
From : Hugh Kelliher	Reference : AEB.MEM.004
To : AEB Members	Date : 21 September 2016
	Issue : 12
cc :	N° Pages : 28

Subject: ATSR Exploitation Board - New Work Items Status

1. Introduction

The ATSR Exploitation Plan (AEP) included a set of proposed projects for consideration by AEB members. This memo provides an update to that list, as amended during the 12th AEB meeting at DECC, London on 6 October 2015 at which it was stated that:

- Caroline Poulsen (CP) noted that some of the work items she has proposed overlap a bit and there is logic to the order in which they are done. A third of the work that needs to be done (covering the 3 work items from CP et al) is common between them.
- 'Continuation of shipborne radiometry...' - ESA plans to support the continuation of the activity from 2017.
- 'Climate Quality Land Surface Temperature time-series for ATSR...' - ESA is funding a team. Pascal Lecomte (PL) says it is planned to be part of the CCI extension.
- Steps required in the conversion of the ATSR Archive to SLSTR format - this is going ahead using the FAST processor.
- Assessment of Argo - this is going ahead a bit under the DECC contract but mostly on the CCI project.
- 'ATSR - The Story' is on hold since DLJ left as no-one else has had time to pick it up.
- 'Solar insolation' - UKSA may be interested in this; it would build on ORAC.
- Sea Ice work items - there is a study that has been funded at Eumetsat on sea ice cloud screening for SLSTR. An ITT is about to be issued.
- Impact of SLSTR backward view – Peter North has produced a tech note for ESA.

The following has been added to Issue 12 of the memo:

- '(A)ATSR L1b Traceability Chain'

Future issues of this memo will include additional proposals as and when they arise.

2. Projects for which funding has been approved

Project Title	Lead
Steps required in the conversion of the ATSR archive to SLSTR format	ESA
ESA are funding Telespazio Vega and RAL to produce a new processor to convert ATSR UBT/L0 data to SLSTR L1 format.	
Continuation of shipborne radiometry to provide a common reference for SST measurements from AATSR and SLSTR	DECC/ESA
Discussions between DECC, NERC and Defra have led to funding for this activity being provided to 31 January 2017. ESA are planning to support the continuation of the activity.	
Assessment of Argo network for SI traceability and stability	DECC/ESA
An assessment of the suitability of Argo to provide traceable measurements has been included in the new DECC contract and an assessment of Argo stability is being included in SST_cci.	
Improvements to the ATSR-1 and -2 data sets	DECC/ESA
The L1b to L2 issues affecting the Pinatubo data are being addressed in Phase-II of ESA's SST_cci project. Other issues are being addressed under the DECC contract, including the processing of the post-June 2003 ATSR-2 data.	
STATS – Validation activities	DECC/ESA
DECC and ESA are funding the continuation of the validation activities needed to ensure a smooth transition from AATSR to SLSTR.	
Climate-quality Land Surface Temperature (LST) time series for ATSR (ARC-LST)	ESA
ESA are funding a team lead by UoL to produce an LST product (GlobTemp).	
Relating land surface air temperature (LSAT) to land surface temperature (LST)	EU
This is addressed in the EU Surface Temperature or All Corners of Earth (EUSTACE) project.	
Arctic surface temperature time series	DECC
DECC are funding UoL to produce an Arctic temperature dataset.	

3. Projects on hold

“ATSR – The Story”	ESA
<p>The process of producing an instrument and a satellite remain mysterious to most people. By creating a minimally technical book that tells the ATSR story from a human perspective, it is hoped that a few more people will feel engaged with science and engineering.</p>	

