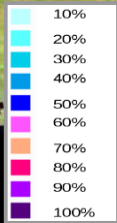
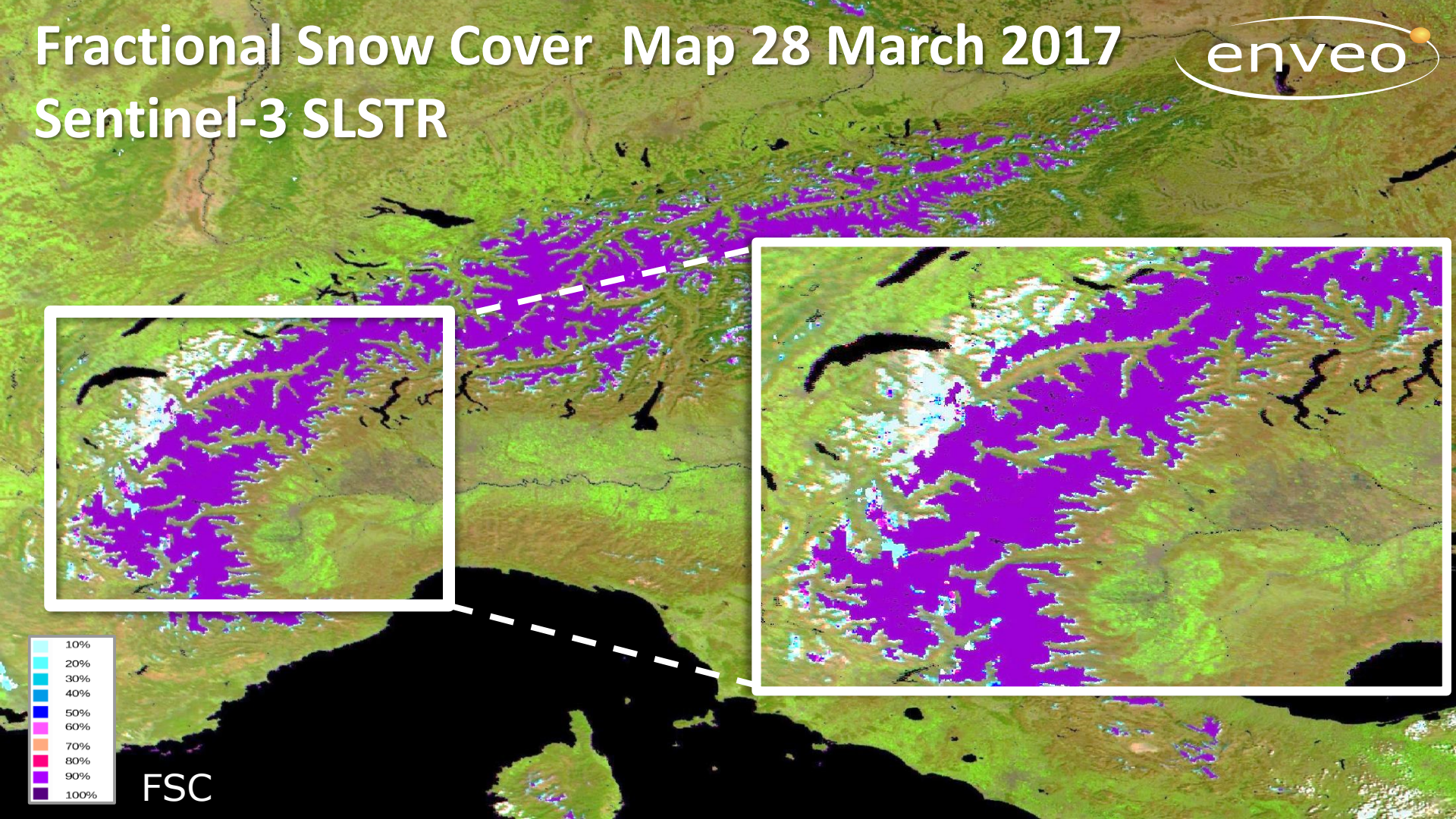


Fractional Snow Cover Map 28 March 2017



Sentinel-3 SLSTR



FSC

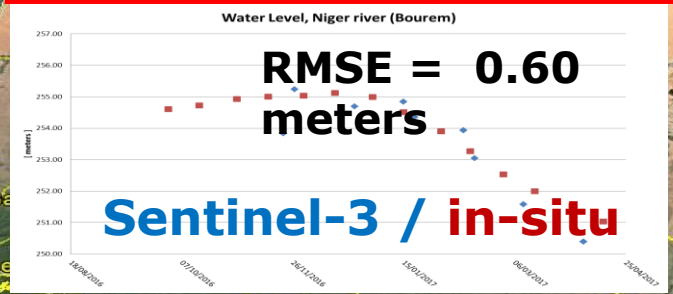
@Google earth



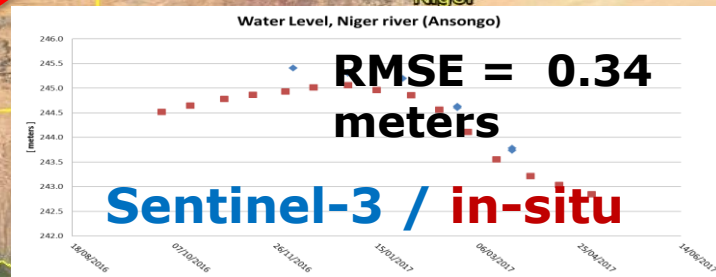
Bourem, Niger river



Ansongo Niger river



Location	Bourem, Mali
Coordinates	16° 57' 06" , 00° -34' 47"
Lake/river	Niger river
Time Period	Oct 2016 – April 2017
Source	Sentinel 3, altimetry sensor, 3 nominal tracks
Product	Water Level Time series
*Distance	~ from 20 to 60 Km depending on the track

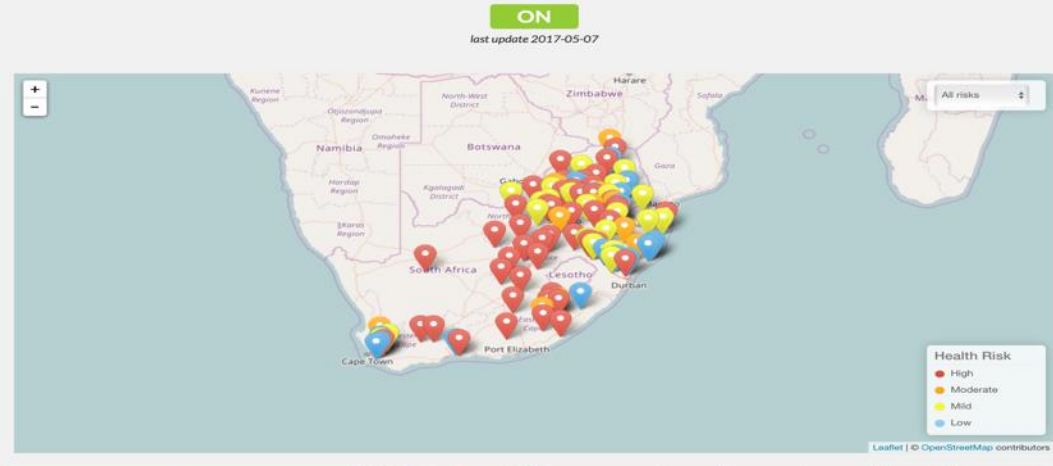


Location	Ansongo, Mali
Coordinates	15° 39' 33" , 00° 30' 06"
Lake/river	Niger river
Time Period	Oct 2016 – April 2017
Source	Sentinel 3, altimetry sensor, 1 nominal track
Product	Water Level Time series
*Distance	~ 20 Km

