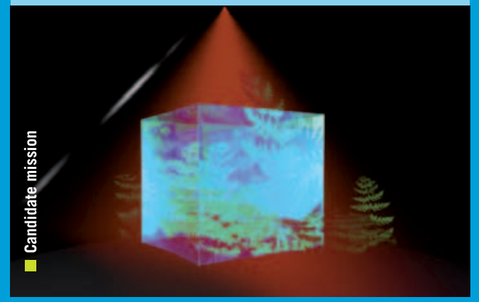
FLEX

To observe global photosynthesis through the measurement of fluorescence

Science: Photosynthetic activity determines how much carbon dioxide is removed from the atmosphere by plants and is therefore an important component of the global carbon cycle and closely linked to the water cycle through plant transpiration. Global observations of photosynthesis would provide information about the important role that plants play in the Earth system, and ultimately advance our understanding of climate.

Mission: The main aim of the FLEX concept is to make global observations of photosynthesis through the measurement of chlorophyll-fluorescence. Chlorophyll-fluorescence radiation is emitted from vegetation in the visible and infrared region of the electromagnetic spectrum and provides unique information about the photosynthetic activity of plants. FLEX will carry a very high-spectral resolution imaging spectrometer that allows the weak fluorescence signal to be decoupled from the reflected sunlight background. Secondary instruments will observe other variables such as vegetation temperature, which together with the fluorescence observations will allow for the assessment of light-use efficiency and exchange of carbon between plants and the atmosphere.

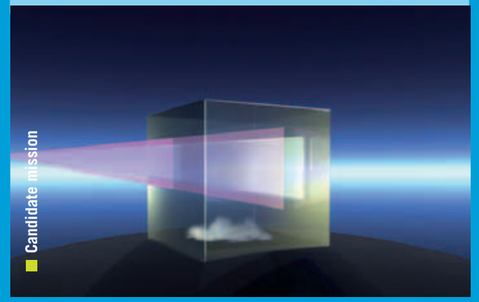


PREMIER

To understand atmospheric processes linking trace gases, radiation, chemistry and climate

Science: Many processes that affect the Earth's climate occur at the boundary between the upper troposphere and lower stratosphere. For example, water vapour, ozone and clouds in this region play an important role in radiative forcing and feedback. Global observations of this part of the atmosphere are currently very limited and consequently our knowledge of processes in this region is very poor.

Mission: The PREMIER concept aims to advance our understanding of the processes that link trace gases, radiation and chemistry in the upper troposphere and lower stratosphere. The radiative effects of water and clouds are at a maximum in this region. It is also a region characterised by small-scale processes that have not been studied by previous missions. The instrumentation will consist of an infrared limb-imaging spectrometer and a millimetre-wave limb-sounder. By linking with MetOp and the National Polar-orbiting Operational Environmental Satellite System (NPOESS) data, PREMIER also aims to provide insights into processes occurring in the lower troposphere.



TRAQ

To monitor air quality and long-range transport of air pollutants

Science: Human activity is, without doubt, changing the composition of the Earth's atmosphere at local, regional and global scales. The changes that are occurring are not only altering the climate, but are also having an adverse effect on ecosystems and human health. With air pollution being a serious public concern, a better understanding of the associated chemical and physical processes affecting air quality is currently needed.

Mission: The TRAQ mission concept focuses on air quality and the long-range transport of air pollutants. The objective is to understand more about the rate of air-quality change at regional and global scales, the strength and distribution of sources and sinks of tropospheric trace gases and aerosols influencing air quality, and the role of tropospheric composition in global change. A new synergistic sensor concept would allow for process studies, particularly with respect to aerosol-cloud interactions. The instrumentation concept consists of imaging spectrometers operating in ranges between ultraviolet and short-wave infrared, spectrometers in the thermal infrared, a multi-directional polarization imager and a cloud imager.

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EARTH EXPLORERS
IN ASSESSMENT PHASE

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Agence spatiale européenne

the Living Planet


Earth Explorer Candidate Missions under assessment

The six Earth Explorer mission ideas outlined here are currently undergoing assessment - prior to a down-selection procedure that will determine which will undergo feasibility study.

The procedure involves the science community right from the beginning and by introducing a peer-reviewed selection process this on-going user-driven approach provides tools with which to further understand and monitor our planet. So far, this method has resulted in the Earth Explorers that are currently being implemented, along with these six candidate missions that were selected in 2006 for assessment study following ESA's Call for Core Mission Ideas.

Within the context of ESA's Living Planet Programme, these missions focus on the atmosphere, biosphere, hydrosphere, cryosphere and the Earth's interior, with the overall emphasis on providing data to advance our understanding between these components and the impact that human activity is having on natural Earth processes.




