Welcome

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ERS-2: Launched in 1995

ENVISAT: Launched Feb. 2002 Fully operational

Meteosat Second Generation
MSG-1 launched Aug. 2002
MSG-2 launched Dec. 2005

MetOp
MetOp-1 launch Oct. 2006

Earth Observation Satellites
Earthnet: European access to non-ESA missions (JERS, LANDSAT, SeaWifs, MODIS, ADEOS-2, ALOS ...)

Applications

Services

Science

Meteo

in cooperation with EUMETSAT


METEOSAT M-1, 2, 3, 4, 5, 6

METEOSAT TRANSITION M-7

METEOSAT SECOND GENERATION MSG-1, 2, 3

METOP 1, 2, 3

CryoSat

SMOS

GOCE

ADM

Earth Watch

ERS-1, 2

ENVISAT

Earth Explorers

ESA Earth Observation Programme

• Living Planet Programme established in 1995 by ESA

• The objectives of the Living Planet Programme are to:
  – Further develop our knowledge of the complex Earth System
  – Preserve the Earth and its environment & resources
  – Manage life on Earth more efficiently/effectively

• Principal types of focused EO mission to realise these goals:
  – Earth Explorer - focused research & tech. demonstration missions designed to advance understanding of Earth System processes
  – Earth Watch - Operational Missions, serving operational and applications markets (e.g. GMES Sentinels)

*Goal is to develop new technologies whilst building long-term European industrial competitive edge - with benefits in both public and private sectors
Where are we?

- ESA’s Living Planet Programme contains the Earth Explorer line of “science-driven” missions

- Approved Earth Explorer Missions:
  - CryoSat (2005 launch - failed)
  - GOCE (planned 2007 launch)
  - SMOS (planned 2007 launch)
  - ADM-Aeolus (planned 2008 launch)
  - Swarm (planned 2009 launch)
  - EarthCare (planned 2012 launch)

- 6 new candidate Earth Explorer missions selected and under study after 2005 *Call for Mission Ideas*
First 4 Earth Explorer Missions

CryoSat-2
1st Opportunity Mission
Variations ice elevation / thickness / mass
Ku-band radar altimeter
Launch failure 2005
Launch 2009

SMOS
2nd Opportunity Mission
Soil Moisture and Ocean Salinity
L-band radiometer
Under construction
Launch 2009

GOCE
1st Core Mission
Gravity field and geoid
GPS receiver and Gradiometer
Nearing completion
Launch end 2007

ADM-Aeolus
2nd Core Mission
Wind speed profiles
Doppler wind lidar instrument
Under construction
Launch 2008

This workshop
Swarm: Mission Requirements

Single satellite
- Magnetic field magnitude and vector components
- Electric field vector components
- Electron density
- Air drag
- Position, attitude and time

Constellation
- 3 satellites:
  - 2 side-by-side in low orbit
  - 1 in higher orbit
- three orbital planes with two different near-polar inclinations
- Near polar orbits for global coverage

accurate enough at satellite altitude to measure the most demanding signals at finest spatial and fastest required temporal sampling
EarthCARE has been defined with the specific scientific objectives of quantifying aerosol-cloud-radiation interactions so they may be included correctly in climate and numerical weather forecasting models to provide:

- Vertical profiles of natural and anthropogenic aerosols on a global scale, their radiative properties and interaction with clouds.
- Vertical distribution of atmospheric liquid water and ice on a global scale, their transport by clouds and radiative impact.
- Cloud overlap in the vertical, cloud-precipitation interactions and the characteristics of vertical motion within clouds.
- The profiles of atmospheric radiative heating and cooling through a combination of retrieved aerosol and cloud properties.
Six new Earth Explorer missions (2006)

1. **BIOMASS** – to take global measurements of forest biomass.
2. **TRAQ** (TRopospheric composition and Air Quality) - to monitor air quality and long-range transport of air pollutants.
3. **PREMIER** (PRocess Exploration through Measurements of Infrared and millimetre-wave Emitted Radiation) – to understand processes that link trace gases, radiation, chemistry and climate in the atmosphere.
4. **FLEX** (FLuorescence EXplorer) – to observe global photosynthesis through the measurement of fluorescence.
5. **A-SCOPE** (Advanced Space Carbon and Climate Observation of Planet Earth) – to improve our understanding of the global carbon cycle and regional carbon dioxide fluxes.
6. **CoReH2O** (Cold Regions Hydrology High-resolution Observatory – to make detailed observations of key snow, ice and water cycle characteristics.)
Scientific challenges for ESA’s LPP

• an updated science strategy for ESA’s Living Planet Programme has been formulated under the guidance of the Earth Science Advisory Committee

• a wide consultation on the strategy with the scientific community was undertaken at a workshop in February 2006

• the document addresses Earth science through the five topics: oceans, atmosphere, cryosphere, land and solid Earth and identifies the challenges for each of these

• particular emphasis is put on the Earth system approach, and on the effect of humankind on that system
Based on information compiled by the International Geosphere-Biosphere Programme (IGBP).

(Image: MERIS mosaic)

Data Sources:
- Carbon Dioxide: NOAA.
- Temperature: Source unspecified.
- Species Extinction: Reid & Miller, World Resources Institute, Washington DC, 1989.