



ESA's Earth Observation Programmes

Vienna, 26 May 2014

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Head of Programme Planning & Coordination
Directorate of Earth Observation Programmes

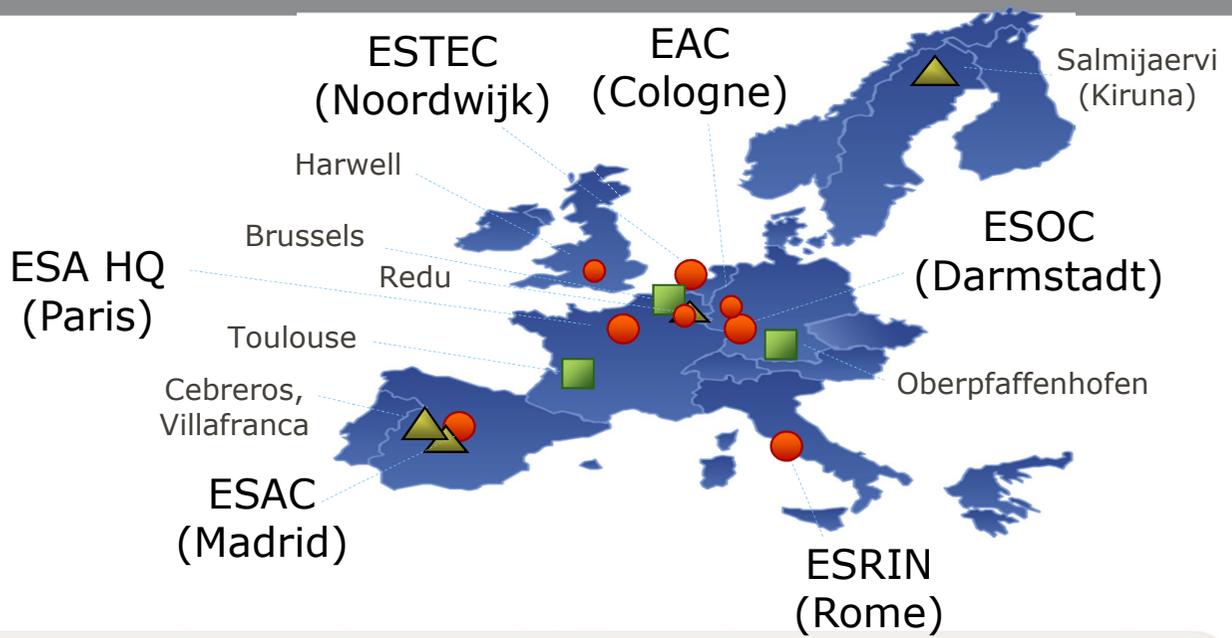
- **50 years celebration in 2014**
- **20 Member States**
- **Five establishments in Europe, about 2200 staff**
- **4,3 billion Euro budget (2013)**
- **Over 70 satellites designed, tested and operated in flight**
- **17 scientific satellites in operation**
- **Six types of launcher developed**



ESA'S LOCATIONS



- ESA sites/facilities
- Offices
- ▲ ESA ground stations

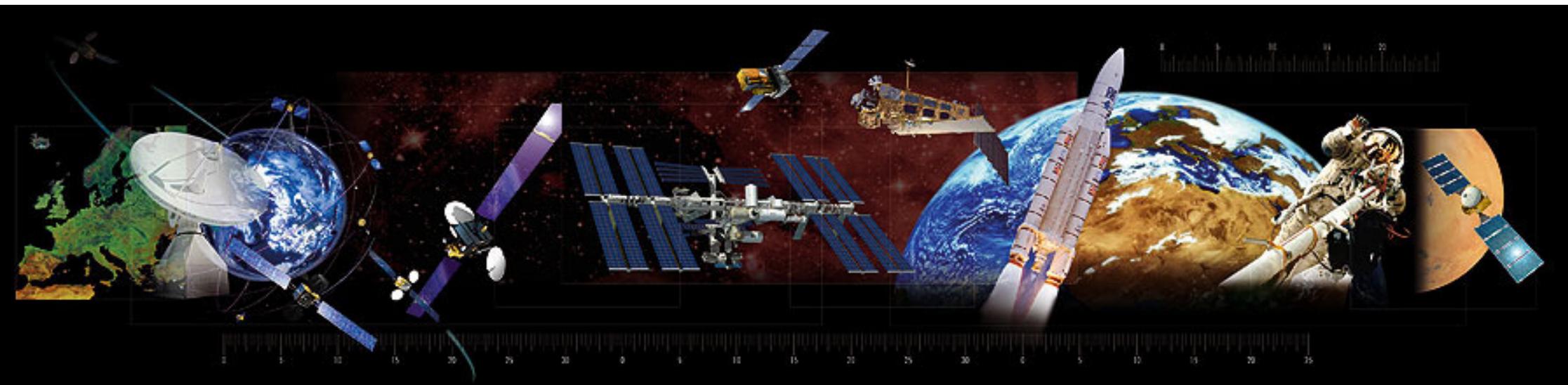


ACTIVITIES



ESA is one of the few space agencies in the world to combine responsibility in nearly all areas of space activity.

- Space science
- Human spaceflight
- Exploration
- **Earth observation**
- Launchers
- Navigation
- Telecommunications
- Technology
- Operations



A New Era of Earth Observation



EO: Tool to tackle global challenges

- Reliable assessment of human activity
- Coverage over space and time
- Long observation intervals
- Large scale observations

First EO Revolution:

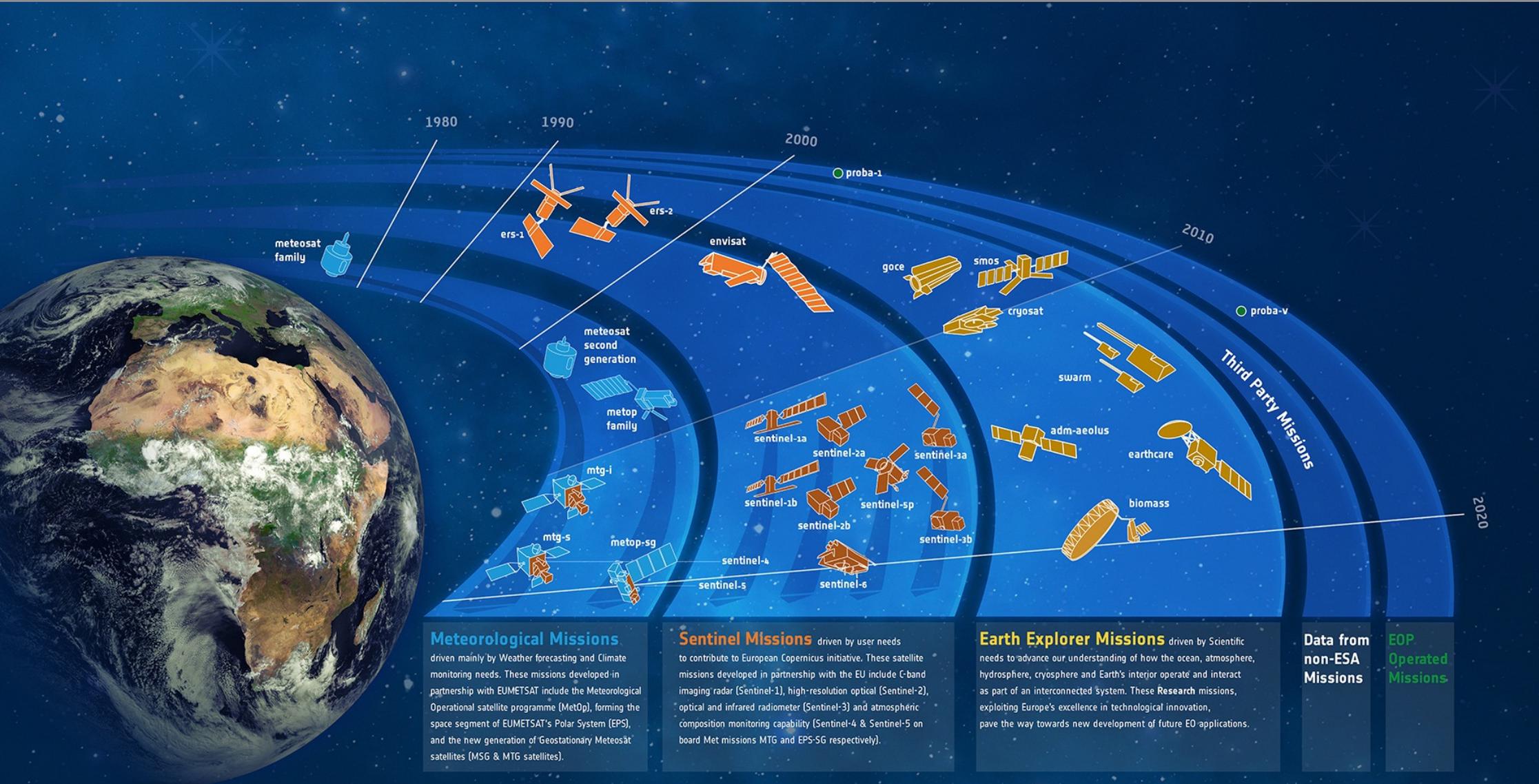
- WWW, broadband data networks, GIS, desktop processing