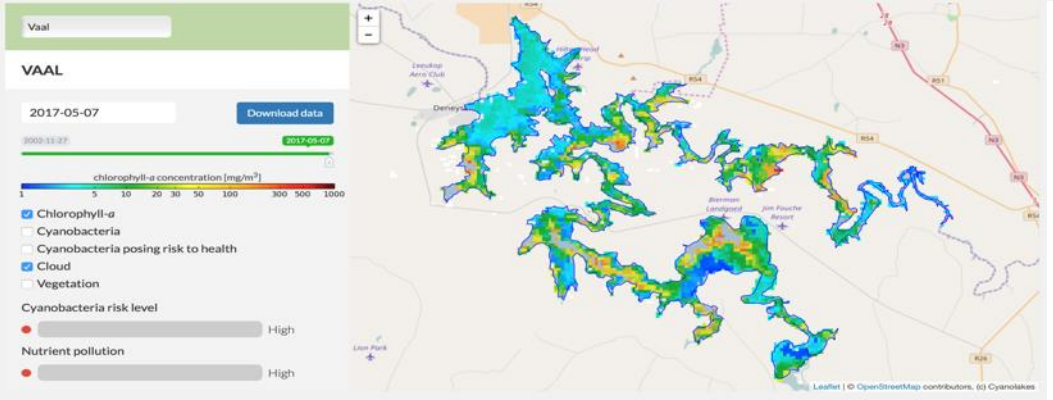
Sentinel-3 for inland water quality

CyanoLakes: <http://eonemp.cyanolakes.com>

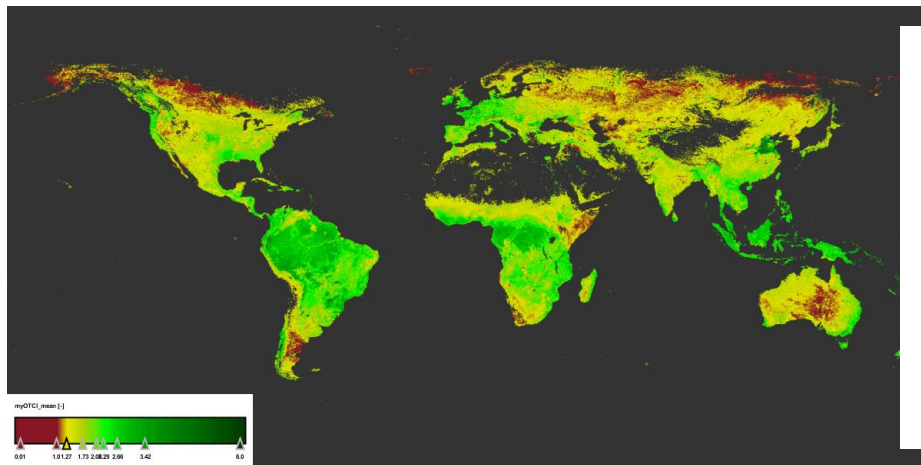
Catapult Open



- ❑ CyanoLakes: winner of Copernicus Masters Ideas Challenge in 2014
- ❑ **Integration of Earth Observation into the National Eutrophication Monitoring Service (EONEMP)** provided by CyanoLakes (Pty) Ltd, funded by the Water Research Commission of South Africa.
- ❑ Service based on MERIS data (10 year archive) and **OLCI** data (live since April 2017)
- ❑ **Monitoring and reporting on eutrophication** (via chlorophyll-a estimates) and cyanobacteria blooms in lakes/reservoirs in South Africa.

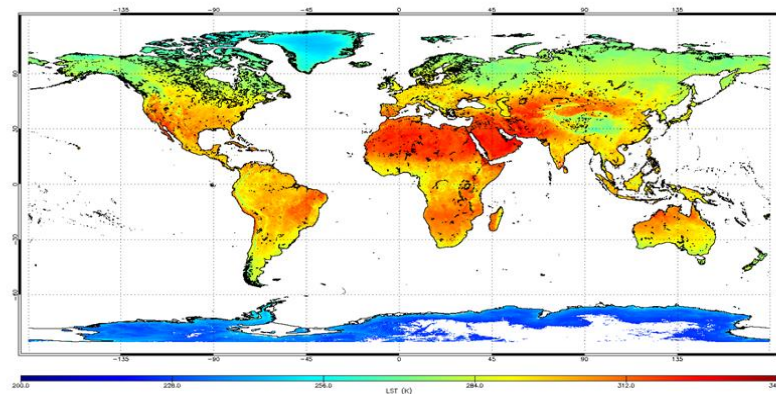


OLCI Terrestrial Chlorophyll Index April-May 2017



Credit: processed by University of Southampton-J. Dash/Brockman Consult (S3-MPC)

Land Surface Temperature monthly composite for September 2016



Credit: D. Ghent, University of Leicester

Sentinel-5 Precursor

The ESA **Sentinel-5 Precursor (S-5P)** is the first atmospheric Sentinel mission focusing on global observations of the atmospheric composition for **air quality** and **climate**.

The TROPOspheric Monitoring Instrument (**TROPOMI**) is the payload of the S-5P mission and is jointly developed by **The Netherlands and ESA**.

S-5P will provide **enhanced radiometric sensitivity & spatial resolution** enabling sampling of small-scale variabilities specifically in the lower troposphere.

Launched **13 October 2017**. **7 year** design lifetime.

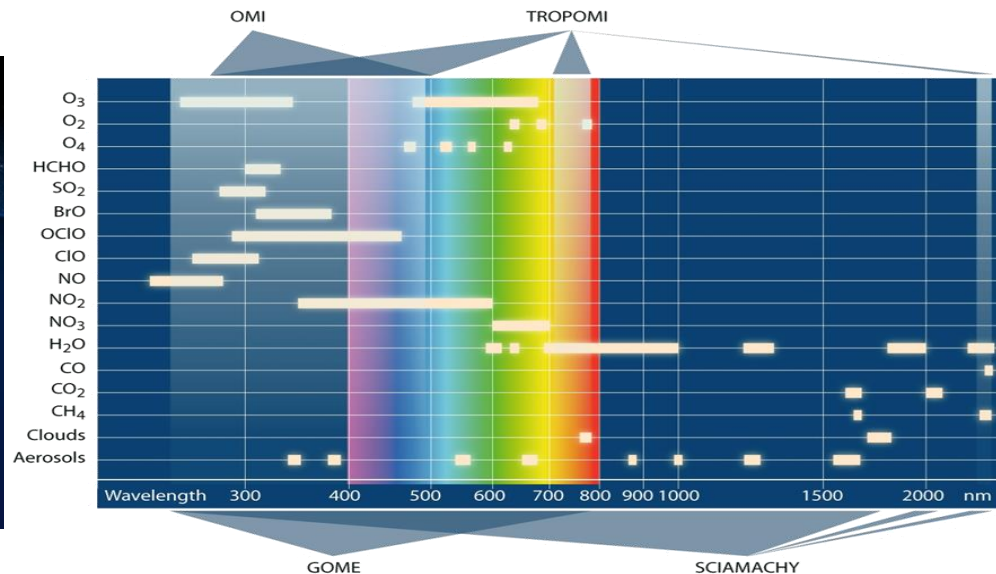
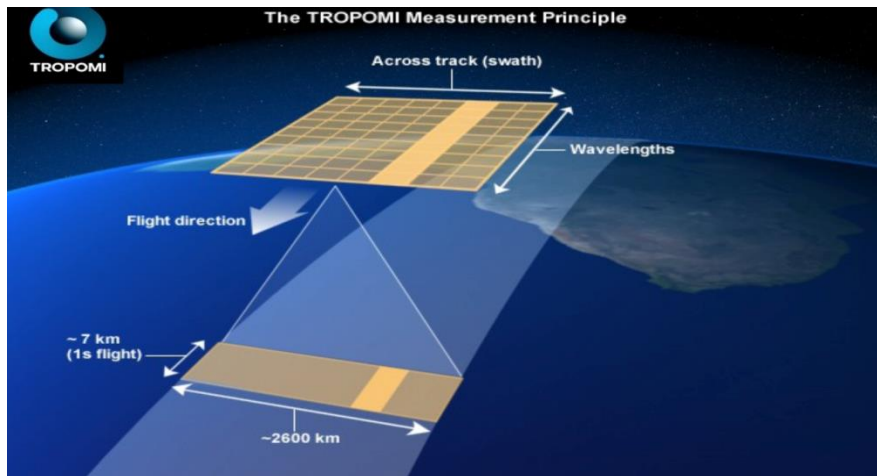
TROPOMI: UV-VIS-NIR-SWIR nadir view grating spectrometer.