4. Projects for which funding is being sought

Project Title	Lead
Impact of backward view on SLSTR to continuity of data from ATSR	ESA
<p>Peter North has looked at this is part but more work is needed.</p>	
STATS – Science activities	UKSA/NERC
<p>There is a clear imperative from the recent EarthTemp Network white paper (http://EarthTemp.net/EarthTempWhitePaper2012.pdf) and GlobTemp user consultation for independent, accurate, stable surface temperature (ST) across <i>all</i> domains, primarily for climate applications. ATSRs should have a central role here, as already with SST. The UK team has established a leading role within Europe on the development and improvement of SST and other ST products. The PI team are preparing a more detailed proposal for the STATS activities.</p>	
Improvements to ATSR solar channel calibration	ESA
<p>Climate studies using ATSR demand stable and consistent radiometric calibration of the solar reflectance channels to uncertainties below 1% (TBC). The ESA CCI programme in particular is driving demand for accurate analysis of long term stability of AATSR channels and the associated uncertainty in order substantiate trends in derived products. It is also important to understand the biases between different derived products as a function of the absolute calibration accuracy of the instrument.</p>	
Polar Surface Temperature – next stage	TBD
<p>To derive a Polar Surface Temperature time series and a combined high spatial resolution ATSR/SLSTR Polar All-Surface Temperature data product in order to improve our understanding of recent changes in the polar regions. SLSTR will enable continuation of the time series and requires solving the problem of the AATSR-SLSTR data gap. Availability of high resolution/high coverage SAR data from Sentinel 1 will allow improvements to the product through higher accuracy of ice masking which will feed into improved cloud detection. Production of a high resolution, long-term data set will be a valuable tool in model verification.</p>	

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Project Title	Lead
Snow/ice surface temperature product	TBD
<p>Ice surface temperature (IST) is critical to understanding climate change in high latitudes. Model projections suggest that the polar regions have the largest climate sensitivity to increasing greenhouse gases. These changes in sea and land ice are not well predicted by climate models and therefore there is an urgent need to evaluate temperature change in the Polar regions in recent decades. The ATSRs are particularly appropriate to monitor surface temperature change at higher latitudes being highly accurate and providing observations over a period of twenty years.</p>	
Long-term climate record from LST	TBD
<p>LST is critical to multiple environmental, agricultural and health related monitoring applications to help assess and mitigate against extreme events such as heat wave events, drought stress in plants (due to the relationship between canopy temperature and transpiration) and fire risk from ignition potential due to changes in surface dryness. The production of a long-term archive would fulfil user needs in climate science, such as model validation, assimilation and land cover change detection; urban planning; and geothermal anomaly monitoring</p>	
Development of long-term fire record via application of SLSTR fire algorithm to ATSR night-time 3.7 micron channel data	TBD
<p>We propose to capitalise on the new SLSTR fire detection algorithm and ATSR reprocessing to optimise and apply the SLSTR algorithm to the ATSR archive, in order to develop a consistent climate quality fire dataset from ATSR that can also be in future blended with the ongoing record from SLSTR to assess trends in biomass burning. In addition to the simple "fire location" information the current WFA reports, we would also include cloud cover and overpass coverage information in the product, such that analyses can take these parameters into account when evaluating trends over time, as is done for example in the prototype Copernicus Atmosphere Service fire emissions estimation system (e.g. Kaiser et al., 2012).</p>	
Full assessment of atmospherically-corrected surface reflectance quality, errors and range of validity	TBD
<p>Correction for atmospheric effects are required for accurate surface reflectance, necessary for albedo, separation of anomalies due to surface change from climate or disturbance atmospheric anomalies in time series, and accurate mapping of surface cover and biophysical parameters. Methods have been developed under previous funding for ATSR and will be continued operationally on SLSTR (Synergy branch) but they have not yet been validated.</p>	
Derivation of vegetation parameters for ATSR	TBD
<p>ATSR has potential for a valuable long-term record of land surface biophysical parameters, relevant to modelling of carbon, water and energy cycles, and detection of anomalies. Recent improvements in model inversion and atmospheric correction will allow a high fidelity dataset to be produced. Existing datasets (MODIS, VGT, and MERIS) do not have such a long series, and show large disagreements.</p>	

