Scratching the Surface? Looking from Space at Human Impact on Earth

Carolyn Roberts

Frank Jackson Professor of Environment
Gresham College London,

and
Water and Environment consultant

‘The Blue Marble’

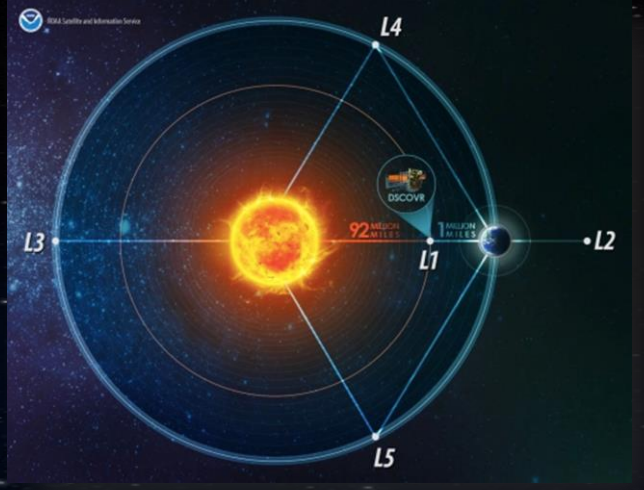
The United Nations Conference on the Human Environment, having met at Stockholm from 5 to 16 June 1972, having considered the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the environment, proclaims that …Man is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth…….man has acquired the power to transform his environment in countless ways and on an unprecedented scale.

NASA, December 1972, Apollo 17 Mission

‘The Blue Marble: The Next Generation’

‘We are all astronauts on a little spaceship called Earth’
Buckminster Fuller (2008)

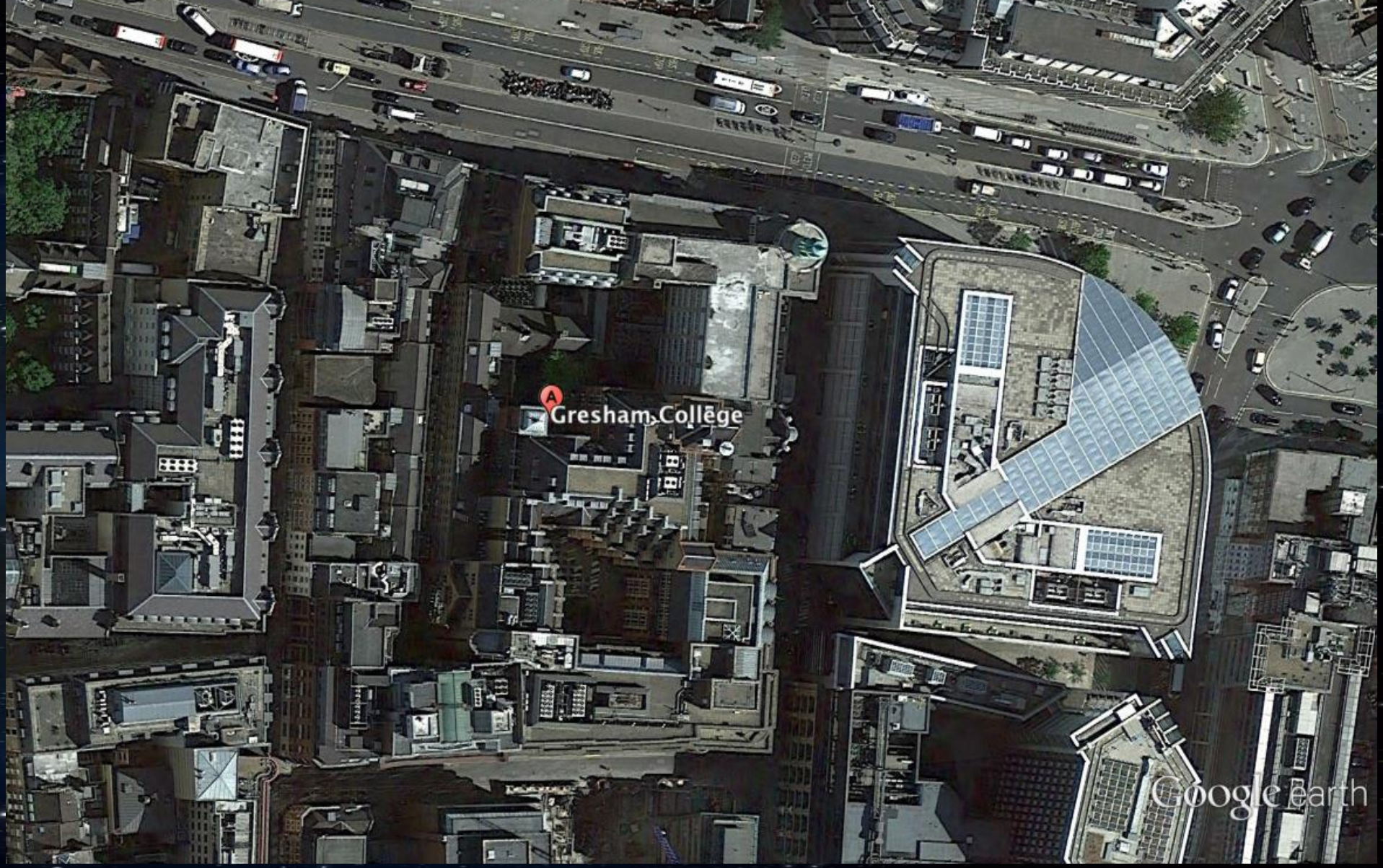
NASA, 2005, multiple cloud free satellite images stitched together



NASA released the first image of Earth taken by the EPIC camera on the DSCOVR satellite, in 2016. It has now captured a full year of our planet, at two hourly intervals, from about one million miles away at Lagrange Point 1

A coming together of…

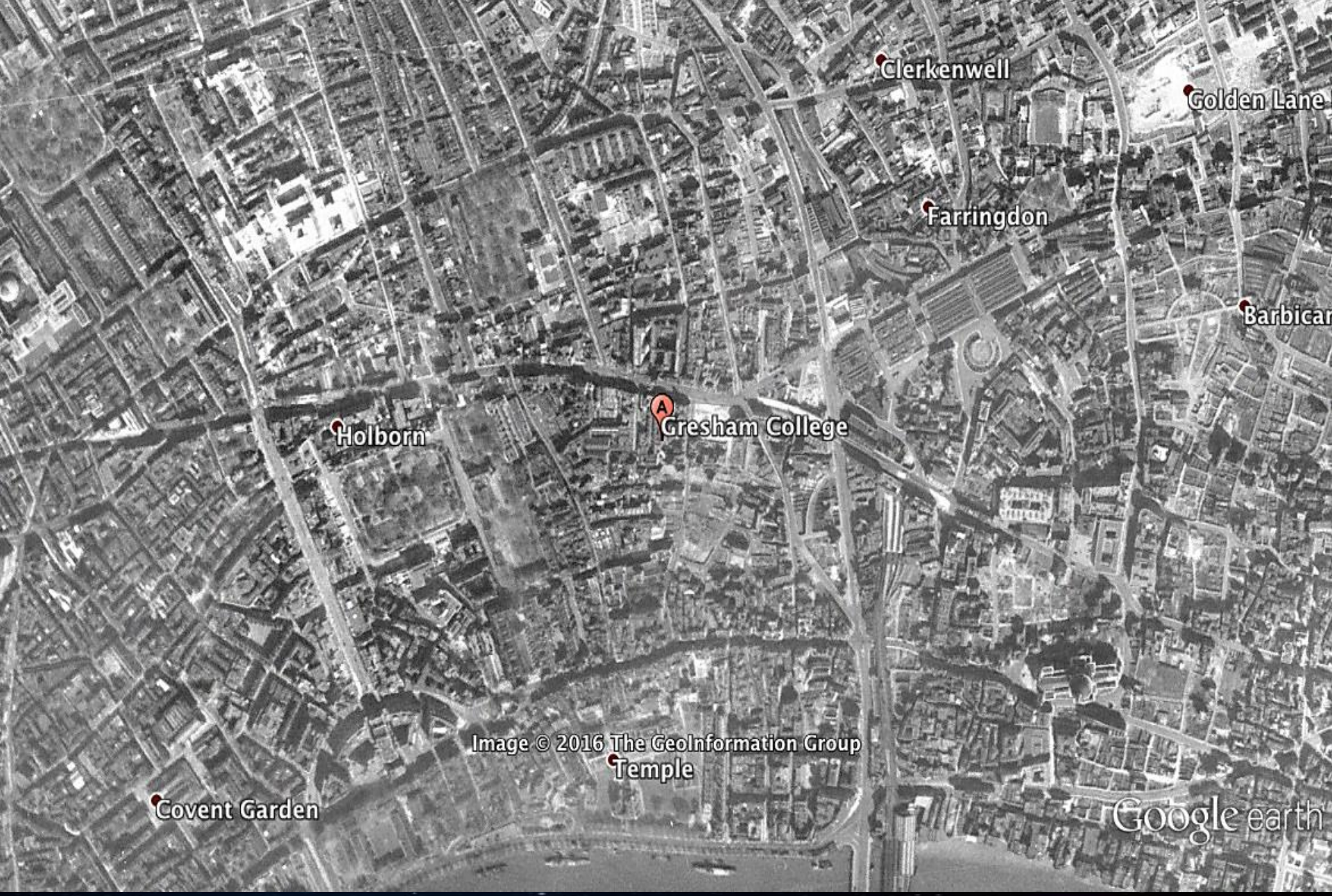
- The operationalisation of Global Positioning Satellites (GPS) for military and civilian uses in 1991, now with 24 military satellites supporting everything from missiles to your mobile phone
- The distribution of data and imagery on the WWW in 1992
- The huge growth in personal computing
- The use of Geographic Information Systems for the management of information
- The privatisation of high resolution satellites in the later 1990s
- The enormous growth in data storage capability, and the decrease in costs, internationally
- The appearance of Google Earth in 2005



Google Earth, apparently 2016, Gresham College

Cambridge Colleges and town centre on Google Earth, 2016


Mauna Loa
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Data LDEO-Columbia, NSF, NOAA
Data MBARI
Google Earth

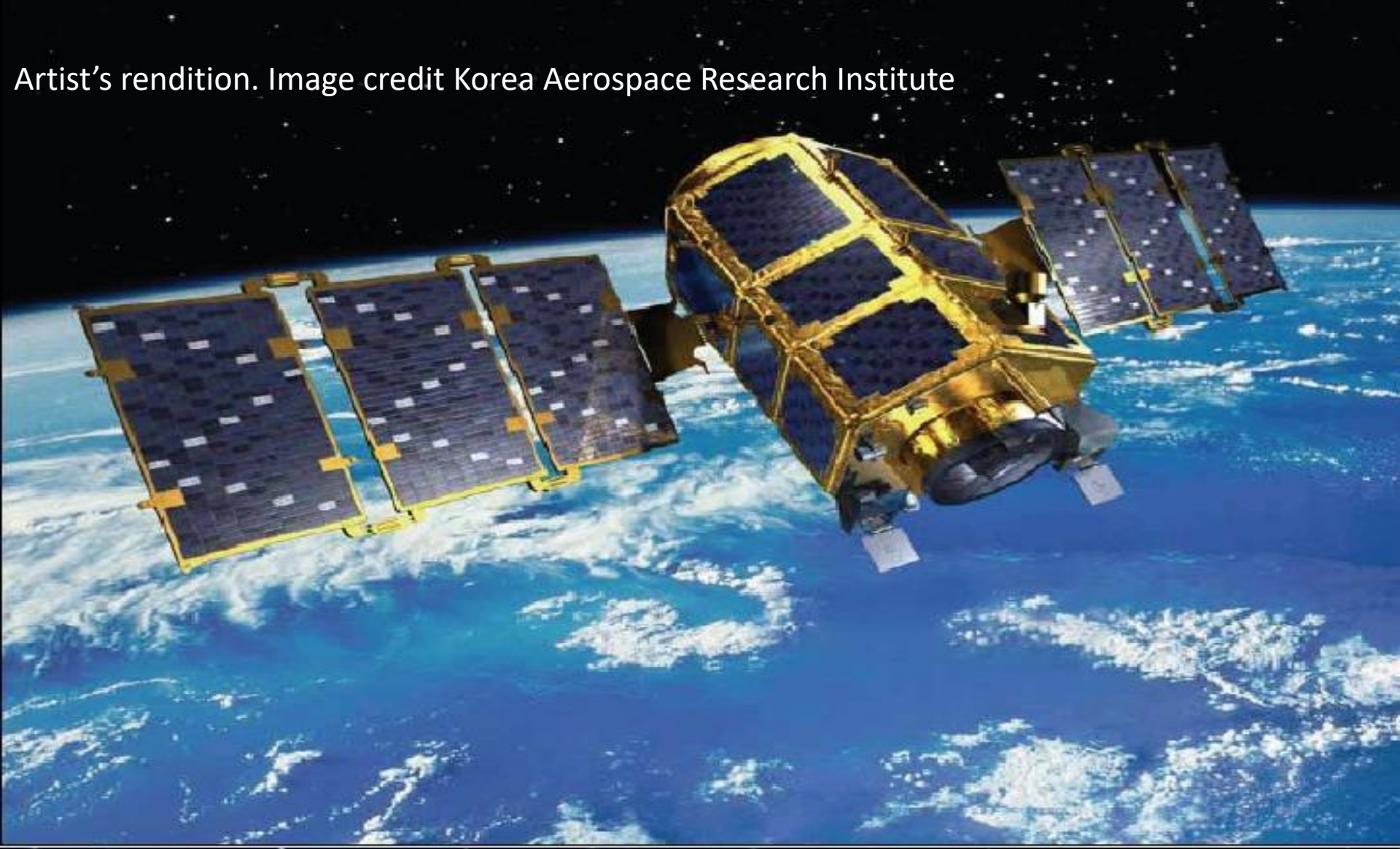


Google Earth, historic image, December

Google Earth zooming in, near Amsterdam

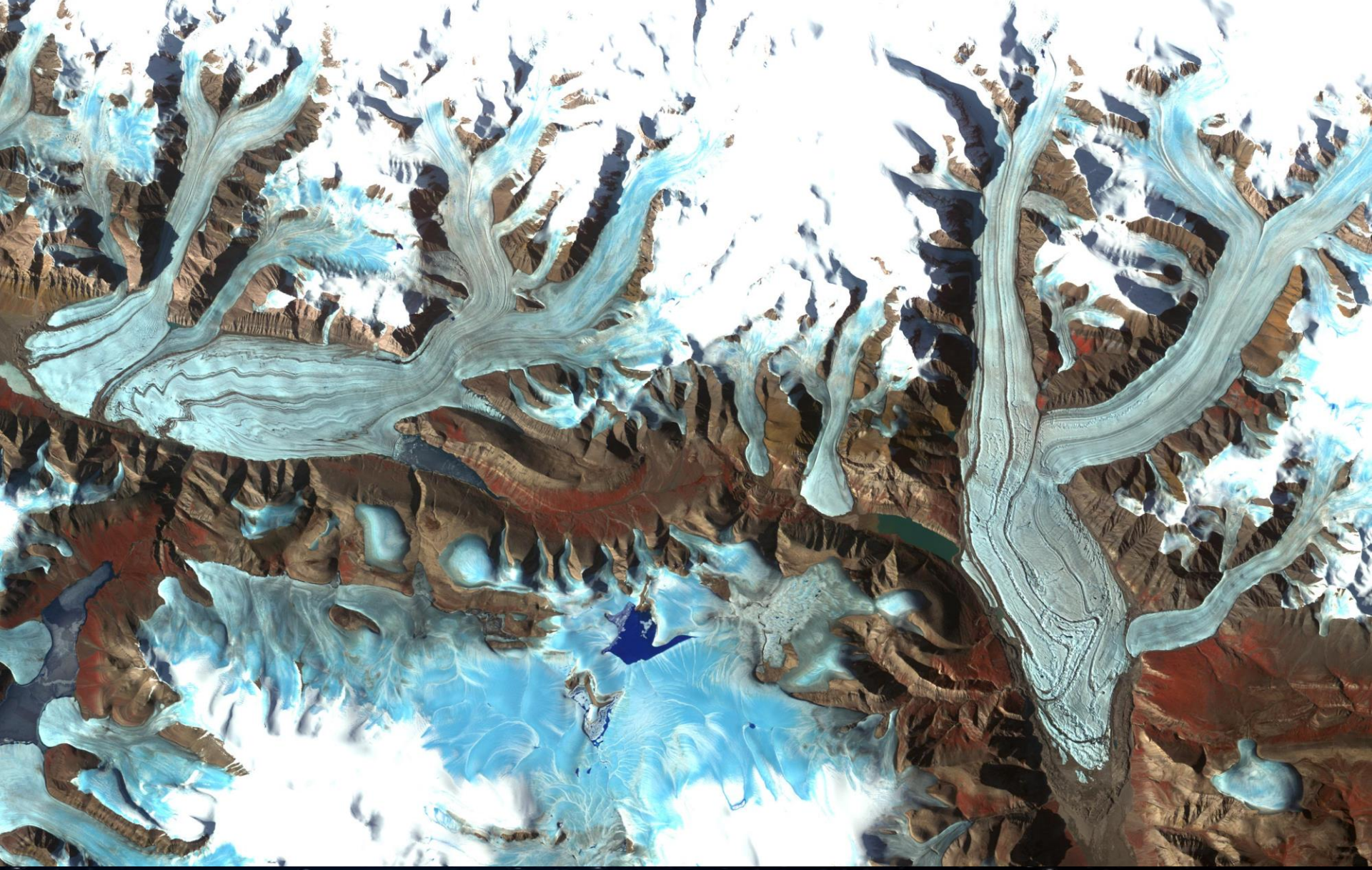
Fields of tulips near Lisse, Amsterdam, Netherlands.
www.yannarathusbertrand.org

