

# The **GEO** Quarterly

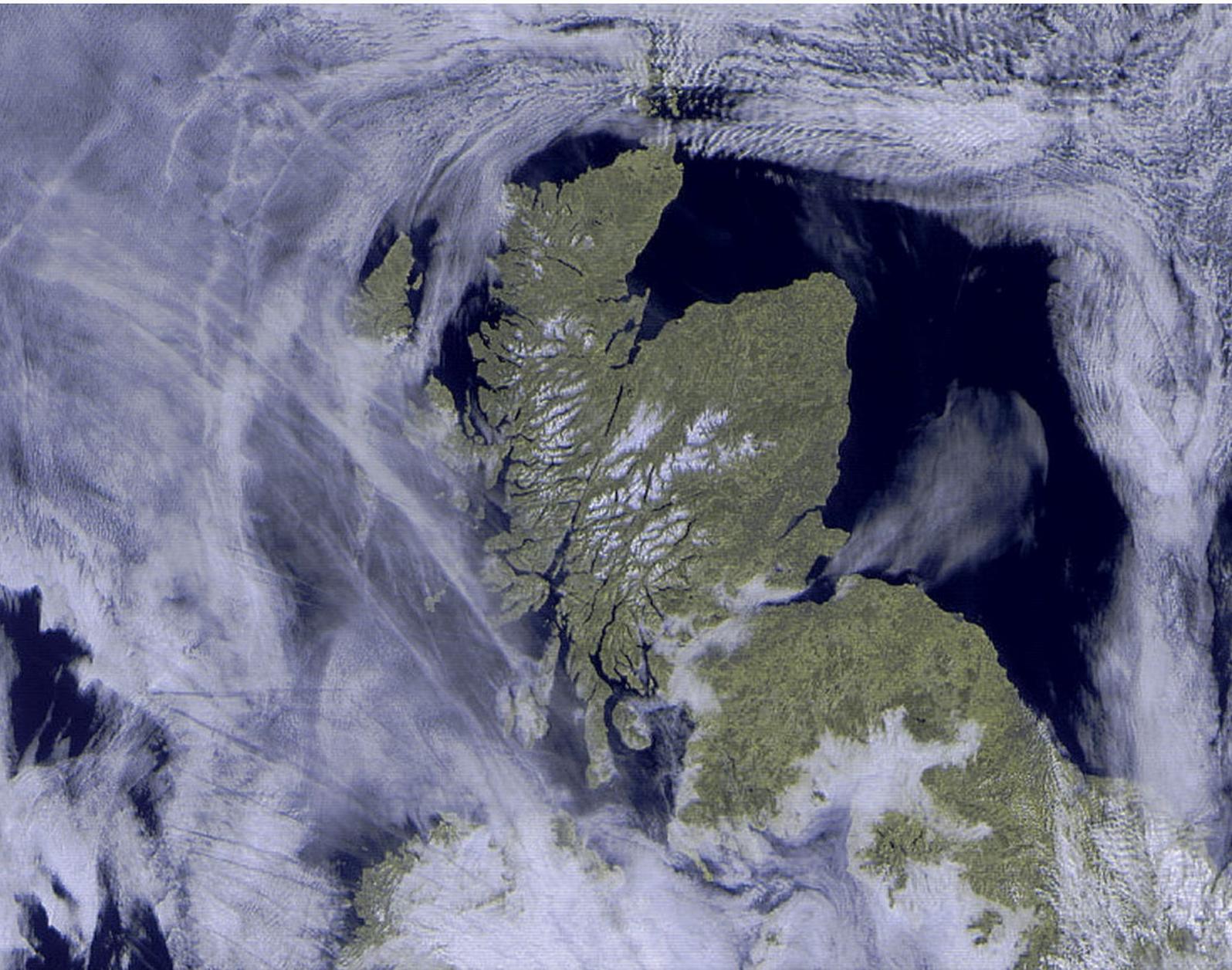
Group for Earth Observation



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

**46**

**June 2015**

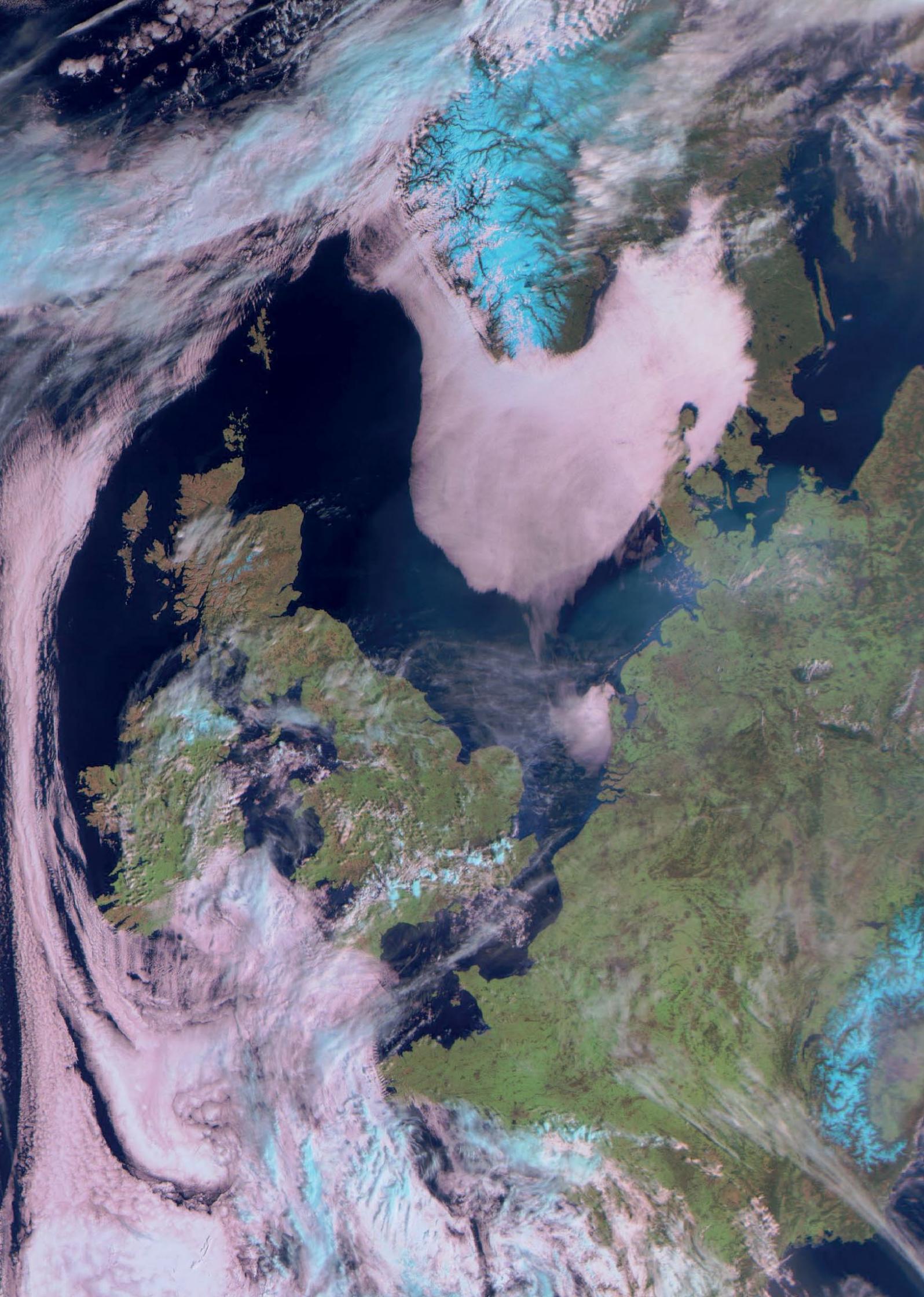


## **Inside this issue . .**

*Norbert Pütz and Marc Peigneux have both experienced RFI interference to their Meteor M2 imagery, and each describes steps he has taken to minimise these intrusions.*

*As manufacturers continue to develop more PCIe cards capable of EUMETCast reception, Mike Stevens describes trials he has undertaken with the TBS6983 and the Technisat Skystar-2 eXpress HD units.*

*And there are features on the recent Solar Eclipse, Cyclones over Vanuatu, Karymsky Volcano, Typhoon Maysak, Bardarbunga, Herbert Island and Elephant Foot Glacier plus many coloured satellite images..*



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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 (December Issue)

Hedgerow Print,  
16 Marsh Lane,  
Crediton, Devon EX17 1ES.  
Tel: 01363 777 595

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# Editorial

Les Hamilton

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The big story of the past three months has been the upsurge in interest in the reception of images from Russia's Meteor-M2 satellite, so much so that GEO's *YAHOO! Group* at

<https://groups.yahoo.com/neo/groups/GEO-Subscribers/info>

received over 400 posts, the majority on this topic, during April alone. Much of this interest has been generated by Alex (Netherlands), Vasili (Russia) and Oleg (Russia). Alex has coordinated testing as the Russian duo produced a succession of software updates that have culminated in a situation where it is now possible to receive Meteor images in real time, just as we do with NOAA APT.

Reception is based upon new SDR Sharp plugins that decode the Meteor transmissions on the fly, and feed them to the imaging software. Particular credit must be given to software designer Vasili, who has created a revolutionary *QPSK-Demodulator* plugin that is extremely sensitive, allowing longer images from weak Meteor signals, and most importantly, is far less susceptible to interference.

Alex has produced a detailed tutorial on setting up a reception platform, and a copy has been lodged in the 'Files' area of *GEO-Subscribers*:

<https://groups.yahoo.com/neo/groups/GEO-Subscribers/files>

The document is called *Receiving Meteor M-N2 in Realtime.pdf*. In addition to detailing all the steps required for setting up your reception platform, the tutorial also contains URLs from which all the relevant software can be downloaded.

Interest in Meteor M2 is really taking off now, and we have included a number of images from this satellite to whet your appetites.

**Copy deadline for the September issue of GEO Quarterly is Sunday, August 16, 2015.**

## Contents

|   |                        |    |
|---|------------------------|----|
| GEO Report and Quarterly Question                   | Francis Bell           | 2  |
| Cover Image Details                                 |                        | 3  |
| Bardarbunga: The Eruption is Over                   | NASA Earth Observatory | 4  |
| EUMETCast DVB S2 Experiences                        | John Tellick           | 6  |
| Using WxTolmg to Produce Images from Recordings     | Peter Marchese         | 11 |
| Solar Eclipse Images from Belgium                   | Andre T'Kindt          | 14 |
| Cyclones Thrash Vanuatu and Western Australia       | NASA Earth Observatory | 16 |
| Ashfall from Karymsky Volcano                       | NASA Earth Observatory | 18 |
| Weather Effects of the 2015 Partial Eclipse         | Francis Greaves        | 19 |
| EMC Advice for using an SDR Dongle                  | Norbert Pütz           | 21 |
| Early Days of Weather Satellite Reception           | Barry Smith            | 27 |
| Elephant Foot Glacier                               | NASA Earth Observatory | 31 |
| Reducing Noise on an SDR Dongle                     | Marc Peigneux          | 32 |
| Testing the TBS-6983 and HD DVB-S2 Tuner PCIe Cards | Mike Stevens           | 34 |
| Super Typhoon Maysak                                | NASA Earth Observatory | 38 |
| Herbert Island                                      | NASA Earth Observatory | 41 |
| Satellite Status                                    |                        | 43 |
| Feedback  |                        | 43 |
| GEO Helplines and Internet Discussion Groups        |                        | 44 |
| GEO Membership Application Form                     |                        | 45 |
| GEO Shop Catalogue and Price List                   |                        | 46 |

# The GEO Report



**Francis Bell**

## **GEO Visit to Darmstadt**

The arrangements for our third visit to EUMETSAT's HQ in Darmstadt, Germany on July 2, 2015 are securely in place. The fine detail of the programme still has to be finalised but it is expected there will be presentations by EUMETSAT staff about their new EUMETCast service and their new high-speed data transmissions, plus at least one presentation by a GEO member. This, together with a tour of the Head Quarters with their new building, should fill a busy day.

An unexpected complication about our visit is the coincidence with the planned launch of MSG-4, currently scheduled for the evening of July 2, 2015: yes, the same day as our visit! Nobody could have foreseen this, but it may be double edged, with much technical activity by EUMETSAT's staff which our visiting group may be able to observe. On the other hand, we must recognise that on this day our GEO visit may not be their highest priority with their latest satellite launch in progress.

We still have places if you wish to register for this visit, if so then please send an email to

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

expressing your wish to join our group visit to Darmstadt.

The planned visit to ESOC on the July 3 is still in doubt because of the launch of MSG-4. However, on the positive side, we have a GEO member who works at ESOC and some negotiation for a visit may be possible. I will keep the GEO website up-to-date with the programme for our Darmsatdt visit.

## **The International Space station ( ISS )**

I continue to follow the imaging from the ISS by logging on to the following websites:

[www.ustream.tv/channel/iss-hdev-payload](http://www.ustream.tv/channel/iss-hdev-payload)  
[www.nasa.gov/multimedia/nasatv/iss\\_ustream.html](http://www.nasa.gov/multimedia/nasatv/iss_ustream.html)

Sometimes there are excellent Earth images from the High Definition TV cameras on the ISS, but I also have to admit it can be frustrating, because it seems impossible to predict at any one time which camera will be functioning. It's possible to have a forward view, a rear view or best of all a vertical view of the Earth. Perm these variables with orbital position, day night and communication links; receiving striking images of the Earth can be a bit of a lottery. However, this does not stop me at home where I regularly run my ISS viewing system.

**Note:** the second website address above also carries audio relating to activities on the ISS.

## **Software Defined Radio (SDR)**

I continue to use the GEO SDR dongle for reception of the NOAA APT polar orbiting satellites and the new Russian Meteor M2 satellite, which transmits LRPT digital images. The low price of the dongle, and free software, makes this an attractive method for live satellite signal reception

and subsequent imaging. At a recent Kempton radio rally I sold all the stock I had in about one hour, which illustrates how attractive this method of satellite reception has become. This dongle is available from the GEO shop together with connectors and cables.

## **Quarterly Question Number 45**

The last Quarterly Question related to an image I received from the ISS. The image was one showing the junction of three great lakes on the USA/Canada border. It showed parts of Lake Superior, Lake Michigan and Lake Huron, with the town of Sault Ste. Marie close to the centre of the image. My thanks to those members who emailed me with the correct names of the lakes.

## **Meteorological Technology International (MTI)**

I have recently received a very interesting 100 page publication from the MTI relating to the monitoring of the Earth's weather from space. This particular edition has informative articles about NOAA's new GOES-R satellite and the UK's Met-Office Space Weather Centre, plus about 18 other related articles. The MTI is based in the UK but its major annual conference, with exhibition, is held in Brussels, Belgium each year. The dates for this year's conference are October 13-15, 2015. If you would like a copy of their latest publication, which is not generally on sale, you could try writing to:

Meteorological Technology International, Abinger House, Church Street, Dorking Surrey RH4 1DF, UK or email

[simon.willard@ukipme.com](mailto:simon.willard@ukipme.com)

State in your correspondence who you are and your interest area, and ask to be included on their mailing list. I cannot promise anything but it's certainly worth a try.



## Future Events

**June 21, 2015** - Newbury Radio Rally. GEO will have a stand at this rally held on the Newbury Show Ground, and will demonstrate live satellite reception from a field location

**July 2, 2015** - GEO's visit to Darmstadt, Germany.

**July 24-26, 2015** - AMSAT-UK will be holding their annual colloquium at the Holiday Inn, Guildford. GEO will have a stand there, and may perhaps make a presentation relating to weather satellite reception. For further information visit AMSAT-UK's web site at

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

**September 25-26, 2015** - The highly popular National Hamfest takes place at the Newark Showground. In the past GEO has run a stand at this rally and details of our attendance this year are under discussion.

## Cover Image Details

### Front Cover

This exceptional **Meteor M2** image was acquired by David Taylor on April 5, 2015. It shows the United Kingdom and western Europe under the influence of a large region of high pressure, in which both Ship Trails (over northern Scotland) and aeroplane contrails and their shadows (over the Irish Sea) are prominent. Perhaps because it was Easter Day, notes David, there was less interference than usual, hence the flawless image. Reception was via a *FUNcube Dongle Pro+* using a 137 MHz filtered HAB preamp. Processing was with the usual software, and the image enlarged 50% with some brightness correction and sharpening applied.

### Inside Front Cover

This **Meteor M2** RGB123 image was captured by Peter Kooistra from the 10:09 UT pass on April 10, 2015. A large anticyclone is in place over western Europe bringing unseasonable warm, sunny weather, except for southern Scandinavia, which is shrouded in fog. The image is also notable as one of the occasional transmissions where channel-3 replaces the usual infrared channel-5, giving

added tonality to the scene. It was recorded with an experimental IF-recorder plugin (Vasili) at 1.4 MSPS with a bandwidth of 90 kHz, using a Chinese €10 RTL2832U dongle with the 820 T2 tuner.

### Inside Back Cover

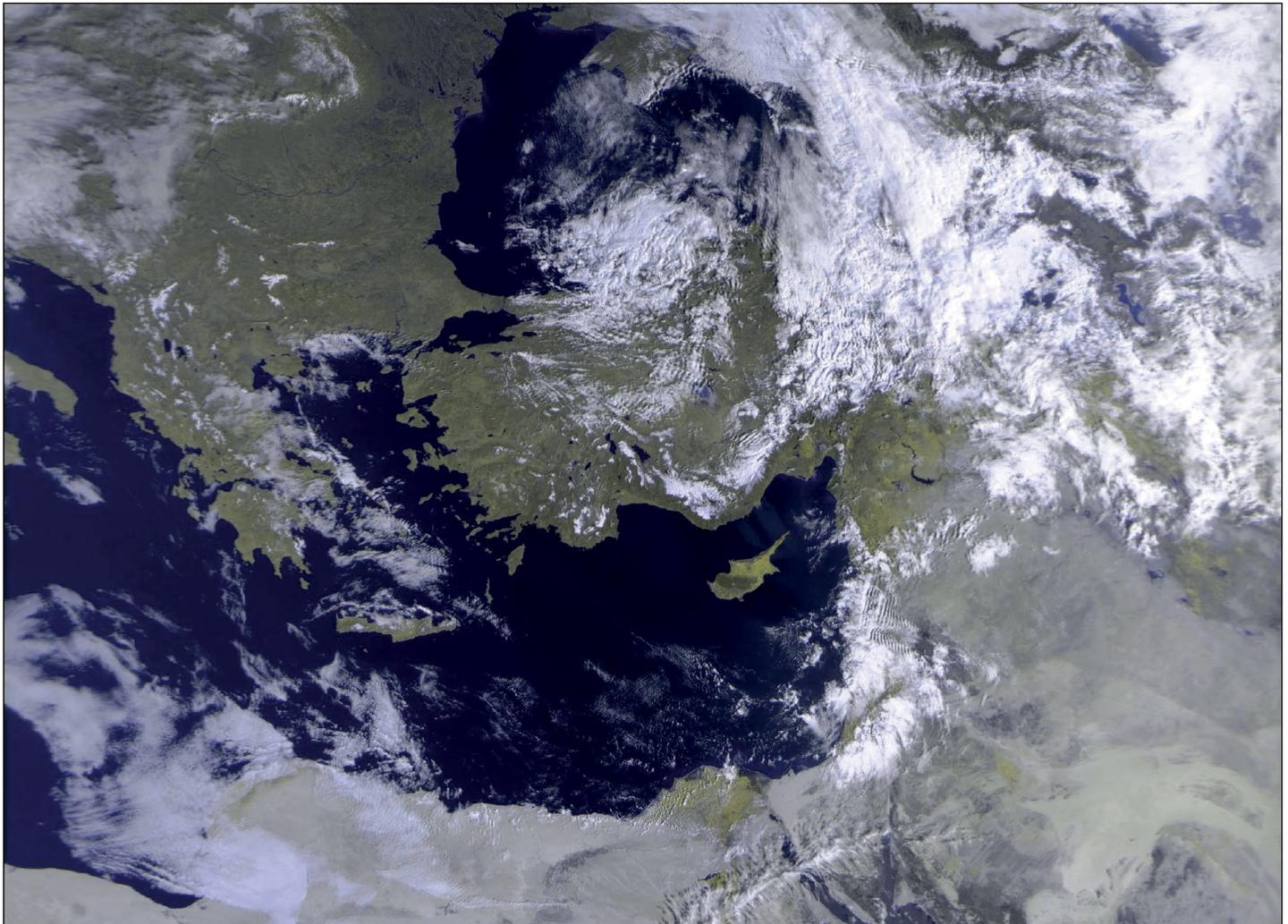
Hendricus Lulofs has been experimenting with **Meteor M2** reception, and recently installed the new QPSK plugin. This is the May 14 image he shared with members via the *GEO-Subscribers* Group, his first with the new software, and his longest and best quality result to date.

*You can learn more about this new methodology by consulting the tutorial mentioned in the Editorial on page 1.*

### Back Cover

This image showing almost the entire UK free from cloud is part of a **Meteosat-10** image downloaded from EUMETCast by Mike Stevens on April 19. Overnight, onshore winds had shrouded the eastern half of Scotland and England with cloud, but by early afternoon, it had almost totally dissipated.

*Image © EUMETCAST 2015*



Enrico Gobbetti acquired this Meteor M2 image of the eastern Mediterranean from the 07:23 UT/15° maximum elevation pass on March 4, 2015

# Bárðarbunga

## The Eruption is Over

NASA Earth Observatory

The Operational Land Imager (OLI) on NASA's Landsat-8 satellite captured this pair of false-colour images of the Holuhraun lava field. The images combine shortwave infrared, near infrared, and red light (OLI bands 6-5-4) to show variations in the temperature of the lava better. This particular band combination also makes it easier to see through the plume of steam and gas rising from the fissure.

Figure 1 shows the region on September 6, 2014, in the early days of the eruption. Newly-formed basaltic rock is black and fresh lava is bright orange. On February 28, Icelandic authorities declared the eruption to be over, and figure 2 shows exactly the same area on April 2, where the lava field remained warm enough to prevent significant accumulation of snow in an otherwise snow blanketed landscape.

Since August 2014, the eruption has produced a lava field that covers 85 square kilometres. The average thickness of the field is between 10 and 14 metres, with a total volume of nearly 1.4 cubic kilometres of lava extruded from the Earth.

The eruption created a number of features—the lava field and several craters—that local authorities are now in the process of naming.

A new lake will probably form when summer melt water runs off of nearby Vatnajökull glacier (seen at the foot of both images).

Although fresh lava has now stopped flowing from Holuhraun, it is possible that activity could resume. One volcanologist monitoring the area noted that Bárðarbunga's caldera, which fed the Holuhraun eruption, has started rising, a sign that magma may be accumulating in the magma chamber again.

*NASA Earth Observatory image by Jesse Allen, using Landsat data from the US Geological Survey*



Figure 1 - Lava from the Bardarbunga eruption spews from a fissure in the Holuhraun lava field on September 6, 2014



Figure 2 - Although the eruption is now over, the erupted lavas remain sufficiently warm to prevent snow accumulating over the Holuhraun area., shown on April 2, 2015.



Peter Kooistra submitted this Meteor M2 image of snow-covered Mount Etna, dating from March 1, 2015.



Robert Moore sent us this interesting clip from a Meteosat-10 image acquired in early evening on April 15 this year. The two streaks running across north Wales are the decaying remnants of contrails. This illustrates just how contrails contribute to global cloud cover.

Image © EUMETSAT 2015

# EUMETCAST DVB-S2 Experiences

## Pointing and Rain Fade Problems

John Tellick

There has been discussion on the User Groups over the last few months about signal strength and required dish size for the 'new' *EUMETCast* DVB-S2 VCM service from *Eutelsat-10*, as users migrate from *Eutelsat-9A* DVB-S. EUMETSAT had suggested that most users would not have to change their dish (apart from re-pointing it) to receive the new *Basic Service*, but a new LNB and cable might be an advantage. However, comparing the EIRP contours for *Eutelsat-10* compared with those for *Eutelsat-9A*, the central area EIRP has been reduced from 50 dBW to 48 dBW and, correspondingly, the level will be lower as you move away from the 'core contour.'

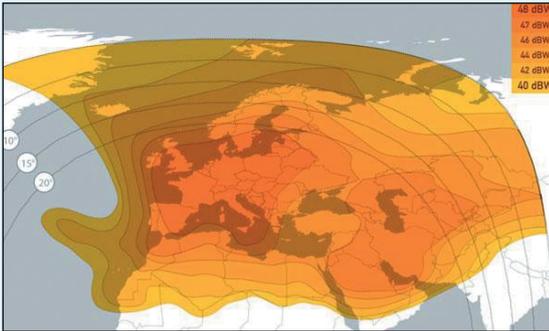


Figure 1 - The Eutelsat-10 EIRP contour map for DVB-S2

This comparative reduction in signal level has already been experienced by users, especially those in Scotland, where some have had to increase their dish size. One could experience quite a drop in SNR when moving the dish over from *Eutelsat-9A* to *Eutelsat-10*. And, if you require the *EUMETCast* HVS Service, dish size increases considerably beyond what we have been used to.