- ▶Spectral range: 270-500, 675-775, 2305-2385 nm
- ▶Spectral Resolution: 0.25-1.1 nm
- ▶Spatial Resolution: 7x3.5 km²
- ▶Global daily coverage at 13:30 local solar time



Sentinel-5P Observation scenario

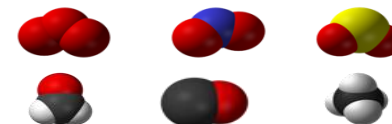
The Sentinel-5P instrument data is **acquired systematically** during the complete orbit according to a simple **baseline observation scenario**

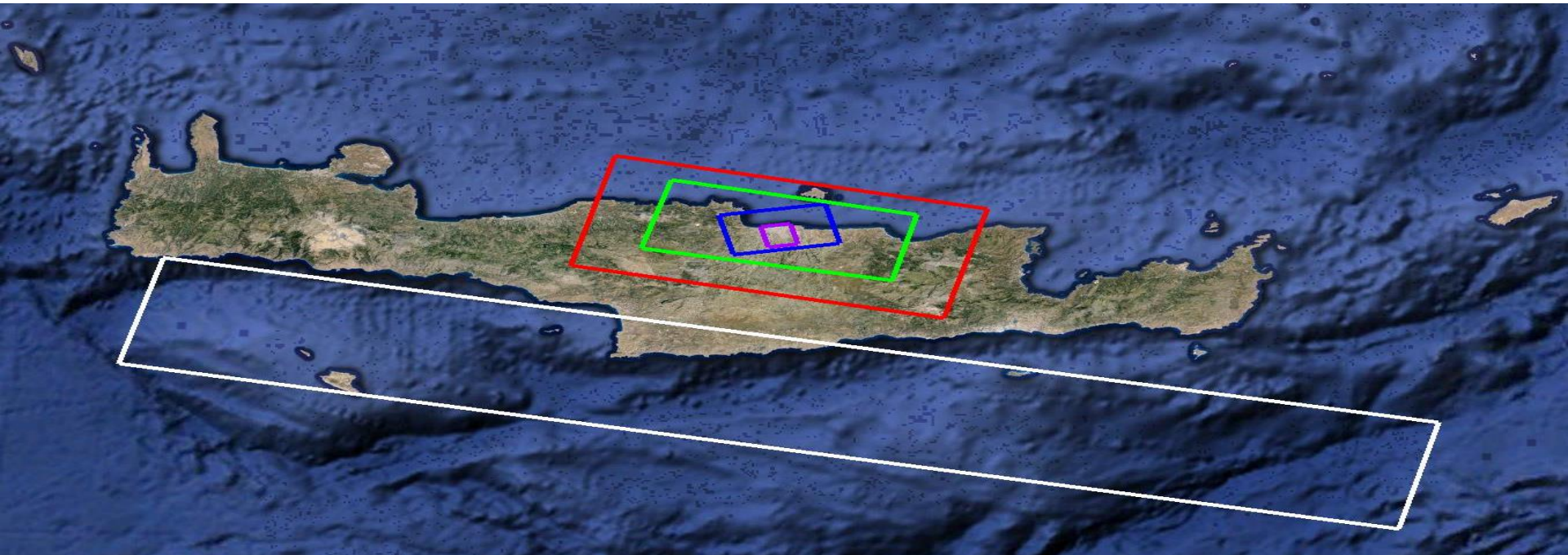


Sentinel-5P: products overview

Sentinel-5 Precursor Data Products		
Product	Description	Remarks
Level 1B	Calibrated, geo-located Earth radiance & solar irradiance spectra in all bands	Systematic processing
Level 2	<u>Column densities/profiles for S5P primary species:</u> <i>UVN channel products</i> O ₃ total & tropospheric columns, profiles NO ₂ total & tropospheric columns SO ₂ , HCHO total columns aerosols aerosol index & aerosol layer height clouds cloud fraction, top height, optical thickness	Non Time Critical: All products Near Real-Time: All species except CH ₄ & tropospheric O ₃
	<i>SWIR channel products</i> CO, CH ₄ total columns	

Near real-time delivery: 3 hours after sensing
Non time critical: 14 days after sensing





S-5P vs SCIAMACHY, GOME-2, OMI:

- Smaller pixels: $7 \times 3.5 \text{ km}^2$
- Larger swath-width (2600 km) with daily global coverage

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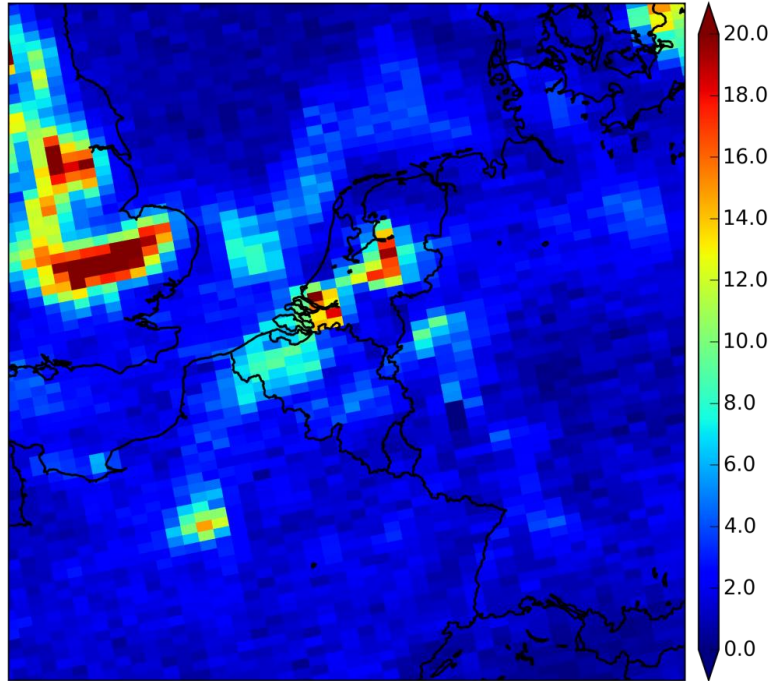
S-5P Data Volume:

