RAL ATSR PLS Report to 17th ATSR Core Group Meeting

Covering the period 1st October 1999 until 31st December 1999

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1. PROGRESS SUMMARY

Good progress has been maintained throughout the period, and a number of milestones achieved.

The ABT merging tool has now produced 16 months of consolidated ABT data, evaluation and checking of consolidated SST data for the CD rom is now underway. SST retrieval coefficient work for ATSR-1 is nearing completion, which will lead to traceability of the code at RAL and of the SST retrieval coefficient generation. The ABF system has been operational throughout the period, with a daily log being maintained to record any problems.

2. INSTRUMENT STATUS

2.1 ATSR-1 STATUS

Throughout this period ATSR-1 has been powered off, and only the basic monitoring activities necessary to check basic health and safety and keep the microwave radiometer in operation are being maintained.

2.2 ATSR-2 STATUS

ATSR-2 has operated nominally throughout most of the reporting period, as usual there have been a few occurrences of high power spikes.

3. REPORTS ON INDIVIDUAL WORK PACKAGES

3.1 WP 1000 SCIENCE EXPLOITATION

3.1.1 WP 1100 Scientific Planning and Project Management

Regular meetings have been held of the ATSR PLS Project team to progress all aspects of the ATSR Post Lunch Support Programme.

3.1.2 WP 1200 Scientific Support

The contents of the CD ROM will be:-

- Booklet
  - Information describing contents.
  - Instrument Operations information.
  - Portability information.
- Daily files containing position and temporal information.

- Nadir and Dual view SST
- Confidence word
- Weekly 1/2 degree SST fields.
- 5 day 1 degree SST fields (Match Met Office Super Observation Data Set)
- 10 Arc minute Weekly SST fields.

The SST will be derived using Merchant et al. Aerosol robust retrieval coefficients.

Consolidated ABT data and the associated SST data for the period May to December 95 for ATSR-2 has been processed. ATSR-1 consolidated ABT and SST data for June/July 95 has also been processed to allow ATSR1/2 intercomparison. Evaluation, quality checking of this data is now underway. This will involve an intercomparison of ATSR-1 and ATSR-2 and comparison with AVHRR SST.

3.1.3 WP 1300 Underpinning Physics

Work continues on the ongoing items listed in Table 2 of the attached summary. The progress on these activities remains good and will be reported at future ACG meetings. The major activities are the updating of the ATSR-1 coefficients and the Cloud Algorithm.

Some work undertaken this quarter leads to a very strong suspicion that under some extreme conditions the 11 and 12 μm infrared brightness temperatures can be affected by sunglint. Further investigation of this is underway, if these suspicions prove correct then a further modification to the SST retrievals will be necessary. Progress on this will be reported at subsequent meetings.

Detailed below is a summary of the work by Dr. Birks on the updating of ATSR-1 coefficients.

Status of SST retrieval developments at RAL

The primary objective of this work is to generate new SST retrieval coefficients for ATSR-1 that take account of the detector temperature dependence of the ATSR-1 12 micron channel profile.

On a more general note, this work requires that the existing RADGEN radiative transfer model and related code be updated to take account of developments in coefficient generation since the original SADIST retrieval coefficients were derived. The coefficient set currently in use in the SADIST processing system includes aerosol robust dual view retrieval coefficients derived from work by C.J. Merchant; at the same time SADIST was updated to use a new across-track interpolation scheme. The existing RAL software requires to be updated to support these developments.

Finally there is a need to establish and maintain traceability of the code at RAL and of the SST retrieval coefficient generation.

Radiative transfer model

An updated version of the RADGEN radiative transfer program at RAL has been developed for this work. The principal new requirements for this version are as follows:

1. Ability to read atmospheric profiles derived from ECMWF data and to interpolate with respect to relative humidity rather than water vapour density;

2. Inclusion of the Watts et al (1996) parameterisation of wind speed effects in the forward view emissivity;

3. Improved portability, to enable transfer to UNIX system;

4. Backwards compatibility with existing versions (RADGEN.FOR;2 and RADGEN.FOR;4) to enable testing against them.

Changes made:

1. Up-to-date continuum, tropospheric and stratospheric aerosol models, based on work by Zavody, incorporated;

2. Code modified to improve portability and efficiency. Portability to unix system has been demonstrated.

3. Modified to accommodate atmospheric profiles based on ECMWF reanalysis data set. Additional surface parameters are also input (following Merchant, 1998) to define surface conditions more accurately. As part of these modifications to adapt to the use of the ECMWF data set, the program now reads surface wind vector from the atmospheric data, for use by the Watts et al (1996) parameterisation scheme.

