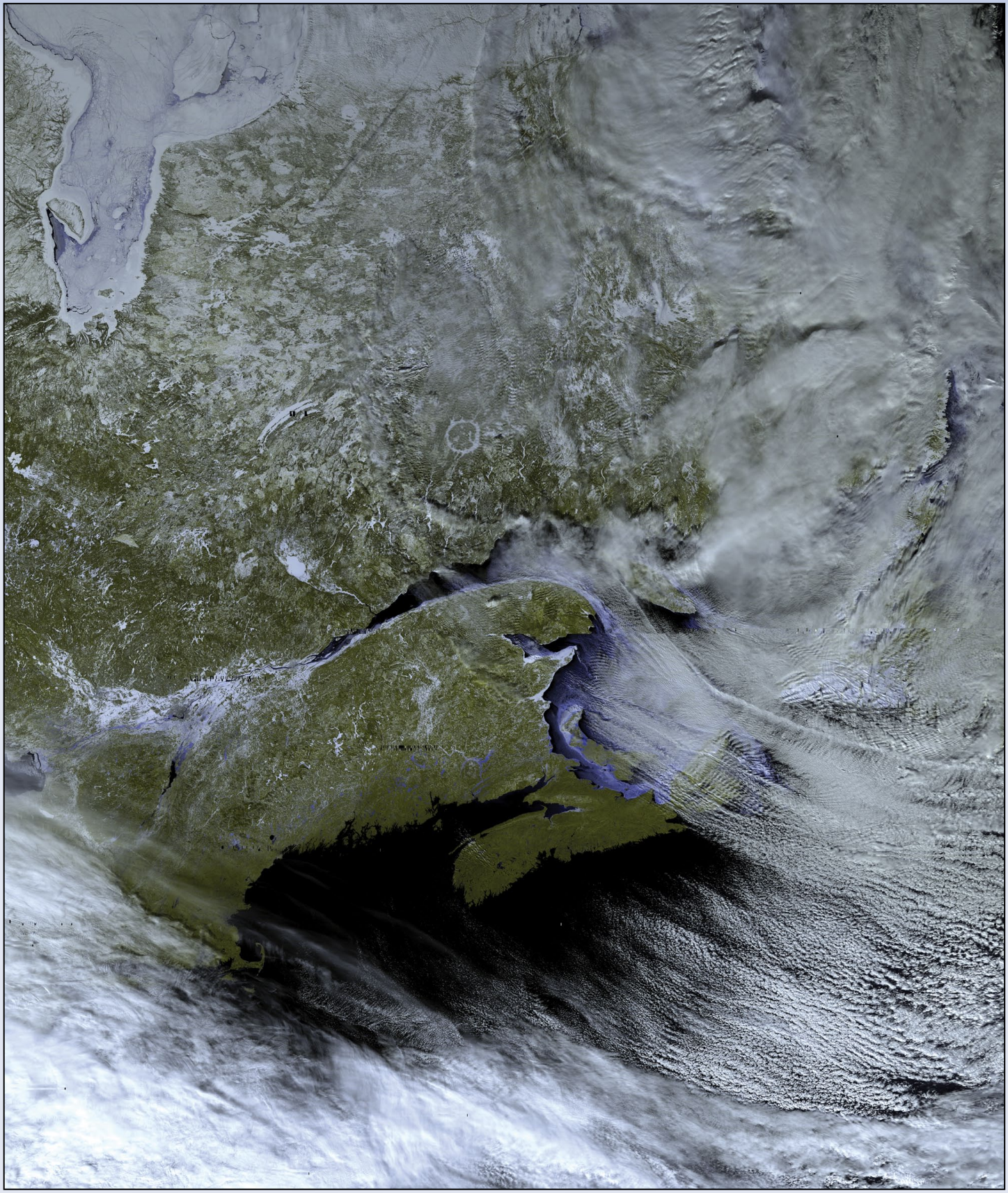
GEO Newsletter

Group for Earth Observation

Group for Earth Observation

No 61 - March 2019



This MODIS image is part of an Aqua X-band transmission dating from February 11 this year, captured by Canadian Jean-Luc Milette using homebrew equipment. The segment displayed above measured 8300 pixels in width and was cropped from the full transmission which measured 13384 × 15040 pixels. Jean-Luc describes his set-up in an article on page 11.

Useful User Groups

Weather Satellite Reports

This group provided weekly reports, updates and news on the operational aspects of weather satellites.

https://groups.io/g/weather-satellite-reports

SatSignal

This end-user self help group is for users of David Taylor's Satellite Software Tools, including the orbit predictor WXtrack, the file decoders GeoSatSignal and SatSignal, the HRPT Reader program, the remapper GroundMap, and the manager programs - MSG Data Manager, GOES-ABI Manager, AVHRR Manager etc.

https://groups.io/g/SatSignal

MSG-1

This forum provides a dedicated area for sharing information about hardware and software for receiving and processing EUMETCast data.

https://groups.io/g/MSG-1

GEO-Subscribers

This is the official group is for subscribers of the Group for Earth Observation (GEO), aimed at enthusiasts wishing to exchange information relating to either GEO or Earth Observation satellites.

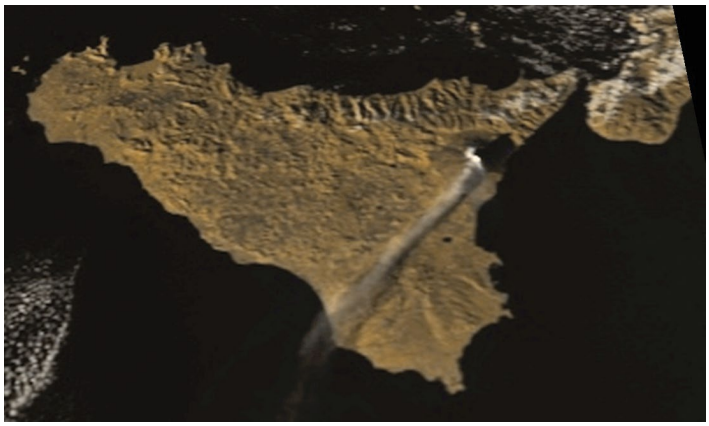
https://groups.yahoo.com/neo/groups/GEO-Subscribers/info

Meteor M N2-2 Delayed Again

Last issue we reported that Russia's next Meteor weather satellite, Meteor M-N2-2, was provisionally set for launch during March 2019. But there has been a further delay, and the WMO's OSCAR website now states that the launch is now unlikely before June 2019 at the earliest.

You can keep up to date with any changes to this information at the following URL

https://www.wmo-sat.info/oscar/satellites/view/483



Peter Kooistra obtained this Feng Yun 3D image of the Etna eruption plume on December 27, 2018. You can read more about this eruption on page 9 inside.

Visit GEO on Facebook

http://www.facebook.com/groupforearthobservation

Group for Earth Observation

and follow the dozens of links to NOAA, NASA, ESA, EUMETSAT and much more ...

From the Editor

Les Hamilton

For years it has been promulgated that ever increasing data rates, and transmission frequencies in the X-band, would lead to the demise of direct reception of high resolution weather satellite imagery by amateurs. But not so.

Earlier this year I received a memo from David Taylor to alert me that Jean-Luc Milette from Québec, Canada had been receiving X-band data from NASA's Aqua and Terra satellites, as well as NOAA 20 and China's Feng Yun 3D. What's even more remarkable is that he is doing so using a hand-tracked dish! One of Jean-Luc's recent images is reproduced, in part on the front page of this Newsletter. The original 132 MB image measured a staggering 11384 × 15040 pixels.

The outcome is that we have an article, starting on page 11 of this issue, where Jean-Luc explains the home-brew system he has devised to achieve this remarkable breakthrough. It's not a full scale construction project, but it should be sufficient to allow those of you who have been heavily involved in home-brew projects over the years to emulate his system.

As you will read elsewhere in this issue, it is with regret that a very poor response to the proposed visit to EUMETSAT next July has resulted in the trip having to be put off— for this year at least. We will address the possibly of such a visit again in the future, perhaps as early as 2020 if there is sufficient interest.

Finally, a reminder that GEO is always interested in learning about initiatives being undertaken by our readers. Jean-Luc's enterprising foray into the world of X-band underlines what is becoming possible. Should any reader contemplate following in his footsteps, we will welcome it if you get in touch and share your experiences with the GEO community.

Materials for publication are always welcome, by email, to

geoeditor@geo-web.org.uk

Contents

The GEO Report

Francis Bell

Darmstadt Visit

Rather distressingly, I have to report the very poor response there has been for our planned GEO visit to Darmstadt on 4th July this year. I spite of the long notice that has been given for this visit and the encouragement relating to the success of our past visits to date there have only been eight registrations for our Darmstadt visit this year.

My judgement is that a group of eight or thereabouts does not justify the potential disruption our visit would cause to the leading international space agencies such as EUMETSAT, ESOC and their associated ground stations. For our last GEO visit in 2015 we had 28 members in the group and in other years our number have been in excess of 30. Just check the number of our members shown in our photographs of previous visits.

I note that in our past visits to Darmstadt, our hosts went to the trouble of organising detailed tours of their facilities, providing guides, plus making formal presentations relating to some technical aspects of their weather satellite reception. For a group of eight this would be unreasonable.

Because of the lack of widespread support for our proposed visit I have decided to cancel this year's visit to Darmstadt. I cannot personally justify the disruption we would cause to the space agencies for such a small number of visitors. Perhaps we can try again in 2020.

I will contact directly those who have already registered with Rob Denton with the news about the cancellation of our 2019 Darmstadt visit.

I am very disappointed with the outcome of this planned visit to our friends at EUMETSAT and ESOC not to mention missing the social experiences we have enjoyed in the past.

GEO Accounts

Again this year we are publishing our annual accounts on our website because we have not had a membership meeting during 2018.

When GEO was first established it was decided to create two bank accounts: the 'Membership A/c.' and the 'Shop A/c'. The Membership A/c was intended to deal with membership subscriptions, printing and the distribution of *GEO Quarterly,* together with other costs involved in running the group. The Shop A/c was, as the name indicates, to deal with the modest trading within the group of electronic equipment and software. This also gave a

GEO Accounts

Year ending November 30, 2018

Shop Account

Income		Expenditure	
Opening balance	£14,019.00	GEO Quarterly No 56	£997.00
Net sales receipts	£1,124.00	Paypal	£121.00
		Bank charge	£20.00
		Transfer to Membership Account	£200.00
Total	£15,143.00	Total	£1,338.00
Closing Balance	£13,805.00		

Membership Account

Income		Expenditure	
Opening balance	£2,179.00	Printers	£2,168.00
Receipts, including transfer	299	Rally charges	£37.00
		Postage	£15.00
Total	£2,478.00	Total	£2,220.00
Closing balance	£258.00		

degree of autonomy to the Shop business, although there has recently been some overlap because the Membership account income has declined.

Notes

The sales and receipts include some late membership subscriptions, via *PayPal*, which we have now stopped taking. Most of the printing and postage charges were leftovers from the publication of our final printed GEO Quarterly. There may be a small *PayPal* charge for last year but it will have to be included in our 2019 accounts.

The value of any equipment that has been purchased to run our group over the years, for example two computers to run displays at exhibitions has been written off and, as best I know, the Shop stock is minimal. The total assets of our group are the balances in the two bank accounts with liabilities limited to running the website and the small annual *Companies House* fee. As director of GEO I have to submit our accounts to Companies House annually.

Coming Event

GEO will have its usual stand at the West London Electronic Show which is to be held at Kempton Park in 14th April 2019. This is usually a busy show covering the interests of amateur radio and electronics. The public entry starts at 10.00 a.m. and the show closes about 3.00 p.m. The cost of entry is just two or three pounds. For additional details go to ***www.radiofairs.co.uk***

Quarterly Question Number 59 Revisited

Further to my piece on Stromboli last issue, I thought the following notes extracted from the Wikipedia website might prove of interest.

