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A future research infrastructure: ICOS - Integrated Carbon Observing System

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ICOS is a new European Research Infrastructure for quantifying and understanding the greenhouse balance of the European continent and of adjacent regions.

It was realized early that, high precision long-term carbon cycle observations form the essential basis of carbon cycle understanding and that these observations must be secured beyond the lifetime of a research project. ICOS aims to build a network of standardized, long-term, high precision integrated monitoring of:

- atmospheric greenhouse gas concentrations of CO_2, CH_4, CO and radiocarbon-CO_2 to quantify the fossil fuel component
- ecosystem fluxes of CO_2, H_2O, and heat together with ecosystem variables.
- The ICOS infrastructure will integrate terrestrial and atmospheric observations at various sites into a single, coherent, highly precise dataset. These data will allow a unique regional top-down assessment of fluxes from atmospheric data, and a bottom-up assessment from ecosystem measurements and fossil fuel inventories. Target is a daily mapping of sources and sinks at scales down to about 10 km, as a basis for understanding the exchange processes between the atmosphere, the terrestrial surface and the ocean.

The ICOS Research Infrastructure was selected by the European Strategy Forum for Research Infrastructures (ESFRI) roadmap in October 2006 as one of the vital new European Research Infrastructures for the next 20 years. ICOS was initiated by successful developments of the research tools and capacity building at the European level necessary to quantify and understand the sources and sinks of greenhouse gases at regional and continental scales (AEROCARB, CARBOEUROPE, NITROEUROPE, and CARBOOCEAN).

The implementation of ICOS will take place in two steps. (1) During the Preparatory Phase starting in 2008 until 2011, the funding commitments will have been endorsed by the governments and mother institutions, the building of the central facilities will be initiated, and the project will be technically developed up to the level of a demonstration year of full operation, but with a reduced number of observational sites. (2) During the follow-up Operational Phase from 2012 until 2031, after the full scale deployment of the network, it will be run in an operational mode, and greenhouse gas concentrations and fluxes will be determined on a routine basis.

The infrastructure will allow an enhanced visibility and dissemination of European greenhouse gas data and products that are both long-term and carefully calibrated. ICOS seeks to meet the data needs of carbon cycle and climate researchers as well as those of politicians and the general public. ICOS will serve as the backbone to users engaged in developing data assimilation models of greenhouse gas sources and sinks, namely reverse modelling, which allows the deduction of surface carbon flux pattern.

A common data center, the Carbon Portal (http://www.icos-infrastructure.eu/) put into place by ICOS, will provide free access to ICOS data services, as well as to links with inventory data, and outreach material. This portal will allow the production web based tools for the survey of sources and sinks in near real time. ICOS will deliver the information in near real time with a quantification of the uncertainty associated with the results due to the use of several different models using different methodologies.

ICOS will enable Europe to be a key global player for in situ observations of greenhouse gases, data processing and user-friendly access to data products for validation of remote sensing products, scientific assessments, modelling and data assimilation.