Status report on the current and future satellite systems by ESA

Presented to CGMS-40 plenary session, agenda item III.3

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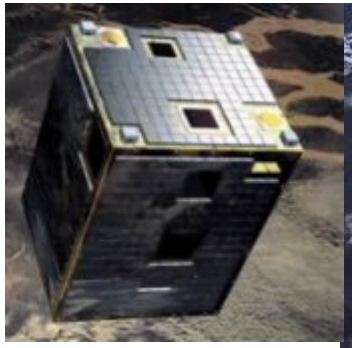
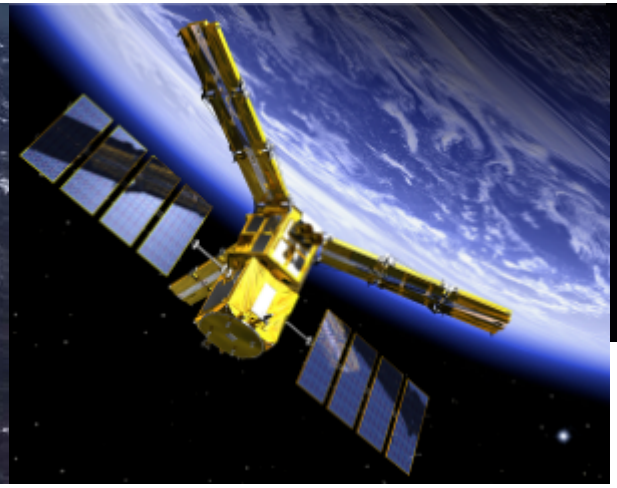
Overview of ESA current satellite systems

- Four ESA missions currently in operation (plus seven missions operated by EUMETSAT)
- > 4,000 Envisat data user projects worldwide in > 70 countries, > 100 Terabytes of data per year, 30 partner mission data disseminated to European users