Stromboli, photographed in 2004
Photo © Steven W. Dengler / Wikimedia Creative Commons

Stromboli is a small island in the Tyrrhenian Sea, off the north coast of Sicily, containing one of the three active volcanoes in Italy. The volcano has erupted many times and is constantly active with minor eruptions, often visible from many points on the island, from the surrounding sea and satellites, giving rise to the island's nickname '*Lighthouse of the Mediterranean*'. Stromboli stands 926 metres above sea level, and over 2,700 metres, on average, above the local sea floor.

Mount Stromboli has been in almost continuous eruption for the past 2,000 years. A pattern of eruption

Map showing the location of Stromboli
Image: Wikimedia Creative Commons

is maintained in which explosions occur at the summit craters, with mild to moderate eruptions of incandescent volcanic bombs, at intervals ranging from minutes to hours. This Strombolian eruption, as it is known, is also observed at other volcanoes worldwide. Eruptions from the summit craters typically result in a few short, mild, but energetic bursts, ranging up to a few hundred meters in height, containing ash, incandescent lava fragments and stone blocks. Stromboli's activity is almost exclusively explosive, but lava flows do occur at times when volcanic activity is high: an effusive eruption occurred in 2002, the first in 17 years, and again in 2003, 2007, and 2013–14.

Quarterly Question

Francis Bell

Quarterly Question 60

The answer to the last Quarterly Question which asked for the identification of a country from its political and coastal outline was Mexico. My thanks to those who emailed me with the correct answer.

The reason I picked this as a question was because of the unusual appearance of the country which is almost always shown with its land connection with Central American countries to the south and the USA on its northern border. However, the major clue for me to the country's identity was the very clearly shown Baja California peninsula, which I have visited twice.

Quarterly Question 61

This Quarterly Question relates to an image taken by the Copernicus Sentinel 1A Satellite in 2015. The question is quite straightforward—name the island group shown in the image and the approximate location of this group. The edited text below has been taken from ESA material published with the satellite image and contains both technical information and enough place names for a reader to identify the island group.

Please send your answers, by May 26, 2019, to

francis@francisbell.com

ESA Text

This Sentinel-1A radar image was processed to depict water in blue and land in earthen colours. It features some islands, including the turtle-shaped Faial, the dagger-like Sao Jorge and Pico Island, with Mount Pico reaching over 2351 metres in height. The image highlights the differences in the relief of the islands, with volcanoes and mountains clearly standing out.

Faial is part of the central group of the islands. The surface area covers 173 km^2. It has some 15 000 inhabitants and its main municipal seat is the city of Horta. Different shades of blue decorate the houses, which divide the fields and line the roads, giving Faial the name 'Blue Island'.

In the 18th century, the development of whale hunting brought whaling fleets to Horta. By the 19th century, Horta had become an important seaport and a layover for a large number of yachts crossing the ocean. Along with other islands in the archipelago, Faial is of volcanic origin. In 1957, a big eruption about a kilometre offshore ejected large quantities of lava and ash, forming an islet that later became connected to Faial by an isthmus.

Unique among these islands São Jorge is uncharacteristically long and slender, and so susceptible to oceanic erosion. The island is 55 km in length, with a mountain range forming its backbone. At 1053 metres, Pico da Esperança is its highest summit. The island has an area of 246 km^2, with an obvious difference in the relief between the western and eastern sections: the western coast is lined with cliffs, while the east is smoother. Similarly, the northern coast has sharp cliffs, while the southern side is less inclined.

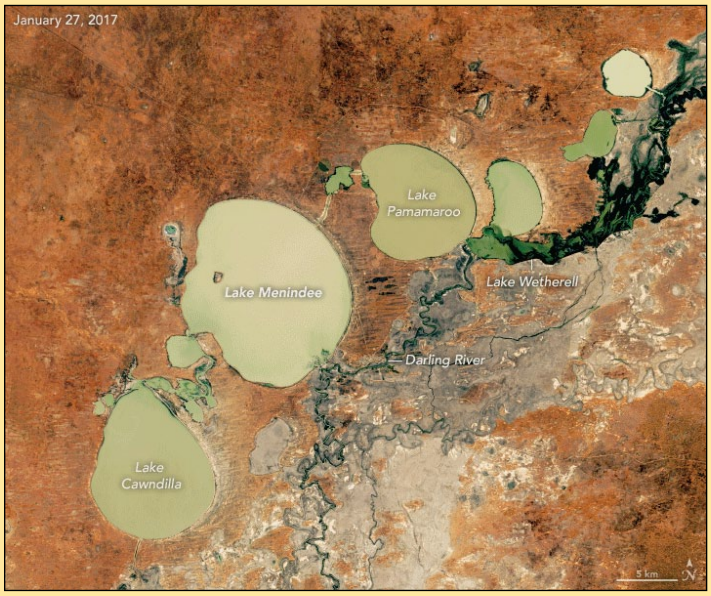
The island's 9500 residents have lived in relative isolation for many years. Disturbed only by rare visits from the authorities, commercial boats from the local islands, or the occasional aristocrat who comes to contemplate the local scenery, life on São Jorge is very relaxed.

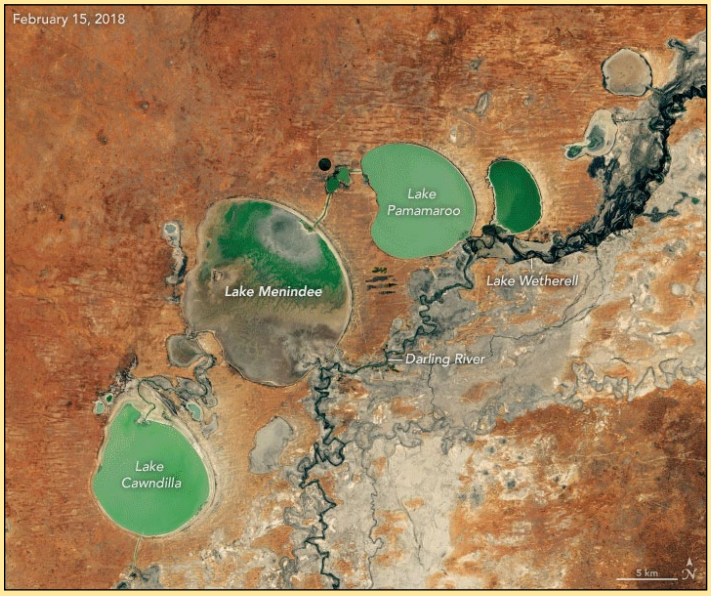
Australia's Disappearing Lakes Disappear Even More

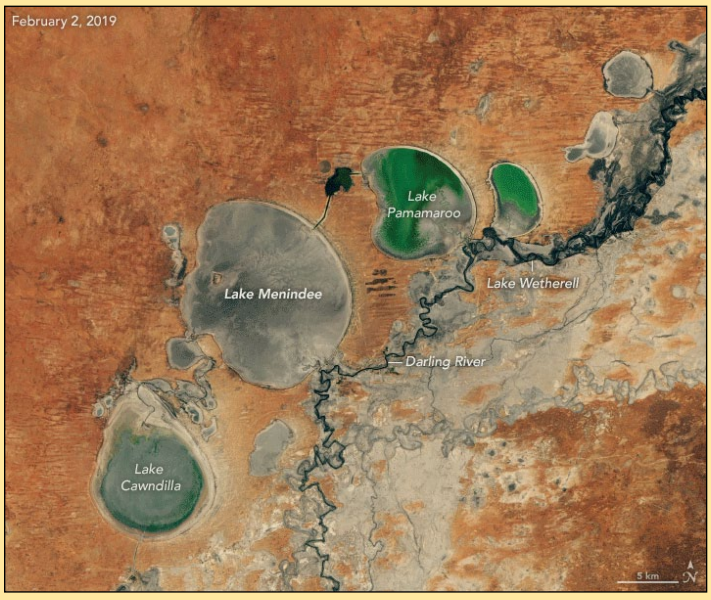
NASA Earth Observatory

In December 2016, the Menindee Lakes of New South Wales were nearly brimming with water. More than two years later, these Australian lakes are almost totally dried out.

These satellite images show the dwindling water levels of the Menindee Lakes, a chain of freshwater lakes located 110 kilometres southeast of Broken Hill. The shallow natural depressions were developed into water storage by the Australian government to manage river flows. The images were acquired by the Operational Land Imager carried by NASA's **Landsat 8** satellite on January 27, 2017, February 15, 2018, and February 2, 2019, shown top to bottom at right..







Water levels often fluctuate as the basins collect precipitation or flood water. Evaporation accounts for about 400 gigalitres of water loss from the lakes every year. At other times the water is released into the nearby Darling River by the New South Wales government. During drought, when less water is coming into the lakes, the basins tend to be drier.

Lake Menindee is the largest of the lakes. But river managers have been keeping as much water as possible upstream in Lake Wetherell and Lake Panamaroo, which supply water to Broken Hill and local communities. Recent years have brought exceptional drought to the area. New South Wales has faced extremely hot temperatures and low precipitation, causing one of its worst droughts on record.

The Lower-Darling River has been experiencing 'extreme low inflows' of water from the Menindee Lakes since August 2018. As of February 18, 2019, the Lower-Darling's storage level had fallen to just one percent. Water has stopped flowing in parts of the river.

Public concerns drastically increased when millions of fish were found floating belly-up along the Darling River on three separate occasions in January 2019. The massive fish kills stemmed from a series of events. As water levels fell, the river stopped flowing, and temperatures were high—creating ideal conditions for blue-green algae to bloom. When a cold front swept through the area and killed the algae, the population of bacteria that feeds on the algae then blossomed. These bacteria consumed most of the available oxygen in the water, causing the fish to suffocate. Some sources say the massive fish kills were partly due to how the Menindee Lakes are managed, while others blame global warming and drought.

NASA Earth Observatory images by Lauren Dauphin, using Landsat data from the US Geological Survey.

Story by Kasha Patel.

South Georgia

European Space Agency

The **Copernicus Sentinel-2** mission takes us over the island of South Georgia. Linked with the South Sandwich Islands to form a British Overseas Territory, this southern Atlantic island is a haven for a vast array of wildlife.

Around five million seals call the island home, as well as 65 million birds of 30 different species. Migrating whales and various fish species populate the surrounding waters and there is a large penguin population.

First discovered by Captain James Cook in 1775, there is no permanent human population on the island, due to its remote location and inhospitable environment. Nevertheless, a British Antarctic Survey research station operates in the capital, King Edward Point, in the island's centre. This is a centre for applied fisheries research, while on Bird Island, lying off the north-west tip of South Georgia, scientists and support staff focus on research into bird and seal biology.

As the image clearly shows, South Georgia is mostly covered in snow. Its polar climate gives it short and very cold summers, and long, freezing and overcast winters. The rugged landscapes of the island are often said to leave visitors in awe, with two mountain ranges dominating—the Allardyce towards the middle of the island and Salvesen in the south.

In 2012 the UK Government designated South Georgia as one of the world's largest sustainable use Marine Protected Areas. Significant investment has also been made in fisheries management and scientific research, as well as targeted conservation efforts to help protect the albatross. South Georgia is home to the Wandering Albatross—the largest flying bird species in the world.

Sentinel-2 is a two-satellite mission to supply the coverage and data delivery needed for Europe's Copernicus programme. The mission's frequent revisits over the same area and high spatial resolution allow changes in inland water bodies and the coastal environment to be closely monitored.

Etna Awakens on its Side

NASA Earth Observatory

For the first time in perhaps a decade, Mount Etna experienced a 'flank eruption'—erupting from its side instead of its summit—on December 24, 2018. The activity was accompanied by 130 earthquakes occurring over three hours that morning, some attaining magnitude 4.3. Mount Etna, Europe's most active volcano, has seen periodic activity on this part of the mountain since 2013.

The image on the right was acquired by the Operational Land Imager (OLI) on the Landsat 8 satellite and shows the ash cloud emitted by the volcano on December 28, 2018. The lower image highlights the active vent and thermal infrared signature from lava flows, which can be seen near the newly formed fissure on the southeastern side of the volcano. The image was created with data from OLI (bands 4-3-2) and the Thermal Infrared Sensor (TIRS) on Landsat 8.

