Group for Earth Observation

When was GEO formed?

GEO was formed in the UK during November 2003

GEO's Aims and Objectives

- To promote live reception of weather satellites for ***amateur*** and ***educational*** users.
- To ***represent the interests*** of the above users with appropriate national and international ***agencies.***
- To promote ***self-education*** in satellite reception and imaging in the amateur and educational sectors.
- To publish an informative, quarterly ***colour magazine***, devoted to Earth imaging and weather satellites.

GEO

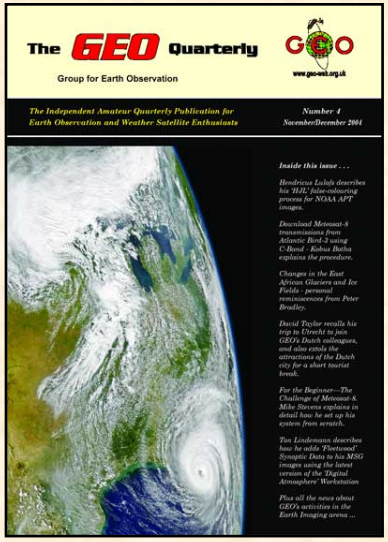
Group for Earth Observation

GEO Quarterly

No 1
March 2004

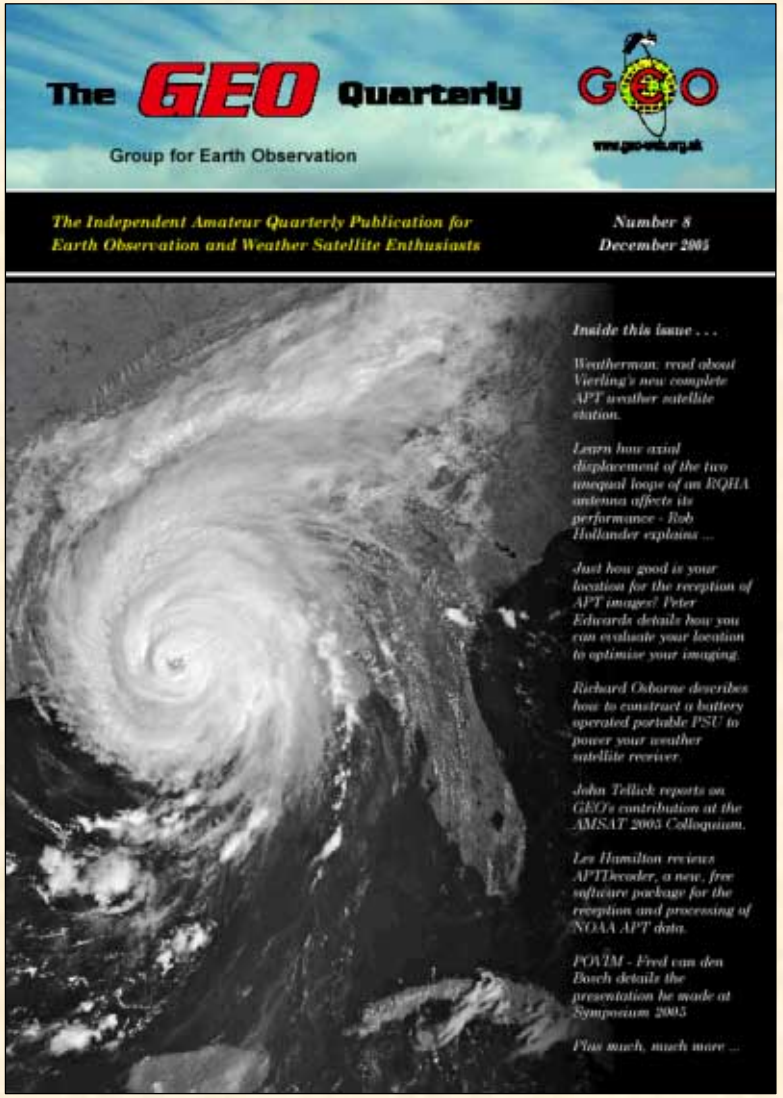
No 2
May 2004

No 3
August 2004



No 4
November 2004

Group for Earth Observation



Quarterlies
5 - 8 (2005)

What's in the GEO Quarterly?

- Guides to setting up hardware and software
- Imaging software reviews and 'how-to' guides
- Reports from meetings and conferences
- Satellite images—many in colour
- The latest Earth-imaging news
- Articles and images describing weather phenomena
- GEO Shop

Group for Earth Observation

NASA's *Terra* satellite acquired what is believed to be the first ever direct observation of a cyclone in the South Atlantic Ocean on March 26, 2004. This Moderate Resolution Imaging Spectroradiometer (MODIS) image shows the storm off southeast Brazil.

Image: Jacques Descloitres, MODIS Land Rapid Response Team at NASA GSFC

A blue halo of phytoplankton curls around the Falkland Islands in this amazing true-color *Aqua* MODIS image from January 26, 2004.

Image: Jacques Descloitres - MODIS Land Rapid Response Team, NASA GSFC

Group for Earth Observation
www.geo-web.org.uk

Welcome to the second issue of the *GEO Quarterly*. Our thanks to all of you who applied for a copy of our Launch Issue earlier this year, and specially to everyone who contacted us with supportive comments.

By the time you read this, the first *GEO* Symposium will have taken place at the National Space Centre in Leicester. Look up the *GEO* website (http://www.geo-web.org.uk) to view photographs taken on the day. A full illustrated report on the Symposium will be published in *GEO Q2*.

This quarter, we have several interesting contributions from overseas readers. Bill Johnston explains how to compile a Radio Horizon Table to help make the most of those low elevation satellite passes; Fred van der Bosch details an improved technique for integrating satellite images into Digital Atmosphere; John Coppens describes how *Linux* users can decode NOAA APT using *Wxtoimg* while Arne van Belle extols the virtues of satellite-TV coaxial cable.

There are also regular submissions from stalwarts Francis Bell, who has some controversial ideas on global warming and climate change, and Peter Wakelin, who continues on the theme of the Indian Space Programme.

We do hope there is something to everyone's taste in this issue—now turn the page and enjoy your copy of *GEO Q2*.

Contents

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Francis Bell — Nigel Evans
Clive Finnis — Ray Godden
Les Hamilton — John Tellick
Peter Wakelin

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Responsibility for Constructional Projects and Software

Every effort is made to ensure that the technical and constructional articles published in this Quarterly are correct. However, the ultimate responsibility is with the reader to ensure the safety of constructions and for any interfacing with other equipment. GEO cannot accept liability for shortcomings in any published design or any constructions carried out by members or other third parties.

Using Wxtoimg Images in Digital Atmosphere

Fred van den Bosch - *fred@vandenbosch.speedlinq.nl*

In December 2003, I posed the question as to whether there was a more intelligent way to use pictures from *WXtoImg* in *Digital Atmosphere*. Then I had some e-mail discussions with Ton Lindemann of *Meteo Maarssen*. His website (in Dutch) is worth a visit.

www.meteo-maarssen.8m.com

This further instalment has been developed on the basis of these contacts. It is still a trial-and-error story, but now in a structured way. New maps can be developed very quickly, especially after you have gained initial experience with my techniques.

Setting up WXtoImg

Open <Options> on the *WXtoImg* menu-bar, and click on <Projection Options...> to display the *Projection Options* input screen (figure 1). Here you must input values for the latitude, longitude, north, south, west and east boundaries, and scale—choose values that will give the image area you want. Additionally, in the <Options> menu, uncheck 'disable map overlay'—this method will not work correctly if the overlay is absent. Finally, move to the <Projection> menu and select 'Orthographic'.

Now you are ready to generate your satellite image. Do so, and write down its width and height in pixels (this will appear on the status line at the bottom of the screen, just before the image is displayed). Finally, choose <Image/White background> and save the image as a BMP file (the image format **must** be BMP for later importing into *Digital Atmosphere*).

Figure 1
The WXtoImg parameter screen

Setting up Digital Atmosphere

Open <Map/Generate map-->Enter lat/lon> and use the horizontal and input exactly the same longitude and latitude values you used in *WXtoImg*. Next, enter the width and height values you wrote down earlier into their respective fields (figure 2) then click 'OK' to generate a map.

You will now have to resort to a little trial and error to select a scale that generates more or less the same size of map as the *WXtoImg* image—precision is not so important at this moment. Once you have generated a map that looks ok, save it with <Map/Save map> as a BMP.

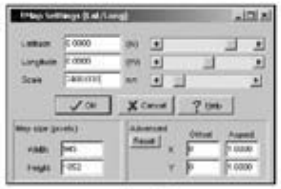

Figure 2
The Digital Atmosphere parameter screen

Figure 5
A WXtoImg orthographic image, is created, complete with country outlines (12:18 UT pass from October 12, 2003).