Second EO Revolution:

- cloud computing, crowd sourcing, big data, new generation mapping tools



ESA Earth Observation Programmes



Copernicus: A New Generation of Data Sources



Sent-1A/B



Sent-2A/B



Sent-3A/B



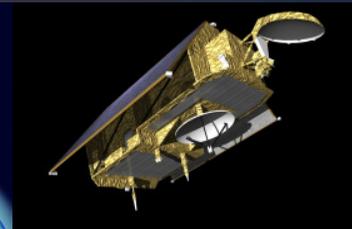
Sent-4A/B



Sent-5A/B/C/5P



Sent-6A/B



- Copernicus is a European space flagship programme led by the European Union
- ESA coordinates the space component
- Copernicus provides decade-long observations for operational, science and commercial users
- Sentinel-1A launched 3 April 2014



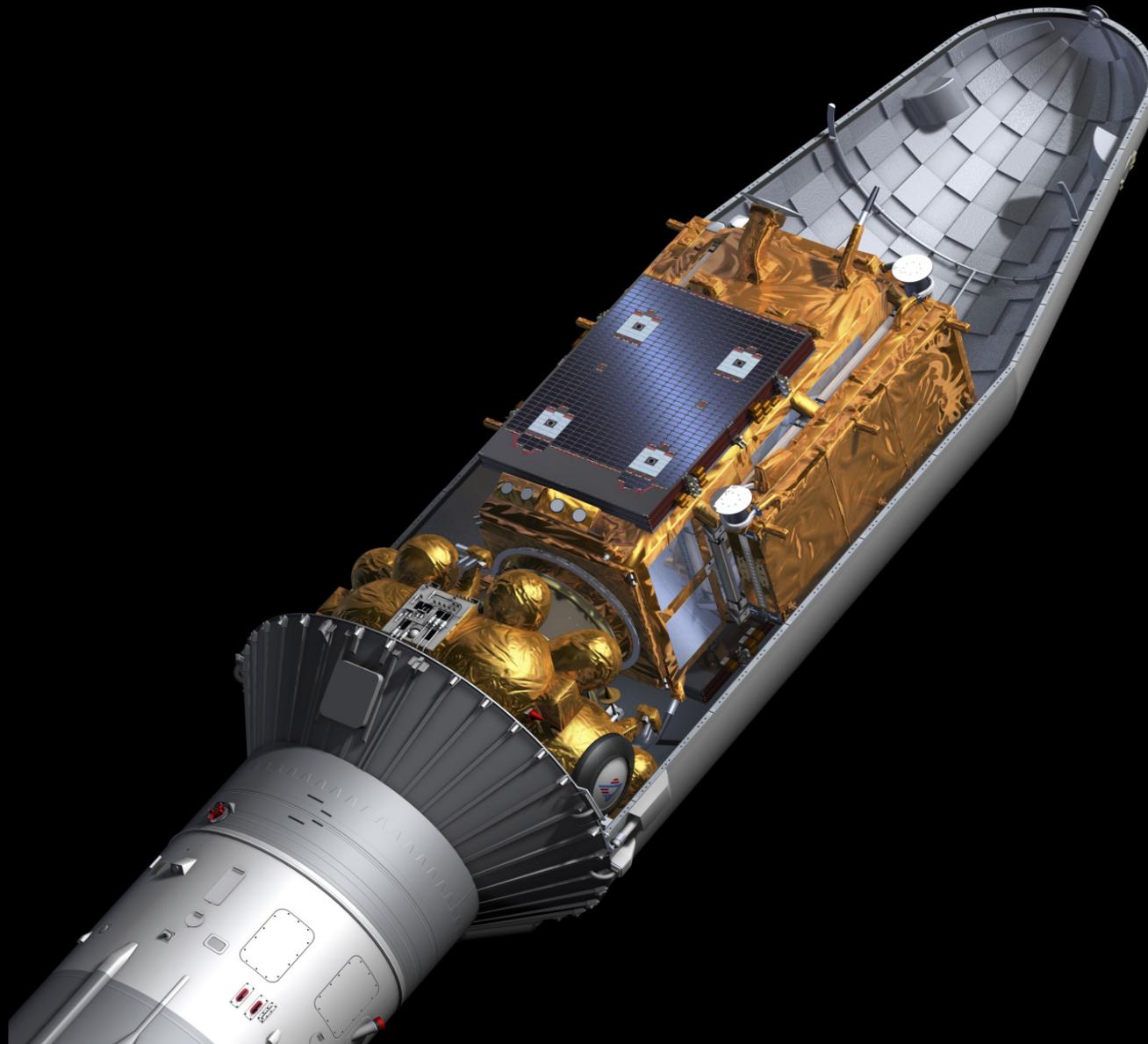
Launch Sentinel-1A



- 3 April 2014
- Kourou spaceport
- Soyuz-2 rocket
- New era of Earth observation



Sentinel-1A in Soyuz



Launch + 3 min 30 seconds

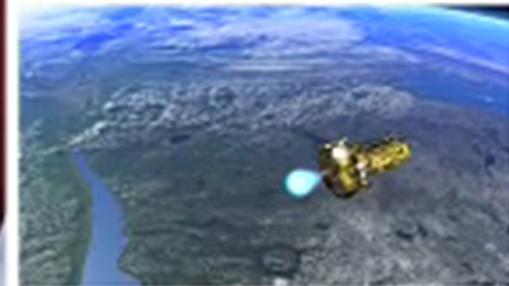
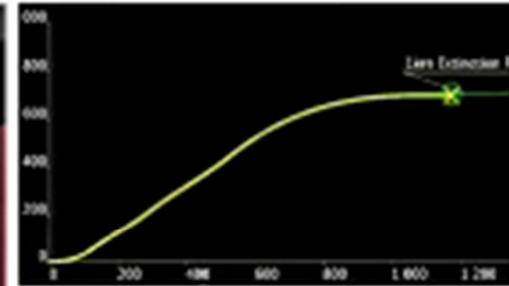


Moments of tension ...