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Project Title	Lead
Retrieval of cloud-top water vapour column (CTWVC) using AIRWAVE algorithm	ESA
<p>The Advanced InfraRed WAter Vapour Estimator (AIRWAVE) algorithm, developed in the context of the ALTS project (ESA), has proven to provide very good water vapour information from the ATSR TIR (thermal infra-red) measurements when applied to clear sky – sea surface scenes. The objective of this project is to include cloudy scenarios in the retrieval of water vapour columns using nadir and forward TIR measurements of the ATSR series.</p>	
(A)ATSR L1b Traceability Chain	TBD
<p>The 4th reprocessing data will have per-pixel uncertainty estimates that are based on the radiometric calibration model implemented in the current L1 processing. The values used in the estimates will be based on the best available information from pre-launch calibration tests and some in-flight data. .</p>	

The following work items are interrelated; the top priority is the PAR work:

Aerosol effects on PAR (Photosynthetically Active Radiation) and direct-diffuse surface irradiance	TBD
<p>Improving our understanding of current and future atmospheric aerosol loads influence on radiation quality and quantity: Comparison of remotely sensed and modelled estimates of the influence of aerosol on direct and diffuse fractions of PAR for the UK models.</p>	
Development of an ATSR broadband radiative flux retrieval for assessing and monitoring Earth's radiation budget	TBD
<p>The forcing due to aerosol-cloud interactions ranks as the most uncertain among the forcings of anthropogenic climate change. The uncertainty is large in part due to “cloud contamination” in satellite retrievals caused by poor cloud masking and 3D effects. Cloud contamination hampers accurate estimates of aerosol optical depth in the vicinity of clouds. By utilising the dual view of the ATSR instrument within the optimal estimation retrieval scheme of ORAC we can limit cloud contamination and produce a highly accurate broadband radiative flux product needed to quantify the global aerosol indirect radiative forcing. Furthermore, this dataset would be used to study cloud feedbacks and changes in global cloud distribution that could be attributable to climate change over the observation period.</p>	
Surface radiation for the solar energy sector from ATSR	TBD
<p>The ability to derive accurate and consistent aerosol and cloud properties from ATSR requires the calculation of up- and down-welling radiation at the surface. Accurate direct and diffuse down-welling solar fluxes are of critical importance for the solar energy sector as well as for biophysical processes, but this capability is not yet utilised. Calculation of direct and diffuse PAR is already on AEB's list of proposed work topics, and the methodology to produce spectrally-integrated fluxes required for the solar energy sector would build directly on that. Informal discussions with a representative of one UK solar energy company have indicated that the sector could be interested in being involved in the specification and development of such a reliable, new satellite data product, and provision of validation data in the form of pyranometer measurements taken at potential UK sites for solar energy development.</p>	

5. Complete Description of all Projects Underway

Project Title	SST Data Continuity - Continuation of shipborne radiometry to provide a common reference for SST measurements from AATSR and SLSTR
Application and/or Underpinning Activity	SST ECV, Ocean, Climate Validation, Data Continuity
Objectives	To establish an <i>in situ</i> data record that can be used to tie together the SLSTR and ATSR climate records (gap-bridging)
Maturity	SST validation of SST in the Bay of Biscay is creating a long-term validation match-up dataset for SST sensors, including AATSR.
Justification	<p><i>In situ</i> validation using ISAR in the Bay of Biscay is required to provide a baseline against which the SST measurements from AATSR and SLSTR can be adjusted, to ensure no offset is introduced into the climate data record.</p> <p><i>In situ</i> radiometry is the only direct way of monitoring the impact on satellite SST products that could follow a major stratospheric aerosol event such as the Mt Pinatubo volcanic eruption.</p>
Priority	High – data continuity is vital in a long-term SST ECV dataset
Urgency	High – funding for ISAR is guaranteed only to 31 December 2012.
Project Description	The ISAR <i>in situ</i> radiometer has been operated by the University of Southampton on a ferry in the Bay of Biscay for 8 years, funded by DECC. This project would continue the observations until at least two years after the start of operational SLSTR measurements. The data will be used to validate AATSR, SLSTR, AVHRR and SEVIRI, and possibly other SST sensors, so that the gap between AATSR and SLSTR can be bridged and both of the instruments can be compared to the same reference <i>in situ</i> dataset acquired by ISAR.
Project Schedule	The DECC contract ends on 31 March 2014, although funding of the deployments on <i>Pont Aven</i> are only guaranteed to 31 December 2012. The funding for the project continuation therefore needs to be resolved as soon as possible.
Resources Required	1 instrument/data scientist full-time, plus ISAR parts for regular maintenance and some T&S to meetings and conferences
Budget	Approx £150k per year
Funding Agency	UKSA/NERC/Defra/DECC to resolve

