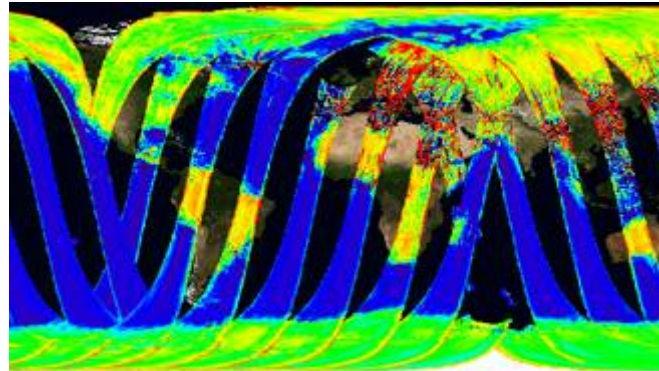
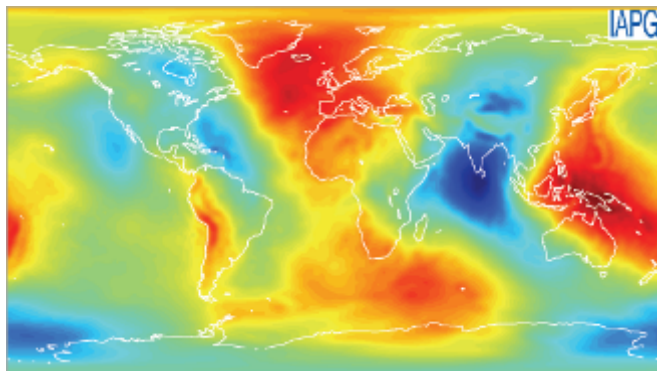


# ESA Earth Observation Programmes



**ESA EO Info Day, Bucharest, 13 March 2013**

**Maurice Borgeaud**

**Head of the Department "Science, Applications, and Future Missions"**

# PURPOSE OF ESA



“To provide for and promote, for exclusively peaceful purposes, cooperation among European states in **space research** and **technology** and their **space applications**.”



## Article 2 of ESA Convention

# ESA FACTS AND FIGURES



- **Over 40 years of experience**
- **20 Member States**
- **Five establishments in Europe, about 2200 staff**
- **4 billion Euro budget (2012)**
- **Over 70 satellites designed, tested and operated in flight**
- **17 scientific satellites in operation**
- **Six types of launcher developed**
- **Celebrated the 200<sup>th</sup> launch of Ariane in February 2011**



# 20 MEMBER STATES AND GROWING



**ESA has 20 Member States: 18 states of the EU (AT, BE, CZ, DE, DK, ES, FI, FR, IT, GR, IE, LU, NL, PO, PT, RO, SE, UK) plus Norway and Switzerland.**

Eight other EU states have Cooperation Agreements with ESA: Estonia, Slovenia, Poland, Hungary, Cyprus, Latvia, Lithuania and the Slovak Republic. Bulgaria and Malta are negotiating Cooperation Agreements.

Canada takes part in some programmes under a Cooperation Agreement.

