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Status of implementation of GCOS Climate monitoring principles by ESA

This paper provides a first analysis addressing to what extent current practice of data handling at ESA adheres to the GCOS climate monitoring principles from satellites.

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Introduction

The Conference of the Parties to the UN Framework Convention on Climate Change adopted ten basic principles for effective monitoring systems for climate at its COP-5 meeting in Bonn in November 1999. Ten additional principles related to satellite systems were subsequently added and are addressed below.

ESA is currently operating the ERS-2 and Envisat satellites and is about to launch the first of a series of Earth Explorer satellites that address a range of Earth science issues. ESA also develops satellites for Eumetsat, where the requirements relevant to many of the monitoring principles are defined by Eumetsat.

Below the implementation of the monitoring principles by ESA are briefly commented upon.

1. - Constant sampling within the diurnal cycle (minimizing the effects of orbital decay and orbit drift) should be maintained

For scientific satellites the orbital requirements vary according to the scientific objectives. For the ERS and Envisat satellites sun-synchronous orbits are used, thereby ensuring constant local time of observations.

2. - Overlapping observations should be ensured for a period sufficient to determine inter-satellite biases

Where similar or identical sensors are deployed on separate satellites, careful intercomparison is performed. This is the case for sensors on the ERS and Envisat satellites, like synthetic aperture radars, radar altimeters, the ATSR instruments and some atmospheric chemistry instruments. This requirement is also supported through the extensive calibration activities undertaken as part of new satellite missions.

3. - Continuity of satellite measurements (i.e. elimination of gaps in the long-term record) through appropriate launch and orbital strategies should be ensured

Although ESA is not in a position to ensure continuity of observations from scientific satellites in general, this is an important element, and indeed a driver, for the planned GMES satellites.

4. - Rigorous pre-launch instrument characterization and calibration, including radiance confirmation against an international radiance scale provided by a national metrology institute, should be ensured

All new instruments are characterised and calibrated before launch, and during the commissioning phase immediately following the launch, calibration is one of the primary goals. In addition regular calibration activities take place during the lifetime of the instruments in order

to account for ageing effects. Depending on the instrument, both onboard and vicarious calibration activities are maintained throughout the mission lifetime.

6. - On-board calibration adequate for climate system observations should be ensured and associated instrument characteristics monitored

See response to item 4.

7. - Operational production of priority climate products should be sustained and peer-reviewed new products should be introduced as appropriate

All products are based on user requirements from outside the Agency.
New products are also being developed in close cooperation with the different users. ESA maintains extensive programmes where new applications and corresponding products are being developed.

8. - Data systems needed **to facilitate user access to climate products, metadata and raw data, including key data for delayed-mode analysis, should be established and maintained**

ESA has a web-based user interface for browsing and ordering data. An extensive archive of data is maintained, from which all data is available to users, also after the end of a mission. This includes a number of products from raw data to higher-level products. The data catalogues can be accessed through the user interface. For many instruments toolboxes are available for users, and reprocessing of archived data sets is done when needed.

9. - Use of functioning baseline instruments that meet the calibration and stability requirements stated above should be maintained for as long as possible, even when these exist on de-commissioned satellites

When launched ESA satellites have a nominal lifetime. Both the ERS satellites have continued functioning well beyond their nominal lifetime, and in both cases operation of the missions has been maintained. When the gyros on ERS-2 failed, new algorithms were developed for the scatterometer in order to allow the operational use of the scatterometer products to be continued in spite of the lower pointing accuracy.

10. - Complementary in-situ baseline observations for satellite measurements should be maintained through appropriate activities and cooperation

ESA performs validation activities both through in-situ and airborne data collection activities. These activities draw heavily on cooperation with other organisations. For some instruments in-situ measurements are being maintained in databases.

11. - Random errors and time-dependent biases in satellite observations and derived products should be identified

This is done through the calibration and validation activities as described above.