EUMETSAT's *EUMETCast* web pages recommend minimum dish sizes of 90 cm for the *Basic Service* and 1.8 m for the *HVS Service* within the central zone contour area. This is in order to maintain the service *Link Margin*, taking into consideration rain fade and possible slight off pointing of the dish alignment and LNB skew.

However, at my location within the central zone, signal level using an *Inverto Black Ultra* LNB on my original 85 cm dish with the SR1 receiver, I was experiencing no packet loss on the *Basic Service* and several dB's of *Link Margin*—although I had to tie up next door's bulging fir tree and move my patio mounted dish slightly, as it had increasingly been partly shadowed by the tree. So that was encouraging, signal wise.

Looking to the future, and the possibility of receiving *EUMETCast* HVS, I purchased a *Triax* 1.1 m dish in early December which, given it's well known name for quality of construction and signal performance, should have been capable of giving me sufficient *Link Margin* (most of the time) for HVS, being inside *Eutelsat-10*'s central zone contour.

Having unpacked the dish and found that it was indeed very well made, as expected, I noticed it had an unusual mast/elevation clamp design, which the supplier's website detailed thus:

The *Triax* 1.1 m TD steel dish features all the well-known reception properties and is distinguished by its design and quick and easy mounting (about 2 minutes).

A novel elevation bracket with scale setting facilitates precise mounting, the pre-mounted feed arm just needs unfolding, and the LNB bracket with the LNB is simply clicked on.

I have many years experience of setting up dishes, including a prime focus 2 m dish for the Soviet C band *Ghorizont* TV satellite in 1980 – with a considerable inclination, and later a prime focus 1.8 m dish for the early days of European Ku-band TVRO and the start of 'DTH Satellite Broadcasting' from *Astra*.

As had been said often on the YAHOO! User Groups, accurate alignment of both the dish and LNB would be required for the slightly more critical reception of DVB-S2 VCM *EUMETCast* from *Eutelsat-10*. In my view, setting up a dish accurately requires that you are able to hold one plane (either azimuth or elevation) rigid while you adjust the other. In fact, I would say this is essential.

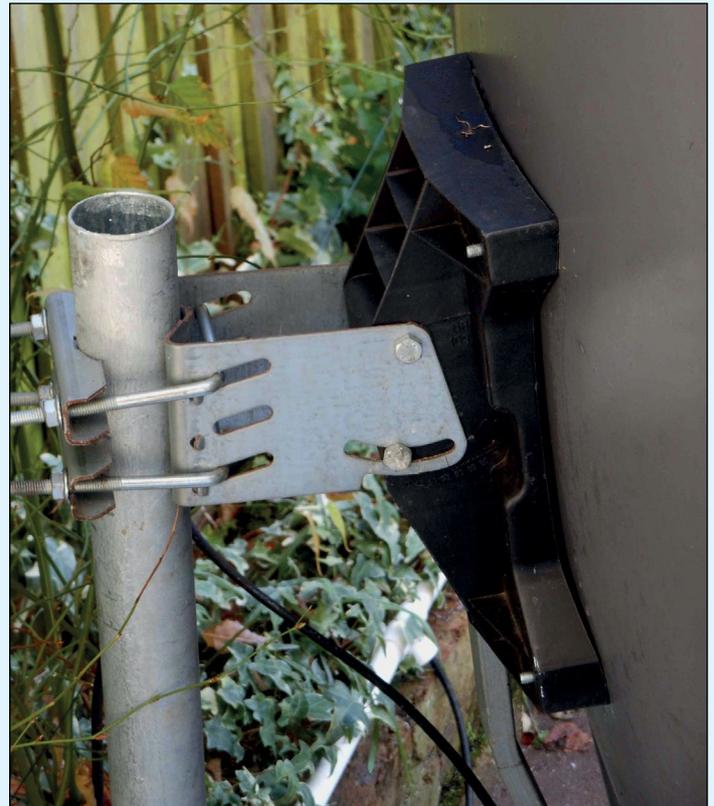


Figure 2 - A 'conventional' clamp arrangement for dish adjustment

The good old, common 'box type' mast/elevation clamp bracket (figure 2) offers this facility as you only loosen one of the two elevation clamping bolts to tilt the dish while adjusting it: the other bolt holds the dish secure. So I was interested to see how the 'novel' *Triax* dish clamp system worked. You will note that the dish doesn't tilt—as is common with just about every other dish—but rotates 'through' the curved clamp mechanism on a curved dish back plate track (figures 3 and 4).

Having set the azimuth, I had to loosen the two elevation clamp bolts in order to allow the dish to swivel vertically in order to adjust the elevation. But, having loosened both clamp bolts, the dish was now able to move from side to side owing to the curved clamp/back-plate mechanism.

It was impossible to make accurately the delicate adjustments in elevation for those elusive decimal points of a dB required on the new service, owing to the dish not being held secure whilst adjustments were made. I gave up after some time, then had another go the next day, but again to no avail.

Fortunately, I had a very old slightly battered 1 m offset dish (with a 'proper' mast/elevation clamp mechanism) in the shed which I set up and aligned accurately in less than 10 minutes. This gave me an SNR of 13.2 dB on the *Basic Service* under clear sky conditions.

### Dialogue

The supplier of the *Triax* dish had meanwhile gone out of business and could not take back the dish nor afford to refund the cost. The new management of the firm wouldn't get involved as 'they had not sold the dish and it wasn't a matter for them to sort out.' I was recommended to get a professional in to install the dish. "Not necessary", I said.

I took the matter up with *Triax*, saying that it was impossible to align the dish accurately owing to the design of the clamp, and that I needed to be able to adjust both azimuth and elevation separately whilst the other plane (and dish) was held secure and rigid (my requirement and functionality). This, I pointed out, can be done with just about every other dish employing the 'box type bracket' clamp design, in order to maximise dish pointing and obtain maximum signal. After a couple of email exchanges, I was told by a manager:

*We manufacture and supply many thousands of the TD series satellite dishes throughout the UK and Europe each year for satellite TV reception.*

*The dish is fit for the purpose it was designed for, i.e., satellite TV reception, and is the preferred choice for many TV system installers.*

*We do not promote the product as having the mechanical functionality you are requesting.*

*Unfortunately the dish appears not to match your particular requirements, but as stated above, we do not claim this design functionality.*

Well, what an admission!

So, if anyone wants a challenge, I have an 'as new' 1.1 m dish going spare.

### Rain Fade?

My old 1 m dish was producing good SNR under clear sky conditions, so I rather eagerly waited for the rain. The first fairly heavy rain of January—and really the first rain since switching to *Eutelsat-10*, produced quite a shock. I noticed that my SNR was down from around 13.2 dB under clear sky conditions, to only 8.3 dB in cloudy, rainy conditions.

"That's not possible", I thought. It hadn't been raining that heavily, and in fact the rain had stopped when I checked the SNR, although it remained heavily overcast.



Figure 3

The Triax clamp arrangement, showing the two clamping bolts. Both bolts must be loosened to adjust elevation, but this allows the dish swivel from side to side in the clamp as well.



Figure 4

The Triax clamp arrangement, showing the curved back-plate of the dish, which is secured by a curved clamp plate.



Figure 5 - Large raindrops on the LNB causing severe signal loss.



Figure 6 - Smaller raindrop accumulation causing minimal signal loss.



Figure 7 - A simple, but effective, LNB rain cover.



Figure 8 - The Mark-2 version of the LNB rain cover.

Then I noticed that the face of the LNB was covered in large drops of rain water (figure 5). I folded a sheet of kitchen towel into a strip and gently wiped the face of the LNB dry from the sides, and immediately the SNR reading recovered to 12.3 dB, which is what I might expect under cloudy rainy conditions?

I had an empty plastic lemonade bottle and made a crude rain cover for the LNB (figure 7) which, despite similar rainfall, kept the LNB dry, with the SNR dropping only to around 12.3 dB. I tried the uncovered LNB situation again when it rained but, strangely, this time the ‘wet LNB face’ signal loss was much less than before—only around 1.5 dB. Looking at the LNB face, it was clear that the water drops were smaller and more dispersed than previously (figure 6).

It had been very windy during this rain episode compared to the still conditions during the first. The dish is tucked into a fairly sheltered position on the patio. So for my situation a rain cover seems to be a worthwhile addition, though perhaps it would be better to open the lower section in case of heavy snow accumulation. A more robust version of the LNB rain cover is shown in figure 8.

I suspect with dishes mounted higher and in the open, wind will keep the LNB face fairly clear of rain drops. But this was quite a worthwhile experiment.

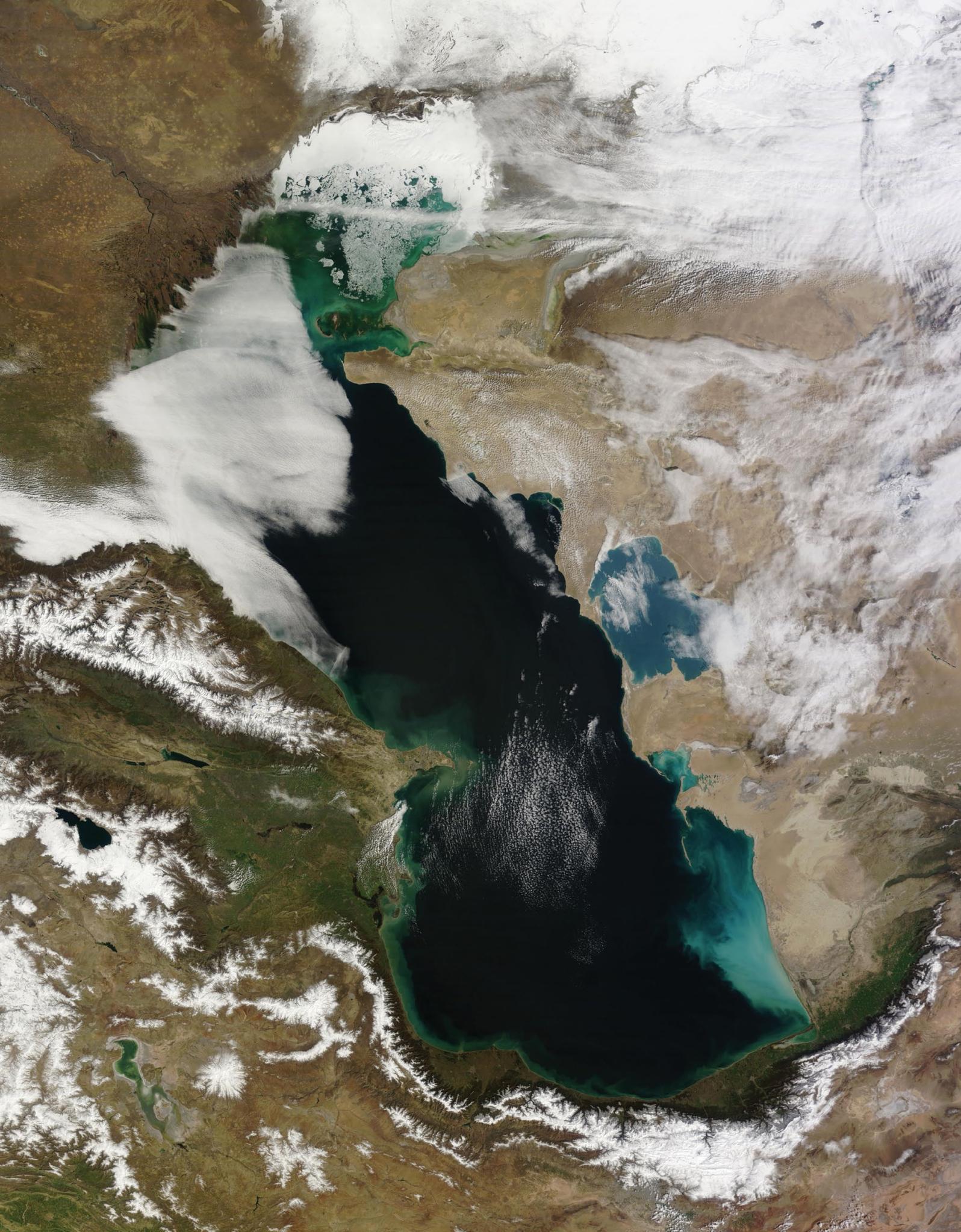
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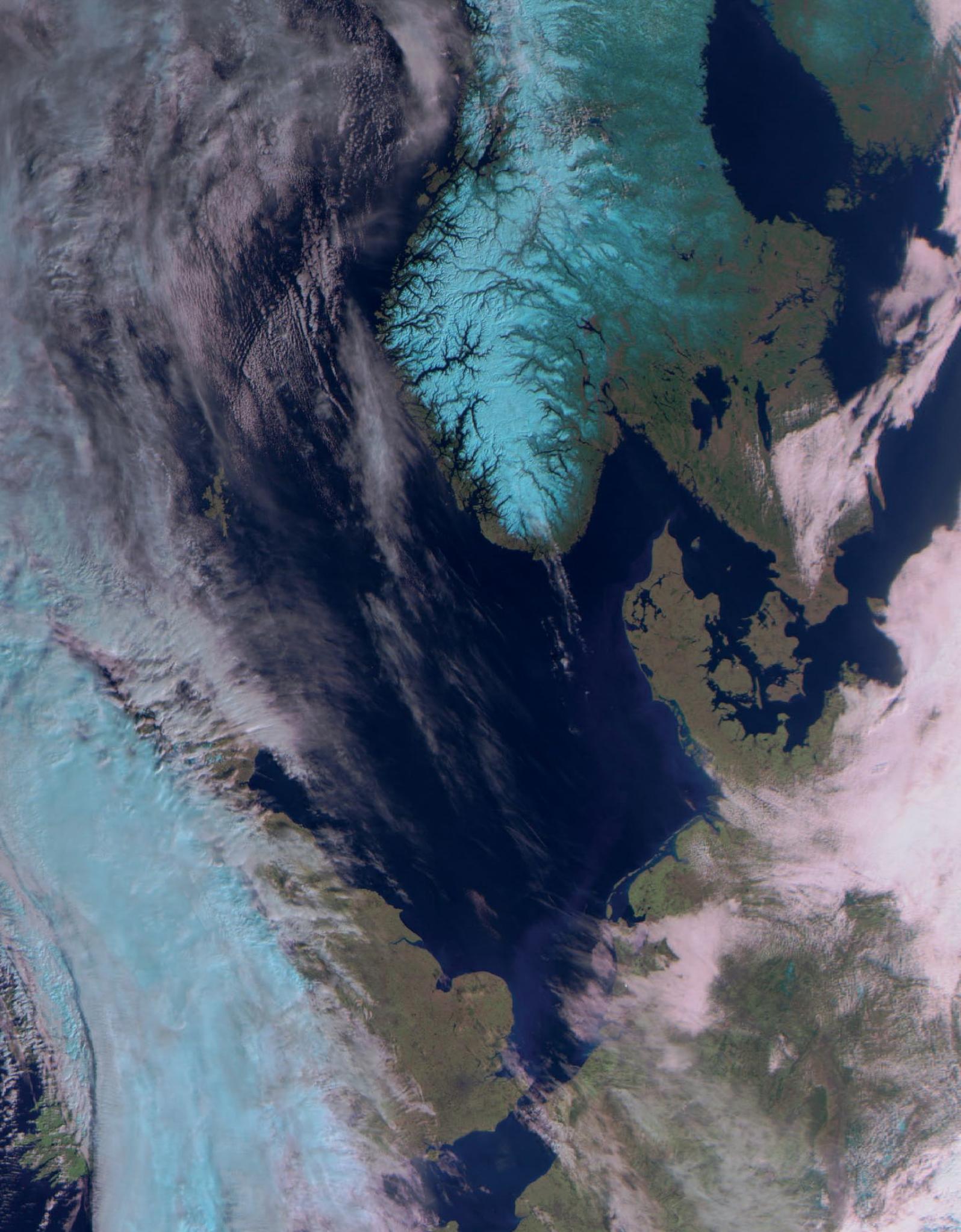
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This MODIS image of the Caspian Sea was acquired by NASA's **Terra** Satellite on March 11, 2015. Although the deep southern basin of the sea remains ice-free, the shallow Caspian Shelf in the north (mean depth between five and six metres) fed by the Volga delta, still harbours considerable quantities of pack-ice. Snow still lingers on the nearby mountain ranges, the Caucasuses to the west and the Alborz range to its south.



This beautiful **Meteor 2M** colour composite LRPT image was captured on March 11, 2015 by Les Hamilton, using an RTL-SDR dongle, ground-mounted QFH antenna and the SDR-Sharp software defined radio. On this occasion the satellite was transmitting channels 1, 2 and 3, which combine to render snow and ice in a cyan colour.

# Using WXtoImg to produce NOAA APT images from recorded satellite passes

Peter Marchese

Although interest has moved recently to Meteor series of weather satellites, there is still much interest in the NOAA series, that do not require such a high level of technology for their reception. Two excellent programs, *WXtoImg* and *SatSignal*, are available to display them and, with the lower bandwidth of their transmissions, horizon to horizon reception is possible with a QFH antenna.

If the receiver and computer are left running continuously, *WXtoImg* will generally record the passes and produce a map overlay which is much appreciated by viewers in the cloudy UK. It is, of course, possible to record the passes overnight with a continuously running receiver, and a recorder switched on for, say, 16 minutes by the reception the 2.4 kHz subcarrier. The images chiefly of interest can then be produced the next day.

In my case I have a *Timestep Proscan* receiver and a *Sony MiniDisk* recorder, into which I have built the 16 minute timer that enables it to record up to five passes overnight. How easy the high precision *MiniDisk* recorder makes things. Back in the sixties, all that I had were cheap tape recorders that were so frequency unstable that one had to record the picture data on one track with a regenerated 2.4 kHz subcarrier with encoded phasing pulses on the other.

Everything is so easy these days with cheap computers and online software. But the first time I was able to see satellite pictures on a monitor screen instead of having to photograph them from a slow scan TV display was in 1984, using the set-up shown in figure 2. I was really proud of the nondescript bit of equipment to the left of the monitor, built from TTL, and all hand wired. It is still serviceable but only has 256 kB of memory, which cost £250 in those days.

I used to be able to read out the pictures from the *MiniDisk* recorder and relabel each .WAV file with the correct pass time in order to make the map overlays fit. But unfortunately,



Figure 1 - Processing a prerecorded NOAA satellite pass using WXtoImg



Figure 2 - The author's original satellite receiving station, dating from 1984, and still in working order.

since replacing my computer, the new model insists on time stamping every audio file it records: so this simple scheme is no longer possible and I have had to adopt a more complex procedure.

Inside an external control unit (figure 3), I have installed a **567** tone-burst detector, the output of which will toggle the playback from the recorder on and off. The **567** is a semiconductor chip that functions

continued on page 14

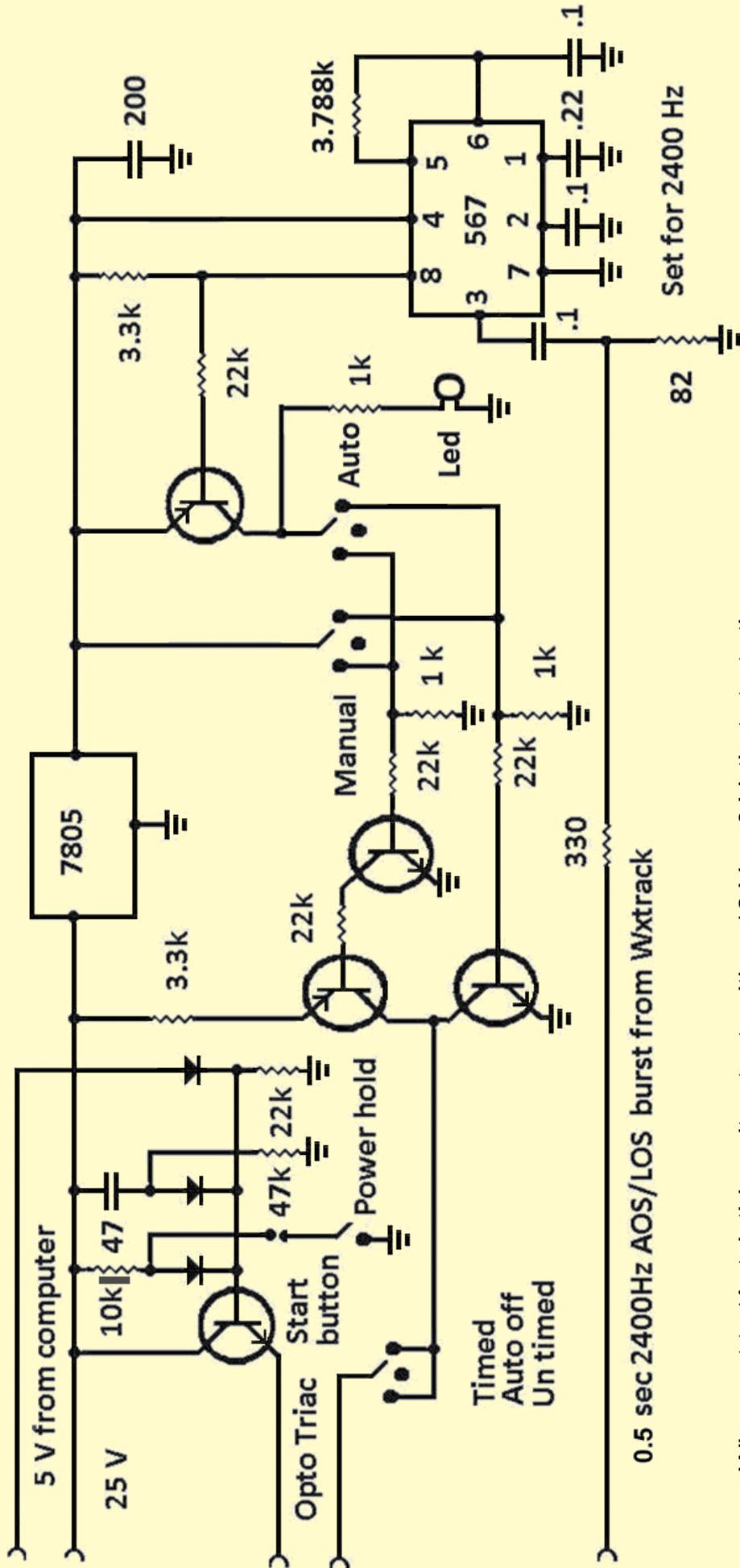


Figure 3 - The Control Unit and Tone Detector

When set to 'Auto', this unit outputs either 12 V or 0 V, that starts the recorder in response to the 0.5 second AOS and LOS 2400 Hz tone bursts from the *WXtrack* program.

0 V runs the recorder untimed, while 12 V runs it for 16 minutes.

This unit also controls the power for the whole system, via the Triac.

