

The **GEO** Quarterly



Group for Earth Observation

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

38

June 2013

Inside this issue . . .

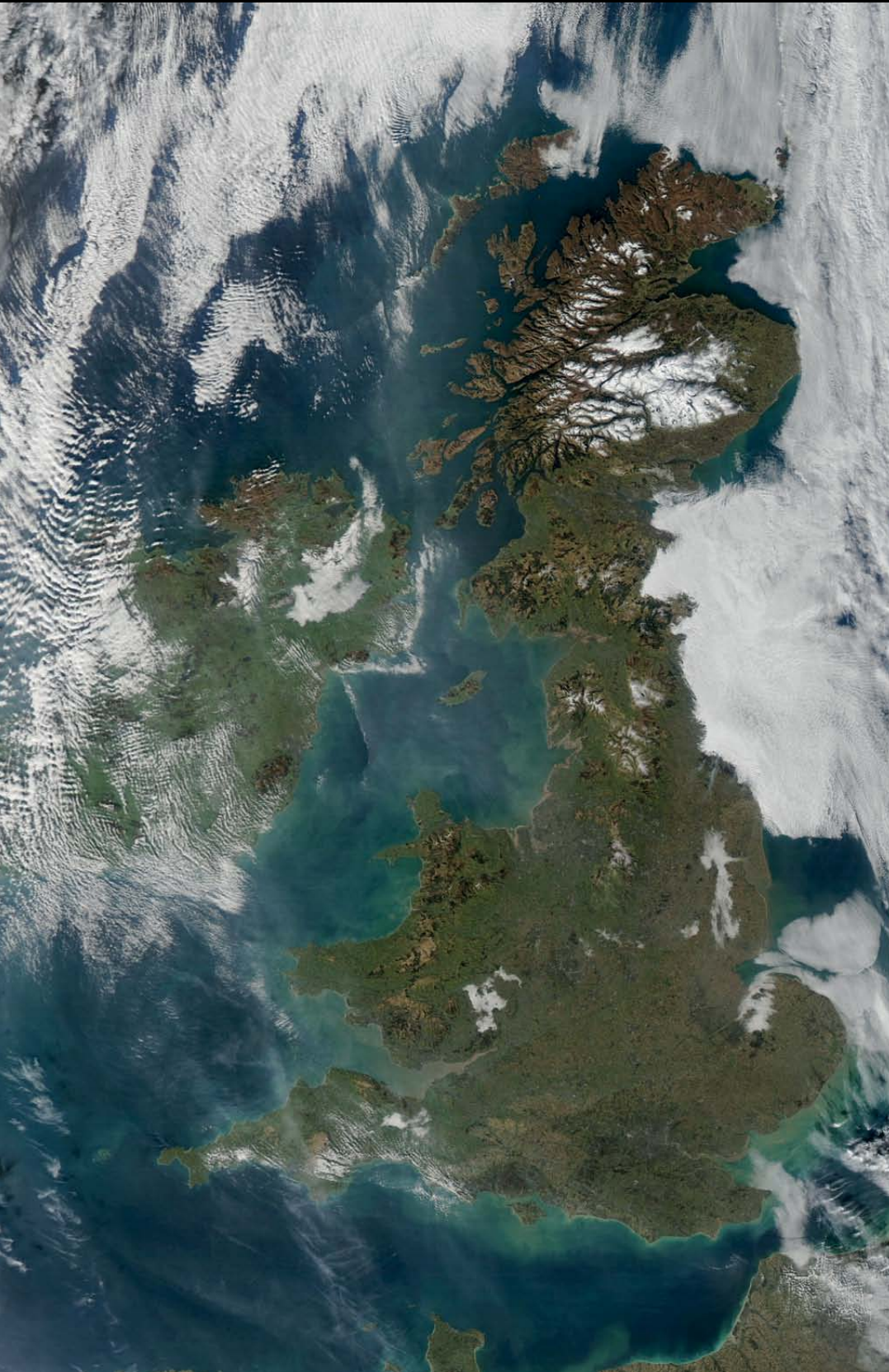
This issue of GEO Quarterly is aimed firmly at newcomers to the hobby—particularly readers who may be setting up their receiving system for EUMETCast for the first time.

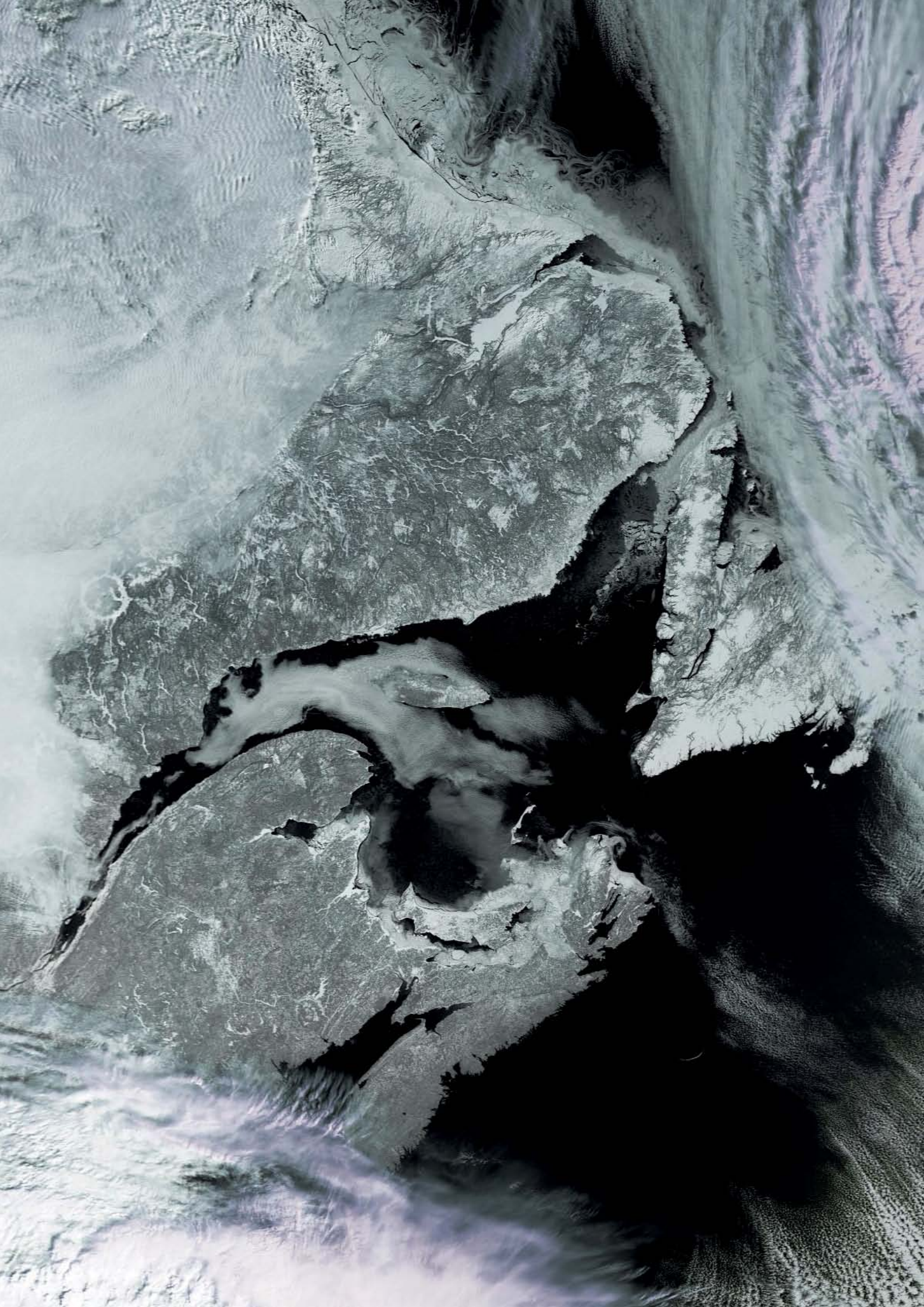
Mike Stevens has updated and expanded the guide to installing EUMETCast that he originally prepared some nine years ago, and in addition has penned an introduction to MSG DataManager, the software you require to convert the received files into satellite images.

Last February's spectacular meteor event over Russia emphasises the importance of observing away from Earth as well as directly down upon it. Les Hamilton has delved deeply into contemporary Russian news reports to piece together a fascinating illustrated account of the event.

For readers migrating to the new Windows 8 operating system, David Taylor provides some helpful notes.

There are also articles on phytoplankton blooms, Antarctic icebergs, the Northwest Passage, and ice on Lake Erie.





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Editorial

Les Hamilton

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Apologies for an error in printing *GEO Quarterly 37* which rendered four of the full-colour pages in a rather insipid monochrome. Since colour was critical for the articles in question, these have all been reprinted in this issue. We hope that this did not detract too badly from your enjoyment of that issue of our magazine.

Recently I had a discussion with Mike Stevens, who noted that there had been considerable development in the *EUMETCast* service since he prepared his introductory guide to it in December 2004. Would this be a good time to update his material? Bearing in mind that GEO has welcomed many new members into the fold in the years since, we agreed that an updated article would be most appropriate and it can be found on page 24. Many GEO readers still use *Windows XP* as their operating system of choice for *EUMETCast* and the current article describes setting up a *EUMETCast* PC under *Windows XP*. But Mike is already working on a follow-up article for our next issue, for the benefit of readers who prefer to make use of the *Windows 7* operating system.

Last year we were forced to revise subscription costs for *GEO Quarterly* in the face of escalating postage charges, particularly for sending the magazines overseas. Realising that readers in far corners of the world could be priced out of the market, it was decided at last December's management meeting to investigate introducing a new subscription category—for an electronic copy of the Quarterly that readers could download as a PDF document. This has been implemented since April this year, as can be seen on the Membership Form on page 39.

Possibly the first thing you noticed when you received this magazine was that it is uncharacteristically slim: in fact eight pages fewer than ever before. Sadly, the readership seems to be running out of ideas for publication. Also, at least three members who actually promised articles for this issue have failed to provide anything. There are in fact only three feature items in this issue, one from myself and two from Mike Stevens. It was only through the inclusion of six NASA Earth Observatory reports and six full-page satellite images that even this disappointing tally was reached. Remember, this is your magazine. Please be prepared to share your experiences and expertise with the readership.

The *GEO Shop* has been selling the new R2FU APT receiver since late 2012 and I would have anticipated some member feedback by now—but nothing: not even a solitary APT image. Hopefully, someone will send me an article reviewing its performance for next issue. It is also disappointing that there has as yet been no follow-up relating to Rob Alblas' article on using a DVB-T USB dongle for APT reception. Surely some of you have tried this out. We would like to know how you got on. Did you receive reasonable images? Were pagers a problem in the UK? If so, has anyone been able to develop a means of overcoming pager interference?

It's perhaps too early to state that *GEO Quarterly* is in crisis. But if there is similar apathy towards providing content for the September issue, its appearance will be delayed until I have sufficient material, however long that may take. Mike Stevens and I cannot carry *GEO Quarterly* forward on our own. We need your help. It would be really terrific to receive enough member contributions to produce a bumper 56-page September Quarterly. Please think about this.

Masthead photograph: Balquhain Recumbent Stone Circle near Inverurie, Aberdeenshire

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The GEO Report



Francis Bell

There have been two important issues which GEO management have been discussing over the past few months. One relates to an electronic format for *GEO Quarterly*, the other to foreseeable changes in the EUMETCast transmissions.

The GEO Quarterly Format

For almost ten years we have been producing our printed Quarterly, which I think has been universally recognised as an excellent publication, with credit owing to our contributors, the editor and printers. However, although printing costs have remained relatively stable, the distribution costs have risen so sharply that we decided to offer an additional or alternative way of distributing *GEO Quarterly*.

You can now subscribe to electronic copies of *GEO Quarterly*, in PDF format, which you will be able to download on to your PC. This distribution format minimises printing and distribution costs and, hopefully, will make the magazine more affordable to enthusiasts in far reaches of the globe. You can read full details about this new venture on the GEO website at

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

It is worth noting that another group to which I belong, AMSAT-UK, is offering an electronic copy of their publication for a reduced membership subscription, their rationale being the same as GEO's.

But for readers who would hate to see the demise of the printed copy, that subscription option does of course continue.

The EUMETCast Service

Another major issue which we are following closely concerns the potential technical changes to the EUMETCast transmissions. For some years now, regular users of this service have anticipated some changes because of the steadily increasing amount of data being disseminated. Apparently, this has now reached the point where the single transponder on *Eutelsat 9A* will soon be saturated—meaning that changes are inevitable. My understanding is that EUMETSAT have announced that they will maintain the present service until January 2015, but overlapping with this there will be a new service starting in August 2014. The new service will require a DVB-S2 receiver which supports VCM mode. Some of our knowledgeable technical members are in touch with EUMETSAT regarding these changes, and I too am trying to establish a source for a suitable receiver for this new service.

Our highest priority over the coming year will be to keep our membership informed of changes to the EUMETCast service.

APT Reception

Recently, I have been taking a renewed interest in NOAA 15 APT reception because of its late afternoon pass over the western Atlantic. I have in mind obtaining an image of Greenland and eastern Canada via NOAA 15 from my home in Surrey so that I may make a submission for GEO's *Farthest West* image competition. So far I have been a little frustrated because, although I can receive NOAA 15 below

an elevation of 10°W, the images I have already received have always shown cloud cover over east Canada. I will continue with this project in the hope that a Canadian summer will reveal details of their coast and land surface.

Rob Denton issued his *Farthest West* challenge on page 33 of last December's Quarterly. The competition was due to close in late April, but, as no entries have yet been received, it will remain open over the summer. Perhaps the dire winter weather coupled with poor channel-2 illumination levels accounted for this. Do please take up Rob's challenge over the summer and send entries either to Rob or the Editor. The most interesting entries will be printed in future issues of *GEO Quarterly*.

Kempton Rally

The Kempton Radio and Electronics Rally last April represented a busy day for GEO, with many rally visitors taking an interest in our stand and the information we had to offer. As well as our own information, and literature relating to home reception of weather satellites, we also had some literature from EUMETSAT on our stand, where we were running three computer demonstrations showing geostationary and polar orbiting satellite images together with brief examples of how to process the raw data.



The GEO stand at Kempton showing David Simmons talking about the FUNcube Dongle Pro+ to some of our knowledgeable visitors.

In addition to seeing some familiar faces we were able to talk to many new visitors, some of whom expressed so much enthusiasm for their own weather satellite reception stations that I feel sure some of them will take up the hobby for themselves.

Two visitors were particularly memorable. One turned out to be an expert with the new **FUNcube Dongle Pro+**, who explained his experiences plus its potential use for APT reception. The FUNcube Dongle Pro+ is effectively a radio receiver capable of receiving frequencies in the ranges 150–240 MHz and 420 MHz - 1.9 GHz, which plugs into a USB port in a suitable computer. For details of this small piece of hardware visit

www.hamradio.co.uk

and go to the Software Defined Radio section: then click the AMSAT-UK logo. This dongle is marketed by Martin Lynch & Sons Tel: 0345 2300 599.

If any GEO member has additional experience of using the **FUNcube Dongle Pro+** dongle for APT or other weather satellite applications we would love to hear from you.

Another visitor who particularly impressed me was an elderly gentleman with a technical and electronic background in the RAF. It turned out that he was one of the first persons in the world to receive live signals from Sputnik-1 in October 1957. I thought the launch of this first man-made satellite was a secret until after its launch: but apparently not, as some details about the satellite and its frequencies had been released by the Russians prior to launch.

Our visitor had spotted these and alerted the disbelieving UK authorities. Consequently, he was able to have his own receiver ready for when the satellite was in orbit and listened to the signals during the Sputnik's 22 days of operation. I will keep in touch with this gentleman because he has some historical receiving and image display equipment which he would like to donate to a museum. I will try to help him progress this worthy project.

My thanks to David Simmons for manning the GEO stand with me all day and offering technical information relating to visitors' enquiries.

Meetings

My recent planned visit to the National Oceanographic Centre's Open Day, which was advertised on our website, unfortunately did not materialise. Snow and road traffic accidents prevented me from attending this year. However, there is to be another Open Day next year which I will advertise to our membership, and I sincerely hope I will be able to be there myself.

This year there have been frustrations in trying to arrange our own GEO meeting and, because of the busy summer of other meetings, GEO may not hold its own event this year, relying on contacts at other events

continued on page 16

Cover and Full Page Image Details

Front Cover

David Taylor spotted this exciting **Aqua** MODIS image of the UK, acquired on February 19 this year. An area of high pressure reveals almost the entire British Isles, with snow prominent on Scotland's Cairngorms.

Image: LANCE-MODIS/NASA/GSFC

Inside Front Cover

Mike Stevens is always on the look-out for interesting images from far-flung corners of the planet. In this **Metop-A** image there is a wonderful shot of the Gulf of St Lawrence and Newfoundland in the grip of winter. Thick ice lines the southern coast of Northumberland Strait to the south of Prince Edward Island.

Image © EUMETSAT 2013

Inside Back Cover

Two images submitted by GEO readers: a fine early **Meteosat-10** image from Mike Stevens (top) and a composite **NOAA-18** APT image from André T'Kindt.

Back Cover

This **Terra** MODIS image from March 9, 2012 shows almost the whole of Scandinavia embraced in a cloak of snow and ice. Only Denmark has escaped winter's grip.

Image: LANCE-MODIS/NASA/GSFC

Page 5

This channel-2 MODIS image from NASA's **Terra** satellite shows turbulent Arctic weather across the Greenland and Norwegian seas. The Svalbard archipelago, including Bear Island, shows well at upper left and Jan Mayen Island is clearly visible at lower left. Cloud streets march southward from the Arctic ice sheet and a succession of comma storm cloud formations bridges the Norwegian Sea

Image: NASA/GSFC/LAADS

Page 17

This **Aqua** MODIS image acquired on the afternoon of April 19, 2013 shows fascinating cloud activity surrounding the islands of the Republic of Cape Verde.

Image: LANCE-MODIS/NASA/GSFC

Page 19

This year's late winter wasn't confined to Europe. North America also endured freezing conditions well into spring as this March 29 image of the Great Lakes and eastern seaboard from NASA's **Aqua** satellite makes clear.

Image: LANCE-MODIS/NASA/GSFC

Page 20

These are the two illustrations that—due to a printing error—failed to

reproduce correctly on page 12 of *GEO Quarterly No 37*.

Page 21

This is a **Terra** MODIS image of the north Atlantic acquired on March 30, 2013. The image shows a wealth of cloud detail: a Polar Low and a Comma system lurk just south of Svalbard, while a large Arctic Cyclone fills the Greenland Basin. High pressure holds firm over Scandinavia, drawing icy winds and snow showers across Britain and the Low Countries.

Image: LANCE-MODIS/NASA/GSFC

Page 33

This image come from the same **Terra** MODIS pass as the colour composite on page 21, but this is a segment from the full resolution, 250 m/pixel channel-2 image, downloaded from the LAADS website, and processed using David Taylor's *L1 Viewer* software. Just look at the amazing detail over Iceland, and the swirls of brash ice looping around the inlets along the coastline of southern Greenland.

Image: NASA/GSFC/LAADS Web

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This cloud-free image of Scandinavia submitted by David Taylor was captured by **Metop-B** on March 9, the same date as the *Terra* image on the back cover. David remarked: "I noticed the clarity of Scandinavia from my NOAA-19 APT image and wondered whether I might have a higher resolution pass from one of the *EUMETCast* services. I wanted the morning pass so that the majority of Norway was near the centre-line of the scene, and thus in the higher resolution part of the image. Checking *Metop-A*, I found that Norway was nearer the edge of the image than I would have liked, then remembered that *Metop-B* follows the same track, but about half an orbit behind. This meant that it would be about 11° west of the *Metop-A* pass. The result was this image, that was much better centred.

"This is of course a false-colour image, where the brightness of the scene is derived from the 0.8 µm visible channel and its colour from the 10 µm thermal channel. The relatively neutral colours indicate temperatures around zero degrees Celsius. The MODIS image on the cover is derived from three channels, one for each of the red, green and blue components of the image. The greater number of visible waveband channels captured by the *Terra* satellite thereby results in a more naturally coloured image."

Image © EUMETSAT 2013

Torres del Paine National Park

A NASA Earth Observatory Report

Grinding glaciers and granite peaks mingle in southern Chile's Torres del Paine National Park. The Advanced Land Imager (ALI) on NASA's Earth Observing-1 (EO-1) satellite captured this summertime image showing a portion of the park, including the Cordillera del Paine range and Grey Glacier, on January 21, 2013. The rivers of glacial ice in the Park grind over bedrock, turning some of it into dust. Many of the glaciers terminate in freshwater lakes, which are rich with this glacial flour, which colours them brown to turquoise. Narrow rivers connect some of the lakes to each other.

The compact Cordillera del Paine mountain range is a combination of soaring peaks and small glaciers, most notably *Torres del Paine*, a group of three closely spaced peaks emblematic of the mountain range and the larger park.

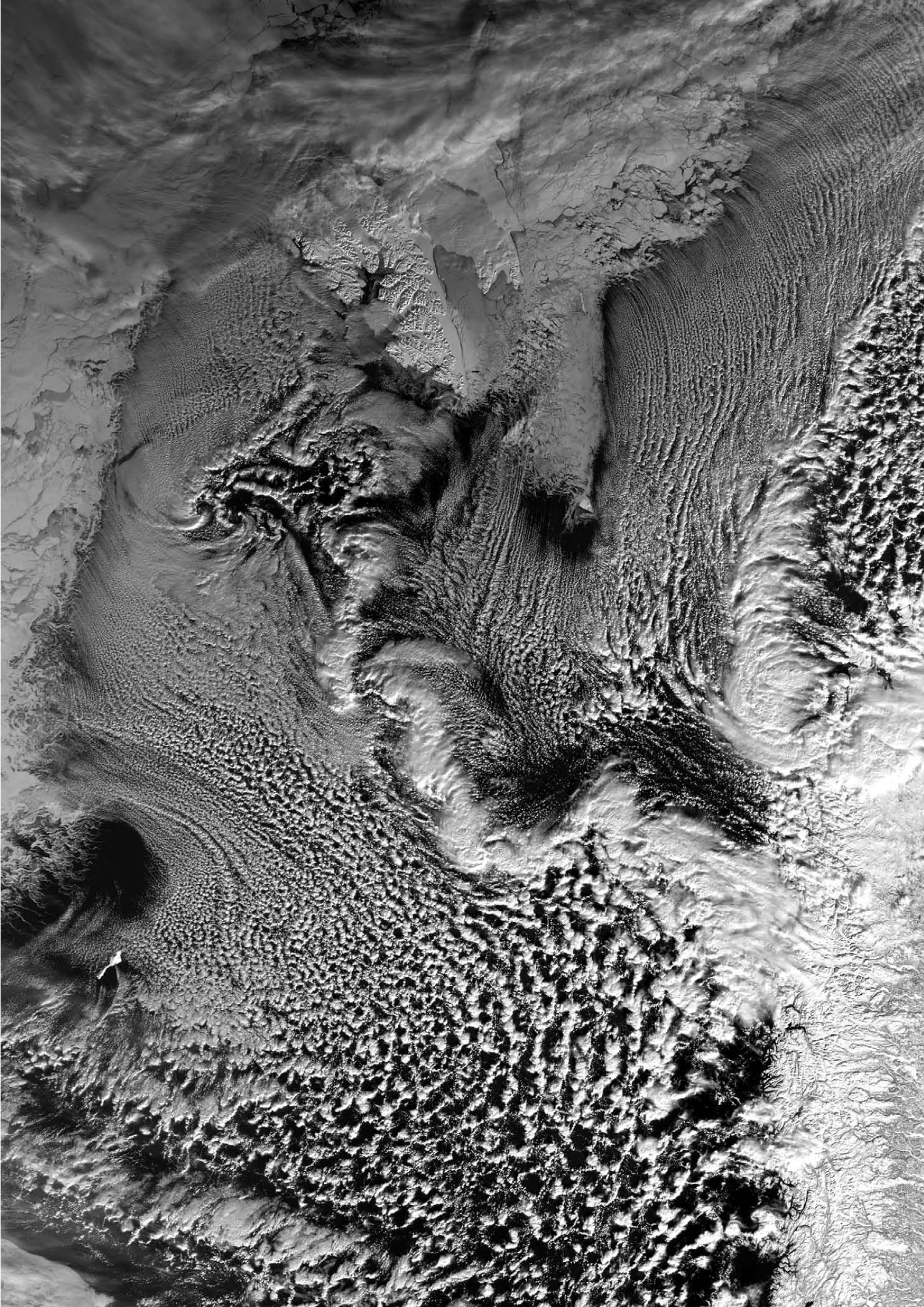
Compared with the Rocky Mountains (70 million years) and the Appalachians (about 480 million years), the Cordillera del Paine is geologically very young, only about 12 million years old. A study published in 2008 described how scientists used zircon crystals to estimate the age of Cordillera del Paine [1]. The authors concluded that the mountain range had been built in three pulses, creating a granite laccolith, or dome-shaped feature, more than 2,000 metres thick.