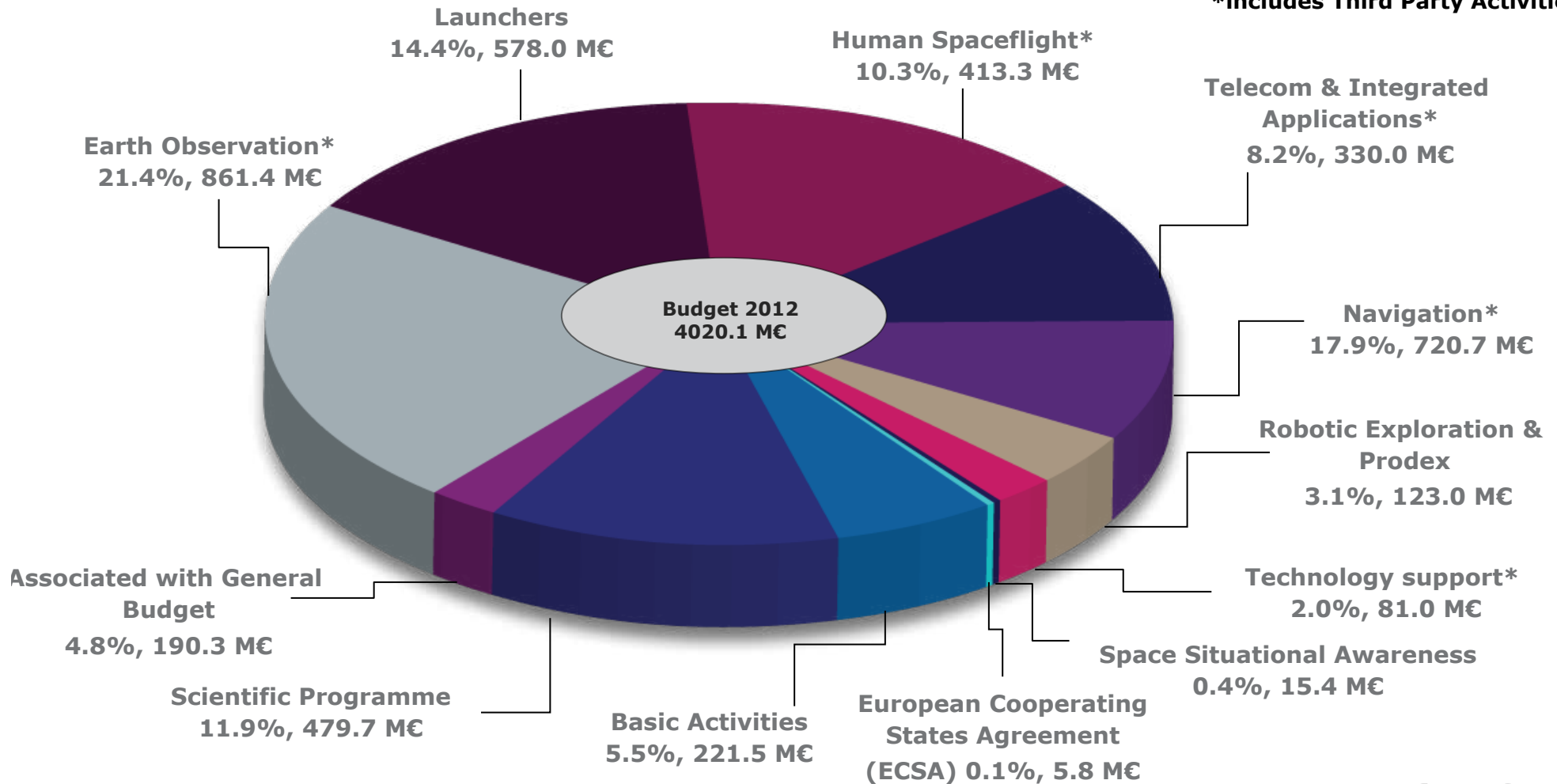


# ESA 2012 BUDGET BY DOMAIN



**M€: Million Euro**

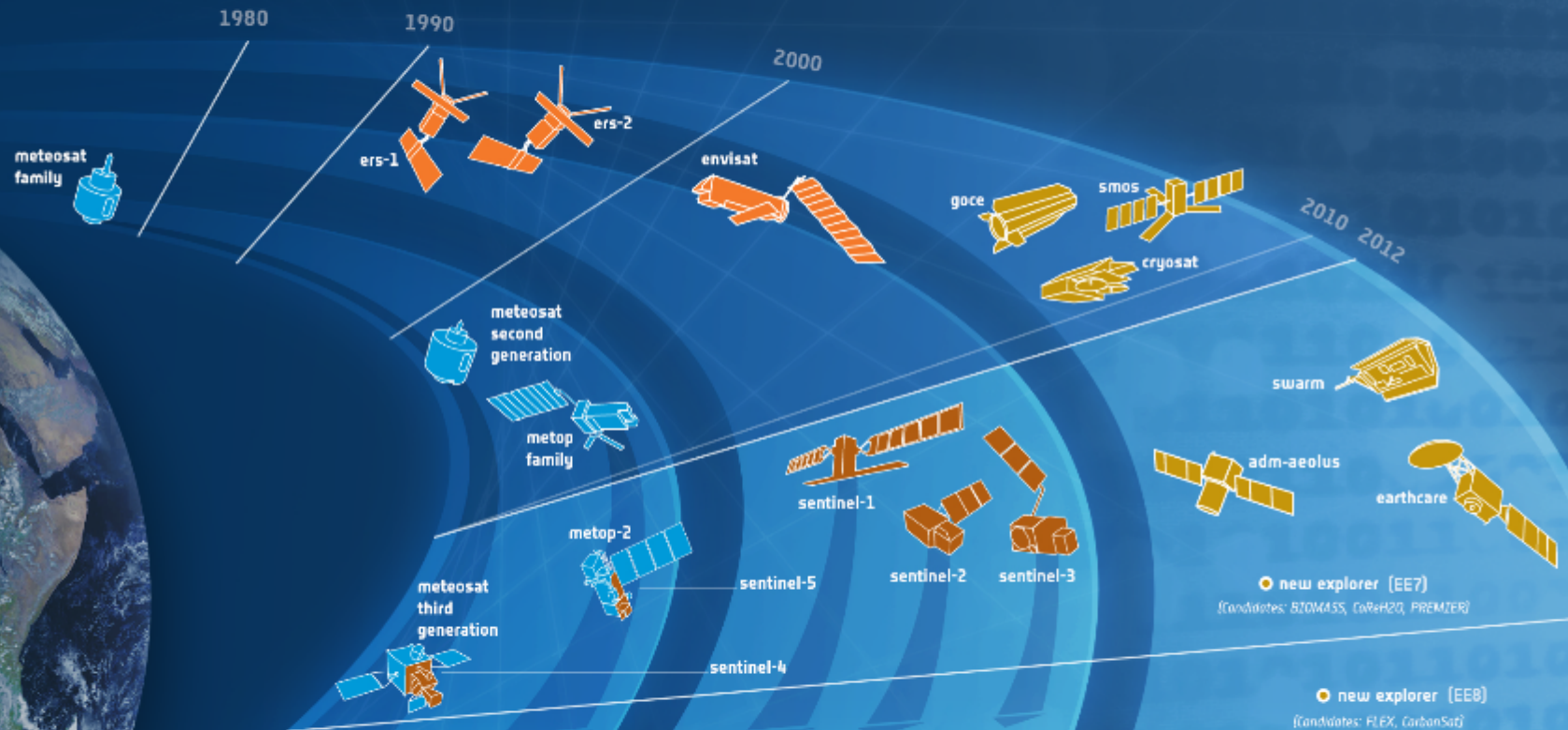
**\*includes Third Party Activities**



European Space Agency

# → OBSERVING EARTH FROM SPACE

## Expanding European Earth Observation capability



### Meteorological Missions

driven mainly by Weather forecasting and Climate monitoring needs. These missions developed in partnership with EUMETSAT include the Meteorological Operational satellite programme (MetOp), forming the space segment of EUMETSAT's Polar System (EPS), and the new generation of Geostationary Meteosat satellites (MSG & MTG satellites).

### GMES Sentinel Missions

driven by Users needs to contribute to the European Global Monitoring of Environment & Security (GMES) initiative. These satellite missions developed in partnership with the EC include C-band imaging radar (Sentinel-1), high-resolution optical (Sentinel-2), optical and infrared radiometer (Sentinel-3) and atmospheric composition monitoring capability (Sentinel-4 & Sentinel-5 on board Met missions MTG and EPS-SG respectively).

### Earth Explorer Missions

driven by Scientific needs to advance our understanding of how the ocean, atmosphere, hydrosphere, cryosphere and Earth's interior operate and interact as part of an interconnected system. These Research missions, exploiting Europe's excellence in technological innovation, pave the way towards new development of future EO applications.

