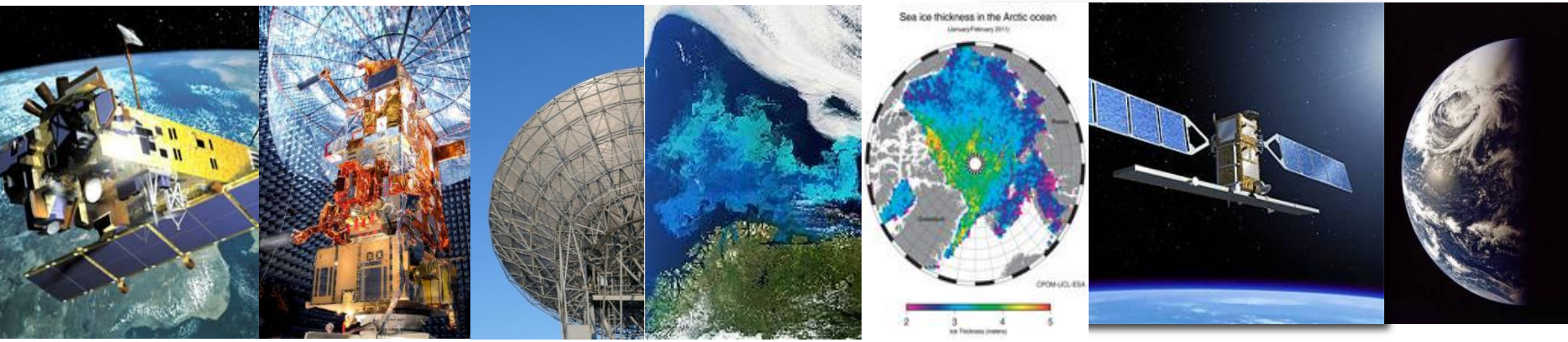
ESA Earth Observation Programmes **towards C-MIN 2012**



Simonetta Cheli, Guido Levrini

Directorate of ESA Earth Observation Programmes

BE Industry Info Day, Brussels

25 June 2012

C-MIN 12: EO programme proposals

At C-MIN 12, a series of Earth Observation Programmes will be tabled for subscription:

1. EOEP-4
2. MetOp Second Generation (MetOp-SG)
3. GSC-3

Additionally Earthnet and Long-Term Data Preservation programmes will be tabled as part of the LoR, as described in C(Min)2008.

Additionally PROBA-V phase Exploitation will be open for subscription, together with on-going ESA programmes.

The Earth Observation Programmes in ESA

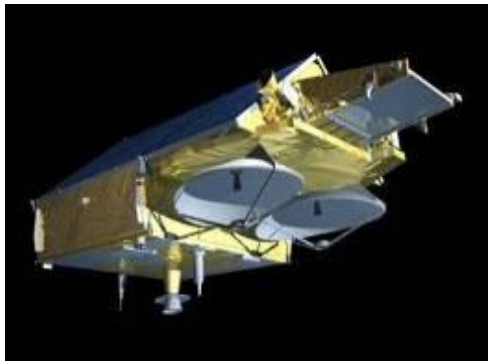
Overview

The ESA Earth Observation "fleet"

In Orbit: ESA Earth Observation satellites

Envisat ceased communication on 8 April 2012

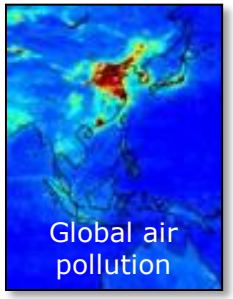
ERS-2 mission ended in 2011

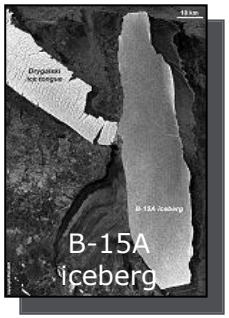


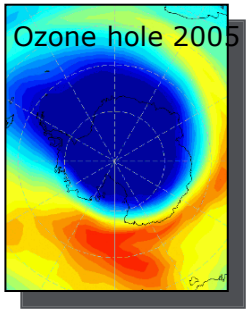
1. Four EO missions in operation
    a. Five more currently operated by Eumetsat
2. Several thousand data user projects worldwide– increasing further
3. More than 100 Terabytes/yr of data
4. 30 partner missions for which data disseminated to European users

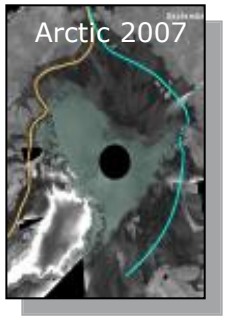
ENVISAT mission: 10 years

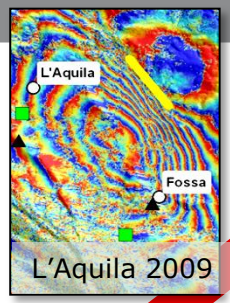
esa

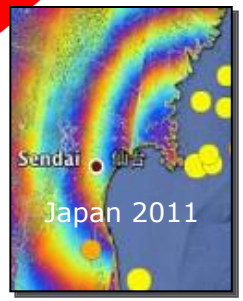


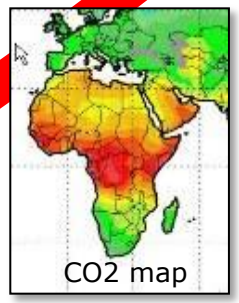


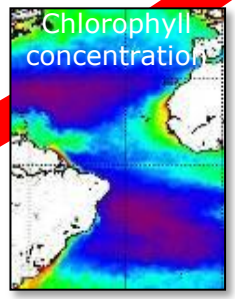


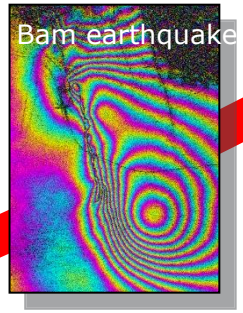












Serving
4000 scientific projects
and
many operational users

Envisat Symposium
Salzburg (A)

Envisat Symposium
Montreux (CH)

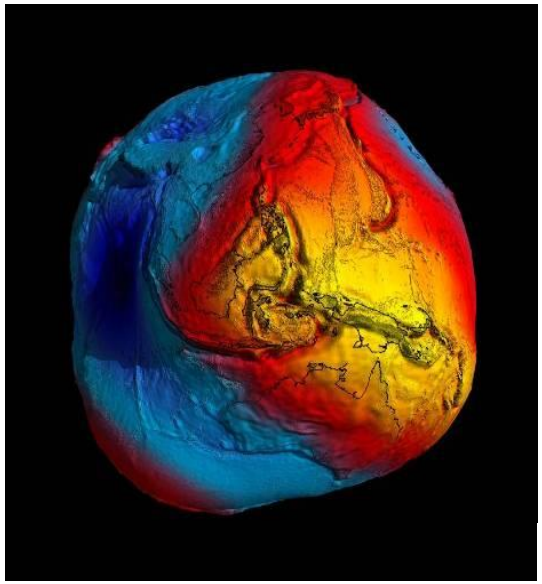
Living Planet Symposium
Bergen (N)

