

PACRIM SCIENCE APPLICATIONS: A DECADE WITH AIRSAR

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The scientific objectives of PACRIM are to advance the understanding of polarimetric and interferometric radar and to promote its application in environmental research designed to detect and quantify changes in the physical and humanly modified ecosystems found on the earth's surface. The information derived will be used to more readily identify environments at risk, improve environmental decision making and the management of resources and thereby lead to the implementation of more effective sustainable land use development practices.

A unique opportunity was afforded Australian remote sensing scientists in September 1993 when the NASA-JPL AIRSAR system was deployed in Australia for the first time. This collaborative research project was organized by NASA's Mission to Planet Earth, Airborne Sciences Program, the Jet Propulsion Laboratory and CSIRO-COSSA and the Centre for Remote Sensing and GIS at the University of New South Wales. A major driver for the mission was the acquisition of data over the SIR-C calibration site at Kerang in western Victoria.

During a four-week period the DC-8 aircraft acquired data over 55 sites on the Australian continent for 35

individual investigators including both US and Australian collaborators.

AIRSAR Australia 1993 made a significant contribution, both in terms of providing the scientific community with access to advanced polarimetric and interferometric radar data for the first time and in fostering a research community interested in using the unique characteristics of radar to analyse a range of environmental surfaces and conditions. The program brought together a research community not previously experienced in using polarimetric radar and helped in providing a knowledge base from which radar could be integrated into research aimed at determining the exact geophysical characteristics of surface materials.

A "Significant Results Workshop" was held in Sydney, 6-8th November 1995 when 34 papers reporting the findings of applying AIRSAR data to a range of environmental and scientific problems were presented (Milne ed., 1995).

A second AIRSAR science mission was carried out in November-December 1996. During this deployment called PACRIM, data were collected over some 120 sites in the Australasian region. Participating countries included the USA

(Hawaii), New Zealand, Australia, Papua New Guinea, Malaysia, Brunei, Cambodia, Thailand, Philippines and Taiwan.

This multi-country mission required a much higher level of organization and management than AIRSAR Australia 1993. Tasks included conducting negotiations at the inter-governmental level to secure MOU's and Letters of Agreement between NASA and the participating countries; communicating and confirming the scientific objectives of the mission with the Principal Investigators involved; raising funds; organizing flight schedules and obtaining flight clearances, as well as managing the movement and transfer of personnel involved in the deployment which extended over a six week period. All this was facilitated by setting up a *Project Management Team* involving NASA HQ, NASA Dryden, JPL, CSIRO and UNSW.

Country Project Teams were set up in each of the participating countries charged with the task of selecting study sites and investigators, prioritizing and managing ground investigations, coordinating in-country logistics and working with the *Project Management Team* to ensure the successful conduct of the deployment over their area.

One of the priorities of the *Project Management Team* was to effectively communicate the scientific objectives of the mission and to implement strategies to ensure that all scientists and investigators involved were given continued support and assistance to help them understand the complexities of AIRSAR data and to be able to undertake the analytical procedures

necessary to process the data and interpret their results. To achieve this, seven science research themes were identified for PACRIM AIRSAR datasets. These were;

- Forestry and vegetation
- Geology and tectonic processes
- Interferometry
- Disaster management
- Coastal analysis
- Agriculture
- Urban and regional development

To support individual investigators to process and analyse their data 12 workshops have been held within the region since 1997. These include meetings focused on data processing and software issues held at JPL and UNSW; regional workshops exploring research themes and skills training held in Malaysia, Philippines, Taiwan and South Korea, and team meetings held in conjunction with conferences such as the Asian Remote Sensing Conference (Taipei 2000, Singapore 2001); Australasian Remote Sensing Conference (Sydney 1999) and more recently at IGARSS2001 held in Sydney where more than sixty presentations were made.

Where it is possible American and Australian scientists have worked with investigators at regional workshops and off-line to assist and support the processing and analysis of AIRSAR data. A major strength of PACRIM and an important outcome has been the education and training of scientists within the region in radar remote sensing and in the formulation of a radar science community well able to progress the application of microwave technologies in environmental research.

PACRIM2 was conducted over a three-month period from 21 July-23 October 2000. During this deployment 600 flightlines comprising 54,000 flightline kilometres of data were recorded over 200 sites in 18 countries and territories within the Pacific-Asia and Australian region. Additional countries participating in PACRIM2 were French Polynesia, Samoa, Fiji, Palau, Northern Marianas, Indonesia, South Korea and Japan.

In addition to POLSAR and TOPSAR capabilities, ATI or Along Track Interferometry was employed in an experimental mode to collect data for measuring ocean current movements in the vicinity of shipping lanes and fishing sanctuaries where oil spills and pollution plumes threaten the marine ecosystem.

When weather permitted data were also acquired by the MASTER MODIS/ASTER airborne simulator instrument that was included in the DC-8 payload for PACRIM2.

A decade of working with AIRSAR data in the Australasian-Pacific region has

provided the opportunity for some 400 investigators from 20 countries, all with different backgrounds and skill levels, to collect, analyse, interpret and apply state-of-the-art radar data to earth-science studies. In addition to the results achieved to date, this research experience has provided important preparation for working with datasets likely to become available in the near future from satellite and commercial airborne radar systems.

PACRIM3 provides NASA with an opportunity to further enhance the scientific and research benefits accruing from radar research. This enhancement will be achieved by supporting the collaborative analysis of PACRIM2 data; by expanding the science base of PACRIM3 to include ice and ocean investigations, and by continuing the collaboration and cooperation between NASA Earth Sciences and the wider world science community.

Milne.A.K., Proceedings of the International Workshop on Radar Processing and Applications, 6-8 November, 1995, University of New South Wales, Sydney., pp86.