The GEO Quarterly

Group for Earth Observation

Group for Earth Observation

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

34

June 2012

Inside this issue . . .

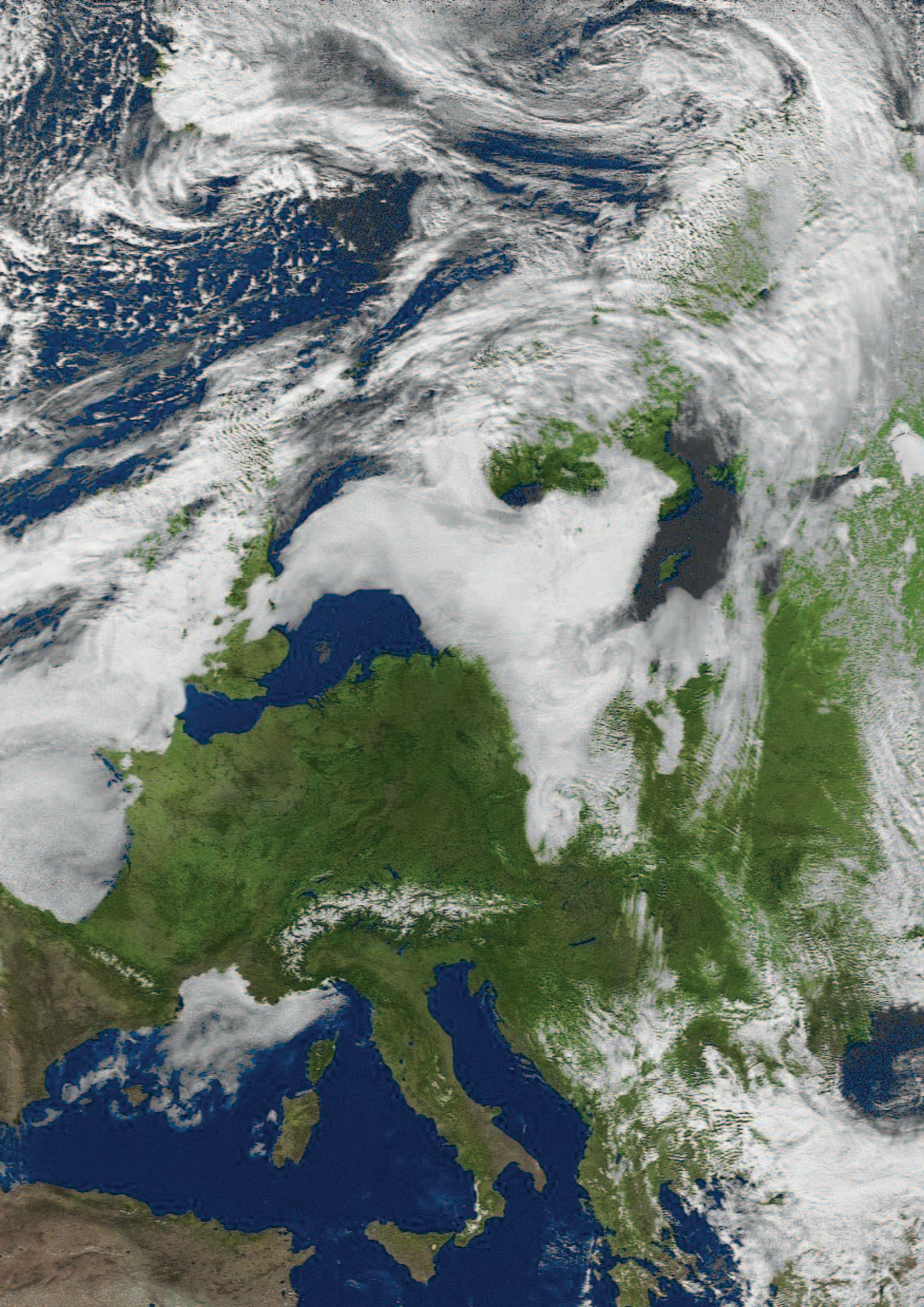
This image of the Aral Sea heralds a treatise from Les Hamilton describing the ongoing developments aimed at improving water flow in the Northern Aral Sea basin.

For the electronic constructors among you, there is a construction article from Guy Martin, who shares his experiences in building a barometer based on a readily available digital pressure sensor.

Esko Petäjä recently spent a holiday in Grand Canaria, where the EUMETSAT Maspalomas receiving station is located. Esko describes what he saw in an illustrated essay.

Several of the worlds volcanoes have been putting on a show in recent months: there are illustrated features on Shiveluch, Etna, Popocatépetl and Puyehue-Cordon.

... plus further articles on the Ganges Delta, Urban Heat Islands, Arctic Sea Ice, and Building a silent, Fanless EUMETCast PC.



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Editorial

Les Hamilton
geoeditor@geo-web.org.uk

It's been very much a race against time getting this issue of GEO Quarterly published on schedule. Francis Bell was on holiday during April and I set off on my own vacation on May 1, the day following copy deadline. The situation was not helped by a major lack of article contributions from the membership: no copy at all was received during the six weeks from mid-March till the end of April, normally the busiest period. As a result, there is much less to read in this issue, the shortfall being made up by increased use of imagery from NASA and NOAA sources. This really does beg the question: 'Is there any demand for GEO to produce an expensive glossy magazine these days?' With the membership now drifting down into the 300s, I have to ask myself if it's worth my output of over 100 man-hours of effort to produce each issue.

It would be interesting to learn your views on how to boost membership numbers, and also suggestions for sourcing expert articles relevant to the interests of GEO Quarterly readers.

Hot and cold are the underlying themes in this issue of GEO Quarterly, with several images of both volcanoes and the Arctic on view. You are reminded of the ongoing *Volcano Challenge*, where we are looking for readers' satellite images including volcanoes. This was intimated by Francis Bell in the March issue, and continues till the end of 2012. Please send your images featuring volcanoes, whether erupting or passive, to ***francis@geo-web.org.uk***. The best ones will be published in upcoming issues of *GEO Quarterly: y*ou can read more about this topic on page 7. Thus far, I haven't received any contributions from readers, but I'm hoping that Francis will find his mailbox bulging with volcanic imagery when he returns from holiday.

I'm indebted to John Heath for pointing me in the direction of a fascinating, new experimental satellite launched earlier this year from Hungary. You can read about this amazing miniature orbiter on page 35. And while on the subject of small satellites, I've included two recent images from Sich-2 on page 44: this satellite really is proving a revelation in terms of the quality of its output.

Not long before going to press came the disappointing news that ESA's flagship Earth orbiting satellite, *Envisat*, was in difficulties, all contact with the craft having being lost on April 8. At the time of writing there is still no definite news as to whether *Envisat's* systems can be restored, but the overriding mood seems to be one of increasing gloom. As a stop-gap measure, the Envi-Ham project continues, filling the void by transmitting older imagery that has not previously been seen. We will cover this situation, as the story unfolds, in the September issue of *GEO Quarterly*.

Contents

The GEO Report

From the Editor

With Francis on holiday during April, and myself likewise for most of May, this has created something of a vacuum as far as the *GEO Report* is concerned: so I've taken the initiative to prepare this short column to keep you up to date.

GEO's Main Event for 2012

Just before he left, Francis sent me an email to state that there would be no GEO Symposium as such this year. However, he was very much hoping that the forthcoming visit to **Surrey Satellite Technology's** new Space Centre (located in the Surrey Research Park, Guildford) on Friday, June 8, would become GEO's Main Event for 2012. We look forward to meeting many of you there.

SSTL is an independent British company which has specialised in the production and delivery of small satellites for over a quarter of a century. Their Space Centre is not open to the general public, and GEO's invitation to a guided tour of their new facilities is a unique opportunity. GEO also hopes to have the use of a meeting room with facilities for displays and demonstrations.

Everyone interested in joining GEO on this visit should register their details with Rob Denton, by email, to

international@geo-web.org.uk

so that you can be kept informed of developments. It is likely that further details of arrangements for this visit will appear on the GEO website nearer the time.

USB Receivers for EUMETCast

Early this year, the GEO Shop's supply of the popular DVB World USB receivers for EUMETCast reception became exhausted when our former supplier was unable to source new units. Locating a new supplier proved troublesome, and for some time the Shop was unable to provide members with a receiver. As you will see from this quarter's advert (page 48), the GEO Shop has at last sourced new stocks (of two different models). As yet, prices have not been ascertained but you can email this address for details and current prices.

tech@geo-web.org.uk

GEO Website

Readers who have visited the GEO website since mid-April should have been pleasantly surprised to find that it is in the process of a major makeover. We are indebted to Alan Banks for his hard work in taking the GEO web pages forward with a bright and breezy new look. You can read more about the website in a short article on page 18.

Envisat and the Envi-Ham Project

In early April, ESA's ground controllers suddenly lost all contact with *Envisat*, bringing to an end the flow of superbly detailed imagery enjoyed by readers who had signed up with the Envi-Ham project.

At the time of writing, ESA still has hopes of regaining control of *Envisat*, which remains in a stable orbit, but the signs are non too encouraging.

As an interim measure, though, the Envi-Ham project continues to provide image downloads, falling back on ESA's sizeable archive of imagery from earlier years, as yet unseen by users.

Cover and Full Page Images

Front Cover

This image of the Aral sea, captured by the MERIS imager aboard ESA's **Envisat** orbiter on October 15, 2011, was sent in by reader Mike Stevens, and inspired the article on the Aral Sea recovery programme, that begins on page 10.

Image: ESA

Inside Front Cover

Anthony Lowe from St Helens captured this fine **NOAA-19** APT image at 11:59 UT on March 15, 2012, showing North Sea fog covering the west side of the UK.

Inside Back Cover (upper image)

By way of contrast with the image on the front cover, Mike Stevens provided this **Envisat** MERIS image showing the Aral Sea in the process of shedding its winter coat of ice on March 21 this year.

Image: ESA

Inside Back Cover (lower image)

Another of Mike Steven's **Envisat** images from the Envi-Ham project, this one shows detail in the English Channel on March 6, 2012.

Image: ESA

Back Cover

This image showing the Netherlands in winter's icy grip is a segment from a MODIS image from NASA's **Terra** satellite dating back to February 10, 2012.

Image: NASA/GSFC, Rapid Response Team

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It's April 4, 2012, and NASA's **Terra** satellite captured this image showing the Arctic ice cap spawning a flotilla of ice floes as it started its seasonal break-up north of Svalbard in the Barentsz Sea.

Image: NASA/GSFC, Rapid Response Team

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The Kamchatkan volcano *Bezymianny* commenced an explosive eruption at 21:27 UT on March 8, 2012, ejecting a massive plume of ash to an altitude of almost nine kilometres, and which stretched 220 km to the northeast. This channel-2 AVHRR image was acquired by **Metop-A** exactly two hours into this eruption, and shows the ash cloud and its shadow on the snow-covered terrain very clearly. Interestingly, the volcano's name, Bezymianny, translates as 'volcano without a name'.

Image: NOAA CLASS Archive

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Fred van den Bosch sent in this beautiful **NOAA 15** APT image he acquired from Vietnam at 16:32 UT on February 23 this year.

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This MODIS image from the NOAA **Terra** satellite, acquired on February 8, 2012, shows the Arctic winter starting to relax its grip over northern Europe. Already there are signs of ice melting round the coastline of the White Sea and the Kanin peninsula.

Image: NASA/GSFC, Rapid Response Team

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This splendid **Envisat** MERIS image of part of the Arctic island of Spitzbergen was sent in by Peter Burden. Acquired during a rare cloud-free spell on March 25 this year, the low, late-afternoon sun highlights the mountainous nature of this island.

Image © ESA

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This superb image of cloud-free Great Britain was provided by David Taylor. A **NOAA-19** AVHRR image acquired from the 13:17 UT pass on March 26, 2012, it coincided with a massive area of high pressure that brought a record-breaking temperature of 24°C to northeast Scotland.

Image © EUMETSAT 2012

The Quarterly Envi-Ham Image

... and Quarterly Question

Francis Bell

This Quarterly Question is somewhat unusual because I don't know the answer myself—hence it may be more appropriately titled as the *Quarterly Query*.

The query relates to an *Envisat* image I received recently via the Envi-Ham project (right). I have to admit to being attracted to images which have some degree of a 'wow' factor associated with them; or perhaps I relate to them in some personal way when they come from a part of the world I know well or have visited. Often, my attraction is to images which may not have any special geographical, oceanographic or meteorological dimensions. In the northern winter, with Europe often cloud covered or dimly illuminated, I often find myself looking opportunistically at images of Africa or other parts of the world covered by Envi-Ham and EUMETCast transmissions.

This particular image covers part of southern Egypt and northern Sudan, and includes the conspicuous river Nile, made clearer because of the agriculture along its banks. I have cruised along part of the Nile from Luxor to Aswan and have also walked along a short section of the Aswan High Dam, hence my personal interest in this river. I also have memories of splendid views enjoyed while flying over Khartoum, which is located at the junction of the White and Blue Niles.

This Envisat image was acquired at 07:53 UT on January 28, 2012. The flooded region is centred approximately 18°45'N, 32°E and shows as a dark swelling on the Nile at upper left.
Image © EUMETSAT 2012

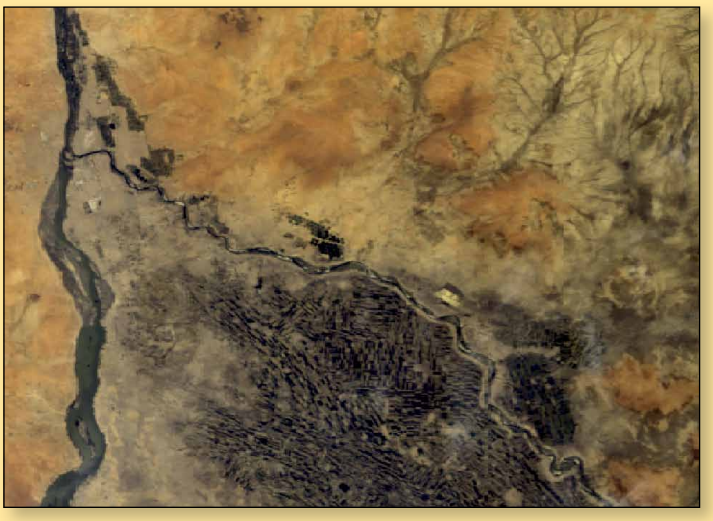
I looked in detail at the satellite image, identifying the courses of the Nile and other rivers. Areas of cultivation stood out clearly, showing in a darker colour compared with the lighter surrounding deserts. Also visible within the image are irrigation circles, identifiable by their darker colour and geometric layout. I understand that most of these circular areas support several crops of alfalfa per year. It's interesting to note the variation in the colour of these circles as crops grow and are harvested throughout the year.

However, what caught my eye in this image was what looks like a substantial water reservoir along the course of the Nile. I was not expecting to see such a feature because I know nothing about a dam or reservoir in this location. I zoomed in and out of the image and viewed different channel colour combinations, but ultimately came to the conclusion that what I was looking at was a large reservoir. I was sufficiently intrigued to investigate the area using my reference atlases and books containing satellite images of the area but could find nothing which illustrated my 'mystery feature'. I eventually came to the conclusion that the feature seen on the image is a consequence of a new dam construction with its associated reservoir; so new that it is not illustrated on maps or visible on old satellite images.

My research did reveal that the location of the apparent new reservoir is just upstream of the Nile's 'Fourth Cataract'. It occurred to me that heavy rain elsewhere in the Nile's catchment area could have generated elevated water levels such that the river was unable to negotiate the Cataract without backing up and producing local flooding.

I know that historically the Nile has periodic flood seasons with the receding water leaving deposits of fertile mud behind and that these floods were a vital factor for the fertility of lands close to the lower Nile. However, for better or worse, the construction of the Aswan High Dam has brought an end to these traditional flood seasons along this lower reach of the Nile. But what about a dam higher up the river?

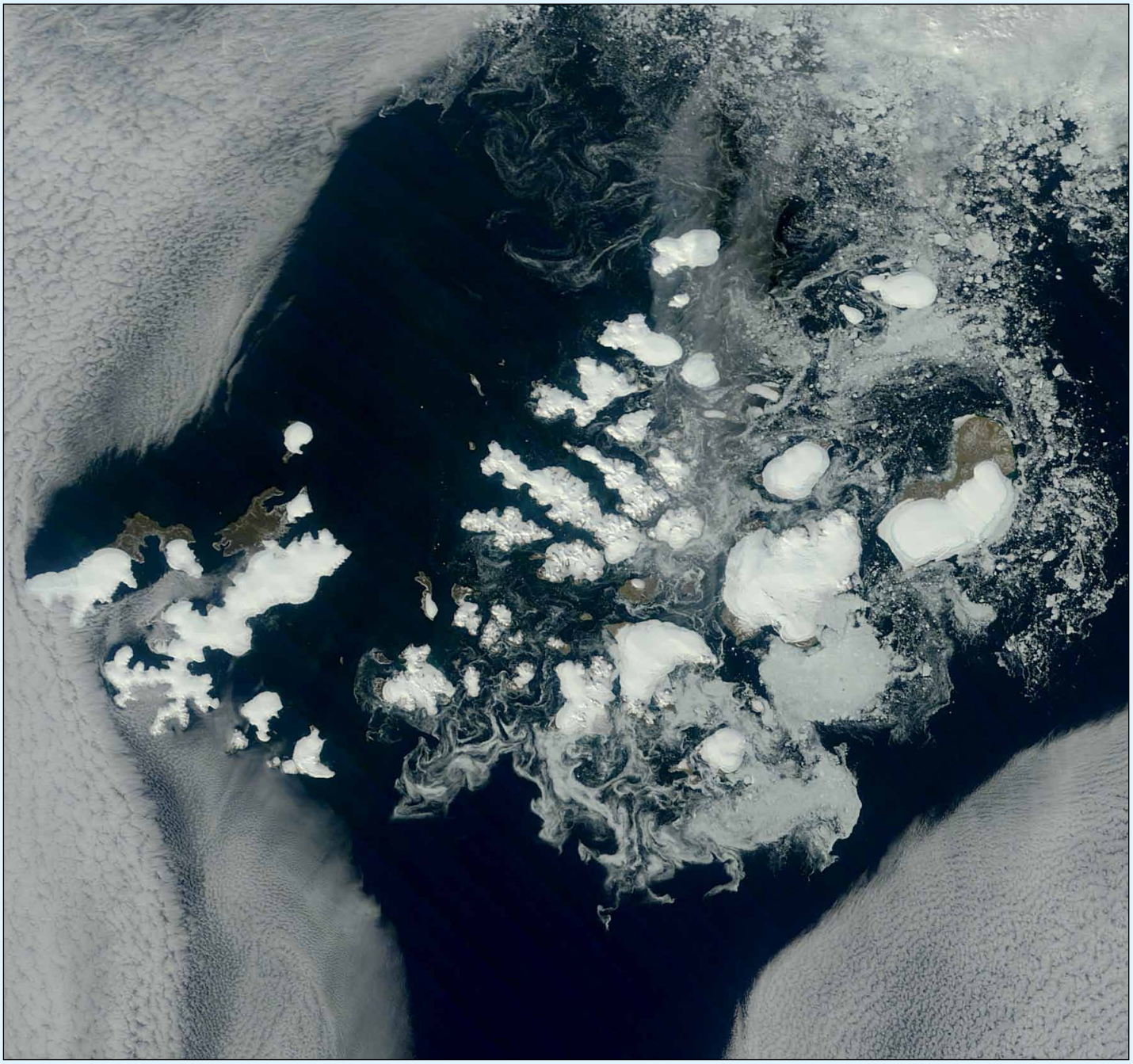
Please, can any reader tell me the background to the feature which looks like a reservoir just up-stream of the Nile's Fourth Cataract. Of course, I will watch this area in future satellite images I may receive, looking for changes which may indicate either seasonal flooding or a dam construction. Please write to the editor with your thoughts and explanations.



This an enlarged section of the above image showing the confluence of the White and Blue Niles at Khartoum. Agricultural patterns can be clearly seen.
Image © EUMETSAT 2012

FRANZ JOSEF LAND

A NASA Earth Observatory Report

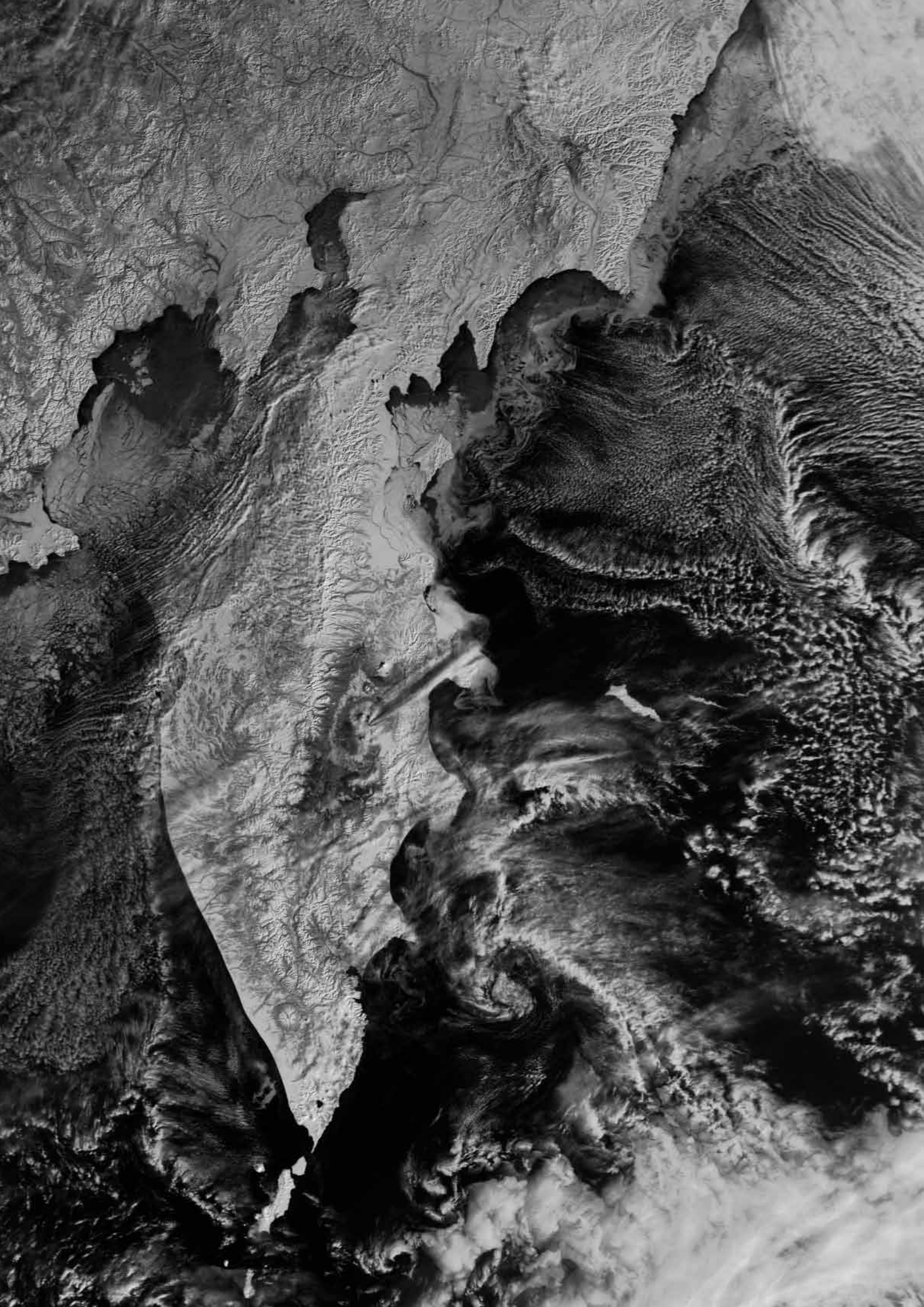


Russia's northernmost territory is Franz Josef Land, an archipelago of almost 200 islands at 80°N, straddling the Arctic where the Barentsz and Kara seas meet. Frequently shrouded by cloud and fog, the skies opened at the height of summer on August 17, 2011, to reveal this island group to the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Terra satellite.

Clouds fringe this natural colour scene, like curtains held back from a window. Around the islands, sea ice forms serpentine shapes of light grey and dull white. The glaciers that cap many of the islands are bright white. Situated about 1,000 kilometres from the North Pole, Franz Josef Land has a punishing climate with an average summer temperature of just 2°C: the highest temperature ever recorded was just 13°C. In winter, this average falls to -22°C: a low of -54°C has been recorded. Glaciers cover roughly 85 percent of the land and sea ice floats in the channels between the islands, even in summer.

In ice-free areas, land cover is pale brown, typical of tundra. The archipelago has been built from Tertiary and Jurassic basalts and, though predominantly ice-covered, there are some areas covered with moss, and supporting lichens and a few Arctic flowering plants such as the alpine saxifrage. Despite the harshness of the climate, Franz Josef Land does support limited native wildlife, mostly walrus, arctic fox, polar bear and seals and beluga whales. In summer, visiting birds include kittiwakes, fulmars, and gulls.

NASA image courtesy Jeff Schmaltz, MODIS Rapid Response, NASA/GSFC



Etna Erupts

John Tellick

Mount Etna, Europe's most active volcano, situated on the east coast of Sicily, erupted briefly during the night of February 8/9 following several eruptions during January 2012. Etna is one of three active European volcanoes, all in Italy: Etna, Stromboli and the 'infamous' Vesuvius, though this last has not erupted since 1944.

Italy is a volcanically active country, mainly due to the meeting of the Eurasion and African plates to the south of the country.

The satellite images from Metop-A, NOAA-19 and Meteosat-9 show the situation before, during and after the eruption.