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Project Title	Steps required in the conversion of the ATSR archive to SLSTR format
Application and/or Underpinning Activity	SST ECV, Ocean, Climate, ARC, SLSTR data format Archive, Data Continuity
Objectives	<p>The objective of this study is to identify the steps that need to be taken to convert the ATSR data to SLSTR format so that the long-term ATSR/SLSTR archive is in a consistent format and future reprocessing of the ATSR archive can be undertaken using the SLSTR processor, allowing the ATSR processors to be retired.</p> <p>The study will focus on what is currently missing in the ATSR archive and what is the minimum starting point e.g. UBTs, UCOUNTS or L0? It will examine possible implementation options.</p>
Maturity	Builds on the definition of the ATSR and SLSTR data formats and the design of the SLSTR processor, and associated documentation.
Justification	Users require that the ATSR/SLSTR be in a common format i.e. the SLSTR format. This requires the conversion of the ATSR archive to SLSTR format. There is also a desire to reduce costs by retiring the ATSR processing hardware and software, once the SLSTR processor is established.
Priority	High – ideally the ATSR archive should be in SLSTR format by the start of the SLSTR mission in 2015.
Urgency	Medium – the analysis needs to be completed by 30-June-2013.
Project Description	<ol style="list-style-type: none"> 1. Review the ATSR and SLSTR data formats and identify the steps needed to convert the ATSR data to SLSTR format, ideally by converting the ATSR data at L1 so that the SLSTR processor may be used to generate the higher level products. 2. Identify any issues that might prevent the retirement of the ATSR processors and suggest possible solutions. 3. Prepare a technical note summarising the technical issues, options and recommendations for the conversion of the ATSR archive and future reprocessing of the data. 4. Provide estimates of the cost of each of the options.
Project Schedule	3 months, starting in spring 2013
Resources Required	Existing experts from the DECC and ESA projects
Budget	Euro 50K (TBC)
Funding Agency	ESA

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Project Title	Improvements to the ATSR-1 and -2 data sets
Application and/or Underpinning Activity	SST ECV, Ocean, Climate, ARC, Archive, Data Continuity
Objectives	The objective of this project is to investigate outstanding ATSR-1 and -2 issues, as identified by the QWG, and to propose solutions that can be implemented in a reprocessing of the ATSR-1 and -2 data.
Maturity	The issues are identified in various QWG and AEB documents. The scope of the activity is broadly understood but up to now, they have been a low priority.
Justification	The ATSR-1 data has been affected by various failures and performance issues with the instrument. It is important from a science point of view to try and improve the data from ATSR-1 as it covers the Mt. Pinatubo period. There are also a few outstanding issues with ATSR-2, including the need to process the remaining post-gyro failure data that has recently been made available by ESA. Data from both sensors should be reprocessed using a full orbital set of restituted state-vectors, interpolating over the orbit to improve geolocation accuracy.
Priority	High – required by the Met Office
Urgency	High – the issues should be resolved prior to conversion of the ATSR data to SLSTR format.
Project Description	Note: Agree list of items first. <ol style="list-style-type: none"> 1. Agree priority of each issue and investigate each one in turn. 2. Prepare a short technical report on each issue and propose solutions to the QWG. 3. Implement and validate agreed solutions. 4. Reprocess archive as agreed with the QWG.
Project Schedule	18 months, starting in summer 2014
Resources Required	Existing experts from the DECC and ESA projects
Budget	TBC
Funding Agency	NERC/ESA