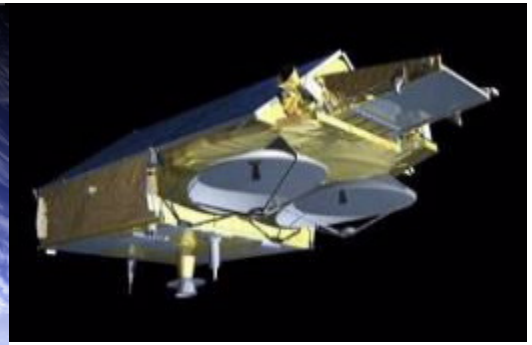


PROBA

GOCE

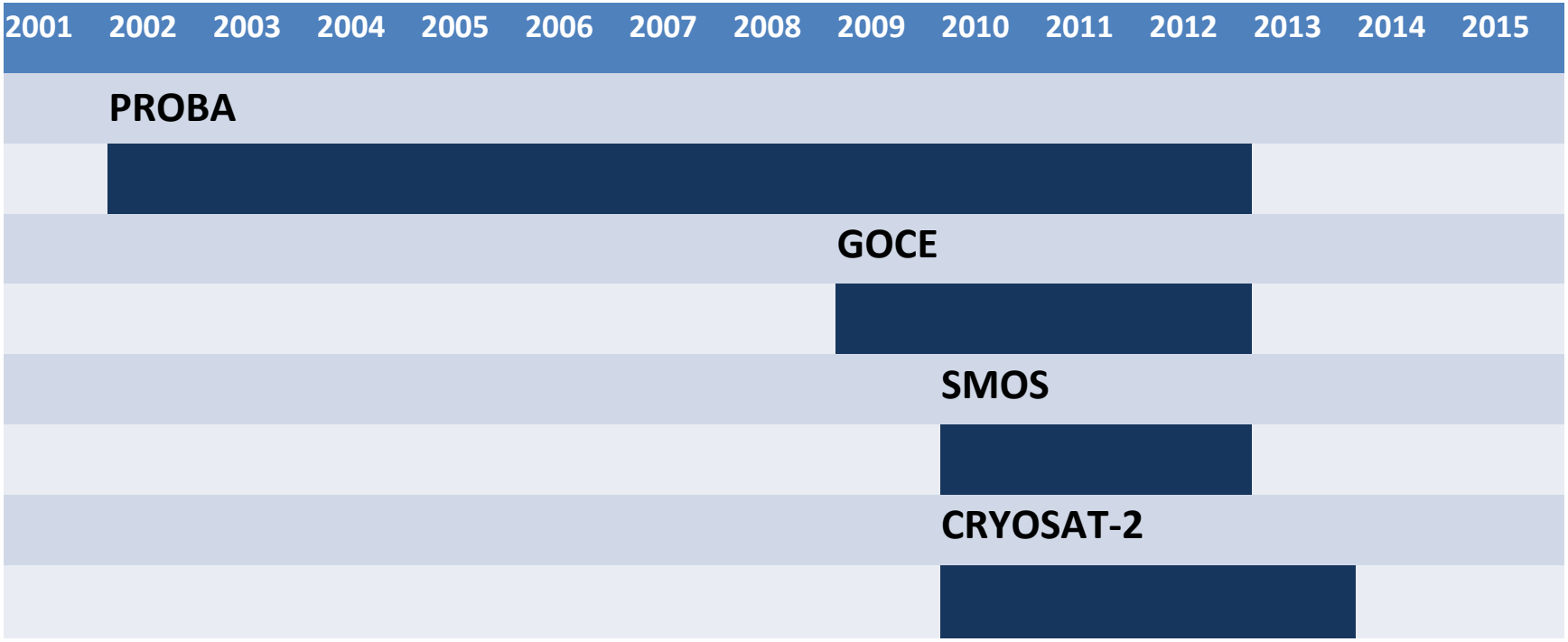


SMOS



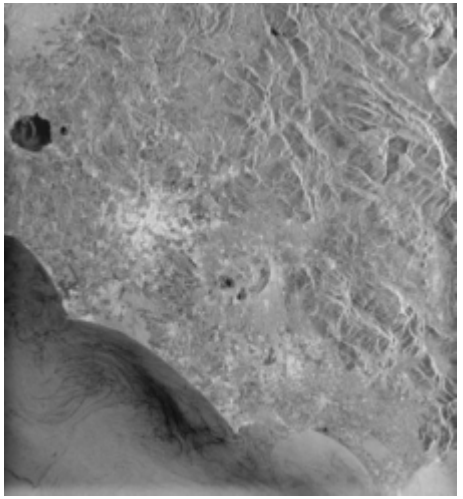
CryoSat

ESA CURRENT MISSIONS TIMELINE

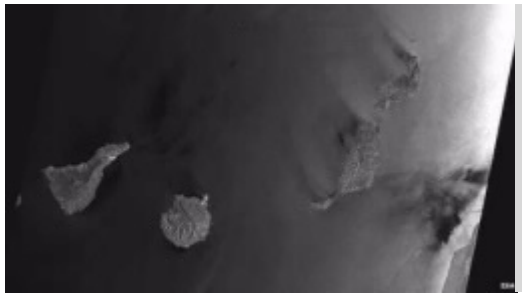


CURRENT R&D SATELLITES

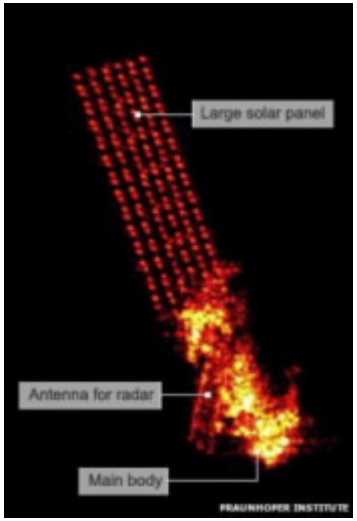
- **ERS-2** mission inactivated on 5 September 2011, after 20 years of ERS-1/ERS-2 operations
- **Envisat** stopped sending data to Earth on 8 April 2012, after 10 years of operation
- **Proba-1**: 10-yr anniversary
- **GOCE** nominal 2-yr mission completed in March 2011
- **SMOS** RFI situation improving
- **CryoSat-2** first Sea ice thickness map presented in June 2011



