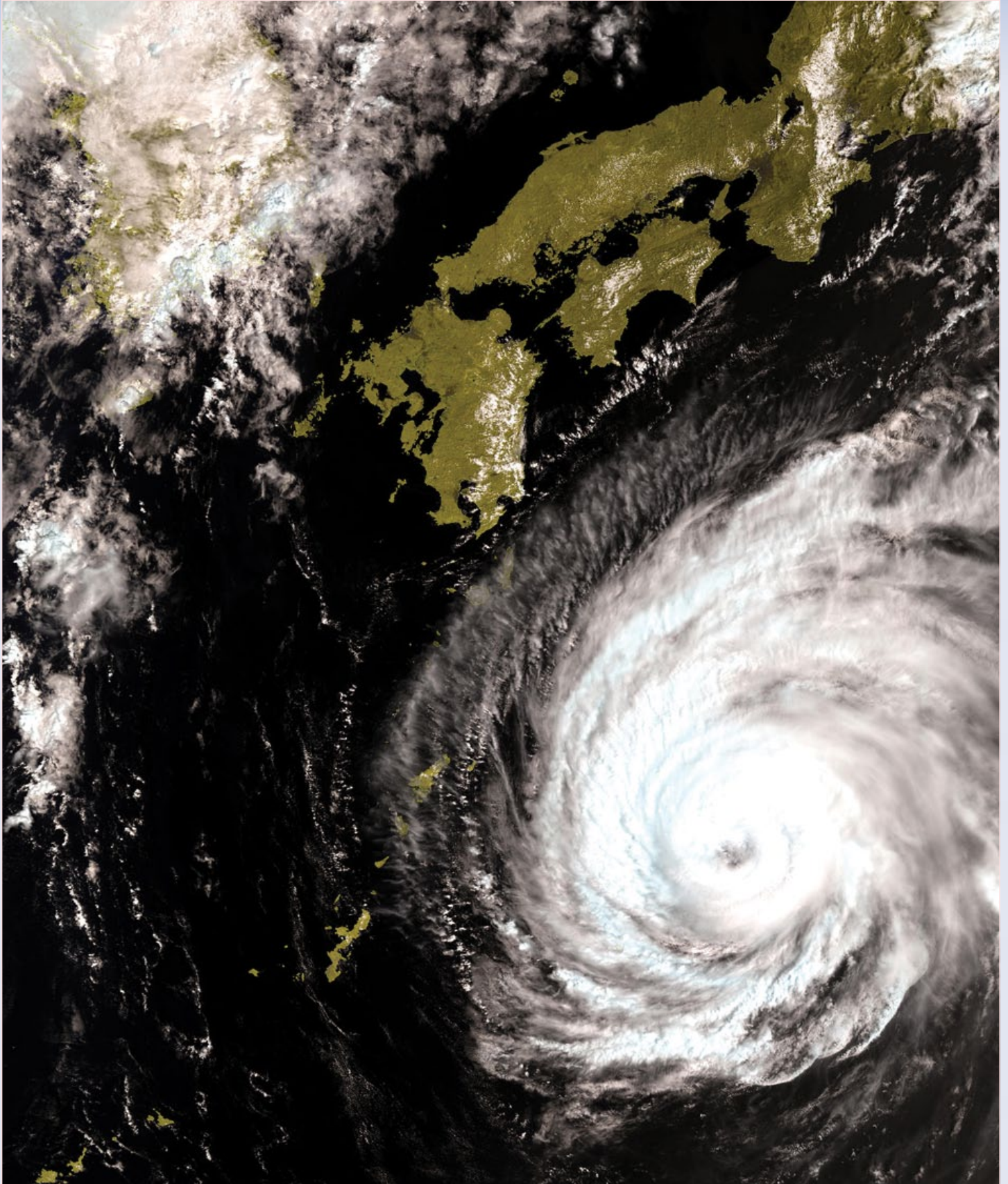


# ***GEO*** Newsletter



***Group for Earth Observation***

***No 59 - September 2018***



Peter Kinghorn sent in this Sentinel 3A image depicting Typhoon Jebi as it approached Japan on September 3, 2018 the day prior to making landfall. Jebi developed into the most severe typhoon to hit Japan for quarter of a century.  
Image © EUMETSAT (2018)

# Proposed Visit to Darmstadt 2019

**Francis Bell**

Our last newsletter contained an article about GEO's previous visits to EUMETSAT's HQ in Darmstadt together with visits to ESOC and the space communication centre at Usingen.

For no specific reason these visits have been on a four yearly cycle and if this is to be continued another GEO visit to Darmstadt in 2019 seems appropriate.

Although no specific arrangements to visit Darmstadt have been made, readers of our last newsletter were invited to register their interest in a possible Darmstadt visit in 2019. The result so far is that a small number of GEO members have registered their interest for a visit. I can understand this because of the lack of a definitive date for the visit. In order to remove any uncertainty I will contact our potential host organisations and try to establish a program of visits with specific time and dates. As soon as I have this information I will email those who have registered their interest and publish the details in our December *GEO newsletter*.

There should be no charges for these visits but individuals will be responsible for their own travel and accommodation.

My thanks to those individuals who have already registered with me and I will keep in touch as necessary.

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# 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>

## New Russian Meteor Launch possible in December

Thanks to Douglas Deans for informing us that Russia's follow-up Meteor weather satellite, Meteor M-N2-2, is provisionally set for launch on December 6 2018. This will replace the ill-fated Meteor M-N2-1 lost at launch last year. It is to be hoped that lessons will have been learned from that fiasco (see report in GEOQ57, page 8), and that the launch will provide us with much needed 'new' AHRPT and LRPT transmissions.

## New URL for Meteor LRPTOfflineDecoder

For some months now Oleg Bekrenev's former '*Meteor.Robonuka.ru*' website has been unavailable.

It transpires that this website, which offers downloads of the popular **LRPTOfflineDecoder** software needed to create images from transmissions by Russia's Meteor M satellites, has this new URL

<http://meteor.robanukah.club/>

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As ever, we are always pleased to receive contributions from readers, be they articles or just interesting satellite images. These should continue to be sent to the Editor at

***geoeditor@geo-web.org.uk***



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## New Website for WXtoImg

*Les Hamilton*

For somewhat more than two years now, the WXtoImg website has no longer allowed registration of the software while its author has remained firmly incommunicado. This has understandably caused great inconvenience to prospective users who wished to upgrade to the Professional Edition with its advanced features.

In 2016, the website offered free upgrade keys, but these expired after 12 months. A new set of keys was

provided in 2017, but these did not work. Matters finally came to a head this summer when, some time between mid May and mid June, all pages of the WXtoImg website were erased.

But the good news is that enthusiast Kevin Schuchmann has built a clone of the WXtoImg website called **WXtoImg Restored**, which permits downloads of the software, and also provides Kevin's Professional Edition Upgrade Key, which will allow access to all the program features.

You can visit this website at the following URL

***<https://wxtoimgrestored.xyz/>***

# Quarterly Question

Francis Bell

## Question 58 (June)

My thanks to the interested people who provided me with a response to Quarterly Question 58, which related to the two satellite images shown as part of the question. The question related to those islands on Earth which are divided into more than one country. The two example images shown were of Cyprus, located at the eastern end of the Mediterranean Sea and Ireland which is located just off the west coast of Great Britain. Cyprus, although it is disputed, is divided into two countries Cyprus and North Cyprus, although to this day the border between them is contentious and is still monitored by a United Nations peace keeping force; it's just a few years since I was there! Ireland is divided into the Republic of Ireland (the south) and Northern Ireland, which is part of the United Kingdom.

The question also invited a response to name other islands in the world which are split between different countries. My initial list of such island which may well be incomplete is as follows:

- 1 **Ireland** which is split between the Irish Republic in the south and the United Kingdom, with about a quarter of the total area located in the north.

