

Fizyka Procesów Klimatycznych

Wykład 5 (Monitoring systemu klimatycznego)

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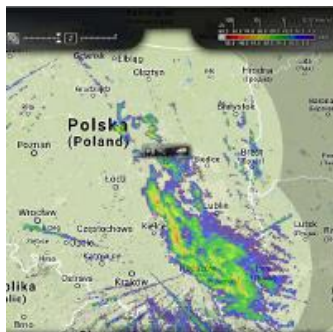
Wykorzystano slajdy dr Aleksandry Kardaś

Rodzaje pomiarów

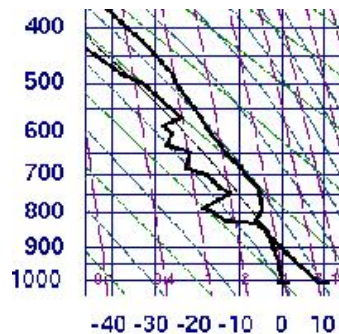
punkto-
we



powierzchnio-
we



„te trzecie”



„In situ”



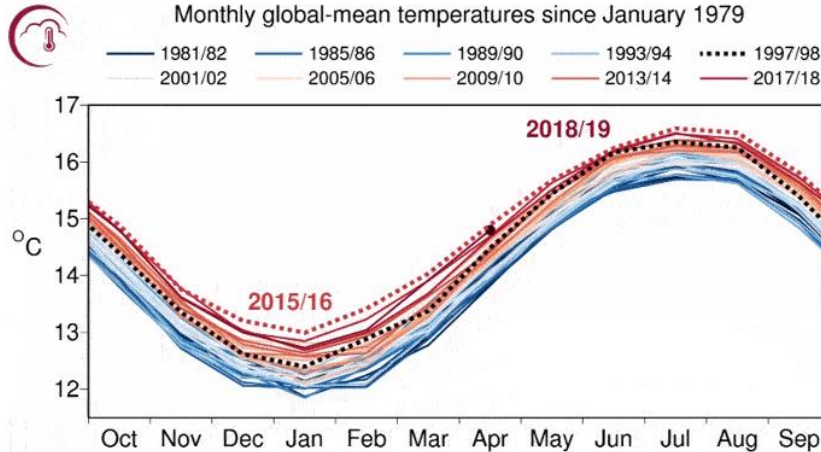
aktywne



zdalne



pasywne



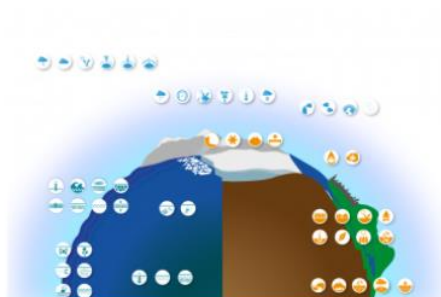
Monthly global average surface air temperatures from 1979 to 2019 provided by the Copernicus Climate Change Service (C3S), Implemented by the European Centre for Medium-Range Weather Forecasts (ECMWF).

Global Climate Observing System (GCOS)

The Global Climate Observing System (GCOS) is co-sponsored by the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC-UNESCO), the United Nations Environment Programme (UN Environment), and the International Science Council (ISC). It regularly assesses the status of global climate observations of the atmosphere, land and ocean and produces guidance for its improvement.

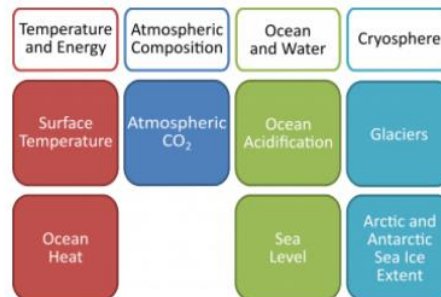
GCOS expert panels maintain definitions of Essential Climate Variables (ECVs) which are required to systematically observe Earth's changing climate. The observations supported by GCOS contribute to solving challenges in climate research and also underpin climate services and adaptation measures.

GCOS works towards a world where climate observations are accurate and sustained, and access to climate data is free and open.



ECV Public Consultation

Public...



Global Climate Indicators

The Global Climate Indicators are a set of ...



The Global Observing System For Climate: Implementation Needs

This plan was published in 2016 and describes...



WORLD
METEOROLOGICAL
ORGANIZATION

Weather · Climate · Water

English ▾

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Global Atmosphere Watch Programme

[WMO Programmes](#)

Tags: [Research](#) [Environment](#) [Atmosphere](#)

GAW

Contact: gaw@wmo.int

Addressing atmospheric composition on all scales: from global and regional to local and urban.

Changes in Earth's atmospheric composition are a serious cause of concern for humanity as they impact weather and climate, human and ecosystem health, water supply and quality, agricultural production, and many socio-economic sectors. The most pressing of the related problems include:

- climate change - due to steadily increasing amounts of greenhouse gases, especially carbon dioxide;
- the ozone hole - depletion of the protective stratospheric ozone layer due to chlorofluorocarbons (CFCs) and halons has increased ultraviolet radiation, which in turn is increasing incidences of skin cancer and other diseases; and
- urban air pollution, especially fine particles, is affecting human health.

Global Atmosphere Watch studies the variability and trends in atmospheric composition and related physical parameters, and assesses the consequences thereof. Advancing scientific understanding in order to address these challenges remains critical. Global Atmosphere Watch also focuses on service delivery in a number of application areas where its data brings added value.

One major aspect of the Global Atmosphere Watch mission is to organize, participate in and coordinate assessments of the chemical composition of the atmosphere on a global scale. In this way, the Global Atmosphere Watch provides reliable scientific information for national and international policymakers, supports international conventions on stratospheric ozone depletions and monitors climate change and long-range transboundary air pollution. Global Atmosphere Watch data are used in the following assessments:

- [WMO/UNEP Scientific Assessment of Ozone Depletion](#)
- [Global Precipitation Chemistry Assessment](#)

Data from the Global Atmosphere Watch feed several bulletins all available in the online [WMO Library](#) and/or on the WMO/GAW Extranet webpage:

- [WMO Arctic and Antarctic ozone bulletins](#)
- [Greenhouse gas bulletins](#)
- [Aerosol bulletins](#)

Naziemne stacje meteorologiczne



Źródło: Wikipedia

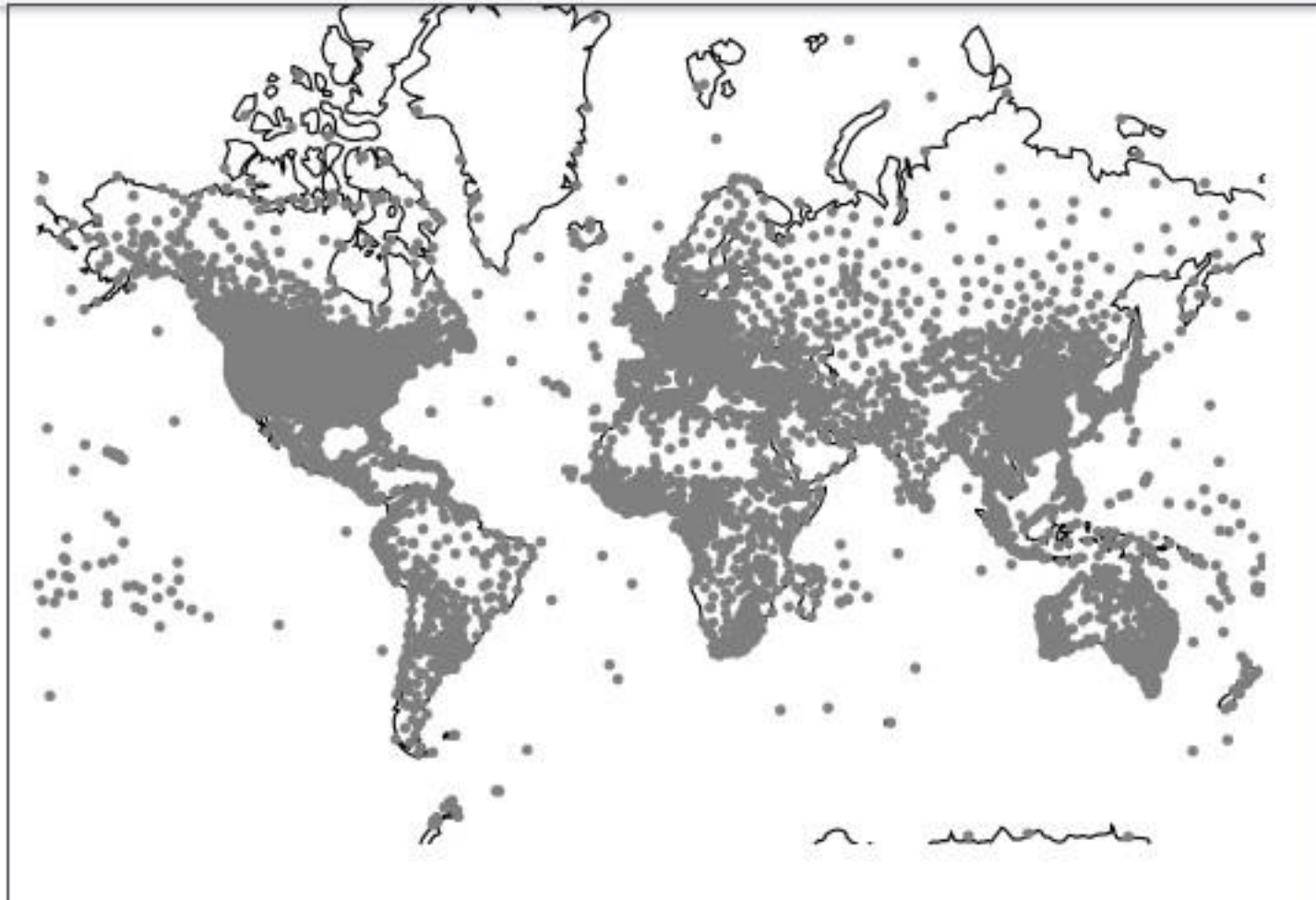
Naziemne stacje meteorologiczne



Naziemne stacje meteorologiczne



Naziemne stacje meteorologiczne



<http://climatemodels.uchicago.edu/timeseries/>



Welcome to WDCGG!

About WDCGG

Data (surface/mobile)

Data (satellite)

Current State of GHGs

Publications

Manuals

Statistics

日本語版 (Japanese)

ATTENTION

Reactive gases measurement data (except for CO) have been agreed to be transferred under the responsibility of the newly established GAW World Data Centre for Reactive Gases (WDCRG) hosted by the Norwegian Institute for Air Research (NILU). Reactive gas data submitted to WDCGG before 1 January 2016 have been migrated to WDCRG.

About WDCGG

The World Data Centre for Greenhouse Gases (WDCGG) is a World Data Centre (WDC) operated by the Japan Meteorological Agency (JMA) under the Global Atmosphere Watch (GAW) programme of the World Meteorological Organization (WMO). WDCGG collects, archives and distributes data provided by contributors on greenhouse gases (such as CO₂, CH₄, CFCs, N₂O) and related gases (such as CO) in the atmosphere and elsewhere.

This website is operated by the JMA in collaboration with WMO.

[Read more](#)

Data Archive

The WDCGG data archive provides observation data on greenhouse gases and related gases along with basic associated information known as metadata.

[Click here for details.](#)

This website has a user registration function to help support contributors.

Many contributors face difficulties with ongoing monitoring due to economic and other limitations. Information on the timing and usage of data provided may help to validate the effectiveness of such work.

This information can also be used to improve services provided to users and contributors and to facilitate the fair use of data.

Against this background, WDCGG kindly invites users to register. User registration is free and easy, and is required for data file downloads.

Sign up now!

Contributors

Contributors are institutes or organizations that collect and submit observation data.

[List of Contributors](#)

To submit data, refer to the [WDCGG Data Submission Manual](#) and [sign up](#) for an account. We look forward to working with you.

What's new

See what's new in WDCGG. Also refer to "[Data Update Information](#)."

25 Mar. 2021

This website has started providing NetCDF format data files and issuance of DOI. Please see the following page for the details: [WDCGG DOI Policy](#)

23 Nov. 2020

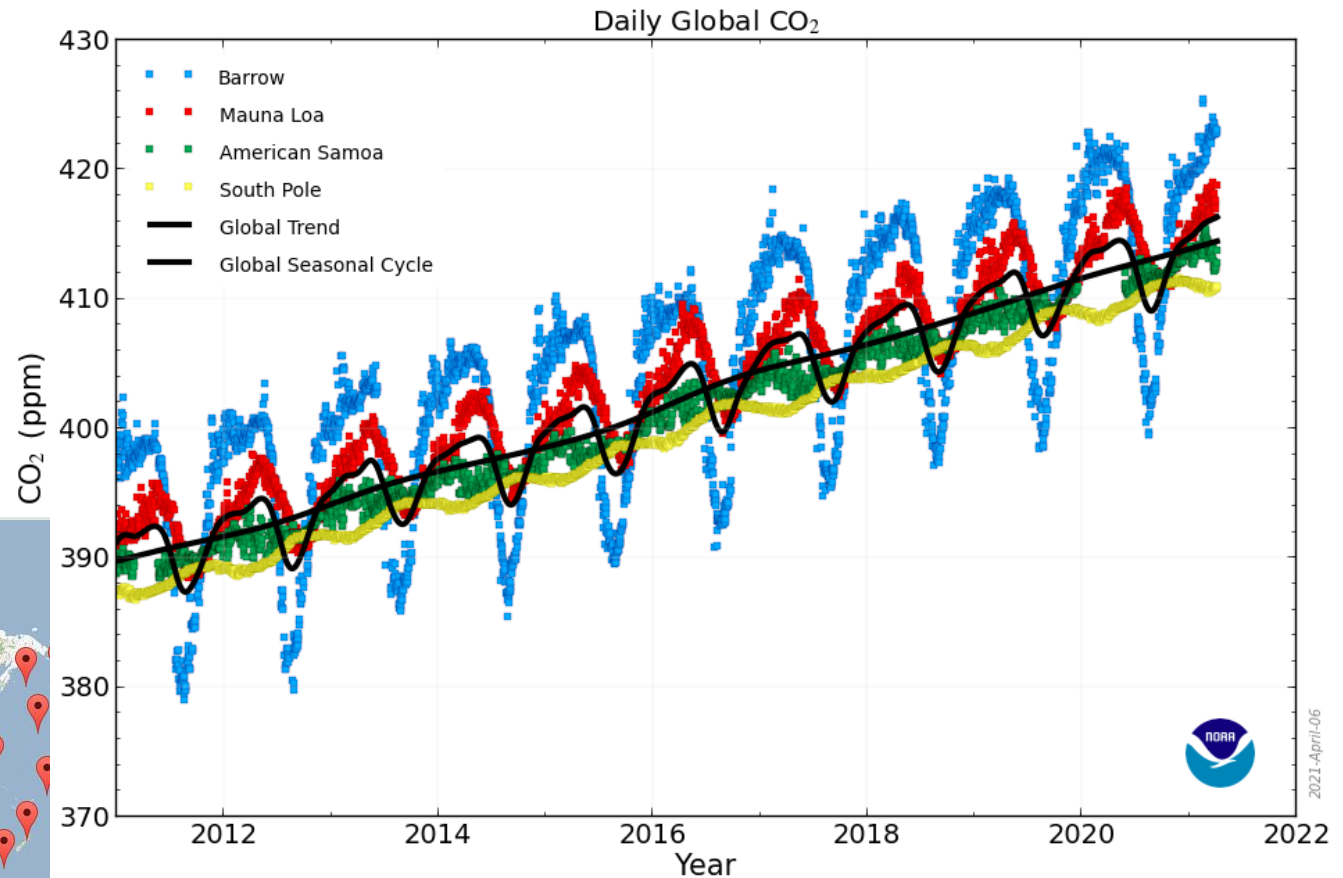
[WMO Greenhouse Gas Bulletin](#) No. 16 is released.