# In Orbit: ESA Earth Observation satellites



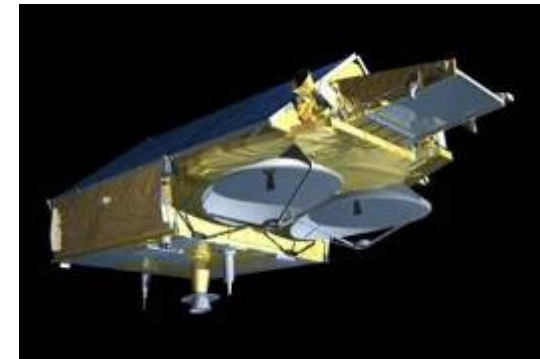
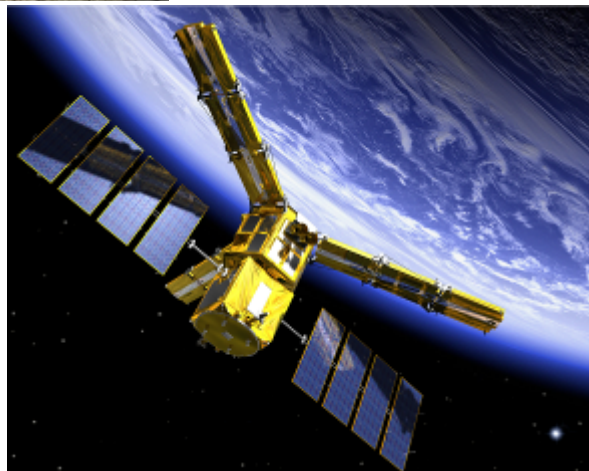
Envisat ceased communication on 8 April 2012



- Four EO missions in operation
  - Five more currently operated by Eumetsat
- Several thousand data user projects worldwide- increasing further
- More than 100 Terabytes/yr of data
- 30 partner missions for which data disseminated to European users



ERS-2 mission ended in 2011



European Space Agency

# The ESA Earth Explorer Missions



**GOCE**  
17 March 2009

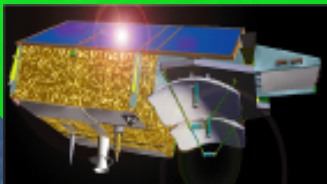


**SMOS**  
2 Nov. 2009



**7<sup>th</sup>, 8<sup>th</sup>  
Explorer**

**Cryosat**  
8 April 2010



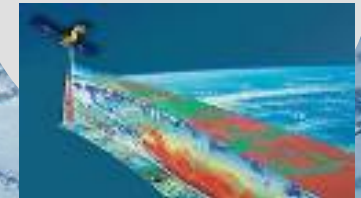
**SWARM**  
Autumn 2013



**ADM  
AEOLUS**

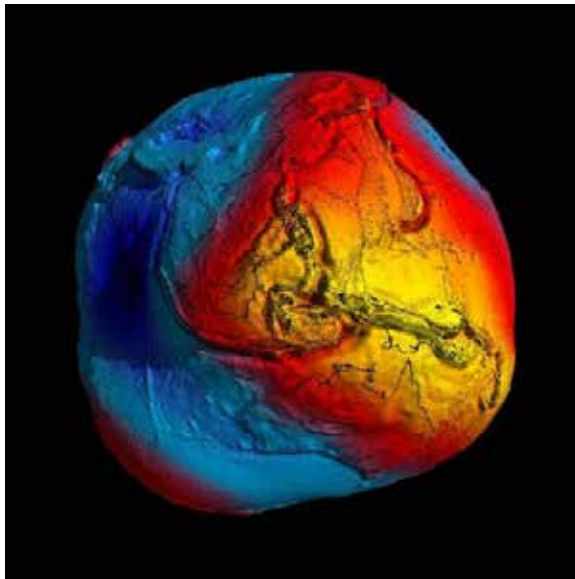


**EARTH  
CARE**





# Results of the Explorer Missions

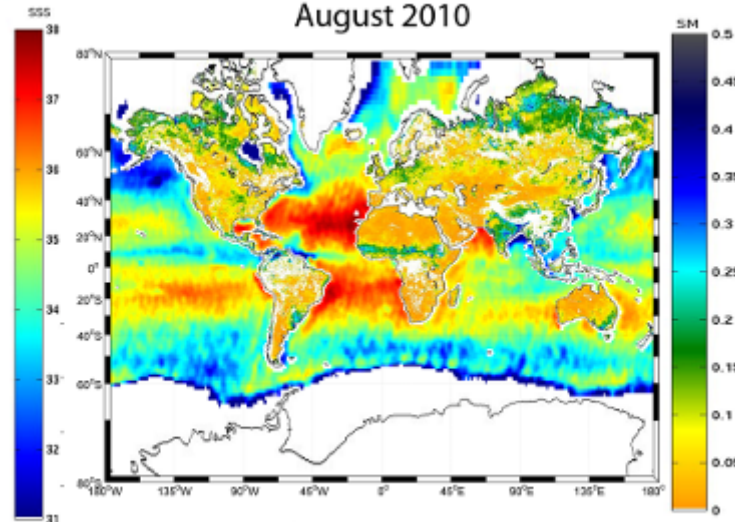


**GOCE:** most accurate Geoid ever, with unprecedented detail

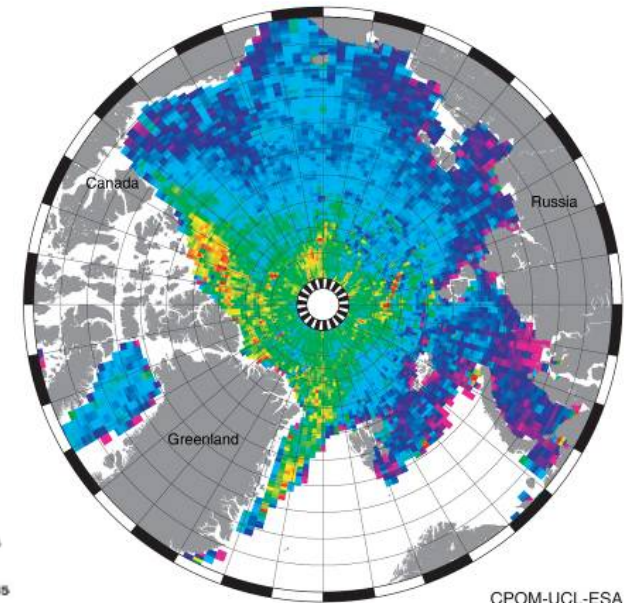
**SMOS:** first global ocean salinity and soil moisture maps (key variables in the water cycle)