- 2 **Cyprus** split between Cyprus and North Cyprus.
- 3 **Hispaniola** (a large Island in the Caribbean) which is split between Haiti and the Dominican Republic.
- 4 The island of **St Martin**. This is a very small island in the Caribbean which is almost equally split between French and Dutch rule. It may be described as the 'Collectively of St. Martin' or perhaps St Maarten.
- 5 **Borneo** split three ways between Malaysia, Indonesia and the Nation of Brunei.
- 6 **Timor** located at the extreme eastern end of Indonesia is split between Indonesia and independent East Timor. A satellite image of Timor is shown in Figure 1.
- 7 **Tierra del Fuego**. This island is at the southern tip of South America and is split between Argentina and Chile.
- 8 **New Guinea**. This large island north of Australia is split between Papua New Guinea and Papua.

I'm sure there must be other islands split between countries, so if you know of any others it's not too late to add to the above list. I compiled the above list because over the years my wife and I have visited all the islands in question except Timor and

*continued overleaf*



Figure 1 - This is a satellite view of the island of Timor, which is approximately 500 kilometres in length.

*Image: Jeff Schmaltz*

MODIS Land Rapid Response Team, NASA GSFC



Figure 2 - This is view of the summit of an active European volcano but the fires shown are not directly related to volcanism but the local dry conditions which have allowed burning of local scrub and woodland.

New Guinea, although in some cases it was a rather brief visit. If you can add further islands to the above list please let me know via email. There is no particular deadline for your contribution.

**Quarterly Question 59**

This question relates to two images of European volcanoes which have been in the news recently although not always for the same reason. Figure 2 shows the summit of a volcano surrounded by fires, although the fires were not directly related to volcanism but more the very dry local conditions and the surface burning of scrub and woodland. Figure 3 show an active volcano with a plume of smoke which is located on the corner of a well populated island which has a characteristic triangular coastal outline.

There is another active volcano in the same country as the those already mentioned which has been in the news recently because of its eruptions. This third volcano lies close to a straight line between the other two volcanoes.

**The question is:** “What are the names of the three volcanoes?”

Answers by email to

***francis@geo-web.org.uk***

by the deadline copy date for the next GEO Newsletter which is November 30, 2018.

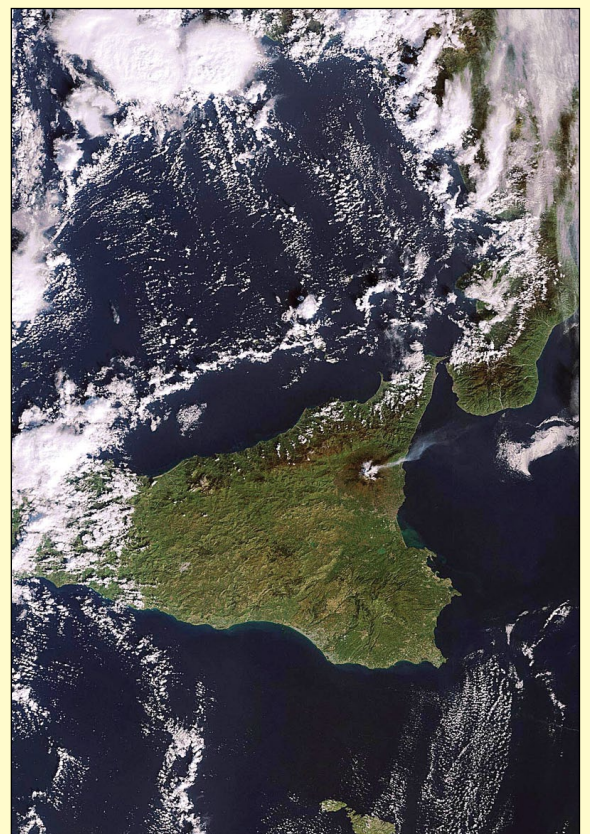


Figure 3 - This is a view of an active volcano on a Mediterranean island showing a plume of smoke being vented from the summit of the volcano.

# When Land Ice Meets Sea Ice

NASA Earth Observatory

On April 21, 2018, pilots guided NASA's P-3 research aircraft over glaciers along Greenland's eastern coast, with walls of ice-carved fjords rising on each side. The flight, to map land ice along the Geikie Peninsula, was part of *Operation IceBridge*—NASA's long-running airborne mission to monitor polar ice.

But the view suddenly changes where the glaciers reach the sea. As the plane looped around for another run up one of eight glaciers targeted for this day, an iceberg caught the eye of Linette Boisvert, a sea ice scientist at NASA's *Goddard Space Flight Center*. She took a photograph (figure 1) from an altitude of 500 meters above Scoresby Sound while flying west toward Vestfjord Glacier.



Figure 1 - A semicircle of fractured sea ice surrounding an iceberg.  
Image: NASA / Linette Boisvert

Icebergs start as land ice—snow that has accumulated on land and, over the course of many years, has been compacted into ice. When this glacial ice flows downstream and reaches the sea, cracks in the ice are widened as warm water and air melt it from below and above, respectively. When these cracks become large enough, pieces break off like fingernail clippings and drift into the water as icebergs. Boisvert's berg was trapped in sea ice—the frozen seawater that floats around on the ocean.

While the sea ice looks as though it would prevent this berg from moving, it was not completely motionless. According to Boisvert, the patterns in the fractured sea ice were probably caused by the iceberg rotating or by part of it breaking off. If part of the iceberg broke off, it would fall into the sea ice, the impact causing the ice to break up in a semicircular pattern on one side; somewhat like ripples in a pond when a stone is thrown into it.

That's not too hard to do: it was first-year sea ice, and therefore thin, flat, and easily broken. Areas of open water between the fractured sea ice had already begun to refreeze. Other small bergs, possibly those that had broken off from the main berg and caused the broken up pattern, are drifting around in the mix. Such a mixture of sea ice and iceberg pieces is called *mélange*—a French word that means 'mixture'.

*"This iceberg was in an area during our flight that we termed 'polar bear highways' because there were so many polar bear tracks on the surface of the sea ice and snow, looping around icebergs and linking one iceberg to another," Boisvert said. "These openings in the ice are ideal places for seals to come out of the water and rest and for polar bears to hunt. Although there were no visible tracks around this iceberg, it might be visited by polar bears as it makes it way to out to the Atlantic Ocean."*

On April 27, Boisvert snapped another photograph of icebergs encased in broken sea ice (figure 2). This photograph showcases all ice types in the fjord of the Kangerdlugssuaq Glacier, as well as the glacier front (top-right). Notice the pond of meltwater atop the iceberg in the center of the image.

*"These images capture the complexity in which land ice and sea ice interact in the Arctic climate system," Boisvert said. "Studying these interactions is very important for understanding changes in some glacier termini and outflow, and sea ice thickness and compaction in the context of climate change...thus reminding us that all ice types matter."*



Figure 2 - Icebergs encased in broken sea ice.  
Image: NASA / Linette Boisvert

# Heatwave Turns Europe Brown

NASA Earth Observatory

A persistent summer heatwave lingered over parts of Europe this year, setting record high temperatures and turning typically green landscapes to brown as the drought intensified.

The lower image on page 8 shows browning in north-central Europe on July 24, 2018, while for comparison, the upper image shows the same area one year ago. Both images were acquired by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's *Terra* satellite.

According to the European Space Agency, these regions turned brown in just a month, during which several countries experienced record high temperatures and low precipitation.

[http://www.esa.int/spaceinvideos/Videos/2018/07/From\\_green\\_to\\_brown\\_in\\_a\\_month](http://www.esa.int/spaceinvideos/Videos/2018/07/From_green_to_brown_in_a_month)

Much of Germany experienced continuous drought conditions since May while the United Kingdom experienced its driest first half of summer (June 1 to July 16) on record.

The image pair opposite shows the burned landscape of the United Kingdom on July 15, 2018, compared with July 17, 2017. Both images were acquired by the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite.

Peter Gibson, a postdoctoral researcher at NASA's Jet Propulsion Laboratory, examined how global temperatures

have varied in June over the past 50 years, using historical temperature data from the NASA Goddard Institute for Space Studies. The data showed a steep, persistent warming trend over the decades, with extreme heatwaves becoming more common.