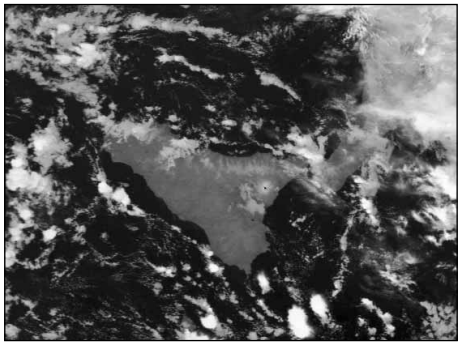


Figure 1
A Meteop-A channel-3 image acquired at 19:48 UT on February 8 shows a hot spot in the crater of snow-covered Etna prior to the eruption.
Image © EUMETSAT 2012

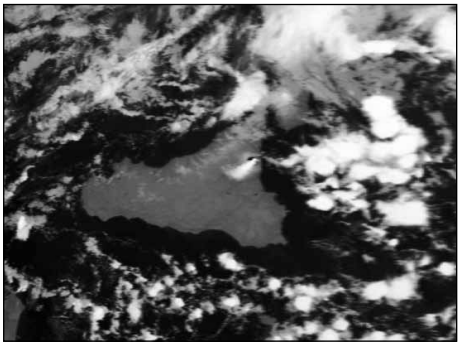


Figure 2
This NOAA-19 channel-3 image taken at 01:25 UT on February 9 shows an enlarged hotspot during the eruption, accompanied by an ash cloud
Image © EUMETSAT 2012

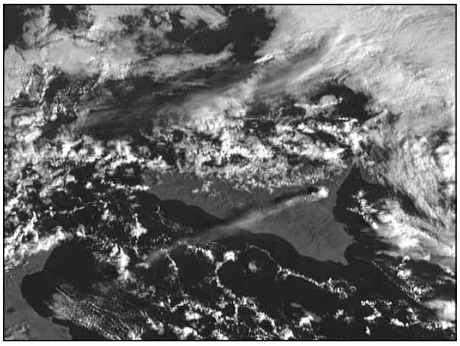


Figure 3
Meteosat-9 HRV 08:00 09-02-12, eruption ceased and cloud trail which remained for a few hours.
Image © EUMETSAT 2012

The Volcano Challenge

Francis Bell

El Pico del Teide

The image opposite is my own submission for the 'Volcano Challenge' announced in *GEO Quarterly 33*. The challenge is to submit a satellite image of any volcano, received live at home using APT, HRPT, EUMETCast or Envi-Ham (but **not** via Internet download). In my image of Tenerife in the Canary Islands, received via the Envi-Ham project, I was able to identify Pico del Teide, located close to the centre of the island. I have in fact seen this volcano while on a fishing boat midway between Gran Canaria and Tenerife, and it was an impressive sight: more so than my fish catch, which was zero. The high relief of the volcano can be assessed within the image by identifying the ring of cloud which surrounds the central peak. This peak is above the ring of cloud, which I would guess to be about half way up the volcano. Relief is not easy to quantify from a satellite image: shadows and snow cover help, but in this case the halo of cloud was a nice give-away.

I researched information relating to Pico del Teide, and discovered it to be 3,718 metres high. Impressively, if the height of the volcano were measured from the surrounding ocean bed, Pico del Teide is the third highest volcano in the world, only surpassed by Mauna Loa and Mauna Kea in Hawaii.

The last major eruption of Pico del Teide was in 1909 but it is still active today, and further eruptions, without a known time scale, are anticipated in due course. The Spanish authorities have created a National Park around Pico del Teide and this area is now well visited by tourists. In 2007 this area was designated by UNESCO as a World Heritage Site.

Further details of Pico del Teide and Tenerife, together with satellite images more detailed than mine, can be found on the Internet. Try the following as examples of places to look:

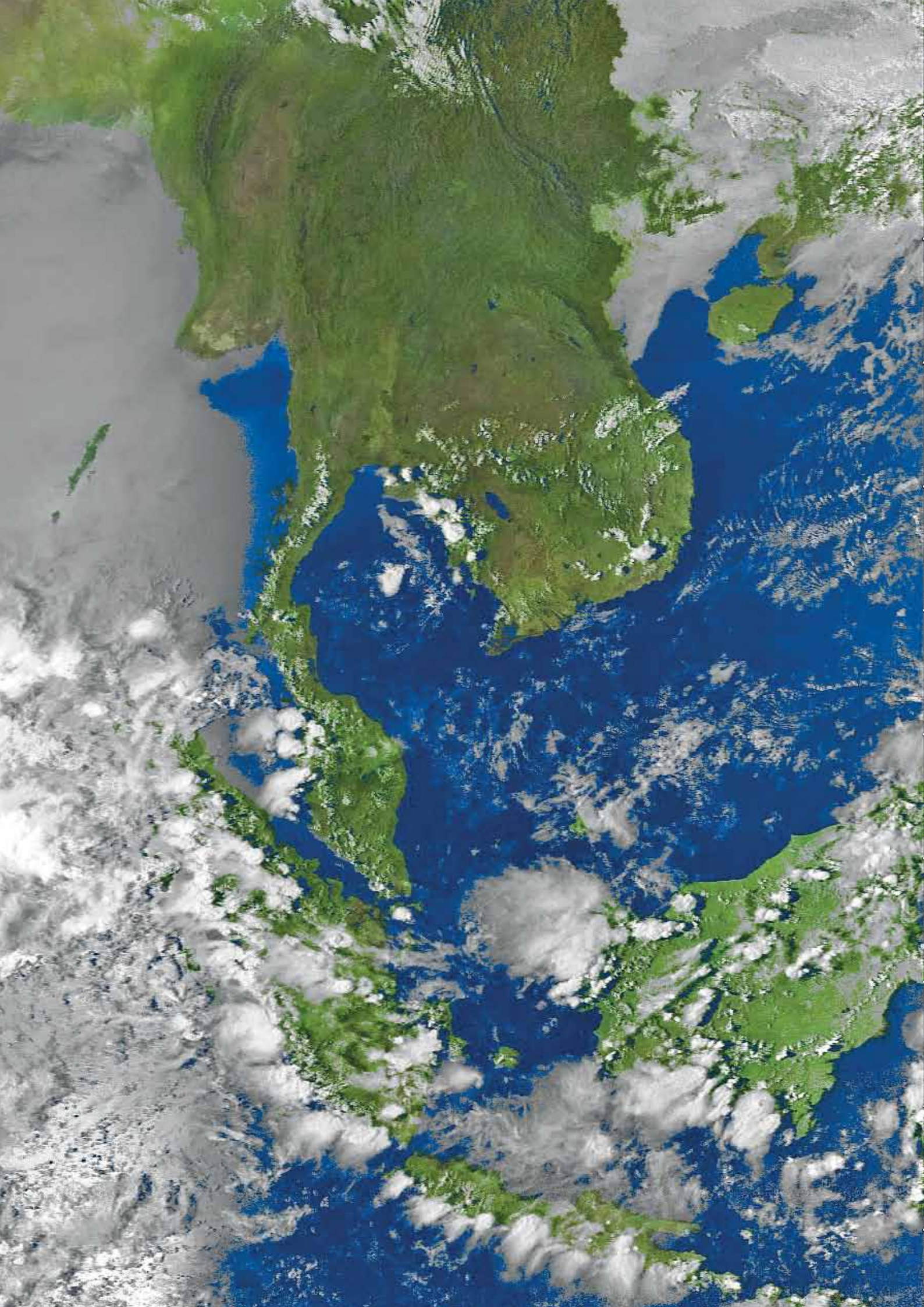
- http://earthobservatory.nasa.gov/IOTD/view.php?id=39621
- http://wikipedia.org/wiki/Teide
- or just try searches for 'Teide'.

Further Entries

All readers are reminded of the invitation to submit an image

This Envisat image of Tererife, with the central summit of Pico del Teide prominent, was received by Francis Bell using his Envi-Ham system, comprising a one metre dish, DVBWorld receiver and a modest computer running free software provided by ESRIN/ESA, on January 25, 2012.
Envi-Ham image © EUMETSAT 2012

containing a volcano (or perhaps several volcanoes) from anywhere in the world, acquired from any satellite. Please respond to this invitation to maintain interest in this topic. Our planet is so geologically active that this topic can never be exhausted.



Urban Heat Islands

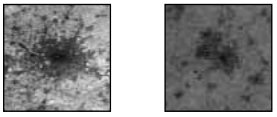
Robert Moore

On the evening of March 27, NOAA-16 produced this very fine channel-3 HRPT image as it passed over my station. What makes this image so special is that, even although it is entirely infrared, it nevertheless appears to give high resolution. We are all used to seeing 'heat islands' in images: areas where the concrete, tarmac and bricks of urban locations have warmed up and radiate infrared wavelengths back towards the satellite. But this particular image appears to show virtually every small town in the UK.

Furthermore, the image actually enables us to distinguish the 'hotter' inner areas of the cities from their cooler outer suburbs. This can be clearly seen in the inset images of London and Birmingham, and similar differentiation is apparent for Manchester and Paris, although not quite so markedly.

Among the very small towns, my own, Holywell, is only about two kilometres square, but it can just be seen as a tiny black dot in the original image on screen. This image was so striking that I dropped a copy into the local secondary school, where I am a governor, suggesting it might be used for a geography test. The image is now on display in the Geography Department.

How did this exceptional image come about? I think there were at least two factors at work. Firstly there was a seasonal factor: it was at the end of winter, and the ground temperature was 8.5° on the 27th. The UK had just experienced a short spell of very hot weather, with high pressure and cloudless skies. The maximum air temperature from the 24th to the 26th was above 19°C at my weather station, and on the 27th it reached 21.3°C. Thus, I suspect, the urban areas had heated up very rapidly while the ground was only just beginning to warm. This maximised the temperature difference between town and country. In mid-summer, when the land has warmed, there would be a smaller difference, thus rendering the smaller settlements in particular, less visible. Secondly, the air was very dry and clear, giving optimum viewing conditions down from space. NOAA-16 does not always give the best of images, but on March 17, it excelled itself.



Close-up (x2) images of the London (left) and Birmingham heat islands.

Syr Darya Control and Northern Aral Sea Project

Les Hamilton

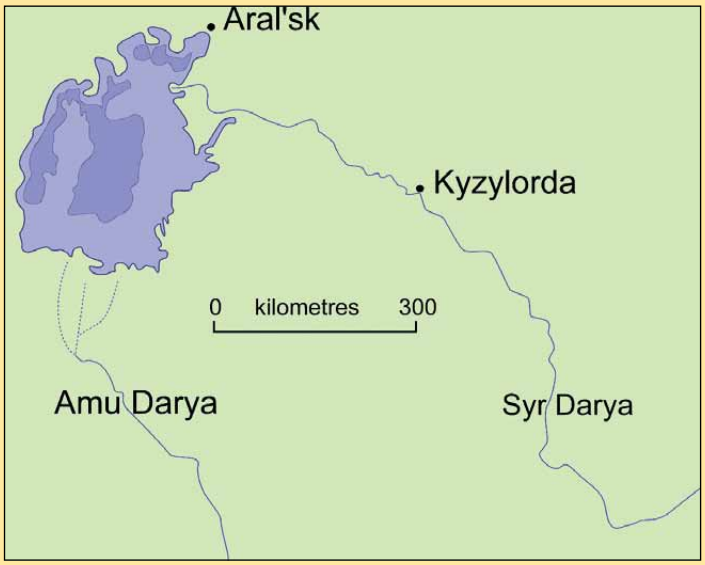
Reader Mike Stevens is one of GEO's ever-growing band of Envi-Ham enthusiasts, who uses the project to download some of the spectacular imagery acquired by ESA's *Envisat* advanced polar-orbiting Earth observatory. Mike sent in the image of the Aral Sea that graces the front cover of this issue. Dating back to October 15, 2011, the image shows clearly the contrasts between the three remaining sections of the Aral Sea, once the world's fourth largest lake.

The Aral Sea has been featured previously in *GEO Quarterly* [1,2,3]. Mike's timely image, the fact that it is now two full years since the Aral Sea was last discussed in our pages, and a report from NASA detailing ten years of *Terra* observations of the sea, provided me with the impetus to investigate its current status.

The Aral Sea Catastrophe

The Aral Sea, which half a century ago was the world's fourth-largest inland lake, is located in the desert east of the Caspian Sea. It is fed by central Asia's two great west-flowing rivers, the Syr Darya in the north and Amu Darya in the south (Map 1). These rivers annually channel glacial meltwater from the Tian Shan mountains into the Aral Sea.

During the 1960s and 1970s, the Soviets built massive dams and canals to extract water from the Amu Darya and Syr Darya for irrigation, primarily directed towards extensive cotton fields in the deserts of central Asia. By 1980, the Aral had shrunk to just 17% of its original surface area and 9% of its former volume, the water becoming so salty that the twenty or so endemic species of freshwater fish had died out. Salt and dust from pesticide and fertiliser residues left on the exposed sea floor were spread far and wide by winds, resulting in severe health and environmental problems. In the early 1960s, a flourishing fishing industry was the mainstay of the local economy, an annual catch of 22,000 tonnes of fish providing employment for 3000 people at the Aral'sk fish processing plant. By 1980 the annual catch was down to 2300 tonnes and, faced with unemployment, many families in Aral'sk and its surrounding villages relocated to the city of Kyzylorda, 450 kilometres away. Figure 3 is a *Landsat* image showing the Aral Sea as it appeared in 1973, before its decline began in earnest.



Map 1
The Aral Sea Basin, with its feeder rivers the Syr Darya and Amu Darya. The 2003 Aral Sea shoreline is shown, shaded darker blue.

Figure 1 - An abandoned ship, high and dry on the seabed near Aral'sk.
Photo: Christopher Staeker / Wikimedia Commons

Figure 2 - This *Landsat* mosaic shows the Aral Sea in 1973, before its area became significantly reduced by water abstraction from its feeder rivers.
Image: NASA/USGS

By 1990, damage to the Aral Sea was so severe that it had split into two parts: the *Northern Aral Sea* in Kazakhstan and the larger *Southern Aral Sea,* shared with Uzbekistan. The desiccation of the Aral basin resulted in serious economic, social and environmental damage. Fresh fish production virtually disappeared as the salinity and pollution levels rose, and tens of thousands of jobs were lost in the fishing, agriculture and service sectors. Many ships were abandoned high and dry on the exposed seabed, and simply left to rust (figure 1).

The North Aral Sea Project - Phase 1

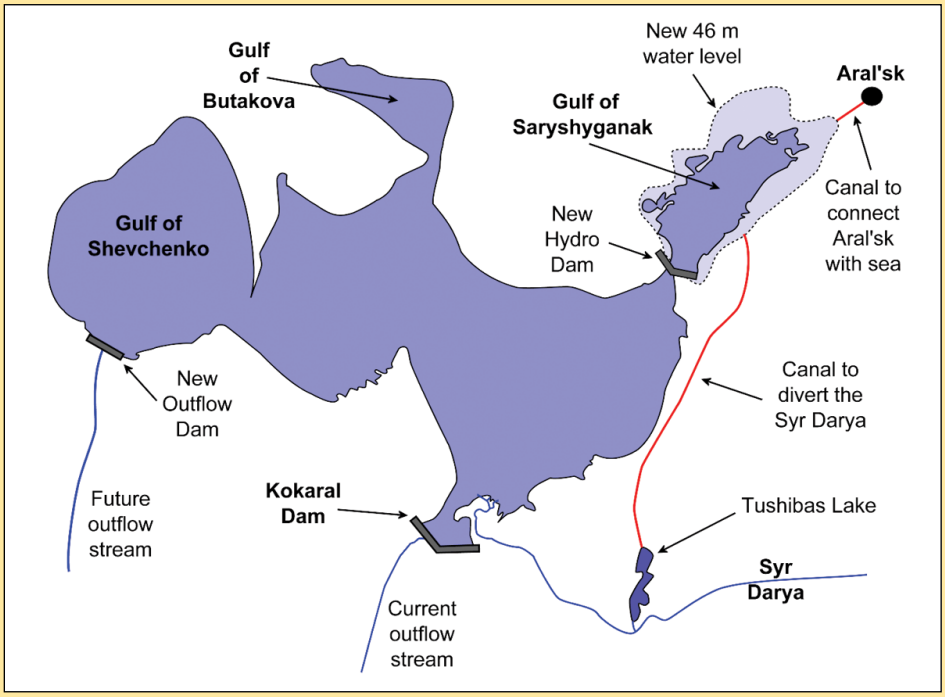
In June 2001, the *World Bank* approved a loan of US$64.5 million towards the *Syr Darya Control and Northern Aral Sea Project*, with the primary aims of increasing agriculture and fish production along the Syr Darya, securing the continued existence of the Northern Aral Sea, and improving ecological conditions in its basin. With the Kazakh government providing the balance of the $85 million finance required to undertake the project, work finally got underway in 2003. By this time, the Aral Sea's shoreline had receded more than 100 kilometres from Aral'sk, and its water level had dropped from an original 53 metres above mean sea level in 1960 to just 30 metres asl.

Figure 3 - The Kokaral Dam
Photo: David Trilling - EurasiaNet.org

Figure 4 - Water pours through the Kokaral spillway
Photo: Panoramio / GoogleEarth

The dominant feature of the recovery scheme was the construction of the thirteen kilometre long *Kokaral* dam—an extensive concrete levee, or dyke—which was completed in August 2005 (figure 3). This barrier effectively ended the spillage of water through the Berg Strait into the Southern Aral Sea, thus allowing the Northern Aral Sea to recover. The dam contains hydraulic gates and spillways (figure 4) which prevent it overflowing by discharging excess water to the south. This maintains the sea's level at the desired 42 metres above mean sea level.

The dam alone was not sufficient to effect recovery of the sea. It was also



Map 2 - Map of the Northern Aral Sea highlighting the Phase-2 strategy.

essential to undertake measures to ensure that more fresh water entered the Northern Aral Sea by increasing the flow capacity of the Syr Darya through:

- building several new dams on the river,
- repairing and improving irrigation works upstream,
- restoring existing flood barriers and building new ones to reduce water loss,
- straightening the river bed at strategic points, and
- restoring fishing lakes in the delta region, to serve as hatcheries from which to restock the Northern Aral Sea's fish population.

Devastating winter floods had long been a regular occurrence throughout long stretches of the lower Syr Darya valley, and particularly severe episodes in recent years had displaced thousands of people from affected areas and caused millions of dollars worth of damage. Water that should have reached the Aral Sea was spilling out of the river and being lost. With the completion of the first phase of the recovery project in 2008, not only was there much improved irrigation for farmland within the river basin, but even more importantly, a significantly increased flow of water was now entering the Northern Aral Sea each year.

It was originally anticipated that the Northern Aral Sea would not rise to its projected 42 metre level for about five years but, just eight months after the dam's completion, during the summer of 2006, water was already being released over the Kokaral's spillway. The dam had raised the surface of the Northern Aral by eight metres and increased its area by 30%. Salinity had dropped by half and freshwater fish such as pike, perch, carp and catfish (which had taken refuge in the Syr Darya), were making their way back into the sea. Progress continued apace, and by early 2008 the Northern Aral Sea had risen the full twelve metres above its 2003 low point to reach the 42 metre benchmark, helping to restore deltaic and riverine wetland ecosystems and promoting a rapidly increasing fish population.

Now, six years after the Kokaral Dam's completion, the Northern Aral Sea, which had receded almost 100 km south of the port of Aral'sk, stands just under 25 km away, and its surface area has increased from a low point of 2,550 km^2 to 3,800 km^2, an increase of 50% over its 2003 area. The fish biomass in the Northern Aral Sea has jumped from 3,500 tonnes to 18,000 tonnes and, although fishing is strongly regulated, fishermen are now landing 6,000 tonnes annually.

Figure 5 - A woman shows off one of the fish caught that day in a fish shop in Aral'sk
Photo: David Trilling - EurasiaNet.org

Before the dam was built, people were leaving the region in droves; now they have started returning. New houses, schools and hospitals are being built in villages throughout the area. In

2008, a new fish processing plant that opened in Aral'sk, with a design capacity of 8,000 tonnes per year, has created 41 new jobs. A billboard outside Aral'sk, official population 30,434 in 2011, proclaims '*Good News—The Sea is Coming Back*'.

The North Aral Sea Project - Phase 2

Soon after the first phase of the Northern Aral Sea Project was declared complete in 2008, the president of Kazakhstan stood on the Kokaral Dam and committed to a five-year, $250 million project that would eventually bring the Northern Aral Sea, still over 20 kilometres distant from Aral'sk, back to the town's harbour. The *World Bank* would again assist with funding, though the major share of the cost would fall to Kazakhstan, financed by revenues from the nation's oil fields (Kazakhstan is expected to double its oil output and become one of the world's top ten oil-producing countries by 2020).

The key premise of the second phase of the project (Map 2), to be actioned between 2010 and 2015, is to further increase the level of the Northern Aral Sea from its current 42 metres to 46 metres, by:

- Constructing a 10.3 kilometre dam and hydro-electric scheme which will isolate the Gulf of Saryshyganak (on which Aral'sk stands) from the main body of the Northern Aral Sea,
- Excavating a 46 km adduction canal from the Syr Darya through Tushibas lake, to fill the Gulf of Saryshyganak and raise its water level to 46 m. The red line in Map 2 shows the course of this canal and the dotted outline indicates the new extent of water in the Gulf.
- With the enlarged Gulf still not bringing the sea to Aral'sk, a 100 metre wide canal will be built to span the final 23 kilometres to reconnect the city with the water, thus restoring its status as a port. This will not be quite the major task it seems because a natural channel already exists: it just needs to be deepened and widened;
- Increasing the height of the Kokaral Dam to between 48 and 50 metres, a move that will eventually raise the surface of the sea by up to six metres and expand its surface from 5440 km^2 to 8000 km^2.
- The spillway which discharges excess water into the Southern Aral Sea will be relocated from the Kokaral Dam to the Shevchenko Strait, which leads south from the Gulf of Shevchenko (the western lobe of the Northern Aral Sea). Here, an additional dam will be constructed to contain the expanded Northern Aral Sea.

It is estimated that this plan will ultimately more than double the volume of water in the Northern Aral Sea from 27 km^3 to 59 km^3.

The plan will bring additional benefits, as the dry bed of the Gulf Saryshyganak is considered to be the main source of the frequent toxic salt, dust and sand storms that beset the Aral'sk region. Flooding this large area, which includes the most critical areas with a high salt content, should alleviate this problem. Furthermore, flooding the Gulf with river water and then discharging its contents through the new dam into the Northern Aral Sea will improve the mixing between salt water in the sea and incoming fresh water from the Syr Darya.

At present, fresh water from the Syr Darya enters the sea very close to the Kokaral Dam (Map 2). As a result, this water does not mix well with the main body of water in the Northern Aral Sea: significant quantities are simply lost through the dam spillways into the Southern Aral Sea. By diverting this fresh water to flow through the entire width of the Northern Aral Sea, from east to west, before exiting via the Strait of Shevchenko, more complete mixing will be assured: this will create a better chemical balance in the sea, allow fresh-water fish species to breed more successfully, and reduce salinity from the current 13-16 g/l to between 2.5 and 3.0 g/l.

It was originally hoped that phase-2 of the Aral Sea Project would bring shipping back to Aral'sk by 2013, but such is the current pace of progress that this now seems unlikely to happen much before 2018.

Flood Control on the Syr Darya

Another major problem that had to be addressed in parallel with work in the Aral Sea Basin was the annual winter flooding of the Syr Darya. This 2112 kilometre-long river rises in the Tian Shan Mountains of Kyrgyzstan and eastern Uzbekistan but, by the time it reaches Kazakhstan, it is meandering along a shallow course through a vast plain filled with sand dunes bordering the eastern and northern edges of the Kyzyl Kum Desert. In winter and spring, this region frequently experienced serious flooding when the river overflows its banks.

Water levels in the Syr Darya are usually at their highest in winter, particularly during January and February. This results when dams higher upstream in Kyrgystan release their contents to generate much needed hydro-electricity. The maximum flow rate that the river can sustain without overflowing is 700 cubic metres per second. When the flow rate exceeds this, the river starts to shatter its crust of ice, creating ice jams which result in floods. In times of snowmelt or heavy rainfall in the catchment area, large regions are susceptible to inundation as the river simply overflows its banks. Figure 6 is a false colour MODIS image dating from March 2, 2004, where floodwater in the Syr Darya shows dark blue and black while ice and cloud are depicted in cyan.

Between February 21-22, 2008, southern Kazakhstan suffered its worst floods since 1969 when the already increased winter flow was suddenly augmented following a sudden increase in temperature accompanied by heavy rain, which caused rapid snowmelt throughout its catchment area. The Syr Darya flooded 48 settlements, inundating 2,345 houses and demolishing 259 buildings

... continued on page 14

Satellite Observations of the Aral Sea

The Aral Sea has been a subject of regular scrutiny by NASA, through its *Landsat* and *Terra* satellite programmes. Recently, in a celebration of ten years in orbit, NASA released the set of images of the Aral Sea reproduced opposite. These depict the ongoing process of desiccation throughout the sea and also the recovery of the North Aral from 2006 onwards. All the images cover the basin of the original Aral Sea. The 1973 *Landsat* image in figure 3 displays exactly the same region and indicates just how severe the loss of water has been in recent decades.

Of course, the process of desiccation relates to climate on a wider scale, exemplified by the images for the years 2009-2011. Fed primarily by the Amu Darya, the eastern basin of the South Aral all but disappeared in 2009, following four years of drought in its catchment area which slowed and eventually curtailed the river's flow into the sea. In 2010, the drought broke and water swelled the eastern basin once again. But in 2011, less water entered the basin, which fell to its lowest level (apart from 2009).

Even if efforts were made to restore the Southern Aral Sea, it is unlikely that the it could recover in the short term; more than 50% of the flow of the Amu Darya would have to reach it to bring the sea back to life. This water, however, is needed to grow crops to feed the populations of Uzbekistan, Turkmenistan, Kazakhstan, Afghanistan, and Tajikistan. While improvements in irrigation efficiency could restore some water to the sea, this would not be enough for a full recovery.

The South Aral Sea is equally unlikely to dry up entirely though. The sea will always receive a modicum of water from rain and snowmelt, irrigation runoff, and ground water. As demonstrated from 2010 to 2011, year-to-year fluctuations in precipitation also have a big influence on the sea's extent, particularly in the shallow eastern basin.