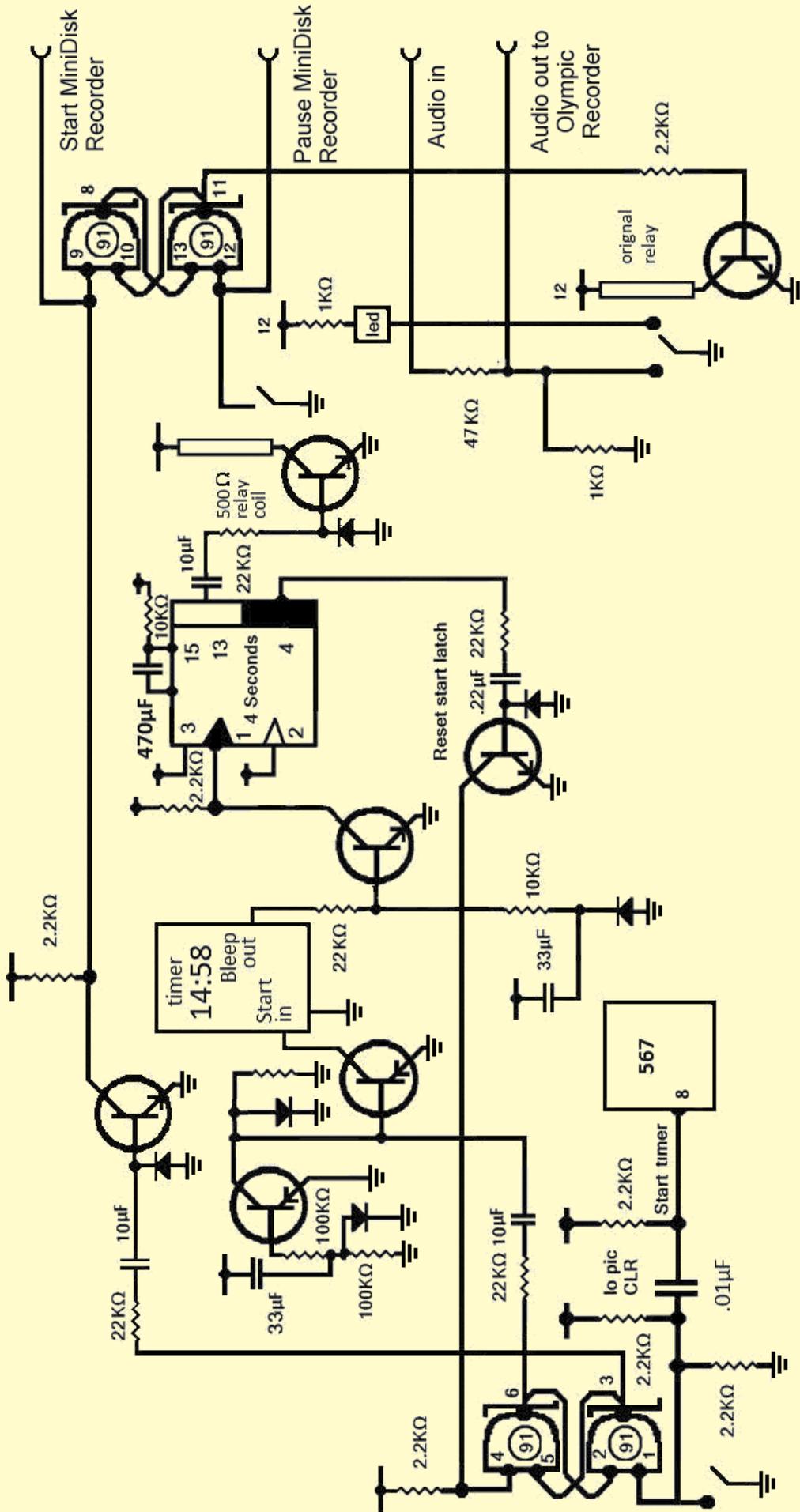


Figure 4 - The Recorder Interface

rather like a radio receiver, and can be configured to output a logic LOW when a particular frequency is fed into it. I chose to use this device as it is fed from the speaker output of the computer and I did not want it responding to the various other beeps that might be emitted.

Sitting under my computer monitor I have a metal box that once contained a 20 MB hard drive, but which now contains a small 25 volt and 5 volt PSU, and an *Opto Triac* which controls the power to my computer, printer, scanner and monitor via a small push button switch: so that when I do a software shut down of the computer, all peripherals are also powered down.

I am running *Windows-10* normally, but this applies to all earlier versions such as *Windows-7* and *Windows-8*. If you go into the 'Control Panel/Sound', then open the 'Sounds' tab, you will find all the pre-recorded sounds that you can get the program to emit. There you will find a selection appertaining to *WXtrack*, as illustrated below. You even have the option to provide you own file for it to output as well.



I used the 'Simple Tone Burst Generator' from David Taylor to generate a 500 ms, 2400 Hz burst, and arranged for *WXtrack* to emit this at the predicted AOS and LOS times.

You can download this software from the following URL:

<http://www.satsignal.eu/software/audio.html#ToneBurst>

My external control unit (figure 4), in addition to controlling the power, is fitted with switches, as follows:

- to control the Mini Disk recorder
- to enable the tone burst control:
  - up:** to start the recorder outputting in response to the tone burst in the 16 minute timed mode
  - mid way:** disconnected
  - down:** stopped and started by the tone bursts but the timer does not run.
- to enables these functions to be performed manually without the tone burst.

All the components are very cheaply available from *Tandy* on-line but not the switches, one of which I had to buy from *Maplin* down town at about five times the proper price!

### Producing the Satellite Images

Now, when I wish to produce an image from a recorded satellite pass, I **must** first reset the computer clock to one minute before the predicted pass time, and then switch on the tone-burst detector. I now start up *WXtrack*, which will emit a tone burst at AOS and LOS, and set *WXtoImg* running on auto mode, so that the software 'thinks' it is receiving a live pass.

This rather complex procedure works fine if you do it all correctly; it just takes a little practice.

Of course the recording setup for *WXtoImg* and the AOS and LOS outputs from *WXtrack* have to match, but this is not difficult and the mismatch is never more than one second.

### And finally ...

If any reader wishes to construct Peter's circuits, he will be happy to reply to any queries at

[Peter.marchese@hotmail.co.uk](mailto:Peter.marchese@hotmail.co.uk)

## Solar Eclipse Photos from Belgium

Andre T'Kindt



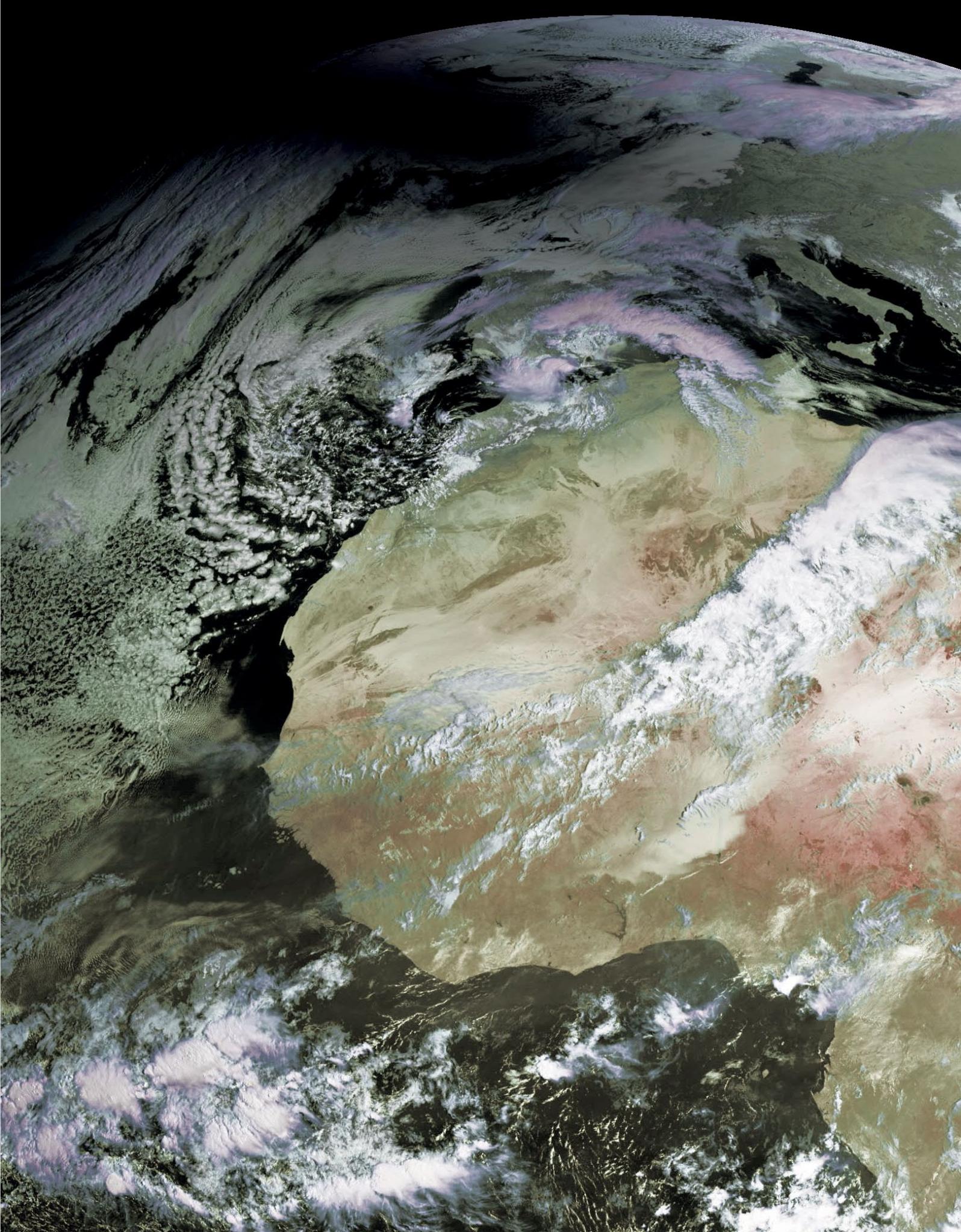
A fine view of the crescent sun, shortly before maximum.



The eclipse reaches maximum



The eclipse nears its end, still visible through light cloud

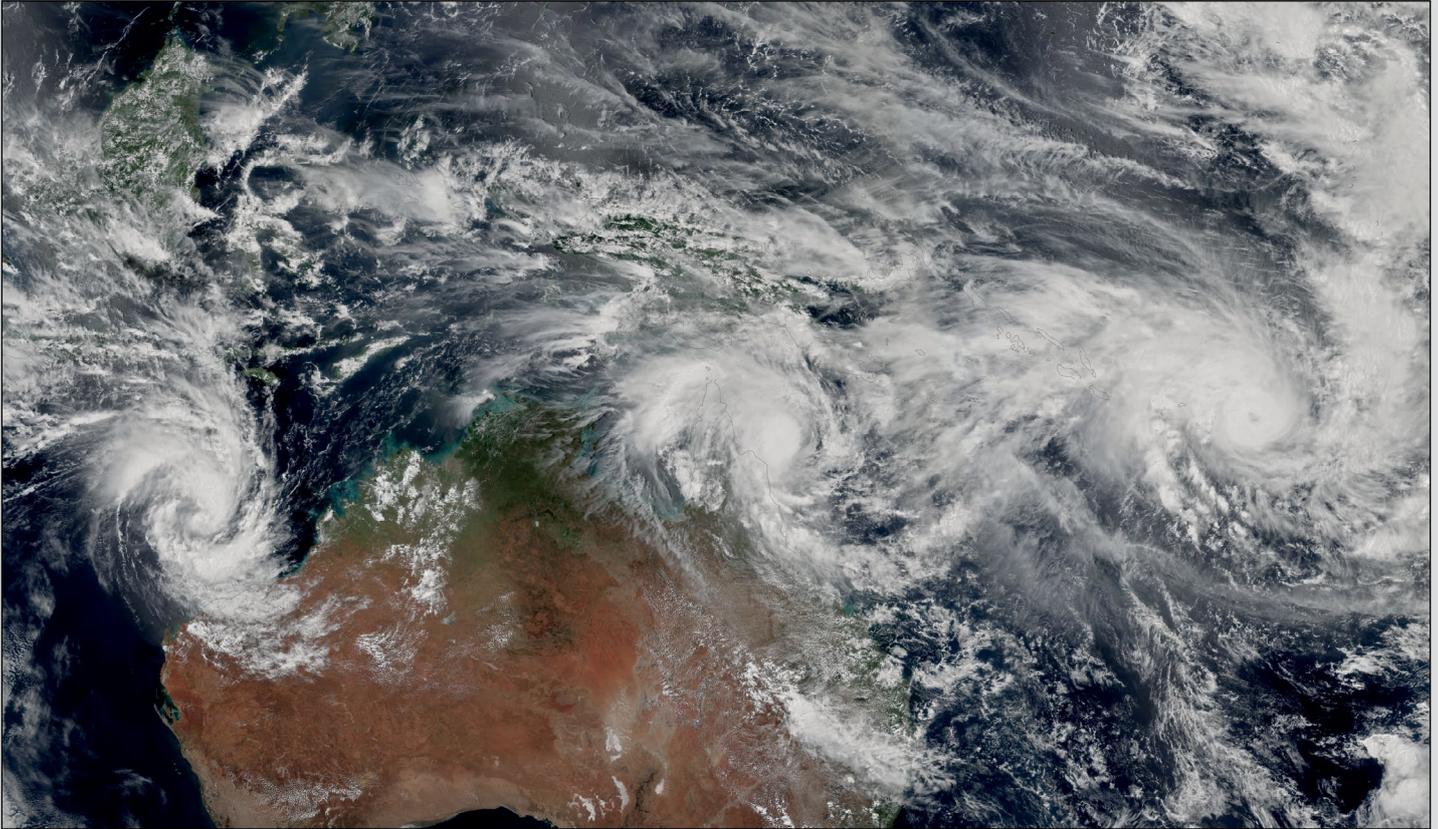


Mike Stevens .sent in this superb Meteosat-10 image showing the umbra of the May 20 solar eclipse centred over the Faroe Islands in the North Atlantic.

*Image " EUMETSAT 2015*

# Cyclones Thrash Vanuatu and Western Australia

NASA Earth Observatory

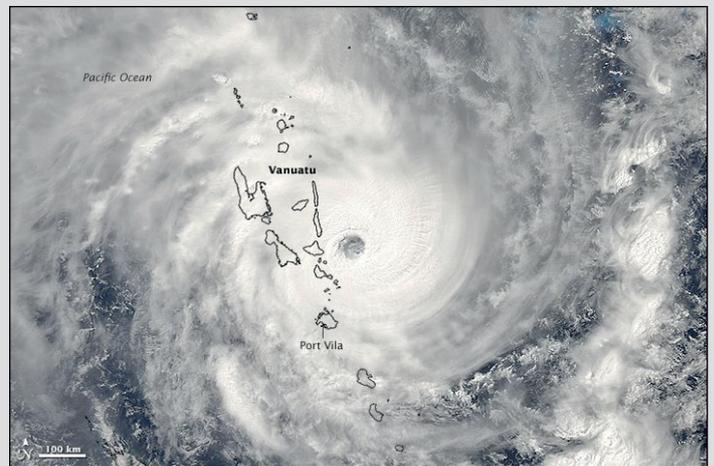


Early March was an unusually busy week for tropical cyclones in the vicinity of Australia. The mosaic above shows three storms—*Pam*, *Nathan*, and *Olwyn*—swirling near the continent on March 11, 2015. The mosaic is based on data collected during three orbital passes of the Visible Infrared Imaging Radiometer Suite (VIIRS) on NASA's *Suomi NPP* satellite. Other satellite instruments that can observe more of Earth's surface at once captured views with a fourth tropical cyclone, *Bavi*, in the Pacific Ocean well north of *Pam*.

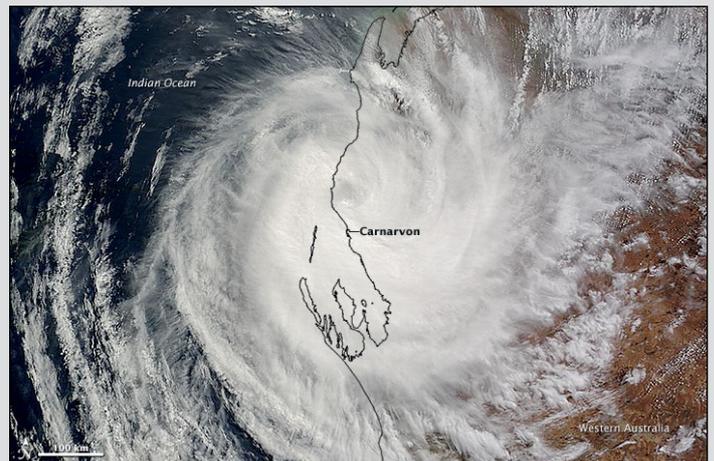
Severe *Tropical Cyclone Pam*, the second most intense storm of the South Pacific Ocean was heading in a southwesterly direction when the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's *Aqua* satellite acquired the upper right image at 02:20 UT on March 13. Not long after this image was acquired, the storm struck the island of Efate, where the east coast probably took the strongest hit, but the capital city, Port Vila, which lies on the southwestern side of the island, also faced extremely destructive conditions. As *Pam* approached the city, it had sustained winds up to 265 kilometres per hour, equivalent to a Category-5 hurricane. Regarded as one of the worst natural disasters in the history of Vanuatu, *Pam* caused several fatalities and numerous injuries, destroyed many villages, disrupted power and water supplies throughout the island.

On the same day, Category 3 Cyclone *Olwyn* made landfall in Western Australia near the city of Carnarvon. The lower image on the right was acquired at 02:55 UT by the MODIS on NASA's *Terra* satellite. Thousands of people in Carnarvon lost power as a result of the storm, which weakened as it pushed inland.

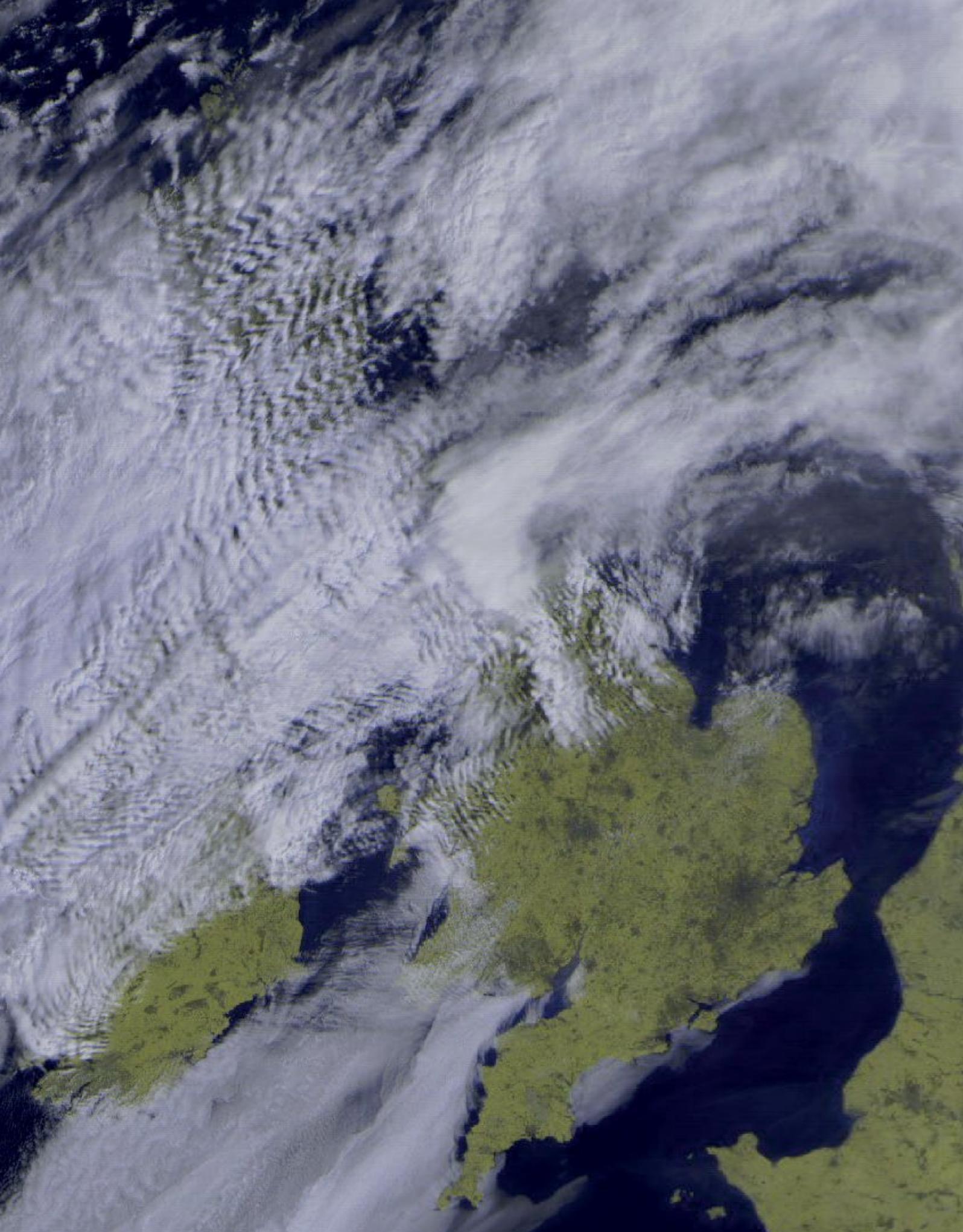
*NASA images courtesy Jeff Schmaltz, LANCE/EOSDIS MODIS Rapid Response Team at NASA GSFC. NASA VIIRS image by Jesse Allen, using data from the Suomi National Polar-orbiting Partnership. Suomi NPP is the result of a partnership between NASA, the National Oceanic and Atmospheric Administration, and the Department of Defense. Caption by Adam Voiland.*



Cyclone Pam strikes Vanuatu



Cyclone Olwyn strikes Western Australia



Douglas Deans is one of a growing band of GEO readers who, after many years dedicated to EUMETCast reception, is enjoying a return to the grass roots of the hobby by dusting off his APT antenna and receiving Meteor M2 imagery. Despite problems with pagers, he has been able to produce some excellent results such as this image of the British Isles acquired on April 14, 2015.

# ASHFALL FROM KARYMSKY VOLCANO

NASA Earth Observatory

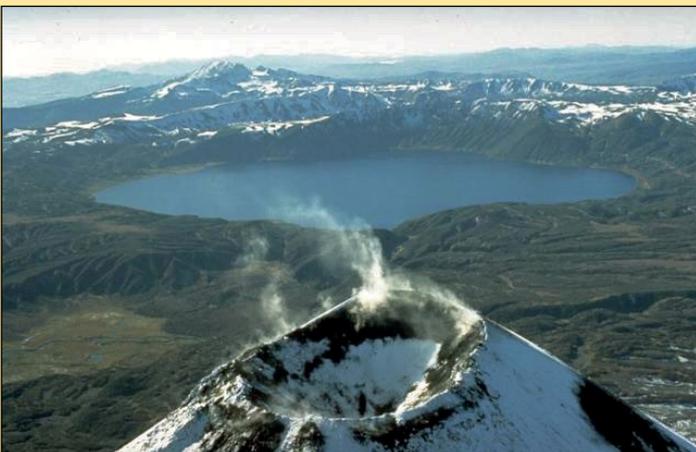


The Karymsky stratovolcano in Kamchatka, photographed in March 2006  
 Photo: Alexander Belousov/kscnet.ru

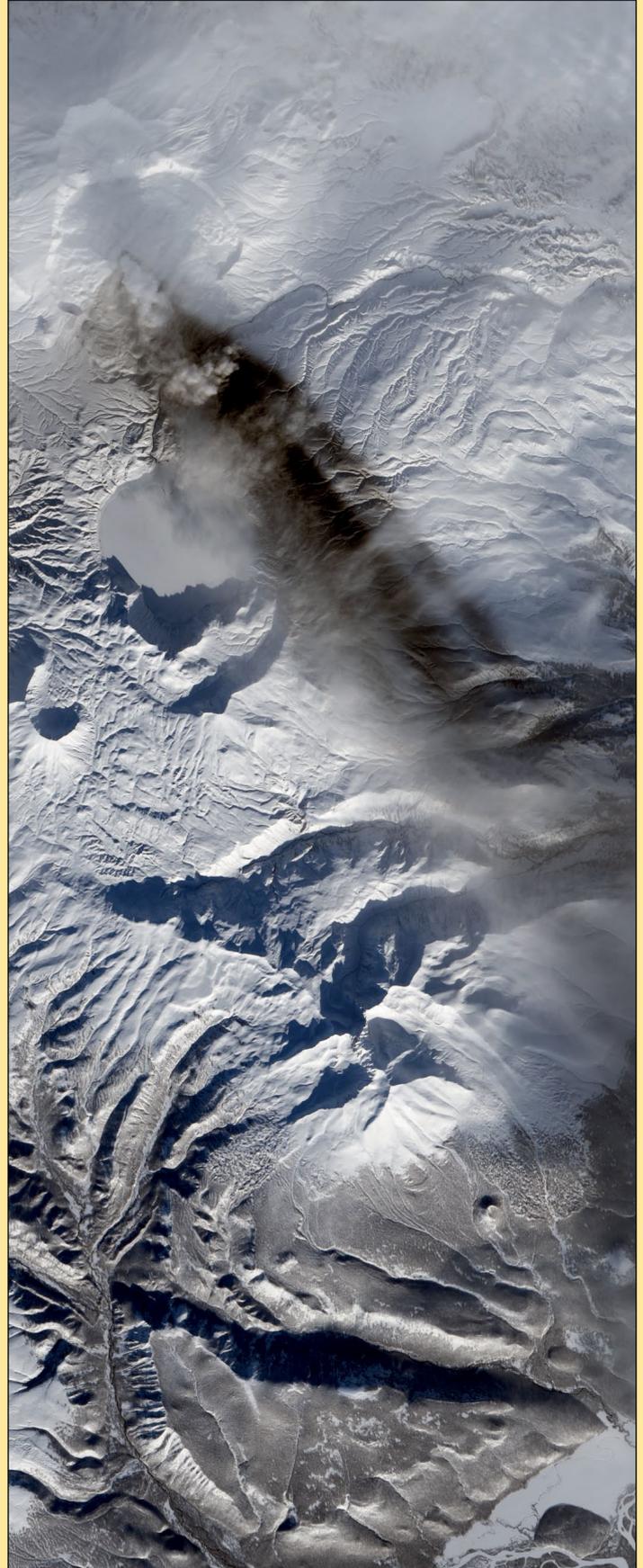
The Karymsky stratovolcano, 1536 metres above sea level, is the most active of Kamchatka's eastern volcanoes, having been almost constantly active since at least the late 18<sup>th</sup> century, when historical records for the region began. Most of its eruptions, and occasional lava flows, originate from its summit. Karymsky's current eruptive phase has now been continuously on-going since 1996, and because of the high levels of volcanic activity in this part of the world, the Kamchatka Volcanic Eruption Response Team (KVERT) monitors the activity levels of many of the volcanoes.