- ~ 1.5 million ground pixels/orbit
- L1: ~ 35 Gbyte/orbit
- L2: ~ 3.5 Gbyte/orbit - Total: ~ 640 Gbyte/day

OMI versus TROPOMI - Spatial Resolution

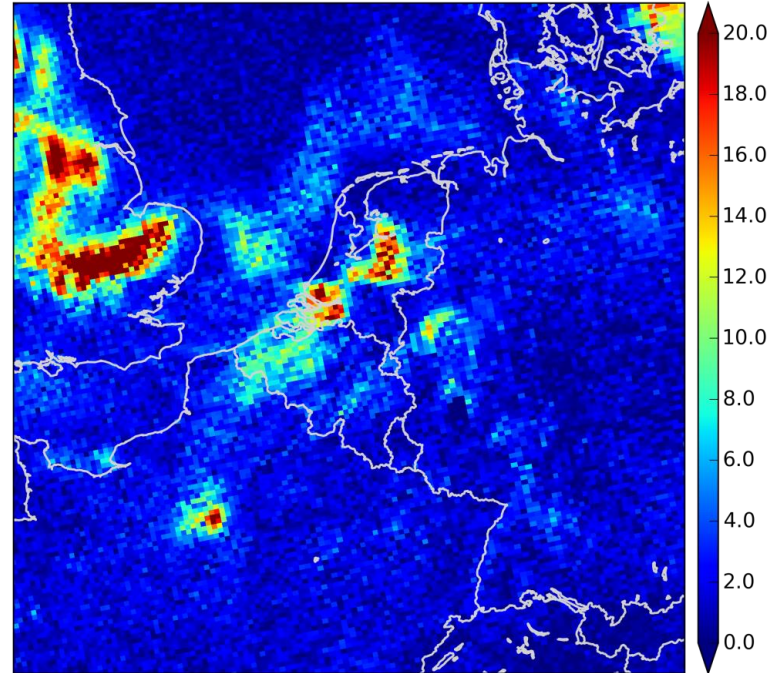


OMI Simulatie: Stikstofdiooxide, 2003-06-16



OMI observations
13x24 km

TROPOMI Simulatie: Stikstofdiooxide, 2003-06-16



Simulated TROPOMI observations
7x7 km

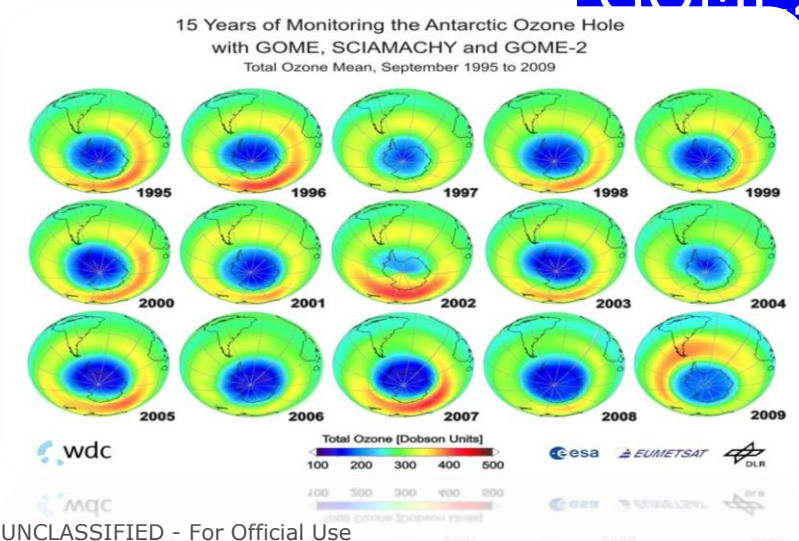
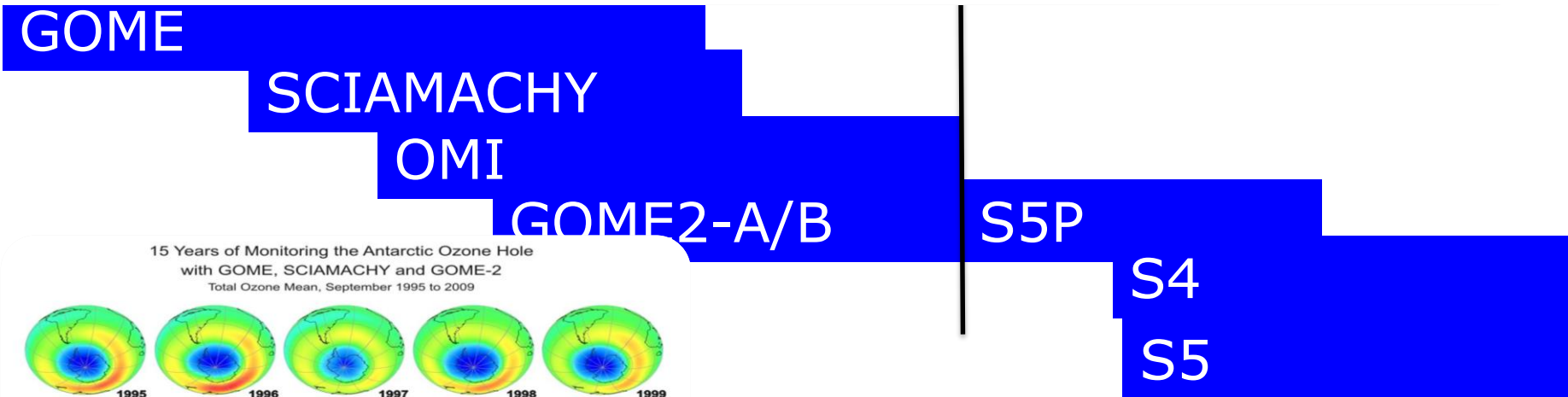
Credits: KNMI