*"If the globe continues to warm, it's clear we will continue to see events like this increasing in frequency, severity, and duration,"* said Gibson, who recently published a study linking global temperatures to regional heatwaves. *"We found that parts of Europe and North America could experience an extra 10 to 15 heatwave days per degree of global warming beyond what we have seen already."*

Gibson said this particular heatwave has been boosted by an unusual positioning and persistence of the jet stream which, since May, had been stationed unusually far north, particularly over Europe, and in a wavy pattern like the uppercase Greek letter omega. The upper level wind pattern trapped an area of high pressure over the United Kingdom that has mostly been windless, cloudless, and very hot.

*"Scientists are still working out the details of how climate change might be influencing the jet stream. But we already know the background state of the climate has warmed by about 1°C, indicating some human influence on this event,"* stated Gibson.

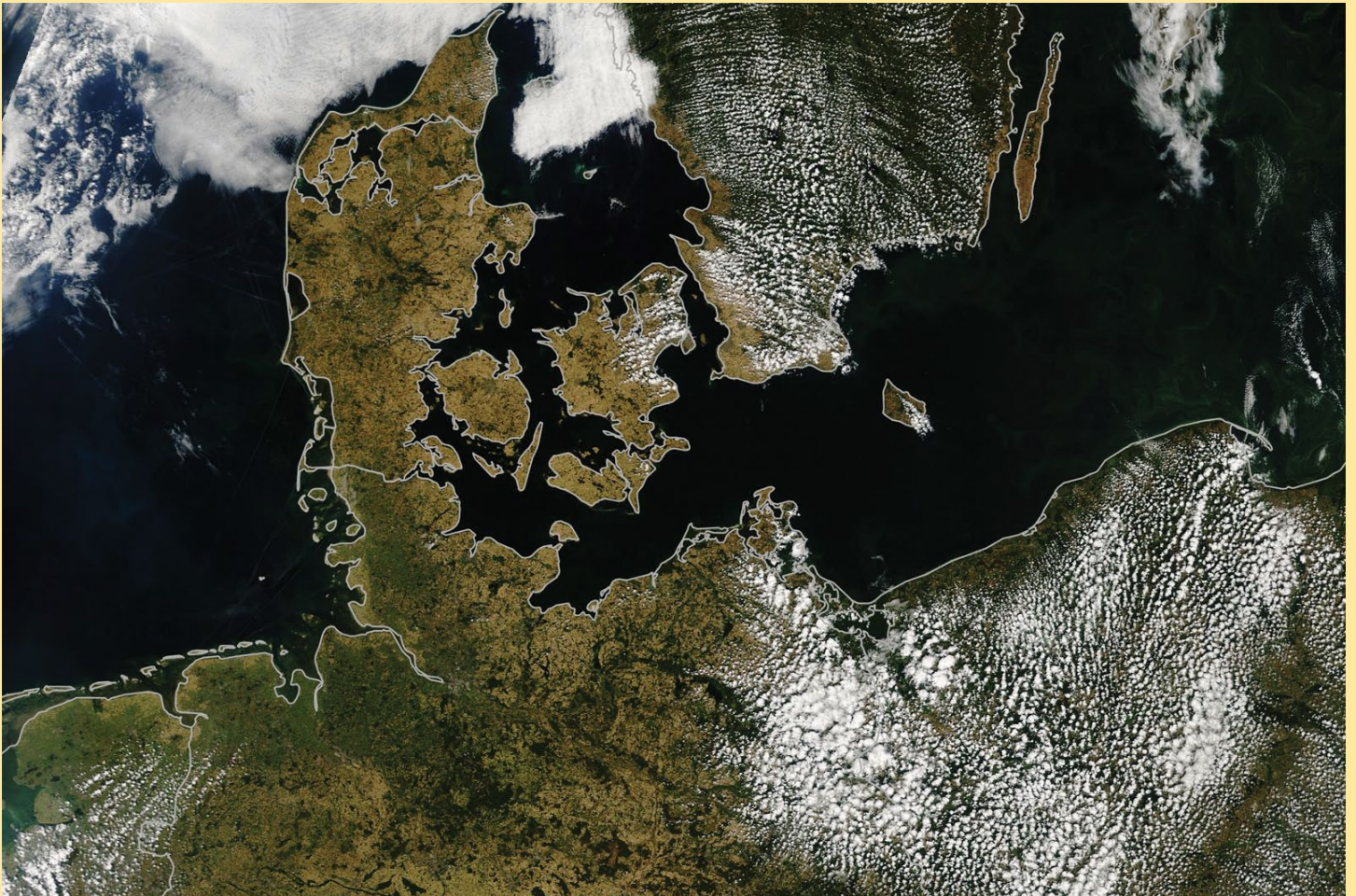
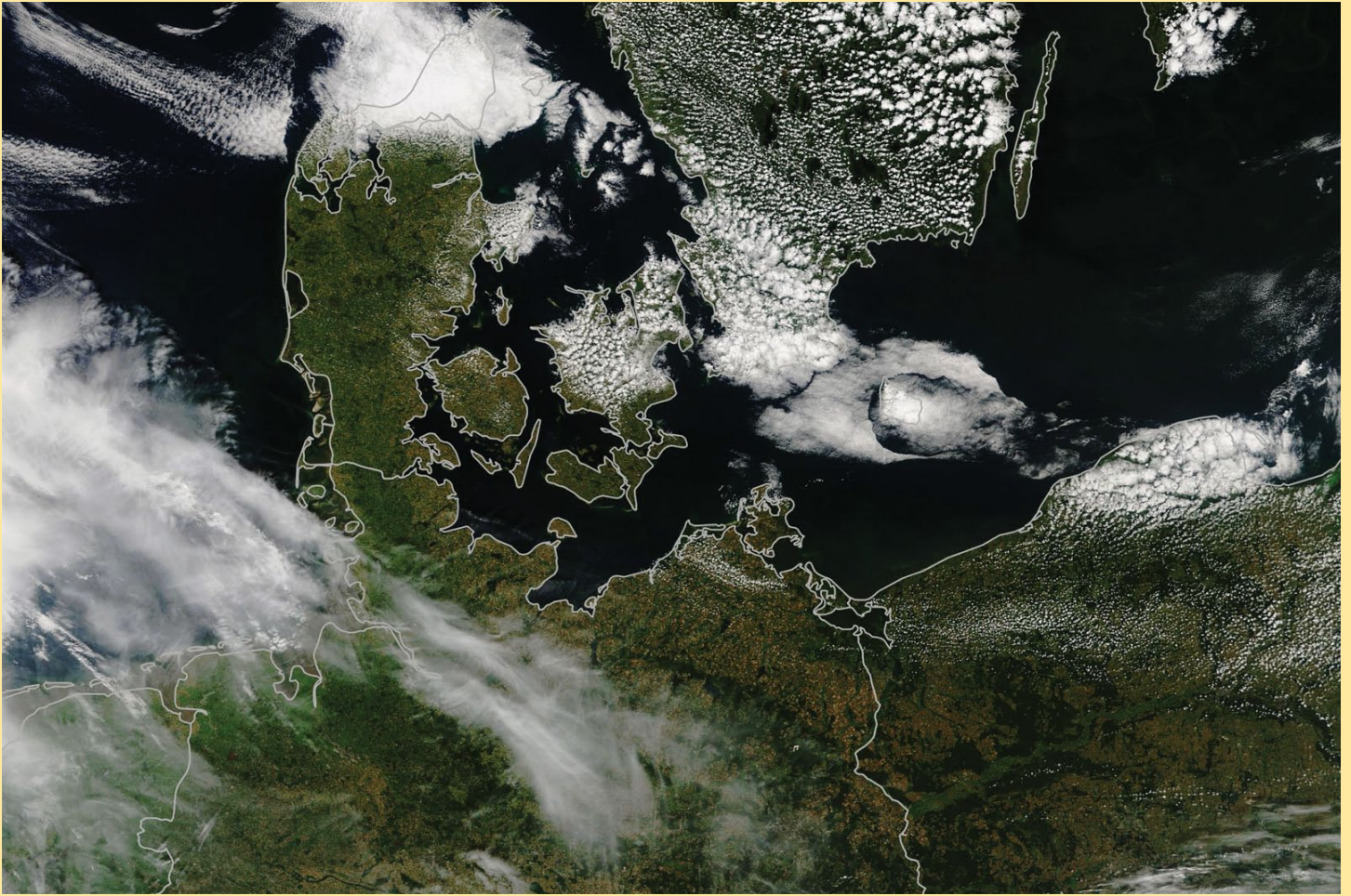
*NASA Earth Observatory images by Lauren Dauphin, using VIIRS data from the Suomi National Polar-orbiting Partnership and MODIS data from LANCE/EOSDIS Rapid Response. Story by Kasha Patel.*