Range of satellites doing different things

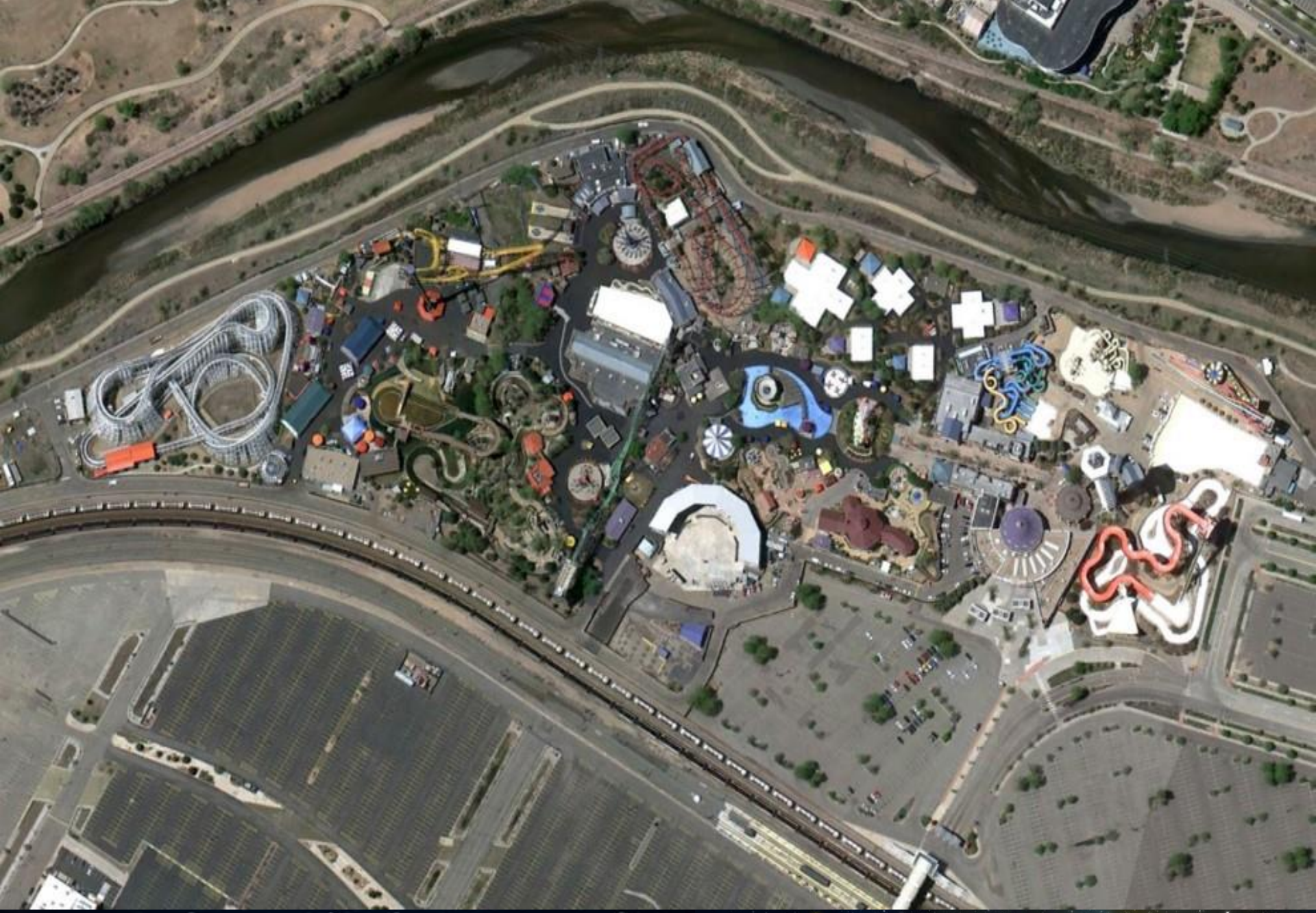


KOMPSAT-2 Korea Multi-Purpose Satellite-2’s main objectives are to provide surveillance capability for large-scale disasters by acquiring high-resolution imagery (1m resolution) for GIS applications

Alleged Prison Camp 22, Hoeryng County, North Korea

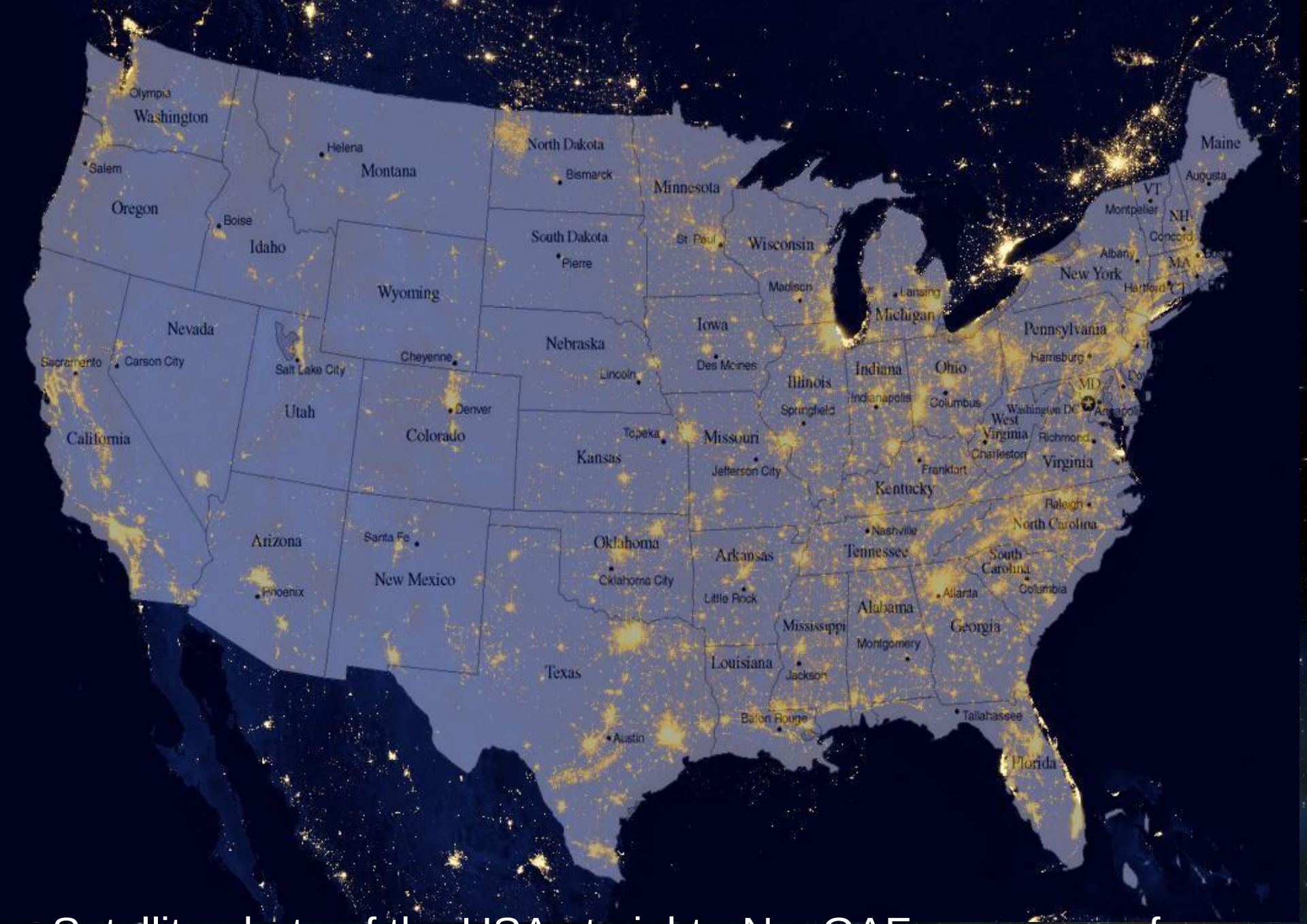


Chapman Glacier, Antarctica. www.satimagingcorp.com



Elitch Gardens Theme Park , Denver, Colorado, USA

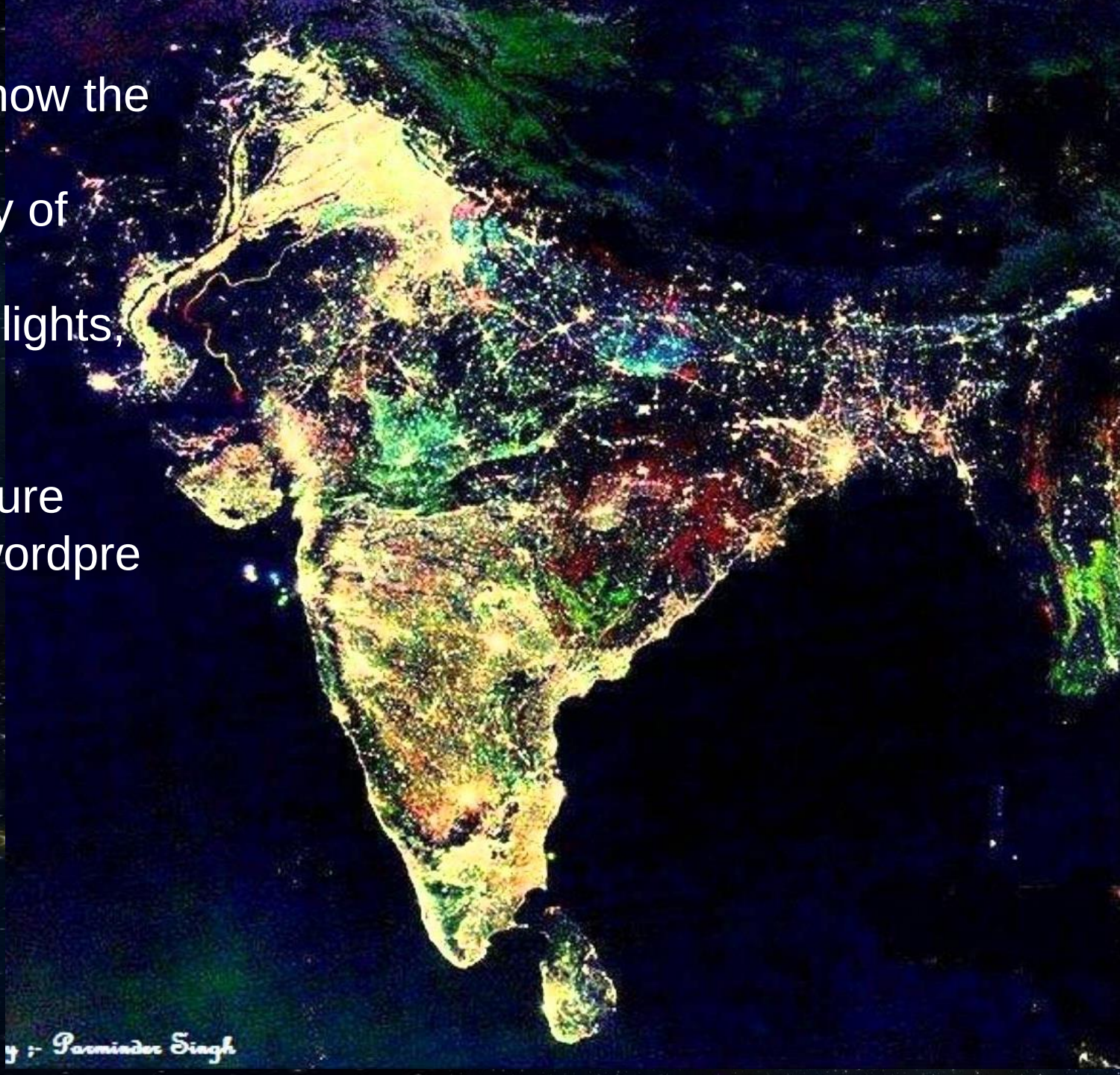
KOMPSAT-2 image of the Zaatari Refugee Camp, Jordan, acquired on June 5, 2013 (image credit: KARI, European Space Agency)



Satellite photo of the USA at night - NeoGAF www.neogaf.com

NASA image compiled to show the evening of the festival holiday of Divali, the celebration of lights, in India.

The Meta Picture
bigfunnysite.wordpress.com



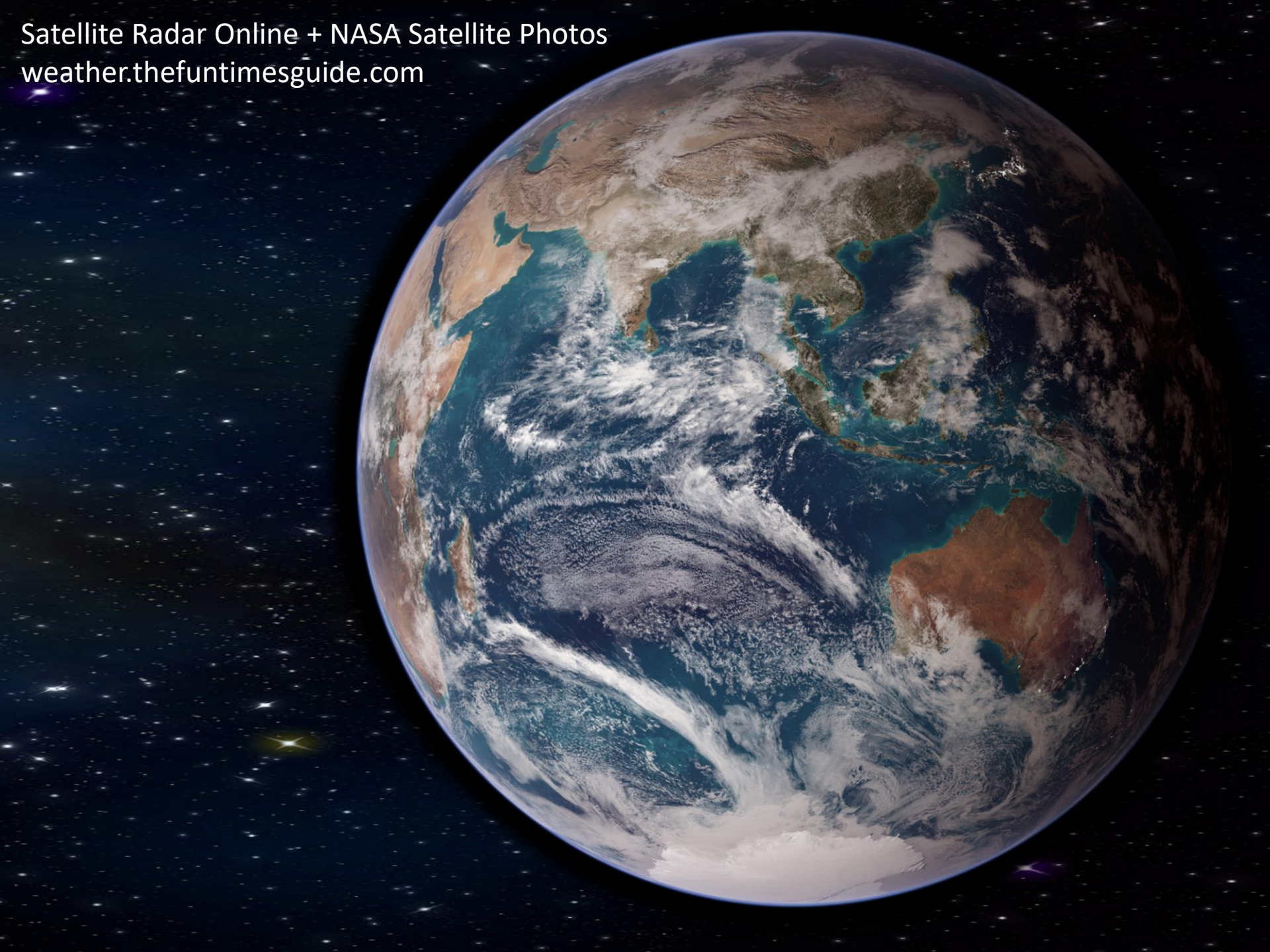

www.damncoolpictures.com


What's this?
200 ft
100 m
©2010 Google - Imagery ©2010 DigitalGlobe, GeoEye, Cnes/Spot Image, Map data ©2010 Tele Atlas - Terms of Use