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Project Title	STATS – Validation activities
Application and/or Underpinning Activity	SST ECV, LST, LWST, Ice Temperature, Synergy Products, Ocean, Climate, Validation
Objectives	The objective of this project is to continue the co-ordination and leadership of Surface Temperature validation in preparation for, and during the operation of, SLSTR. The work is to be performed within the context of the 'STATS' collaborative ground segment.
Maturity	The work follows on from the DECC-funded activity with an extended scope to include temperature synergy products with OLCI.
Justification	Validation is an ongoing and crucial activity that is needed to ensure the quality of SLSTR data for use both in operational and climate applications. The UK team has established itself as the leading group within Europe for SST validation.
Priority	High – The validation activities are essential to the success of SLSTR
Urgency	High – ESA is calling for a proposal on the topic by 31 December 2012
Project Description	<ol style="list-style-type: none"> 1. Continue to co-ordinate SST validation activities, playing a leading role in GHRSSST, CEOS and other relevant organisations. 2. Prepare the SLSTR SST validation plan, based on the AATSR SST validation plan. 3. Prepare validation plans for LST, lake and other surface temperature products. 4. Support QWG activities. 5. Prepare reports, presentations etc.
Project Schedule	Start on 1 March 2014 and continue on a 2 year basis
Resources Required	Existing experts from the DECC projects
Budget	Annual budget £150k (TBC)
Funding Agency	UKSA/DECC

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Project Title	Assessment of Argo network for SI traceability and stability
Application and/or Underpinning Activity	SST ECV, Ocean, Climate, ARC, Validation
Objectives	The objective of this project is a metrological analysis of whether Argo can formally fulfil this role and warrant the AATSR record as SI traceable on a global basis.
Maturity	New proposal
Justification	The network of Argo profiling floats reportedly has SI-traceable stable ~1 mK accuracy and near-global coverage (albeit sparser than drifting buoys). [Note: Although depth-to-skin geophysical differences are present in float-satellite comparisons, with appropriate filtering of matches, the size of these is the same as the size of point-to-pixel effects in comparisons of <i>in situ</i> radiometers, so comparisons can be just as precise.] The Argo system may therefore be able retrospectively provide matches with SI traceability, needed in addition to those from radiometers, as well as a stability reference for much of the AATSR mission.
Priority	High – with ARC SSTs prominent in drafts of IPCC AR5, SI traceability of ATSR-based datasets is central to their credibility
Urgency	High – IPCC cycle is well advanced
Project Description	<ol style="list-style-type: none"> 1. Establish co-operation between UK and international Argo community. 2. Formally review status of SI traceability “at point of use” for Argo near-surface SST measurements. 3. Refine skin-to-depth model for Argo appropriate depths and define uncertainty budget. 4. Rebuild AATSR-Argo match-up and multi-sensor match-up datasets using revised, improved Argo database and latest ARC / SST CCI products. 5. Formal analysis of precision to which datasets tie satellite SSTs to SI standards. 6. Determine stability of ARC/Argo time series
Project Schedule	18 months, starting in summer 2014
Resources Required	Existing experts from the DECC and ESA projects plus links to NPL
Budget	Euro 150K (TBC)
Funding Agency	NERC/DECC/ESA with possible contribution from NPL. The stability assessment activity may be done in SST_cci Phase-II

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Project Title	Climate-quality Land Surface Temperature (LST) time series for ATSR (ARC-LST)
Application and/or Underpinning Activity	LST secondary ECV, land surface environmental change; land surface response to more extreme weather such as droughts and extended cold spells.
Objectives	To derive a climate-quality time series for LST from (high quality LST with well understood errors) ATSR data at a 5 km grid scale (0.05 deg).
Maturity	The quality of the LST from ATSR is outlined in QWG and ESA reports. The need for LST and its potential is well outlined in the AEP, the EarthTemp network meeting, GlobTemp user consultation meeting and GCOS documents.
Justification	SST has become an excellent product from ATSR with high fidelity. The improvement in LST offers similar prospects and there is strongly increasing user need for LST data of high (climate) quality. This is evidenced in many of the recent documented meetings such as EarthTemp.
Priority	High
Urgency	High. The production of ATSR time series is already underway and being assessed. Climate quality is therefore much higher in user's perceptions.
Project Description	<ol style="list-style-type: none"> 1. Produce climate-quality LST with verified radiative transfer, coefficients and emissivity. 2. Produce much needed improvement in cloud clearing over land 3. Produce gridded climate time series with biome classification and uncertainties.
Project Schedule	30 months, starting summer 2014.
Resources Required	Person at Leicester (LST algorithms; data production), Reading (cloud clearing over land); RAL (radiometric calibration, data archiving); Hadley Centre (climate science user)
Budget	Approx. £400-500,000
Funding Agency	NERC/DECC/ESA