Ash spewing from the fissure cloaked adjacent villages and delayed aircraft from landing at the nearby Catania airport. Earthquakes occurred in the subsequent days after the initial eruption and displaced hundreds of people from their homes, according to news reports.

NASA Earth Observatory images by Joshua Stevens, using Landsat data from the US Geological Survey.

Text by Kasha Patel.

Figure 1 - Mount Etna and its Ash Cloud

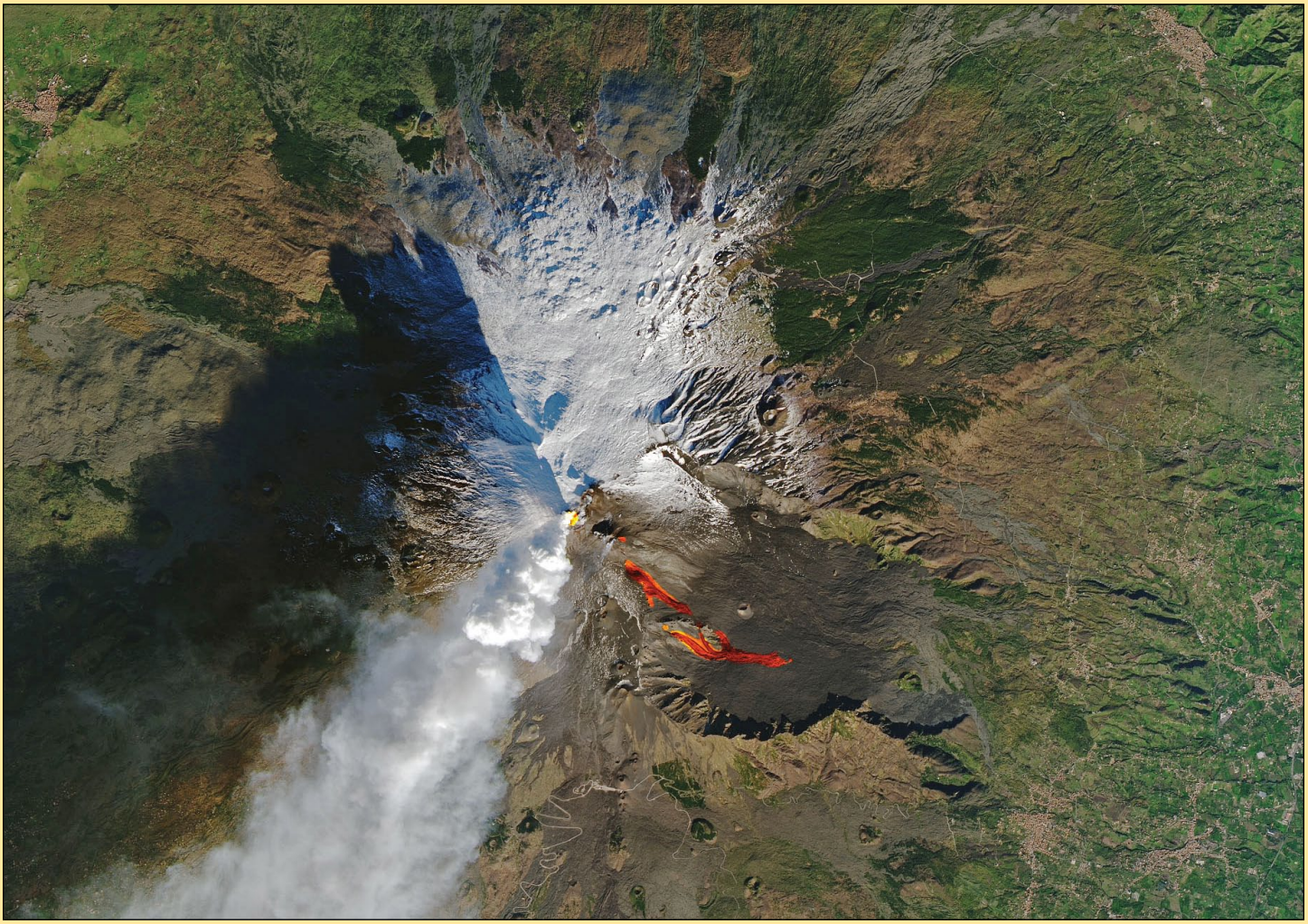


Figure 2 - The the active side vent and thermal infrared signature from lava flows at Mount Etna, in Sicily, on December 28, 2018., *NASA Earth Observatory images by Joshua Stevens, using Landsat data from the US Geological Survey.*

This Meteor M2 channel-5 infrared image was received in Aberdeen, Scotland at 20:06 UT on the evening of January 30, 2019 during the coldest spell of weather experienced by the British Isles since 2010. The country is almost cloud-free, and while southern England was relatively mild at -6°C, Braemar in Scotland's Grampian Highlands recorded a low reading of -14.5°C.

How to Receive X-Band Weather Satellites

Jean-Luc Milette

At first, I thought that amateur reception of X-band weather satellite images would be impossible. It needed equipment costing $15,000 dollars or more. Then I thought that, if people can receive Deep Space probes as amateurs, I should be able to receive X-band signals too.

I had no downconverter, no LNA, nothing so I had to start from scratch. Where could I find a downconverter? I searched the internet but found almost nothing. Maybe I could use a modified Ku band LNB that I had available?

I first checked the Web to learn which frequencies the X-band weather satellites were using:

Satellite	Frequency (MHz)
Aqua	8160
NOAA 20	7812
Feng Yun 3D	7820
Terra	8212.5

Sourcing a Suitable LNB

A normal Ku band downconverter has an IF frequency from 950 to 1450 MHz. So, for a normal Ku band downconverter, the local oscillator frequency is 10750 MHz. This covers 11700 to 12200 MHz.

Let's start with **Aqua** satellite, 10750-8160=2590 MHz, which is beyond the IF frequency of the stock downconverter. So the stock LNB oscillator frequency is no good for X-band.

Fortunately, my stock LNB had a DRO oscillator. I searched the Net, and found replacement DRO pucks which had a 9475 MHz frequency.

So, repeating the calculation for the Aqua satellite: 9475-8160 MHz=1315 MHz, which is now within the LNB IF frequency.

Now repeating the calculation, this time with **NOAA 20**: 9475-7812=1663 MHz, a value not too far from 1450 MHz.

But then, I thought, there are already some Ku band downconverters on the market which use a 9750 GHz internal oscillator, so these should work right of the box?

