The GEO Quarterly

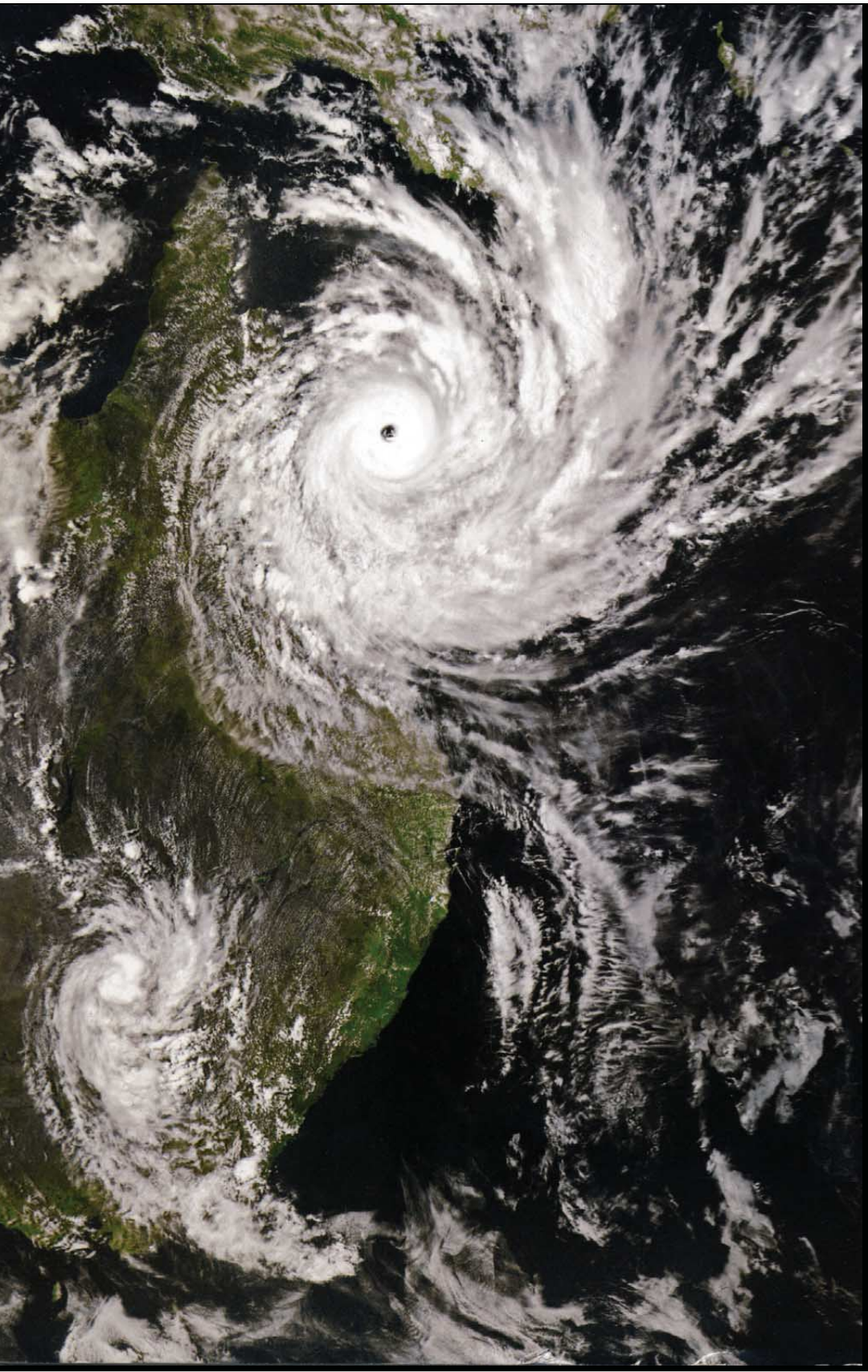
Group for Earth Observation

GEO Group for Earth Observation

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

Number 29

March 2011



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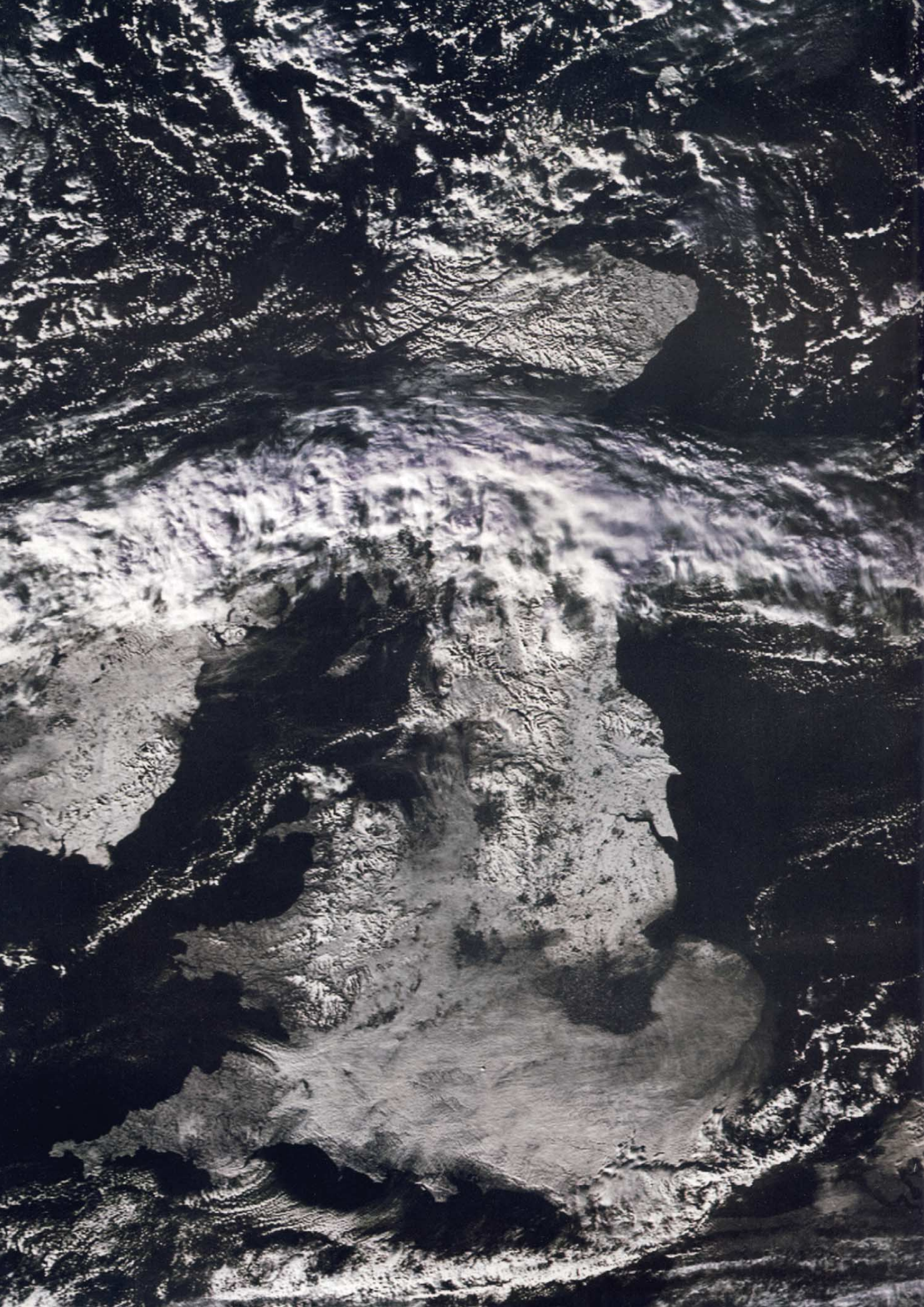

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Publisher
Published by The Group for Earth Observation Limited, a company in England and Wales, limited by guarantee and not having share capital. The Company number is 4975597.

The registered office is Coturnix House, Rake Lane, Milford, Godalming, Surrey GU8-5AB England.

Printing
Hedgerow Print
16 Marsh Lane
Crediton
Devon EX17 1ES

*The **GEO** Quarterly*

March 2011

Editorial: Peter Green

And so, my fellow GEO members: ask not what GEO can do for you - ask what you can do for your GEO.

It seems each quarter that I have to appeal for submissions for your quarterly. I would have expected to be have been inundated with images and articles this quarter with all the dramatic weather events around the world in the last few months. I have calculated that producing your magazine takes about a working week of my time every quarter. My day starts around 0430 most days, my wife and I run our own business which keeps me busy until around 1230, I then have a part time job every afternoon until 1700 (this includes Sundays), and every Saturday we do the 'turn around' on our holiday cottage. So I think you will agree my time is limited.

I find doing this job for you enjoyable and I have learned a new skill. However, after my appeals, inevitably, articles keep arriving after the deadline for submissions. This causes a lot more work and the inevitable delay of the magazine going to the printers and out to you. To quote David Taylor "if all the members contributed just one page a year, we could have a 100-page magazine each issue". That would keep me busy, but the point is well made. So, please support me and make the next issue, Q30, a bumper one, with YOUR article and images. My since apologies to JFK for misquoting him.

In this issue are details of our visit to EUMETSAT Headquarters in July and our Symposium on 7th May, two articles from members about their receiving stations, Les Hamilton looks at the Arctic Meltdown. Arne van Belle has two articles, the first on Receiving Envisat DDS & EUMETCAST on page 12 then on page 21 Arne has A New Challenge using a multi-LNB dish.

Dale Hardy has part 1 of The Great Australian Flood-2011 with some dramatic images, John Tellick reminisces about his travels to the Sahara and tells us about Cultivation in the Sahara, and there is much more for you.

Take a look at David Painters article on Remote Imaging of Siberian Oil & Gas Installations and see how he uses the Envisat images he receives.

Thank you to all those members who sent in articles and images, your time, trouble and expertise is greatly appreciated. I hope you all enjoy this quarterly.

Contents

The GEO Report

Francis Bell

My usual welcome to new GEO members and a thank you to those of you who continue to support the group by renewing your membership for a further year. Recently I wrote to about 120 lapsed members reminding them that their membership had expired and inviting them to renew for 2011. A very encouraging number did rejoin. This just underlines the point of not forgetting to renew your membership when you receive your notice. It takes time, trouble and expense to contact lapsed members but also in the meantime they may have missed out on important satellite news.

A further comment about our membership must be very complimentary. You only have to read some of the articles in the Quarterly to realise how knowledgeable and talented some member are: also the recognition that they are willing to take the time and trouble to share their skills and advise others. I can look after some administrative areas on behalf of GEO, I can also wheel and deal with planning events but if I encounter a technical problem I go running to the membership for help.

Envi-Ham Project

I have recently been in touch with Stefano Badessi who is the Principle Investigator for the Envi-Ham project. He informed me that the original 100 licence allocation for this project has been fulfilled. However, the good news is that ESA/ESRIN have extended this number to 150, hence the opportunity for new people to join this exciting project still exists.

Just to remind you, the licence and software for this project are free and providing you have a suitable computer the only additional hardware needed are a satellite receiver (cost about £60) and a one metre satellite dish. You may apply to join the project by contacting ESRIN at tta@esa.int. The usual proviso applies here - please do not apply for a licence unless you are really serious about Envisat reception, otherwise you may be taking a licence which would be more actively used by another.

The Envi-Ham project is in its infancy and may be expected to survive beyond the life of the current Envisat satellite, that is, in the future, there may be other satellite data disseminated via this Envi-Ham protocol, an exciting prospect! In our 'Letters to the Editor' section there is a brief exchange of letters about Envi-Ham: it's worth reading by anybody contemplating applying for an Envi-Ham licence.

For our next Quarterly I will try to publish some statistics about the numbers and geographical distribution of Envi-Ham project licence holders.

Other Publications.

I have just received my copies of EUMETSAT's 'Image' and ESA's 'Bulletin', both excellent free publications. For details of how to receive your own copy look for the contact details given in recent GEO Quarterlies.

Timestamps on Images

Recently, an experienced GEO member, Storm Dunlop, contacted me pointing out that it would enhance the scientific value of some of our published images if the time the images was taken / received was published together with the image. We usually do this but apparently there is an international standard for publishing time in relation to images and I guess also conventional photographs. The convention is to give the year, month, date, hour, minutes in that order. I now try to do this with images I submit for publication and it would be a useful standard for members to adopt where possible.

Laptop Request !

In GEOQ28 there was brief mention of our need for two laptops to be used for displays at exhibitions, meetings and shows. I do have two laptop computers for my own for personal use and in the past I have taken these shows - see GEOQ28 page 21 featuring our stand at the National Hamfest in 2010. However, it is a little disappointing to share these computers with GEO business. It is useful to have several computers on a show stand. Our group has recently purchased a new desktop computer which we used for live EUMETCast reception at shows: but it would be great if we could have two dedicated laptops which could run a library of images and different PowerPoint presentations. These computers need not be state-of-the-art but just powerful enough to run slide shows together with a screen large enough for a public stand. This would mean I could reserve my own laptops for personal use.

Here comes the request: do you have a suitable spare laptop computer that you would be willing to donate to GEO or sell for a modest amount of money? Batteries should not be an issue because we always have mains electricity on our stands. If you can help out here please email francis@geo-web.org.uk

Finances

I will publish our group accounts for the last year and have these available at our AGM on 7th May 2011. In broad terms, our membership subscriptions just cover the publication and distribution of the *GEO Quarterly* leaving only a small buffer for other running expenses. The GEO Shop makes a profit for us which, when necessary, provides a buffer for us covering unexpected expenses, for example the purchase of a new computer for editorial use. By law I am obliged to submit to Companies House an annual statement of accounts but this tends to be a summary of the year's turnover with little detail.

Use of GEO logo

GEO recently received a request from a member to use our logo on his amateur radio QSL card. GEO readily agreed to this request. There is a wider issue here relating to the promotion of GEO so, if any member wishes to use our logo in an appropriate context this would be welcomed. It could be printed on letter heads, QSL cards or on a web site. Provided it is in context there should be no problem, see page 25 for an example. If you want an electronic copy of our logo, email francis@geo-web.org.uk

Coming Events for 2011

The dates for the NOAA Direct Readout Conference in Miami this year are April 4-8. A separate notice relating to this conference appears on page 3, and should be consulted by all interested. For fuller details go to NOAA's web site www. directreadout.noaa .gov GEO has attended the previous four NOAA conferences and will try to contribute in 2011 either by

personal representation or contributing to delegate literature and perhaps a poster display. It will be an important conference revealing NOAA's future weather satellite programmes.

17th April - West London Radio and Electronic Show, Kempton. GEO have booked a stand here. For details see RadCom or visit 'Radio Fairs' web site.

7th May - GEO's symposium. See the separate notice in this Quarterly and visit our web site for details of registration for this event.

19th June - Newbury Amateur Radio Rally. For details see RadCom or visit their club web site. GEO has booked a stand.

4th and 5th July - UK Space Agency. This is the UKSA's first annual conference which is to be held in Warwick. No details are available at the time of writing. Follow the Details on the UKSA's web site.

7th and 8th July - GEO's visit to EUMETSAT and ESOC in Darmstadt. For details see the separate notice in this Quarterly and visit our web site for details of registration.

29th to 31st July - AMSAT are holding their annual colloquium at the Holiday Inn, Guildford. GEO often have displays or make presentations at this meeting but details are not yet in place for this year. Visit AMSAT's web site **amsat-uk.org** for details as they become available.

30th September and 1st October
This is the National Hamfest Newark. GEO will have a stand and perhaps make a presentation relating to weather satellite reception at home.

19th March and 14th May - Our friend in the Netherlands, Werkgroep Kunstmanen will be holding their regular meetings in Utrecht. For details of these meeting visit their web site at: ***www.kunstmanen.nl***

2011 Satellite Direct Readout Conference

The National Oceanic and Atmospheric Administration (NOAA) 2011 Satellite Direct Readout Conference will host this year's conference from April 4-8, 2011 at the Hilton Miami Airport Hotel in Miami, Florida.

Prior to the Conference, the NOAA GOES Data Collection System (DCS) will hold a training session on 02 April 2011. All conference participants are welcome to attend.

The focus of the conference will be on current GOES and POES data access, distribution, and preparing users for the upcoming changes to NOAA satellite programs. We will present users with information on APT, HRPT,GVAR, ARGOS DCS, GOES DCS, LRIT, EMWIN, GEONETCast Americas and other NOAA systems. We will also review the upcoming GOES-R and Joint Polar Satellite System (JPSS) Programs.

We hope to build on our earlier success in 2008 to make the 2011 conference even better. Approximately 200 administrators, managers, and scientists from 29 countries participated in the last forum that was held in December 2008.

GEO Symposium

Saturday, May 7, 2011

Francis Bell

Arrangements have now been confirmed for GEO's 2011 Symposium, which will be held at the **National Space Centre**, Leicester on Saturday May 7, 2011. Doors will open at 9.00 am for registration and the programme begins at 10.30 am.

The National Space Centre (NSC) is located approximately one mile north of Leicester city centre and is close to the A6 road. There are many direction signs to the NSC in and around Leicester. There is a large car park at the NSC and parking is free for our delegates.

On arrival, enter the front door of the NSC then turn right along a short corridor to the symposium rooms. Register your attendance (£12) and you will be given a free car-parking pass, to be displayed on your car, and a free ticket for entry to the public exhibition areas within the NSC. These tickets will be valid all day.

The programme for the day still has to be confirmed but, at the time of writing, we hope have speakers from

- EUMETSAT - Plans for the future.
- Leicester University - An update on GERB data from the instruments on Meteosat
- The NSC - Near Earth object research
- Participation in the Envi-Ham project

Time is available for other speakers. Please contact Francis Bell if you have something to offer. The day will end with the GEO AGM.

Facilities for workshops, displays and demonstrations will be available but details here must rest with delegates. It is hoped that many members will be willing to share their experiences with us in a practical way.

Accommodation

For delegates staying overnight in Leicester, there are many local reasonably priced hotels. In the past, a popular choice has been the Campanile Hotel with its nearby restaurants. The details of the hotel are

Hotel Campanile
St Matthews Way
Bedford Street North
Leicester LE1 3JE
Tel: 0116-2616600

The hotel website shows a location map. A concessionary rate has been arranged for a room and continental breakfast. If you use this hotel, please tell them you are with the GEO group.

Registration

If you intend coming to the symposium, please register via our website

www.geo-web.org.uk

On the first web page there is a link to the symposium registration form: please use this form. The £12.00 fee may be paid on the day but pre-registration helps with our own organisation. It will still be possible simply to turn up on the day, but do pre-register if you can.

Provided they have an interest in Earth observation, friends who are not currently members of GEO will be welcome: hopefully they may be encouraged to join GEO. Delegates may wish to bring their own computer memory stick for storage of any software or presentation material which may be available during the day. Please also bring something which may be donated as a raffle prize: the raffle contributes significantly to covering the cost of the day's event. Some food and drinks are for sale within the NSC.

I hope the symposium will be well attended and provide the opportunity to share experiences and bring ourselves up-to-date within the challenging and fast moving hobby of Earth observation.

For the very latest information visit the GEO website at

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

DVB World with Windows-7

Mike Stevens

Well, here we are again! It seems that each time we solve one problem, along comes another to challenge our brains. This time it's *Windows-7*, quite a different animal from any other operating system we have known. *Windows-7* takes a bit of getting used to, and there appear to be many variations on a theme with this software.

Although we have two *Acer* PC's running with *Windows-7*, they show some marked differences in the behaviour of the software that's installed on them. So what I am about to tell you should be treated as a guide only, as it could produce different effects on different computers. But it has worked for me, and it may help you too. I have an *Acer X3300* PC with 5 GB memory and 640 GB hard drive running *Windows-7*, a very adaptable PC, and I wanted to run my new *DVB World* receiver with it. You might think that would be easy enough—but is it?

With *Windows XP* it's not much of a problem, but with *Windows-7* you have to stop, think and list all the necessary procedures before you start—and then work through them methodically one by one until setup is complete. This is just what I did. One important thing I discovered is that you should **not** use the mini CD-ROM supplied with the receiver for installing *EUMETCast*: it is just not suitable! You **must** instead use the CD-ROM from GEO to install the correct software. Also, the receiver will only operate correctly through a **USB-2** high-speed port.

Start by inserting the GEO CD-ROM and printing out the installation instructions for the *DVB World Receiver*. Have a good read before you start, to familiarise yourself with the installation procedures.

The first operation in *Windows-7* is to turn off the *User Account Control*. If you type 'UAC' into the search box it will bring up the Control Panel for this item. There is a slider bar on the left hand side of the box which you should move down to the position 'never notify' then click 'OK'. On some computers this step does not matter, but on others is does: so for convenience do it. You can turn it back on again later if you wish. Now you can start the installation as listed in the guide. Again, you may get some variations from the guide: not all of the boxes marked came up for me but it still installed OK.

When you are in *Windows-7*, make sure that the destination folder for the software is located within 'C:\tools\DVB World' because the 'Program Files' folder in *Windows-7* is protected. Once you have installed this software, you have to install two additional items of software to set up the satellite transponder and data settings for *EUMETCast*. This is where I found things becoming complicated. What you are doing is adding information to the *Registry* and, on some PCs, this will be blocked by security programs. You may therefore have to run them under 'Run as Administrator'. If even that is not so successful you will have to set them up manually.

I entered these two items of software and assumed that the *Eurobird-9* satellite and the correct transponder had been set because everything seemed to turn out as specified. But in fact it hadn't and I had to perform the set-up procedures manually. As a restart of the system was not required after installing the software, you can now add the rest of the information.

The next item is the IP Address. Follow the guide for this—it is very explicit and will get you there. Don't worry if there are some screen variations: just follow it through. My own IP address came out eventually as 192.168.238.239, as I had previously had my other receiver on the system with 192.168.238.238, and that information stays within the *Registry*. Make sure that the 'Subnet Mask' comes out as 255.255.255.0 (it should set itself to this value automatically).

Assuming that *Tellicast* is installed, open the Tellicast Client Configuration file '*recv.ini*' and insert the same IP address, i.e. 192.168.238.239 and save. You now have to enter all the remaining settings manually within the *DVB World* software. Again, follow the instructions in the installation manual, which are precise and accurate. Extra care is needed when you come to add the PIDs. In the PID Information section, click the 'Add' button and then select 'Decimalization' (you **must** do this). Now enter the first PID value, followed by 'OK'. If you don't follow this precisely you will not end up with the correct PID's in the system. Now you have to repeat 'Add' and 'Decimalization' for every PID separately. When all the required PID values have been entered, click 'Apply' to confirm then 'OK' to exit. At this point, it's recommended that you stop and restart *DVB World*.

Now that all settings are complete, you can locate and start *DVB World*. According to the instructions, the Green IP dot in the lower tray of the screen should start automatically, but on my *Windows-7* PC it will not. I have to toggle the IP button in the top of the menu bar, but in *Windows XP* it starts on its own—another anomaly, but no great problem.

With all this done, the system should start up with the *Tellicast* icon showing as a Purple 'T' on a white background, indicating that all is well and that reception has started. But again, mine didn't! So what had gone wrong?.

Windows-7 possesses an excellent firewall and that was the key item I had neglected. You have to go to the search box and type in 'Firewall'. A box appears where you must select 'Allow a program through Windows Firewall'. This reveals another box which heads, 'Allow programs to communicate through Windows Firewall'. If '*DVB World*' is not shown within the list you will have to add it manually. To do so, go to the bottom of the box and click on 'Allow another Program', when a list of all your programs will appear. Scroll down until you find *DVB World*, highlight it, then click on 'Add'. It should then show on the list of allowed programs.

Finally, and most importantly, you must tick the first box beside '*DVB World*' then scroll across and tick the 'Home/Work (Private)' and 'Public' boxes, otherwise it will not run correctly. When I did this, my system immediately sprang into life. *Tellicast* started, reception began and everything was working fine.

My conclusion with this is that some *Windows-7* systems appear to work differently from others, and that there is no single golden rule for program installation. Some systems behave as described in the installation guide whereas others do not. Just do what works for you. One other bonus I have with the *Acer* and new receiver is that it all works without a RAMDisk. Happy weather watch from Portland.

Arctic Meltdown

Lowest ever January Sea Ice Recorded in 2011

Les Hamilton

Figure 1
December average sea ice in 2008
Credit: National Snow and Ice Data Center

Figure 2
December average sea ice in 2009
Credit: National Snow and Ice Data Center

Figure 3
December average sea ice in 2010
Credit: National Snow and Ice Data Center

The current winter may prove to be a decisive episode in the fate of the Arctic regions of our planet. As has been reported previously in GEO Quarterly, there is continuing concern over the ever-decreasing amounts of Arctic sea ice that remain at the height of summer [1,2]. Now, in early 2011, the extent of winter sea ice in the Arctic stands at a record low point since satellite measurements began, and may have a significant influence on events yet to unfold throughout 2011.

The illustrations above demonstrate how extensive this year's reduction in sea ice is. Normally, by December, Hudson Bay is entirely frozen over, while Baffin Island and the northern half of Greenland are thickly encased in ice (figures 1 and 2). In December 2010, by contrast (figure 3), much of the eastern portion of Hudson Bay has yet to freeze; Hudson Strait, south of Baffin Island, remains ice-free; and the Davis Strait to the west of Greenland remains clear as far as 75°N.

During the summer of 2010, atmospheric conditions over the Arctic shifted between warm episodes that favoured melting and cooler stormy conditions which, while slowing the melt-rate, helped to break up the ice.

Early in the melt season, ice extent was relatively high following a long winter dominated by an extreme negative phase of the Arctic Oscillation (see panel on next page), which would favour the retention of ice through the summer. But in June, a combination of high pressure over the central Arctic Ocean coupled with unusually low pressure over Siberia resulted in warm conditions over much of the Arctic Ocean, followed by a strong westward ice motion off the Siberian coast which promoted rapid ice melt.

By contrast, a series of low-pressure systems dominated the central Arctic Ocean during July, slowing the melt rate: but the stormy conditions helped to break up the sea ice cover. High pressure then returned during August and September and helped drive the sea ice towards its September 19 minimum of 4.60 million square kilometres (Mkm^2). The net effects of these variations contributed to the ultimate low ice extent.

Following the 2010 summer melt season, which produced the third lowest ice extent during the satellite record (the period during which Arctic ice has been monitored by satellites), both the Northwest Passage and the Northern Sea Route across Asia were declared to be open. Two sailing expeditions, one Norwegian and one Russian, successfully navigated these passages.

The average sea ice extent for September 2010 was 4.90 (Mkm^2), the third lowest on record, 2.14 Mkm^2 below the 1979-2000 average, but still 600,000 Mkm^2 above the record average September low recorded in 2007. Ice extent fell below the 1979 to 2000 average everywhere except in the East Greenland Sea near Svalbard. At the end of summer 2010, less than 15% of the remaining Arctic sea ice exceeded two years of age, compared with between 50% and 60% during the 1980s.

Following the September sea ice minimum, the return of polar darkness progressed an initially rapid freeze-up and, by October 1, the five-day average ice extent had already risen almost 20% to 5.44 Mkm^2. But by the end of September, ice growth had slowed, and extensive areas of open water still remained in the Beaufort, Chukchi, Kara and Barents seas.

Another strongly negative phase of the Arctic Oscillation during November and December dominated the middle and polar latitudes of the northern hemisphere, resulting in higher-than-normal pressures over the Arctic region, with corresponding lower-than-normal pressures in middle latitudes. With high pressure in charge over the Beaufort and Chukchi seas and Greenland, and unusually low pressure across the Kara and Barents seas, warm air from lower latitudes inhibited the rate of freezing to such an extent that the average Arctic sea ice extent during December 2010 reached only 12.00 Mkm^2, 270 000 km^2 below the previously recorded minimum and the lowest ever recorded for December. Near-surface air temperatures over the Siberian and Alaskan side of the Arctic had been 3-5°C warmer than normal during November while air temperatures over Baffin Bay were 8°C above average.

