THE ATSR SERIES - PIONEERING THE TRANSITION FROM EXPERIMENTAL SENSOR TO OPERATIONAL SYSTEM FOR CLIMATE MONITORING AND OTHER APPLICATIONS

David Llewellyn-Jones [1]
[1]

Abstract

The series of three Along-Track scanning Radiometers have been generating measurements of Sea-Surface Temperature (SST) to the high standards of accuracy required for climate research and monitoring, on a near-continuous basis, for the entire ERS-Envisat era, which began with the launch of ERS-1 on July 17th, 1991. The third ATSR, AATSR, is still producing high-quality data from the Envisat Platform.

In addition to the main data-product, SST, the ATSR sensors also generate a Land surface Temperature (LST) product and, since the launch of ATSR-2 in 1995, with its added visible-wavelength and near infra-red (Vis/NIR) channels, the ATSR sensors have produced data relating to land-cover. In addition, several interesting atmospheric data-products, mainly making quantitative estimates of atmospheric aerosols are in advanced stages of development at several research centres.

The principal defining technical feature of the ATSR sensors is the dual view, whereby each view of the Earth's surface is sampled twice at two different angles of incidence, close to the nadir and at an angle of about 50º to Nadir, thereby sampling the surface through two different lengths of atmosphere. This provides additional information about the atmospheric correction. The instruments also feature a sophisticated and stable on-board calibration system, combined with sensitive, mechanically- cooled detectors, as well as excellent optical and thermal design.

The SST data-products have been subject to a rigorous and comprehensive validation programme involving *in situ* measurements from buoys and from autonomous radiometer systems and from high-precision point measurements from special-purpose radiometers. These measurements have shown that accuracies in the range of 0.1 - 0.2ºC are regularly achieved, demonstrating that SST measurements from space, suitable for climate applications, are achievable on a systematic basis.

Recently, the entire SST data-set has been re-processed to a consistent standard of processing and formatting. This data set, designated '(A)ATSR version 2'', is being applied to investigations of long-term geophysical changers over the 17-year observing period. This data-set is now being made available to the world-wide user community through Data-centres hosted by ESA.

[1] Space Research Centre, University of Leicester, Leicester, UK

For more definitive climate investigations a further programme of data analysis is underway: (A)ATSR Re-processing for Climate – the (A)ARC project. In this programme, the retrieval methods are being refined and particular attention is being paid to sensor drift. One very significant aspect of the drift analysis is a detailed investigation of the behaviour of the sensors during the two 'overlap periods', when successive instruments were making simultaneous observations. The resulting re-processed data-set will be of great importance for climate applications.

Perhaps the most significant development in the recent history of the ATSR
Sensors has arisen from the GODAE-GHRSST Pilot Project. This has been the development and production of an operational SST product in a form that can be readily used by operational entities such as Metrological Agencies using Numerical Weather Prediction (NWP). The UK Met Office has developed a daily SST analysis, based on AATSR data as the accuracy-defining input element, which in turn is used as input to their daily NWP operations. This development marks the transition of the ATSSR sensors from experimental to operational status.

The ATSR sensors will be described, and recent results of investigations using the version 2 data-set will be discussed, as well as the new operational applications of the SST data. Planned future developments for data-continuity in the GMES programmes will also be described in outline.