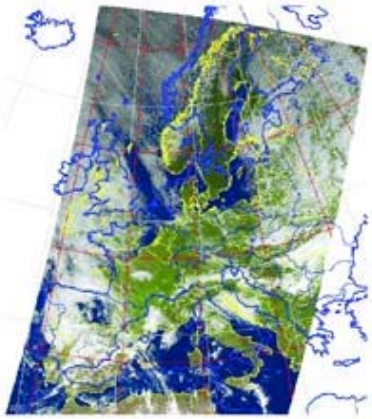

Figure 6
First attempt loading the image into Digital Atmosphere. Registration between image and map is poor.

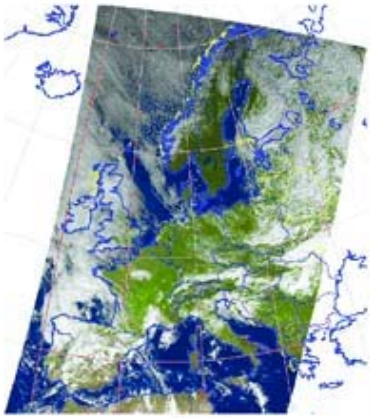

Figure 7
Following fine tuning, as explained on the opposite page, the image and map now show excellent registration.

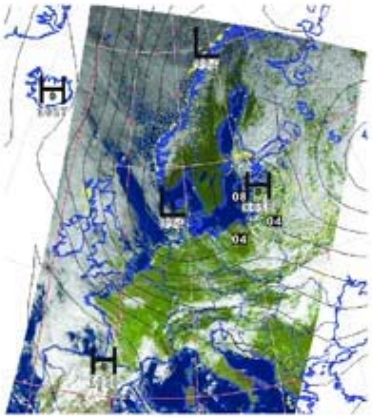

Figure 8
The WXtoImg image loaded into Digital Atmosphere, with added synoptic sea-level pressure overlay.

The R2FX
APT Receiver
for Weather Satellites

Les Hamilton

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

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

Manufacturer's Specifications

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

The *R2FX* Package

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

Power Supply for the *R2FX*

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

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

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

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

Setting up the *R2FX*

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

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

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

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

Frequencies currently provided are:

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

Using the *R2FX*

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

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

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

Figure 2
The back panel of the R2FX, showing connectors

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

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

Figure 5
My first NOAA 17 image received at 10:34 UT on April 28, 2005 using the R2FX. A stepped pattern of short, dark, horizontal lines mars the image. The effect is most clearly evident over northern Scandinavia and over the mass of cloud at upper left. This effect is easily addressed by converting the R2FX from 'antenna diversity' to single-antenna mode.

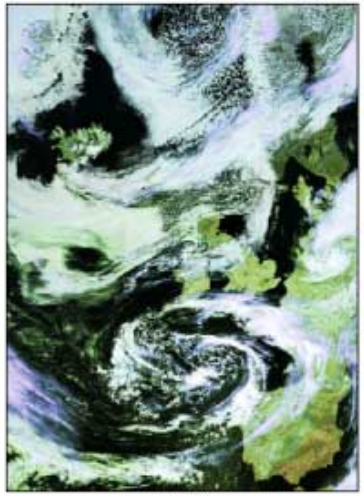

Figure 6
This image from NOAA 17 was acquired at 11:40 UT on May 15, 2005 after the R2FX had been adjusted for single-antenna operation.

Processing: both the above images were produced using Satsignal

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APTDecoder

New Software for NOAA APT Processing

Les Hamilton

Some months ago, **Patrik Tast** of Vastervik in Finland released *APTDecoder*, a software package that allows you to capture NOAA APT audio, convert it into weather images, then subsequently process these to add colour, remove noise, create a weblog and much more. Although still under continuous development, *APTDecoder* already offers a host of features which make it a powerful rival to established favourites in its field, like *WXsat*, *WXtoImg* and *Satsignal*.

Obtaining and Installing APTDecoder

APTDecoder is free software and is available both from the Software Library and by direct download from:

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

The single installation file will, by default, install *APTDecoder* in the folder 'C:\APTDecoder' although it does offer a 'browse' button that allows you to select your own preferred location. The first time you run *APTDecoder*, it is a good idea to open the **<Help → About>** menu and click where it says 'Create a desktop shortcut'.

Preparing APTDecoder for Imaging

APTDecoder offers a host of user options. Here are just a few that you are recommended to modify before starting to use the program.

- Click **<Settings → General settings>** and in the *General* tab check *'Enable auto recording and processing'* so that satellite passes will be captured automatically.
- Open **<Settings → Ground station>** and type in your latitude, longitude, altitude and station name.
- Make sure you are on-line then open **<Satellite → Keplerian elements>** and click *'Download'* to import the latest 2-line elements.
- Open **<Satellite → Active APT satellites>** and place a check mark against the names of those satellites from which you wish to create images. *Note:* If no satellite is checked, the program will not do anything!

Capturing your first image

Now just leave *APTDecoder* running. The legend at the top of the screen announces which satellite is approaching and continually updates its azimuth and elevation, as well as stating the maximum elevation and AOS (Acquisition Of Signal—the time when the satellite rises above your horizon). Signal capture then commences (figure 1), the image displaying in real-time as it builds up. Note the floating overlay which shows full details of the satellite pass; this overlay does not appear on the saved images. Once the pass is complete the satellite audio, the decoded image and an information file are all saved automatically.

Setting Recording Volume

If you already have other software such as *WXsat* or *WXtoImg* working satisfactorily on your PC, the recording level should

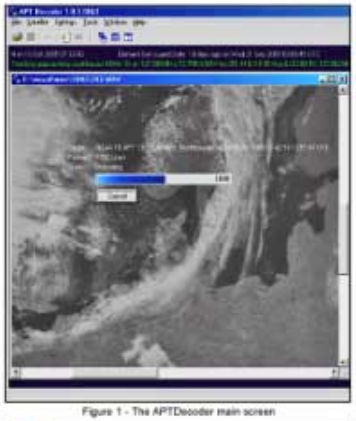

Figure 1 - The APTDecoder main screen

Figure 2
The APTDecoder folder tree

Figure 3 - The Image Enhancement Window

Understanding Ship Trails

Les Hamilton

Every once in a while, when conditions are favourable, weird snaking cloud patterns can show up on weather satellite images. A good example can be seen south-west of the UK in Ruud Jansen's superb NOAA-17 image reproduced here.

These unusual cloud formations are ship trails, a phenomenon that owes its origin to the exhaust emissions from shipping plying the oceans of the world.

The Formation of Cloud

To understand how ship trails arise, it is necessary first to detail how 'normal' cloud forms in Earth's atmosphere. Ship trails are, after all, just one particular form of cloud, albeit man-induced.

Earth's atmosphere contains water vapour but this does not automatically condense into liquid droplets to form clouds, even when the temperature is well below freezing. Cloud formation depends on the presence of aerosols—suspensions of tiny, microscopic solid and liquid particles dispersed throughout the atmosphere.

Cloud-forming aerosols originate, in the main, from natural sources like sea salt, volcanic ash, desert dust and biomass burning but also, increasingly, through the burning of fossil fuels by man.

Aerosol particles often contain substances that dissolve easily in water (such as sea salt, sulphur dioxide etc.) and it is these that provide the cloud condensation nuclei (CCN) around which water molecules condense. If the air were devoid of aerosol particles, cloud, mist and fog would never form at all and the sky would be forever clear and cloudless!

Figure 1 - Ship trails west of Biscay - NOAA 17 APT - 11:48 UT on February 10, 2005
Image: Ruud Jansen Processing: WXtoImg software

When do Ship Trails Form?

Ship trails generally form in the still, moist air commonly associated with anticyclonic conditions, when the sea is overlain with a stable layer of air at a similar temperature to that of the water itself. This layer may on occasions already contain thin cloud or mist but it is in effect supersaturated and lacks sufficient CCNs to generate full-scale cloud.

When ships pass through this region, fine aerosol particles from their exhausts float up through the moist layer of air where they become additional CCNs. This means that water vapour in the air now contains many more nuclei upon which to condense and these produce new cloud droplets where few may have existed before. The outcome is that the cloud becomes more reflective to sunlight.

As a ship crosses the ocean its exhaust issues a continual stream of CCNs in its wake. Consequently, its path shows up as a trail of shallow stratus clouds—a 'ship trail'. This cloud streamer often stretches for hundreds of kilometres and can extend tens of kilometres in width.

Generally speaking, the faster a ship travels, the narrower, longer, and less diffuse its ship trail will be. Slower ships leave shorter, wider, and more diffuse trails. It is worth noting that ship trails often reflect the direction and speed of local winds as much as the direction and speed of the ship itself.

Ship trails normally persist for many hours and sometimes remain visible for days on end provided that the air mass surrounding them remains relatively undisturbed.

Ship trails show up well in satellite images, even those from low-resolution APT transmissions. The trails show up most strongly in reflected radiation (NOAA channels 1, 2 and 3) where they appear as

Who Manages GEO?

