



CARBON FROM SPACE 1st Announcement

**ESA-ESRIN, Frascati,
Italy**

6-8th June 2005

Background

The publication of the IGOS Integrated Global Carbon Observation (IGCO) Theme Report and the current concerted effort to produce the subsequent Implementation Plan have identified a number of actions where the various Space and/or Operational Agencies need to take action to help quantify the spatial variability in concentrations of atmospheric carbon in its principal forms – carbon monoxide, carbon dioxide and methane and subsequent to that the consider how to determine the exchange fluxes between surface and atmosphere. In response to this need and the identified actions the European Space Agency will convene a symposium to help clarify the identified actions, to identify the necessary steps to implement such actions and aid it, and its sister Space/Operational Agencies, to devise a joint approach to meet these requirements in research and operational terms. This symposium will have as its specific objectives the following:

- 1) obtaining information on gaseous concentrations of carbon in the atmosphere from space-based observations and their validation using in situ methods (e.g. ground-based FTIR)
- 2) the development of new sensors and programmes to provide continuity of the existing measurements even where those instruments were not specifically designed for estimating atmospheric carbon.
- 3) the ingestion/assimilation of such gaseous concentrations of carbon in models of atmospheric transport to determine carbon fluxes
- 4) provision, again globally, of the key parameters required to constrain estimate surface-atmosphere exchange, particularly wetland distribution and variability, disturbance extent and timing, vegetation activity, ocean colour and ancillary atmospheric and ocean variables controlling the fluxes.

Content

1) Gaseous concentrations of carbon

Global estimates of atmospheric concentrations of CO, CO₂ and CH₄ from remote sensing platforms are critical as boundary constraints for characterisation of the global carbon cycle. Observations need to be spatially comprehensive, cover long time periods, and achieve the highest possible level of accuracy that is obtainable with current satellite systems. This section will comprise discussion of the products from the existing set of satellite sensors, their inter-comparison, validation against representative *in situ* and ground based remote sensing measurements (FTIR systems, networks of



flux towers and in situ atmospheric concentration observations), and experiments in multi-sensor approaches. Emphasis will also be placed on the use of systematic aircraft measurements to validate satellite observations. The principal contributors to such an exercise are seen as the Principal Scientists for individual instruments (AIRS, Sciamachy, TOVS), the key scientific groups developing research and semi-operational products from these instruments, and the ground-based measurement community. Discussion of key additional measurements e.g. aerosols will also be included.

2) New sensor programmes and continuity

The second key objective is to examine issues related to maintenance and continuity of the observation effort through the development of satellites and sensors capable of measuring these gases beyond the timeframe of the current generation of satellites. This should concentrate on the IGCO identified actions with respect to IASI, CrIS, OCO, Sciamachy and GOSAT and the concomitant development of a ground processing system which can deliver the required products in a simple format for ingestion in global carbon models. Such discussion is intended to help ESA in its plans for development of the GMES Sentinels in Atmospheric Composition. Further, given the research nature of OCO/GOSAT, it should consider their continuity to account for the very significant inter-annual variability in the sources and sinks across one full ENSO cycle. Finally, discussion should be focused on the key next generation of observations, based on active techniques that are capable of measuring the atmospheric column without diurnal, seasonal, latitudinal, or surface restrictions.

3) Modelling

One of the key limitations, in the context of Space Agency commitment to provision of observations, is their relatively limited uptake and use in atmospheric transport models. A vital component of the symposium will be a session on assimilation of such satellite-based remote sensing data and in-situ data in models, focusing on examples of such activity with the current generation of observations and on plans for the development of assimilation schemes to ingest both the current generation of measurements (MOPITT, AIRS, Sciamachy) and those upcoming (IASI, CrIS, OCO, GOSAT). The key players in atmospheric chemical transport modelling will contribute in this section.

4) Surface-atmosphere exchange of direct relevance to 1)

Besides the pure atmospheric data assimilation problem significant improvement in attribution of flux sources and sinks can also be achieved by the development of key surface datasets. A large number of potential land and ocean surface products could contribute to this, however, it is felt that to make rapid progress in a relatively short amount of time the discussion should be focused on three specific areas:

- 1) Fire distribution and timing – as sources and constraints on spatial variability. This will encompass both active fires and burned area and possibly can include some discussion on biomass consumption. Key elements here will be the GLOBCARBON burned area products plus the identified IGCO action on synthesis of active fire products towards a global daily distribution product as required by IGCO.



- 2) Anthropogenic emissions – as sources directly through fossil fuel consumption by industry, transport and domestic use and cement production.
- 3) Wetlands – a major gap in surface observations is the absence of detailed information on the spatial distribution and temporal variability of ‘wetlands’ as key sources of methane emission. These include: permanent wetlands, seasonal flooded wetlands, fens, bogs, marshes, and rice paddies.

Timing and Format

The symposium will be convened at the European Space Agency ESRIN site in Frascati, Italy (in the Castelli Romani hills outside Rome) from the 6th–8th June 2005 and will take the form of the four dedicated sessions described above, comprising presentations from recognised experts in each field and discussion sessions. In addition an open poster session is envisaged.

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