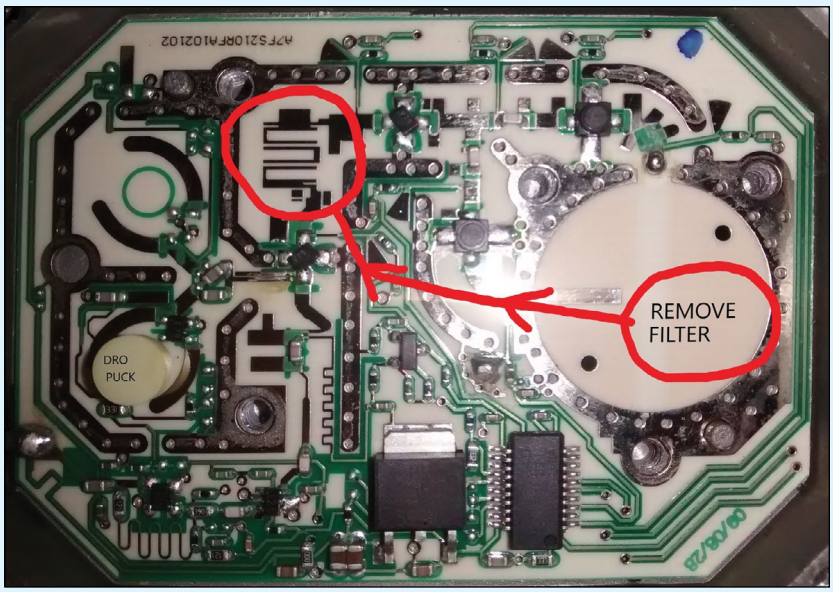


Figure 1 - Remove the bandpass filter

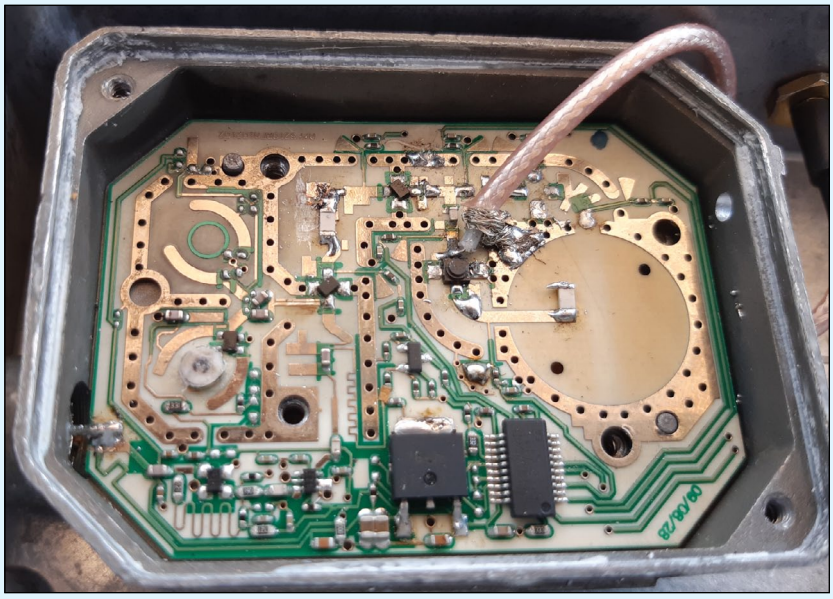


Figure 2 - The stock LNB after removing the bandpass filter

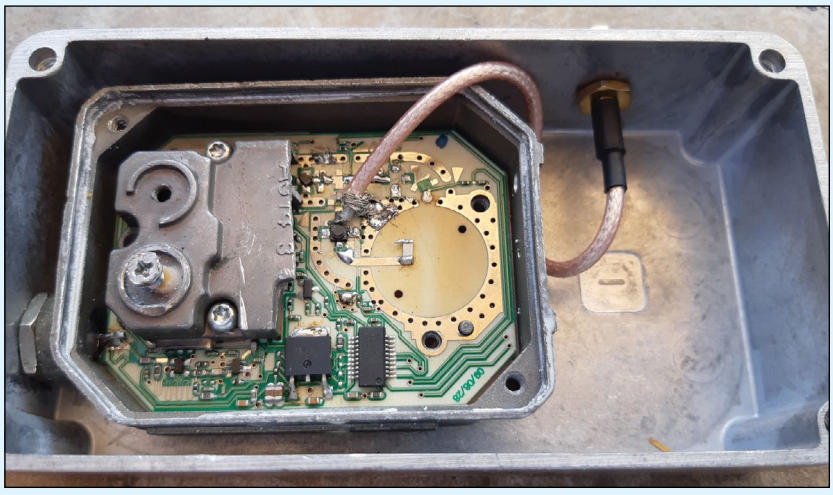


Figure 3 - The completed modification

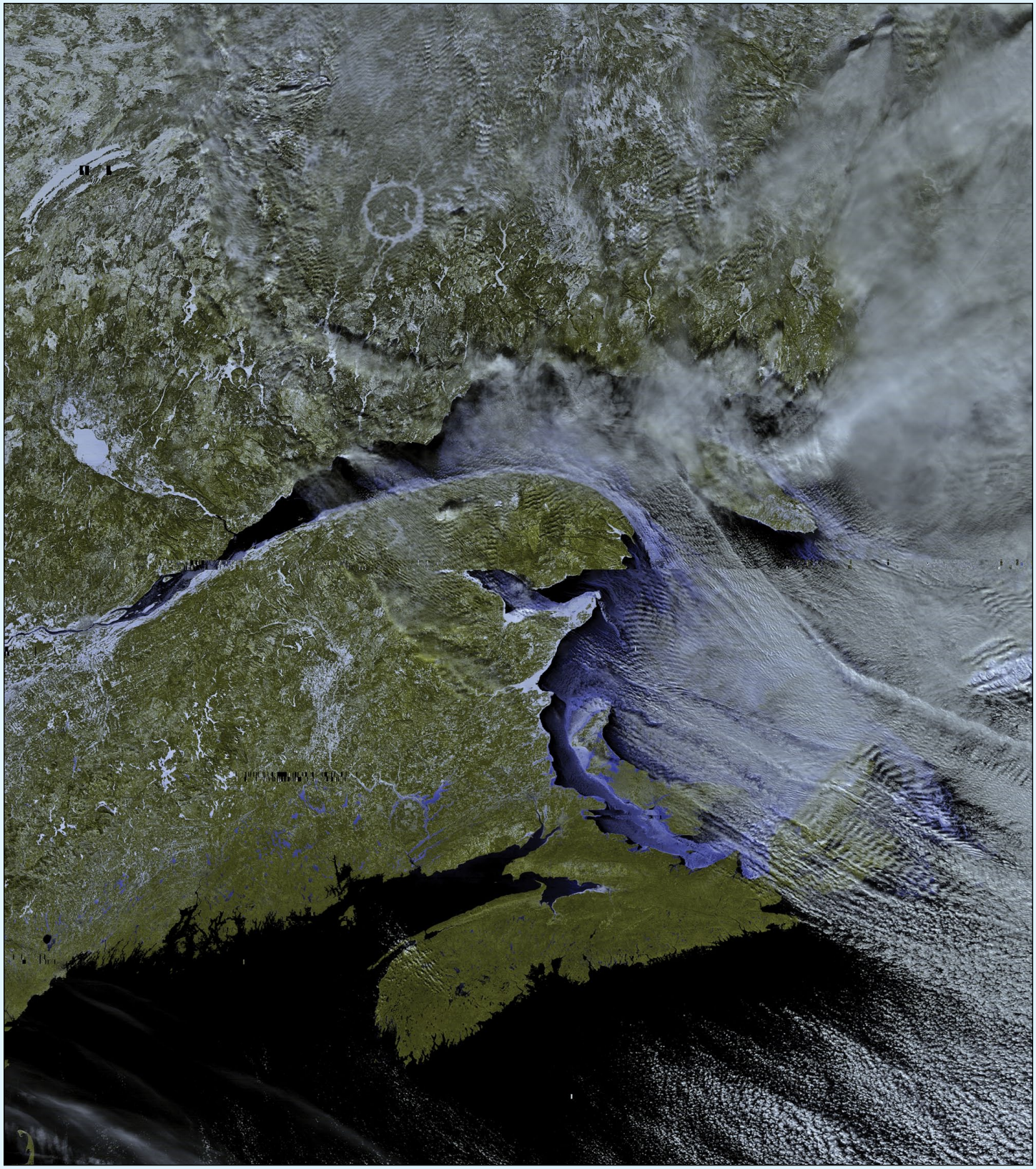


Figure 4 - This section from Jean-Luc's front cover Aqua MODIS image centres on the Gulf of St Lawrence, and emphasises the resolving power of the image

I ordered a PLL LNB with the 9750 MHz internal oscillator but, after testing, found that the chip inside the PLL LNB has a filter to block X band reception. So it was back to square one and my old LNB.

I opened it and removed its microstrip bandpass filter (figure 1). Then I removed the old DRO puck and installed the new one with 9475 MHz (figs 2, 3). This worked, but it had very low sensitivity, because the stock waveguide was simply too small for X-band. So now I had to make a waveguide myself.

The Waveguide

The waveguide consists of a length of copper pipe (figures 5, 6, 7, 8). When testing, I slotted the copper tube in order to be able to play with the backend distance. After a lot of testing, the distance from

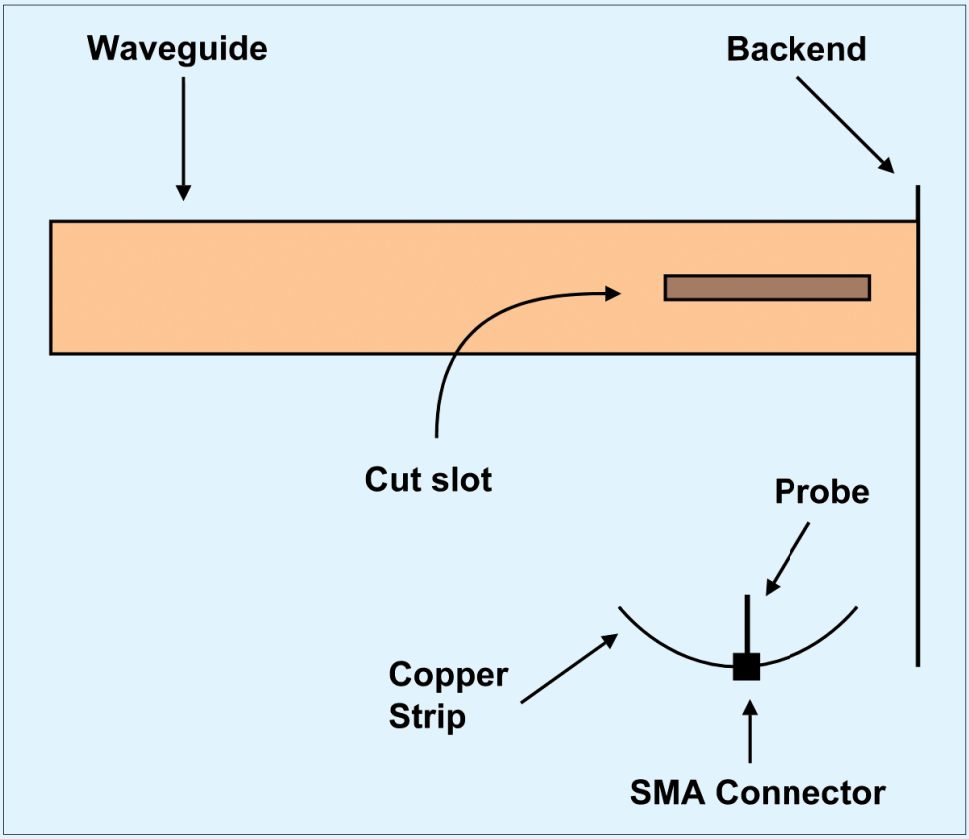


Figure 5 - Waveguide Prototype Schematic

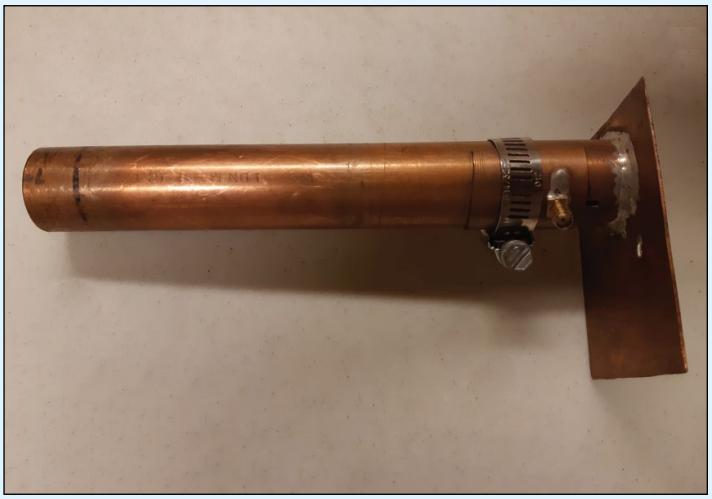


Figure 6 - The Waveguide

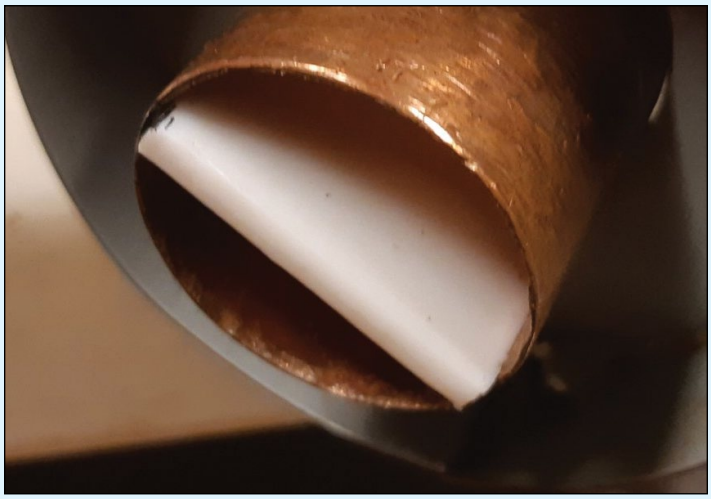


Figure 8 - The teflon Polarizer

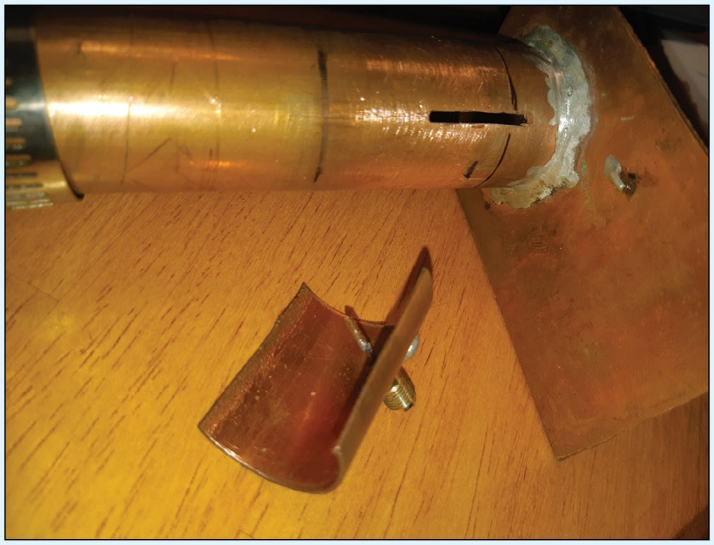


Figure 7 - The Prototype Feed

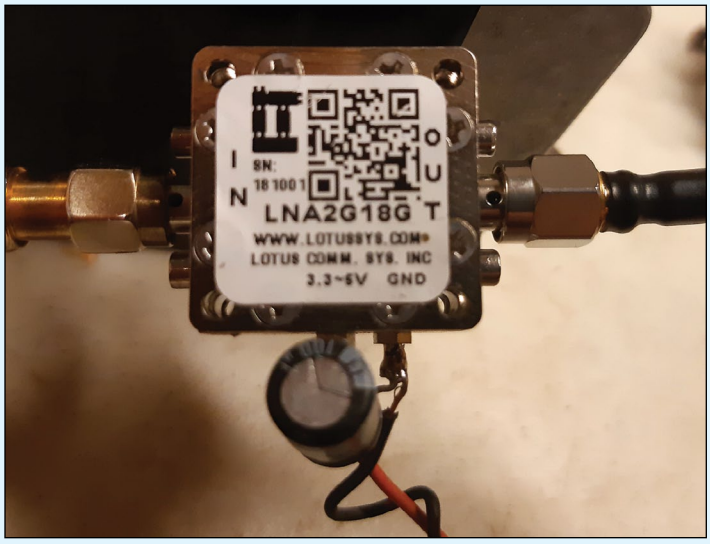


Figure 9 - The Lotus Communications 2-18 GHz 1.4 dB NF LNA

probe to backend should be 16.8 mm. The probe length is 10 mm. These measurements are to be used without the sliding probe. (Simply make a hole in the tube and solder it to your SMA connector.)

The waveguide length is not critical: I used 19 centimetres.

Stock Ku band LNA modifications

At first, I tried to input the signal directly to the first stage transistor, but I had oscillation problems. So I input the signal to the second transistor, and then it worked. The LNA I am using is a *Lotus Communications 2-18 GHz 1.4dB NF* (figure 9).