Final ERS-2 SAR image taken over Rome, Italy



Last data transmitted from Envisat: SAR image of Spain's Canary Islands



Radar image of Envisat taken from the ground

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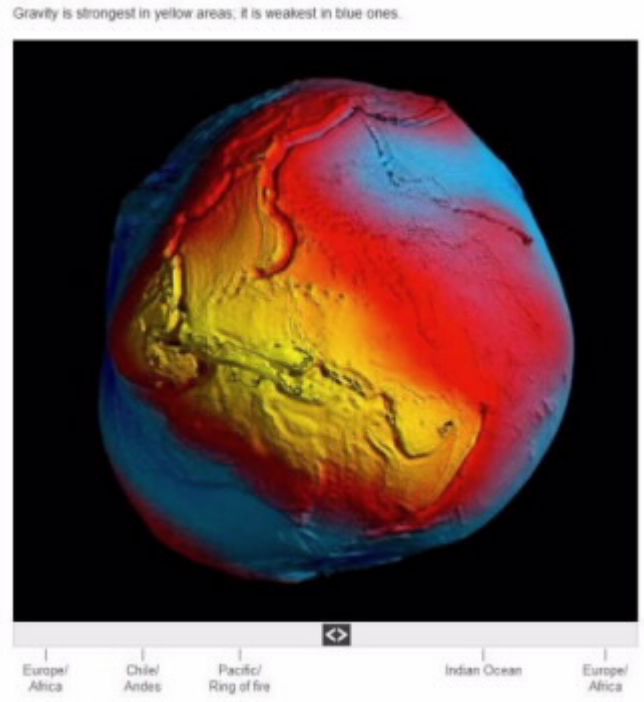
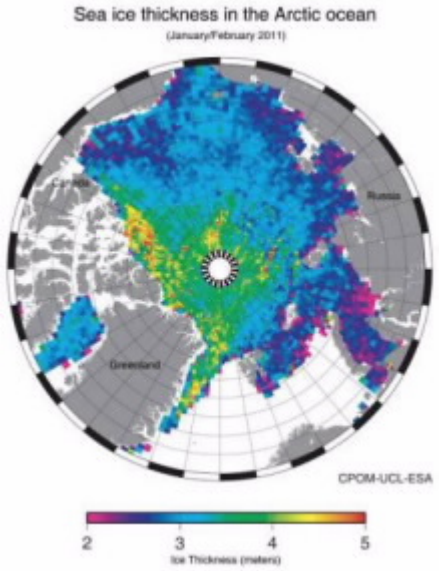
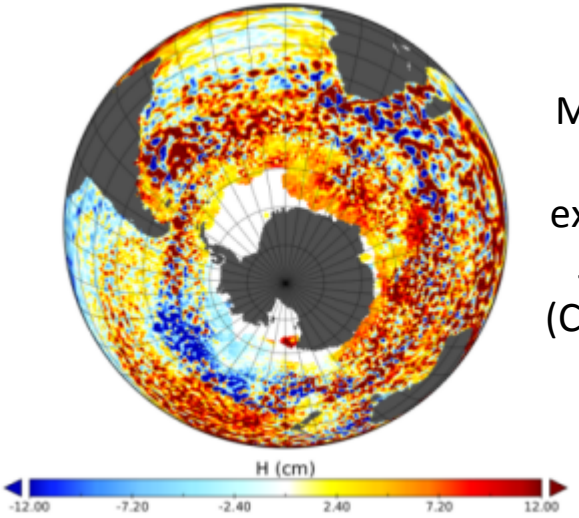
HIGHLIGHTS FROM GOCE AND CRYOSAT







Multi-mission map of Sea Level Anomalies on 2012/01/01 exploiting 4 altimeters: Jason-2, Jason-1, Envisat and CryoSat (Credits: *Cnes*-Ssalto/*Duacs-Esa)*

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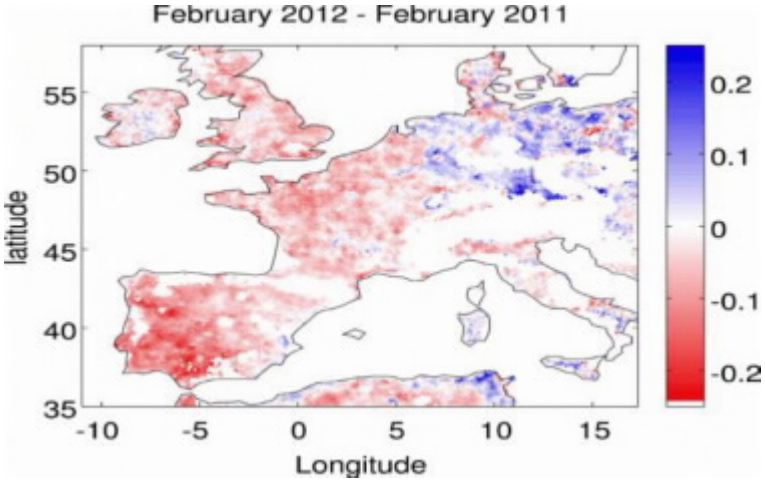
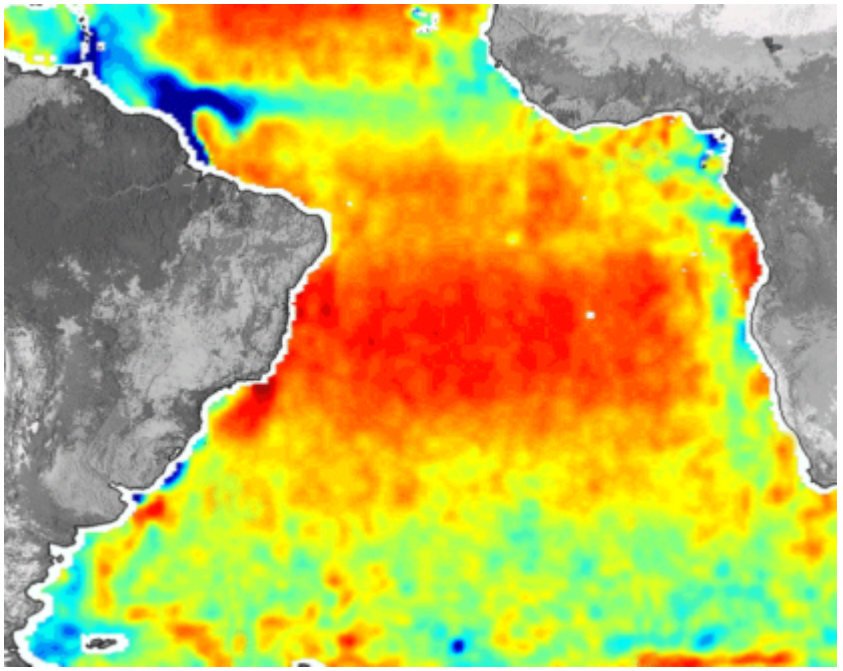
HIGHLIGHTS FROM SMOS