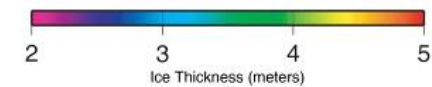
August 2010



Sea ice thickness in the Arctic ocean  
(January/February 2011)



CPOM-UCL-ESA



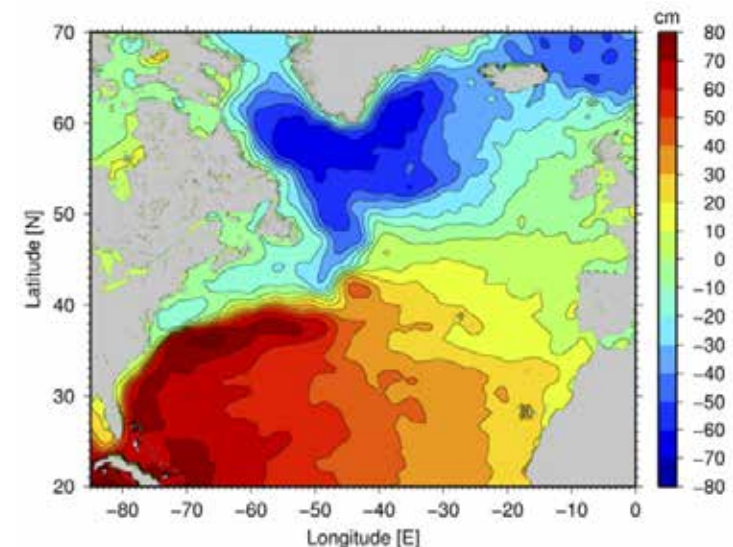
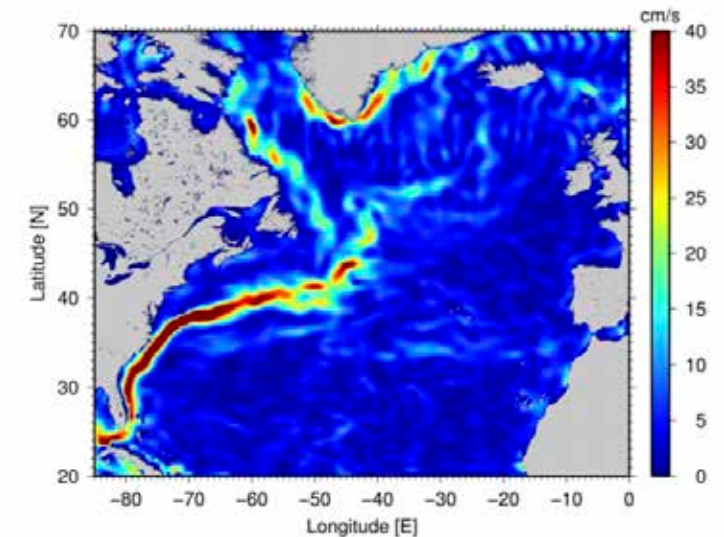
**CryoSat:** first Arctic sea ice thickness map

European Space Agency

# GOCE: Nominal mission completed – science from space continues



- All mission requirements have been fully met by end 2012.
- GOCE could map gravity signals significantly beyond original goal of spherical harmonic degree 200 (100km).
- For the first time, global currents can be extracted directly from satellite altimetry data.
- Lowering of orbit started in August 2012, 240 km have been reached in December, 235 km by the end of February 2013.
- This increases accuracy and resolution (100 to 80 km) of measurements, improving view of smaller ocean dynamics.