NASA's EOS AM-1 Satellite, *Terra*, Tracks Ten Years of Change

A NASA Earth Observatory Report

On December 18, 1999, NASA launched its first Earth observing satellite EOS AM-1, better known as '*Terra'*. This series of images from *Terra's* Moderate Resolution Imaging Spectroradiometer (MODIS) documents changes in the Aral basin throughout the past decade. In 2000, the lake was already just a fraction of its 1960 extent (black outline), and the Northern Aral Sea had separated from the Southern Aral Sea, the latter now split into eastern and western lobes that remained tenuously connected at both ends. By the decade's end, the southern connection had been severed after the shallower eastern sea retreated rapidly. Especially large retreats in the eastern lobe of the Southern Aral Sea occurred between 2005 and 2009, when drought limited, and finally cut off, the flow of the Amu Darya. Water levels increased in 2010 after the drought broke but began to dwindle again in 2011.

August 25, 2000

August 15, 2001

August 20, 2002

August 12, 2003

August 16, 2004

August 12, 2005

August 15 2006

August 16, 2007

August 18, 2008

August 16, 2009

August 26 2010

August 15, 2011

http://earthobservatory.nasa.gov/Features/WorldOfChange/aral_sea.php

and eight schools. Two bridges were destroyed and large sections of roads washed out. There was only one fatality, but 12,744 people had to be evacuated from their homes, losing almost all their possessions, including cattle, poultry and food reserves. The damage was estimated to have cost $125 million. The pink shading in Map 3 illustrates the extent of the 2008 flooding. Unfortunately, due to persistent cloud cover, there is no satellite image of this event.

As hundreds of thousands of people live along the flood plains of the lower Syr Darya, and in view of the enormous cost of reparations, the Kazakh government realised that decisive action was called for. A gigantic new flood-control reservoir at Koksaray was commissioned to combat the flooding threat, and construction began in June that very year. With speed very much of the essence, a workforce of two thousand set about building a 44 kilometre long, 7.7 metre high retaining dam designed to hold 460 square kilometres of water to a depth of 6.5 metres. Construction of the Koksaray reservoir was completed on schedule in December 2010, and the final concreting of the back slope of the dam was carried out the following January. It was planned to abstract up to three billion cubic metres of water (that's three cubic kilometres) between January and March.

The Koksaray reservoir is a buffering facility and is only intended to operate for a maximum of two months in each year. When the winter flow-rate of the Syr Darya exceeds the critical 700 m^3/s, water will be abstracted into the holding reservoir to reduce the flow to a safe level. The accumulated water will then be released gradually, during subsequent months, to augment the river's flow during the dry season and meet the needs of agriculture, as well as assisting in reviving the Aral Sea.

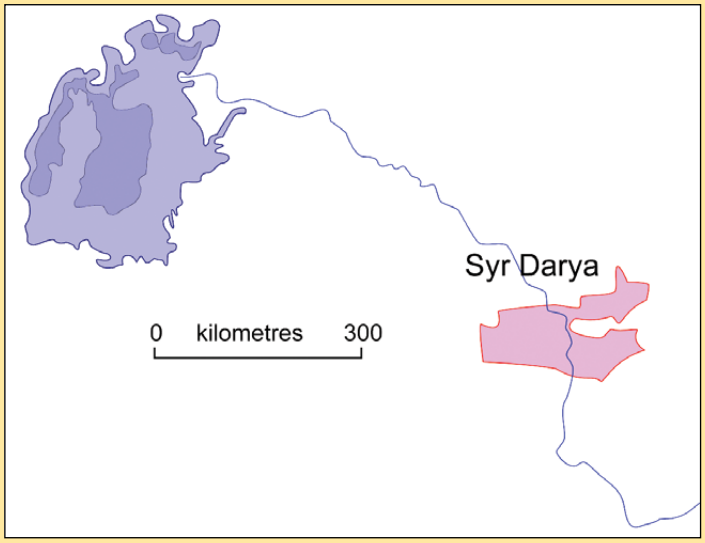
By early 2011, the reservoir was storing two billion cubic meters of water and had already proved its worth by preventing floods in southern of Kazakhstan that year. Once the dam is fully commissioned—some time during 2012—it will have a holding capacity of three billion cubic metres of water.

In the past, when the Syr Darya flooded, much of the overflow spilled into the Kyzyl Kum Desert where it was lost forever, the desiccated terrain simply acting as a giant soakaway. Now, following improvements to flood embankments along the river, these losses are being reduced to further improve the flow capacity of the Syr Darya, ultimately making more water available to replenish Saryshyganak Bay and the lakes in the Syr Darya delta.

The Southern Aral Sea

As the MODIS images on page 27 clearly show, the Southern Aral Sea, most of which lies in poorer Uzbekistan, is being largely abandoned to its fate. Uzbekistan shows no interest in restoring the flow of the Amu Darya into the sea, preferring to continue the river's exploitation as a source for the irrigation of its cotton fields. Rather, the Uzbeks currently view the dried out sea bed as a resource for the extraction of oil and gas. In August 2006, the Uzbek government announced that they had signed a production agreement with an international consortium of petrochemical companies to explore for oil and gas in the Aral basin. Following initial drillings, a preliminary estimate suggested natural gas reserves of at least eleven billion cubic metres.

All is not gloom, however. In October 2011 the UN Economic Commission for Europe (UNECE) announced an initiative whereby it aims to reverse environmental degradation in the Southern Aral basin by working with the governments of Kazakhstan, Turkmenistan and Uzbekistan to clothe tens of thousands of hectares of the dry bed of the Southern Aral Sea in forests. This will stabilise the dried out sea floor and help to reduce the 70 million tonnes of sand, salt and dangerous chemicals lifted from the bed of the Aral Sea into the atmosphere every year by the wind.



Map 3 - The area inundated by the devastating 2008 floods is shown in pink.

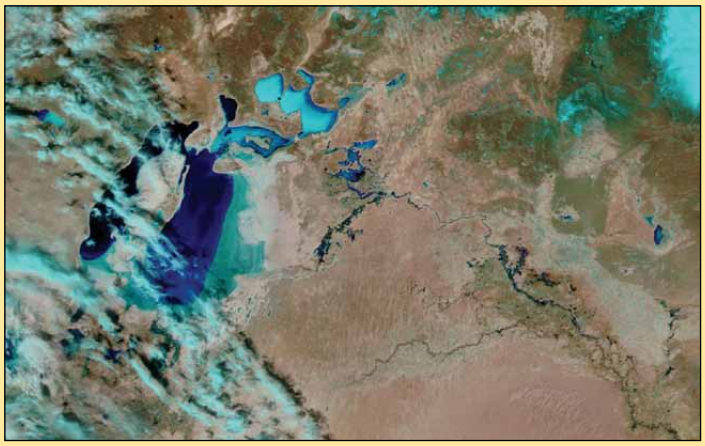


Figure 6 - The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's *Aqua* satellite acquired this false colour image showing flooding along the Syr Darya on March 2, 2004.

Credits

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

Much of the textual information in this article has been acquired from contemporary Russian websites, from *Eurasianet.org* and *Kazakhstan Today.*

References and Further Reading

1 Aral Sea - GEOQ 16, page 25 (2007)
2 Aral Sea Update - GEOQ 18, page 32 (2008)
3 Northern Aral Sea Rides Wave of Optimism GEOQ 24, page 27 (2009)
4 Aral Sea - http://en.wikipedia.org/wiki/Aral_Sea
5 Aral Sea - http://ru.wikipedia.org/wiki/Аральское_море
6 The Aral Sea Crisis http://www.columbia.edu/~tmt2120/introduction.htm

Erratum

In GEO Quarterly No 33, the resolution of Sich-2 was incorrectly stated on page 32, paragraph 2, as 8 kilometres per pixel.

The correct figure should have been 8 metres per pixel.

Oldest Arctic Sea Ice is Disappearing

A NASA Earth Observatory Report

Mean Arctic Sea Ice during the three months from November 1, 1979 till January 31, 1980.
Image by the NASA Scientific Visualization Studio based on data from the Special Sensor Microwave Imager/Sounder of the Defense Meteorological Satellite Program.

A recent report in the *Journal of Climate* in February 2012, authored by NASA scientist Joey Comiso, has highlighted as never before the dramatic decrease in Arctic Ocean sea ice over the past 32 years. A senior scientist employed at NASA Goddard Space Flight Center, Maryland, he found that the oldest and thickest Arctic sea ice has been disappearing at a faster rate than the younger, thinner ice at the edges of the ice cap. This rapid disappearance of older ice makes the Arctic Ocean's ice cap more vulnerable to further decline.

The images on these pages show sea ice coverage in 1980 and 2012, as observed by passive microwave sensors on NASA's *Nimbus-7* satellite and by the Special Sensor Microwave Imager/Sounder (SSMIS) from the Defense Meteorological Satellite Program (DMSP). Multi-year ice is shown in bright white, while average sea ice cover is shown in light blue to milky white. The data shows the ice cover for the period of November 1 through January 31 in these respective winters.

Types of Sea Ice

There are three basic types of Arctic sea ice. There is the young seasonal ice which is formed during the winter: this ice is thin, and typically melts completely again the following summer. Secondly, there is perennial ice, ice cover that has persisted beyond at least one summer. Finally, comes the thickest ice, termed multi-year ice, which will have survived through two or more summer melt seasons. All multi-year ice is of course perennial ice, but not all perennial ice is multi-year ice.

Quantifying Sea Ice Cover

The rapid disappearance of older ice makes Arctic sea ice even more vulnerable to further decline in the summer. The research takes a closer look at how multi-year ice (ice that has survived through at least two summers) has diminished with each passing winter throughout the last three decades. Multi-year ice extent—which includes all areas of the Arctic Ocean where multi-year ice covers at least 15% of the ocean surface—is diminishing at a rate of 15.1% per decade.

But there's another measurement that allows researchers to analyse how the ice cap evolves: multi-year ice area, which ignores regions of open water between regions of ice floes and focusses exclusively on the areas of the Arctic Ocean that are completely covered by multi-year ice. Sea ice area is always smaller than sea ice extent, and it is this that provides scientists with the information needed to estimate the total volume of ice in the Arctic Ocean. Comiso found that the area of the multi-year ice is shrinking even faster than its extent: by -17.2% per decade.

Mean Arctic Sea Ice during the three months from November 1, 2011 till January 31, 2012
Image by the NASA Scientific Visualization Studio based on data from the Special Sensor Microwave Imager/Sounder of the Defense Meteorological Satellite Program.

Logistics of Ice Formation

The average thickness of the Arctic sea ice cover is declining because it is rapidly losing the multi-year ice, its thickest component. At the same time, the surface temperature in the Arctic is rising, which results in a shorter ice-forming season. It would take a persistent cold spell in order for multi-year sea ice and other ice types to grow thick enough during the winter to survive the subsequent summer melt season and reverse the trend.

Scientists differentiate multi-year ice from both 'seasonal' ice, which comes and goes each year, and 'perennial' ice, defined as all ice that has survived at least one summer. In other words.

It was found that the decadal decrease in the extent of the perennial ice was 12.2% whereas the decline in its area is 13.5%. These numbers indicate that the thickest ice, multiyear-ice, is declining faster than the perennial ice that surrounds it.

As perennial ice has retreated during the past three decades, it has opened up new areas of the Arctic Ocean that could now become covered by seasonal ice during winter. A larger volume of younger ice means that a higher portion of it has survived through the summer and is available to form second-year ice. This is probably the reason why the perennial ice cover, which includes second year ice, is not declining as rapidly as the multiyear ice cover.

Multi-year sea ice is shrinking rapidly, and hit its record minimum extent in the winter of 2008 when it was reduced to about 55% of its long term average since the late 1970s, when satellite measurements of the ice cap began. Multi-year sea ice then recovered slightly in the three following years, ultimately reaching an extent of 34% above the 2008 figure, but dipped again in winter of 2012, to its second lowest value ever. Some reports credit the 2012 level as the lowest ever extent [1].

Measuring Ice Thickness

For this study, Comiso created a time series of multi-year ice using 32 years of passive microwave data from NASA's *Nimbus-7* satellite and the US Department of Defense's Defense Meteorological Satellite Program, acquired during the winter months from 1978 to 2011. This is the most robust and longest satellite dataset of Arctic sea ice extent data to date.

Young ice, made from recently frozen ocean water, is saltier than multi-year ice, which has had more time to drain its salts. The salt content in first- and second-year ice endows them with different electrical properties compared with multi-year ice: in winter, when the surface of the sea ice is cold and dry, the microwave emissivity of multi-year ice is distinctly different from that of first- and second-year ice. Microwave radiometers on satellites are able to pick up these differences, observed as variations in brightness temperature, for the different types of ice. The brightness data are then fed into an algorithm which discriminates multi-year ice from the other ice types.

Nine Year Cycle

Comiso compared the evolution of the extent and area of multi-year ice over time, and confirmed that its decline has accelerated during the last decade, in part because of the dramatic decreases of 2008 and 2012. He also detected a periodic nine-year cycle, where sea ice extent would first grow for a few years, and then shrink until the cycle started again. This cycle is reminiscent of one occurring on the opposite pole, known as the Antarctic Circumpolar Wave, which has been related to the El Niño-Southern Oscillation atmospheric pattern. If the nine-year Arctic cycle were to be confirmed, it might explain the slight recovery of the sea ice cover in the three years following its historical minimum in 2008.

Reference

1 GEOQ 32, page 26 - Arctic Meltdown

GEO's Updated Website

Les Hamilton

Around the middle of April, visitors to the GEO website would have noticed a number of changes taking place. A clean modern 'Home Page' now greets them, thanks to the efforts of new webmaster Alan Banks.

When GEO was founded, following a meeting of interested parties in late 2002, Ray Godden took on the role of providing the fledgling organisation with a 'window on the world'. At that time, making GEO's presence known was paramount, and Ray was instrumental in setting the wheels in motion.

The original website proved functional and informative, and with the addition of electronic ordering to the GEO Shop, developed into an indispensable interface with the membership

But times move on and, with Ray's retirement as webmaster, it became clear that GEO needed someone with the skills to take the website forward. Following an appeal for help, Alan stepped into the frame and has been experimenting with various ideas in recent months. The image opposite shows the new GEO home page. Alan has brought new ideas into play, and all of us on the Management Team are excited about the new, fresh styling.

Many of the pages are still in the 'old style', but they will be progressively converted to mesh in with the 'new look'.

Our thanks are due to Ray for getting the GEO website up and running, and to Alan to taking it forward into GEO's second decade.

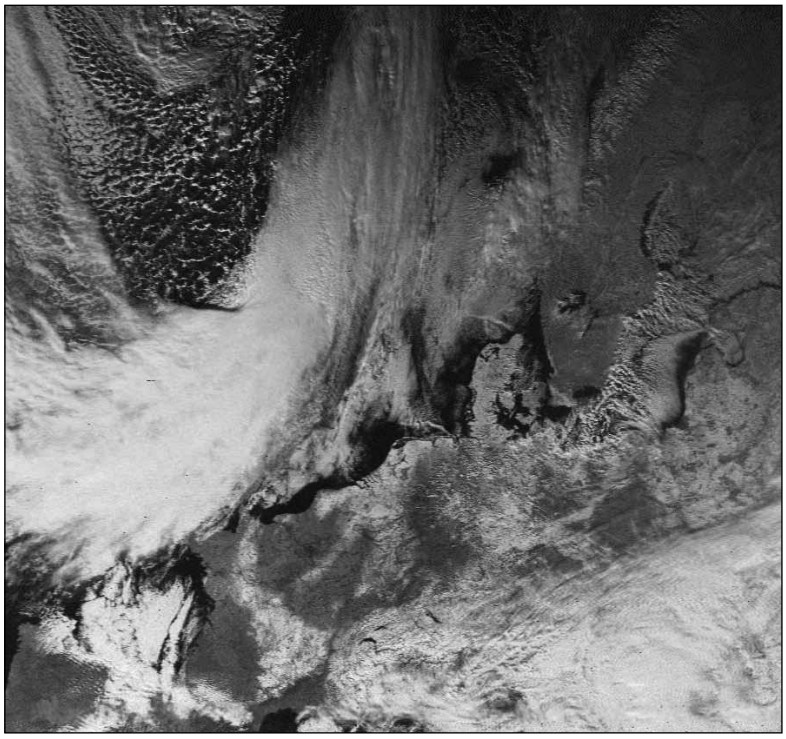
Snow Cannon

Anders Höök

Early last February, I got a couple of APT-images showing what the meteorologists here in Sweden call the 'snow canon'. In the image opposite, you can see that a wind from the east is blowing over the Baltic Sea, which was ice-free and also relatively warm (above 0°C). There, the air takes up moisture, then blows in over the very cold land, precipitating this moisture as snow near the coastline. This is the 'snow canon' [1].

The clouds gathering near the coastline are easily seen but they don't reach very far inland. For instance, at Vallentuna where I live, some 25 kilometres inland, we haven't got much snow, but people living near the coast have got quite a lot.

The image is from NOAA 19 at 12.19 UT (maximum elevation 36 degrees) on February 4. It was decoded with Patrik Tast's *APTDecoder* and the image processed with David Taylor's *SatSignal 5*.



This NOAA-19 channel-4 image was acquired at 12:19 UT on February 4, 2012

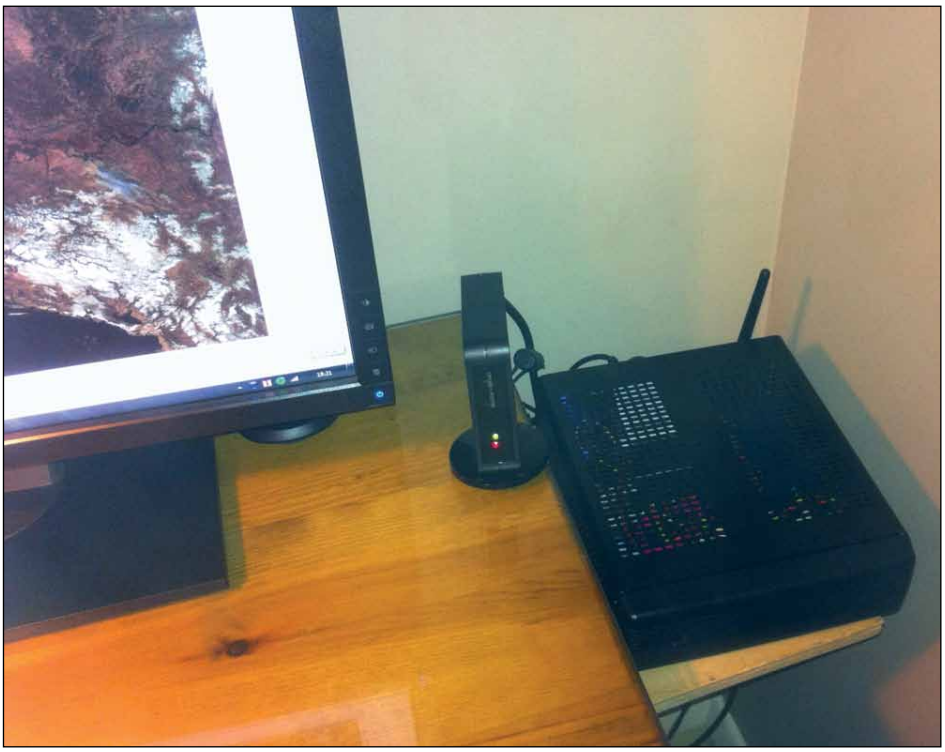
1 This seems to be a similar effect to the 'Lake Effect Snow' sometimes experienced around America's Great Lakes [Ed].

Build a Silent, Fanless PC for EUMETCast

Angus Crawford

My son David, who is far more 'up' on computer components and stuff than I am, is a real stickler for noise. When he visited recently, he remarked that, although the *Shuttle Cube* computer that I use for receiving *EUMETCast* wasn't too noisy, there were totally quiet, fanless products out there. He guided me through a couple of Internet pages to illustrate what he meant. I had wanted to change my OS from XP to *Windows 7* for a while, so I took this as the impetus I needed to upgrade my system.

I settled for an *Asus AT5IONT-I* deluxe 1.8 GHz motherboard. This is fanless, has a large finned radiator covering most of its surface, and uses an external power supply. I added 4 GB of DDR2 133 SO-DIMM RAM and boxed it all up in an *MS350 Universal Mini-ITX* enclosure. This has lots of ventilation slots and is quite small, as you can see in the photograph.



The author's home built mini EUMETCast computer

All these components were purchased online from *mini-itx.com*, who provided a competitive price and quick, well-packaged delivery. I use a solid state disk (SSD) in the *Shuttle* so opted for a 90 MB *OCZ 1.8" SATA* SSD from *Lambda-Tek online*. This SSD needs an additional adapter to connect into a normal SATA cable and power cable, a fact that only became clear when I tried to assemble my components. This adapter was sourced at my local computer shop but, as it is available from Lambda-Tek, I recommend ordering it with the SSD.

The final piece of hardware for my set-up was a *TechniSat SkyStar* USB-HD receiver, available from *Amazon*.

Having put all the bits together, I fired it up, installed Windows 7, and went through the tedious process of installing all the latest Microsoft updates. I transferred my *EUMETSAT* EKU key from my *Shuttle* and, using David Taylor's excellent instructions for installing the required software and my copy of EUMETCast Client Software v 5.5, I was almost there.

http://www.satsignal.eu/wxsat/Dexatek/index.htm

One snag I had not anticipated was that *Windows 7* treats the *SkyStar* receiver as a network device and needs to know its IP address. For *Windows 7,* go to **Control Panel>Network** and **Internet>Network Connections**. Choose the connection that relates to *TechniSat*. Select 'Properties' from the **Status Dialog,** then 'Internet Protocol Version 4 (TCP/IPv4)' followed by 'Properties' again. This duologue lets you set the IP Address and the subnet mask: use the figures David Taylor recommends in his *EUMETCast Troubleshooting Guide* (URL at the foot of this page), or what is already in your *recv.ini* file, with a subnet mask of 255.255.255.0. Once I finally got this IP Address set my system sprang into life and started downloading data.

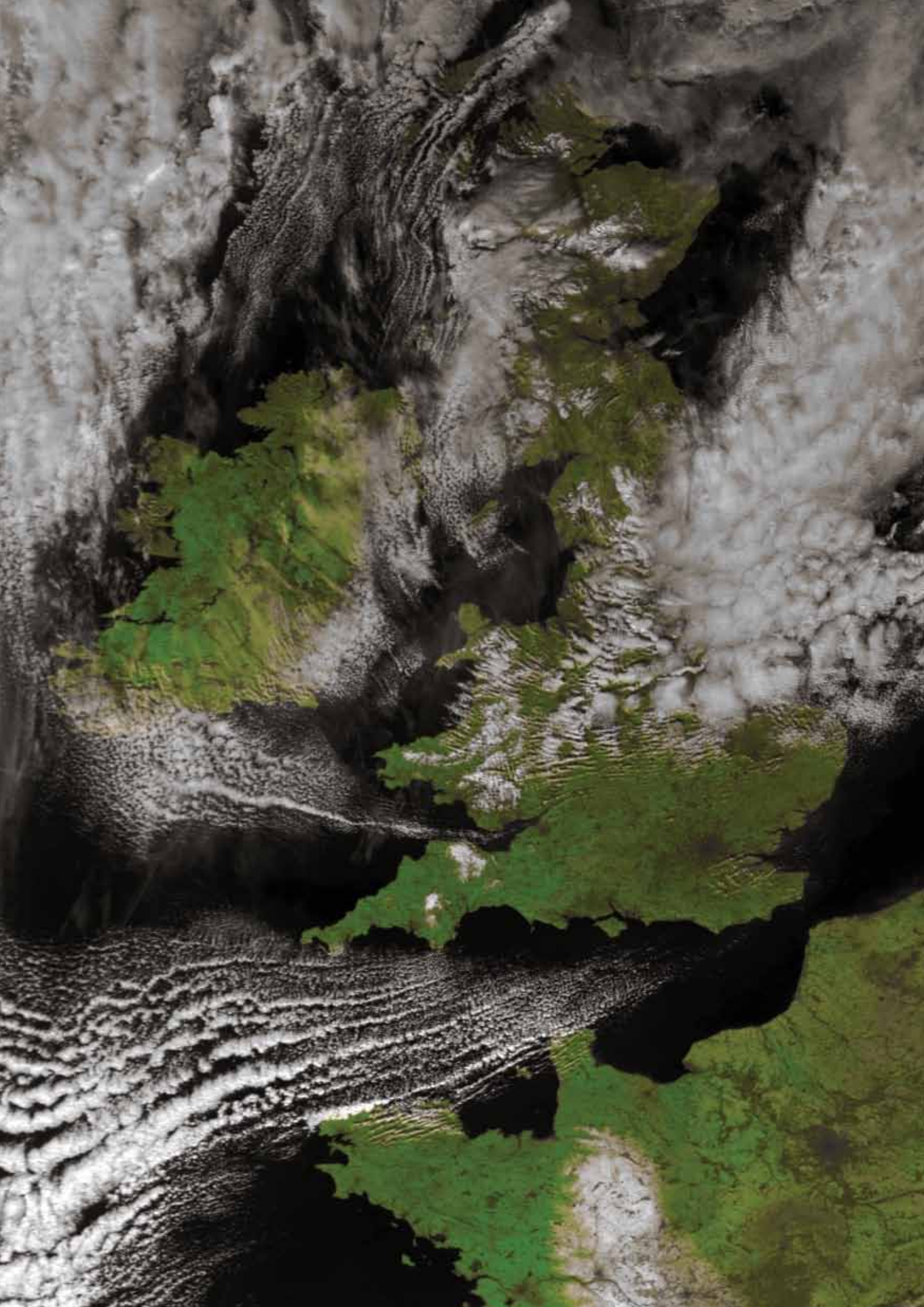
I decided not to install a RAM disk (as I had on the Shuttle) and, to date, I have not suffered any segment losses. I suppose the read/write time of the SSD is sufficiently fast that a RAM disk isn't required. I currently run two installations each of *MSG Data Manager* and *MSG Animator* (one for RSS) along with *Metop Manager*, *DWDSAT HRPT Viewer* and my *Davis Weatherlink* data logger software—all at the same time.