Reference

- 1 Michel, Baumgartner, et. al. Incremental growth of the Patagonian Torres del Paine laccolith over 90 k.y. *Geology*, 36(6), 459–462 (2008).

NASA Earth Observatory image created by Jesse Allen and Robert Simmon, using Advanced Land Imager data from the NASA EO-1 team. Caption by Michon Scott.





Chelyabinsk Fireball

Russian Meteor believed World's largest since Tunguska

Les Hamilton

It was just like any other Friday morning in Chelyabinsk, a Russian city of over a million inhabitants, situated in the southern Urals some 1500 kilometres east of Moscow. Workers were in their offices, children were at school and shoppers in the streets. But at 9.20 local time on the morning of February 15, 2013, everything changed. This was to prove to be an experience that none of the city's residents would ever forget.

This was the day of Earth's most massive cosmic invader since the Tunguska event of 1908. It produced a fireball that seared across the skies, trailing a spectacular vapour trail in its wake (figures 4-7), before finally exploding into fragments that produced meteor showers over a wide area. Its totally unexpected arrival brought traffic in Chelyabinsk to a standstill as the fireball exploded almost directly above the city, briefly rendering the dawn brighter than midday sunshine. Alerted by the flash, people rushed to windows and out into the streets to view the display. Two and a half minutes later, a series of violent sonic booms rent the air, shattering windows, setting off car alarms and triggering security systems that temporarily disconnected the city's gas supply and central heating systems. There was widespread panic and confusion. Over 1500 people suffered injuries, nearly all from flying glass. Some Chelyabinsk residents reported that the air smelled like gunpowder following the explosion. Many felt the heat from the explosion on their faces.

Eye-witness statements painted a vivid picture of the event:

- "I glanced up and saw a glowing dot in the west, which got bigger and bigger, like a soccer ball, until it became blindingly white."
- "It was like a train falling down from the sky."
- "There was panic. People had no idea what was happening. Everyone was going around to people's houses to check if they were okay."
- "We saw a big burst of light, then went outside to see what it was and we heard a really loud thundering sound."

The trail from the Chelyabinsk meteor was imaged by both Meteosat-9 and Meteosat-10. By great good fortune, one of the United States DMSP polar orbiting satellites was also well placed to image the event. The flight of the meteor across the Urals was marked by a ball of fire flying roughly from north-east to south-west. At the extremity of its range, Meteosat-10 caught a hint the meteor's glowing trail in an HRV image just as it crossed Earth's limb (figure 1). Meteosat-9 located at 9.5°E was better placed to observe the event, although readers are unlikely to have noticed because the RSS images disseminated via *EUMETCast* are 'rectified' to 0.0°. We are grateful to Simon Proud and the University of Copenhagen for making figure 2—derived from the original Level-1 data—available to GEO. The DMSP satellite, flying close to the terminator, obtained a more extended infrared image of the meteor (figure 3). The map (figure 14) shows the path taken by the meteor as it crossed the Urals and approached Chelyabinsk.

Though widely described as a meteor, NASA later established that the fireball was in fact due to a small member of the *Apollo* family of near-Earth asteroids, all of which cross Earth's orbit on their way to perihelion. NASA estimated it to measure 17 metres across and have a mass of almost 10 000 tonnes. The body entered Earth's atmosphere at a shallow, grazing angle with a velocity of around of 64 000 kilometres per hour. Its fireball created a vapour trail across the sky for fully half a minute before it disintegrated with a spectacular explosion that outshone the midday sun (figures 5, 6). The trail stretched for 480 kilometres across the heavens (figure 7) and the energy released during its passage through the atmosphere—in which the meteor was completely destroyed—was estimated to be nearly 500 kilotonnes. By comparison, the nuclear bomb dropped on Hiroshima in 1945 released an estimated 15 kilotonnes of energy.

Initially, it was uncertain whether the event had been due to a single large body or a swarm of many smaller ones.



Figure 1 - A Meteosat-10 HRV SEVIRI image shows the meteor trail just crossing Earth's limb. Processing: Simon Proud/University of Copenhagen Image © EUMETSAT 2013



Figure 2 - Meteosat-9 viewed the Russian meteor from 9.5°E, providing a much better view. Processing: Simon Proud/University of Copenhagen Image © EUMETSAT 2013

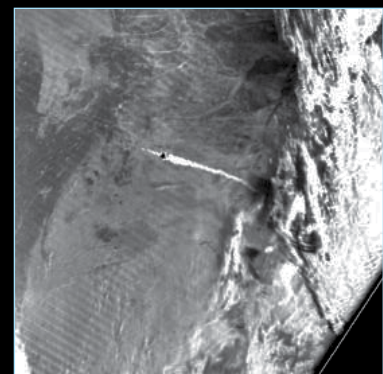


Figure 3 - The meteor trail shows well in this DMSP infrared image Image: CSU / CIRA / Colorado State University

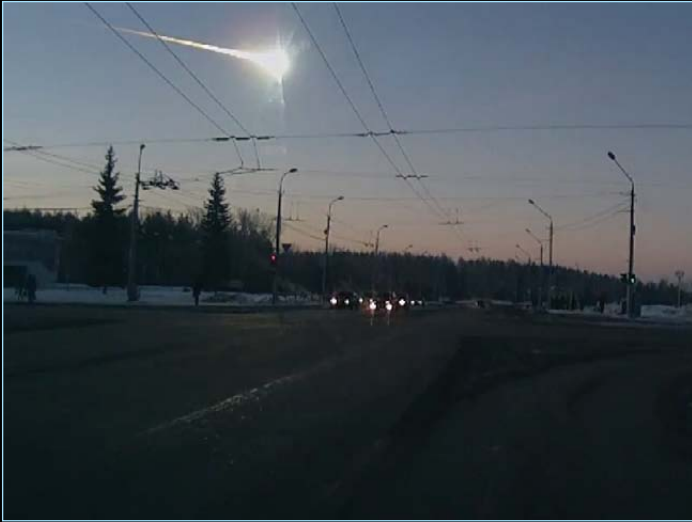


Figure 4 - A dash-cam view of the fireball from Kamensk-Uralsky.
Dashcam Video: Aleksandr Ivanov



Figure 5 - Seconds later, the explosion - brighter than the sun.
Dashcam Video: Aleksandr Ivanov



Figure 6 - The fireball was seen from Kostanay in neighbouring Kazakhstan.
Dashcam Video: Roman Belchenko



Figure 7 - The meteor trail across the dawn sky above Chelyabinsk.
Photo: Lenta.ru / @Maxwell_ru



Figure 8 - A school with many of its windows blown in.
Photo Lenta.ru / @KozzyKoder



Figure 9 - The Chelyabinsk Zinc Plant with half its roof missing and its wall collapsed.
Photo A Pospel / Wikimedia



Figure 10 - Children being evacuated from a school in Chelyabinsk.
Photo: Miass / Wikimedia

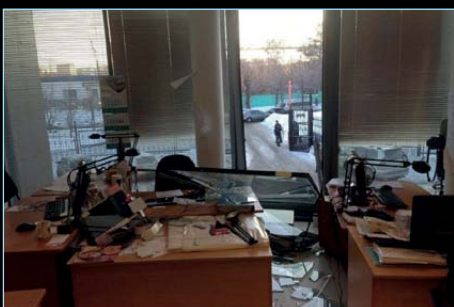


Figure 11 - An office window blown in by the blast.
Lenta.ru / Althathwe Leprosorium



Figure 12 - The hole in the ice where a meteor fragment entered Lake Chebarkul.
Photo Chelyabinsk Region Police Department



Figure 13 - One of the Chebarkul Lake meteorites.
Photo: Denis Panteleev

But Russia's national space agency, *Roscosmos*, soon confirmed that the event was caused by a single body which burned up as it traversed the atmosphere, disintegrating into smaller pieces. *Roscosmos* estimated that the meteor had been moving at a speed of 18 kilometres per second.

The flash of the explosion lasted for about five seconds, and the three loud sonic booms (the first the most powerful) that followed created shock waves that blew in windows and damaged thousands of buildings around the city of Chelyabinsk (figures 8, 9, 10, 11). The actual altitude of the meteor remains uncertain: an early estimate claimed that the explosion took place between 60-70 kilometres above ground but later measurements from the other side of the city suggested around half that figure.



Figure 14 - The path of the Chelyabinsk meteor over the southern Urals.

The final consensus was that the explosion occurred between 25 and 30 kilometres above Chelyabinsk. Certainly, many eyewitnesses saw the explosion hundreds of kilometres from its epicentre, some hearing the booms more than five minutes after the flash. The fireball was even viewed in Orenburg, 770 kilometres from Chelyabinsk.

Consequences

It was fortunate indeed that the Chelyabinsk meteor made only a grazing entry into Earth's atmosphere. The consequences, should such a massive body have reached the ground, are almost unthinkable: one estimate was that an area of 200 square kilometres would be totally devastated. Even so, the final tally of damage to property and human injuries resulting from the meteor was without parallel in recorded history.

The meteor's explosion created sonic shock waves and showered debris over a large area of the region. In total, 1,586 people, 324 of them children, were injured, most by flying glass and debris: but there were no reports of anyone actually being hit directly by meteoritic debris. Although two thirds of the injuries were classified as 'slight', 63 individuals were detained in hospital, 25 of them for a week or more before being discharged. At the Chelyabinsk Tube Rolling Plant, several people suffered broken bones and head injuries from falling beams. One 52 year old woman who was thrown from a ladder suffered a spinal injury and was airlifted to Moscow for treatment. She was discharged three weeks later and returned home by train. Although an ambulance was sent to meet her at the station, she declined its assistance and went home herself.

On the property front, almost 7000 apartments and family homes suffered broken windows and blown-in window frames, as well as 740 educational institutions, 290 hospitals and clinics, and 69 cultural facilities. It was estimated that a total of 200 000 m² of glass would have to be replaced. By March 5, glazing was fully restored in 98% of the affected buildings, including 99% of homes.

The Chelyabinsk authorities announced that they would pay compensation to victims of the blast, including free replacement of windows. Those requesting outpatient treatment for injury could receive sums as high as 5 000 ₺ (roubles) if they suffered actual bodily harm, and up to ten times this figure for serious injury.

Part of a wall of the important Chelyabinsk Zinc Plant was knocked down and almost half of its roof was blown off (figure 9). The Zinc Plant is a fully integrated company which mines and processes ore into refined zinc and zinc alloys. It boasts market shares of 60% within Russia and 2% globally.

A number of major sporting facilities were badly damaged by the blast, and were closed pending repairs. Hardest hit was the *Ural Lightning* ice skating arena which was partially destroyed after two major supporting cross-beams in the roof crashed to the ground (figure 19). Damage repairs are likely to cost as much as 200 million ₺ and it is not known when the arena will reopen. So severe was the meteor's shock wave that only the north wall remained sound as the pressure from the explosion forced the supporting frameworks of all the other walls out of alignment. These walls will certainly have to be strengthened, and the possibly remains that they may have to be largely rebuilt. At the time of the meteor explosion, about 100 children were skating in the arena. Fortunately, none of them was hurt and the building was completely evacuated within five minutes.

Also damaged was the *Traktor Sports Palace*, an ice hockey stadium, though repairs were expected to be completed within a week. The recently renovated swimming pool and the Olympic Judo Training Centre both lost almost all their windows and face respective repair bills of 15 million and 2 million roubles. In total, it has been estimated that the full cost of repairs throughout the Chelyabinsk region will be at least one billion roubles, equivalent to about \$US33 million.

Immediately following the meteor, Chelyabinsk authorities assessed the damage it caused and discovered that almost all the broken windows were in the city itself. With a midday temperature of -12°C expected to fall to -17°C overnight, repairs were very much a priority, and more than 24,000 people, many of them volunteers, were mobilised that very afternoon from throughout the region to start covering windows, gathering warm clothes and food, and participating in other relief efforts. Crews from glass companies in adjacent regions were also flown in, and 585 teams were deployed on the immediate task of simply covering shattered residential windows with plastic sheeting or wooden boards.

The following day, with the temperature at -18°C and much of Chelyabinsk's gas supply cut off, it was decided to close all schools and kindergartens for the following Monday and Tuesday.

Meteorite Finds

Close to the town of Chebarkul, 80 kilometres west of Chelyabinsk city, local fishermen broke the news that an eight metre wide hole had suddenly appeared in the frozen surface of Chebarkul Lake. As this lake always remains completely frozen over between November and March, the conclusion was that a large fragment from the meteor must have landed there (figure 12).

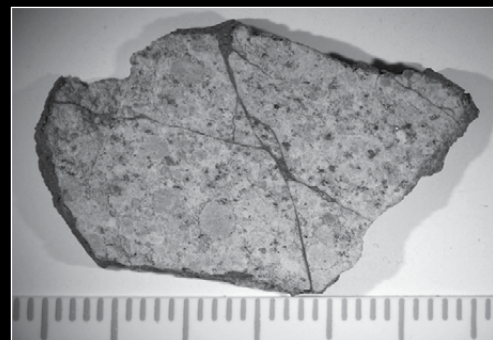


Figure 15 - A slice from one of the Chebarkul Lake meteorites.
Photo - Mikhail Nazarov



Figure 16 - Pieces of the Chelyabinsk meteor seen in a laboratory in Yekaterinburg. Black shock veins are visible in the broken specimen in the background.
Credit: The Urals Federal University Press Service / Alexander Khlopotov



Figure 18 - Searching Cherbakul Lake for Meteorites.
Photo © The Central Military District press service

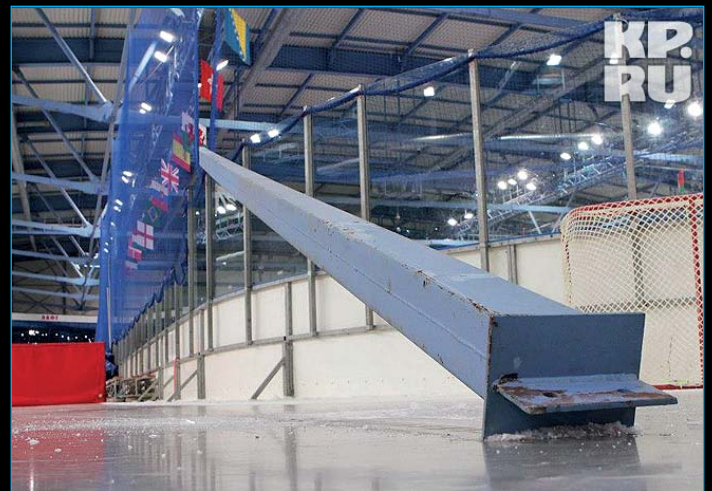


Figure 19 - Damage to the interior of the Ural Lightning arena.
Photo: Ria Novosti

A party of six divers scoured the bottom of the lake the following day searching for fragments of the meteor, but found nothing due to the murkiness of the water. However, three days later, a more determined search of the surrounding ice by scientists (figure 18) found 53 meteorite fragments, which were delivered to the Ural Federal University in Yekaterinburg for analysis (figures 13, 15, 16). The largest fragment found by the end of February (1.8 kg) was discovered by Maria Penkova, a 24 year-old student from Yekaterinburg (figure 17). Maria found the meteorite quite by chance while she was participating in a search expedition. Thirty students in all, led by a team of experts, were searching along the meteor's path in the neighbourhood of the village of Emanzhelinka when Maria spotted a large tunnel in the snow: and there was the meteorite at the end of it^[1].



Figure 17 - The 1.8 kg meteorite fragment found by Maria Penkova
Photo: Maria Penkova/Pravda

Over the following weeks, many more fragments were found and over a hundred were sent to Moscow for further study. There, it was established that the fragments were mainly of stone with a nickel-iron content of just under 10%, which belonged to the most common class of chondrites (stony meteorites). The fragments, most less than a centimetre in size, contained a mix of minerals, including olivine, pyroxene, troilite, kamacite and magnesium-rich

chrysolite—all common materials found in stony meteorites—were definitely of extra-terrestrial origin. The Laboratory of Meteoritics at the Vernadsky Institute of Geochemistry and Analytical Chemistry in Moscow determined that the fragments showed evidence of an ancient cosmic collision, and were 4.5 billion years old.

It is believed that a much larger fragment, perhaps half a metre across and with a mass of up to half a tonne, created the hole in the ice and remains to be discovered beneath the bed of Cherbakul Lake. It is planned to resume the search of the lake bed in early summer once all the snow and ice have dispersed.

Aeroplane Near Miss

At the same time as the meteor exploded, a Tatarstan Airlines Bombardier CRJ-200 aircraft was making its landing approach to Chelyabinsk Airport, a few kilometres north of the city. Crew commander Alexander Arkhipov explained how they had experienced a sudden 'bright glow' to the right of the plane then watched as three huge glowing chunks of the meteor went flying past. And copilot Sergei Kotov told how the heat from the cosmic body burned his face. Crew members agreed that it was a miracle that they escaped unhurt.

Infrasound Detection

A testament to the power of the Chelyabinsk meteor explosion comes from the fact that infrasound waves from it were picked up at 03:22 UT by more than a third of the Comprehensive Nuclear-Test-Ban Treaty Organisation's International Monitoring System's stations. These facilities are designed to track nuclear blasts across the planet through the infrasound that they generate. These low-frequency sound waves, inaudible to the human ear, were first picked up at the Qaanaaq infrasound station in Greenland. Infrasound waves can travel across continents and are detected through the micropressure changes in the atmosphere that

Continued overleaf

they generate. It was this data that confirmed that the meteoroid spent 32.5 seconds travelling through the atmosphere before it disintegrated.

The Dashboard Camera Phenomenon

It may come as a surprise that such an unexpected occurrence as a meteor fireball, which lasted under half a minute, should have been extensively documented on video [2]. A search on *YouTube* will throw up dozens of videos showing the meteor trail and recording the fireball and the sonic booms. A clue to this can be found from the fact that so many of these videos were shot from within motor vehicles.

In Russia there is a growing trend among motorists to mount 'dashboard' cameras in their cars. These are small video cameras, which are attached to the dashboard or rear-view mirror of a road vehicle in order to film oncoming traffic and the road ahead. They are immensely popular in Russia because of motorists' fears about the corruption, violence and insurance fraud schemes that make driving in their country a nightmare. Fitted in vehicles mainly for insurance purposes, the cameras store video images on a hard drive and have provided essential evidence in many successful claims following traffic disputes. Many drivers have their dashboard cameras running all the time they are on the road and, though it was pure happenstance that the meteor figured in so many videos, it is less surprising knowing the foregoing.

This rare and spectacular phenomenon was captured on video by numerous witnesses. Two of the best fireball videos (figures 5, 6) are found at these URLs:

http://www.youtube.com/watch?v=sl_RknL9G-Q
<http://www.youtube.com/watch?v=b6J2iniSGKI>

In the aftermath of the explosion, residents of the Chelyabinsk, Tyumen, Sverdlovsk and Kurgan regions of Russia, as well as northwest Kazakhstan, continued to experience what their media termed 'meteor rain', as fragments from the fireball continued to burn up in the atmosphere. In many of the *YouTube* videos of the event, this creates a background noise similar to rapid, distant gunfire which persists for some time following the main explosion.

Most of the information in this article has been gleaned from translations of contemporary Russian news sources. Among these, the following feature most prominently:

Gazeta News	-	http://www.gazeta.ru/
Lenta-RU	-	http://lenta.ru/news/
Voice of Russia	-	http://rus.ruvr.ru
Wikipedia	-	http://ru.wikipedia.org/
Pravda	-	http://www.kp.ru/

Useful References

- 1 Pravda
<http://www.kp.ru/daily/26037/2952726/>
- 2 Alexander Zaytsev's Meteor Web Page
<http://say26.com/meteorite-in-russia-all-videos-in-one-place>
- 3 Wikipedia
http://en.wikipedia.org/wiki/2013_Russian_meteor_event
- 4 Meteorite hits Russian Urals
<http://rt.com/news/meteorite-crash-urals-chelyabinsk-283/>

Some Notes on Windows-8

David Taylor

Windows-8 is, in many respects, *Windows-7* with a new user interface (UI), so if you are happy with *Windows-7*, you can stop reading now: there's no need to upgrade a working *Windows-7* PC. Equally, should you have a *Windows-8* PC forced upon you, either through an upgrade or a new purchase, and you don't like the new UI, then a simple solution may be just to install a replacement shell such as *Classic Shell*, which is free and which can be downloaded from

<http://www.classicshell.net/>

This note is primarily concerned about running *EUMETCast* on *Windows-8*, and covers three areas: hardware, drivers and software.

Hardware

The *DVB World* receiver stocked by the *GEO Shop* continues to work on *Windows-8*. Unfortunately, some of the hardware supplied by other manufacturers isn't supported: for example, my own *TechniSat* USB 2 box. It seems that *TechniSat* will not be providing *Windows-8* drivers for some of their devices, so check first before making a purchase. If necessary, you could swap to an external *DVB World* USB box should your internal card no longer be supported.

My own tests have shown that connecting via a USB 3.0 port may cause more missed packets than connecting via a USB 2.0 port, so be prepared to try different ports if necessary.

Drivers

If you are running the 32-bit version of *Windows-8*, just install the default drivers.

If you are running the 64-bit version of *Windows-8*, be sure to use the drivers and *DVB World* software provided on the *GEO CD* which comes with the *DVB World* box. There is more information on my Web site at

<http://www.satsignal.eu/wxsat/Dexatek/Dexatek.html#64-bit>

Software

I installed from a *EUMETSAT 5.8 CD* which contains full instructions as a set of PDF files, as well as many of the programs and drivers

you need, so I won't waste space by reproducing their material here. I would suggest the following, though.

- Leave UAC (User Authorisation Control) on at its default settings.
- Don't install the main programs to the \Program Files\directory. There are restrictions on that directory (and have been since *Windows Vista*) which make it awkward to edit files there.

Instead,

- Create a new directory C:\Tools\
- Set that directory security to: Everyone, Full Control
- Install the *DVB World* software to C:\Tools\DVB-World\
- Install the *TelliCast* software to C:\Tools\EUMETCast\
- Install the *eToken* software to the default directory
- Install *SatSignal* software to C:\Tools\SatSignal\

As there are no user-editable files with the *eToken* software, you can take the default install directory for that program.

You may find that the program *TheaterMgr.exe* takes an excess of CPU or Virtual Memory. If it's a problem, stop the *DVB World* program, rename *TheaterMgr.exe* to *TheaterMgr.hidden.exe*, and restart *DVB World*.

Caveat

It is clear that everyone does not share my experiences, and Ian Deans contacted me to state:

"Your experience with *Windows-8* is completely different from mine. I cannot get my *Dexatek* box (with *DVBWorld* drivers 2007/8) to work with *Windows-8* 64-bit despite having spent hours trying. On the other hand, my *Technisat* USB HD box is working a treat on *Windows-8* 64-bit, using 4.6.0 drivers and software (even better than it did on *Windows-7* 64-bit).

"On *Windows-7* 64-bit I had few losses but quite a high number of missed and recovered packets. But these are reduced to zero with *Windows-8*, with the exception of those instigated at the *EUMETSAT* end. All these results are from the same computer."