England, on July 17, 2017



England, on July 15, 2018



All Europe suffered in this summer's heatwave, so much so that the land, normally green, turned brown with drought. These two images from NASA illustrate the changes for Denmark: upper image from July 2017, the lower one for July 2018. NASA Earth Observatory images by Lauren Dauphin, using VIIRS data from the Suomi National Polar-orbiting Partnership and MODIS data from LANCE/EOSDIS Rapid Response



# Rare Fair Skies Over All of the UK and Ireland

*One of the cloudier places on Earth was bathed in clear sunshine for a day*

## NASA Earth Observatory

Islands tend to have a lot of cloud cover, thanks to the moisture all around them. Landmasses in middle latitudes also tend to be cloudier than other parts of the planet. And the intersections between different atmospheric circulation patterns can lead to a lot of cloud cover.

The United Kingdom and Ireland fit all of those categories, and they are among the cloudiest places on Earth. Air masses from the Arctic, southern and northern Europe, the Maritimes, and the Gulf Stream all come crashing together in this region. Yet in late June 2018, England, Ireland, Scotland, and Wales all bathed in a rare day of cloud-free skies.

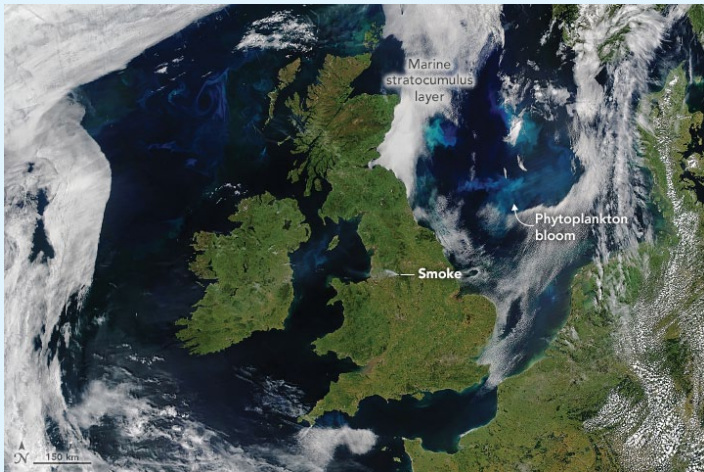
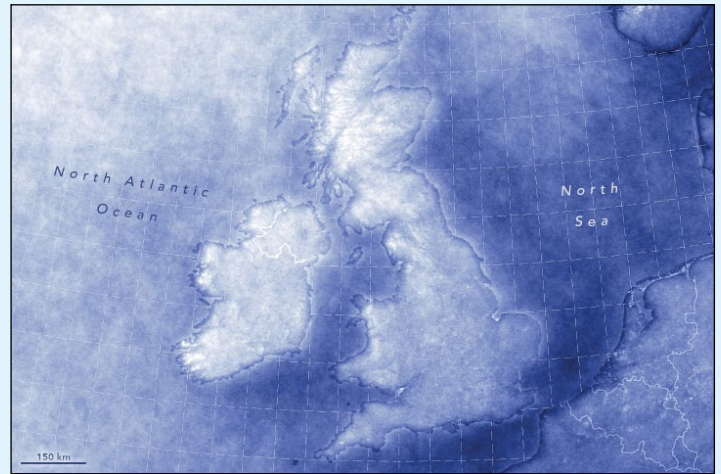


Figure 1 - This composite image using data from both NASA's Aqua and Suomi-NPP satellites, shows the UK and Ireland totally cloud-free.

On June 27, 2018, satellites captured the data for the natural colour image shown in figure 1. It is a composite of scenes acquired by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite and by the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite. While the islands on that day were cloudless, the seas around them were blanketed by lumpy marine stratocumulus clouds. Note, too, the phytoplankton bloom in the North Sea.

According to a 2012 study based on MODIS data, the probability of cloud-free skies on any given day over Great Britain is 21.3%, with a maximum probability of 33.3% in November and 12.9% in March. Overall, about 67% of the Earth is bathed in clouds on any given day, with just 10% of the ocean being completely cloud-free.

This map in figure 2 was developed using observations made by the MODIS instruments on both the Terra and Aqua satellites. It is based on



**Clear Skies on June 27**  
Less likely  More likely

Figure 2 - A cloudiness probability map

cloud-cover data collected on every June 27 between 2000 and 2017. Areas where the sensors observed clear skies most often are shown with dark blue; areas where the sensors observed the most clouds on June 27 are white.

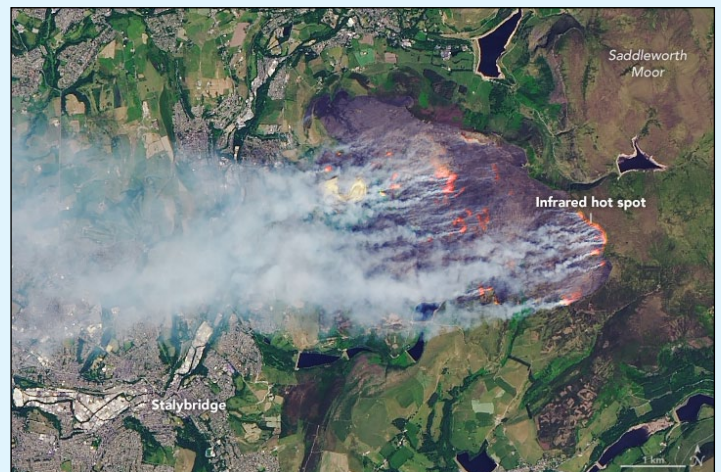


Figure 3 - Smoke from the wildfire on Saddleworth Moor

The one blemish on the image above is the thick smoke from the Saddleworth Moor fire near Stalybridge, England. Fires spread across nearly seven square miles of moorland. The Operational Land Imager (OLI) on Landsat 8 acquired a natural-colour image of the blazes around midday on June 27 (figure 3).

*NASA Earth Observatory images by Joshua Stevens, using VIIRS and MODIS data from LANCE/EOSDIS Rapid Response and the Level 1 and Atmospheres Active Distribution System (LAADS) and Land Atmosphere Near real-time Capability for EOS (LANCE), and Landsat data from the U.S. Geological Survey.*

# ***GEO Outreach***

Visit to the *Space Link Foundation* Meeting in Farncombe,

*Francis Bell*



Visitors to the *Space Link* event who are almost ready for one of the presentation. GEO's stand is just visible in the back left hand corner of the room.

The '*Space Link Foundation*' is an organisation which has been running for about 20 years with its objective of bringing space education and space science into schools. In addition to visiting schools directly with information, demonstrations and sometimes live satellite reception, there is an annual meeting for any interested school. This one-day meeting is held at a school in Farncombe, Surrey where distinguished guests present various space topics to visiting schools. Over the years GEO has contributed to all of these meetings and did so again in June 2018 with our demonstration stand, providing appropriate information emphasising how individuals or schools can receive their own satellite data or access interesting information via the Internet. The attached photographs indicate the scale and quality of this year's meeting.

If any reader wants more information about the Space Link Foundation I suggest they visit their website at [www.spacelink.org](http://www.spacelink.org), and if you are supportive of any local school you may wish to invite *Space Link* to visit the school in question.