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Gap-Filler/Precursor

1995 2000 2005 2010 2015 2020 2025 2030



Credits: DLR, ESA, EUMETSAT & WDC

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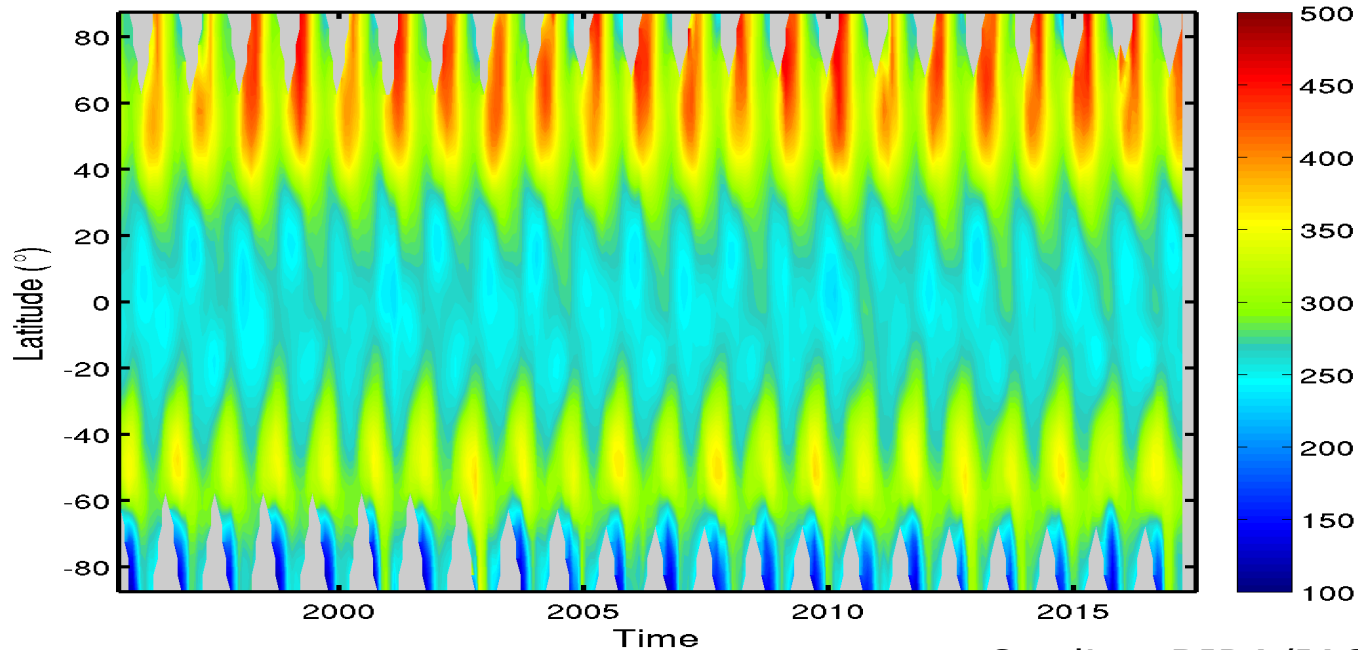
Ozone Essential Climate Variable



Ozone Climate Change Initiative Project: esa-ozone-cci.org

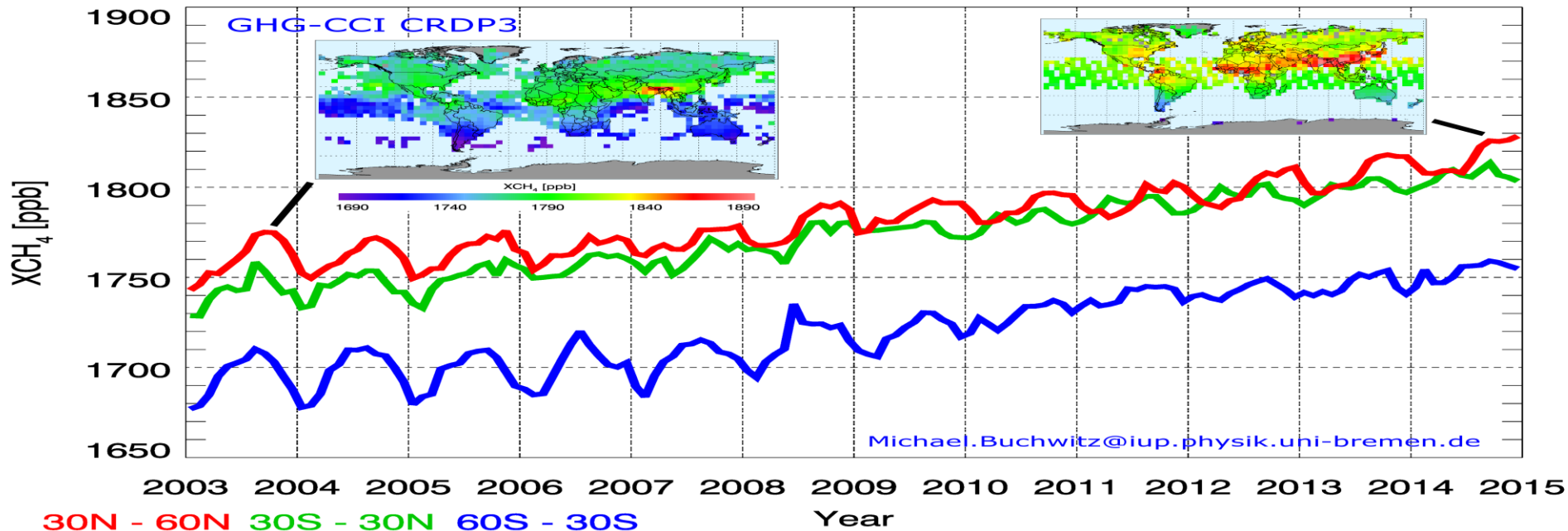
Combined GOME, SCIAMACHY, GOME-2, and OMI products

CCI-II Total O₃ zonal means (DU)

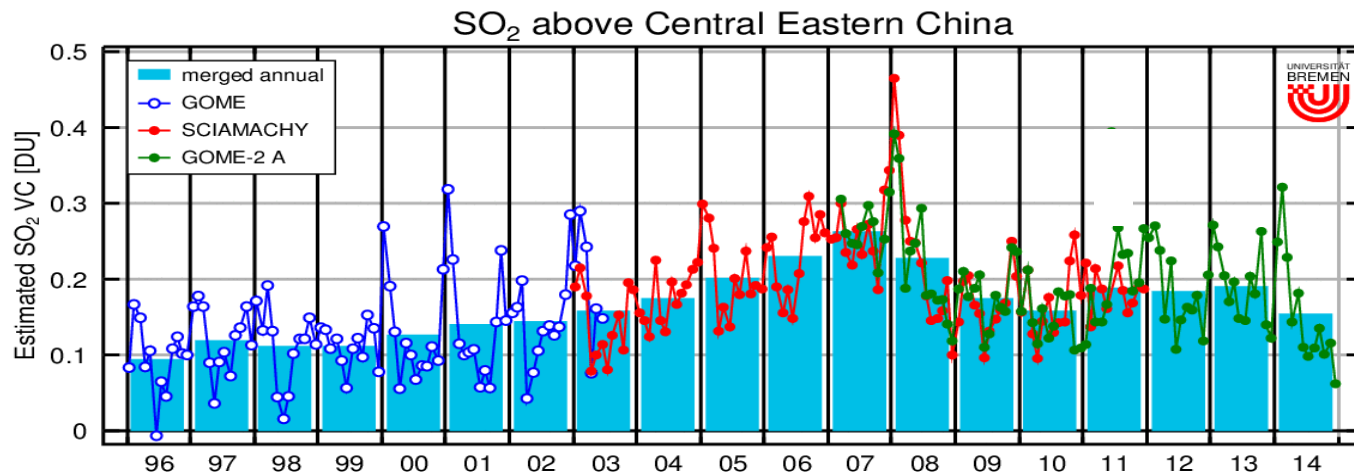
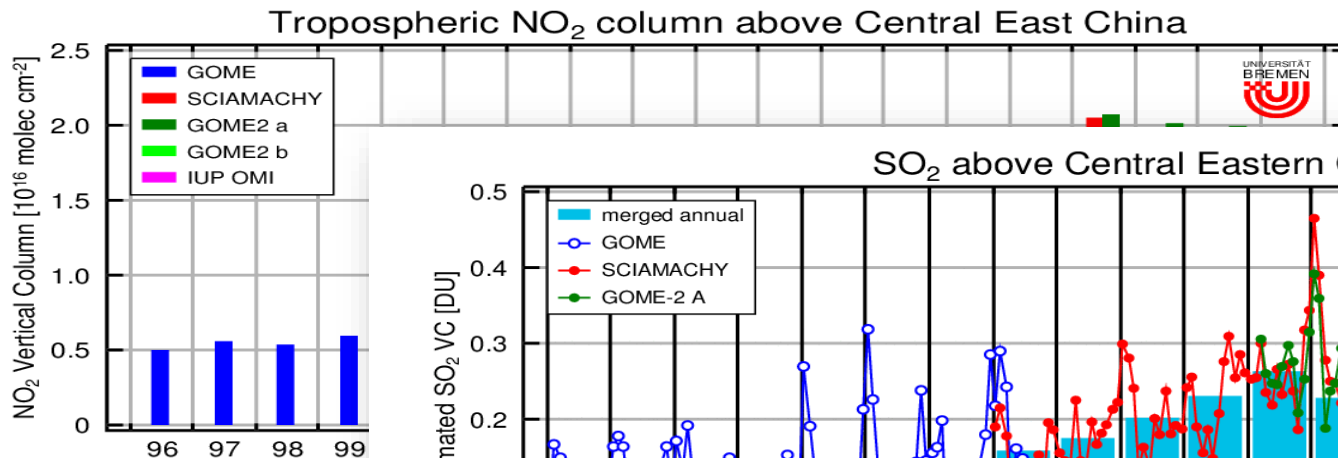