An introduction to *MSG DataManager*

Mike Stevens

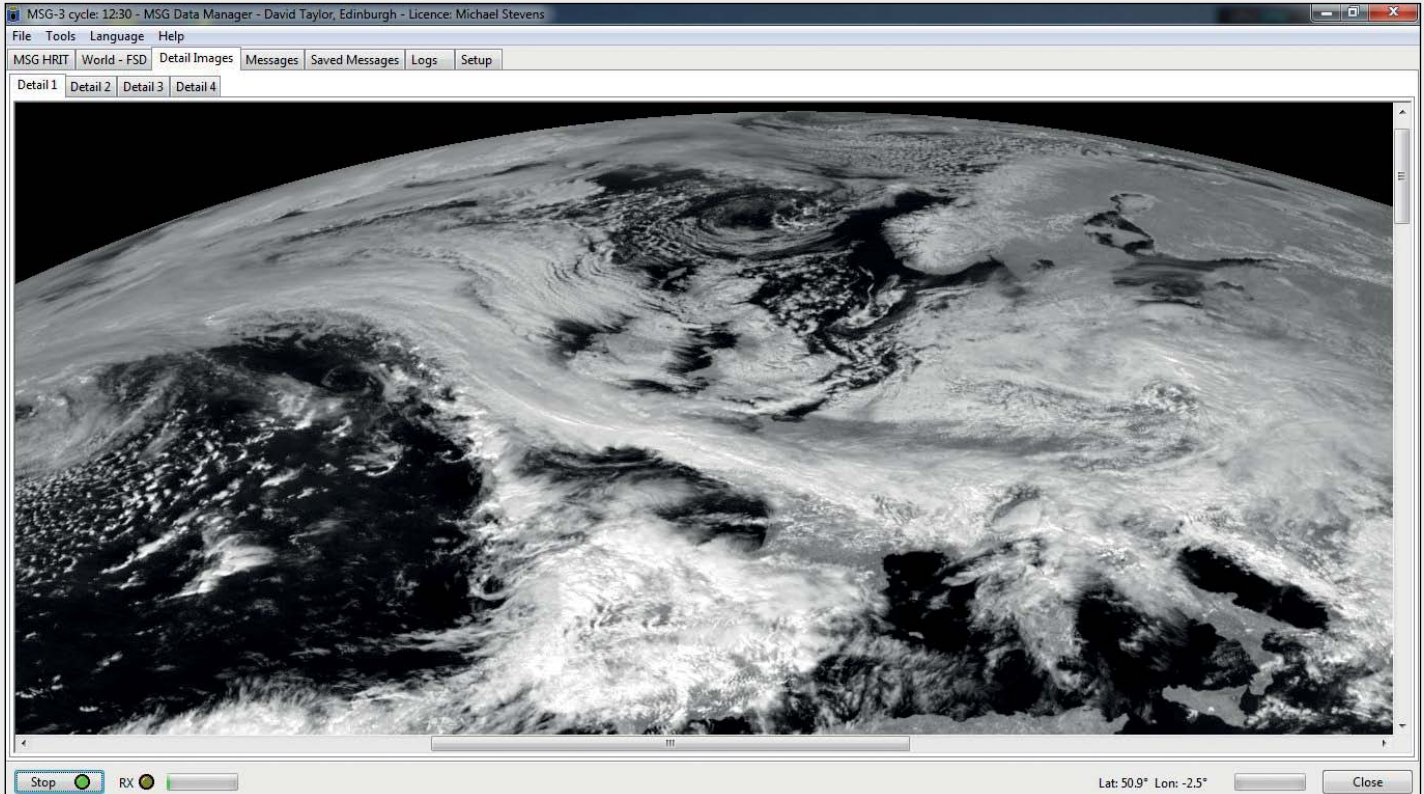


Figure 1 - A northern hemisphere image from March 29, 2013 displayed in *MSG DataManager*
Image © EUMETSAT 2013

I have done many things within my hobby of Amateur Radio since first being licensed back in 1978. I 'worked' Pitcairn Island in the Pacific, the Falkland Islands just prior to Invasion, and also Australia and New Zealand. But when I discovered that it was possible to receive pictures of our planet via weather satellites, I sidestepped slightly within the hobby to take up what became a fantastic new challenge. And one software program in particular that, for me, stood out from all the others was David Taylor's *MSG Data Manager*.

MSG is an acronym for Meteosat Second Generation, a family of Geostationary weather satellites. The current ones are Meteosat-10 (MSG-3) and Meteosat-9 (MSG-2). The former is used for full Earth scanning and produces full disc images like the one on page 33; Meteosat-9 provides the Rapid Scan Service (RSS) over Europe, and is used primarily for the compilation of high-resolution weather movies. Imagery from both these satellites can be decoded using *MSG Data Manager*.

First, of course, you need to be receiving data via *EUMETCast* transmissions (see page 29). And if you do not yet have *MSG DataManager* installed, visit David Taylor's website

http://www.satsignal.eu/software/msg_dm.htm

where, in the section 'What is the *MSG Data Manager*?', you will find the link 'Download the *MSG Data Manager*'. Note that this program is free to download and comes with a 30-day free-trial period which allows you plenty of time to evaluate it. This same page also provides full explanations of the software and what it is intended for.

I would suggest saving the downloaded file within your **Downloads** folder. This file is a zip archive with a filename such as

'*msg-data-manager.2.6.9.zip*'. In addition, if you haven't already been using any of David Taylor's software, you will also need to install his **Runtime Library Bundle** which can be downloaded from

<http://www.satsignal.eu/software/runtimes-setup.100.zip>

Unzip the *MSG DataManager* archive and extract the actual installation file, named '*msgdatamanager-setup.exe*' (recognisable by its small MSG satellite icon). Follow the same steps with the runtimes bundle access the '*runtimes-setup.exe*' file. Double-click this now to install all its contents.

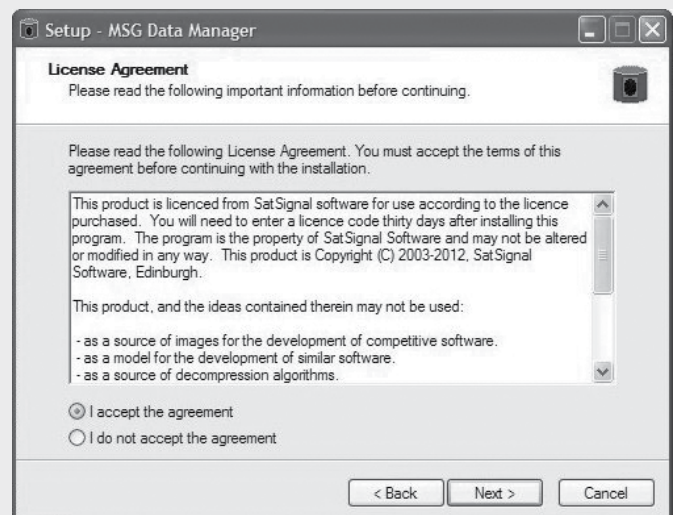


Figure 2 - The 'Accept the Agreement' screen

Next, double-click on 'msgdatamanager-setup.exe', to bring up the program's setup screen and click **Next** to start the installation process. By default, the software installs into a folder called **Tools** on your **C:drive**, just above the **Windows** folder. Its full path is **Tools\Satsignal\MsgDataManager**.

The next screen you see will be the License Agreement (figure 2) where you must tick the box, 'I accept the Agreement' before clicking **Next** to continue. This leads on to a screen where you will be asked to select the **Destination Location**. This actually shows the path described above, so just click on **Next** to go on to the next stage, which asks you to select the **Start Menu Folder**.

Again, it's all set in place for you, so click **Next** once more to proceed to the **Additional Tasks** screen where I recommend that you tick the box which ensures you will have a shortcut icon for the program on your desktop. Click **Next**, **Install** and **Finish** on the subsequent screens, and the job is complete. I strongly recommend that the check-box on this final screen is ticked so that you can look into the ReadMe file, and if necessary print it off for future reference.

Preparing the program for Decoding

When you run MSG DataManager for the first time you will see the registration reminder panel (figure 5), unless of course you have already purchased a full licence from David Taylor.

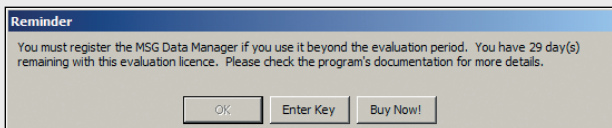


Figure 5 - The registration reminder panel

If, like most first-time users, you opt to take advantage of the 30-day trial period, there is a six second countdown before this panel closes and MSG DataManager Starts running. Now you are ready to set-up the software to decode the incoming EUMETCast data to get those fantastic pictures.

Go to **Setup** tab (figure 6), then its **Options** tab. Your first task is to set the correct folders for your received *Tellicast* files, raw data and processed images. If you have set up your system for EUMETCast in accordance with my article on page 28, the **Tellicast Received files location** will be

C:\Program Files\T-Systems\Business-TV-IP\received

as shown in figure 6 opposite (and also in figure 11 on page 34). Use the **Browse** button to locate this folder, highlight it with the mouse, then click on **OK** in the Browse window to confirm your selection and the received location will show in the box. As far as the folders for the **raw data** and **processed images** are concerned, the default folders shown in figure 6 are automatically created for you by *MSG DataManager*, and I recommend that you use them.

You will notice that a lot of the small boxes on the **Setup** screen are already ticked for you, while others are left for you to decide what you want the software to do. Let's examine a few options:

In the **Detail Image Auto-save** panel, you might want to tick 'Save only visible part' and set the number of days for data retention (before the program automatically deletes them).

In the **Program controls** panel are several more choices. The ones that I have ticked are: 'Announce Events', 'Enable Screen Saver', 'Notify Scan End', 'Persistent Images' and 'Skip Data Before Today'. But of course, the choice is entirely yours..

In the **RX disk space control**, tick the 'RX space monitor' box and set 'Auto-clean minutes' to 20, a good time to try for a start. **Program auto restart** I leave as it is, and I set **RX watchdog** to 3 minutes. I'll leave the **Visible data limits** settings to your own discretion.

Now open the **Channel Selection** tab (figure 7). Most of the selections within this section will be dependent on which data types you opted

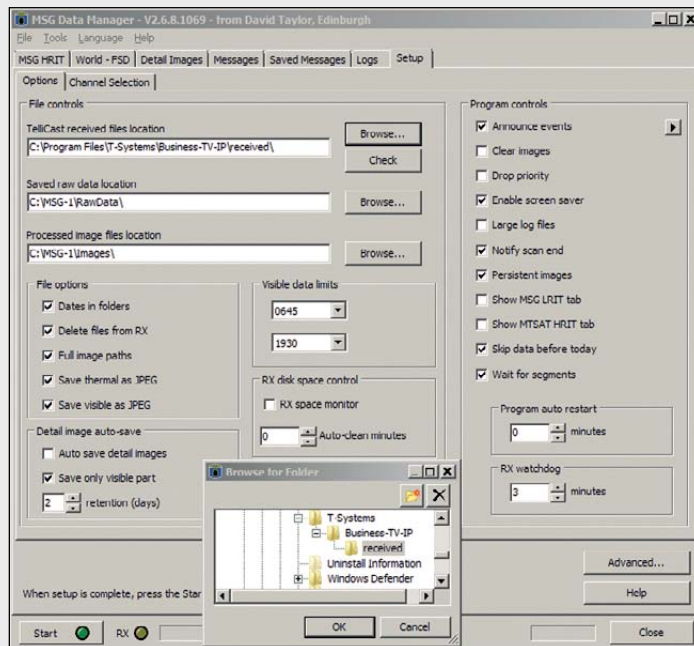


Figure 6 - Setting the 'Received' files location

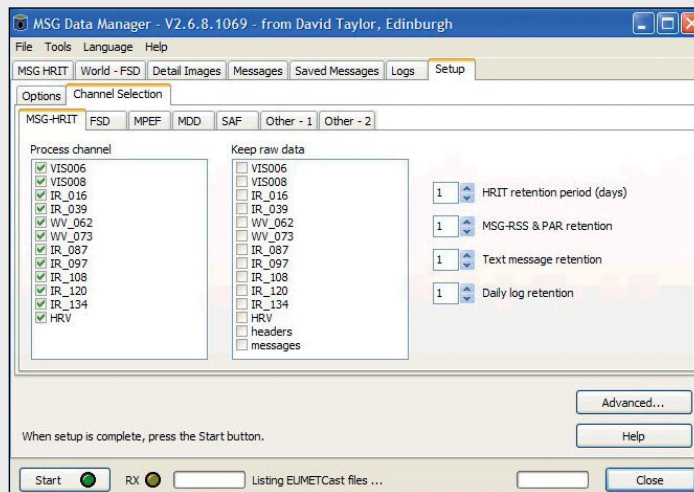


Figure 7 - The channel selection screen

to receive when you registered with *EUMETCast*. I am just going to point you towards the most popular ones and leave the rest for you to decide.

The first tab, **MSG-HRIT**, is the most popular one; tick all the boxes and set all the retention boxes to one day. In the **FSD** tab (Foreign Satellite Data), tick all the **Process channel** boxes, but in the **Ch.11 data (CMA)** panel, just tick the **FDI-visible** box to start with. You can try others later. Tick the **Manage CMA data** and the **Unzip CMA data** boxes.

Selections from the **MPEF**, **MDD** and **SAF** tabs will be at your discretion, if you are receiving those data: probably best to leave these all unchecked till you become more familiar with the program.

Finally, there are the 'Other' tabs for more specialised data types. Again, these are probably best left until you decide to expand your data horizons. One possible exception is in the **Other-2** tab, where you may wish to tick the top box in the **MODIS L1/L2 data** panel if you are interested in images from these satellites.

I am not going into depth on the other boxes as David Taylor's excellent website explains everything in much more detail for those of you who require more in-depth information.

One final tab is revealed by clicking the **Advanced** button in the bottom right hand corner of the screen. This provides a large

continued on page 36

Icebergs and Sea Ice off the Mawson Coast

A NASA Earth Observatory Report



As the southern hemisphere summer drew to a close, sea ice and icebergs floated along the Mawson Coast of East Antarctica. The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's *Aqua* satellite captured this natural-color image on March 15, 2013. As MODIS acquired this image, a cold wind was blowing off the Amery Ice Shelf, freezing ocean water and creating streamers off the ice shelf edge—a recurring event in this region. Easily pushed by winds and currents, this new, thin ice formed intricate patterns on the sea surface.

Icebergs of varying sizes and ages also floated along the coast. The biggest was B-15T, a remnant of a much larger iceberg that formed long ago and far away from the Mawson Coast. B-15^[1] calved off the Ross Ice Shelf, nearly halfway around the continent, in March 2000.

Ice shelves are thick slabs of ice attached to the coastline. Multiple ice shelves occur along the Antarctic Coast, and chunks are regularly breaking off into icebergs that get caught in the ocean currents and circle the continent for years, as Iceberg B-15T has done.

But some icebergs escape those currents and drift northward into warmer waters. Another remnant of B-15, Iceberg B-15J, drifted north and broke into much smaller pieces in December 2011 and January 2012.

Reference

1 B15-A Iceberg blocks McMurdo Sound - GEOQ 5, page 27 (2005)

Good Morning Vietnam

Francis Bell

GEO membership tends to be concentrated in the UK and Europe but we also have members in the USA and spread throughout the rest of the world. My own travels sometimes take me to some of these distant countries and, where reasonably possible, I like to take my weather satellite interests with me. My mobile APT station has been successfully operated in Europe, North and South America, Africa, Asia and on board ships in the Atlantic and Indian oceans.

During one of my trips to the west coast of the USA, I arranged to meet up with Ed Murashie, a GEO member who is very active with satellite reception and who has been a regular contributor to *GEO Quarterly*. I was staying in a hotel about 30 miles from Ed's home so the opportunity to meet up was too good to miss. I spent a delightful evening with Ed and his partner discussing GEO, weather satellite reception in America, and other unrelated matters.

In February this year my travels dispatched Nadine and myself to Vietnam and Cambodia. Distant though it may be, Vietnam has one GEO member. About two years ago, Fred van den Bosch and his wife Minh moved there from the Netherlands. I have known Fred for about ten years and he has visited our home in the UK in addition to being a delegate at several of our annual meetings at Leicester and Guildford. I have also met Fred in Utrecht when I have attended *Werkgroep Kunstmanen* meetings.

I have kept in touch with Fred and Minh since their move to Vietnam as I know that Fred continues to pursue his interests in weather satellites. His APT images are sometimes published in *GEO Quarterly*, the most recent being a composite of several APT passes centred over Vietnam [1].

With the help of my travel agent, I adjusted our Vietnam travel

itinerary so that we could spend a few days in Nah Trang, a well developed town with a population of about 300,000 located mid way along the Vietnamese coast. We spent several days in Nah Trang, and spent one full day visiting Fred and Minh who live in a rural village about ten miles inland. I was impressed to see Fred's satellite receiving station, located on the roof of his new house. Currently Fred is receiving APT using a QFH antenna and *WXtormg* software to decode the signals. He is progressing with HRPT reception and I saw his rotors and antenna in his garage awaiting installation on the roof.

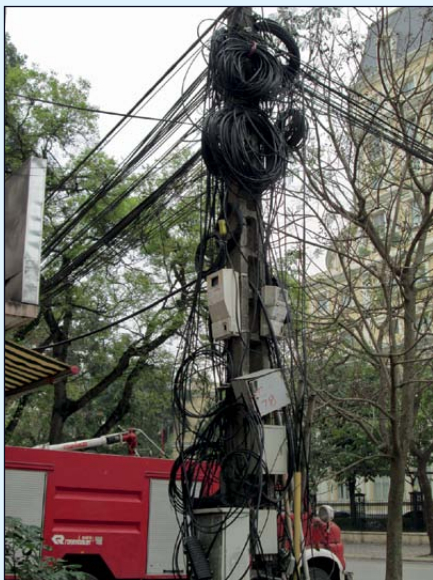


Figure 1

This was a common site in Hanoi, with power (and perhaps telecommunications lines) installed with a little extra cable in anticipation of future adjustments. I don't know what effect this would have on broadband speeds.

I asked Fred about his broadband and Internet access and was surprised to learn that it was about as fast as the service I receive via my own BT service in the UK. What a surprise! Just look at the photograph I took of some Vietnamese electrical services in Hanoi

(figure1)—and Fred lives in a rural village. However, knowing how resourceful Fred is, I expect his communication links were part of the planning before moving to Vietnam from the Netherlands.

What Fred does not have is the equivalent of the *EUMETCast* service which we enjoy in Europe. I didn't have time to discuss with him the possible reception of geostationary satellites at his home. I believe Vietnam is within range of *Meteosat-7's Indian Ocean Data Coverage* transmissions, but I don't know if user services are transmitted from this satellite, or if they are relayed via a commercial communications satellite. Perhaps a member living in that part of the world would let me or the editor know via a brief article which we could publish.

Finally, my thanks to Fred and Minh for hosting us for a full day, together, with trips to the local market and a nearby French colonial house. I hope we can meet up again one day. And for other GEO members living in exotic places: please send me an invitation to visit you—I just might do so.

1 GEOQ 36, page 25.

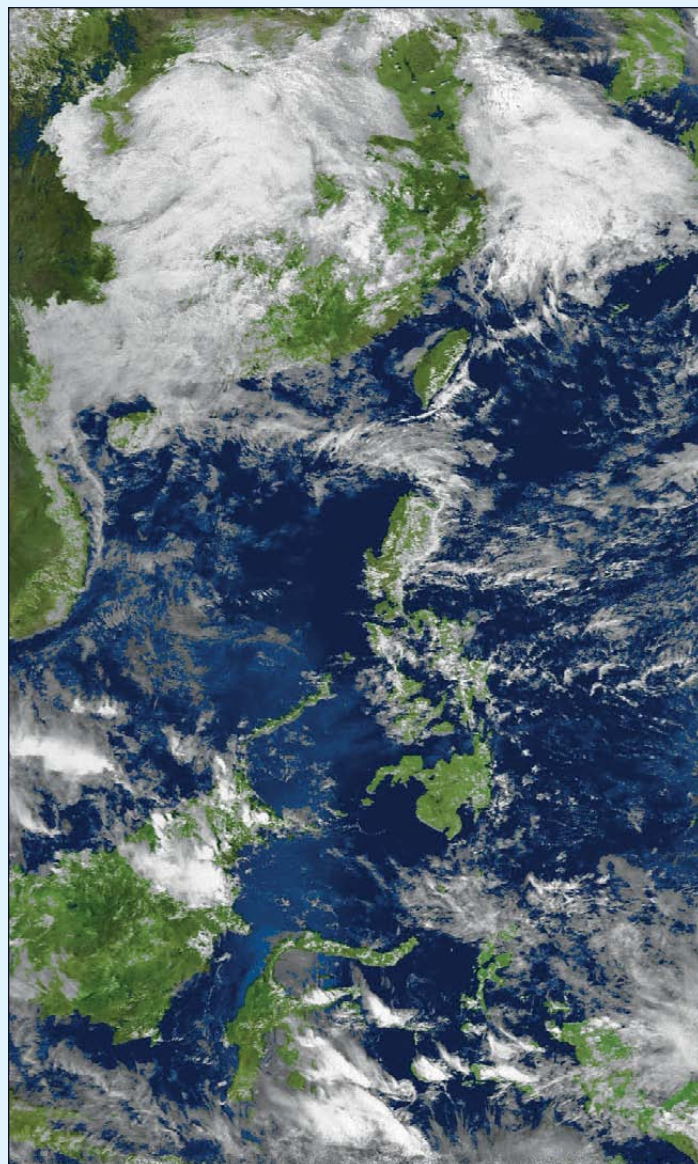


Figure 2 - A NOAA 19 image recorded by Fred van den Bosch at 12.21 local time on February 25, 2013.

The GEO Report

continued from page 3

planned by others. In the meantime I will try to progress our own GEO visit to a UK space centre this year. Events where GEO intends to have a presence this year are:

- The **Newbury Radio Rally** (June 16), where GEO will have our usual stand. For further details of this event visit www.nadars.org.uk
- The **Royal Meteorological Amateur Conference** (Sept 13-15) at the University of Reading, which aims to look at how weather impacts our lives: from weather observing and photography, to sharing our passion of meteorology with others. It is planned that the programme will include keynote contributions from both professionals and amateurs. GEO is hoping to have a stand in the exhibition area running live EUMETCast images. Visit www.rmets.org/event for more details.
- The **European Space Agency Symposium** (Sept 9-13), with support from the UKSA, is holding this symposium in Edinburgh. GEO is planning to have a display in the 'Poster Display' area. For more details visit http://www.esa.int/Our_Activities/Observing_the_Earth/Highlights/See_you_in_2013. Delegate entry is free of charge.
- The **National Hamfest** (Sept 27-28) takes place at Newark Showground. It is a busy two-day show, and GEO will run its usual stand. For more details visit www.nationalhamfest.org.uk.
- The 2nd **Meteorological Technology World Expo** (Oct 15-17) is being held in Brussels and is a major event offering free entry for delegates. It is uncertain whether or not GEO will have stand here, but as there is free entry it may be attractive to attend as a delegate. For more information visit www.MeteorologicalTechnologyWorldExpo.com.

Werkgroep Kunstmanen Meetings

Our Dutch friends, Werkgroep Kunstmanen, hold regular Saturday meetings in the Nimeto, Utrecht, The Netherlands. Doors open at 10.00 am and the meetings start at 11.00 am. Future dates for 2013 are September 19 and November 1.

For more information visit

www.kunstmanen.net

QUARTERLY QUESTION

Quarterly Question 37

Readers will remember that the previous *Quarterly Question* related to the altitudes of EUMETSAT's polar orbiting **Metop-B** satellite and **Meteosat-10** which is in geostationary orbit.

The question was prompted in my mind by the scale of the distances involved between these satellites, both of which I receive at home on a regular basis. The low-earth sun-synchronous orbit of Metop-B allows it to overfly the Earth at approximately the same local time each day and mathematics defines the altitude of this orbit: in the case of Metop-B, this is quoted by EUMETSAT as being 817 kilometres.

However, the question was: "How many times further away is Meteosat 10 in its geostationary orbit". To answer this, you have to know the altitude of this orbit. Members responding to the question quoted several figures for the altitude of Meteosat 10, all of which were close together, so I have taken an average which comes out as 35,782 kilometres. This generates an orbital period of one day, hence its stationary position in the sky.