A nice feature of the ASUS motherboard is that you can set it up to re-boot Windows after a power interruption. I have all the above programs in the 'Startup' folder so, when Windows reboots, all my receiving software is restarted automatically. I run *TrimTree* and *Kepler Manager* (-Auto) once a day through Task Scheduler to keep things neat and tidy. I had hoped to be able to install the current version of Windows 7 that I have on my main computer but Microsoft is too smart and requires activation with a new key. I have found that an OEM copy of Windows 7 from *Amazon*, which is quite a bit cheaper than the full product, to be sufficient.

I had ordered a small case fan but it hummed, so I unplugged it and have been happily running the whole system without any forced ventilation for about three weeks now. The unit set on a couple of narrow boards attached to the side of my desk so there is airflow all around.

All in all, my new set-up cost me about £622, which was rather more than I intended when I set out (isn't it always the way?). But I now have an up-to-date set-up running Windows 7 in complete silence. I have also renewed my understanding of how the whole thing goes together, so I hope the learning curve will not be quite so steep when I get the next EUMETCast upgrade or David Taylor comes up with some wizard new piece of software.

Happy receiving.



Winter Cloud Streets

John Tellick

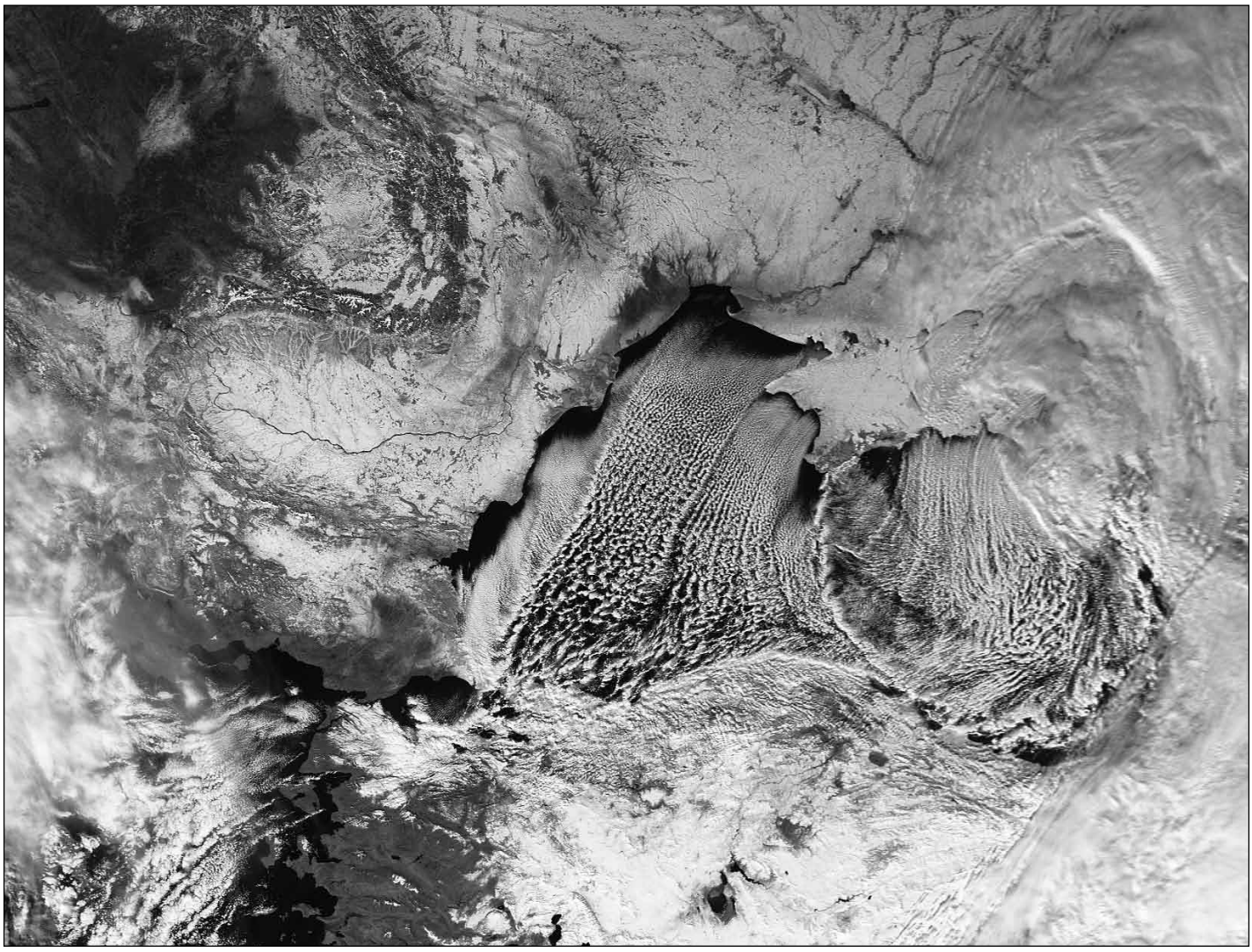


Figure 1 - Cloud streets stream across the Beach Sea in this AVHRR image from NOAA 19 on February 1, 2012
Image © EUMETSAT 2012

I'm sure many of you like me will be familiar with—and fascinated by—cloud streets, which show up well in satellite imagery. It's very common to see then streaming off Greenland into the North Atlantic. Another good place to look is from the Ukraine into the Black Sea in winter. Figure 1 shows cloud streets where cold air from Ukraine meets the relatively warm waters of the Black Sea.

I was, however, rather surprised to see cloud streets, unusually, in the English Channel. On February 2, just a few days after winter finally arrived in SE England, both polar orbiter AVHRR and Meteosat-9 HRV imagery showed a spectacular display of the phenomenon spreading southwest along the English Channel. The NOAA-19 image is reproduced opposite, and the earlier Metop-A version can be viewed on page 22.

The conditions I always thought responsible for cloud streets—a cold steady air stream passing from cold land over warmer sea, were just right. There was settled high pressure driving a cold northeasterly air flow from northern Europe across the UK, which resulted in cloud streets when it encountered the warmer waters of the English Channel and the Bay of Biscay. So, I thought it about time I investigated how cloud streets form and found this: '*The exact process that leads to the formation of horizontal convective rolls is not well understood.*' Not a good start.

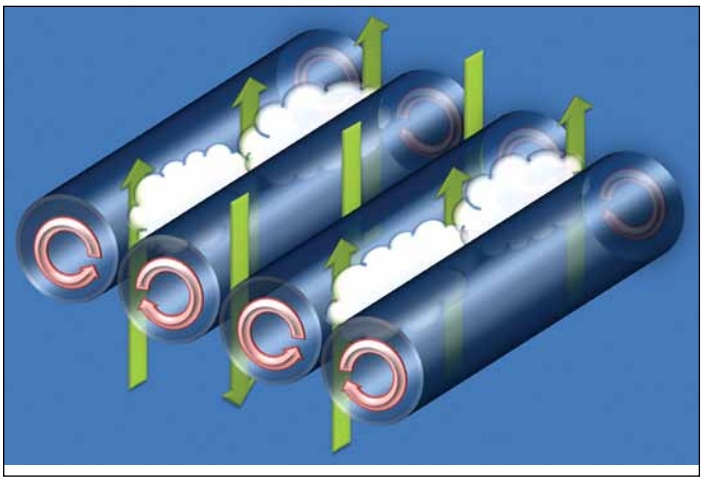


Figure 2 - Formation of the 'rolls'
Source: Daniel Tyndall, University of Utah / Wikimedia Commons

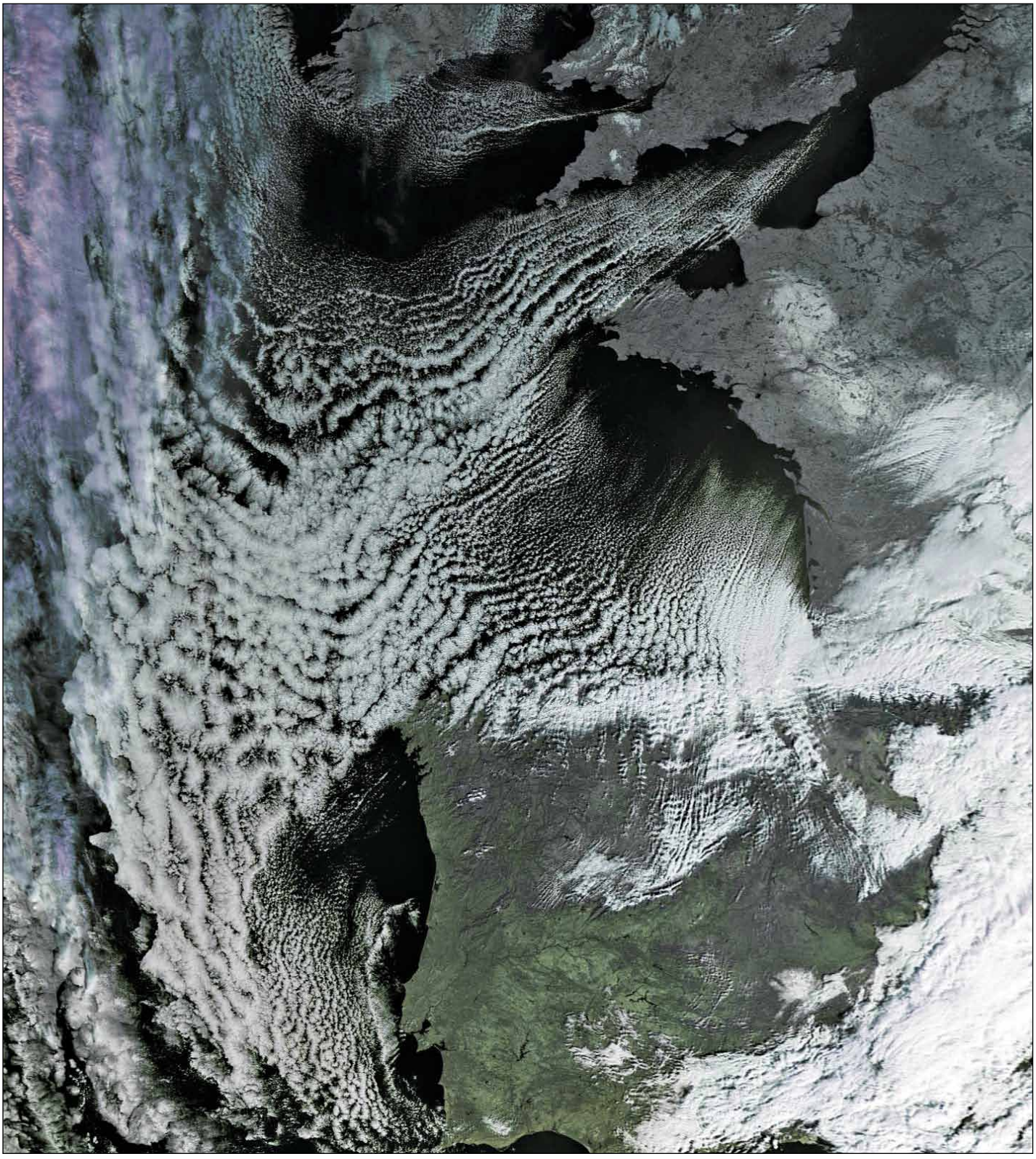


Figure 3 - The February 2 Metop-A image showing cloud streets in the English Channel and Bay of Biscay

By the way, the correct term for these clouds is *horizontal convective rolls:* they are counter-rotating vortex rolls, so I'm informed. Now that does sound interesting and, indeed, high resolution satellite imagery does show them under good conditions to be roll or tube-like in structure, rather than flat. Figure 3 shows diagrammatically the formation of such rolls.

Reading further, one finds that these clouds are '*long rolls of counter-rotating air that are oriented approximately parallel to the ground in the planetary boundary layer*' and '*If the environmental air is near saturation, condensation may occur in updrafts produced from the vortex rotation. The sinking motion produced between alternating pairs of rolls, combined with the updrafts, will produce cloud streets. Typical updraft and downdraft speeds are usually less than 1 m/s. Gliders often use the updrafts produced by the rolls to gain altitude while flying.*'

Beyond this, the 'mechanics' of the process do become rather complicated so, if you are interested in further explanation, *Wikipedia* is a good start.

All images received via EUMETCast processed with HRPT Reader and GeoSatSignal-7.

Farewell Atlantis

A Space Shuttle departs ISS for the Last Time

A NASA Earth Observatory Report

Like a comet streaking through the atmosphere, ***Space Shuttle Atlantis*** left the International Space Station for the final time on July 21, 2011, descending to a smooth landing at NASA's Kennedy Space Center in Florida. This astronaut photograph, taken from the vantage point of the ISS, shows the streak of an ionized plasma plume created during the shuttle's descent through the atmosphere.

At the time of the image, ISS was positioned northwest of the Galapagos Islands, with Atlantis roughly 2,200 kilometres to its northeast, off the east coast of the Yucatan Peninsula. The maximum angle of the shuttle's descent was roughly 20°, though it appears much steeper in this photograph because of the oblique viewing angle from ISS.

In the background of the image, airglow hovers above the limb of the Earth. **Airglow** occurs when atoms and molecules high in the atmosphere (above 80 kilometres altitude) release by night the excitation energy they absorbed from sunlight (particularly ultraviolet radiation) during the day. Much of the green glow is attributable to oxygen molecules.

Astronaut photograph ISS028-E-18218 was provided by the ISS Crew Earth Observations experiment and Image Science & Analysis Laboratory, Johnson Space Center.

Building a Barometer

using a Digital Pressure Sensor

Guy Martin

I was looking to build a barometer as part of a weather station and tried various sensors that were easily available. The project was to interface the pressure sensor with a PIC chip, the readout being performed by an LCD display. Analogue sensors proved difficult to interface and get a consistently accurate readout due to voltage drift and temperature variations. They would be great to detect when an air compressor tank was full but not for reasonably accurate atmospheric measurements.

I discovered a digital pressure sensor MS5534 made by *Intersema*, a Swiss company. This looked as though it would provide a consistently accurate readout.

http://www.meas-spec.com/product/t_product.aspx?id=5027

This device is an on-chip pressure sensor and thermometer. The sensor itself is of course analogue, but the A/D conversion is performed on-chip with a high degree of accuracy. Various coefficients which describe the parameters of the conversion are stored in the chip's memory during the manufacturing process. There are six parameters in total, which are read out of the chip, stored in the processor (PIC) and are used as part of the mathematical formulae applied to the pressure and temperature readings to obtain accurate readings. The data is transferred to the PIC using two signals, one a clock and the other a reversible data line.

There were two slight drawbacks: first that it was surface-mount, but luckily with only six pins; second that I had to buy it from Switzerland (and my local bank took a lot of persuading that there was such a thing as a low cost international transfer). You can now buy these devices from this company:

http://www.nickbelsondesign.co.uk/html/ecomerce.htm

The device requires a 3.3 V nominal power supply and a square-wave clock feed of 32.768 kHz, and is easily interfaced to a controlling PIC chip. However, imagine my surprise when *Elektor Magazine* fell through the letter box and contained an article about a weather data logger that appeared to use just this device. On examination, it only appeared identical and was an HP03S made by a Chinese company *HopeRF*. *Elektor* had these for sale in their online shop, and they were a lot cheaper than the *Intersema* sensor.

It was different in that there were eleven coefficients instead of six and the device used the I2C protocol (a two wire system for the transfer of data between devices which is in common use in many domestic devices such as televisions, for controlling various components such as tuners). The *HopeRF* website has some useful information on using the sensor.

http://www.hoperf.com/sensor/barometer_sensor/HP03S.htm

I therefore decided to make a stand-alone barometer using one of these HP03S sensors, a PIC chip and a 20x4 LCD display (a display of 20 characters and 4 lines which can be purchased cheaply on *eBay*) As the sensor requires a 3.3 V supply, I decided to run the PIC on 3.3 V as well, for simplicity. But the LCD requires 5 V, so pull up resistors were used between the PIC and the LCD. The PIC is quite happy about this arrangement. I used an 18F2525, mainly because I had some left over from a previous commission.

The barometer was designed to run from a 9 V DC plug top adaptor. A 5 V regulator supplied the LCD and a 3.3 V regulator supplied the PIC and sensor. It is sometimes useful to connect the input via a bridge rectifier; it then doesn't matter about the polarity of the supply or even if it is AC—it all comes good.

The sensor requires a 32.767 kHz square wave clock signal, provided by a watch crystal, using two gates from a 4011 quad NAND gate configured as an oscillator. A switch was also included in the circuit in order to enter the height of the station, so that sea level pressure could be calculated. The switch needed to be debounced, which was achieved by means of two spare gates. The circuit is shown opposite.

Circuit Operation

On switch-on, a brief copyright message appears followed by a read-out of local atmospheric pressure (QFE) and a request to enter your height above sea level so that sea level pressure can be calculated (QNH).

Obviously, the device will measure atmospheric pressure at the height where you are situated, which will be less than the atmospheric pressure at sea level. In aeronautical terms this is known as QFE, or aerodrome pressure. QNH is sea level pressure for a certain region. Pressure altimeters require a base pressure to be entered in order to calculate height; for example, if you land at an airport 200 metres above sea level, you need to enter the pressure corresponding to an height of 200 metres to obtain accurate altimeter readings above that airport.

Back to the display: *Enter height x 1000 feet* is displayed, with an initial reading of zero. Pressing the switch will increment the height up to nine when it will roll over to zero again. If there are no key presses for two seconds, *height x 100* is requested, and so on until the system knows your height. It is assumed that the height is greater or equal to zero (sea level) and less than 9999. It will now display both pressures and await trend data. The current pressure is stored and is compared in three hours time with the new current pressure to get the trend (rising quickly, falling slowly etc).

I spent a long time poring over how to convert pressure at height (P_{ht}) to sea level pressure (SLP). Some hideous equations were tried, some of which gave ridiculous results, no doubt due to programming errors. I eventually discovered the following simple formula with better than 2% accuracy between sea level and 2000 feet:

$$SLP = P_{ht} + (\text{height in feet})/30$$

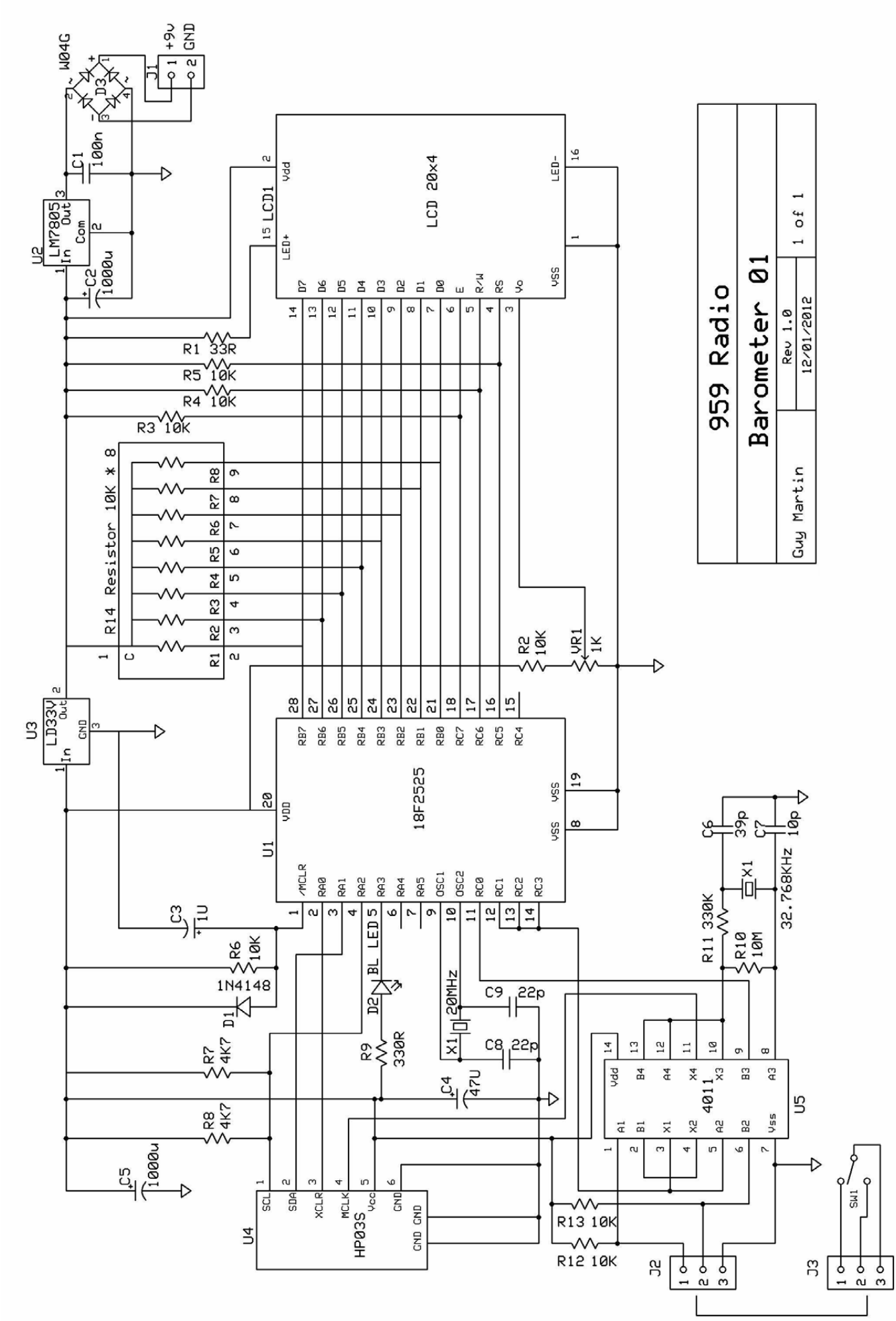
The change of pressure over three hours can also be displayed. Key presses will toggle between current pressure and stored pressure. Below is a picture of the unit with some test data.

With different software, this unit could become an altimeter. It can also display temperature but, since it was intended to be an indoor unit, there are probably already thermometers in other pieces of domestic equipment.

Comparison with my commercial weather station indicates an accuracy of around 0.6 mb (which equates to 18 feet), which seems reasonable as the unit is mounted on the roof of a bungalow. It is usually about 1 mB different from the Met Office site. I guess, as meteorologists (using the term loosely as far as I am concerned), we are more interested in change and rate of change of pressure rather than actual pressure. The sensor will give a readout to two decimal places with an accuracy of ± 1.5 hPa (1 hPa = 1 mb).

This article is intended to describe the use to which a simple pressure sensor may be put and my implementation of a circuit to do just that. If there is any interest among readers for building one, I can make the PIC hexcode available. The parts are readily available, the sensor from *Elektor*,

Continued on page 37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Guy Martin
LCD 20x4
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+9v
GND
C1 100n
C2 1000u
R1 33R
R5 10K
R4 10K
R3 10K
R2 10K
VR1 1K
C3 1U
R6 10K
1N4148
D1
BL LED
D2
R9 330R
R7 4K7
R8 4K7
C5 1000u
C4 47U
20MHz
X1
C8 22p
C9 22p
C6 39p
C7 10p
32.768KHz
R11 330K
R10 10M
R13 10K
R12 10K
SW1
J2
J3

The Maspalomas Satellite Reception Centre

Esko Petäjä

We were having a winter holiday trip in Grand Canaria during late February 2012. While planning the trip, I noticed that there is a large and important satellite receiving centre there, which plays an important role in reception of the data from MSG-2, NOAA HRPT,Metop-A and Envisat that we receive through EUMETCast or Envisat DDS. This article will describe the station background and history, and also shows some pictures of antennas that I was able to take while hill climbing near the station.

Station Information

Maspalomas station is located in the southern part of Gran Canaria,, in the Canary Islands, 205 metres above sea level at Montaña Blanca (27°45'N, 15°38'W). The station, which is operated by *Instituto Nacional de Tecnica Aerospacial* (INTA), is located on a hill which guarantees good visibility. Towards the south, the horizon is sea level; towards north it is about five degrees. Weather conditions here are very good, with just 102 mm average rainfall over the past six years. Hail and thunderstorms are very uncommon, and snow and ice never occur. In recent years, the temperature has stayed between 10.7°C and 39.5°C.

Figure 1 - Welcome sign outside INTA

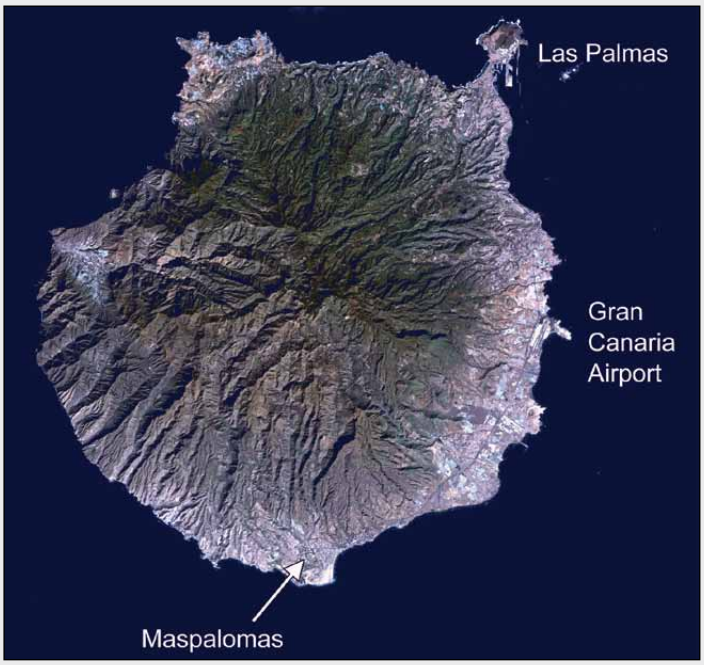


Figure 2 - Landsat Image of Gran Canaria showing location of Maspalomas
Image: NASA

Station History

The station at Maspalomas was originally built for the NASA Mercury programme in 1960, the choice of location being determined by the fact that Cape Canaveral and Maspalomas are at the same latitude, with an ocean between them. The station was first used to support the Mercury-Atlas-4 unmanned flight, launched on September 13, 1961, and which made one orbit of the Earth. And of course, it was involved in the first manned flight—by John Glenn—on February 20, 1962, as well as subsequent Mercury manned space flights during 1962–63. The Maspalomas station was part of the NASA Mercury network, comprising 14 stations distributed around the world. Maspalomas also monitored subsequent US space missions such as Gemini, Apollo, Apollo-Soyuz and Skylab till 1975.