Areas such as Hudson Bay, Hudson Strait and Davis Strait are normally completely frozen by late November but in 2010 these still contained large areas of open water (figure 3). In fact, for a spell during mid December, the Arctic ice extent actually stopped increasing for about a week, an unusual though not unique event.

January 2011

Arctic sea ice extent for January 2011 was the lowest in the satellite record for that month. The Arctic Oscillation persisted in its strong negative phase during most of January, keeping the ice extent low, averaging 13.55 Mkm^2 for the month. This was 50,000 km^2 below the record low set in 2006 and 1.27 Mkm^2 below the 1979 to 2000 average. At the turn of the year, Hudson Bay, Hudson Strait and Davis Strait still had areas of open water and Hudson Bay did not completely freeze over until mid-January, a month later than normal. The Labrador Sea was still largely free of ice, except in protected bays along the coast.

Ice extent for the Arctic as a whole increased at an average of 42,800 km^2 per day through the month of January, which is about average. By contrast, regional ice growth was particularly slow compared with past years. Normally at this time of year, ice extends several hundred kilometres from the coast all the way from Hudson Strait to Newfoundland.

Figure 4 shows the trend in the daily Arctic sea ice extent as of February 12, along with daily ice extents for previous low-ice-extent years. The lower continuous black line shows data for 2010-2011, the dashed line data for 2005-2006 (the record low for January came in 2006), and the broad upper black line the 1979 to 2000 average. The grey area around this average line shows the two standard deviation range of the data. The linear rate of decline for January was -3.3% per decade (figure 5).

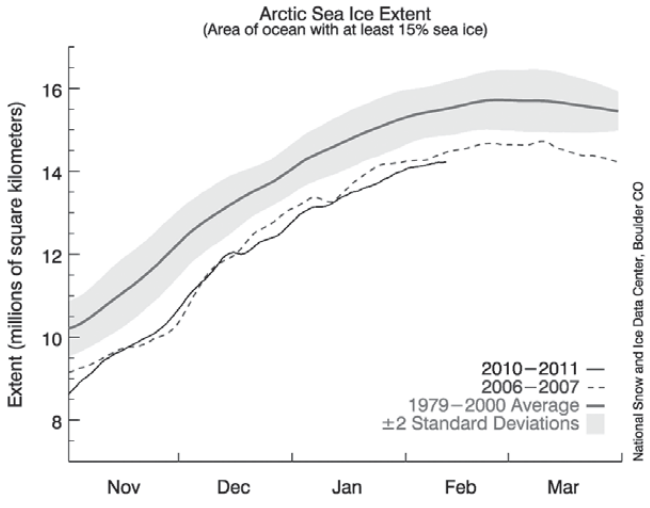


Figure 4
Average sea ice comparisons
Credit: National Snow and Ice Data Center

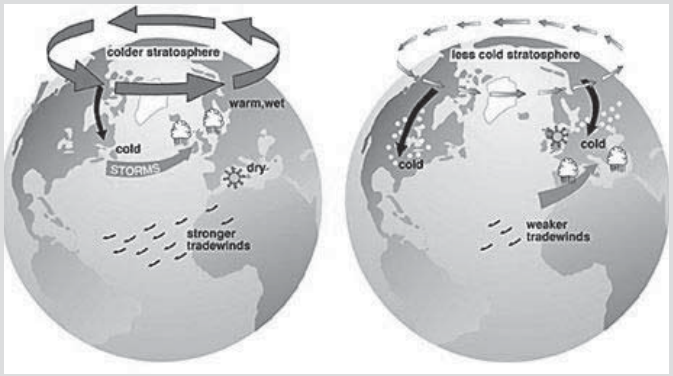
Air temperatures above much of the Arctic were some 2-6°C above normal throughout January: warmest areas were the eastern Canadian Arctic Archipelago, Baffin Bay, Davis Strait and the Labrador Sea, where temperatures were fully 6°C higher than average. Over the western Canadian Arctic Archipelago and Scandinavia, however, temperatures were near average. These elevated temperatures arose two sources: unfrozen areas of the ocean which continued to release heat to the atmosphere, and the wind patterns accompanying the negative phase of the Arctic Oscillation which fed warm air into the Arctic. Near the end of January the negative Arctic Oscillation pattern finally broke down and became positive, a factor that usually favours ice growth.

The Arctic Oscillation

Readers will almost cetainly be familiar with the *El Niño-La Niña Southern Oscillation* in the Pacific Ocean, which is now recognised to have a major influence on weather patterns world-wide. What may be less well known is that there is also an Arctic Oscillation related to opposing atmospheric pressure patterns in the middle and high latitudes of the northern hemisphere.

The Arctic Oscillation exhibits two states. The first of these (the 'negative phase') occurs when pressure over the Arctic is relatively high whilst lower pressure persists over middle latitudes centred at approximately 45°N. The second state (the 'positive phase') is active when higher atmospheric pressure at midlatitudes drives ocean storms northwards and changes in the circulation pattern to bring wetter weather to Alaska, Scotland and Scandinavia but drier conditions to the western United States and the Mediterranean.

In the positive phase, frigid winter air extends less far into central North America as it would during the negative phase of the oscillation. This keeps much of the United States east of the Rocky Mountains warmer than normal but renders Greenland and Newfoundland colder than usual. Weather



patterns in the negative phase are, in general, the reverse of those prevailing during the positive phase, as illustrated below.

Over most of the past century, the *Arctic Oscillation* alternated between its positive and negative phases. Starting in the 1970s, however, the oscillation has tended to remain in its positive phase, causing lower than normal Arctic air pressure and higher than normal temperatures throughout much of the United States and northern Eurasia.

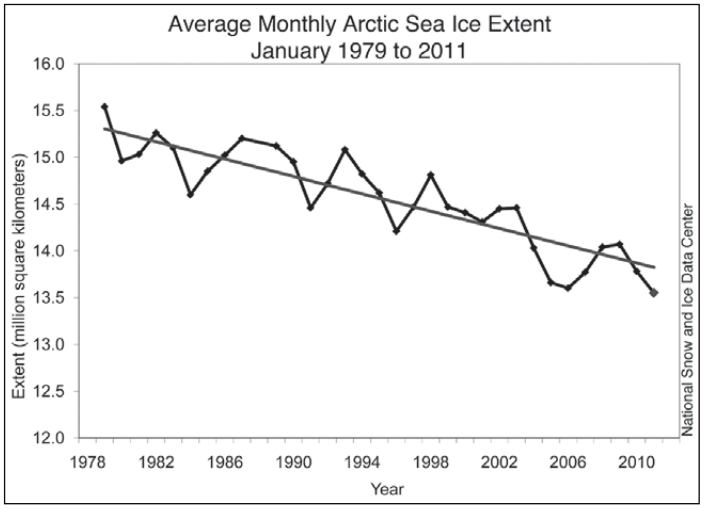


Figure 5
The year-on-year trend in average January monthly sea ice extent
Credit: National Snow and Ice Data Center

Potential links with mid-latitude weather

While the Arctic remained warmer than normal, cold and stormy weather affected much of the Northeast US and Europe. Winter 2010-11 paired the anomalously warm Arctic with cold and snowy weather for the eastern US and northern Europe. Is there a connection?

Warm conditions in the Arctic and cold conditions in northern Europe and the US are linked to the strong negative mode of the Arctic Oscillation. Cold air, being denser than warmer air, sits closer to the surface. Around the North Pole, this dense cold air causes a circular wind pattern called the polar vortex , which helps to keep the cold air trapped near the poles. When sea ice has not formed during autumn and winter, heat from the ocean continues to escape, warming the atmosphere. This may in turn weaken the polar vortex and allow air to spill out of the Arctic Basin into mid-latitude regions, bringing potentially cold winter weather to lower latitudes.

Some scientists have speculated that more frequent episodes of a negative Arctic Oscillation, and the stormy winters that result, are linked to the loss of sea ice in the Arctic. Scientists at NOAA Pacific Marine Environmental Laboratory recently noted a link between low sea ice and a weak polar vortex in 2005, 2008 and the past two winters: these were all years with very low September sea ice extent over the Arctic. It has also been suggested that there could be a relationship between autumn sea ice levels and mid-latitude winter conditions. Another current theory is that there may be a potential relationship between early snowfall in northern Siberia, a negative phase of the Arctic Oscillation, and more extreme winters elsewhere in the northern hemisphere.

Continued research on these ideas may shed light on these possible connections and should have the potential to improve seasonal weather forecasting.

References

1 Arctic Meltdown, GEO Quarterly 17, 2008

2 Arctic Meltdown, GEO Quarterly 21, 2009

Figure 6
Arctic sea ice on February 12, 2011. At last Hudson Bay and Hudson Strait have iced over.The grey line beyond the ice front represents the 1979-2000 average ice extent at this date.
Credit: National Snow and Ice Data Center

Open Air Learning Programme OPAL

An Observation Programme which will interest GEO Members.

Contrail spotting and other observations are part of a project being run jointly between The Met Office, the Royal Meteorological Society and Imperial College London with support from the Natural History Museum and the Field Studies Council. The programme is being funded by the National Lottery.

It is possible to participate in this OPAL project if you live in England. On application, a free pack is available to assist you with local observations. The project is scheduled for March to May 2011 and the programme is looking for as many observations as possible.

If you wish to participate in this interesting project with its practical observations of our climate/weather then follow these links. You do not have to register you can just send in observations but if you do register you may ask for the free observation pack. Observation will relate to aircraft contrails, cloud height, wind speed and direction together with a personal perception of warmth.

Go to **www.opalexplorenature.org/climatesurvey** you can download the Field Guide, Workbook and Cloud Chart before the survey starts. If you want to request the free pack email your request to :-**opal@metoffice.gov.uk**

Quarterly Question 29

Francis Bell

I was prompted to ask this question for two reasons. Firstly, I was impressed with the detailed interest and the number of members who responded to the last Quarterly Question. Secondly, there was a little nostalgia on my part. I was looking through some of the files in my archive of the early images that I received when I first joined the Envi-Ham project and I was attracted to an image which now forms the substance of this question. This was one of the first Envisat images I received after my home system had been commissioned.

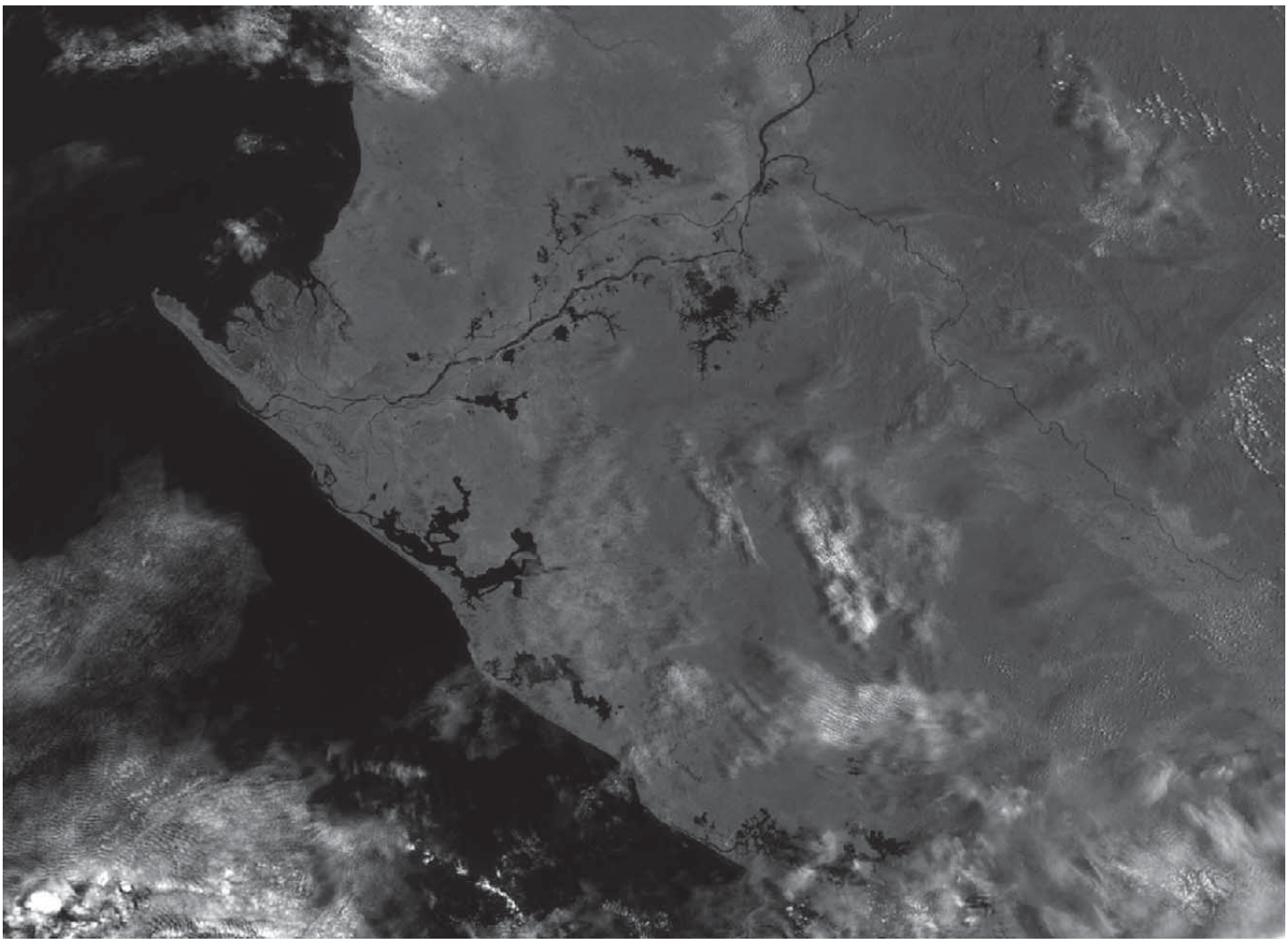
In those early days I was so inexperienced I could not combine the many channels I was receiving into a singe colour composite image, hence highlighting a particular feature in which I was interested. Instead, I had to choose a single channel, that is one out of 15, which I thought might be appropriate. I often chose channel 12 as a visible channel. Subsequent experience now allows me a more sophisticated approach, with colours and overlays being extracted from the raw image data. Unfortunately, in the meantime, I had deleted the raw image file which would have allowed further processing. Instead I was left with my limited archived file. However, I still feel the image is striking for its high resolution, lack of cloud cover and the distinctive coastal outline it reveals. The file is dated 2010 February 13th - 08 07.

At the time of writing I am trying to receive a comparable Met-2 image but local cloud cover is obscuring the coastal outline which I want to see. Having identified the location illustrated in the published Envisat image, a resourceful member may wish to submit their equivalent Met-2 image of this area to our editor. This is an invitation!

Now for the question, which is similar to last time: what is the name of the river shown in the image? The river in question flows in an arc from approximately east to west across the image. The broad tributary river entering from the north is not part of the question unless you wish to name it separately.

There are two clues. The river in question is reputed to be 1200 km long '(this should give you a scale and the give-away)' the equator runs across the upper quarter of the image. Oh and how many words do you know which contain five vowels and only one consonant?

Answers by email to francis@geo-web.org.uk before the deadline for our next Quarterly. The prize for the winner, who will be chosen at random, will be attractive postcards from Indonesia - not the same country through which our river flows, but a similar latitude!



The Envisat image relating to Quarterly Question

My Weather Satellite Station

Esko Petäjä

I have written this article describing my weather satellite station, and how I got started with the hobby, in the hope that it may help other beginners.

Station Location

My station is located on the west coast of Finland as indicated in figure 1. I know of only one private individual who is receiving *EUMETCast* here in Finland, although there are others in the Met Offices and Universities. Sometimes I feel alone, but I have been trying to raise interest here in Finland. Figure 2 is an aerial view showing my location.

How I got started

I have been a radio amateur since 1990 (call signal OH6MQM) and have seen that there are also many other Hams who are members of *GEO*. I have dreamt of starting with weather satellites for many years, and finally, at the beginning off 2010, I started to listen to their signals with my old AOR 2002 receiver, using *Orbitron* for satellite tracking. I waited till the correct time and manually tuned the receiver to the correct frequency. Quite soon, I realised that I needed a dedicated receiver and purchased an *R2FX*. For my antenna, I used first used a home-made crossed dipole, then, later on, a double cross dipole. The receiving software I used was *APT Decoder* from Patric Task. At first, I did not get good results using APT, due to many reasons (antenna location too near to trees etc).

During this time I also read some articles with information about *EUMETCast* but, as a beginner, I found there was much to learn. At this time I purchased a license from *EUMETSAT* and my first DVB receiving card, the *Technisat Skystar-2* v 2.8. I also had an 85 cm offset dish free and used that for reception. Everything was new to me: from how to find the correct satellite PID and obtain a good signal on the correct frequency. But I was faced with a '*yellow T in T system*'. The reason was that I was receiving the wrong satellite (Hot Bird 13) which has, however, a transponder on the same frequency; a typical, simple, silly error for a beginner.

Finally, I did get my system running, using an old *Pentium-4* PC workstation for both reception and processing but it proved to be absolutely too slow for that purpose. Luckily, it soon 'died' after working continuously with an 80% processor load. During spring 2010, I read an article in *GEO Quarterly* about receiving from *Envisat*, and fell so in love with the idea that I applied for a licence the very next day. After completing the paperwork, I finally got my Envi-Ham license, No 0067. I also set up a reception system and got it running, but did not concentrate on it very much until the autumn. When my first workstation failed, I purchased a new one, also updating my antennas and home network at the same time.

Receiving System

My receiving system is built from the following components, as illustrated in figure 3.

Antennas

For *EUMETCast* reception I used a 1.5 m prime focus dish. This was an old dish from a friend who is doing satellite antenna installation; it was lying in his back yard and I cleaned and refurbished it.

Figure 1 - My Station Location

Figure 2 - An aerial photo showing my station (red box)

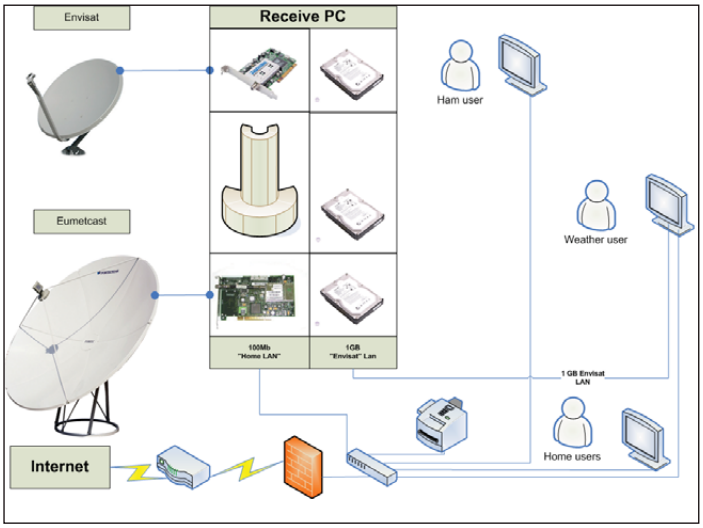


Figure 3 - Components of the Reception System

It has a very heavy construction, built from 2 mm aluminium. The signal level it offers is not as high as a large new dish due to inaccuracy of manufacturing, but the signal is very steady. Pointing the antenna was very easy and it tolerates much rain and snow without losing any packets of data.

For *Envisat,* I use a 1.15m offset dish which gives signal levels from 50-60%. Dish construction and mounting is quite light and I need to rebuild it during next summer once the snow has gone. I also noticed that an offset dish performs less accurately that a true prime focus dish. It would be good to have that kind off new dish for Envisat too but they are quite expensive to by new.

For APT I use a double cross dipole antenna, home made according to Gerald Marten's instructions. Antenna location is too much inside trees and I do not get a good signal.

The Reception PC

For a processing PC I use an old *AMD 2.0G* workstation with 1.5MB RAM. It has three hard drives and 300MB of RAM-disk. The first hard drive is an 80GB IDE type for the *Windows XP* operating system. The second is a 1Tb Serial ATA drive for *EUMETCast* as is the third. There is also an external cooling fan which cools all three drives.

The PC has two network cards, one (100MB) which is connected to my Home Network (1GB) and a second (also 1GB) which provides the point-to-point connection to the reception PC. This also has two network cards. This network is used only to deal with large *Envisat* files, so as not to disturb and place a heavy load on the 'Home Network'. The reception PC is located in my 'Server Room' (figure 7), a small cabinet which has a ventilation tube and fan direct to the outside air. This leads excess heat outside during the summer. In winter, I keep this closed, retaining the heat indoors for warmth.

The DVB cards I use are the *Skystar 2 v 2.8* for *Envisat* and the *Broadlogic 2030* for *EUMETCast.* The latter card was on ESA's recommendation list for *Envisat* and I got it from *EBay,* as new, for $20. It is very sensitive, but is somewhat obsolete and does not have drivers for *Windows-7.*

The Processing PC

My processing PC is a *New I-5* based system running *Windows-7.* This has 4GB RAM and two serial ATA drives, the first for the operating system and programs, the second one for data. I use a standard 21.5 inch monitor which I find good for showing images. Additionally, I have connected an old 32-inch flat panel TV (which has a broken TV tuner and is retired from its original work) as a second monitor. This is very good for displaying weather animations.

Displays

Whenever there are multiple PCs, using monitors is always a little bit problematic. There are three solution available:

- Using only a remote desktop or VNC
- Using KVM switches
- External displays

Using a remote desktop or VNC saves space but will not cover situations where there is a need to enter BIOS level or other services where *Windows* is not active. KVM switches solve this problem but there is no possibility of seeing data from multiple sources at the same time. Extended displays require more space.

Because I wish to use multiple screens, I have started to build a 'Super Display', constructed from old flat-screen monitors which I got from a second-hand market for almost nothing. I cannibalized these to get out their display units. These I mount into aluminium frames which are, in turn, mounted into a wooden frame to create my 'Super Display' with six screens. This was then mounted into a wall, saving space for tables. Each display was then connected to dedicated PC (each PC is capable of driving two monitors using a dual-display driver). In this way I can get overviews of all my satellite data at a glance. If there is something very important, then I can switch it to the 32-inch monitor using the processing PC and a remote desktop. Multiple monitors are used not only for weather data, but also for other data such as *APRS* and *Planes.*

Figure 4 - EUMETCast antenna covered with snow

Figure 5 - Envisat antenna

igure 6 - Crossed dipole hiding in the snow

Figure 7 - The Server Room

Software

For *EUMETCast*, I use the excellent software from David Taylor while with *Envisat* I use *Beam* software. *SatSignal* software has many possibilities and, after gaining some experience, I find the programs easy to use.

There are still many new thinks to be learned. So far, due to lack of time, I have only used the *Beam* software to display *FRS* data. One missing element in *Envisat* is a good prediction system. Files just appear without me understanding which area they cover.

I use the following programs from *SatSignal Software*:

* MSG Data manager
* MetOp Manager
* GeoSatSignal
* MSG Animator
* Modis L1 Viewer
* AVHRR Manager
* Mapping tools

Figure 7 - The 'Super Display' Unit

Figure 8
One element from the display unit (aluminum frame and screen element).

The Monitoring System

After running my system for a while, I discovered a need to monitor the station, specifically for these points:

- Are all system up and running?
- How is the signal level over an extended period?
- How is the data flow developing?
- Hard disk usage and Temperature?

I set up *MRTG Manager,* which has been described in several previous *GEO Quarterly* articles. It was nice to work at the DOS prompt and do some simple *Perl* programming. I got my system running and am now very satisfied with it. I can see long term trends in signal variation and can ensure that systems are fully operational all the time.

I would recommend for everybody who runs a system 24/7 to use such a monitoring system.

Understanding Data

Once my system became fully operational I was very impressed with the large colourful images. I now needed to learn to understand what these images were showing and how this data could be used for analytical purposes. I received basic meteorological training during my Aviation studies and this has given me some basic fundamentals of weather. Additionally, I purchased several books from Amazon (see list below) to understand more. The books cover basic analysis of weather and satellite imagery. I have also been studying material using Cluts. I have learned a lot but still feel a little bit weak in this area.

I believe that there is a lot of scope for GEO to provide this kind of training, especially for beginners.

Book Recommendations

1 Watts, A - 'The Weather Handbook', Waterline Books, 1994
2 E.D.Conway - 'An Introduction to Satellite Image Interpretation' (Maryland Space grant Consortium)

Tips for Beginners

Starting and learning a new hobby typically requires trial and error procedures. I always hope that other newcomers to satellite imaging will not need to make same errors I did. Here are a few tips based on my experiences:

- Spend time to read carefully all instruction manuals before starting
- I recommend using a two-PC system if possible, from the point of available space
- Invest in a PC with a powerful processor. This makes use of the system much faster and easier.
- Building a powerful PC from components will not cost a fortune.

Future plans

In future, I plan to study more how to analyse images and then also to understand more from the weather. Additionally, there is ongoing work with image overlays. I would like to show, in the same picture, weather data overlain with planes and gliders. When this project is at a more mature stage, I plan to write an article about this.

Reference

http://www.poes-weather.com/media/MARTES.pdf

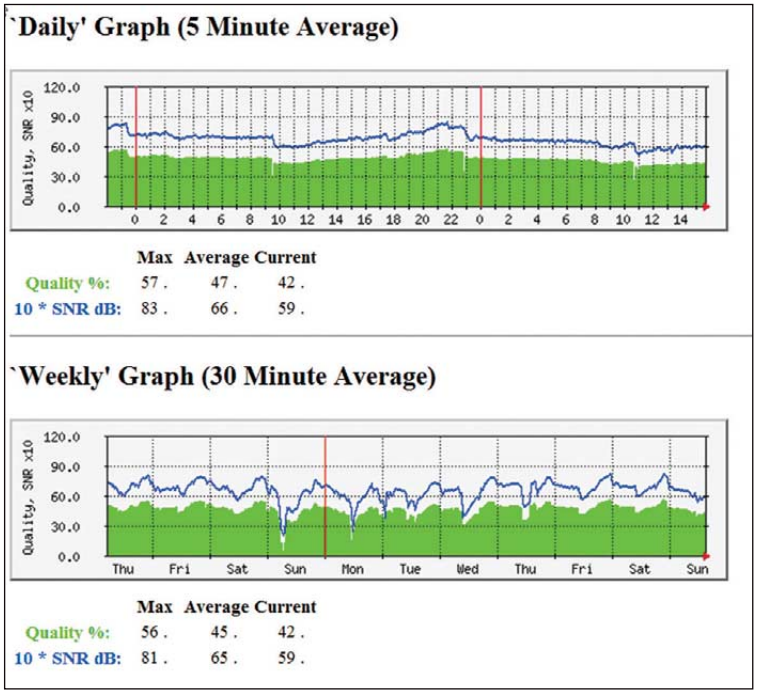


Figure 9 - Envisat monitoring with MRTG.

The Met Office is inviting amateur weathermen and women to help them monitor the skies

Weather-watchers are being asked to send information about their local area to a new website due to go live next month.

The Weather Observations Website (WOW), which is also backed by the Royal Meteorological Society and the Department for Education, hopes to capitalise on social media and the nation's well-known interest in the weather to create a "hub" for localised observations. The idea is that they can fill in the gaps between official Met Office weather stations and create a more accurate, detailed picture of what is happening.

A Met Office spokesman said: "The technology has come on leaps and bounds. There is a lot of equipment around the country, and with the interest in weather and the interest in social media this is bringing it together. But the website isn't exclusive to people with expensive equipment. It could just be someone uploading a photograph or writing 'It's raining here'."