The Akademia Nauk caldera—now filled with water to form the present-day Karymsky Lake—is located to the south of Karymsky volcano. Calderas are formed by an explosive eruption that empties a volcano's magma chamber, causing the structure to collapse and form a crater-like depression. Akademia Nauk last erupted in 1996.

Evidence of Karymsky's frequent eruptions is visible in this natural-colour satellite image, acquired by the Operational Land Imager (OLI) aboard the **Landsat 8** satellite on January 18, 2015. A streak of dark ash extends southeast from Karymsky's summit amidst a backdrop of snow, skirting to the east of frozen Karymsky Lake.



The steaming summit of Karymsky, with the scenic lake-filled Akademia Nauk caldera to its south.  
 Photo: Dan Miller (USGS)/Wikimedia



An ash cloud streams from the summit of Karymsky  
 Image by Jesse Allen, using Landsat data from the U.S. Geological Survey.

# Observing The Weather Effects of the 2015 Partial Eclipse



*Francis Greaves*

The effects of an Eclipse on the weather are documented all over the place. I noticed that the BBC were promoting a project <sup>[1]</sup> to record various aspects of the weather during the Partial Eclipse of March 20, 2015, organised by the Department of Meteorology at the University of Reading. However, I could not contribute because a postcode was required to register and there are no post codes in the depths of West Cork, Ireland where I live (see figure 1). I enjoyed excellent views of the 1999 Total Eclipse on St Marys, Isles of Scilly, so was very excited to be able to experience this one at home, even though it would be only a Partial Eclipse (referred to as Eclipse from here on). The forecast looked promising too.

We were due to have 92% of the sun covered at 09:22:34 UTC, which I expected would have noticeable effects on the weather. I was able to observe the Eclipse in various ways, using special eclipse glasses, a colander, a pin-hole camera and my Digital SLR with a 500 mm lens and Solar Filter. Fortunately, the cloud cleared during the first part of the Eclipse, and then we had a pretty clear sky for most of the Eclipse itself. Being stuck out on the Mizen Peninsula we tend to get significantly less cloud than inland sites. In the photograph I took at maximum coverage you can see the irregular edge of the moon quite clearly.

The expected effects on the weather are as follows:

- A fall in Solar Radiation
- A fall in Temperature of about 1°C or 2°C caused by a reduction in the radiation from the sun
- A fall in Wind Speed
- A reduction in the variability of Wind Direction due to the stabilisation of the boundary layer, and an associated reduction in turbulence <sup>[2]</sup>. The Wind Direction has also been found to 'back' (go anticlockwise) due to an 'Eclipse Cyclone' <sup>[2]</sup>.

I have an excellent Automatic Weather Station (AWS) (well three actually), but my old *Instromet* system is slowly dying. My *Davis Vantage Pro* works well most of the time. I have used the data from my fancy *Campbell Scientific* AWS, recording data every five minutes <sup>[3]</sup> to examine the data for the Eclipse. In particular, the Ultrasonic Wind sensor at a height of six metres is very sensitive and accurate, especially at low wind speeds. The site is very exposed on the northern side of the Mizen Peninsula, 2.8 km from the sea at a height of 60 metres above sea level. We look out down Dunmannus Bay into the Atlantic. The anemometers are on a 10 m mast well away from the house. The AWS is away from the house nearby, and well exposed.

The Eclipse started at 08:19:06 UTC and finished at 10:30:23 UTC. During the period of maximum coverage, there was an eery darkness, and the birds became quiet, as we had expected.

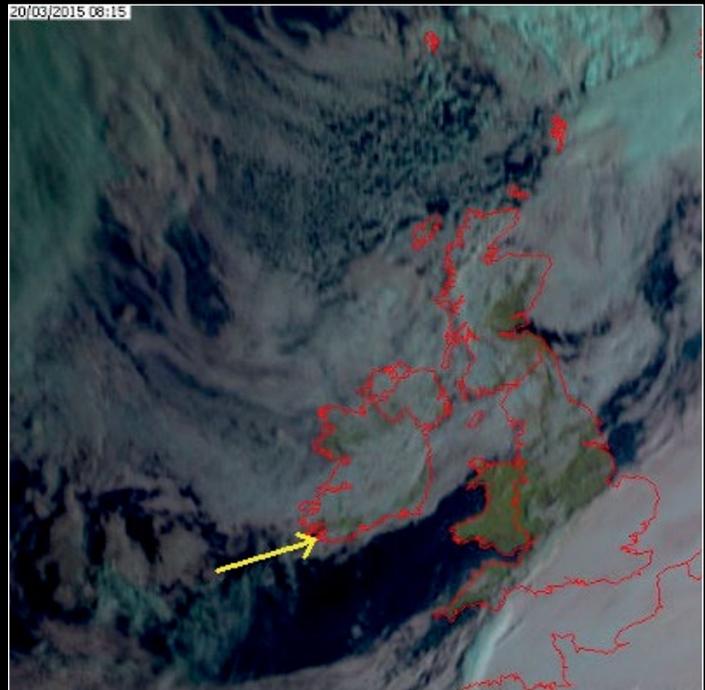


Figure 1  
The approaching eclipse at 08.15, showing the author's location

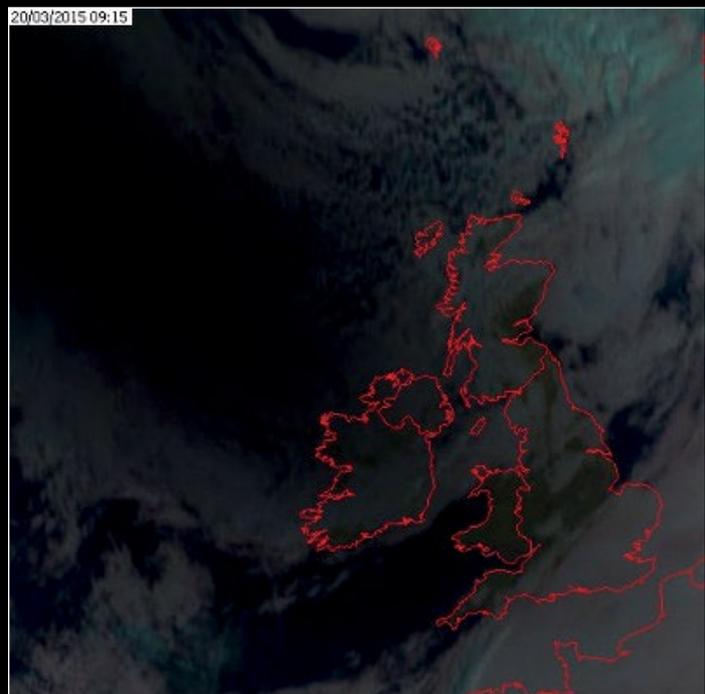


Figure 2  
The eclipse at 09.15, close to maximum

I have included the False Colour Images of the British Isles from EUMETCast for 0815, 0915, and 1015 UTC, which show my location, the cloud cover and the darkness of the Eclipse at 0915 UTC rather well.

I have provided graphs showing the effect of the Partial Eclipse on Solar Radiation, Air Temperature and Relative Humidity (RH), Wind Speed and Direction. Each of the graphs has a blue horizontal arrow to show the period of the Eclipse and a vertical arrow at the maximum point. This is what I observed:

- The Solar Radiation was kept down somewhat early in the eclipse by the cloud cover, remaining down during the Eclipse period, rising rapidly at the end. The dotted line shows the expected rise in clear weather.
- The Air Temperature (blue line), which should have been rising steadily, fell by 1°C then remained pretty static, eventually lagging behind the expected rise by about 2°C and then catching up very quickly once the Eclipse was over. The dotted line shows the expected rise in Temperature.
- The Relative Humidity rose quite sharply as the Temperature fell, then fell back as the Temperature rose once again.
- The Wind Speed Average (red line) and Gust Speed (yellow line) rose early in the Eclipse and towards the end from about 0.4 - 1.0 m/sec to 2 - 3 m/sec, falling back by about 1.5 m/sec in the middle.
- The Wind Direction (blue line) very clearly shows a reduction in variability. The general trend is represented by the dotted line. The general direction however 'veered' (moved clockwise) from SSW to NW then back to SW.

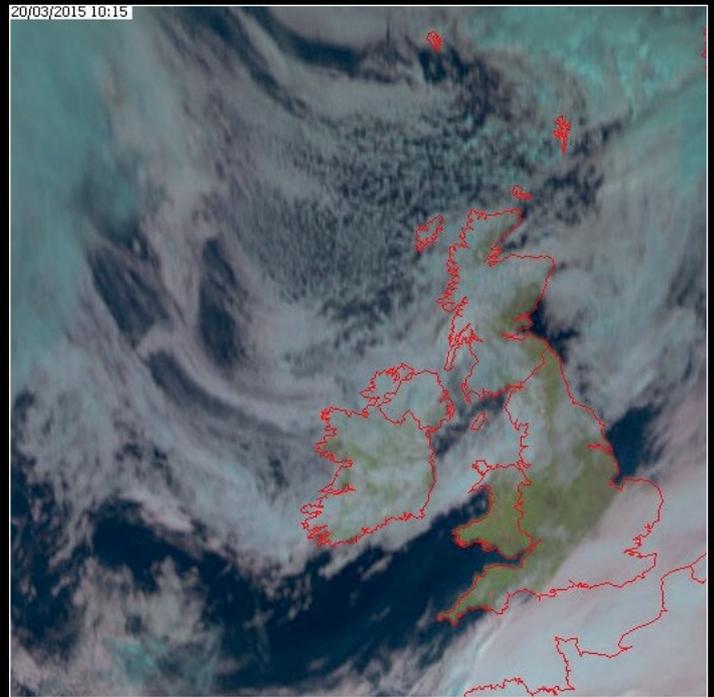
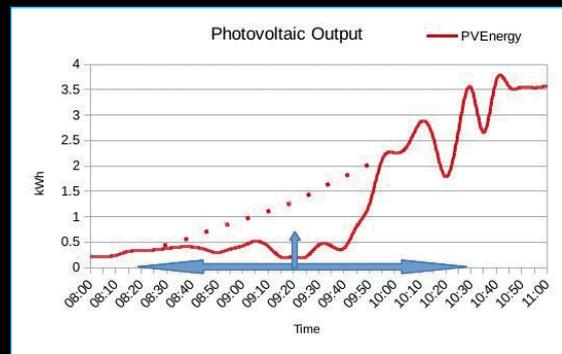
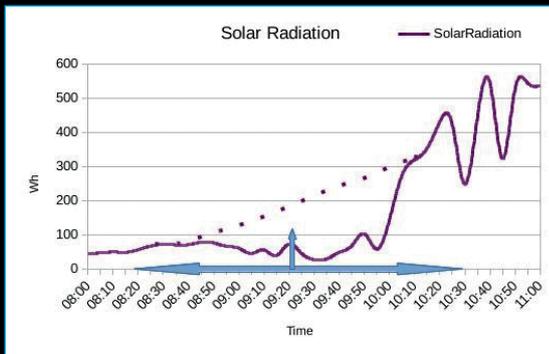
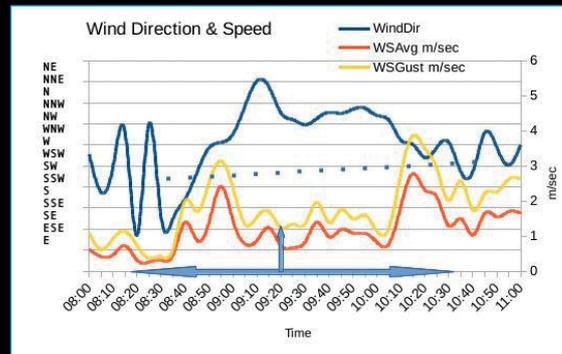
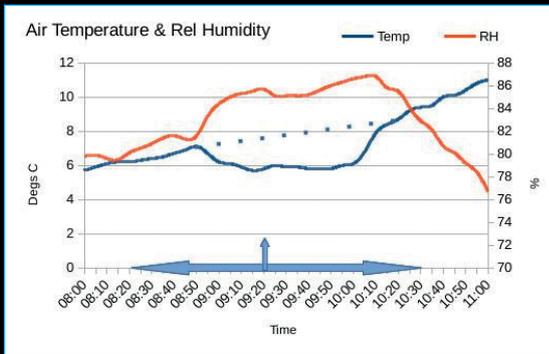


Figure 3 - Post eclipse at 10.15 UTC



**Conclusion**

The effects that I observed from my Automatic Weather Station on the weather by this Partial Eclipse are pretty much as expected. The Solar Radiation, Air Temperature and Wind Speed all fell. However, some of the changes in Wind Direction were not what I expected. There was a reduction in the variability of the wind direction, but instead of backing, the wind veered quite markedly.

I think I am correct in saying, if there was an Eclipse Cyclonic effect (wind in an anticlockwise direction round an Eclipse), and we were on the East side of that 'Eclipse Cyclone', then you

would expect the wind to veer, which is what happened here in Sunny West Cork.

The rise in RH is to be expected because, as Temperature falls, the ability of the air to hold moisture will also fall, so the RH will rise. Once the Eclipse was over, the Air Temperature rose once again, causing the RH to fall.

Being able to look at these data enhanced my Eclipse Experience, and should I be able to enjoy another one, then I will be trying to take weather observations as well as enjoy all the other sensations of this natural wonder.

**References**

1. [http://www.met.reading.ac.uk/outreach/newex\\_2015/index.html](http://www.met.reading.ac.uk/outreach/newex_2015/index.html)
2. <http://blogs.reading.ac.uk/weather-and-climate-at-reading/2015/how-do-solar-eclipses-affect-the-weather/>
3. These data are available as a CSV file at <http://www.themetman.net/content/eclipse-2015#CSVFile>

# EMC Advice for using an SDR-Dongle for Meteor M2 Reception

Norbert Pütz

After several years away from satellite imaging, while raising my family, I recently took an interest again, particularly towards the new Russian Meteor M2 satellite. But, like many other users, I was being plagued by interference. Because these unknown effects were disturbing my Meteor M2 satellite reception, the LRPT decoder was not able to decode my recorded signals from south of the Alps; additionally, lots of coloured lines spoiled my satellite pictures. Figure 1 shows part of one of my images: the broad white band is due to a processing fault aboard Meteor-M2 that produces these breaks in imaging every 6½ minutes, but the thin coloured lines below it are the result of interference.

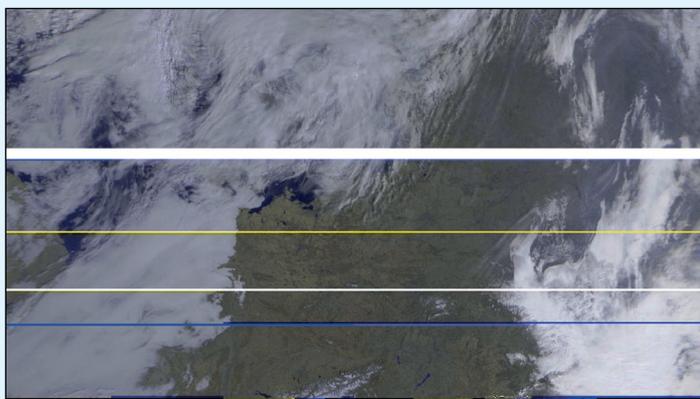


Figure 1 - Part of a Meteor image showing interference lines

Some time ago, I read in a Russian publication the words 'USB-bus noise may be present', which prompted me to investigate the Electro Magnetic Compatibility (EMC) of my reception system. So I decided to take my spectrum analyser, fitted with a magnetic near-field probe, to search for the reasons for my interference. Fortunately, Würth Elektronik GmbH was able to supply me with two USB-filter sticks for test purposes. I discovered four possible ways of combatting interference, and these are detailed below.

### 1 - Use a USB-extension cable

It is well worth while using a short (~20 cm) USB extension cable to attach the RTL Dongle to your computer, specially if it is a laptop. By applying this measure you'll reduce the influence of the radiated magnetic near-fields of your computer on your receiver dongle,

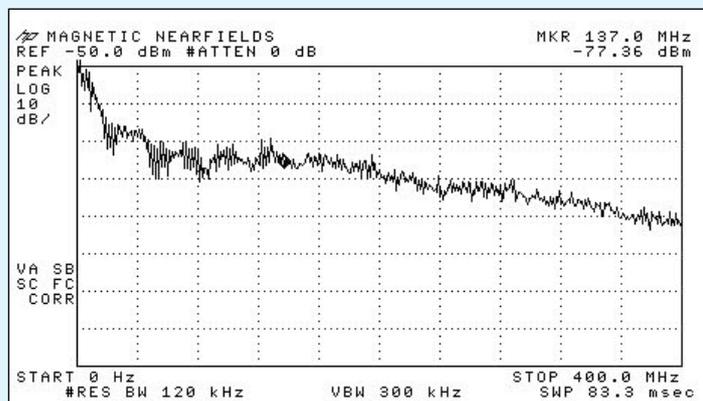


Figure 2

A plot showing magnetic near-fields in the frequency range 1 - 300 MHz from the author's laptop computer.

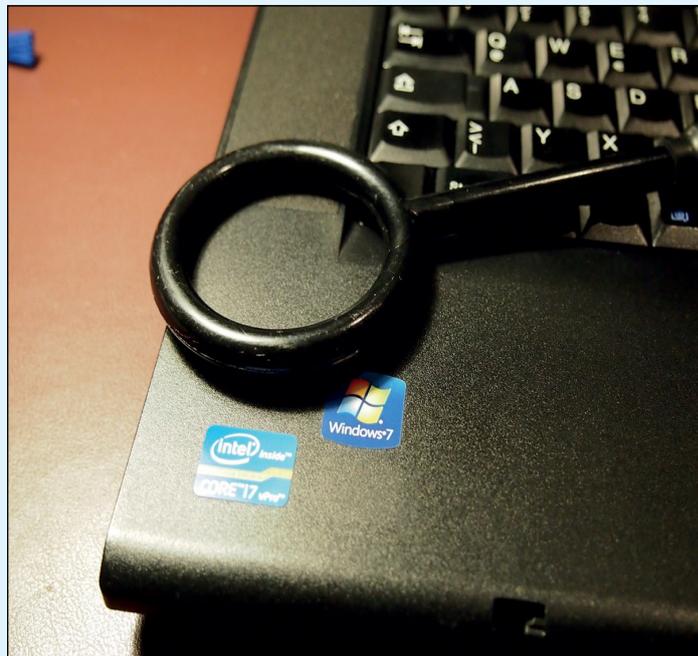


Figure 3 - Measuring magnetic near-fields on the laptop bezel.

My *Lenovo T520* laptop computer gives off strong magnetic near-fields next to its speaker and also from the USB socket at the left side of its housing (figure 2).

There are two ways in which emissions can be propagated by the USB-interface:

- along the screen of the USB-cable
- inside the screen, on the VCC /GND wires and the two symmetrical data lines

To suppress the emissions on the screen, place a suitable clam-shell ferrite core on it.

### 2 - Fit a Passive USB-filter

A passive USB-filter suppresses the conducted radiations (common mode currents) on the two symmetrical data lines and the VCC line. These RF currents may reduce the sensitivity of the *Funcube* dongle, because they can couple into your *Funcube* dongle. Even the perfect Faraday cage of a Desktop PC will not prevent this type of radiation.

At the moment, I'm testing a Würth 829 999 USB-filter stick with great success. You can read more about this device at

[http://www.we-online.com/web/en/electronic\\_components/extra\\_pbs/USB2\\_0.php](http://www.we-online.com/web/en/electronic_components/extra_pbs/USB2_0.php)



Figure 4 - A Funcube Pro+ dongle attached to the Würth USB-filter stick

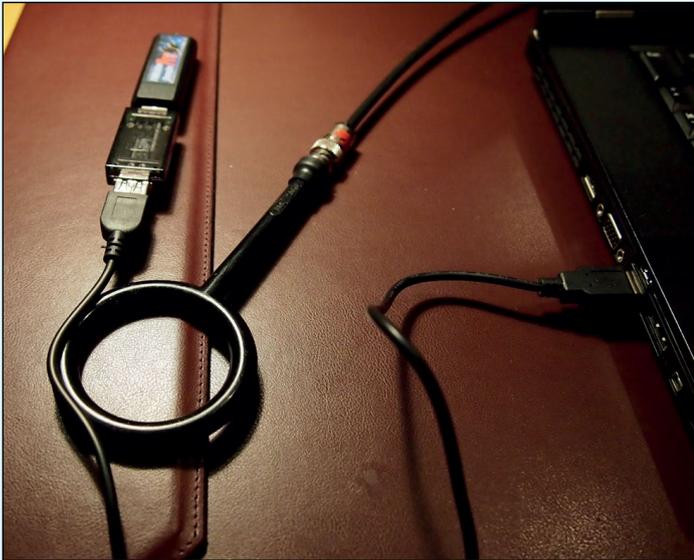


Figure 5 - Measuring the USB-noise on the screen.

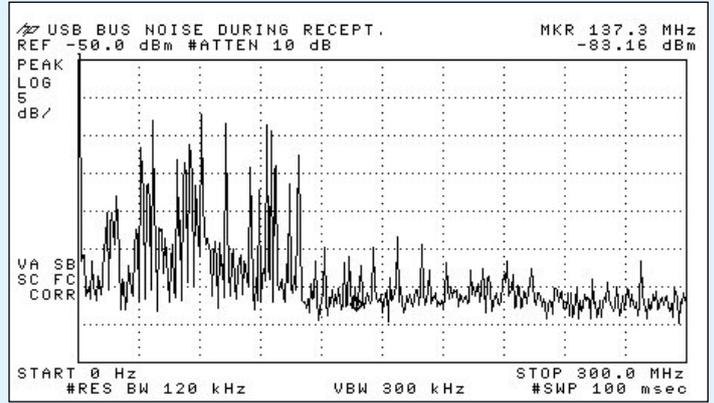


Figure 6 - This plot shows the noise on the USB-cable screen.

Figure 4 shows my **FUNcube Dongle Pro+** connected to a short USB extension lead through the **Würth 829 999** USB-filter stick. The circuitry inside the USB-filter stick is shown in figure 7.

Figure 5 shows me measuring the USB-bus noise on the screen of the USB cable adapter, using a magnetic near field probe (loop). The frequency range is approximately 1 - 200 MHz. This noise will not be suppressed by the filter stick, and can only be dealt with by placing a clam-shell ferrite core around the screen. Figure 6 is a plot showing the measured USB noise.

