CGMS

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STATUS OF THE CURRENT ESA EARTH OBSERVATION MISSIONS

CGMS is informed of the status of the current European Space Agency Earth Observation missions. Two of them, MSG and MetOp are in co-operation with EUMETSAT.

The success of the Envisat mission, launched in 2002, is well-established, with a constant increase of user demand for data and services. Today, the Envisat mission has exceeded the original foreseen 5 years lifetime and a 3 years extension from 2011 to 2013 has been approved.

ERS-2, the second ESA EO mission, launched in 1995, has remained operational during 16 years before being de-orbited in the summer of 2011. Overall the ERS-1 and ERS-2 missions have delivered 20 years of valuable data. PROBA, an experimental ESA satellite, provides remarkable hyperspectral data since 2001. The archive contains more than 15,000 products.

The Gravity field and steady-state Ocean Circulation Explorer, GOCE, was launched on 17 March 2009. The nominal mission, consisting of 6 uninterrupted global measurement cycles, has been completed. GOCE data are of excellent quality. A new geoid, based on 3 cycles (6 months of data) has been released. The solution based on the full nominal mission data will be available in the fall of 2011.

The Soil Moisture and Ocean Salinity mission SMOS was launched on 2 November 2009 and was commissioned in May 2010. SMOS Level 2 data products were released at the end of October 2010. Reprocessed data are available from the cal/val portal since mid-February 2011. The RFI (radio-frequency interference) has significantly improved.

The Cryosat-2 satellite was successfully launched on 8 April 2010 and since then, commissioning and validation activities have taken place. Data was first released to the cal/val teams just after three months. Commissioning activities were completed on 25 October 2010. Release of systematic Cryosat products (Level 1b and 2) to scientific community is going on. Greenland ice sheet and sea ice cover profiles reveal striking features of the Arctic behavior.

About 4000 data user projects worldwide use data from the ESA EO missions and this number is increasing further. The total volume of ESA EO missions data exceeds 100 Terabytes per year.

STATUS OF THE CURRENT ESA EARTH OBSERVATION MISSIONS

1. INTRODUCTION

The Envisat mission, launched in 2002, is well established, with a constant increase of user demand for data and services. A major milestone was the ESA 2010 Living Planet Symposium in Bergen (Norway) attended by 1250 participants. Today, the Envisat mission has exceeded the original foreseen 5 years lifetime and a 3 years extension from 2011 to 2013 was approved.

ERS-2, the second ESA EO mission, launched in 1995, continues to satisfy the steady increasing data demand despite the failure of the gyroscopes and the low rate recorders for which workaround solutions have been successfully implemented. PROBA, an experimental ESA satellite, provides remarkable hyperspectral data since 2001. The archive contains more than 15000 products.

The Gravity field and steady-state Ocean Circulation Explorer, GOCE, was the first Explorer satellite launched on 17 March 2009. The nominal mission, consisting of 6 uninterrupted global measurement cycles, has been completed.

Two other Explorer missions are currently flying: the SMOS satellite was launched on 2 November 2009 and was commissioned in May 2010.The Cryosat-2 satellite was launched on 8 April 2010 and since then, commissioning and validation activities have taken place. Commissioning activities were completed on 25 October 2010. Release of systematic Cryosat products (Level 1b and 2) to scientific community is going on.

2. STATUS OF THE ERS MISSIONS

The ERS-1 spacecraft, which ceased its operations in March 2000, is regularly tracked to predict and avoid possible interference with the orbits of other missions.

After 16 years of successful operations, and a highly satisfactory scientific and applications output, the ERS-2 satellite performed its last data take in early July 2011, 20 years after the start of the ERS-1 mission in July 1991.

For its last months of activity, ERS-2 was moved into a 3-day repeat cycle, following the same ground track than ERS-1 during the Ice Phases in 1992 and 1994. The ERS-2 Ice Phase covered a period of 4 months (March - June 2011) and allowed gathering 3-day repeat SAR data on polar areas (observation of ice-stream dynamics and glacier grounding lines) as well as on Japan to observe post-seismic displacements after the large March 2011 earthquake. In addition scatterometer data over the Brazilian rain forest were acquired for cross-calibration purposes.