The calculation is $35,782 / 817 = 43.8$.

Therefore Meteosat 10 is 43.8 times further away than Metop-B.

My thanks to the following members who submitted whole number answers which I judged to be correct. They also gave correct

answers to the second part of the question.

Frank Skillington, UK
Andreas Lubnow, Germany
Elmar Bogels, The Netherlands

The second part of the question, which was more light-hearted, related to a science fiction series called '*A Hitchhiker's Guide to the Galaxy*' by Douglas Adams, which was aired on both BBC radio and TV. (Repeats of these broadcast may still be seen or heard from time to time).

In the series there was a computer called *Deep Thought* which was charged with coming up with the answer to 'The Ultimate Question of Life, the Universe, and Everything'. The computer took 7.5 million years to come up with the answer of 42. The author was questioned later and admitted there was no particular significance in the number 42: he just invented it as an answer.

A slight admission on my part is that when I first did the calculation for the ratio of the polar orbiting and geostationary satellite altitudes, I mis-remembered the geostationary value as being 34,782 which, fortuitously produced the beguiling—but incorrect—answer of 42.

Quarterly Question 38

This Quarterly Question has been prompted by a Data Access Bulletin recently released by EUMETSAT. I am a regular receiver of the EUMETCast service and am registered to receive many of the image sequences disseminated via *Eutelsat 9A*. I hope this will continue beyond planned changes to this service. To establish my present home system I have relied on advice and help from more technically knowledgeable GEO members than myself. I always seem to find myself on a learning curve about these matters, and this continues.

However, about a year ago I became a little more adventurous and thought I would look to the future; so, in addition to the *DVB World* receiver which I use every day for EUMETCast reception, I purchased two additional receivers from a German supplier. One was the *TechniSat SkyStar-S*, the other a *TechniSat SkyStar-S2 HDTV* model, both of which worked perfectly with the current EUMETCast DVB-S service.

The rationale behind the purchase of the *SkyStar-S2 HDTV* receiver was the forecast that the EUMETCast dissemination service would change in the foreseeable future. What I really wanted to know was whether this new, modestly priced receiver would work with the new service due to start in about one year.

Keeping track of news from EUMETSAT, I read a bulletin about the migration of the current EUMETCast DVB-S service to the DVB-S2 standard. This is a 'Must Read' for those wishing for a smooth transition to the new standard for their home EUMETCast system.

EUMETSAT's decision to change standards is due to the increasing quantity of data being transmitted via the *Eutelsat 9A* transponder, which is anticipated to more than double in the next few years.

Quarterly Question 38 is

"What is the current EUMETCast Europe assigned net data rate on *Eutelsat 9A*'s transponder?"

Your answer should be given in units of Mbps. You may already know the answer to the above question, but if not, using EUMETSAT's technical publications may give you the answer. If all else fails, go to

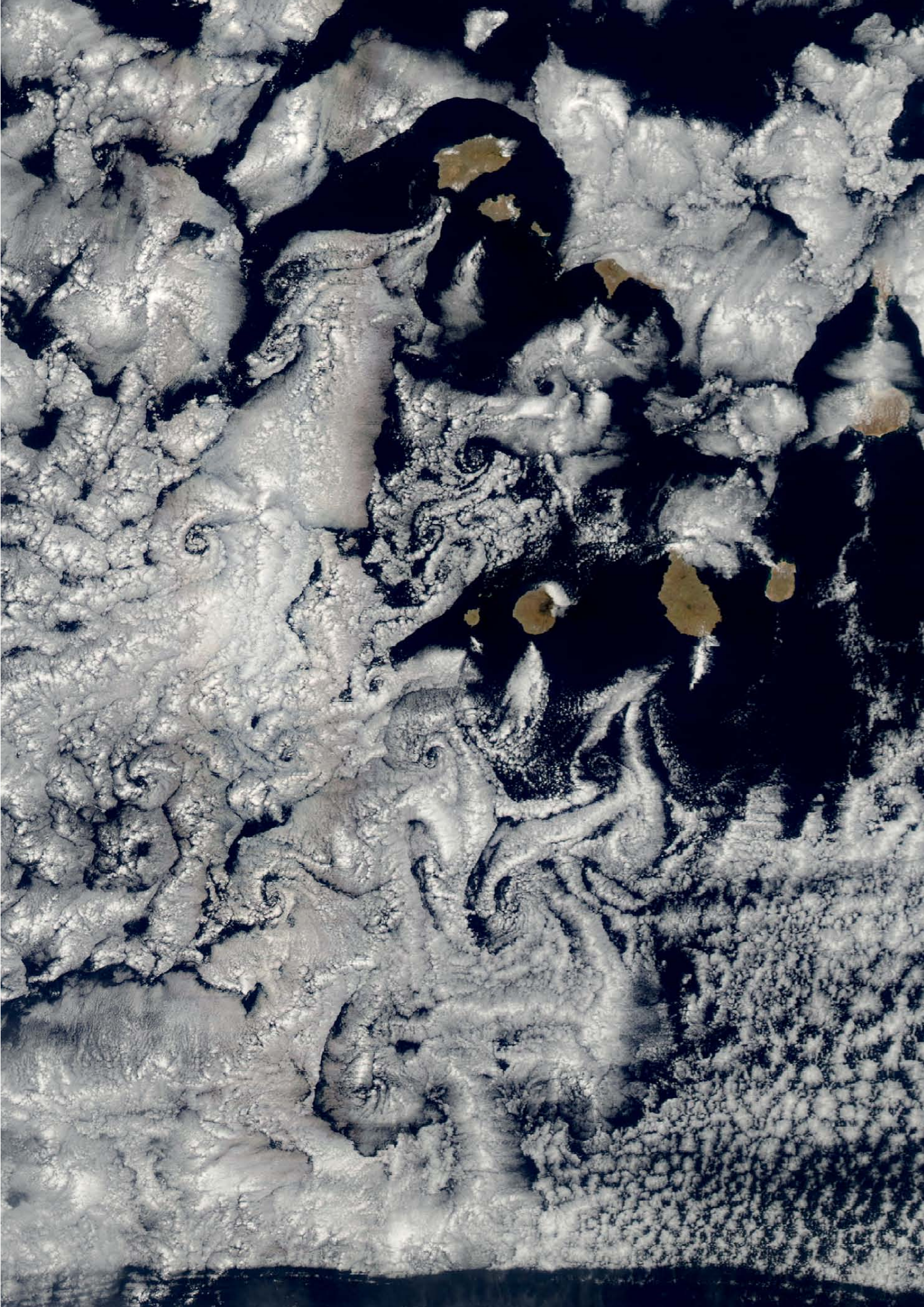
www.eumetsat.int/Home/Main/DataAccess/EUMETCast

and follow the link to '*EUMETCast Europe Migrating from DVB-S to DVB-S2*'. Read this document and you will find the answer.

Answers should be sent to

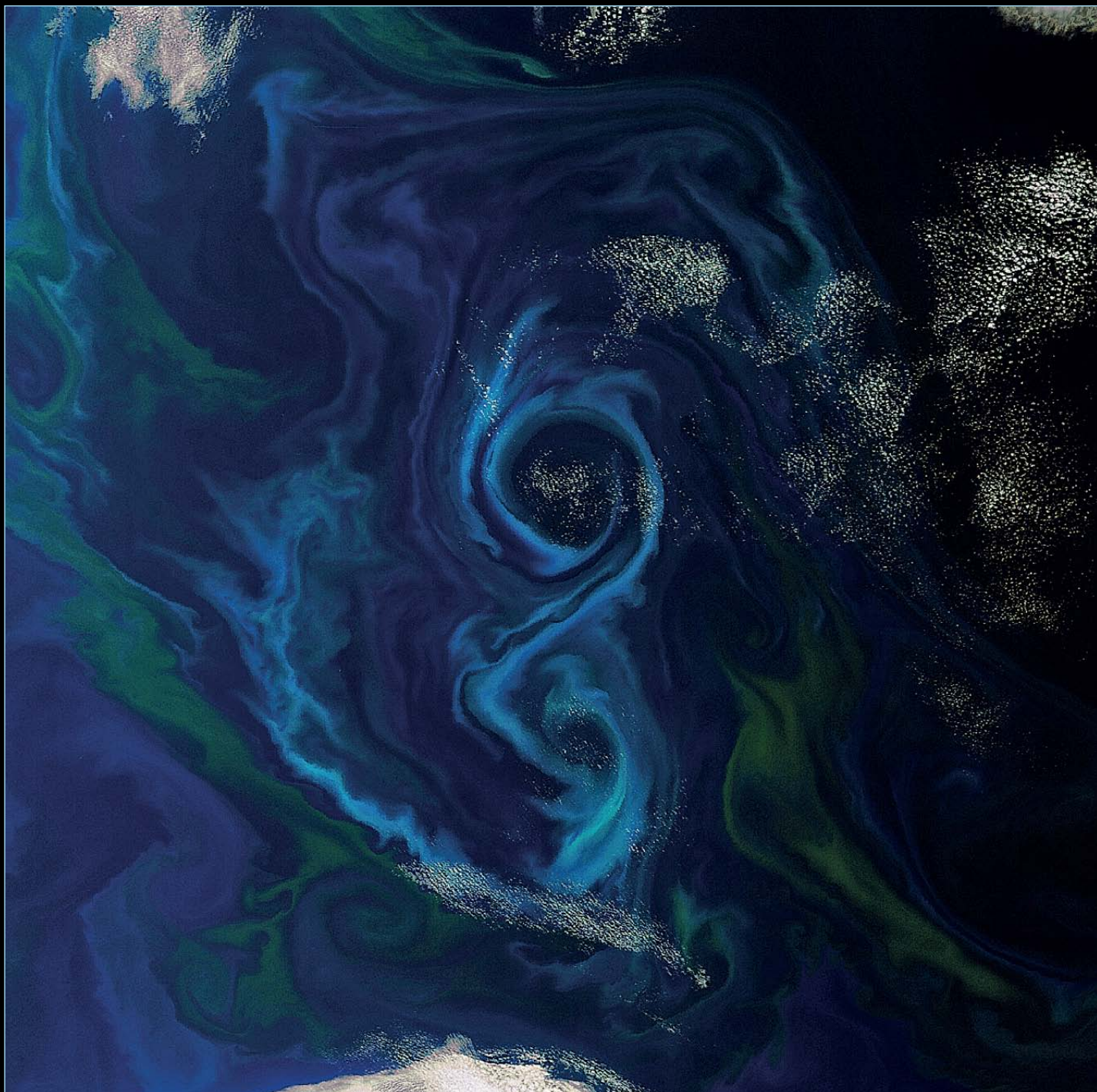
francis@geo-web.org.uk

before the copy deadline for our next GEO Quarterly (July 28).



Southern Summer Bloom

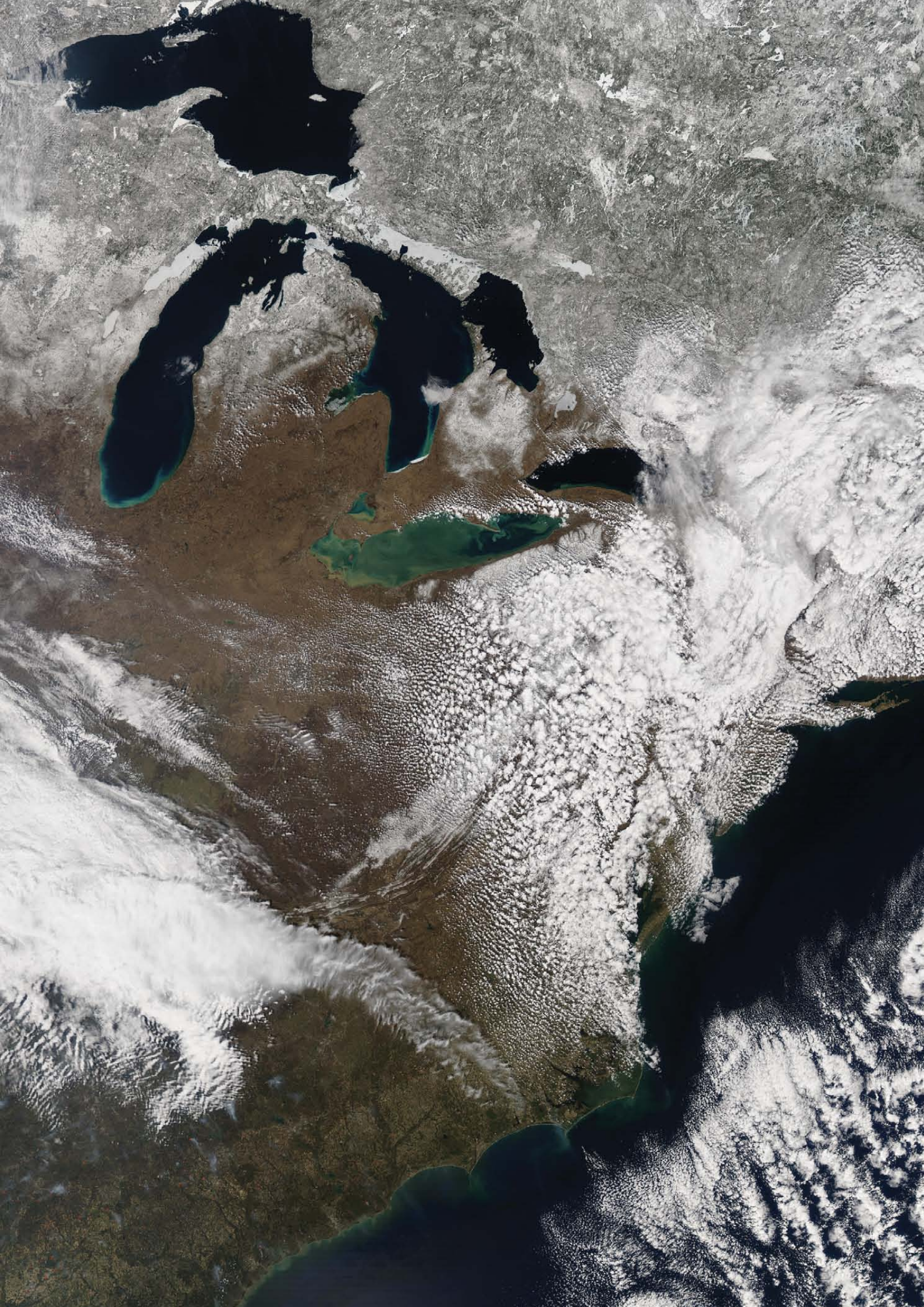
Jason Hopkins

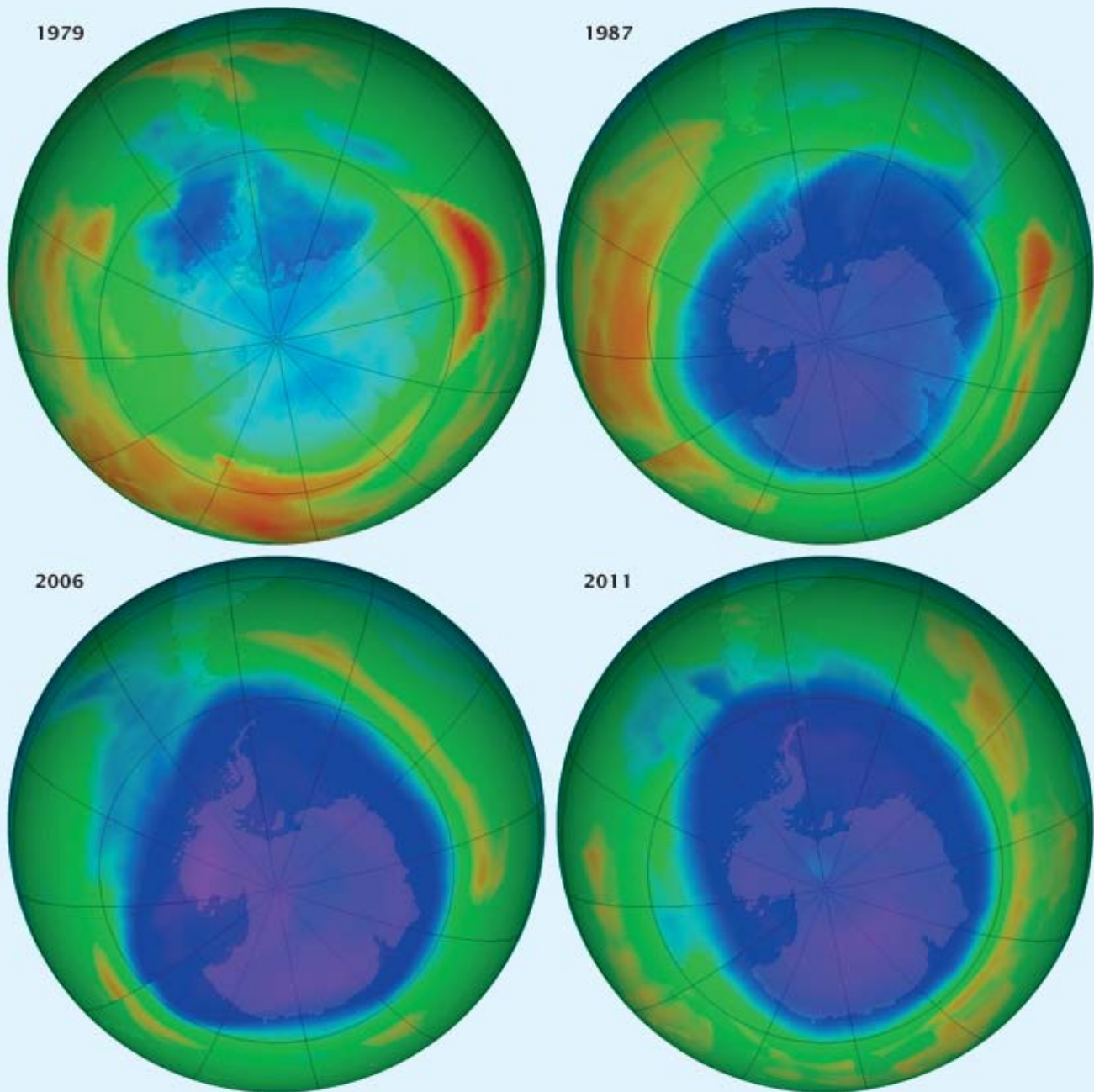


Phytoplankton undergo an annual cycle of growth similar to deciduous terrestrial flora, and need both sufficient light and nutrients to grow. In winter, mixing of the ocean by the wind increases the supply of nutrients needed for phytoplankton growth. However, this same mixing, combined with weak sunlight, means that phytoplankton do not receive enough light to grow. As the strength of the sunlight increases during springtime, and mixing reduces, phytoplankton are able to take advantage of these improved conditions, resulting in a 'spring bloom'. The rapid increase in phytoplankton numbers associated with the bloom can be large enough to alter the colour of the seawater and it is this change in colour that can be viewed from space.

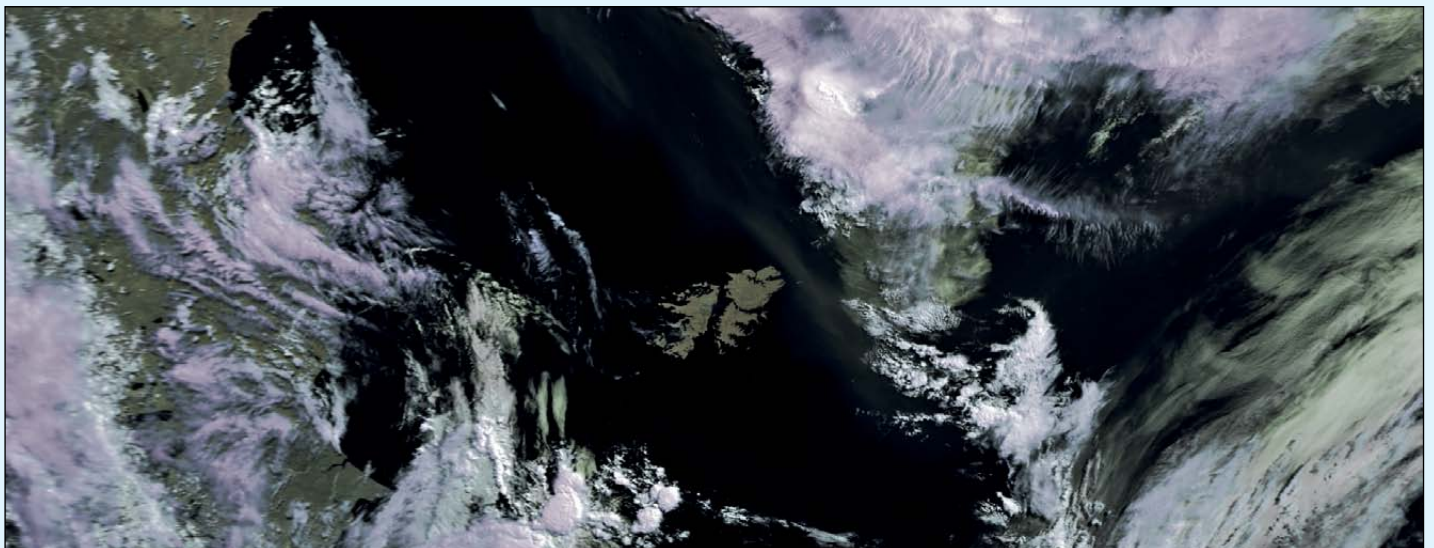
This Envisat image shows both the growth of different types of phytoplankton (indicated by the different shades of colour) and also the influence of the ocean currents. The word 'plankton' comes from the Greek, and means drifter or wanderer, indicating that most phytoplankton can't swim. This means that ocean currents can influence the distribution of these tiny plants. The figure-of-eight pattern in this image is probably an ocean eddy that has been highlighted by the phytoplankton. These spinning parcels of water can draw cold, nutrient-rich water up from the deep ocean and into the sunlit upper layer, resulting in the ideal environment for phytoplankton growth.