He said that once posted online, the information "will be quality tested" to make sure it can be relied upon.

The spokesman for the Exeter-based weather agency added: "On behalf of the UK the Met Office operates a network of more than 200 weather observing stations, however by their very nature they can not cover every single corner of the UK.

"This project will enable the public to fill in some of those corners, providing valuable information that can be shared with other enthusiasts through the website. Although the observations submitted to WOW will not be used for input into Met Office weather forecast models, the purpose of the website is to provide a platform for the sharing of current weather observations."

http://www.metoffice.gov.uk/climate/uk/wow.html

http://www.rmets.org/

The above article courtesy Exeter Express and Echo

Receiving Envisat DDS and EUMETCast

... using 1 antenna, 1 cable and 1 PC

Arne van Belle - EHAM-044, PE1PSJ

Coordinator (Radio Observers) at Werkgroep Kunstmanen, The Netherlands.

Why Receive Envisat DDS and EUMETCast?

EUMETCast delivers images from geostationary weather satellites, which are positioned all around the world, and ideally suited for overviews and animations.

But *Envisat DDS* disseminates *Envisat* images with a stunning 260 x 290 metre resolution from certain areas, which allows you to zoom in almost endlessly to show details that *EUMETCast* can not. Although *EUMETCast* also supplies polar images (AVHRR, Metop and MODIS), the resolution delivered by *Envisat* is currently the highest receivable by amateurs.

Why Use Just a Single Antenna?

As *EUMETCast* relays data from many meteorological satellites from a single geostationary TV broadcast satellite (*Eurobird 9*), so ESA relays data from the polar-orbiting *Envisat* through a fixed geostationary satellite (*Eutelsat W2A*)—so you don't need a tracking antenna to receive it.

Receiving *Envisat DDS* and *EUMETCast* normally requires the installation two satellite dish antennas, routing two cables and having two receivers connected to two separate PCs. Amateur users living in residential areas may not have space for mounting two dish antennas. In some residential areas, planning allows only one dish. With only one degree of separation between the two satellites, it should be possible to receive both using the same dish.

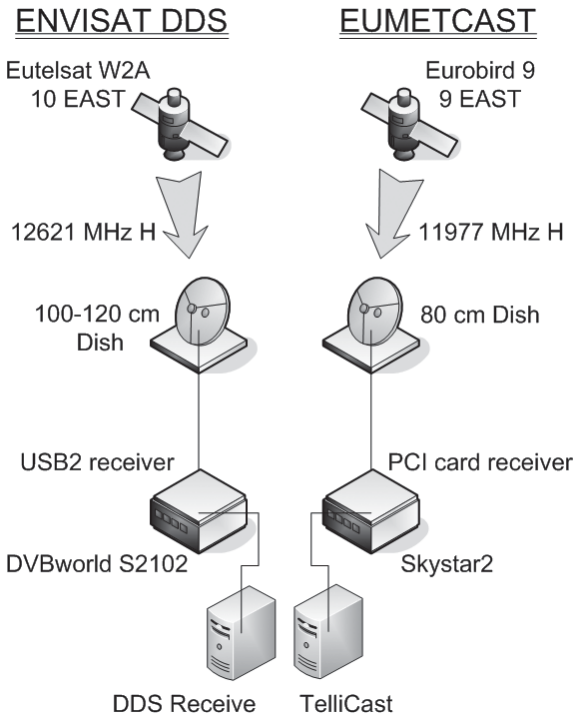


Figure 2 - The traditional 2-dish, 2-lead 2-computer system

Can both Services be Received Successfully on one Antenna?

First check if you have a free line of sight to both satellites.

www.dishpointer.com

is an ideal tool that produces overlays on *Google Earth* and can warn you about possible obstacles in your line of sight.

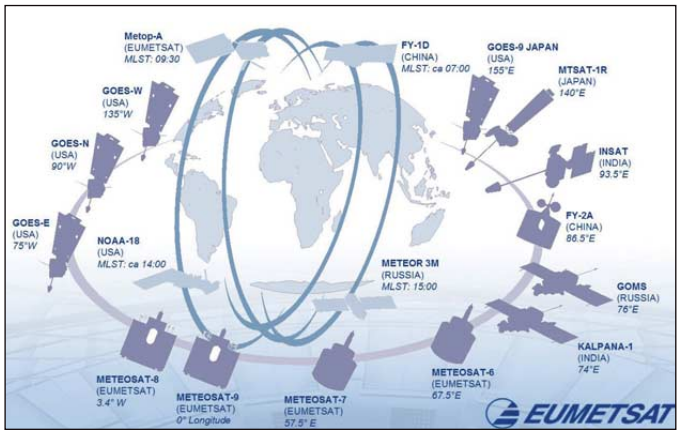


Figure 1 - Earth's constellation of geostationary and polar weather satellites

Envisat DDS is transmitted by *Eutelsat W2A* at 10° east on Ku high band. *EUMETCast* is using Eurobird-9 at 9° east, also on Ku high band. Both *EUMETCast* (11977 MHz) and *Envisat-DDS* (12621 MHz) use horizontal polarisation.

Footprints show that *Eutelsat W2A*'s beam is wider than that of *Eurobird-9* but about 2 dBW lower over most parts of Europe (figures 6, 7). This is why a minimum of a 1.0 meter dish is required (1.2 meter is preferred) for *Envisat DDS* while *EUMETCast* can easily be received using a 0.85 m dish.

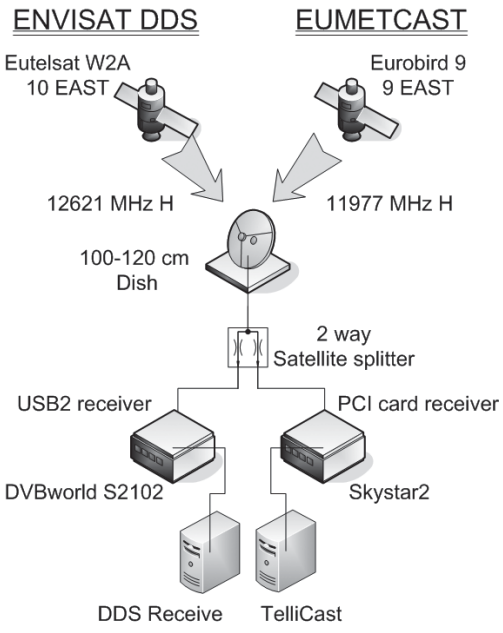


Figure 3 - A system for using a single antenna

A calculation using *Satmaster Pro* shows that a 1.0 metre dish has sufficient beamwidth to receive both 9°E and 10°E transponders using the same LNB. There is some 'off-axis gain loss' on both transponders however: in the worst case this can be as much as -1.5 dB (for comparison, -3 dB represents a signal reduction by a factor of two).

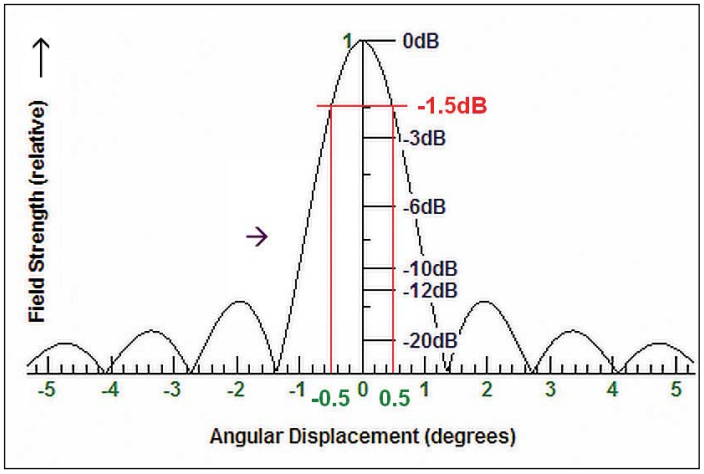


Figure 4
A Rectangular Aperture Beam Pattern produced by *Satmaster Pro* for uniform illumination, a 1-metre antenna aperture and 12.621000 GHz

For a free demonstration version of *Satmaster Pro,* go to

http://www.arrowe.com/

By aligning the dish carefully between 9.5°E and 9.8°E, you can receive almost the maximum signal level from the weaker *Envisat DDS* with only a minor signal loss on *EUMETCast.* Although a larger dish would yield more gain, it would also have a narrower beamwidth, making the use of a single LNB more difficult.

My test set-up consists of a 1.0 metre offset dish on a portable tripod in the garden (figure 8). This *TRIAX TDS 110* dish is specified as having a gain of 40.2 dBi at 11.7 GHz. A cheap *FaVal Universal* single LNB with typical 0.2 dB noise figure is used. The coaxial cable used is 25 metres of good quality *KOKA799* (remember that for *Envisat* at 12.621 GHz, the IF frequency is 2021 MHz). Any good-quality satellite TV cable should suffice but good old *RG59* will be too lossy for longer runs.

Feeding two Receivers from a Single LNB and Cable

A signal from the single LNB is applied to both receivers using a 2-way satellite splitter (figure 5). These splitters, which can be found at satellite equipment shops, are specified as having an insertion loss of less than 6.5 dB at 1750-2400 MHz and an isolation better than 16 dB at 1750-2400 MHz.

When both receivers are applying both power and a 22 kHz pulsed signal to the LNB (to activate high band), the 22 kHz signals will periodically cancel each other out, causing flipping between low and high band. A DC-blocker is used to block the power supply and 22 kHz pulse from one of the receivers. Alternatively, you can look for a 2-way splitter with only one 'DC pass' port. Another way of achieving this, for DIY-ers, would be to open up a splitter and remove the diode at one of the receiver ports.

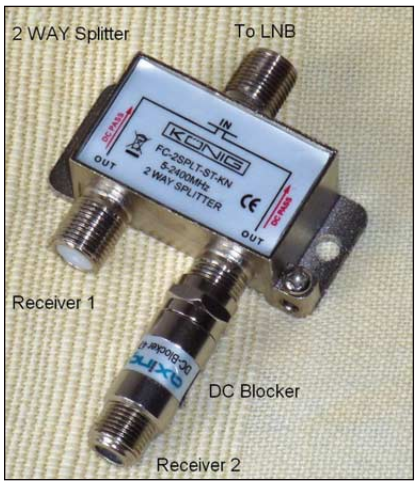


Figure 5 - A typical DC-blocker unit

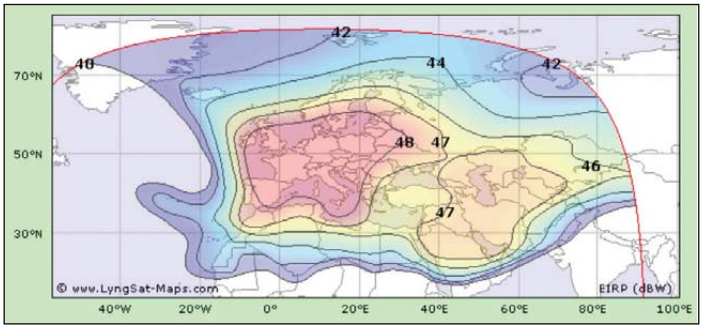


Figure 6
The Eutelsat W2A footprint, illustrating why a minimum 1.0 m dish is required for *Envisat DDS*

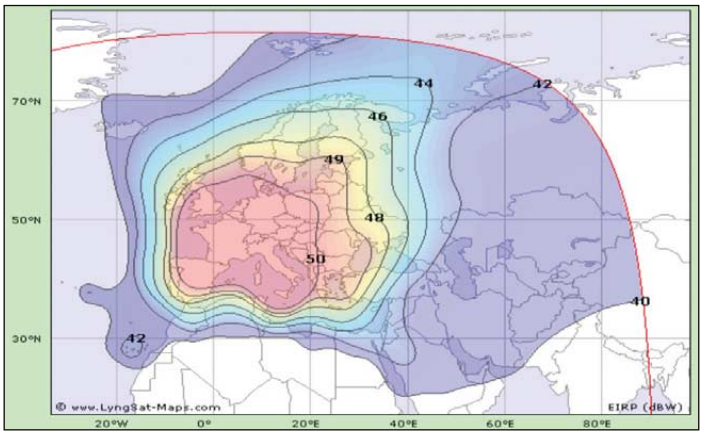


Figure 7
The *Eurobird-9* footprint, which allows *EUMETCast* reception with an 85 cm dish

Can Both Streams be Decoded on one System?

If you do not want to miss any images, you have to receive around the clock, and running two PCs does increase electricity costs and generates more heat and noise.

Nowadays, PCs have enough performance to receive and process both services simultaneously. But receiving around 30GB of *Envisat* data and around 40GB of *EUMETCast* data per day is quite a challenge. Running two receivers of the same type and brand on a single system is generally not supported, as you need separate control over both receivers.

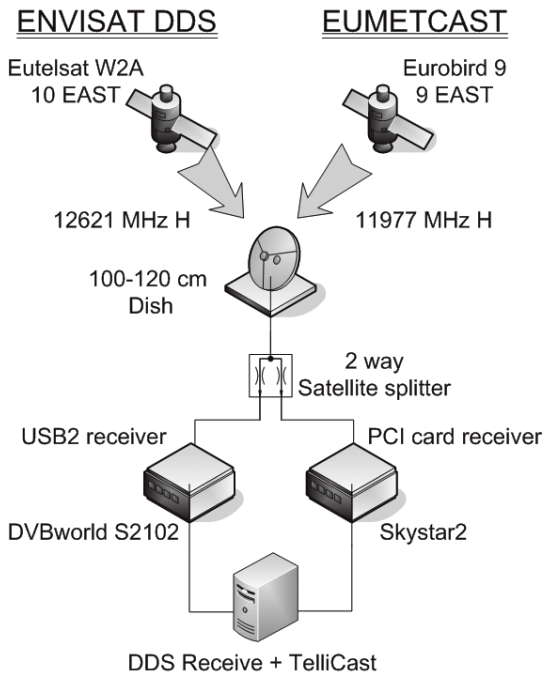


Figure 9 - The modified system for using a single computer

That is why I use a *Skystar-2* PCI card receiver for *EUMETCast* and an external *DVBworld* USB2 receiver for *Envisat DDS*. The *DVBworld* receiver is used for *Envisat DDS* because it performs better on weak signals compared to the older Skystar-2 v 2.6, especially during rain fades. I used the DVB-S2 version that performs similarly to the DVB-S version that the *GEO Shop* sells.

The *Skystar-2* PCI (2.6 version) requires a 5 volt full-height PCI slot whereas the *DVBworld* unit requires a USB 2.0 port and is powered by an external 9V, 2A supply.

The *TelliCast* client software for *EUMETCast* and the *DDS Receiver software* run happily together on the same PC as long as each receiver has its own fixed IP address.

- the *Skystar 2/TelliCast* was set at 192.168.238.238
- the *DVBworld/DDS receiver* was set at 192.168.238.239

Figure 12 on the following page is a screenshot showing dataflow from both receivers.

Choosing a Suitable PC

Most *EUMETCast* data is directly processed on the same (receiving) PC using David Taylor's *MSG Data Manager*, *AVHRR Manager* and *Metop Manager* software.

Although reception of *Envisat* data over *DDS* is less demanding than *EUMETCast*, viewing large *Envisat* files with *BEAM-Visat* does require lots of memory and processing power. I choose a dual-core *Intel i3-530* PC as a good compromise between performance and energy consumption. Receiving over 70 GB data per day needs a large and fast hard disk, so I choose a 1.5 TB drive with a 32 MB cache. The large cache compensates for the lower rotation speed of this ECO drive nicely.

Solid state disks, with their fast access, should make the use of a RAM disk unnecessary, but handling this large amount of data every day may wear them down very quickly, so I choose another approach. Because most *EUMETCast* data is processed directly after reception, this data is 'short lived'. Why not store all this temporary data on a large RAM disk?

A 2 to 4 GB RAM disk is created for temporary storage and holds, not only the temporary *TelliCast* files, but also the received raw data and the received *Envisat* files. The free *DataRAM* RAM disk offers a second and very fast storage path that is not easily 'clogged' by *Windows*. This RAM disk is able to use memory above the 4 GB

Figure 10 - The *DVBWorld* receiver

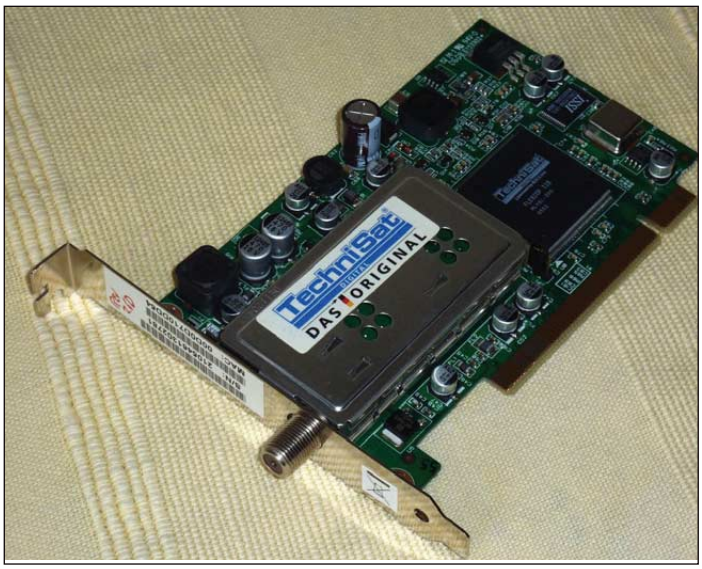


Figure 11 - The Skystar-2 PCI card receiver

limit that *Windows XP* normally cannot access, and proved to run stably under 64-bit Windows-7 too.

When the hard disk is heavily loaded, *TelliCast* and *DDS Receiver* continue to write to the RAM disk, preventing data loss.

Although the CPU should be sufficient to view and animate images on this PC too, I prefer to do image processing and animations on a second PC that retrieves data over a LAN. To keep this set up running correctly, housekeeping is required. A simple DOS script checks the *Envisat DDS* 'Received' folder on RAM disk every two minutes and moves completed data to the hard drive at low priority.

A second DOS script checks the *EUMETCast* 'Received' folder on RAM disk every 10 minutes and moves data that has not been processed since the previous check. Normally, all *EUMETCast* data is processed from RAM disk and written to the hard drive using David Taylor's 'Manager' programs, but Murphy can strike here too, and halt processing. These simple DOS scripts prevent the RAM disk overflowing.

With up to 70 GB data per day, keeping your hard drive from overfilling is a challenge. Luckily, David's software contains options to automatically delete older data so do set those retention limits correctly.

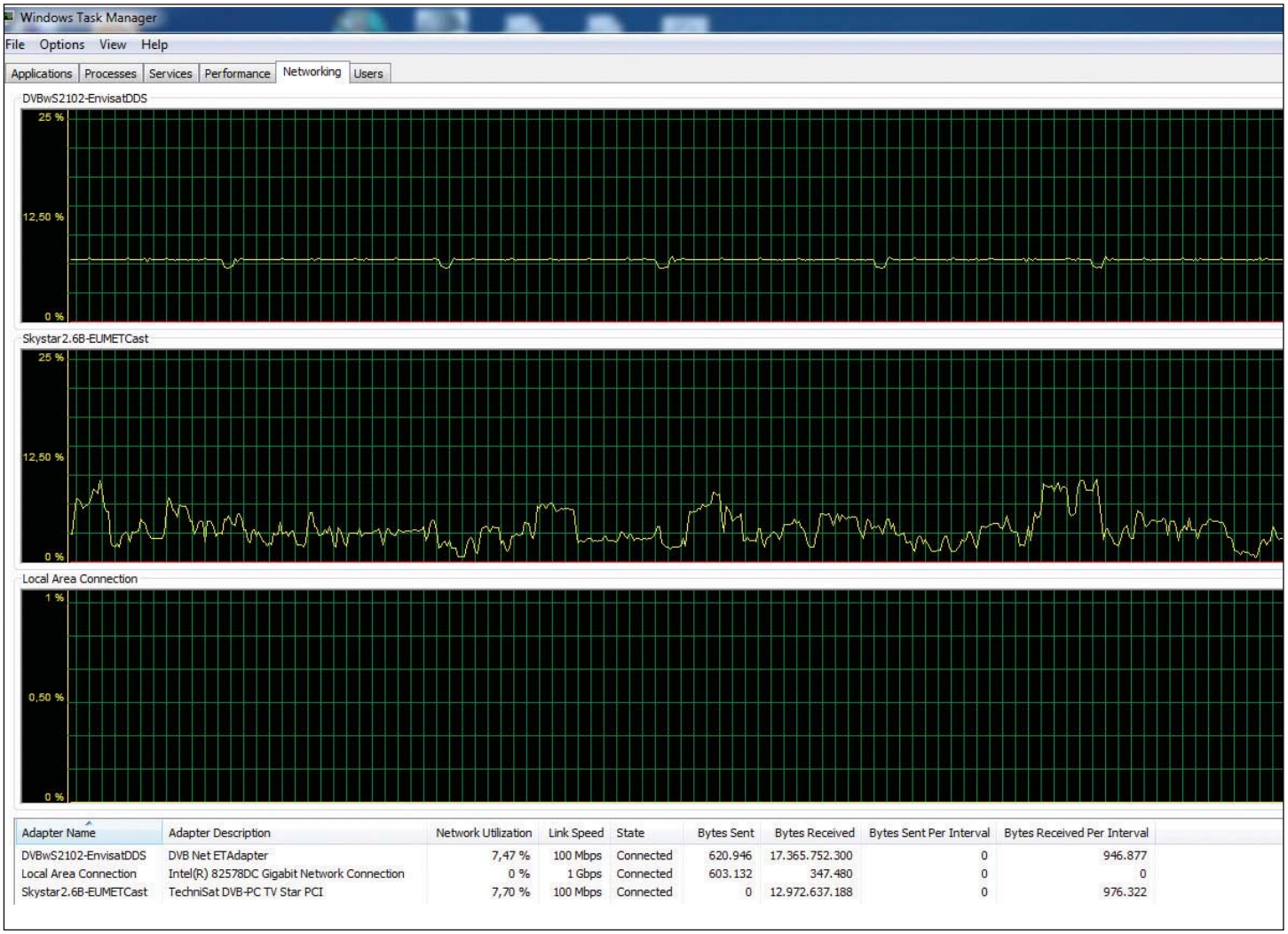


Figure 12 - A screenshot showing simultaneous dataflow being acquired from both the DVBWorld and Skystar-2 receivers

Conflicting Software

As it is never connected to the Internet, I do not run a virus scanner or firewall on this PC as these are known to degrade performance. My other system is well protected of course.

Windows own defragmenter disrupted reception too much and was disabled. *MST Defrag* showed good results but can cause data loss while *TelliCast's* temporary files are being written to the hard drive. This issue was solved by holding these temporary files on RAM disk, thus isolating them from *MST Defrag*. A test with the free *SmartDefrag* looked fine at first but Version 1.5 of this program slowly eats up all my memory and needs a weekly restart to prevent this. Further tests with *Jkdefrag*, *Mydefrag* and *Auslogics* are planned.

What Operating System Should be Used?

I started using *Windows XP*, which offers all that is needed for *EUMETCast* and *Envisat DDS* and does run stably if kept clean. But this 32-bit operating system is not able to use my 8 GB memory efficiently and, of course, is not sold any more.

Although I managed to utilise 3 GB for XP itself and 4 GB for the RAM disk, others may run into compatibility issues with their onboard video adaptor as this also uses some memory.

Because most PCs come with *Windows-7* nowadays, I started a test using the 64-bit version, which can use the total of 8 GB of memory without resorting to any tricks. Finding a *DVBworld* driver that received data correctly under it was not easy but finally I had my best results using a mix of the 20080415 and 20081224 drivers.

Although *Windows-7* has been running stably for months now, at first I had unexplainable data losses. It turned out that *Windows-7*, by default, schedules a lot of hidden maintenance tasks like disk defragmentation in the quiet hours. After disabling about 14 of these 32 scheduled processes, my system is now almost free of missed files. My old *Pentium-4* at 3 GHz, running XP, still shows fewer missed files, but I should mention that this system only does *EUMETCast* and not *Envisat*.

Figure 13
The Coolmaster Centurion-5

The Custom-Built Hardware

To achieve a stable long-lasting system running 24/7, sufficient cooling is a major concern, so I invested in a *CoolerMaster Centurion-5* case (figure 13) with an all-mesh front that takes in cold air. The cold air is first lead across the hard disk, then used to cool memory and main board. It then passes a *Thermaltake Sonic Tower* CPU heatpipe cooler. A 120 mm temperature-controlled fan mounted on the rear panel finally expels the hot air from the CPU cooler and expels this through the PSU (figure 14).

These *Akasa* fans measure 120 x 20 x 25 mm and have automatic speed control from 800 up to 2300 rpm via a built-in thermal sensor and long life twin ball bearings. They run very silently at room temperature but can speed up to expel 178 cubic meters per hour at 45°C.

Figure 14 - PC with optimised cooling to provide low noise

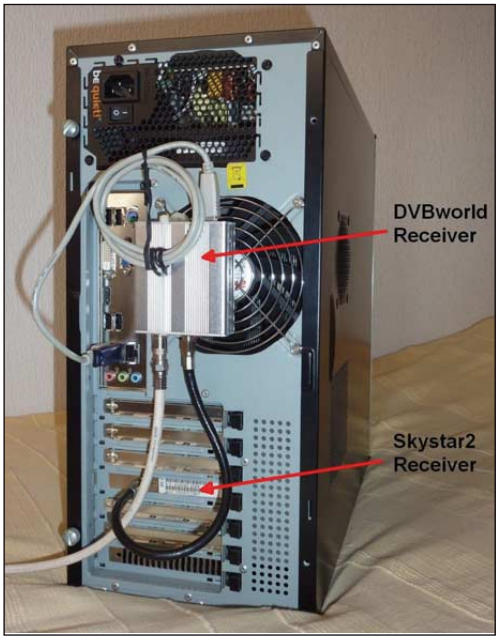


Figure 15 - The rear panel of the PC

Clear front covers (taken from presentation folders) and *Sellotape* were used to create an air duct around the CPU heat pipe cooler. This way the (often) noisy CPU cooler fan was not needed.

A carpet tile was glued to the inside of each large panel. The hairy surface layer of these carpet tiles absorbs high pitched noises and the bitumen base dampens vibrations in the thin metal panels perfectly. Preparing the case this way may look like a lot of work but it is very rewarding as the system is now barely audible from a metre away, while hard disk, system and CPU temperatures stay well below 40°, even under heavy load.

A minor concern was the high temperature of the *DVBworld* box when running 24/7, but mounting this box in the airflow from the case fan solved this (figure 15). Note that, in this photo, the loop-through output of the *DVBworld* receiver was used to feed the *Skystar-2*, but this caused interruptions on *EUMETCast* when tuning the *DVBworld* receiver so a splitter is now used.

This system (including both receivers but with monitor switched off) consumes an average of only 56 watts while receiving and decoding *EUMETCast* and receiving *Envisat DDS*.

Required Components

- Intel DH55TC main board with integrated graphics
- Intel Core i3-530 CPU with Thermaltake Sonic Tower heat pipe cooler + DIY air duct
- 4 x 2 GB DDR3 RAM (you could start with 2 x 2 GB as this memory is still costly)
- 1.5 TB hard disk: Samsung HD154UI EcoGreen F2 with 32 MB Cache
- BeQuiet! Pure Power BQT L7, 350 watt, high efficiency power supply (82-87% efficiency)
- Coolermaster Centurion 5 Midi tower case, with all mesh front and 120 mm case fan
- 2 x *Akasa* temperature-controlled 120 mm fan with dual ball bearing AK-174BKT-B to replace the fans in the case and PSU
- Skystar 2 PCI (2.6 Version)
- DVBworld USB2.0 receiver from the GEO Shop.
- 2-way Splitter: König FC-2SPLT-ST-KN
- Axing SZU 14 DC Blocker

The two Dellen lakes – one meteorite crater

Anders Höök

Last summer, I visited the area around where I was born, a place called 'Dellenova', a sort of museum dedicated to the meteorite impact that later formed the two Dellen lakes. The enthusiastic museum guide presented a lot of information and also gave us visitors the opportunity to experience a simulated earthquake. I thought this may be of interest to GEO readers.