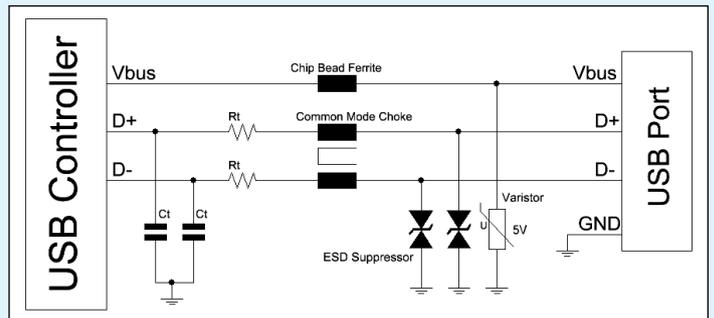


Figure 7 - The circuitry inside the Würth 829 999 USB-filter stick

*continued on page 24*

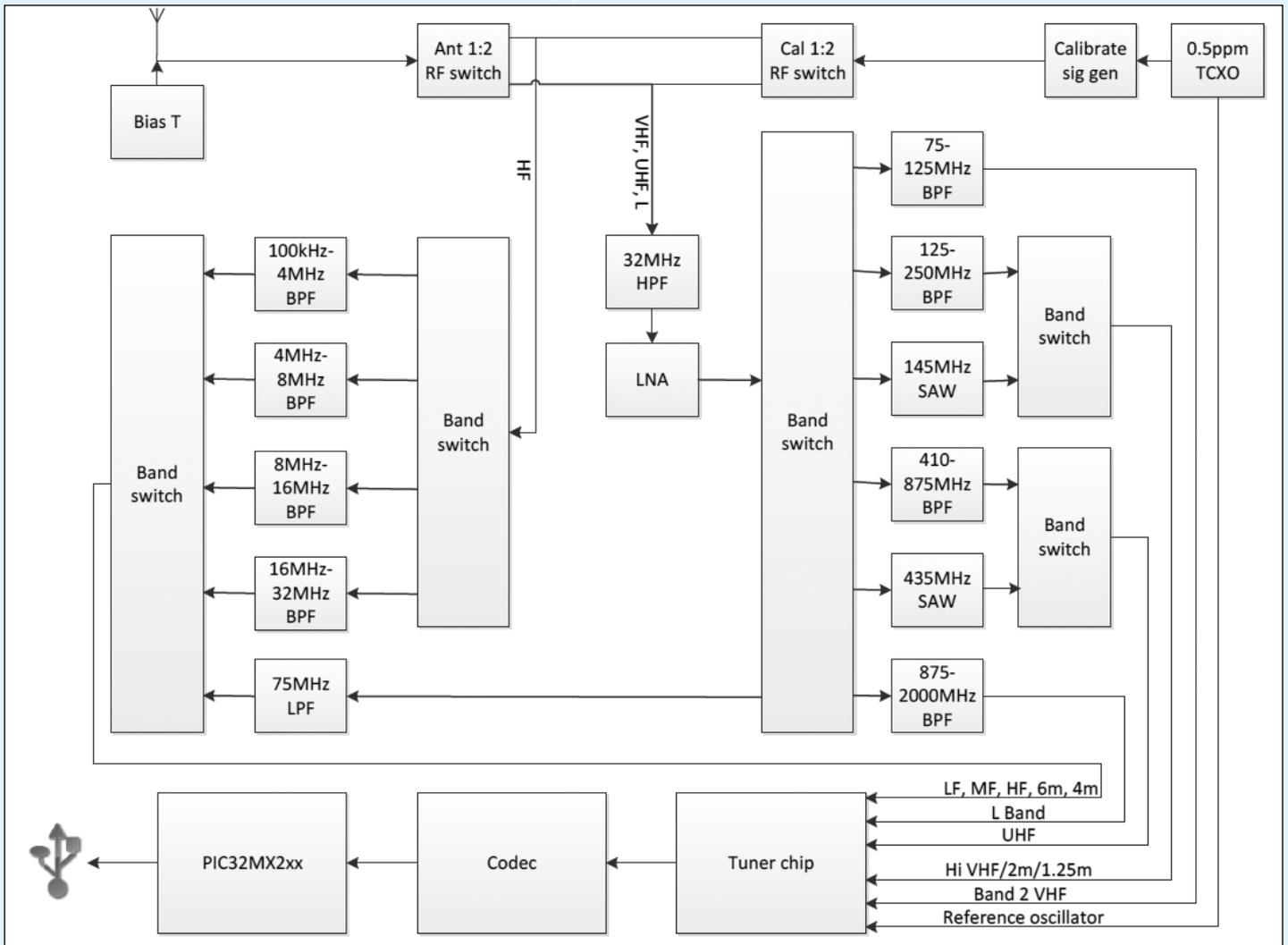


Figure 8 - A block diagram showing the circuitry of the Funcube Dongle Pro+

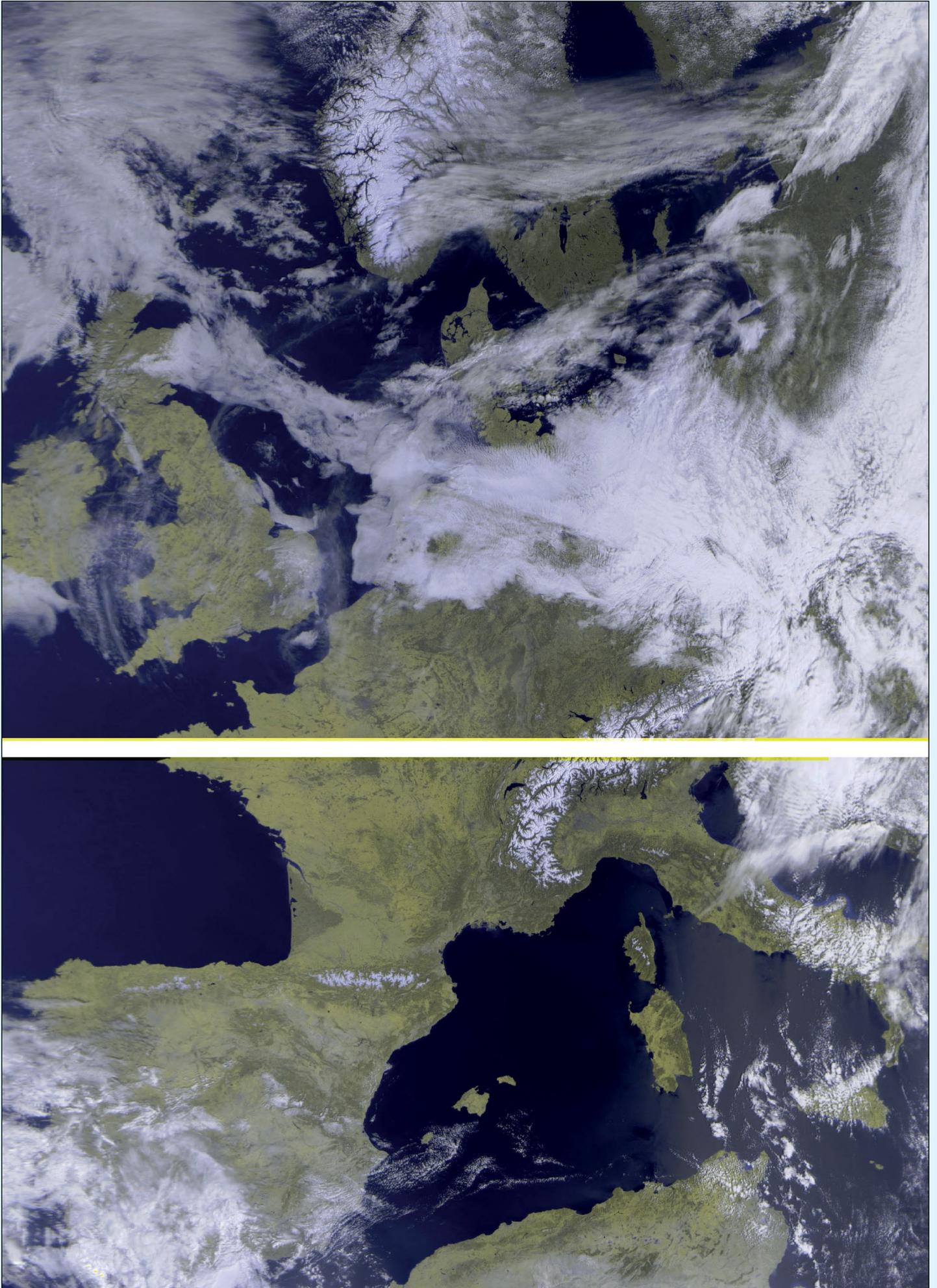


Figure 9 - Meteor M2 at 09:08 UT on April 8, 2015, received when using a USB-filter stick

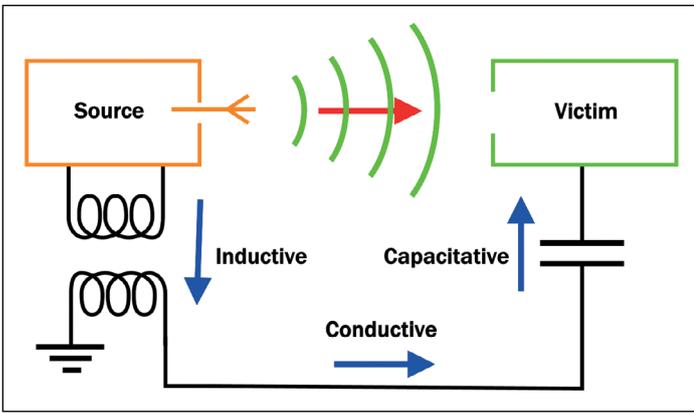


Figure 10  
The four electromagnetic interference coupling modes

**3 - Aircraft radio**

In the case that you are living in an area which is suffering from aircraft radio or similar sources of interference, you have to use a **Funcube Dongle Pro+** rather than a basic RTL-SDR dongle. The Funcube device implements many more filtering options through its preselectable filter banks. A block diagram of the Funcube Dongle Pro+ circuitry is shown in figure 8.

**4 - Tips for Reducing Unwanted In-House Noise**

Don't forget that the harmonics of switched power supplies can disturb your LRPT reception too. You can locate these by using a Long/Medium wave compact radio with an integrated ferrite rod antenna: I use a *Sony ICF-SW7600* for this purpose.

For test purposes disconnect your switched power supplies from the mains during satellite reception. Later you can replace them. Figure 10 illustrates the four electromagnetic interference coupling modes. The victim (susceptible device) is, of course, your RTL or Funcube dongle.

Figure 11 shows my original *TA-1 antenna* (Russian version), complete with an *SSB Electronic LNA 137A* preamplifier

**Summary**

By choosing the appropriate EMC measures, a Meteor M2 transmission with a signal to noise ratio higher than 6 dB will give you great results.

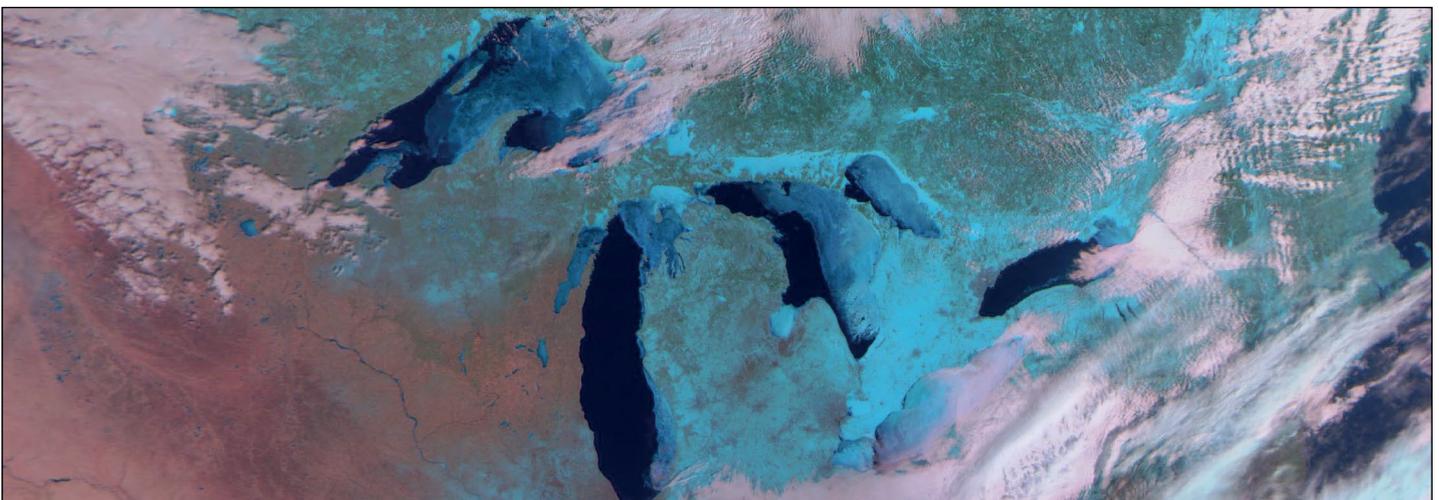
When I received Meteor M2 without using a USB-filter stick (figure 1), the southern parts of Europe were not detectable by the LRPT decoder software.



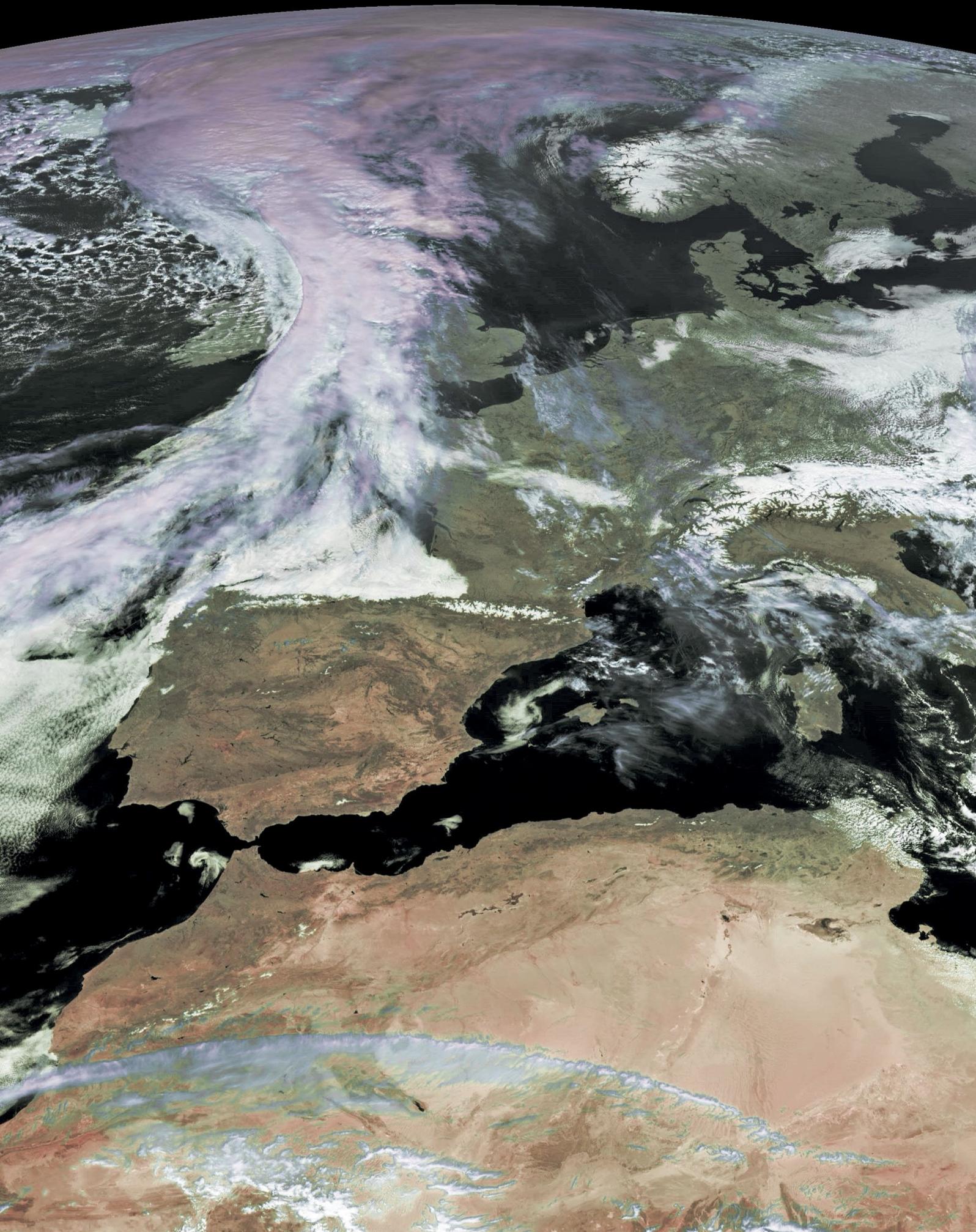
Figure 11  
The TA-1 antenna used for Meteor M2 reception.

But with the filter in place (figure 9), not only was the number of interference lines much reduced, but good quality imaging became possible much farther to the south, all the way to North Africa.

Of course, nothing can be done about the wide white band, which results from a processing defect aboard Meteor M2. No image data was transmitted during these few seconds. But there was only a single white interference band in the entire image, a great improvement.



This segment from a March 11, 2015 Meteor M2 image was posted on *GEO-Subscribers* by Jim Scheffler. One of the infrequent RGB123 transmissions, it renders snow and ice in cyan, emphasising winter's embrace on the Great Lakes and their surroundings.



This Meteosat image received by Mike Stevens via EUMETCast shows an active front which battered the UK with intense wind gusts and heavy rain on March 15, 2015.

Image © EUMETSAT 2015  
[www.geo-web.org.uk](http://www.geo-web.org.uk)



Mahesh Vhatkar (VU2IIA) sent us this Meteor M2 image of India. It has been enhanced by *DCE Autoenhance* software, which is easy to use and has useful features. Process involved adjusting 'Auto balance', 'Mid-tones', 'Remove Blue cast', 'Enhance color', 'Filer simulator' and 'Sharpen' located under their respective tabs, but not the 'Hotpixel' and 'Denoiser' options. The program does a reasonably good job of enhancing terrain and cloud simply and quickly.

# Early Days of Weather Satellite Reception

Barry Smith

Barry Smith is one of the 'Old Timers' of weather satellite imaging, having cut his teeth on the APT satellites in the early 1980s. But never one to duck a challenge, Barry has recently taken on board the challenge of LRPT from Russia's Meteor M2 satellite, and one of his images appears on the following page. Barry has been kind enough to provide the following brief summary explaining how his interest in this hobby developed.

I was introduced to weather satellite reception in the early 1980s (I can't remember the exact year) by a very good friend of mine and fellow radio amateur, David Duff G3VYV, who sadly died unexpectedly in 1999. David was the science teacher at a secondary school in Skelmersdale.

The exact details are lost in the mist of passing years, but I can recall a small number of pupils, myself and David going to the school on a Sunday with a home made 4 or 5 turn helical beam antenna, home made receiver, *Unilab* interface and a *Muirhead* fax machine. I can't remember the model number of the *Muirhead* but do remember it having the same shape as an upright piano, about half the size and quite heavy. The 'write head' had been modified and an LED was fitted instead of the original, which may have been a hot wire stylus for recording on to thermal paper.

The satellite, of an early TIROS/NOAA vintage, was tracked 'by ear', pointing the beam in its direction and listening for the best signal to noise ratio. The *Muirhead* received the audio via the *Unilab* interface and illuminated the LED which was focused on a sheet of photographic paper on the drum inside the fax machine. Once the satellite had passed, the photographic paper was developed in the darkroom and we were all excited seeing the picture appear. It was in black and white, of course, but was in focus and perfectly exposed. It's a great shame that I don't have the original, or a copy.

David then changed jobs and started work for Unilab, developing science instruments for schools, including a weather satellite receiver and an interface for the then popular BBC 'B' computer. When RIG (the Remote Imaging Group) was formed in 1985, both myself and David were early members. I still have every issue of their newsletters. Issue No 1 is dated June of that year.

As the technology advanced, firms like *Cirkit* started selling components which allowed you to build receivers. In 1982 a German amateur radio magazine, *UKW Berichte* (the English edition was called *VHF Communications*) had started a series of articles describing how to build a hardware decoder, designed by another radio amateur (YU3UMV), which took the audio from a satellite receiver, processed it, stored the 'image' in RAM and output a CVBS video signal to a monitor, resulting in a live scrolling picture on the screen.



The author's Cirkit receiver and YU3UMV decoder

Some clever people designed modifications to the framestore to provide visible/IR switching, extra memory, and so on. You may be surprised to learn that the basic framestore only stored the image as 6 bits (64 grey levels) in 64 kB of memory. Later, it was possible to fit larger memory chips (256 kB) which stored four images, selected by a switch. In a 1986 advert for a kit to construct the YU3UMV framestore with 256k memory chips, the asking price was £78.37, equivalent to about £212 in 2015.

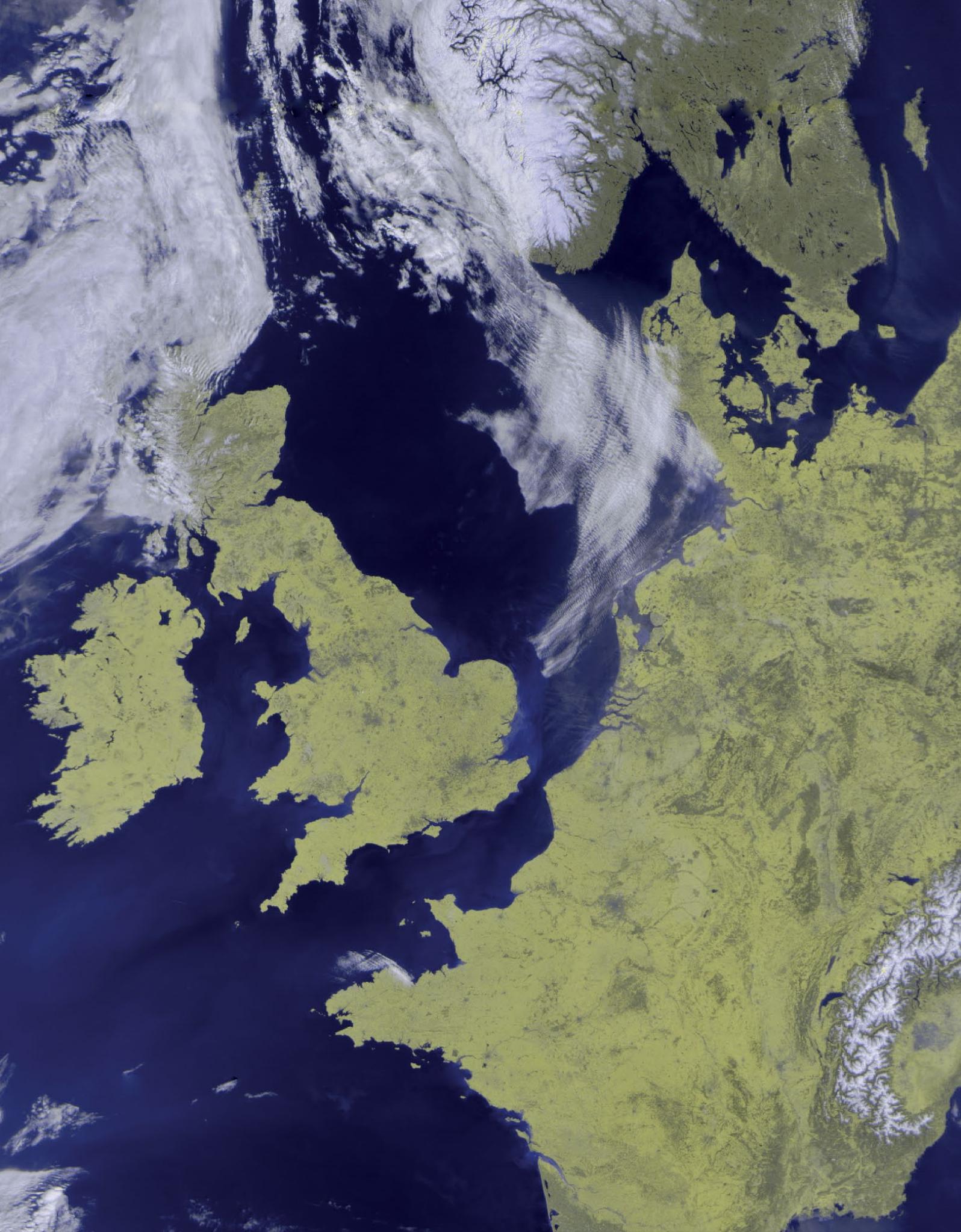
Other modifications were published which added frequency scanning, squelch and tape recorder control to the *Cirkit* receiver.

As well as decoding and displaying pictures for low Earth orbit APT satellites (American and Russian), the decoder could also process the analogue signals from the early geostationary Meteosat satellites. I bought a second-hand, one-metre prime focus dish and down-converter (to convert 1691 MHz to 137 MHz) and soon had pictures from Meteosat. I have a photo (taken of the monitor screen with an early digital camera) of Meteosat-7 from November 2004. Unfortunately, that phase of my activities didn't last for long as the analogue transmissions were soon to cease: so I bought an LNB and pointed the dish a *Hotbird* for TV reception.