Image: European Space Agency (ESA)

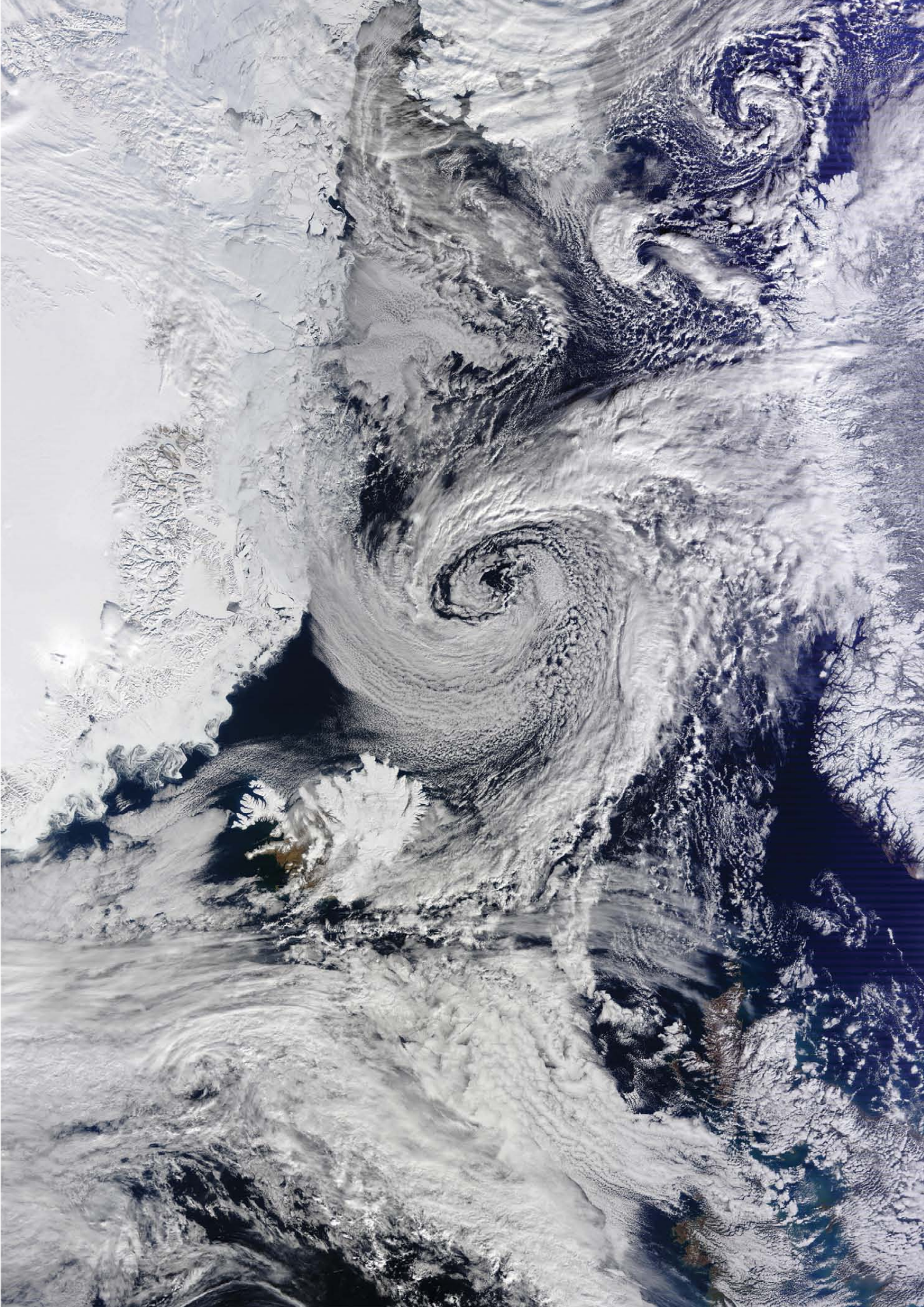




These are the four total-ozone maps that should have accompanied the article on page 18 of GEO Quarterly 36

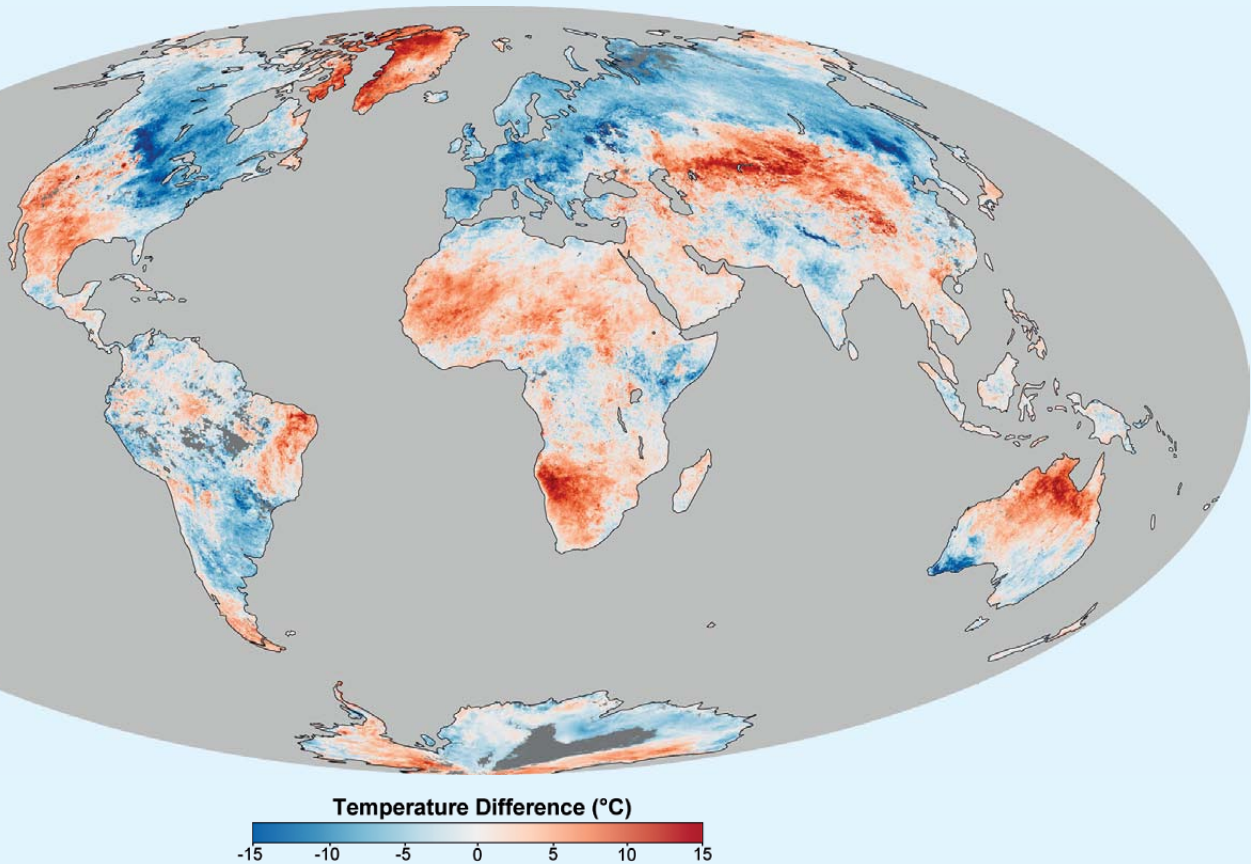


This is the Terra MODIS image from Robert Moore that failed to make an appearance in GEOQ 36. Acquired on January 10, 2012, the Falkland Islands are prominent in the south Atlantic ocean. Image © EUMETSAT 2012



A Spring of Contrasting Temperatures

A NASA Earth Observatory Report



While a high-pressure weather system brought warmer than normal temperatures to Greenland and northern Canada during March 2013, much of North America, Europe, and Asia shivered through weeks of unseasonably cool temperatures. The contrasting temperatures are no coincidence: the same unusual pressure pattern in the upper atmosphere caused both events.

Atmospheric pressure patterns are constantly in flux as air masses of differing temperatures and densities move around the skies. One key measure of pressure that meteorologists track closely is known as the **Arctic Oscillation (AO) index**, which relates to the difference in relative pressure between Arctic and mid-latitudes. Changes in AO have can major impacts on weather patterns around the world.

When the AO index is in its 'positive' phase, air pressure over the Arctic is low, pressure

over the mid-latitudes is high and prevailing winds confine extremely cold air to the Arctic. But when the AO is in its 'negative' phase, the pressure gradient weakens. The pressure over the Arctic is not as low and pressure at mid-latitudes is not as high. In this negative phase, the AO enables Arctic air to flow to the south and warm air to move north.

In late March, the AO dropped to -5.6, one of the five lowest values ever recorded by meteorologists. The temperature anomaly map above, based on data from the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's *Aqua* satellite, shows how this affected temperatures in the northern hemisphere. The map displays land surface temperature anomalies between March 13 and March 20, 2013, compared with the average for the same date span between 2005 and 2012. Areas with above-average temperatures appear in red and orange; areas with below-

average temperatures appear in shades of blue. Much of Europe, Russia, and the eastern United States experienced unusually cool temperatures, while Greenland and Nunavut Territory in Canada were surprisingly warm for the time of year.

Many parts of the northern hemisphere endured near record-breaking cool temperatures as the value of the AO fell. The United Kingdom, for example, experienced its fourth coldest March since 1962. In the latter part of March, two-thirds of weather stations in the Czech Republic broke records, Germany had its coldest March since 1883 and Moscow its coldest March since the 1950s.

NASA Earth Observatory image by Jesse Allen and Robert Simmon, using MODIS data from the Land Processes Distributed Active Archive Center (LPDAAC).

Arctic Oscillation data from the NOAA National Weather Service Climate Prediction Center.

Lake Erie Ice

Keith Fraser



Processing: Les Hamilton's *SmoothMODIS* and David Taylor's *Correct Geometry*
Image: LANCE/NASA/GSFC/Earth Science Data and Information System

I was fascinated by the article in *GEO Quarterly 36* on 'New Polar Records', regarding receding ice cover and the Beaufort sea. I now live in Buffalo, NY, on Lake Erie. This lake is quite shallow, about 64 metres deep, so it freezes over most years causing shipping on the Great Lakes to cease until spring. This is welcomed in Buffalo because Lake Effect Snow from an open lake also comes to an end and the citizens of Buffalo can stop shovelling.

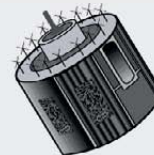
Until a few years ago, ice fishing was popular here, many people driving over frozen Lake Erie in their 4 x 4 trucks to take cabins out on to the ice. They would then drill holes in the ice to fish through. But not any more! Lake Erie has not really frozen for about five years now, and the last big freeze of note took place in early 2004. The MODIS image above was acquired from NASA's *Terra* satellite, on February 28, 2004. The ice over the lake is clearly defined as it

starts breaking up, although at the eastern end, near Buffalo, you can still see a region of solid ice.

The breaking ice is a problem for the Power Authority at Niagara Falls, who have to employ an ice boom across the entrance to the Niagara river to prevent damage to turbines at the Hydro plants on both the US and Canadian sides.

As I write this on February 2 this year, the temperature of Lake Erie is +1°C so the water still contains a great deal of latent heat, so the lake won't freeze over this year. Lake Ontario, on the other hand, never freezes: the water there is too deep and upwellings bring warmer water up from the depths to the surface. This means that Watertown, at the eastern end of Lake Ontario, is unofficially the snow capital, as it suffers from lake effect snow all winter long.

Eumetcast and MSG Setup



Mike Stevens G4CFZ

Back in November 2004 I wrote about the challenges of receiving the then Meteosat-8 weather data via the new *EUMETCast Broadcast System*—and a challenge it most certainly was. Little did we know how *EUMETCast* was to expand in the years ahead, and now seems to be the right time to provide an update for all the newcomers to our fantastic hobby of Earth Observation via weather satellites. I think we can all agree that we have seen some pretty impressive images since 2004.

Let's start at the beginning. The first thing you must do is to apply to EUMETSAT for a licence to receive the satellite data. A visit to the GEO website at

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

or following the link **Register for EUMETCast** on the home page, will open the **EUMETCast On-Line Registration** page. I would suggest that you print that page off so that you have direct access to the information; this will prevent you having to keep looking the page up for reference. As you will see, it is very extensive in detail and provides an excellent guide to the types of satellite data you can receive via *EUMETCast* once registration is completed.

Once you have filled in the relevant details at

<http://www.eumetsat.int>

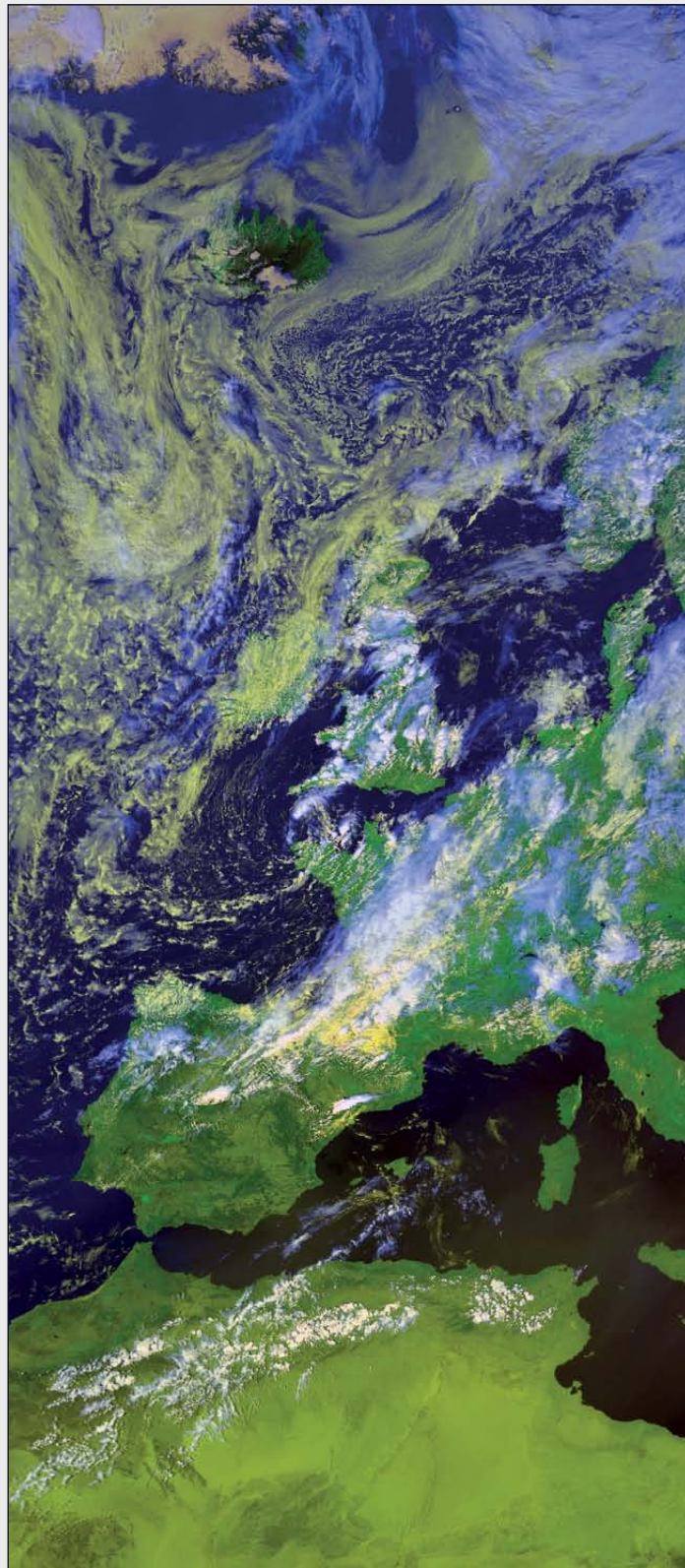
through the **Data Access Tab** on the home page, you will be led through the system to register as a new user. Just follow those instructions to start the process rolling.

There is a lot of excellent information on the GEO website that will help and assist with the hobby, and it makes a good reference point from which to start.

Once your registration has been accepted by EUMETSAT, you will be contacted for payment of the €100 cost of the EKU and software. This can vary depending on the exchange rate at the time but currently works out at around £85. Your EKU Key and software will be despatched to you, usually by courier, and must be signed for. They will usually arrive within four working days, as mine did. The Key will be programmed to accept all the data types that you requested when filling out your online registration.

Your next step must be to decide on the PC you are going to use to receive the data from *EUMETCast* (the *reception PC*). If you read some of the information that's going around (including in earlier issues of *GEO Quarterly*) most users will state that you don't need a super PC: but I would recommend a good computer with at least 2 GB of memory and a hard drive of about 120 GB. I say this because experience has taught me that, as far as memory and hard drive capacity are concerned, you cannot have too much. Other people will have their own ideas, but for me it all comes down to past experiences. Don't be afraid to experiment to find out what works best for you. My own PC is an *Acer Aspire* with 320 GB hard drive and 8 GB RAM which handles everything in the one unit. Many enthusiasts make use of a RAMDisk, but my PC manages fine without one. The system described is my choice, and I am in no way saying this is what you must go for. Make your own choice and work within your budget.

The next task is to obtain your DVB satellite receiver, the most obvious choice of course being the *DVB World*



EUMETCast now provides access to a range of channels of MODIS imagery from NASA's Terra and Aqua satellites. This is a Terra colour composite image dating from August 6, 2012.

Image © EUMETSAT 2012

DVB-S USB-2 unit recommended by GEO for trouble free EUMETCast reception—and a good one it is too. Purchased from the *GEO Shop* at

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

it comes complete with a GEO setup CD and all instructions.

Software Installation

Now let me say right here that all the following software installation and instruction is centred on *Windows XP*: *Windows 7* is another article completely, and though there are similarities, a *Windows 7* system has its own differing requirements.

The next move is to install and connect your *DVB World* receiver. Make sure you use the GEO CD and **not** the small CD supplied by the receiver's manufacturer. This will **not** install the correct data for *EUMETCast*. Follow the instructions on the GEO CD and you will install everything without problems. As soon as the process is complete and you have the *DVB World* icon on your desktop leave this for the moment. I will come back to this matter later.

Aligning your Dish on EUTELSAT 9A

Of course, reception of *EUMETCast* requires a correctly aligned antenna, so your next move is to assemble and erect your satellite dish. The most popular size of dish is 80 cm but you can equally well make use of a one-metre dish—it's again up to yourself. I use a one-metre dish, securely ground mounted, with a clear line of sight to the satellite, as I am located right on the extreme south coast of England.

In order to align your dish on *Eutelsat 9A* (the satellite that disseminates the *EUMETCast* data streams), you require two vital pieces of information: the satellite's azimuth (degrees clockwise from north) and elevation (degrees above your southern horizon). The easiest way to access this information is by means of David Taylor's *WXtrack* software, which can be downloaded from

<http://www.satsignal.eu/software/wxtrack.htm>

There are two points to address in the *WXtrack Setup* tab.

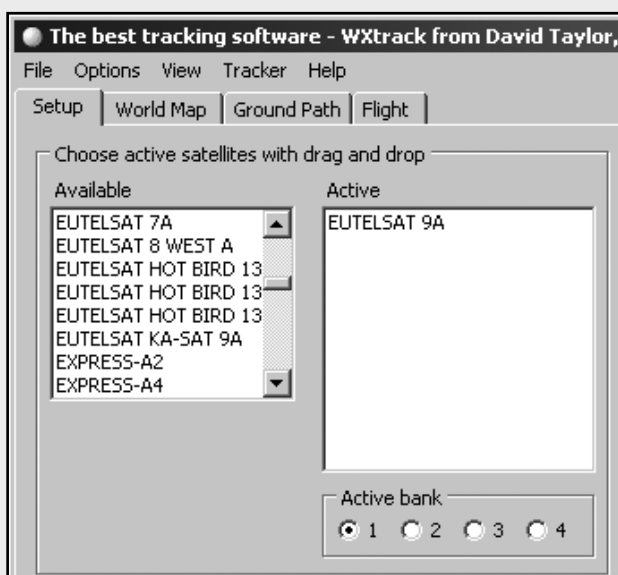


Figure 1 - Selecting *EUTELSAT 9A* in *WXtrack*

First, you must drag the entry for 'Eutelsat 9A' from the 'Available' list to the 'Active' list, as shown above.

Secondly, you must edit your location details into the **My Location Details** panel at the bottom right of the tab. Just click the **Edit** button, input your details (City name, latitude, longitude), and click **OK**.

But just a minute: where do you find accurate latitude and longitude details for your station? The best solution is to use *iTouchMap.com* where you simply zoom into your location on a *Google Map* and click the cursor over it.

<http://itouchmap.com/latlong.html>

As soon as you click on the map, a panel underneath it instantly updates with the required latitude and longitude.

Now open *WXtrack's World Map* tab and make sure that *Eutelsat 9A* is selected in the **Sat** drop-down list at the foot of the screen (figure 6). The panel to its right, circled in red, provides the angular information that you require. Now you are in a position to align your satellite dish on *Eutelsat 9A* and start receiving data via *EUMETCast*.

Eutelsat 9A at 9° East is not too difficult to find. Mount your dish and secure it loosely for the time being. You are going to use the software in your *DVB World* receiver to get the alignment spot-on. You need a compass to assist in positioning the dish. Remember to check for the magnetic variation (or declination) at your location. This is most conveniently done using magnetic-declination.com

<http://magnetic-declination.com>

where, once more, you click over your location on a *Google Map*. This time though, an infobox pops up with the information you require. Indeed, as it also reveals your latitude and longitude, you can use this as a one-stop means of collecting all the necessary data for aligning your dish. At my location the variation is just under 2° at the moment, giving an approximate azimuth for *Eutelsat 9A* of 165°, but remember this is different for other parts of Europe. Another site you may find useful to find this information is

www.dishpointer.com

Initial Rough Dish Alignment

To start aligning your dish, first rotate it round to the appropriate azimuth angle and lock it in place. Next, deal with the dish's elevation. This will vary with latitude, so start with 10° and be prepared to increase or decrease it later in stages from there. The farther north your station, the shallower will be the elevation angle.

Preparing the Software for Accurate Dish Alignment

Now go to your *DVB World* receiver, making sure that the antenna download is connected. The most popular cable is *CT100*, which consists of braided copper with an aluminium foil screen and single stranded copper inner conductor. All my connections are made with F-Type connectors, with shrink-tubing as extra waterproof protection.

Run the *DVB World* software by clicking on the icon and your DVB receiver will initialise. The image shown in figure 2 should appear on your screen. Click on the **setup icon** (which looks like a spanner), next to the **IP button** at the top of this screen. This will open the **Configuration panel** (figure 3).

Start with the **Sat Config** tab, go to the **Sat** drop-down list, click on the right hand end-arrow and look for 'Eurobird 9 at 9° East' in the list of satellites that opens up. Click on this to highlight it then click the **Apply** button at the foot of the tab.