arisatospace HD
service & solutions

19:31



JOSEF ASCHBACHER
Head of Programme Planning & Coordination Service, ESA

Altitude : 695 Km

Distance : 5 313 Km

VS 07

Speed : 7,46 Km/s

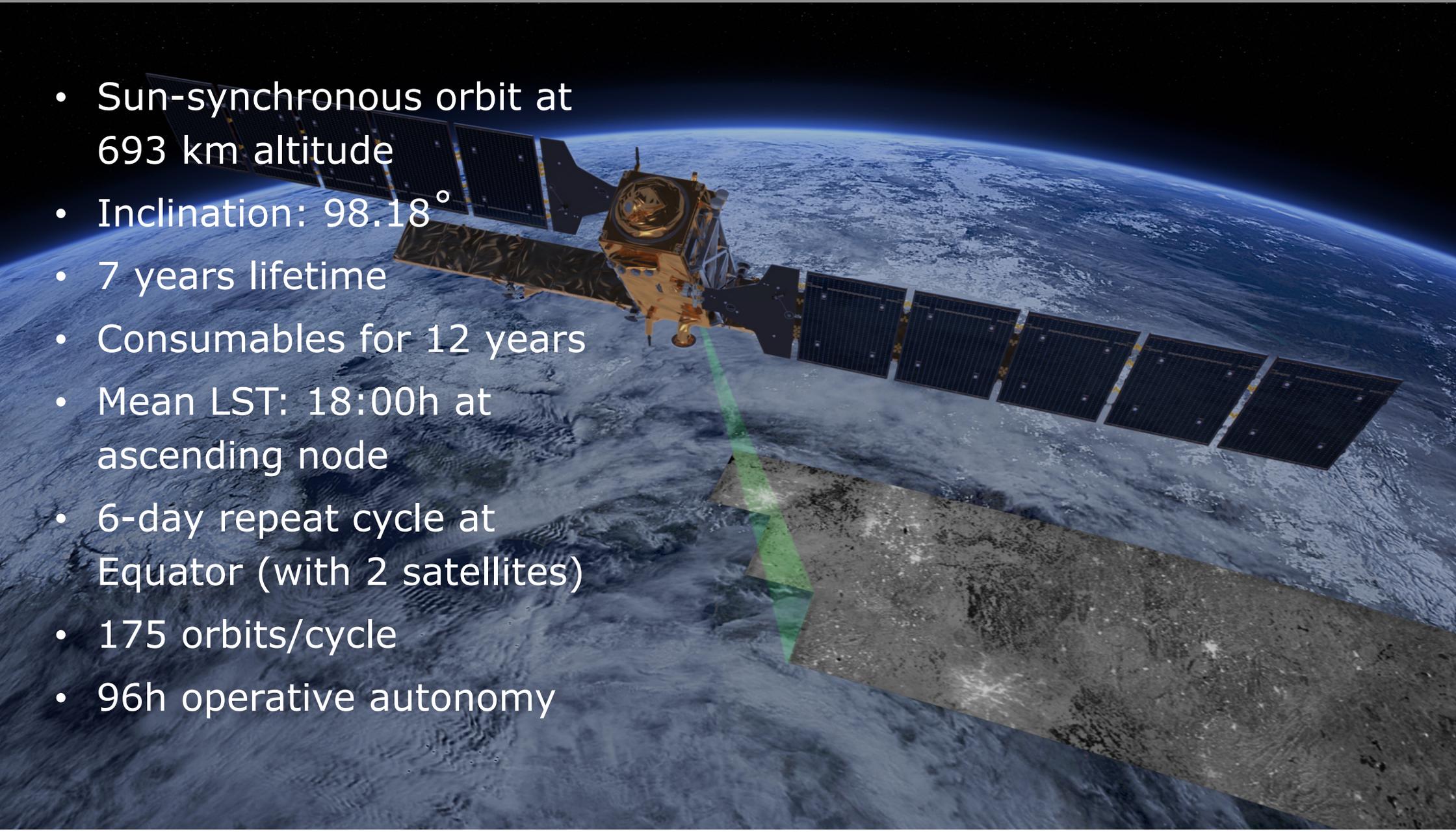
Unfolding in Orbit



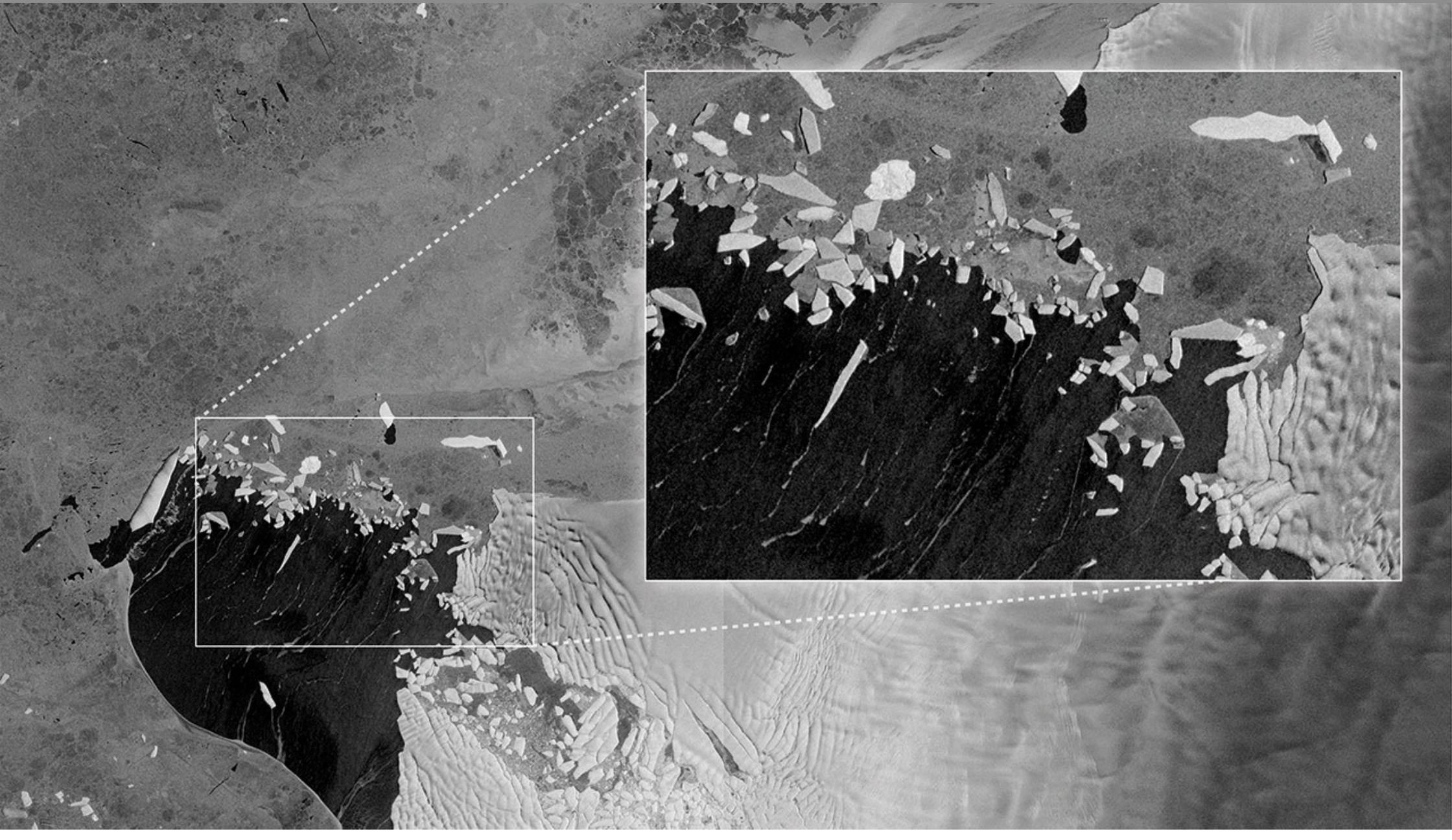
Sentinel-1: Mission Profile



- Sun-synchronous orbit at 693 km altitude
- Inclination: 98.18°
- 7 years lifetime
- Consumables for 12 years
- Mean LST: 18:00h at ascending node
- 6-day repeat cycle at Equator (with 2 satellites)
- 175 orbits/cycle
- 96h operative autonomy



First Images of Sentinel-1A

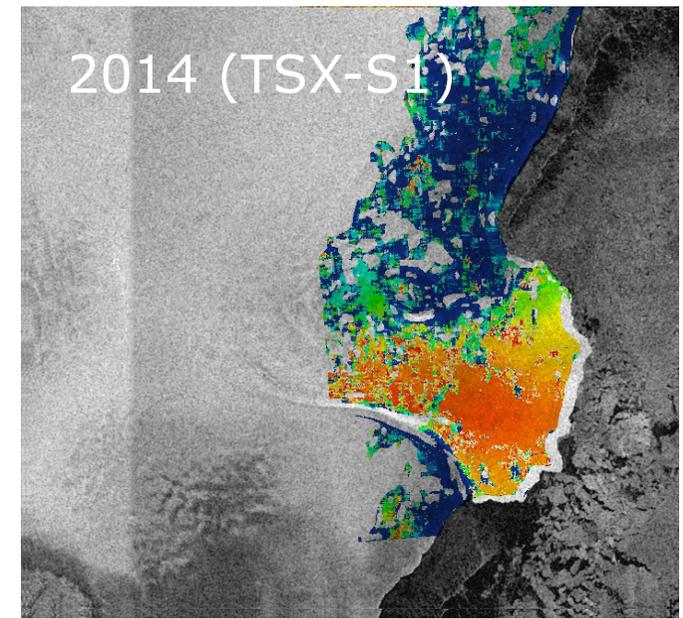
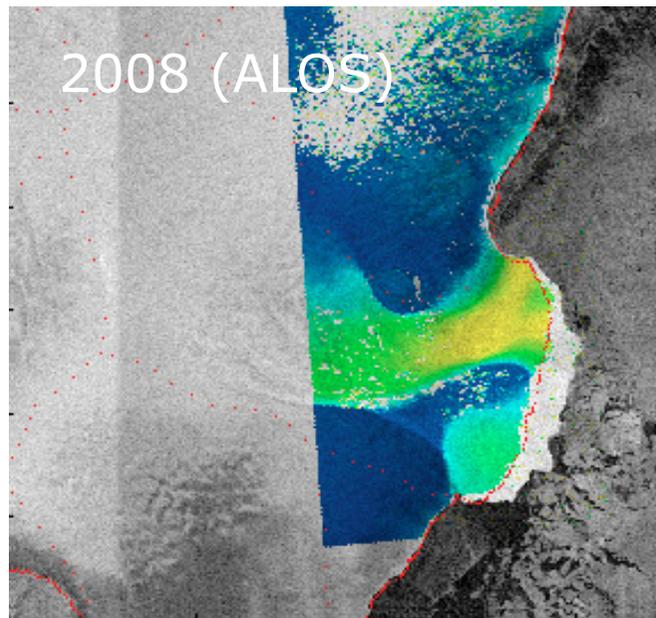
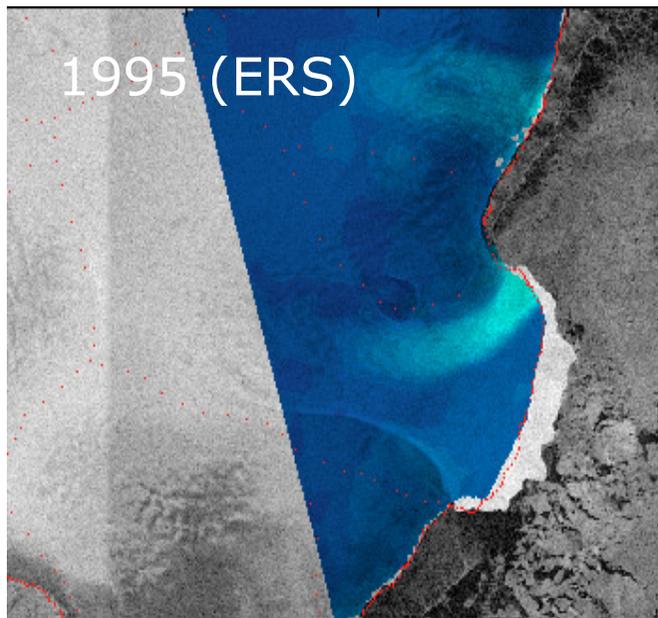