GEO is currently managed by a team of nine

Francis Bell	-	Publicity
Nigel Evans	-	Membership Secretary
Clive Finnis	-	RIG Shop
Ray Godden	-	Webmaster
Peter Green	-	International Liaison
Les Hamilton	-	Editor, GEO Quarterly Magazine
David Painter	-	Education co-ordinator
John Tellick	-	Liaison with Agencies
Peter Wakelin	-	Meteorological Guru

GEO

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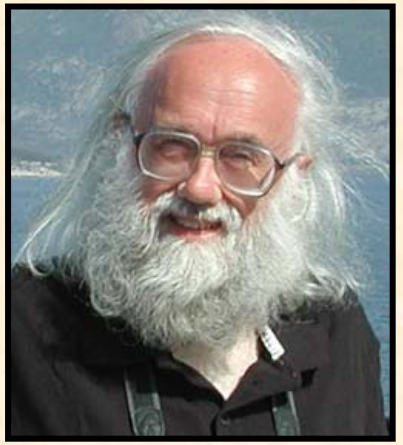
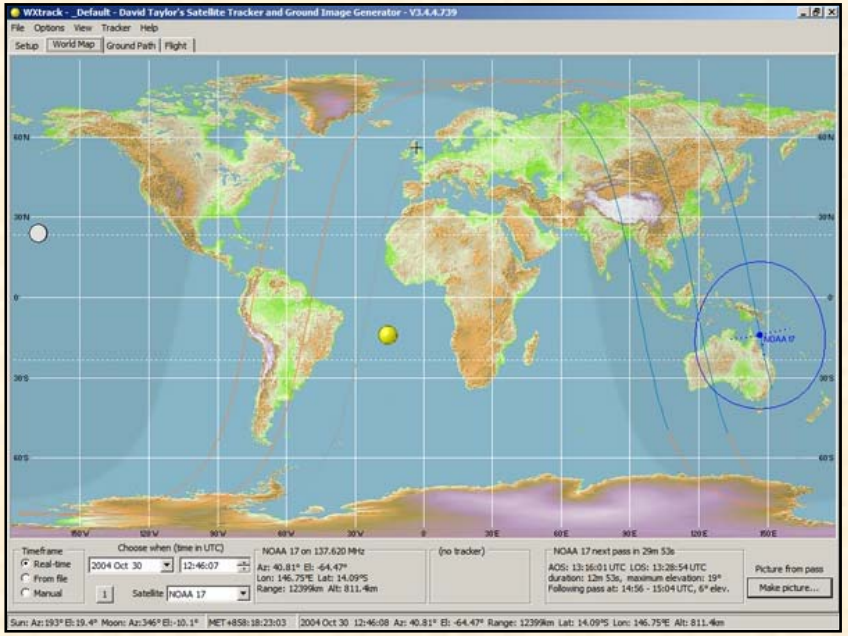
Professional Consultant



GEO is fortunate to be able to call upon renowned software author David Taylor as a consultant.

David’s experience is a great asset to our Group



Membership

Although based in the UK, GEO currently has an international membership of over 500 encompassing more than 30 countries

30% of GEO members live outside the UK

What do GEO Members do?

- Most GEO members download weather satellite images, in real time, from Polar Orbiting and Geostationary weather satellites
- GEO members have a collective fascination for all forms of Earth imaging
- Many GEO members are experienced in the use

What do GEO Members do?

Some GEO members design receivers, antennas and other associated hardware

GEO members help each other by offering advice and sharing experiences

GEO members strive to advance their hobby by pushing back the frontiers of what is currently

EO

Group for Earth Observation

EO collaborates with the talented Dutch group ‘Werkgroup Kunstmanen’

Who can Join GEO?

GEO Membership is open to any ***amateur*** enthusiast with an interest in the Earth, Earth imaging, weather atellites and weather phenomena in general

t is one of GEO's prime aims to target the ***education*** ector and to encourage young people everywhere to ake an interest in the well-being of our planet

hat are the Benefits of Membership?

4 issues of ***The GEO Quarterly***, our colour magazine, annually (see examples on our stand)

The opportunity to attend an annual Symposium at the National Space Centre, Leicester

Sharing experiences with like-minded friends

What Does GEO do for its Members?

- GEO represents the interests of its members with *EUMETSAT*, the European Organisation for the Exploitation of Meteorological Satellites
- GEO also represents its British members with the UK Met Office
- GEO's policy is to liaise with all appropriate

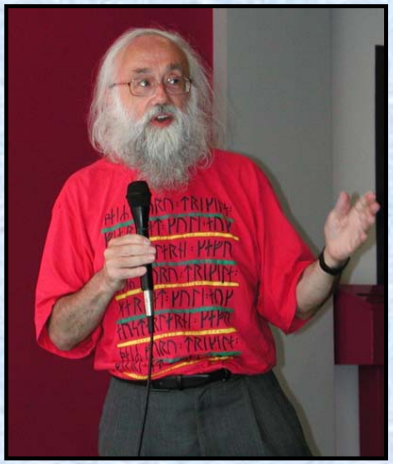
Leicester Symposium - May 2004

Leicester Symposium - May 2004

Leicester Symposium - May 2004

GEO Visits 'Werkgroep Kunstmanen'

in Utrecht, Holland (September 2004)



GEO Symposium - April 2005

Member's Achievements

GEO numbers among its membership many
ndividuals who have enthusiastically pioneered
veather satellite imaging since the days before
he personal computer arrived on the scene

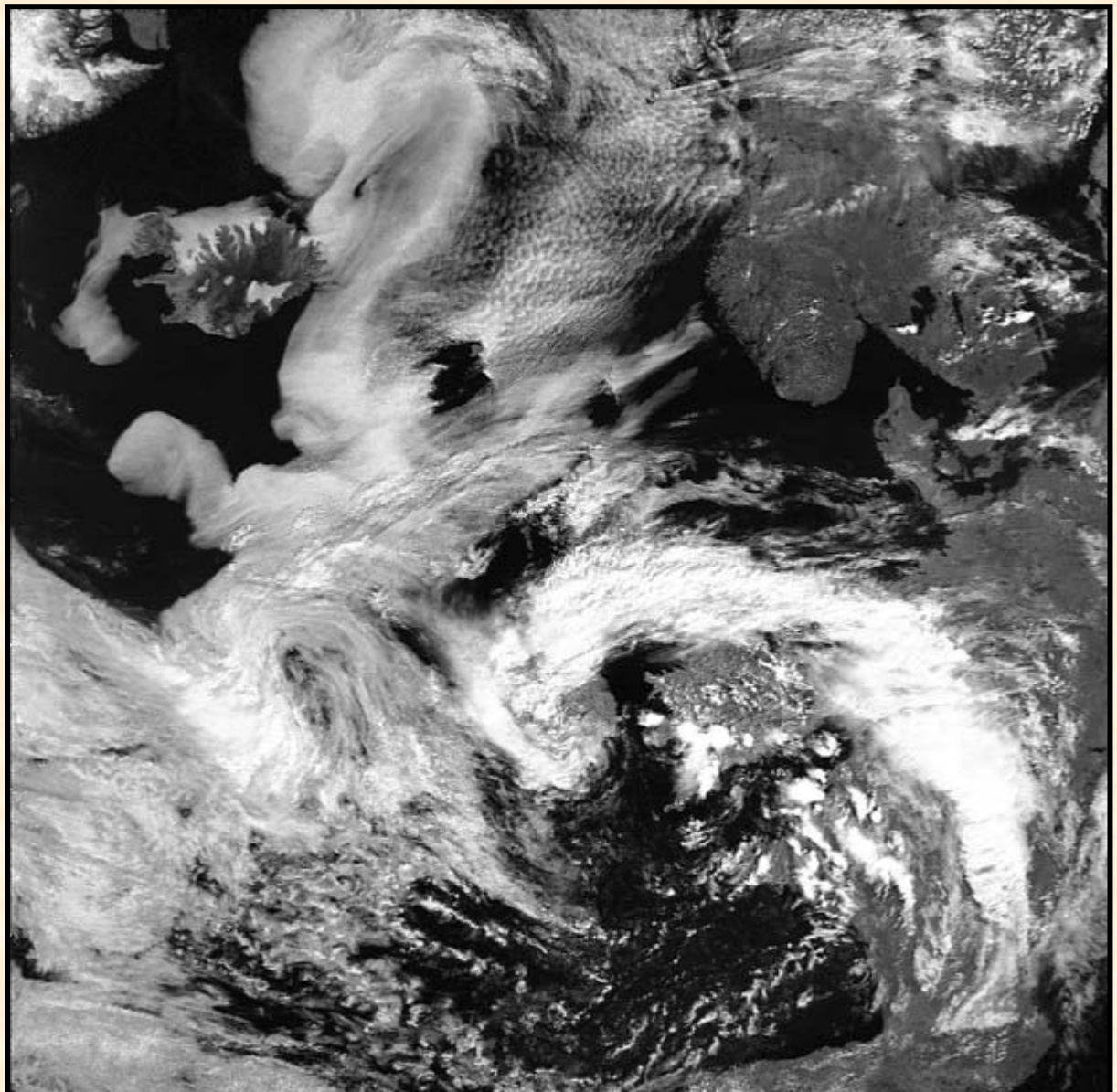
atellites involved have included

- APT from the early NOAAs
- APT from the now defunct Russian Meteor series
- Meteosat 1.7 GHz Wefax and Primary Data services
- NOAA HRPT reception