INTA was involved in operating the station from the beginning, initially with an almost token staff, which has gradually, grown to over 60. In more recent times, Maspalomas has been involved with missions for ESA, SARSAT (emergency beacons), EUMETSAT, NASDA and JAXA (Japanese Space Agency) as well as local Spanish civil and military programmes.

Figure 3 - Maspalomas Control Centre in 1960

MSG Operations

The Primary Ground Station for the Meteosat Second Generation (MSG) satellites is in Usingen, Germany, about 30 kilometres north of Frankfurt. Some of us visited this station during the GEO visits. The separate Back-up and Ranging Ground Station (BRGS) is located in Maspalomas. This location is sufficiently separated from Usingen to allow accurate ranging measurements to be made to determine the precise location and orbit of the MSG satellites. Maspalomas station is also dedicated to provide telecommanding and telemetry support to the ground network for the operations of the satellites in case of a complete system failure at Usingen.

Figure 4
The MSG Reception Antenna (at right)

ESA/ESRIN Operations

Some GEO readers are receiving Envisat images through the Envi-Ham project. Envisat has three command and control centres: Darmstadt (ESOC), Kiruna-Salmijärvi (ESA) and Svalbard. One of the payload receiving stations is located in Maspalomas, from where high quality MER-FRS data is forwarded to Frascati in Italy (ESRIN) and Kiruna-Salmijärvi in Sweden (SSC), which then takes care of the uplink of data to the *Eutelsat W2* satellite for transmission by DDS to Envisat users. Following picture shows Envisat data management system.
The station has a 10 metre antenna for receiving in the following frequency bands:

L -	1.650-1.750 MHz	40 dB
S -	2.200-2.300 MHz	40 dB
X -	8.025-8.400 MHz	55 dB

Figure 5 - The Maspalomas Receiving Station

The antenna can be moved with a maximum elevation rate of 7º per second and an azimuth rate of 12º per second.

Figure 5 shows the reception antennas and ground station located on a hill near the sea. Figure 6 shows a close-up view of the antenna used for Envisat. Figure 7 illustrates all the4 components of the Envisat data management system.

Figure 6
The 10 m Envisat Antenna

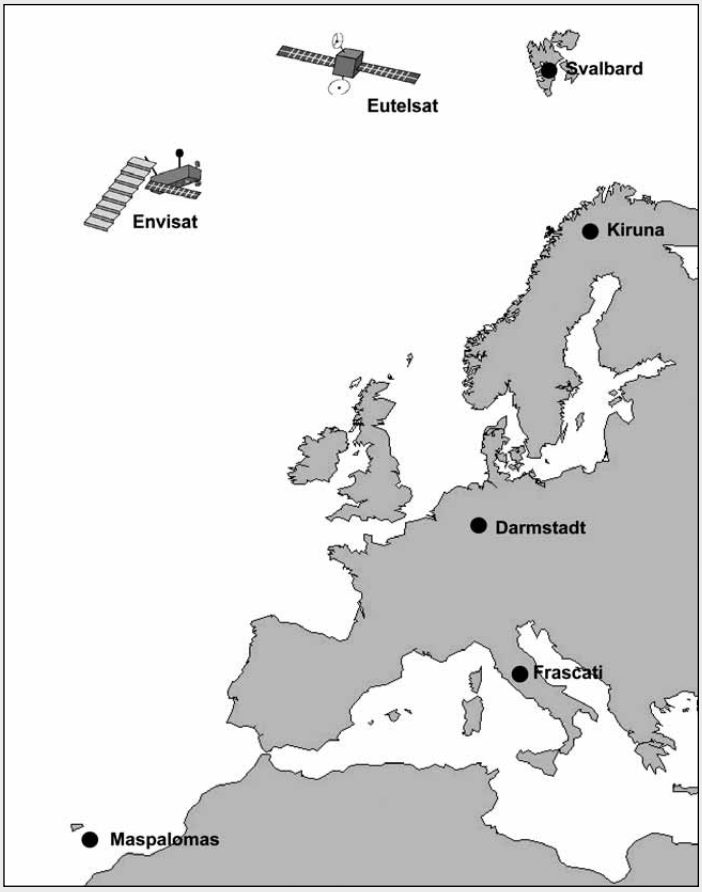


Figure 7 - Envisat Receiving Stations

EUMETSAT-EARS Mission

Maspalomas has also been receiving data from the NOAA and Metop polar orbiting satellites since July 2005 using the antenna shown in figure 8. The EARS-AVHRR service collects AVHRR instrument data from the both NOAA and Metop via a network of HRPT stations and retransmits it via EUMETCast.

Figure 8
The Reception Antenna for EARS-AVHRR

To ensure the efficient and timely delivery of data the received HRPT stream is handled in small segments. The EUMETSAT data centre decides which data will be used so that end users obtain a continuous set of 'best quality' segments for the regional pass.

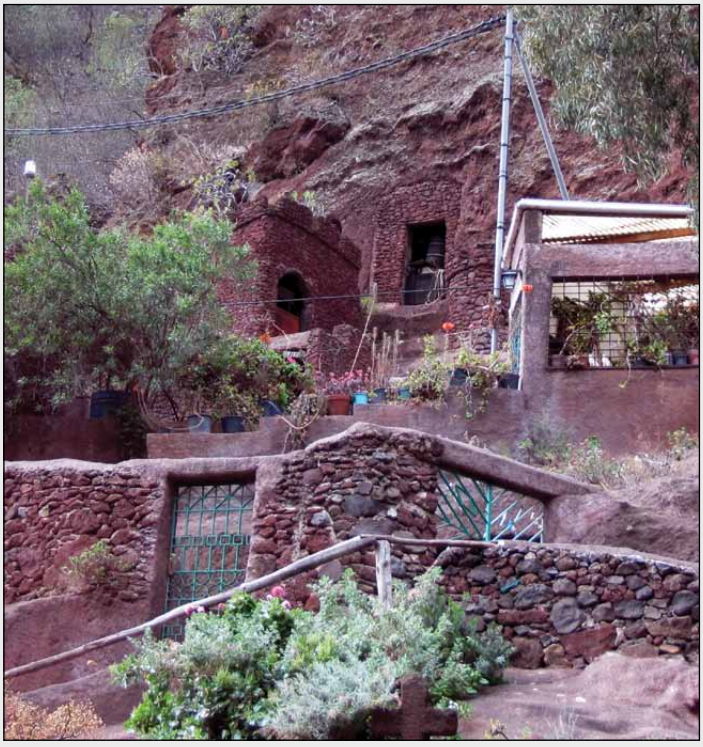


Figure 9 - Our Luxury Cave Holiday Home in Gran Canaria

Cave Holidays

Gran Canaria is a very interesting place for travelling and our holiday accommodation was in an ancient cave in the hillside (figure 9). We also visited some luxury caves, fitted out with all the conveniences of modern life, including a top-of-the range TV system.

Green Energy

Gran Canaria harnesses solar and wind energy like no-where else, and gains 20% of all its energy requirements from renewable sources. Wind turbines can be seen everywhere, and almost every roof houses a warm water solar heating unit (figure 10). These heating units were invented by an Australian company in 1953, and now they are world leaders in this area. A very interesting and good invention, helping to save our planet.

Figure 10 - One of the ubiquitous solar roof-mounted water heating units

The Ganges Delta

John Tellick

Have you ever had one of those moments when you made a rash decision and a day later wondered: "What am I doing here?" Very early in my BBC career, in March 1969, whilst still only an assistant recordist with the Film Unit, I passed the allocation office on my way home one afternoon. They were desperately trying to find a recordist to cover rioting and political unrest in East Pakistan. "I'll go" said I glibly. I was young and 'raring to see the world' in those days.

Well, 24 hours later, I was on a plane with a cameraman and Michael Charlton (*Panorama*) heading for Frankfurt. There we would board a Lufthansa Boeing 707 to Karachi, my arm aching after being pumped full of vaccinations, heading for a 'civil war zone.' The next day we flew to Dacca, where I'm pleased to say a rather nice 4-star *Intercontinental Hotel* awaited us.

This was the first of many trips to third-world countries during my BBC career. It was to be exciting and 'full of the unknown' in more ways than one. In fact, I found all my many further trips to third-world countries exciting, though not all offered a 4-star hotel. Far from it on several trips—once, in Zimbabwe I experienced five days in a prison cell.

Martial Law had been declared before we arrived in Dacca, so things had quietened down. This meant, although covering the political situation, we had to find 'something else' to film. We went off up country to see life in the hinterland, flying to Chittagong, a port on the Bay of Bengal, to film the Jute industry and taking a train to Sylhet in the northeast of the country, where we stayed to film on a tea plantation up in the foothills, which was just beautiful.

East Pakistan was such a fascinating, bustling country, full of new sights, sounds, colours and experiences. I really enjoyed the trip, though having an 'upset stomach' on the overnight train from Sylhet back to Dacca, followed by two days ill in bed, made one rather grateful for a bit of 4-star comfort. But I digress ...

The Ganges enters the Indian Ocean through the world's largest river delta, and one of the most geographically turbulent areas in the world—the country now being Bangladesh and the capital Dhaka. The Delta extends over 105,000 square kilometres to cover the entire southern part of Bangladesh and continues into the Indian state of West Bengal. It is extremely vulnerable to climate change which, it is predicted, will increase precipitation and cause more frequent and stronger cyclones and floods. Flooding in the delta can also occur from heavy runoff from the melting snows of the Himalayas.

A number of large rivers flow through the Ganges Delta, including the Padma (main distributary of the Ganges) and the Jamuna (main distributary of the Brahmaputra), which merge and then join the Meghna before flowing through the delta into the Bay of Bengal. Most of the delta is composed of alluvial soils made from small sediment particles that finally settle as river currents slow down in the estuary. Note the sediment outflow into the Bay of Bengal in the satellite images opposite.

These rivers are all nutrient-rich, making the low-lying delta one of the world's most fertile regions. The major crops grown here are rice, jute and tea. Fishing is also an important activity in the delta region, with fish being a major source of food for many of the people who live there.

Three terrestrial ecoregions cover the delta. The Lower Gangetic plain's *moist deciduous forests ecoregion* covers most of the delta, although the forests have mostly been cleared for agriculture and only small enclaves remain. Thick stands of tall grass, known as canebrakes, grow in wetter areas. The *Sundarbans freshwater swamp forest* ecoregion lies closer to the Bay of Bengal; this ecoregion is flooded with slightly brackish water during the dry season, and fresh water during the monsoon season. These forests, too, have been almost completely converted to intensive agriculture, with only 130 km^2 of the ecoregion's 14,600 km^2 currently protected. Where the delta meets the Bay of Bengal, *Sundarbans mangroves* form the world's largest mangrove ecoregion, covering an area of 20,400 km^2 in a chain of 54 islands. They derive their name from the predominant mangrove species, *Heritiera fomes*, which are known locally as sundri or sundari.

Animals in the delta include the Indian Python, Clouded Leopard, Indian Elephant, as well as crocodiles which live in the Sundarbans. Also living in the Sundarbans is the endangered Bengal Tiger—of which there were estimated (in 2010) to be only 440 left in the whole of Bangladesh.

Two species of dolphin can be found in the delta: the Irrawaddy Dolphin and the Ganges River Dolphin. The Irrawaddy Dolphin is an oceanic dolphin that enters the delta from the Bay of Bengal. The Ganges River Dolphin is a true river dolphin, but is extremely rare and considered endangered.

The Images

The images opposite, from a Metop-A descending pass on January 24, 2012, show not only cloud-free detail of the Ganges Delta, but demonstrate examples of how ground features, vegetation and crops can be highlighted using the 5-channel AVHRR data, either individually or in combination, thanks to the processing facilities of David Taylor's *HRPT Reader*. It's interesting to see how different features are highlighted by different channel combinations.

Both NOAA-18 and Metop-A polar orbiters carry the 6-channel AVHRR/3 radiometer—though only 5 channels are transmitted simultaneously. Channel-3 has two switchable spectral range settings: 3A at 1.58-1.64 μm and 3B at 3.55-3.93 μm.

NOAA-18 transmits channel 3B all the time for forest fire detection: hot spots show up well using this channel, as most users will have observed. Metop-A, however, switches between channels-3A and -3B on both descending and ascending passes as the satellite crosses the terminator. Channel-3A is transmitted by Metop during daylight, and has the ability to readily distinguish between areas of snow and cloud owing to the low reflectance of snow at 1.6 micrometres (μm). When used in an RGB combination this gives rise to the well-know cyan colouring of snow. Channel-3A also provides the necessary information for providing 'true colour' RGB images.

It's well worth trying various combinations of channels 1–5 in the RGB boxes of *HRPT Reader* for both NOAA-18 and Metop.

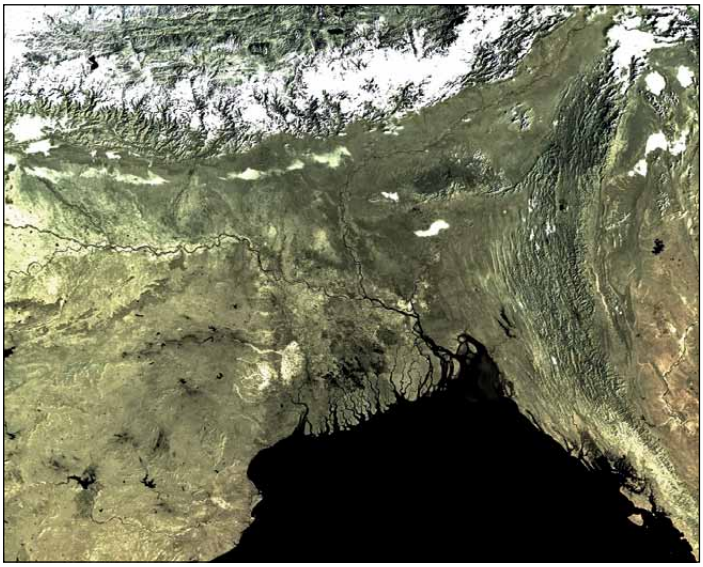


Figure 1 - Bangladesh/NE India and the Ganges Delta as portrayed by *HRPT Reader's* false colour tab.
Image © EUMETSAT 2012

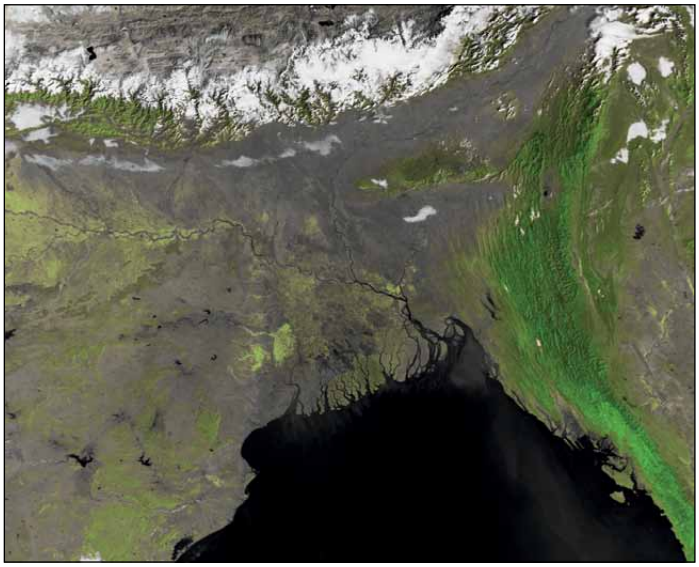


Figure 2 - Bangladesh/NE India using *HRPT Reader's vegetation* tab.
Image © EUMETSAT 2012

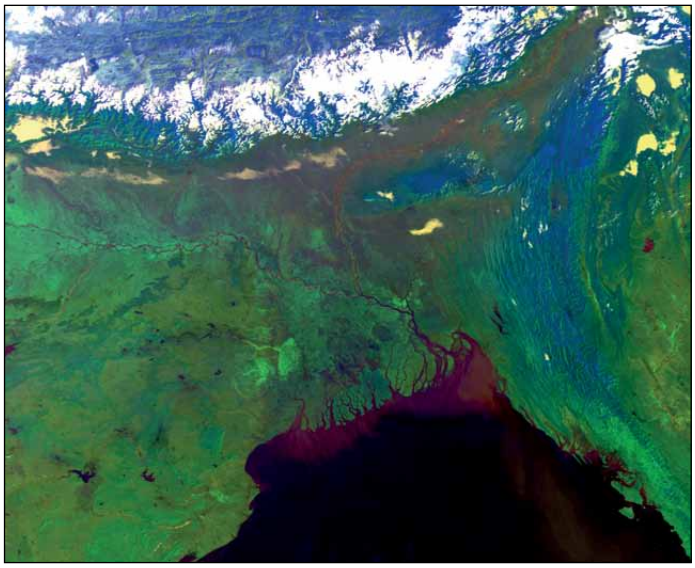


Figure 3 - Bangladesh/NE India using *HRPT Reader's* RGB 234 tab shows delta sediment flowing into Bay of Bengal
Image © EUMETSAT 2012

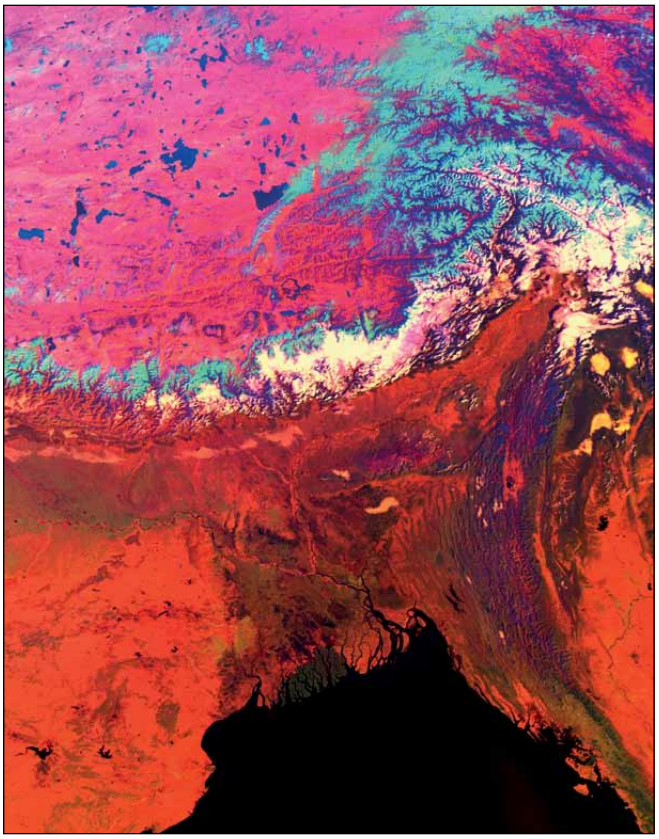


Figure 4 - Bangladesh/India wider view using *HRPT Reader's* RGB 324 tab. Note how mountain snow is clearly shown in cyan, and the very distinct area in the centre of the delta.
Image © EUMETSAT 2012

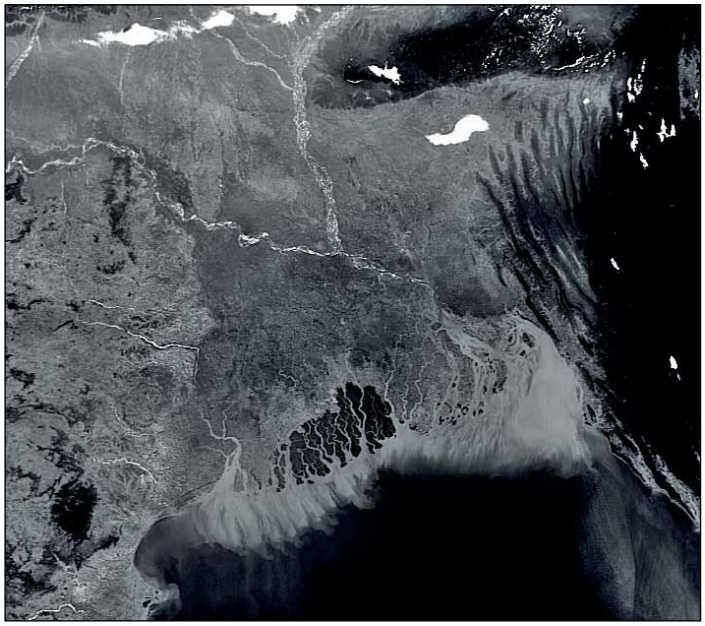


Figure 5 - The AVHRR channel-1 clearly shows river sediment flowing into the Bay of Bengal.
Image © EUMETSAT 2012

Figure 6 - Lush vegetation and crops on a Sundarban farm.
Photo: Arne Hückelheim/Wikimedia

Europe's Incredible Winter

Les Hamilton

We reported last issue how, in the final week of January, much of Europe suddenly found itself in the grip of some of the harshest winter weather for decades. But this proved to be but the tip of the iceberg as the first two weeks in February saw temperatures tumbling to close on -40°C. This major freeze-up brought traffic chaos to the continent, blocking roads, shutting down airports, freezing rivers and canals, and trapping thousands in remote mountain villages in the Balkans. Heavy snow was recorded from the UK to Italy, the Balkans, Turkey and Russia: tens of thousands of villagers became prisoners in their own homes as snow drifts quickly rose above their rooftops.

This was no mere cold snap however, as weeks of extreme weather meant tragedy throughout Europe: more than 600 deaths, half of them in Ukraine, could be attributed directly to the conditions. From late January until mid-February the entire continent was in deep-freeze, experiencing some of the heaviest blizzards in living memory. Tens of thousands became trapped in their villages by walls of snow and impassable roads while the authorities struggled to airlift food to them.

But it was not all doom and gloom: there were also opportunities for fun in the snow. Children in Rome and along Croatia's Adriatic coast made the most of the rare snow. In Sarajevo citizens organised their own winter Olympic games, skiing down the main streets and leaping from upper floor windows into deep drifts of snow. Some cruised the streets, towed behind cars on skis. And in the Netherlands, canals froze creating a mecca for skaters.

The last time significant snow fell in **Rome** was 1986, so it comes as little surprise that the authorities were completely unprepared as the capital ground to a halt. Cars and buses struggled to climb icy hills while the Colosseum, Palatine Hill, Forum and other attractions were closed to visitors for fear they might injure themselves by slipping on the ice. All schools in the city were closed. In the country as a whole, temperatures fell to -25°C at Lake Garda in the north, while even the normally balmy south of Italy plummeted to -10°C. **Milan** recorded a low of -12°C, prompting the authorities to open part of the city's subway system as a refuge for some 100 homeless people. There were reports of wolves scavenging among the deserted streets of the village of Trasacco, 80 kilometres east of Rome. And the famous canals of **Venice** started freezing over, preventing gondoliers from plying their trade on the city's picturesque waterways.

With **Italy** almost entirely blanketed in snow, hundreds of barns collapsed under the unaccustomed weight, and thousands of farm animals perished as a result. Near the southern town of Candela, in Puglia, the army had to be deployed to help hundreds of people who became stranded on a blocked road overnight. In some areas in the foothills of the Alps, rescuers had to pluck people from their homes, as drifting snow reached three metres in depth.

Bucharest, where the mercury failed to climb above zero between January 24 and February 12, recorded its lowest temperature, -24°C, on two consecutive February mornings. The average high for this time of year is just 3°C. Snow was lying 30 cm deep in the city and had piled up even higher to the west, in Bosnia and Herzegovina where, in the capital Sarajevo, over a metre had accumulated. Last winter, Sarajevo received a mere two centimetres of snow. In the east of **Romania**, 23,000 people were isolated in over 200 small communities after more than a week of heavy snow blocked roads and wreaked havoc on the rail network. Residents were worried that their houses might collapse under the heavy snow as rescuers attempted to bring them food, water, medicine and wood. A five-month-old girl with severe pneumonia had to be taken to a hospital by sled after authorities struggled for six hours to reach her.

In **Bulgaria**, rescue teams fought to evacuate inhabitants after heavy rain and melting snow caused the dam on the Ivanovo reservoir to collapse, releasing a 2.5-metre flood of water which engulfed 700 homes in the village of Bisser, near the Greek border. There were only five minutes warning of the onrushing deluge, and it was miracle that only five of the villagers lost their lives in the terror. Downstream, four others perished when their cars were swept away by the floodwaters. Officials warned that two other even larger dams, at Ivaylovgrad and Studena, were on the brink of overflowing, and urged people to be ready for evacuation.

The **Balkan Peninsula** suffered badly from a series of potent snow storms, the direct result of the jet stream dipping much farther south than normal. This allowed storms to pick up moisture over the waters of the Mediterranean and Aegean seas before dumping it on the already frozen landscape of the peninsula. As a consequence, the **Serbian** government declared an emergency situation, with at least 70,000 people cut off by the heavy snow: these included shutting down all schools for a week to save power and keep the children safe. The youngsters in the capital, Belgrade, made the most of the situation, making for the city's parks for sledding and building snowmen. The river Danube, one of Europe's main transport arteries, was barely navigable around Belgrade and river traffic was virtually at a standstill along a 170 km stretch. In an effort to save power for domestic heating, some 2,000 industrial businesses were closed to limit the strain on hydro-power plants, which were struggling because of the build-up of ice.

In the **Netherlands**, Europe's deep freeze came close to making the nation's *Elfstedentocht* (Eleven Cities Tour) ice skating marathon a reality for the first time since 1997. This race, held along a 200 kilometer network of canals connecting eleven towns and cities in Friesland, is a major attraction, and draws thousands of participants and more than a million spectators. Alas, with the course just a few days of being considered fit for the event, the thaw set in. But many stretches along the canal network were safe for skating, and thousands of skating enthusiasts took to the ice. You can see some of Rob Alblas' photographs overleaf.