4. Watts et al (1996) parameterisation scheme for reflectivity/roughness effects added.

The above changes are complete. A final modification to the program is required. Existing versions of RADGEN calculate transmission etc. at a fixed (hard-coded) set of air mass values (angles of incidence). The new developments require greater flexibility in the selection of air masses, and therefore the code is to be modified to accept input files of air mass values and corresponding emissivities. At the same time an external scheme to derive such files by interpolation of tabulated emissivity/reflectivity values is required. The latter is well advanced.

Atmospheric Profile Set

Software to decode ECMWF reanalysis data (which comes in GRIB format) and to extract atmospheric profiles from the decoded data has been implemented. A new set of atmospheric profiles (essentially that used by Merchant et al) has been generated in this way.

Temperature dependent instrument LUTs

A scheme for deriving the modified frequency response of the 12 micron channel as a function of detector temperature was devised by A. Zavody, and this has been used to derive modified responses and corresponding temperature-to-radiance look-up tables at 11 detector temperatures between 85 and 110 K inclusive.

This existing scheme is based on laboratory measurements of flight spare detectors, and so may not be fully representative of the actual instrument. Work is in progress to quantify any differences (although this need not preclude the use of the existing model profiles to generate coefficients).

Coefficient retrieval scheme

The scheme used to generate the original, banded coefficients for the ATSR-1/2 instruments includes the modelling program RADGEN that generated the brightness temperatures, but also three subsequent stages as follows:

1. A step to sort and reformat the RADGEN brightness temperatures for subsequent processing.

2. An interpolation scheme to find the BTs at the (band centre) air mass values actually required from those at the air mass values computed by RADGEN. This step has been modified to make it more efficient, but is no longer required if the new across-track interpolation scheme is used.

3. The generation of the matrix of normal equations and its solution to find the actual coefficients. This has been rewritten in IDL to make it easier to adapt to the requirements of the detector temperature scheme and other developments. In particular a version that implements the aerosol robust scheme of Merchant (1998) has been written.

These changes are in place.

3.1.4 WP 1400 Management Interfaces

The Project Scientist has maintained regular management level contact with ESA counterparts at ESA-HQ, ESTEC, ESRIN and ESOC. User Group Meeting.

3.1.5 WP 1500 Promotion

The EOS Article has now been published, and stimulated considerable interest in the ATSR programme from an influential US researcher currently interested in climate change.

The Flyer is now with the printers an will be ready for distribution with EOQ and the next WOCE Newsletter.

The article for the ESA Earth Observation Quarterly is now complete and was submitted to ESRIN before Christmas.

The new ATSR WWW site will be on line from the 18th January. Status logs for both software and hardware are included. ACG members are encouraged to comment on the site

At the last meeting we reported that we had contacted ERDAS(UK) and PCI Geomatics concerning the inclusion of ATSR data formats into their image processing products. We have heard nothing from PCI, but ERDAS(UK) responded very positively. This has been followed up with ERDAS, and we have received in the last week a partial solution from them which will allow users to read the image data straight from the GBT files. However, it does not give the users direct access to the header information, or the georeferencing, and like the ingestor in ENVI, does not cope properly with the exceptional values and image flags. The current solution requires the generation of a very simple header file that describes the GBT products and allows them to be read by IMAGINE. It is not clear how to take this forward, and the ACG's advice on how to proceed is welcomed. It would be fairly straightforward to devise a scheme for automatic generation of these header files from a GBT product, but as already stated it is only a partial solution. The more complete solution would require a proper interface to IMAGINE to be developed by ERDAS, which would cost money.

The project team at RAL continues to receive frequent enquires about "anomalies" in ATSR-1 and -2 image data that stem from incorrect interpretation of the data formats. Mostly these are to do with users not understanding or reading the documentation concerning byte ordering within the products or how to interpret the exceptional values and blanking pulse/cosmetic fill flags. However, some of the queries are about image artefacts that result from instrument "features" such as pixel map changes, or scan jitters. The lack of clear documentation explaining these quirks is obviously frustrating to users, and some people may even be put off using the data altogether when they see features they do not understand. In response to this need for improved and more accessible documentation, a "Frequently Asked Questions (FAQ)" document about ATSR images is being prepared. This FAQ will document the common "features" seen in the images and include annotated illustrations of each "feature" to allow the user to self-diagnose the source of the artefact. For those artefacts which are not caused by an unavoidable "feature" of the instrument a solution to the problem will be offered in the text of the document. An outline of this FAQ document now exists which will be completed during the next quarter. The full document will be made available to users as a PDF file, but it anticipated that a simplified version of the document as web-based image troubleshooter will also offered through the project web pages. This clearer documentation should make ATSR data more accessible to users and reduce the number of queries to the project team.