Difference in soil moisture in Europe from February 2012 and 2011. The red color (negative values) indicates 2012 is dryer than February 2011, while the blue depicts more soil moisture in 2012 than in 2011 (Credits: CESBIO/ESA)



SMOS is now approaching its objective of 0.1 psu accuracy for a 10–30 day average, over an open ocean area of 200 km x 200 km

FUTURE R&D SATELLITES

- Two main lines of missions
  - Earth Explorers: research-oriented missions
    - Core missions: (GOCE), ADM-Aeolus, EarthCARE
    - Opportunity missions: (SMOS, CryoSat-2), SWARM
  - Earth Watch: operational missions
    - MTG and Post-EPS (now named EPS-SG) in cooperation with Eumetsat
    - GMES Space Component: the Sentinels

OVERVIEW OF ESA FUTURE SATELLITE SYSTEMS

EARTH EXPLORERS

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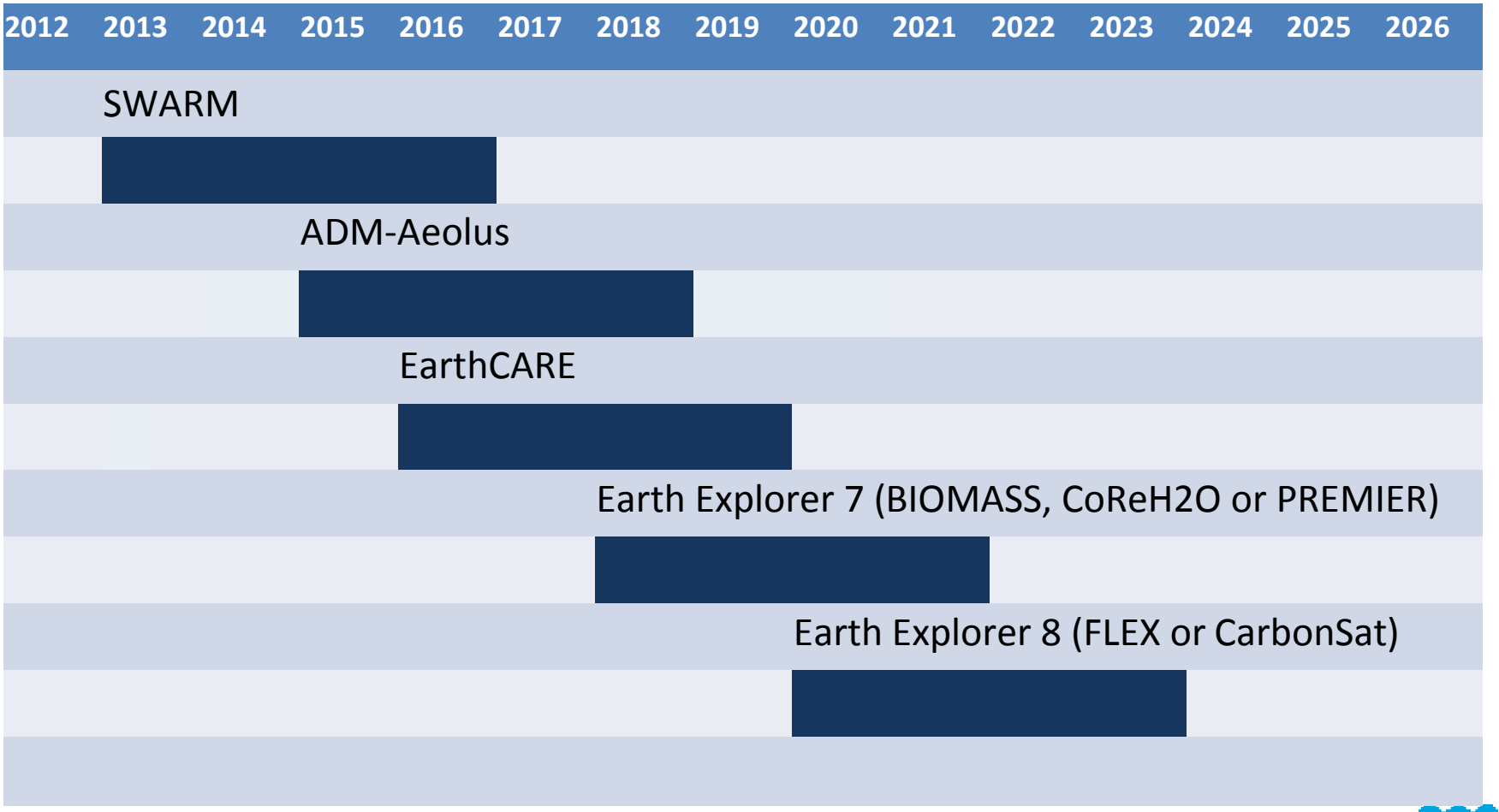
EARTH EXPLORER FUTURE MISSIONS TIMELINE