Harbour of Antwerp, Belgium



Past Work with Similar Data

- *Unique (first ever) combination of S1A stripmap and TerraSAR-X SAR data provides first map of Austfonna ice speed in 2014*
- *Data show that glacier at Cap Mohn has experienced a rapid acceleration*



Ice Speed (kilometres per year)



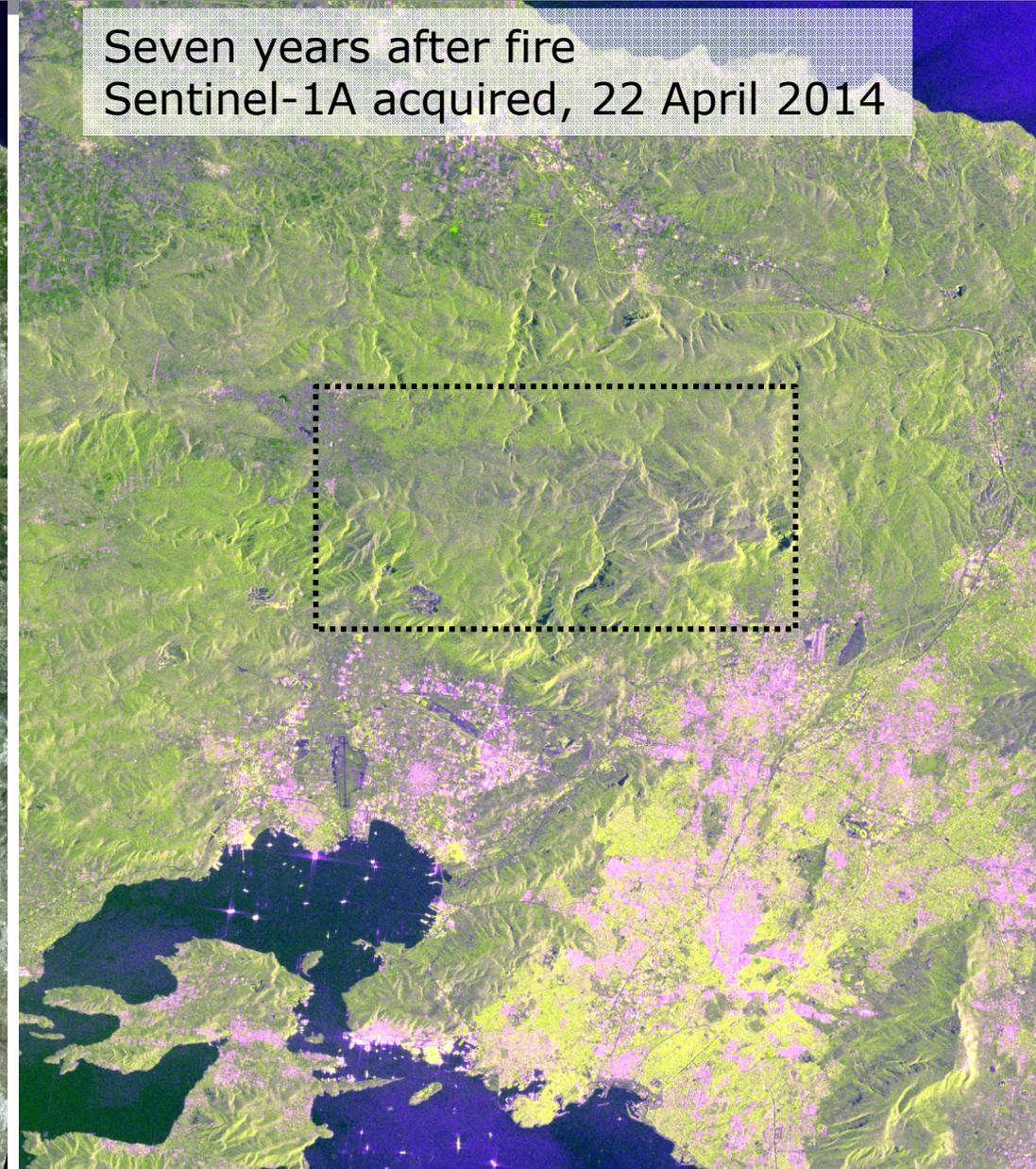
Credit: N. Gourmelen,
University of Edinburgh