Mar 02 | **Sep 04** | **Apr 07** | **Jun 10** | **Mar 12**

and many workshops dedicated to specific Envisat user communities

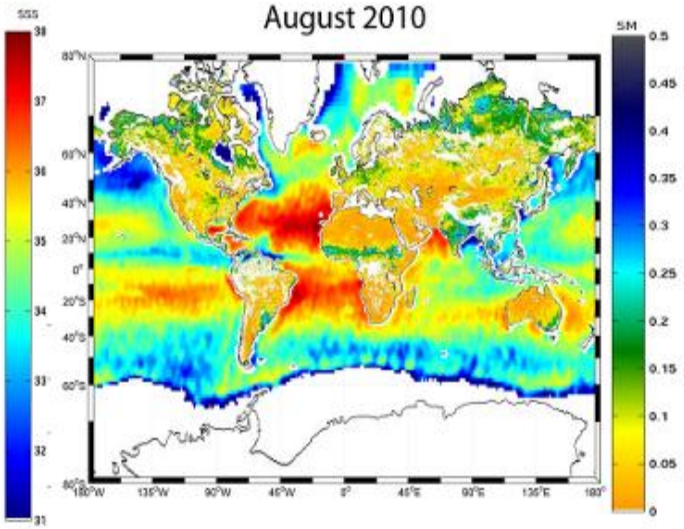
European Space Agency

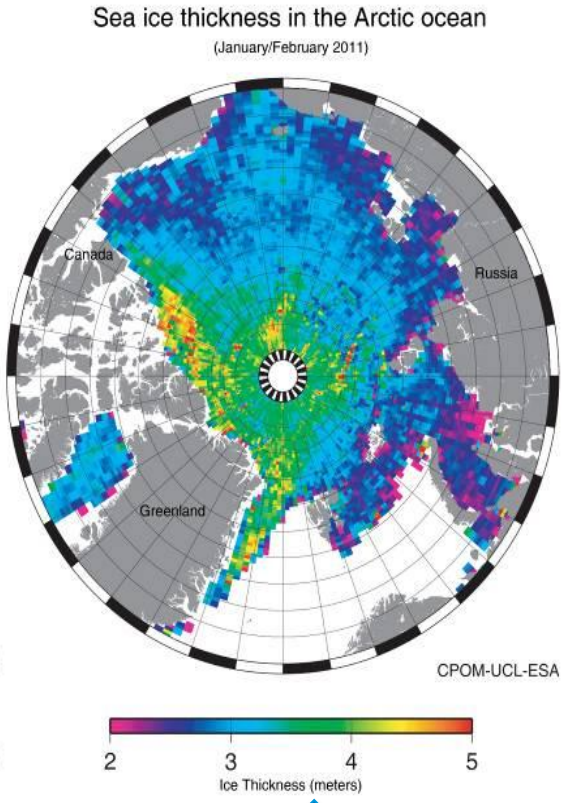
Results of the Explorer Missions



GOCE: most accurate Geoid ever, with unprecedented detail

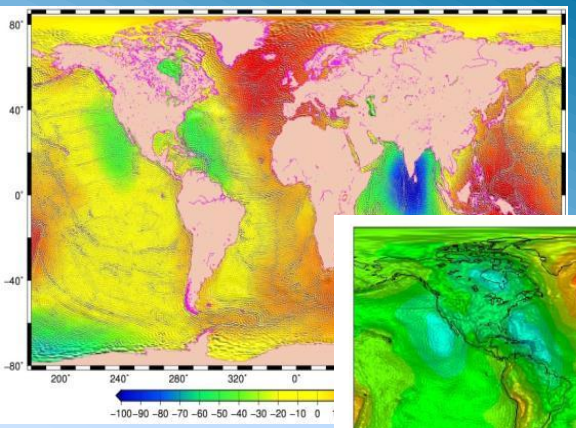
SMOS: first global ocean salinity and soil moisture maps (key variables in the water cycle)



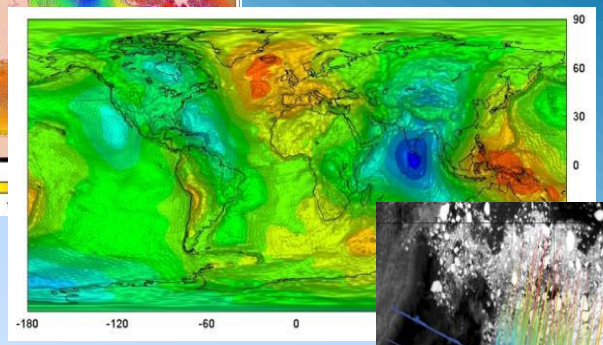


CryoSat: first Arctic sea ice thickness map

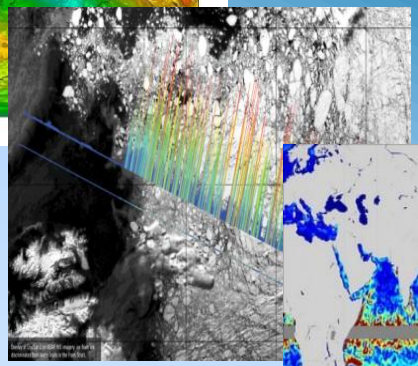
ESA mission synergies



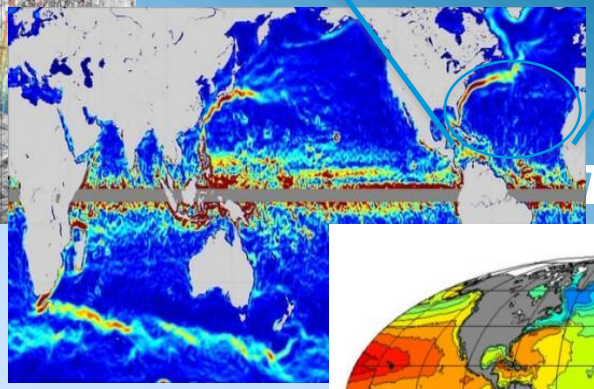
Altimetry map *(Envisat, Jason)*



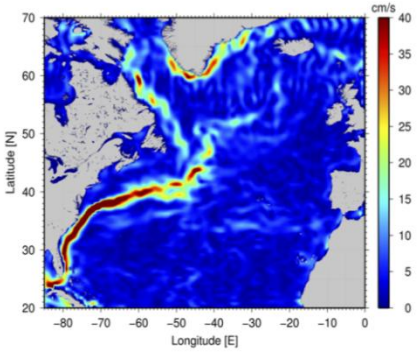
High precision Geoid (GOCE)

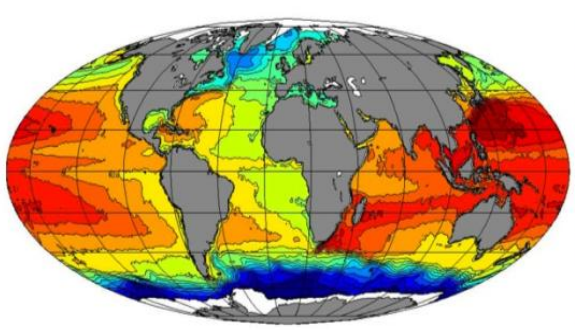


CryoSat Data of Ice/Water surface



Ocean currents (GOCE)





Ocean Dynamic Topography

The Living Planet Strategy

Objectives:

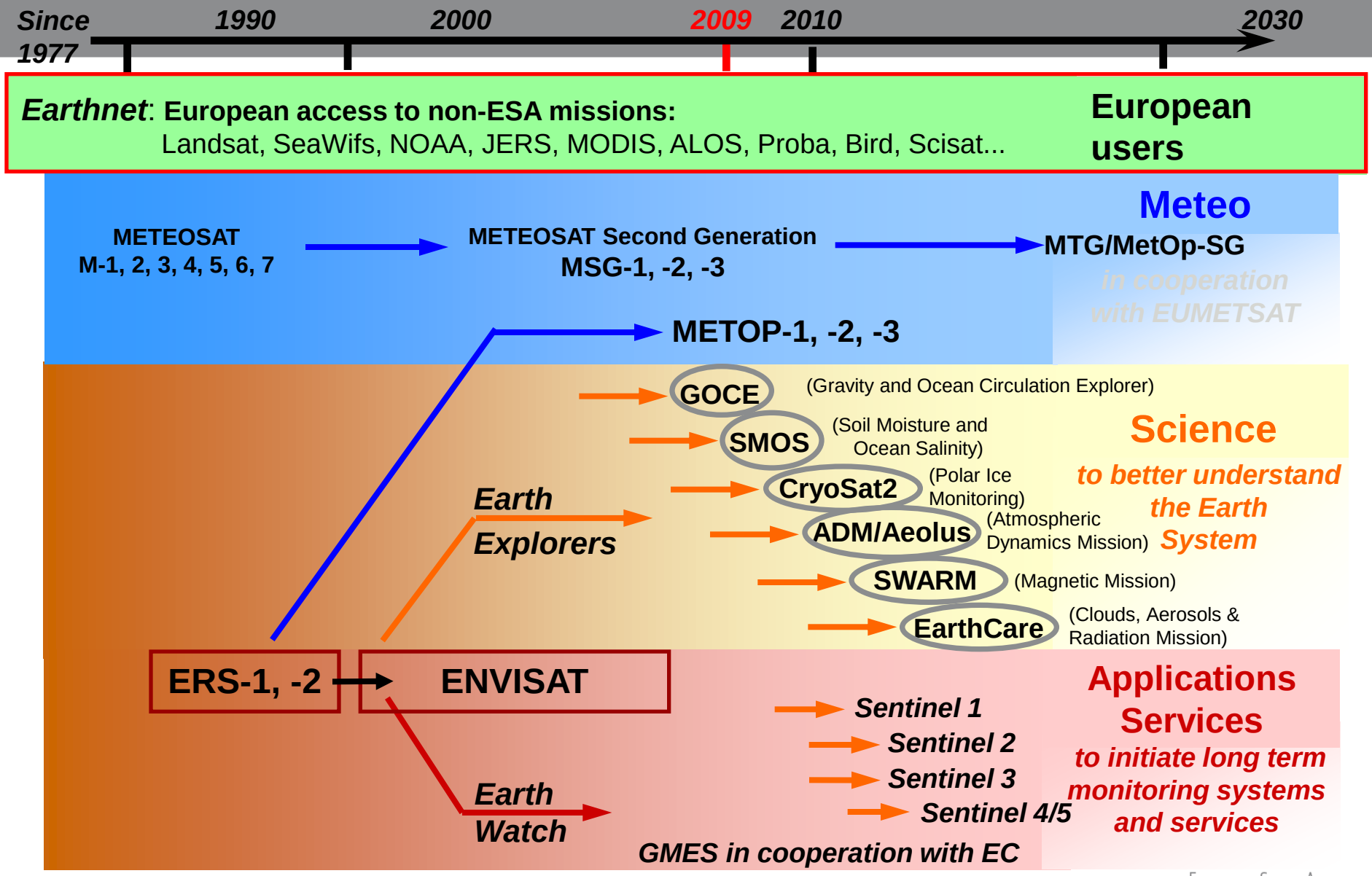
- Maintain Europe at leading edge of sciences
- Increase use of Earth Observation in formulation, implementation and monitoring of public policies and in the provision of public services
- Foster the development of commercial services using Earth Observation

