

## **REPORT ON AUSTRALIAN ACTIVITIES TO THE CEOS WGCV#18**

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### **Structure of Report:**

In this report we will provide some up-to-date information on four of our Cal/Val activities. A list of background information has been supplied over the past few meetings and these are listed below. This report will not report on this background material. The reader is directed to the previous Australian country reports to WGCV meetings which are available via links on the CEOS WGCV homepage. On-going activities identified in past reports to WGCV-11 to WGCV-16 are listed below.

### **Reported at WGCV-18**

- 1. Evaluation of Hyperion Performance at Australian Hyperspectral Cal/Val Sites**
- 2. The Second Infrared Radiometer Calibration and Inter-comparison at the Uni. of Miami**
- 3. Participation in ESA's MERIS and AATSR Validation Team**
- 4. ESA ENVISAT Validation Rehearsals**

### **Past reports to WGCV Meetings:**

- WGCV-11: Validation of sea surface temperatures at our Townsville and Perth sites.
- WGCV-12: CSIRO CIGSN Land Calibration Sites at Hay (Uardry), Alice Springs (Amburla), and Broome (Thangoo).  
Antarctic validation activities.  
Ocean colour cal/val.  
POLDER calibration campaign.  
Validation of sea surface temperatures at our Townsville and Perth sites.
- WGCV-13: CSIRO CIGSN Land Calibration Sites  
Validation of sea surface temperatures at Townsville, Perth, and Hobart.
- WGCV-14: Ocean colour calval.  
Use of the moon for GMS calibration.
- WGCV-15: A special report on Western Australian activities, including
- (a) Validation of satellite-derived oceanographic parameters
  - (b) SST Algorithm Development and Validation
  - (c) SeaWiFS and Ocean Colour Sensing
  - (d) Solar Photometry Field Site on Rottneest Island for Validation of Maritime Aerosol Optical Thickness
  - (e) Solar Photometry Field Site on Rottneest Island for Validation of Oceanic Atmospheric Correction to Satellite Data
  - (f) Satellite Validation Field Site at Broome, Western Australia (Thangoo)
  - (g) Cloud Height Product Validation
- WGCV-16: Radar altimeter product validation including plans for JASON.

NOAA AVHRR Vis/NIR channel calibration in Australia.  
WGCV-17: Radar altimetry; Plans for the validation of sea surface height derived from the new satellite Jason-1.  
Land surface temperature from ATSR-2 and AATSR data.  
Sea surface temperature from ATSR, MODIS, and GLI

## **1. Evaluation of Hyperion Performance at Australian Hyperspectral Calibration and Validation Sites (NRA-99-0ES-01)**

**NOTE:** Further details can be found at <http://www.eoc.csiro.au/hswww/Hyperion.htm>

CSIRO (Australia) has a range of active programs in earth observation and in hyperspectral research leading to high quality inputs to many integrated applications in Australia, the USA and the Asia-Pacific region. These include large area land rehabilitation and monitoring as well as resources inventory and management. The CSIRO Office of Space Science & Applications (COSSA) seeks to coordinate and support these activities across Divisions in CSIRO. The Australian Centre for Remote Sensing (ACRES) is an accredited data reception and distribution organization with two (potentially three) fully operational X-Band stations and involvement in the Landsat-7 series. The CSIRO and ACRES are partners in the proposed ARIES-1 spaceborne hyperspectral system. In this proposal, an Australian Team coordinated by CSIRO Earth Observation Centre (EOC) (refer Appendix 1) and ACRES proposes to use existing Australian calibration and validation sites and specific existing hyperspectral test sites with range of existing and ongoing data collection and analysis programs to evaluate Hyperion instrument and product performance. The Team proposes to monitor Hyperion's performance against benchmarks of ground and airborne data at Australian sites and support Data Collection Events (DCEs) by providing capacity to download current data holdings or Australian data using the Australian X-Band stations that are operated by ACRES. Reception stations at Alice Springs in central Australia and Hobart in the very south of Australia are currently able to carry out this activity. These stations will be involved in collecting Landsat-7 data. It is possible a third station in the West of Australia will be established during the lifetime of the EO-1 mission. If the EO-1 mission is launched during the northern hemisphere winter as planned, the Australian Team has offered its expertise and sites to engage in early mission proving and vicarious assessment of the EO-1, especially Hyperion and to provide capacity to unload stored data from previous DCEs. The CSIRO hyperspectral research program has an established set of sites and a growing base of environmental information allowing spectral modelling and measurement. The Australian HyMap airborne system (Cocks et al., 1998 and Appendix 3) is already being used and we are proposing to undertake a benchmarking and cross-calibration of HyMap as part of the activity. A new Australian hyperspectral instrument, OARS, will also be offered in support of this activity. We are also proposing to engage in a joint NASA/CSIRO AVIRIS mission to establish cross-calibration and performance synchronization between the Australian systems (HyMap and OARS plus ground data systems) and the NASA benchmark appropriate calibration sites in the US or (preferably) Australia. When the mission has become established we have proposed that specific DCEs focus on five key applications areas where product performance is the major issue. These are two geologically oriented sites, one rangelands site, one rain-forest and tropical coastal site and one temperate forest

site. In all of these cases there are external resource or environmental drivers for the evaluation of the applications products and comparisons of performance in this between the current airborne data and the Hyperion space-based data.