SDR

For SDR, at first I used a *HackRf* with the Aqua satellite. This satellite transmits with a bandwidth of 15 MHz, so I chose a 16 MHz sampling rate with *HDSDR* software.

For Feng Yun 3D, you need an SDR capable of covering at least 30 MHz. I currently use a *LimeSDR* with 40 MHz sampling. Speaking of sampling, if you want to be serious in X-band reception, consider using an SSD hard drive.

Demodulation

For demodulation, I use *GnuRadio for Windows*. I have written the scripts myself. But they are freely available.

After demodulation, which creates soft bits, I created a program in C++ to transform from soft bits to CCSDS frames. This program is also free. Finally, I created another program to convert CCSDS frames into a picture.

Additional Satellite Information

NOAA 20	Aqua/Terra	Feng Yun 3D
RHCP	RHCP	RHCP
QPSK	QPSK	QPSK
FEC 1/2	no FEC	Double FEC 3/4
Symbol Rate 15 MHz	Symbol Rate 7.5 MHz	Symbol Rate 30 MHz
Bandwidth 30 MHz	Bandwidth 15 MHz	Bandwidth 60 MHz
Resolution 475 m/pixel	Resolution 250 m/pixel	Resolution 250 m/pixel

Feng Yun 3D uses two viterbi encoders, so decoding requires two viterbi decoders.

Regarding Dish Size

At first, I used a 1.7 m dish with good results from Aqua satellite. But, the bigger the better, I bought a 2.4 m dish. I can say that with NOAA 20, 2.4 m is a must, the signal fluctuates and is lower than other satellites.

Aqua is the strongest, Feng Yun 3D also. But do not forget these satellites use circular polarization. The

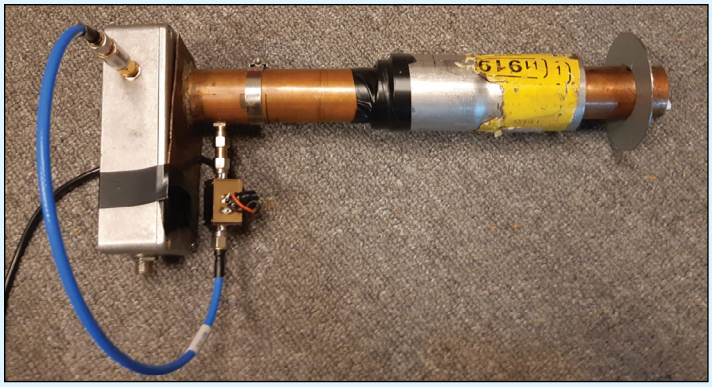


Figure 10 - The whole Downconverter and LNA

Figure 11 - The author's 1.7 metre dish

waveguide is linear polarization, so to convert from linear to circular you need to insert a piece of teflon just at the waveguide mouth, this will give you a 3 dB gain.

The teflon polarizer should be placed at a 45° angle relative to the probe (figure 7). If you don't use the teflon part, it will still work, but you will lose 3 dB.

Have fun !!

For software download or questions, contact me on *Twitter* at

https://twitter.com/LucMilette?lang=en

or email to

jlm80286@hotmail.com

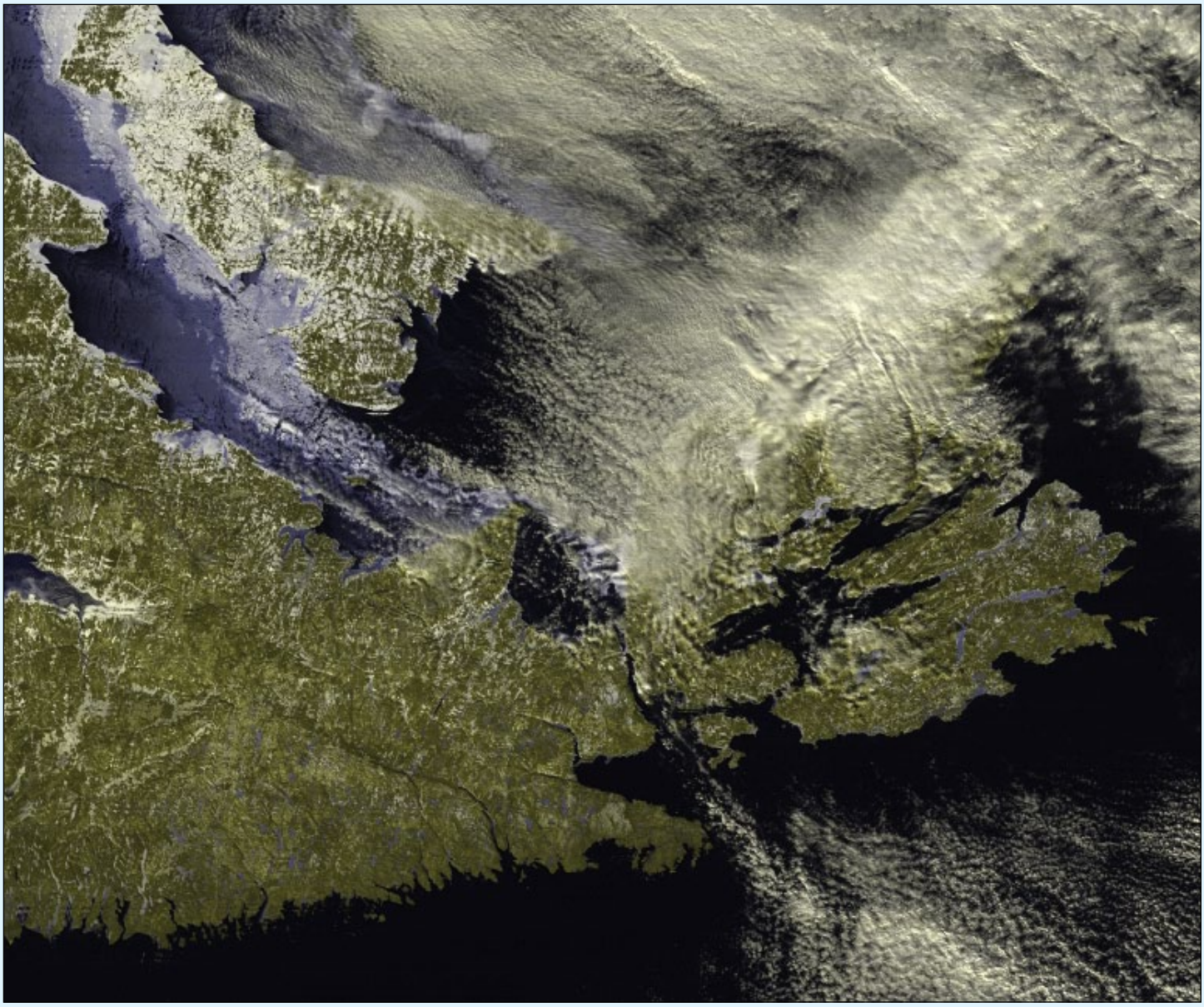


Figure 12 - This image of Nova Scotia showing detail of Cape Breton Island and part of Prince Edward Island came from a NOAA 20 transmission on January 13, 2019.