19 Nov. 2020

[WMO WDCGG Data Summary](#) No. 44 is released.

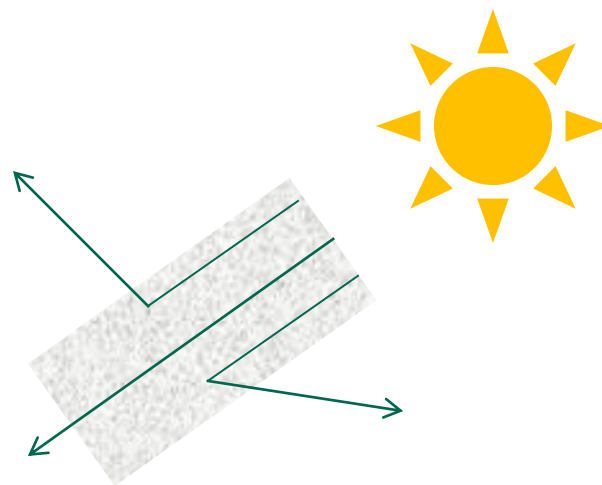
[See more news...](#)

Pomiary dwutlenku węgla



<http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html>

Pomiary aerozolu – AERONET



$$I = I_0 e^{-\tau}$$

grubość
optyczna

Pomiary aerozolu – AERONET

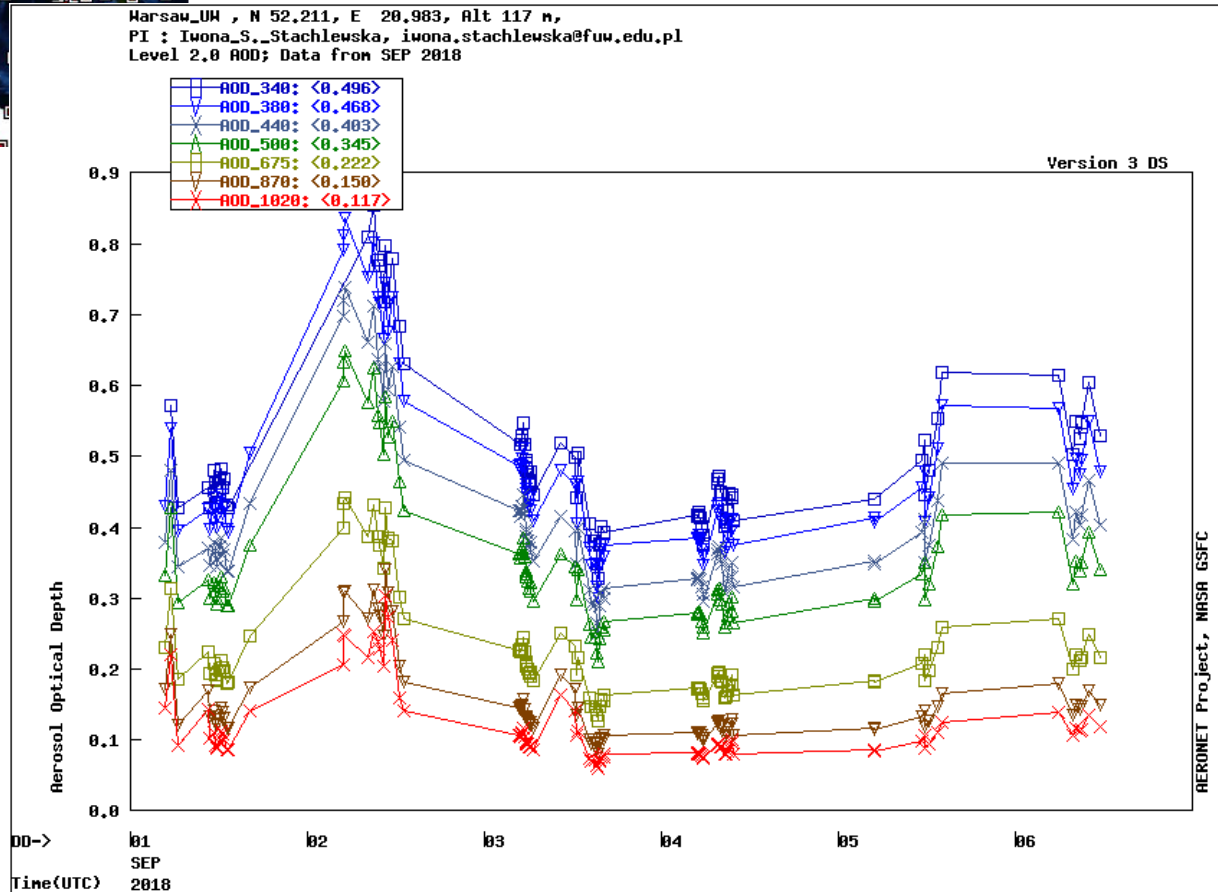
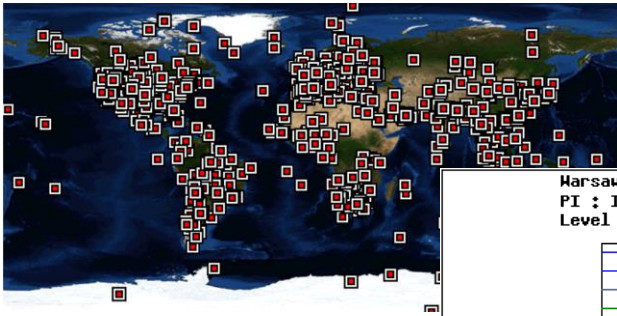




Image 1



Image 2

Image 1 - view of the sunphotometer.

Image 2 - view of the sunphotometer.

Site Coordinates and Elevation:

- Latitude: 52.21093° North
- Longitude: 20.98264° East
- Elevation: 117.0 Meters

Site Description:

- The sunphotometer #359 has been installed at the roof-platform of the Faculty of Physics of the University of Warsaw in a co-location with the Raman polarization lidar. The facility is located on the 4th floor of the building, at the corner of the Banacha and Pasteura streets, at the University Campus Ochota, in the city center of Warsaw, in a close proximity of the Pole Mokotowskie Park. As this is a strictly non-industrial and residential part of the city, we typically expect at this site the aerosol types such as local anthropogenic pollution of urban origin due to main sources being primarily local transportation and secondarily domestic heating (both contributing to local episodes of winter smog), and thirdly frequent events of local pollen. There are documented in literature also other sources of the aerosols measured over the site, which can be attributed to the long-range transport of frequently occurring biomass burning advection (aged biomass burning aerosols from North America and relatively fresh aerosols for Eastern Europe - Ukraine, Belarus), as well as less frequent long-range transport of the pollution from Western Europe and the mineral dust often (mixed with pollution) advection.

Principal Investigator(s) Information:

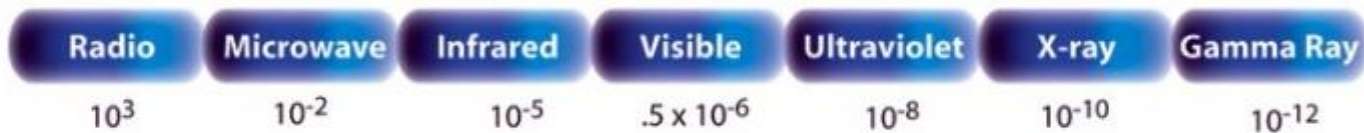
- Iwona S. Stachlewska
 - E-mail: iwona.stachlewska@fuw.edu.pl
- Iwona S. Stachlewska
University of Warsaw
Faculty of Physics
Institute of Geophysics
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office: +48225532046
mobile: +48693798579
e-mail: iwona.stachlewska@fuw.edu.pl

THE ELECTROMAGNETIC SPECTRUM

Penetrates
Earth
Atmosphere?



Wavelength
(meters)



budynki



ludzie



krople
deszczu



krople
chmurowe



cząstki
aerozolu



molekuły

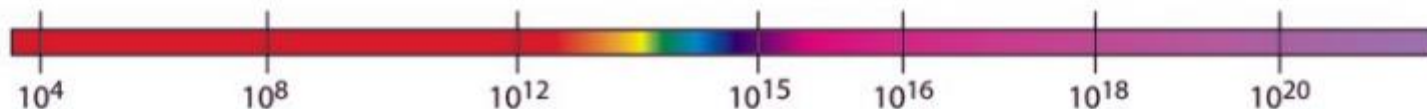


atomy



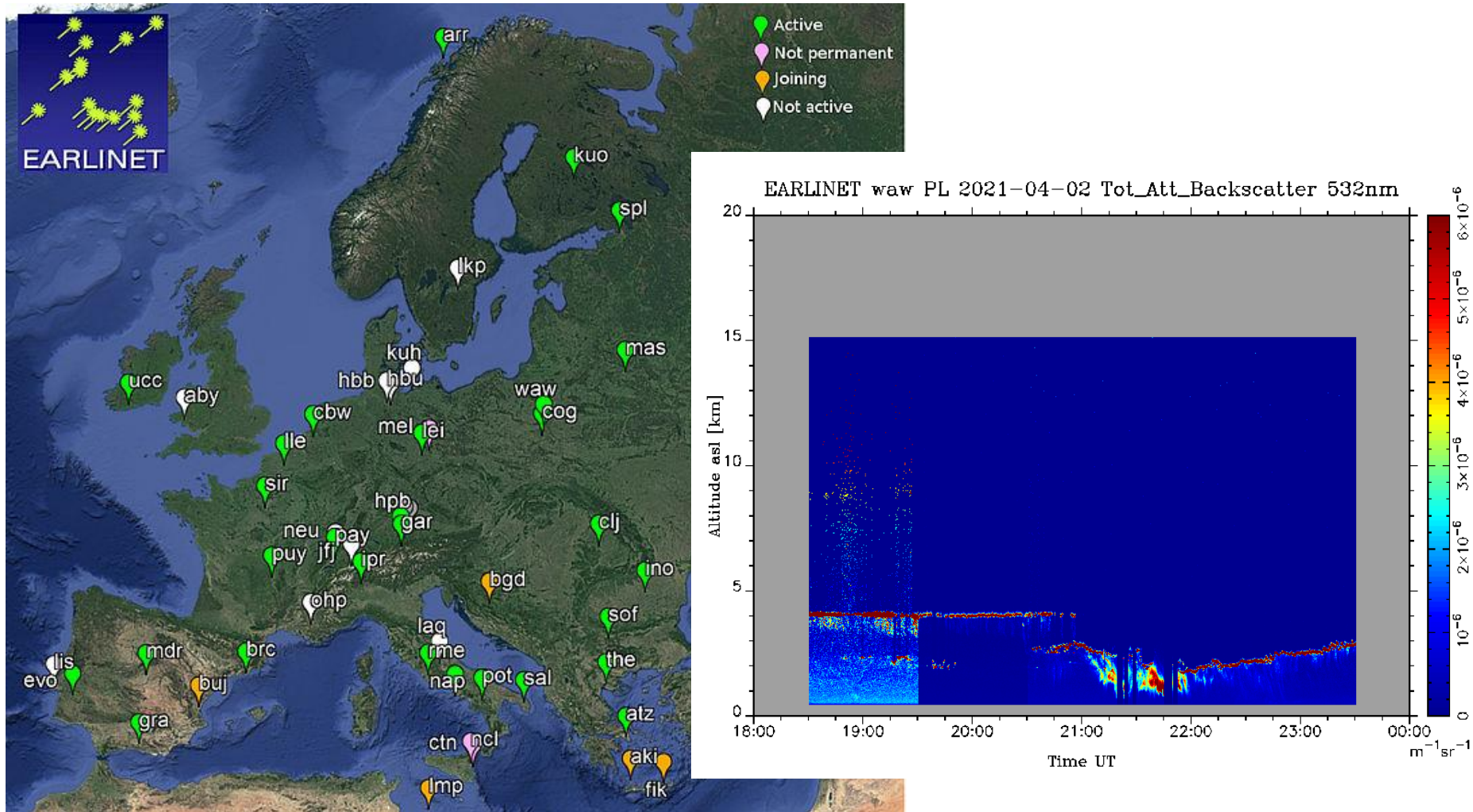
jądra
atomowe

Frequency
(Hz)