GHG Climate Change Initiative Project: esa-ghg-cci.org

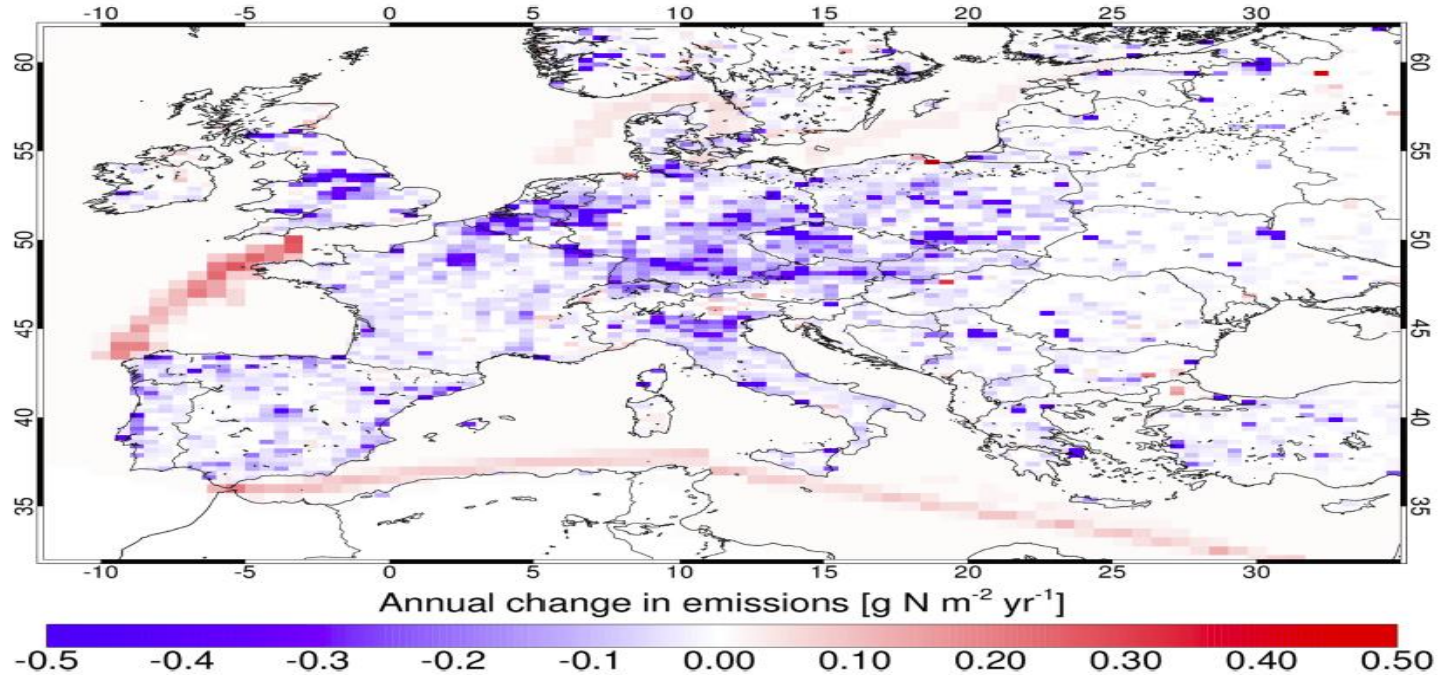
Methane SCIAMACHY/ENVISAT & TANSO-FTS/GOSAT



Continuation of long-term trend analysis of air quality concentrations



Annual changes in OMI NO_x emissions (2005-2008)



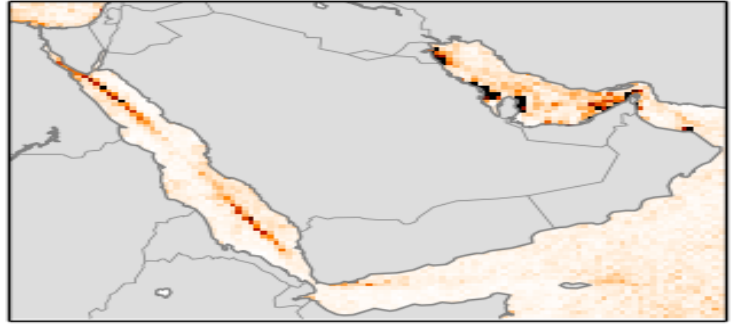
Gulf of Aden



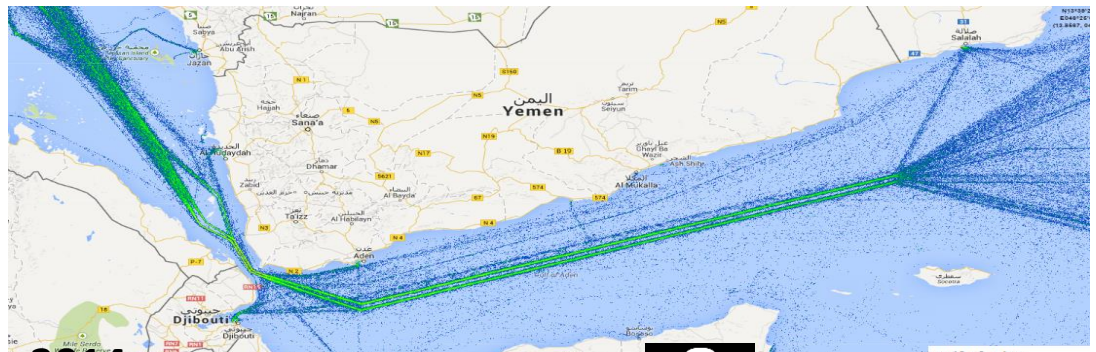
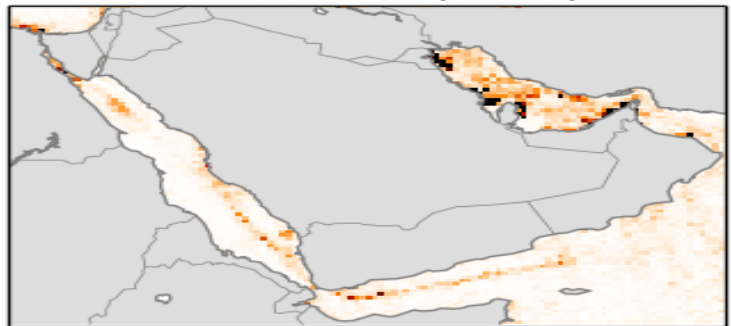
2008