NOAA APT Imaging

NOAA-17 channel-2 APT image

1:24 UT August 12, 2004



NOAA APT maging

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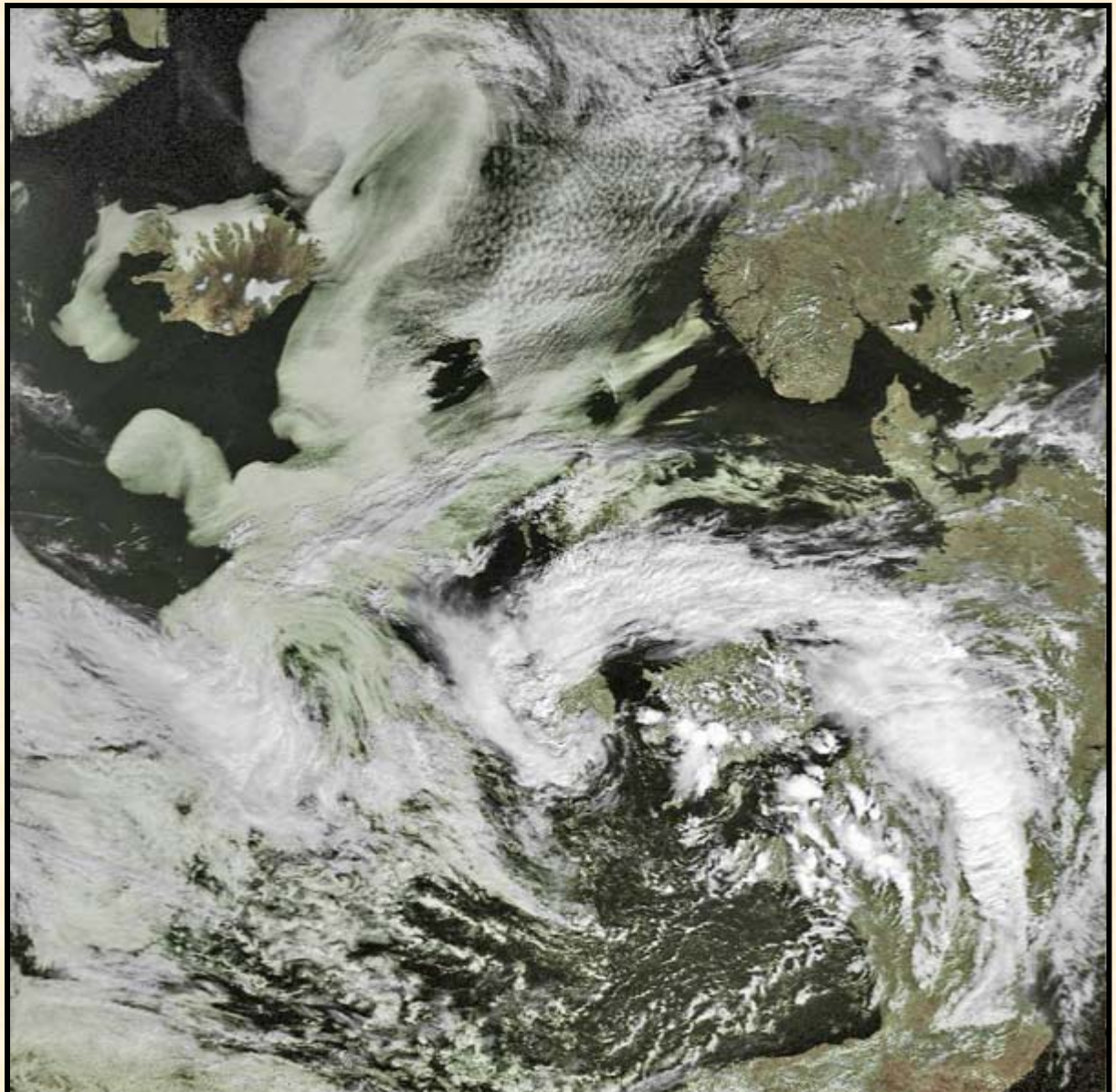
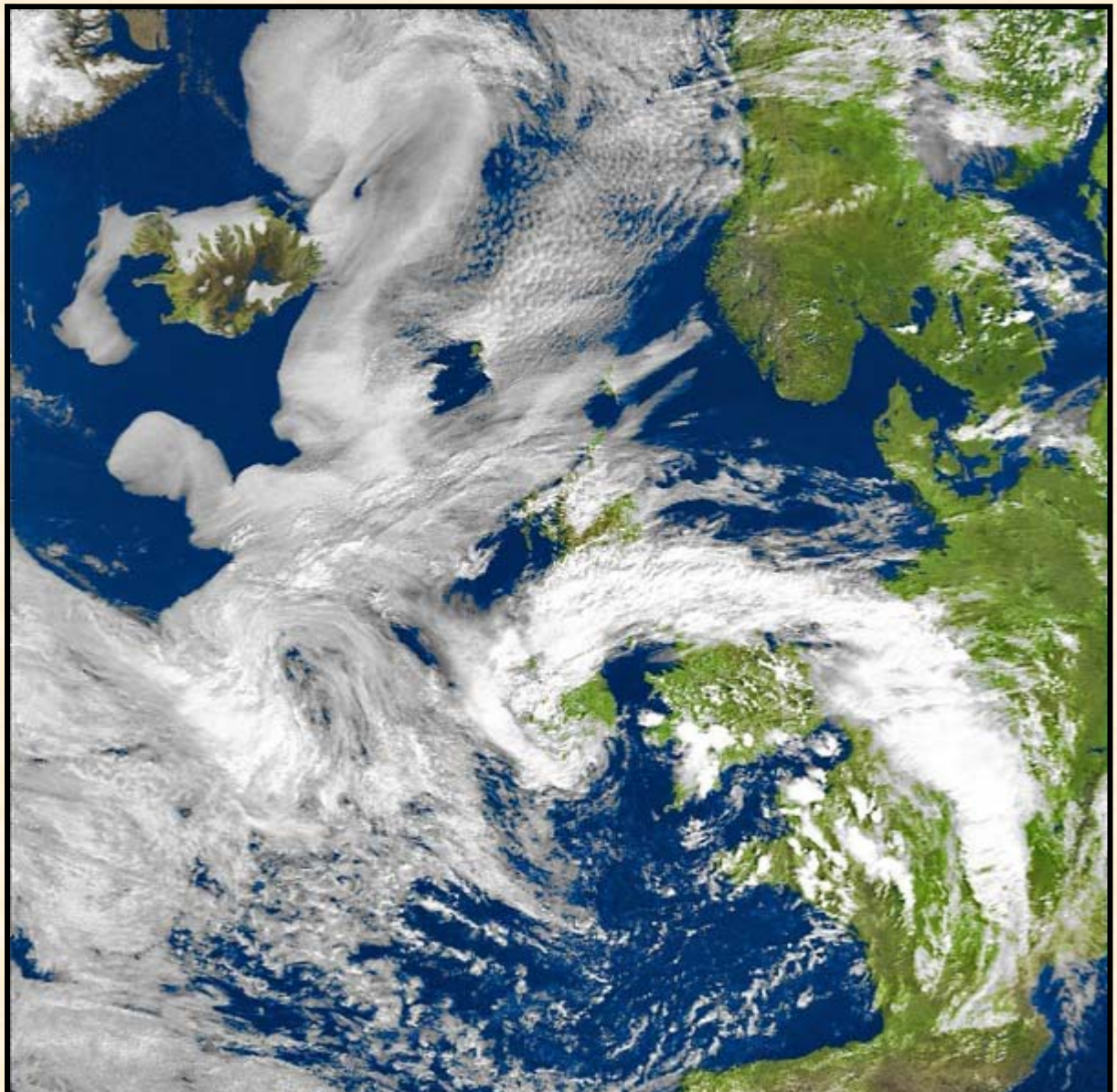