Pomiary aerozolu –Earlinet

A European Aerosol Research Lidar Network to Establish an Aerosol Climatology



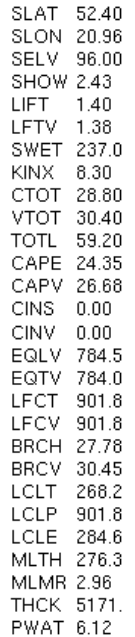
Radary meteorologiczne



Stacje aerologiczne

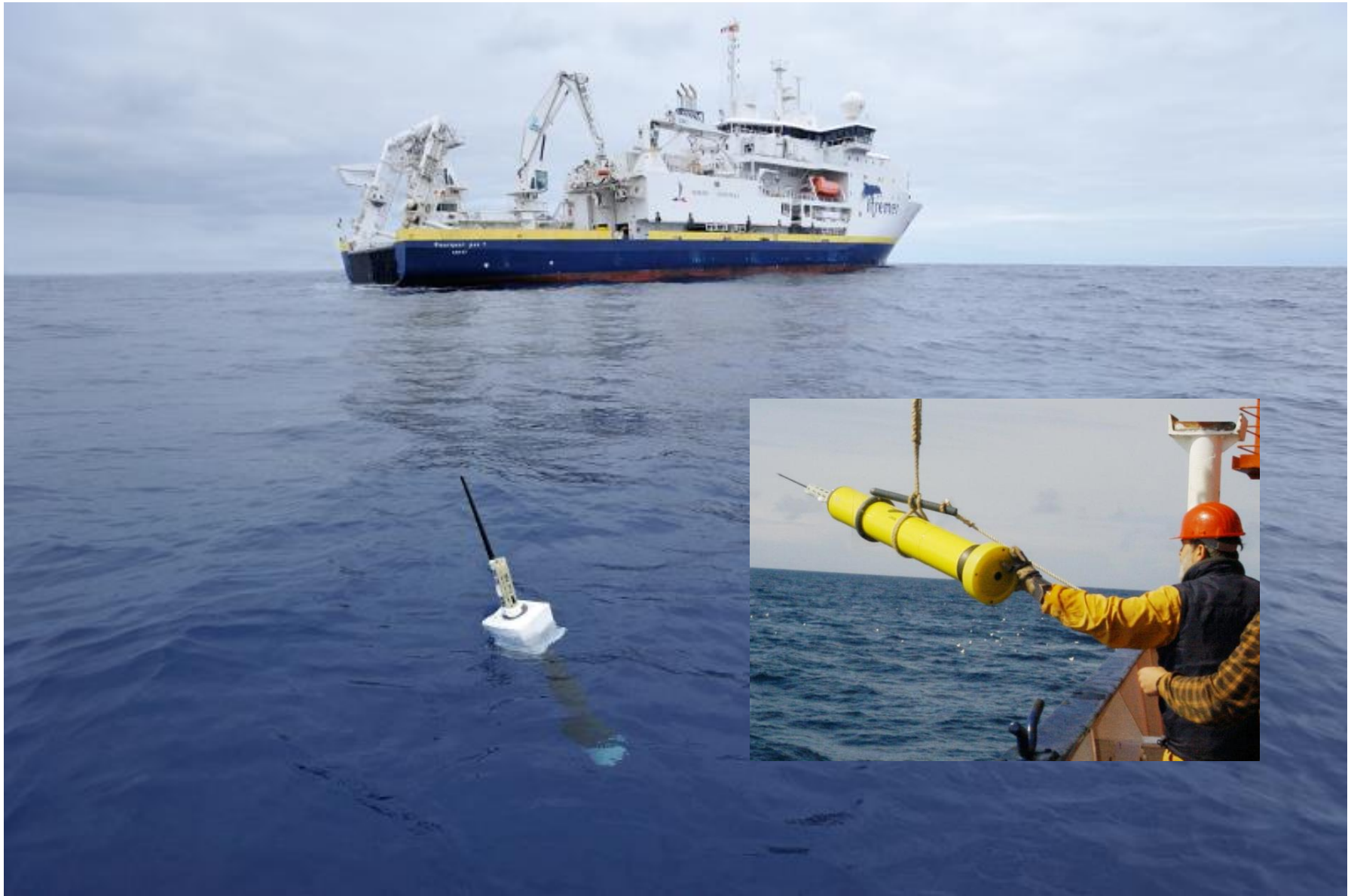


A map of the North Atlantic region showing the location of two stations: OSO11 and ENOL. OSO11 is located on the coast of North America, and ENOL is located in the North Atlantic Ocean. The map includes the outlines of North America, Europe, and Africa, as well as the surrounding oceans.

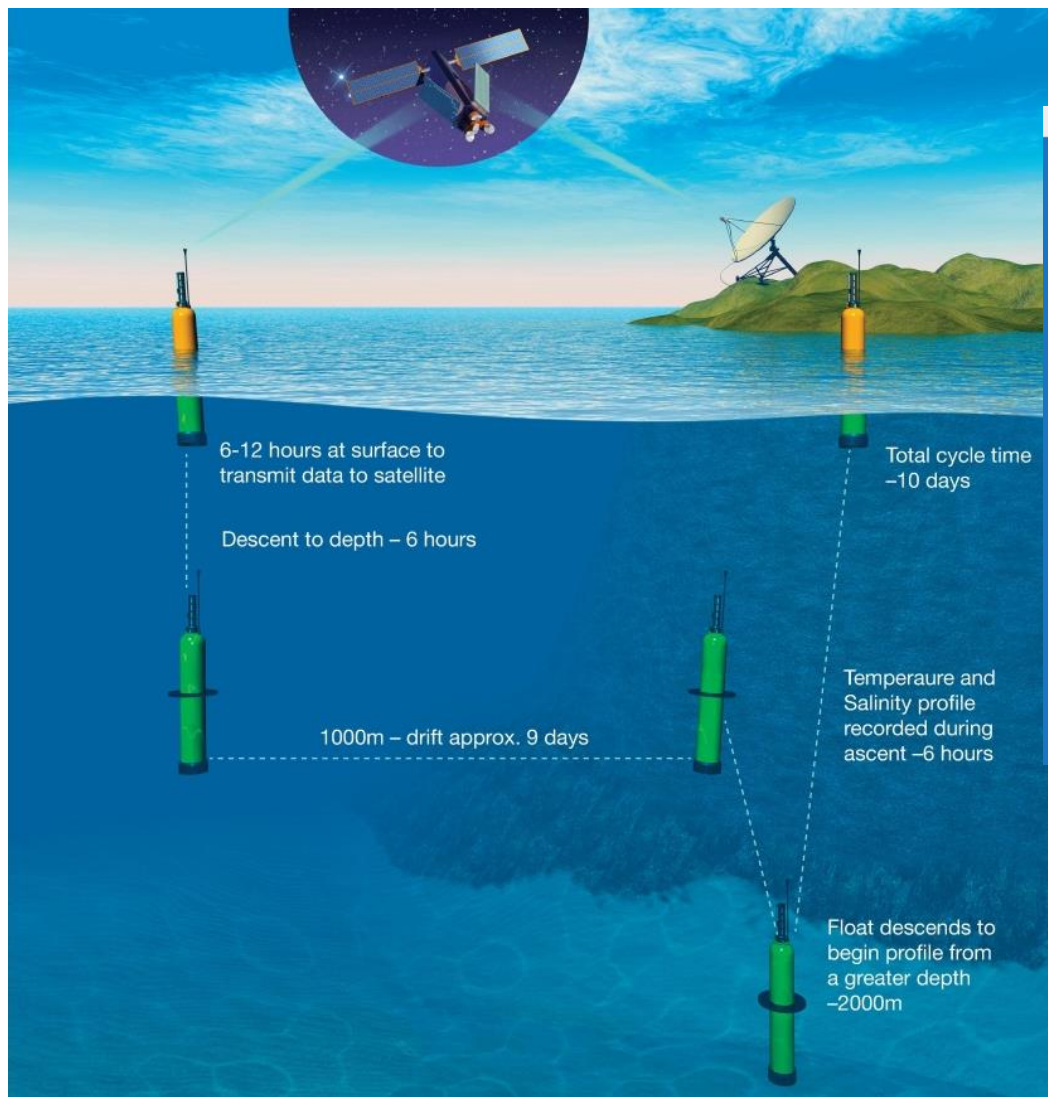


<http://weather.uwyo.edu/upperair/sounding.html>

Pomiary w morzu – projekt Argo



Pomiary w morzu – projekt Argo



The screenshot shows the Argo.NET website interface. The header includes the URL www.argo.net and a list of national websites: Australia, Canada, China, France, Germany, India, Japan, Mexico, Netherlands, Norway, South Korea, Spain, UK, USA, and more. Below the header, there are links to Argo Regional Centres: Pacific Ocean, North Atlantic Ocean, South Atlantic Ocean, Indian Ocean, and Southern Ocean. The main content area features a globe with a grid of float locations and a detailed diagram of the float's mission cycle. The diagram labels the total cycle time as ~10 days, the time at the surface as ~10 hours, the descent to drifting depth as ~1000m, the drifting period as ~8-10 days, the ascent recording as ~10 hours, and the descent to profiling depth as ~2000m. The website also includes a welcome message, a description of the project, and links to the Project Office, Information Centre, and Data.

www.argo.net

National Argo Websites: Australia Canada China France Germany India Japan Mexico Netherlands Norway South Korea Spain UK USA ...more...

Argo Regional Centres: [Pacific Ocean](#) [North Atlantic Ocean](#) [South Atlantic Ocean](#) [Indian Ocean](#) [Southern Ocean](#)

ARGO.NET

WELCOME TO THE INTERNATIONAL ARGO PROJECT HOME PAGE

Argo takes the pulse of the oceans, collecting and distributing temperature and salinity observations from a fleet of 3000 underwater robots.

Argo Project Office

Argo Information Centre

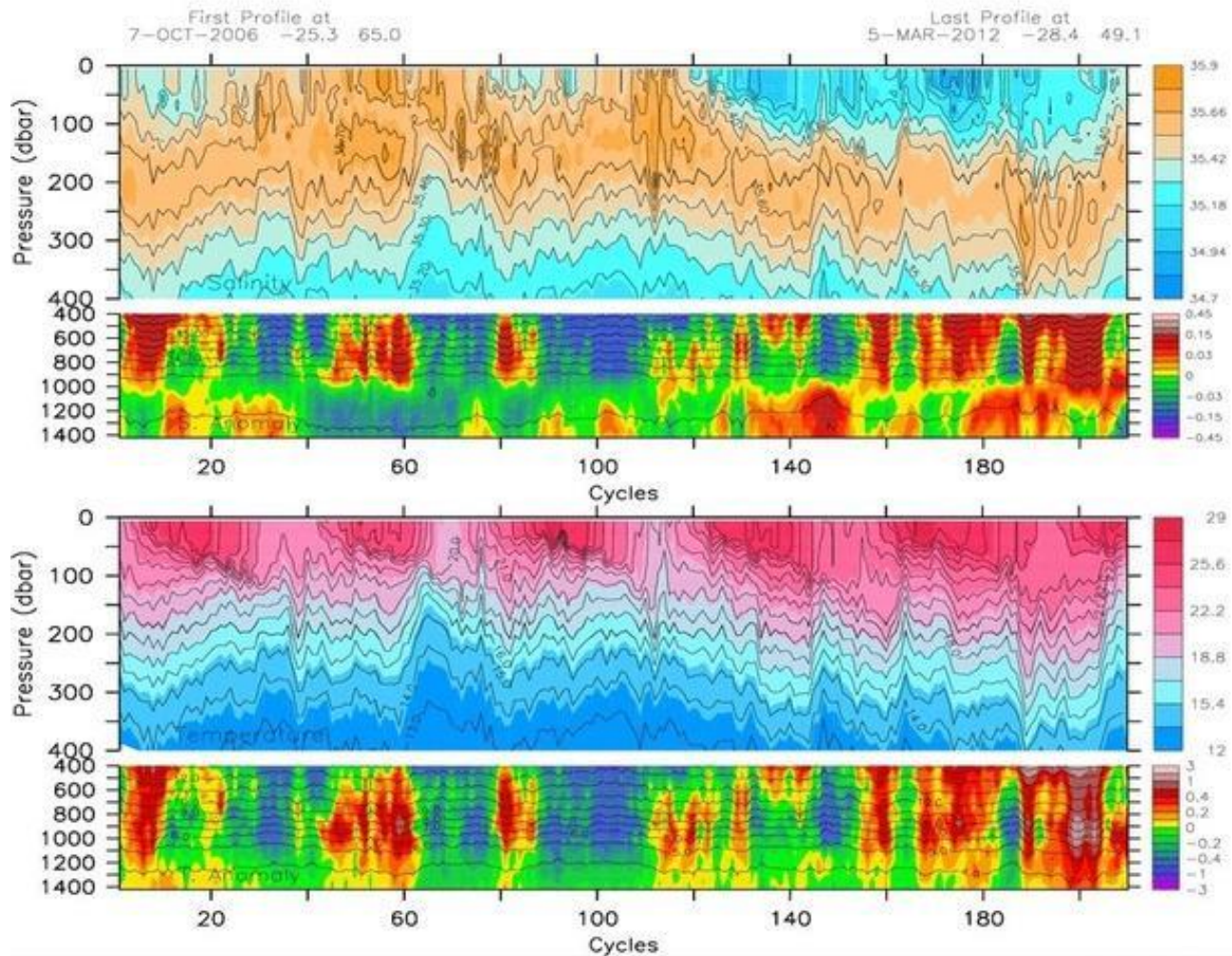
Argo Data

[FLASH version](#) (Please click on picture above to start animation)
[HTML version](#)

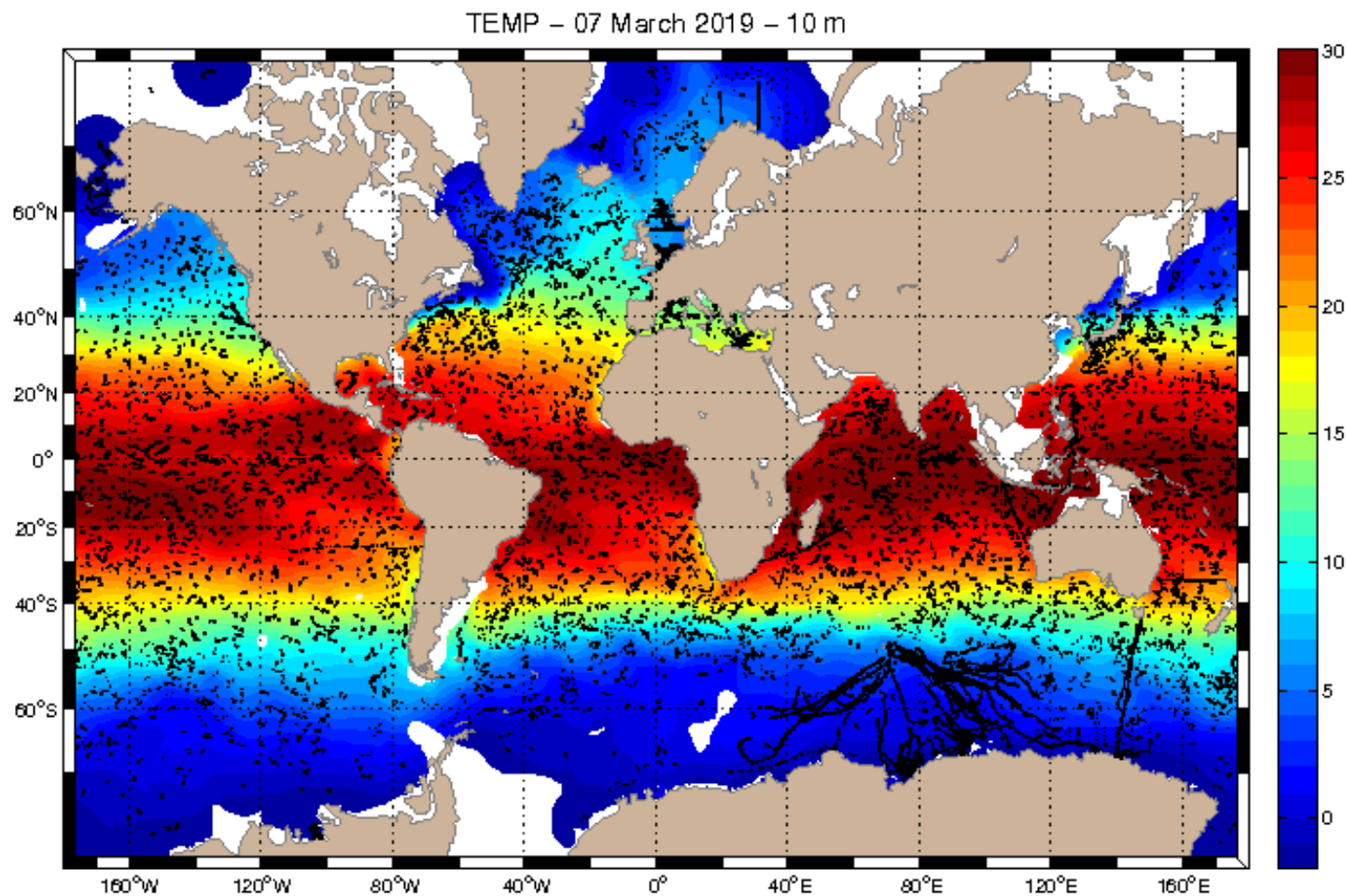
[Contact](#) [Credits](#)