Vegetation Generation

A month after fire
ASTER acquired, 20 July 2007



Seven years after fire
Sentinel-1A acquired, 22 April 2014



Sentinel Deployment Schedule



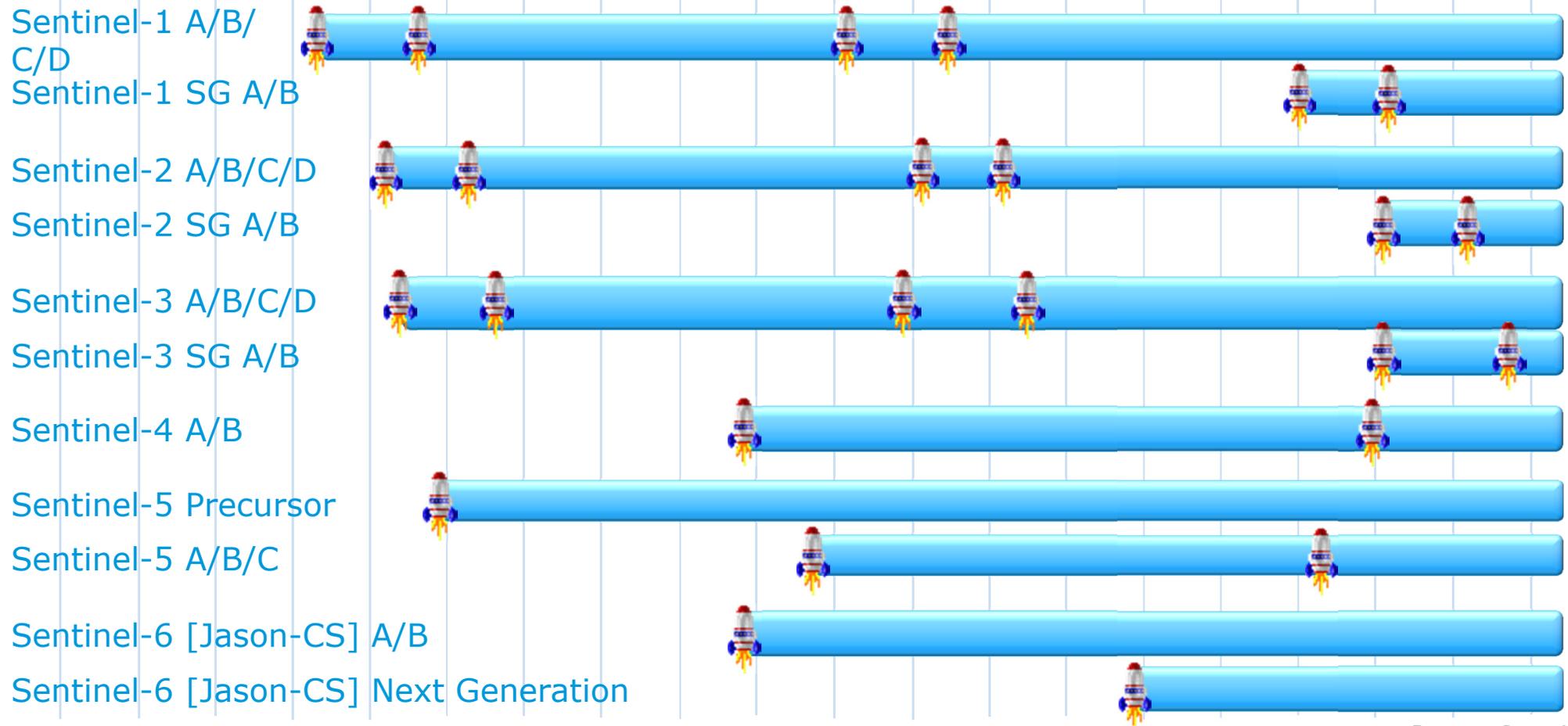
2011

2014

2020

2030

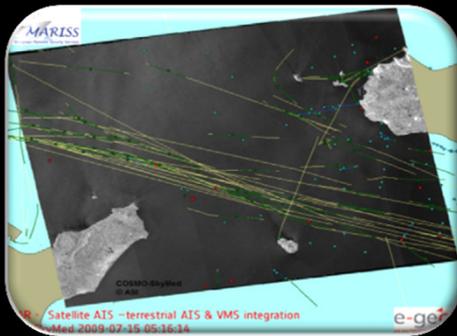
Access to Copernicus Contributing Missions data



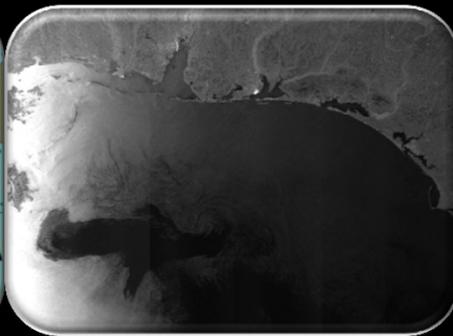
Sentinel Data Policy = **FREE and OPEN access**

- **ESA Sentinel Data Policy** (Sep 2013) and **EU Delegated Act** on Copernicus Data and Information Policy (Dec 2013)
- Main principles of Sentinel data policy:
 - **Open** access to Sentinel data by anybody and for any use
 - **Free** of charge data licenses
 - Restrictions possible due to technical limitations or for security reasons