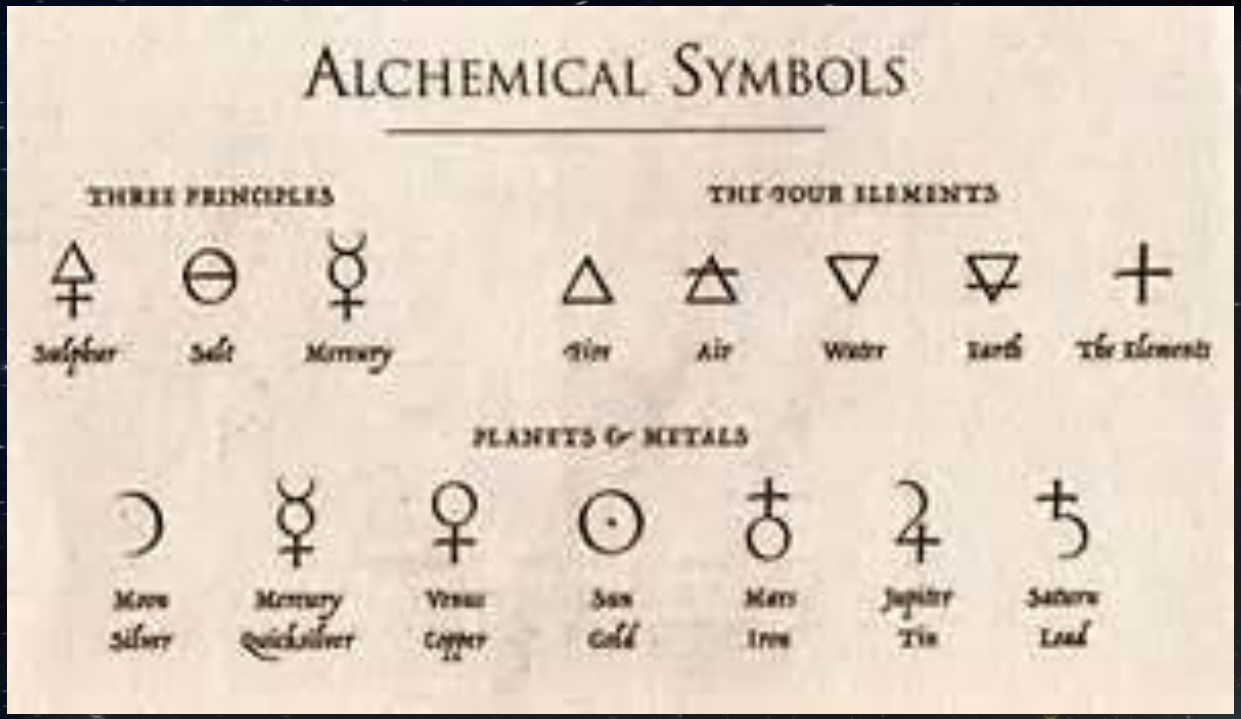
Giant Italian Rabbit, produced by group of artists near Artesina, Italy. SPOT image

Super Crab at Whitstable, Kent?

Satellite Radar Online + NASA Satellite Photos
weather.thefuntimesguide.com

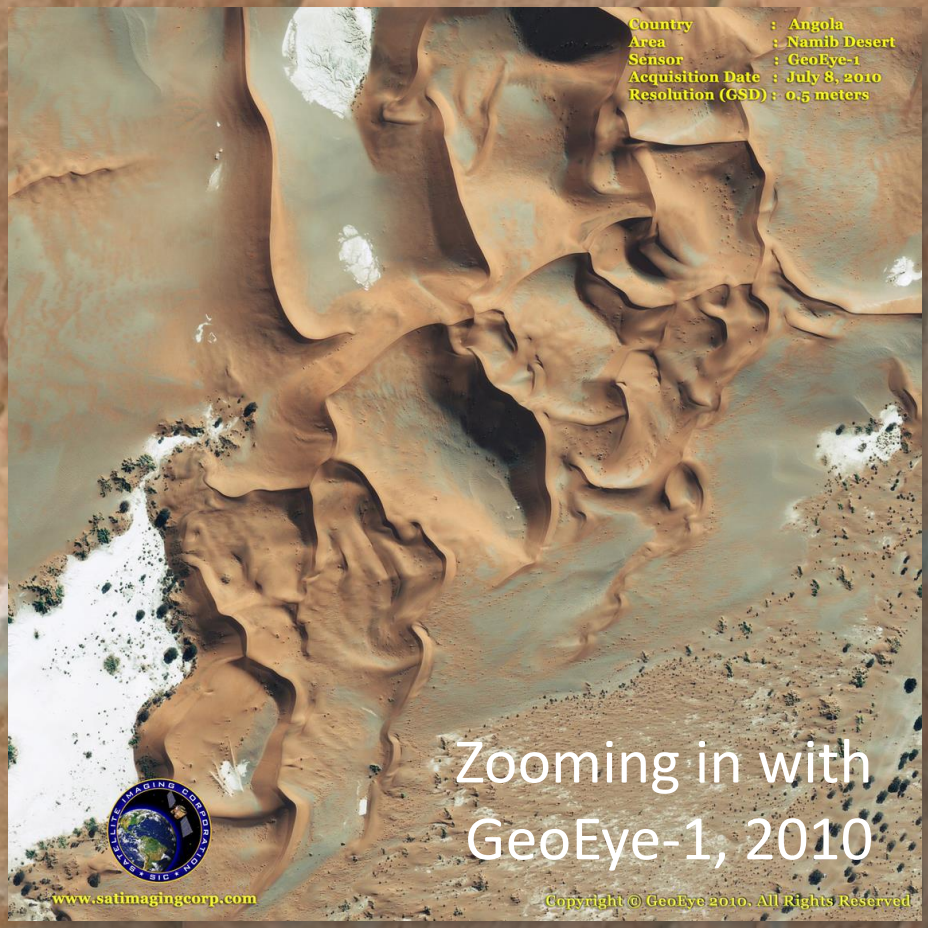


Elemental icons – the four elements of nature and history



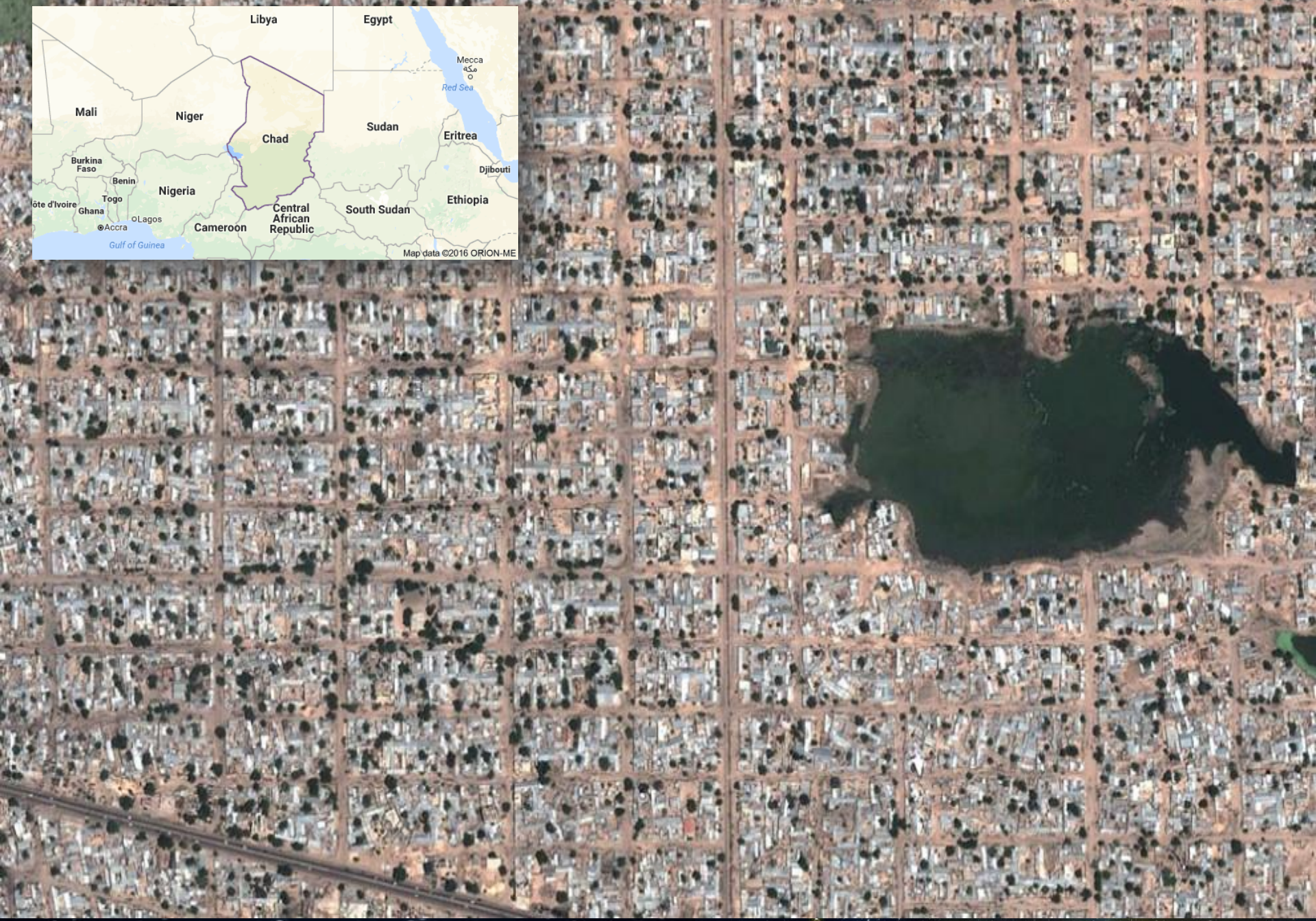
A mixture of science, philosophy and mysticism.....