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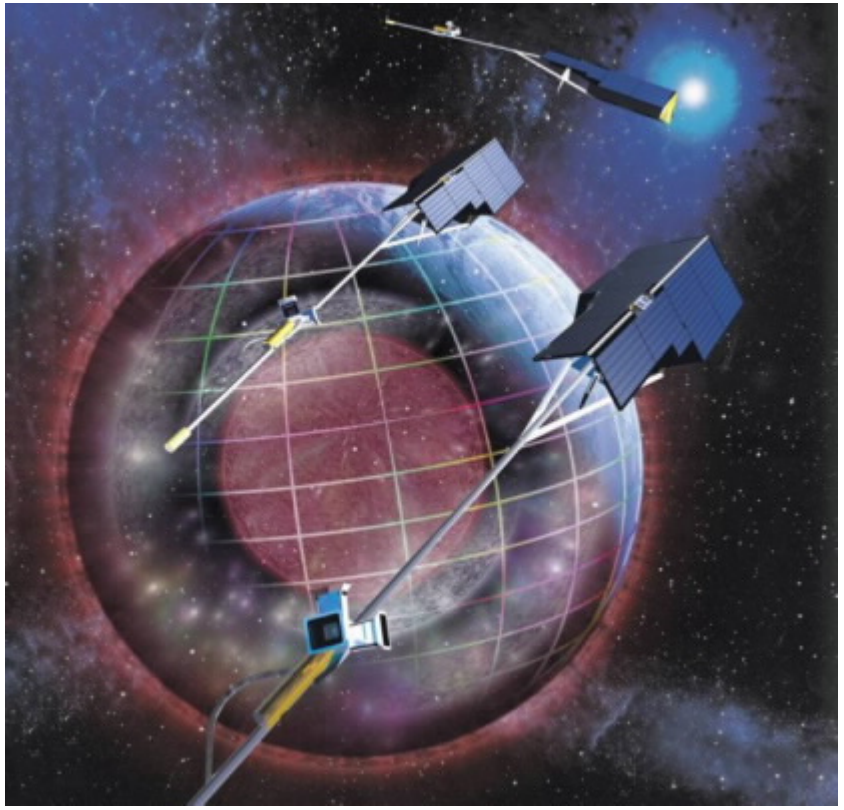
SWARM – ESA'S MAGNETIC FIELD MISSION

- Goals
  - to provide the best-ever survey of the Earth's geomagnetic field and its variation in time
  - to gain new insight of the Earth's interior and climate
- Status
  - Satellites manufacturing, components integration and testing ongoing
  - GS development progressing
  - Launch scheduled for November 2012



ADM-AEOLUS – ESA'S WIND MISSION

- Goals
  - to provide global observations of wind profiles from space
  - to improve the quality of weather forecasts and our understanding of atmospheric and climate processes
- Status
  - Implementation of the continuous mode of the ALADIN instrument ongoing
  - Satellite platform back in storage
  - Satellite acceptance review planned by January 2014

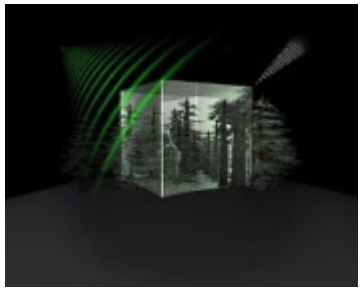
EarthCARE – ESA'S AEROSOL MISSION

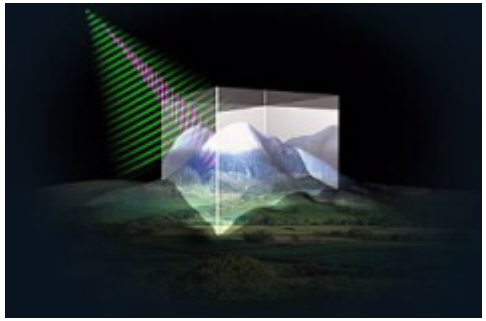
- Goals
  - A better understanding of the interactions between cloud, radiative and aerosol processes that play a role in climate regulation.
- Status
  - EarthCARE independent assessment concluded
  - Preparation of Phase C/D

