French contribution to the Global Climate Observing System

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Introduction and general considerations

This report gives an overview of the GCOS activities in France in the three domains and how to respond to the GCOS IP. The GCOS program, which means observations for monitoring the climate in the three domains is mainly driven by Météo-France for the atmospheric domain, but other institutions are working in the field of climate, especially for specific purposes (oceanography, glaciers, greenhouse gas composition, …). A number of observations are done for research purposes, and the problem is "how to insure these observations in the long term?". Also, in some cases, these climate observation networks are developed along an european structure (Framework Program), and the national level is not pertinent ! Another item for consideration is the question of historical data, which appear very useful to understand present and future climate (these programs are mentioned as research programs in the National Communication and concern paleo-climatic data).

Finally the question of the GCOS program in developing countries, especially in Africa can be considered in the frame of the programmes AMMA and RIPIECSA, which looks like to a follow-up of AMMA. As a conclusion, the inventory of these observations for climate is written down every five years for the National Communications for the Climate Convention, in the chapter "Research and Systematic Observation". The last update (4th National Communication) can be found on the Unfccc website (www.unfccc.int, see National Reports, or look at the following web link : www.effet-de-serre.gouv.fr/images/documents/4th National Communication.pdf).

Atmospheric domain

This is a domain operated by Météo-France. The whole system consists of 6 GSN stations (surface observations) on the continental France (with messages CLIMAT sent to NCDC, USA) and 14 ones for over-seas territories. For GUAN (altitude observations) the network consists of 9 stations in over-seas territories (producing messages CLIMAT TEMP). 9 other GSN stations have been defined on continental France to reproduce the effect of orography on the climate (in the frame of ECSN project).

For chemistry of the atmosphere, there are four stations in continental France measuring precipitation chemistry, radiation and tropospheric ozone (belonging to the BAPMON network). Overseas ozone is measured at three sites in the frame of the NDACC network (stratospheric and upper tropospheric ozone). Other complimentary measures of the ozone are done in different sites located around the globe (Finland, Russia, Greenland and Brazil). Finally the CO_2 is measured (RAMCES program) in Amsterdam island, Mace Head (Ireland), Puy de Dôme and Biscarosse, with some flasks in 12 sites located around the world. Similar measurements are done for other green-house gases in the frame of this RAMCES program, allowing to compute their budget over a region like Europe or America, or an hemisphere. All these measurements contribute to the GAW network. The operating agencies are INSU-CNRS for NDACC and LSCE for RAMCES. As an example of RAMCES measurements (Bousquet et al., 2006) show the contribution of anthropogenic and natural sources to the atmospheric methane variability.

Other initiatives in that field of monitoring the atmospheric composition and where France plays a role are the following European projects : GEOMON (Geophysical fields Monitoring)

which concerns the measurements in four domains (Greenhouse gases-GHG, atmospheric pollution, aerosols, stratospheric ozone); MACC (Monitoring Atmospheric Composition and Change), which is the follow on of GEMS (2005-2009) and which try to build a high-level monitoring of GHG, reactive gases and aerosols, including data-assimilation and multi-model forecasting. A last point to be mentioned is the french involvment in the Integrated Carbon Observing Strategy (ICOS).

Oceanic domain

The French contribution to oceanographic observation for climate comes under the GOOS system (Global Ocean Observation System) and contains the following measurement systems: voluntary and occasional observation ships, ocean gauges (GLOSS network), floating and anchored weather buoys and, finally, sub-surface floaters like ARGO (Coriolis Project). We also maintain the PIRATA observation system (anchored buoys) in the tropical Atlantic ocean and TAO for the Pacific ocean. We would like to emphasize the operational direction of ocean observation, with Mercator modelling projects, the Coriolis observation project, which have been integrated in the data assimilation experiment GODAE (2003-2005). The seven French agencies involved in oceanography (CNES, CNRS, IFREMER, IPEV, IRD, Météo-France and SHOM) are joining forces to develop a complete and coherent system of operational oceanography based on three projects : satellite altimetry (JASON), global numerical modelling with assimilation (MERCATOR) and *in situ* measurements (Coriolis). The Coriolis project allows to construct an operational structure for acquiring, collecting, validating and distributing world ocean data (temperature, salinity and current profiles) responding to the needs of modellers (MERCATOR) and of the scientific community (under CLIVAR). For main results of this project see Mercator website (www.mercator-ocean.fr).

Terrestrial observations

The Global Terrestrial Network (GTN) deals with observation of mountain glaciers, and measurements of carbon fluxes linked to terrestrial ecosystems (FLUXNET). Mountain glaciers are thus studied in numerous parts of France (five glaciers) and abroad, in particular by LGGE, IRD and CEMAGREF. The Observatory GLACIO-CLIM, which is labelled as "Observatoire de Recherche en Environnement", consists of monitoring some glaciers on different latitudes (which implies different regimes). The sites concerned are in mainland France (5 glaciers), in Bolivia and Ecuador, in Antarctica (2 glaciers). An example of the monitoring of four glaciers in France we refer to (Vincent, 2002). For the Observatory Glacio-Clim see the Web site : www.lgge.ujf-grenoble.fr/ServiceObs/. France is also actively participating in measuring carbon fluxes in terrestrial ecosystems (6 sites with different land cover) carried out under the international programme Fluxnet, and the various programmes connected with the Carboeurope project group. The Carboeurope integrated project aims to determine the role of european continent in the global carbone cycle. The agencies involved in this program are : INRA, CNRM, LSCE… An example of such measurements is given in (Ciais et al., 2006) concerning the heat and drought event of summer 2003 in Europe. More specific experiments have recently been conducted in the SouthWest France (Les Landes, May-June 2005, Dolman et al., 2006) with various land cover. Finally forest ecosystems have also been systematically observed by the National Forestry Inventory (IFN) every ten years for almost forty years, through a mechanism put in place after the damage caused by acid rain.