Vatnajokull
Image IBCAO
Image Landsat
Google Earth



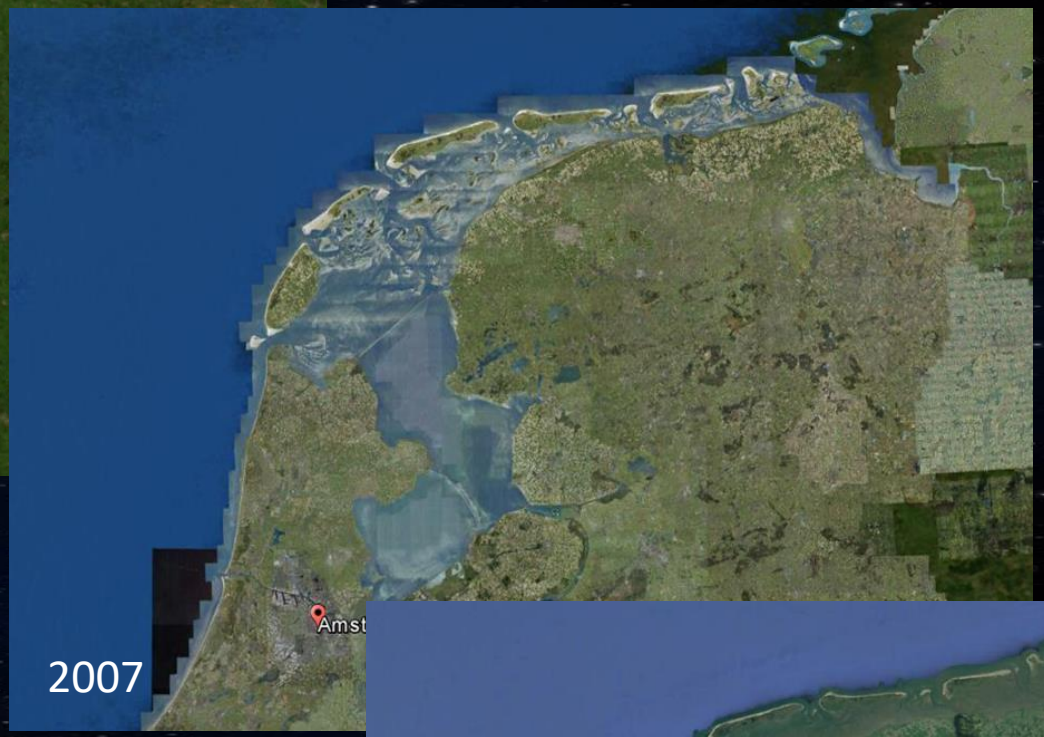
Grand Erg Oriental, Algeria

Homestake Gold Mine, South Dakota, USA

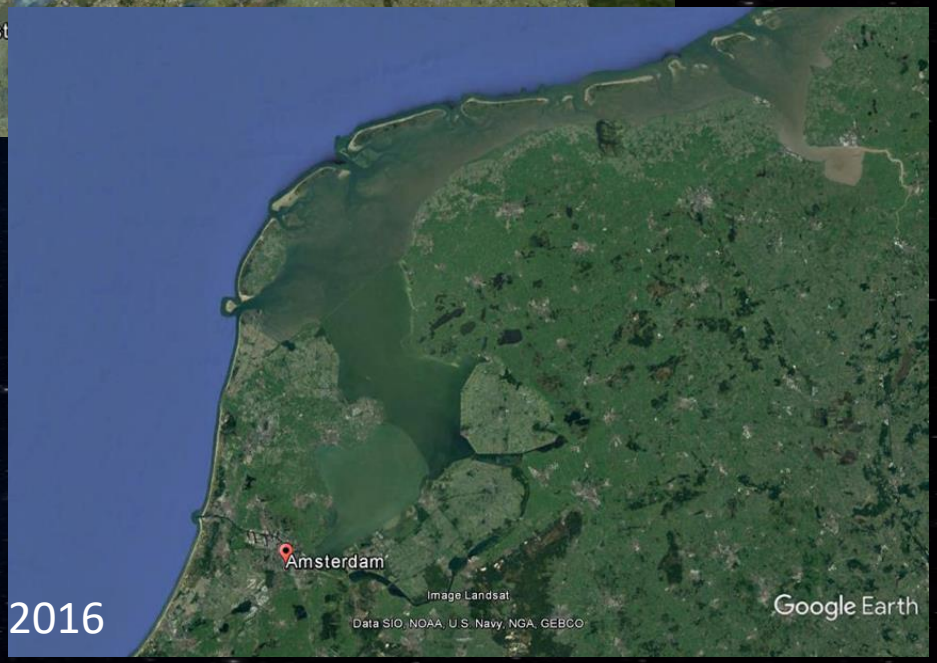


The area of N’Djamena, the capital of Chad

2001



2007

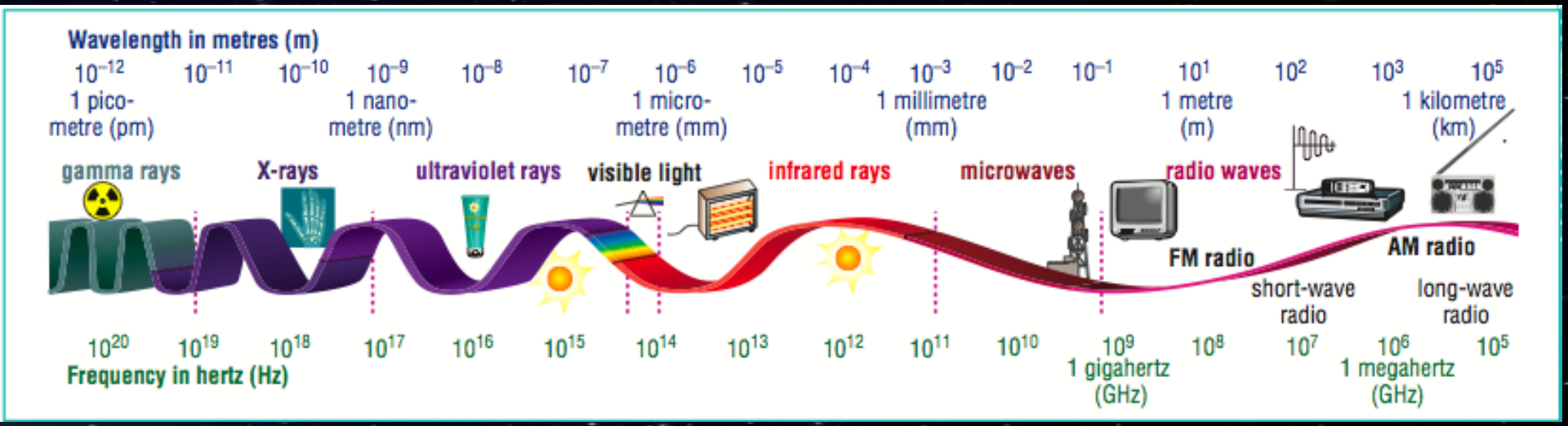


2016

Changes in the land surface of the Netherlands

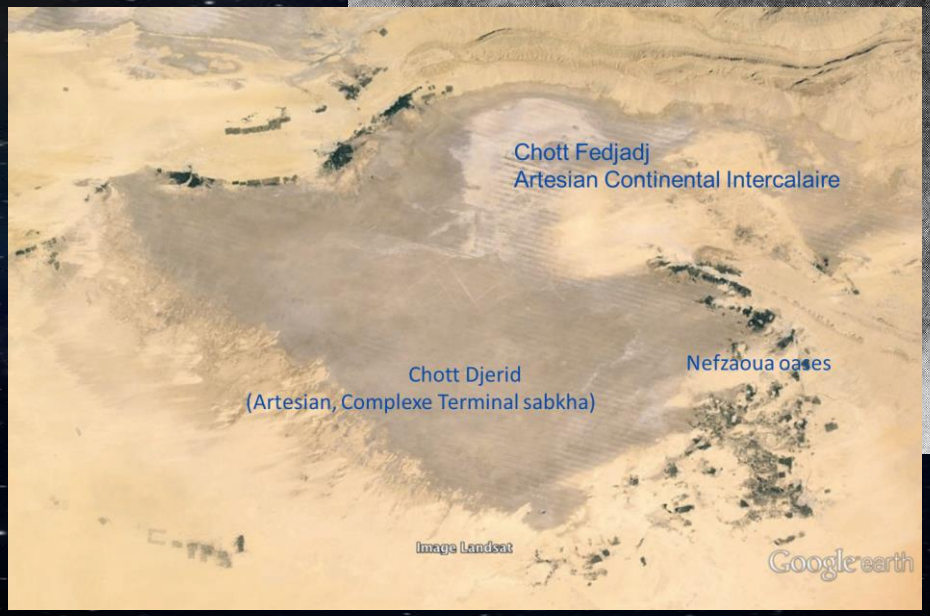
Great Pyramid of Khufu, Egypt

The Electromagnetic Spectrum



Sensors are designed to detect a specific range of wavelengths, depending on the intended purpose. One satellite can carry several sensors, and images can then be combined in different ways to highlight particular features.

Single band (infrared) image, showing presence of water in a mosaic of hard copy from the 1980s, Tunisia

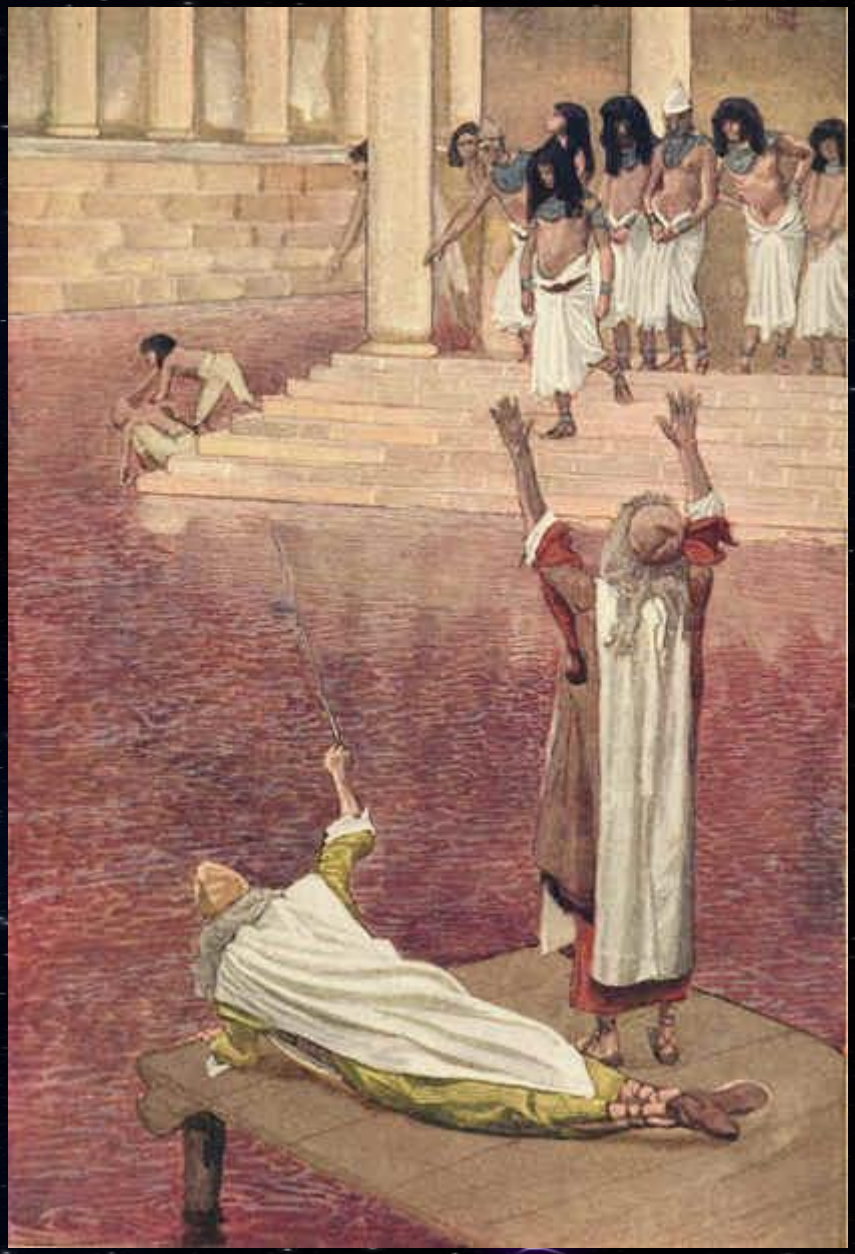


‘True’ colour composite of Souther Tunisia used by Google Earth

Nile Delta, ‘true colour’ LANDSAT image

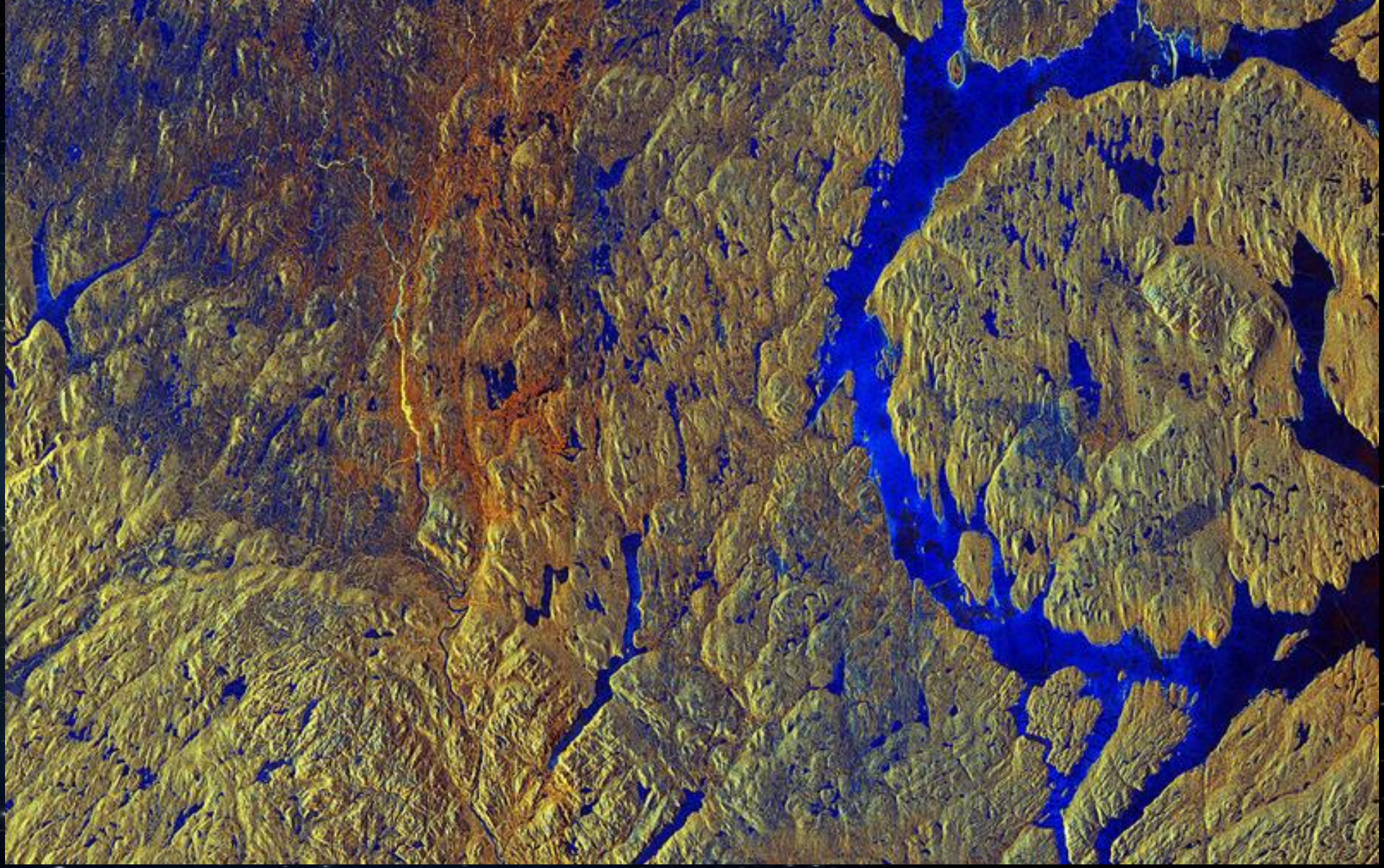
‘The First Plague: Water Is Changed into Blood’, by 19th century French painter James Tissot

Water bodies are often shown in red on ‘false colour’ images



A ‘false colour’ satellite image of the Nile using infrared technology Areas with high infra red radiation are shown in red (Courtesy European Space Agency, April 2016)

A image from the Sentinel-2A satellite, with infrared showing a central-pivot irrigation system in Saudi Arabia. (Photo: ESA)

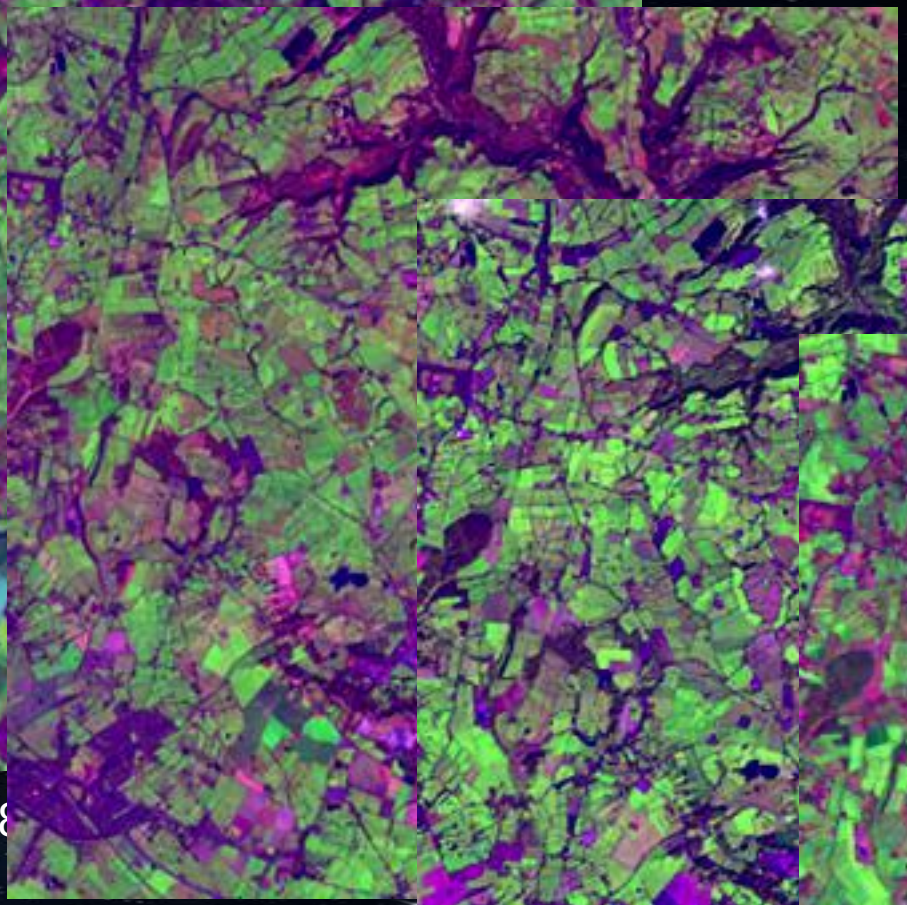


Canada's Manicouagan Crater, created by an asteroid strike. In this false-color radar image, the blue is areas of ice and water and the yellows and oranges are vegetation. (Photo: ESA)

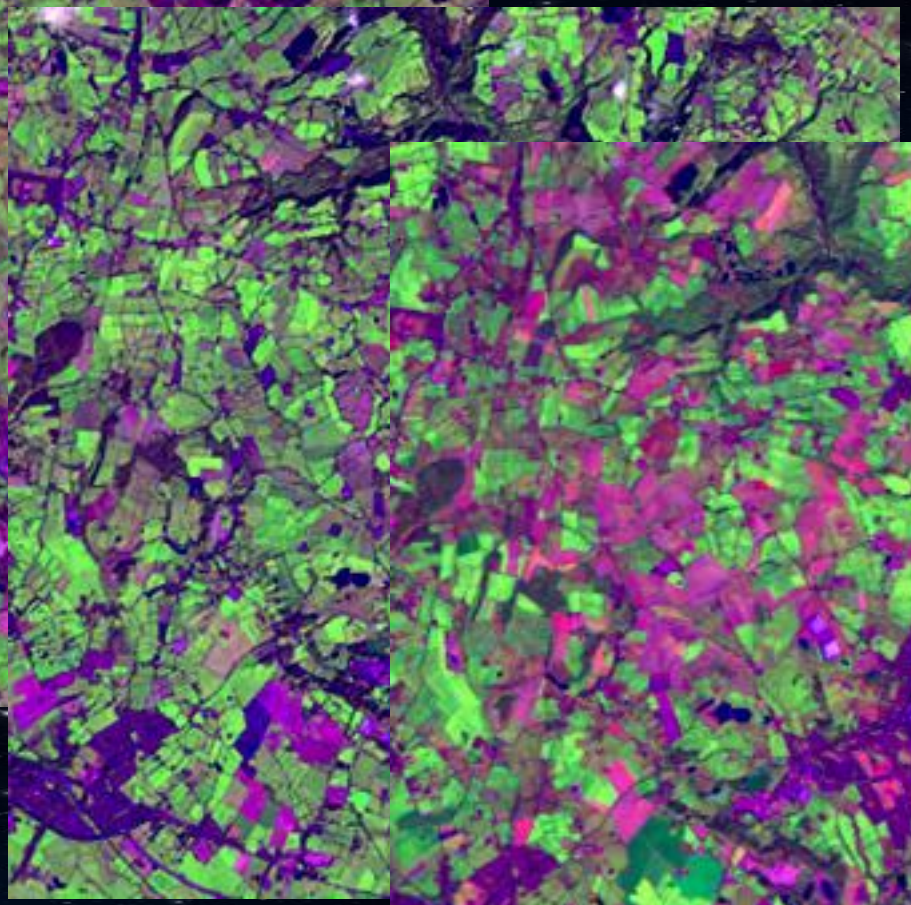
Central California seen through Sentinel-1A's radar, with the San Andreas fault line running diagonally down from top left. (Photo: ESA)

