Experimental datasets of potential IPWG interest

CGMS is informed about the experimental campaigns organized by ESA, which datasets could be of potential interest for IPWG.

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1.- INTRODUCTION

The International Precipitation Working Group IPWG was established in June 2001 by the CGMS. It focuses the scientific community on operational and research satellite based quantitative precipitation measurement issues and challenges.

The first workshop of the group took place at INM, Madrid –Spain on 23-27 September 2002, the second at the NRL, Monterey, CA, USA, on 25-28 October 2004. ESA is represented at the IPWG, and made presentations of relevant activities t the above meetings.

One of the recommendations of the IPWG was to make an inventory of available relevant datasets. This paper is ESA contribution to such inventory.

2.- ESA EO CAMPAIGNS

The main objective of the ESA Earth observation campaigns is to provide support for the preparation of future space programmes and their users. The programme of campaign activities includes support for experiments related to atmospheric dynamics, atmospheric chemistry, coasts and oceans, ice and the land.

Instruments include lidars, nadir sounding spectrometers, limb sounding interferometers and microwave limb sounders that have capabilities for measuring atmospheric chemical composition and dynamics. Instruments for the observation of the ocean and land include high-resolution spectral imagers, advanced SARs, microwave radiometers and altimeters.

Another important objective is the validation of satellite data products against independent measurements. This requires field campaigns using instruments on land, on ships, on aircraft and balloons in order to make a variety of in-situ measurements of surface and atmospheric variables.

Many of the requirements for campaigns come from ESA advisory groups supporting current missions in orbit as well as future missions.

ESA does not own nor operate the facilities, but collaborates with national institutes and international organisations.

Campaign requirements are associated with different objectives for technology, geophysical modelling, simulation and validation.

2.-1 Technological requirements

The main technological requirements for campaigns are testing new technologies from aircraft platforms and the improvement of performance specifications for future space-borne missions. New technologies tested on airborne platforms and from ground sites include multi-band, polarimetric SARs, SAR interferometers, imaging spectrometers, microwave radiometers, radar altimeters, microwave limb sounders, lidars, and rain/cloud radar. Data from the corresponding

campaigns are used to assist in the specification of future space-borne instruments, algorithm development and planning validation.

2.-2 Geophysical modelling

The main objective of geophysical modelling is the development of operational algorithms for the so-called Level-2 products from space-borne sensors. Level-2 products are obtained through a conversion from calibrated sensor outputs in terms of physical variables (backscatter coefficient, reflectance, brightness temperature) to target characteristics (ocean wind and waves, suspended matter, biomass and soil moisture on land, trace gas concentration in the atmosphere). The development of Level-2 products is difficult and takes time. It involves a learning process both inside the Agency and within the potential user community. Its importance however, cannot be easily overestimated

2.-3 Modelling

Simulation is aimed at providing data sets to ESA engineers and the scientific and applications user community for training and testing purposes. In many applications the end user can only be satisfied with higher than Level-2 products, whereby the Level-2 product is merged (assimilated) with other, non-satellite data. Campaigns have proven to be the ideal vehicle for involving the end-user community in the early development of these assimilation schemes. A number of remote sensing data sets have been collected in conjunction with the associated ground data. These include the following:

- ERS radar data, airborne radar data and microwave radiometer data in a number of wavebands over:
  Tropical forest
  Semi arid zones (SAHEL)
  Agricultural fields
  Coastal zones
  Snow and ice
- Optical spectroscopy data over:
  Agricultural fields
  Forest
  Desertification zones
  Lakes
  Coastal waters
  Open ocean
- Lidar data both from space and from land stations of various clouds, ocean and land surfaces
- Ground-based radar observations of rain and clouds

After initial analysis of these data sets as reported during the final campaign workshops, the data are available as inputs for future mission definition studies and algorithm development work.

In the field of passive microwave remote sensing, radiometer measurements from aircraft are made to study the measurement of soil moisture and ocean salinity from space. These data are supported by measurements from oil rigs and buoys.

In the field of active optical remote sensing, lidar measurements from the ground as well as from aircraft are made to observe clouds, atmospheric water vapour profiles and ice sheets in combination with radar.

2.4 Calibration and validation

Following internationally agreed definitions, instrument and data calibration involves pre-launch and post-launch measurements to fully characterise the payload instruments and subsequent activities to configure the ground processors to provide calibrated (Level 1b) data products (radiance, reflectance, transmittance, polarisation, radar backscattering coefficient, radar echo-time delay). Geophysical calibration and validation is a process whereby geophysical data products (Level 2) are derived from the Level 1 data products and checked against independent (in-situ) measurements of the relevant geophysical variables. These include atmospheric variables (temperature, pressure, atmospheric constituents, aerosol and cloud parameters), marine variables (ocean surface wind and waves, ocean colour, sea surface temperature, sea-ice thickness, ocean salinity) and land variables (vegetation index, temperature, pressure and reflectance). For each geophysical data product, a number of different in-situ measurements have to be made by ground-based, airborne and balloon-borne instruments. After the commissioning phase of a typical mission, the validation programme will make a quality assessment of the geophysical data products and will recommend re-calibration and algorithm development as appropriate.

3.- ARCHIVES CONTENT AND ACCESS

ESA is in the process of organising a centralised archive of datasets, which are usually maintained by the organisations or principal investigators conducting the campaigns. Such archive will initially be made available internally to ESA in order to set up and validate access procedures. It is envisaged to make it available externally during 2006.

The campaigns that are of relevance for atmospheric calibration/validation are:

- CLARE 2000 (Cloud Lidar and Radar experiments) and
- WALEX 2002 (Water vapour Lidar Experiment), WALEX-3 being planned
- Many of the campaigns organised for Envisat cal/val

4.- REFERENCES

More information can be found at:

http://www.esa.int/esaLP/SEM49L1DU8E_LPcampaigns_0.html

http://envisat.esa.int/workshops/acve2/

http://envisat.esa.int/pub/ESA_DOC/envisat_val_1202/proceedings/

http://envisat.esa.int/calval/proceedings/