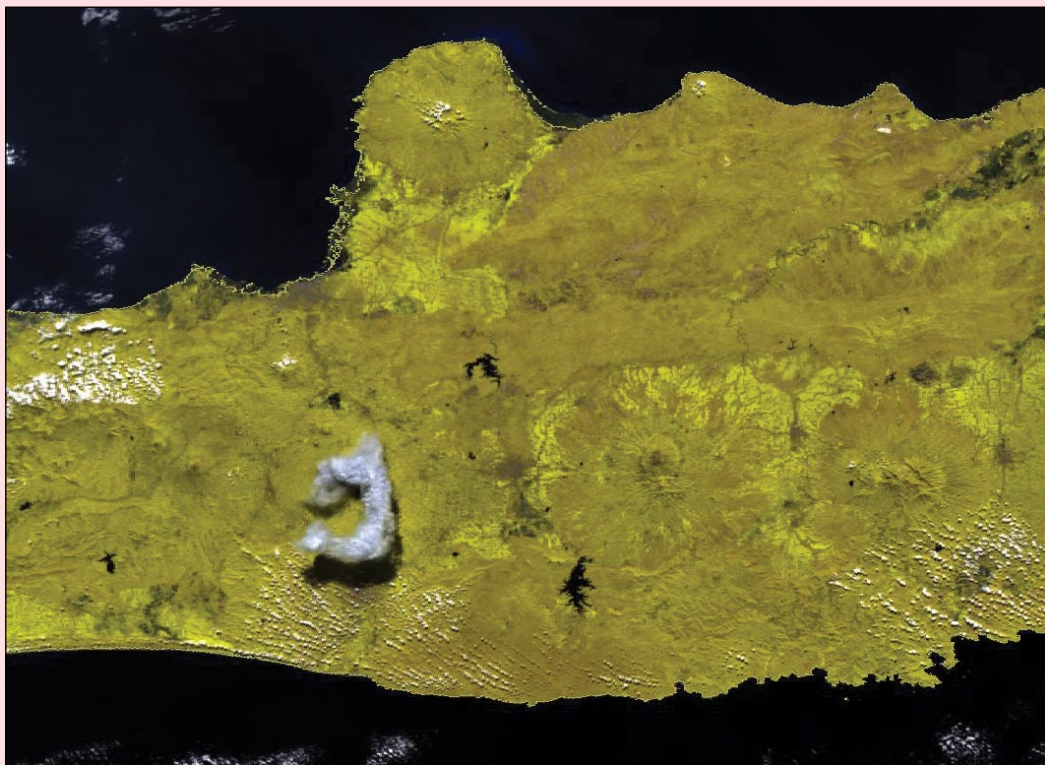


Dr. Helen Sharman, the first Briton in space talking to a visitor just before her presentation to the audience. Robert Coombes a director of *Space Link* and an active member of GEO is shown in the background. When Helen was on the MIR space station I was the first amateur to talk to her over the radio and we have subsequently remained in contact and I hope friends.



A young and very interested visitor to the Space Link event. Previously I had a long conversation with her while she was visiting our GEO stand and her sincere interest in our activities can be demonstrated by the publication resting on her lap!

## Eruption Plume on Java



This Sentinel-3 image was received by one of our readers as a EUMETCast HVS-1 transmission on June 1, 2018 and shows this eruption plume from the Merapi volcano in Java very clearly.  
Image © EUMETSAT 2018

Merapi, one of Indonesia's 129 active volcanoes, is located about 28 kilometres north of Yogyakarta on Java, a city with a population of 2.4 million. Additionally, thousands more live on the flanks of the volcano. Merapi has a history of regular eruptions since 1948 and as recently as November 1994, a pyroclastic flow following an eruption killed 27 people. A major eruption in 2010 claimed 347 lives and displaced over three hundred thousand from their homes.



On July 6, 2018, Enrico Gobbetti downloaded two successive Meteor M2 images, both perfect with no intrusion of the buffer overflow effect. This is a section from the 07:28 UT pass, showing the east Mediterranean basking in hot sunshine.

# Palk Strait

*MODIS Web*



The waters of the Palk Strait separate Sri Lanka from the tip of India. At the narrowest point, the Palk Strait measures about 53 kilometres in width.

A chain of islands and coral reefs stretch across the southern end of the strait. Most often called Adam's Bridge, this feature is also called *'The Bridge of Rama'*. Sacred to the Hindu religion, the bridge was said to be built by Lord Rama, who visited many towns in the region. The shoals are primarily limestone and the waters in this location are quite shallow—some data suggests the 'bridge' may be the remnants of a true land bridge that once stretched between India and Sri Lanka.

On July 23, 2018, NASA's *Aqua* satellite passed

over the Palk Strait, allowing the Moderate Resolution Imaging Spectroradiometer (MODIS) flying aboard it to acquire a true-colour image of the region.

Swirls of greens, milky-blue, and tan float in the waters of the Palk Strait. These colours are most likely created by a combination of sediment, which flows into the Strait from several large rivers, and phytoplankton. Phytoplankton are microscopic plant-like organisms that frequently flourish in these waters and—in very large numbers—can be easily seen from space.

Bands Used: 1,4,3

*Image Credit: Jeff Schmaltz, MODIS Land Rapid Response Team, NASA GSFC*

# Restless Kilauea

*European Space Agency*

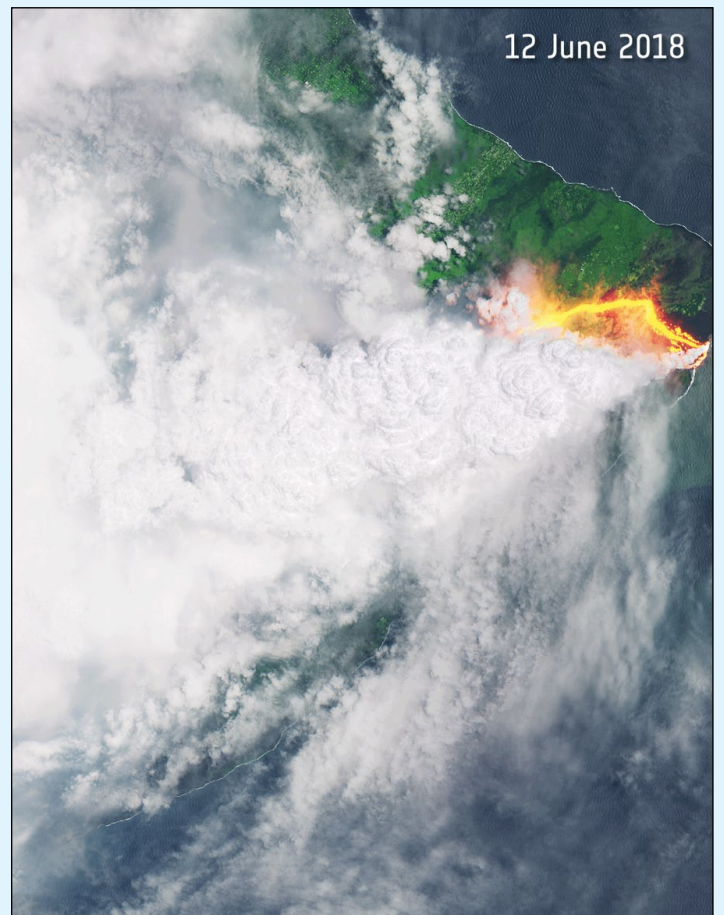
Fiery lava continues to pour from the Kilauea volcano on Hawaii's Big Island. These Copernicus Sentinel-2 images from May 23, June 7 and June 12, 2018 show the relentless flow of lava and clouds of ash.

The eruption, which began in early May, has destroyed more than 600 homes, spread lava over more than 800 hectares of land and opened up at least 22 fissures in the ground, according to Hawaii County Mayor Harry Kim.

Although this eruption has produced slow-moving lava, which has allowed people to evacuate, it is reported to be the most destructive eruption in the US since that of Mount St Helen's in 1980.

While the Sentinel-2 mission mainly provides information for agricultural and forestry practices, and to map changes in land cover, its images of disasters such as volcanic eruptions can be used to help assess damage.