In northern Sweden, in the area of Hälsingland, some 300 km north of Stockholm, there are two lakes, North Dellen (figure 1, a Terra MODIS image) and South Dellen (figure 2, my own NOAA 19 APT image, decoded and processed with Patrik Tast's APTDecoder). The lakes are faintly visible west to northwest of the large Hornslandet peninsula that protrudes into the Sea of Bothnia.

Northern Dellen has an area of 81 km2 and South Dellen 50 km2; their maximum depths are 48 and 50 metres respectively. Some 90 million years ago, a meteorite with an estimated diameter of about one kilometre hit this area, producing a crater with a diameter of some 19 kilometres, an area of about 300 km2 and a depth about 250 metres, some 50 m of which is water. The centre of the crater is located at 61°51' North, 16°41' East. In the central part there is a magnetic melt of material from the impact, with a diameter of nine km and a depth of 100 m. This mineral has been named 'Dellenite'. Until relatively recently it was believed that the lakes had a volcanic origin, but research in the 1980s has, however, shown that they are the result of a meteorite impact.

All of Scandinavia, including the Dellen area, has been covered with inland ice at least four times. The last cover melted about 10 000 years ago. The inland ice depressed the ground quite considerably and also tilted it somewhat towards the east. This is why the lakes presently do not form a circle. The northern shore of North Dellen has the most well preserved circular form.

I can add that the area around the Dellen lakes is a very beautiful rural landscape.

There is another even bigger meteorite crater in the landscape at Dalecarlia, called the Siljan Ring (figure 3), at 61°02' north, 14°54' east. It was created earlier, some 370 million years ago. That meteorite's diameter is estimated to have been about four km and the resulting crater, the biggest in Europe, has a diameter of 55 kilometres. In figure 2, the Siljan Ring is just visible to the southwest of Hornslandet. I also looked at the area in question in 'Virtual Ocean', explained in GEO Q27. With the use of 'Basemaps: Geology, Oil and Gas Fields of Europe and Turkey', I made the geological map reproduced in figure 4. There, the Siljan Ring is visible as a remarkably circular feature. To my annoyance the meteorite impact that created the Dellen Lakes is not visible so clearly.

References

http://www.dellenova.se/ (in Swedish)
Brochure from Hudiksvall's Tourist Information
http://sv.wikipedia.org/wiki/Dellensj%C3%B6arna
http://www.dellenit.se/DELLENBYGDEN/historia.html

http://en.wikipedia.org/wiki/Dellen (in English)
http://en.wikipedia.org/wiki/Siljan_(lake) (in English)
http://en.wikipedia.org/wiki/List_of_impact_craters_in_Europe (in English)

Virtual Ocean -> Basemaps -> Geological Maps -> Europe -> Geology, Oil and Gas Fields of Europe and Turkey (USGS) (in English)

Fig 1 North (Modis Terra 2009-05-01 10:30 UT)

Siljan Ring, fig 3 (Modis Terra 2009-05-01 10:30 UT, location 61^{o} 02' North, 14^{o} 54' East

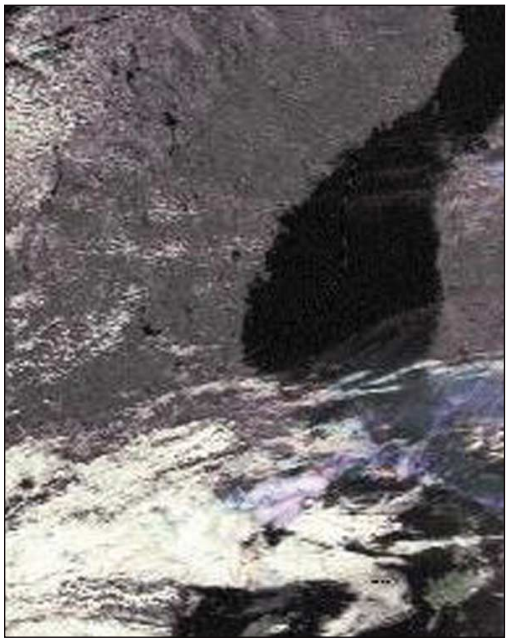


Fig 2 South Dellen my own APT image (figure 2: NOAA 19 2010-08-15 12:04 UT

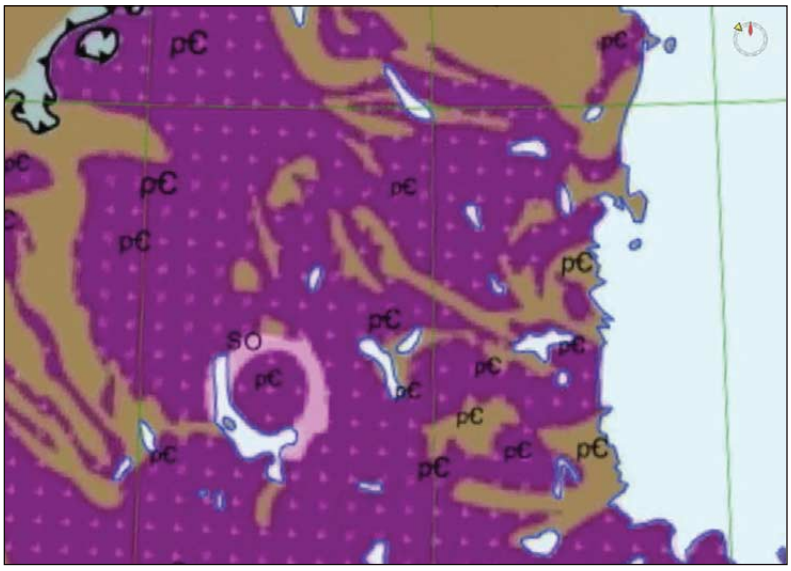


Fig 4. I also looked at the area in question in "Virtual Ocean", explained in GEO Q27. With the use of "Basemaps: Geology, Oil and Gas Fields of Europe and Turkey" I made the geological map

Cultivation in the Sahara

John Tellick

I seem to have a fascination for deserts, especially the Sahara.

This might have come from the fact that I have filmed in various parts of the Sahara – three filming trips to Egypt for the BBC the first of which was to Ismailia and the Suez Canal in 1971 to cover the aftermath of the '6 day war' between Egypt and Israel in 1967 which closed the canal for some years, the visit of Leonid Brezhnev in Cairo and then on to film the Aswan Dam – which at that time was surrounded and guarded by USSR SAM rockets – which we were 'not supposed to see' from our curtained bus and certainly not allowed to film!

Other trips to Egypt took me from Alexandria all the way down the Nile to many of the archaeological sites ending up at the Abu Simbel temple on Lake Nasser for BBC Science Features series.

OK, we didn't venture into the Sahara much – that came later on a trip to Sudan.

We had been filming in the southern Sudanese town of Juba – again early 70's regarding the political problems between north and south Sudan – which continue to this day.

Back in Khartoum the BBC 24 hours programme wanted a film on the political problems in Eritrea so we set out on a night time crossing of the eastern Sahara/Nubian desert from Khartoum to Kassala in the back of an open Land Rover truck.

I was up for a bit of adventure in those days and adventure this certainly was!

Crossing the uninhabited desert at night on just a sandy track under the stars was 'interesting' to say the least – and very cold.

However, a day or so after arriving in Kassala the authorities got wind of what we were up to – planning to meet 'the rebels' and cross over the border where they had promised us a 'bit of subversion' to film and we were placed under house arrest for several days before being loaded up on the truck again for a night passage back to Khartoum.

A further Saharan adventure came several years later on the south eastern Moroccan/Algerian border filming a costume drama about an English explorer.

Desert landscapes at the foothills of the Hindu Kush also featured in a filming trip to Mazare-e Sharif in northern Afghanistan in the early 70's for The Ascent of Man.

And a memorable filming trip in the early 80's to the Great Victorian Desert in South Australia and the town of Coober Pedy (which I believe is Aboriginal for 'white man in a hole') where most people lived in homes carved out of the rock and mined in holes in the desert for opals.

Al Khufrah Irrigation Project in Libya

But I digress – this is becoming a bit of a travelogue.

With the advent of EUMETCast allowing inexpensive and easy reception of high resolution HRIT and AVHRR data, looking at the globe from 0 degree location, two things stand out - the enormous size of Africa and the vast area that is the Sahara Desert.

With our 'high resolution' imaging – well medium really compared to other environmental satellites – the Sahara is shown to be more than just a featureless expanse of sand.

Indeed, vast areas of sand dunes show up well under the right light condition – in winter via polar orbiters and early morning/late afternoon with Meteosat HRV. More impressive are the dark rocky outcrops, they show up well in daylight, especially low Sun angles. But do look at them at night in the IR channels of Metop and NOAA AVHRR where they are possibly even more impressive as the sand cools quickly but the rocks retain their heat.

I was having a look at a VIS AVHRR image in December and noticed a road network showing up quite well in Libya. To the south were a series of regular dark spots in blocks.

These were also visible on Meteost-9's HRV early morning imaging.

A quick zooming in on Goggle Earth showed these to be very large circular areas of crop cultivation in the desert.

In fact you can zoom in very close but the area is not identified as such by Google Earth apart from Farm @ Sahara.

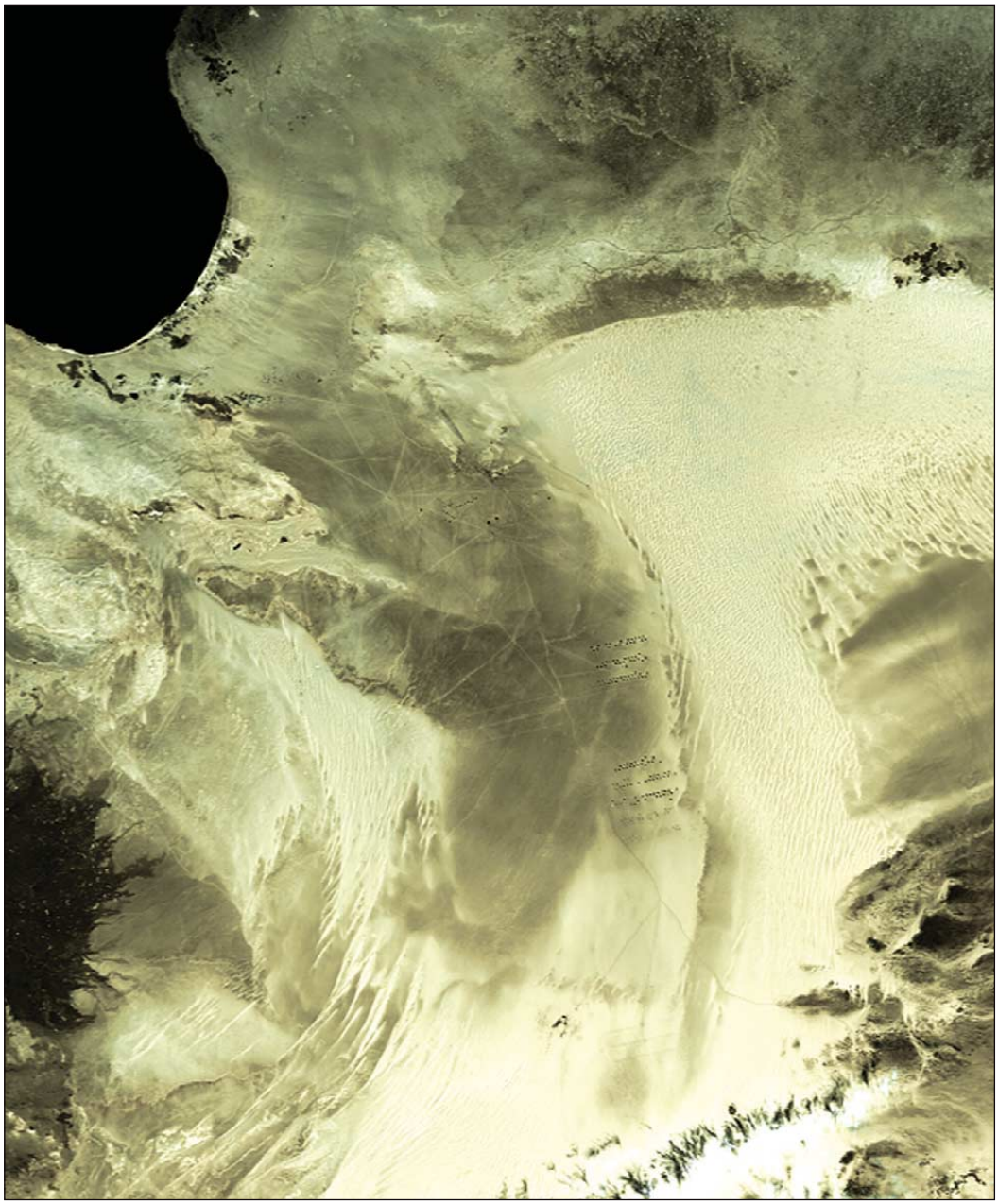
I haven't been able to find any further information about the above by Googling – the project that is identified by this means is the Al Khufrah Irrigation Project which is further to the south.

The Al Khufrah circular cultivation areas are shown here in a photo and I guess the Farm @ Sahara ones are the same.

An area of 'desert cultivation' which many will be familiar with from EUMETCast imaging and one that has supported one of the worlds great civilisations, is of course the Nile which shows up well – especially if you experiment with the processing tabs of HRPT Reader.

It's interesting to note that most of the crop cultivation takes place on the western banks of the Nile and of course across the vast Nile delta.

So, spending a bit of time processing images and keeping your eyes open can be quite rewarding.



Road network and crop cultivation at 'Farm @ Sahara' in Libya - Metop image 2011-01-23 12:27:33

Cultivation along the Nile in Egypt - NOAA Image 2011-01-23

A New Challenge

Using a Multi-LNB dish for Envisat DDS and EUMETCast

Arne van Belle

Having already been successful in using my WaveFrontier T90 multi-LNB toroidal dish for both EUMETCast and Satellite TV reception, I set myself the challenge of seeing if I could add Envisat DDS reception to it too.

This particular dish utilises a specially curved sub reflector to spread the incoming signal over the multiple LNBs, which are mounted on a curved rail (figure 1). I felt that it should also be possible to receive Envisat DDS via another LNB. This T90 dish has a gain of 39.6 dBi @11.7 GHz, just a little lower than my 1.0 meter test set up.

On the Wavefrontier T90, the optimal distance between the 9°E and 10°E LNBs is 24 mm, compared with 17 mm for a 1.0 meter standard offset dish. However, experiments with a single LNB had shown that either Envisat or EUMETCast suffered from this compromise.

While a single LNB can be used on a standard dish, two LNBs are required on the T90. But on a standard LNB the feedhorn diameter is 50 to 60 mm.

In a "you never find out if you don't try" attempt, I modified two standard LNBs then glued them together to create a special 'TwinSat' LNB with only 30 mm distance between the two units (figure 2). Figure 3 compares the original single LNB with the 'TwinSat' version. Of course, the modified LNB had to be weatherproofed for outdoor use and this is shown in figure 4.

The final result is an all-in-one satellite reception set-up with sufficient signal level on both EUMETCast and Envisat. Not only that, but this single dish can currently receive signals from ten different satellites located between 28.5° and 5°W (figure 5).

Using quad output LNBs and multiple switches, this dish now supports Envisat DDS and EUMETCast on two PCs, in addition to another three satellite TV receivers.

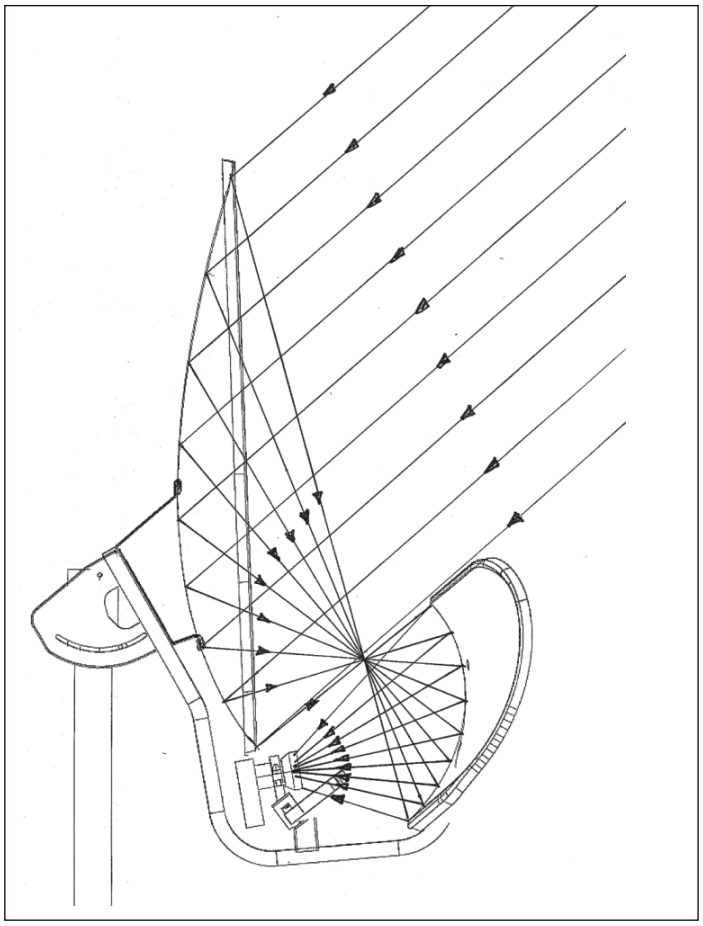


Figure 1
Illustrating how the specially curved sub reflector spreads the incoming signal over multiple LNBs.

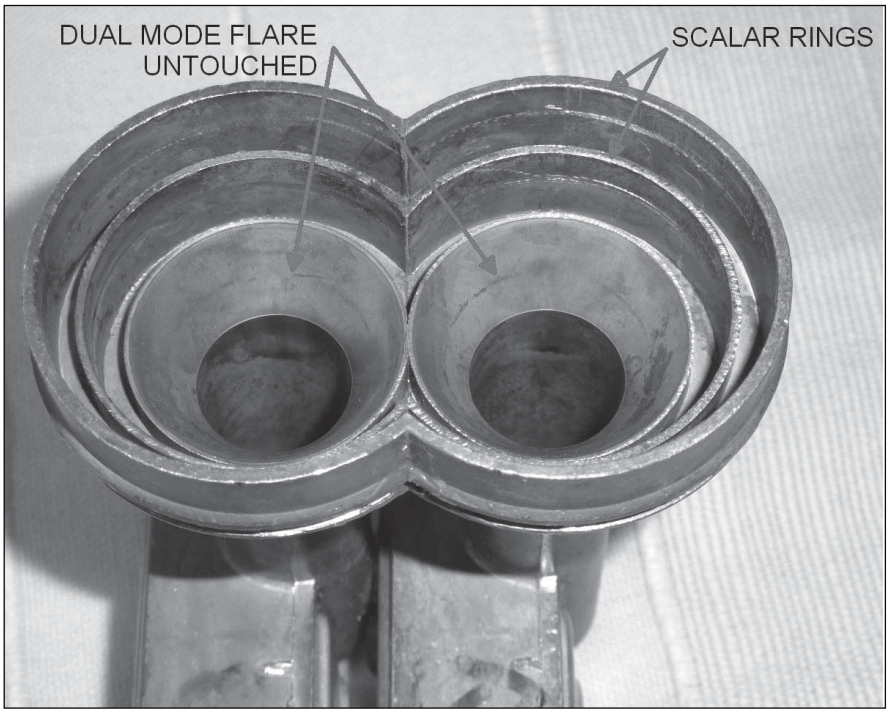


Figure 2 - The modified 'TwinSat' LNB

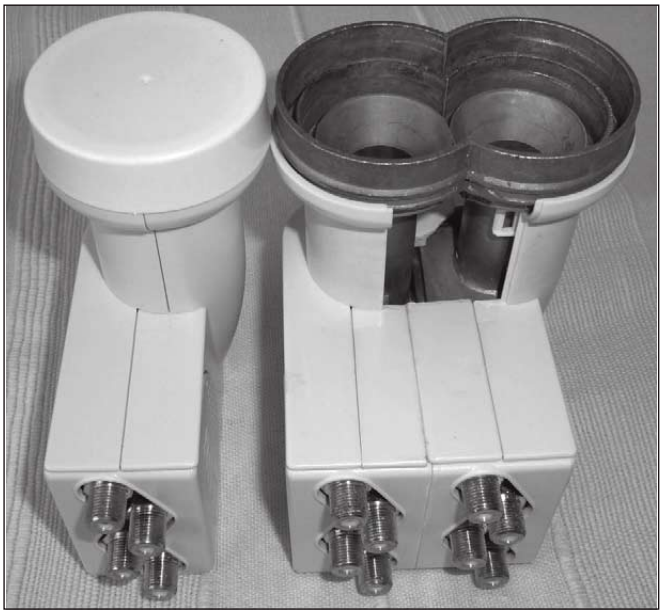


Figure 3 - The original LNB (left) compared with the 'TwinSat' LNB

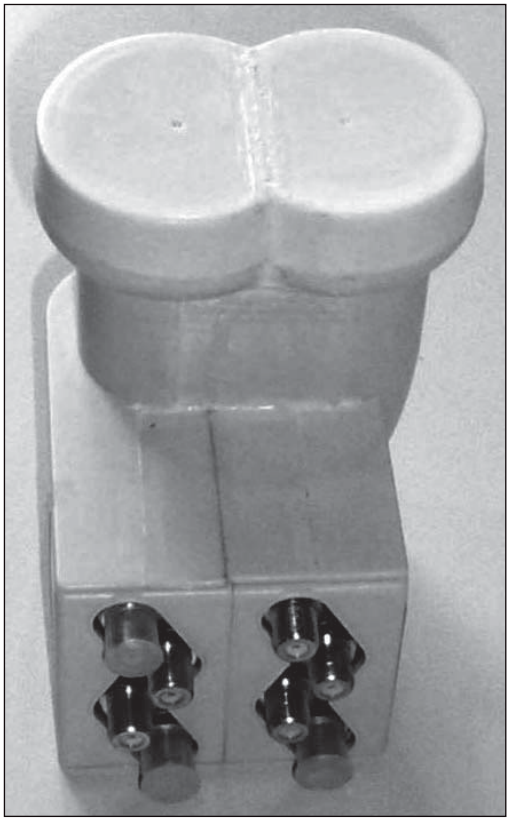


Figure 4 - The weatherproofed 'TwinSat' LNB

Figure 5
This single dish with multiple LNBs receives from satellites at 28.5°E, 23.5°E, 19.2°E, 16°E, 13°E, 10°E, 9°E, 5°E, 1°W and 5°W

GEO Shop

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

The 'Pager-Hardened' R2ZX

APT Weather Satellite Receiver

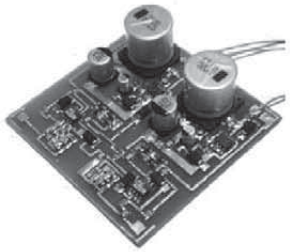
This upgraded version of the German-built R2FX receiver has been developed specially for the UK market and is available solely from the GEO Shop. If you are in an area suffering from pager interference on the NOAA-18 frequency of 137.91 MHz, this receiver should be the answer to your problems - see the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

UK member's price - 210.00 UK non-member's price - £224.00

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

UK member's price - £180.00 UK non-member's price - £194.00

John Silver's Lightning Radar Board



This is a DIY kit for constructing the circuit boards needed to develop your own system to detect and track thunderstorms in your vicinity, using a computer and readily available free software. Full instructions (which appeared in an article in GEO Quarterly 17) are included.

UK members price - £55.00
UK non-members price - £65.00

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

UK members price - £20.00
UK non-members price - £24.00

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

UK members price - £35.00
UK non-members price - £40.00

DVB World DVB-S USB2102

This superior 'free-to-air' **USB2** DVB satellite TV and data receiver is recommended for trouble-free *EUMETCast* reception on the Windows Vista platform. This plug-and-play unit comes with comprehensive installation instructions and a CD-ROM of driver software. It is very similar to the Dexatek unit reviewed by David Taylor in GEO Quarterly No 17

UK members price - £60.00
UK non-members price - £70.00

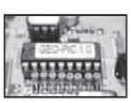
Universal Ku-band Satellite TV LNB 0.20 dB

(or equivalent)

This is a quality high specification Universal LNB for use with the SkyStar 2 PCI card, *Dexatek* and *DVBWorld* USB receivers and digital satellite TV receivers.

UK members price - £12.00
UK non-members price - £18.50

GEO PIC 1.0 for the RX2



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

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

Current Price List

	Members Prices UK	EU	RoW	Non Members UK	EU	RoW
APT Equipment						
R2ZX APT Receiver (no PSU)	210.00	214.00	222.00	224.00	228.00	236.00
R2FX APT Receiver (no PSU)	180.00	184.00	192.00	194.00	198.00	206.00
BNC Lead (0.25 metre)	4.75	5.50	6.00	6.75	7.50	8.00
UK Power Supply Unit (12 volt)	8.50	-	-	11.00	-	-
Dartcom High Quality QFH Antenna	269.00	349.00	-	289.00	369.00	-
John Silver Preamplifier (built)	35.00	36.00	37.50	40.00	41.00	42.50
John Silver Lightning Radar Board	55.00	68.00	61.00	65.00	68.00	71.00
Bias Tee	20.00	20.50	21.00	24.00	24.50	25.00
GEO-PIC 1.0	7.00	7.80	8.40	7.00	7.80	8.40
Martelec MSR40 EPROM	10.00	10.75	11.25	10.00	10.75	11.25
EUMETCast Equipment						
DVB-S USB2102 Receiver	60.00	65.00	-	70.00	75.00	-
Telestar 80 cm dish with LNB	69.50	-	-	76.50	-	-
Telestar Ku band universal LNB	12.00	13.50	-	18.50	20.00	-
Technisat Satfinder Alignment Meter	25.00	28.50	-	28.50	31.50	-
Miscellaneous						
GEO Quarterly Back Issues (subject to availability)	3.50	4.20	5.10	n/a	n/a	n/a
GEO Quarterly (PDF issues on CD) Annual compilations 2004-2009 (state years required)	8.00	8.80	9.30	n/a	n/a	n/a
GEO Membership (4 x *GEO Quarterly*)	20.00	24.00	28.00	20.00	24.00	28.00

Payment by direct bank transfer can be arranged. Please email
francis@geo-web.org.uk
for BIC and IBAN bank details

All prices are in £ sterling and include postage and packaging

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

Orders should be sent to:

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

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

+44 (0) 1202 893 323

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

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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, non-members cannot benefit from the discounted prices available to members.

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

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

TechniSat SatFinder Antenna Alignment Meter

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

UK members price - £25.00
UK non-member's price - £28.50

Telestar 80 cm dish and Universal 0.2 dB LNB

(or equivalent)

This quality solid steel offset dish, designed for digital and analogue reception, is coated with electrostatic polymer. The bracket has been heat dipped and zinc treated for maximum corrosion protection. Complete with LNB.