Land Cover mapping

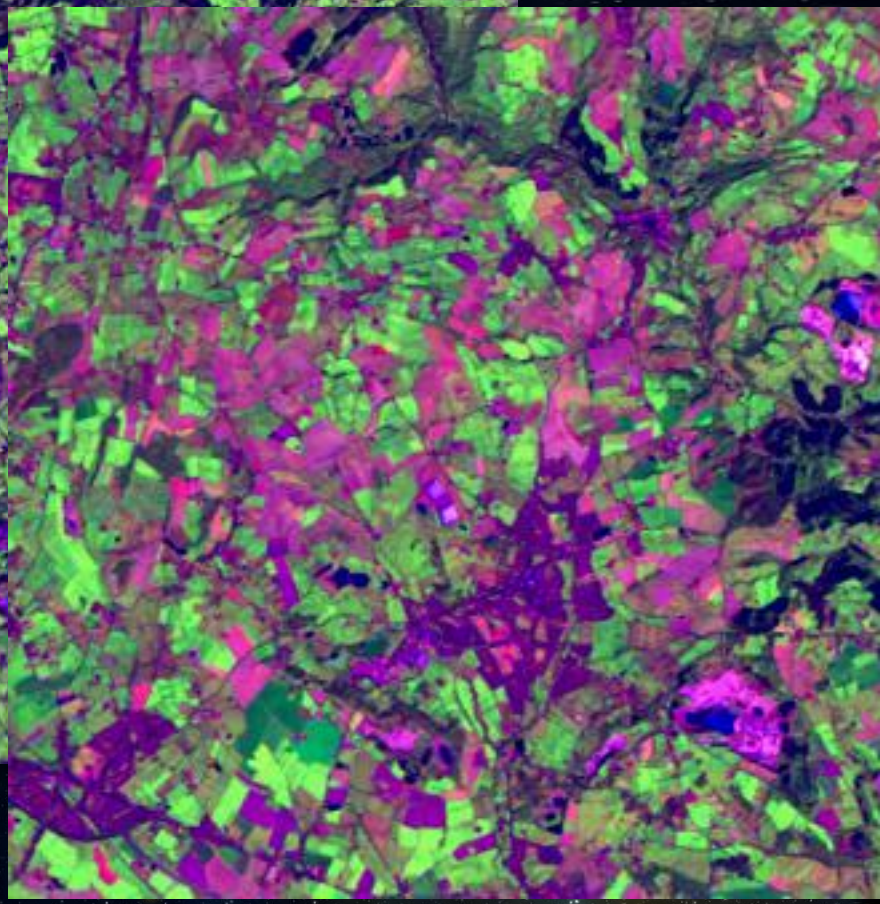
1992/05/18



2002/04/04



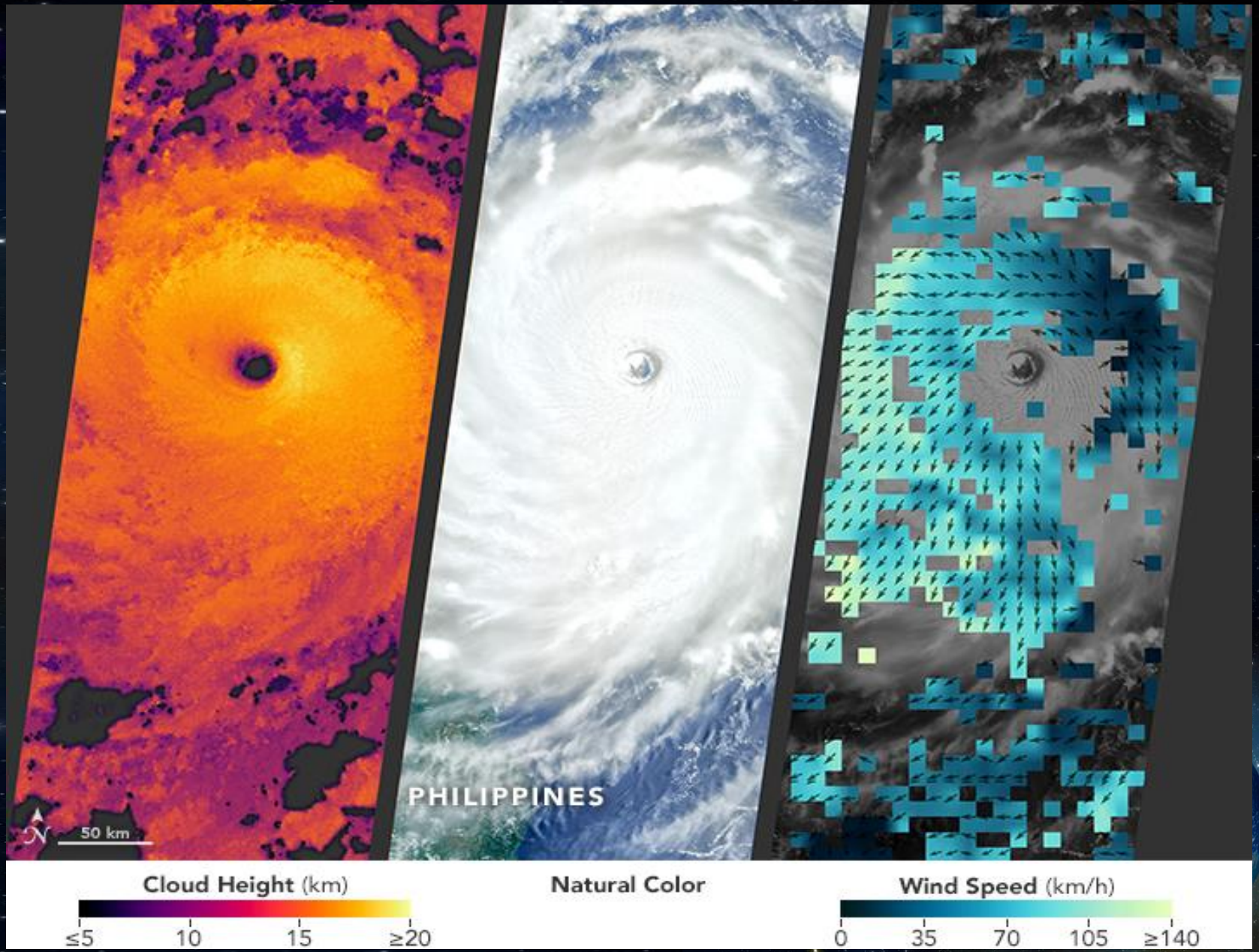
2002/09/11

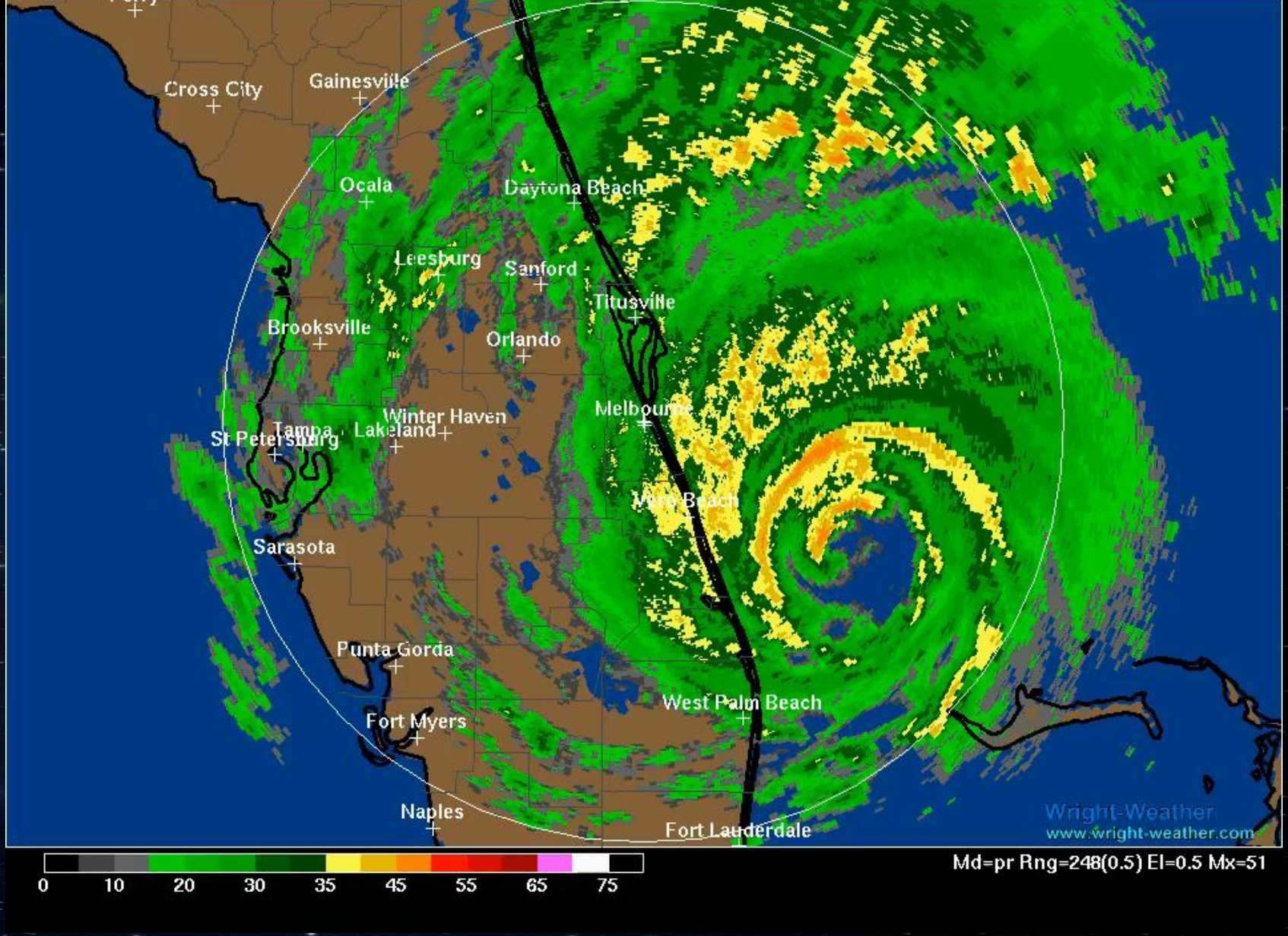


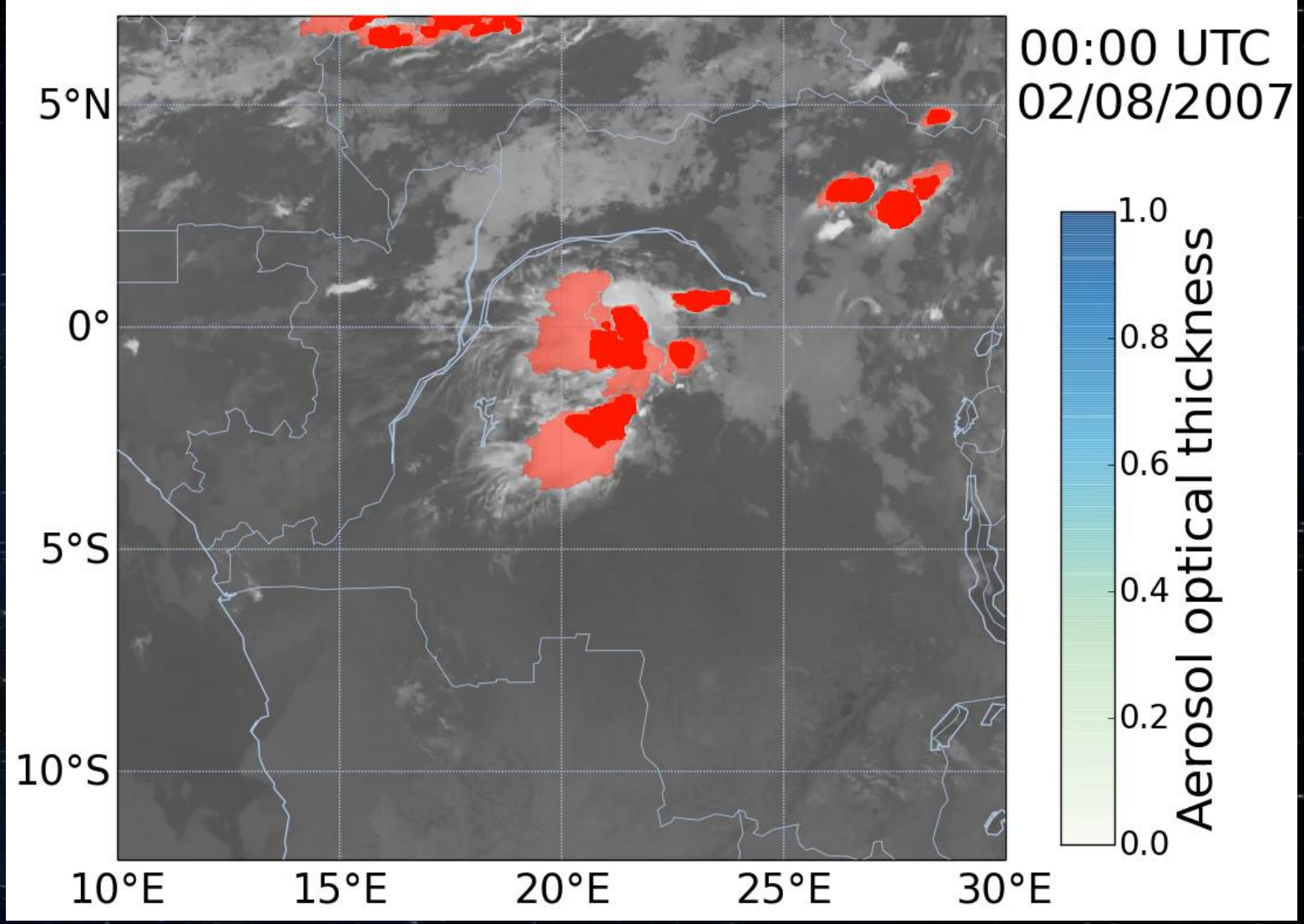
2006/06/10

Taiwan

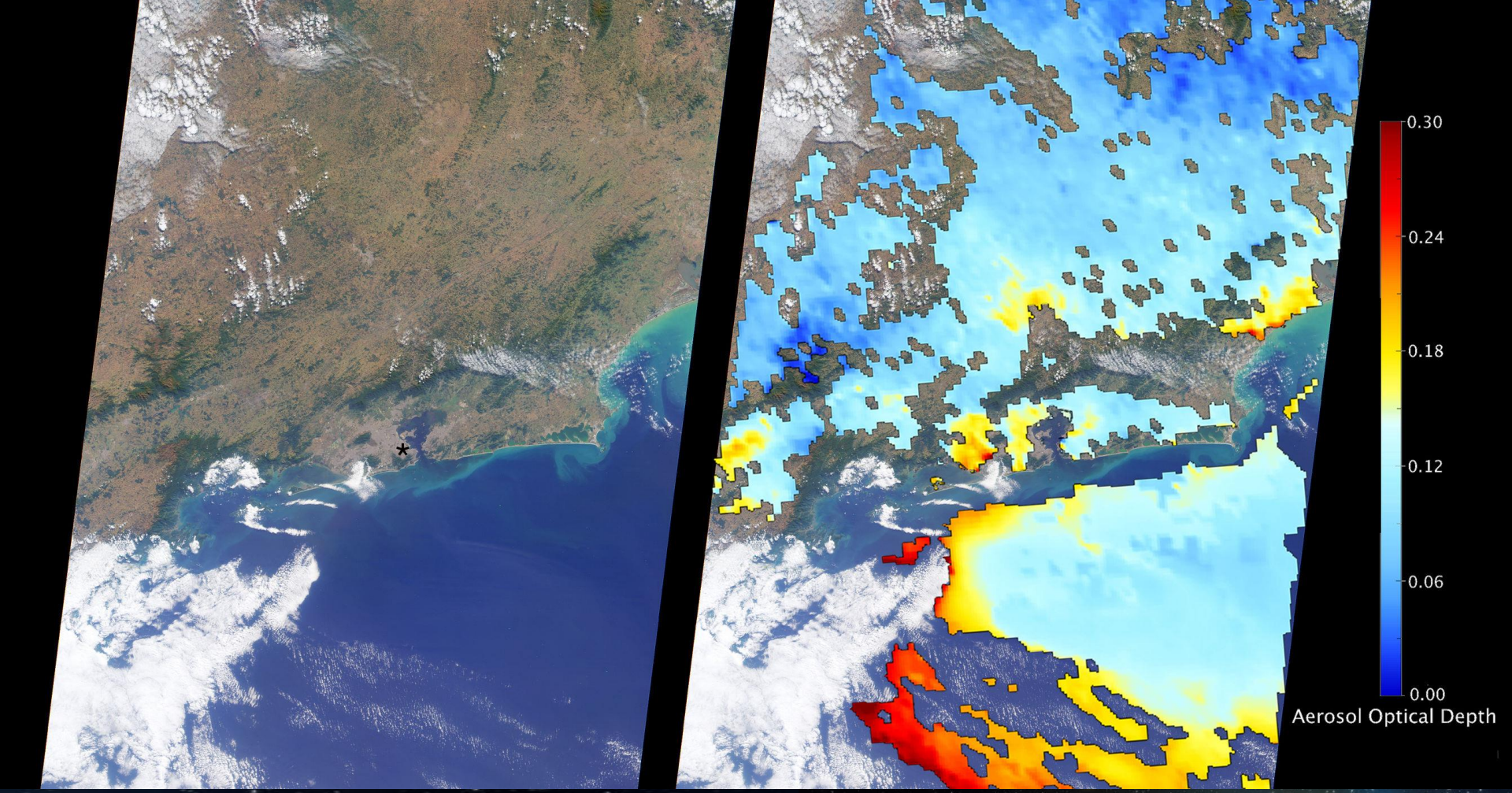
The Eye of a 'Super Typhoon' (Photo) from NASA MISR equipment




Cross City
Gainesville
Ocala
Daytona Beach
Leesburg
Sanford
Titusville
Brooksville
Orlando
Winter Haven
Melbourne
Tampa
St Petersburg
Lakeland
Vero Beach
Sarasota
Punta Gorda
West Palm Beach
Fort Myers
Naples
Fort Lauderdale
Wright-Weather
www.wright-weather.com
0 10 20 30 35 45 55 65 75
Md=pr Rng=248(0.5) El=0.5 Mx=51



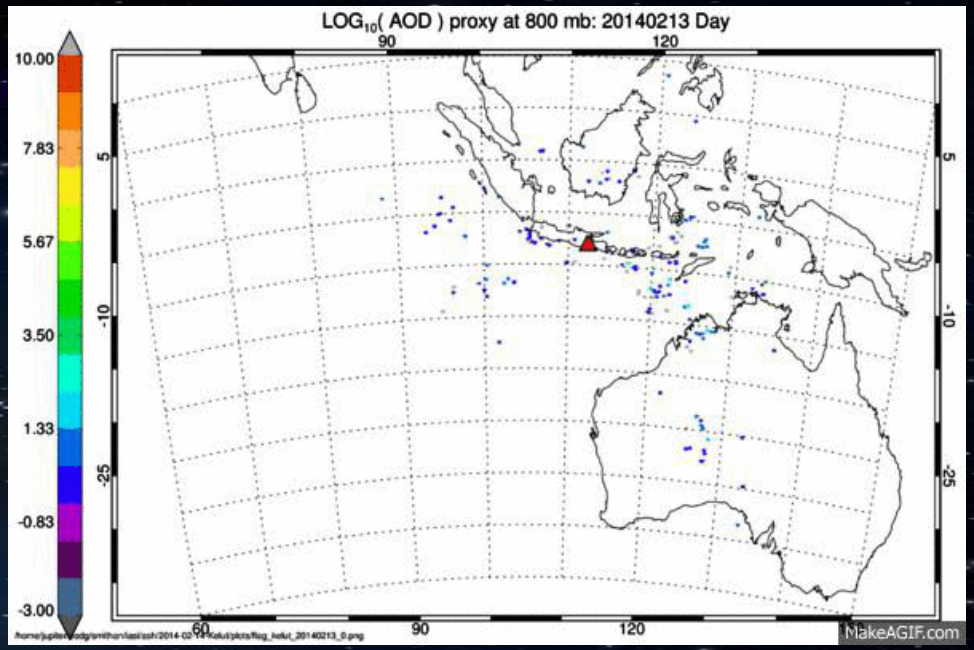
Convective core of clouds of dust in Saharan areas, work of Nick Schutgens, Philip Stier and others, University of Oxford

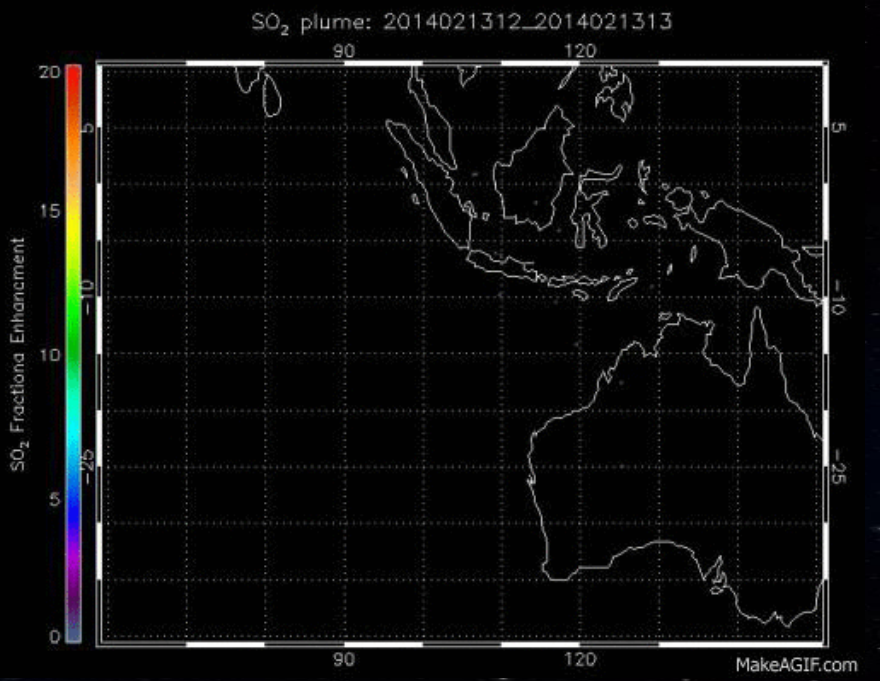