*Copyright: contains modified Copernicus Sentinel data (2018), processed by ESA, CC BY-SA 3.0 IGO*



# County Fire Lights Up the Night

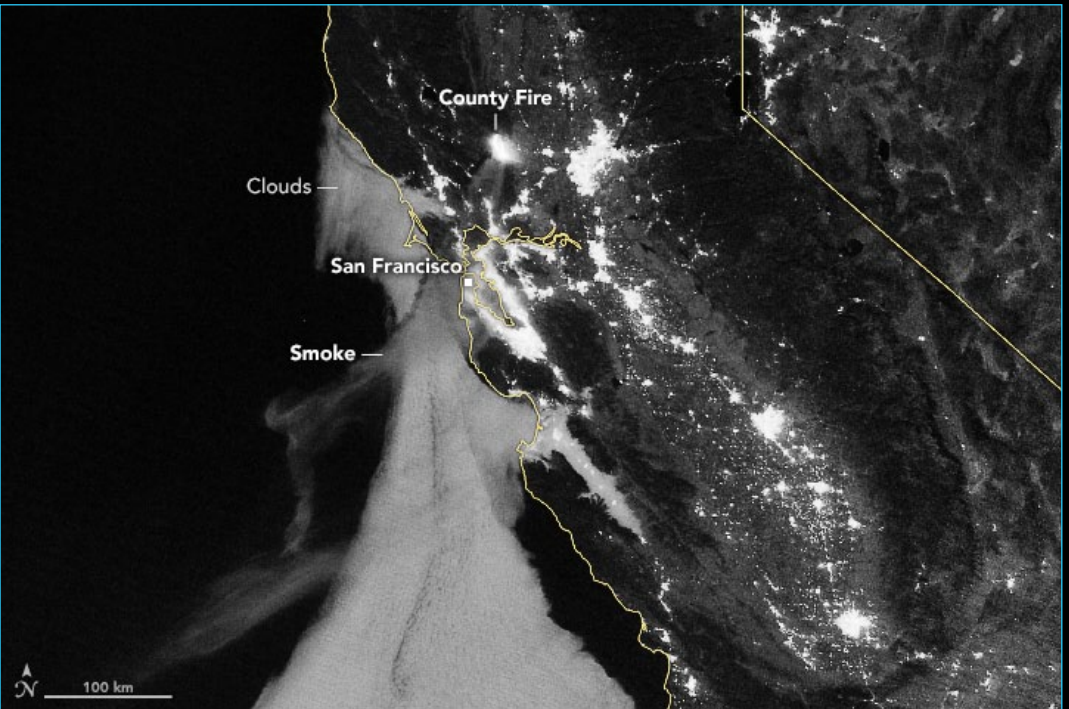
NASA Earth Observatory

Light from the County Fire illuminated the night skies of northern California when the *Suomi NPP* satellite acquired the upper image opposite overnight on July 1, 2018. With plenty of light from a nearly full Moon, the smoke was even visible streaming southwest toward San Francisco Bay and the Pacific Ocean.

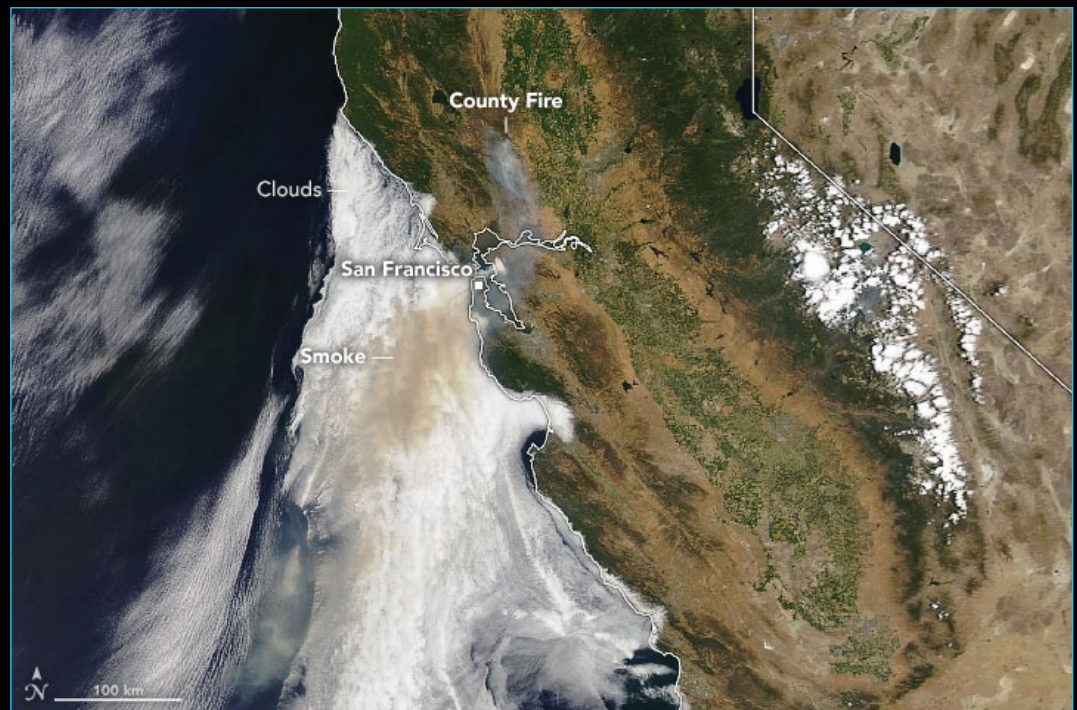
The fire had started the day before and burned a few thousands acres near the rural community of Guinda, but it quadrupled in size overnight as strong winds fanned the flames in hot, dry weather. By the afternoon of July 2, the blaze—just three percent contained—had charred more than 18,000 hectares and forced hundreds of people to evacuate the area.

The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's *Aqua* satellite captured a natural-colour image of the fire on the afternoon of July 1. Thick smoke streamed southwest toward San Francisco Bay, where many people woke up to unusually dark skies and peculiar views of orange clouds and fog. Significant amounts of smoke appeared to be drifting above the cloud layer.

Roughly 1,200 fire personnel were trying to control the fire. They had 119 fire engines and



This is an overnight image acquired on July 1 by the Suomi NPP satellite's "Day/Night band".



This is an afternoon MODIS image acquired on July 1 by the Aqua satellite.

12 helicopters at their disposal, according to *California Department of Forestry and Fire Protection*.

The night-time image was acquired with the 'day night band'

of the Visible Infrared Imaging Radiometer Suite (VIIRS). VIIRS detects light in a range of wavelengths from green to near-infrared and uses filtering techniques to observe signals such

as city lights, auroras, and wildfires.

NASA Earth Observatory images by Joshua Stevens, using MODIS data from LANCE/EOSDIS Rapid Response and Suomi NPP VIIRS data from NOAA's National Centers for Environmental Information (NCEI). Story by Adam Voiland

# Receiving Images from Feng Yun 3A

*Les Hamilton*

Soon after *GEO Newsletter 58* was published, I was taken to task by one of our Dutch readers, Peter Kooistra, who has been regularly receiving high-resolution Feng Yun 3A AHRPT images directly from the satellite. Peter noted that this satellite was stated to be 'inactive' in our listing of *Currently Active Satellites*, yet he was regularly receiving strong signals from it.