UK members price - £69.50
UK non-members price - £76.50

NOAA Satellite Predictions

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

Compiled by Les Hamilton

NOAA 15 137.62 MHz	NOAA 18 137.9125 MHz	NOAA 19 137.10 MHz
Dec 01 03:55 05:35 15:23 17:03	01:24 03:04 12:57 14:39	01:58 03:39 11:51 13:32
Dec 02 05:11 06:51 14:59 16:39	02:53 04:35 12:47 14:28	01:47 03:28 11:41 13:21
Dec 03 04:47 06:27 14:35 16:14	02:43 04:24 12:36 14:17	01:37 03:18 11:31 13:11
Dec 04 04:23 06:03 14:12 15:50	02:32 04:13 12:25 14:06	01:26 03:07 11:21 13:00
Dec 05 03:59 05:39 15:26 17:07	02:21 04:02 12:15 13:55	01:16 02:57 11:11 12:50
Dec 06 05:15 06:55 15:03 16:43	02:11 03:52 12:04 13:44	01:06 02:46 12:39 14:22
Dec 07 04:51 06:31 14:39 16:18	02:00 03:41 11:54 13:34	00:55 02:36 12:29 14:11
Dec 08 04:27 06:07 14:16 15:54	01:49 03:30 11:44 13:23	02:25 04:07 12:19 14:00
Dec 09 04:03 05:43 15:30 17:11	01:39 03:19 11:33 13:12	02:15 03:56 12:08 13:50
Dec 10 05:19 06:59 15:06 16:46	01:28 03:09 13:02 14:44	02:05 03:46 11:58 13:39
Dec 11 04:54 06:35 14:43 16:22	02:58 04:39 12:51 14:33	01:54 03:35 11:48 13:28
Dec 12 04:30 06:10 14:19 15:58	02:47 04:28 12:40 14:22	01:44 03:25 11:38 13:18
Dec 13 04:07 05:46 15:34 17:15	02:36 04:17 12:30 14:11	01:33 03:14 11:28 13:07
Dec 14 05:22 07:02 15:10 16:50	02:26 04:07 12:19 14:00	01:23 03:04 11:17 12:57
Dec 15 04:58 06:38 14:46 16:26	02:15 03:56 12:09 13:49	01:13 02:53 11:07 12:46
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EUMETCast On-Line Registration Guide

If you require to register as a first-time user for any of the free *EUMETCast* data streams such as MSG, NOAA AVHRR, Metop etc., or need to renew an existing subscription, this **must be done on-line**.

GEO has produced a step-by-step guide to the entire process at

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

This guide also contains a direct link to the official *EUMETCast* on-line **registration form**, which can otherwise prove somewhat tricky to locate.

GEO Helplines

Douglas Deans
Dunblane, Perthshire, SCOTLAND
All aspects of weather satellites from APT, HRPT to Meteosat-8 DVB/EUMETCast systems.

- telephone:(01786) 82 28 28
- e-mail: dsdeans@btinernet.com

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

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

Mike Stevens
Portland, Dorset, England.
Advice offered on EUMETCast (MSG and Metop) and APT.

- email: stevens312@btinternet.comf

Guy Martin G8NFU
Biggin Hill NW Kent, ENGLAND
Guy is prepared to advise anyone who wishing to receive MSG/Metop using Windows 2000 or XP. Can also help with networking and ADSL router setup..

- gmartin@electroweb.co.uk

Hector Cintron
San Juan, Puerto Rico, USA
Hector is prepared to field enquiries on HRPT, APT, EMWIN and NOAAPORT

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

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

Internet News/ Discussion Groups

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

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

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

GEO-Subscribers
This is GEO's own group, where members can exchange information and post queries relating to any aspect related to weather satellite reception (hardware, software, antennas etc), Earth observation satellites and any GEO-related matter.

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

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

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

MSG-1
A forum dedicated to Meteosat Second Generation (MSG), where members share information about the EUMETCast reception hardware and software.

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

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

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

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

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

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

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

Weather Satellite Reports
This group provides weekly reports, updates and news on operational aspects of weather satellites.

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

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

http://groups.yahoo.com/group/wxtoimg-l/

The Copy Deadline for GEO Quarterly No 30 is Saturday, 2nd April, 2011

The Editor is always delighted to receive articles and images for inclusion in *GEO Quarterly*. These can relate to any aspect of Earth Imaging, especially

- Technical articles concerning relevant hardware and 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, DVD). But of course we will also accept handwritten and 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: **JPG, BMP, GIF, TIFF** etc. Images in both monochrome and colour are welcomed. 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 for illustrative purposes within an article.

If your article submission contains embedded images and diagrams, please note that you must **also submit the individual, original 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,

Peter Green
'Hollowtree'
Eggesford, Devon EX18 7QX, England.
Tel: 01769 580 700

The most efficient way to do this is as **email attachments** to the following address

geoeditor@geo-web.org.uk

And finally . . .
if you do have material ready for the next issue of GEO Quarterly, please submit it **as soon as it is ready**—do not wait till the deadline above: this will simply create an editorial log-jam and delay publication.

Group for Earth Observation

Membership Application Form

PayPal

Current Subscription Rates

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You can make your annual GEO Membership payment by any of the following methods:

- **PayPal** - Visit the GEO Shop website at ***http://www.geo-web.org.uk/shop.html*** and add your subscription to your basket
- UK residents may pay by means of a **personal cheque** or **Postal Order** made payable to '*Group for Earth Observation*'
- Payment by **direct bank transfer** can be arranged. Please email francis@geo-web.org.uk for BIC and IBAN details.

Name (please PRINT clearly)

Address

Town/City

Postcode/ZIP

Callsign

Country

Telephone Number

FAX

Email Address (please print **very** clearly)

Declaration

I wish to join GEO, the Group for Earth Observation, for a period of one year.

I sign below to confirm that I have no objection to my membership details being held on a computer database and understand that these details will be used exclusively for internal GEO administration purposes.

Signature

Date

Your subscription is valid for one year from your date of application and entitles you to all the privileges of membership of the Group for Earth Observation, including four issues of GEO Quarterly. Please note that your subscription will commence with the issue of GEO Quarterly that is current at the time of your application. Back issues, where available, may be ordered from the GEO Shop.

Please send your completed form to:
David Anderson (GEO subs),
35 Sycamore Road,
East Leake
Loughborough LE12 6PP, UK

GEO Subscriptions
35 Sycamore Road.
East Leake.
Loughborough LE12 6PP
England, UK.

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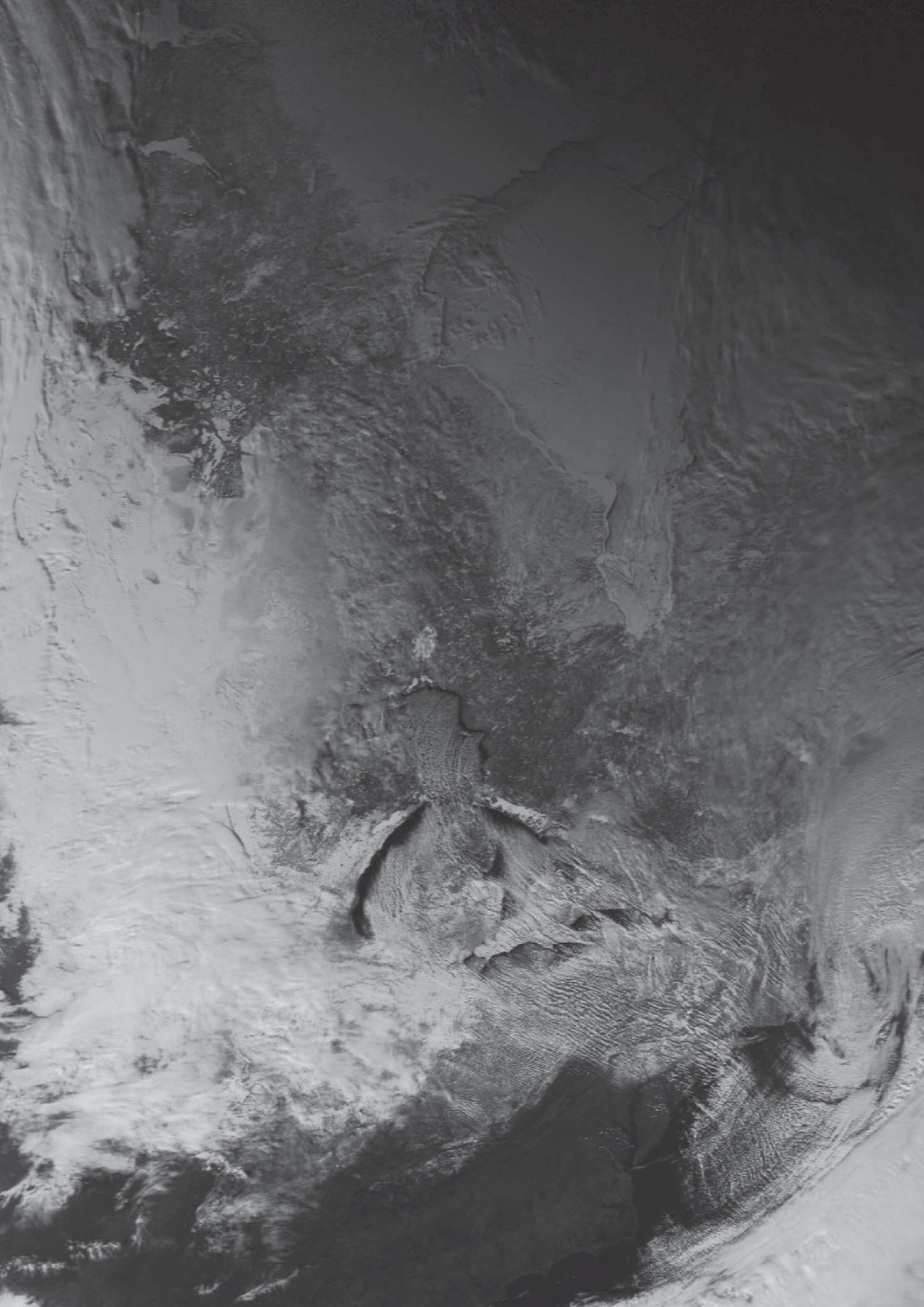


GEO's visit to EUMETSAT, Darmstadt 7th - 8th July 2011

Francis Bell

GEO's visit to Darmstadt later this year is confirmed for Thursday and Friday, July 7-8. Delegates who anticipate joining us for this visit should register by visiting

www.geo-web.org.uk

The website contains the notice about our Darmstadt visit and provides a link to the **registration form**. Please use this form.

Our group will be guests of EUMETSAT so the fine details of the visit will be in their hands. My broad expectation is that we will arrive at EUMETSAT HQ at 9.00 am on July 7, and spend the day visiting their extended HQ and technical facilities—perhaps with presentations relating the current and future EUMETSAT programmes.

On Friday July 8 we will again meet at EUMETSAT HQ, but this time to join a coach for the one hour journey to Usingen, where EUMETSAT have their large dishes and ground station for direct communication with their satellites. Hopefully we can look at the dishes and go into the control rooms there.

On return to Darmstadt, we are scheduled to start a 90-minute tour of the European Space Operations Centre (ESOC). Unless our numbers are very high, we should all be able to start the ESOC tour at 1.30 pm. The tour will involve a short presentation plus a tour of their control rooms and displays. Access to some areas may depend current satellite operations. Our two day visit will end at 3.00 pm on leaving ESOC.

Please note that, when visiting both EUMETSAT and ESOC, a list of visitors has to be produced so it will be of great help if delegates would register in advance via the website—see above. Also note that some form of photo identity will have to be produced when entering EUMETSAT HQ and ESOC.

There is no specific charge for this visit as we will be guests of the host organisations. However, there will be a small charge to cover the coach hire, the ESOC tour guide fees and some small miscellaneous costs. The actual cost will depend on our numbers but should be in the region of 15 - 20 euros.

Travel and accommodation must be the responsibility of individuals but the following may be useful background. There are several hotels in Darmstadt but the one chosen by many delegates for our visit in 2008 has only a limited number of rooms, but a nearby hotel of similar standard has been contacted and they will offer a price concession to GEO members.This hotel is

ETAP Hotel
Kasinostrasse 4- 6
64293 Darmstadt
Telephone ++ 49 6151 393720

Use the Internet 'ETAP Hotel Darmstadt' for a location map and visitor reports. The hotel may be contacted by email, in English or German, at

H3526@accor.com

The ETAP hotel is conveniently located within walking distance of Darmstadt town centre, the EUMETSAT and ESOC HQ buildings and the railway station. For those flying into Frankfurt airport it is worth noting that there is a shuttle bus service between the airport and the centre of Darmstadt.

For any member who might wish to stay an extra day or two after our programme of events, you may find a visit to nearby Heidelberg attractive. During midsummer weekend it is likely that there will be additional activities in the town as well as the river, university and the castle (of brothers Grimm fame). There is a regular train service between Darmstadt and Heidelberg and for those travelling in small groups the fare is very modest.

For up-to-date details relating to GEO's Darmstadt visit our website

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

Quarterly Question Number 28

Francis Bell

Quarterly Question 28 appeared on pages 28 and 29 of our December 2010 publication. Readers may remember that it was prompted by an Envisat image I had received using my home Envi-Ham system plus a subsequent Meteosat 7 Indian Ocean image via EUMETCast. The question asked for the name of the river featured in the Envisat image of tropical East Africa. The line of this river was also just identifiable on the Meteosat 7 image but this time it was shown as a sinuous political overlay not the river itself.

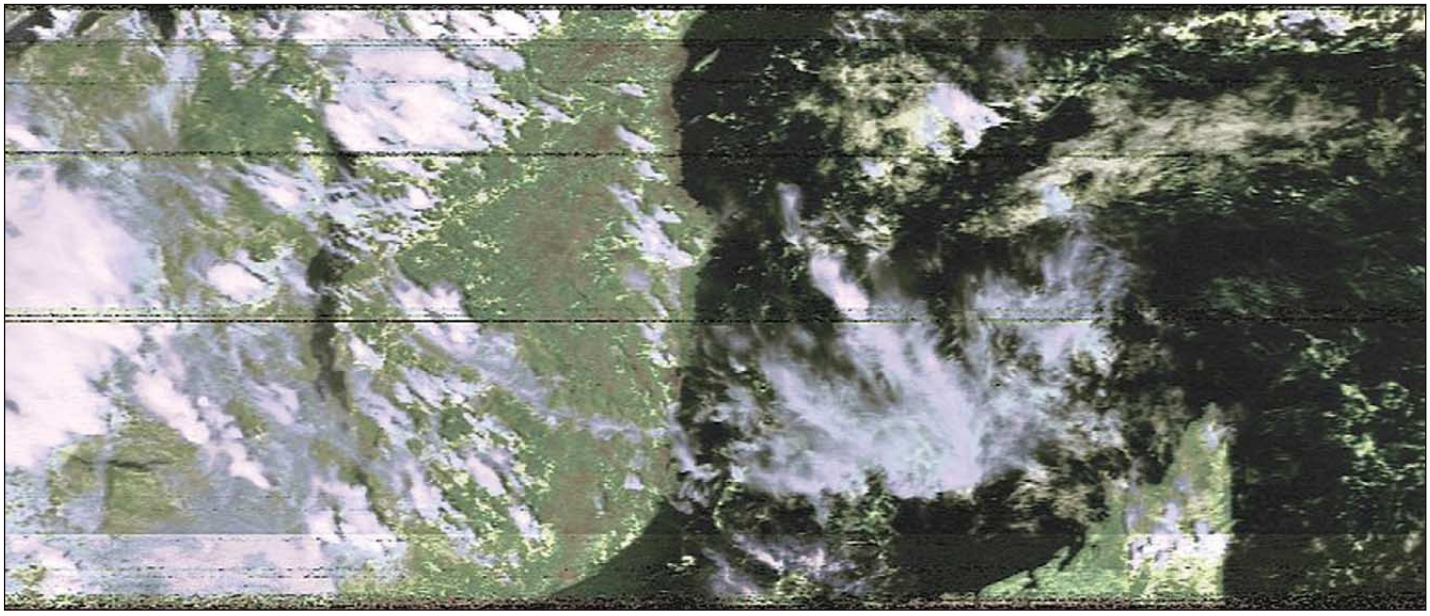
I was very pleased with both the number and geographical diversity of our members who sent in answers. All the answers submitted were correct. Below is a list, in no particular order, of those members giving a correct answer. I was happy to accept either or both of two names: River Ruvuma in Portugese Rio Rovuma.

Mike Brag Timaru New Zealand
Yves Ducas Namur Belgium
Andreas Lubnow Braunschweig Germany
Ronald Ertl DKINJ Germany
Rob Denton Leicestershire UK
Ruud Jansen Haarlem Holland
Dave Rennolds G0BXS Oxford UK
David Pykett Grimsby UK
Elmar Bogels PE1LHC Brunssum Holland
Frank Skillington Nottingham UK
John Morris Bolton UK
Dave Lane G3VOM Manchester UK
Nick Tebneff VK5NT South Australia
Anders Hook Vallentuna Sweeden
Fritz Zajicck 0E3FZB Austria
Frank Allica Australia - Captain of the cruise ship 'Spirit of Adventure'

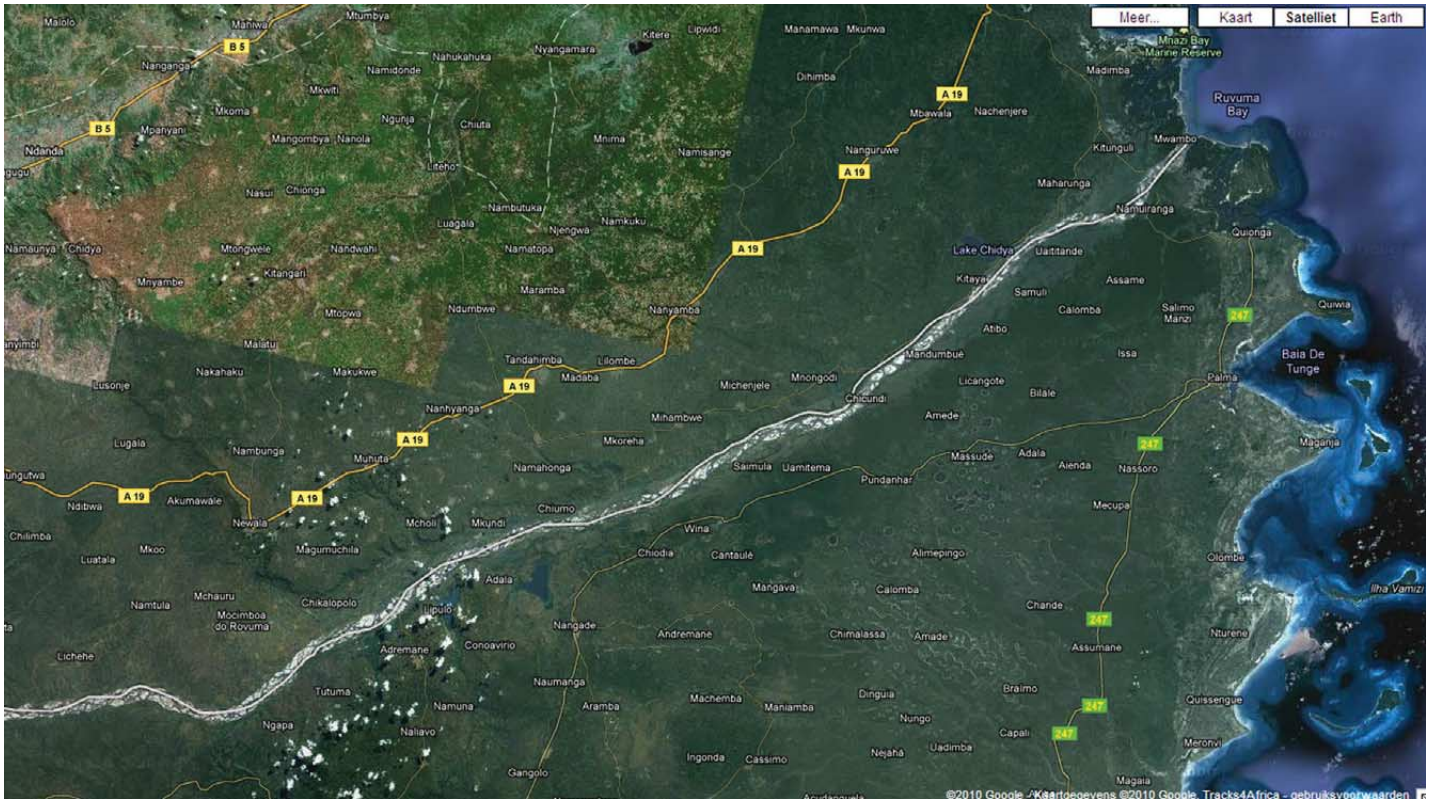
Some members just briefly gave the name of the river others included additional details. Some of this extra background material is shown below in an email from Ruud Jansen.

Hi Francis,

The answer to the Quarterly Question in number 28 is Ruvama River. I have used Google Maps and then also the Encyclopedia Britannica on the Internet. Ruvuma River, Portuguese Rio Rovuma, perennial river rising in the Matagoro Mountains in south eastern Tanzania. Flowing eastward into the Indian Ocean at a point about 20 miles (32 km) north of Cape Delgado, the Ruvuma River forms the boundary between Tanzania and Mozambique for a length of 400 miles (650 km) from the coast and has a total length of about 475 miles (760 km). Its chief tributaries are the Lugenda, Lucheringo, Likonde, Muhuwesi, and Lumesule rivers. The Ruvuma River passes over several cataracts, so that it is navigable only by small craft up to the Upinda Rapids, about 60 miles (100 km) inland.I have added a PC-screen image capture (opposite) of the Google map image of this River.



This is an APT of the River Ruvama area which I received using my portable APT station while onboard a ship in Mombasa. Although I was operating from an upper deck, there were still bits of ship metal work obscuring a clear view of the sky. Even so I was pleased with the result - I had my APT image of the Ruvama River area albeit with some interference. Other images I received during this journey were interference free but less interesting.



Google map image of Ruvama River suppled by Ruud Jansen © Google

GEO Logo

As noted on page 2 in the GEO Report we recently received a request from a member to use our logo on his amateur radio his QSL card. GEO readily agreed to this request. There is a wider issue here relating to the promotion of GEO so if any member wishes to use our logo in an appropriate context this would be welcomed. Here is an example of our logo. If you would like an electronic copy of our logo email:

francis@geo-web.org.uk

Mount Everest

A NASA Earth Observatory Report

This astronaut photograph highlights the northern approach to Mount Everest from Tibet (China). Known as the northeast ridge route, climbers travel along the East Rongbuk Glacier (image lower left) to camp at approximately 6,100 meters above sea level. They next ascend the North Col—a sharp-edged pass carved by glaciers, at image centre—to reach a series of progressively higher camps along the North Face of Everest. Climbers make their final push to the summit (just off the top edge of the image) from Camp VI at 8,230 meters.

Located within the Himalaya mountain chain, Everest is the Earth's tallest mountain, with its summit at 8,848 meters. On May 20, 2009, former NASA astronaut Scott Parazynski became the first human to both travel into space and to climb to the summit Everest.

Astronaut photograph ISS026-E-15208 was acquired on January 6, 2011, with a Nikon D2Xs digital camera using an 800 mm lens.

This image is provided by the ISS Crew Earth Observations experiment and Image Science & Analysis Laboratory, Johnson Space Center.

Greeting Messages 2011

My thanks to those members who sent me greetings for Christmas and the New Year by card or email. I received on behalf of GEO greeting from UK members but also many from Europe ant the rest of the world.

EUMETSAT kindly sent a card personally signed by nine members of their staff. I also received a greeting from our friends / members in Argentina. It's great to know our group is so widely supported.

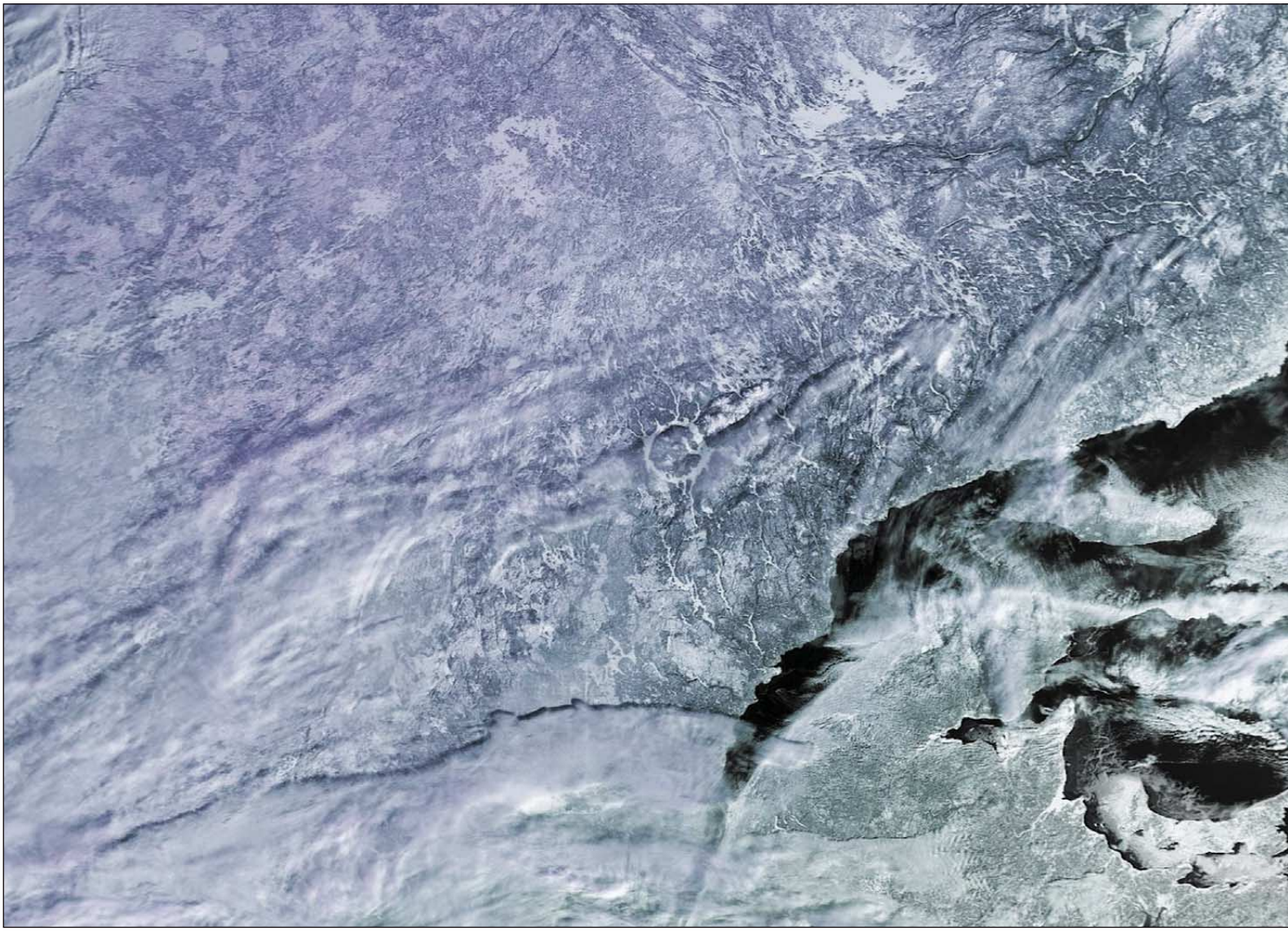
Inevitable there will be changes in the world of weather satellites and earth observation during 2011 and it's reassuring to know we have so many talented members around the world.

Francis Bell

Manicouagan crater in Quebec

Robert Moore

This is the Metop-A image of 7 February 2011. The crater is 100 km across and one of a series, originally formed in a line across the then continental plate, when an asteroid broke up on entering the Earth's atmosphere about 212 million years ago. There have been many such impacts, of which the Arizona crater is perhaps the most famous result, but many impacts would have been in the sea and others on land have been overgrown by forests and jungle The Manicouagan crater always shows up extremely well from space and here it is highlighted by snow and ice, making it especially conspicuous.