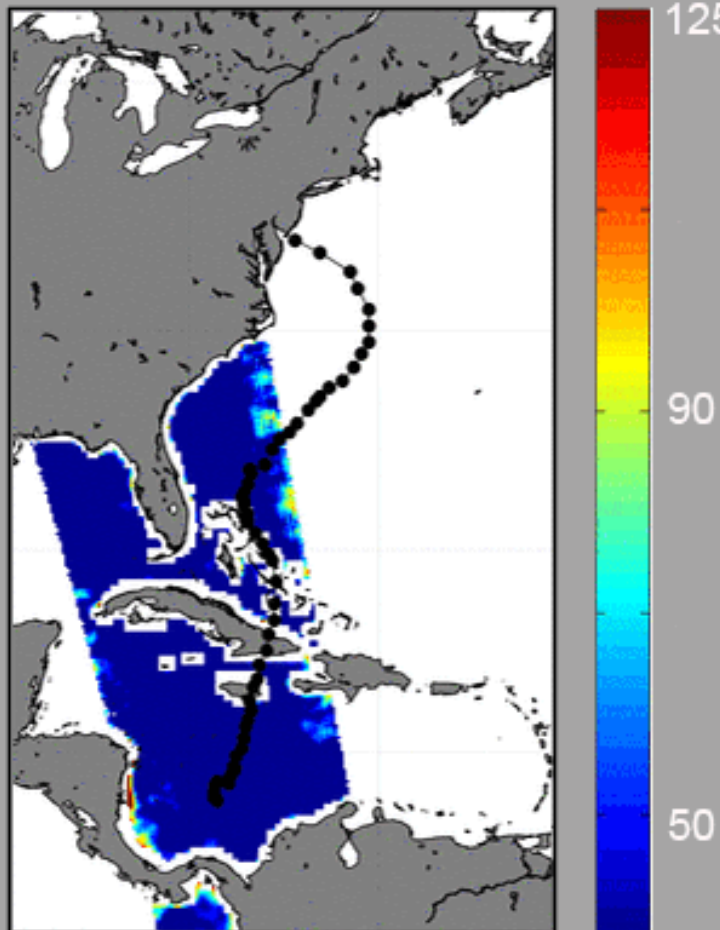


# Hurricane Sandy



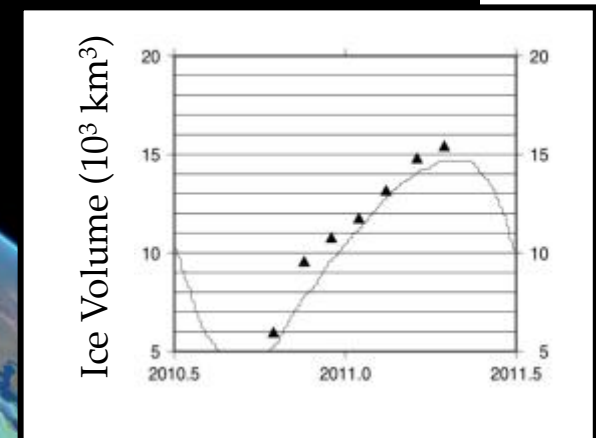
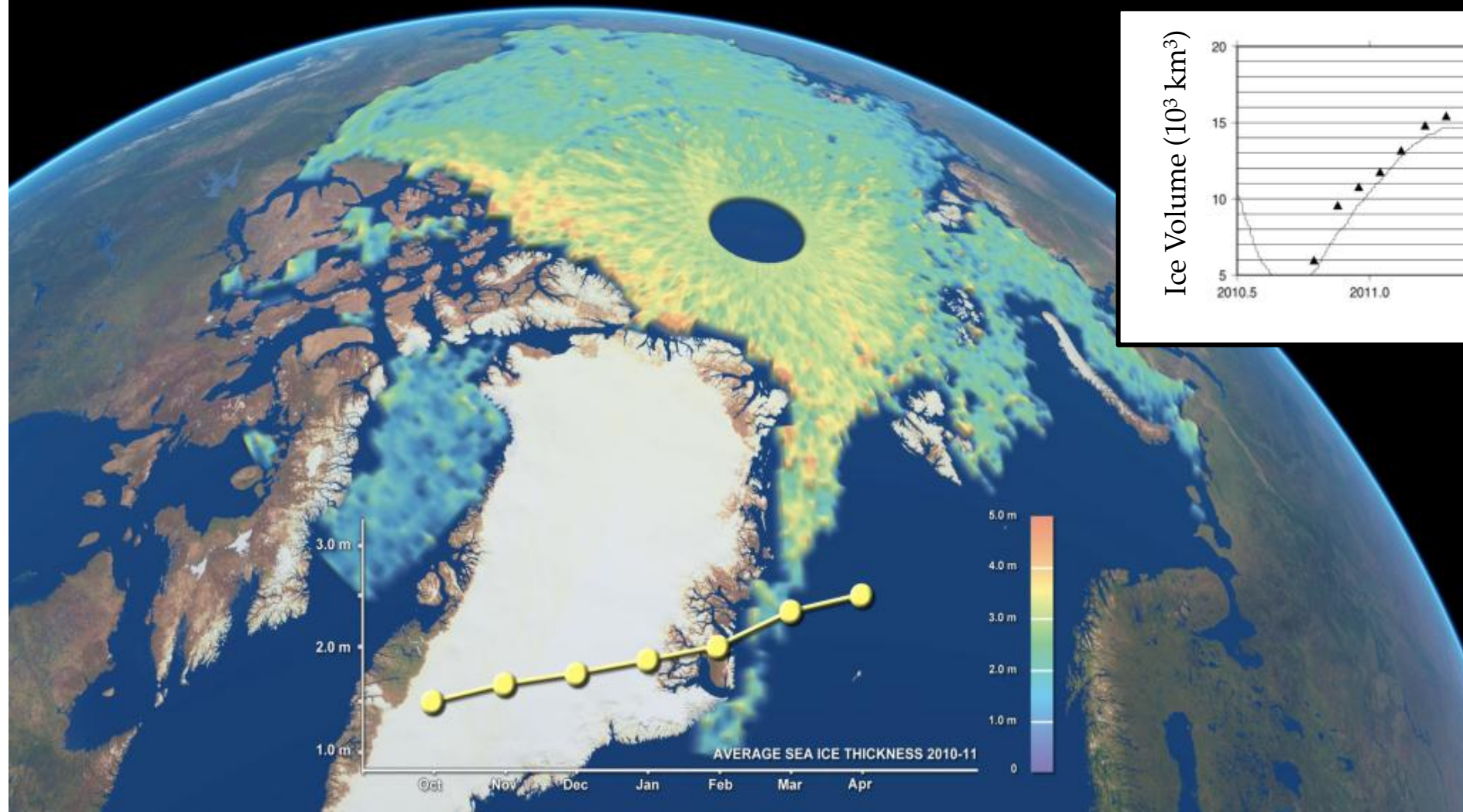
22 October 2012

wind speed  
km/h



- Left side: Estimates of surface wind speeds (km/hr) from SMOS data along the track of Hurricane Sandy.
- Spanning 1800 km, this super storm is the largest Atlantic hurricane on record, devastating parts of the Caribbean and northeastern US in October 2012.
- ESA's SMOS microwave radiometer (L-band) provided reliable estimates of surface wind speeds in this intense storm.