Pomiary w morzu – projekt Argo

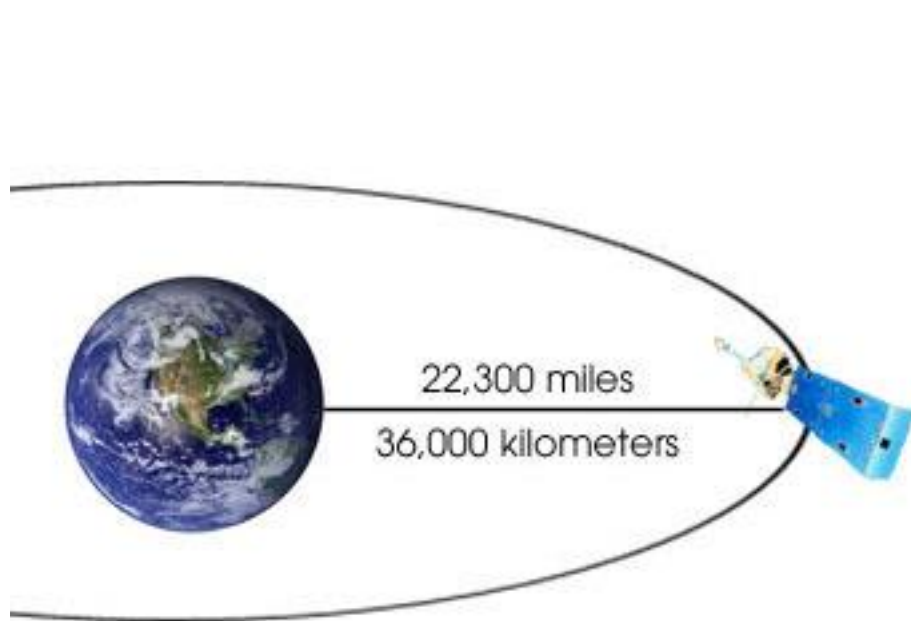
Display of the floats temperature (lower) and salinity (upper) "Waterfall" : Contour plot of all profiles.
Deeper than 400 dbar, the anomaly, defined relative to the mean at that pressure, is displayed.
No quality control is performed on this data



