CURRENT STATUS OF THE VALIDATION OF THE ATMOSPHERIC CHEMISTRY INSTRUMENTS ON ENVISAT

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Envisat is ESA's advanced Earth observing satellite launched in March 2002 and is designed to provide measurements of the atmosphere, ocean, land and ice over a five-year period. After the launch and the switch-on period, a six-month commissioning phase has taken place for instrument calibration and geophysical validation, concluded with the Envisat Calibration Review held in September 2002.

In addition to ESA and its industrial partners in the Envisat consortium, many other companies and research institutes have contributed to the calibration and validation programme under ESA contract as expert support laboratories (ESLs). A major contribution has also been made by the Principal Investigators of approved proposals submitted to ESA in response to a worldwide "Announcement of Opportunity for the Exploitation of the Envisat Data Products" in 1998. Working teams have been formed in which the different participants worked side by side to achieve the objectives of the calibration and validation programme.

Validation is a comparison of Envisat level-2 data products and estimates of the different geophysical variables obtained by independent means, the validation instruments. Validation is closely linked to calibration because inconsistencies discovered in the comparison of Envisat Level 2 data products to well-known external instruments can have many different sources, including inaccuracies of the Envisat instrument calibration and the data calibration algorithms. Therefore, initial validation of the geophysical variables has provided feedback to calibration, de-bugging and algorithm
improvement. The initial validation phase ended in December 2002 with the Envisat Validation Workshop at which, for a number of products, a final quality statement was given. Full validation of all data products available from the Atmospheric Chemistry Instruments on Envisat (MIPAS, GOMOS and SCIAMACHY) is quite a challenge and therefore it has been decided to adopt a step-wise approach. As a first step the intention is to arrive at a first quality assessment of the data products for near-real time distribution. This core validation was performed during the commissioning and validation phase of Envisat. The results of this exercise have been presented at the Envisat Validation Workshop. It was already anticipated early in the program that more work needed to be done after this workshop on all Envisat data products both for near-real time and for off-line distribution.

The algorithms designed to derive estimates of the atmospheric constitutes need to be verified. For this a large number of correlative observations under a wide range of conditions are needed to arrive at a representative and statistically significant data quality assessment, and to provide insight into sources of error both in the Envisat data and the correlative data sets. In order to achieve this within the tight time schedule the best use must be made of the available resources. For the Atmospheric Chemistry Instruments on Envisat it has therefore been decided to plan a joint geophysical validation programme that is not instrument specific but serves all three instruments. For the co-ordination of the activities the Atmospheric Chemistry Validation Team was formed (ACVT). The ACVT methods can roughly be categorised into different approaches and consistent with these the group is divided into different subgroups on balloon and aircraft campaigns, ground-based measurements, model assimilation and satellite intercomparison.

The data coming from the various validation campaigns are stored within a central data storage facility established at the Norwegian Institute for Air Research (NILU) in Norway. NILU provides access to correlative measurements from sensors on-board satellites, aircraft, balloons and ships, as well as from ground-based instruments and numerical models, such as that of the ECMWF. Particular emphasis has been put on the quality control of such data. Users are able to connect with the database to add or retrieve data according to their requirements. Access to such a range of data have strengthened the statistical significance of the results and increased the chances of detecting errors in the processing algorithms. Two types of data are stored in the NILU database, fixed point and transect data. Transect data is only provided for inclusion in the database for selected times which
correspond to the satellite overpass. Envisat data is not stored in the NILU database although other correlative satellite data is included to facilitate their comparison with data acquired by Envisat.

The European Space Agency (ESA) organised a workshop in Frascati from 9 to 13 December 2002 to review the first results of the validation of the geophysical data products from its environmental satellite Envisat. The objectives of the Envisat Validation Workshop were:

. to review the Level 2 product algorithms using the results of the validation campaigns,
. to review the geophysical consistency of the Level 2 processor products,
. to provide an error estimation of the Level 2 products,
. to recommend instrument re-calibration and algorithm development where needed.

At the Envisat Validation workshop held in Frascati, Italy, from 9-13 December, scientists and engineers presented analyses of the exhaustive series of tests that have been run on each of Envisat’s sensors since the spacecraft was launched in March. On the basis of workshop results it was decided that most of the 73 data products provided by the Envisat instruments are ready for operational delivery.

Although the main validation phase for the atmospheric instruments of Envisat will be completed this year, ongoing validation products will continue throughout the lifetime of the Envisat mission. More specifically, the main validation phase (i.e. with intensive validation activities) will be completed in 2003, whereas the long-term validation phase will:
- Provide assurance of data quality and accuracy for applications such as climate change research
- Investigate the fully representative range of geophysical conditions
- Investigate the fully representative range of seasonal cycles
- Perform long term monitoring for instrumental drifts and other artefacts
- Validate new products.

The paper will discuss the general status of the calibration and validation activities for GOMOS, MIPAS and SCIAMACHY. The short-term and long-term validation plans will be presented.