At the top right of the tab, open the **Transponder** drop-down list and click 'TP14_11977_27500' to highlight it and again click the **Apply** button. The following fields should now display as follows:

Transponder:	TP14_11977_27500
Type:	Fixed
Frequency:	11977 MHz
Symbol Rate:	27500 ksps
Polarization:	Horizontal
Puncture Code:	DVBS QPSK ¾

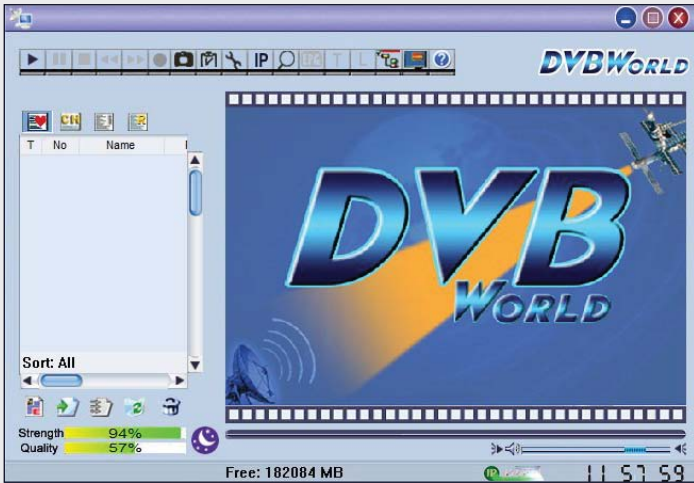


Figure 2 - The DVB World start-up screen

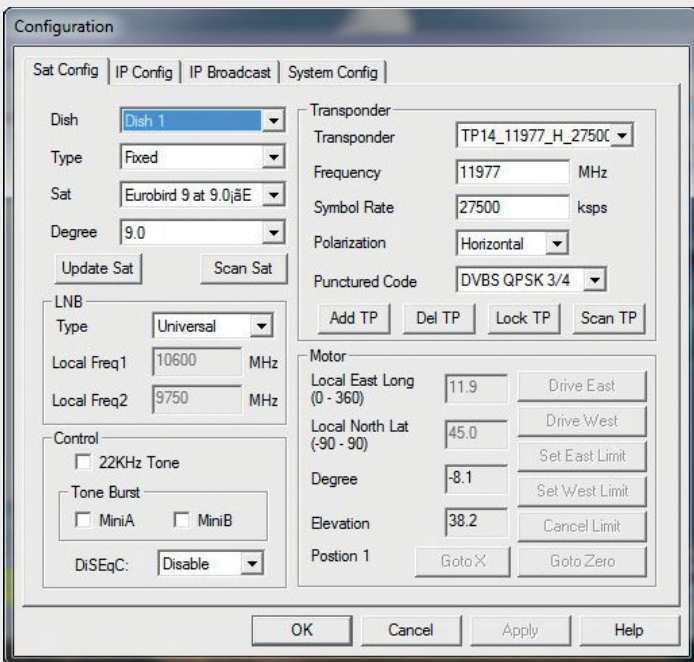


Figure 3 - The EUMETCast Sat Config Tab

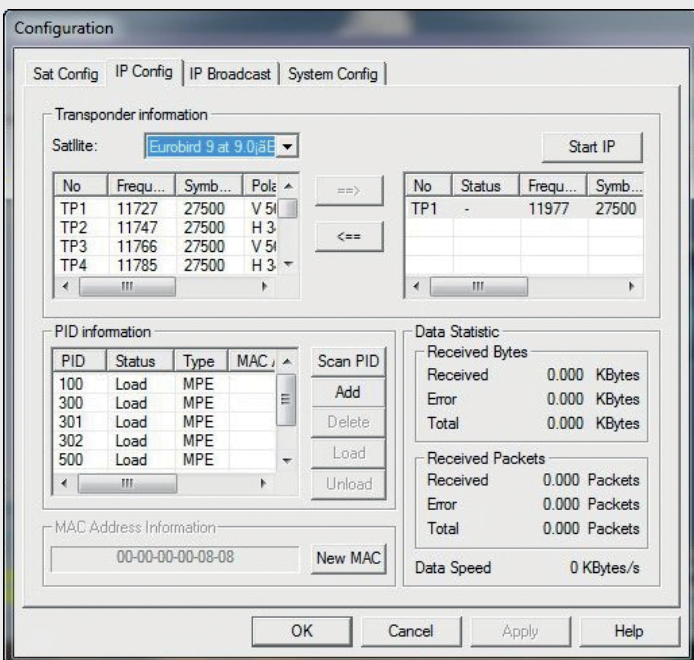


Figure 4 - The EUMETCast IP Config Tab

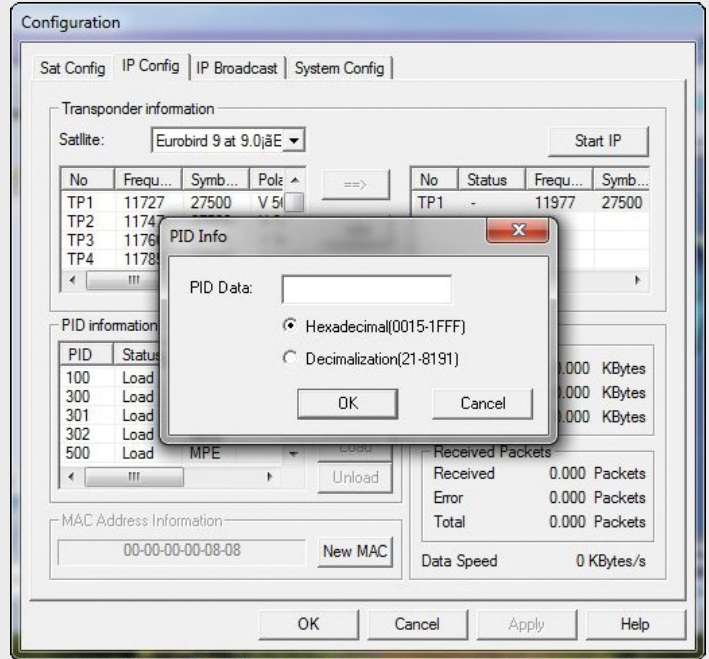


Figure 5 - The EUMETCast IP Config Tab and the PID input window

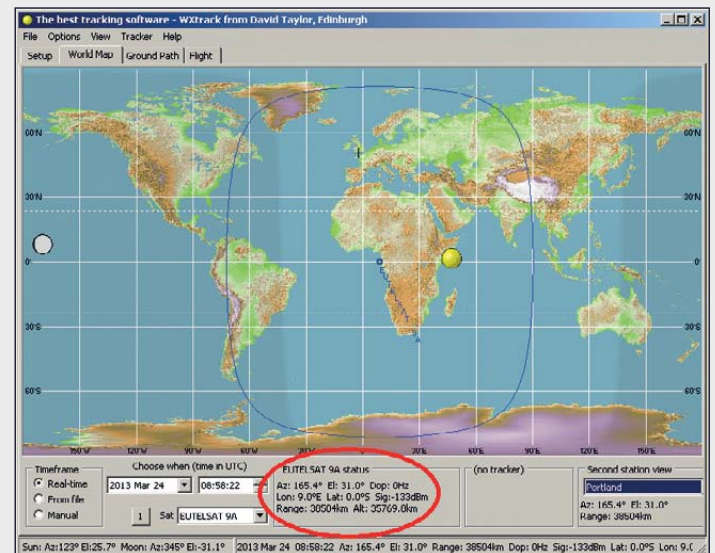


Figure 6 - Using WXtrack to determine Eutelsat 9's azimuth and elevation

If any of those fields are not as above, then change them to agree. Most important is the Polarization, which must read as 'Horizontal'.

Open the **IP Config** tab (figure 4) which sets up the system to work correctly. What follows is very important as it sets up the parameters to receive *EUMETCast* data correctly. In the **Transponder Information** panel the Satellite should be shown as 'Eurobird 9', below which is a list that you scan to find '11977-27500'. Select this and transfer it to the right hand panel by clicking the ==> arrow. Once done, click **Apply**.

Move down to the **PID Information** panel where you must insert the required PID values that *EUMETCast* uses for data transmission. Click on the **Add** box and another small box marked 'PID Info' will appear (figurer 5).

It's here that you will input your required *packet IDs* (PIDs), as follows: click into the **Decimalization** box, remove the zero from the box, input '100' then click **OK**. You will see '100' appear in the lower box. Now it's important that you enter all the other PIDs in exactly the same way: 300, 301, 302, 500, 509 and 510. When completed all PIDs will be visible in the **PID Information** box. Now click **Apply**.

Final Accurate Dish Alignment

Return now to the **Sat Config** tab and click on **Lock TP**. Immediately, you will see a box appear indicating **Strength and Quality**. At this point, you must go back to the satellite dish and readjust its azimuth and elevation to get the best figures possible. You are looking for **Strength** in the range 60% to 95% and **Quality** between 50% and 75%. Here, at my location, I am receiving Strength 95% and Quality 60% with my one-metre dish. Your figures will differ somewhat due to the local terrain and any objects that may lie between you and the satellite. Once you are satisfied that the figures are the best you can get, lock the satellite dish securely so it cannot move in the wind.

Preparing for EUMETCast Reception

By now it is assumed that you have received all the relevant software and EKU from *EUMETSAT*. Place the EKU into a suitable USB socket and load the **EUMETCast CD** (which should be version 5.6) in the PC. When the screen menu opens, select **EKU Software**, then select **RTE_3.65** and install. You will be informed if there are any problems.

Go back to the menu and select **Tellicast** then select **T-Systems** and install this. You will get a prompt to enter your EUMETSAT key code. Make sure you **copy and paste** this code in place. **Do not type it in**—because this just does not work. Once done, exit setup, remove the CD and restart the PC. The *Tellicast Icon* should now appear in the toolbar at the foot of your screen: it will either show as red with a black 'T' or yellow with a black 'T'.

Required Modifications

The first step here is to make sure that *DVB World* is going to connect with *Tellicast* or nothing will happen. To do this, click the **Windows Start Button** followed by **Run** to bring up the window shown in figure 7. Type in 'CMD' then click **OK** to reveal a command prompt box with a flashing icon. Here, type in 'ipconfig/all' and press the 'Enter' key. Immediately, a list of all items connected to your PC will appear. Look for **DVB Net ETAdaptor**, locate it and check what its IP Address is. It should read as '192.168.238.238'. If not, you will have to change it. **If the value is correct, skip the following paragraph.**

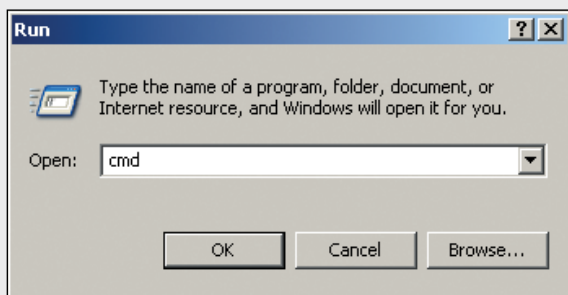


Figure 7 - Running Windows CMD utility

If the IP Address is wrong, go to **Start, Control Panel**, and open **Network Connections**. Find and select *DVB Net ETAdaptor* and right click it to show the **Properties** tab. A box will appear as 'Local Area Connection Properties'. Highlight 'Internet Protocol (TCP/IP)' and again click **Properties** when yet another box appears. This time, select **use the Following IP Address**, click in the tab, go to the **IP Address** line and type in '192.168.238.238'. Move down to the next line, **Subnet Mask**, and type in '255.255.255.0' (or it may simply drop in place for you). Finally, keep clicking **OK** to exit, then close **Network Connections**.

Updating the Tellicast Configuration Files

If you have never been involved with editing configuration files before I suggest that you regularly save everything as you go along. The files you will have to edit are called **recv.ini** and **recv-channels**, and are to be found in the **Program Files / T-Systems / Business TV-IP** folder. Navigate to this folder and double-click *recv.ini* file to open it.

The first lines to change are in the **[Watchdog]** section. Insert the line **max_memory_usage=500000000** then save the file. Move down to the **[Logging]** section and change the **log file** number to '2' and **log level** to 'quiet' and save once more. In the **[parameters]** section, type in **tmp_directory=temp** and save.

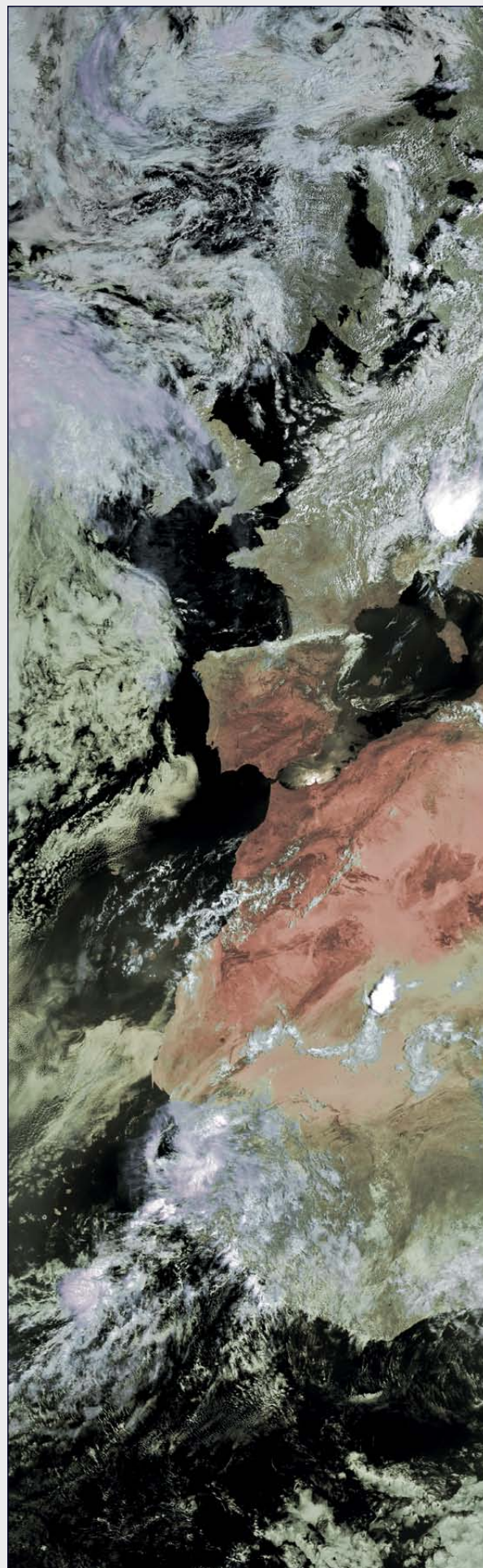


Figure 8 - This Metop-A image dates from July 21, 2012
Image © EUMETSAT 2012

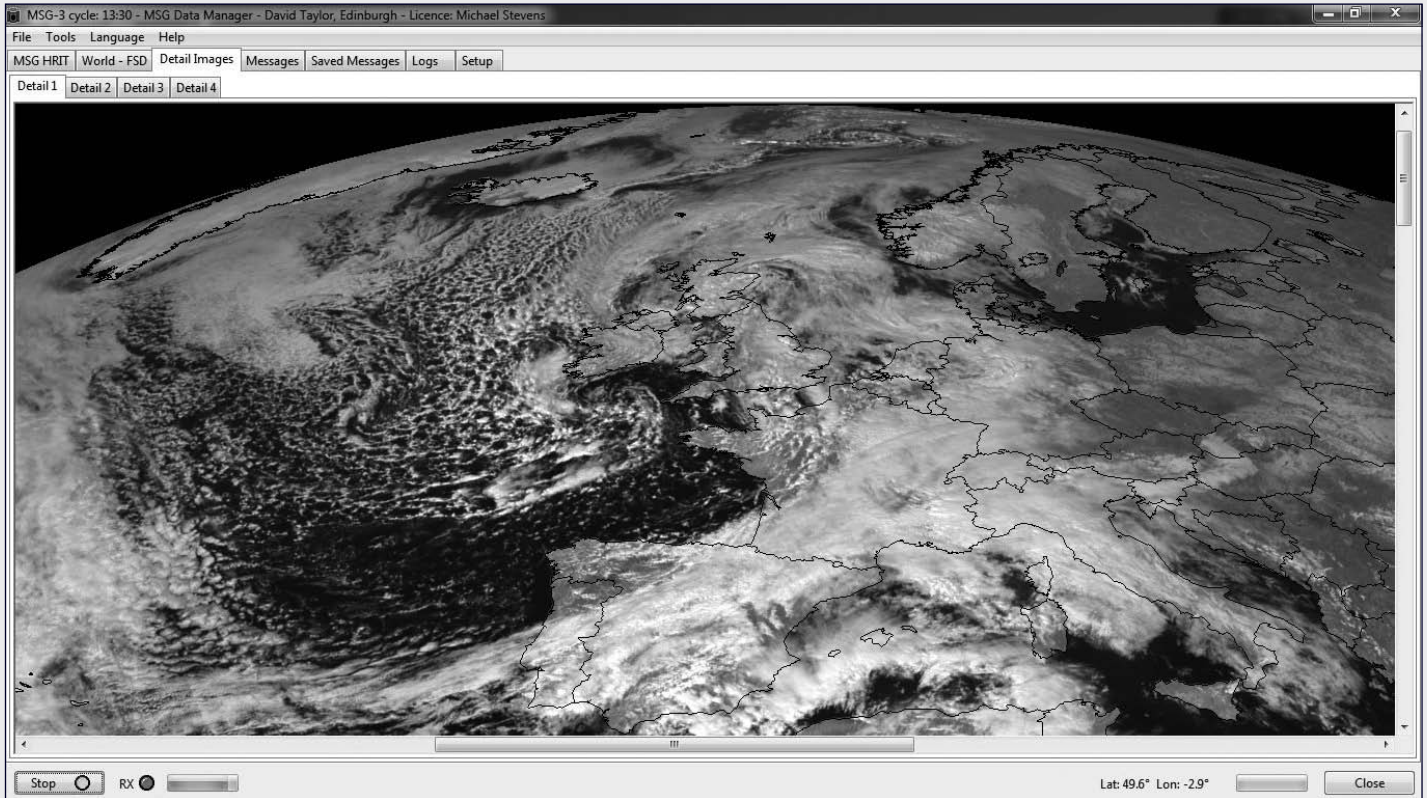


Figure 9 - A typical channel-1 Meteosat-10 image displaying in MSG DataManager
Image © EUMETSAT 2013

```
# recv.ini - TelliNet+TelliCast+TelliVision: central Receiver Configuration File
# additional files: see license.ini, recv-channels.ini (optional)
# for more information on file format use help menu in Tellicast shell
#
# 2-4-3 10-10-2005
#
[recipient]
user_name=MichaelStevens
user_key_

[shell]
login=none
port=2517
refresh=3

[watchdog]
max_memory_usage=500000000
#error_script=none./error.sh
#error_script_cause_announcement=30

[logging]
log_file_size=1000000
log_file_number=2
log_level=quiet

[locations]
file_database_directory=receiving/tmp
log_file=>>recv.log
license_file=C:\Program Files (x86)\T-Systems\BusinessTV-IP\license.ini
channels_file=C:\Program Files (x86)\T-Systems\BusinessTV-IP\recv-channels.ini

[announcement_channel]
address=224.223.222.223:4711
name=TSL Announcement Channel

[parameters]
tmp_directory=temp
interface_address=192.168.238.238
file_database_size=300000000
file_delivery_counter=50
file_delivery_speed=20000000
```

Listing 1 - The author's *recv.ini* file

```
# recv-channels.ini - TelliCast+TelliVision Client channel
configuration file
#
# 2-4-3 10-10-2005
#
target_directory=received
# target_directory: Directory for received files. The target_
directory name
# is relative to the current working directory.
# syntax: target_directory=<directory>
# default: received

[EUMETSAT Data Channel 1]
target_directory=received

[EUMETSAT Data Channel 2]
target_directory=received
```

Listing 2 - Essential edits to the *recv-channels.ini* file

Note: '#' at the start of a line means that it is 'commented out' so will not receive any data.

Directly under that you will see the **interface_address** which should be the same as the one you entered in the properties box. Finally, you need to change the **file_database_size** to read '300000000' (eight zeroes), then save again to close the file. Listing 1 shows the whole of my own *recv.ini* file for reference. If you wish to set yours up exactly the same as mine, then your system should certainly work.

Now double-click on the *recv-channels.ini* file to open it to make some more edits. If you don't, all the satellite data will pile up into a single received file and overload it. First, you have to get rid of the wildcard symbol [*] and re-direct all the data to its correct file. Listing 2 is a cut-down version of the file showing its opening lines to give you a guide as to how to start 'channelizing' your data. These will allow you to receive the basic Channel-1 and Channel-2 data streams.

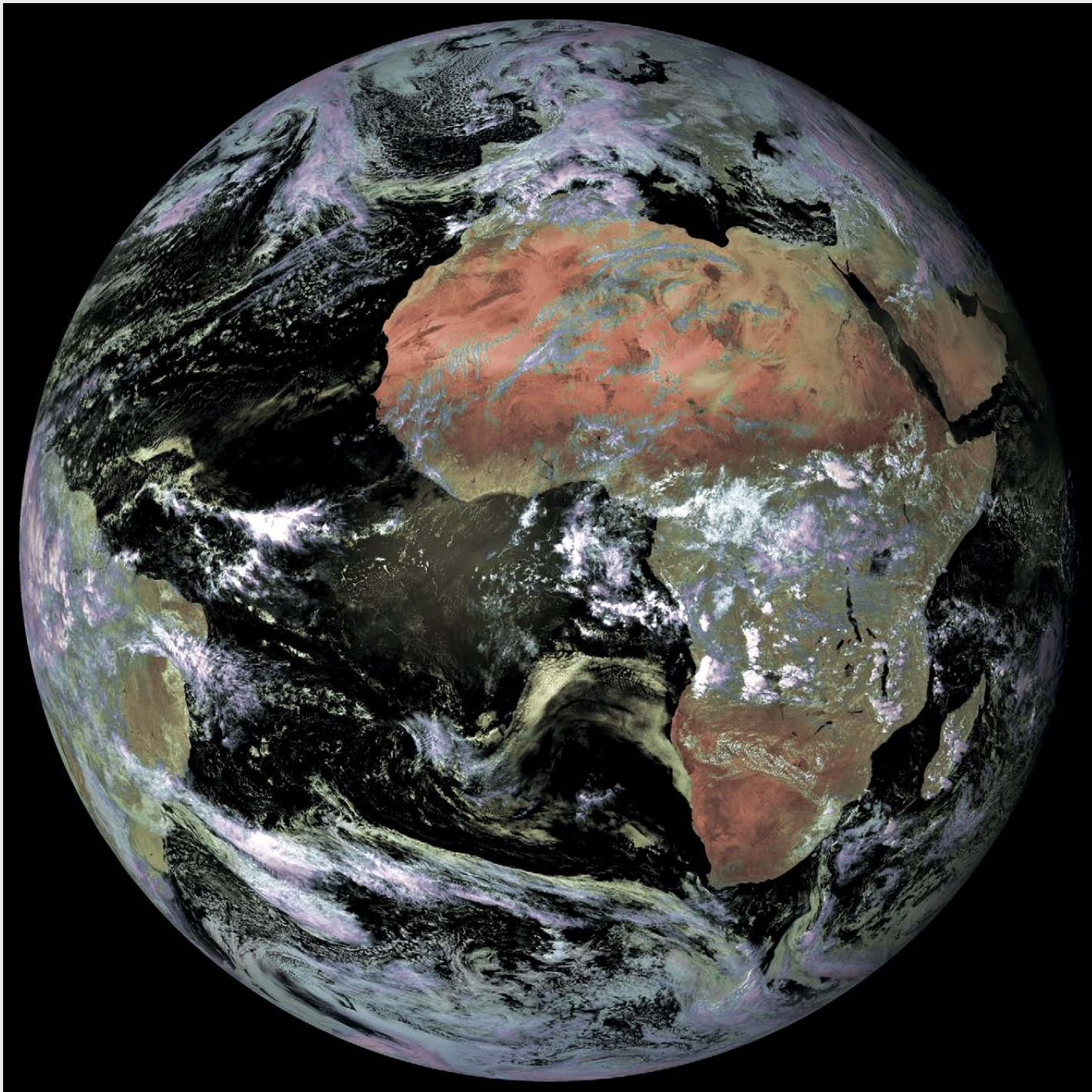


Figure 10 - This false colour Meteosat-10 image dates from 13:15 UT on March 17, 2013
Image © EUMETSAT 2013

I am not going to lay out the complete files here as it will be your choice what you actually receive via *EUMETCast*, but you can refer to my full *recv-channels.ini* file, shown in Listing 3, and copy the features you require.

There are varying ways of editing these files, and a look at David Taylor's excellent *EUMETCast* web pages will explain even further. Here you will find lots of very good information, including details of the complete set of data channels. The two channels shown in Listing 2 will get you operational to start with.

<http://www.satsignal.eu/>

System Check

Let's do a system check to make sure everything has been covered. If you have successfully completed the following eight steps, you are ready to start imaging.

- Tellicast software Installed
- EKU and Software Installed
- DVBWorld Receiver and Software Installed.
- DVB World Configuration done and PIDs installed
- Command check for correct IP Address
- recvd-ini file updated.
- recvd-channel.ini file modified to receive data
- Satellite dish aligned and secure.

Activate *DVB World* by clicking on its desktop icon. The software will initialise and load. Now go to the **IP Button** at the top of the box (figure 2) and double click it. Both the **Strength** and **Quality** bars at bottom left of the window should go green, as should the **IP bar** at lower right. The main *Tellicast* icon on your lower tool bar should show as a Pink 'T' on a white background. If all is well, you should be receiving *EUMETCast* data files. You can now move to the **Received File folder** within the **Tellicast Software Folder** and see incoming data files.

```

# rcv-channels.ini - TelliCast+TelliVision Client channel configuration file
#
# 2-4-3 10-10-2005
#
target_directory=received
# target_directory: Directory for received files. The target_directory
name
# is relative to the current working directory.
# syntax: target_directory=<directory>
# default: received

[EUMETSAT Data Channel 1]
target_directory=received

[EUMETSAT Data Channel 2]
target_directory=received

[EUMETSAT Data Channel 3]
target_directory=received

[EUMETSAT Data Channel 4]
target_directory=received

#[EUMETSAT Data Channel 5]
#target_directory=received-MSG-RSS

#[EUMETSAT Data Channel 6]
#target_directory=received-MSG-RSS

[EUMETSAT Data Channel 11]
target_directory=received

[EUMETSAT Data Channel 12]
target_directory=received

[DWDSAT]
target_directory=C:/Received Files-DWDSAT

[EPS-10]
target_directory=received-AVHRR

[EPS-15]
target_directory=received-NOAA-GAC

[Info-Channel-1]
target_directory=received

[Info-Channel-2]
target_directory=received

[WWW-Channel]
target_directory=www/eumetsat

tmp_directory=receiving/tmp/files
# tmp_directory: If this parameter is given tc-rcv will internally
# store/compose all received files within the given directory and
# later move them to the target directory.
# While this option requires an additional move operation it
# guarantees that all files appearing in the target directory are
# fully written to the file system.
# syntax: tmp_directory=<directory>
# default: undefined=off, but default value may be redefined in
# rcv.ini

# Section per channel or channel group identified by channel name
(wildcard
# "*" allowed at end of name)

#activate_ftp_forwarding=1
# activate_ftp_forwarding: Will activate FTP forwarding for the correctly
# received files according to the rcv.ini [ftp_forwarding]
# parameters.
# syntax: activate_ftp_forwarding=<value of range>
# range: 0/1
# default: 0=off

#tmp_directory=receiving/tmp/files
# tmp_directory: If this parameter is given tc-rcv will internally
# store/compose all received files within the given directory and
# later move them to the target directory.
# While this option requires an additional move operation it
# guarantees that all files appearing in the target directory are
# fully written to the file system.
# syntax: tmp_directory=<directory>
# default: undefined=off, but default value may be redefined in
# rcv.ini

#tmp_prefix=
# tmp_prefix: Like tmp_directory, but files are composed within the final
# target directories but stored with the given prefix in front of
# the normal filenames until the files are fully written.
# syntax: tmp_prefix=<file name start>
# default: undefined=off, but default value may be redefined in
# rcv.ini

#tmp_suffix=.tmp
# tmp_suffix: Like tmp_prefix, but adding a suffix to the normal filenames
# until the files are fully written.
# syntax: tmp_suffix=<file suffix>
# default: undefined=off, but default value may be redefined in
# rcv.ini

```

Listing 3 - The author's complete *rcv-channels.ini* file

You can now load and activate David Taylor's *MSG-Data Manager* software and start watching the incoming satellite pictures on your screen.