The Living Planet Programme

Today, the biggest threat to life on Earth is global change, which not only encompasses the consequences of a warming climate, but also the large-scale impact that a growing global population and continued economic growth place on the Earth's resources and environment.

It is crucial that we continue to monitor our planet from space if we are to better understand the Earth system as a whole and develop ever-more sophisticated models to predict future global trends. As our quest for knowledge builds, so does our demand for accurate satellite data to be used for numerous practical applications relating to protecting and securing the environment.

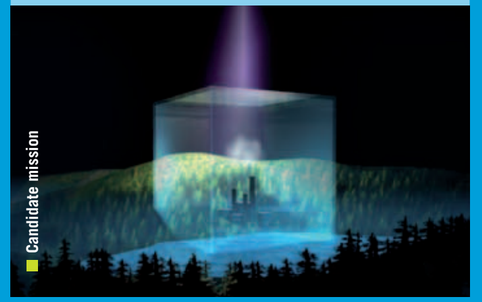
These challenges form the basis of ESA's Living Planet Programme, which comprises two main areas: a science and research component and the Earth Watch element designed to facilitate the delivery of data for the eventual use in operational services. Earth Watch includes the well-established meteorological missions with EUMETSAT, and also new missions focusing on the environment and civil security under GMES (Global Monitoring for Environment and Security) - a European Commission initiative through which ESA carries the responsibility for implementation of the space component.


A-SCOPE

To improve our understanding of the global carbon cycle and regional carbon dioxide fluxes

- **Science:** Carbon dioxide is considered one of the most important anthropogenic greenhouse gases contributing to climate change. Continued observations of atmospheric carbon dioxide from space are needed for a better understanding of the global carbon cycle and regional carbon dioxide fluxes. Observations are also required for the validation of greenhouse gas emission inventories.

- **Mission:** The A-SCOPE mission concept aims to observe total column carbon dioxide with a nadir-looking pulsed Differential Absorption Lidar (DIAL). The lidar would have high-resolution ranging capability to provide additional information on tree canopy height. In addition, aerosol and cloud layer information could be gained as a spin-off. Contextual information would be acquired by an imaging instrument. The mission would realise a spatially-resolved global carbon budget combined with diagnostic model analysis through global and frequent observation of carbon dioxide.

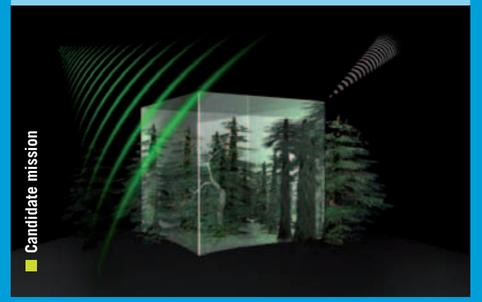


BIOMASS

To take global measurements of forest biomass

- **Science:** Currently, one of the most important but least quantified aspects of the Earth's carbon cycle is the role that the terrestrial biosphere plays in the uptake of atmospheric carbon dioxide. Global monitoring of forest biomass is essential to determine the sources and sinks of carbon as a result of land use change and natural processes, which would lead to improved present assessments and future projections of the carbon cycle.

- **Mission:** The objective of the BIOMASS mission is to acquire global measurements of forest biomass to assess terrestrial carbon stocks and fluxes. The mission concept is envisaged as a novel spaceborne P-band synthetic aperture polarimetric radar operating at 435 MHz and a 6 MHz bandwidth. In addition to valuable data on forest biomass, the choice of radar sensor means that the mission could also provide new information on ice-sheet thickness and internal structures in cold regions, subsurface geology in arid regions, as well as data on soil moisture, permafrost and sea-surface salinity.



COREH$_2$O

To make detailed observations of key snow, ice and water cycle characteristics

- **Science:** Water held in snow, ice and permafrost in the cryosphere and cold regions is an important component of the Earth system. Observations of the key characteristics and variability in snow and ice, and their contribution to the global water cycle are required for modelling land surface, atmosphere and ocean processes in cold environments, and to further our understanding of how climate change is impacting these regions.

- **Mission:** The CoReH$_2$O mission concept aims to fill the gaps in current information on snow, glaciers and surface water. The objective is to improve the modelling and prediction of water balance and streamflow for snow covered and glacierised basins, the modelling of water and energy cycles at high latitudes, and the forecasting of water supply from snow cover and glaciers, including the relation to climate change and variability. The mission concept employs twin frequency synthetic aperture radars (9.6 and 17.2 GHz) in two consecutive mission phases to deliver all-weather, year-round information on regional and continental-scale snow-water equivalent.