NOAA APT maging



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NOAA APT maging

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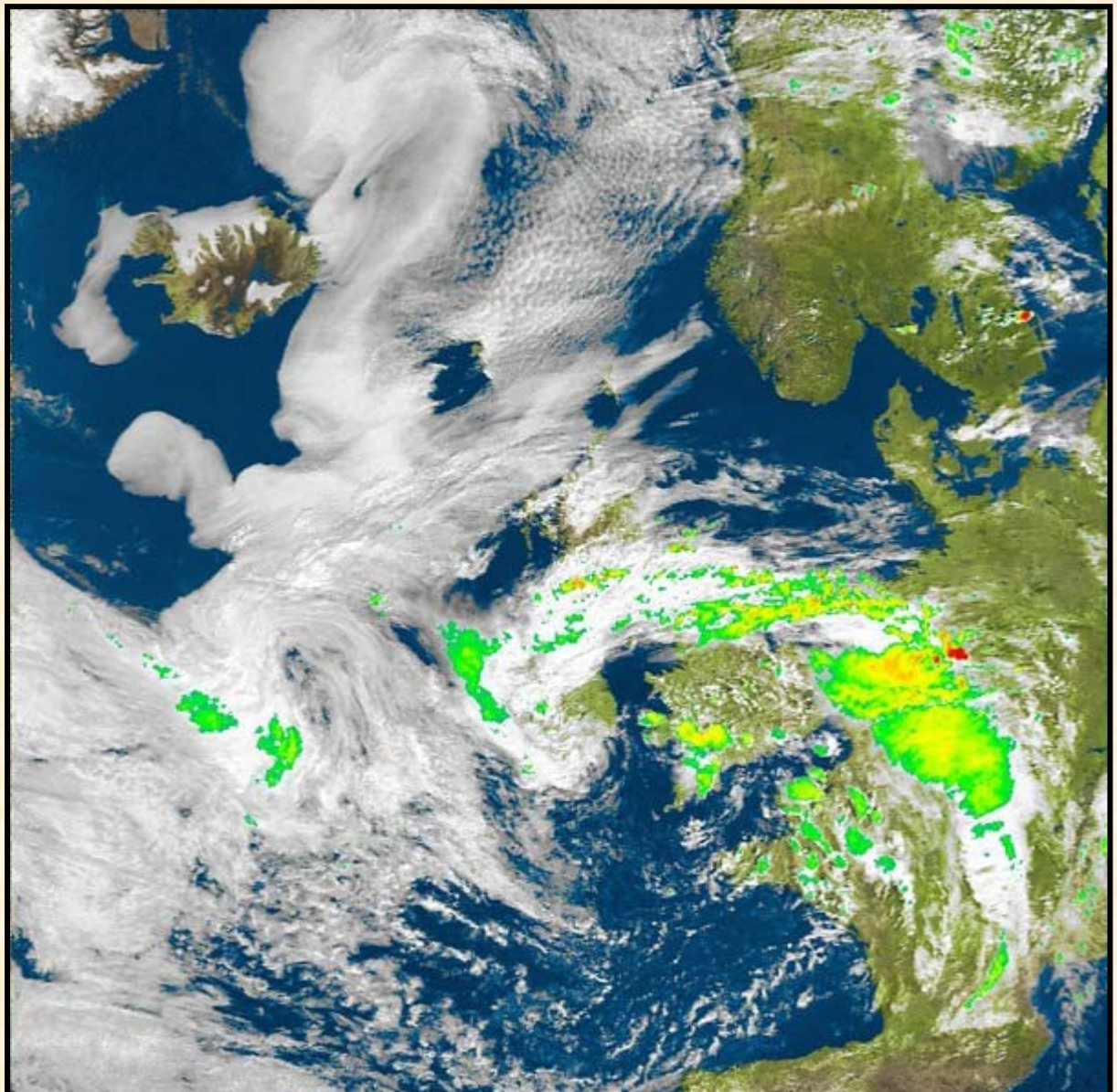
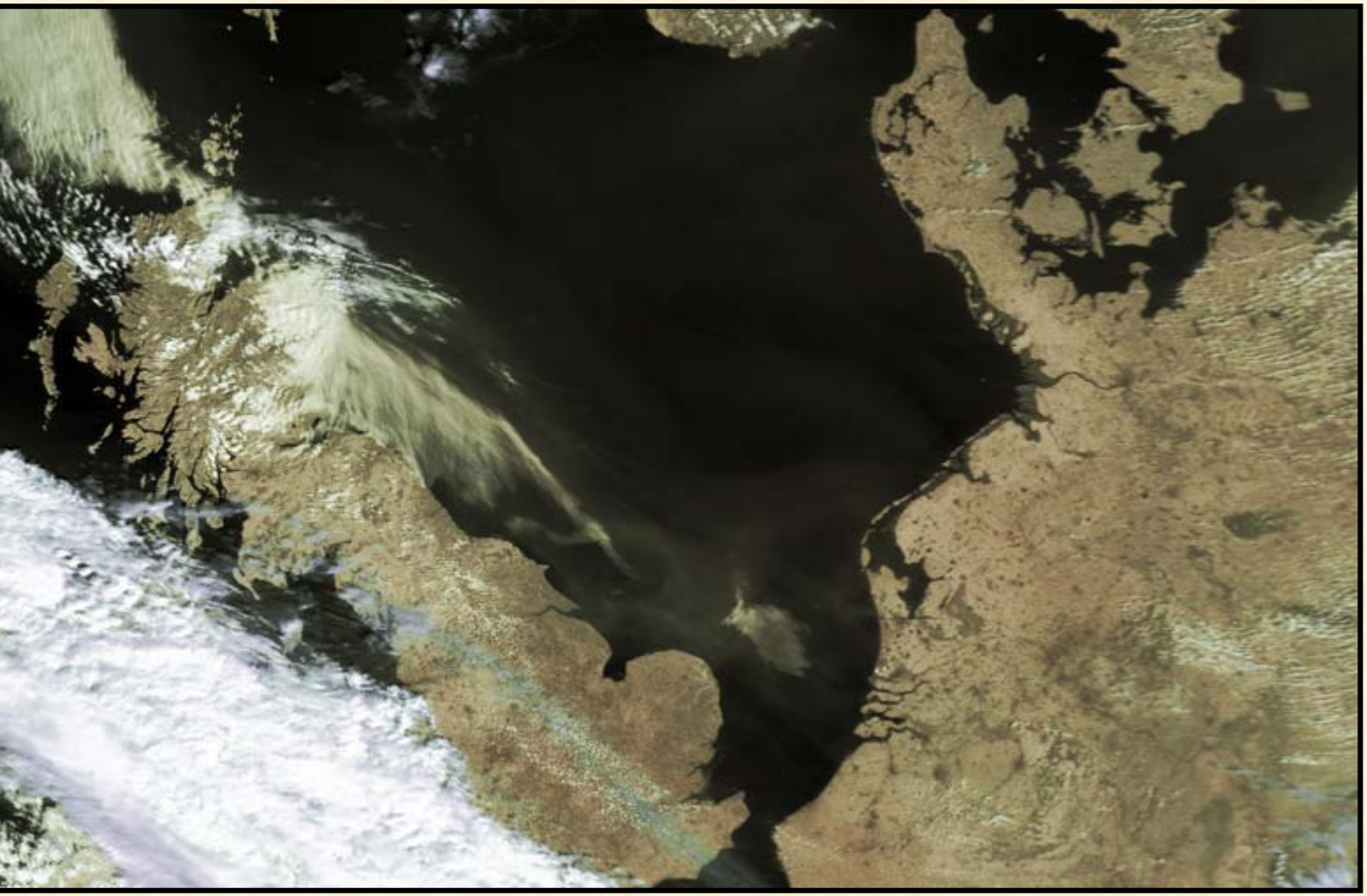
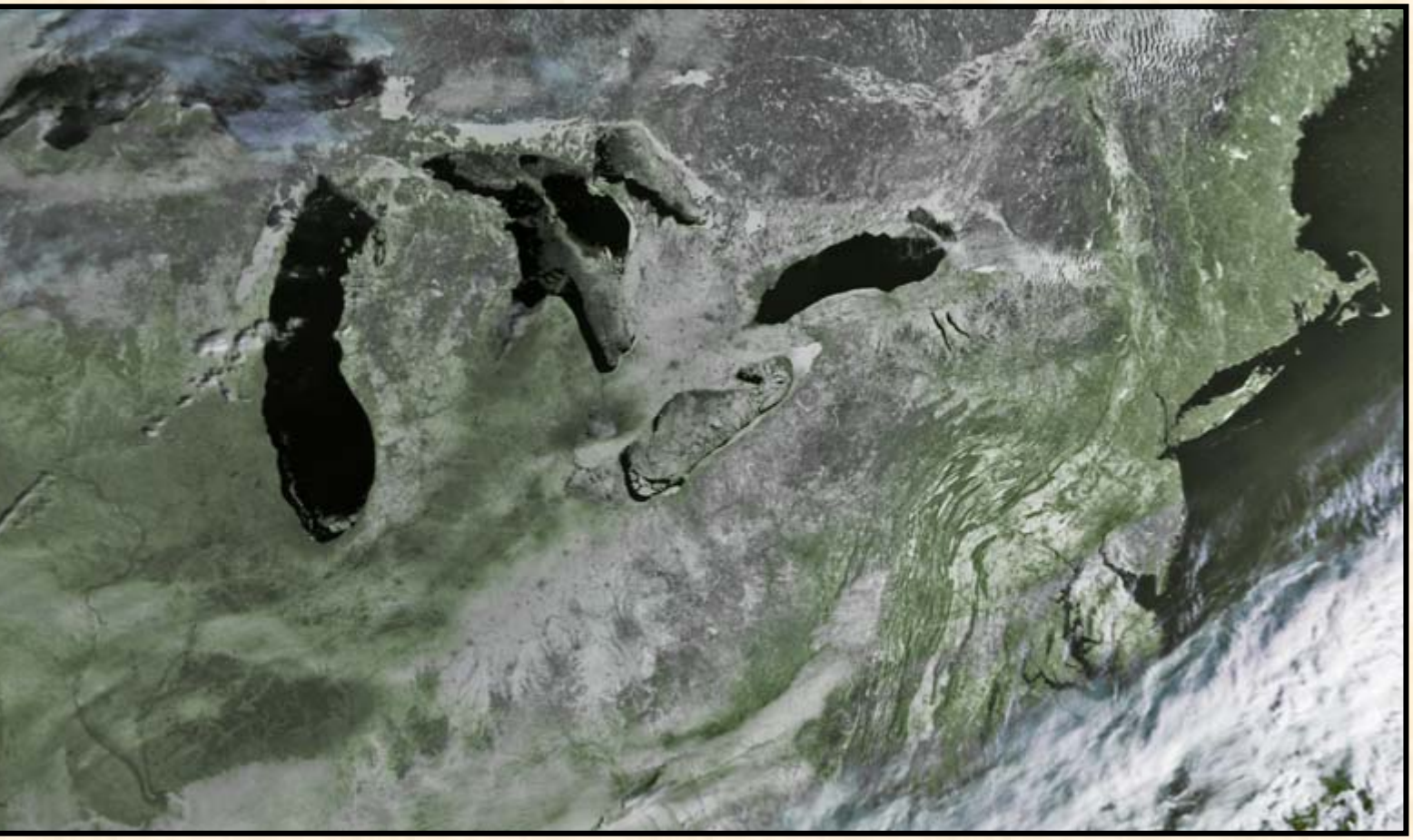