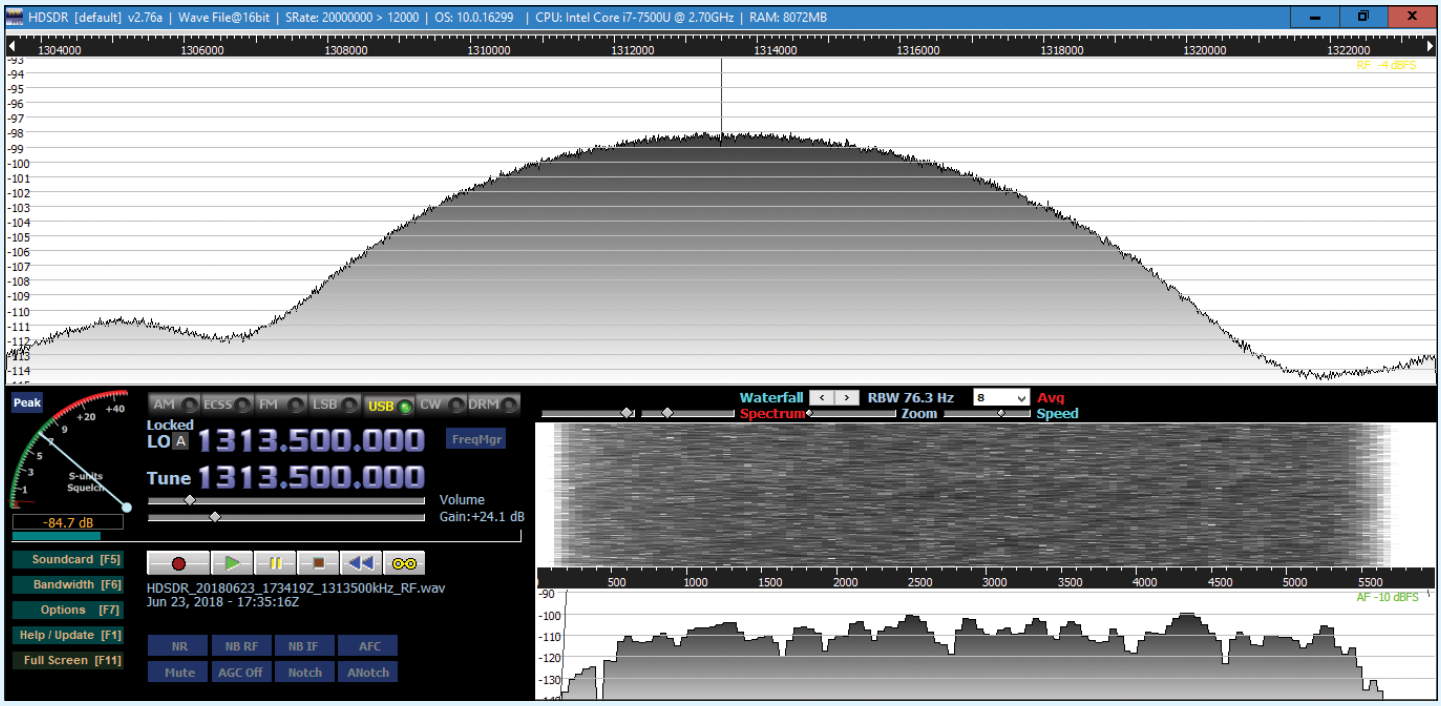


Figure 12 - An Aqua waveform during decoding

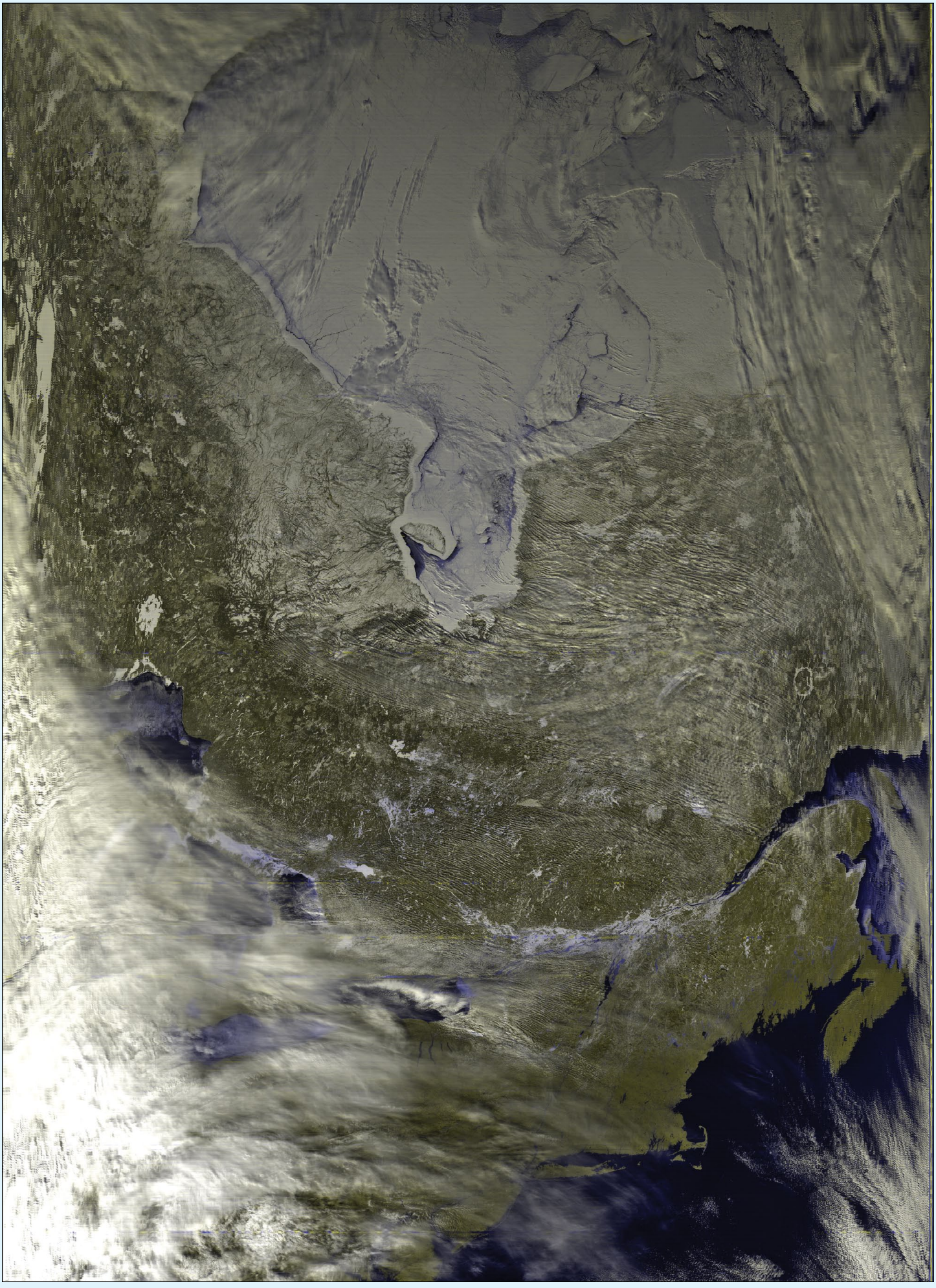


Figure 13 - This image of stretching from Hudson Bay to Nova Scotia was acquired from a pass of China's Feng Yun 3D satellite.

Makgadikgadi Salt Pans

NASA Earth Observatory

The Makgadikgadi Salt Pans, imaged by NASA's Terra satellite on June 10, 2018.
NASA Earth Observatory image by Joshua Stevens, using MODIS data from LANCE/EOSDIS Rapid Response

Northeast of Africa's Kalahari Desert and southeast of the Okavango Delta lies one of the largest salt pans in the world. It was once the site of one of the largest inland seas on Earth.

On June 10, 2018, the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite acquired this natural-colour image of the Makgadikgadi Salt Pans. The collection of salt flats covers roughly 30,000 square kilometres (10,000 square miles) amidst desert and dry savanna in Botswana. Located in Makgadikgadi National Park and Nxai Pan National Park, the salt pans are rivalled in extent only by the Salar de Uyuni in Bolivia.

For much of the year, the salt pans glimmer in white, parched by the sun and the salt and allowing little more than algae to grow. But during the rainy season (roughly November to March), the area can be transformed into a crucial wetland. Water can flow in from the Boteti and Nata rivers, filling ephemeral ponds, watering holes, and shallow lakes and creating short-lived but abundant grasslands. The event draws migrating wildebeest and zebras, as well as the predators that hunt them. The waters fill with ducks, geese, pelicans, and flamingos—one of just two breeding spots in southern Africa for the long-legged birds.

The pans are the salty remains of ancient Lake Makgadikgadi. Scientists estimate that the inland sea once spanned anywhere from 80,000 to 275,000 square kilometres. The Okavango, Zambezi, and Cuando rivers likely emptied into this lake until tectonic shifts changed the elevation of the landscape and a changing climate dried up the rains.

Story by Mike Carlowicz.

Viewed in context, the Makgadikgadi Salt Pans appear at centre right in this wider view, with the Okavango delta clearly visible to its northwest.
NASA Earth Observatory image by Joshua Stevens using Terra MODIS data from LANCE/EOSDIS.

Clouds and eddies off Newfoundland and Labrador, Canada

MODIS Image of the Day

A complex pattern of clouds, snow, ice and ocean was captured in a true-colour image by the Moderate Resolution Imaging Spectroradiometer (MODIS) on board NASA's *Terra* satellite on January 9, 2019 as it passed over the Hamilton Inlet in Newfoundland and Labrador, Canada (figure 1).

The land surrounding Hamilton Inlet, lying in the south-west third of this image, sports a snowy blanket while the waters of the inlet appear bright white, which means they are covered in ice. Heavy banks of clouds cover the western side of the image, in some places obscuring the land from view. These clouds thin as they stretch towards the east. A second bank of marine cloud can be seen along the eastern edge of the image.

Between these banks of clouds, clear skies allow visualisation of a peculiar pattern of bright white swirls just off the coast. While these appear to be white clouds, they are almost certainly actually formed by ice caught in the offshore eddies of the Labrador Current. The Labrador Current flows from the Arctic Ocean southward along the coast of Labrador and around Newfoundland to the east coast of Nova Scotia.

Each year, Arctic sea ice increases throughout the winter, reaching its maximum extent around March. It then melts during the summer, reaching its minimum in September. By January, Arctic freeze-up is well under way in many locations, such as off the coast of Labrador and Newfoundland. As ice begins to freeze, it remains malleable and can easily break into many small fragments. Such fragments can be stirred by ocean currents into cyclone-shaped vortices that may range in size from a few hundred feet to a few hundred miles in diameter. Ice eddies are most common in the spring and fall months when the ice is warm enough to fragment, but still cold enough to remain frozen as it is moved by the ocean current.

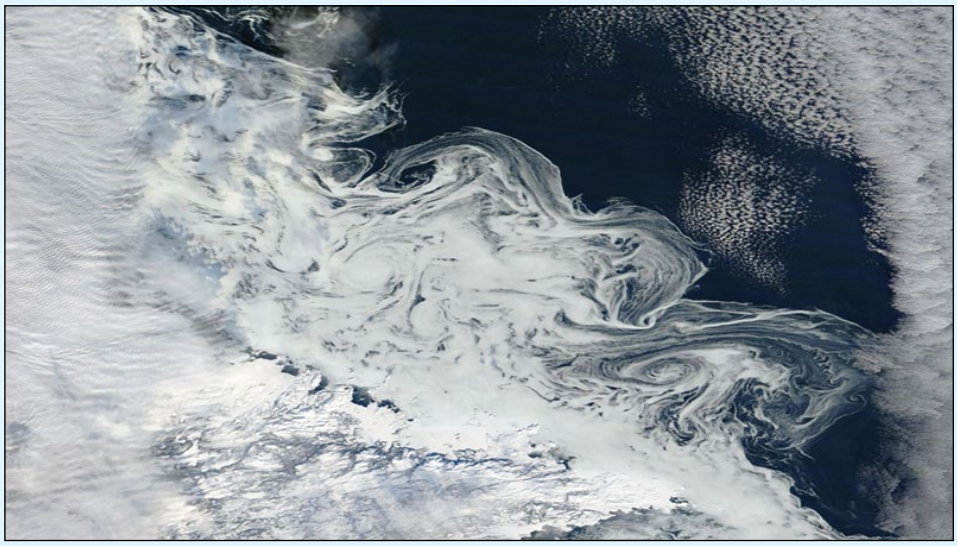


Figure 1
Image acquired by NASA's Terra satellite on January 9, 2-19 by combining bands 1, 4 and 3.
Image Credit: MODIS Land Rapid Response Team, NASA GSFC

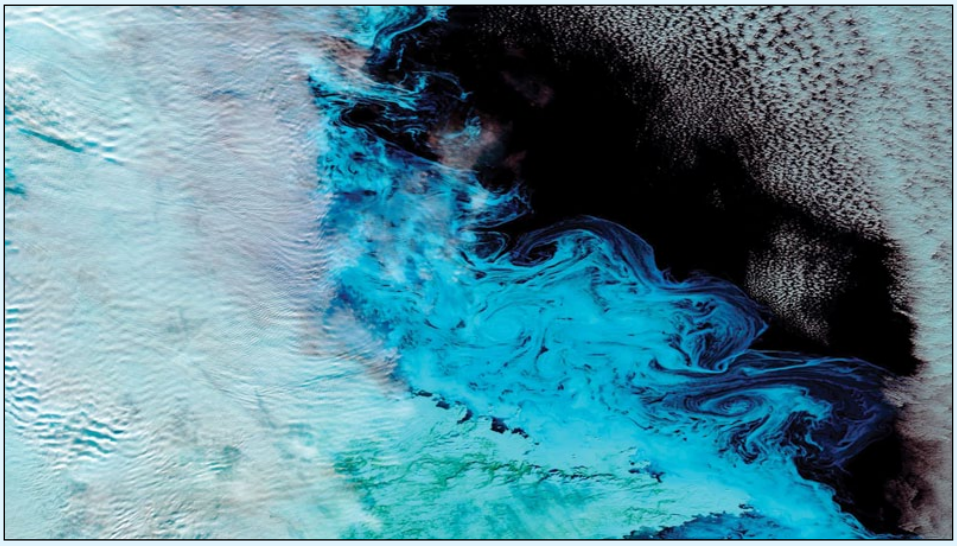
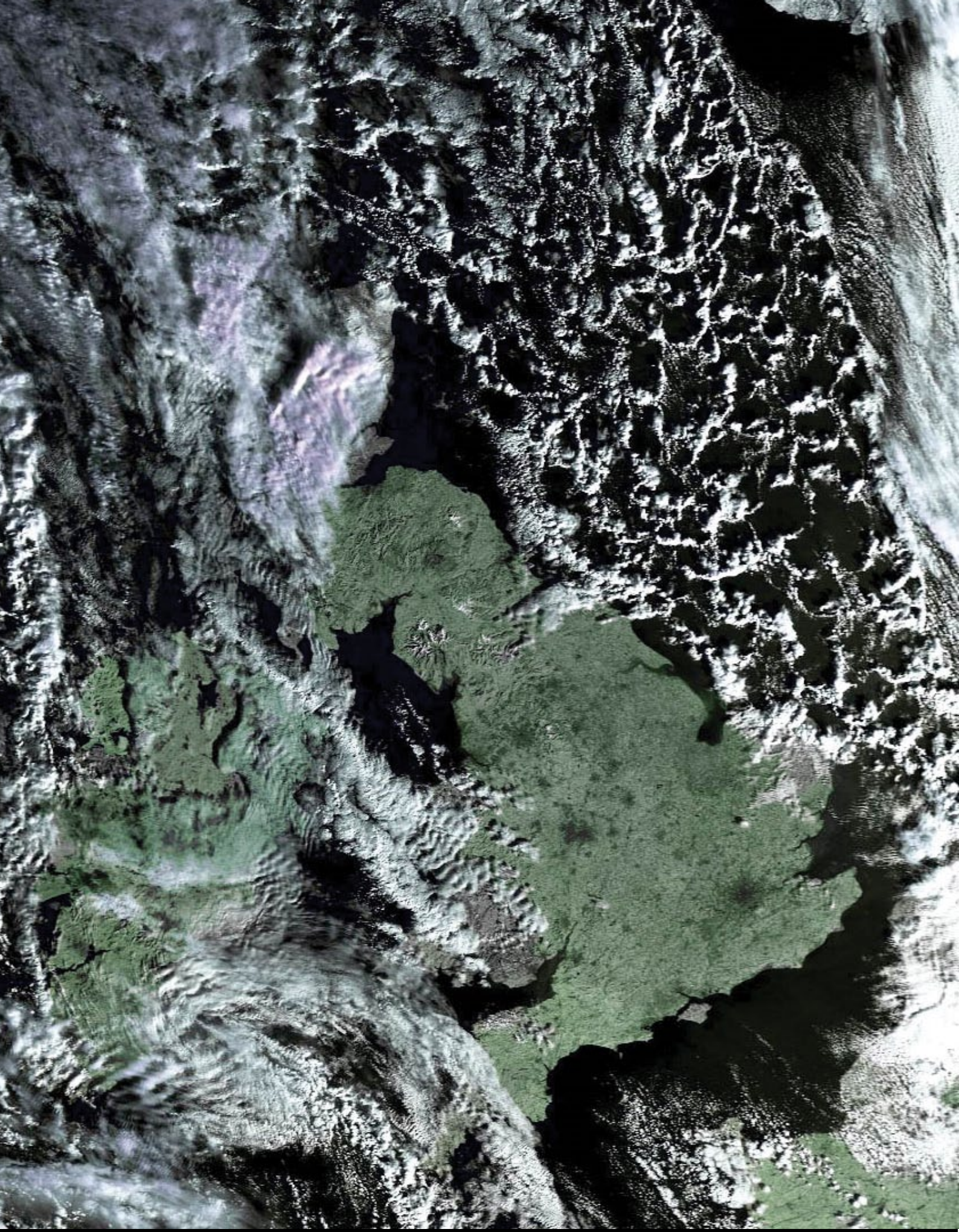