The first ten days of February were the coldest experienced in the Netherlands for 95 years. The average temperature recorded at De Bilt Meteorological Centre during this period was just -7.0°C. Since records were first kept in 1901, only once, in 1917, has there been a colder start to February (when the average temperature was -7.2°C). In **Amsterdam**, the canals were frozen over, closing them to commercial shipping, and providing citizens with more skating opportunities. In The Hague it was reported that a man had tried to smuggle marijuana into the prison. Taking advantage of the snowy weather, he concealed a package of the drug in a snowball, which he tossed over the wall of the prison. Unfortunately, the snowball crumbled, revealing its contents, and the man was arrested.

Meteorologists in **Belgium** stated that the country had recorded its longest cold snap in 70 years, with temperatures in the suburbs around Brussels remaining below zero for 13 consecutive days.

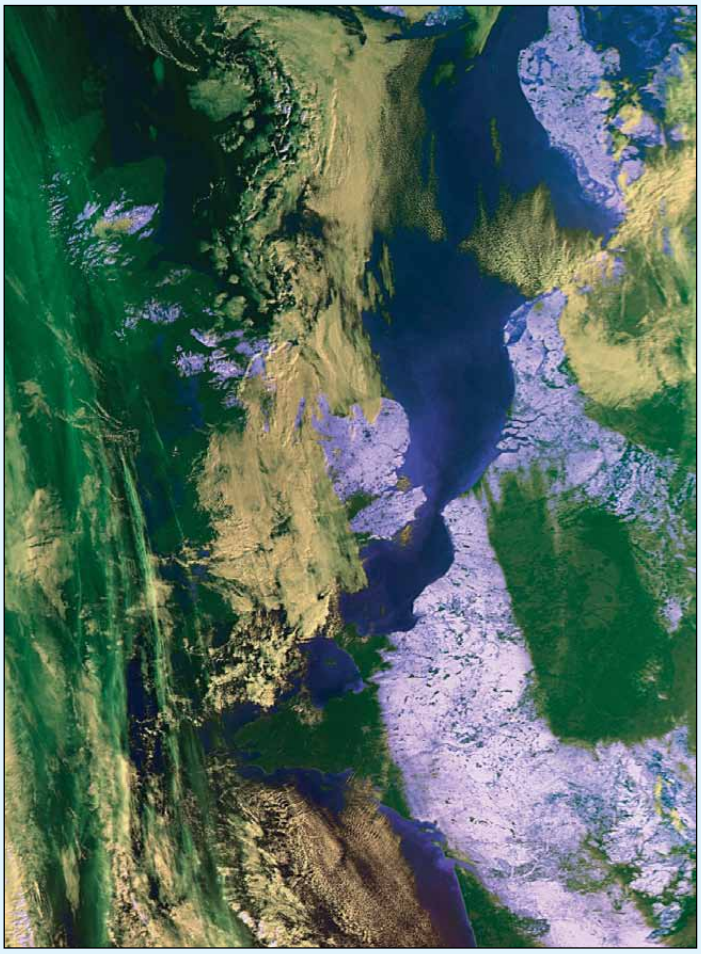


Figure 1 - A Metop-A image from 10:31 UT on February 7, 2012, processed using David Taylor's HRPT reader with the NOAA snow filter.
Image © EUMETSAT 2012 - provided by James Brown

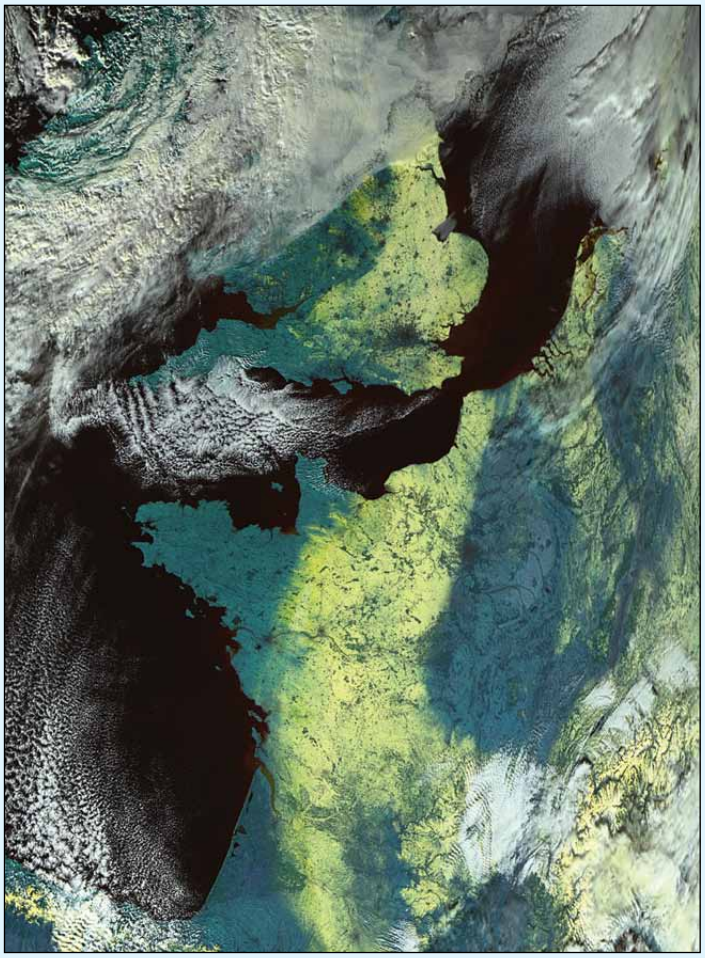


Figure 2 - An *Aqua* MODIS image from February 11, 2012, processed using David Taylor's L1 MODIS Viewer using the RGB521 filter.
Image © EUMETSAT 2012 - provided by James Brown

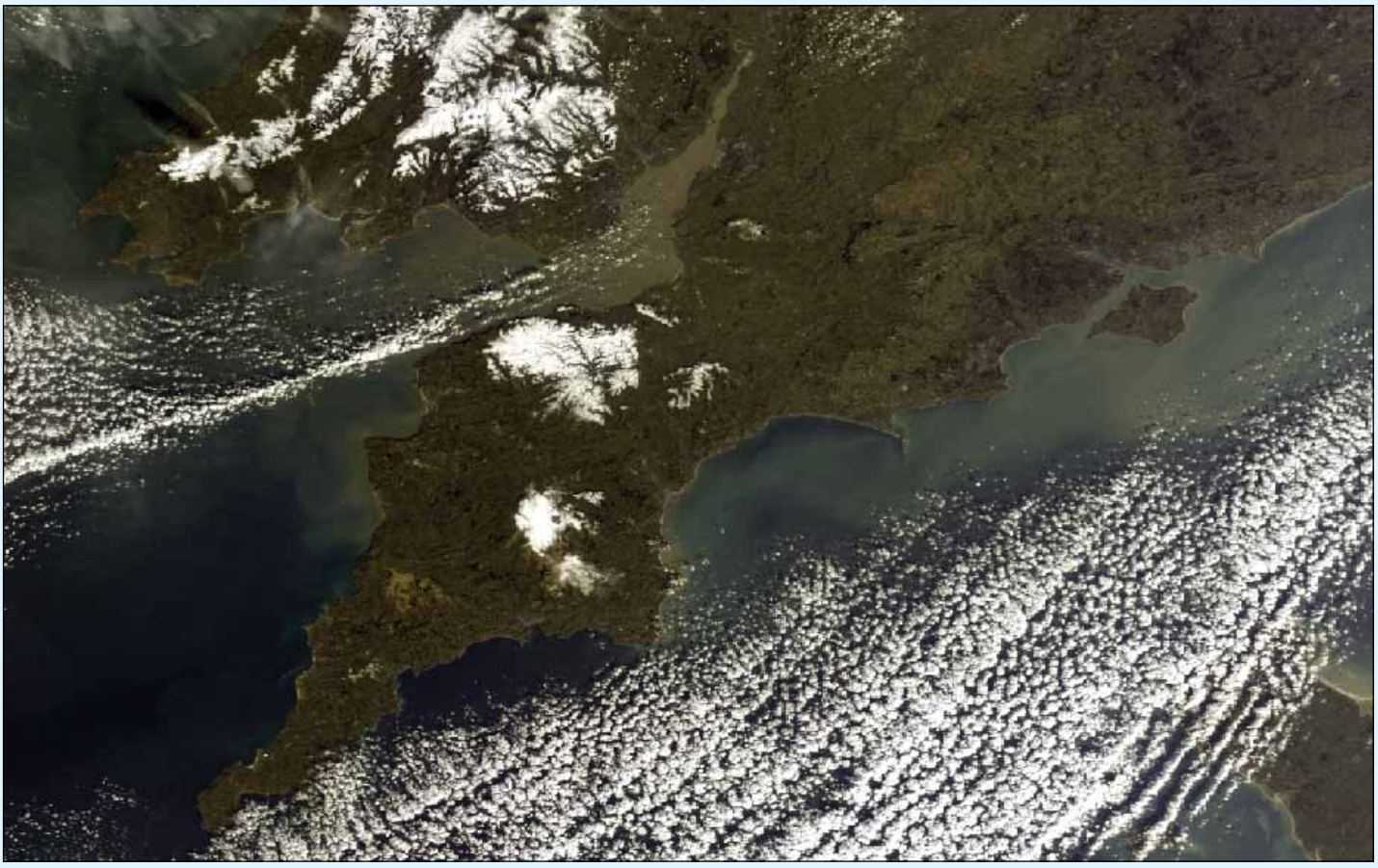


Figure 3 - This Envisat MERIS image was acquired by Mike Stevens on February 2, 2012, and chows snowfall over Dartmoor and Exmoor and south Wales.
Image © EUMETSAT 2012

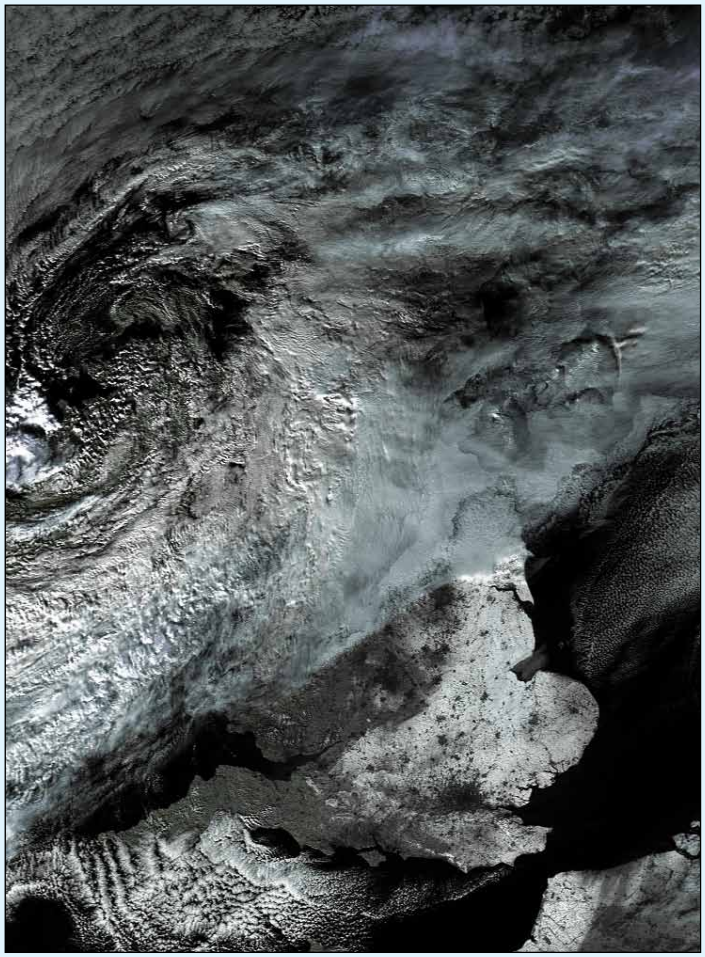


Figure 4 - David Taylor acquired this NOAA-19 image showing snow covering SE England from the EUMETCast EARS data on February 11, 2012.
Image © EUMETSAT 2012

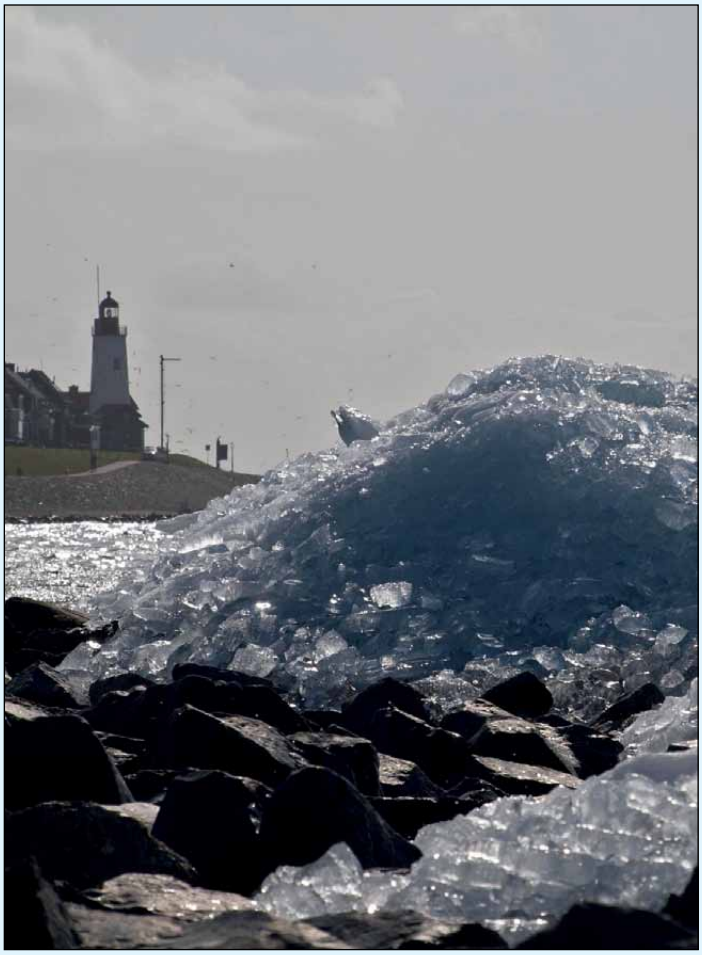


Figure 5 - Ice piles up near Urk, on the shore of IJsselmeet in Netherlands
Photo: Rob Alblas

Robert Moore sent us this photo of his daughter and her two sons having supper in an igloo they built in their West Sussex garden. They said that the quickly igloo warmed up inside once they were all in.
Photo © Sven Howarth-Moore

A picture like a painting. Halfway between the cities Stavoren and Hindelopen
Photo: Rob Alblas

Skaters enjoying the ice on the canals in Hindelopen
Photo: Rob Alblas

In **Bosnia**, hundreds of villages found themselves marooned behind snowed-in roads and avalanches as authorities resorted to helicopters to evacuate the sick and deliver food. In the village of Zijemlja, 120 people were without electricity or telephone contact for three full days. In **Sarajevo**, thousands trudged to work with only occasional buses braving the deep snow. Volunteers turned out to clear the tram lines. Householders were told to keep their refuse off the streets because it would be days before the authorities were in a position to collect it. In a sign of the extreme weather conditions, the city hospital in Split, **Croatia**, used up two years' supply of plaster in one week in treating the unusually high number of bone fractures caused by slips on snowy and icy streets. In **Poland**, 20 people died in one particularly cold 24-hour spell of freezing weather, bringing the total death toll this year to over 100. The majority of these victims either froze to death or were suffocated by fumes from defective heaters.

Skaters on a frozen lake near Koudum, Friesland, in the north of the Netherlands. Tracks were prepared for the 200 km 11-city skating tour, but it was cancelled (ice not thick enough as 15 cm was needed over the full 200 km). But this did make it possible to do the tour as an individual.
Photo: Rob Alblas

In **Montenegro**, the government imposed a state of emergency after snow had blocked roads and railways across most of the country. More than 50 people were stranded on a train in the north of the country for more than two days before they could be freed by emergency rescue crews. In the mountain town of Zabljak, snow was over two metres deep. In many locations, the heaviest snow for 63 years sealed off hundreds of villages, trapping thousands of residents in their homes. In the capital, Podgorica, the authorities banned all private traffic as the city was brought to a standstill. Snow approached a metre in depth, a 50-year record, and closed the city's airport. An avalanche halted rail services to Serbia. Officials claimed that this was the most snow they've seen in Montenegro since 1949.

One of Europe's busiest waterways, the 2,860-kilometre **River Danube**, which flows through nine countries and is vital for transport, power, irrigation, industry and fishing, was wholly or partially blocked from Austria to its mouth on the Black Sea by thick ice, the worst for quarter of a century. Shipping was brought to a standstill for several weeks with scores of vessels confined to port. There were ice floes as much as half a metre thick at Belgrade.

The part of the Danube that flows through **Bulgaria** froze over for the first time in 27 years and, for the first time in decades, parts of the **Black Sea** froze near its shores, while the Kerch Strait linking it with the Sea of Azov was closed to navigation after more than 120 ships became trapped in it by ice. Bulgarian authorities banned all navigation on the river, reporting that the Danube was up to 90% ice-covered, with well over 200 ships stranded in six river ports and the river channel itself. Even farther west, in Austria, navigation was impossible as the river developed a layer of ice that was up to 12 centimetres thick in places.

The 'highway' to Dokkum, the most northern city in Friesland.
Photo: Rob Alblas

In European **Russia**, the temperature remained abnormally warm up till January 19, 2012, then turned abruptly. The average February temperature for Moscow is around –9°C, but a week into the month it was down to -20° with predictions that it could drop much farther, perhaps as low as -35°. By way of contrast, the north of Siberia was, at the same time, enjoying temperatures 14° above average. This was the coldest winter Russia had endured since that of 2005-2006.

Following a massive pile-up in a blizzard, about 100 damaged cars blocked the **Czech Republic**'s major road artery between Prague and the eastern part of the country and Slovakia.

The Thaw

The rapid thaw that arrived on February 20 brought chaos to the River Danube in the Serbian capital Belgrade, when massive ice floes careened into boats and bridges, causing widespread damage. The thick ice which had covered the waterways during the freeze began to break up as temperatures rose: boats crashed into each other and one boat owner claimed that the ice had moved so fast that there had been nothing they could do to save them. In the Kapetanija marina in the Serbian capital, only a small number of the hundred or so boats moored there escaped major damage. Debris was scattered among the breaking ice for hundreds of metres along the river, and several floating restaurants, barges and boats were beached on the banks of the Danube after the ice snapped their anchor lines.

The Cause?

A report from *NASA Science News* explained what happened (see URL at the foot of this page). A tight polar vortex that had bottled up the cold arctic air in the early part of the of winter suddenly weakened, allowing cold air to sweep out of Siberia into Europe. Such severe winters have occurred in the past: in winter 1683/84, the River Thames in England remained frozen with a thick layer of ice for nearly two months; in winter 1812, Napoleon's *Grande Armee* was defeated by the extreme cold in Western Russia.

The polar vortex is set up by the Arctic Oscillation [1] and traps a circulation of frigid air around the North Pole. Eventually, the Oscillation turned negative, allowing the cold air to escapes towards lower latitudes, resulting in the killing extremes noted above. However, breakdown of the vortex cannot completely account for the severity of the winter in Europe, and some climatologists attribute the unusual cold to Global Warming. The contention is that, since sea ice is being melted by warmer temperatures in the Arctic, more moisture is available for the atmosphere to pick up and drop as snow. As a result, Siberian snow cover increased, which in turn produced a cooling effect that spread throughout Europe.

Reference

1 Arctic Oscillation: GEOQ 29, page 6.

http://science.nasa.gov/science-news/science-at-nasa/2012/16feb_deepfreeze/

MaSat-1

Hungary's First Satellite

MaSat-1
Image: ESA

Les Hamilton

History was created on February 13, 2012 when Hungary became the 47th spacefaring nation, following the successful launch of their first satellite, *MaSat-1*. Along with seven other student built amateur radio satellites, *Masat-1* was just one of a total payload of eight cubesats launched from Kourou spaceport by ESA's new 30 metre tall, 130 tonne *Vega* launch vehicle.

Cubesats

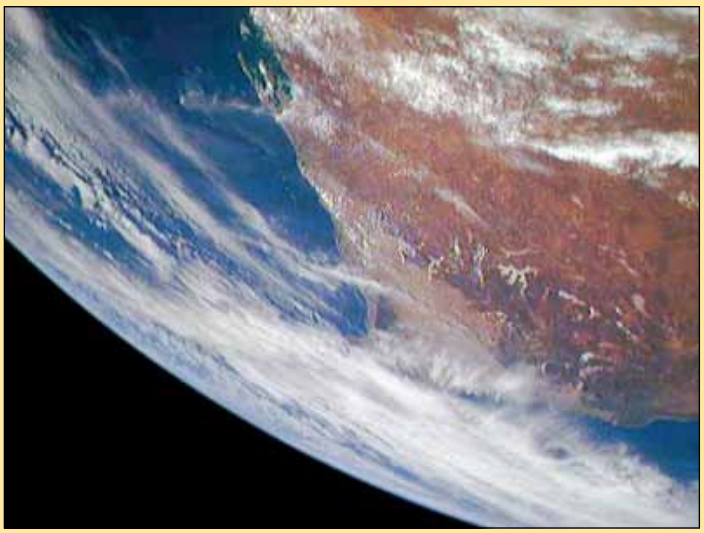
Cubesats are picosatellites—tiny satellites in the form of cubes measuring just ten centimetres on each side—with a maximum mass of one kilogram, intended for operation from university or radio amateur ground stations. They offer hands-on experience to aerospace engineering students in the design, development, testing and operation of a real spacecraft system and its ground segment. The cubesats launched in February were built by European universities as part of the ESA Education programme. They encompass a range of designs, miniaturised technologies and sensors, and are deployed into highly inclined 1441 x 310 km orbits. They have nominal working lifetimes of up to four years.

MaSat-1

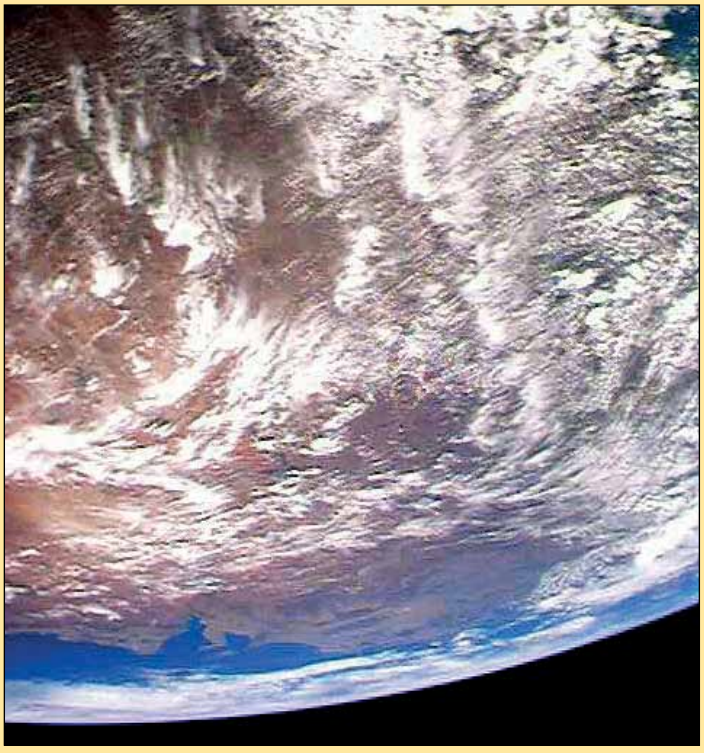
The MaSat project originated in September 2007, when a group of undergraduate and PhD students at BME (the Budapest Technical and Economics University) decided to design and build a small satellite. The initiative was encouraged by two departments of BME—the Department of Electron Devices and the Department of Broadband Infocommunications and Electromagnetic Theory—in cooperation with the Hungarian Space Office and various domestic companies. Since launch, the satellite has operated flawlessly, steadily transmitting data to the primary ground control station at the University, as well as to the secondary ground control station at Érd (also in Hungary). In addition to these domestic control stations, more than 120 radio amateurs have been receiving the satellite from around the world, contributing to the success of the mission.

MaSat's first image, the east coast of southern Africa, on March 8, 2012.

Although kept a secret prior to its launch, it was later revealed that *MaSat-1* carries a small on-board camera with a 640 × 480 pixels sensor, yet a mass as small as that of a 2-euro coin. The ground resolution in its images varies between 1 and 10 kilometres per pixel, depending on the craft's orbital position. At present, the space stabiliser and passive operating system of *Masat-1* only allow the satellite to acquire images of Earth's southern hemisphere. Work on the satellite's situation stabiliser is ongoing, and if active stabilisation becomes part of the daily routine, *Masat-1* should be able to provide images of the northern hemisphere as well.