EARTH EXPLORER 7 STATUS

Industrial Phase A system studies for the 3 missions are progressing well and have passed the stage of the Preliminary Concept Review

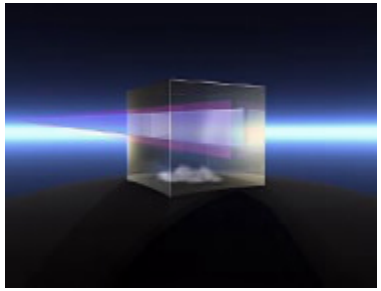
- **BIOMASS:** single satellite carrying a P-band SAR to provide continuous global interferometric and polarimetric radar observations of forested areas



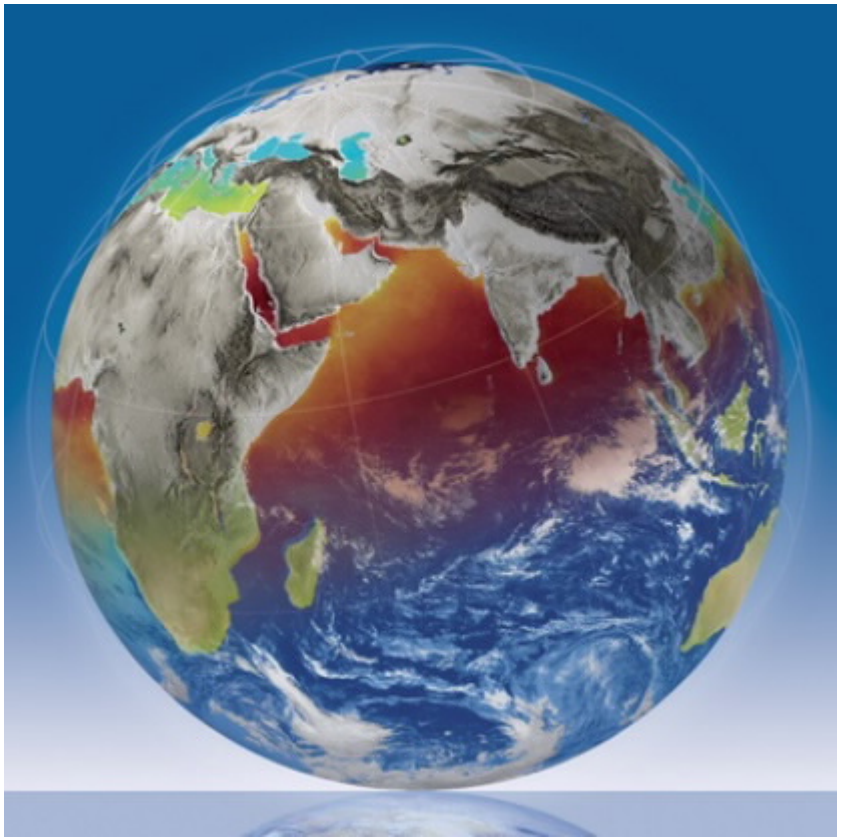


- **CoReH2O / Snow mission:** single satellite with dual-frequency (X, Ku), dual-polarisation SAR to observe snow/ice at high spatial resolution

- **PREMIER:** 3-D fields of atmospheric composition in upper troposphere and lower stratosphere with an infrared limb-imaging spectrometer and a mm-wave limb sounder



EARTH EXPLORER 8 STATUS



- The procurement process for the Phase A/B1 activities for both mission candidates has started
  - **FLEX**: to provide global maps of vegetation fluorescence, which can be converted into an indicator of photosynthetic activity, in order to improve our understanding of how much carbon is stored in plants and their role in the carbon and water cycles
  - **CarbonSat**: to quantify and monitor the distribution of carbon dioxide and methane for a better understanding of the sources and sinks of these two gases and how they are linked to climate change