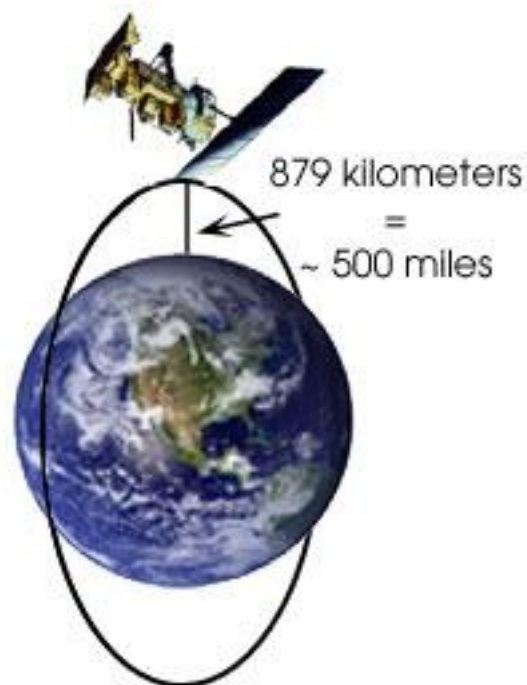
Pomiary w morzu – projekt Argo



Pomiary satelitarne – rodzaje satelitów

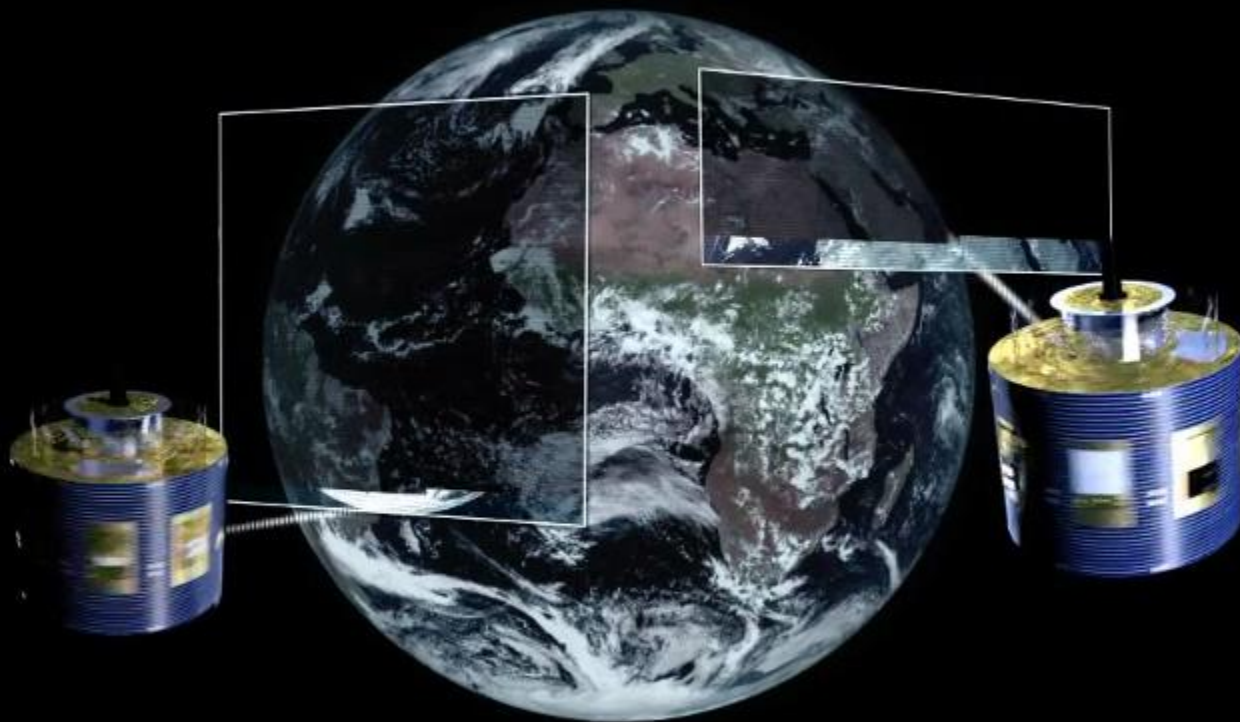


geostacjonarne



okołobiegunowe

Satelite geostacionarne

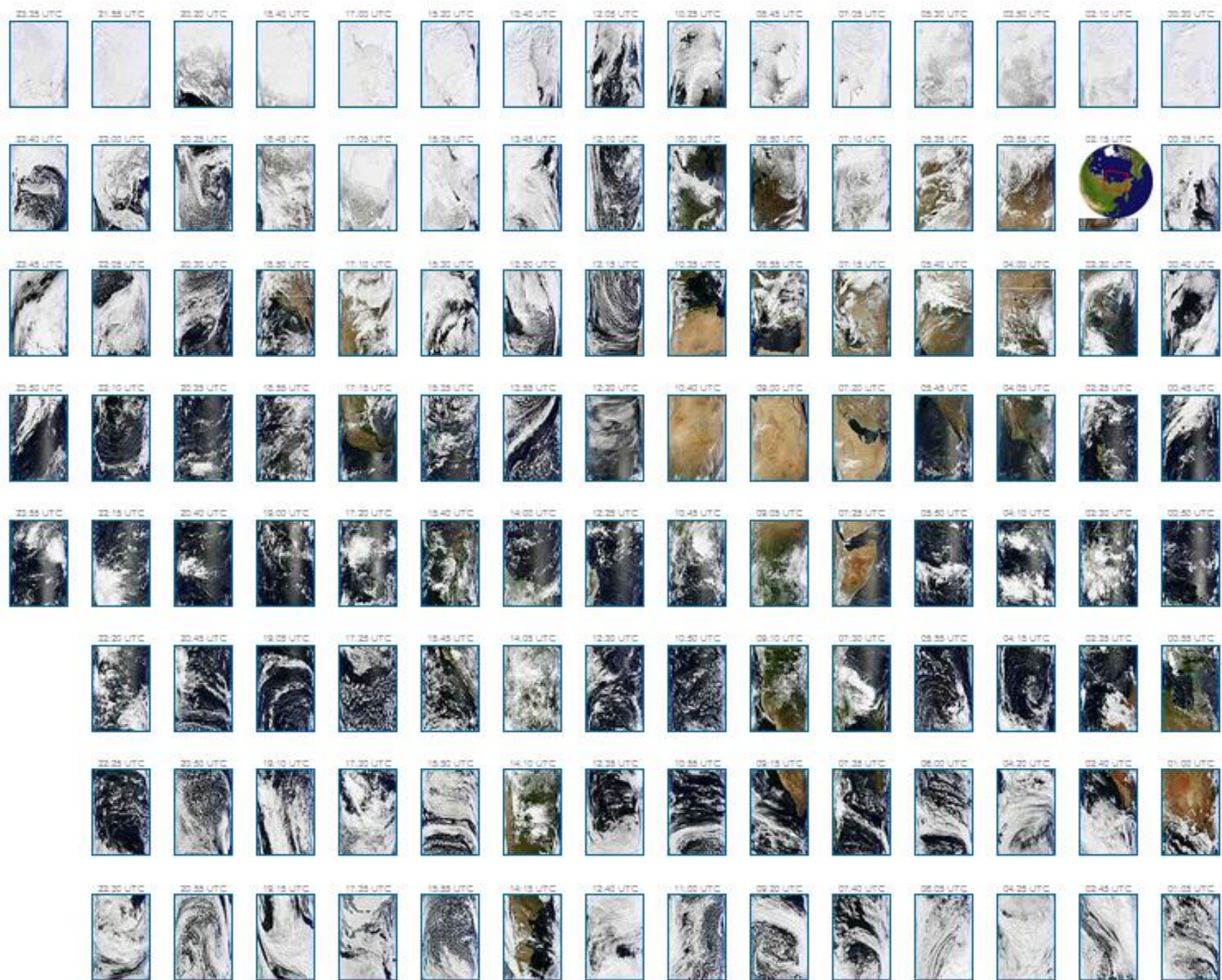


Time-lapse
00:46

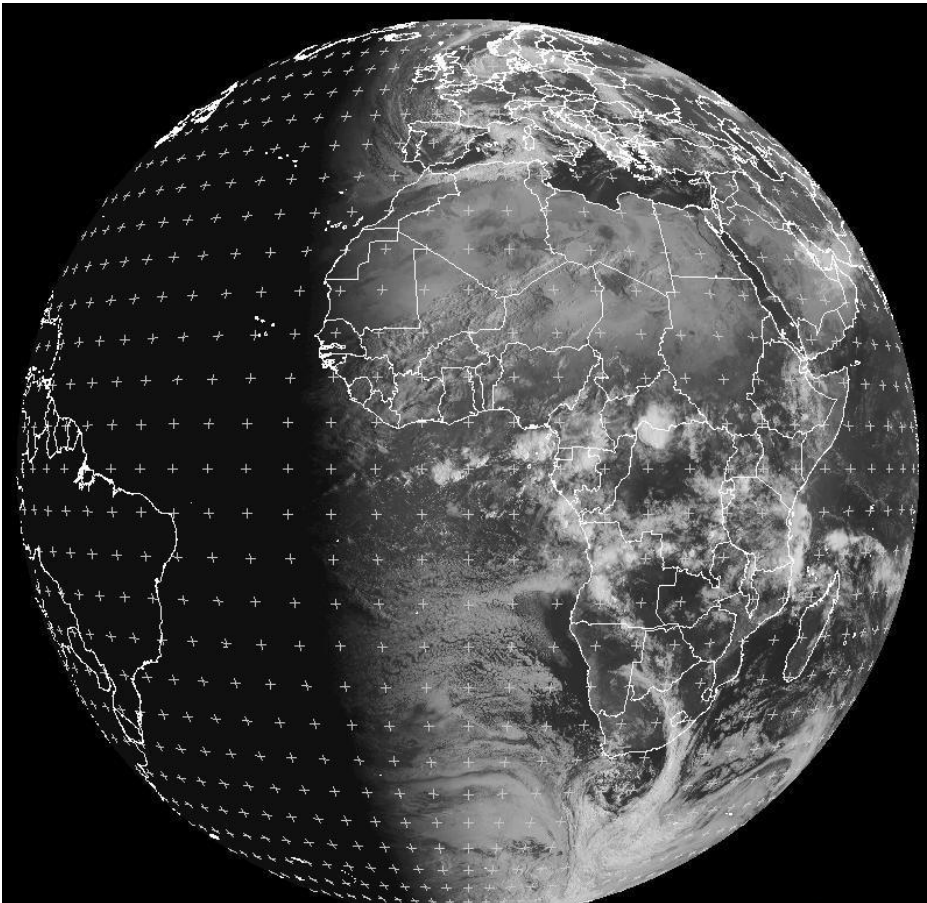
Animated representation

Satelity okołobiegunowe

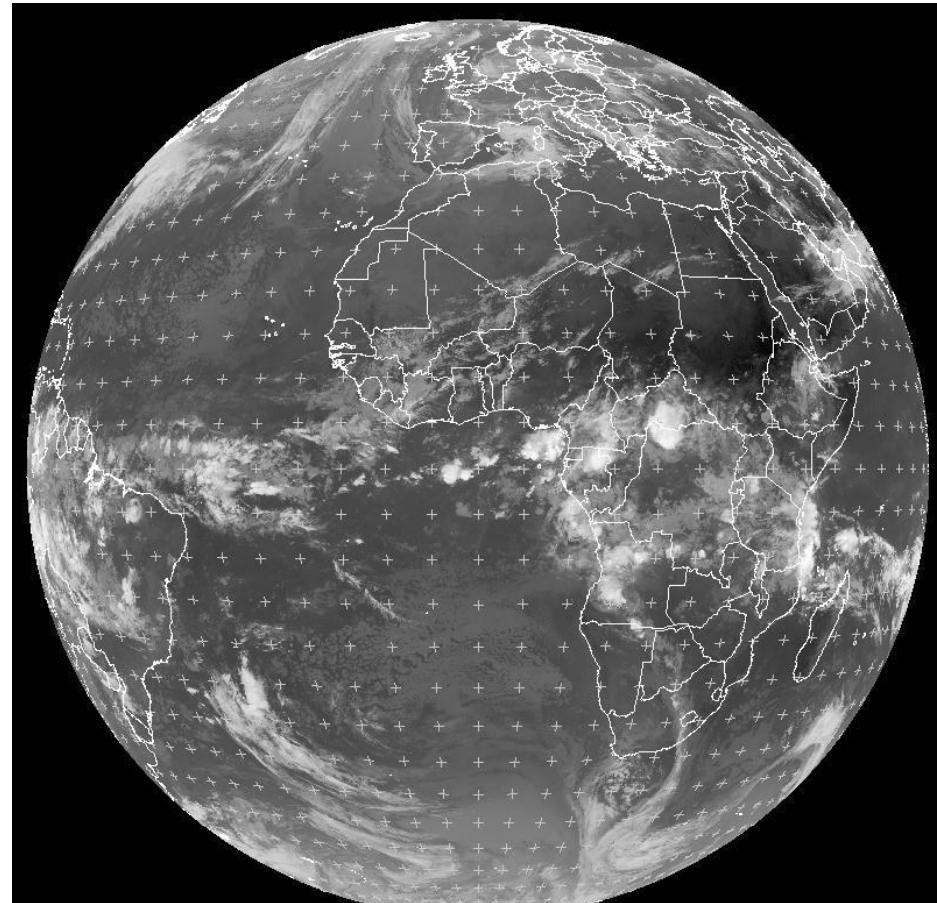




Satelity geostacjonarne



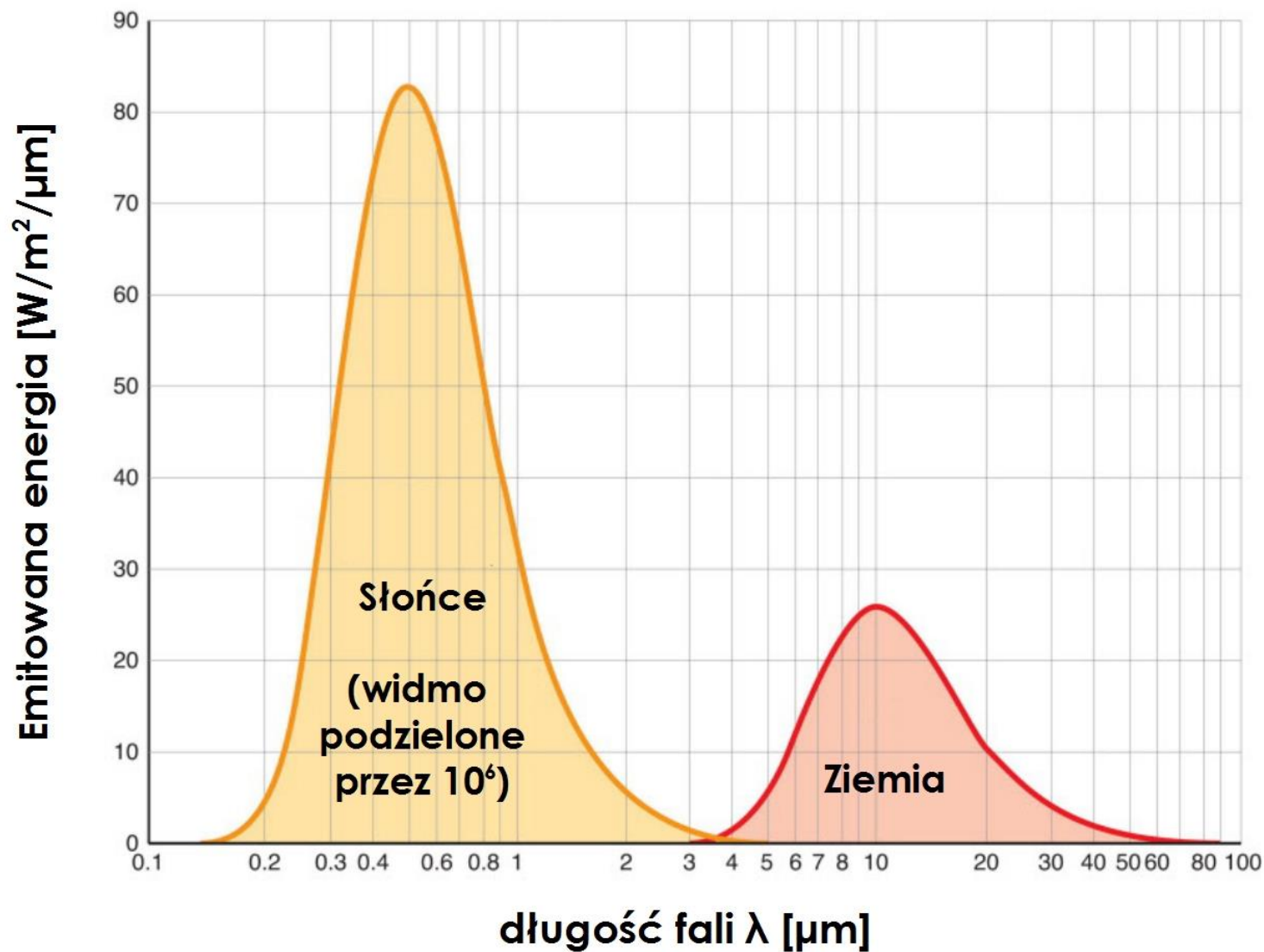
widzialne



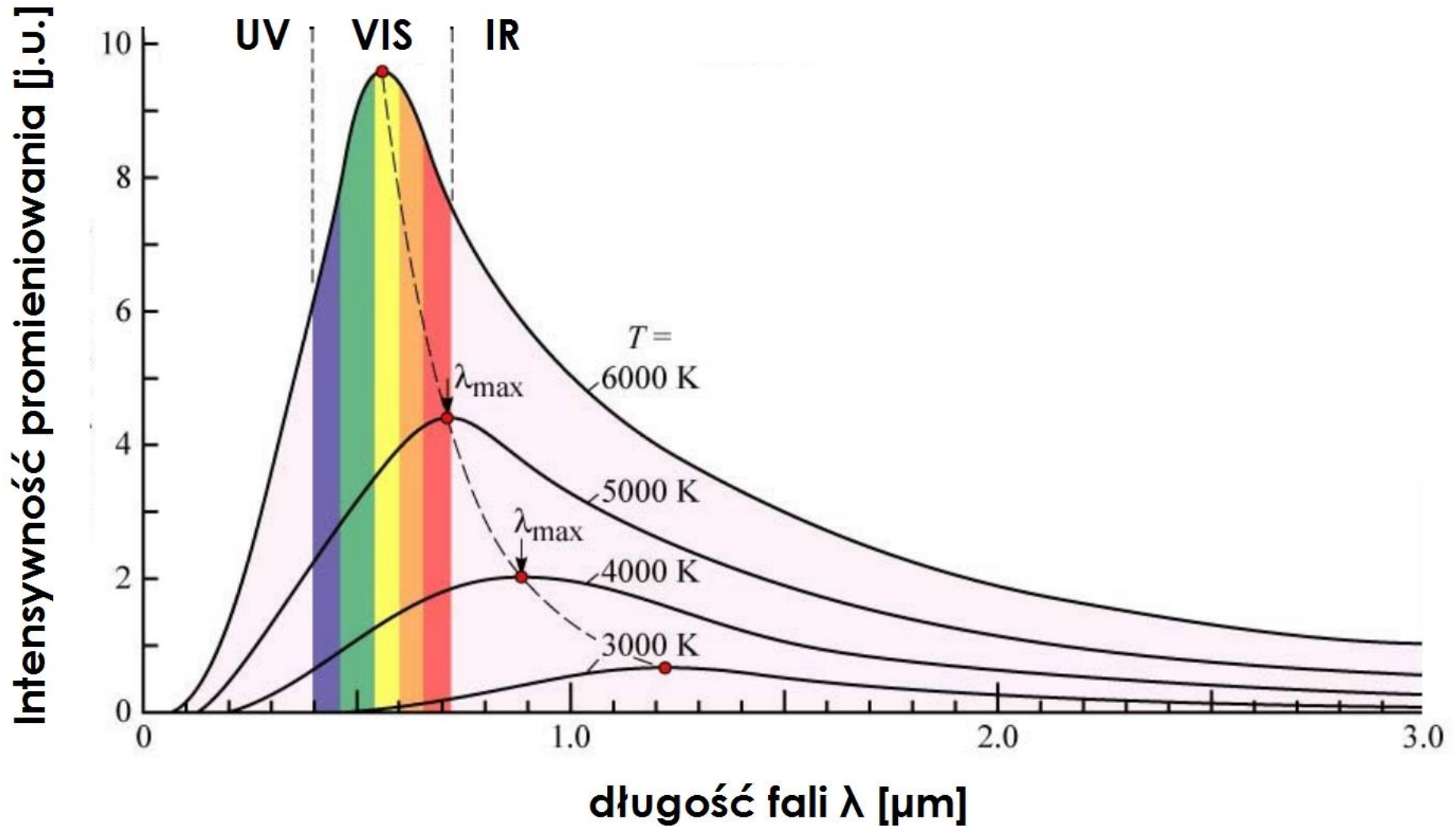
podczerwień

<http://www.eumetsat.int>

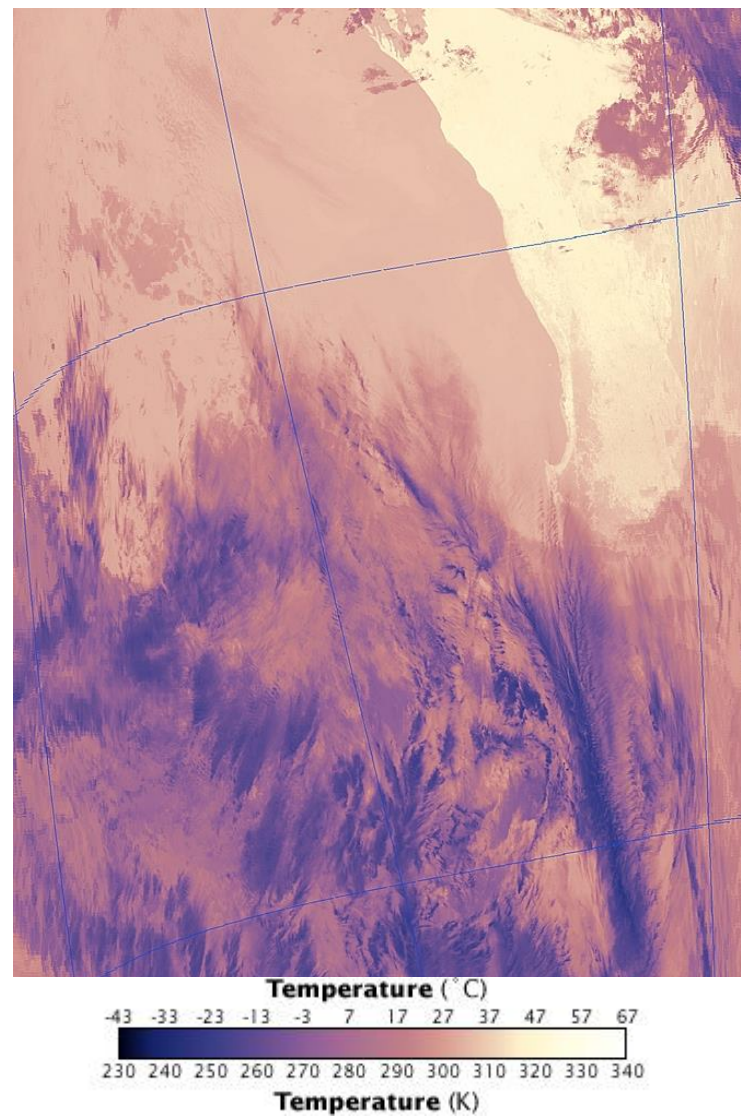
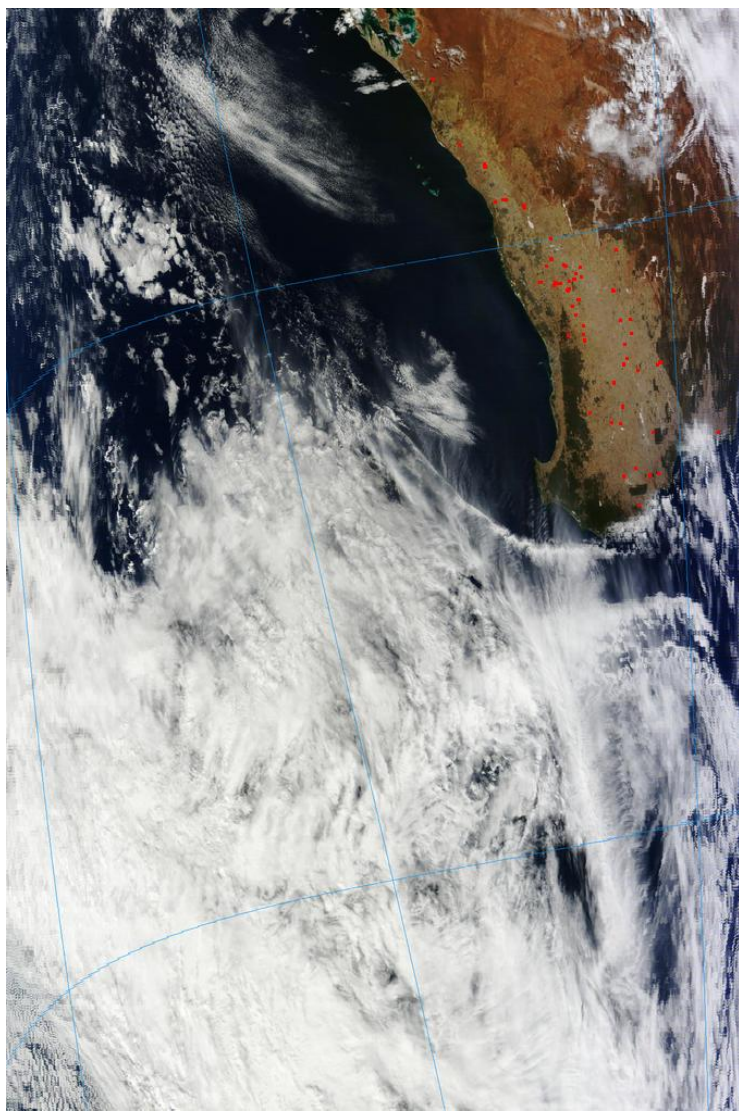
Ciało doskonale czarne