NOAA HRPT Imaging



Feng Yun 1D C/HRPT Imaging

An image from one of our US members, Bill Johnston, who lives in New Mexico



eosat-8

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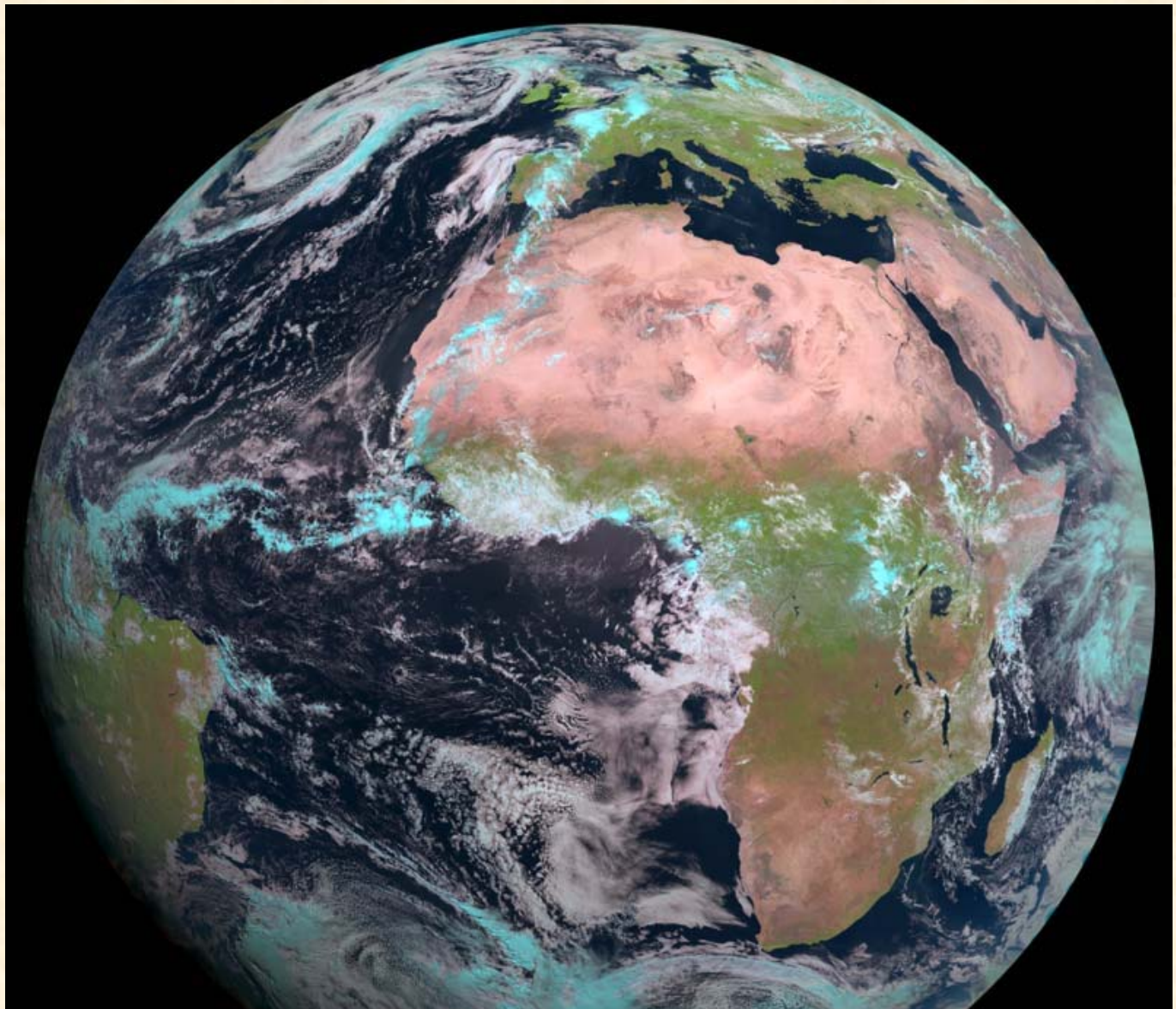
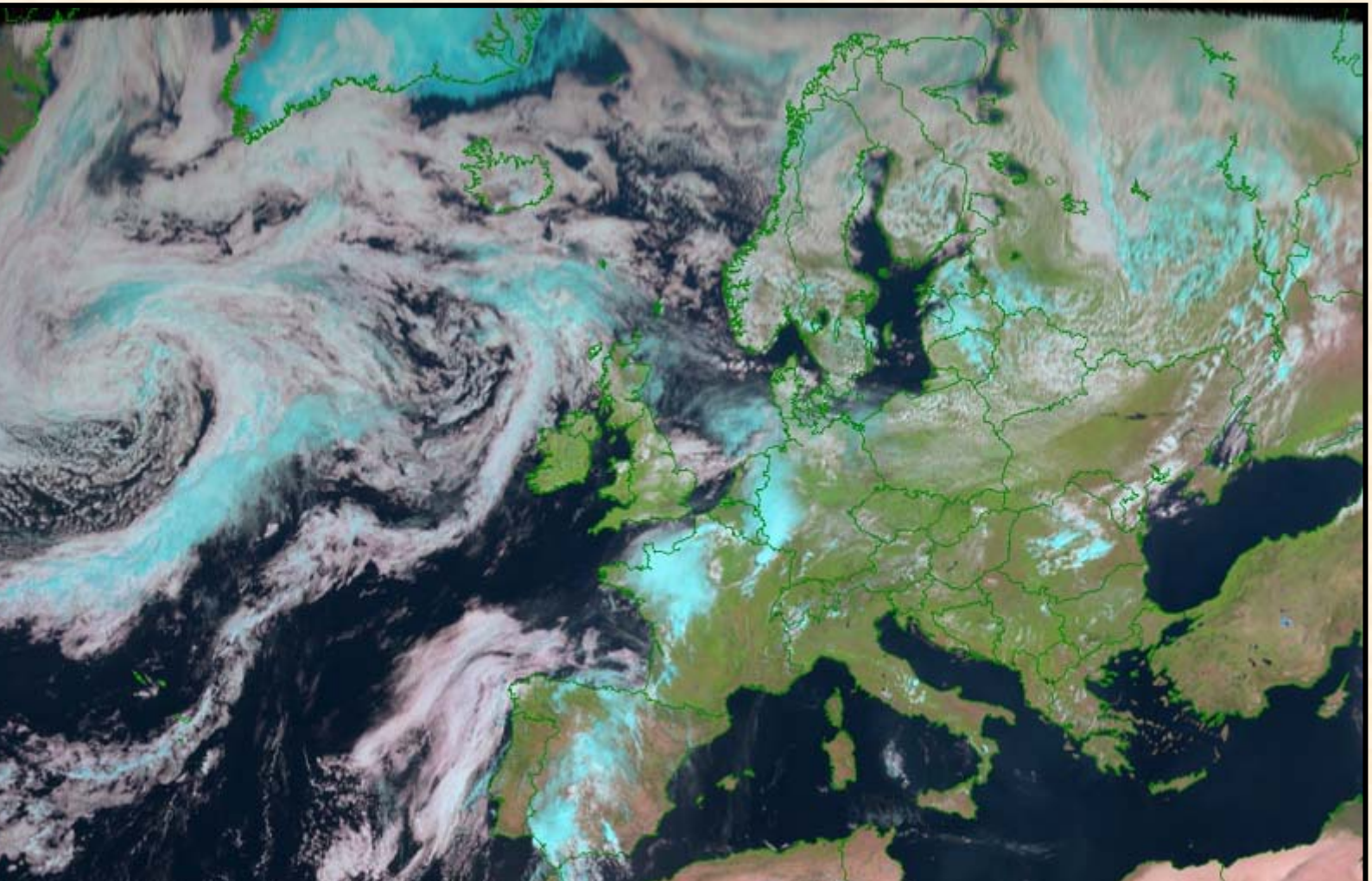


