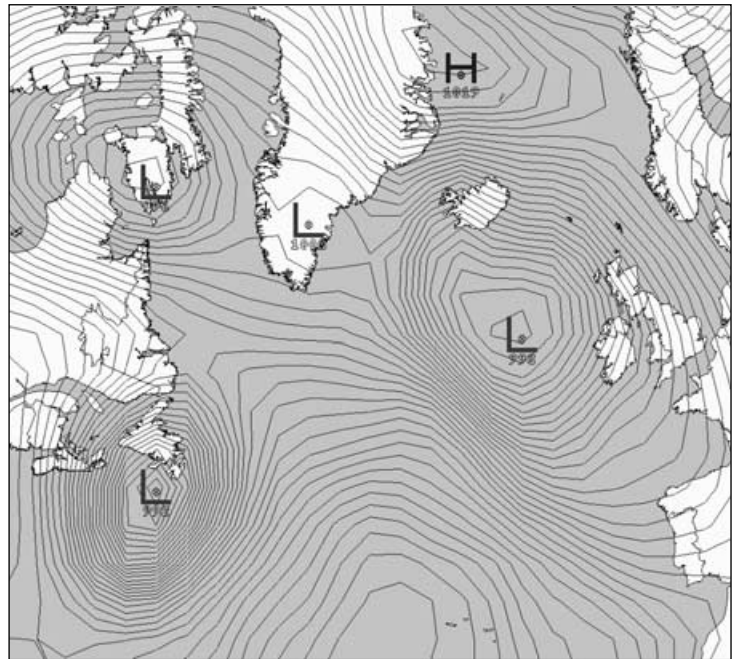
There followed an eventful eastward passage homeward as we followed a course in the wake of storm *Florence*, encountering the waves it had created. Then, in the mid Atlantic, we met two more depressions with their associated high seas. Severe movements of the ship continued but fortunately there were no more injuries and all the passengers and crew who did get back to Falmouth were relieved.

Sometimes when going on holiday I take my portable weather satellite receiving station with me. This time I just took my handheld scanner and a laptop computer to keep me occupied during those days at sea. Out of interest, I did listen to some satellite passes but I had no way of displaying the images on the laptop. If I had been able to do this perhaps I might have been able to influence some of the reckless ill-informed decision making to which we were all unnecessarily exposed.

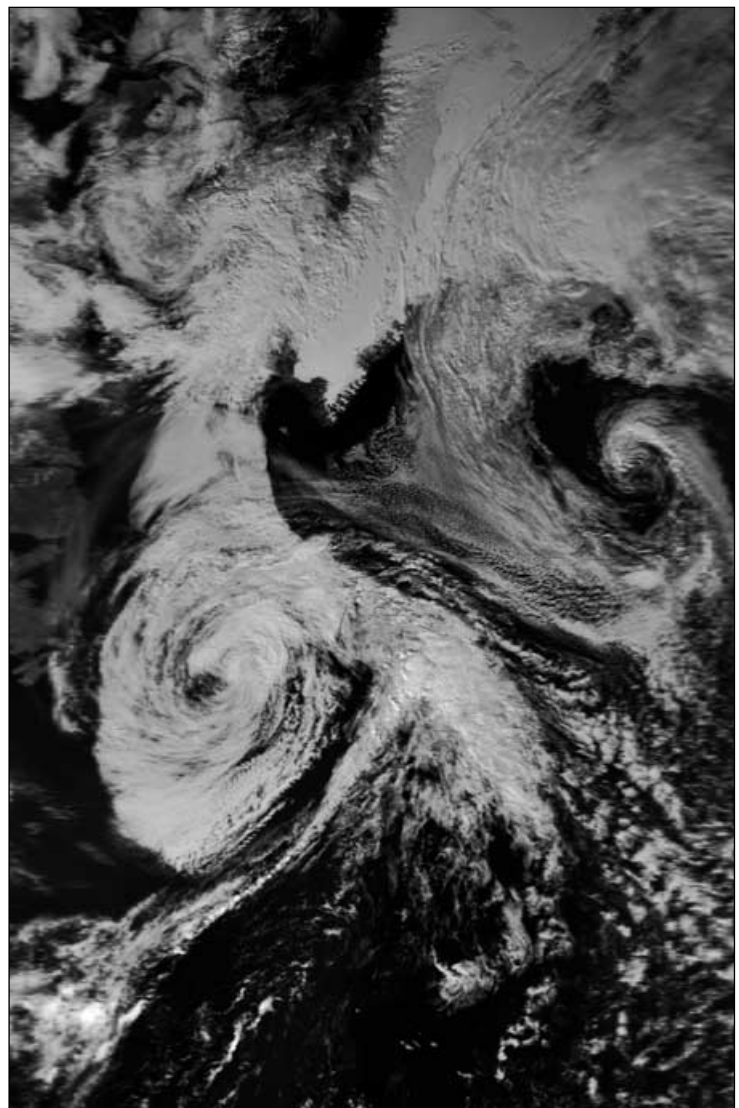
I am now researching weather satellite archives to piece together a comprehensive meteorological story of the cruise. Perhaps the folly which I expect to reveal and document may influence cruise operators in the future.

No sympathy is necessary for Nadine and myself. We have the good fortune to be home safely and we are resilient and stand by our personal decision making. Others passengers were not so fortunate and one did not return!

The cruise ship was 'Athena' registered in Portugal, the ship's operator was Classic International Cruises based in Portugal and the tour operator was Travelscope Holidays Ltd, a UK travel operator.



Above: the surface pressure chart for the north Atlantic for 12:00 UT on September 13, 2006 clearly showing the two low pressure storm centres mentioned in the text.



This NOAA-18 image shows extratropical storm 'Florence' off Newfoundland at 15:19 UT on September 14, 2006 when the ship's position was close to 47°N, 43°W

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