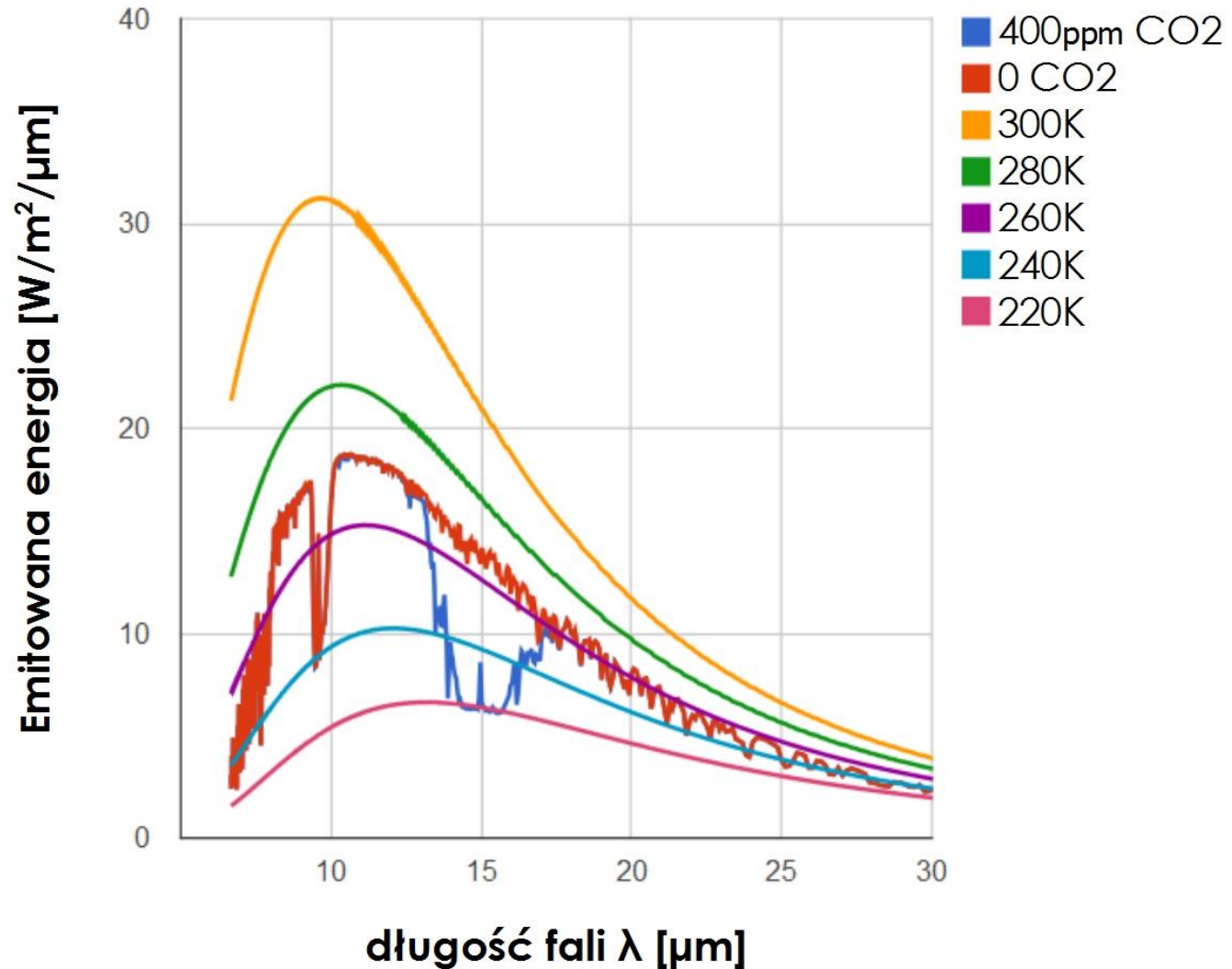
Ciało doskonale czarne



Temperatura z pomiarów satelitarnych



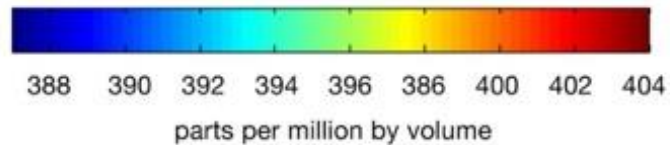
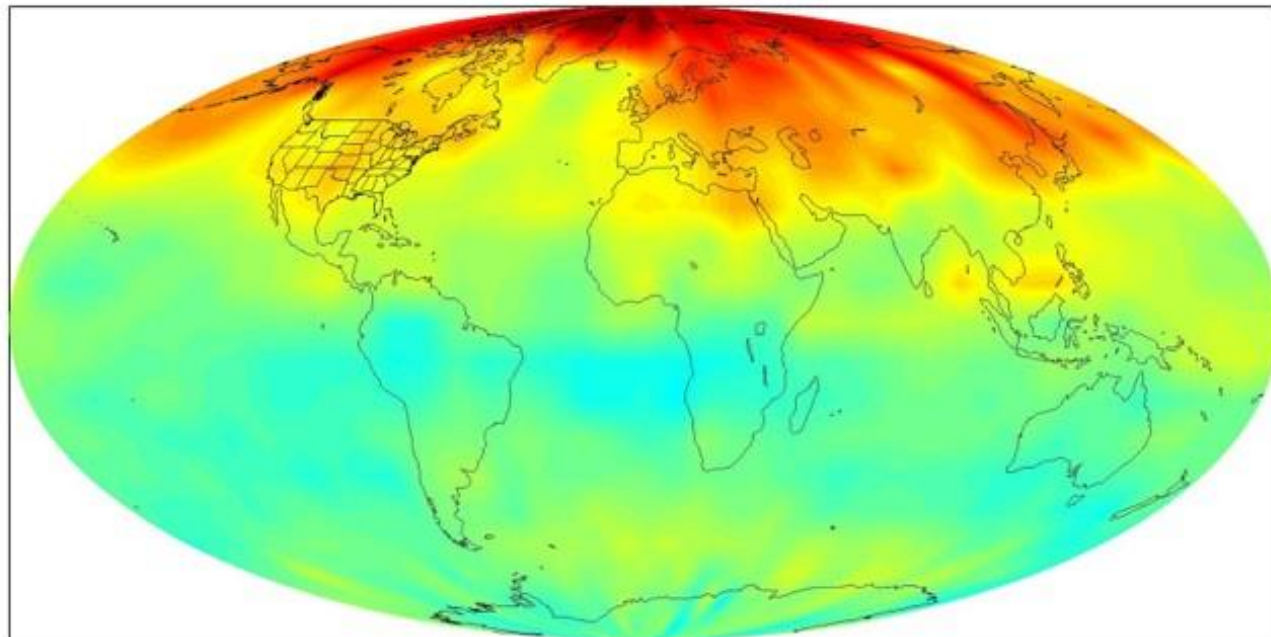
Gazy śladowe



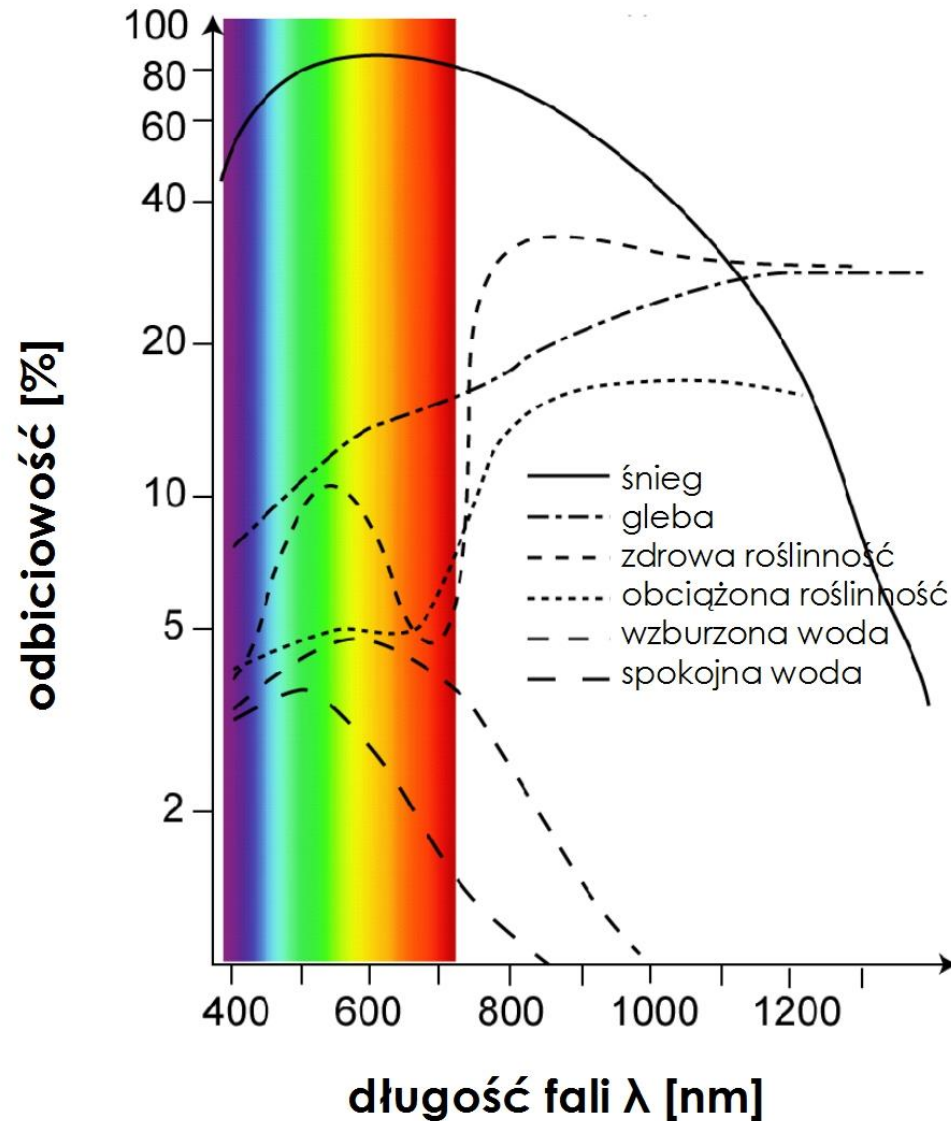
Gazy śladowe

Carbon Dioxide in Earth's Mid-Troposphere, April 2013 Monthly Average

Global average concentration 396.86 ppm in mid-troposphere (roughly 3-6 miles (5-9 km) in altitude)
Data source: AIRS, the Atmospheric Infrared Sounder on NASA's Aqua satellite



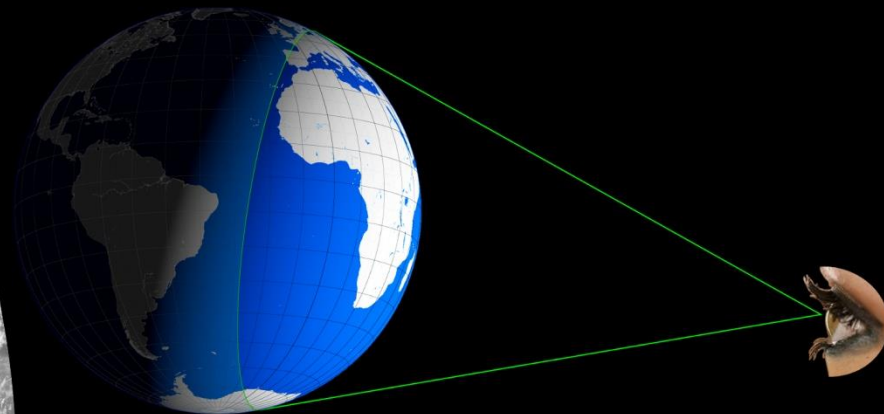
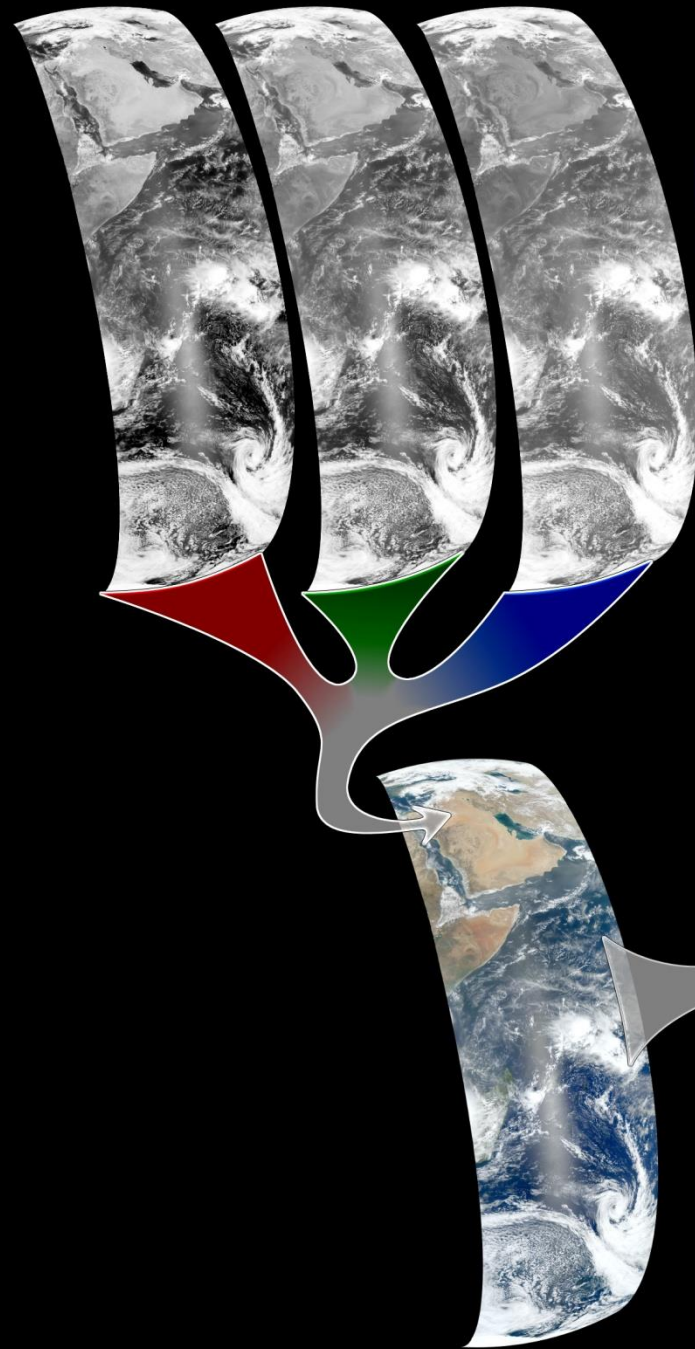
Oddziaływanie z promieniowaniem