Implementation:

- EARTH EXPLORER SATELLITES

  for science and technology demonstration
- EARTH WATCH SATELLITES

  for long-term operational monitoring
- Operational ACCESS TO DATA,
- Support to EXPLOITATION: Science, reference data sets, development of services


Since 1977
1990
2000
2009
2010
2030
Earthnet: European access to non-ESA missions:
Landsat, SeaWifs, NOAA, JERS, MODIS, ALOS, Proba, Bird, Scisat...
European users
Meteo
METEOSAT
M-1, 2, 3, 4, 5, 6, 7
METEOSAT Second Generation
MSG-1, -2, -3
MTG/MetOp-SG
in cooperation with EUMETSAT
METOP-1, -2, -3
GOCE
(Gravity and Ocean Circulation Explorer)
SMOS
(Soil Moisture and Ocean Salinity)
CryoSat2
(Polar Ice Monitoring)
ADM/Aeolus
(Atmospheric Dynamics Mission)
SWARM
(Magnetic Mission)
EarthCare
(Clouds, Aerosols & Radiation Mission)
Earth Explorers
Science
to better understand the Earth System
ERS-1, -2
ENVISAT
Sentinel 1
Sentinel 2
Sentinel 3
Sentinel 4/5
Earth Watch
Applications Services
to initiate long term monitoring systems and services
GMES in cooperation with EC

Earth Observation Envelope Programme 4th Period (EOEP-4)

The Functions of the EOEP

EOEP is the backbone of ESA EO strategy. It provides room for:

- **Scientific Earth Explorer Missions**
- **Preparation of Operational Programmes**
  - Eumetsat missions
  - GMES Space Component (GSC)
  - Climate Change Initiative (CCI)
- **Technology Development**
- **Set up of an operational G/S infrastructure**
- **Mission continuity, data exploitation**

EOEP-1 **2000-2002** → **EOEP-2** **2003-2007** → **EOEP-3** **2008-2012** → **EOEP-4** **2013 +**

The scientific merits of the EOEP

In 2011, a successful scientific and programmatic review of the Earth Observation Envelope Programme (EOEP) was held.

The review team of external science experts concluded that the EOEP

- "has evolved very successfully during the past decade in **developing, launching and operating state-of-the art** space-based EO satellites"
- "has emerged as a sustained technology programme at **very high innovation level**" and produced
- "**substantial scientific output** with **significant impact** on our understanding" of Earth.

EOEP-4 for C-MIN 2012

EOEP has been conceived as an 'envelope' program:

1. It provides a continuous long-term planning mechanism with successive periods of nominally 5 years.
2. It enables a flexible and responsive definition of program content
3. It offers recurrent opportunities in terms of proposed new calls for missions/activities
4. It ensures a balance across the programme objectives from technology development, mission development to operations, science and exploitation
5. It empowers the program participants in the direction of the program content via selection procedure for Earth Explorer missions and approval of yearly work-plans

EOEP-4 will span the period 2013-2016, with commitments up to 2020.(4 years + 6 months for operations)

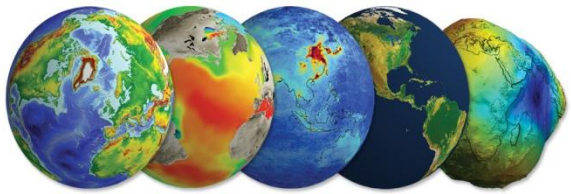
EOEP-4 for C-MIN 2012

- The program assumptions are:
  - a balance between new missions and exploitation activities
  - a minimum of order 60% of funding in mission development, including ongoing development and new opportunities
  - significant new space segment opportunities within the period

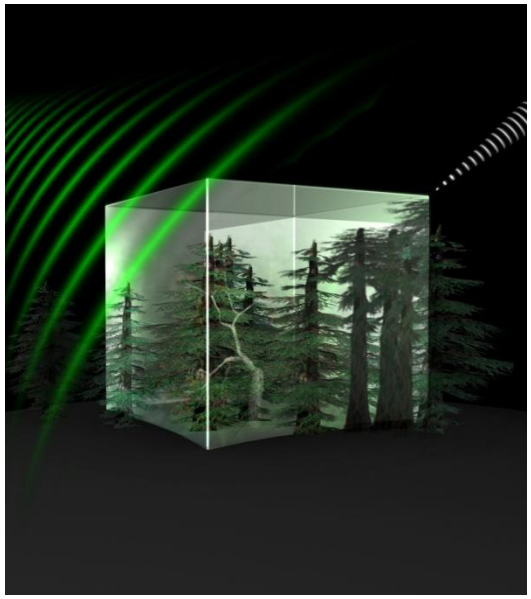
- A balanced program proposal with a financial envelope of 1600 M Euro (2012 e.c.)

- This funding level will allow:
  - Development of next generation Explorer missions (EE-7,EE-8, EE-9, EE-10 (Phase A)); collaborative payloads and missions, in close cooperation with MS, e.g. EE-X; an improved level of technical preparation of missions, in line with the orientations of the Code of Conduct (final selection only after phase B1; increased activities on instrument pre-development, as per lessons learnt from GOCE/Aeolus, coordinated with MS).
  - Science exploitation of the EO data (including Sentinel missions)
  - Continuity of missions (e.g. Explorers) beyond currently approved lifetime
  - Innovative G/S solutions for an 'open and operational' access to EO data by different users communities
  - (Pre) development of future EO services; provision of prototype reference data sets
  - Preparation of future EO operational systems

