New European project launched to address shortcomings in climate data

November 4 2011

A major European joint research project has kicked off to establish the infrastructure and expertise needed to make earth measurements which are sufficiently accurate to make reliable predictions about the effects of climate change. The project is a consortium of European National Measurement Institutes (NMIs) led by the UK's National Physical Laboratory (NPL) and will devote some 28 man years of effort to bringing greater accuracy to data acquired by the European Earth Observation (EO) community.

Monitoring the Earth system is crucial to understanding environmental changes and to developing long term mitigation and adaptation strategies for climate change. Global observations can only be made from space. Although such observations are being made, the challenging environment limits the accuracy of current measurement systems. In the case of climate measurements, uncertainty is often a factor of 10 larger than required by climate scientists, who often need measurements of the same level of accuracy found in national measurement laboratories.

The project, European Metrology for Earth Observation and Climate (MetEOC) will build a coordinated international capacity and demonstrate its potential capabilities as it seeks to develop a virtual centre for excellence. Activities will initially focus on the optical domain. This future European Metrology Centre for Earth Observation and Climate (EMCEOC) will provide a one stop shop for builders, calibrators and users of satellites and other in-situ EO instruments. Its establishment is timely as the new Quality Assurance Framework for

Earth Observation (QA4EO) starts to become more widely implemented. The key principle of QA4EO requires all data and derived knowledge to provide a quality metric based on evidence of its traceability to a community defined reference standard, ideally based on SI units, in a coherent and consistent way.

The project is structured into four technical themes:

Theme one will adapt and evolve state of the art calibration equipment and methods at NMIs to improve the calibration accuracy of satellites and aircraft based sensors pre-launch. This will include novel techniques to allow NMI accuracies to be provided directly to sensors even under flight conditions, e.g. thermal/vacuum. The project will use tuneable laser radiation which will allow an order of magnitude improvement in accuracy. This theme will also look to analyse the future needs of the EO community for microwave measurements, working with global partners to establish best practices and a strategy for the future.

Theme two will develop the capabilities to provide pre-flight calibration of a novel calibration reference for use "on-board" an aircraft/balloon platform (as a pre-cursor to a future satellite mission). The limb sounding instrument it is used with needs regular calibration to maintain its required accuracy in measuring trace gas species in the atmosphere. An uncertainty improvement of more than a factor two will be achieved, leading to improved resolution and quantification. In recognition that the performance of most optical sensors will degrade from their pre-flight calibration, efforts will be made to recover accuracy through post-launch methods – typically viewing "test-sites" on the ground, ideally calibrated to the SI units – the universal system of measurement.

The third theme addresses this fundamental issue of calibrating test sites through improvements in the accuracy of Ocean Colour Measurements and reflectance of land and vegetation. Ocean colour is a key Esssential

Climate Variable (ECV) quantifying the amount of phytoplankton -_which absorbs ~ half of the anthropogenic emitted CO2. For Land, the project will not only look to establish instrumentation and methods for the calibration of satellites, but also models to retrieve vegetation type. This will include the development of an instrument to allow the spectral reflectance signature of individual leaves to be made whilst still attached to their host plant and collated into a library for use by satellites.

The final technical forth theme will develop a ground based prototype of techniques required to establish high accuracy SI traceability in orbit on board a satellite – the long term goal of the international EO community. This "NMI in space" concept is another NPL led project called TRUTHS. This demonstrator will reduce risk and bring forward the date when such a mission can be launched with the uncertainty needed to establish a global climate observing system.

In addition to ensuring that these technical activities are fully disseminated to the international EO community, the project will look to collect future measurement needs. It will develop a road map to prioritise future activities based on the needs of climate and future sensor concepts so that we can continue to improve our understanding of processes and impact. It will also develop and deliver a dedicated training program to up-skill the European workforce in terms of its understanding of uncertainty and calibration techniques.

The outcome of this three year programme will be a body of research, technology, and expertise which can be drawn on by all aspects of the earth observation industry to ensure future missions meet the accuracy levels required for understanding climate change, and that policy makers can rely on the information they deliver. It is anticipated that this will lead to a self-sustainable, transnational virtual centre of excellence - EMCEOC - able to provide the long term measurement expertise and infrastructure to support the European Space Agency, EUMETSAT and

the EC, national space agencies and provide an interface between industry and academia.

Dr Nigel Fox, project lead at NPL, who is also chair of the infrared, visible and optical sensors (IVOS) sub-group of the international Committee on Earth Observation Satellites (CEOS) international, says: "This project will significantly advance our knowledge and understanding of earth observation techniques, and improve the accuracy of our data. This will allow us to make more accurate predictions of the effects of climate change and inform long term international decisions about adaptation and mitigation."

Provided by National Physical Laboratory