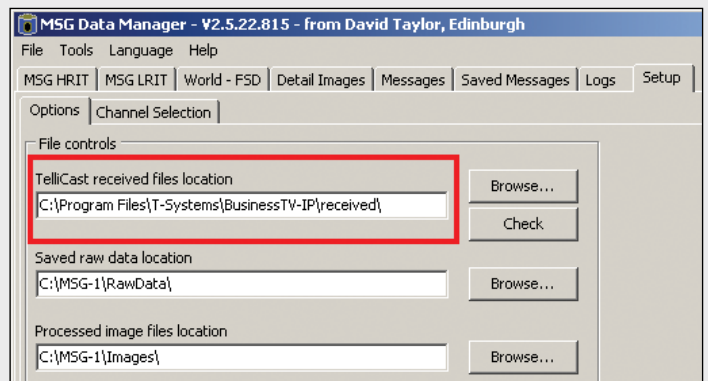
Note: MSG DataManager software for viewing *EUMETCast* images can be downloaded from

http://www.satsignal.eu/software/msg_dm.htm

Although this software is not free, it does come with an initial 30-days of free usage to allow you to evaluate it before having to purchase a registration code (£59.95).

In order to use this software, you must open its **Setup** tab and ensure that the **File controls** section contains the correct paths for accessing the *EUMETCast* data and saving the decoded images (figure 11). If you now open the program's **MSG HRIT** tab, you should start to see the various channels of MSG imagery building up on the screen (figure 12).

Be warned that all this data coming into your system, if not controlled, will soon fill up your hard drive—so make sure you do some cleaning-up now and again. Helpfully,

Figure 11 - Checking the file paths in *MSG DataManager*

MSG DataManager contains options to delete data after a selected time interval.

When you have fully understood all the workings of *EUMETCast* you will be able to receive satellite imagery from

numerous sources in addition to *Meteosat*: these include high resolution AVHRR images from *Metop-A*, *Metop-B* and the *NOAAs* as well as MODIS-L1 imagery from NASA's *Terra* and *Aqua* satellites. It just depends on what you choose to receive. Software for generating images from all these data sources is available from David Taylor's excellent website where there is also a wealth of fantastic information. The pictures from *Meteosat-10* (MSG-3) and the *Metop* satellites are amazing.

If you do experience problems there are people on hand to help so don't be afraid to ask. Particularly useful is David Taylor's **SatSignal YAHOO! User Group** at

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

We all had to learn, so have fun and enjoy.

My thanks to all who have helped me in the past. Happy weather watch from Portland.

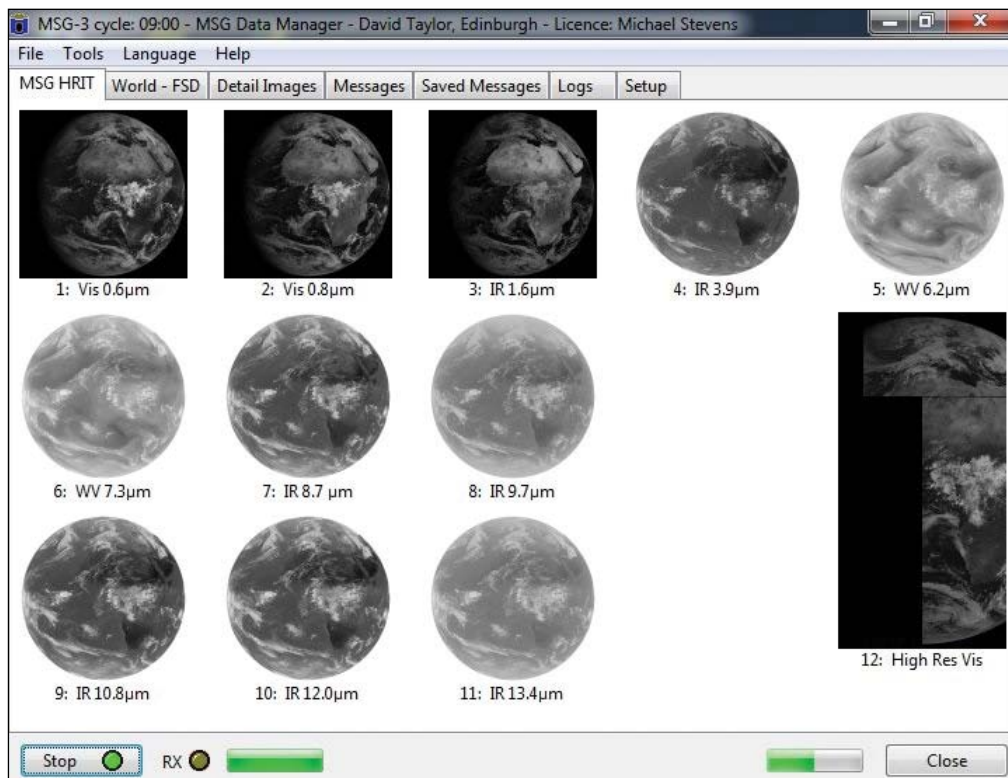


Figure 12 - The various MSG images building up in *MSG DataManager*

Introducing the new R2FU APT Receiver

Holger Eckert

Although the *GEO Shop* has been supplying the new R2FU APT weather satellite receiver since early this year, little has been heard from readers who have purchased units. Hopefully, there will be some feedback in the months ahead, perhaps including a detailed review of the unit. Meantime, in an attempt to fill the information void, we contacted the designer of the R2FU, Holger Eckert, who emailed back the following information.



About 70% of the R2FU circuit design is new, the most obvious difference being the USB interface, incorporation of which actually caused me the most design problems. USB 2.0 clocks at 400 MHz and I was surprised how much noise that makes if you want to receive signals with -120 dBm of power. It was the number of PCB re-designs required that delayed the release of the receiver from June till December 2012. I originally wanted to integrate a soundcard chip into the board as well, but that would have required shielded compartments and would have exceeded my cost target.

The USB interface is designed as a virtual COM port. That guarantees that all the programs which control the receiver still work without changes.

The RF front-end is similar to that of the R2FZ, which means that I am using a highly selective crystal filter instead of the earlier ceramic one. Nearby interference sources should not, therefore, harm the reception of weather satellite signals.

The USB supply made it necessary to use 3.3 volts internally instead of 5 V, and this required the replacement of the silicon

transistors of the input stage and the mixer by GaAsFETs. This had the welcome side-effect of improving the noise figure by half a decibel. The surplus gain of the GaAsFETs made it possible to use a better band select filter, and image rejection therefore improved from 50 to 80 dB, which is even better than with the R2FZ.

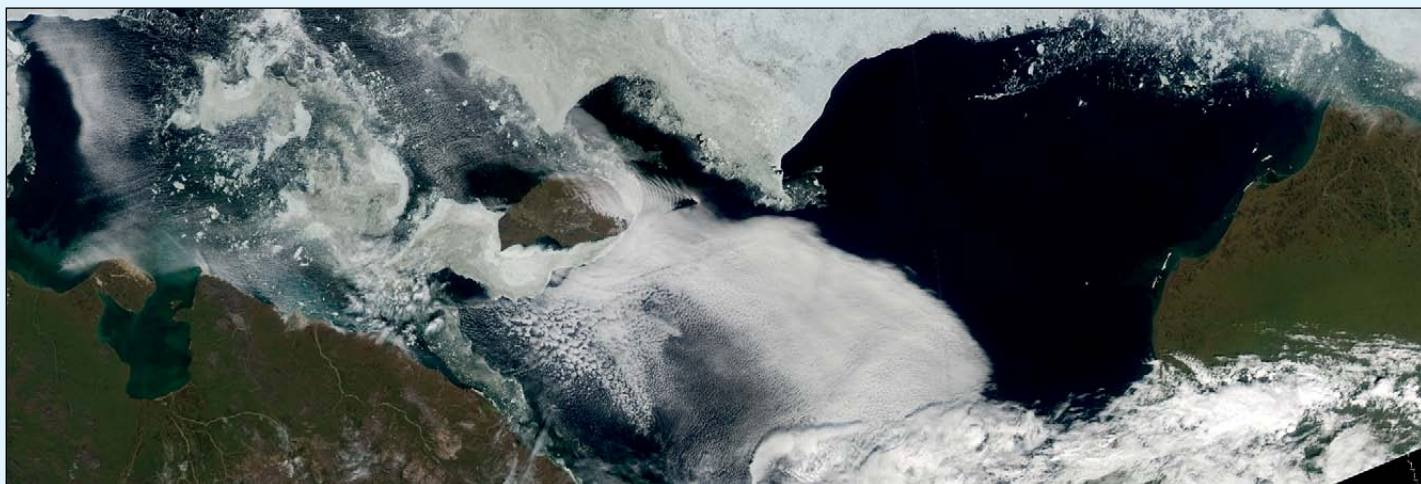
There are a few other small changes: you no longer have to open the lid to reposition a jumper if you want to switch on the remote supply for an external LNA, as this is now done by a software command. The LNA supply includes a fuse which, hopefully, will provide protection in the event of a short at the antenna port. The disadvantage of USB is that most of the commercially available external LNAs do not work any more because they need 12 volts. So I have developed a 5 V compatible LNA for the receiver.

On the PCB there are provisions to switch the IF bandwidth to make it possible to receive other satellites like Orbcomm, Tubsat, SAFIR and whatever else may be transmitting on the 137 MHz band. This feature is not implemented at present however, as I don't know if people are interested in such things.

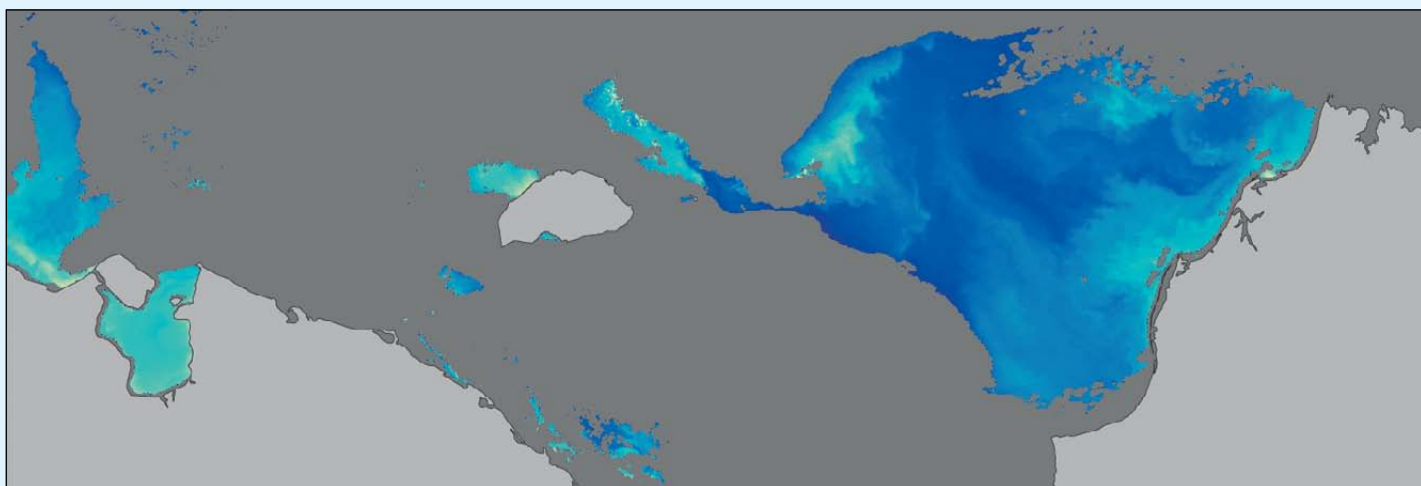
Sea Ice Skylights Spur Phytoplankton Blooms

A NASA Earth Observatory Report

Text adapted from *Melt Pond 'Skylights' Enable Massive Under-Ice Bloom in the Arctic* by Rebecca Lindsey, NOAA ClimateWatch Magazine



Wrangell Island and the Chukchi Sea as viewed by *Aqua* on July 10, 2011.



Chlorophyll Concentration (mg/m³)
0.1 1.0 10 100

A plot of chlorophyll levels (due to plankton blooms) in the same region, as detected by *Aqua* on July 10, 2011.

For much of the winter, the sun barely rises over the Arctic Circle. In mid-winter, it doesn't rise at all. Most of the Arctic Ocean is capped by ice, and beneath this, phytoplankton—the microscopic, photosynthesising organisms that underpin the entire ocean food web—take a “long winter’s nap”. But when sunlight returns in the spring and the ice retreats, it’s like a cover being drawn off the roof of a greenhouse. The water along the edge of the retreating ice explodes with blooms of phytoplankton.

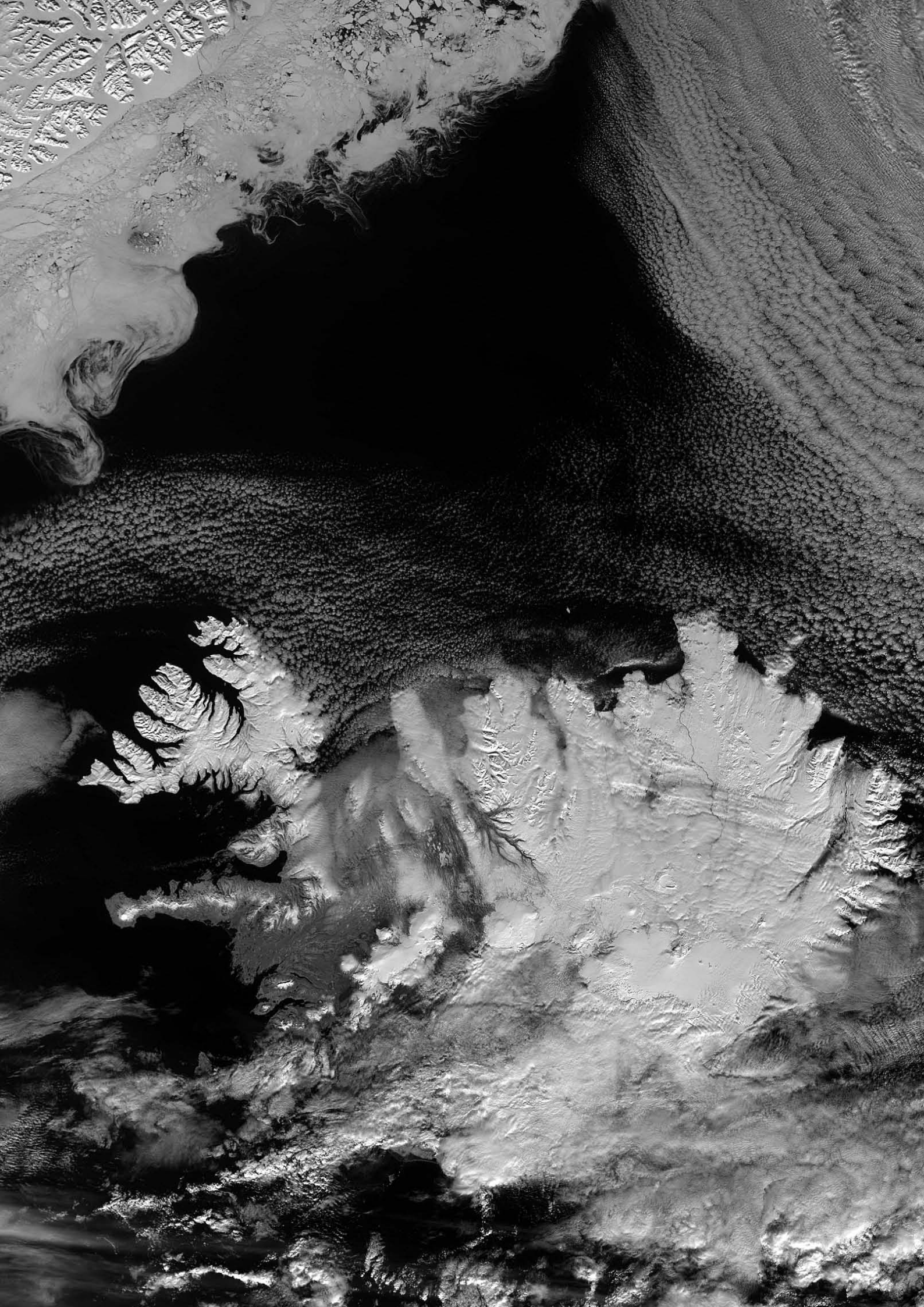
The images above offer two views of a phytoplankton bloom in the Chukchi Sea, northwest of Alaska, as imaged by the MODIS instrument aboard NASA’s *Aqua* satellite on July 10, 2011.

The upper image is a natural colour view while the lower one is a plot showing the concentration of phytoplankton in milligrams per cubic meter of seawater. Blue indicates areas with low concentrations of chlorophyll, and yellow indicates areas with high concentrations; land is light gray, and areas where MODIS could not collect data due to clouds or sea ice blocking the satellite sensor’s view are dark gray.

North of Wrangel Island, the sea ice has a dingy look in the natural colour image. Although this could result from sediment, its distance from shore—plus the fact that the ice is fringed by waters with extremely high levels of chlorophyll—suggests that the ice has been discoloured by algae and other phytoplankton.

According to Arctic oceanographer Karen Frey, the discolouration is consistent with an unusual phenomenon that she encountered while on a research cruise in the Chukchi Sea in July 2012: a massive bloom of phytoplankton stretching some 100 kilometres beneath the ice-pack. Historically, the ice in this area had been thick enough, even in spring, to keep the waters beneath in darkness. But in the past decade ice conditions have changed dramatically, leaving a thinner ice cover laced with shallow ponds of meltwater. These ponds act like skylights, allowing light to filter through and support phytoplankton blooms beneath the ice.

NASA Earth Observatory images created by Jesse Allen, using MODIS data from the Land Processing Distributed Active Archive Center (LP DAAC).



Sea Ice Retreats in the Northwest Passage

A NASA Earth Observatory Report



The Peary Channel separating Melville Island and Victoria Island is choked with ice on July 17, 2012.
NASA image by Jesse Allen, using data from the Land Atmosphere Near real-time Capability for EOS (LANCE).



Just over two weeks later, the Peary Channel appears largely ice-free on August 3, 2012.
NASA image by Jesse Allen, using data from the Land Atmosphere Near real-time Capability for EOS (LANCE).

Ice retreated rapidly in the Parry Channel, part of the famous Northwest Passage, between mid-July and early August 2012.

These images, acquired by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite, show significant changes over two weeks. The top image shows Parry Channel choked with ice on July 17. The lower image shows the same region on August 3, when open water dominated the scene, with only remnant ice still clinging to the shores of Victoria and Melville Islands. On July 30, ice cover was roughly 33% compared with the long-term median of 79%.

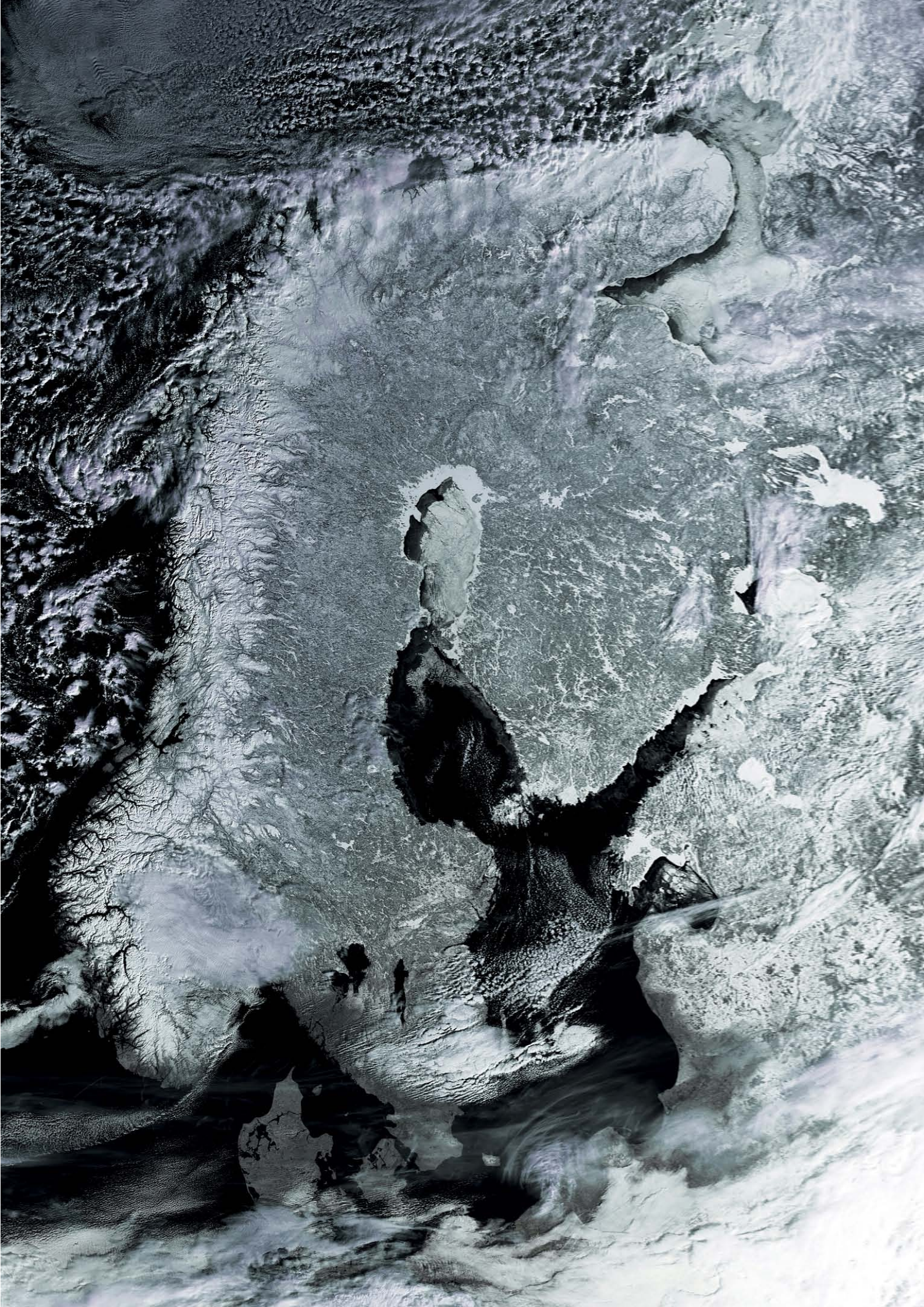
However, thin sea ice can evade detection by satellite sensors such as MODIS yet still be thick enough to impede shipping so, while the Parry Channel appeared almost entirely free of ice, it was not necessarily open for navigational purposes. Close examination of the image from early August does show lingering patches of ice south of Melville Island.

Regardless of whether ships can easily pass through it, recent studies suggest that certain organisms have begun to take advantage of open water along the Northwest Passage. A 2007 study on *Neodenticula seminae*, a plankton species

historically endemic to the Pacific Ocean, discovered that the species had turned up in the North Atlantic. The research suggested that the plankton's route included the Canadian Arctic Archipelago.