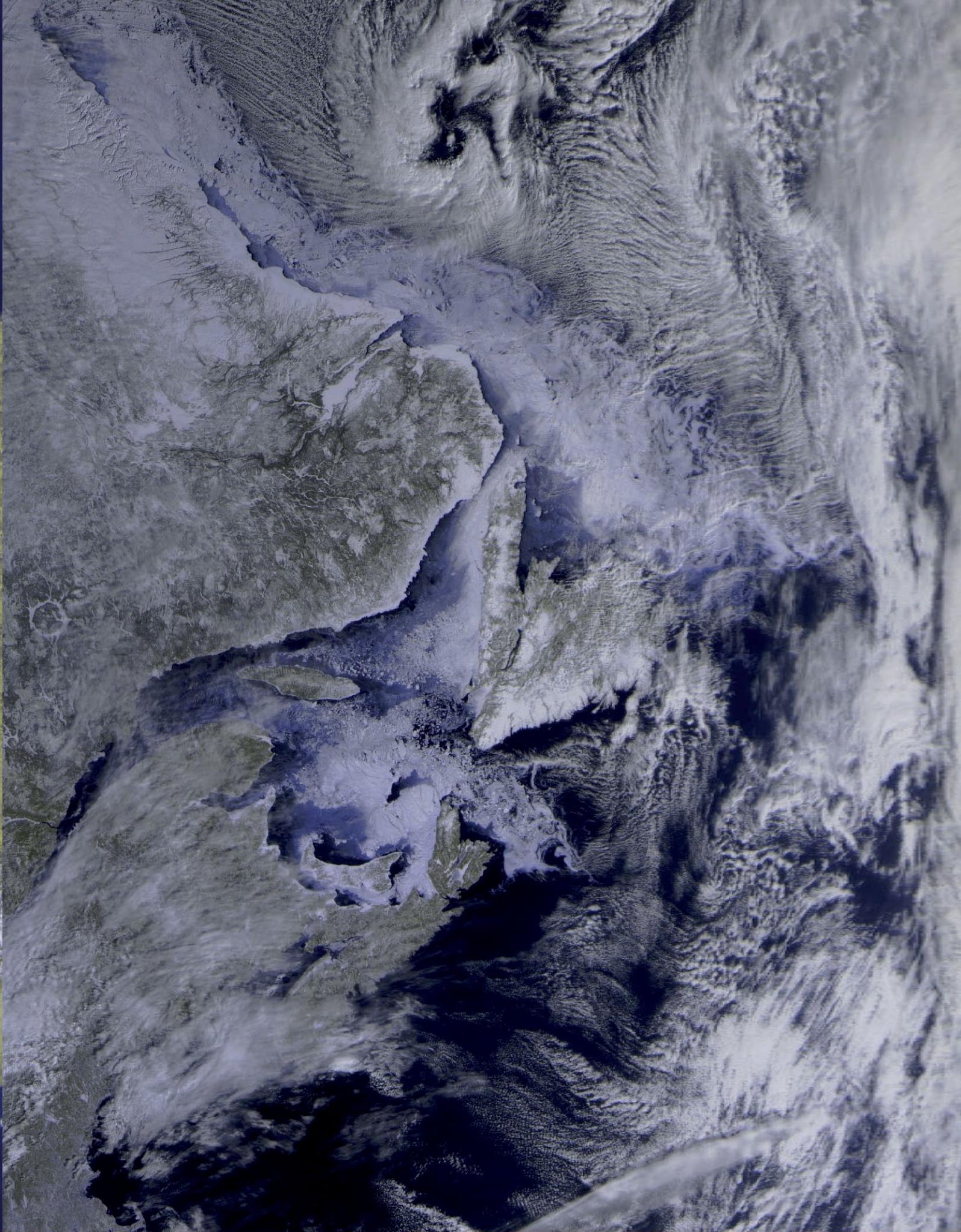


The author's one-metre prime focus dish and a Meteosat-7 image

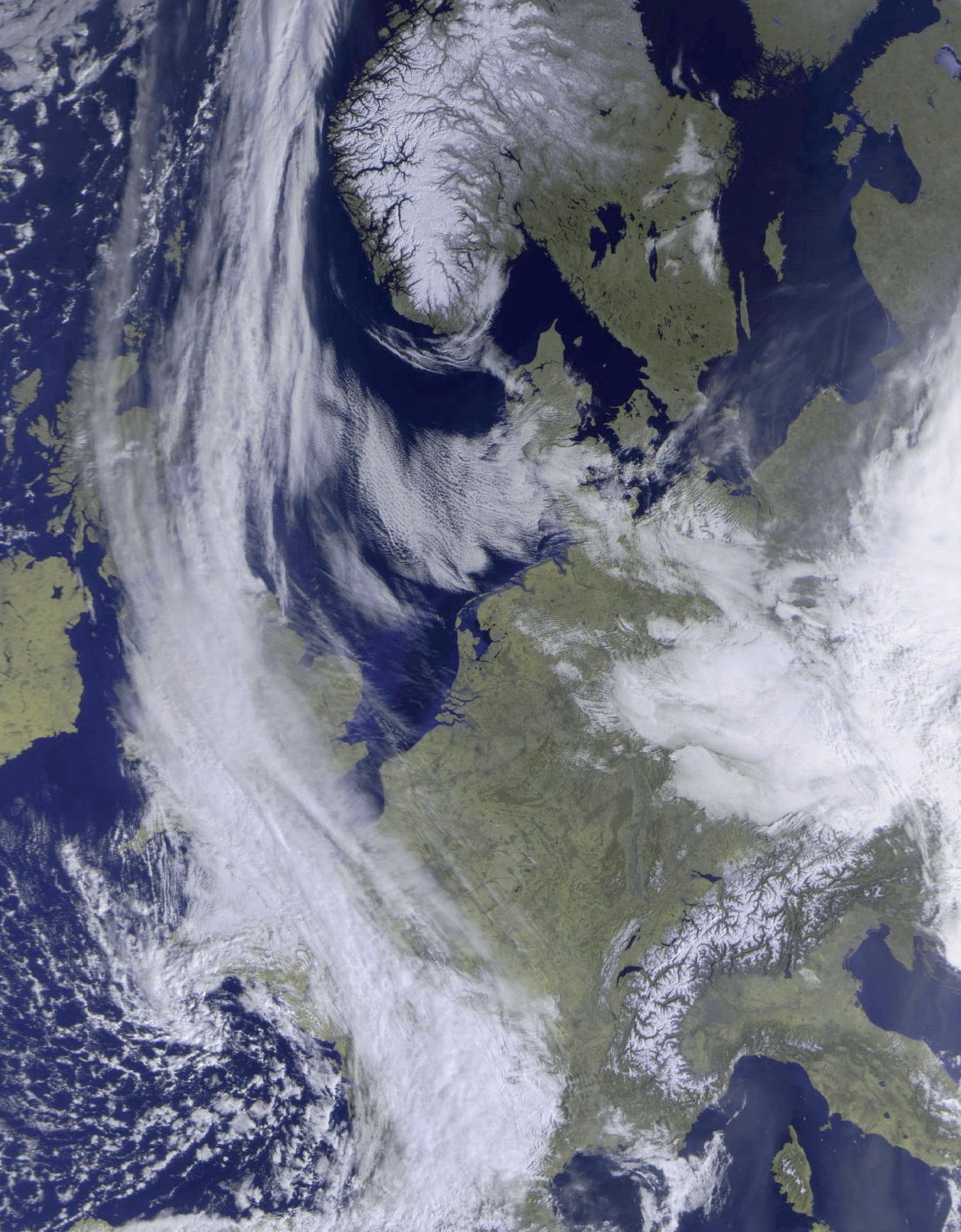
Nowadays, you can receive low resolution pictures from NOAA fully automatically with a suitable receiver and software, and high resolution pictures from the Russian Meteor low Earth orbit satellite with cheap hardware and free software. But one thing hasn't changed over the years - you do need a good antenna.



Barry Smith from Darwen in Lancashire has recently started acquiring imagery from the Meteor M2 satellite. This image, from April 21, 2015, shows a splendid view of anticyclonic weather over the British Isles and western Europe.



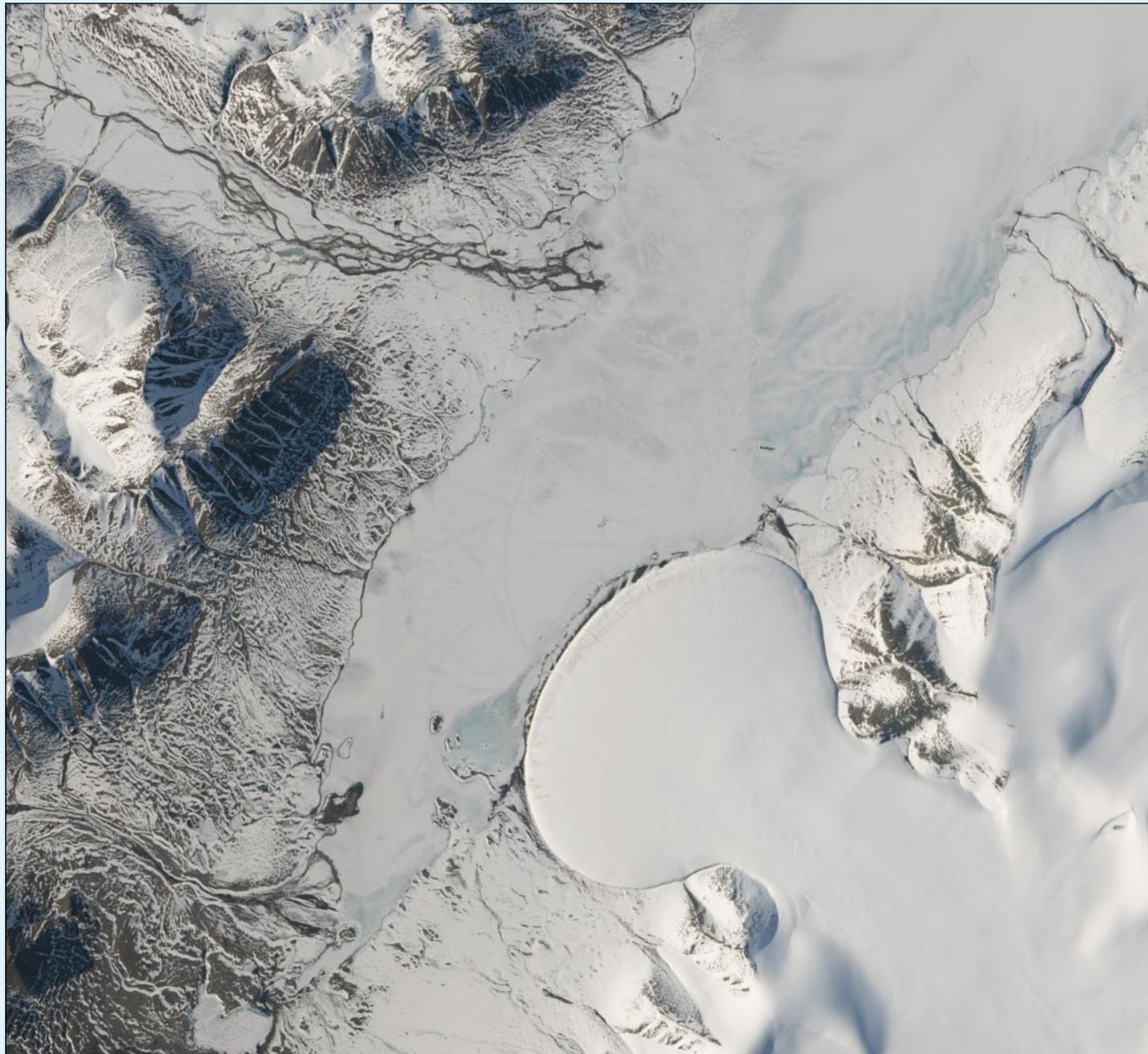
This Meteor M2 image of eastern Canada from Jim Scheffler dates from March 9, 2015, and shows exquisite detail of the St Lawrence estuary, Labrador, Newfoundland, Prince Edward Island and Nova Scotia.



Enrico Gobetti sent in this Meteor 2M image he decoded from the 09:22 UT pass on March 13, 2015, showing a high pressure regime over western Europe. The mountains of Norway and the Alps are nicely revealed through their snow cover, while snow lying over Scotland's Grampian Mountains can just be seen through bands of hazy cloud.

# Elephant Foot Glacier

NASA Earth Observatory



NASA Earth Observatory image by Jesse Allen, using Landsat data from the U.S. Geological Survey

Imagine pouring batter on to a griddle and watching the mixture spread out into a round-shaped pancake. The movement is similar to the flow of piedmont glaciers, which form when ice spills from steep valleys on to a relatively flat plain. Such glaciers are known for their highly symmetric, fan-shaped lobes.

Greenland's Elephant Foot Glacier, for example, has such a distinct shape that it stands out dramatically from its surroundings when viewed from space. The Operational Land Imager (OLI)

aboard NASA's **Landsat 8** satellite acquired this image of the glacier on June 21, 2014.

Elephant Foot is an excellent example of a piedmont glacier, so much so that it is often used as the example of a piedmont glacier because it is so symmetric. Located in northeastern Greenland, on the Kronprins Christian Land peninsula, the glacier is not connected to Greenland's main ice sheet. Rather, it's part of a network of glaciers and ice caps that pepper the periphery of the island.

Research has shown that, as a whole, these outlying glaciers and ice caps account for as much as 7% of Greenland's total ice cover, and they are responsible for 20% of the island's contribution to sea level rise.

Elephant Foot Glacier is just one of the beautiful scenes contained within this image swath acquired from across the Arctic by Landsat 8. To interactively explore the entire swath and to view more image highlights, read the full story at the URL below.

# Reducing Noise on an SDR Dongle



Marc Peigneux

Being so often absent from home because of my work, I finally took advantage of Bank Holidays to spend some time investigating in detail how to receive Russia's Meteor-M2 satellite, and get some of the data it provides. Earlier articles published in *GEO Quarterly* encouraged me, and helped me to make some successful trials.

Although I increased my chances of receiving the satellite's VHF signal by using a selective 136-138 MHz preamplifier coupled with a QFH antenna, I unfortunately had similar experiences to many others who have experimented in using an SDR RTL dongle to decode Meteor's QPSK signal: the sensitivity of these small receivers is rather weak.

In the previous issue, Les Hamilton related that some jamming problem happened with Scottish 'paggers'. I also noticed that the dongle itself was acting like a very good 'wide band antenna'.

My problem was that a lot of unwanted electronic signals (radiated on VHF band by several electronic devices present in my 'technical room' (figure 3) were present on the *SDR Sharp* spectrum analyser screen, seriously disrupting the Meteor M2 signal.

As metallic boxes are frequently used to isolate electronic devices working on high range frequencies, I decided to enclose my dongle in a metal box to see if this made any improvement (figures 1, 2). My result was remarkable: dongle encapsulation resulted in a 10 dB improvement in the signal to noise level. That is a really significant gain!

The box to hold the dongle was simple to make. It includes a switch to connect the antenna (and its preamplifier) to either the R2ZX receiver for the NOAA APT satellites, or towards the dongle for Meteor QPSK demodulation. It also has an input connector for attaching a correctly filtered power supply to power the antenna preamp and the R2ZX. A 1 nF capacitor isolates the dongle antenna input from the power supply.

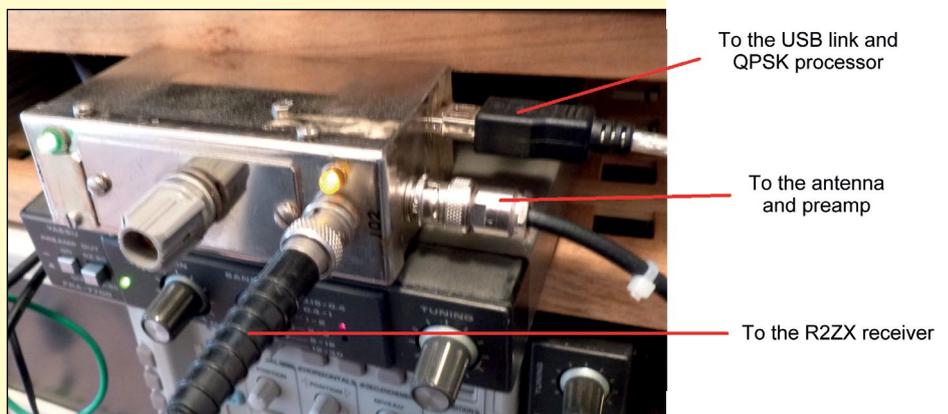


Figure 1 - An outer view of the metal enclosure containing the RTL Dongle



Figure 2 - A close-up photograph showing the dongle encapsulated in its metal box



Figure 3 - The authors 'technical room' - full of potential interference.

I still follow the traditional checklist of disruptive devices I need to switch off before each satellite pass: Internet box, other computers, and indeed any device in the vicinity of the dongle

that might produce electromagnetic radiation. With these dongle receivers, every little thing that can be done to reduce the noise problem is extremely valuable!



This **Meteor M2** channel-5 infrared image was posted on the *GEO-Subscribers YAHOO!* forum by Jeff Kelly, who drew particular attention to the warmer waters of the Gulf Stream as it makes its way north off the coastlines of Florida, the Carolinas, Virginia and Delaware. These warmer (darker) waters contrast greatly with those of the North Atlantic around Long Island and the even colder Great Lakes.

# Testing the TBS-6983 and Skystar 2 HD eXpress DVB-S2 Tuner Cards

Mike Stevens

I have chosen two different tuners to highlight in this article: the **TBS-6983 Dual Tuner Card** and the **Technisat SkyStar 2 eXpress HD DVB-S2 Tuner PCIe Card**.

Any controversy as to which is the best tuner for *EUMETCast* has now more or less been settled by members making their own distinct choices. And with the *EUMETCast* switch-over now completed—except for the live HVS Service transmissions—we can now settle down and perhaps continue to experiment as more tuners able to deliver the new DVB-S2 ACM/VCM service come on the market.

### The TBS 6983 PCIe Card

The **TBS-6983** is the latest DVB-S2 tuner card to come from our friends out in the Far East. I have been using one since August 2014, and it has proved to be a very reliable unit, especially in severe weather conditions when it has held its own extremely well. This unit, as you can see from the picture, is much the same as the **TBS-6925**, except that you have twin input sockets for satellite feeds from the LNB: one is *Tuner 'A'*, the other *Tuner 'B'*, and you can connect to either one for *EUMETCast* Reception of weather data.



The TBS-6983 Dual Tuner Card

The card was sent to me and others in the Group for trial and evaluation, and immediately after installation and testing I realised that it was very stable, with excellent front end gain. Despite some very severe weather conditions, including heavy rain and strong to gale force winds, its performance did not deteriorate. The lowest SNR was 9.8, and although there was some Packet Loss, most were FEC recovered and very few segments were missing from the images. These mainly affected Metop A, and most occurred in the dark and over the sea. Coincidental, no doubt.

I am sure most of you are now able to install and set up a PCIe card. If not, I would recommend you get the help of an expert or knowledgeable member to do this for you. Alternatively, you can refer to my article on the TBS-6925 in *GEO Quarterly 44*: installation is the same, but with slightly different software [1]. Once you are plugged in and the software has been installed, the set-up screen is again similar to the TBS-6925 and, as you can see from figure 1, you are now able to see all the active PIDs and

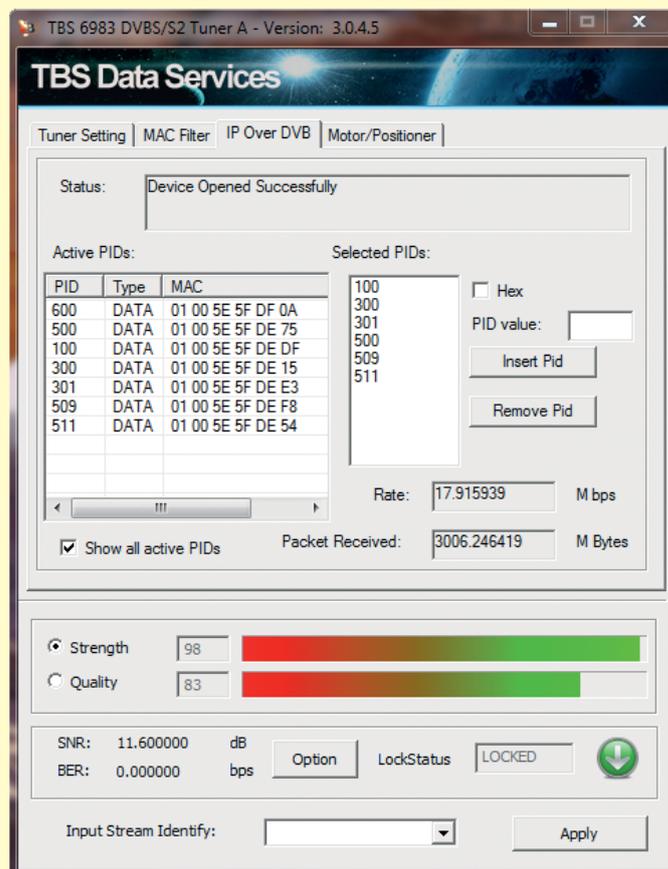


Figure 1 - the TBS-6983 set-up screen

the incoming data stream without any system crash or BSOD. The one advantage of this PCIe card is that there is no separate power supply to bother with: it connects directly within the PC. You just have to set the IP Address correctly and you are done.

So operation of the **TBS-6983 card** is simple once it has been set up. Lets deal with that. On activation of the TBS-IP Icon on your desktop, a *User Account Control (UAC)* box will appear, asking if you wish to proceed. You say 'yes', of course. Then the **TBS box** appears for you to select which Tuner to use, 'A' or 'B'. I use Tuner A, but its your choice to decide which one.

The **TBS 6983 DVB/S2 Tuner A - Version 3.0.4.6 Data Services Box** now appears, and its here that you input all the relevant information: i.e., Satellite, Frequency, Polarity, Symbol Rate and MODCODES. Remember to tick the correct ones: '8PSK 3/5' for the Basic Service and '16APSK 2/3' for HVS. Click 'OK' followed by 'Lock TP', then go to the **IP over DVB** tab and input all the required PIDs for the services you require. I would then advise to re-boot the PC as this settles everything in. When you come back to that screen, with the **TBS Data Services** box, you can tick the **Show all Active PIDs** box and they will appear on the **Active PID** screen so you will see that your data is correct and flowing in the **Packet Received** box.

Having now used this **TBS-6983 Tuner PCIe Card** for eight months, I can with all honesty say it's an excellent unit. It's very robust and seems to remain constant with my system even in severe weather conditions, and the Gain and Sensitivity also are very good. My unit at the moment is running with Signal 98%, Quality 82% SNR = 11.7 and BER = 0.00000. The lowest it has ever been, during some very heavy rain, was SNR of 9.8 and Quality that dropped to 78%, but I had no segment loss on images. Missed Packets before FEC were 291, FEC Recovered Packets were 289. The Tuner usually runs with both these on zero. The Chip/Demodulator is different from the TBS-6925 and is more robust and reliable, but tuner design is much the same, which makes for an excellent DVB-S2 unit to receive the *EUMETCast* Transmissions.

**The Technisat SkyStar 2 eXpress HD PCIe Card**

Now lets look at the Technisat **SkyStar 2 eXpress HD PCIe Card**, which is capable of reception of the *Basic Service* only, but in this case an advantage, because, as it only receives BS and not HVS, there is no interference whatsoever on the BS Service, which remains constant throughout.



The Technisat SkyStar 2 eXpress HD PCIe Card

There are several ways to install and run this card. You can follow the EUMETSAT set-up procedures, or you can use the accompanying CD and install from this. I used this CD and it installed and worked first time.

The main installation detail on this unit is that it is **not** powered directly from the PCIe slot, but via a separate Molex connector on the side of the card (shown at upper right in the photograph above). Many computers possess one or more spare Molex connectors, intended to power additional items such as DVD and CD drives. To enable this card to work, you have to connect into the power supply using a Molex cable and connector. If your computer lacks such a spare connector, and you are uncertain how to proceed, contact an IT expert or a local computer repair shop to assist with installation.

Once you have installed and connected the PCIe card, use the accompanying disk to install the software. This is very easy. Just follow the on-screen instructions, and when completed you can then insert all the relevant information into the *Technisat* software, such as Satellite: Eutelsat 10A, and so on (figures 2, 3). Near the foot of figure 2 is a button labelled 'Data Services'. Click this to reveal the **Data Services Screen** where you input all the PIDs relating to the *EUMETCast* Operational Data (figure 4). At this point you may need to refer to the *EUMETSAT Guide* for further information. When all the software has been installed, locate the program **Setup4pc** and place a shortcut on the desktop to assist with further set-up.