This dual image shows the coastline of Rio as seen from NASA's Terra Satellite. On the left, the image is superimposed with measurements of air pollution that lingers above the city.
Credit: NASA/GSFC/LaRC/JPL-Caltech, MISR Team

A satellite view of California’s Soberanes Fire (Source: NASA Worldview).


Soberanes Fire raging in rugged inaccessible terrain, <20% contained. Smoke discernible via #VIIRS. #BigSurfire
2nd August 2016
NOAA-NASA Suomi NPP VIIRS True Color
2011 UTC, August 2, 2016
CIMSS, SSEC, UW-Madison





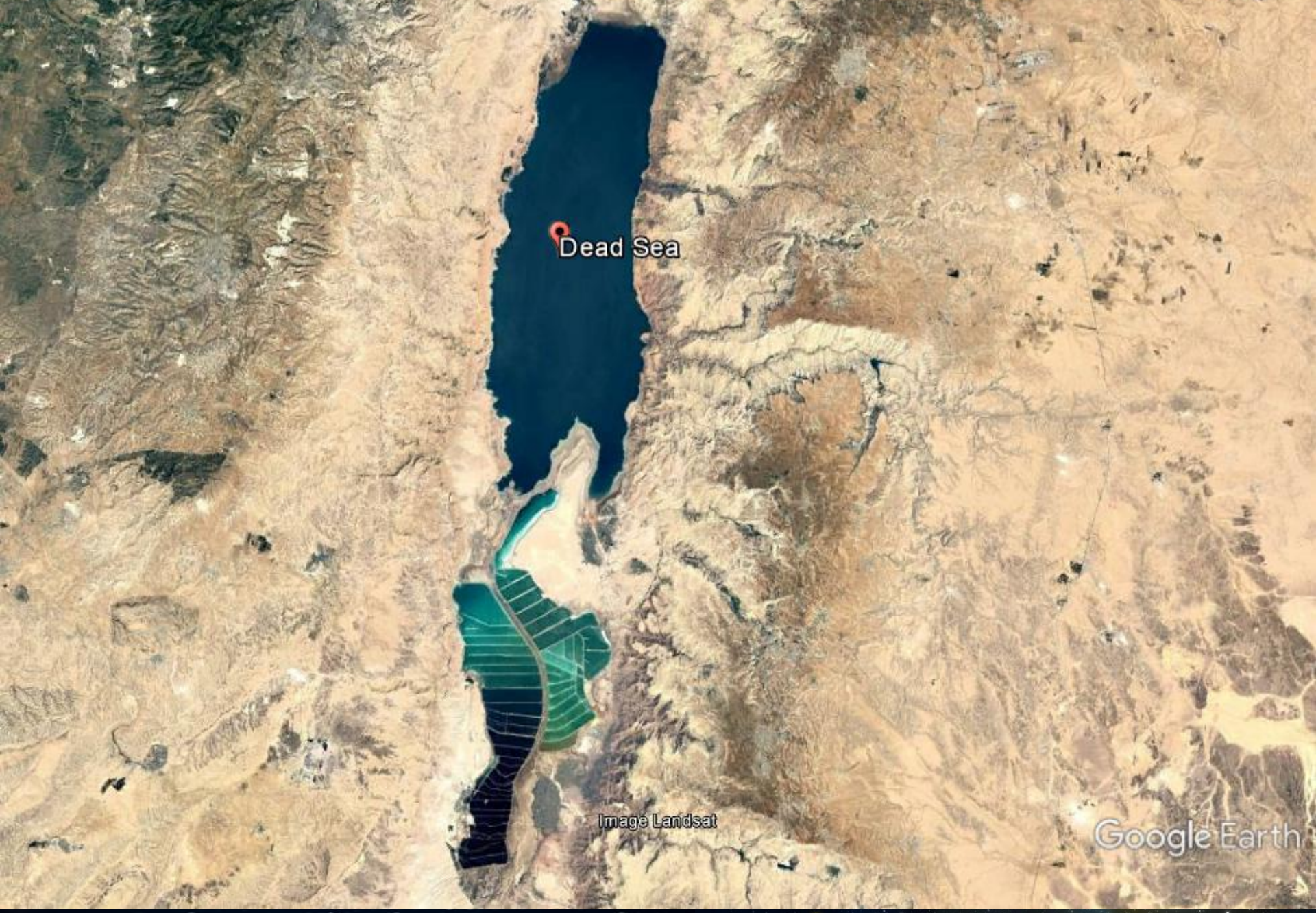
Tracking ash plumes and Sulphur Dioxide plumes from volcanic activity in Indonesia. Work of Elisa Carboni, Don Grainger and team, University of Oxford

Aurora over Canada and the Northern USA, captured by the SUOMI NPP satellite

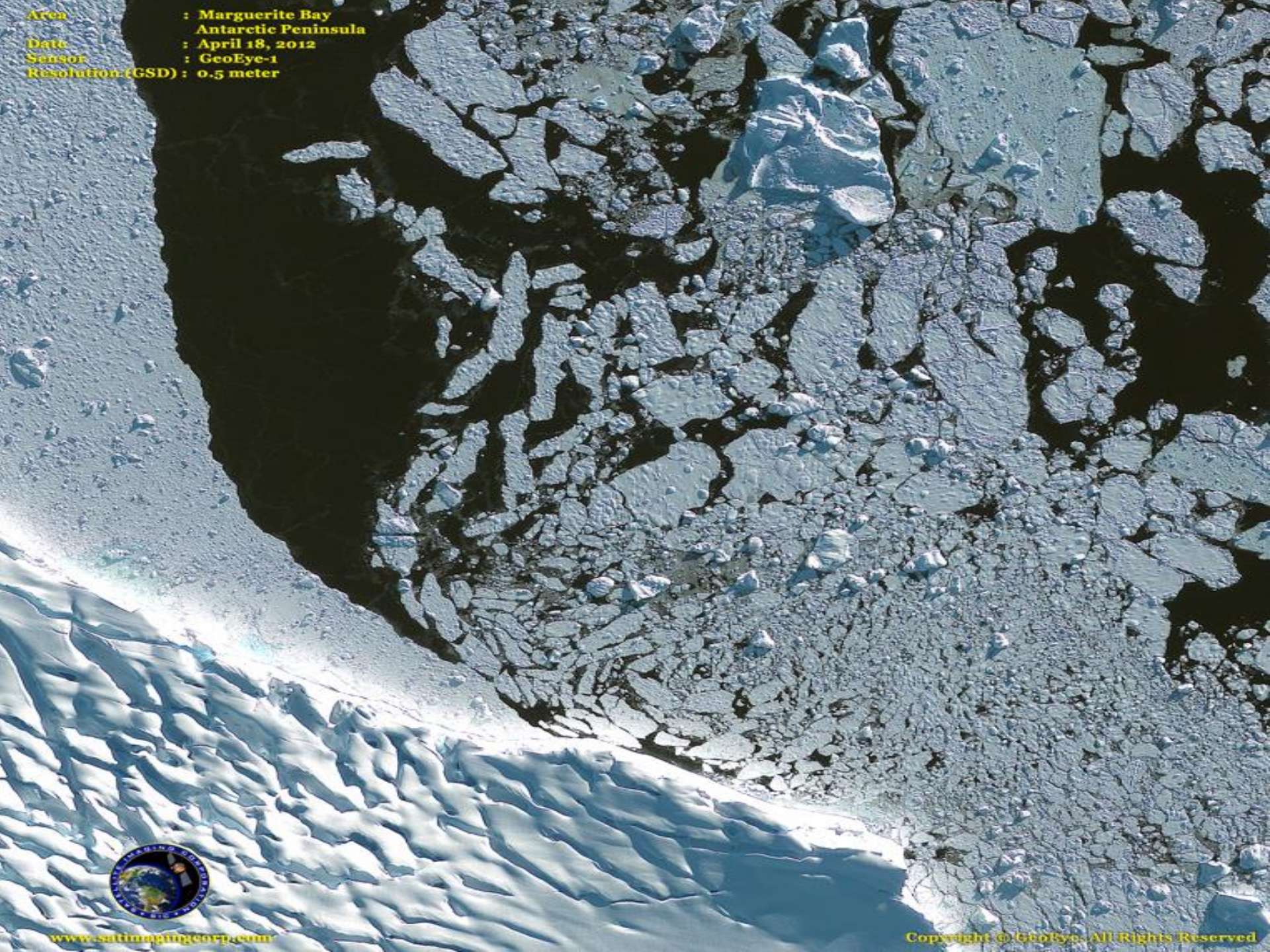
The aurora from the International Space Station