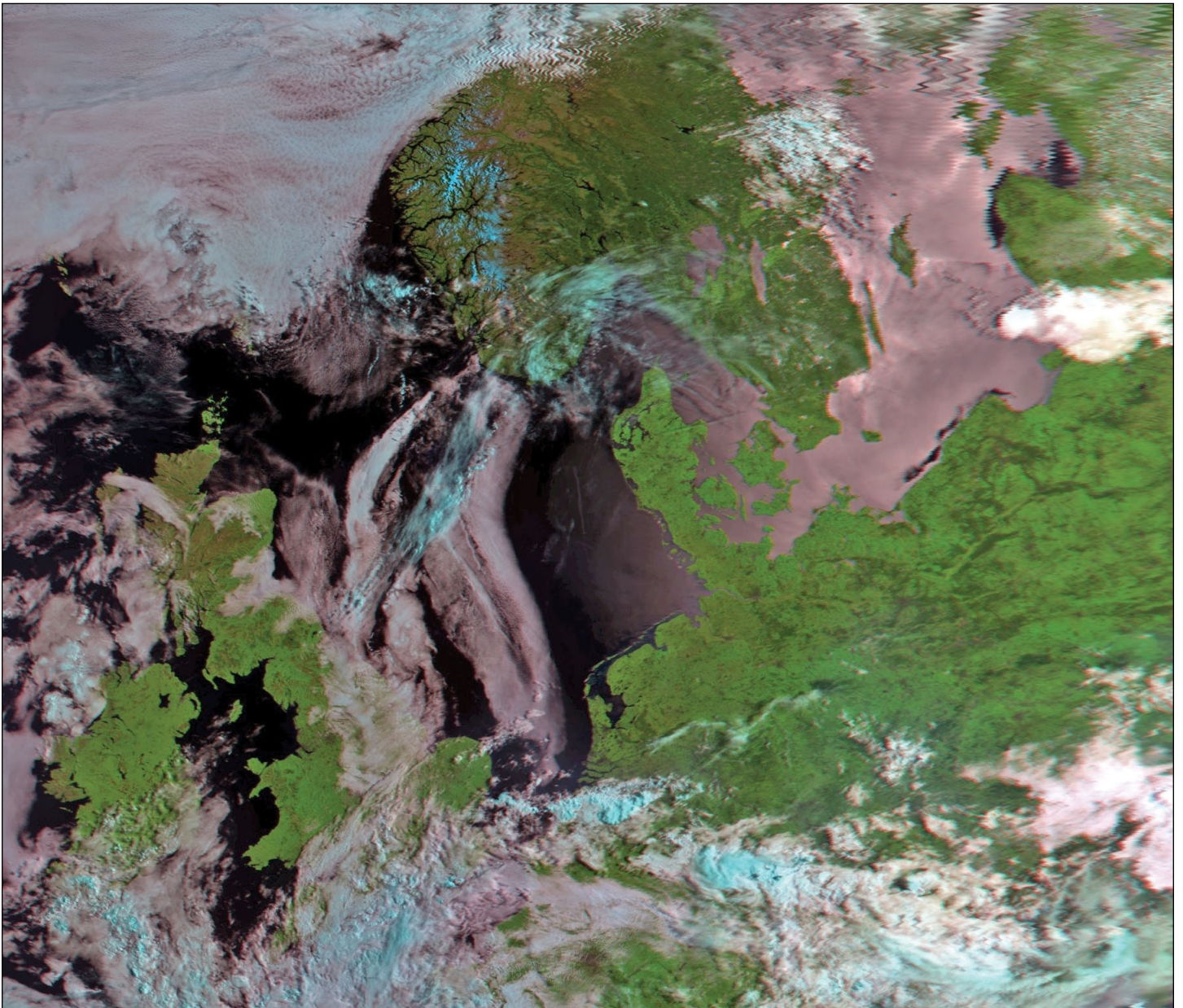
I contacted Douglas Deans, who no longer lists FY-3A in weekly *Satellite Status*, and he conformed that the satellite is considered by both China and the WMO to have reached the end of its life and that its official status is indeed 'inactive' as of January 2015. You can read the official information at this URL

<https://www.wmo-sat.info/oscar/satellites/view/113>

According to ESA's *eoPortal News*, FY-3A was retired on January 5, 2015, ending the global image coverage service. Several of FY-3A's mission instruments had by then failed:

- MWRI failed soon after launch
- IRAS failed in October 2008 (inactive);
- SBUS failed in December 2008 (inactive);
- ERM-1 failed in May 2008 (inactive);
- MWTS-1 failed in December 2012 (inactive).

So, although officially retired, it seems that the AHRPT imaging is still active, for whatever reason. Below are some of Peter's images, which are all the more remarkable because he hand tracks his antenna during the satellite pass.



This RGB FY-3A image dates from 07:33 UT on June 7, 2018

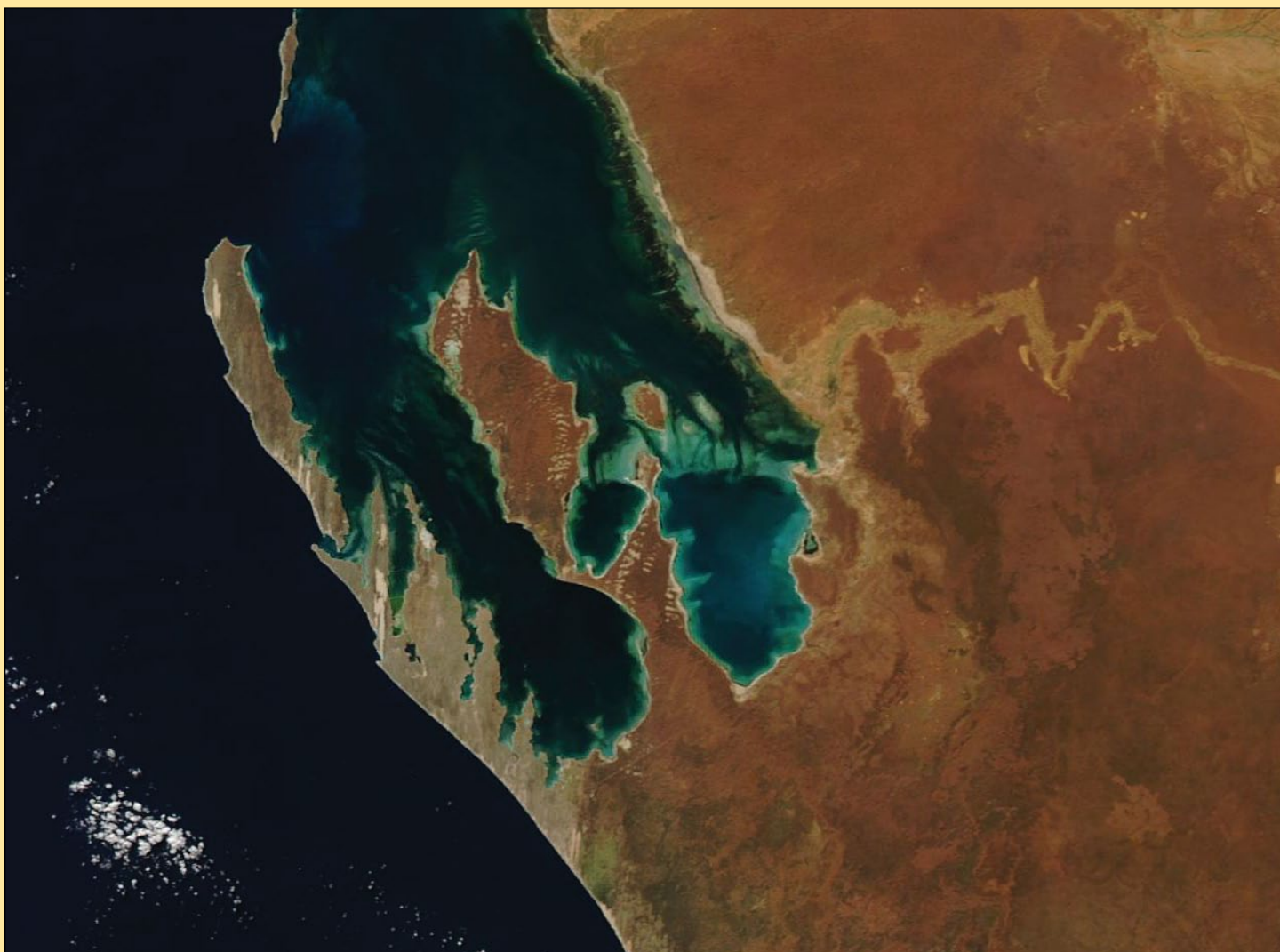




Peter Kooistra also receives images from FY-3C. This one, from 07:33 UT, July 1, 2018 is an RGB197 image, coloured using two IR and one near IR channels. This gives more realistic land colours, though at the expense of somewhat reduced sharpness, to depict western Europe at the height of the summer heatwave.

# Shark Bay, Australia

*MODIS-Web*



This MODIS image of Shark Bay, Western Australia, was acquired on July 10, 2018 by NASA's Aqua satellite.