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Project Title	Relating land surface air temperature (LSAT) to land surface temperature (LST)
Application and/or Underpinning Activity	LSAT is a primary ECV, and is primarily based on <i>in situ</i> data. LST would very usefully complement LSAT by providing greater statistical sampling and components of spatial variation of surface temperature. However, work is needed to explore relationships between LSAT and LST.
Objectives	To derive procedures for relating LSAT to LST and enable LSAT-like climate information to be derived from satellite LST.
Maturity	Promising statistical work on this problem has been performed in the Hadley Centre and also in other countries. Maturity is probably low to medium. The need for LSAT and LST relationships is well documented in the EarthTemp network meeting documents. The importance of LSAT for climate is well recognised in IPCC and GCOS.
Justification	SST has become an excellent product from ATSR with high fidelity. The ARC project has inferred SST depth from ATSR data which enables satellite and <i>in situ</i> data to be compared and combined with fidelity. A similar approach for deriving LSAT from LST would be similarly beneficial.
Priority	High
Urgency	High. The development of LSAT relationships could result in a much greater use of satellite LST data in IPCC assessments as part of AR6.
Project Description	<ol style="list-style-type: none"> 1. Investigate LSAT, LST relationships at quality controlled, <i>in situ</i> ground stations which are suitably sited. 2. Investigate LSAT, LST relationships in re-analyses. 3. Test LSAT derived from LST relationships against <i>in situ</i> records and models, and assess uncertainties.
Project Schedule	24 months starting Summer 2014
Resources Required	Leicester, Hadley Centre, Edinburgh/Reading
Budget	TBC
Funding Agency	NERC/DECC/ESA

Comment from Met Office received 18-09-14:

Climate Quality ATSR LST time series – no planned MO activity.

Relating LST and LSAT: MO activities in EUSTACE (Horizon2020 project) and GlobTemperature (ESA project). For EUSTACE, we will do some investigations into LSAT/LST relationships at some *in situ* sites (i.e. project aim #1 in AEB doc) such as the ARM and KIT/LSA-SAF sites in Africa. We will also derive statistical relationships relating LST and LSAT for the globe based on work carried out in EURO4M (a now-completed Framework 7 project – see http://www.metoffice.gov.uk/hadobs/msg_tmaxmin/) and trial a new approach for estimating LSAT from satellite data using physically-based model. We will evaluate the satellite LSAT estimates against *in situ* data (i.e. #3 aim in AEB doc) but there is no formal plan to compare with model data in EUSTACE. In GlobTemperature we will compare LST, satellite LSAT, *in situ* LSAT and reanalyses LSAT and LST over Europe for selected, well-observed regions (i.e. #2 aim in AEB doc, but only for Europe).