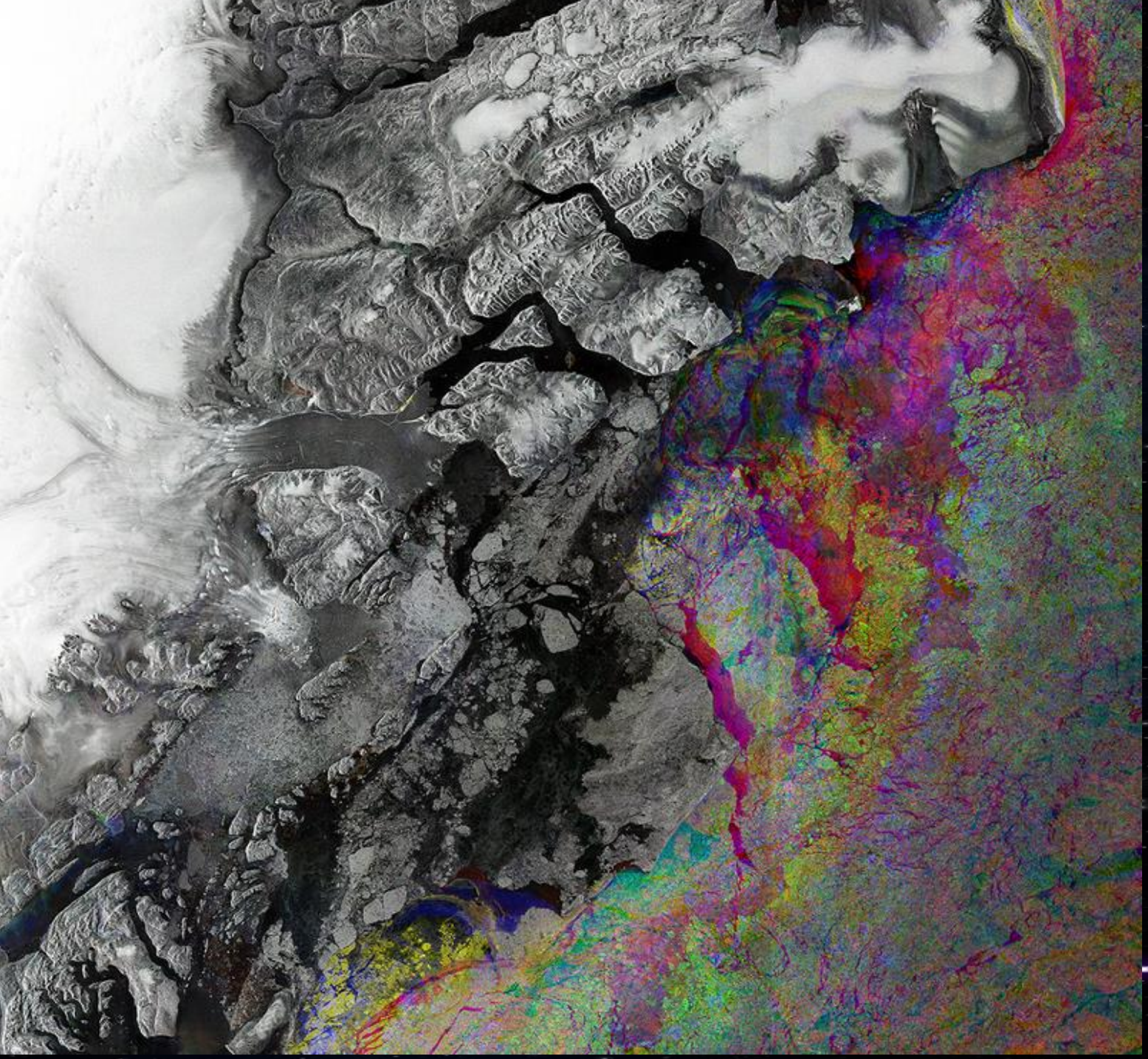
FIRE!

Fossilised meandering, and sediment laden water, Mississippi Basin, USA

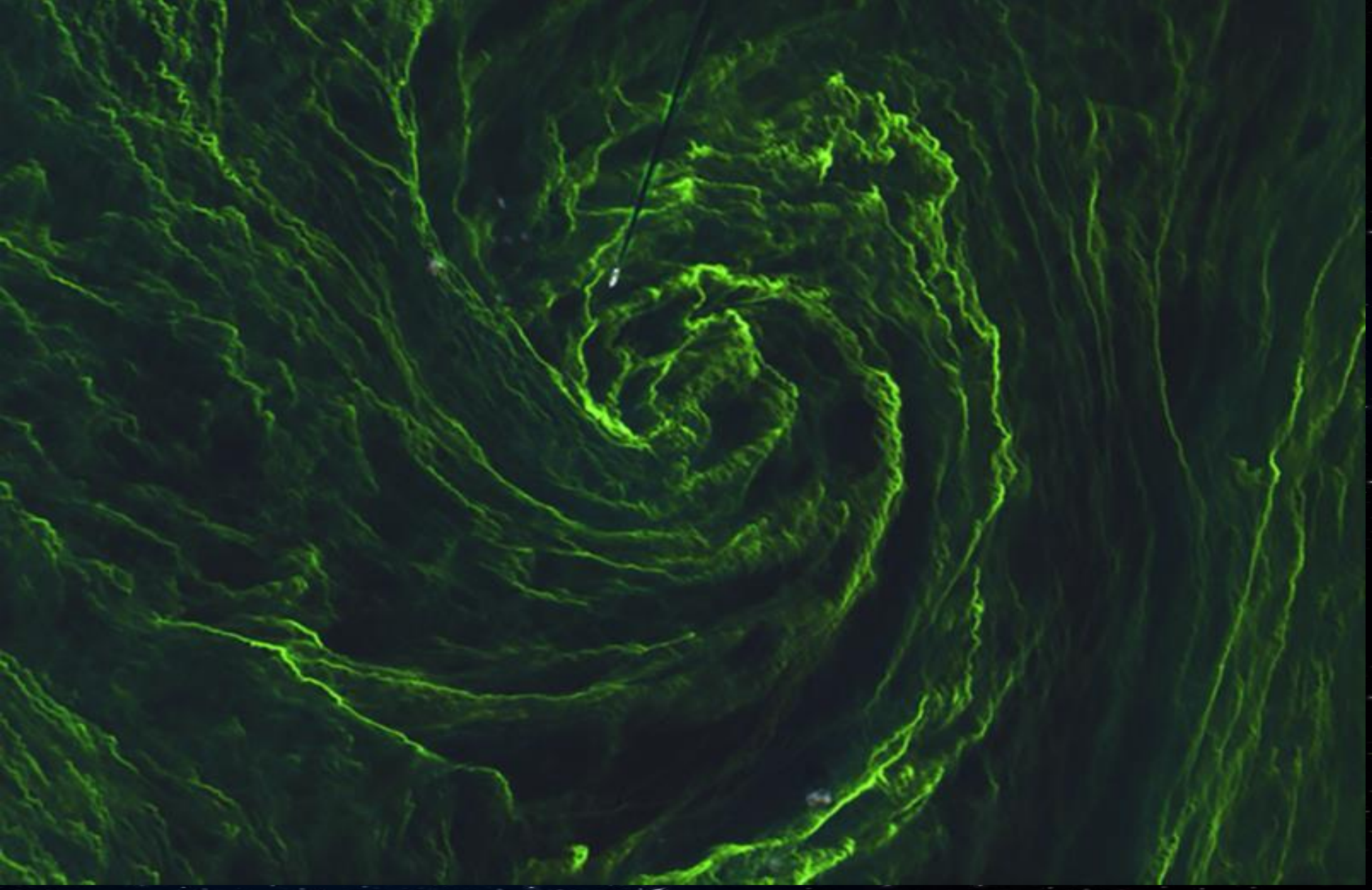

Dead Sea
Image Landsat
Google Earth

A multi-temporal radar image from Sentinel-1A of the Aral Sea in Central Asia. The name is something of a misnomer: the sea has largely dried up. (Photo: ESA)


Area : Marguerite Bay
Antarctic Peninsula
Date : April 18, 2012
Sensor : GeoEye-1
Resolution (GSD) : 0.5 meter
www.satimagingcorp.com
Copyright © GeoEye. All Rights Reserved

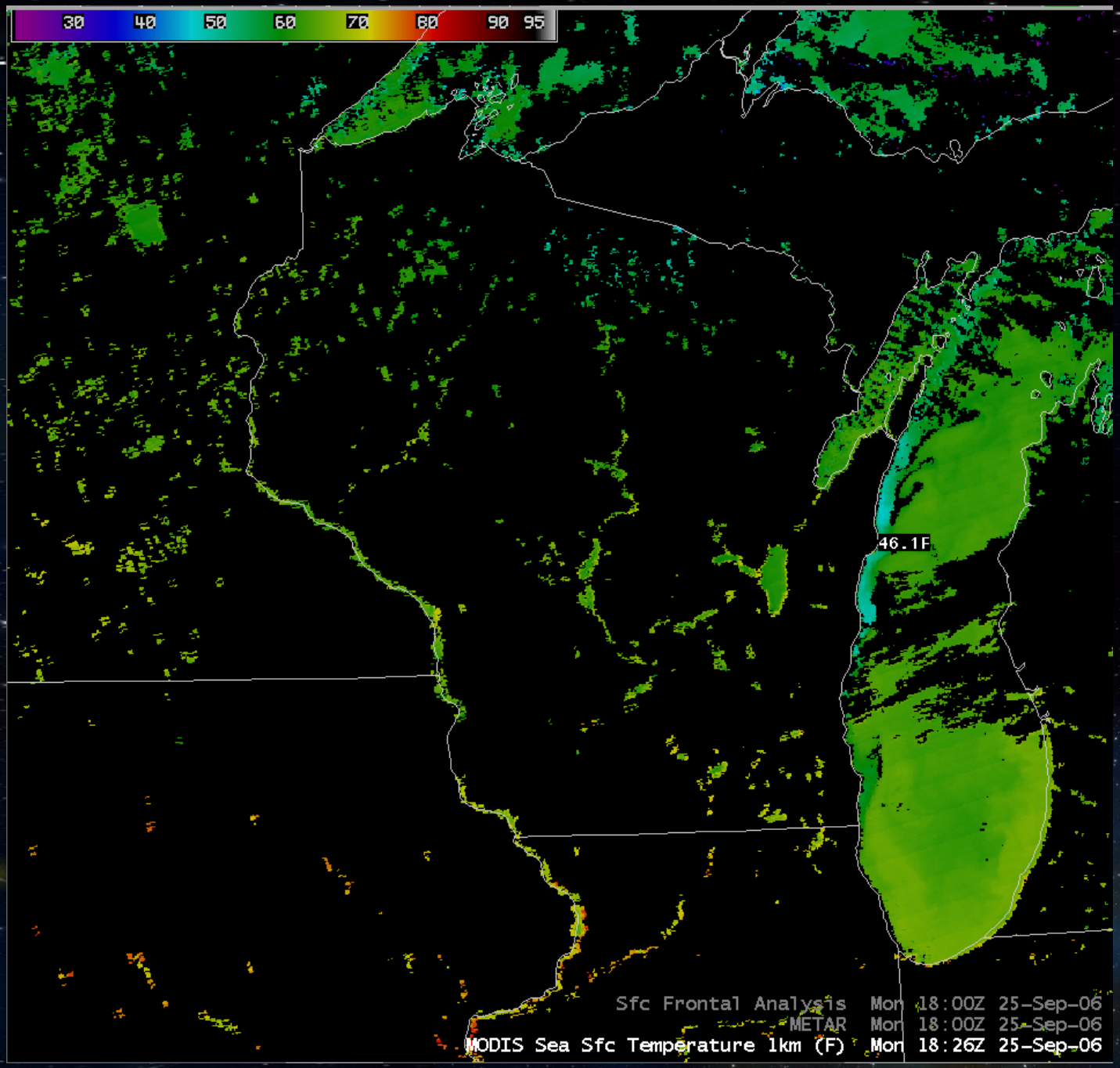


The European Space Agency's Sentinel Satellite has a fundamental application for climate change. In February, March and April 2016, Sentinel-1A captured three radar images of Greenland's northeast coast. The composite is a vividly detailed, half monochrome, half rainbow image. The colours indicate the changes in sea-ice during the three-month period. The same satellite is monitoring Greenland's Zachariae Isstrom glacier, in near-real time (in the image at centre-left), such is the state of its erosion by warmer water.



An algae bloom in the Baltic Sea, as pictured by Sentinel-2A. A boat cuts down from the top of the image. (Photo: ESA)

Upwelling of cool water in Lake Michigan « CIMSS Satellite Blog cimss.ssec.wisc.edu