MaSat-1 imaged SW Australia at 03:07 UT on March 12, 2012



MaSat-1 imaged SE Australia at 05:52 UT on March 12, 2012

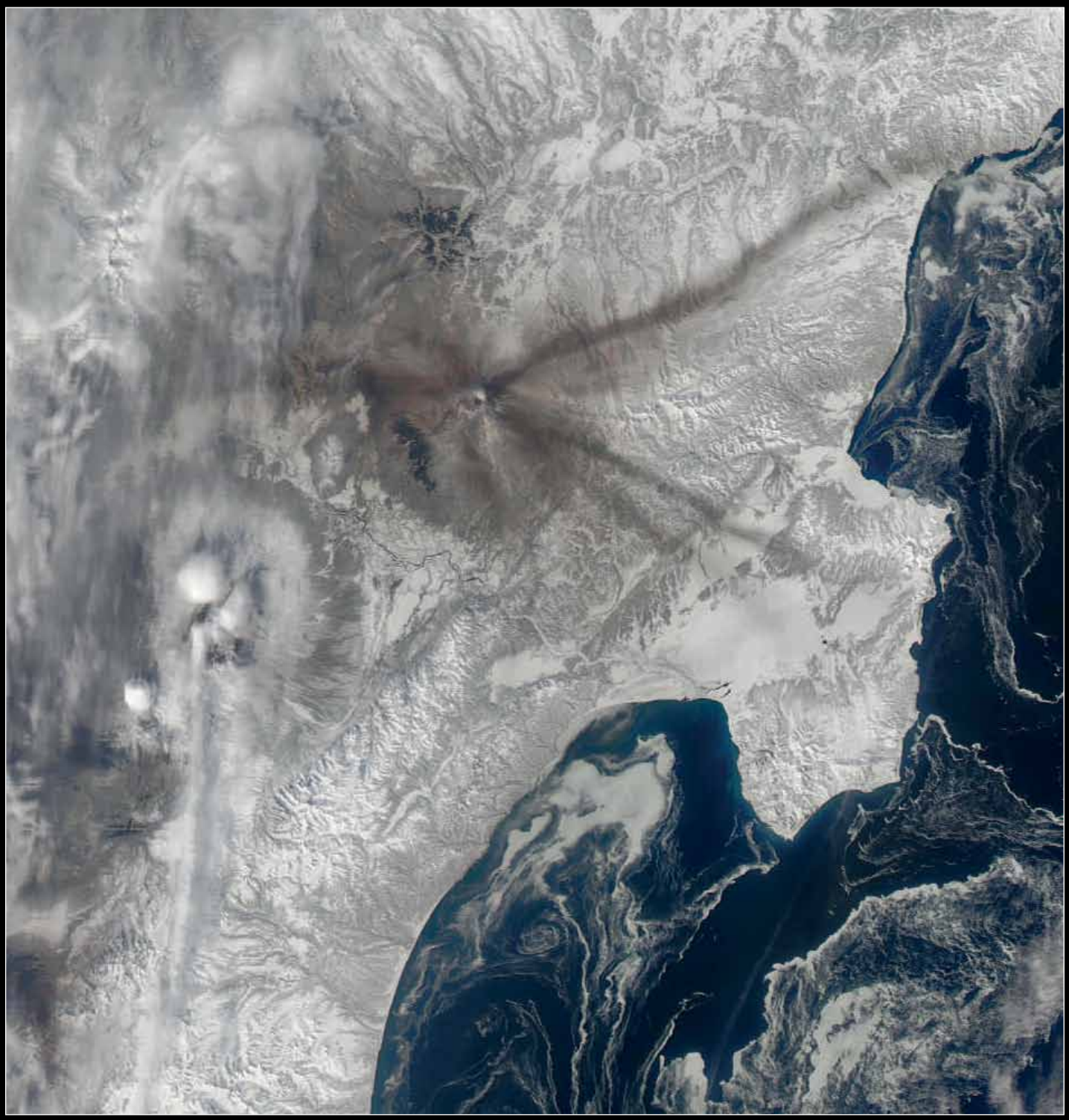
Images are stored in the camera and later transmitted to Earth when within range of a receiving station. As a pass of the satellite lasts a mere ten minutes, each picture has to be divided into several downloadable segments. MaSat's transmitting antenna is simply a 16-cm length of steel measuring tape. Of course, the picture quality cannot compete with the multi-billion dollar US weather satellite images, but does illustrate what is possible from a small satellite on a limited budget.

Reference

1 AMSAT -http://www.uk.amsat.org/5781
2 MaSat Home - http://cubesat.bme.hu/en/

Shiveluch Erupts

NASA Earth Observatory



Shiveluch, in Russia's Kamchatka peninsula, is one of the most active volcanoes on Earth and, during the first three weeks of April 2012, periodic brief bursts of volcanic activity left radial streaks of ash on the surrounding snow. Between April 4 and April 22, when this *Aqua* MODIS image was acquired, little or no new snow fell on the region, with the result that fallen ash remained visible throughout this period.

Varying wind directions at the time of each eruption determined where the erupting ash would be deposited and produced the 'cartwheel' pattern seen here. Additionally, the stronger or lengthier the eruption, the longer its resulting ash streak.

The natural-colour satellite image above was collected by the Moderate Resolution Imaging Spectroradiometer (MODIS) on the NASA's *Aqua* satellite. The *Kamchatka Volcanic Emergency Response Team* reported ash plumes that extended as far as 120 kilometres from Shiveluch on April 17 and 18. One of these eruptions was most likely the source of the conspicuous streak that stretches to the northeast.

NASA images by Jeff Schmaltz, LANCE/EOSDIS MODIS Rapid Response

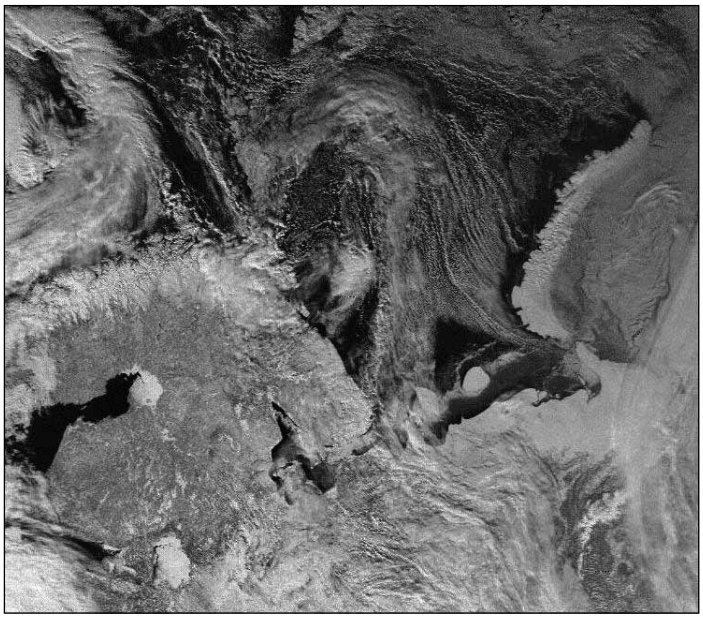
FeedBack

The page where readers can express opinions about GEO Quarterly Matters

Email: geoeditor@geo-web.org.uk

Hello Les,

GEOQ 33 happily arrived a few days ago and, as always, it is very interesting reading. I noticed that you are the author of a lot of the articles. Especially the article 'Sahara Revealed' pleased me, as did the article you wrote quite a while ago on the Aral Sea (GEOQ 16), which I have read several times. But also the article by Robert More was really interesting. If I should wish something more in GEOQ 34, it would be more articles on meteorology.



A NOAA 19 APT image of the Barentsz Sea at 09:53 UT on March 18, 2012.

I received this APT image, decoded and processed with Patrik Tast's APT Decoder, covering the Barentsz Sea. There are cloud streaks, and a weak cloud ridge can be seen near the Kola Peninsula. It would be nice to hear something about this from someone who knows more about meteorology than I do.

Best regards
Anders Höök, Sweden.

Hello Francis ...

Thank you for the latest copy of the GEO Quarterly that I received this morning, along with your polite reminder that I had not renewed my GEO subscription. The truth is that I made a positive decision not to renew my membership, this being mainly due to having limited funds that must instead be directed towards my current activities in the area of alternative astro-physics.

I would love to be a life-long member of all the groups I have been drawn into in the past but that would be impractical. In terms of cutting my ties with weather satellite monitoring, I fully intend to build on what I learned as a GEO member, in fact, it was my activities there that helped open the door to my current area of interest. This seems to be how my succession of hobbies has worked for me.

Thank you again for your interest in my involvement with the GEO group. I intend to remain a subscriber to the GEO internet forum on Yahoo. I wish you ongoing success and satisfaction in your role of GEO Director and offer a special special thank you to the GEO group and its members.

Take care ... Tom Findlay, England.

Building a Barometer

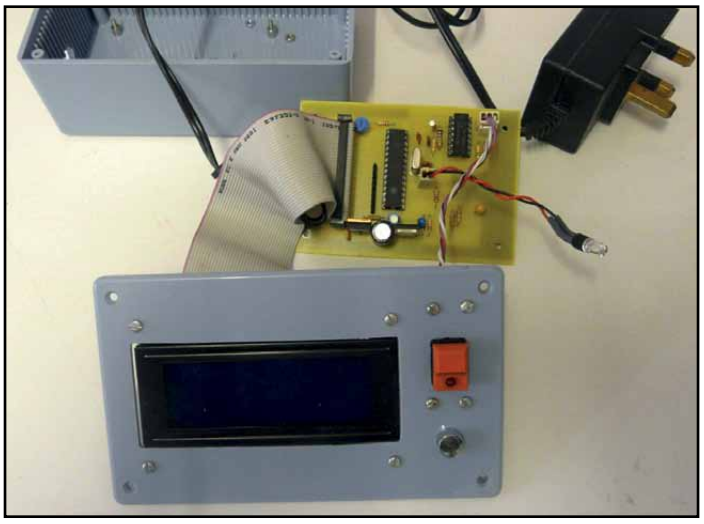
using a Digital Pressure Sensor

continued from page 24

LCD from *eBay* and all small parts from places like *Cricklewood Electronics, Farnell* and *Rapid* with a minimum order charge. It is easily built on *Verboard*, with the exception of the surface mount sensor. I make my own PCBs so mounting it was not a problem but the pin spacing is 0.05 inch, so it won't fit directly into *Veroboard* but could have wires soldered to it. Below is a picture of my finished unit (disassembled).

Guy Martin will be happy to answer readers' queries by email

gmartin@electroweb.co.uk



Guy Martin's home-brew electronic barometer

Missing Quarterly?

If your copy of GEO Quarterly has failed to arrive by mail within four weeks of the advertised publication time, please contact our Membership Secretary, who can arrange for a replacement copy.

Contact Details

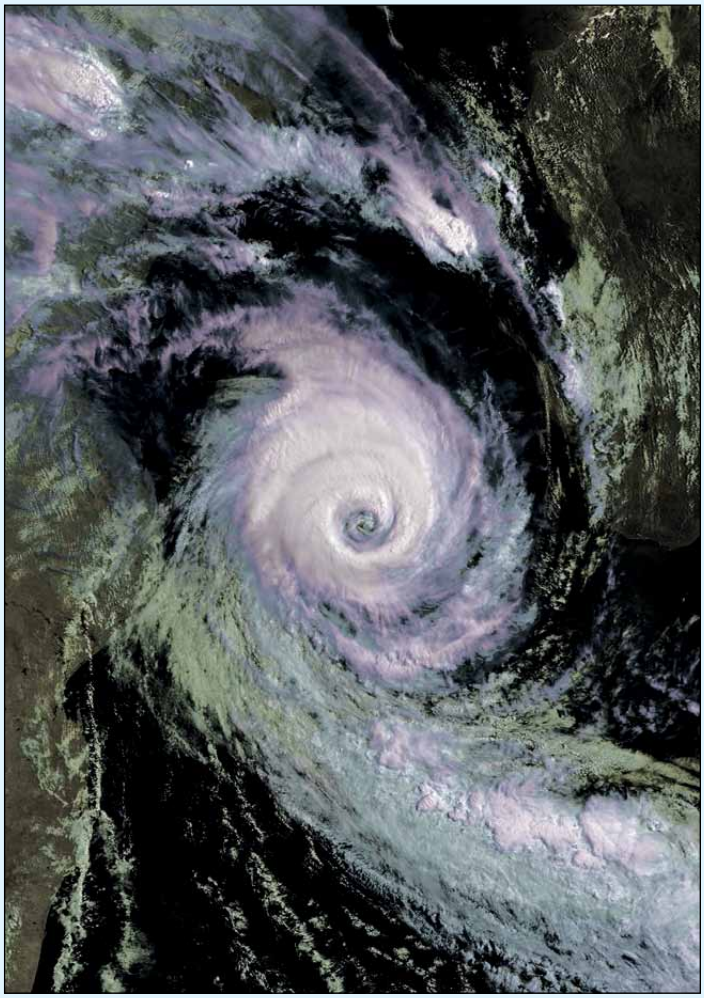
David Anderson,
35 Sycamore Road,
East Leake, Loughborough LE12 6PP
England, UK.

Telephone - 01509 820 067
Fax - 01509 559 015
email: members@geo-web.org.uk

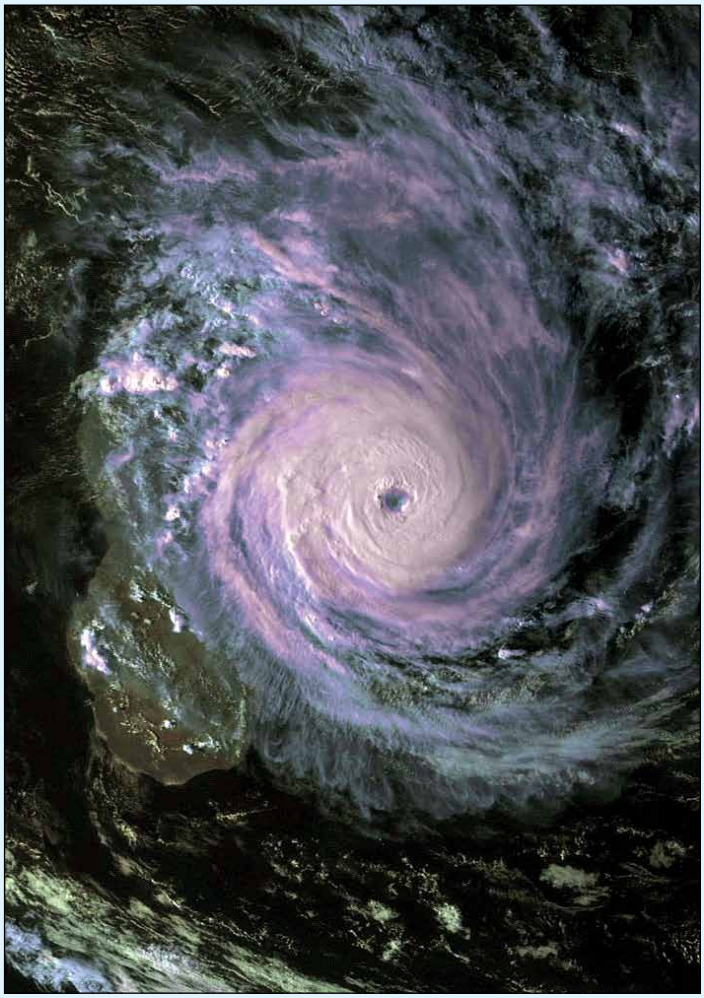
Cyclones Funso and Giovanna

hit the SW Indian Ocean

John Tellick



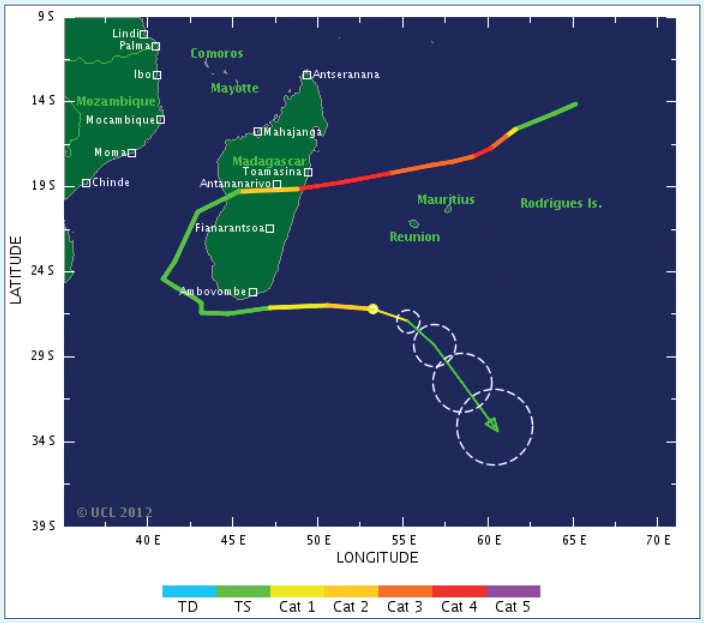
Metop-A AVHRR image from January 27, 2012 showing Cyclone **Funso** tracking down the Mozambique Channel.
Image © EUMETSAT 2012



Meteosat-7 image from February 13, 2012 showing Category 4 Cyclone **Giovanna** crossing the coast of Madagascar.
Image © EUMETSAT 2012

January and February 2012 have seen two intense Category-4 cyclones in the southwestern Indian Ocean. Category-2 cyclone **Funso** caused considerable damage, flooding and some loss of life in Mozambique, but thankfully proceeded to track down the Mozambique Channel between Africa and Madagascar as it strengthened to category-4. Considering the intensity of this storm, nearby African countries were fortunate to be spared from its destructive winds of up to 220 kph. Funso arrived only a few days after tropical depression **Dando** which caused flooding to several SE African countries in the same area.

In February cyclone **Giovanna** headed ominously towards Madagascar for several days as it developed into a category-4 storm. Giovanna made landfall in the early morning of February 14, just north of Vatomandry and continued to track across a large part of the island at category-3. Giovanna caused considerable damage to homes, crops and, power lines; trees blocked roads and there was serious flooding; and there were 16 deaths while 11,000 were made homeless. After downgrading to a tropical storm, Gilvanna meandered down the southwest coast Madagascar for another four days before heading back into the Indian Ocean, where it briefly increased to a category-2 cyclone again before finally petering out.



Cyclone Giovanna's actual and predicted track as of February 20, 2012.

The UK Space Agency

... and its publication SPACE:UK

Francis Bell

It was just a few days after writing for *GEO Quarterly 33* my brief reviews of three space related journals received, free of charge, from ESA, EUMETSAT and the Natural Environment Research Council, that a further free publication dropped through my letter-box. This was *Space:UK* published by the new UK Space Agency (UKSA).

Looking back through past *GEO Quarterlies,* I note that I had reviewed this publication before in our *Launch Edition* in 2004. However, in those days, it was published by the British National Space Centre (BNSC), a partnership between six Government Departments, two Research Councils, the Met Office and the Technology Strategic Board. This has recently evolved into the new *UK Space Agency*. In the past, I have had dealings with BNSC, visiting their offices in London and attending their conferences in Godalming, Surrey with GEO exhibition materials. Also, in the educational section of *Space:UK*, there have been reports of personal radio contacts made by my school with the MIR space station and several NASA space shuttles. Although I am not fully up-to-date with the changes relating to BNSC, I believe all their responsibilities have been transferred to the newly formed UK Space Agency.

I know UKSA held their first conference for the UK Space Industry in Manchester last year. I am told that the UK Space Industry is worth about £6.5 billion annually to the UK economy and indirectly supports about 65,000 jobs. I have no inside knowledge, but with such a massive industry to coordinate, a national agency seems logical, hence the birth of the UK Space Agency. I do not know the mandate or terms of reference for UKSA but I am researching this for my own satisfaction and understanding. If there is a knowledgeable member within GEO it would be great to be informed about those matters, which would be of interest from our perspective of Earth observation and weather satellites. This is a direct request—so if you think you can contribute UKSA information, please let myself or the editor know so that we can share it with others. The UKSA's web site is

www.bis.gov.uk/ukspaceagency

and I am reading these informative pages with interest.

Magazine Review

The winter 2011 edition of *Space:UK* is slightly bigger than usual, with 26 high quality colour pages. The editorial directive is that the publication should try to cover the whole range of British space endeavours. Reflecting UKSA's new publishing responsibility, page two carries a report by Emma Lord, Director of Policy and Operations for UKSA, which is worth reading, anticipating, as it does, UKSA's priorities for 2012.

Other articles include reports relating to new missions researching the Sun and *Dark Matter*, Rescue Satellites, the Martian adventures, Farewell to ERS-2, Underground Astronauts, a main feature relating to a mission to Mercury (including a Mercury pull-out poster), an article on Living in Space, and UK Rocket Pioneers. The final five pages are devoted to an educational and careers section.

Request

This is a request directed towards GEO members who may be interested in receiving this free publication on a regular basis. The availability of this publication in a printed format depends on there being a viable number of subscribers/readers: see my reviews in *GEOQ33*. Please apply to UKSA to receive this free publication. With my last copy I received a renewal card which I have

completed and returned to UKSA, but it is clear that new readers can also apply to receive regular copies. There does not seem to be an email contact address, so send a letter or card asking to be included on the distribution list.

Be sure to include in your letter, your name and full postal address with post code and country. Say what organisation you represent (GEO), and state something like: "I wish to subscribe to UKSA's newsletters and mailings, including Space:UK". Then say how many copies you would like: for most people this will be one but, if you belong to a club or other group, you may ask for two or more copies.

Address your letter to:

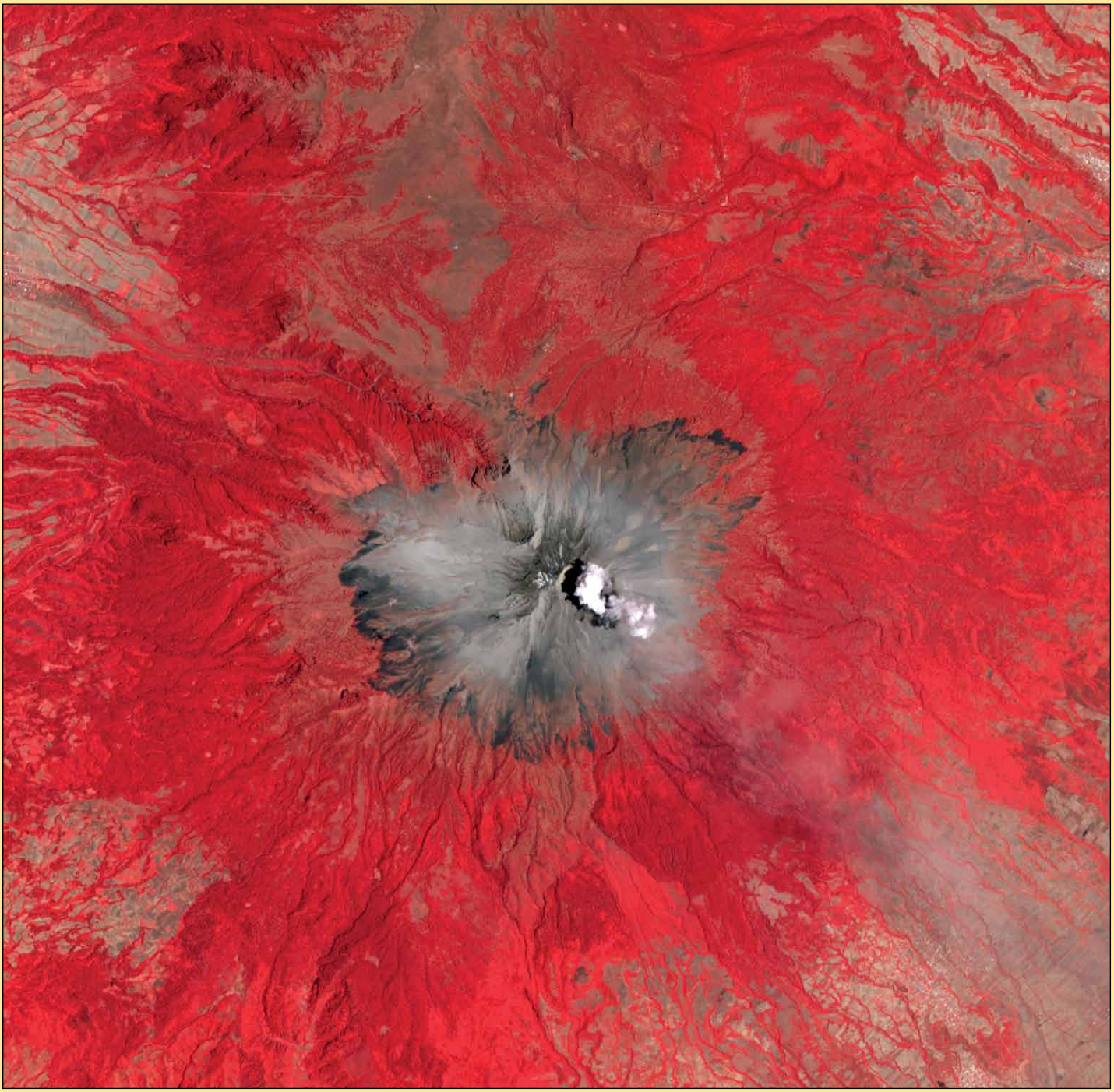
Newsletter and Space:UK Subscription
UK Space Agency
Polaris House
North Star Avenue
Swindon SN2 1SZ

It is worth noting that there is a request for 'country' in the subscriber's address, so people outside the UK may also be able to receive *Space:UK* free of charge. It's worth a try. Please action the above subscription request for this and other publications. If you don't then one day they may not be available in printed format.

Finally. Those who have a copy of the Winter 2011 *Space:UK* may be able to answer my question about the phonetic spelling of the word 'optic', spoken with a Welsh accent. Is the answer on the inside back cover of this latest Space:UK publication?

Popocatepétl Awakes

A NASA Earth Observatory Report



The 5426 metre high Popocatépetl (Aztec for 'Smoking Mountain') is situated 70 kilometres southeast of Mexico City and is one of Mexico's most active volcanoes. It has been showing signs of increasing eruptive activity since the start of 2012, with near constant venting from fumaroles and minor steam, gas, and ash emissions. By mid-April, activity had increased significantly, when explosions were propelling volcanic blocks 500 meters beyond the crater rim while substantial ash plumes were rising 1.5 kilometres above it.

The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) instrument flying aboard NASA's *Terra* satellite captured this false-colour image of the volcano at 17:17 UT on April 23, showing a plume of gas and steam drifting east above the crater. The red colour depicts forests and vegetation surrounding the volcano.

The last major eruption of Popocatépetl occurred 1200 years ago, when vast quantities of lava and ash from it completely filled many of the surrounding valleys. Since then, there have been at least five moderate eruptions, two of them during the 1900s.