The Great Australian Flood - 2011

Part 1

Dale Hardy

Late 2010 dealt farmers in Australia's 'Wheatbelt' a change in fortune. After *three consecutive years of drought*, rains finally drenched southeastern Australia. August brought record-setting precipitation to parts of New South Wales and Victoria, and September 2010 was Australia's wettest September on record. September rainfall totals in the 'Wheatbelt' ranged from average to significantly above average, according to the Australian Bureau of Meteorology.

The vegetation image (figure 1) shows how plants responded to the rainfall along the border between Victoria and New South Wales in the Murray River basin. It was made from measurements taken by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's *Terra* satellite between September 7 and 22, 2010, compared to average conditions during the same period in 2006.

Green dominates the 2010 image, indicating that plants were growing more robustly than the average for most of the region. Fields of crops form tiny squares and rectangles: natural vegetation is smoother and more continuous. In general, the natural vegetation responded to the rain more than nearby crops, though this may be a matter of timing. Many of the crops that grow in northern Victoria and southern New South Wales—including corn, sorghum, rice, cotton, millet, and potatoes—are usually planted, beginning in September or October. The fields that show little response to the rain may have been planted with one of these crops or may be fallow for the year. Primary grain crops (wheat, barley, and oats) are usually growing by September.

The abundant rain made conditions for some crops ideal. As the end of the planting season neared in December, Australia was looking at the possibility of a record cotton harvest. The rain also helped refill reservoirs that had dwindled during the drought, making more water available for irrigated crops. The rain also had negative consequences. Rivers throughout eastern Australia flooded. The lush vegetation and water supply created habitat for plague locusts; swarms of them were reported along the Murray River in early December.

By December 8, Australia had recorded its wettest spring on record. The unusual rainfall was caused by *La Niña*, which warms ocean temperatures north of Australia and strengthens trade winds, bringing rain to northern and eastern parts of the continent. *La Niña* and its counterpart, *El Niño,* are major factors driving the cycles of drought and rain in eastern Australia.

Peruvian fisherman named *El Niño* (Spanish for 'the boy child') after the Christ Child because the climate phenomenon usually shows up around Christmastime. But its counterpart, *La Niña*, is the gift giver, bringing cold, nutrient-rich water to the equatorial Pacific off South America. Those nutrients are a boon to marine life, supporting a larger fish population and increasing the fishermen's catch. Fishermen might expect a good year ahead, as a strong *La Niña* is now dominating the Pacific Ocean.

'This is one of the strongest *La Niña* events in the past half century, and will likely persist into the northern hemisphere summer,' says Bill Patzert, an oceanographer and climatologist at NASA's Jet Propulsion Laboratory. 'Climatic impacts include heavy rains and flooding, which have damaged crops and flooded mines in Australia and Asia. It also has resulted in flooding in northern South America and drought conditions in Argentina. This powerful little lady is spreading her curses and blessings across the planet. She's the real deal.'

La Niña's cold water signal is strong in figure 2. The left hand image shows ocean surface temperatures on December 15, 2010, as measured by the Advanced Microwave Scanning Radiometer for EOS (AMSR-E) on NASA's *Aqua* satellite. In December 2010, sea surface temperatures were colder than average across the equatorial Pacific.

The right hand image depicts the heat content of the ocean surface between December 14 and 16, 2010, as observed by the U.S.-French Ocean Surface Topography Mission (OSTM) flying on the *Jason-2* satellite. Water expands as it warms, so warmer water has a higher surface elevation than cooler water. The blue valley streaking across the middle of the sea surface height image is the signature of *La Niña.* The intensity of the cold water and the depth and extent of the valley point to an intense event.

Like *El Niño*, *La Niña* arises from changes in both the ocean and the atmosphere. High pressure usually dominates the atmosphere over the eastern Pacific, while low pressure tends to reign in the west. The pressure difference creates the trade winds, which blow surface water across the equatorial Pacific to a pool of warm water in the west. Cooler deep water wells up to replace the surface water and during La Niña events, the pressure difference and the resulting trade winds are stronger. The more intense winds push more water west, where it builds up north of Australia. Meanwhile, more cold water wells up in the central and eastern Pacific.

La Niña occurs only when both the ocean and the atmosphere change together, which they did in 2010, when more than 200,000 Australians were affected by December floods in Queensland. High waters washed out roads, isolated entire towns and forced thousands to evacuate. The coastal city of Rockhampton braced for major flooding, which was expected to arrive on New Year's Day but actually began a week earlier with the arrival of *Tropical Storm Tasha.*

Tropical Storm Tasha was short lived but, during its brief appearance, the storm pounded northeastern Australia, battering the Queensland coast with heavy rain. *Tasha* reached tropical storm strength on December 24 and made landfall along the Queensland coast near Cairns the next day.

As *Tasha* abated, a second low-pressure system formed off the coast, promising more precipitation. Forecasters expected heavy rain for several more days in almost every major Queensland town. Eighteen rivers were on flood watch throughout the state as of December 27.

Figure 3 is a colour-coded image showing rainfall in Queensland between December 20 and 26, 2010. The heaviest rainfall—more than 400 millimeters—appears in

dark blue. The lightest amounts—less than 50 millimeters—appear in light green.

This image is based on data from the Multisatellite Precipitation Analysis produced at NASA's Goddard Space Flight Center, which estimates rainfall by combining measurements from many satellites and calibrating them using rainfall measurements from the Tropical Rainfall Measuring Mission (TRMM) satellite.

More torrential rains pounded southeast Queensland on January 10, 2011, bringing devastating flash floods to several communities just west of Brisbane. Figure 4, from the Multi-Satellite Precipitation Analysis (MPA) based on data from the Tropical Rainfall Measuring Mission (TRMM), shows this intense rain. The storm was relatively concentrated, with the highest rainfall west and northwest of Brisbane. In the darkest blue regions, the TRMM MPA recorded rainfall totals greater than 200 mm for the day.

The rain fell on already saturated ground with nowhere to go, and the water formed intense flash floods that ripped through the Lockyer Valley, killing ten people and leaving 78 missing, according to news reports. The water drained east, pushing several rivers past major flood stage.

The storm continued a trend of rainy weather linked to La Niña. According to the Australian Bureau of Meteorology, Queensland had the wettest December on record in 2010, while the continent as a whole experienced its third wettest year.

As flood waters moved south from Queensland in early January 2011, one of the first communities affected in neighbouring New South Wales was Goodooga. Already remote, the village was expected to be isolated from the outside world for up to six weeks.

Australia's Bureau of Meteorology issued multiple flood warnings for the state of Victoria on January 19, as flooding spread south from New South Wales. Meanwhile, the *Herald Sun* reported that the January floods were expected to cost the state of Victoria hundreds of millions of dollars, particularly in infrastructure damage and agricultural losses.

The entire region is more vegetated in 2011, and multiple rivers have pushed over their banks. The Bureau of Meteorology warned of moderate flooding along parts of the Murray River, which marks the boundary between Victoria and New South Wales, and also issued major flood warnings for the Avoca, Loddon, and Wimmera Rivers, all of which have spilled on to floodplains (figure 5).

Besides widespread flooding in Victoria, the floods in New South Wales swelled the Murrumbidge River, which passes through a marshy area en route to the Murray River, transforming it into a sprawling lake.

As I write this, with the strong *La Niña* weather episode expected to continue into March, leading to an increased risk of more rainfall and tropical cyclones, further massive destruction is expected in northern Queensland with severe *Tropical Cyclone Yasi* predicted to hit near Cairns with winds exceeding 300 kph.w

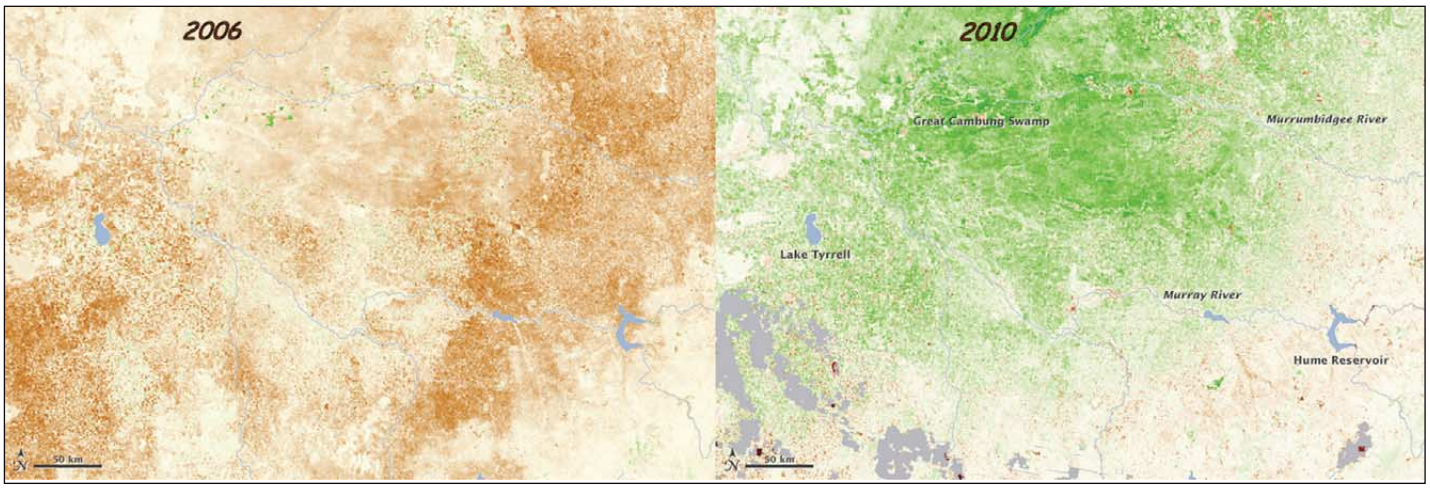


Figure 1 shows how plants responded to the rainfall along the border between Victoria and New South Wales in the Murray River basin.

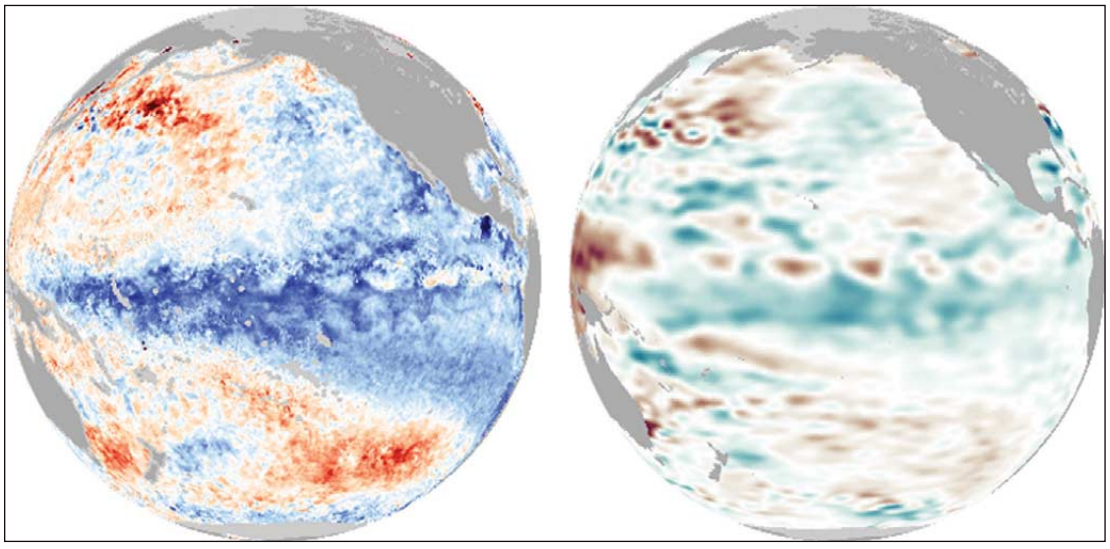
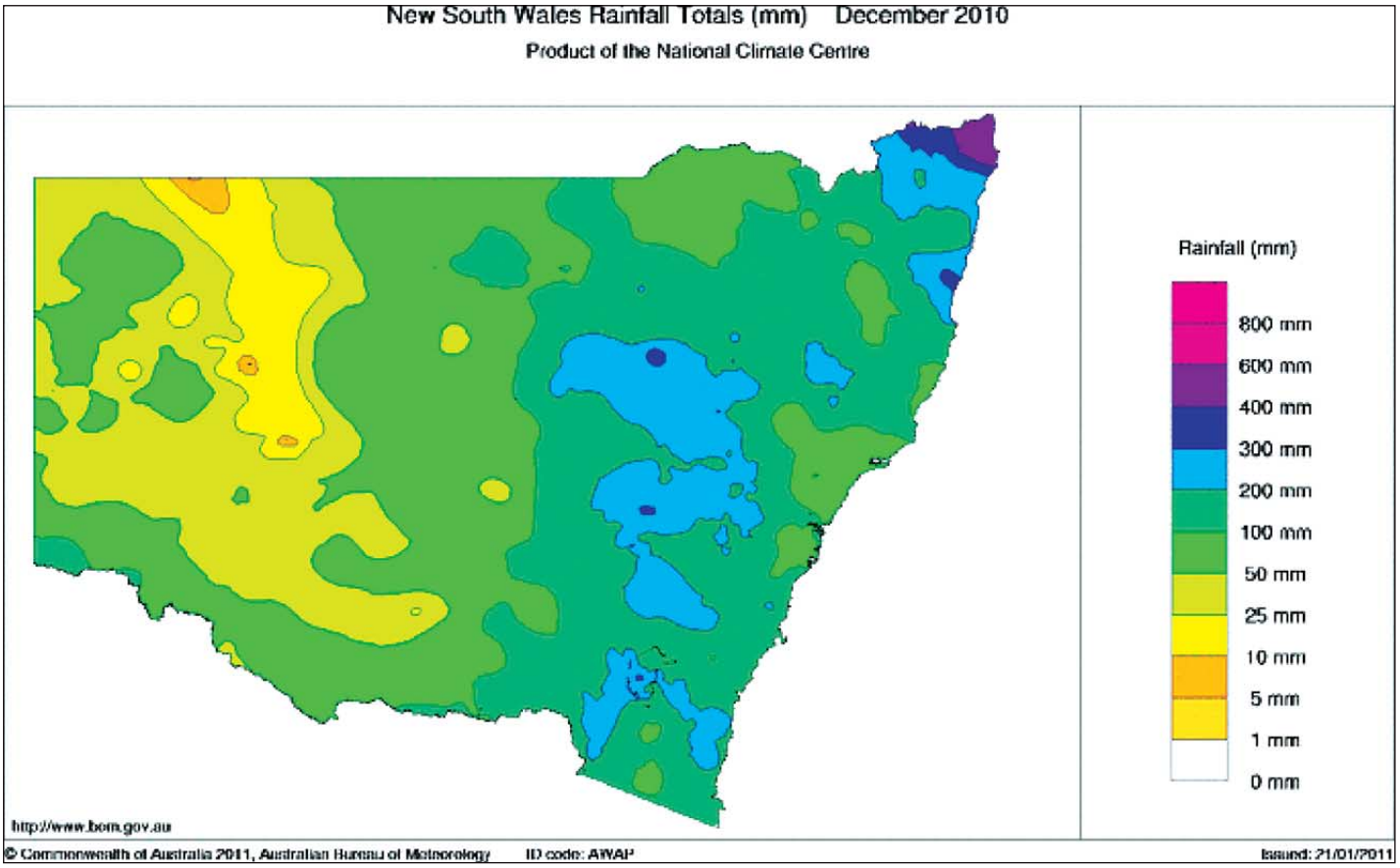


Figure 2 *La Niña's* cold water signal is strong



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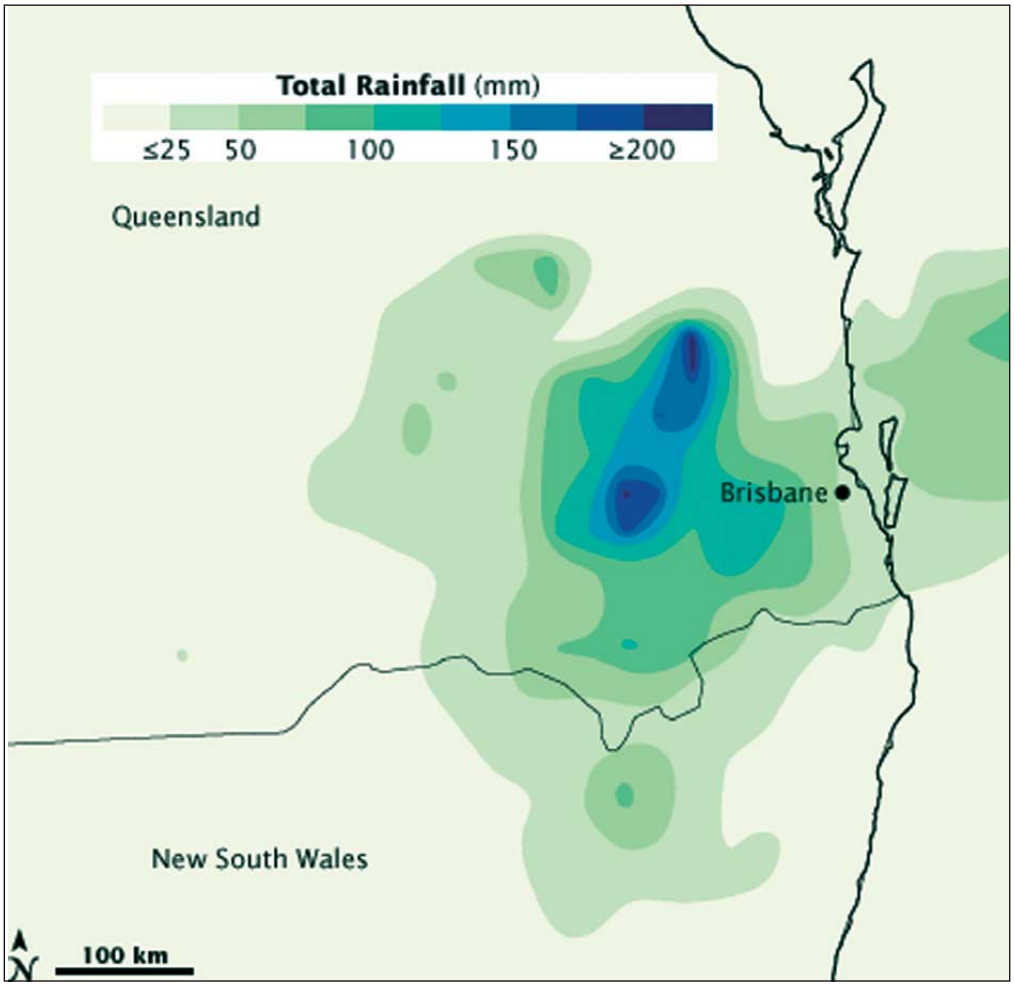

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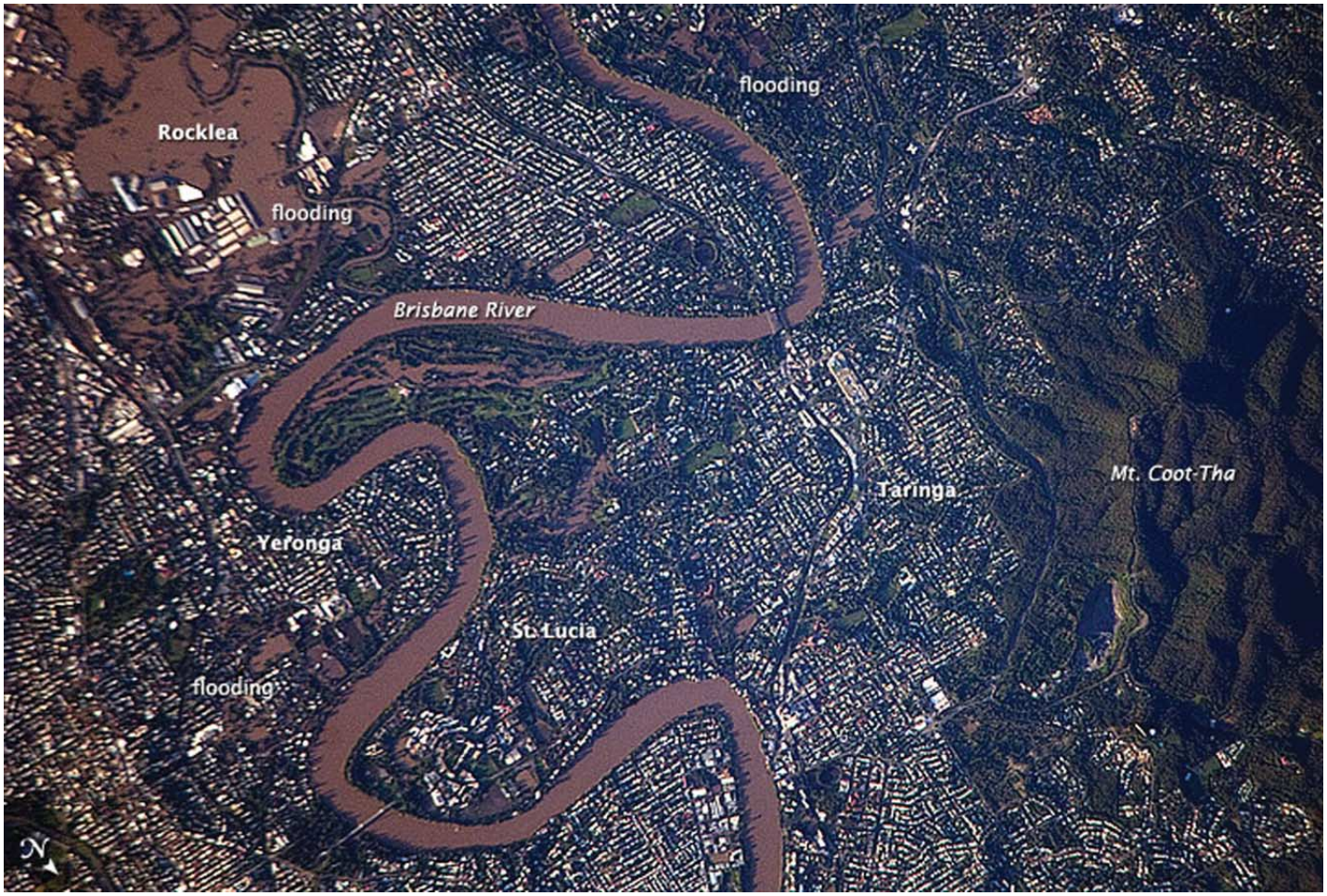


Figure 5 Brisbane River in flood

The human side of the flooding Ipswitch under water

Roos being rescued

Homes under water

Buckled railway lines

Ronse Radio Station

Andre T'Kindt

My name is Andre T'Kindt. I live in the Belgium city of Ronse, some 60 km south west of Brussels and about 40 km from Gent. My first radio licence was ON2KBV, which I obtained in 1989. I continued on to obtain after a further exam to gain a definitive radio licence with callsign ON1LTA. Finally gaining the call sign ON4TKA after further examinations.

I was always interested in FAX reception beginning with the COMMODORE 64 and a small interface connected to a wide band receiver.

I am also very interested in weather satellites, receiving Meteosat at 1.7 GHz and APT on lower frequencies.

The antennas I have are a 1.8m prime focus dish, an omnidirectional antenna and a 2x9 element beam type for lower altitude passes.

The programs used are Wxtoimg and WXtrack

I also receive Slow Scan Television on the 2m band.

Here are some pictures of my shack, my antennas and QSL cards

My antenna tower and 1.8m dish

Above and below examples of my QSL cards

A view of my shack

Remote Imaging of Siberian Oil and Gas Installations

David Painter

Insignia of the Khanty-Mansiysk Autonomous Okrug

Hopefully, your central heating has been working well during the recent cold months and you are sitting comfortably as you read this. When you next switch on your gas central heating, have a small thought for the route your fuel may have taken before reaching your boiler; it may have travelled quite a way before reaching your home.

The World Bank estimates that over 150 billion cubic metres of natural gas are flared or vented annually, an amount worth approximately 30.6 billion dollars, and which is equivalent to 25% of the United States' gas consumption or 30% of the European Union's gas consumption per year. Although moves are afoot to stop the practice, such burning of unwanted residues is still a major source of global pollution and a contributor to global CO_2 emissions. Russia burns off approximately 50 billion cubic meters of mixed gases every year, either as safety releases to reduce well pressures, or as part of the removal of unmarketable condensates and gases.

Many oil and gas production facilities have co-sited 'flares' while others have diesel power-stations which emit diesel exhaust plumes so, in theory, these should be visible in the Metop and NOAA satellite data.

Figure 1- Image of Typical Gas flare
Credit:Otto Energy

I decided to try and locate evidence of flares and exhaust plumes using NOAA and Metop AVHRR imagery of the many oil and gas wells that now litter the frozen Siberian tundra. Other resources were used to confirm their locations and thus provide satellite images of them. By using a combination of AVHRR channels 3, 4 and 5, it should be possible to tease these out from their surrounding terrain and create meaningful false colour images to highlight them.

Not knowing where these locations were, I initially used the AVHRR data to detect f and then verified the target locations by other means. It is surprising just how much information there is on the Internet about locations in the middle of no-where, some perhaps known only to a thousand or so people (and several billion Siberian midges).

Figure 2- Map of Siberia

The map of Siberia above shows areas of Russian oil and gas production. The area that initially interested me was the Khanty-Mansiysk Autonomous Okrug, which covers over 500 00 km^2 of western Siberia and is Russia's largest producer of oil and gas. In 2006, this region exported two billion barrels of oil and gas condensate (liquefied natural gas), most of it exported to western Europe. The map illustrates the remoteness of this operation. The mechanism for transporting the gas to Europe is extensive, and visits some very remote locations along the way.

Not all oil and gas pipelines or installations burn off waste gas and, increasingly, it is considered a waste of money to do so. Mostly, it is the older fields, or those with other unwanted by-products or contaminants, that operate flares. Natural gas is useless as a fuel unless it can be transported to the consumer. Before transportation, water, oil and other condensates are first removed as these can cause the formation of hydrates which can seriously affect the flow through pipelines and plant, and could result in large explosions. The remaining gas is then compressed.

The map in figure 3 (overleaf) gives an indication of the scale of the gas pipeline network across Europe and the remoteness of many of the production locations (though it does not show them all). The major pipelines all start at Urengoy, the worlds second largest gas field complex, and one of the more established (1966). Urengoy gas field produces 260 billion cubic meters of natural gas, more than 5000 tons of condensate and 825 00 tons of oil per year. Thousands of small gas wells feed into a maze of pipes here, most from within the Arctic circle. Six 1.5 metre diameter steel pipes start their trek west at Urengoy, each of the various gas fields along the way adding in their gas at a massive 220 bar pressure. Other

Figure 3 - Russian Pipeline Map

pipelines criss-cross the former Soviet states, importing and exporting as required from the gas main network.

Figure 4 is a Metop image dating from November 28, 2010, showing one of the regions of interest. Note Novaya Zemlya and the Kara Sea in the north and the Ob river running down to Surgut. The location of Urengoy is highlighted. To view the locations of the gas and oil facilities, the image has been zoomed up, and they are denoted by the green/yellow pixels on the processed image. Using Virtual Ocean/Google or other online data, individual facilities can be identified from the Metop image. One such facility is Seliyarovo on the Ob river.