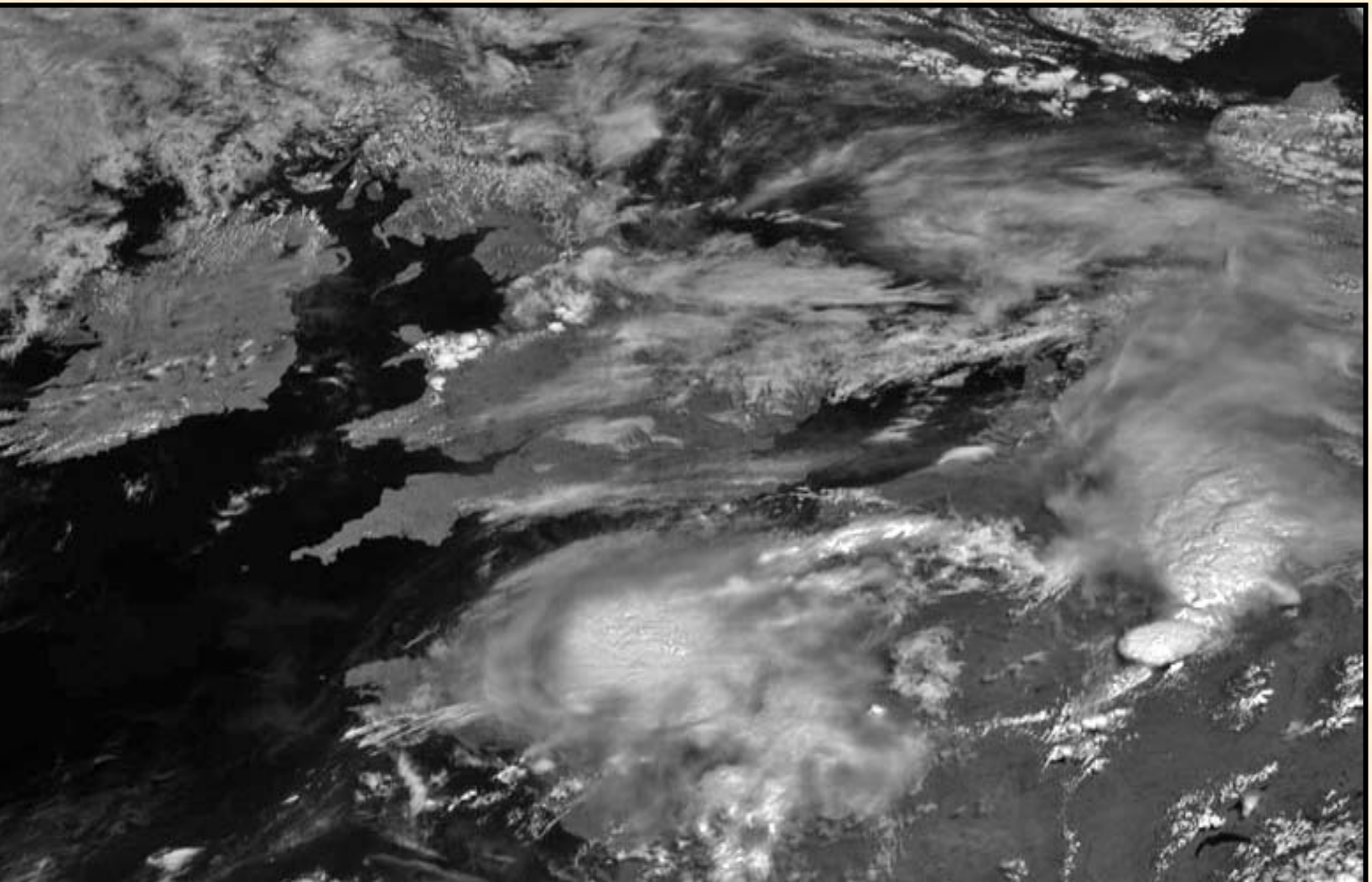
ne 14, 2003
METSAT 2003

Meteosat-8

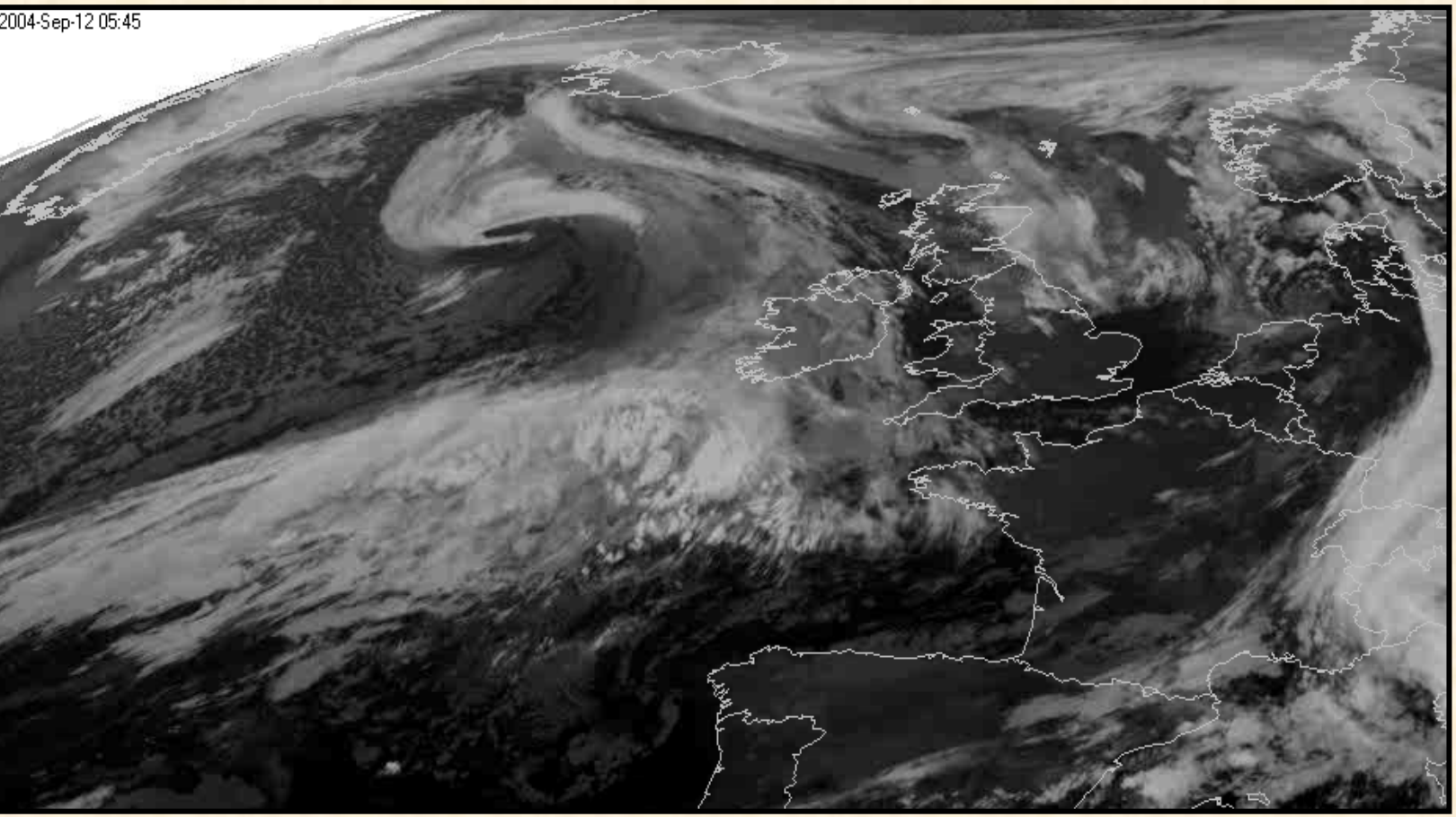
This is part of the same image, shown at its full resolution of 2.5 km/pixel