Figure 2
Image acquired by NASA's Terra satellite on January 9, 2-19 by combining bands 7, 2 and 1.
Image Credit: MODIS Land Rapid Response Team, NASA GSFC

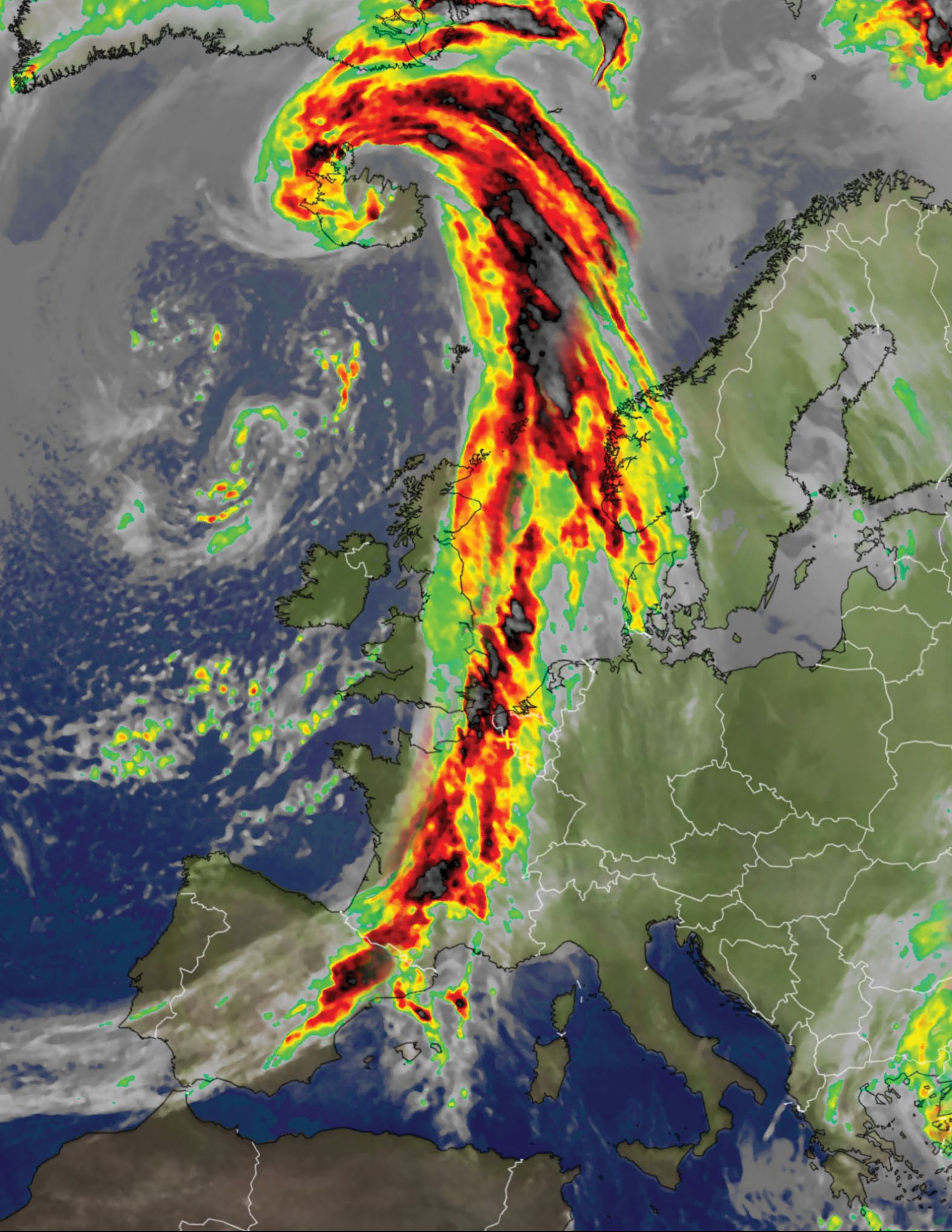
Swirls of ice imitating cloud

When seen from space, complex winter scenes that include cloud, snow, and ice may look like a magnificent study in white. Thanks to similar reflectance values, cold and fluffy clouds, brittle and frigid ice, and soft, fluffy snow all appear similar in true-colour satellite imagery. While this conveys the power and chill of a winter landscape, scientists frequently need to be able to differentiate these features. To tell the difference between snow, ice, and cloud, scientists often turn to false-colour images.

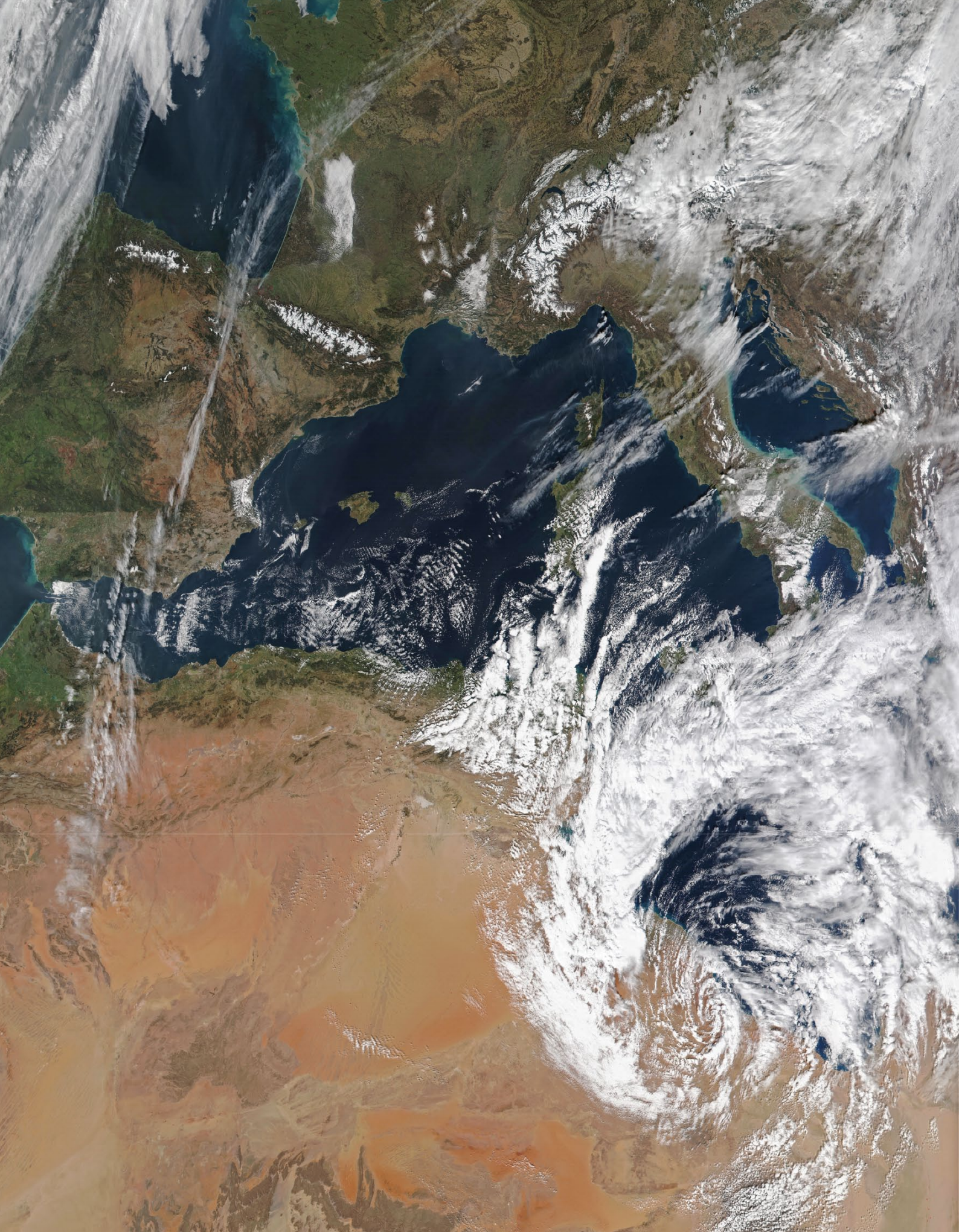
In a false-colour image from the same Terra pass (Figure 2), which combines both infrared and visible light (true-colour uses visible light only), the differences between ice, cloud, and snow are readily apparent. Ice now shows in mid-range blue while vegetation appears green, snow appears bright turquoise, water appears black, and cloud renders as white or, in some areas, very light pink. With this combination of channels the swirls are easily recognised as ice which has been swirled into eddies by the off-shore currents.



Robert Moore shared this Metop-A image received on January 28, 2019, and wrote “The British Isles have been under cloud for a long time. Today’s Metop-A image shows England, southern Scotland and much of Wales cloud free. In addition to the obvious heat islands of Manchester, Merseyside, Birmingham and London, many smaller towns show clearly in this image.”



This remarkable APT image showing a band of heavy rainfall crossing the North Sea during a storm on December 18, 2018 was sent to us by André T'Kindt from Ronse in Belgium. It is a composite, created in WXtoImg, from NOAA 15 and NOAA 18 passes using *mcir/precipitation* mode.