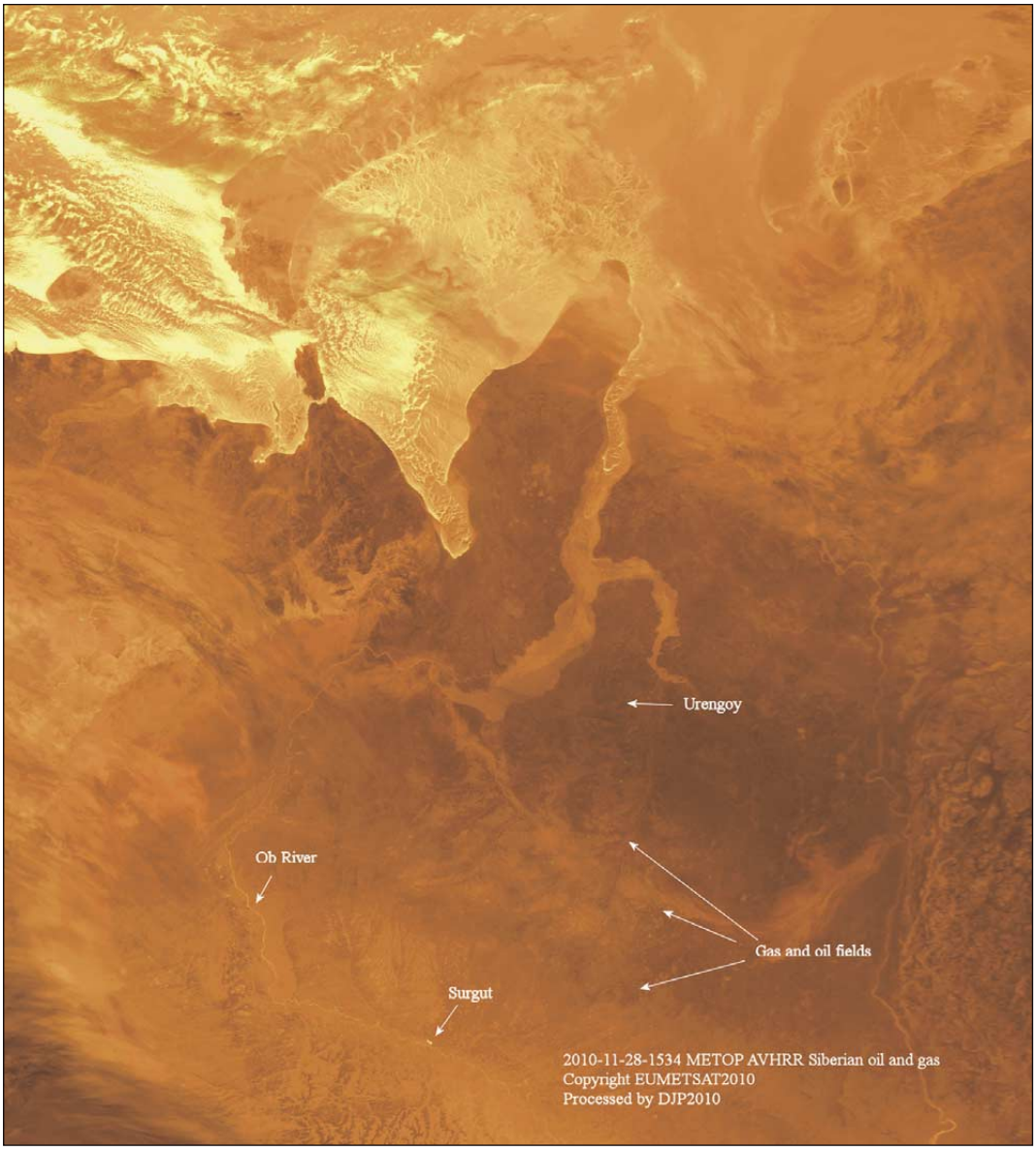


Figure 4 - Siberian Oil and Gas

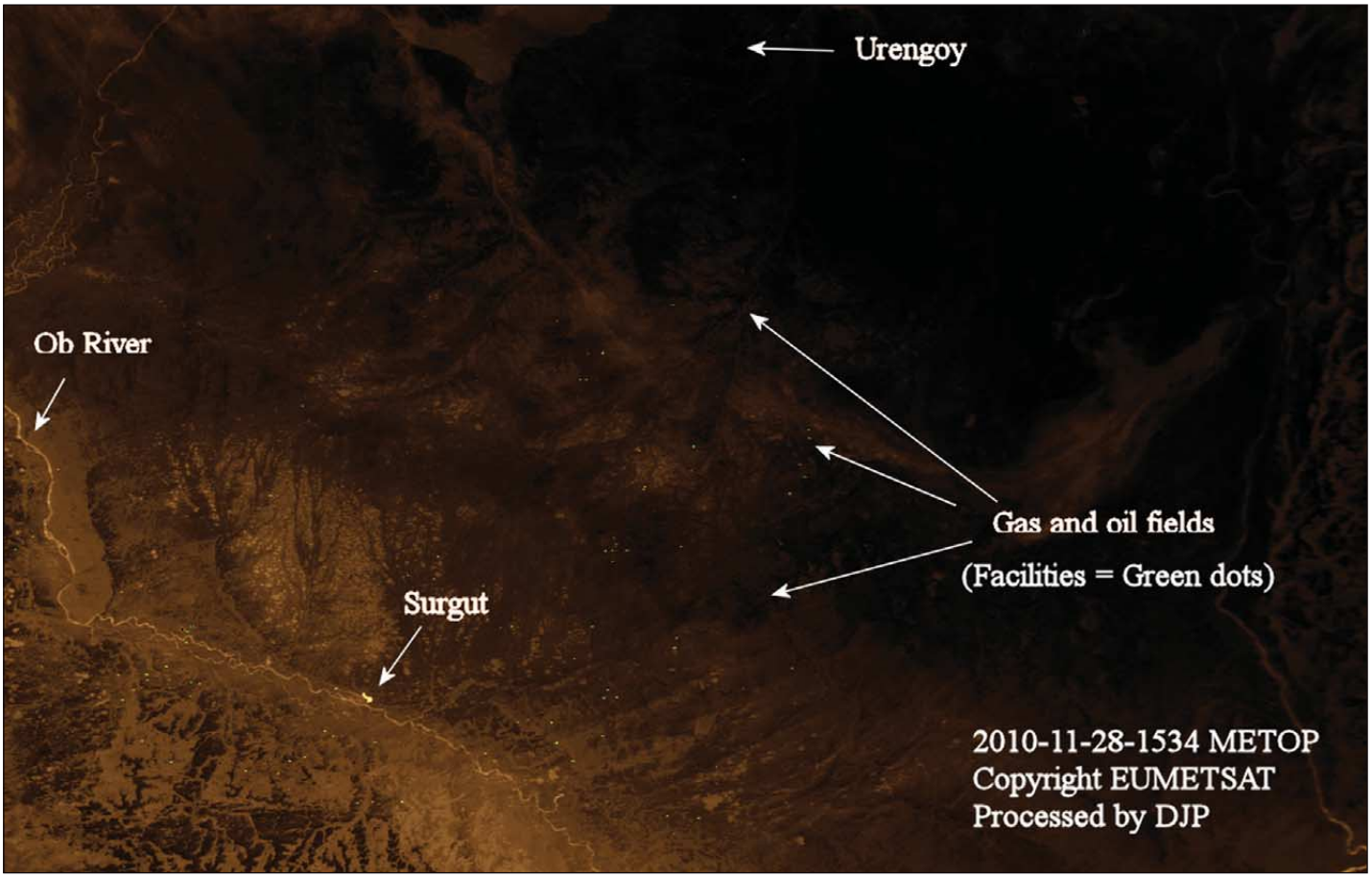


Figure 5 - Siberian Oil and Gas

Figure 5 shows an enlarged region of green/yellow pixels denoting detection of oil and gas wells or other facilities. The city of Surgut is shown. It is evident that some of the wells produce a higher level energy signature than a entire city. Figure 6 shows the Seliyarovo gas production facility and surrounding wells on the River Ob near Surgut. Latitude 61.32° Longitude 70.389°.

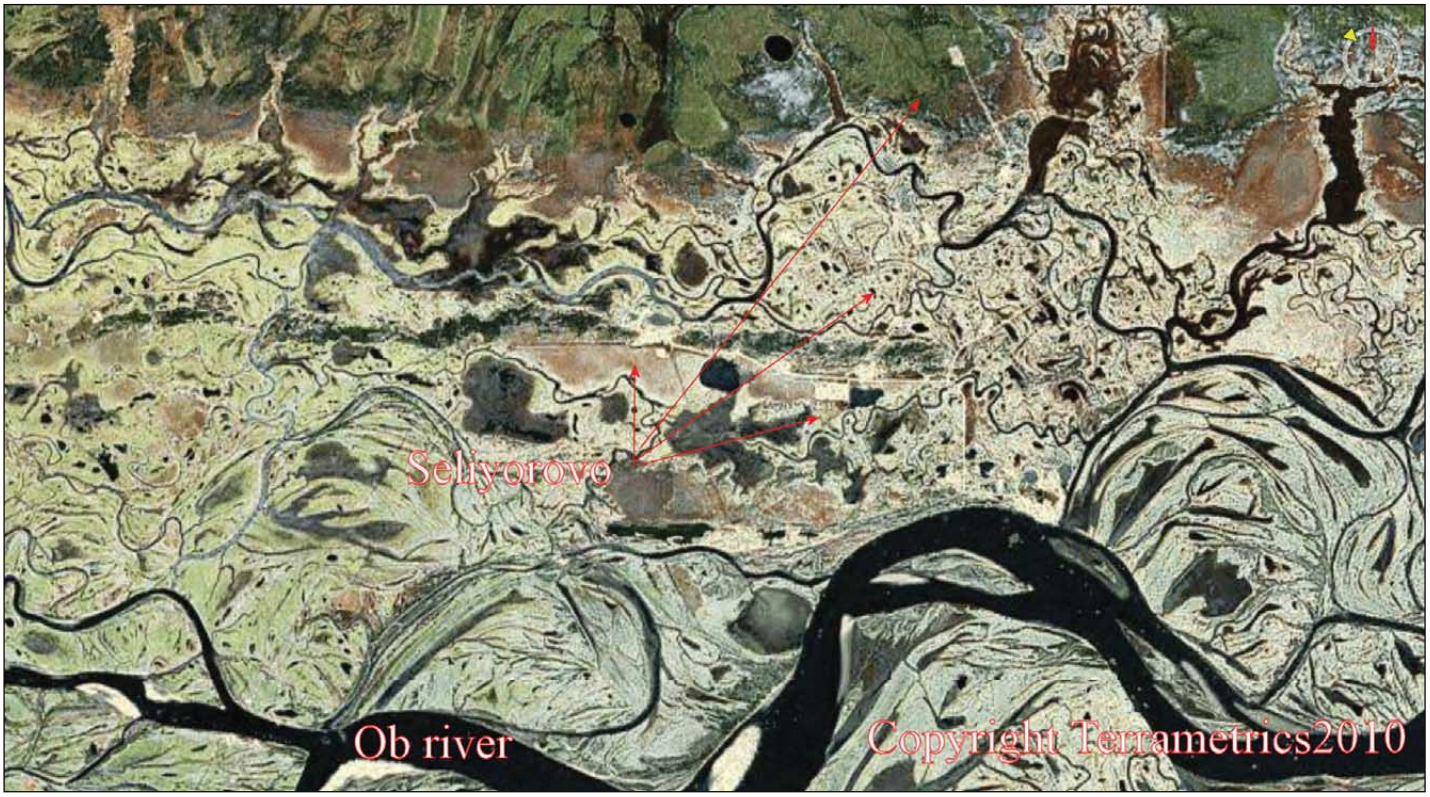


Figure 6 - Sellyarova
Image: © Terrametrics 2010, Geocentre consulting 2010 from Virtual Ocean.

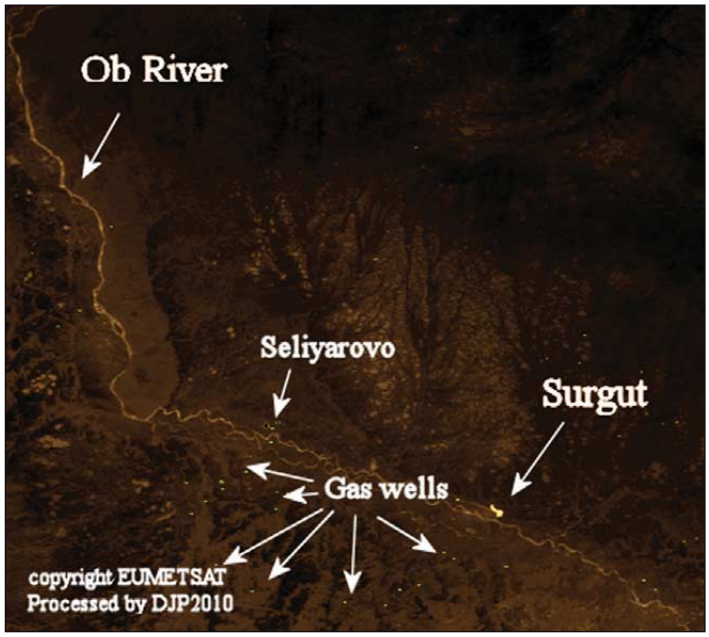


Image 7 - Siberian Oil and Gas

Figure 7 is a much enlarged Metop image showing lighter pixels at locations corresponding to oil and gas wells in Western Siberia.

One of the methods I used to verify the detected locations of gas and oil installations was to overlay the processed Metop image on Google Earth; this was achieved with some manual tweaking of the image geometry, as the projection and orientation of the spacecraft image were unknown. The result indicated that the intensities and shapes of the pixels in the Metop image corresponded very well with the expected ground image features, and with the oil and gas facilities in Google Earth and Virtual Ocean.

In some cases, multiple pixels align exactly with multiple well locations surrounded by barren tundra; in other cases, multiple flare stacks on the Google data corresponded to multiple bright pixels on the Metop data at the same locations.

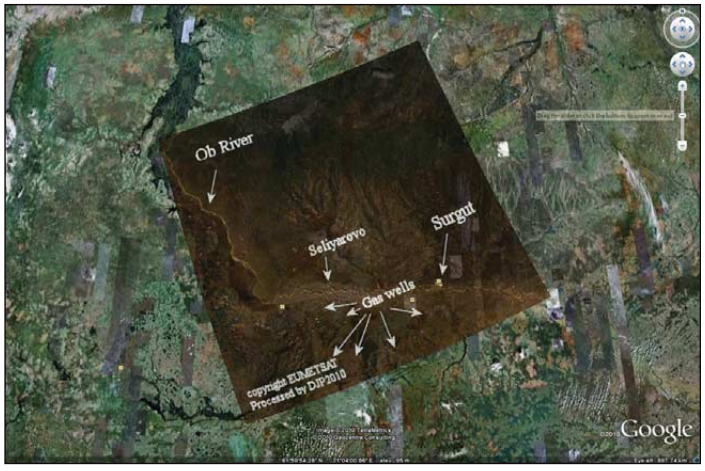


Image 8 - METOP image overlain with *Google* Map

Figure 8 is a Metop image overlain upon Google Earth, showing correlation with other image source data and confirming the locations of brightness pixels that correspond with the locations of oil and gas facilities.

Siberia and other remote locations are littered with these wells and most are visible with care from AVHRR images. It is possible that these could be remotely monitored by spacecraft sensors for emissions once their locations are known.

Vankor

An unexpected discovery for me was the location of the new Vankor gas field, which produces a massive infrared signature; this may possibly be due to the fact that this facility is still in development and not yet fully connected to the pipe network. The Vankor field is estimated to have reserves of 520 million metric tons of oil and 95 billion cubic meters of natural gas. Production was launched in August 2009. The target for annual production at the field is 510 thousand barrels per day, or 25.5 million tonnes of oil per year (about 5% of total Russian oil production). Oil from Vankor is one of the main inputs to the Eastern Siberia – Pacific Ocean pipeline.

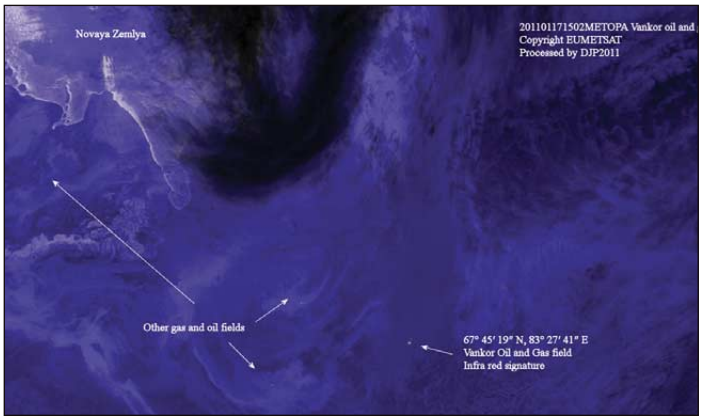


Figure 9 - Flaring from the Vankor Oilfield

Figure 9 is a greyscaled Metop image showing the northern location of the Vankor Oil and gas field. Note the magnitude of the infra-red signature indicating massive gas flaring taking place within the Arctic circle.

Figure 10 shows the Vankor oil production facility under construction in northern Siberia. The facility is currently scaling up production. The Vankor oil and gas field is the biggest discovered and brought into production in Russia in the last 25 years.

A total of 142 wells had been drilled at Vankor by the end of 2009, including 119 production and injection wells. Construction work completed at the field included 1,685 infrastructure facilities, 148 m of field pipe-work, 60 km of gas pipe work, 120 km of roads, storage facilities, a mini-refinery and several up-to-date shift camps—all within the Arctic circle.

Conclusion

The NOAA and METOP polar orbiting satellites can be used to locate, with reasonable accuracy, the locations of oil and gas facilities through their differentially large infra-red signatures. Resolution of the signals detected will obviously only be accurate to an image pixel (approximately 5 km), but in remote locations such as this it is not so much of a problem.

Next time you switch on your gas, consider the distance it may have travelled, and from where it could have come from.

Continued page 44

Figure 10 - Construction of the Vankor Facility

Cover and Full Page Images

Front Cover

Cyclone Yasi off Queensland NOAA 19 at 03:48 UT on February 2, 2011. Processed in David Taylor's HRPT Reader to display vegetation.

Inside Front Cover

David Taylor sent in this image from NOAA-19, showing the frozen UK last December 6.

Page 23

Keith Fraser NOAA18 APT for Jan-21-2011 1858Z. Winter ice is starting to grip North America. Top left, the Great Slave Lake, Lake Athabasca is below, centre is Hudson Bay and James Bay, all frozen solid. Lake Erie is 80% ice. The interesting feature is that the lake effect clouds from Lake Superior are reaching down across Lakes Huron and Ontario to New York City. The temperature here in Buffalo NY should drop to minus 20C , so even deep Lake Superior will start to freeze soon.

Page 37 (Below)

George Newport sent in this image of Typhoon Megi.

Page 38

ESA's Metop-A satellite captured this splendid channel-2 AVHRR image of Scotland on February 10, 2011. Snow is clearly visible over the Highlands as the clouds dispersed to provide a day's relief during a spell of gloomy wet weather.

Page 43

The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite collected this view of New England, the Canadian Maritimes, and coastal waters at 15:25 UT on January 24, 2011. Lines of clouds stretch from northwest to southeast over the North Atlantic, while the relatively cloudless skies over land afford a peek at the snow that blanketed the northeast just a few days earlier. Cloud streets form when cold air blows over warmer waters, while a warmer air layer (temperature inversion) rests above both. The comparatively warm waters of the ocean give up heat and moisture to the overlying cold air mass and thermals of warmed air rise through the atmosphere until they reach the inversion layer. Here, the air rolls over like the circulation in a pot of boiling water, its water vapour cooling and condensing into flat-based, fluffy-topped cumulus clouds that line up parallel with the wind.

Credit: NASA image by Jeff Schmaltz, MODIS Rapid Response Team, GSFC

Inside Back Cover

This image of Southern Europe was prepared using David Taylor's MODIS Viewer program, which has combined channels 1 and 2 (vegetation mode). Resolution is one km/pixel , but it is possible to interpolate down to 250 m/pixel using this software. See Computer Corner (p.41) for a full explanation.

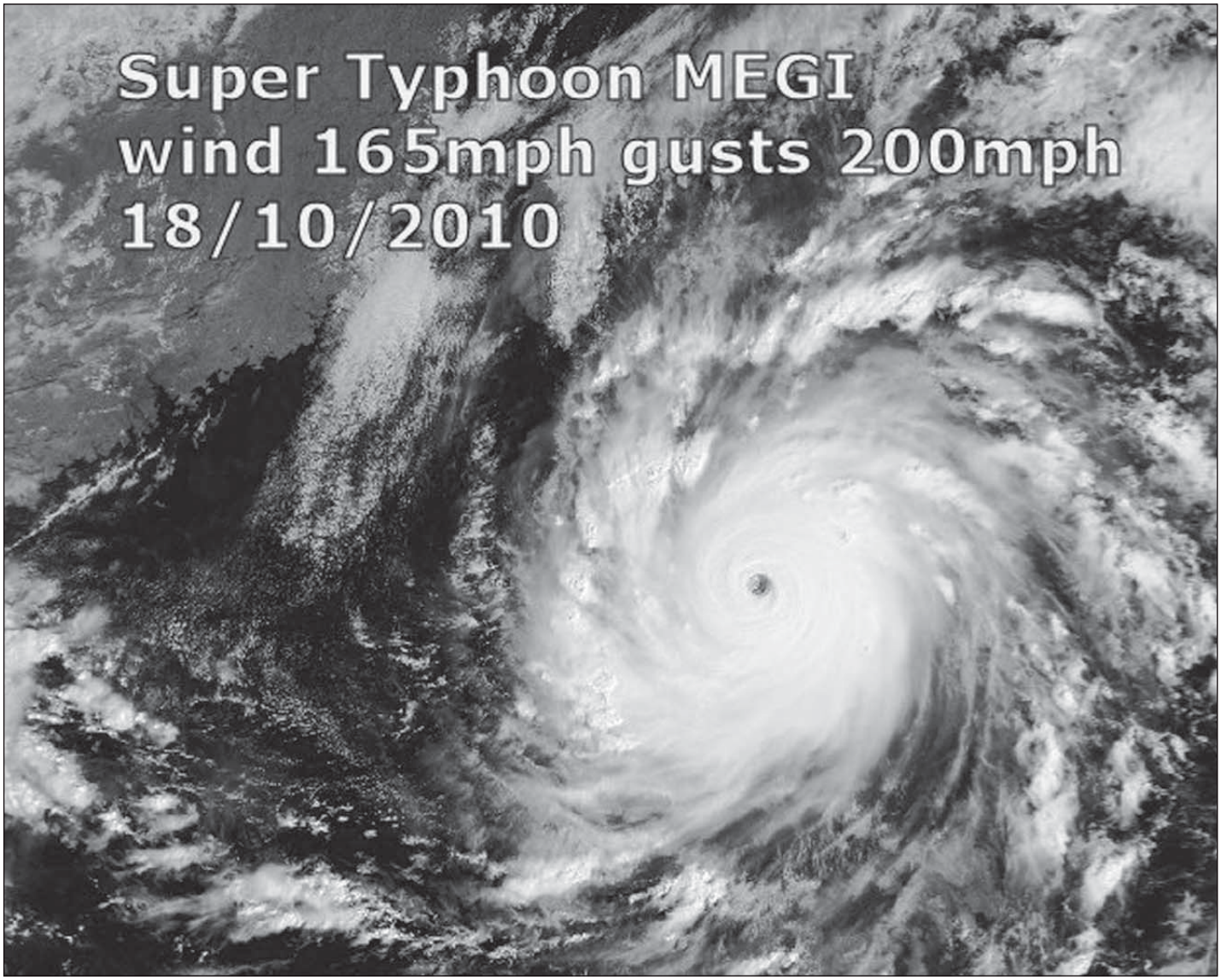
Back Cover

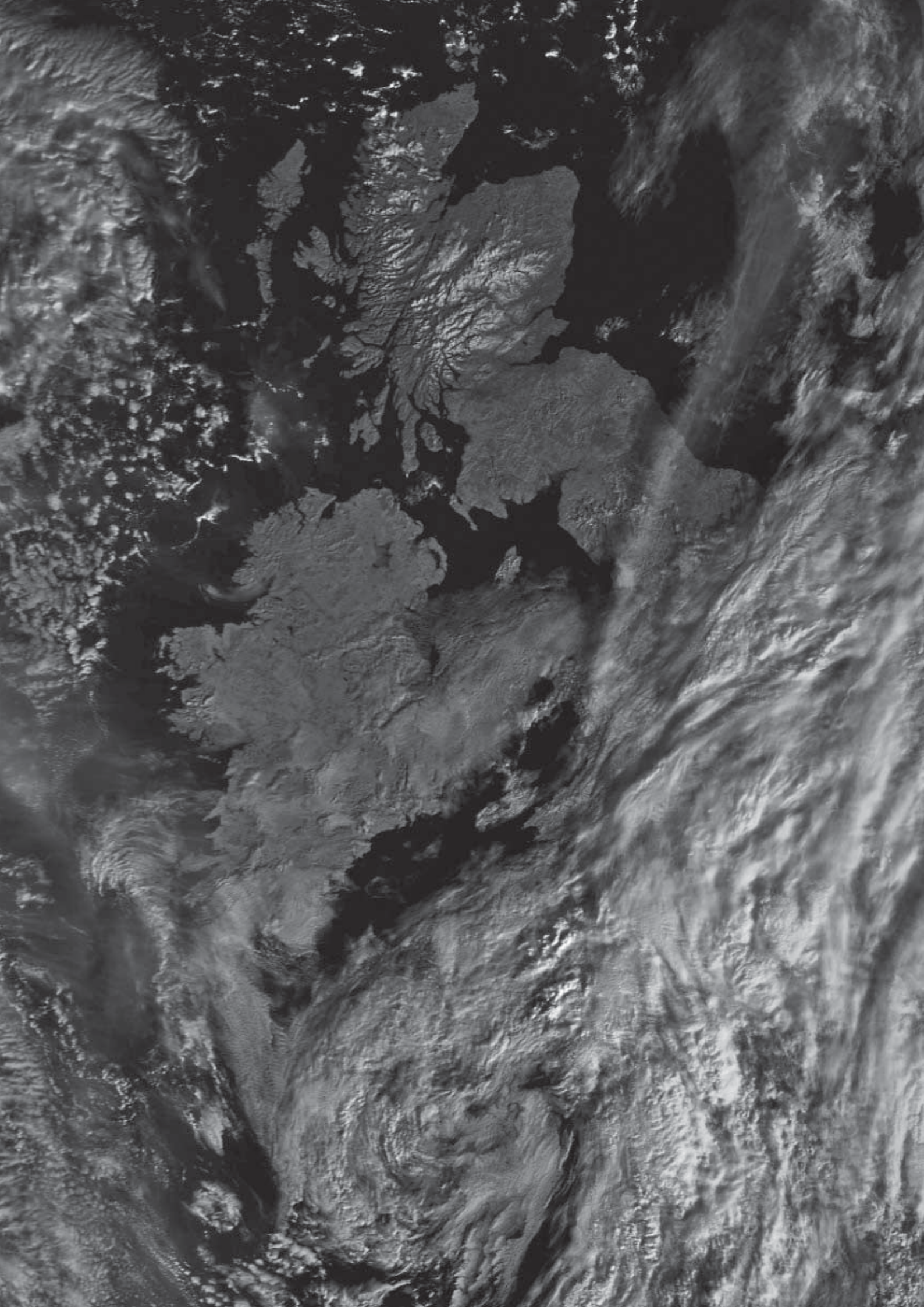
David Painter provided this 2010-09-02-0158 Metop-A image showing Hurricane Earl 'refuelling' from the Gulf Stream before making landfall.