Credits: KNMI

DECSO v3b (2007)



DECSO v3b (2010)

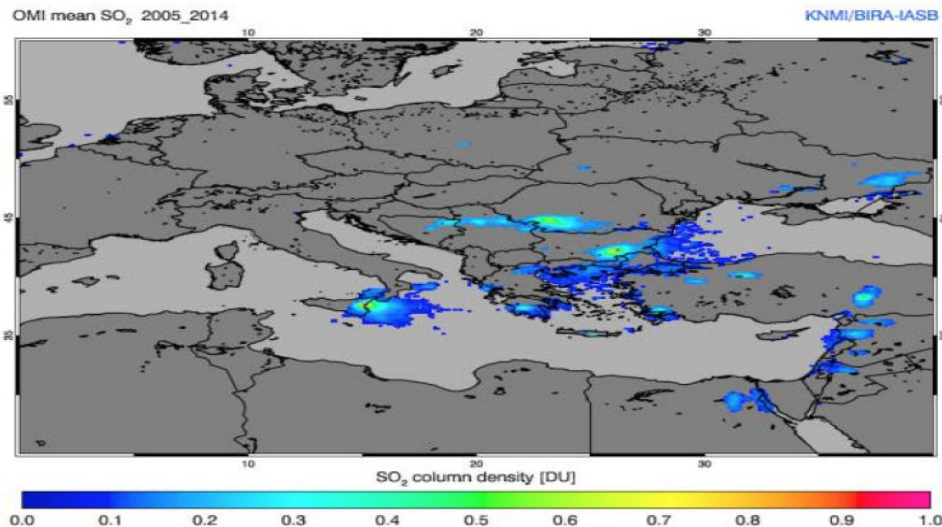


2014

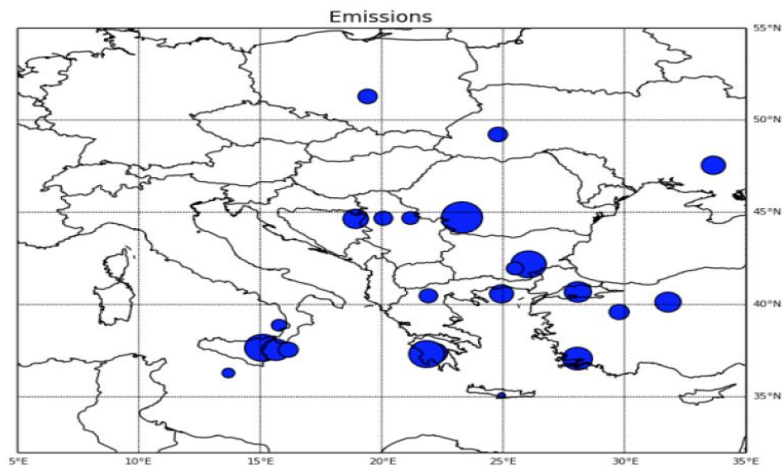
Gulf of Aden
marinevesseltraffic.com



SO₂ sources in Europe (coal firing power plants except Etna)



Average SO₂ as measured by the OMI satellite instrument during 2005 to 2014.

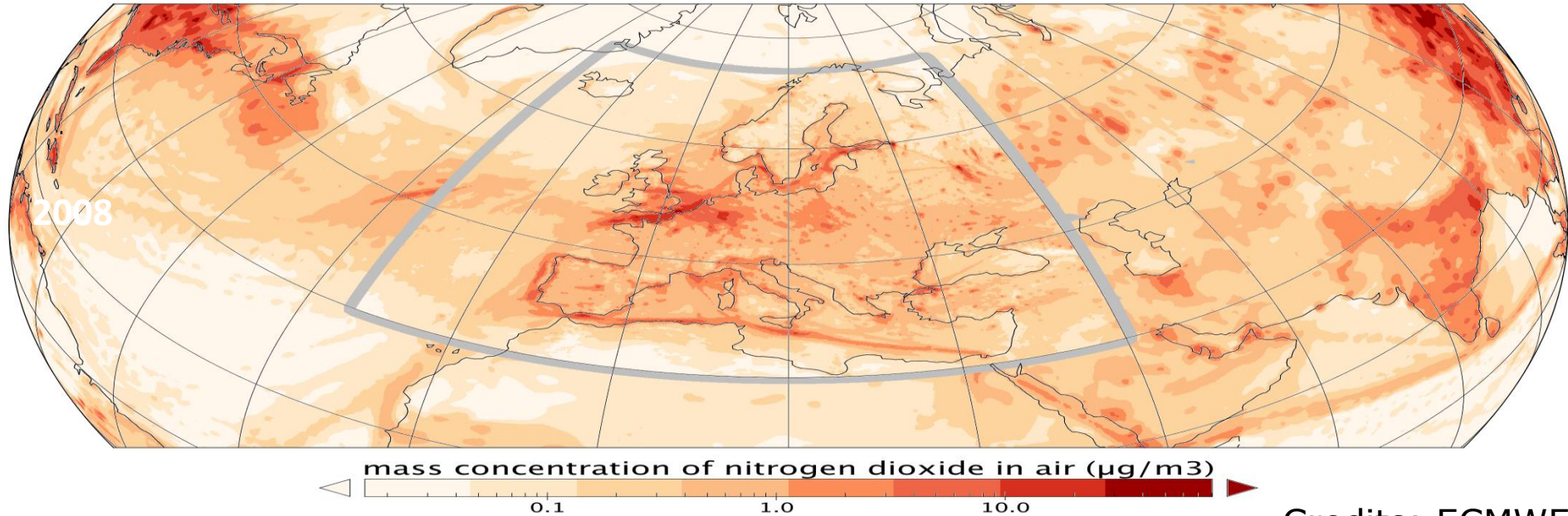


Derived point sources of SO₂ emissions. The emission strength of the source is indicated by the size of the blue dots.

Credits: KNMI

Copernicus Atmospheric Monitoring Service – global assimilation of satellite data at ECMWF

CAMS regional NO₂ analysis embedded in CAMS global forecast



Credits: ECMWF



Sentinel Data Policy = FREE and OPEN access

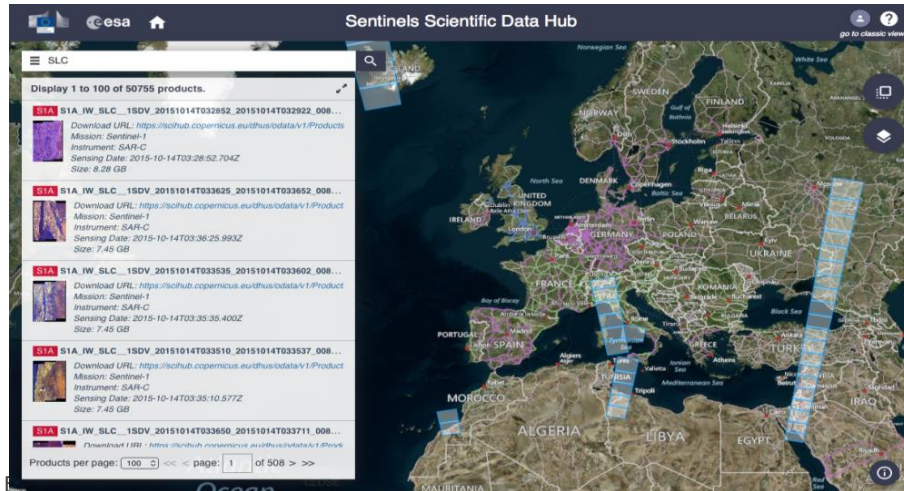
Users shall have **free, full and open** access to Copernicus dedicated Sentinel data and Copernicus service information