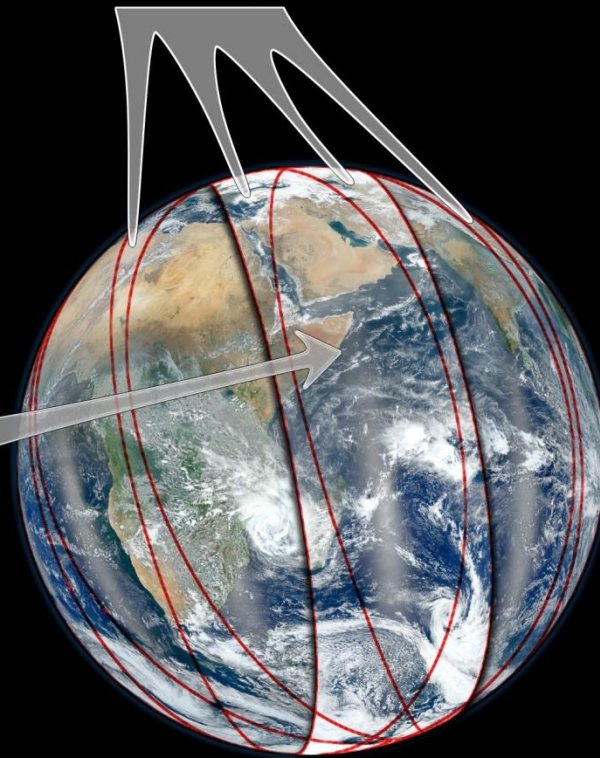
Red
671-nanometer band

Green
551-nanometer band

Blue
443-nanometer band



Orbit Overlaps

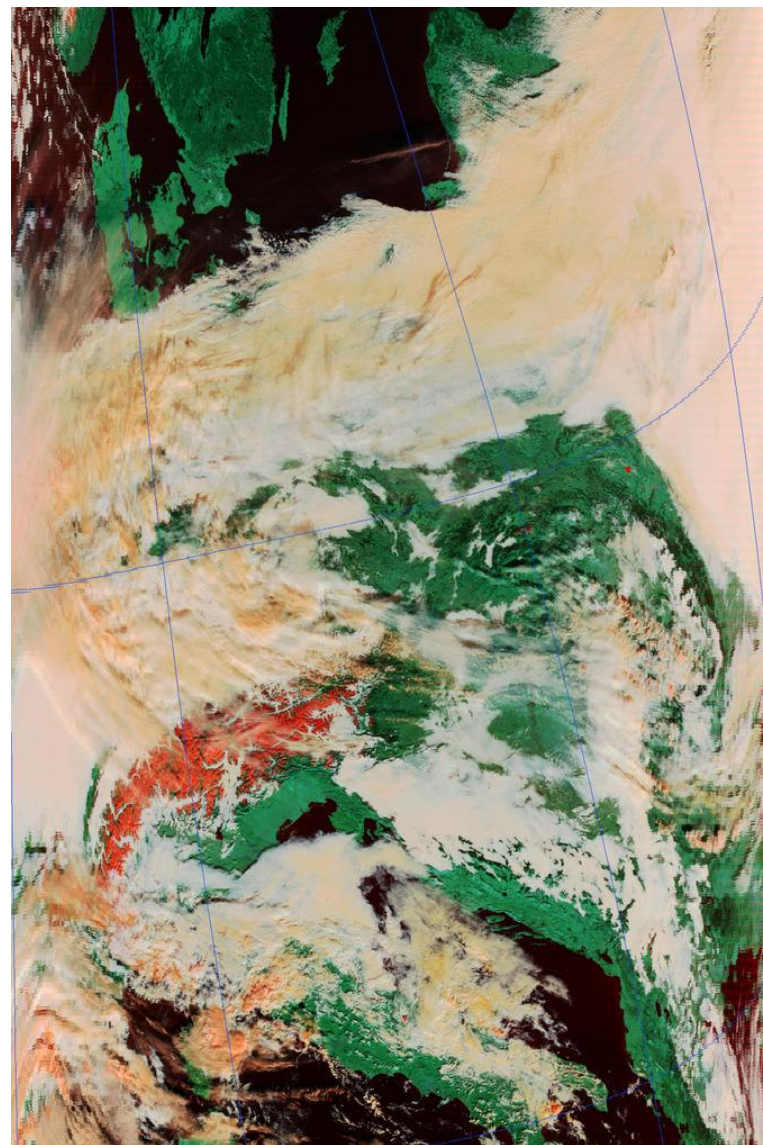
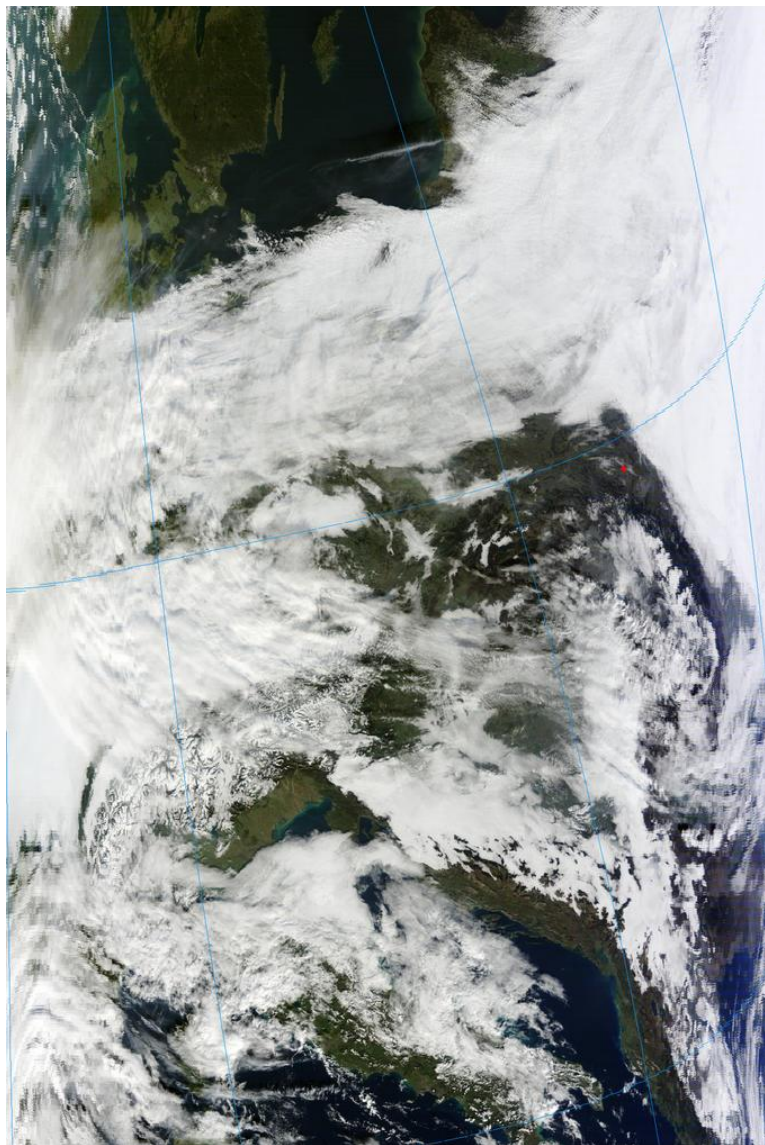


Przykład analizy danych z wielu kanałów 3-6-7

	śnieg	chmury lodowe	rośliny	woda	chmury wodne
479 nm	O	O	P	P	O
1652nm	P	o	O	P	O
2155 nm	P	o	P	P	O

O – odbija, P - pochłania

Przykład analizy danych z wielu kanałów



EUMETView

▼ Eumetsat view *

▼ Layers

☒

☐ ☐ Precipitation rate at ground by ...