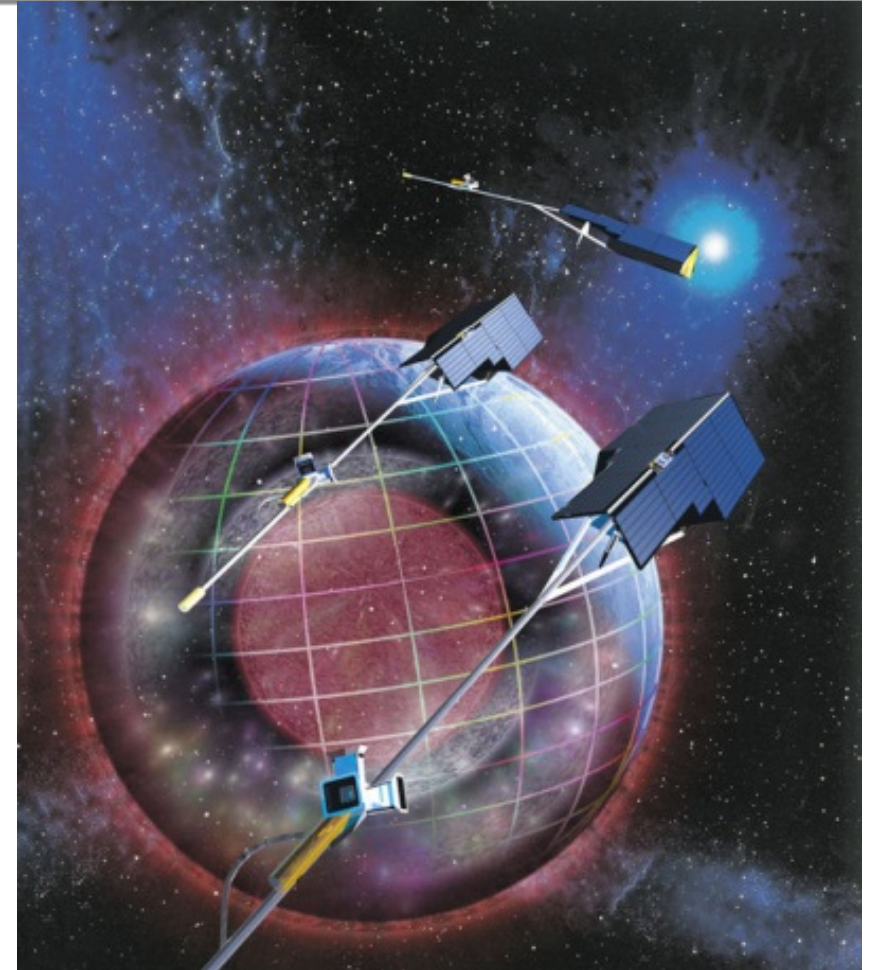
# Cryosat Seasonal cycle of arctic ice thickness - October 2010 to April 2011 (*published April 2012*)



# Swarm Status



- Preparation of launch campaign is on-going.
- Rockot launches were resumed on 17 January 2013.
- Target launch date for the Swarm mission is currently autumn 2013.
- Anisotropy issue:
  - ESA has taken the decision to characterise the effects of anisotropy, with the aim to reduce the error from a level of 130 pT down to few 10ths of pT.





## – Status:

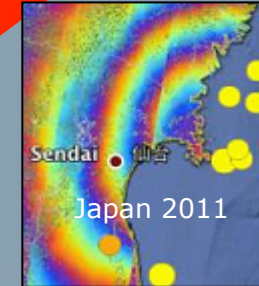
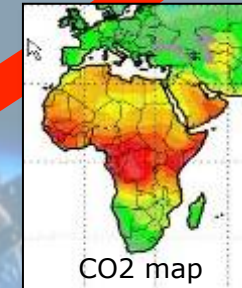
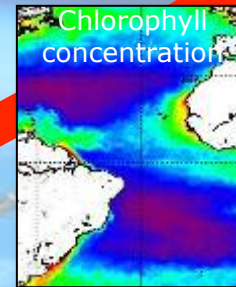
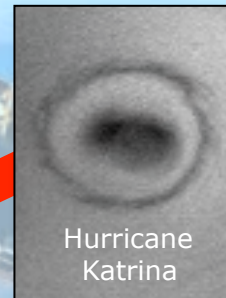
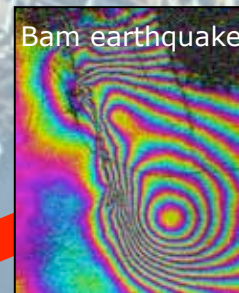
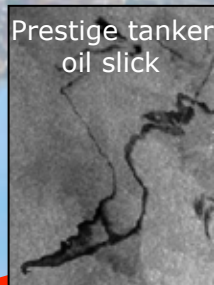
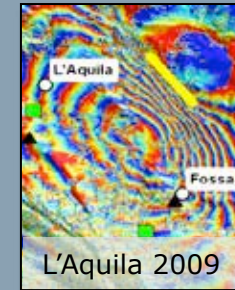
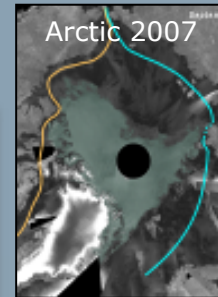
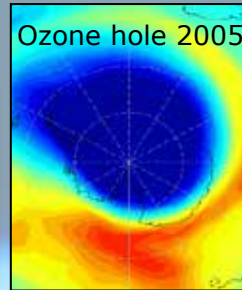
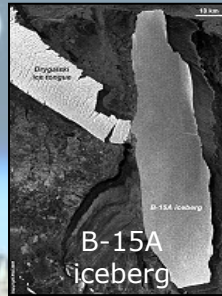
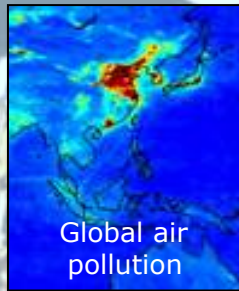
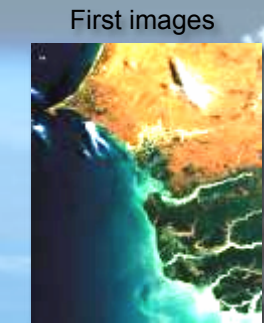
- Scientific Impact Studies show that operating Aladin in continuous mode improves Numerical Weather Forecasts (NWF).
- Laser integration completed for IR section of 1<sup>st</sup> flight laser.
- Shock characterisation test planned for mid-2013.
- Launch scheduled for July 2015.

## – Status:

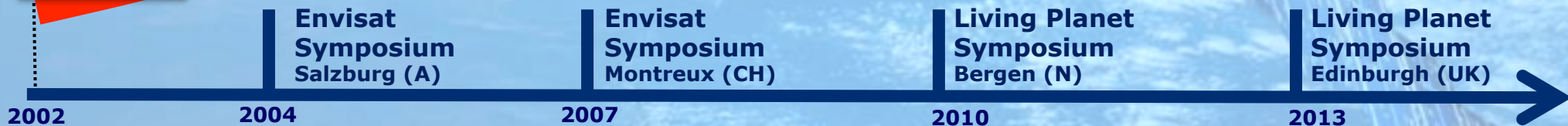
- The MSI test campaign is running.
- JAXA: mechanical qualification of the CPR has been initiated.
- After schedule consolidation, launch is now planned for November 2016



# ENVISAT mission: 10 years



**Continuing demand:  
~600 user proposals or  
registrations for Envisat  
data in 2012  
-> Need for Long Term  
Data Archiving (LTDA)**



*and many workshops dedicated to specific Envisat user communities*



# ESA Ministerial Council 2012



- The ESA Council at Ministerial Level took place 20 to 21 November 2012 in Naples, Italy.
- EOP's three programmes submitted for subscription: EOEP-4, MetOp-SG and GSC-3 (incl. Sentinel-5, Jason-CS).
- The Ministerial Council took place under very difficult economic boundary conditions and discussions centred on future of Ariane and ISS.