Status of the EE-7 mission candidates Biomass, CoReH2O, PREMIER



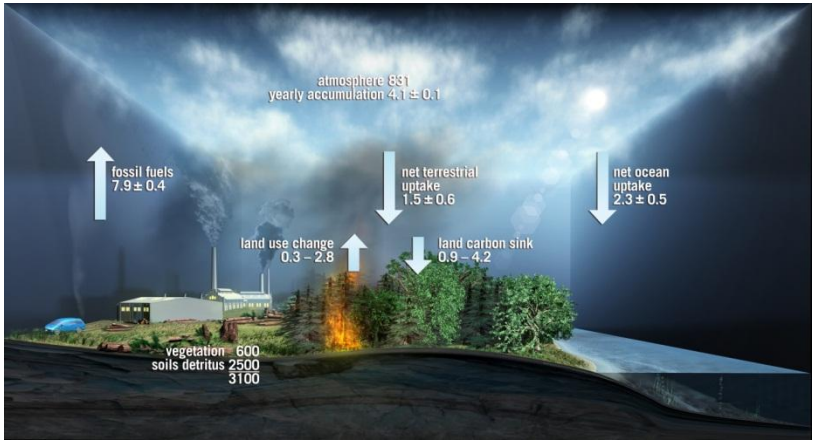
Biomass



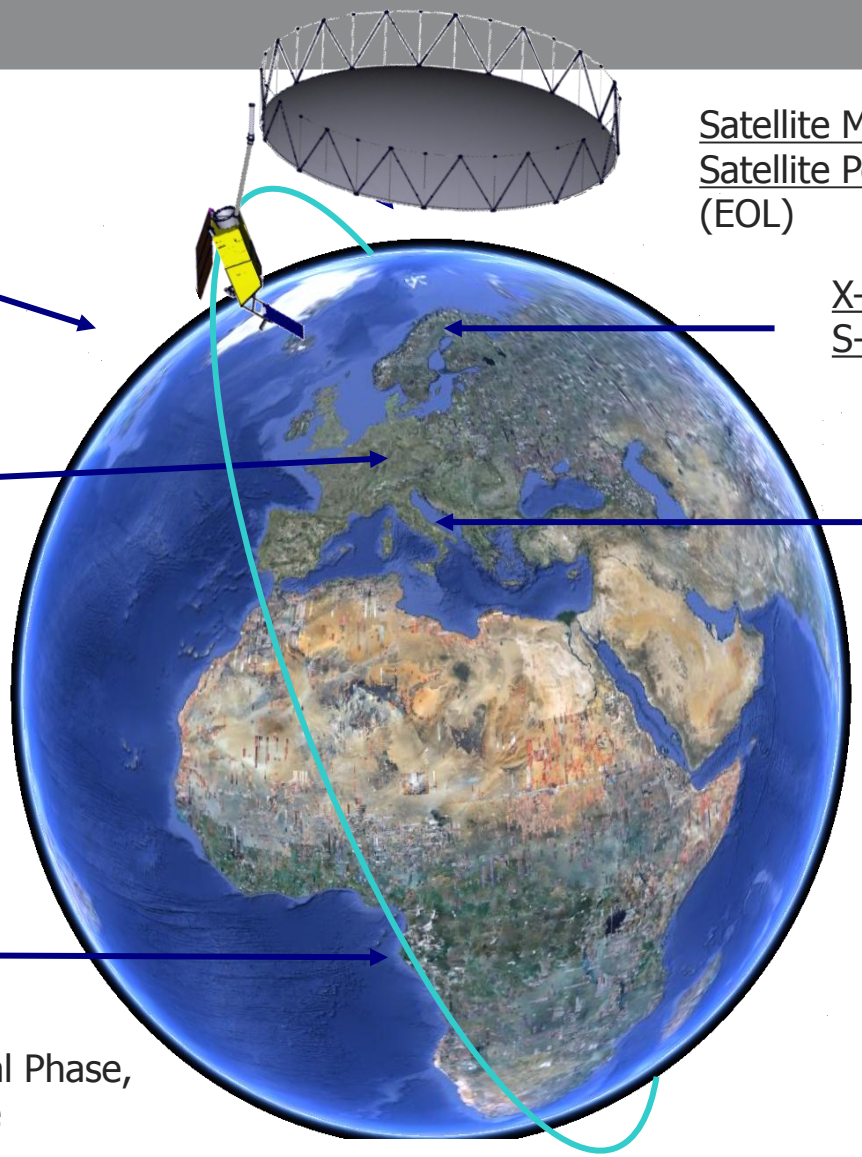
AN ESA EARTH EXPLORER CANDIDATE TO MEASURE THE BIOMASS OF THE EARTH'S FORESTS

BIOMASS aims to observe forests biomass and height globally for a better understanding of the carbon cycle to

1. Improve current estimates of forest carbon stocks
2. Reduce uncertainty in deforestation emissions to a level comparable to uncertainty in net ocean flux
3. Improve estimates of terrestrial carbon sinks from regrowth and reforestation



Biomass 'first' : P-band SAR from space



Satellite Mass: ~ 1200 kg
Satellite Power Gen.: ~ 1.5 kW (EOL)

Instrument:
P-band SAR
Operating in interleaved stripmap mode

X-Band Receiving Station
S-Band TT&C Station

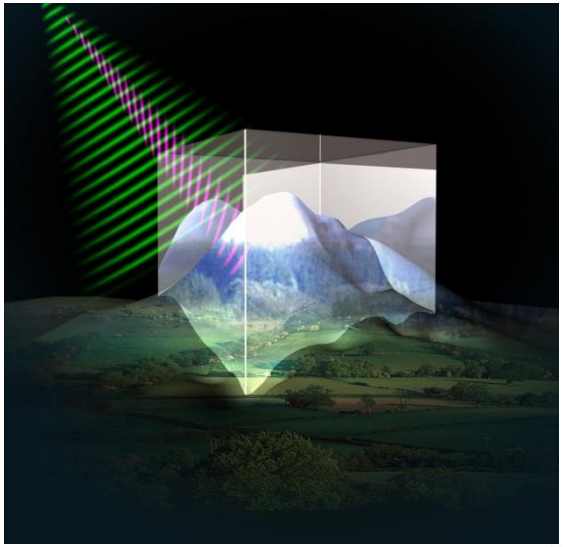
Flight Operation Centre

Processing Centre

SUN

Orbit:
Sun Synchronous
LTAN: 18:00
Altitude: ~640 km
Repeat cycle: 25 days Nominal Phase, 4 days for Tomographic Phase

CoReH2O



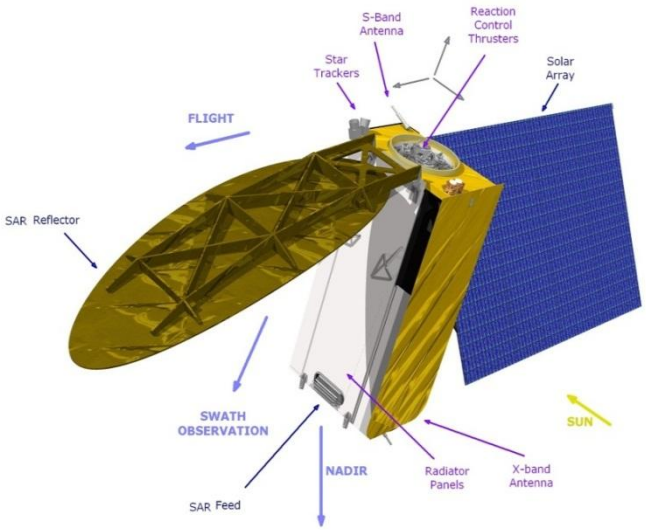
AN ESA EARTH EXPLORER CANDIDATE TO OBSERVE SNOW AND ICE

Measurements of Snow Water Equivalent (SWE) and Snow Extent (SNEX) globally, with high resolution, high accuracy and temporal revisit.

Objectives:

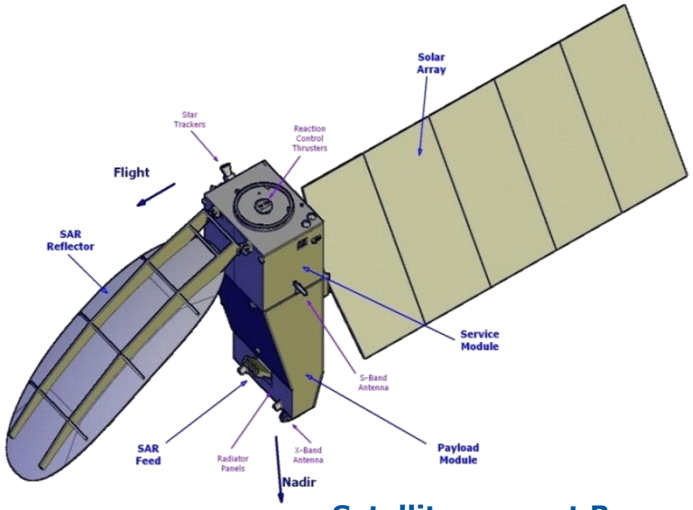
- Quantify fresh water in terrestrial and glacier snow
- Evaluate and reduce uncertainty of snow water storage and budgets
- Validate and improve hydrological processes in NWP models
- Validate snow and ice processes in global climate models

CoReH2O 'first': X/Ku-band simultaneous SAR observations



Satellite concept A

Mass	1200 kg
Power	~3.5 kW Peak Power
Size	4.2-4.3 m by 1.8 m reflector

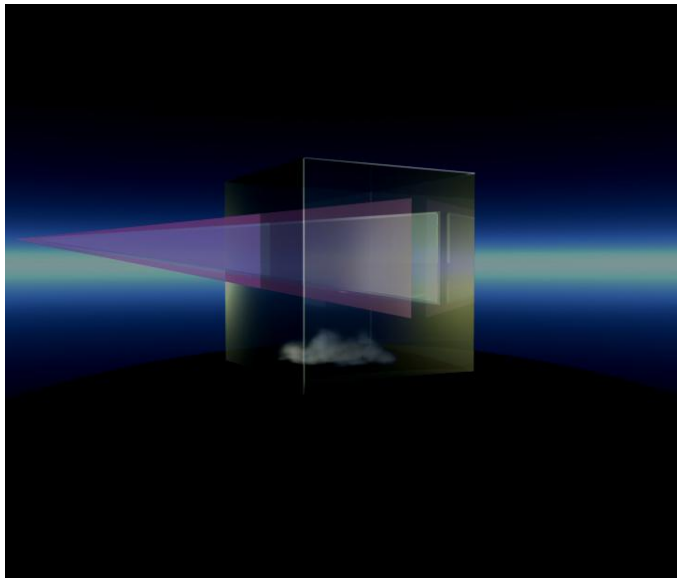


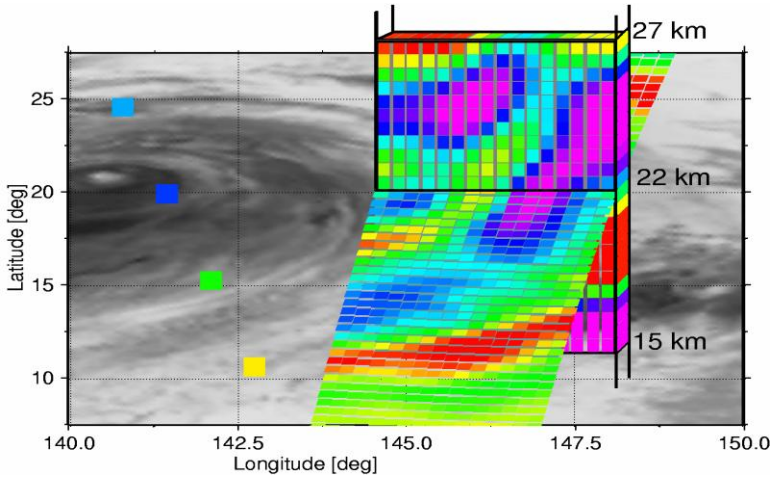
Satellite concept B

Mission profile: Snow & Sea Ice areas coverage with wide swath (100 km); highly repeatable and automated mission