Meteosat-8

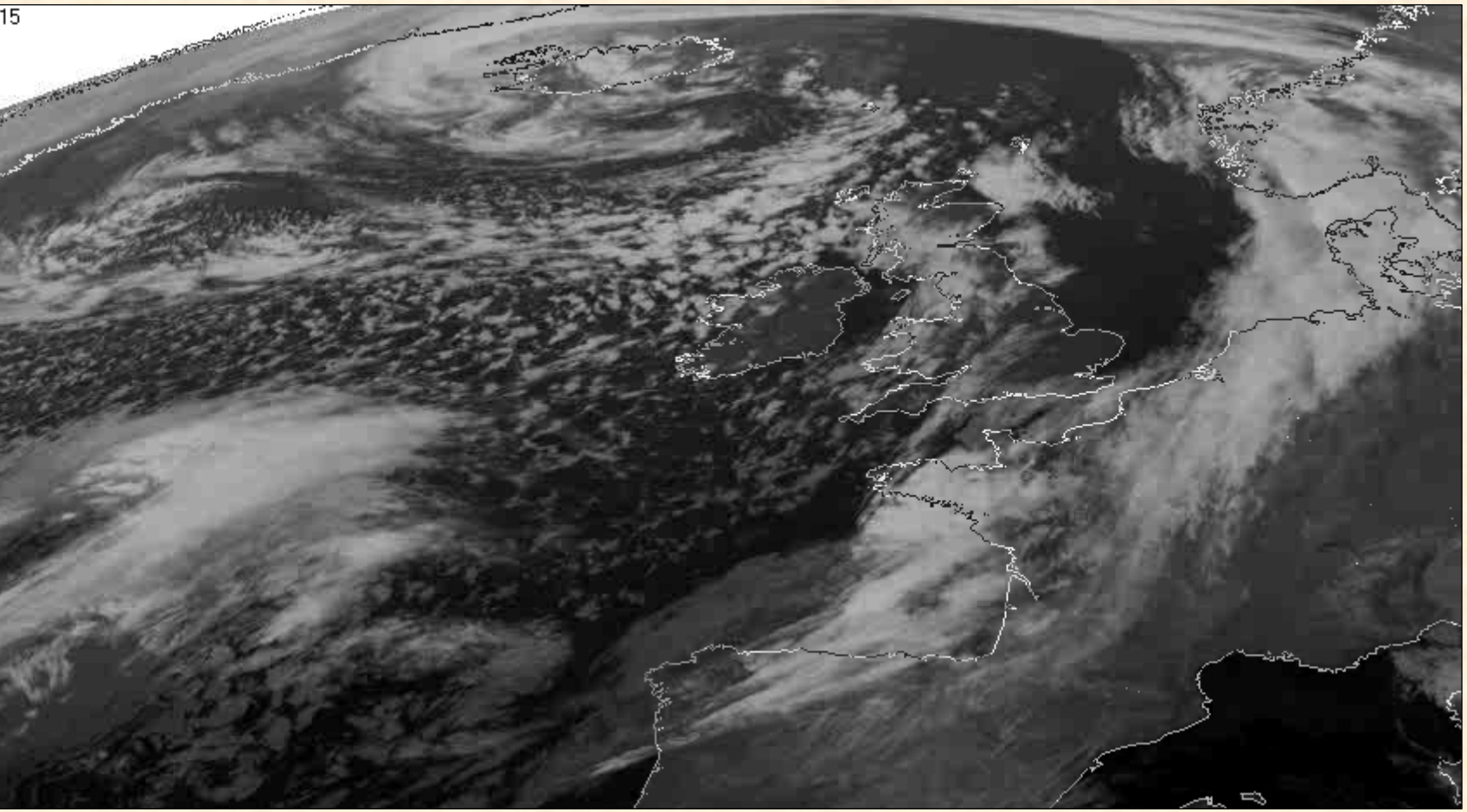


Meteosat Second Generation



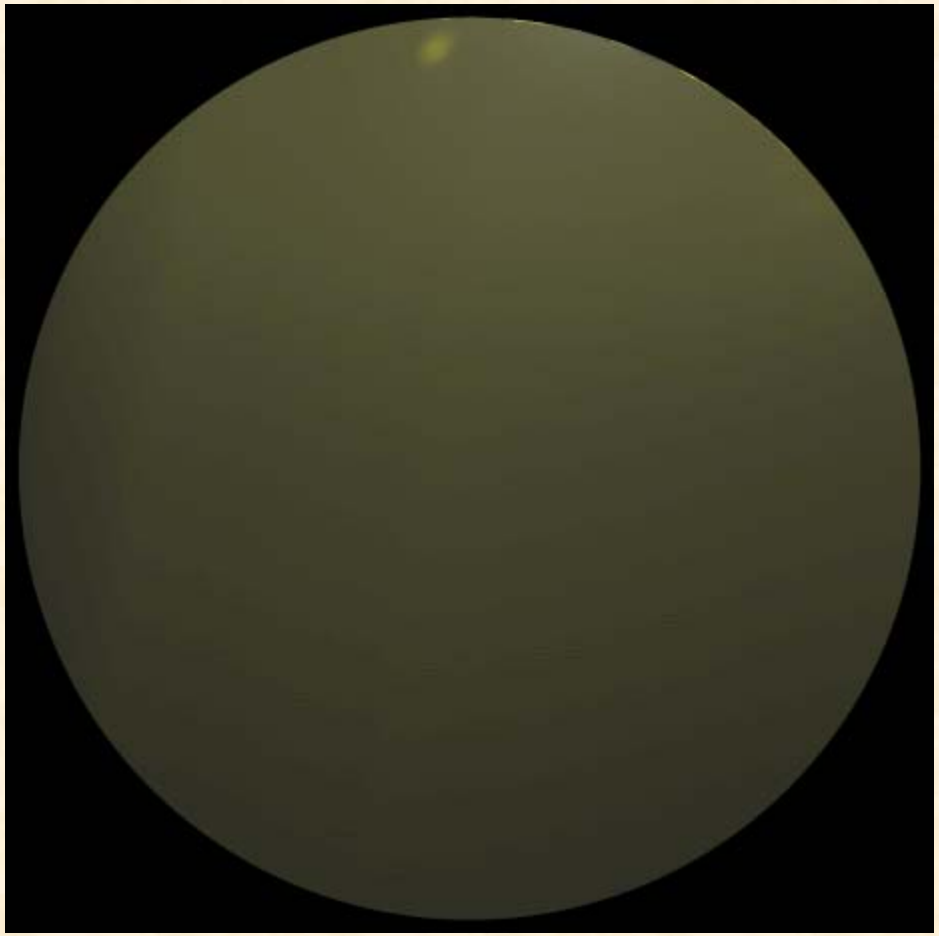
Click on this image to start the animation

Meteosat Second Generation



Click on this image to start the animation

Meteosat Second Generation



Click on this image to start the animation

Meteosat-8 | RIT ***animation***, August 26, 2004

EO Shop

naged by **Clive Finnis**,
GEO Shop can supply
the hardware needed for
reception of both polar
biting and geostationary
ather Satellites.

GEO Shop

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

The era of Meteosat WEFAX imaging is nearing its end—transmissions are due to be switched off for good some time during December 2005. The *GEO Shop* can help you to prepare for the future by migrating to Meteosat-8. Meteosat-8 data is disseminated via a domestic DVB link from the Hot Bird-6 geostationary satellite. You will find all the hardware your require on this page.

You have to register with EUMETSAT and obtain an amateur user licence from the Met Office and, in addition, purchase the *Tellique* software and *e-Token* key unit. If you are unsure how to obtain these, please consult Mike Stevens' article '*Meteosat 8—the Challenge*' in GEO Quarterly No 4. You can find a detailed guide to completing your *EUMETCast* Registration Form on the GEO website at ***http://www.geo-web.org.uk/eumreg.html***

TechniSat SkyStar 2 PCI Card
A 'free to air' DVB satellite TV and data receiver card as recommended by EUMETSAT. This card requires installing inside the computer and comes with comprehensive installation instructions and CD-ROM of driver software (if you do not feel confident about installing cards inside your computer use the USB version below)
UK - £49.50
Continental Europe - £51.00

Meteosat-8 image - © *EUMETSAT 2004*

TechniSat SkyStar 2 USB Box
The external version of the above which plugs into the computer's USB socket and does not require installing inside the computer.It comes complete with power supply, USB cable & CD-ROM of driver software.
UK - £109.50
Continental Europe - £121.50

TechniSat SatFinder Alignment Meter
A very useful and sensitive meter which is a great help in setting up and aligning the dish for maximum signal. The meter comes with full instructions.
UK - £21.50
Continental Europe - £24.50

GEO PIC 1.0 for the RX2
Programmed with the new channel frequencies required for NOAA-18.
UK - £7.00
Continental Europe - £7.40
Rest of World - £8.40

GEO/Dartcom EPROM v 1.3
UK - £10.00
Continental Europe - £10.75
Rest of World - £11.25

Ordering and Shipping

The Future

GEO plans to:

- Continue to monitor what is possible for direct users of Earth imaging satellites
- Explore educational applications and opportunities
- Enjoy the technical challenges

Above all, our ultimate aim must be:

To care for, and have an awareness about, our Sapphire and Emerald planet

Though we are an **amateur** group, we should always remember that one gentleman who described himself as an amateur received, three years later, the ***Nobel Prize***

THE END