Once installation is complete and you run the program for the first time, you should see a screen such as figure 5 to confirm that all is working well. As I explained earlier, you can follow the *EUMETSAT Guide* for all of the installation instructions if you so

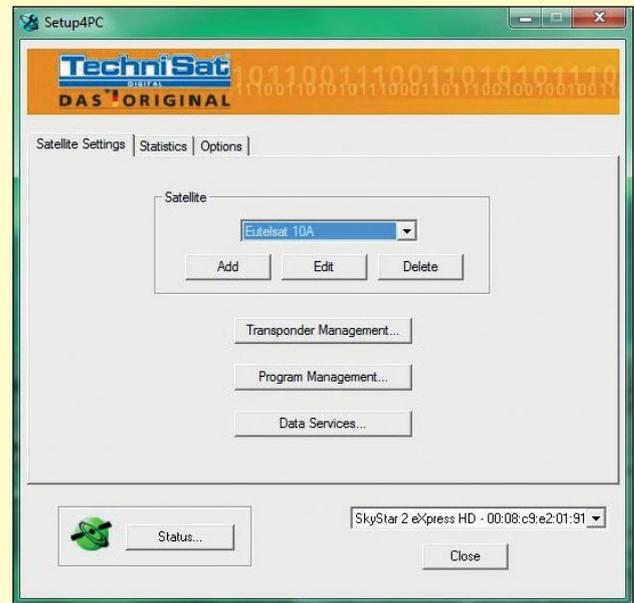


Figure 2 - The opening Technisat SkyStar screen

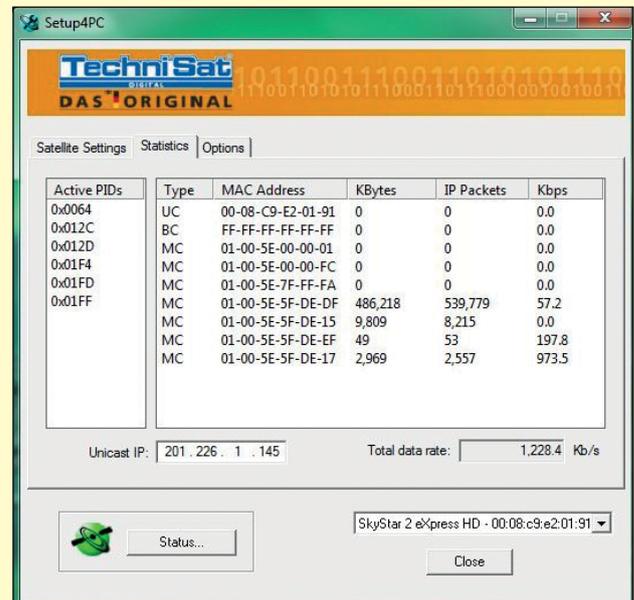


Figure 3 - Displaying the active PIDs

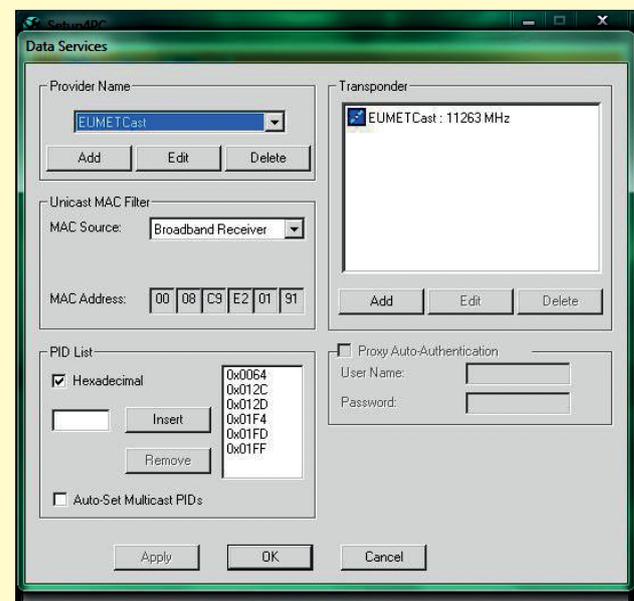


Figure 4 - Data Service Panel

wish, its your choice. I chose to do it from the supplied CD and it worked perfectly first time.

So, to conclude all my findings, the **TBS-6983** is by far the superior tuner, and will receive all the Data Transmissions: both the currently available *Basic Service*, as well as the *High Volume Service* when it starts in the future. It costs around £200. The **Technisat SkyStar 2 HD** is a good, relatively inexpensive tuner if you just want to receive the *Basic Service*, and can be purchased for around £50.

I did these experiments to help evaluate the differences between a reasonably priced tuner (the *TBS*) and a very cheap tuner (the *SkyStar*) so that you can see for yourselves what is available at the moment. I know which I prefer, but as always, the final choice is up to you.

**Reference**

- 1 Testing PCIe 6925 and 6983 Cards for EUMETCast GEOQ 44, page 13, December 2014.

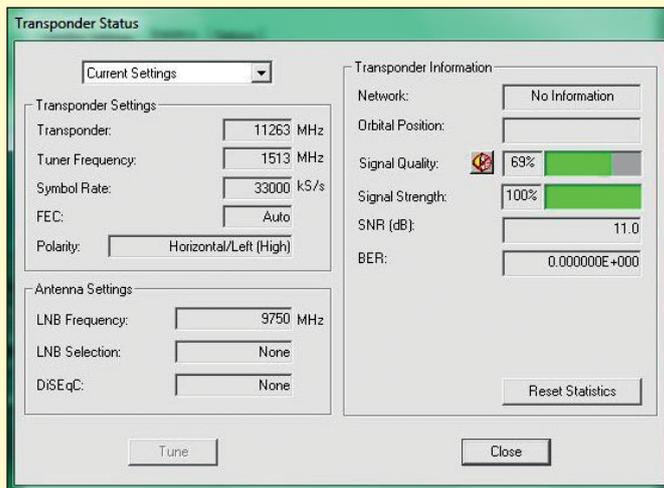
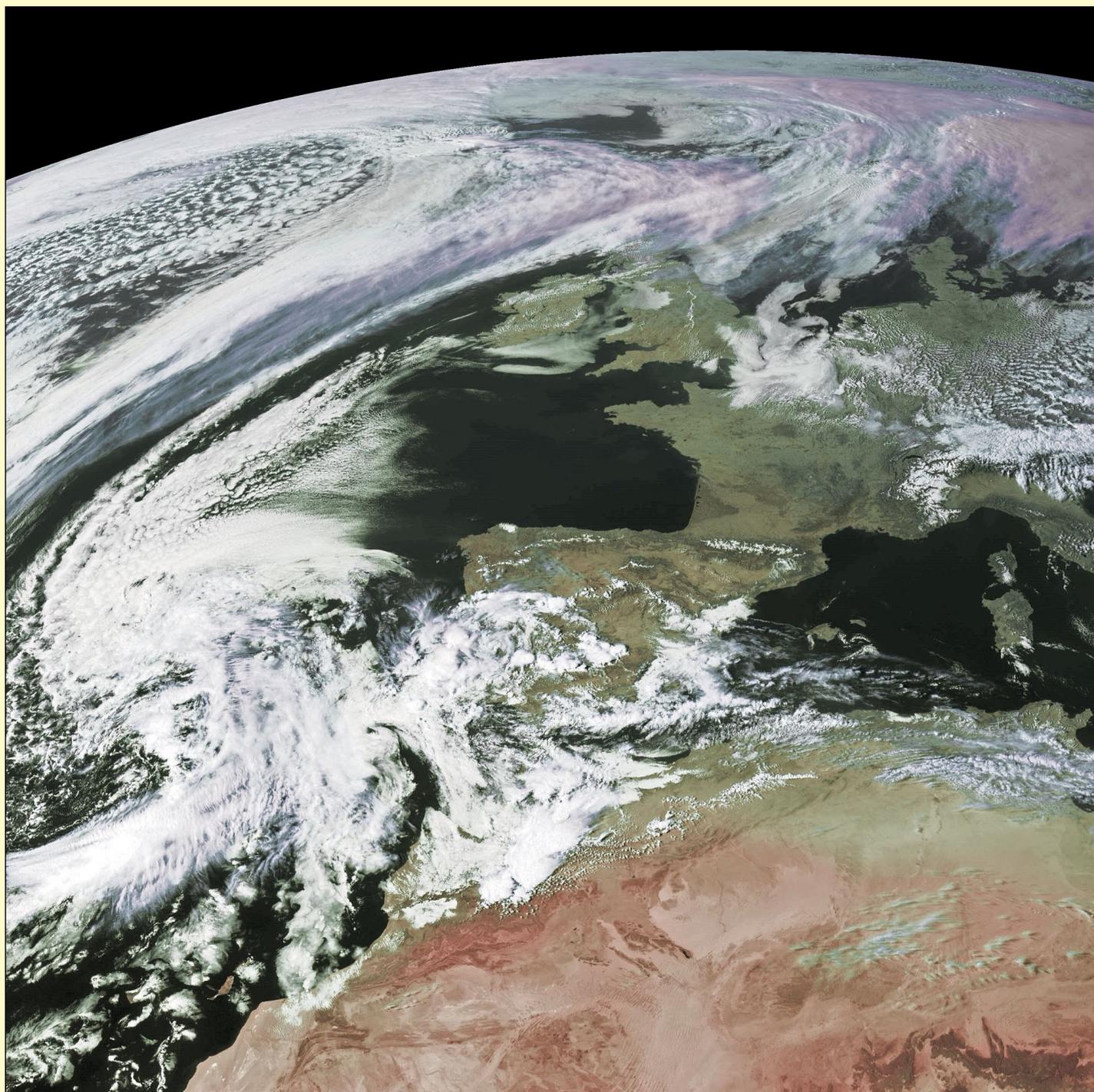
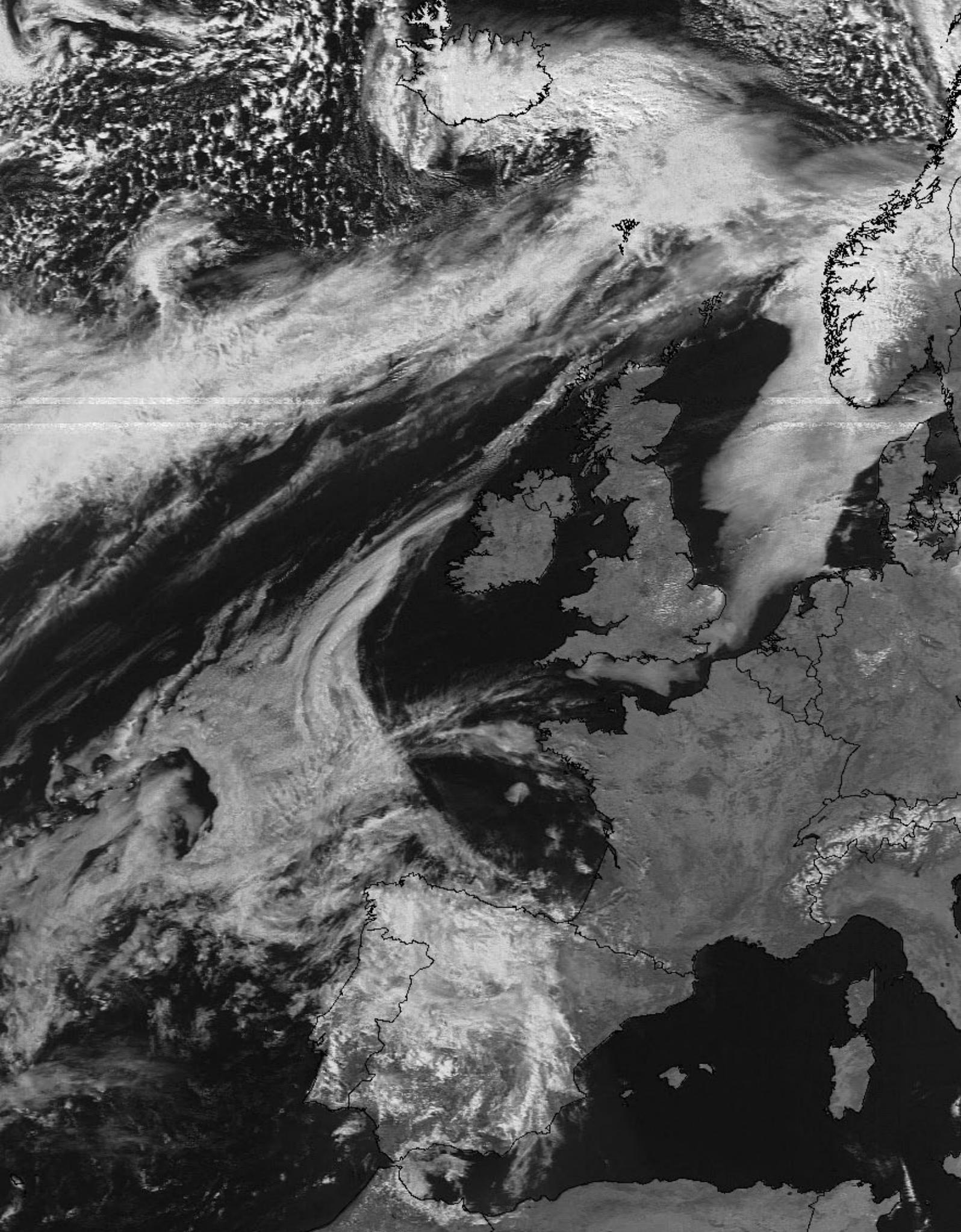


Figure 5 - The SkyStar system in operation



This Meteosat image was acquired using the TBS-6983 card at 15:30 UT on April 6, 2015  
Image © EUMETSAT 2015



Despite all the recent interest in Meteor 2M's LRPT imagery, many readers still enjoy capturing APT imagery from the NOAA satellites. André T'Kindt sent in this **NOAA 19** image acquired from the 13:48 UT pass on April 9, 2015, showing excellent ground detail throughout western Europe.

# Super Typhoon Maysak

NASA Earth Observatory



Above: Super Typhoon Maysak as seen from the ISS on March 31  
Image: ESA/NASA/Samantha Cristoforetti

Typhoon Maysak, an unusually early storm for the northwest Pacific, strengthened abruptly on the last day of March and grew into a category 5 super typhoon, the most powerful yet recorded in this region. While Maysak was near peak intensity, astronauts on the International Space Station were treated to an awe-inspiring view of the storm. 'Looking down into the eye—by far the widest one I've seen—it seemed like a black hole from a sci-fi movie,' tweeted NASA astronaut Terry Virts. European Space Agency astronaut Samantha Cristoforetti shared the sentiment, stating: 'Commands respect even from space.'

What caught the astronauts' attention was Maysak's eye. Reported to be 30 kilometres wide by the *Joint Typhoon Warning Center*, the eye had a near perfect ring of convection swirling around it. The storm appeared to be an annular tropical cyclone, a subcategory of storm known as a 'doughnut' storm.

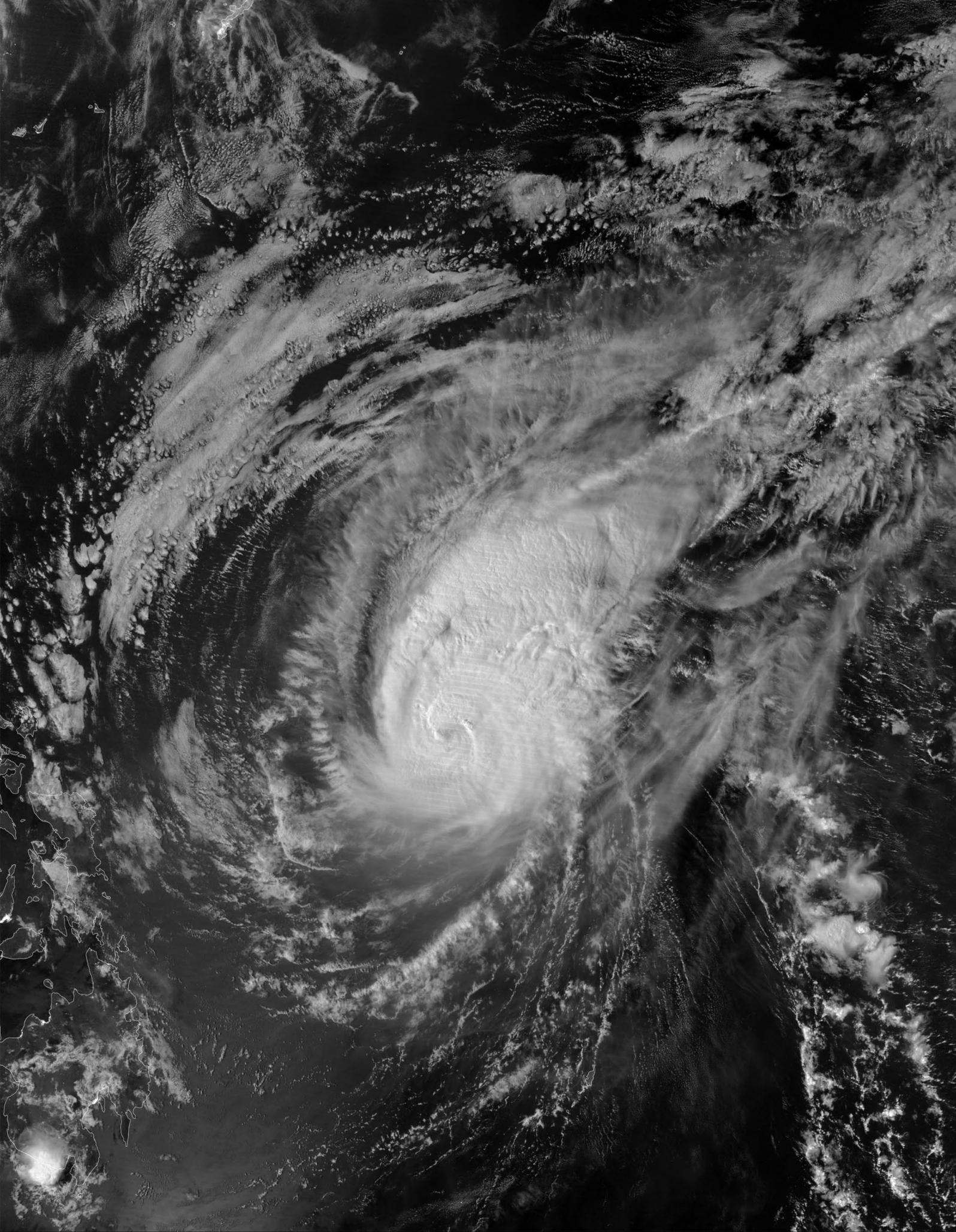
The photograph of the eye offers a good example of the 'Stadium Effect', a meteorological phenomenon defined by the eye being wider at the top of the storm than the bottom, like the shape of a sports stadium. The effect happens because rising air in the eyewall tends to slope outward, while the air in the eye itself is descending. Cyclones typically form eyes when a storm's winds exceed 125 kilometres per hour.

In Maysak's case, the storm weakened on its approach to the Philippines as it encountered stronger upper level winds and dry air. When it made landfall on the island of Luzon on April 4, it was barely a Category-1 storm.

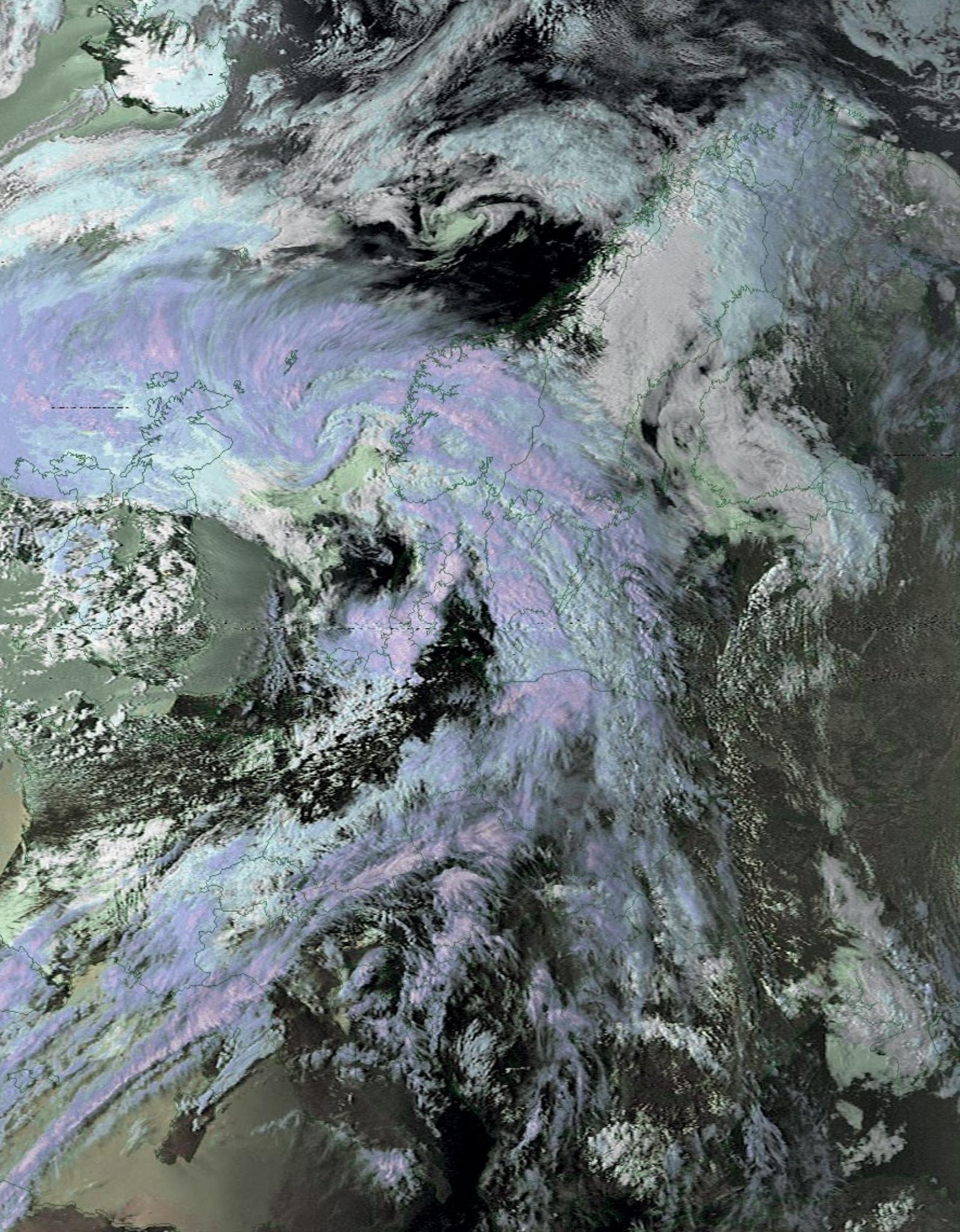
On the following page is a night-time VIIRS image acquired by the Suomi-NPP satellite shortly after midnight, local time on April 2/3, by which time the storm lacked an obvious eye, suggesting that it was weakening.



The eye of Maysak, clearly showing the 'Stadium Effect'



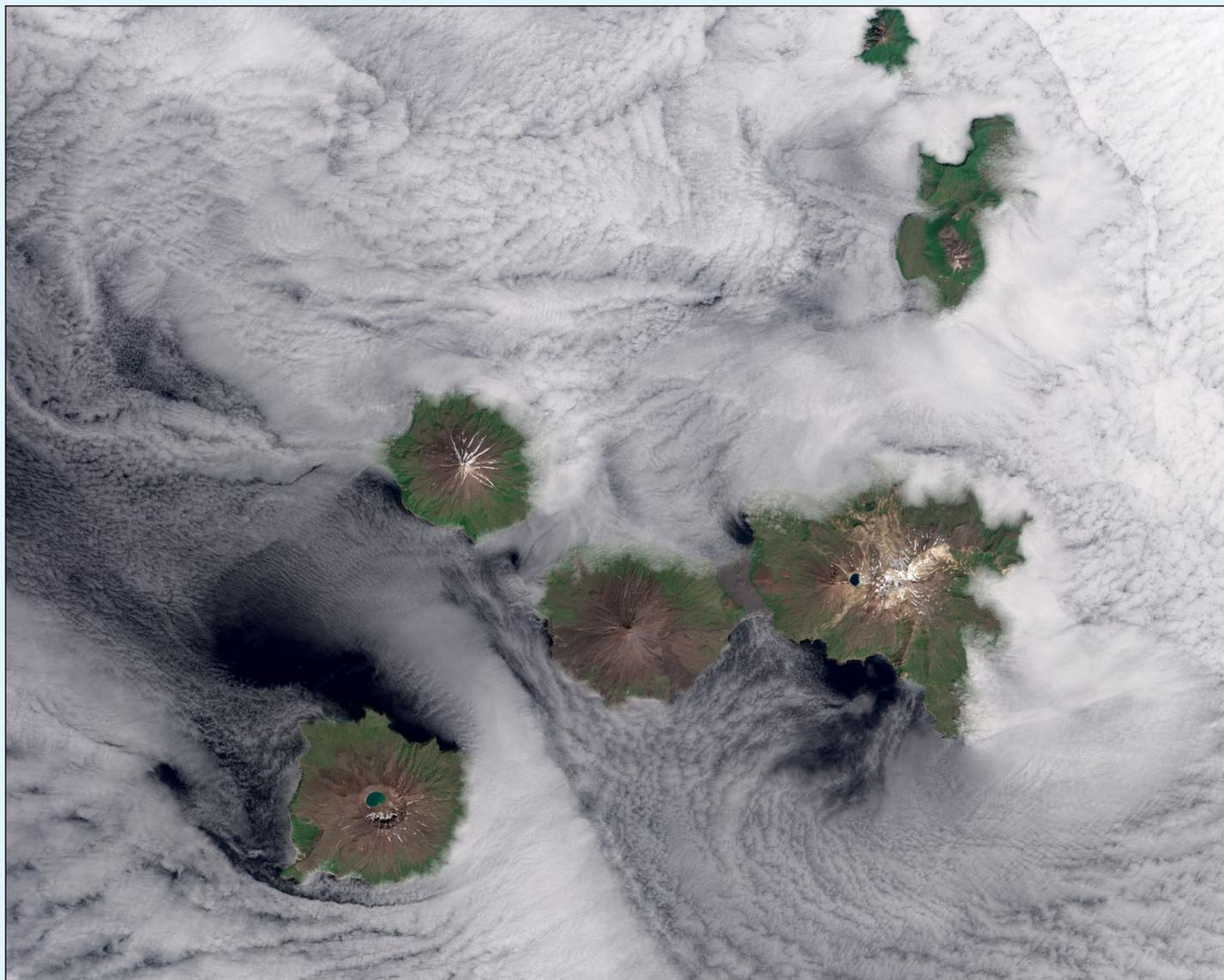
Typhoon Maysak, viewed by NASA's Suomi-NPP satellite, at 12:42 a.m. local time on April 3, 2015.  
NASA Earth Observatory image by Jesse Allen, using the VIIRS day-night band data from the Suomi National Polar-orbiting Partnership satellite.