- Phase 1 (year 1 & 2): 3 days revisit (~666 km altitude)
- Phase 2 (year 3+): 15 days revisit (~645 km altitude)

PREMIER





AN ESA EARTH EXPLORER CANDIDATE TO OBSERVE ATMOSPHERIC COMPOSITION

PREMIER will be the first mission to observe upper troposphere / lower stratosphere (UTLS) trace-gas 3D fields at high resolution to improve the understanding of:

1. UTLS structure and its impact on surface climate and dynamical coupling
2. Trace gas exchange between troposphere and stratosphere
3. Impact of convection, pyro-convection and their outflow on the UTLS
4. Processes linking the UTLS to the lower troposphere

Data products

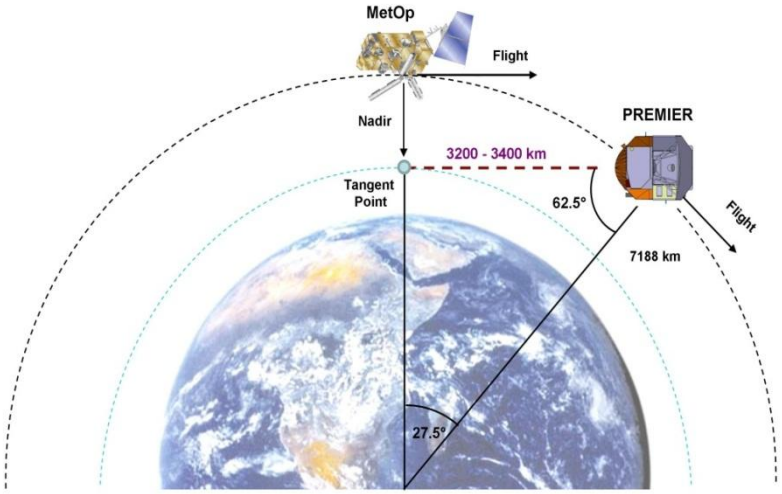
mandatory:
H_2O, O_3, T, HNO_3, NO_2, CH_4, CFC-11, CO, HCN, PAN, extinction coeff.

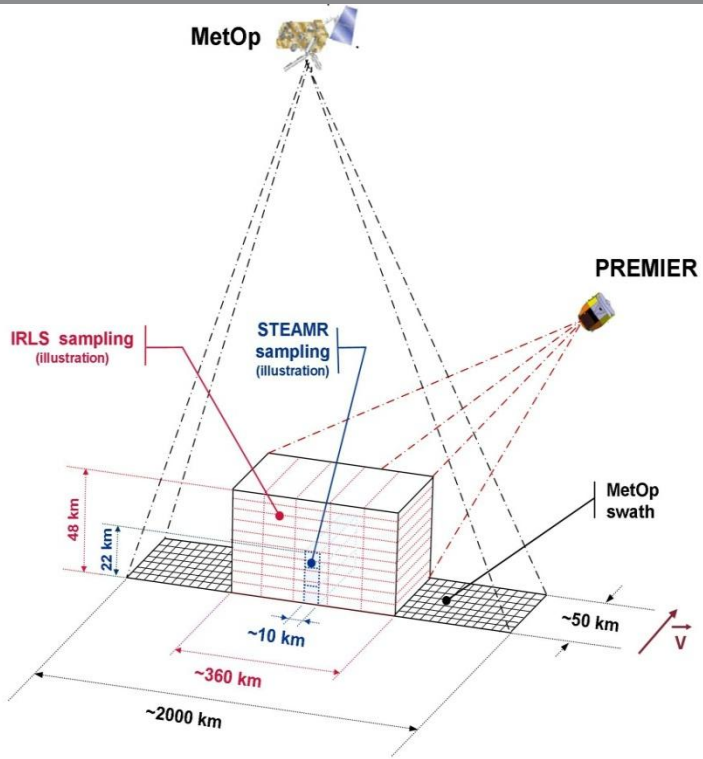
additional:
$ClONO_2$, CH_2O, NH_3, HO_2NO_2, CFC-12, HCFC-22, N_2O, SF_6, HDO, CH_3Cl, CH_3Br, CH_3CN, CH_3OH, H_2O_2, CH_2O, C_2H_6, N_2O_5, SO_2, OCS, ClO, $ClONO_2$, $BrONO_2$, C_2H_2, acetone, isoprene, HCOOH

PREMIER observation concept

- PREMIER will observe 3D atmospheric composition fields through the use of Infra-Red limb imaging spectrometry (IRL). Millimetre-wave limb sounding will provide 2D data in presence of cirrus clouds and complementary chemical species

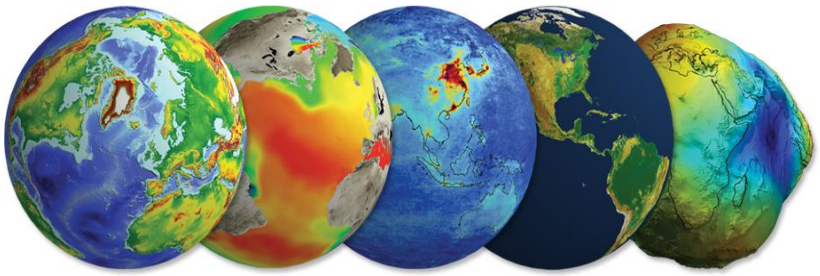
- PREMIER data will be extended to the surface through the synergy with nadir observations from MetOp instruments, improving estimates of biogenic, pyrogenic and anthropogenic emissions



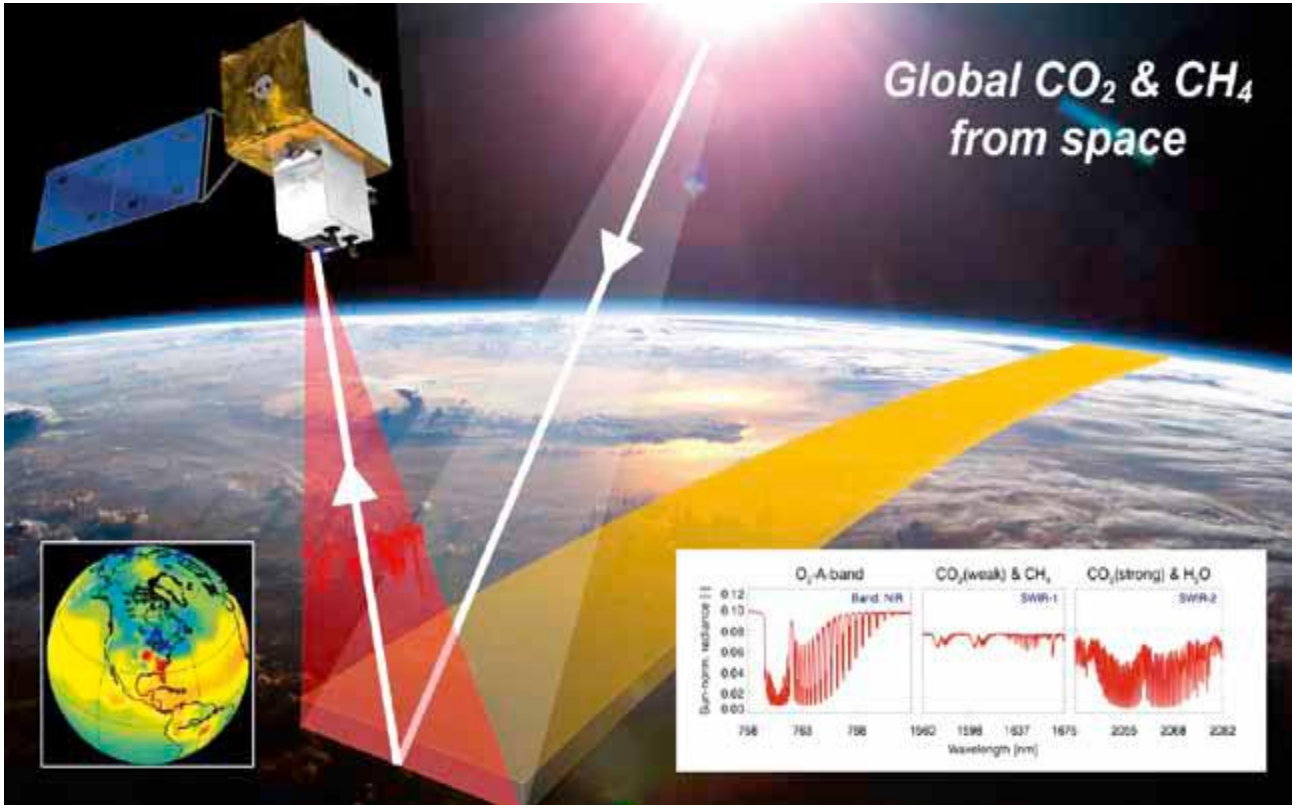


- Infra-Red (IRLS) and mm-wave (STEAMR) limb sounding
- Loose formation with MetOp to ensure synergy with MetOp nadir-looking observations
- Co-registered measurements of IRLS, STEAMR and MetOp