Coordination at national level and documentation

During the year 2008 a meeting with the French agencies involved in the different components of GCOS will be an opportunity to discuss the future plan to fulfil the GCOS IP. These institutions are mentioned at the end of that paper. That could also be done in the frame

of the French GEO-GMES group, which holds a regular meeting, every three months. Several publications in French have also been written for different workshops in France, illustrating various aspects of the third National Communication (2001), see the references Juvanon du Vachat (2003, 2004) at the end of that paper.

GCOS in Africa

After the GCOS regional meeting held in Niamey (march 2003), a number of discussions have occurred on how to restore the deficient networks for climate observation, especially in that part of Africa (West and Central Africa). It is important to mention the AMMA experiment (Redelsperger et al., 2006) conducted in that region, leading to restore some radio-soundings and fine scale measurements covering meteorology but also hydrology and aerosols. The operational measurements cover a period up to the end of 2007, but in the frame of the RIPIECSA experiment the sustainability of a part of the meteorological network will be insured for one more year. Finally a new project supported by FFEM (French component of GEF), along with other organisations (ACMAD, ..) has been recently proposed, in order to comply with G8 commitments for France ("Climate and observations for Africa"). That project is mainly built on the question of "Climate adaptation for Africa", in the sectors of agriculture, water resources and health, but also the prevention of the consequences of severe weather and climate events. A similar project has been formulated and supported (July 2007) by this FFEM agency in the context of "adaptation" and covering the five islands of the west part of the Indian ocean (Réunion and Mayotte, Mauritius, Madagascar, Comoros, Seychelles). It is a pilot project in the context of "Impacts, Adaptation and Vulnerability".

Conclusion

As an interim report before the next fifth National Communication, there is a need to clarify the future plans in the different domains covered by GCOS, in accordance with GCOS IP and with the deadlines for submission to UNFCCC (15 september 2008). That will be done at the institutional level (INSU, …) inside the french GEO-GMES group and in relation with the COP agenda. The new reporting format will also be used for that National Communication. We refer again to the web link to the 4th National Communication, where the detailed inventory of the networks, including the space component can be found : www.effet-de-serre.gouv.fr/images/documents/4th National Communication.pdf).

French Institutions involved in climate observations

CEMAGREF : Centre d'Etudes du Machin. Agricole, du Génie Rural et des Eaux et Forêts
CNES : Centre National d'Etudes Spatiales
CNRS : Centre National de Recherche Scientifique
CNRM : Centre National de Recherche Météorologique (Météo-France)
IFN : Inventaire Forestier National
IFREMER : Institut Français de Recherche et d'Exploitation de la MER
INSU : Institut National des Sciences de l'Univers
INRA : Institut National de la Recherche Agronomique
IPEV : Institut Paul Emile Victor
IRD : Institut de Recherche pour le Développement
LGGE : Laboratoire de Glaciologie et de Géophysique de l'Environnement
LSCE : Laboratoire des Sciences du Climat et de l'Environnement
Météo-France (Direction de la Climatologie)
SHOM : Service Hydrographique et Océanographique de la Marine

Acronyms

ACMAD : African Centre for Meteorological Applications for Development

AMMA : African Monsoon Multidisciplinary Analysis
ARGO : Array for Real time Geostrophic Oceanography
BAPMON : Background Air Pollution MONitoring
CLIVAR : Climate Variability and Predictability
COP : Conference of Parties (Unfccc)
ECSN : European Climate Service Network
FFEM : Fonds Français de l'Environnement Mondial
GEF : Global Environment Fund
GAW : Global Atmosphere Watch
GCOS : Global Climate Observing System
GCOS IP : GCOS Implementation Plan
GEMS : Global Earth-system Monitoring using Satellite and in-situ data
GEO : Group on Earth Observations
GEOMON : Global Earth Observation and MONitoring of the atmosphere
GLOSS : Global Sea Level Observing System
GMES : Global Monitoring for Environment and Security
GODAE : Global Ocean Data Assimilation Experiment
GOOS : Global Ocean Observing System
GSN : GCOS Surface Network
GTN : Global Terrestrial Network
GUAN : GCOS Upper Air Network
ICOS : Integrated Carbon Observation Strategy
MACC : Monitoring Atmospheric Composition and Change
NDACC : Network for the Detection of Atmospheric Composition Change
PIRATA : Pilot Research Moored Array in the Tropical Atlantic
RAMCES : Réseau Atmosphérique de Mesure des Composés à Effet de Serre
RIPIECSA : Recherche Interdisciplinaire et Participative sur les Interactions entre les Ecosystèmes le Climat et les Sociétés d'Afrique de l'ouest
TAO : Tropical Atmosphere Ocean
UNFCCC : United Nations Framework Convention on Climate Change

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