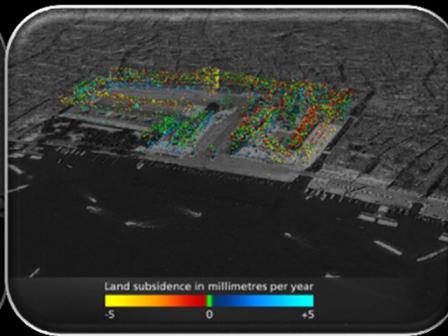
Some Sentinel Application Areas



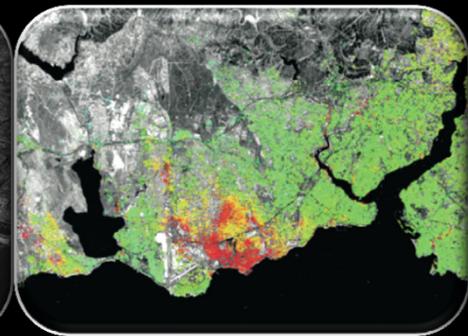
Maritime surveillance



Oil spills



Land subsidence



Tectonics



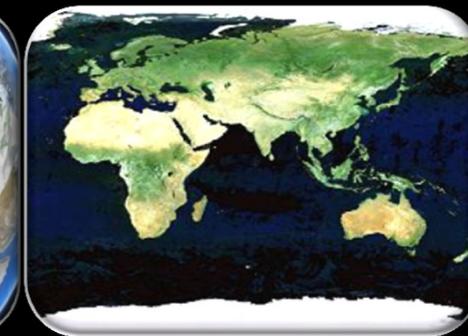
Volcanoes



Floods



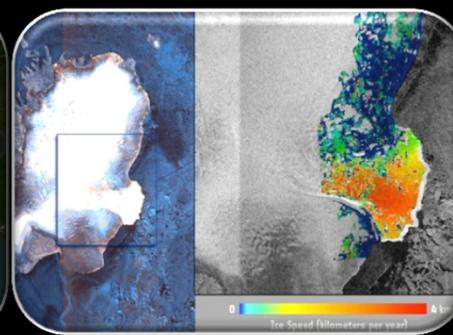
Deforestation



Vegetation



Sea ice extent



Ice speed

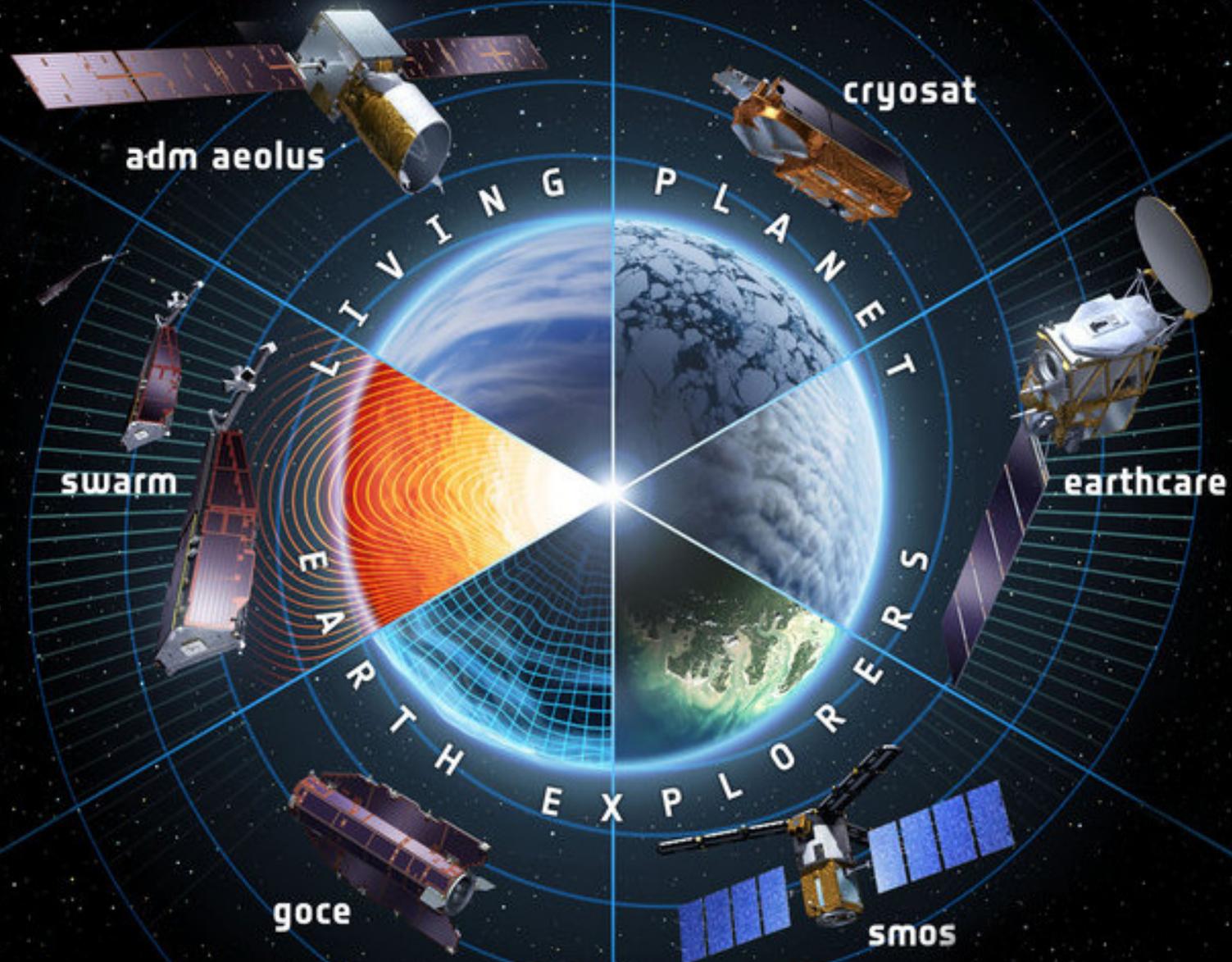


Atmosphere



Ocean colour

Science – the Earth Explorers



Swarm Science Objectives



understanding the weakening of Earth's protective shield

understanding the "Earth's dynamo" in the outer core

mapping magnetic fingerprints in Earth's crust/ Composition of the mantle

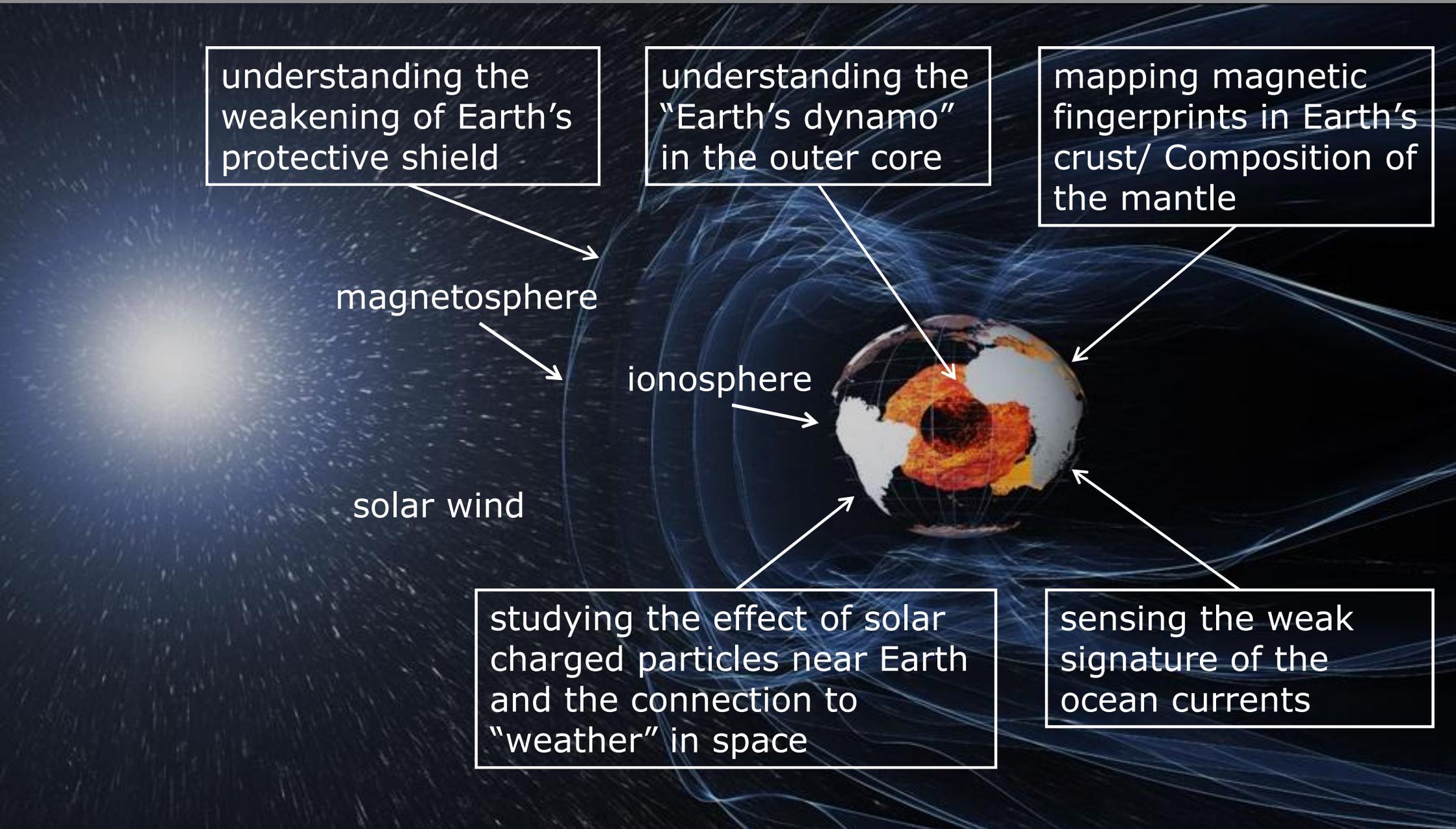
magnetosphere

ionosphere

solar wind

studying the effect of solar charged particles near Earth and the connection to "weather" in space

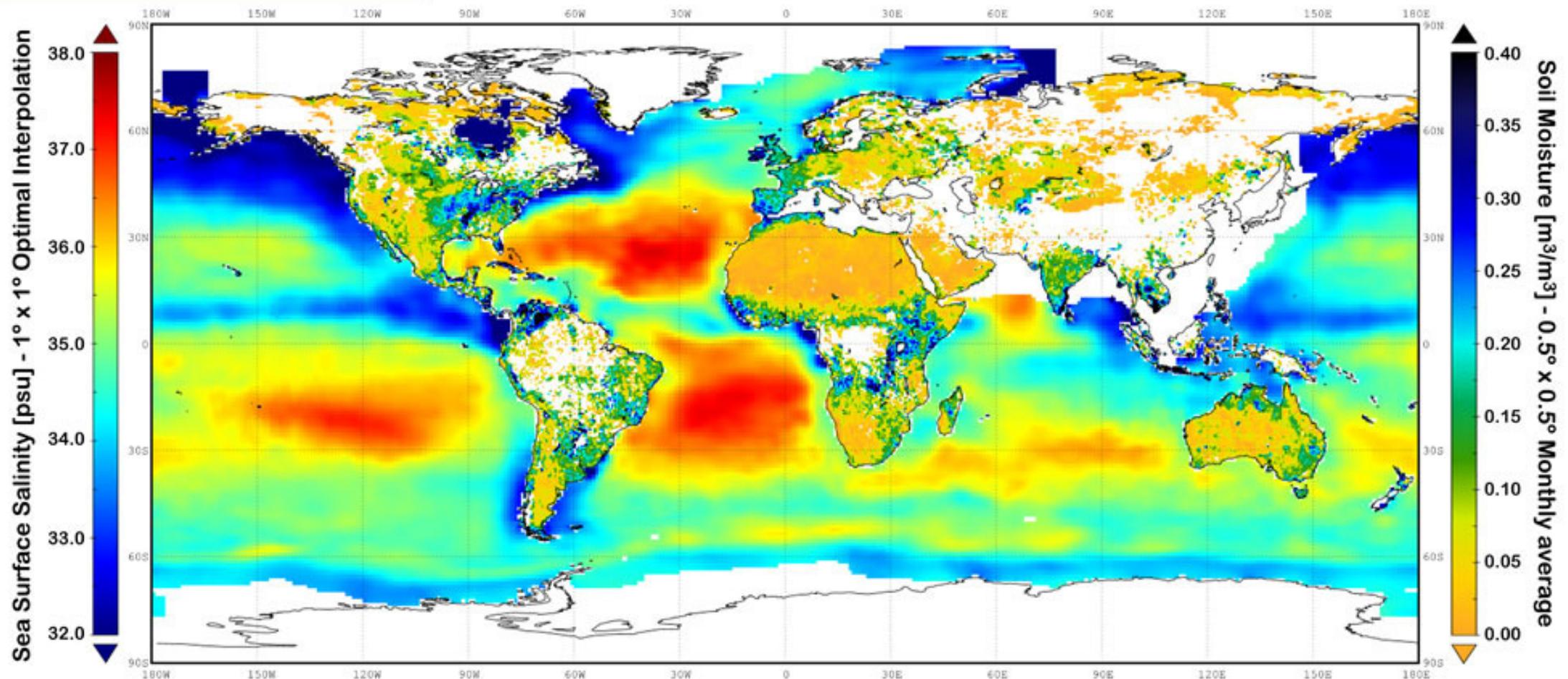
sensing the weak signature of the ocean currents