Swirls of bright blue in the waters of Shark Bay, Australia point to the presence of phytoplankton in the water. These plant-like microscopic organisms exist in the waters year-round, but reproduce in large numbers when nutrients, daylight length, and water temperatures are favourable. At such times, the algal blooms become so large that they can easily be seen from space.

Like terrestrial plants, phytoplankton play an important role in the carbon cycle by using photosynthesis to consume carbon dioxide and release oxygen. In addition, carbon can be sequestered in the ocean bottoms as the organisms die. Phytoplankton also form the base of the marine food web, feeding everything from the microscopic, animal-like zooplankton to multi-ton whales. Smaller fish and invertebrates also graze on phytoplankton, and those organisms in turn feed other fish, mammals, birds—and even humans.

Shark Bay has been designated as a UNESCO World Heritage Site, notable for its luxuriant beds of sea-grass, for providing a home to the dugong (sea cow), and for its rich biodiversity.

Not only phytoplankton exist in these waters: so do other plant-like features: stromatolites. These are large colonies of algae which form hard, dome-shaped deposits. According to the UNESCO description, these stromatolites are among the oldest forms of life on Earth. Shark Bay is also home to five endangered species of mammals.

The Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's *Aqua* satellite acquired this true-colour image of Shark Bay, Australia on July 10, 2018, by combining bands 1,4 and 3.

*Image Credit: Jeff Schmaltz,  
MODIS Land Rapid Response Team, NASA GSFC*

# Currently Active Satellites and Frequencies

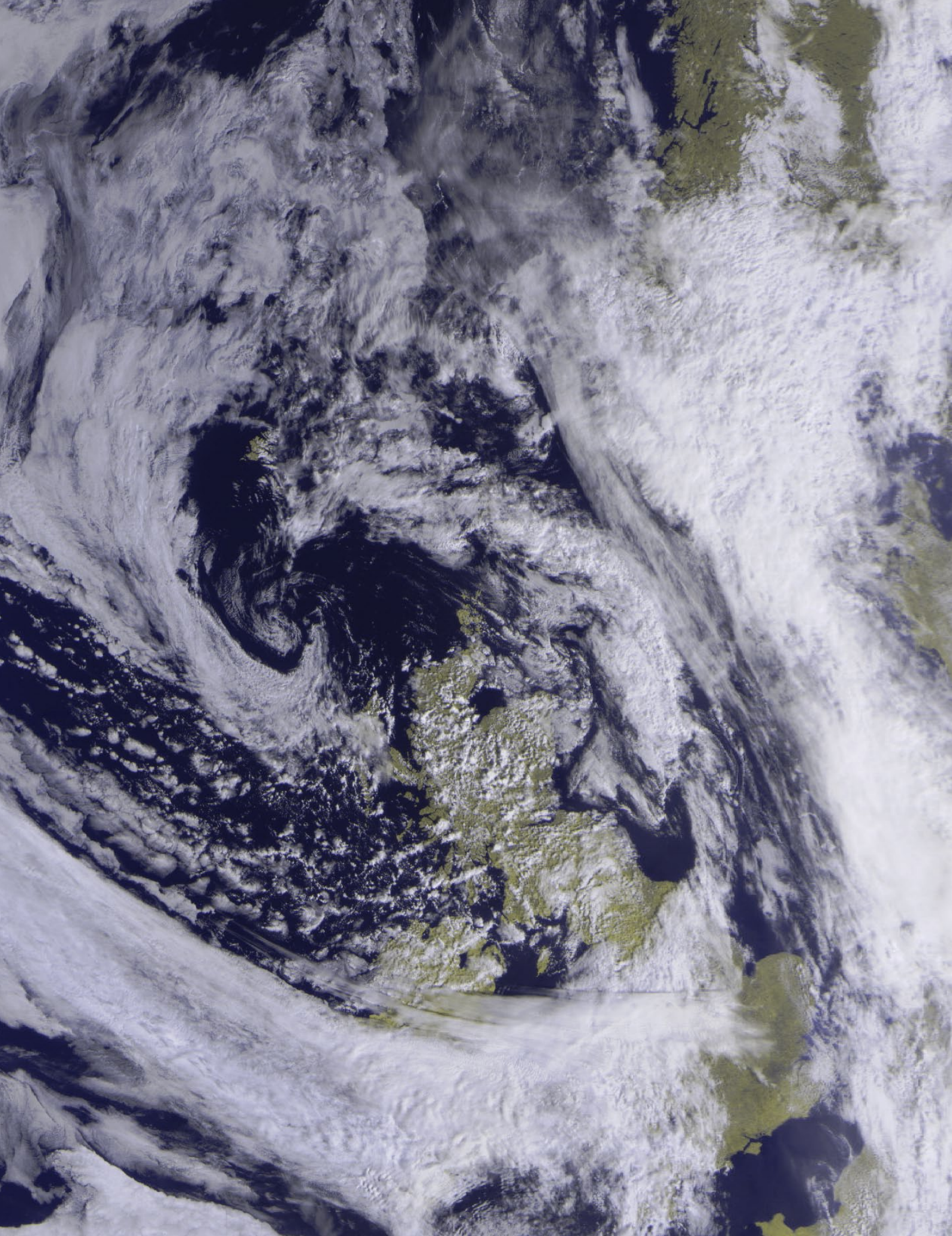
Polar APT/LRPT Satellites			
Satellite	Frequency	Status	Image Quality
NOAA 15	137.6200 MHz	On	Good
NOAA 18	137.9125 MHz	On	Good
NOAA 19	137.1000 MHz	On	Good <sup>[1]</sup>
Meteor M N1	137.0968 MHz	Off	Dead <sup>[7]</sup>
Meteor M N2	137.9000 MHz	On	Good

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 <sup>[2,9]</sup>
Feng Yun 3B	1704.5 MHz	RHCP	AHRPT	Active <sup>[2]</sup>
Feng Yun 3C	1701.4 MHz	RHCP	AHRPT	Active <sup>[2]</sup>
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? <sup>[7]</sup>
Meteor M N2	1700.0 MHz	RHCP	AHRPT	Good

Geostationary Satellites				
Satellite	Transmission Mode(s)		Position	Status
Meteosat 7	HRIT 1691 MHz / WEFAX 1691 MHz		57.5°E	On
Meteosat 8	HRIT (digital)	---	3.5°E	Standby <sup>[3]</sup>
Meteosat 9	HRIT (digital)	LRIT (digital)	9.5°E	On <sup>[4]</sup>
Meteosat 10	HRIT (digital)	LRIT (digital)	0°W	On
GOES-13	GVAR 1685.7 MHz	LRIT 1691.0 MHz	75°W	Backup East
GOES-14	GVAR 1685.7 MHz	LRIT 1691.0 MHz	105°W	Standby
GOES-15 (W)	GVAR 1685.7 MHz	LRIT 1691.0 MHz	135°W	On <sup>[5]</sup>
GOES-16 (E)	GRB 1686.6 MHz	HRIT 1694.1 MHz	75°W	On <sup>[8]</sup>
MTSAT-1R	HRIT 1687.1 MHz	LRIT 1691.0 MHz	140°E	Standby
MTSAT-2	HRIT 1687.1 MHz	LRIT 1691.0 MHz	145°E	On
Feng Yun 2D	SVISSR	LRIT	86.5°E	Off <sup>[6]</sup>
Feng Yun 2E	SVISSR	LRIT	86.5°E	On
Feng Yun 2F	SVISSR	LRIT	112.5°E	On
Feng Yun 2G	SVISSR	LRIT	105.5°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 operational backup satellite
- 4 Meteosat Rapid Scanning Service (RSS)
- 5 GOES 15 also transmits EMWIN on 1692.70 MHz
- 6 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.
- 7 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.
- 8 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.
- 9 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.



This Meteor M2 image acquired at 10:14 UT on September 6, 2018 depicts Scotland in the embrace of a depression that brought a mixture of sunny spells and heavy showers of rain and hail. The image was captured by Les Hamilton using a USB dongle with *SDRsharp* followed by image processing in *LRPTOfflineDecoder* and *SmoothMeteor*.