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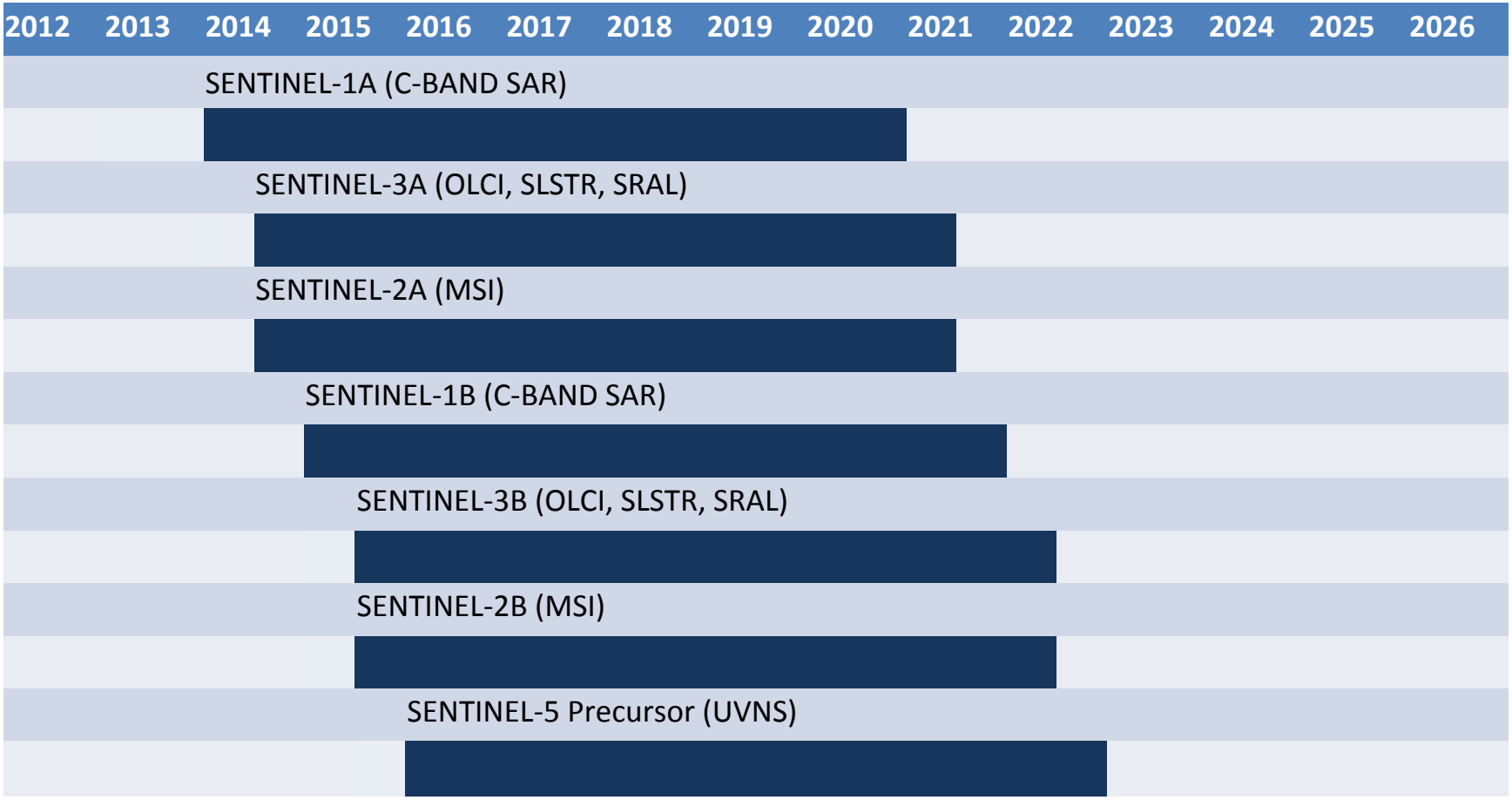
OVERVIEW OF ESA FUTURE SATELLITE SYSTEMS

EARTH WATCH FUTURE MISSIONS TIMELINE



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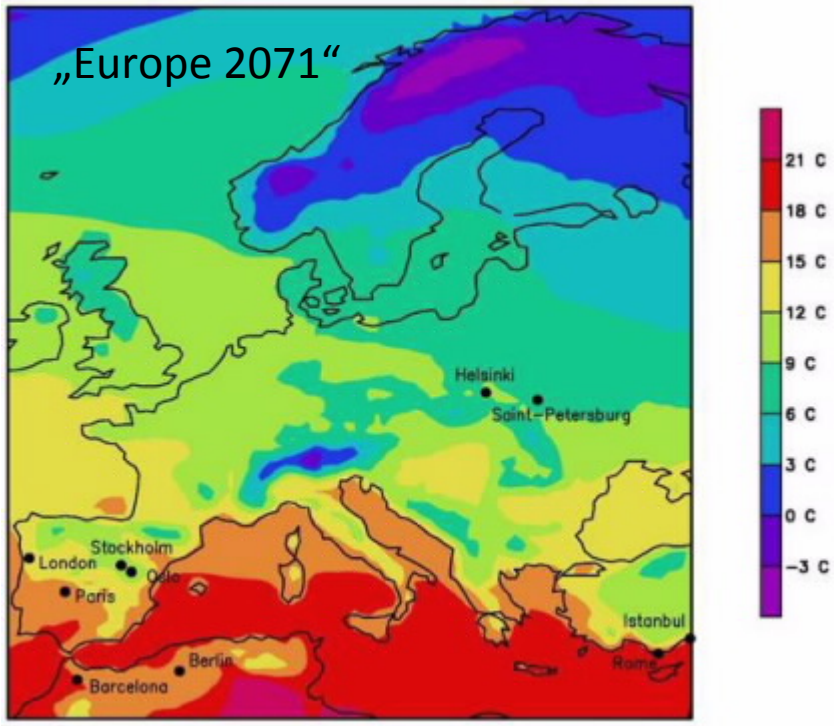
SENTINEL STATUS