SMOS Measurements



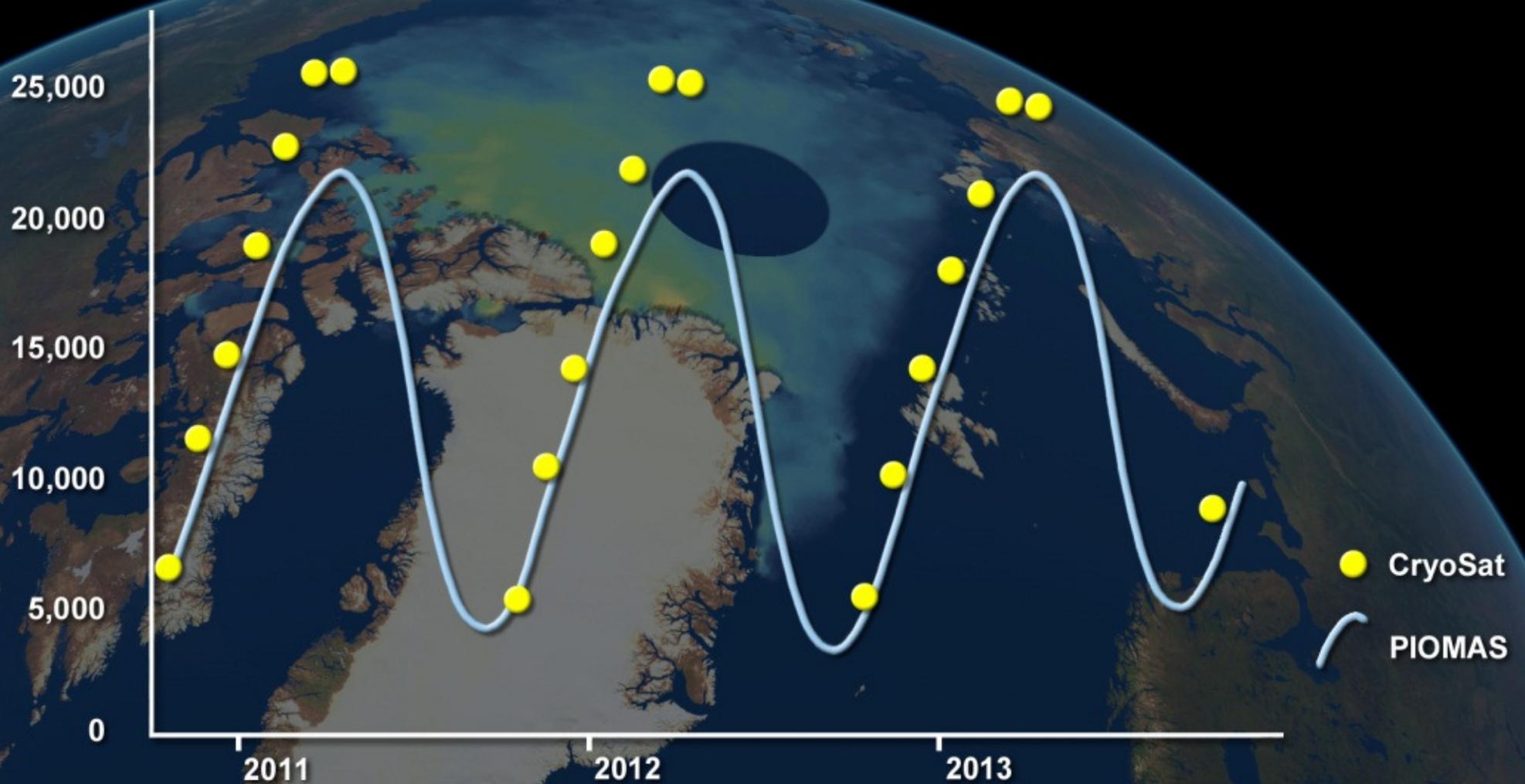
Sea Surface Salinity and Soil Moisture November 2011



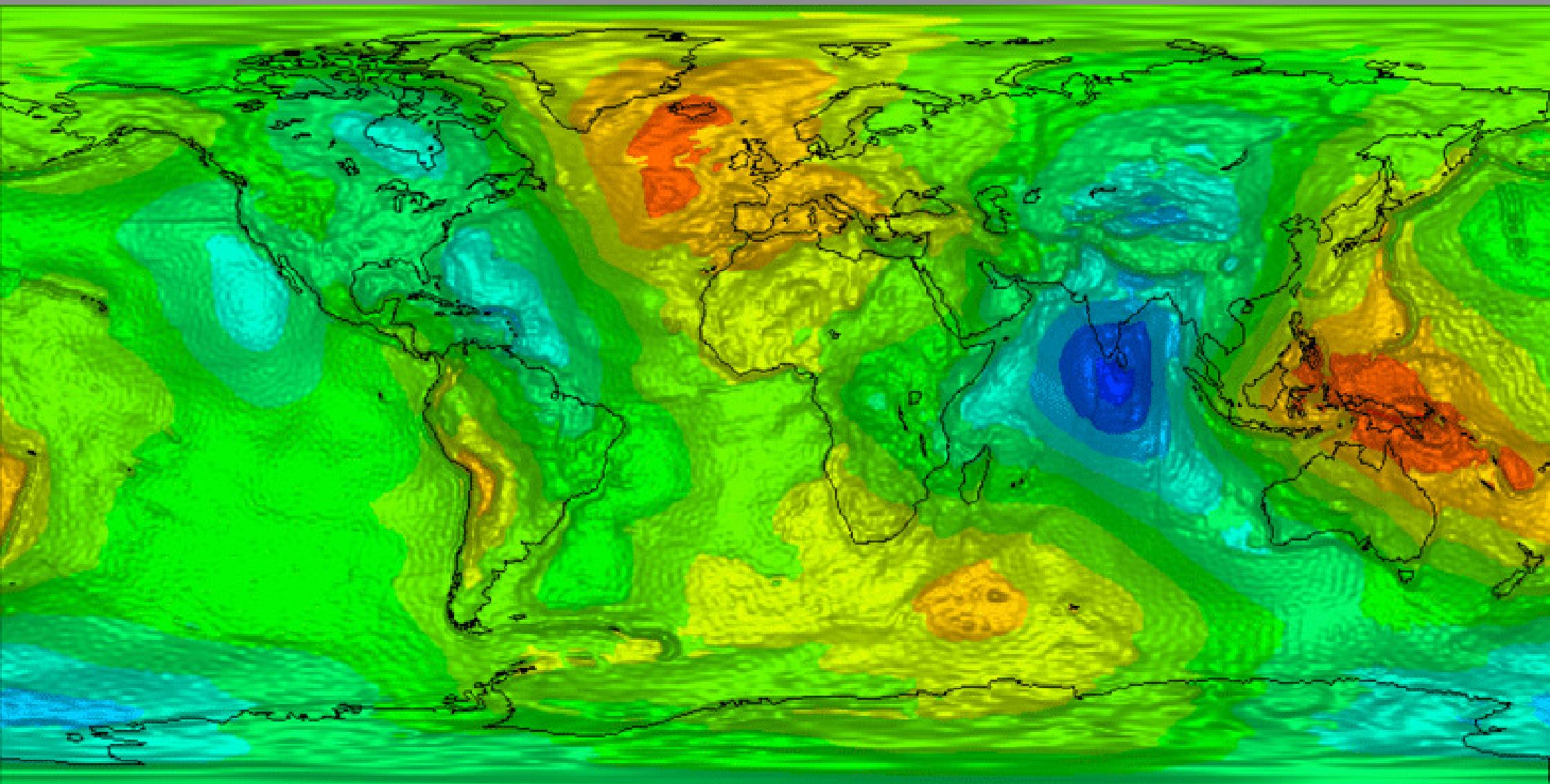
Equiangular projection centered on 0.00°E