Status of the EE-8 mission candidates Carbonsat, FLEX



CarbonSat

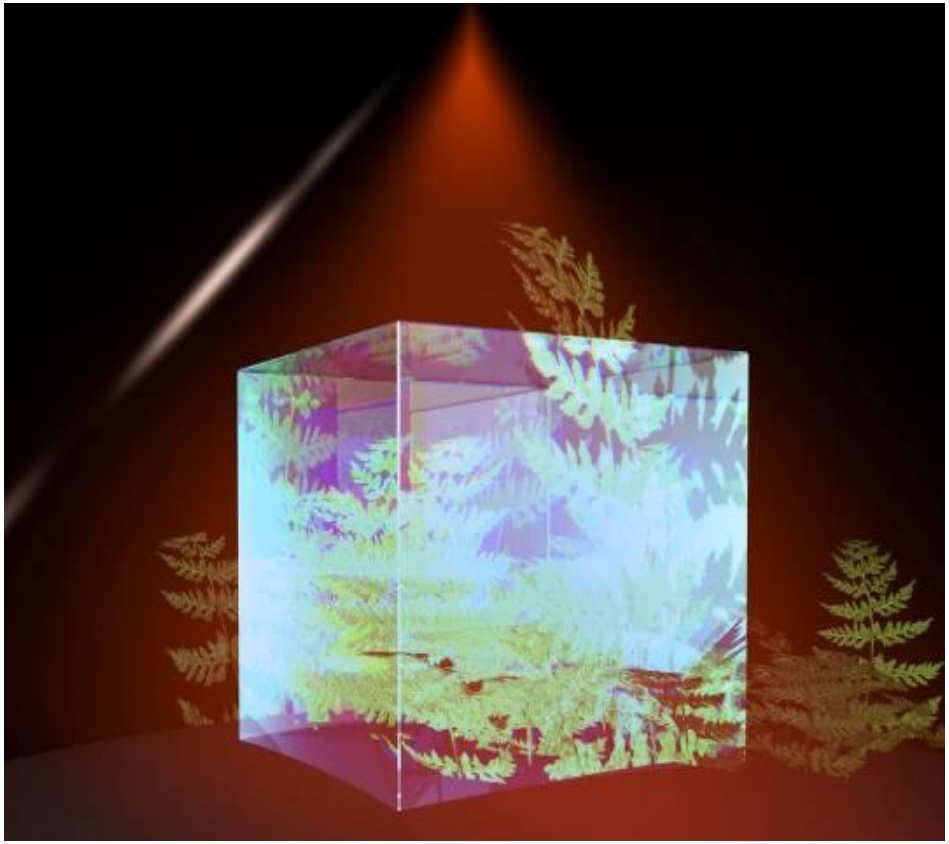


CarbonSat: to quantify and monitor the distribution of carbon dioxide and methane => better understanding of the sources and sinks of these two gases and how they are linked to climate change.

CarbonSat

- A single nadir-pointing satellite carrying a single instrument: The Green House Gases Imaging Spectrometer (GHGIS), operating in pushbroom mode archiving longitudinal coverage pole wards of 40° within 12 days with a pixel size of 2 x 2 km^2
- GHGIS records data in three spectral bands: NIR (747-773 nm) with a resolution of 0.1 nm; SWIR1 (1559 - 1675 nm) with a resolution of 0.30 nm; SWIR2 (1905 - 2095 nm) with a resolution of 0.5 nm
- GHGIS: based on single-slit dispersive concept using immersed or transmission gratings, with detectors and SWIR2 spectrometer elements passively cooled to 150-180 K and 250 K, respectively, and a set of calibration units (e.g. sun-illuminated diffuser) in front of the spectrometer
- Role of the Cloud and Aerosol Imager (CAI), proposed in the 'goal configuration', is fulfilled intrinsically by the imaging spectrometer
- Platform with pointing capability for sun-glint over the ocean and snow- and ice-covered high latitude areas (pitch only) as well as sun-pointing for radiometric calibration
- Satellite compatible with the Vega launcher
- Mission duration of three years, with a goal of five years

FLEX



FLEX: to provide global maps of vegetation fluorescence, which can be converted into an indicator of photosynthetic activity => better understanding of how much carbon is stored in plants and their role in the carbon and water cycles

FLEX

- A single three-axis stabilized satellite flying in tandem with Sentinel-3, observations between FLEX and Sentinel-3 instruments acquired within 6 to 15 s from each other

- A FLuORescence Imaging Spectrometer (FLORIS) acquiring images in the spectral range 500-780 nm, with a sampling of 0.1 nm in the oxygen bands (O_2-A [755-780 nm] and **O_2-B [677-697 nm]) and 0.5 to 2 nm elsewhere.**

- FLORIS operates in pushbroom mode with a swath of 100 to 150 km (contained within one of the Sentinel-3 OLCI camera swath) and a pixel size of 0.3 x 0.3 km^2 . For radiometric calibration it relies on both cross-calibration with the equivalent bands of OLCI and dedicated on-board calibration device

- OLCI and the SLSTR on Sent-3 provide complementary information to measure fluorescence signal - FLEX and Sentinel-3 images are co-registered by on-ground processing through correlation algorithms

EE - X

- EE – X is the acronym for a ‘small’ Earth Explorer mission, to be selected and implemented under EOEP-4
- This small mission is either a mission ‘in full’ or an instrument using a flight opportunity.
- Cooperation with national EO programmes will be encouraged (e.g. In-Kind Contributions).

EOEP – Potential Belgian Role

- At this early point of definition of EE-7, E-8 and EE-X missions (a fortiori selection), it is difficult to map any meaningful Belgian industrial involvement.
- Still, Belgian industry and institutions have so far been active and successful in participating in all the programme lines (techno, mission implementation, exploitation).
- The cumulative Belgian 'geo-return' on EOEP is well above 110%, as a token of the potential for Belgian actors to be involved in the programme.
- Besides direct 'geo-return', EOEP offers an environment nurturing the further creativity of the Belgian actors: technology for future missions, access to data, access to processing toolkits, co-location events, access to service 'end users', etc.
- In general, performance of Belgian Industry in Earth Explorers satellite's development activities has been satisfactory.

EOEP – Belgium's participation in EOEP up to date

- **Aeolus**
  - CSL -Vacuum Mechanical Test Fac
  - AMOS- Thermal Shrouds & MGSE Support
  - Euro Heat Pipes S.A- Laser Cooling System
  - Sonaca- Optical Bench
- **EarthCARE**
  - Thales Alenia Space (ETCA)- DC/DC Convertor of S-Band transponder
  - Euro Heat Pipes S.A- Laser Cooling System
  - INST ROYAL METEOROLOGIQUE- Level 2
  - Xenics- Detectors
  - Spacebel- Mass Memory & Formatting Unit (MMFU) ASV
  - CSL – Potential candidate for test facilities

EOEP – Belgium's participation in EOEP up to date

- **Swarm**
  - Thales Alenia Space (ETCA)- DC/DC Convertor of S-Band transponder
- **GOCE**
  - Nexans- Harness
- **CRYOSAT**
  - Thales Alenia Space (ETCA)- SIRAL EPC and DC/DC converter
- **General**
  - Engineering and Administration Support from RHEA

EOEP – 4
potential items of interests in the space segment

- Mechanical Test Facilities
- Thermal Shrouds, MGSE , OGSE
- Laser Cooling System
- DC/DC Convertor
- Optical Bench
- Infra-red Detectors
- On-Board Software Systems & System Validation Facilities
- Harness
- Engineering Services
- Ground segment and definition of operations

VAE - Value Adding Element
Overview of EOEP-4 proposal : Main elements

- **Scale-up EO Services for International Development Banks :**
  - **World Bank :** priority areas : Oceans, Urban, Forestry, Disaster Risk Reduction,
  - **European Investment Bank and European Bank of Reconstruction & Development :** in support of infrastructure developments,
  - **UN-IFAD** : in support of agricultural developments.
  - **Asian Development Bank :** areas TBD following first discussions 2012.

- **Develop Civil Security Sector :**
  - **European and international Law enforcement agencies** : Monitoring / surveillance/Intelligence services; making use of NRT/VH-res European EO missions.

- **Expand Corporate Industry Markets :**
  - **Re/Insurance** : Index-linked schemes for Floods & Crops, Risk assessment,
  - **Oil & Gas :** Environmental Impact, Health & Safety, Arctic Explorations,
  - **Renewable Energy :** Resources assessment (solar, wind, hydro, bio-fuels),
  - **Green Business** : Corporate sustainable development, Eco-Systems services.