Note the sea through the eye of the storm, and how the warm waters of the gulf stream are as "warm" as the man made energy output.

Also note black cloud rising into a cleansed atmosphere from New York.

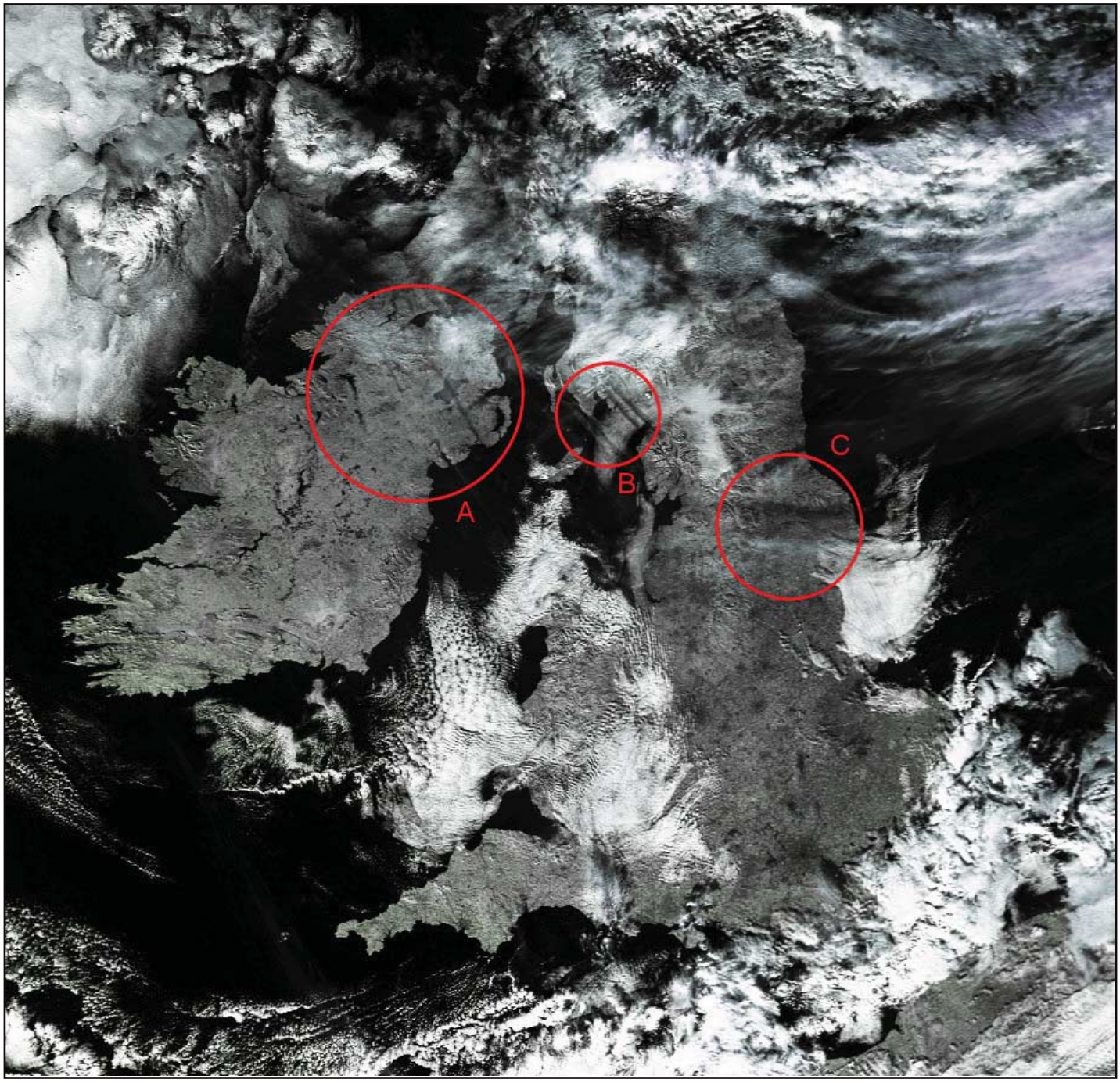
Yellow is Warmer, Red is colder.





The Challenge: At what altitude are the aircraft flying?

David Taylor



Here's an image taken around 13:12 UTC on 2011 Jan 21 by NOAA-19. It's a false-colour image processed from EUMETSAT EARS AVHRR data - available to anyone with a EUMETCast system. Yes, it's another UK image, but there is a challenge with this image!

The challenge is: At what altitude are the aircraft flying? In the three circled regions, you will see two bands - a light band due to an aircraft condensation trail, and a dark band to the north or east of the trail, which is the shadow of the trail in the ground. At (B) there appear to be two trails, and two shadows. Given that the pixel spacing is 1.09km (or by measurements of known ground locations in the image), and by finding the angle of elevation of the sun at that time, can you work out at what altitude the aircraft trails were? Is your answer "reasonable". And if anyone is running the Plane Plotter software, would you like to venture what the aircraft were? Track (C) looks as if it's been around for some time judging by the lateral spread.

FEEDBACK

The Column for Readers' Letters and Queries

email: geoeditor@geo-web.org.uk

Dear Francis,

Having had an interest in weather satellite information for the last 10 years during which time I have mainly used David Taylor's programs.

Having read your article in the last GEO report I am seeking advice from yourself regarding the Envi-Ham project. You make a very serious point about clogging up ESRIN's system and not applying for a licence unless you are serious about participating in the project with the volume of information it generates.

I have delayed applying thinking I might do so later or when I retire and I have more time to devote to such things. Now you point out that 70 of only 100 licenses have been taken so what advice can you give me on how to proceed ? Do I try to register or delay and possibly miss out.

It was something I was looking forward to for the future.

Many thanks, Regards

Richard Johnson

Dear Richard,

Thanks for your email regarding the Envi-Ham project. I'm pleased you have taken an interest. I am in semi-regular touch with the project and I know that now 100 licenses have been issued. Agh!

The good news is a further 50 licenses have been earmarked for future applicants. I have written some notes for the coming (this) GEO Quarterly along these lines. I think there may be 10 or 12 UK license holders all of whom have joined via the GEO connection. It's very difficult for me to offer advice to you - except if you are sincere apply for your license now even if your intention is to fully exploit it at a later date. At least you will be in the system. Just to note you must have a one metre dish or better. I tried with 85 cm and failed. The software side is a black art to me but with help I have been running Envi-Ham successfully for 18 months. Go for it! Please keep in touch.

Kind regards

Francis

Dear Francis,

Tut, tut, tut, Francis! What's the use of your having the finest 'Dictionary of Weather', when you don't sit down and read it? (You do read dictionaries, don't you? I do.)

The cloud is a banner cloud, which forms in the lee of an abrupt peak in the presence of a suitable humid airstream. In this case the wind is known as the levanter, an easterly wind _known_ for producing a banner cloud behind the Rock.

The actual mechanism probably has two components. There is a lee eddy behind the peak, raising air to above the condensation level. In addition, there is probably a reduction in air pressure, again behind the peak, which (as you suggest) would be similar to the reduction in pressure above the wing of an aircraft, or the reduction in the centre of wing vortices that produces the two trails of cloud in a condensation trail.

Look up 'banner cloud' and 'levanter' !

Yours,

Storm Dunlop

Dear Peter Green,

Domestic problems have meant that I have only just read the September issue of GEO Quarterly. May I make a few points?

First, please, please, try to give the dates of any images. The image on p.7 from Jordi Mas Bonet could be on any date. As someone who is primarily interested in the meteorological uses of satellite images, this is frustrating - and especially so, if it shows some feature that I might like to use in one of my books.

Second, again please do encourage people to give dates with the months _in letters_. I am just having a bit of a nightmare sorting out a whole lot of material where there is a mixture of European- and US-style numerical dates. Is it not possible to encourage members to use the internationally recognised, scientific method of specifying the date and time of phenomena? (This is actually a legally acceptable method in the UK.) One simply gives the information in decreasing order of size: year, month (in letters - in full or abbreviated), day, hour (24-hour clock), minutes, seconds (and fractions thereof if necessary). So today and the time I am writing this are: 2010 Nov.29 07:55 ... Astronomers (amateur and professional) have done this for years and years, but meteorologists and others seem strangely reluctant.

Third, on a specific note, the details on p.3 of the full-page image on p.15 appear to be a quote from someone. But who? No date, no time, nobody!

Best wishes,
Yours,
Storm Dunlop

Ed: Thank you for your comments, constructive comments are always welcome, the quote page 3 was from sent in by David Taylor

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Dear Francis,

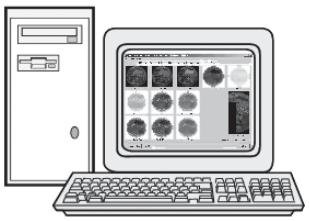
I just sent in my Paypal payment for the renewal. I guess my excuse for not renewing sooner was that my antenna got corroded and the images were very noisy so I turned it off. I have just rebuilt my antenna and I am receiving images again! See at http://home.comcast.net/~tegwilym/wxtoimg I have to figure out some noise problems, but it cleared up a lot when it started raining. Anyway, you mentioned in your letter that you could send me a disk and a copy of the latest Quarterly? I'd be interested in both of these. I've been doing some astronomy also, and put up a new website with my images. http://tegwilym.zenfolio.com.

So when it is clear I look up much of the time from Seattle, but I look down at the clouds from NOAA..

Thanks! Tom Gwilym, Renton, USA

Continued on page 42

Computer Corner



Douglas Deans - dsdeans@btinternet.com

Although Windows-7 has been well received by both the industry and the public, there is no doubt that many people will probably stay with their existing operating system (OS): if things are running well, then why not? However, users should be aware that Microsoft, understandably, will not continue to support some older systems indefinitely and this means that those systems will not receive security updates.

All version of Windows have what Microsoft refers to as 'support lifecycles'; so if you are running a version of Windows for which support has ceased, you are taking a big risk and leaving yourself open to attack.

It is important that, where possible, you keep updating and installing the latest security updates, including up-to-date Service Packs (SP).

At the time of writing, XP users running SP2 are no longer being issued with updates and are therefore vulnerable whilst those on SP3 will be supported until at least April 14, 2014. So please be careful.

Just a quick further report on my mini-computer, details of which were provided in my previous column. It continues to perform well, without any issues, and the summer heat has passed without incident (and almost forgotten following the 2.5 feet of snow and temperatures down to -15°C since late November!). So my one slight concern about overheating has proved groundless.

You will remember that, in my last column, I explained that the only fan in the mini-computer is a small power supply fan and that the Intel Atom chip is cooled passively by a large heatsink. Of course the big advantage of the unit is that it is very quiet and is an ideal candidate for using overnight on EUMETCast systems. Another useful feature for that use is its very low power consumption, something we pensioners have to think about seriously. Under present tariffs, it will be less than 10p for a 24 hour run. Quite remarkable for such a system.

Again as I mentioned before, whilst it is quite possible to run EUMETCast on a single modern computer along with all the other processing and day-to-day chores, best performances are still achieved with a 2-computer system. Do remember that, as you are likely to be using a simple network, you do not need to double up on mouse, keyboard and monitor if you choose to do this. There are numerous Virtual Network Computing (VNC) programs available and many are free. This allows you to display and interact with the screen of another computer via your own network (and also the Internet if you so wish). You can also use KVM switches but, to be honest, they are very cumbersome, cluttering the back of the computer with cables. In my opinion (and I have used both for long periods), the VNC route is by far the easiest and neatest solution. At the moment I use the free version of UltraVNC, which works well, allowing me to use the mouse and keyboard of my main computer to control my EUMETCast one too. Of course, most of the time the EUMETCast computer is just quietly getting on with its job with no intervention required. For those interested in UltraVNC, more information and download options can be found at

http://www.uvnc.com/

There are, of course, many other equally good programs, although I have not used them myself.

This quarter I will be continuing with my new section detailing file and data types on the EUMETCast data channels. So far, I have looked at Channels 1, 2, 3 and 5, Now I will deal with Channel 4, a considerably simpler one than Channel 3. I make no apologies for repeating that I hope readers will consider building up a comprehensive package of the EUMETCast channel filetypes as the project continues. This is a unique opportunity to have something that is not available elsewhere in this format.

EUMETSAT Data Channel 4

This channel carries a range of data which seem to have no correlation.

The first of this data is FSD. You will remember from GEO 28 that Channel 3 carries 3-hourly GOES-W (GOES 11), 3-hourly GOES-E (GOES 13) and 3-hourly MTSAT-2 imagery. However, the additional FSD data needed to make the service hourly for these satellites is provided on Channel 4. So, for example, channel 3 will provide the 00, 03, 06, 09 scans whilst the in-between scans, for 01, 02, 04, 05 etc. will be provided on Channel 4.

GOES-E, GOES-W and MTSAT-2 data are provided at 4 wavelengths. Here are examples of the typical file types provided for the FSD service on Channel 4.

L-000-MSG2_-GOES13_____-00_7_075W-PRO___-201101150100-_

L-000-MSG2_-GOES13_____-00_7_075W-000001___-201101150100-C_

Repeated for segments 000002 – 000007 inclusive and for each of the other 3 wavelengths.

L-000-MSG2_-GOES11_____-00_7_135W-PRO___-201101150100-_

L-000-MSG2_-GOES11_____-00_7_135W-000001___-201101150100-C_

Repeated for segments 000002 – 000007 inclusive and for each of the other 3 wavelengths.

L-000-MSG2_-MTSAT2_____-00_7_145E-PRO___-201101150100-_

L-000-MSG2_-MTSAT2_____-00_7_145E_000001___-201101150100-C_

Repeated for segments 000002 – 000006 inclusive and for each of the other 3 wavelengths.

The next data to appear on this channel are meteorological, specifically the Regional Instability Index derived from Meteosat 9. Atmospheric air mass instability has been developed by the SAF in support of Nowcasting and Very Short Range Forecasting but produced at EUMETSAT. This product is provided to help in Nowcasting (forecasting up to six hours) severe weather. This is the pixel-based version of the Global Instability Index (GII) which I described last quarter as part of the meteorological data sent on Channel 3. It has always puzzled me why the RII is on Channel 4 whilst much of the other MPEF data is on Channel 3 but, when questioned, EUMETSAT advised me it was because RII covers only Europe, and is produced

as a subset of the MSG image disk over Europe.

Typical file names are

L-000-MSG2_-MPEF_____-RII____-PRO____201101142315-_
L-000-MSG2_-MPEF_____-RII____-000001____201101142315-_

Each file is approximately 1.6 MB and there are 96 files per day.

The next data on this channel consists of Polar Wind files.

MODIS and AVHRR data are used to retrieve tropospheric winds (speed, direction, and height) in the polar regions by tracking cloud and water vapour features. Much of this information cannot be generated fast enough for use in early NWP model runs due to the delay in obtaining MODIS and AVHRR data (typically 1-4 hours). To improve the timeliness of the wind data, direct broadcast (DB) sites provide real-time access to water vapour winds (wvap) BUFR files from MODIS data, as well as IR cloud-drift winds (cdft) BUFR files from both MODIS and AVHRR data.

Typical file names are

satwnd.BUFRcdft.N19.D2011019.T0835Z.PBRW.bufr

satwnd.BUFRcdft.AQUA.D2011019.T0257Z.MCMR.bufr

satwnd.BUFRcdft.TERRA.D2011019.T0804Z.PAFA.bufr

satwnd.BUFRwvap.AQUA.D2011019.T0257Z.MCMR.bufr

satwnd.BUFRwvap.TERRA.D2011019.T0804Z.PAFA.bufr

File sizes vary considerably but average about 50 kB. There are about 108 files per day.

Finally, and keeping the best until the end, this channel also provides MODIS Aqua and Terra level-1 radiance data and geo-location data. The radiance data is spatially thinned and is a subset of channels covering Europe, the North Atlantic and the northern polar region. The geographic thinning means that the image file locations comply strictly with the following co-ordinates.

West bound longitude -60°

East bound longitude - 45°

North bound latitude - 65°

South bound latitude - 25°

18 channels are provided and, whilst this is not the full complement of the satellite, it is more than enough to provide superb imagery and a wide range of derived images.

Typical file name is

thin_MOD021KM.P2011014.2130.hdf

File sizes vary greatly, but full 5 minute segments containing visible imagery can be larger than 85 MB. There are approximately 78 files per day.

Also on channel-4 is high-resolution MODIS geo-location data. This product is intended to be used in conjunction with the level-1 calibrated radiances but some viewing programs such as David Taylor's Modis Viewer do not need this data.

Typical file name is

thin_MOD03.P2011014.2130.hdf

File sizes are approximately 25 MB and as for the radiance files there are about 78 per day.

To demonstrate the quality of the MODIS images, please see the image of Southern Europe reproduced on the inside back cover. The image has been prepared using David Taylor's Modis Viewer program and has combined channels to provide the vegetation mode. The image shown has 1-km resolution but it is possible to interpolate images down to 250 m using this software. Obvious things to note in the image are snow on the Alps, the detail and lack of vegetation around Mount Etna on Sicily and the clarity of topography that has been achieved using the 1-km setting.

As well as continuing to build up a composite channel-by-channel list, I will of course be advising of any changes to channels which I have already dealt with in previous Quarterlies. I have one such update this quarter. The LRIT service, which was listed under my channel-3 description last time, has, since January 18, 2011, been withdrawn from the EUMETCast system. It is still available via the EUMETSAT ftp service and, of course, as direct readout from Meteosat-9. Given the quality, frequency of scans, and number of channels provided in the HRIT service, not to mention the rapid scan service from Meteosat-8, it does seem likely that many subscribers would not have been using the EUMETSAT LRIT service.

Program Updates.

David Taylor's programs (latest releases).

Remember that the list below is for fully tested releases and does not include the latest beta (or alpha) versions currently on test. Those can also be downloaded from David's site.

ATOVS Reader	v 1.2.2
AVHRR Manager	v 2.0.6
BUFR Viewer	v 1.1.6
CMA Viewer	v 1.2.0
DWDSAT HRPT Viewer	v 1.2.4
GeoSatSignal	v 7.2.0
GRIB Viewer	v 2.3.10
GroundMap	v 2.1.6
HDF Viewer	v 1.4.4
HRPT Reader	v 2.9.6
Kepler Manager	v 1.4.0
MapToGeo	v 1.1.8
Metop Manager	v 1.4.8
MODIS L1 and Fire Viewer	v 1.0.4
MSG Animator	v 2.5.44
MSG Data Manager	v 2.5.44
PassControl	v 3.2.4
SatSignal	v 5.2.2
Sea-Ice & SST Viewer	v 1.4.2
Wxtrack	v 3.8.10

To learn more about these programs and to download the latest updates please go to:

http://www.satsignal.eu

Continued from page 40

Dear Tom,

Thanks for your email it was great to hear from you and pleased your back both receiving APT and as a GEO member. As promised I will send you the disc containing back issues of our Quarterly together with a recent printed Quarterly. I am anxious to learn any news about NOAA's future satellite programmes and reception of weather satellites in the USA and the rest of the world so please keep in touch with any personal reports and news.

Regards, Francis

Full Meridian of Glory: Perilous Adventures in the Competition to Measure the Earth

Paul Murdin, Copernicus Books (Springer Science) 2009, ISBN 978-0-387-75534-2, 187 pp. £15.19.

The observation of Earth is as old as mankind, but the science of Earth observation is modern. In the second half of the 17th century, surveyors set out to map France using triangulation and astronomical observations. As part of this process a meridian was established through Paris. The meridian itself was of considerable scientific interest because differences in the length of one degree of latitude along it would enable the shape of the Earth to be calculated.. The accuracy of the measurements depended, of course, on the quality of the instruments used and on the mathematical abilities of the scientists. But however accurately measured, changes over short distances were of limited use. The surveyors had to extend their activities further towards the north pole and the equator. They had to contend with fearful hazards on mountain tops, arctic weather conditions in Lapland, suspicions on the part of local residents and a shipwreck on the way home. In Latin America, not only were the terrain and climate hostile, but also the local inhabitants and the Spanish authorities. In the Mediterranean, the surveyors again encountered hostile locals, plus brigands, pirates and the Royal Navy's blockades. Science then, as now, was embedded in—and a product of—national and geopolitical processes as well as the rivalries and clashing *egos* of scientists and their patrons. The ambitions of Louis XIV and the beginnings of the scientific revolution were background to the early work, but the French Revolution and Napoleonic wars plus the colonial aspirations of the European powers provided the context within which the major scientific endeavours were undertaken. Making observations from hilltops and signalling between them are dangerous activities in times of political turbulence.

The French Revolution sought to establish an age of reason, although many scientists had problems because they had, or appeared to have, aristocratic origins. The new governments wished to regulate not only local administration and the calendar but coinage and weights and measures. Thus the meridian became important, especially because its length was to provide the basis for a 'rational' or 'natural' unit of length.. The metre was to be one ten millionth of the distance from the pole to the equator, but this depended on which meridian was used because, as we now know, Earth is not a regular sphere. The length of the meridian differs at various longitudes, so the metre is, in a sense, arbitrary and not universal, being based on a calculation of the length of the Paris meridian.

Murdin blends serious scientific discussion with a series of adventure stories—for measuring the meridian was indeed a series of perilous adventures, spread over many years. The latter part of his book tells a slightly more prosaic story but an extremely interesting one nevertheless. With the extensions of empires, the beginnings of globalisation and transcontinental railway travel, there came a need to standardise time measurement and to harmonise diverse national chart and mapping systems to a common datum. This happened late in the 19th century. How Greenwich rather than Paris emerged as the Prime Meridian is another interesting tale well told by the author.

Today, satellites enable us to measure the Earth with great accuracy, and we see that latitude can no longer be regarded as fixed because the polar axis rotates and continents drift. The 'true' Prime Meridian no longer lies along the line of the original transit circle at Greenwich but passes through the car park of the tearoom some 60 metres away. There is no active observation or timekeeping at either Greenwich or the Paris Observatory, both of which are now simply sites of historical interest. But they both have a tale to tell and Murdin tells it in this highly readable book which I imagine every member of GEO will enjoy. A cracking good read.

Robert Moore

Siberian Oil and Gas continued from page 37

References

Quite a useful site for more exotic locations travel
http://iguide.travel/Western_Siberia#/Map

Khanty Mansiysk
http://www.admhmao.ru/english/obsvedE/frame5.htm

Oil production

http://www.rogtecmagazine.com/2010/03/blackbourn-reports-western-siberia.html
http://www.rogtecmagazine.com/uploaded_images/Picture-1-720819.jpg
http://www.eegas.com/photos.htm
http://www.theodora.com/pipelines/russia_former_soviet_union_pipelines.html
http://www.theodora.com/pipelines/russia_ukraine_belarus_baltic_republics_pipelines_map.jpg

Oil fields

http://en.wikipedia.org/wiki/Urengoy_gas_field
http://en.wikipedia.org/wiki/Vankor_Field
http://www.rosneft.com/Upstream/ProductionAndDevelopment/eastern_siberia/vankorneft/
http://www.nornik.ru/en/about/

Other

http://en.wikipedia.org/wiki/Gas_flare
http://news.mongabay.com/bioenergy/2007/09/first-global-satellite-survey-of-gas.html

Climate Week

The Met Office is proud to be the lead science advisor for Climate Week, a national occasion highlighting the efforts being made to help combat climate change.

Climate Week will shine a spotlight on the many positive steps already being taken in workplaces and communities across Britain.

Thousands of businesses, charities, schools, councils and others will run events throughout Climate Week, which takes place during 21-27 March 2011. Tesco is the headline sponsor of Climate Week and it will be promoting this event throughout the country.

People will demonstrate what can be achieved, share ideas and encourage thousands more to act during the rest of the year.

Our role as lead science advisor is to explain some of the key science issues around climate change, answering questions such as 'What is the climate system?' and 'How does the weather drive our climate?'.

The climate section of our website provides information and resources to help you understand more about our climate, climate science and climate change. Keep visiting our website regularly to see the latest news and features.

Climate Week takes place 21-27 March 2011. For more information about how you can get involved visit:

www.climateweek.com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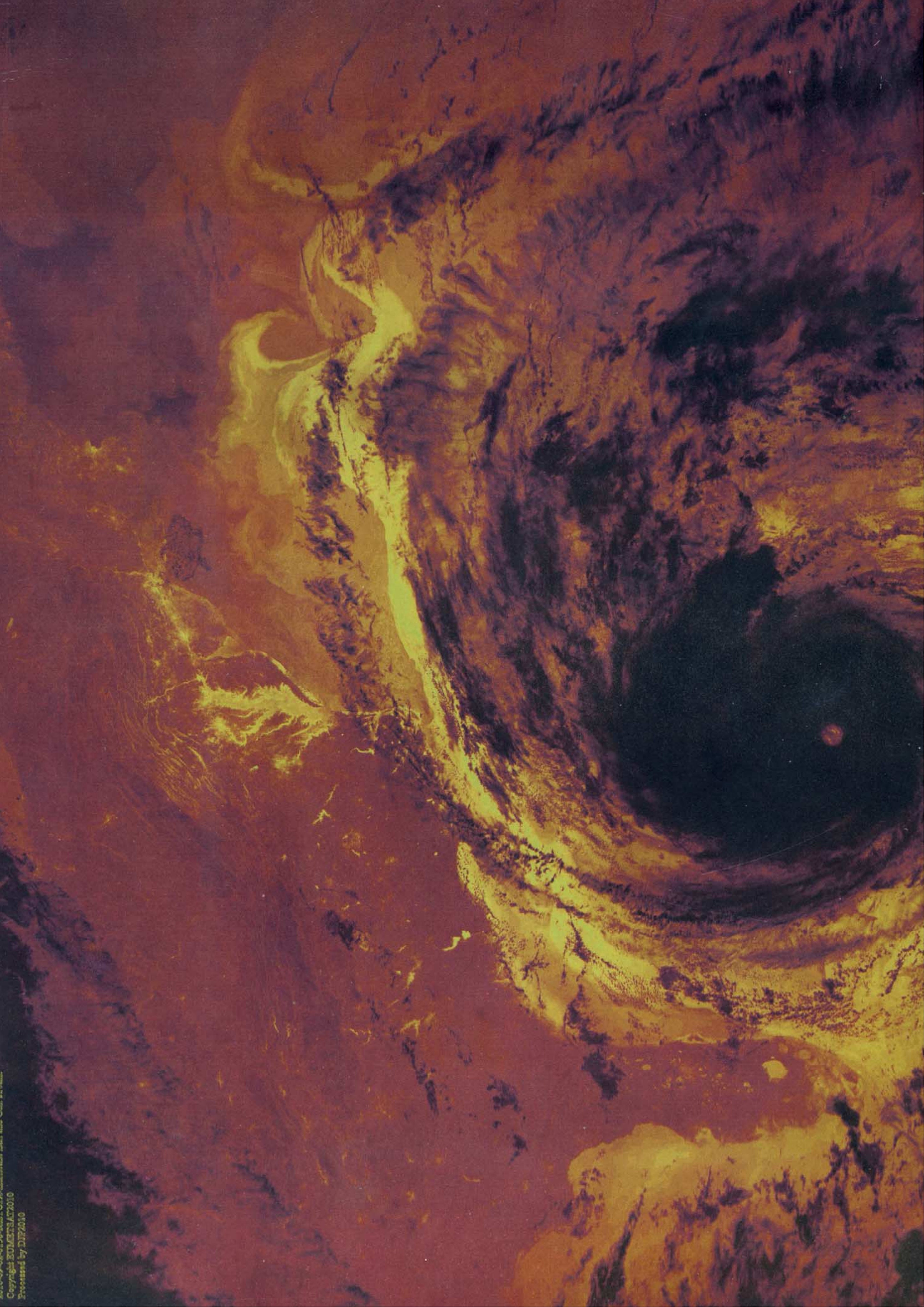
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