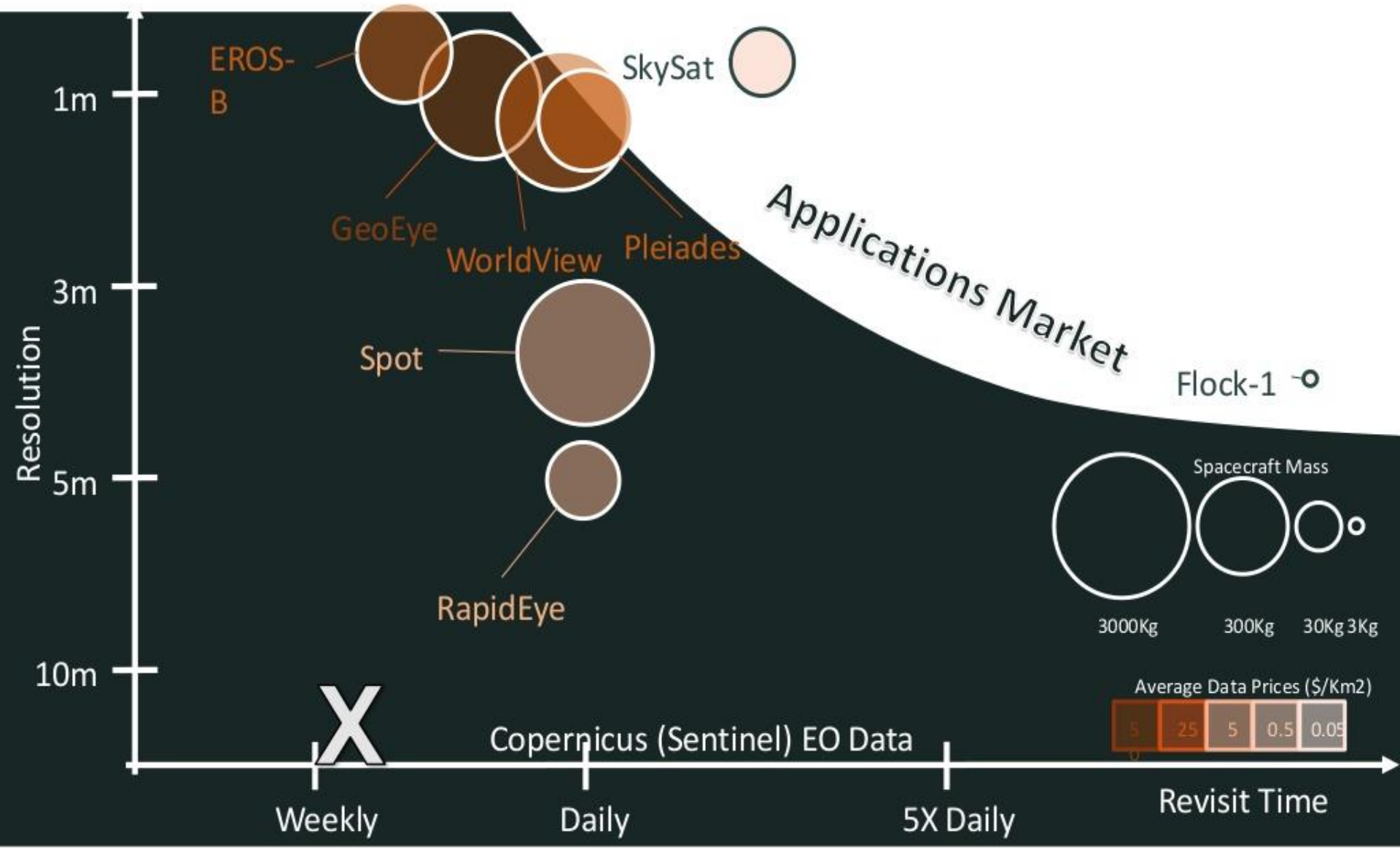


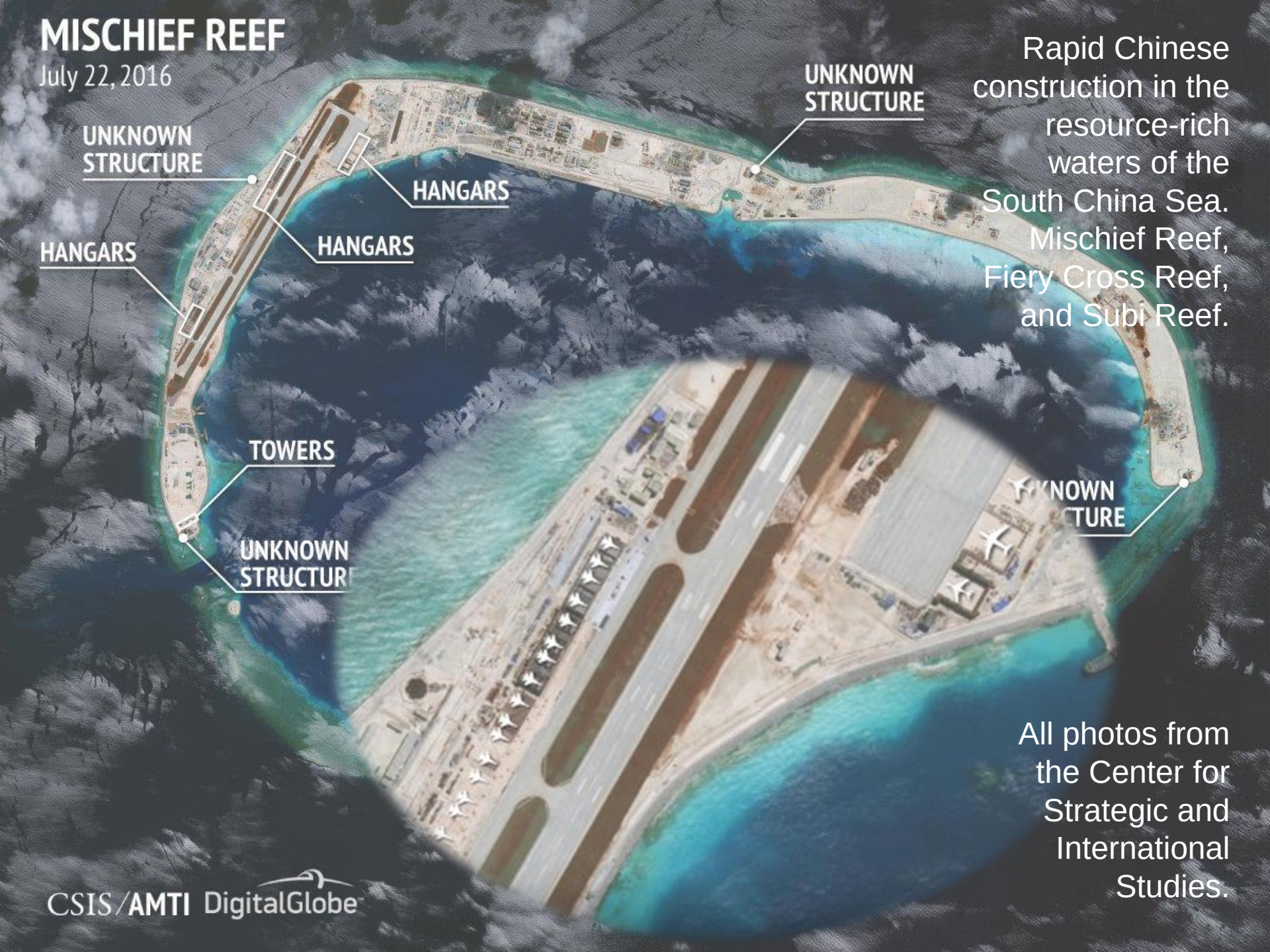
Costa Concordia, Isola de Giglio, Tuscany, Italy in 2012. 33 died. pinterest.com


IMO Number 8293221
Flag Liberia
MMSI 10292837
Call Sign HAK3
Reg No
Gross Tonnage
Owner Hawk Ltd
Operator Hawk Ops
Vessel Type Fishing Vessel
SOG/COG /
AIS Date 2013-09-03T 21:38:51Z
Action
Add to favorite
Vessel History
BW Denise
IMO Number 9193733
Flag Liberia
MMSI 9248368
Call Sign LAHW7
Reg No
Gross Tonnage
Owner BW Gas LPG Ltd
Operator BW Gas AS
Vessel Type Tanker
SOG/COG /
AIS Date 2013-09-03T 21:38:51Z
Action
Alert Filter
Area
Vessels
Date
AIS ON
Proximity Alert OFF
Exclusion Zone Alert OFF
Slow Alerts OFF
Speed
7.0kn
10kn
220m
400m
2
4
Timeline
1995
2000
2001
2002
2003
1995
Wavestorm 3 Cargo Belize 3/7/2013 08:00
AIS/S-AIS
VMS
Synthetic Aperture Radar (SAR)
Electronic Intelligence (ELINT)
Existing Databases
Combined with Satellite Imagery

Improvements in resolution come at a price

Institute for Environmental Analytics

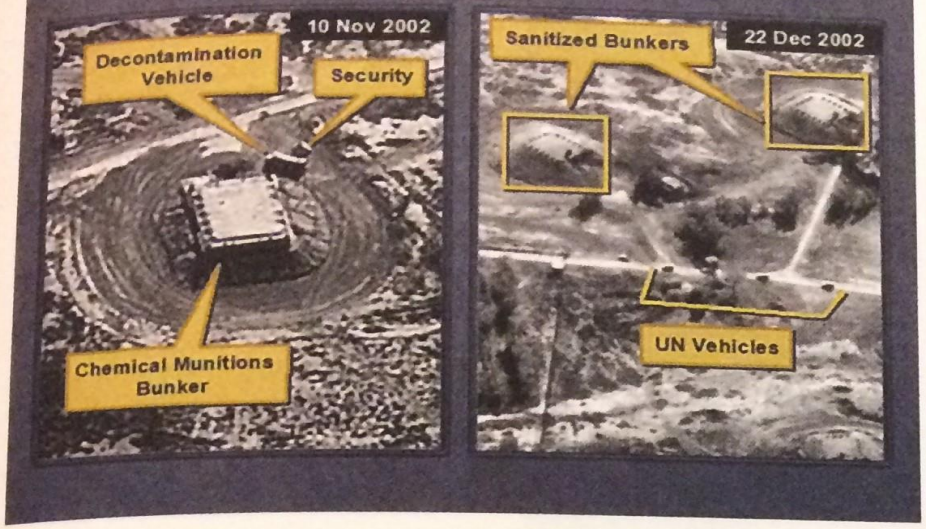


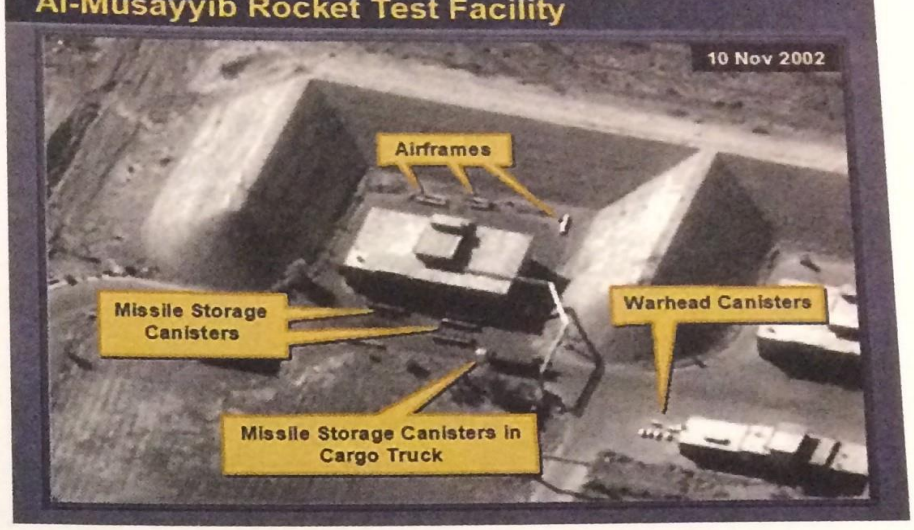


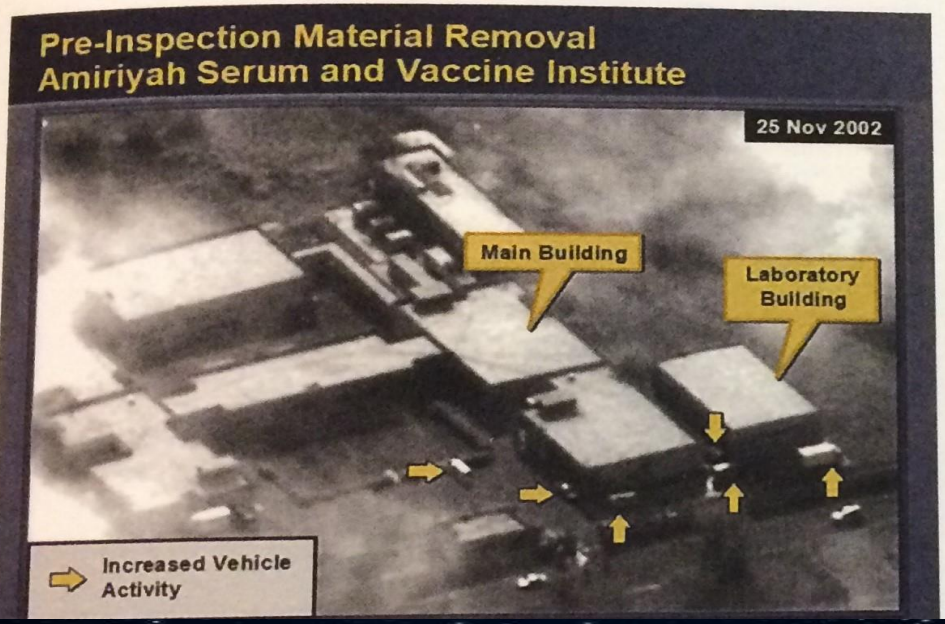
Rapid Chinese construction in the resource-rich waters of the South China Sea. Mischief Reef, Fiery Cross Reef, and Subi Reef.

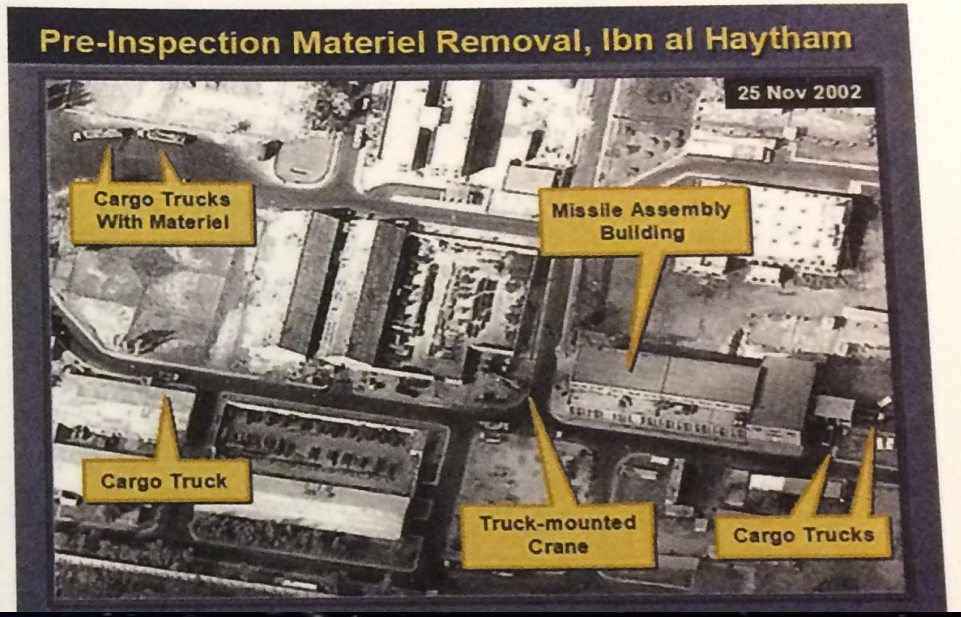
All photos from the Center for Strategic and International Studies.

Please note the aircraft in the above satellite image were added for illustrative purposes.





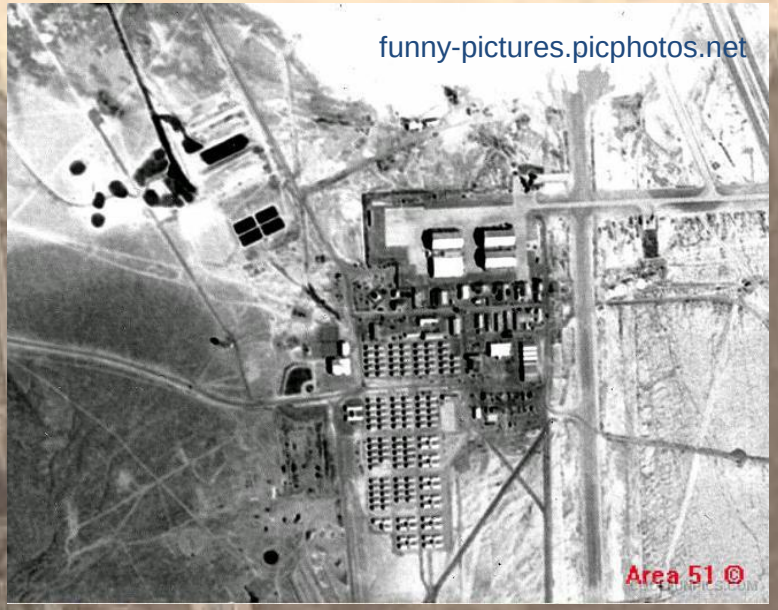




Four slides from US Secretary of State Colin Powell's presentation on Iraq to the UN Security Council, 5th February 2003. Many satellite images were displayed that day without access to the original satellite data. Images from US Department of State.

GCHQ, Cheltenham, Gloucestershire

Area 51, Nevada, USA



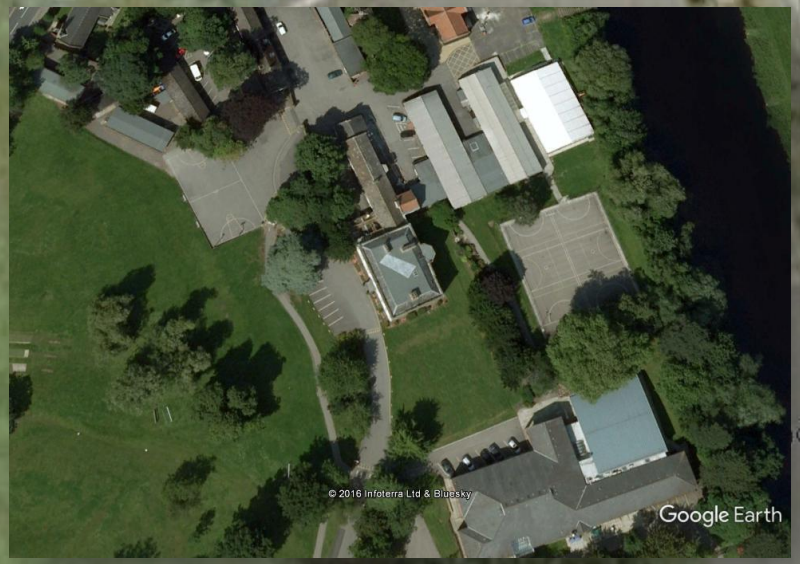
2007 Hangar

2014 Hangar

US Air Base Area 51, NE of Las Vegas. Posted by ‘Earthly Mission’.

The U.S. government did not acknowledge the base until 2003, so it was a frequent subject of conspiracy theories and UFO folklore.
It does not appear on public U.S. government maps, which show only a disused mine.
The original film taken by U.S. Corona Spy satellite in the 1960s was altered prior to declassification; in answer to freedom of information queries, the government claimed that the pictures had been destroyed. Terra satellite images (which were publicly available) were removed from web servers in 2004, and from the monochrome 1 m resolution USGS data made publicly available. NASA Landsat images are still available. Higher resolution (and more recent) images from other satellite imagery providers (including Russian providers and IKONOS) are commercially available. These show, in detail, the runway marking, base facilities, aircraft, and vehicles.

Opinion on Google Earth from North of the border?



Yarm School roof, Stockton-on-Tees, in 2006, and 2016

BIG BROTHER IS
WATCHING YOU

Wildebeest migration, Kenya

Barra Olympic Park 1JUL2012

Barra Olympic Park 23AUG2013

Barra Olympic Park 12APR2015

Barra Olympic Park 13JUN2016