- **Overall** subscription to ESA programmes: **10,119 Billion Euro**
- **EO Budget:** 1,9 Billion Euro
  - **EOEP-4:** 1002 Meuro (64%)
  - **Metop Second Generation:** 808 Meuro. It was the only oversubscribed program of CM12 with 103,65%; in addition there will be the EUMETSAT contributions to this programme.
  - **GSC-3** (core elements Sentinel-5 and Jason-CS): 47 Meuro for phase 1 and an advance subscription of 43 Meuro for phase 2, open for subscription until 2014.
- Additional contributions for:
  - CCI programme (13,3 Meuro)
  - GMES Service Element (2,4 Meuro)
  - Proba-V exploitation phase (31,3 Meuro)
  - Earthnet and Long Term Data Preservation (Budget might be reduced)

## Romanian subscription

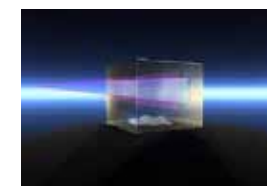
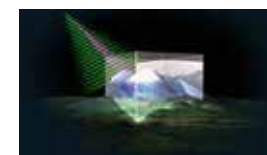
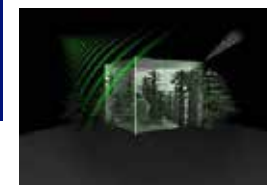
EOEP-4:	20.2 M€
METOP-SG:	2.04 M€
GSC-3:	0.29 + 1.74 M€
Earthnet	via General budget
LTDP:	via General budget
GSTP-6 el. 1:	12.5 + 5 M€

- Originally 1,6 Billion Euro had been requested for EOEP-4 at Ministerial Council 20/21 Nov 2012.
- 1002 Meuro have been subscribed, corresponding to 64%.
- Implementation discussed with scientists and PB-EO:
  - continue with Earth Explorer 7 but scrutiny of costs
  - EE8: Feasibility review after phase A and selection after AB1. Procurement to be financed by EOEP-5. Reductions of operation costs, technologies, studies, exploitation budget maintained
  - Potential of Small Mission explored
  - Call for EE9 will be initiated but approach still to be confirmed



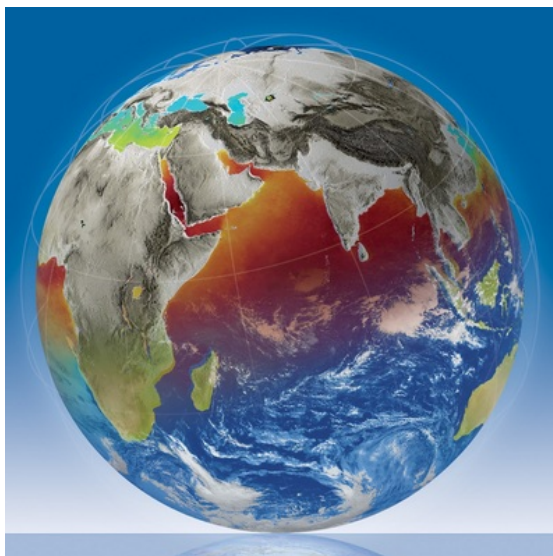
## 7<sup>th</sup> Earth Explorer User Consultation Meeting 5-6 March 2013 in Graz

- **BIOMASS** to provide **continuous global** interferometric and polarimetric radar **observations of forested areas**
  - **CoReH2O / Snow mission** to observe snow / ice at high spatial resolution
  - **PREMIER** to provide atmospheric composition in upper troposphere and lower stratosphere
- => Selection of the mission in May 2013



## 8<sup>th</sup> Earth Explorer: Phase A/B1 studies on-going

- **FLEX:** to provide **global maps of vegetation fluorescence**
- **CarbonSat:** to quantify and monitor the **distribution of carbon dioxide and methane.**



# Climate Change Initiative status



- The CCI Mid-Term Review was successfully held in September 2012, kicking-off the second 3-year term of the programme.
- All CCI teams have established robust and detailed user requirements for their ECVs.
- Teams have completed first version of Product Specifications.
- Good cooperation with EUM; international coordination is well established via CEOS WG-Climate.
- ECMWF is member of CCI advisory committee.