☒

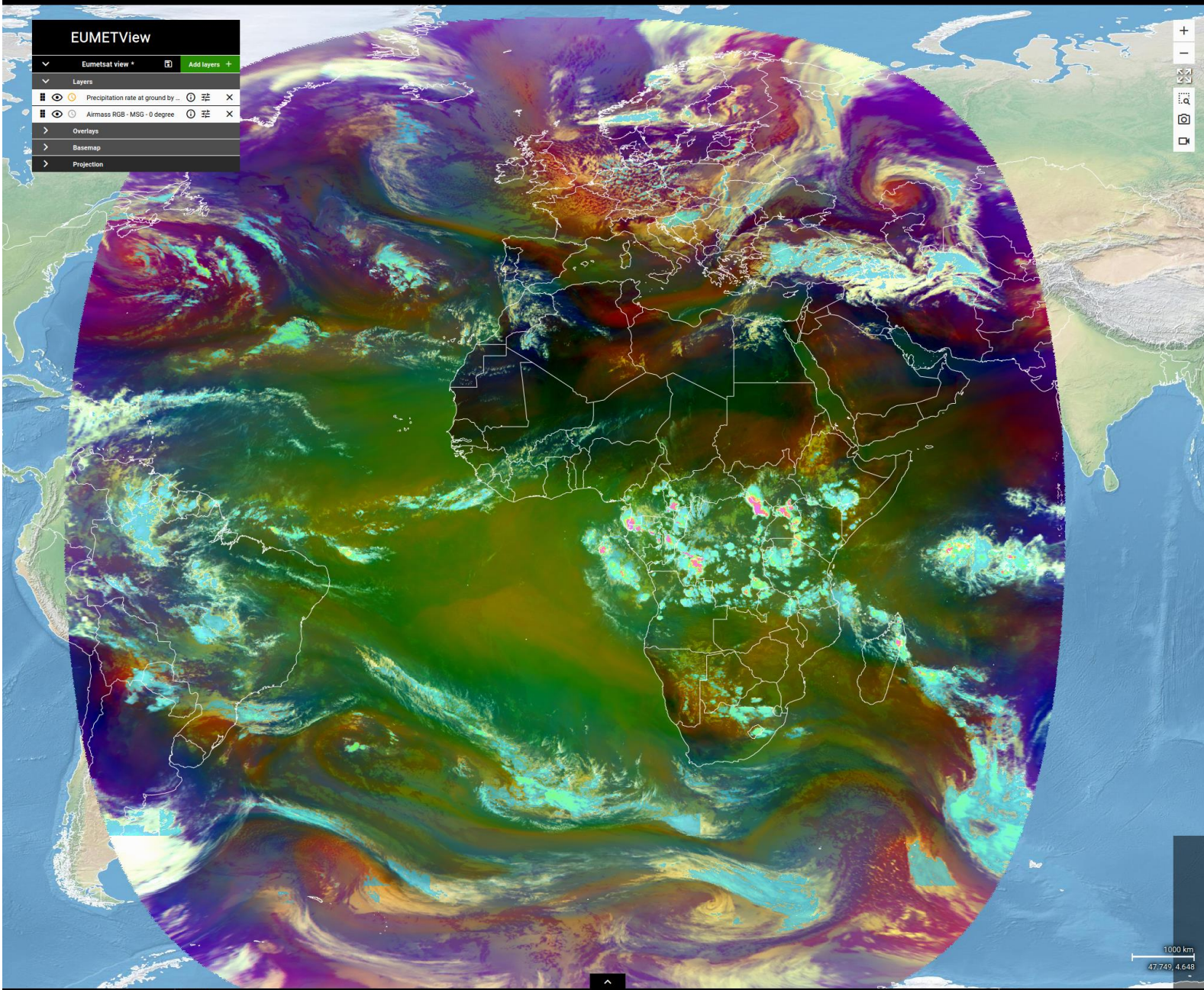
☐ Airmass RGB - MSG - 0 degree

> Overlays

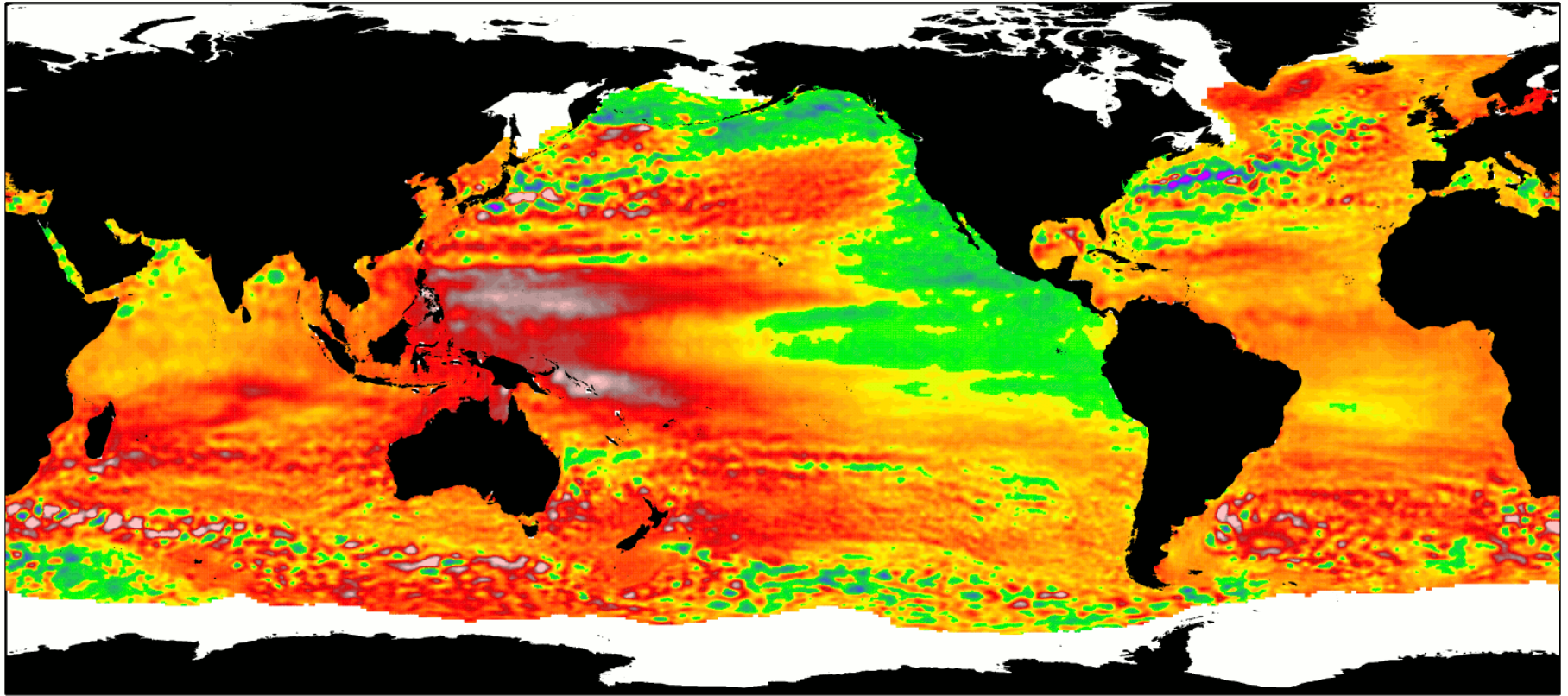
> Basemap

> Projection

Add layers +

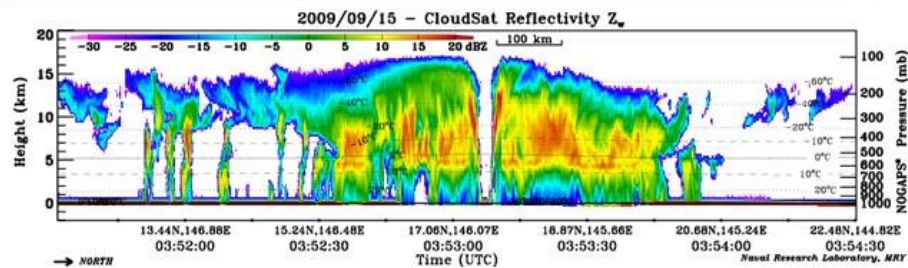
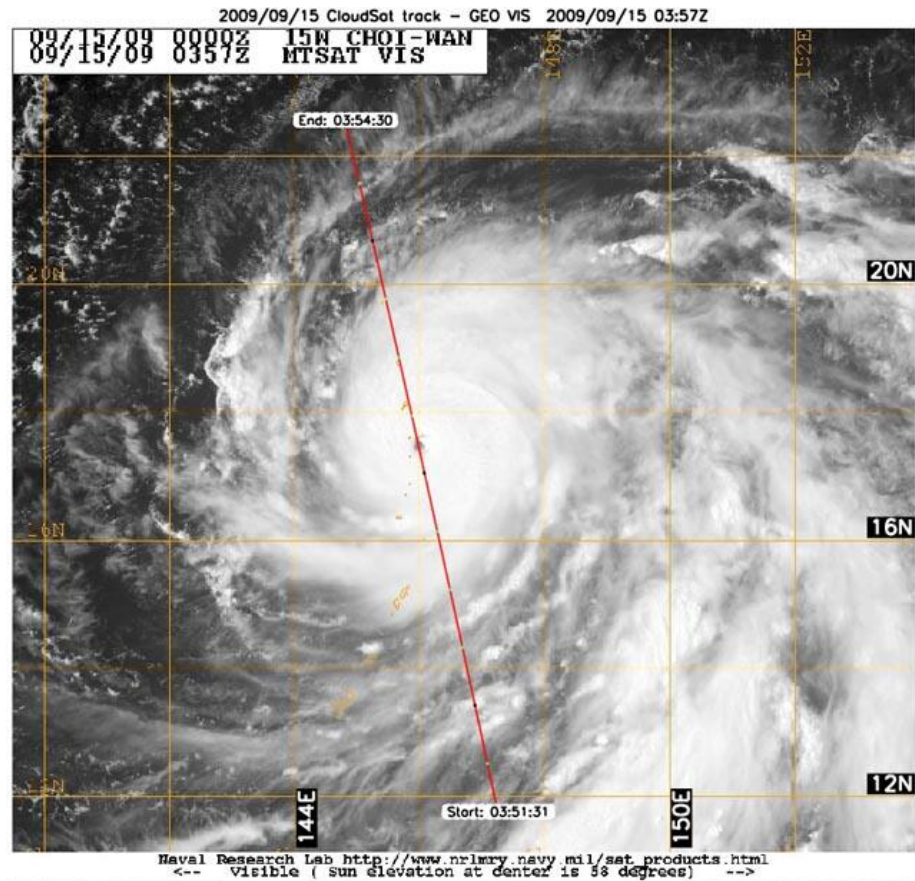


Radary satelitarne – powierzchnia Ziemi

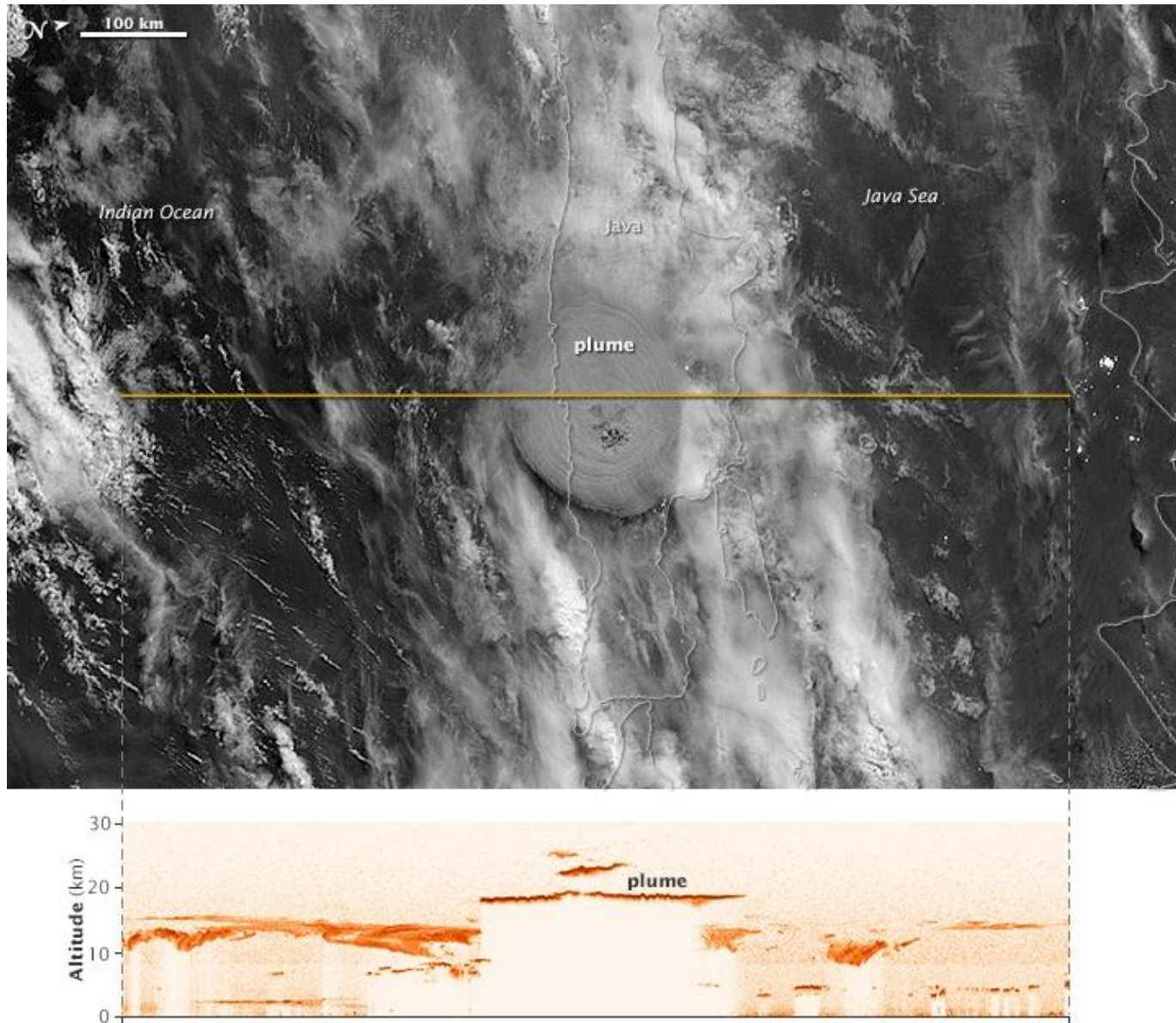


-20 -15 -10 -5 0 5 10 15 20
1993 to 2008 Change in Sea Level (in centimeters)

Radary satelitarne – opady



Lidar satelitarny



https://worldview.earthdata.nasa.gov/?v=-199.85240603644647,-100.49222665148064,156.25865603644647,106.96097665148064&t=2021-04-05-T12%3A25%3A51Z

Search for places or enter coordinates

NASA WORLDVIEW

Layers Events Data

REFERENCE

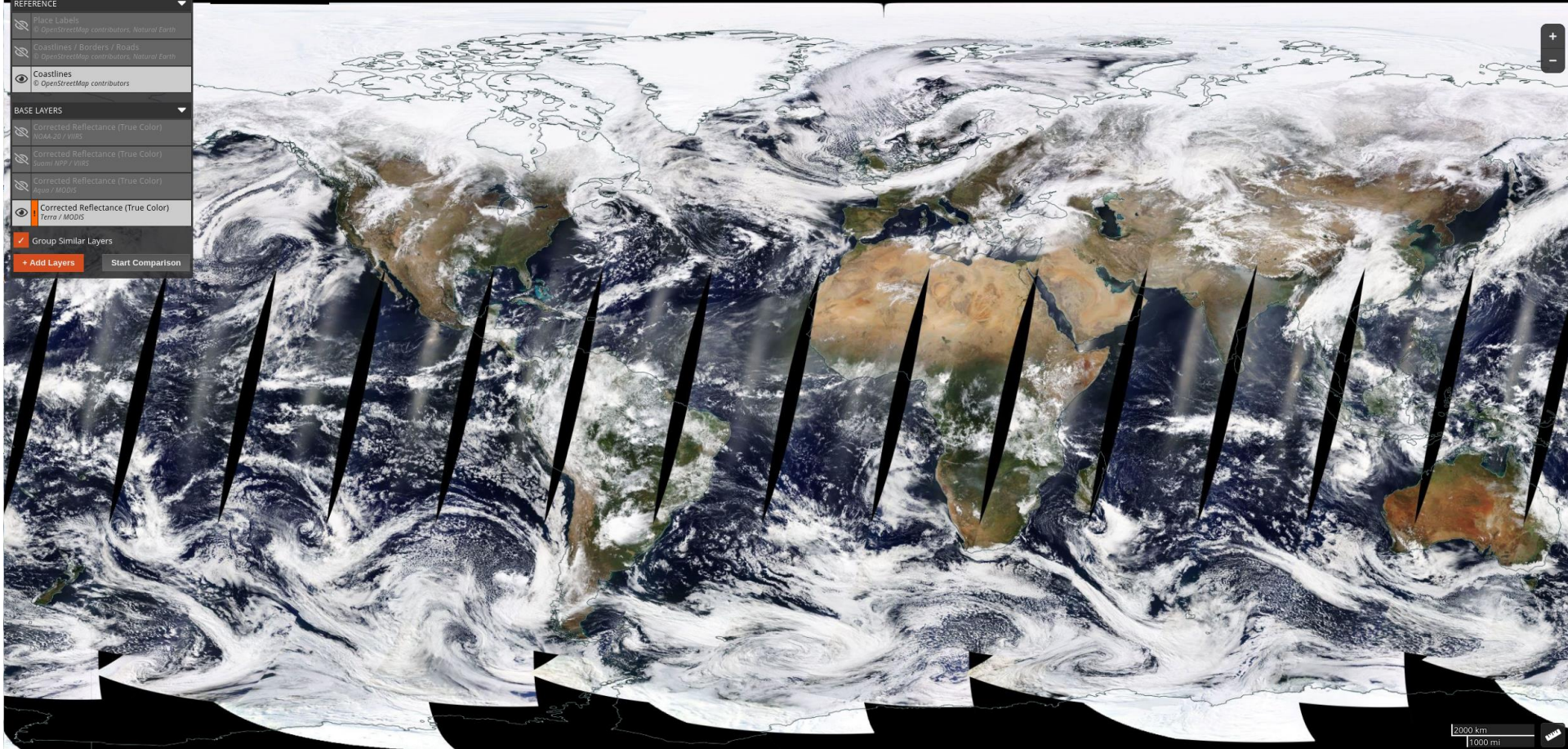
- ☐ Place Labels
OpenStreetMap contributors, Natural Earth
- ☐ Coastlines / Borders / Roads
OpenStreetMap contributors, Natural Earth
- ☒ Coastlines
OpenStreetMap contributors

BASE LAYERS

- ☐ Corrected Reflectance (True Color)
NOAA-20 / VIIRS
- ☐ Corrected Reflectance (True Color)
Satellite MPP / VIIRS
- ☐ Corrected Reflectance (True Color)
Aqua / MODIS
- ☒ Corrected Reflectance (True Color)
Terra / MODIS

Group Similar Layers

+ Add Layers Start Comparison



2000 km
1000 mi

-19.0498°, 16.7467° EPSG:4326

2021 APR 05 1 DAY

DEC 2020

JAN 2021

FEB 2021

MAR 2021

APR 2021

DAY



Ship trails & industrial plumes

2018-2021

Region

Atlantic Ocean, Pacific Ocean,
Belarus

Satellites

Meteosat-11, NOAA-20, Suomi
NPP

Instruments

SEVIRI, VIIRS

Channels/Products

Night Microphysics RGB, Cloud
Phase RGB, Day-Night Band, Cloud
Type RGB, Day Microphysics RGB,
OCA Cloud Effective radius
product