CryoSat: The Ice Mission

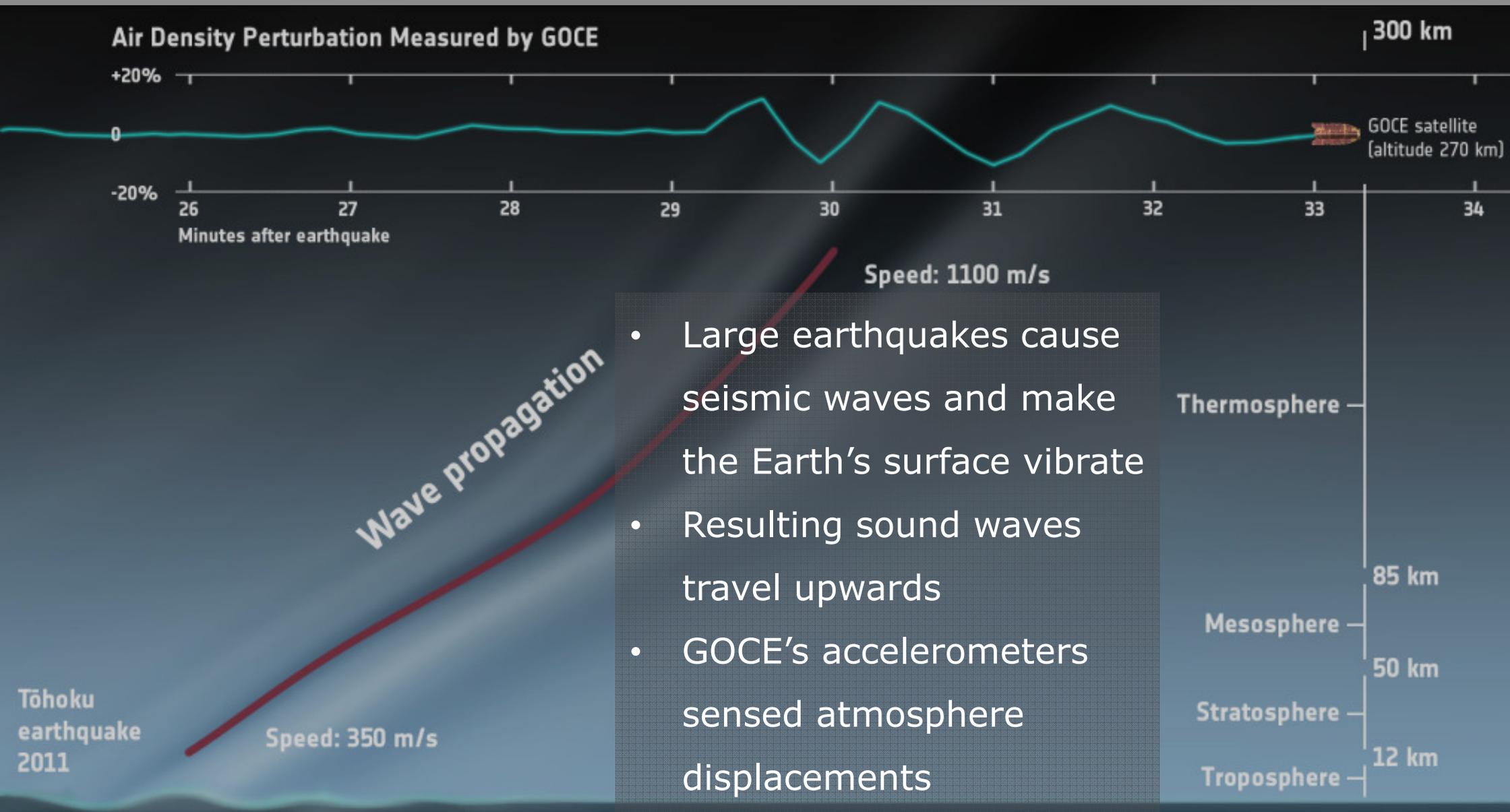
Arctic Sea Ice Volume
(cubic km)



GOCE: Geoid in 2D



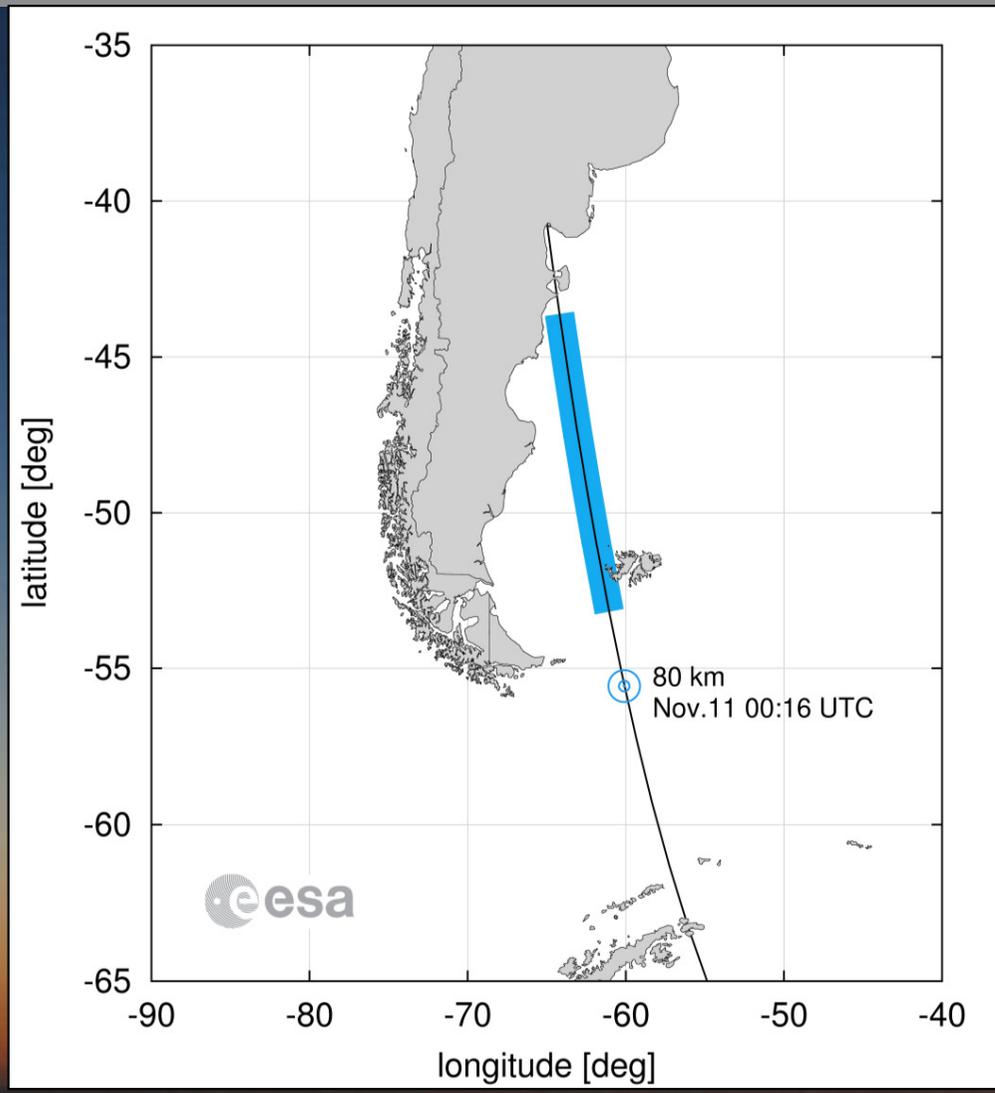
GOCE: Seismometer in Space



GOCE Re-Entry 11 November 2013



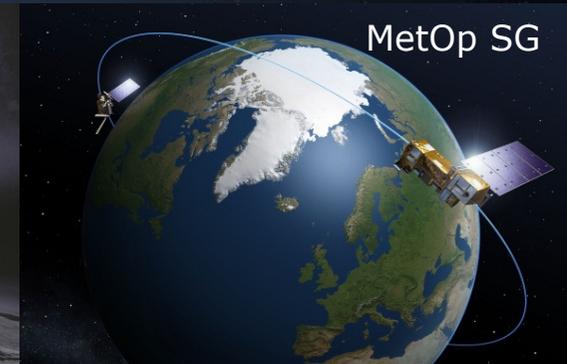
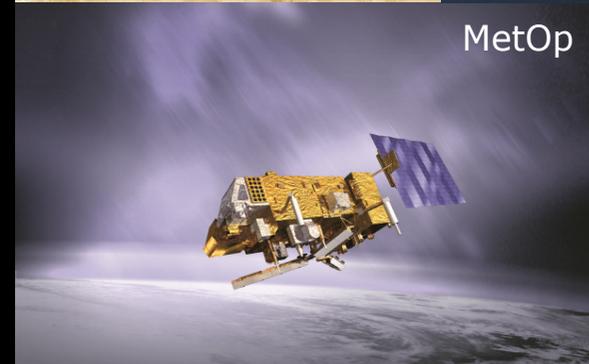
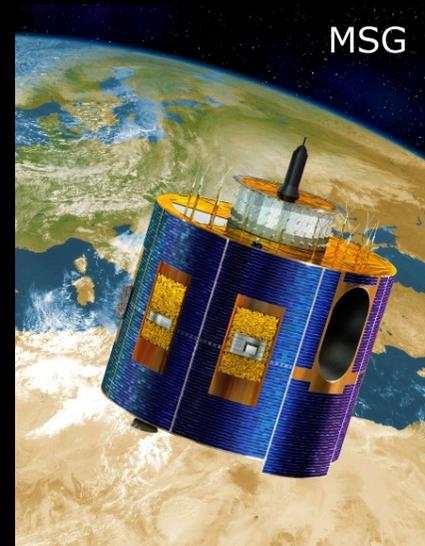
- As seen from the Falkland Islands...



Meteorological missions



- ESA develops prototype satellites and, on behalf of EUMETSAT, procures recurrent satellites
- EUMETSAT procures launchers and LEOP services
- EUMETSAT operates the satellites
- Currently Meteosat Second Generation (MSG) missions in GEO and MetOp missions in LEO
- MeteoSat Third Generation (MTG) and MetOp Second Generation under development



Thank you!