VAE – Value Adding Element
Overview of Belgian participation

EO Value-Adding Companies :

- Land Cover, Crop Monitoring
- Urban mapping
- Environmental Impact Assessment
- Crop Yield estimation
- Atmospheric monitoring

Industrial Users :

- Geo-marketing research / consultancy
- Renewable Energy : Hydro-Power
- Certification Organic Crops,
- Sugar Beet Production (world leader)

International Development Banks:

12 Projects (since 2002), including :

- Support to World Bank (urban vulnerability),
- Support to European Investment Bank (motorway construction, environmental protection),
- Environmental impact of Hydro-Power operations,
- Improving Sugar Beet production,
- Certification of organic crops,
- Population & infrastructure for geo-marketing,
- Atmospheric monitoring of ship emissions.

Data User Element: Belgium in EOEP-3

GLOBCOVER *

GLOBVOLCANO

GLOBEMISSION

GLOBWETLAND

coastcolour

- U.C. Louvain
- BIRA-IASB
- VITO
- I-MAGE Consult
- KEYOBS S.A.
- MUMM
- Eurosense

* Globcover for EOEP-2

GMES Programme and GSC-3 Proposal for C-Min

Global Monitoring for Environment and Security

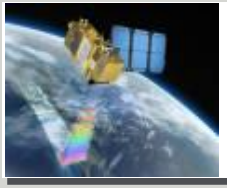
European independence in data sources for environment and security monitoring

Global, timely and easily accessible information in domains such as Land, Marine, Emergency response, Atmosphere, Security and Climate Change

GMES dedicated missions: Sentinels

Sentinel 1 – SAR imaging
All weather, day/night applications, interferometry

2013 / 2015



Sentinel 2 – Multi-spectral imaging
Land applications: urban, forest, agriculture,..
Continuity of Landsat, SPOT

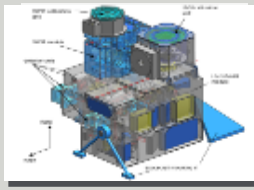
2013 / 2015

Sentinel 3 – Ocean and global land monitoring
Wide-swath ocean color, vegetation, sea/land surface temperature, altimetry

2013 / 2014

Sentinel 4 – Geostationary atmospheric
Atmospheric composition monitoring, trans-boundary pollution

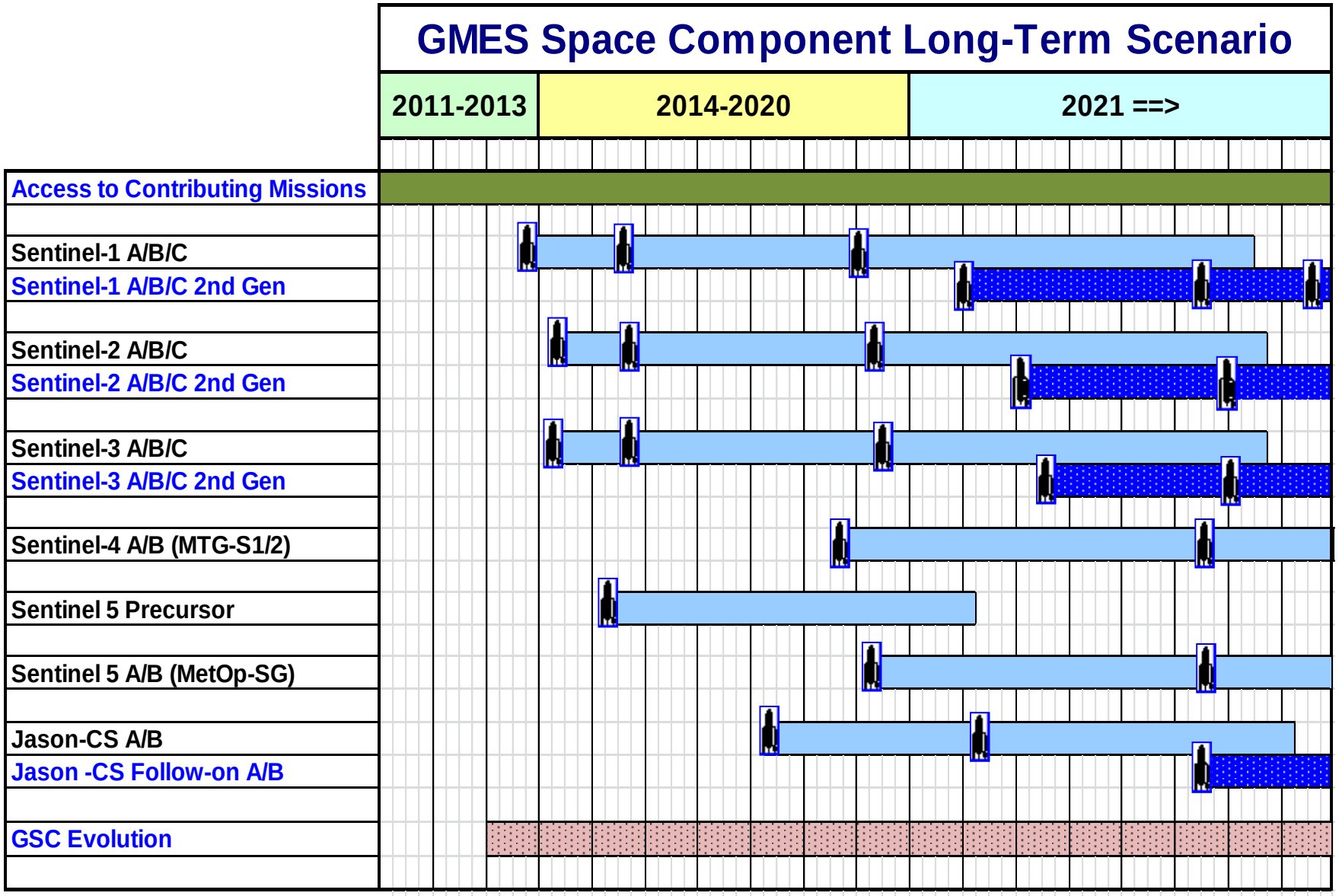
2020



Sentinel 5 – Low-orbit atmospheric
Atmospheric composition monitoring
(S5 Precursor launch in 2015)

2020+

Users need decade-long term perspectives



GMES Sentinel Data Policy Principles

FULL and OPEN*

* Joint Data Policy Principles
- adopted by ESA in '09,
- EU legal act to be prepared in '12

* free-of-charge licenses

* if not constrained by security or technical restrictions

GMES Space Component (GSC-3)

GSC-3: proposal for C-MIN 2012

- **Sentinel 5**
  - ✓ ESA contribution of 163 M€ (2012 e.c.)
  - ✓ MetOp-SG passenger PL, GS integration into EPS-SG provided by EUM (TBC)
  - ✓ 3 units, first unit financed by ESA MS, recurrent units and operations by EU (according to LTS)
- **Jason-CS**
  - ✓ ESA contribution B2/C/D/E1 of 188 M€ (2012 e.c.), assuming launcher provided by US
  - ✓ 2 units, first unit financed by ESA MSs, second unit and operations by EU (according to LTS)
  - ✓ Launch 2018 (JCS-A) and 2023 (JCS-B)
- **GSC Coordination and Studies Activities**
  - ✓ ESA contribution ~23 M€ (2012 e.c.)
  - ✓ Programme coordination, GSC system architecture analysis, Threat and Vulnerability assessment, GSC evolution
- **PDGS Adaptation, mainly Sentinel-5P (15 M€)**
- **Sentinel data interfaces for national use 16 M€/8 years**

2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
26	73	97	93	60	35	13	8	405