The **Copernicus Ground Segment architecture implements this policy**, and includes an **evolutionary approach** to further enhance the data exploitation by the broad user community

The CSC Ground Segment features **dedicated data access infrastructure solutions**, tailored to the needs of the various use typologies

Sentinel Data Dissemination: Overview

- Online access to Sentinel **products** via dedicated data hubs
 - ➔ Any user can **register** at **scihub.copernicus.eu**
- ESA CSC Ground Segment data distribution is ensuring that **at any point in time any user can retrieve all Sentinels products**
 - Includes most recent products as well as full Long Term Archive



**Data Hub software (DHuS)
provides an OPEN SOURCE Web
interface**

**Advanced APIs are available to
allow users to set scripts to
automatically download data**

Sentinel Open Data Hub: Web Interface

Catapult Open



The screenshot displays the Copernicus Open Access Hub interface. At the top, there are navigation links for 'SIGN UP' and 'LOGIN'. Below, a search bar is visible with the text 'S2A_MSIL2A_20171018T100031_N0205_R122_T32TGM_20171018T100200'. A list of search results is shown, including product identifiers like 'S2A_MSIL2A_20171018T100031_N0205_R122_T32TGM_20171018T100200' and their corresponding satellite and instrument details. A 'Download TCI' button is present. Below the search results, a terminal window is open, displaying a shell script for querying the data hub. The script includes comments and commands for setting environment variables, preparing a query statement, selecting the output format to JSON, and executing the query. The terminal output shows the query statement being constructed and executed.

Straightforward registration

flexible search

Product inspection

Individual and batch download

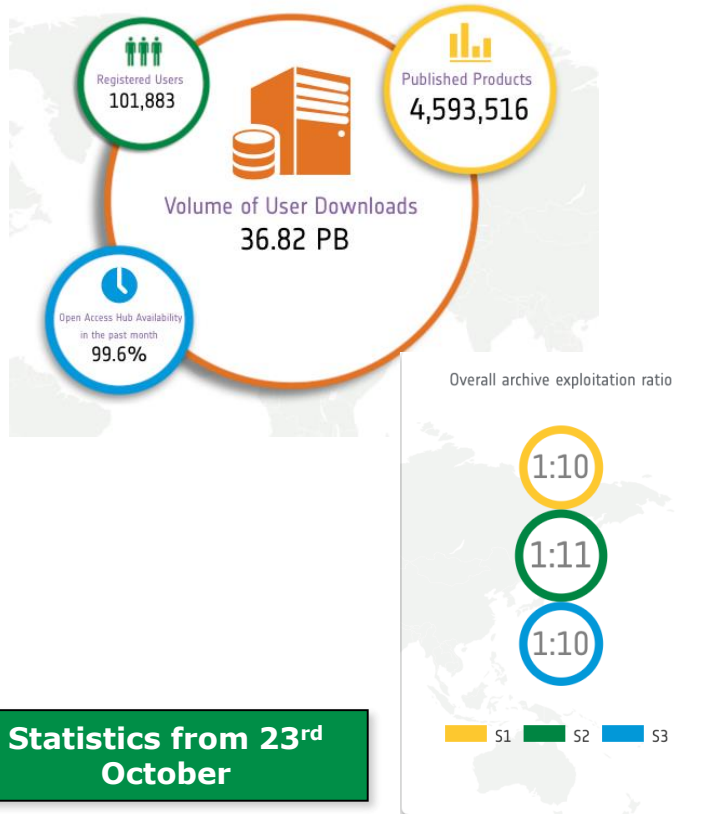
Powerful Programming interface

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European Space Agency

Sentinel Data Dissemination: Statistics



Statistics from 23rd
October

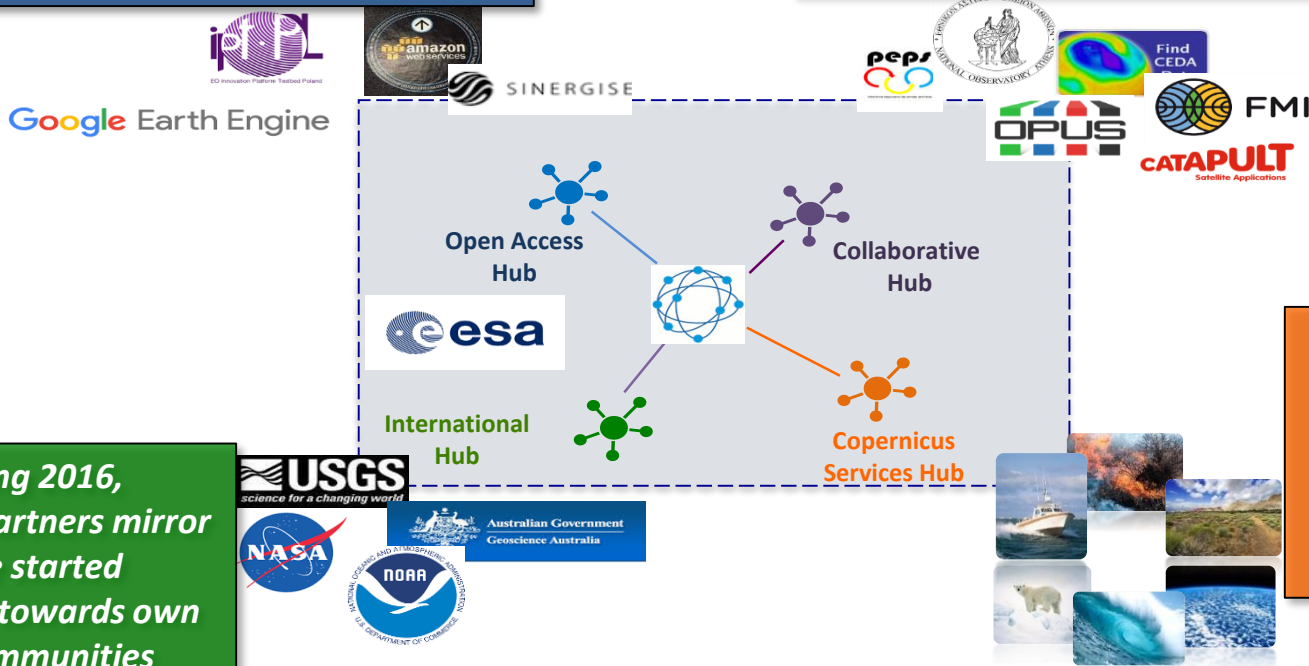
- Complete Sentinel production since **October 2014** is available **on-line**
- Over 200,000 new products each month
- **Over 3 million downloads** to users in a single month
- Volume of products published in year 2016 the equivalent of **50** years of ENVISAT mission data

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Sentinels Products re-dissemination

Large and small private companies are re-distributing Sentinel products via free and pay-per-use schemes

Collaborative mirror sites directly serve more than 3000 users (status end 2016)



As of spring 2016, international partners mirror sites have started disseminating towards own national communities

Copernicus Services are providing their higher level products to approx 10,000 users (status Q1-2016)

ESA Copernicus website
<http://www.esa.int/copernicus>



Interested
in more?



EC Copernicus website
<http://copernicus.eu>

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European Space Agency