R2ZX Revives Enthusiasm for WXsats

Les Hamilton

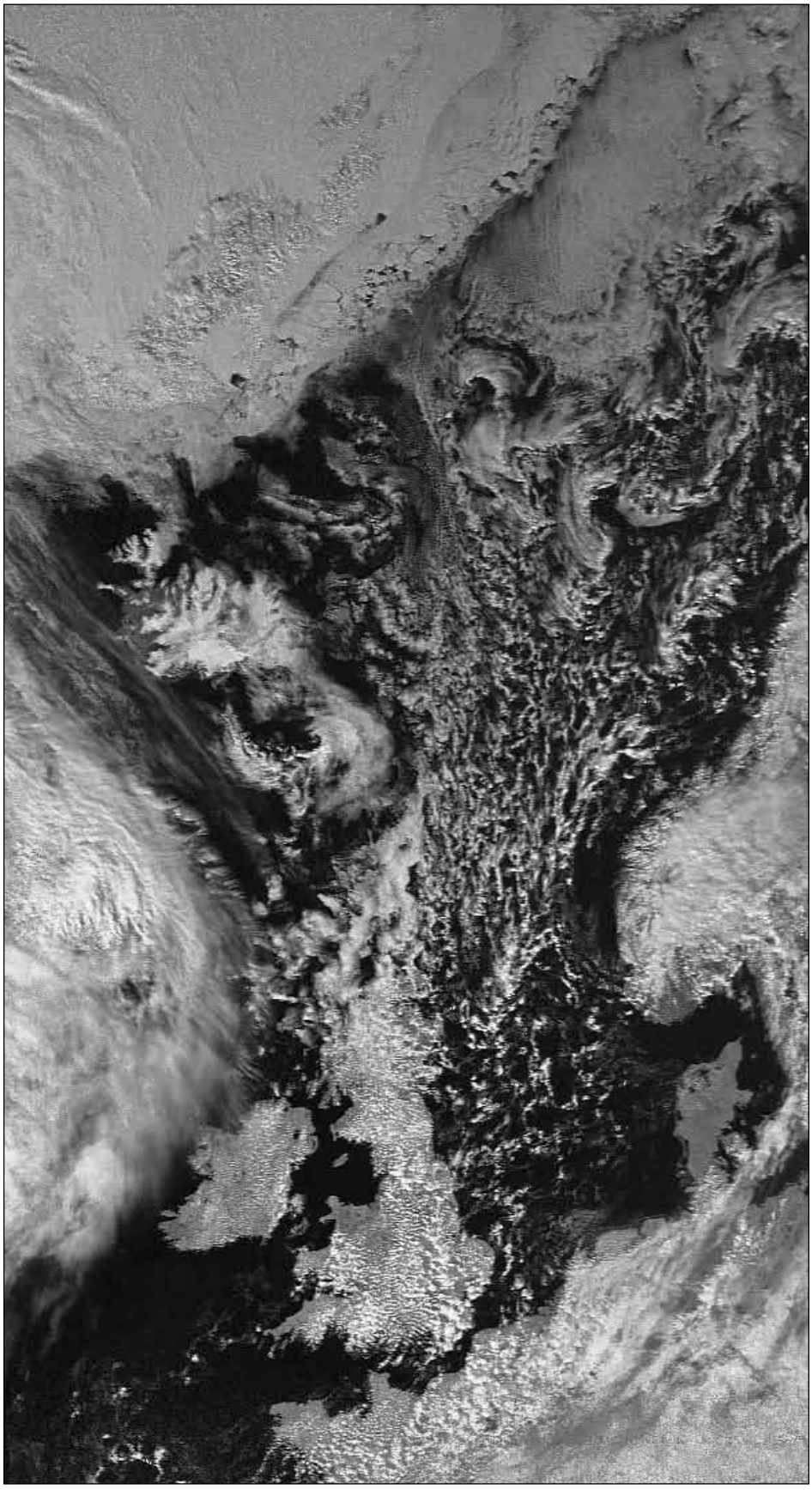
I recently received a number of emails from Graeme Caie, who lives in Aberdeen in northeast Scotland, relating his experiences with an R2ZX APT receiver that he had newly purchased from the *GEO Shop*. Graeme had been involved with weather satellite reception for many years, firstly using a *Maplin* receiver that lacked PLL tuning. This, of course, was in the years before pager interference blighted the hobby, and, despite the simplicity of the receiver, image quality was excellent.

Graeme went on to build several receivers himself, all of which produced excellent images—until the pager problem started. At that time *Cirkit* were producing a receiver with a 30 kHz IF, which continued to produce good images until the reception frequencies changed with the arrival of NOAA-18 and NOAA-19. Unfortunately, these new frequencies were not accessible with the crystals in the receiver, and Graeme moved away from the hobby.

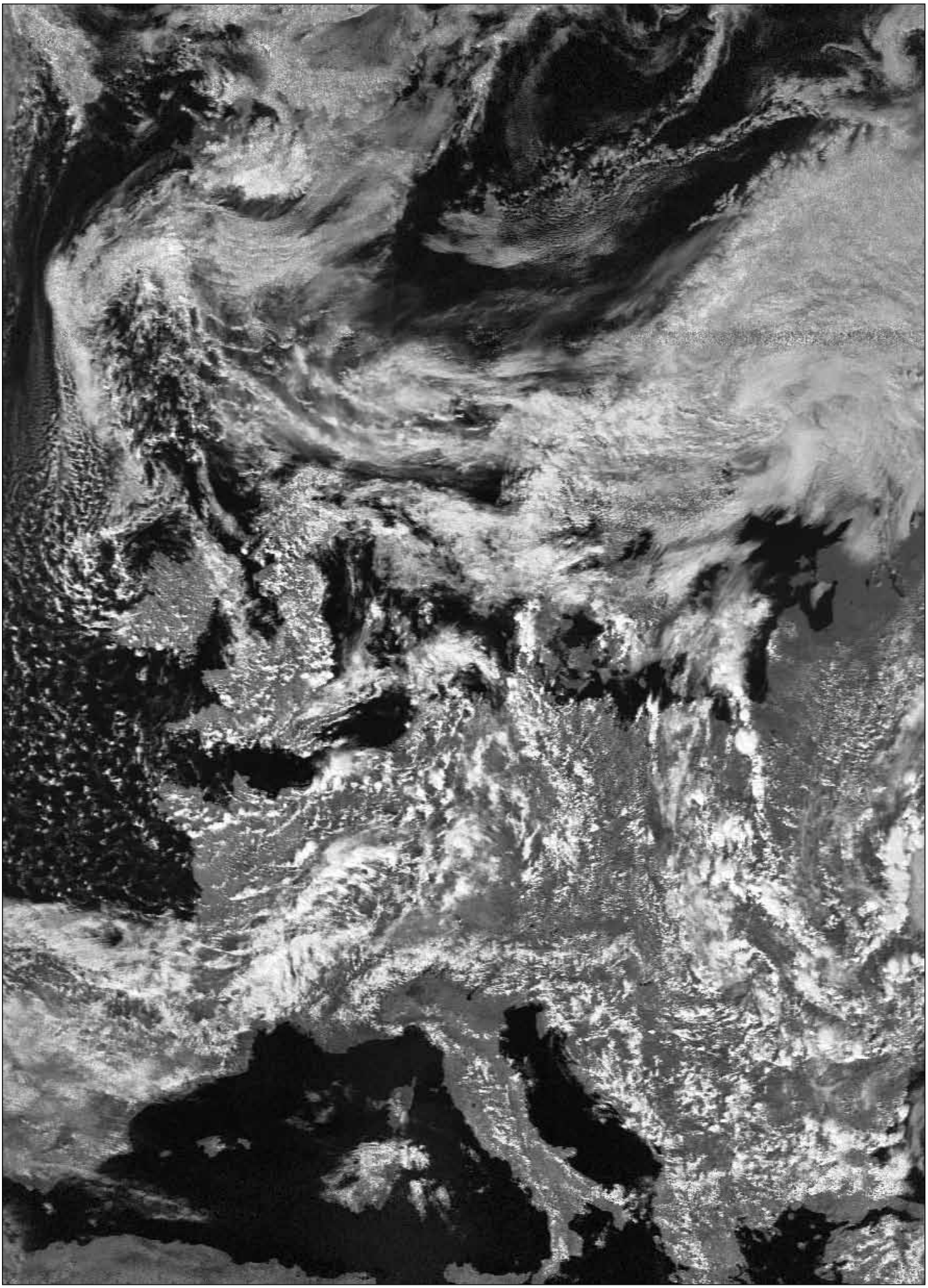
After several years, Graeme felt the urge to resurrect his hobby before APT died and, on the recommendation of GEO, purchased an R2ZX, which he describes as 'this wonderful little receiver—what a gem'. Within an hour, Graeme had already picked up NOAAs -15, -18 and -19 using an indoor antenna, without any pager problems. Graeme continued: 'Having attempted many things to remove the interference from my receivers, and failed, I think this design is brilliant'.

Graeme has now built a crossed dipole antenna and slung it on to a tree at the back of his garden. Some of Graeme's images appear below. and on page 43 I suspect, though, that he may have to reposition his aerial once the trees come into full leaf.

A NOAA-15 image from 13:51 UT on April 15, 2012



Part of the 13:13 UT NOAA-19 image on April 15, 2012, received using an indoor antenna.



April showers over Europe in this image, acquired from NOAA-19 using the tree-mounted antenna, on April 21, 2012.

Sich-2 Showcase

Ukraine's Sich-2 satellite continues to transmit regular high-resolution images of selected locations on the Earth's surfaces. The images below include extremes, a cityscape and a mountain range.

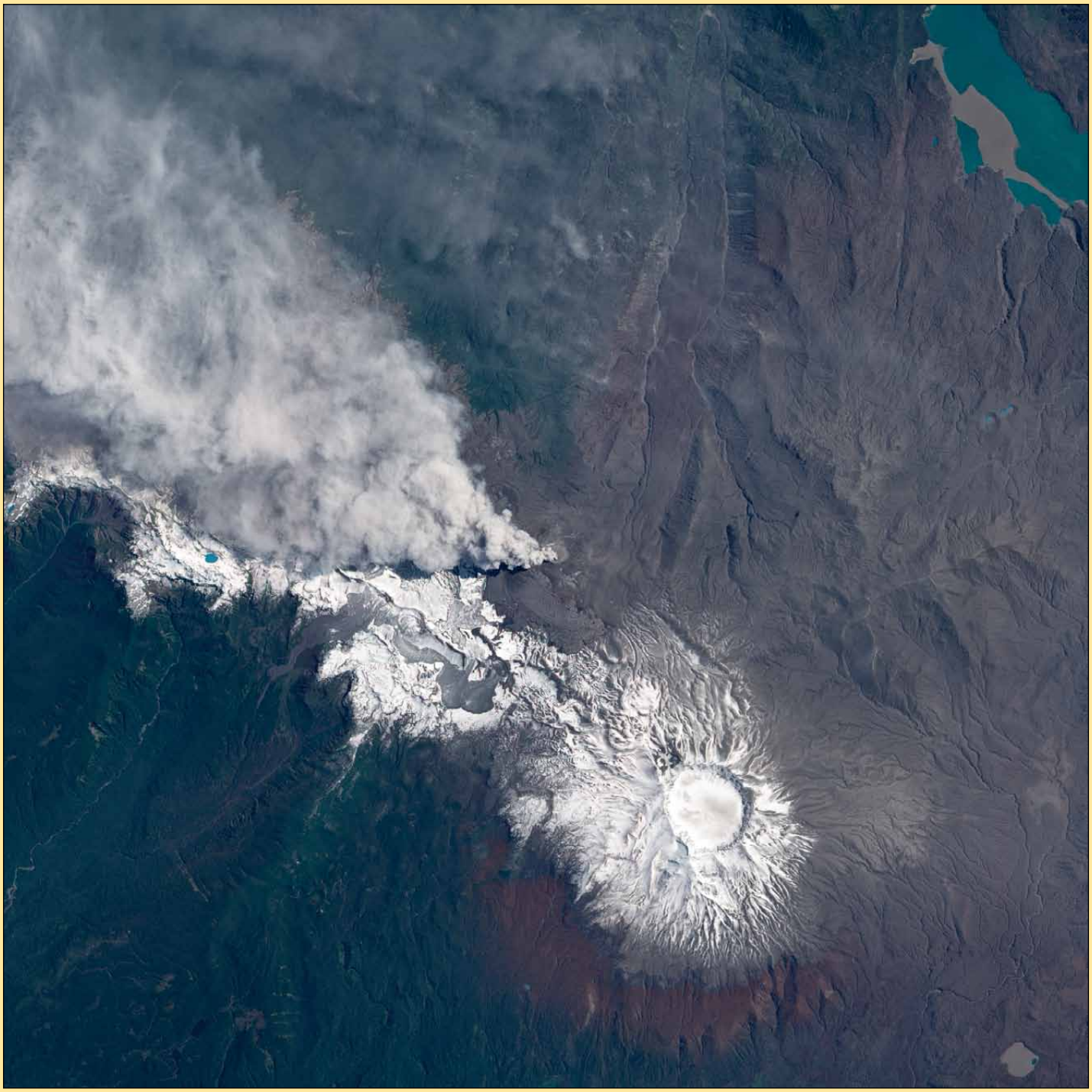
Images courtesy Dniprokosmos (www.dniprokosmos.dp.uk)

The United States city of Cincinnati was imaged by Sich-2 on March 6, 2012

Sich-2 imaged these snow-covered mountain ranges near Ighil M'Goun (4071 m) in Morocco's High Atlas on February 27, 2012.

PUYEHUE-CORDÓN CAULLE

A NASA Earth Observatory Report



Chile's Puyehue-Cordón Caulle Volcano erupted explosively in early June 2011, sending volcanic ash around the Southern Hemisphere. By late December, although activity at the volcano had calmed, volcanic ash and steam continued to pour through the fissure that opened in June, the airborne ash continuing to cause disruptions to air travel through the region to Patagonia.

Reaching an altitude of 2,236 meters, Puyehue-Cordón Caulle is a stratovolcano, a steep-sloped, conical volcano composed of layers of ash, lava, and rocks released by previous eruptions. This volcano comprises part of the largest active geothermal area in the southern Andes. Evergreen forests to the east of the volcano have been damaged by months of nearly continuous ashfall whereas forests to the west have only received intermittent coatings of ash and appear relatively healthy. The government of Chile has declared an agricultural emergency for the Los Rios region due to the destruction caused by ash falls.

The Advanced Land Imager (ALI) on NASA's Earth Observing-1 (EO-1) satellite captured this natural-colour image on December 23, 2011. The active fissure lies northwest of the Puyehue caldera, and a plume blows from the fissure toward the west and north. This image shows not just ash but also snow on the volcano surface, including the caldera.

NASA Earth Observatory image created by Jesse Allen, using EO-1 ALI data provided courtesy of the NASA EO-1 team.

EUMETCast On-Line Registration Guide

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

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

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

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

GEO Helplines

Douglas Deans
Dunblane, Perthshire, SCOTLAND.
All aspects of weather satellites from APT, HRPT to Meteosat-9 DVB/EUMETCast systems.

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

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@btopenworld.com

Mike Stevens
Portland, Dorset, England.
Advice and assistance offered on **EUMETCast** (MSG and Metop) and **Envi-Ham** (including ESA's *Visat* software for decoding the images).

- email: mike1g4cfz@msn.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 34 is Sunday, August 5, 2012

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.

Group for Earth Observation

Membership Application Form

Current Subscription Rates

United Kingdom ... £20 Europe ... £24 Rest of World ... £28

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

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

Name (please PRINT clearly)

Address

Town/City

Postcode/ZIP Callsign

Country

Telephone Number FAX

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

Declaration

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

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

Signature

Date

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

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

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

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

GEO Shop

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

The 'Pager-Hardened' R2ZX
APT Weather Satellite Receiver

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

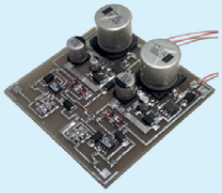
UK members price - £210 **UK non-members price - £224.00**

We still stock the original R2FX receiver which has proved itself to be a top-quality receiver throughout Europe and the world at large. Members in the UK find that the R2FX gives perfect reception of NOAAs 15 and 19, and in favourable locations (pager-free) of NOAA-18 also.

UK members price - £180 **UK non-members price - £194.00**

John Silver's Lightning Radar Board

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



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

Current Price List

	Members' Prices			Prices for non-Members		
	UK	EU	RoW	UK	EU	RoW
R2ZX APT Receiver (no PSU)	210.00	214.00	222.00	224.00	228.00	236.00
R2ZX APT Receiver (no PSU)	180.00	184.00	192.00	194.00	198.00	206.00
BNC Lead (0.25 metre)	5.35	6.10	6.60	7.35	8.10	8.60
UK Power Supply Unit (12 volt)	9.50	---	---	12.00	---	---
Dartcom High Quality QFH antenna	275.00	355.00	---	295.00	375.00	---
John Silver Preamplifier (built)	35.00	36.00	37.50	40.00	41.00	42.50
John Silver Lightning Radar Board	55.00	58.00	61.00	65.00	68.00	71.00
Bias Tee	24.00	24.50	25.00	28.00	28.50	29.00
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~~	90.00	95.00	---	100.00	105.00	---
Telestar 80 cm dish with LNB	69.50	---	---	76.50	---	---
Telestar Ku band universal LNB	12.50	14.00	---	19.00	20.50	---
Technisat Satfinder Alignment Meter	26.50	29.50	---	29.50	33.50	---
GEO Quarterly Back Issues (subject to availability)	3.50	4.20	5.10	n/a	n/a	n/a
GEO Quarterly (PDF on CD) 2004-2011 (Annual compilations - state year)	8.00	8.80	9.30	n/a	n/a	n/a
GEO Membership (4 issues annually)	20.00	24.00	28.00	20.00	24.00	28.00

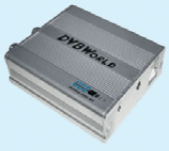
All prices are in £ sterling and include postage and packaging

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 - £24.00
UK non-members price - £24.50

DVB World DVB-S2 USB Receiver



The DVBWorld **DVB-S** USB-2 superior 'free-to-air' satellite TV and data receiver is recommended for trouble-free *EUMETCast* reception. It is supplied with a GEO set-up CD containing software and instructions.

UK members price - £ASK
UK non-members price - £ASK

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

UK members price - £ASK
UK non-members price - £ASK

APT Preamplifier

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

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

Universal Ku-band Satellite TV LNB 0.20 dB (or equivalent)

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

UK members price - £12.50
UK non-members price - £19.00

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

Ordering and Shipping

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

Orders should be sent to:

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

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

+44 (0) 1202 893 323

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

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

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)
for GEO Quarterly are

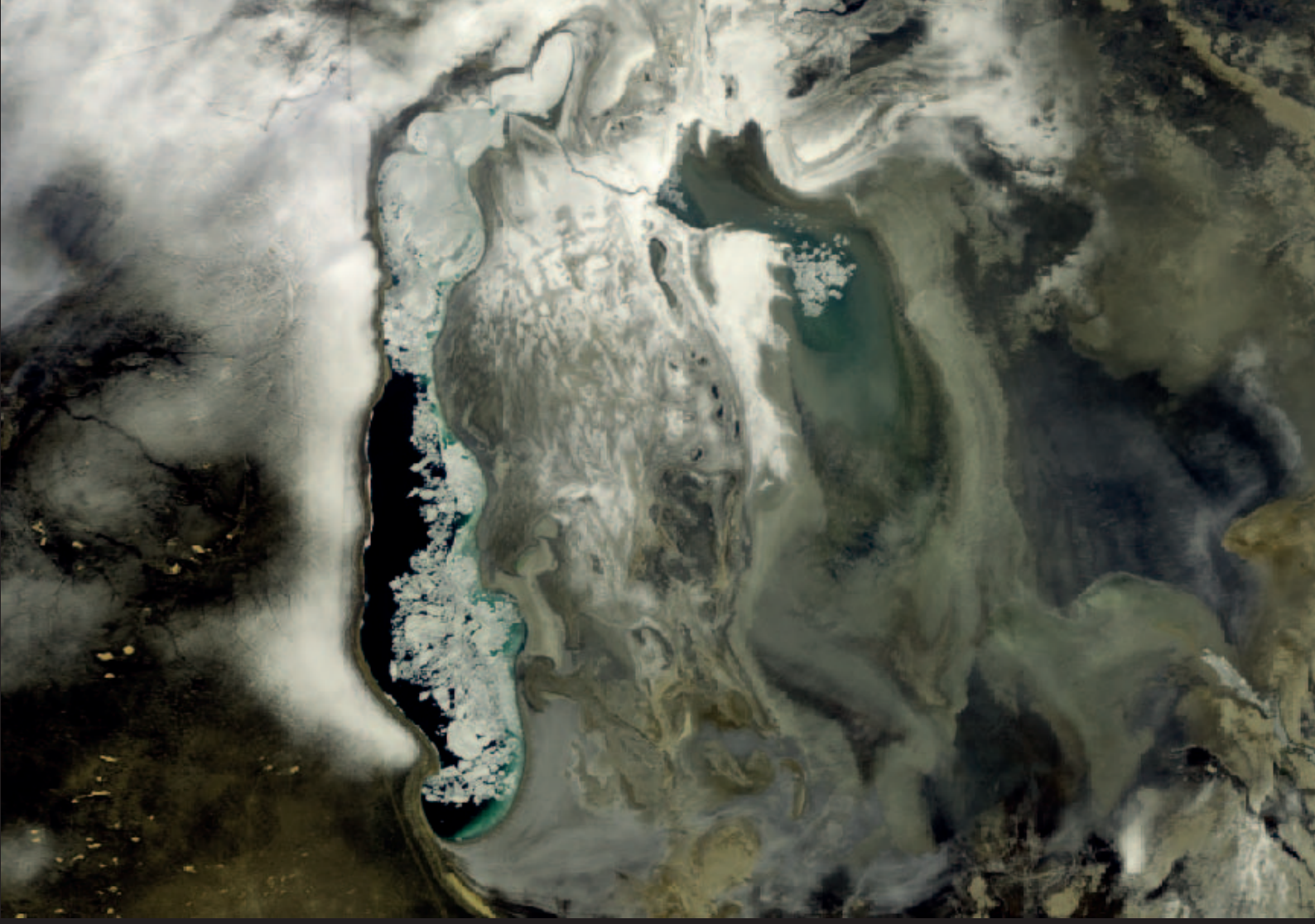
£20 (UK)
£24 (EU)
£28 (rest of world)

Telestar 80 cm dish and Universal 0.2 dB LNB

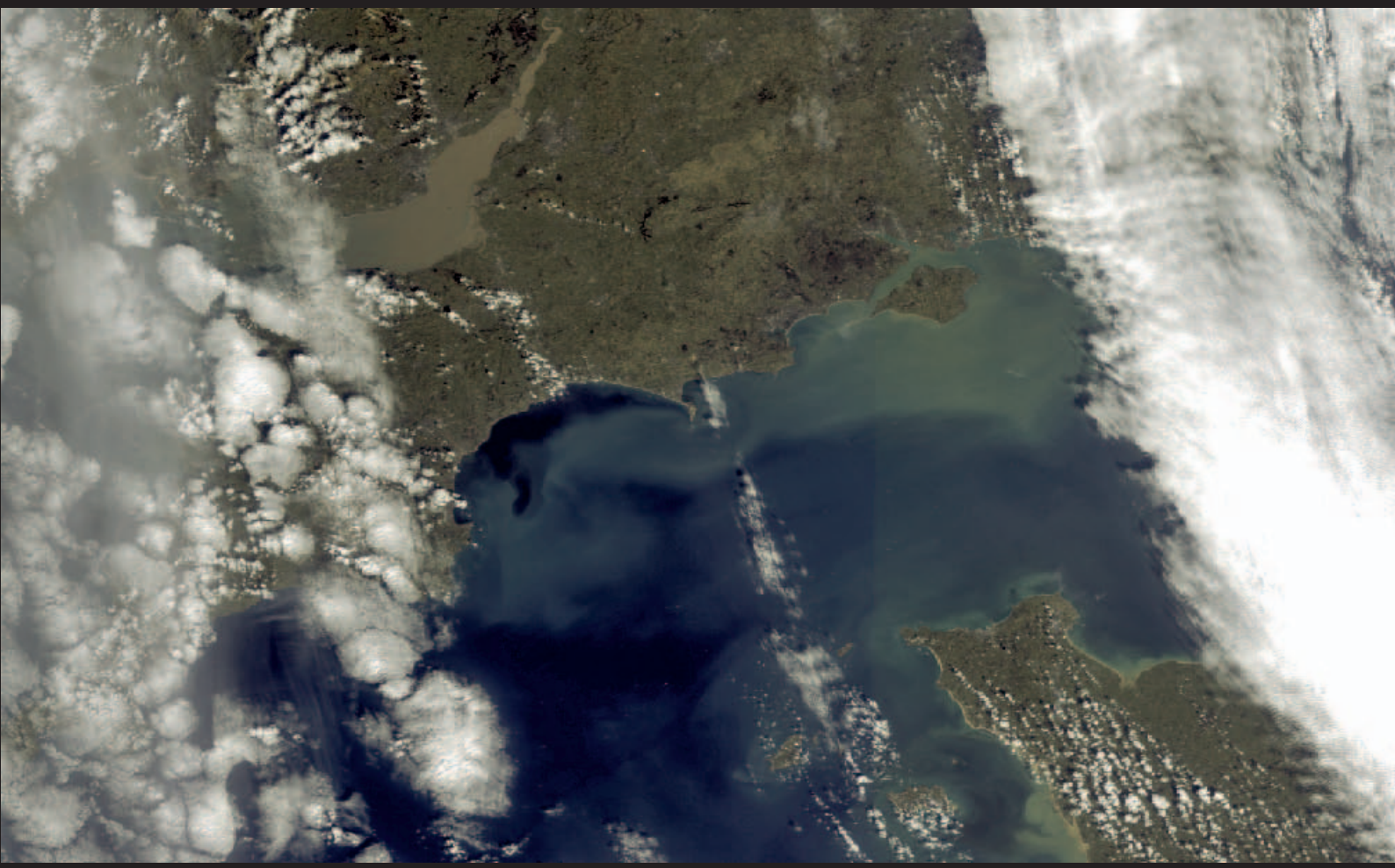
(or equivalent)

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

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



Mike Stevens spotted this Envisat MERIS image of the Southern Aral Sea, dating from March 21, 2012, with the winter ice cover starting to break up



Another fine MERIS image from Mike Stevens, this time showing detail in the English Channel on March 3, 2012