GMES Space Component: Belgium results

GMES element	Procurement item	ESA or FP7	Contractor selected
S1 A	Power Control and Distribution Unit (PCDU)	FP7	ETCA
S1 A	Transmit X-band Assembly (TXA)	ESA	ETCA
S1	Technical support for S1 mission implementation	ESA	RHEA
S1	GMES-S-1 Soil Moisture Algorithm Development	ESA	LHWM Gent University
S1 B	Power Control and Distribution Unit (PCDU)	FP7	ETCA
S1 B	Transmit X-band Assembly (TXA)	ESA	ETCA
S1 B	Deployment Control Unit (DCU)	ESA	ETCA
S2 A	MSI Prime & System Support - Activities	ESA	Astrium SAS
S2 A	MSI Test Facilities	ESA	CSL
S2 A	Mirror Polishing & Coating	FP7	AMOS
S2 A	Secondary Structure, PIP & Thermal HW	FP7	CSL
S2 A	Beam Splitter	ESA	AMOS
S2 A	Sun Beam Diffusor & Characterisation	FP7	CSL
S2 A	X-band Subsystem (XBS)	ESA	ETCA
S2 A	S-band Subsystem (SBS)	ESA	ETCA
S2 B	MSI Test Facilities	ESA	CSL
S2 B	Mirror Polishing & Coating	FP7	AMOS
S2 B	Secondary Structure, PIP & Thermal HW	FP7	CSL
S2 B	Beam Splitter	ESA	AMOS
S2 B	Sun Beam Diffusor & Characterisation	FP7	CSL
S2 B	X-band Subsystem (XBS)	ESA	ETCA
S2 B	S-band Subsystem (SBS)	ESA	ETCA
S2	Pre-development activities S2 Definition Study	ESA	Cypress
S2	Technical support for S2 mission implementation	ESA	RHEA
S3 A	Satellite MGSE - Part 1	FP7	AMOS
S3 A	Platform EGSE items - Pyro POWER SCOE & COTE	FP7	ETCA
S3 A	PCDU - Power Control and Distribution Unit	FP7	ETCA
S3 A	SBT - S-band Transponder	ESA	ETCA
S3 A	TX Assembly (TXA)	ESA	ETCA
S3 A	STR - Star Trackers	FP7	Cypress
S3 A	SRAL RFU EPC Ku&C Band	ESA	ETCA
S3 A	OLCI EGSE Support	ESA	AUSY
S3 A	OLCI Recurrent OGSE	ESA	CSL
S3 A	OLCI Calibration Hardware	FP7	CSL
S3 A	OLCI Calibration Mechanism	ESA	CSL
S3 A	OLCI Electronic Unit	ESA	ETCA
S3 A	OLCI COSA OGSE/Tools	ESA	CSL
S3 A	OLCI Hemisferical measurements on the Spectral diffusers	ESA	CSL
S3 A	Payload Electrical architecture support	ESA	Astek BE
S3	Management Reserve (A/B) Utilisation	ESA	various
S3	Technical support for S3 mission implementation	ESA	RHEA
S3	S3 Land Synergy Products for SPOT VGT continuation	ESA	VITO
S3 B	Satellite MGSE's	FP7	AMOS
S3 B	Platform EGSE items - POWER SCOE & COTE	FP7	ETCA
S3 B	PCDU - Power Control and Distribution Unit	FP7	ETCA
S3 B	SBT - S-band Transponder	ESA	ETCA
S3 B	TX Assembly (TXA)	ESA	ETCA
S3 B	STR - Star Trackers	FP7	Cypress
S3 B	SRAL RFU EPC Ku&C Band	ESA	ETCA
S3 B	OLCI Calibration Hardware	FP7	CSL
S3 B	OLCI Calibration Mechanism	ESA	CSL
S3 B	OLCI Electronic Unit	ESA	ETCA

- In GMES Segment-1/-2, Belgium has already achieved georeturn =1.
- More precisely, Belgium has totaled contracts for ~31 M€ against an ideal target (when taking the recent CAC increase into account) of ~20.5 M€ (2012 ec) and a contribution of ~24 M€.

GMES Space Component – Belgium role

- Potential role of Belgium industry on Segment-3 should build upon the good results achieved in Segment-1/-2.

- Concerning geo-return, GSC-3 will follow the std ESA rules (Segment-3 is not a joint programme with EC, it is a traditional ESA optional programme). This means that we "re-start from scratch" (so to say).

- A contribution at least in the order of GDP is expected. On the one side, it is fully justified by past performance; on the other side, it will still likely lead to an over-return.

MetOp Second Generation (MetOp-SG)

MetOp-SG Programme

- Collaborative programme with EUMETSAT.
- Designed to provide data continuity with, and to enhance the observations from, the existing first generation MetOp series (beyond 2020).
- Current MetOp satellites provide essential meteorological observations from polar orbit.
- ESA is responsible for the development of the prototype satellites and, on behalf of EUMETSAT, for the procurement of the recurrent satellites.
- EUMETSAT contributes to ESA development costs for the satellites and funds all the recurrent satellites.
- In addition, EUMETSAT develops the ground segment, procures the launch and LEOP services and performs the operations.

MetOp-SG for C-MIN 2012

- Overall programme size (ESA + EUM): > 3 Beuro.
- 2-satellite constellation – recurrent models (nominally 2 series of 3 satellites each).
- Proposal for Phase B2/C/D, spanning period ~2013-2022.
- Inclusion of ICI instrument to be decided by EUMETSAT Council on 5-6 July 2012.

MetOp-SG Payload Complement

Satellite	Instruments	Instrument Provider
Sat-A	METimage	DLR via EUMETSAT
	IASI-NG	CNES via EUMETSAT
	MWS	ESA – MetOp-SG
	RO	ESA – MetOp-SG
	3MI	ESA – MetOp-SG
	Sentinel-5	ESA – GMES
Sat-B	SCA	ESA – MetOp-SG
	MWI	ESA – MetOp-SG
	RO	ESA – MetOp-SG
	ICI (option)	ESA – MetOp-SG (option)
	Argos-4	CNES via EUMETSAT

MetOp-SG – Potential Belgian Roles

- MetOp-SG is a large programme and offers several possible roles for Belgian industry, with a global potential well above GNP level.
- With the recurrent satellites, MetOp-SG provides security for long-term industrial activities and workload / employment.
- Belgium is a EUMETSAT Member State and will contribute to the mandatory EUMETSAT EPS Second Generation programme at GNP level (2,6% in EUMETSAT framework).

Other Elements in General Budget

Other elements in General Budget

- Two other elements will be tabled in C-MIN 12, namely **Earthnet** and **Long-Term Data Preservation**, as part of the Level of Resources.
- Both critical elements are not exclusively related to ESA Earth Observation but cover the cooperation with and support to Member States, International Cooperation and elements common to different ESA directorates

LoR Element - Earthnet

- Science Access to National and International missions, Coherent PI Projects data access to ESA and Third Party Missions
- Implementation of the International Charter for Space and Major Disasters
- International Presence: Cooperation with China, Russia, US, Africa and any European and International Organisations
- Outreach, education, training
- Of the order of 22M/year

Relevance for Belgium:

- Guaranteed access to Third party mission EO data
- International agenda (Africa – Tiger and Charter)
- Proba-1 operations

LoR Element - Long-Term Data Preservation

- Assuring the long term data access (starting 5 years after the end of the mission lifetime)
- Relying on a distributed infrastructure with modern physical and virtual archives
- Evolution of processing and data access systems to allow 'use/exploitation of the data'
- Approach shared
    - with other national EO space systems in Europe (see agreed LTDP guidelines)
    - with SRE/HSO in ESA
- Assumption: 17M (2012 ec) annually in average for EO part

Relevance for Belgium:

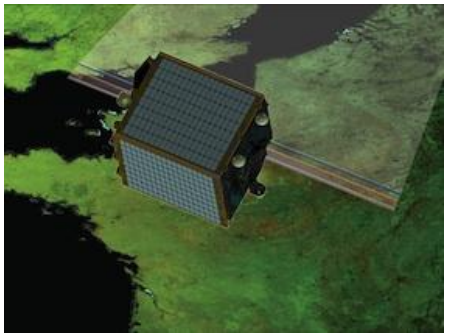
- Guaranteed access to EO data (unique long-time series back to 1990's)
- Proba-1 data
- Industry involvement in data preservation/mining/reprocessing tools

PROBA-V

Phase-E

PROBA-V Exploitation Phase (PROBA-VE)

PROBA Vegetation (PROBA-V) is the third mission of ESA D/TEC for the In-Orbit Demonstration (IOD) of technologies. It ensure the generation of "Vegetation" products data in continuity of the CNES SPOT/Vegetation missions. It will bridge the gap between SPOT/Vegetation decommissioning and the availability of the Sentinel 3A and -3B constellation between 2013 and 2015. To be launched end of 2012.



The new **PROBA-VEGETATION** payload consists of three aligned wide-field pushbroom radiometers (blue/red/NIR/SWIR) with a ground sampling distance of 100/350m for all bands, except SWIR 200/700m.
Quasi-daily acquisition of all land masses, along a repetitive seasonal pattern.

Flight Operations
Spacecraft and payload control and monitoring from REDU ESA Ground Station(B).
Payload data downlink via TBD Northern latitude station(s)

Payload Data Processing
User Segment in Mol (B) at the VITO.

PROBA-V Exploitation Phase (PROBA-VE)

PROBA-VE is a new element of the Earth Watch Programme, to be subscribed at the time of C/M 12, covering:

- the operations of PROBA-VE for the 2.5 years of 'nominal' ops phase, plus possibly 2.5 years extension,
- and the preservation of the archives for another 5 years.

Operations include mission management, data acquisition, processing and distribution of a pre-determined list of products, promotion of the use of PROBA-VEGETATION data.

Category	Indicative description	Spatial resolution	Title	Indicative access timeliness
P-Products	Level 1C = Level 1B further radiometrically corrected at pixel level (unprojected TOA reflectance).	Kilometric	P	72 hours
S - Products	Level 3 composite product of atmospherically corrected L2A data, projected onto a uniform space grid, corrected for cloud, ice/snow artefacts.	Kilometric	S1 TOA S1 TOC S10 TOC	72 hours 72 hours (10days)+ 72hours

PROBA-VE – potential Belgian role

- Valorisation of past investments/experience in both the Vegetation monitoring area and PROBA, through the re-use of facilities/capacities in ESA Redu and VITO.

- Continuity of the support to the VGT user community, especially until commissioning of Sentinel-3a/b.

- Synergy with Vegetation national programme: possibility for the programme participants to design and to offer additional products (e.g. higher geometric resolution) and services (e.g. NRT time delivery).