On 4 July, the ERS-2 payload was switched-off. After a careful preparation during the reporting quarter, the ERS-2 satellite de-orbitation initiated on 6 July. The objective of the de-orbitation maneuvers is to gradually lower the ERS-2 satellite below 600 km so that the satellite could re-renter and burn into the atmosphere within less than 25 years. The de-orbitation maneuvers, which are not free of risk considering the age of the satellite and the lack of fully functional gyro sets, should have been completed in September 2011.

The 20 years of ERS missions have been celebrated with a special event on 27 September at ESRIN.

The most complete information about the ERS missions can be found on the mission web page at http://envisat.esa.int/.

3. STATUS OF THE ENVISAT MISSION

The Envisat mission successfully reached 9 years of exploitation in 2011. In order to operate the Envisat satellite for few additional years, its orbit was modified in October 2010 (new altitude, new repeat cycle). All scientific and operational applications were maintained after the orbital change, with the exception of SAR Interferometry.

The Envisat mission proceeded nominally during the reporting period. Thanks to its SCIAMACHY and MERIS instruments, the Envisat mission could provide remarkable observations of the Grimsvötn volcano eruption in Iceland in May.

The third reprocessing of the MERIS dataset is completed with data gradually made available to users. This marks an important milestone for the ocean color user community.

The most complete information about the Envisat mission can be found on the mission web page at http://envisat.esa.int/.

4. STATUS OF CHRIS/PROBA

The Earthnet/Third Party Mission (TPM) programme enables harmonized access to non-ESA missions for the benefit of European users. Currently, ESA provides access to data from 25 Third Party Missions and more than 30 instruments. One of them is CHRIS/Proba:

Proba-1 is running nominally in its 10th year of successful operations. Processing and data distribution to users were carried out nominally. Proba-1 with the CHRIS instrument is supporting a large user community (around 400 Cat-1 projects). For the 10-year anniversary in October 2011, a special brochure has been prepared. Several web stories on the achievements of Proba-1 and especially CHRIS data exploitation are planned for publication around the October timeframe. More information on CHRIS/Proba can be found at http://earth.esa.int/missions/thirdpartymission/proba.html

5. GOCE

The aim of the Gravity field and steady-state Ocean Circulation Explorer (GOCE) mission is to provide global and regional models for the Earth's gravity field and for the geoid, its reference equipotential surface, with high spatial resolution and accuracy. Such models will be used in a wide range of research and application areas, including global ocean circulation, physics of the interior of the Earth and leveling systems based on GPS.

The mission responds to the requirements put forward by many international scientific programs such as the WOCE, CLIVAR and GOOS. It is designed for the determination of an accurate description of the ocean dynamic topography and, thereby, the mean ocean circulation, as an essential complement to the precise monitoring of ocean temporal variability already provided by altimetry. The gravity vector cannot be measured directly in orbit, but can be inferred from other observations. The GOCE carries a gravity gradiometer that measures gravity gradients and GNSS (Global Navigation Satellite Systems) receivers for precise satellite positioning. The satellite was launched into a 96.67 degrees sun-synchronous orbit on 17 March 2009, and reached it's 254.9 km mapping altitude in early September the same year, after successfully completing the commissioning phase and the instrument calibration. Mapping of the Earth gravity field is being carried out in cycles of 61 days. Contrary to pre-mission operations scenarios operations are also carried out in the eclipse season. The first gravity field solutions from the mission were released in 2010, and are proving to change the understanding of the Earth gravity at medium-to high resolution.

GOCE successfully completed its nominal mission on 15 April 2011. The primary mission goal of acquiring 12 months of excellent quality data had already been achieved at the end of February 2011. Currently continuing in its extended phase the mission will – as more data is being collected – steadily deliver even further improved gravity field and geoid data products.