An example of one Australian activity in Hyperion Cal/Val follows. This is one of many such activities described at the URL given above.

### **EO-1 HYPERION Cal/Val activities at Moreton Bay**

Moreton Bay, near Brisbane, has been chosen as the Australian EO1-HYPERION coastal site to be used for Cal/Val activities. Moreton Bay shows spatial gradients in optical depth, bathymetry, and substrate composition. The turbid and humic river inputs, as well as the open ocean flushing, determine the water quality of the bay. Recently lyngbya toxic algae blooms have become a serious environmental and health concern in the Bay. Several field campaigns, carried out to coincide with Hyperion overpasses, focussed on the retrieval of Inherent Optical Properties (IOP's), Apparent Optical Properties (AOP's), substrate reflectance spectra, and water quality parameters. Instruments used were ASD and UniSpec with UW optical fibres, RAMSES profiling spectrometer, PSICAM, HydroScat-6, Licor-1800, and HPLC. Spectra from a 12<sup>th</sup> Jan. 2001 Hyperion image show very close agreement to in situ upwelling radiance spectra. HYPERION also accurately discriminates various water types in this river to oceanic water environment. The preliminary results suggest that imaging spectrometry from space will become a worthwhile tool for detection and monitoring of water quality in coastal systems.

## **2. The Second Infrared Radiometer Calibration and Inter-comparison - RSMAS, University of Miami, USA. 28 May 2 June, 2001**

Following a successful proposal for funding to the CEOS Plenary in November 2000 validation scientists from USA and Australia have organised The Second Infrared Radiometer Calibration and Inter-comparison to be held in Miami during the last week of May, 2001. The outcomes and benefits of the Workshop will be reported in a separate document.

After the initial funding offer from EUMETSAT, additional funds have been supplied by NOAA and ESA. The financial support of these three agencies is acknowledged as well as the in-kind contributions from the University of Miami and CSIRO, Australia. Other institutes have sponsored the contributions and attendance of their validation scientists.

## **3. Participation in ESA s MAVT**

The European Space Agency has established several validation teams for the instruments on ENVISAT. One of these, the MERIS and AATSR Validation Team (MAVT), involves Australian scientists. Representatives are Dr Arnold Dekker for MERIS, and Drs Fred Prata and Ian Barton for AATSR.

Australians have been represented at the three MAVT meetings held to date.

For **MERIS** Australian scientists are finalising a program of ground truth data collection for the ocean colour products to be derived from MERIS data. A proposal entitled "Validation, Development, and Application of Ocean Colour Algorithms in Australian Coastal Waters", was approved by ESA.

The team has access to large oceanographic research vessels and smaller coastal research vessels, and to equipment including profiling spectroradiometers, profiling and underway fluorometers, spectrophotometers, HPLC pigment systems. A new prototype instrument (PSICAM) measures absorption spectra of water samples independent of scattering using a spherical integrating cavity method developed by CSIRO.

Measurements to be made on field campaigns will include HPLC pigments, chlorophyll fluorescence, suspended sediments and turbidity, dissolved and particulate absorption spectra, particulate scattering and backscattering spectra, and profiles of upwelling and downwelling spectral radiance/irradiance. Sun photometers and other instruments will be used to characterize atmospheric transmission and scattering, including the effects of aerosols, during field campaigns. Observations of sea-state will also be recorded, including wave conditions and white-caps.

Data from a bright, stable desert calibration site maintained by CSIRO will be available to MERIS.

The field data collected will be used to assess the accuracy of MERIS standard products and algorithms, including normalised water-leaving radiance, aerosols, and CASE 2 pigment, gelbstoff and suspended sediment.

Ground measurements will be made at the following locations:

Moreton Bay, Joseph Bonaparte Gulf, Gulf of Carpentaria, Hobart, Cairns, Townsville, Perth, N.W. Shelf, Prydz Bay, Antarctic Ice Edge, and Tinga Tingana (the desert site to be used for vicarious calibration of MERIS radiances).

For **AATSR** ground measurements will be made from research vessels of opportunity as well as regular passenger ferries near Perth and Townsville. Details have been supplied in previous reports to the CEOS WGCV (see above).

#### **4. ESA Validation Rehearsals**

Australian scientists have participated in the first ENVISAT Validation rehearsal conducted during October 2000. The second rehearsal will take place in late June, 2001 and Australia will again participate.

**NOTE:** These rehearsals have been most successful: perhaps the WGCV could consider formulating a recommendation to the CEOS member agencies to consider similar rehearsals for new satellite instruments and data products.

**Acknowledgement:** Details of the MERIS proposal were supplied by John Parslow and Arnold Dekker.