3.2 WP 2000 IN-FLIGHT OPERATIONS

3.2.1 WP 2100 System Management

The software, hardware, and data links necessary to support the ATSR-1 and 2 instruments have been maintained throughout the period.

Philippe Goryl has confirmed in a fax to Dr. Mutlow that the DECNET protocol will be maintained for file exchange between RAL and ESOC. In order to satisfy this, two solutions are under evaluation:

1) Either establishing via BT a new direct link between RAL and ESOC, only for Decnet;

2) or accommodating the traffic via ESRIN and the existing ERS links over an IP tunnel.

Whatever the solution ESA has confirmed that there is no intention to discontinue the service. The DECNET protocol will be used.

3.2.2 WP 2200 Instrument Operations

ATSR-1

Nothing to report. ATSR-1 is powered off, and only the basic monitoring activities necessary to check basic health and safety and keep the microwave radiometer in operation are being maintained.

ATSR-2.

ATSR-2 continues to perform well. The instrument has been running continuously since November 1998. The scan mechanism is running nominally with no indications of the drive problems previously encountered. ATSR-2 continues to operate really well.

Detector outgassing was carried out during November when ERS-2 operations had a planned shutdown to avoid being powered for the Leonid shower. Parameters for gain, etc., as checked from trend plots and VISCAL performance, returned to known baseline trend lines.

Over Y2K ATSR-2 operated continuously and without problems. This was expected since the on-board software has a 4msec binary clock and no concept of date.

There was just one high power spike taken by the scan mirror system during the warmest part of the instrument's year, just prior to Christmas. The subsystem is operating well with a steady trend towards cleaner running.

The daily routine engineering monitoring has continued, and the data buffering arrangements successfully yielded a complete data set over the Christmas break. There was a data gap for all instruments because ESOC chose to shutdown the IDHT data system over Y2K.

John Wright is addressing the ongoing activities of putting more ATSR-2 operational information on the WWW and identifying all the S/W tools that we have on ATSROP so that all the required ones can moved over onto ATSENG.

The visible calibration table is now being updated once per fortnight.

The VISCAL data is available from:

http://www.atsr.rl.ac.uk/html/calibration_table.html

Support from ESOC for ATSR-2 continues to be excellent.

3.2.3 WP 2300 Monitoring

ATSR-1: Basic health and safety check has been maintained over the period.

ATSR-2: Detailed daily monitoring has been maintained in case the scan anomaly recurs.

3.2.4 WP 2400 Troubleshooting and Diagnostics

No action has been required during this quarter.

3.2.5 WP 2500 On-board Software and High-level Documents

No work required during this quarter.

3.2.6 WP 2600 ATSR-2 X-band EDS development and Maintenance

There has been no work in this reporting period.

3.2.7 WP 2700 Maintenance of the S-Band EDS-1/2

System Testing of the EDS-2 port to the new ALPHA/VMS system was completed successfully. The old system remained operational to allow the new system hardware to be used for final Y2K testing of SADIST-2 and EDS-2, where the system clock was set to 2000 (during Nov/Dec 1999) to ensure complete compliance. The EDS-2 operations will move to the ALPHA system by the end of January.

3.3 WP 3000 CALIBRATION AND VALIDATION

3.3.1 WP 3100 Calibration and Validation Planning

The situation regarding the forthcoming campaigns is under review, an update will be given to the ACG meeting.

3.3.2 WP 3200 Infrared Calibration and Validation

A summary of the status of the campaigns analysis and validation points will be tabled at the ACG meeting.

SISTeR instrument BETH

Work on the instruments has been slow over this quarter, with Tim Nightingale concentrating on analysis of campaign data.

3.3.3 WP 3300 Visible Calibration and Validation

Work on the long term monitoring of the visible channel calibration and the intercomparisons with other sensors continues. Reflectance channel intercomparison of ATSR-2 with AVHRR, POLDER and VGT is underway. Preliminary comparisons with POLDER data have been made.

Dave Smith is currently preparing a paper “Calibration monitoring of the visible/near infra-red channels of ATSR-2 using stable terrestrial sites”. A draft has been completed and is currently being reviewed by N.Rao from NESDIS.

3.4 WP 4000 ALGORITHMS

3.4.1 WP 4100 Algorithm Management

3.4.2 WP 4200 Algorithm Development

Reported under Science support, as the current work relates to improvements in the algorithm coefficients and a review of the cloud algorithm and its performance.

3.4.3 WP 4300 Algorithm Maintenance

Other than those reported above, no significant maintenance activities have been required during this reporting period.