Both the space and ground segment performed nominally throughout the reporting period. No anomalies were encountered.

Scientific data acquisition was at 100% and only interrupted twice for the (meanwhile) routine gradiometer calibrations that are performed at the end of every 61-days measurement cycle. The product generation is also at 100%, as all processing orders have been successfully executed. These gapless data streams are clear indicators of the robustness of the instruments and of the science data processing systems. More information can be obtained from the GOCE web site at http://www.esa.int/esaLP/LPgoce.html .

6. CRYOSAT

The goals of Cryosat are to measure fluctuations in marine and land ice mass fluxes within the limit set by natural variability. Predicting future climate and sea level depends on knowledge of such fluctuations, while present observations are deficient in time and space. Cryosat and International Programs will provide a decade of focused study of the roles of the cryosphere.

The technical concept consists of a single spacecraft in a high inclination orbit, carrying a Ku-band altimeter, measuring altitude with detailed precision, capable of operating in conventional pulse limited mode, synthetic aperture mode and interferometry mode.

The satellite was launched into a 92 degrees non sun-synchronous orbit on 8 April 2010 by a Dnepr vehicle from the Baikonur Cosmodrome. The main instrument - the altimeter SIRAL - was switched on a few days later and immediately showed that it was in perfect state. Commissioning and validation activities started soon after and only three months later, the first data were released to the cal/val community. The ground segment software and dissemination systems are in good shape. The release of Cryosat data to the scientific community started in autumn 2010, just after the end of the commissioning.

The CryoSat mission overall performed well during the reporting period, except for five days following an electrostatic discharge inside the Electronic Power Conditioner on April 30, causing the main instrument SIRAL stopping generation of science data.

Investigation carried out by industry led to the conclusion that the route cause was provoked by external electrically charged particles. Neither the instrument nor other subsystems were damaged.

An atypical trend of the Attitude Cross-check parameter, observed for the first time in February, is still under investigation. Nevertheless the values have returned to nominal figures.

The overall Payload Data Ground Segment (PDGS) performed nominally. Some recurring problems related to the acquisition system in Kiruna led in one case to the loss of some data on May 30. An internal anomaly review board has identified a series of contingency measures to re-establish seamless operations. These measures are currently being put into effect by the ground segment operations teams.

A further upgrade of the Level 1b and Level 2 processors is required following recommendations of the CryoSat Quality Working Group. This upgrade is essential to achieve the first mission objective next year. The first reprocessing campaign has been postponed to the 2nd quarter of 2012.

The first major post-launch validation campaign was successfully carried out in April and May 2011 in collaboration with NASA.

The status of the mission and plans for the Arctic spring validation campaign were presented along with latest scientific results at the European Geophysical Union (EGU) General Assembly in April in Vienna.

The first CryoSat Arctic sea-ice thickness map was presented at the Salon International de l'Aéronautique et de l'Espace at Le Bourget in June 2011.

More information on Cryosat-2 can be found at http://www.esa.int/esaLP/LPcryosat.html .

7. SMOS

The Soil Moisture and Ocean Salinity (SMOS) mission is the European Space Agency's (ESA) second Earth Explorer Opportunity mission. The scientific objectives of the SMOS mission directly respond to the current lack of global observations of soil moisture and ocean salinity, two key variables used in predictive hydrological, oceanographic and atmospheric models. SMOS

observations will also provide information on the characterization of ice and snow covered surfaces and the sea ice effect on ocean-atmosphere heat fluxes and dynamics, which affects large-scale processes of the Earth's climate system.

The SMOS mission was launched on 2 November 2009 from Plesetsk, Russia. The first 6 months of the mission were dedicated to commissioning the satellite and payload. The commissioning phase ended successfully in May 2009, with both space and ground segment functioning well and system requirements being fulfilled. Since then SMOS has entered its routine operations phase.