And a 2012 study on bowhead whales, where individuals were tracked using satellite transmitters, revealed that Pacific and Atlantic populations had begun to overlap in the Northwest Passage as early as August 2010.

NASA Earth Observatory images by Jesse Allen, using data from the Land Atmosphere Near real-time Capability for EOS (LANCE).



An introduction to MSG DataManager

... continued from page 13

number of options, most of which, fortunately, are already set up with working default values. These options are for you to experiment with as you gain more experience of the software.

One option that it is most important to change, however, is in the **Satellite** panel at lower right. You must make sure that you highlight the correct reception satellite for your data or you will not receive

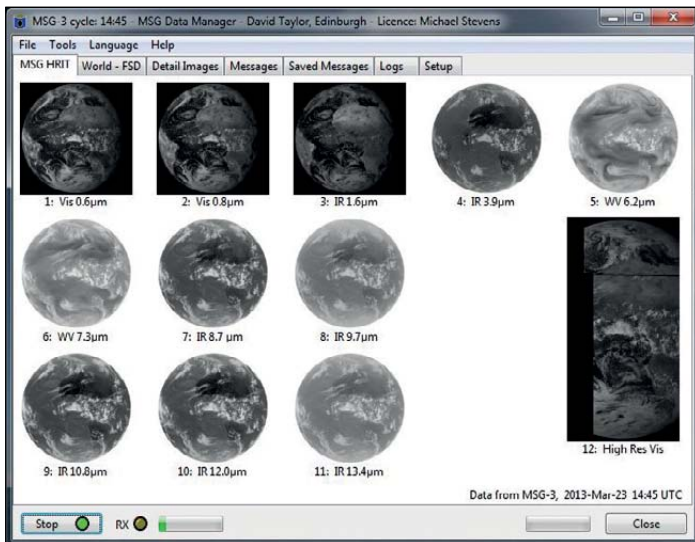


Figure 8 - The MSG HRIT channels screen

anything. David Taylor discussed this in GEO Quarterly 37.

Please refer to that for clarification. Suffice it to say that the current MSG satellite is now MSG-3 and **not** MSG-2.

You should now be ready to actually receive EUMETCast data. Return to the main **MSG HRIT** tab at the top of the screen and click the **Start** button in the bottom left-hand corner. Within just a few minutes you should observe images of Earth starting to build up on the screen as illustrated in figure 8.

As soon as all the global discs are complete, move the mouse over the first one and right-click on it. A small box will appear asking you for your preferences—click on **View with Detail 1**, and the full-sized image will appear in a new tab named **Detail 1**. Having viewed this image, you may now want other options. If so, right-click over the image and a list of options will appear. Most of the options are self explanatory.

Some of the options like the 'Thermal LUT' and 'Visible LUT' can lead to the creation of coloured images (figures 3, 4) but may require an additional program, *GeoSatSignal*, to be installed before they become fully operational.

MSG DataManager is a fantastic piece of software with which to look at the Earth and its weather. As you become more experienced, do try out more of the different parameters built into the software. You will be amazed at some of the results you obtain.

References

- 1 EUMETCast and MSG Setup - GEOQ38 (this issue), page 28
- 2 GeoSatSignal 5: the basic functions - GEOQ9, page 34 (2006)
- 3 GeoSatSignal 5: advanced options - GEOQ10, page 16 (2006)

NOAA 17 Decommissioned

If a reminder were needed that the era of APT is drawing to an end, the number of available satellites transmitting this mode decreased to three when NOAA 17 was decommissioned on April 10 this year. Launched in June 2002 and assuming operational status the following October, NOAA 17 provided flawless APT and HRPT imagery until its scan motor started to develop problems during 2010 and finally stalling in October that year. The problem proved insoluble, and after a lengthy period when no imagery was produced, even though the carrier could still be detected, the satellite was deactivated.

The only remaining APT satellites (and remember there are no more in the pipeline) are NOAA 15, still operating after 15 years in orbit, NOAA 18 (launched 2005) and NOAA 19 (launched 2009). Once three fail, the era of APT will be at a decisive end.

Currently Active Satellites and Frequencies

Polar APT 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 N1	137.1000 MHz	Sporadic	[1]

Polar HRPT/AHRPT Satellites				
Satellite	Frequency	Mode	Format	Image Quality
NOAA 15	1702.5 MHz	Omni	HRPT	Weak
NOAA 16	1698.0 MHz	RHCP	HRPT	Good
NOAA 17	1702.5 MHz	RHCP	HRPT	None: scan motor failure
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]
Metop A	1701.3 MHz	RHCP	AHRPT	Good
Metop B	1701.3 MHz	RHCP	AHRPT	Good
Meteor M N1	1700.0 MHz	---	AHRPT	[2]

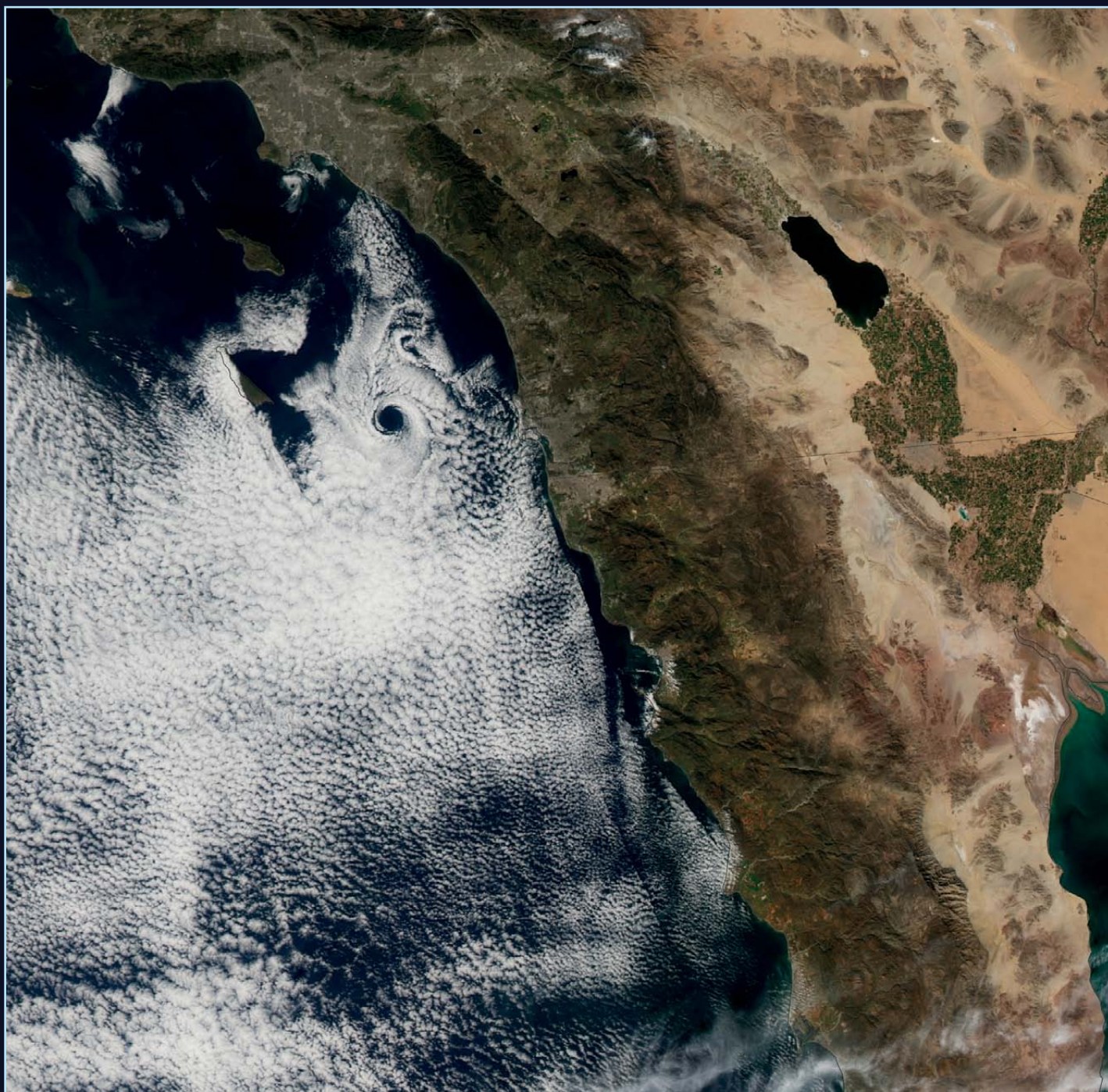
Geostationary Satellites				
Satellite	Transmission Mode(s)		Position	Status
Meteosat 7	HRIT 1691 MHz / WEFAX 1691 MHz		57.5°E	On
Meteosat 8	HRIT (digital)	LRIT (digital)	3.5°E	On [4]
Meteosat 9	HRIT (digital)	LRIT (digital)	9.5°E	On [5]
Meteosat 10	HRIT (digital)	LRIT (digital)	0°W	On
GOES-12	---	GVAR 1685.7 MHz	60°W	On
GOES-13 (E)	LRIT 1691.0 MHz	GVAR 1685.7 MHz	75°W	On [3]
GOES-14	---	---	89.5°W	Standby
GOES-15 (W)	LRIT 1691.0 MHz	GVAR 1685.7 MHz	135°W	On [3]
MTSAT-1R	LRIT 1691.0 MHz	HRIT 1687.1 MHz	140°E	On
MTSAT-2	LRIT 1691.0 MHz	HRIT 1687.1 MHz	145°E	On
Feng Yun 2D	LRIT	SVISSR	86.5°E	On
Feng Yun 2E	LRIT	SVISSR	104.0°E	On

Notes

- 1 LRPT Signals have been reported from Meteor M N1 but are sporadic with periods off. This satellite's carrier frequency can cause interference to NOAA 19 when the two footprints overlap.
- 2 These satellites employ a non-standard AHRPT format and cannot be received with conventional receiving equipment.
- 3 GOES 13 and GOES 15 also transmit EMWIN on 1692.70 MHz
- 4 Meteosat operational backup satellite
- 5 Meteosat Rapid Scanning Service (RSS)

Catalina Eddy

A NASA Earth Observatory Report



On February 17, 2013, the MODIS radiometer aboard NASA's Aqua satellite captured this natural-colour image of an atmospheric eddy off the coast of Southern California. This pattern is known to meteorologists as a Catalina Eddy, or coastal eddy, and forms when an upper-level air flow interacts with the rugged coastline and islands off southern California.

The interaction between low- and high-pressure systems—with offshore winds blowing from the north and coastal winds from the south—gives the marine stratus clouds a cyclonic, counter-clockwise spin. The eddy is named for Santa Catalina Island, one of the offshore Channel Islands between Los Angeles and San Diego.

Catalina eddies can bring cooler weather, fog, and better air quality into southern California as they push the marine boundary layer farther inland. These mesoscale eddy patterns can be up to 200 kilometres across and can last from a few hours to several days. They form most frequently between April and October, peaking in June.

A time-lapse video from the GOES-West weather satellite shows the evolution of the eddy over roughly eight to ten hours, and can be downloaded from the URL at the foot of this page.

NASA Earth Observatory image by Jesse Allen, using data from the Level 1 and Atmospheres Active Distribution System (LAADS). Caption by Michael Carlowitz

http://eoimages.gsfc.nasa.gov/images/imagerecords/80000/80591/goes_eddy_2013048.h264.mov

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.

GEO Helplines

Douglas Deans

Dunblane, Perthshire, 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

Surbiton, Surrey, ENGLAND.

Meteosat-9 advice: registering for the various MSG services, hardware and software installation and troubleshooting. John will also field general queries about any aspect of receiving weather satellite transmissions.

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

Geoff Morris GW3ATZ

Shotton, Flintshire, NE WALES.

Geoff has lots of experience with aerial, coax,connectors, mounting hardware etc. and has also done a lot of work with the orbiting satellites. Geoff has been a EUMETCast Meteosat-9 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@btoopenworld.com

Mike Stevens

Portland, Dorset, England.

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

- email: mikeg4cfz@gmail.com

Guy Martin G8NFU

Biggin Hill NW Kent, ENGLAND

Guy is prepared to advise anyone who wishing to receive **MSG/Metop** using Windows 2000 or XP. Can also help with networking and ADSL router setup.

- gmartin@electroweb.co.uk

Hector Cintron

San Juan, Puerto Rico, USA

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

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

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

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 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

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

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

APT Decoder

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

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

GEO-Subscribers

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

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

Satsignal

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

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

MSG-1

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

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

Copy Deadline for GEO Quarterly No 39 is Sunday, July 28

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

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

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

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

Images and Diagrams

Images can be accepted in any of the major bitmap formats: **JPG, BMP, GIF, TIFF** etc. Images in both monochrome and colour are welcomed. Line drawings and diagrams are preferred in WMF, EPS or postscript formats. We can also scan original photographs, negatives and slides.

Gridding, Overlays and Captions

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

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

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

Particularly large attachments (8 MB and above) can be transmitted via *YouSendIt*

www.yousendit.com

And finally . . .

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

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R2FU Weather Satellite Receiver for NOAA APT



This state-of-the-art, USB powered APT receiver for the NOAA satellites is also controlled via a USB port, so no longer requires a serial interface like its predecessors. It also features hardened filtering to overcome UK paggers.

UK members price - £210.60
UK non-members price - £230.60

DVBW DVB-S USB2102 Receiver



This DVBWorld **DVB-S USB-2** receiver is recommended for trouble-free **EUMETCast** reception. It is supplied with a GEO set-up CD containing software and instructions.

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

DVBW DVB-S2 USB2104 Receiver



This DVBWorld **DVB-S2 USB-2** receiver is also available for those who wish to receive FTA satellite HDTV on their computer (but not recommended for **EUMETCast** reception).

UK members price - £75.00
UK non-members price - £85.00

Sandpiper Turnstile Antenna



This high-quality turnstile antenna has been specially manufactured for GEO, for use in APT reception from the NOAA polar orbiting weather satellites.

UK members price - £65.00
UK non-members price - £77.50

Telestar 80 cm dish and Universal 0.2 dB LNB (or equivalent)



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

UK members price - £72.00
UK non-members price - £79.00

Current Price List

	Members' Prices			Prices for non-Members		
	UK	EU	RoW	UK	EU	RoW
R2FU APT Receiver	210.60	216.00	224.00	230.60	236.00	244.00
BNC Lead (0.25 metre)	5.50	6.25	6.75	7.50	8.25	8.75
UK Power Supply Unit (12 volt)	10.50	-----	-----	13.00	-----	-----
Sandpiper Turnstile Antenna	65.00	-----	-----	77.50	-----	-----
Dartcom High Quality QFH antenna	280.00	360.00	-----	300.00	380.00	-----
Bias Tee	25.00	25.50	26.00	29.00	29.50	30.00
GEO-PIC 1.0	7.00	7.80	8.40	7.00	7.80	8.40
Martelec MSR40 EPROM	10.00	10.75	11.25	10.00	10.75	11.25
DVB-S2 USB Receiver (DVBW 2102)	60.00	65.00	-----	70.00	75.00	-----
DVB-S2 USB-S Receiver (DVBW 2104)	75.00	80.00	-----	85.00	90.00	-----
Telestar 80 cm dish with LNB	72.00	-----	-----	79.00	-----	-----
Telestar 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) 2004-2012 (Annual compilations - state year)	8.00	8.80	9.30	n/a	n/a	n/a
GEO Membership (4 magazines p.a.)	25.00	35.00	40.00	25.00	35.00	40.00

All prices are in £ sterling and include postage and packaging

Ordering and Shipping

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

Orders should be sent by email to

tech@geo-web.org.uk

or made through theGEO Website at

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

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?

Subscription Rates (12 months, 4 issues, including P&P) for GEO Quarterly are

£25 (UK)
£35 (EU)
£40 (rest of world)

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.

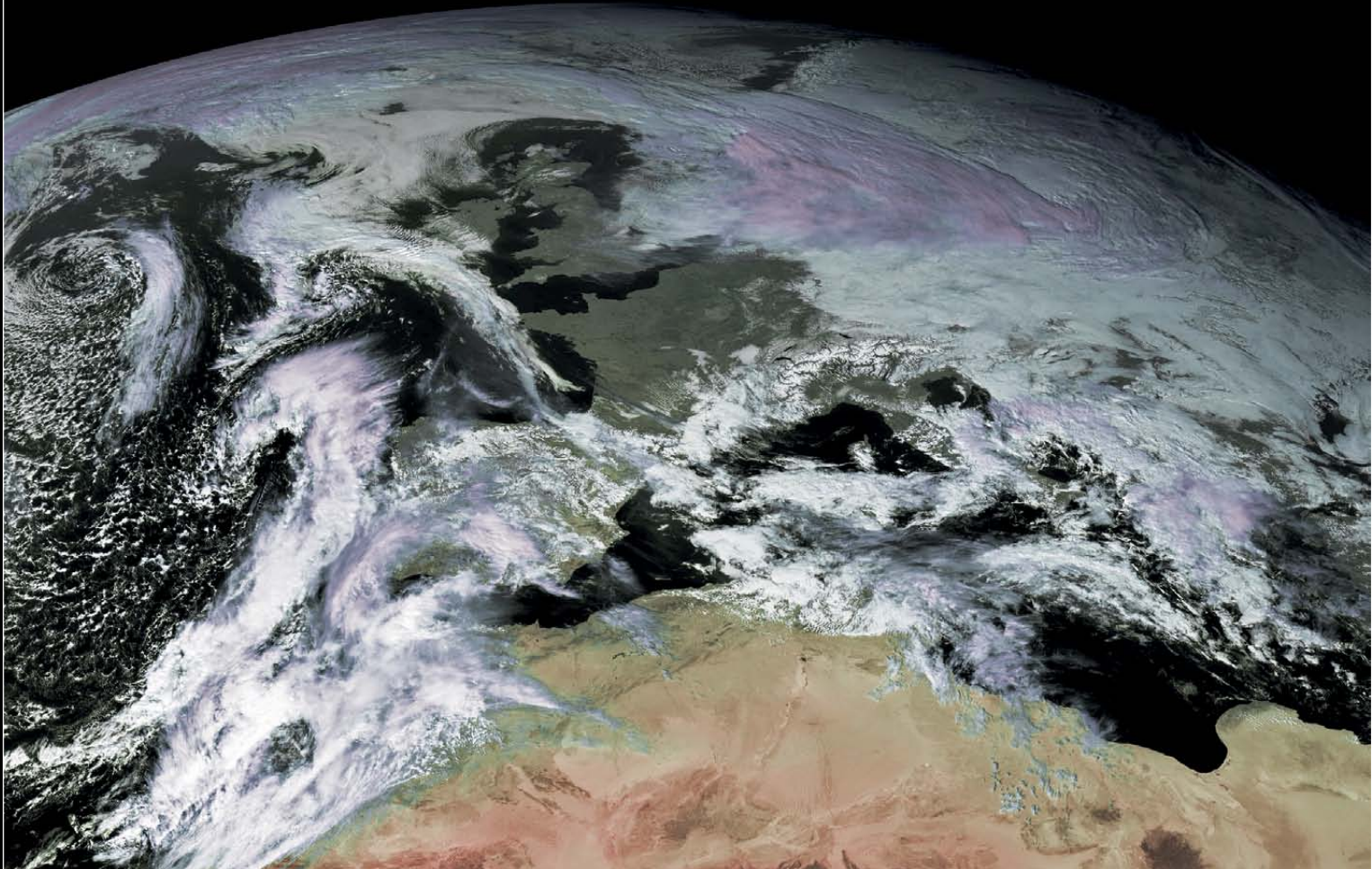
UK members price - £7.00
UK non-members price - £7.50

GEO Bias Tee

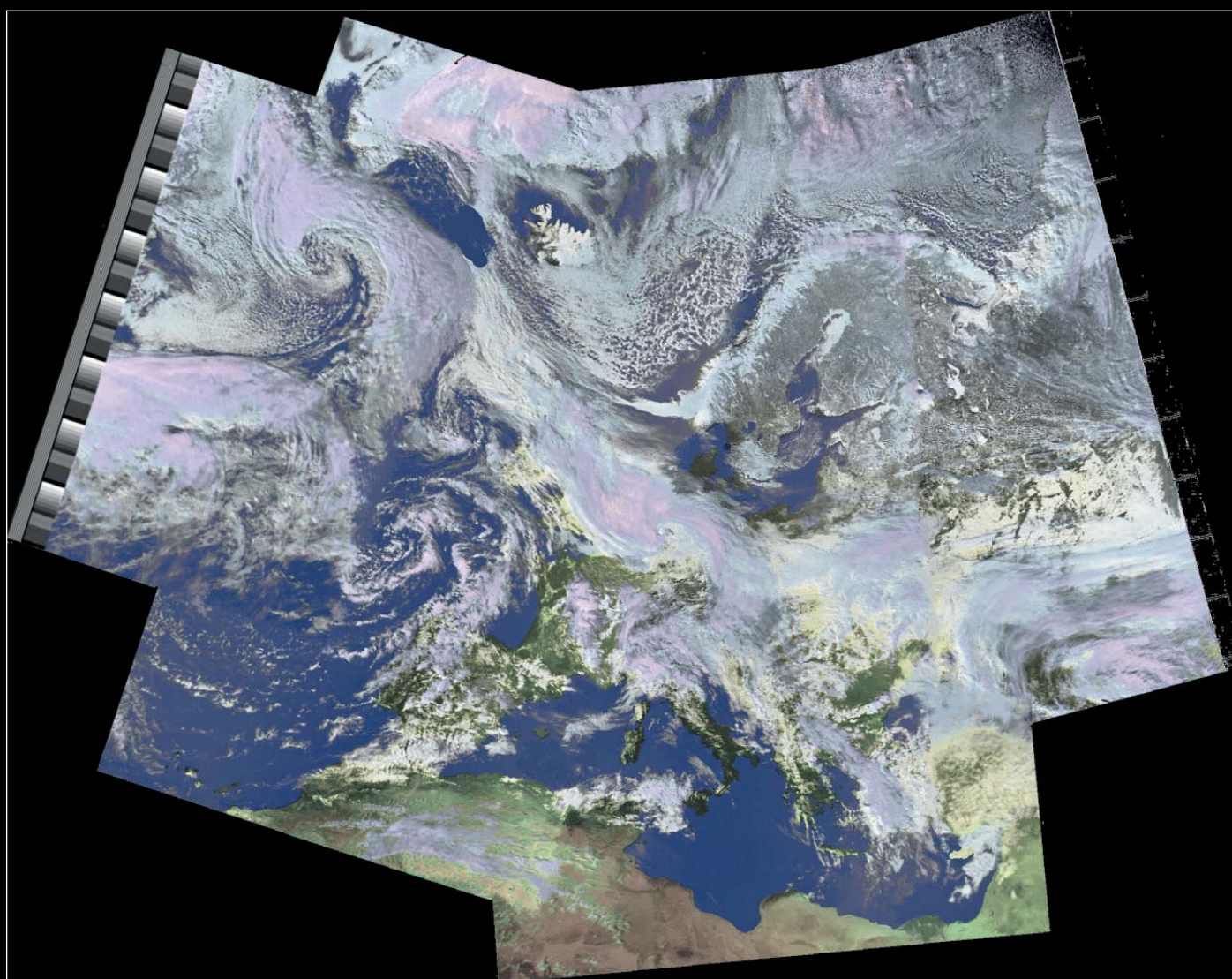


The Bias-Tee allows a mast-head preamplifier to be used with the 'Antenna 2' input of an R2FX or R2ZX. Only the 'Antenna 1' input normally feeds power to a preamp. The Bias-Tee now allows you to power twin preamps and maintain the receiver's Antenna Diversity feature.

UK members price - £25.00
UK non-members price - £29.00



This striking image from Meteosat-10, acquired at 13:30 UT on February 18, 2003, was downloaded via EUMETCast by Mike Stevens
Image © EUMETSAT 2013



This composite of four NOAA 18 passes on March 9 this year was produced by GEO member André T'Kindt from Ronse in Belgium