3.5 WP 5000 DATA PROCESSING SOFTWARE

The ABT Collocation and Consolidation software (CoCo) is now in operational use. ATSR-2 data for June to December 1995 (i.e. from ATSR-2/ERS-2 launch up to the scan mirror failure) was processed to allow scientific assessment of the new product. Experience with this initial processing run suggested improvements to the overall data processing scheme which have now been incorporated. One minor bug remains - this is under investigation now, but is not serious enough to delay futher processing which is now underway. Currently the processing rate is 1 month every 3 days, including product archiving to tape and QA. July 1996 to June 1997 ATSR-2 data is currently being processed and will be complete by the end of January.

The 3-month cloud-free Drifting Buoy Inter-comparison data set and catalogue is available to interested users. TAR tapes are available in exabyte format of the GBT-only data or the GBT and GSST data.

3.5.1 WP 5100 Software Requirements

The ESA LRDAF tapes have ~43 files, the RAL consolidated LRDAF will have significantly more files (initially ~200files). In order to facilitate this, changes are required to the catalogue design aspects of the SADIST pre-processor. The architectural design for this has now been completed.
It should be noted that once the number of files on a RAL consolidated LRDAF tape >400 files, the ATSR-1 archive can be accommodated on the AIT Jukebox.

3.5.2 WP5200 Software Maintenance (SADIST-2 V300)

The Y2K compliant version of SADIST-2 (v320) has been installed and is now in operional use at RAL, and all ESA data-processing centres (ESRIN, UK-PAF and the TSS NRT facility). No problems have been reported.

A sequential list of all SADIST-2 version numbers has been prepared which explains the enhancement and/or bug-fix associated with each new version. This list appears on the new ATSR Project Web Pages.

3.6 WP6000 DATA HANDLING

3.6.1 WP6100 Data Management

The State Vector information from ESRIN continues to be received successfully, including simulated year 2000 state vectors which were archived at RAL.

3.6.2 WP6200 Archive Improvements & Population.

LRDAF tapes have continued to be received at RAL. A comparison between the new and previous data sets for 1992 has taken place which shows that new data set contains many orbits previously omitted.

3.6.2.1 WP6201 Data Archive Maintenance.

It was intended that the full MRF-processing run from this data would start in Q3 1999. However, this will now be delayed until changes have been made to sadist2 to correct the output of asst/abt products.

3.6.3 WP6300 Primary Mission Processing.

During this period, the ABF has been brought on-line again and population with ATSR-2 data, as generated through MRF processing has resumed. However, problems with the interface software between the ABF and the data processing cluster has slowed the rate of progress of MRF processing. Despite this, as indicated at the previous ACG meeting, the backlog of processing was cleared before the end of 1999.

As agreed at the previous ACG meeting, the processing of the backlog of ATSR-2 data has taken priority. Inevitably, this has meant that processing of some individual high-resolution data requests has had to be delayed. However, now the backlog has been cleared, these will be undertaken as soon as possible.

3.6.3.1 WP6301 Browse Population & Operation.

The ABF has operated throughout the period. A log is now being maintained that records on a daily basis the ABF performance and problems if any. There have been some problems associated with the interface between the ABF and the data processing cluster, which are currently under investigation.
A full report will be given to the ACG meeting.

3.6.4 WP6400 Full Resolution Data Processing for the NERC Community.

The following table summarises data services provided this quarter.

	Received	Completed	Products Distributed
1999 Q2	15	11	22060
1999 Q3	11	5	7008
1999 Q4	4	4	16312

3.6.5 WP6500 Reprocessing.

ATSR-2 MRF processing is currently up to date, there is no backlog.

3.6.6 WP 6600 Order Handling and Distribution

See reports under above work packages.

The following users have requested data during the reporting period

Name	Institute	Country	Requests
John Marsham	University of Edinburgh	UK	1
Chris Merchant	University of Edinburgh	UK	1

The following users have requested data during the reporting period

Name	Institute	Country	Requests
Aleksei Romanov	Russian federation of research Institute	Russia	1
Thouron Odile	Universite de Lille	France	1

Listed below are institutions that have accessed the ASST FTP site

Institution
Meterological Office
Southampton Oceanography Centre
University of Leicester
ESRIN
School of Engineering of Bilbao, Bilbao, Spain
Russian Academy of Science

4. WP 7000 HIGH LEVEL MANAGEMENT

4.1 WP 7100 OVERALL RAL PROJECT MANAGEMENT

Regular progress meetings with the Project Scientist and the EO Data Group Leader have been held to progress work.

5. PLANS FOR THE NEXT QUARTER

The specific milestones for the next quarter are given in Table 3 of the attached progress summary, plus the following list of standing activities:

- Continued operational support for the ATSR-1 and -2 instruments.
- Continued ATSR image product service.
- Continued routine ATSR-2 ASST processing.
- Continued routine ABF population and image generation through the Master Request File.
- Continued support for routine ABF operations to users.