A ‘medicane’ was reported on GEO-Subscribers internet forum by John Tellick, on February 24, 2019. The event is well illustrated by this **NOAA 20** image transmitted at 12.30 UT on that date. The storm caused havoc over the Mediterranean Sea, particularly around Greece, where shipping was confined to port to port. There was also a report from Malta of boats being washed ashore and on to roads by rough seas.
Image: NASA’s Worldview (https://wvs.earthdata.nasa.gov/) / EOSDIS

Currently Active Satellites and Frequencies

Polar APT/LRPT Satellites			
Satellite	Frequency	Status	Image Quality
NOAA 15	137.6200 MHz	On	Good
NOAA 18	137.9125 MHz	On	Good
NOAA 19	137.1000 MHz	On	Good [1]
Meteor M N1	137.0968 MHz	Off	Dead [8]
Meteor M N2	137.9000 MHz	On	Good

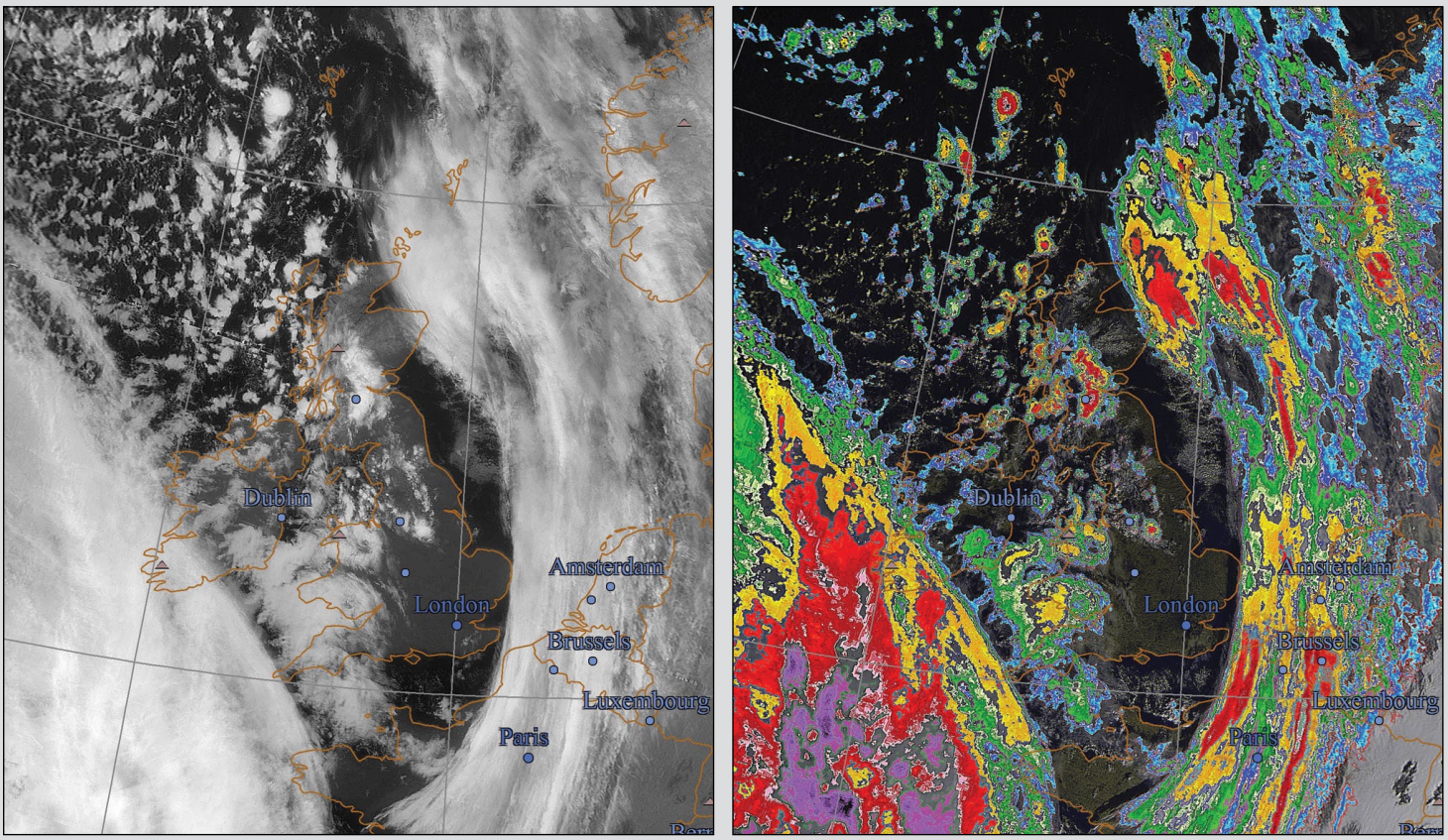
Polar HRPT/AHRPT Satellites				
Satellite	Frequency	Mode	Format	Image Quality
NOAA 15	1702.5 MHz	Omni	HRPT	Weak
NOAA 18	1707.0 MHz	RHCP	HRPT	Good
NOAA 19	1698.0 MHz	RHCP	HRPT	Good
Feng Yun 1D	1700.4 MHz	RHCP	CHRPT	None: Device failure
Feng Yun 3A	1704.5 MHz	RHCP	AHRPT	Inactive [2,10]
Feng Yun 3B	1704.5 MHz	RHCP	AHRPT	Active [2]
Feng Yun 3C	1701.4 MHz	RHCP	AHRPT	Active [2]
Metop A	1701.3 MHz	RHCP	AHRPT	Good
Metop B	1701.3 MHz	RHCP	AHRPT	Good
Meteor M N1	1700.00 MHz	RHCP	AHRPT	Dead? [8]
Meteor M N2	1700.0 MHz	RHCP	AHRPT	Good

Geostationary Satellites				
Satellite	Transmission Mode(s)		Position	Status
Meteosat 8	HRIT (digital)	LRIT (digital)	41.5°E	IODC
Meteosat 9	HRIT (digital)	LRIT (digital)	3.5°E	On [5]
Meteosat 10	HRIT (digital)	LRIT (digital)	9.5°E	Off [4]
Meteosat 11	HRIT (digital)	LRIT (digital)	0°W	On [3]
GOES-13	GVAR 1685.7 MHz	LRIT 1691.0 MHz	60°W	Off
GOES-14	GVAR 1685.7 MHz	LRIT 1691.0 MHz	105°W	Standby
GOES-15 (W)	GVAR 1685.7 MHz	LRIT 1691.0 MHz	128°W	On [6]
GOES-16 (E)	GRB 1686.6 MHz	HRIT 1694.1 MHz	75.2°W	On[6,9]
GOES-17	GRB 1686.6 MHz	HRIT 1694.1 MHz	137.2°W	[11]
MTSAT-1R	HRIT 1687.1 MHz	LRIT 1691.0 MHz	140°E	Standby
MTSAT-2	HRIT 1687.1 MHz	LRIT 1691.0 MHz	145°E	On
Feng Yun 2D	SVISSR	LRIT	123.5°E	Backup/Off [7]
Feng Yun 2E	SVISSR	LRIT	86.5°E	On
Feng Yun 2F	SVISSR	LRIT	112.5°E	Standby
Feng Yun 2G	SVISSR	LRIT	99.5°E	On
Feng Yun 2H	SVISSR	LRIT	86.5²E	
Feng Yun 4A	HRIT (digital)	LRIT (digital)	99.5°E	On

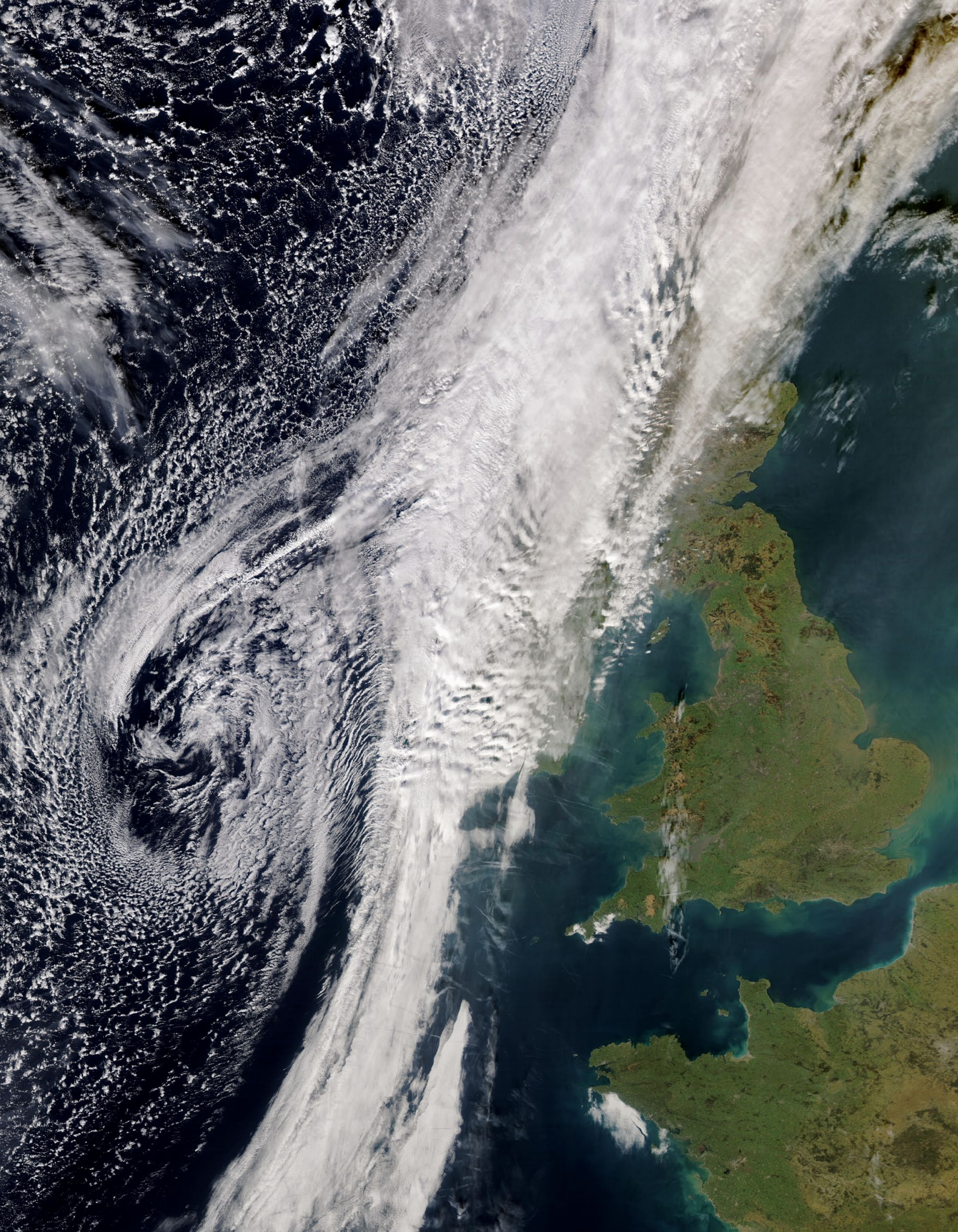
Notes

1 LRPT Signals from Meteor M N2 may cause interference to NOAA 19 transmissions when the two footprints overlap.
2 These satellites employ a non-standard AHRPT format and cannot be received with conventional receiving equipment.
3. Meteosat prime Full Earth Scan (FES) satellite
4 Meteosat backup Full Earth Scan (FES) satellite
5 Meteosat prime Rapid Scanning Service (RSS) satellite.
6 GOES 15 also transmits EMWIN on 1692.700 MHz
GOES 16 also transmits EMWIN on 1694.100 MHz
GOES 17 also transmits EMWIN
7 There has been no imagery from Feng Yun 2D since June 30, 2015. Since Feng Yun 2G is operating from the same position (86.5°E), it is likely that FY-2D is now in standby as a backup satellite.
8 On March 20, 2016, Meteor M1 suffered a catastrophic attitude loss, frequently pointing its sensors towards the sun. The following day all signals ceased and it seems highly probable that this satellite is now incapable of imaging the Earth.
9 GOES Rebroadcast (GRB) provides the primary relay of full resolution, calibrated, near-real-time direct broadcast space relay of Level 1b data from each instrument and Level 2 data from the Geostationary Lightning Mapper (GLM). GRB replaces the GOES VARiable (GVAR) service.
10 Although Feng Yun 3A's status is recorded on the wmo-sat website as 'inactive (end of operation)', it continues (as of June 2018) to transmit imagery.
11 GOES 17 is expected to start operations during January 2019.

Many readers have had reason to value assistance from the **Eumetsat User Service Helpdesk** over the years, and Nigel Heasman thought you might like to see this photograph he has of two of the helpful ladies who run it,



Joachim Scharrer sent in some interesting GIS processed images from Russia's Meteor M2 satellite. Both these image segments have been taken from the 09:39 UT pass on January 21, 2019. The left-hand image shows the British Isles sitting between two weather fronts; the right-hand image has been processed to highlight rainfall.



There was an early taste of spring when NASA's Aqua satellite captured this MODIS image of the British Isles on February 15, 2019. The jet stream was keeping the Atlantic depressions at bay and bathing the region in warm air from the Azores. Most places enjoyed temperatures of 15°C and more.
Image: LANCE, Rapid Response, Global Imagery Browse Services (GIBS), Worldview