- The Sentinel satellites (1A/B, 2A/B, 3A/B, 4 and 5 “Precursor“) are under development, Sentinel-5 under definition
- Sentinel-1
  - Phase D activities
- Sentinel-2/3
  - Phase C/D activities
- Sentinel-4
  - Instrument configuration swap on MTG-S
- The ground segment (data reception, processing and distribution) being implemented
- Sustainability of operational GMES is the biggest political challenge
- ESA Member States have adopted a FREE and OPEN data policy for the Sentinel missions

THE ESA CLIMATE CHANGE INITIATIVE

- 13 selected ECVs addressed in Phase 1
  - All CCI teams have now established robust and detailed user requirements
  - Most teams have also completed the first version of the Product Specifications
  - Scientific interactions with CMUG and different CCI project teams continue to develop fruitfully
  - International coordination is progressing constructively, both within Europe and internationally via the recently established CEOS WGClimate

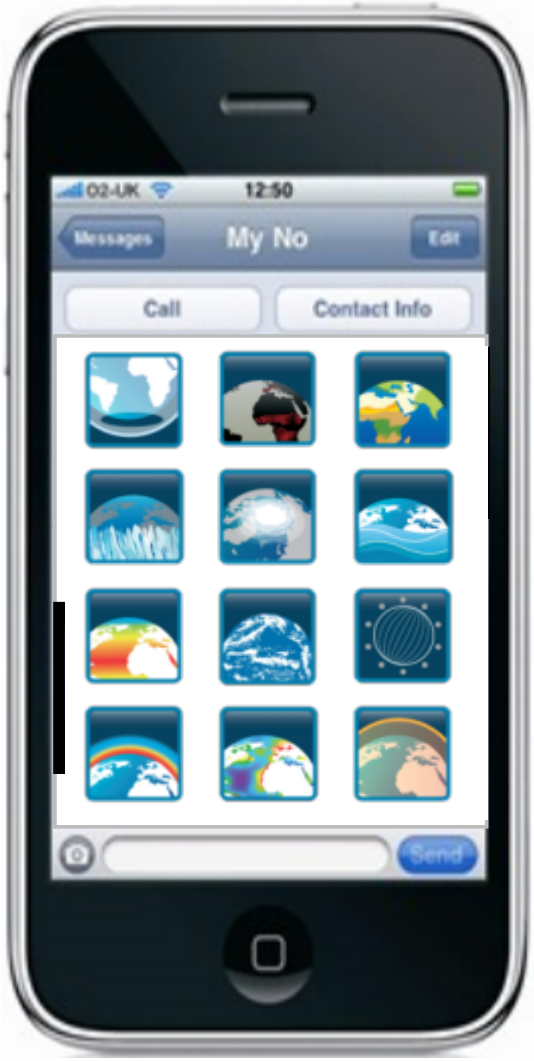


Centre International de Recherche sur l'Environnement et le Développement and Ecole Nationale de la Météorologie, Météo-France (Source: guardian.co.uk)

THE CCI THIRTEEN ESSENTIAL CLIMATE VARIABLES

http://www.esa-cci.org

- Aerosol
- Clouds
- Fire
- GHGs
- Glaciers
- Ice sheets
- Land cover
- Ocean Colour
- Ozone
- Sea Ice
- Sea Level
- Sea Surface Temperature
- Soil Moisture



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KEY ISSUES OF RELEVANCE TO CGMS

- Earth Observation programmes for C-MIN 2012
  - Fourth Period of the Envelope Programme (EOEP-4)
  - MetOp Second Generation
  - GMES Next Programmatic Period
    - Jason-CS
    - Sentinel-5
    - GMES Space Component Coordination and Studies Activities
    - Further activities related to adaptation and Ground Segment coordination
  - Level of Resources Elements
    - Earthnet
    - Long Term Data Preservation