This NOAA 18 colour composite image from André T'Kindt, who lives in Ronse in Belgium, acquired from the 15:05 UT pass on May 5, 2015, shows the depression that brought heavy rainfall to much of the UK and The Netherlands. The image is also noteworthy for the interesting sunglint in the Mediterranean, and around both England and Iceland.

# Herbert Island

NASA Earth Observatory



The Islands of the Four Mountains, imaged by Landsat-8's OLI instrument on July 29, 2014  
 NASA Earth Observatory image by Jesse Allen, using Landsat data from the U.S. Geological Survey

One of the *Islands of the Four Mountains*, Herbert—at lower left of the image above—is a volcanic island located in the Aleutian chain off Alaska. A symmetrical stratovolcano stands in its centre, rising 1,280 metres above the north Pacific Ocean: the entire island is just 10 kilometres across. Herbert sits within a few tens of kilometres of three other volcanoes: Carlisle, Cleveland, and Tana.

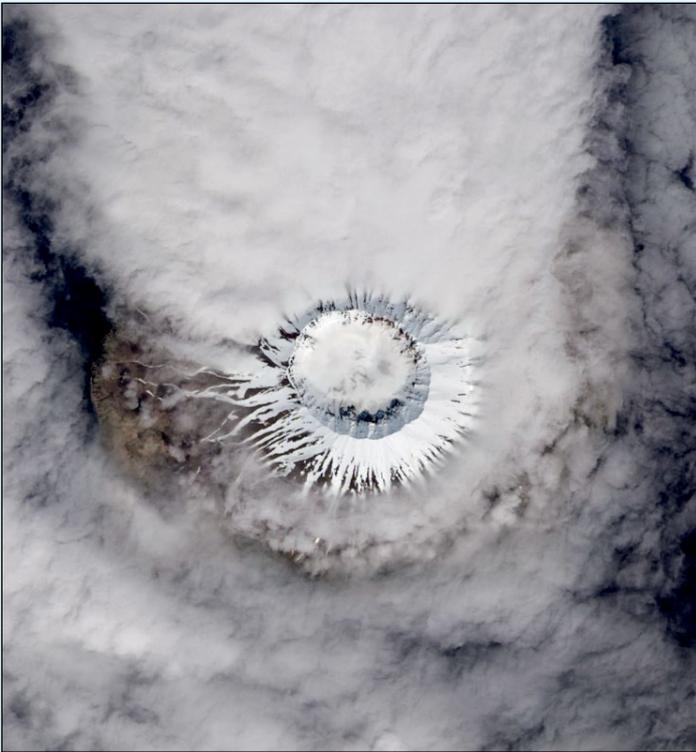
Both images above were acquired by the Operational Land Imager (OLI) on the **Landsat-8** satellite. The circular formation in the centre of Herbert is a 2-kilometre wide summit caldera. The straight-down (nadir) satellite view can make it difficult to determine which part of the landscape stands taller than the other, a phenomenon known as relief inversion.

In the June 8, 2013 image (next page), the summit and caldera are coated with snow and ice, while lower elevations appear to be clear. Clouds obscure most of the slopes and lowlands, with thicker cover on the north side

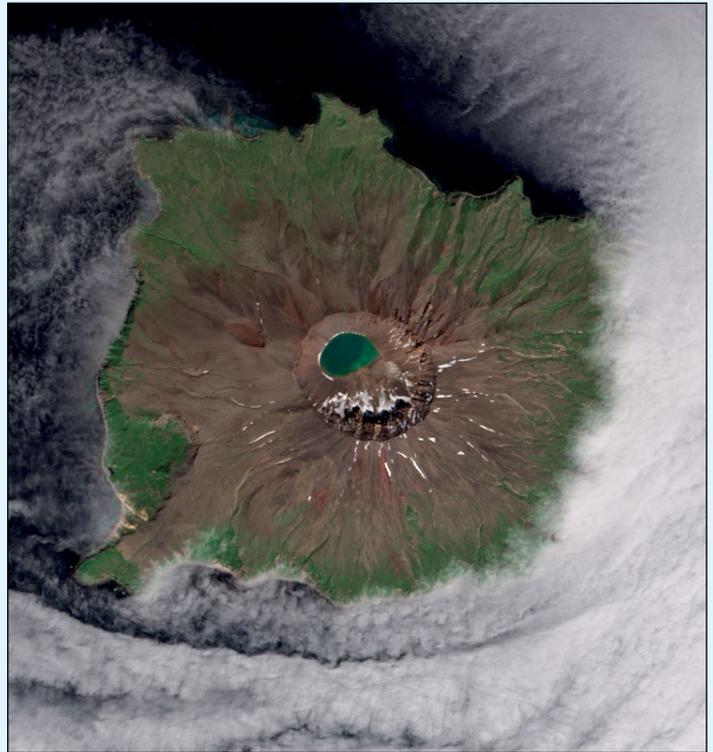
of the island. A similar pattern repeats at other nearby islands, suggesting that winds were out of the south and the volcanic islands were affecting the formation of clouds.

In the July 29, 2014 image, the volcano is nearly ice free and the marine clouds are mostly offshore at midday. Alaska and its surrounding waters were unseasonably warm in 2014, perhaps leading to more melting. A melt lake fills roughly a third of the caldera.

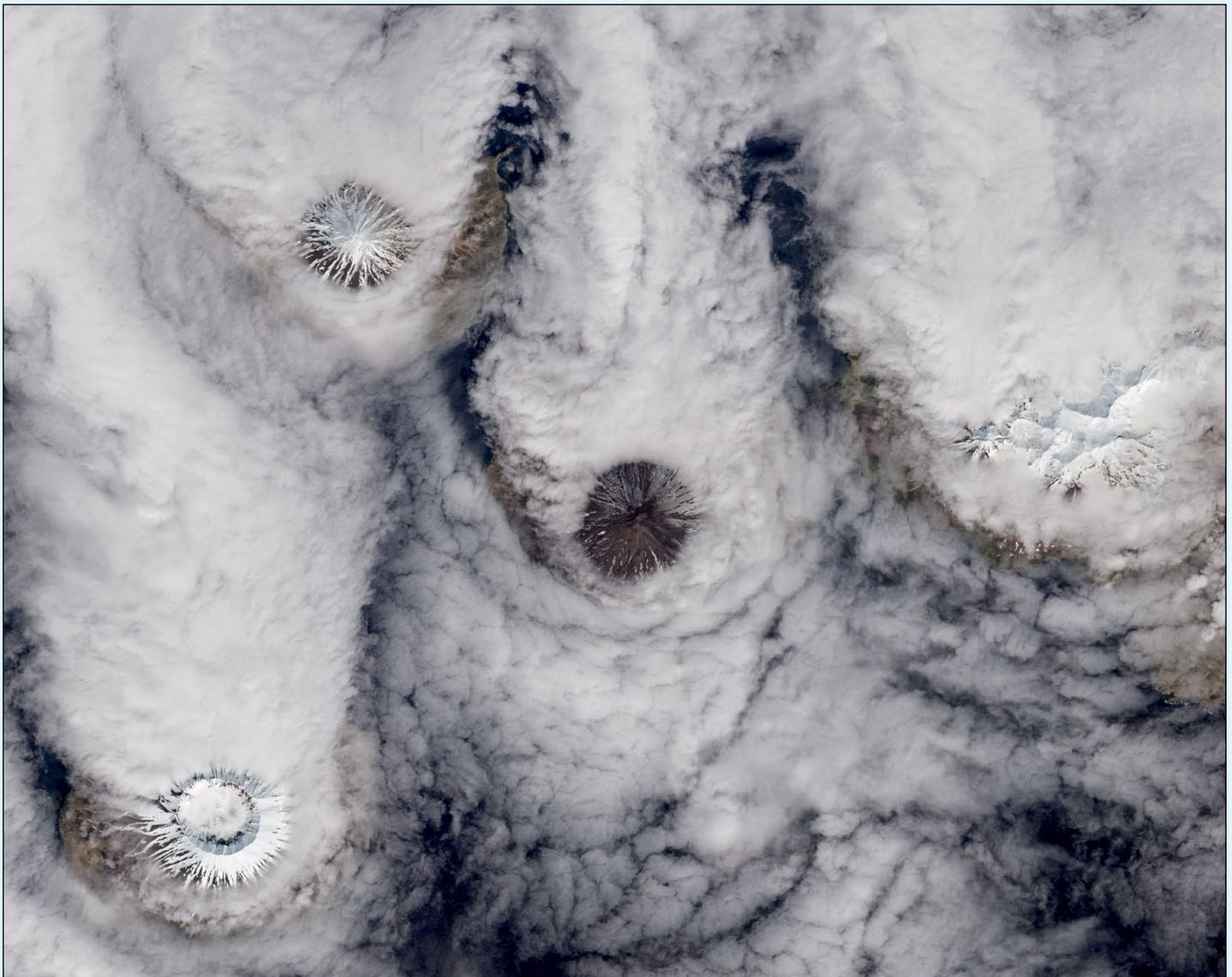
The remote volcanic island has scarcely been studied and there are no records of eruptions there. Geologists have been much more interested in Cleveland volcano, which sits just 5 kilometres to the east on Chuginadak Island. Cleveland is one of the most active volcanoes in the Aleutians. Scientists at the Alaska Volcano Observatory keep track of all of the volcanoes in the Aleutians because ash eruptions can create hazards for aeroplanes that pass through the area on their way from North America to Asia and Europe.



The Herbert Island caldera on June 8, 2013  
Image: NASA/GSFC



The Herbert Island caldera on July 29, 2014  
Image: NASA/GSFC



The Islands of the Four Mountains, imaged by Landsat-8's OLI instrument on June 8, 2013, showing snow cover patterning.  
NASA Earth Observatory image by Jesse Allen, using Landsat data from the U.S. Geological Survey

## Currently Active Satellites and Frequencies

| Polar APT/LRPT Satellites |              |        |               |
|---------------------------|--------------|--------|---------------|
| Satellite                 | Frequency    | Status | Image Quality |
| NOAA 15                   | 137.6200 MHz | On     | Good          |
| NOAA 18                   | 137.9125 MHz | On     | Good          |
| NOAA 19                   | 137.1000 MHz | On     | Good / [1]    |
| Meteor M N2               | 137.1000 MHz | On     | Good / [1]    |

| Polar HRPT/AHRPT Satellites |            |      |        |                      |
|-----------------------------|------------|------|--------|----------------------|
| Satellite                   | Frequency  | Mode | Format | Image Quality        |
| NOAA 15                     | 1702.5 MHz | Omni | HRPT   | Weak                 |
| NOAA 18                     | 1707.0 MHz | RHCP | HRPT   | Good                 |
| NOAA 19                     | 1698.0 MHz | RHCP | HRPT   | Good                 |
| Feng Yun 1D                 | 1700.4 MHz | RHCP | CHRPT  | None: Device failure |
| Feng Yun 3A                 | 1704.5 MHz | ---  | AHRPT  | [2]                  |
| Feng Yun 3B                 | 1704.5 MHz | ---  | AHRPT  | [2]                  |
| Feng Yun 3C                 | 1704.5 MHz | ---  | AHRPT  | [2]                  |
| Metop A                     | 1701.3 MHz | RHCP | AHRPT  | Good                 |
| Metop B                     | 1701.3 MHz | RHCP | AHRPT  | Good                 |
| Meteor M N2                 | 1700.0 MHz | RHCP | AHRPT  | Good                 |

| Geostationary Satellites |                                |                 |          |             |
|--------------------------|--------------------------------|-----------------|----------|-------------|
| Satellite                | Transmission Mode(s)           |                 | Position | Status      |
| Meteosat 7               | HRIT 1691 MHz / WEFAX 1691 MHz |                 | 57.5°E   | On          |
| Meteosat 8               | HRIT (digital)                 | ---             | 3.5°E    | Standby [3] |
| Meteosat 9               | HRIT (digital)                 | LRIT (digital)  | 9.5°E    | On [4]      |
| Meteosat 10              | HRIT (digital)                 | LRIT (digital)  | 0°W      | On          |
| GOES-13 (E)              | GVAR 1685.7 MHz                | LRIT 1691.0 MHz | 75°W     | On [5]      |
| GOES-14                  | GVAR 1685.7 MHz                | LRIT 1691.0 MHz | 105°W    | Standby     |
| GOES-15 (W)              | GVAR 1685.7 MHz                | LRIT 1691.0 MHz | 135°W    | On [5]      |
| MTSAT-1R                 | HRIT 1687.1 MHz                | LRIT 1691.0 MHz | 140°E    | Standby     |
| MTSAT-2                  | HRIT 1687.1 MHz                | LRIT 1691.0 MHz | 145°E    | On          |
| Feng Yun 2D              | SVISSR                         | LRIT            | 86.5°E   | On          |
| Feng Yun 2E              | SVISSR                         | LRIT            | 104.0°E  | On          |
| Feng Yun 2F              | SVISSR                         | LRIT            | 112.0°E  | On          |

### Notes

- 1 LRPT Signals from Meteor M N2 may cause interference to NOAA 19 transmissions when the two footprints overlap.
- 2 These satellites employ a non-standard AHRPT format and cannot be received with conventional receiving equipment.
- 3 Meteosat operational backup satellite
- 4 Meteosat Rapid Scanning Service (RSS)
- 5 GOES 13 and GOES 15 also transmit EMWIN on 1692.70 MHz

## FEEDBACK

*The column for Readers'  
Letters, Queries and Discussion*

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

To David Anderson

Thanks for your email. I have decided to discontinue my membership of GEO because I am no longer an active weather satellite user. I took my equipment out of use during some renovating and decorating last year.

In that time, technology has moved on, with a new system coming in requiring yet more hardware and software to make use of it. This has its implications in terms of investing time, money and effort in getting to grips with it all, and it is a bigger commitment than I am willing to make. I have many demands on my time and I just can't fit it in any more, beyond doing the occasional APT image, while that remains available.

I would like to thank you and the other GEO committee members, past and present for all your hard work, which was very much appreciated. Perhaps you would be kind enough to pass on my thanks to those of them that you can.

Regards  
Terry Mullen

### 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.php>

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

### Weather Satellite Reports

If there is a single Internet Forum that is relevant to all weather satellite enthusiasts, it must surely be Douglas Deans' Weather Satellite reports.

Here you will find every conceivable type of information about weather satellites, whether polar or geostationary, APT, HRPT, LRIT, EUMETCast or whatever.

Absolutely everything is covered, and the information is updated every week. Special additional bulletins may be issued if an important change takes place mid week.

You can read the bulletins from this URL

<https://groups.yahoo.com/neo/groups/weather-satellite-reports/info>

or, even better, elect to have the reports sent to you by email every Monday.

### Internet Discussion Groups

There are a numerous Internet-based discussion groups of interest to weather satellite enthusiasts. The home page for each group provides an email address through which you can request membership. Even a blank email containing the word 'subscribe' in its Subject line is all that is required.

#### APT Decoder

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

<https://groups.yahoo.com/neo/groups/APTDecoder/info>

#### 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.

<https://groups.yahoo.com/neo/groups/GEO-Subscribers/info>

#### 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).

<https://groups.yahoo.com/neo/groups/SatSignal/info>

#### MSG-1

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

<https://groups.yahoo.com/neo/groups/MSG-1/info>

#### WXtoImg-I

A forum for users of the *WXtoImg* software application for receiving and processing imagery from the NOAA satellite APT signals.

<https://groups.yahoo.com/neo/groups/wxtoimg-I/info>

### GEO Helplines

#### Douglas Deans, Dunblane, Scotland.

All aspects of weather satellites from APT, HRPT to Meteosat-9 DVB/EUMETCast systems.

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

#### John Tellick, Surrey, England.

Meteosat 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, Flintshire, NE Wales.

Geoff has lots of experience with aerial, coax connectors, mounting hardware etc. and has also done a lot of work with the orbiting satellites. Geoff has been a EUMETCast Meteosat 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, Dorset, England.

Assistance with reception of EUMETCast to include Metop-A and Metop-B; also MSG Data reception and set-up within the PC, assistance with dish alignment and set-up, and installation and set-up of TBS DVB-S2 units.

- email: mikeg4cfz@gmail.com

#### Guy Martin, 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, Puerto Rico, USA.

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

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

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

### Copy for GEO Quarterly

Original contributions relating to any aspect of Earth Imaging should be submitted in electronic format (although handwritten and typed copy will be accepted).

Please note that **major articles** which contain a large number of illustrations should be submitted **as early as possible before copy deadline**, to give time for preparation prior to publication.

Please note that it is preferred that satellite images are provided **without added grid lines, country outlines or captions** unless these are considered essential for illustrative purposes in an accompanying article.

#### Submission of Copy

Materials for publication should be sent to the editor,

**Les Hamilton**  
8 Deeside Place  
Aberdeen AB15 7PW  
Scotland

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

[geoeditor@geo-web.org.uk](mailto:geoeditor@geo-web.org.uk)  
Particularly large attachments (8 MB and above) can be transmitted via *Hightail*

<https://www.hightail.com/>

# Group for Earth Observation

## Membership Application Form



**Current Subscription Rate for All Members is £15**

**This will bring you 4 electronic (PDF) GEO Quarterlies  
You will also be mailed a *printed copy* of the December issue**

**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.php> 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 [members@geo-web.org.uk](mailto:members@geo-web.org.uk) for BIC and IBAN details.

Name (please PRINT clearly)

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

Address

**Declaration**

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

Town/City

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.

Postcode/ZIP

Callsign

Country

Signature

Telephone Number

FAX

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.*

**If you prefer not to remove this page from your Quarterly, a photocopy or scan of this Membership Form is perfectly acceptable**

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For our full range, visit **GEO Shop** at  
<http://www.geo-web.org.uk/shop.php>



### Ayecka-SR1 DVB-S2 VCM USB Receiver

This advanced DVB-S2 VCM Receiver has been extensively tested by both EUMETSAT and GEO, and has proved to be exceptionally suitable for trouble-free reception of the EUMETCast DVB-S2 transmissions that became standard from the start of 2015.



The price includes a USB cable, wall power supply, shipping and *Paypal* fees.

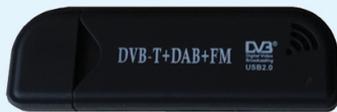
UK members price - £365.00  
EU members price - £375.00

### Current Price List

|  | Members' Prices |        |        | Prices for non-Members |       |       |
|--|-----------------|--------|--------|------------------------|-------|-------|
|  | UK              | EU     | RoW    | UK                     | EU    | RoW   |
| Ayecka SR1 DVB-S2 Receiver   | 365.00          | 375.00 | 380.00 | -----                  | ----- | ----- |
| Edimax USB 2.0 Fast Ethernet Adapter                                   | 15.00           | 17.00  | 18.00  | -----                  | ----- | ----- |
| DVB-S USB 2102 Receiver  | 60.60           | 67.00  | -----  | 70.60                  | 77.00 | ----- |
| SDR Dongle kit for APT/LRPT  | 20.00           | 25.00  | 26.00  | -----                  | ----- | ----- |
| Sandpiper Turnstile Antenna  | 71.00           | -----  | -----  | 83.50                  | ----- | ----- |
| GEO-PIC 1.0 for the RX2 Receiver                                       | 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 |
| 80 cm dish   | 72.00           | -----  | -----  | 79.00                  | ----- | ----- |
| Ku band universal LNB  | 13.70           | 15.20  | -----  | 20.20                  | 21.70 | ----- |
| Technisat Satfinder Alignment Meter                                    | 26.50           | 29.50  | -----  | 29.50                  | 32.50 | ----- |
| GEO Quarterly Back Issues (subject to availability)                    | 3.80            | 4.60   | 5.60   | n/a                    | n/a   | n/a   |
| GEO Quarterly (PDF on CD) 2004-2014 (Annual compilations - state year) | 8.00            | 8.80   | 9.30   | n/a                    | n/a   | n/a   |
| GEO Membership (4 PDF magazines and one printed magazine per year)     | 15.00           | 15.00  | 15.00  | 15.00                  | 15.00 | 10.00 |

All prices are in £ sterling and include postage and packaging

### Receive NOAA APT and Meteor M2 LRPT with an SDR-RTL dongle



This RTL2832 R820T dongle for SDR DAB DAB+ and FM radio has a frequency range from 24 to 1700 MHz, and comes complete with an SDR Driver CD, 2 MCX-SMA aerial patch leads and 5 adapters (SMA/BNC male and female, BNC-SO239, and SMA male/SMA male).

UK members price - £20.00  
EU members price - £25.00

### Inverto-Black-Ultra High-Performance LNBS

GEO currently recommends these LNBS for EUMETCast reception. We are currently **not stocking** this item but it is available at **Amazon**.



<http://www.amazon.co.uk/gp/product/B0010NAEKI/>

Twin LNB 40mm 0,2dB £15.50  
Single satellite LNB £ 9.95

### 80 cm Dish



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 - £72.00  
UK non-members price - £79.00

### Ordering and Shipping

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

Orders should be sent by email to

[geonlinestore@gmail.com](mailto:geonlinestore@gmail.com)

or made through the GEO Website at

<http://www.geo-web.org.uk/shop.php>

Goods are normally shipped within 28 days, subject to availability.



### Not yet a GEO Member?

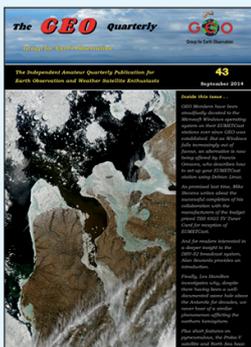
GEO can provide most of the items advertised (with the exception of GEO Quarterly back-issues and CDs) to both members and non members: but non-members cannot benefit from the discounted members prices.

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

**Annual Subscription Rate for all regions in now £15 (UK)**

For this you will receive 4 electronic (PDF) copies of GEO Quarterly Magazine. In addition, you will be mailed a **printed version** of the December magazine.

### GEO Quarterly - Back Issues (Only available to GEO Members)



Paper copies of back issues of GEO Quarterly may be available, but it is advisable to check before ordering.

UK members price - £3.80

Annual compilations of GEO Quarterly back issues in PDF format are available on CD. Be sure to state the year of each annual compilation that you wish to order.

UK members price - £8.00

### 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 - £26.50  
UK non-member's price - £29.50

### GEO PIC 1.0 for the RX2



Programmed with the new channel frequencies required for NOAAs 18/19.

UK members price - £7.00  
UK non-members price - £7.50

### Edimax USB 2.0 Fast Ethernet Adapter



This adapter enables you to add a *second* network connection for your PC/Laptop, to connect to the Ayecka SR1 Traffic port, thereby relieving loading on the home network. Typically, you would assign this adapter with an IP address on the same network as the SR1 i.e 192.168.10.103. Data from the SR1 passes directly to the PC whilst its internet connection remains on your usual home network 192.168.1.xxx (Management Port).

UK members price - £15.00  
UK non-members price - £17.00