The development of the SMOS mission was conducted in cooperation between ESA, CNES and CDTI under the overall responsibility and leadership of ESA. In the operations phase ESA and CNES share the responsibility for running the mission. The platform is operated under full CNES responsibility. No major anomalies or failures have been identified since launch, and the same applies for the interfaces to the payload.

No major anomalies have impacted the availability of SMOS science data in the recent period.

The RFI situation in particular over Europe continues to improve. However, some very strong sources are still present.

The 1st reprocessing campaign, to take place in Q3 2011, is under preparation. CNES/CESBIO has agreed to perform the level 2 soil moisture reprocessing.

The 5th Quality Working Group (QWG) meeting took place at the end of May, focusing on the progress of the improvements to the level 1 and 2 processors in preparation for the 1st annual reprocessing of SMOS data in Q3 2011. In particular the land-sea contamination and the short-term drift have significantly improved.

ESA and CNES are jointly organizing a SMOS workshop on 27-29 September 2011 in Arles, France. Approximately 100 abstracts have been received, reviewed and authors have been notified about the acceptance of their contribution.

For more information on SMOS, please refer to the SMOS web site at ESA (http://www.esa.int/esaLP/LPsmos.html)

8. ESA CLIMATE INITIATIVE PROGRAM

The ESA Climate Change Initiative (CCI) program will bring together European expertise that cover the full range of scientific, technical and development specializations available within the European Earth Observation (EO) community. It will establish lasting and transparent access for global climate scientific and operational communities to its results. The essential feature of the program will be to implement a coherent and continuous suite of actions that encompass all steps necessary for the systematic and timely generation of relevant ECVs according to the increasingly urgent needs of the international climate change community. In this context it can be noted that the quadri-annual IPCC process, drawing primarily upon peer reviewed published results, implies much more frequent updating and reanalysis than would result from a 'best effort' approach.

The program objectives will be achieved by five main activities:

1. Gathering, collating and preserving the long-term time series of climate-related observations in ESA's distributed archives;

2. Periodically (re-)processing the basic EO-data sets from each individual mission and applying the most up-to-date algorithms and corrections to system calibration and data validation;

3. Integrating the calibrated data sets derived from individual contributing EO missions and sensors to constitute the most comprehensive and well-characterized global long term records possible for each ECV;

4. Assessing the trends and consistency of the ECV records in the context of climate models and assimilation schemes; and

5. Developing improved models and algorithms for the production of required variables from emerging data sources, consistent with the long term record.

The ESA program aims to establish a framework to implement active feedback between each of the five steps identified above. It will focus on those ECVs for which data from ESA missions, and relevant European national missions, are of particular importance. It will be closely coordinated with, and can potentially support, related actions on other ECVs, such as those for which meteorological missions are the primary source. The present static situation of ad hoc or isolated fixed-term projects will move towards a long-term cyclical process of systematic updates, regeneration and reanalysis of the underlying fundamental data records, and the production of fully up to date, complete and consistent records of relevant ECVs.

9. INTERNATIONAL CHARTER ON SPACE AND MAJOR DISASTERS

Following the UNISPACE III conference held in Vienna, Austria in July 1999, the European and French space agencies (ESA and CNES) initiated the International Charter "Space and Major Disasters", with the Canadian Space Agency (CSA) signing the Charter on October 20, 2000. Since its signing, the International Charter on Space and Major Disasters has been providing important EO satellite data input to natural hazards post-crisis management around the world, with both increasing Charter activations and participating space agencies as data providers. Further information can be found at http://www.disastercharter.org

10. REFERENCES

Further information about the various ESA missions can be found on the following WWW addresses which offer the possibility to download many supporting relevant documentation:

http://www.esa.int

http://earth.esa.int

http://earth.esa.int/missions/thirdpartymission/proba.html

Complementary to this report is the information contained in the “CGMS Consolidated report” and in CGMS-38-ESA-WP-02 and CGMS-39-ESA-WP-03 regarding future missions and the ESA support to GCOS and other climate monitoring activities respectively.