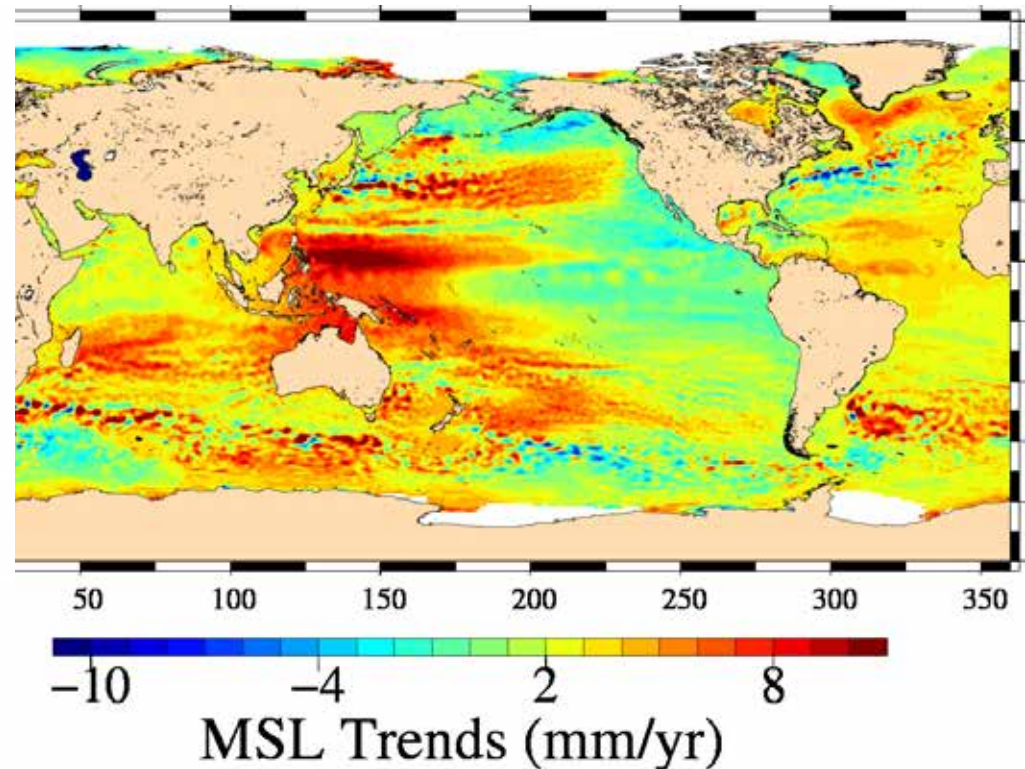
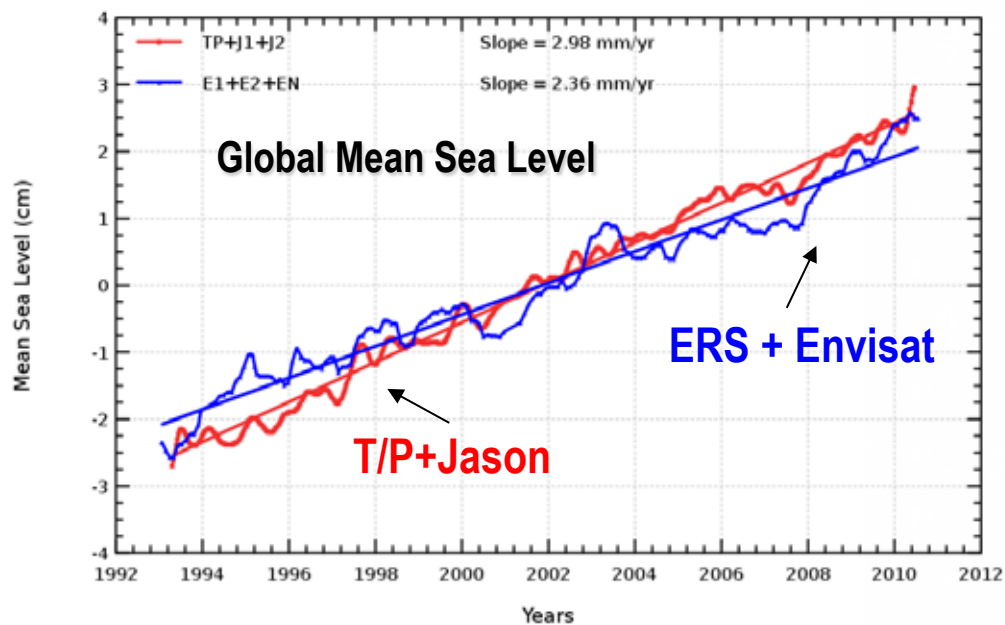


European Space Agency

# Sea Level CCI



RELEASE of the NEW  
Sea Level ECV PRODUCT  
18 years from 1993 to 2010



Thanks to the SLCCI project

- EOP runs a programme for auditing industry – in general three main purposes:
  - Address compliance aspects to contractual requirements
  - Address quality issues arising from contracted activities
  - To promote quality standards applications (ECSS, ISO, EN).
- Audits may also be offered to company willing to increase their awareness on ESA quality expectations and practices and to undertake internal improvement actions.
- Audit process typically addressing organisation's "quality" management system, project management and "product" assurance aspects.
- Typical audit duration two days.
- Mutual agreement reached for audit outcome and resulting actions.
- Audit results will not be disclosed to third parties.
- Contact [andrea.simonini@esa.int](mailto:andrea.simonini@esa.int) for more information.

# Agenda for today



## DRAFT PROGRAMME

### ESA Earth Observation Info Day, v2

13 March 2013

Bucharest, Romania

09:00	Welcome	<b>Romanian Representative</b>	11:10	Missions Operations and Ground Segment: <ul style="list-style-type: none"><li>• Mission Operations and Maintenance (Operations of Earth Explorers, Cal/Val, processors upgrade, re-processing of ERS/Envisat missions)</li><li>• Ground Segment Development</li><li>• Earth Explorer Level 2 products</li></ul>	<b>Henri Laur</b> Head of ESA Earth Observation Mission Management Division
09:10	Presentation on ESA Earth Observation Programmes	<b>Maurice Borgeaud</b> Head of Science, Applications and Future Technologies Department, Directorate of Earth Observation Programmes			
09:30	Preparatory Activities for Future Missions, including: <ul style="list-style-type: none"><li>• Science</li><li>• Campaigns</li><li>• Technologies (Microwave and Optical Instruments; Equipment for low-Earth Orbit Satellites)</li><li>• EE7 and EES</li></ul>	<b>Pierluigi Silvestrin</b> Head of Future Missions Division, Directorate of Earth Observation Programmes <b>Remo Bianchi</b> Mission Science Division <b>Klaus Scipal</b> Mission Science Division	11:40	Mission Data Exploitation <ul style="list-style-type: none"><li>• Data User Element (DUE)</li><li>• Value Adding Element (VAE)</li><li>• Support to Science Element (STSE)</li><li>• Scientific Exploitation of Operational Missions (SEOM)</li></ul>	<b>Mark Doherty</b> Head of Earth Observation Exploitation and Services Division <b>Mike Rast</b> Head of Science Strategy, Coordination and Planning Office
10:10	Presentation on GMES Programme	<b>Thomas Beer</b> GMES Space Office, Directorate of Earth Observation Programmes	12:10	Discussion	
10:30	Presentation on MetOp Second Generation Programme	<b>Graeme Mason</b> MetOp Second Generation Programme Manager	12:30	Lunch	
10:50	Coffee		13:30	Bilateral Meetings	
			16:00	End of the Day	