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Project Title	Arctic surface temperature time series
Application and/or Underpinning Activity	The poles are regions of high sensitivity and recently have been shown to exhibit large change in the Arctic even on a 15 year time scale (Shepherd et al, Science, 2012). These changes in sea and land ice are not well predicted by climate models and therefore there is an urgent need to evaluate temperature change in the Polar regions in recent decades. A Polar Surface Temperature (PST) time series (PSTtime) from ATSR, with uncertainties, would have a major impact and give the international community, including governments, much more information on the driving of Polar change. Work will be needed, beyond the current DEC contract (ends March 2014), to 1) increase confidence in ice temperature retrievals; 2) improve cloud clearing; 3) improve uncertainty estimates; 4) compare to MODIS to verify consistency and look at gap filling; 5) extend to SLSTR early years and develop operational product; 6) compare to climate models for their verification and improvement.
Objectives	To derive a Polar Surface Temperature time series and a combined high spatial resolution Polar ST data product.
Maturity	Good maturity for SST component provided ATSR V2.1 ARC L2P (1 km resolution) ARC is produced. Will require verification in the Arctic and Antarctic. Medium maturity for LST (non-ice) Lower maturity for ice-ST and sea-ice ST. Requires cloud clearing/sea-ice/ice/snow discrimination.
Justification	Importance of change in the Arctic and Antarctic is very high. In situ data in the Arctic and Antarctic is limited and therefore satellite data are particularly significant providing a much more extensive regional coverage. Therefore the remote sensing data are worthy of more extensive investigation and exploitation through the combination of different surface temperature determinations (sea surface, sea-ice surface, ice surface and land surface temperatures). Importantly, the new derived information from ATSR (and SLSTR) requires use of 1 km resolution surface temperature data which will be available from summer 2013 for AATSR and 2015 for SLSTR; high spatial resolution is required because of the heterogeneity of the polar ocean, ice and land. Experience of analysis with AATSR will be used to improve data from SLSTR. The combination of the 1 km individual data sets into a combined polar surface temperature product will deliver mean polar time series and also high spatial resolution polar data as a product for use in ST analyses and model verification. The ability to test models with such data (and to point to processes for improvement) is urgently required.
Priority	High
Urgency	High. The development of PST time series is the next scientific challenge for SST-related research and requires ST for all domains.
Project Description	<ol style="list-style-type: none"> 1. increase confidence in ice temperature retrievals; 2. improve cloud clearing over sea-ice and ice. 3. improve uncertainty estimates particularly for ice ST and land ST 4. compare to MODIS to verify consistency and look at gap filling; 5. comparisons to models for verification and model improvement 6. extend to SLSTR early years and develop operational product
Project Schedule	36 months starting March 2014 (depending on tasks agreed)
Resources Required	Leicester, Reading (Merchant)
Budget	Annual budget (estimate) of £120 K
Funding Agency	DECC/NERC/ESA?

6. Complete Description of Proposed Projects

Project Title	Impact of backward view on SLSTR to continuity of data from ATSR
Application and/or Underpinning Activity	Validation, Algorithms, Data Continuity
Objectives	To determine the consequences of a change from a forward to a backward view on SLSTR for existing ATSR products, including SST, LST, clouds and aerosols
Maturity	Sufficient knowledge of the ATSR dual-view characteristics is available to undertake this stage
Justification	Potential modifications need to be identified to the data processing algorithms and software for SLSTR, to ensure the continuity of the ATSR datasets.
Priority	High – need to identify any potential problems with the changed view before the cost of any modifications to the SLSTR algorithms becomes prohibitively high.
Urgency	High – originally driven by Sentinel-3 CDR but now required before the Sentinel-3 launch
Project Description	TBD
Project Schedule	6 months, starting in early 2014 (TBC)
Resources Required	TBD
Budget	TBD
Funding Agency	ESA

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Project Title	STATS – Science activities
Application and/or Underpinning Activity	SST ECV, LST, LWST, Ice Temperature, Synergy Products, Ocean, Climate, Algorithms, Science
Objectives	The objective of this project is to lead development of mutually consistent “whole-Earth” Surface Temperature products using ATSR and SLSTR data: across all domains (sea, land, ice, lakes, urban). The work is to be performed within the context of the ‘STATS’ collaborative ground segment.
Maturity	The work follows on from ESA, NERC and DECC-funded activity with an extended scope to include temperature synergy products using OLCI information.
Justification	There is a clear imperative from the recent EarthTemp Network white paper (http://EarthTemp.net/EarthTempWhitePaper2012.pdf) and GlobTemp user consultation for independent, accurate, stable surface temperature (ST) across <i>all</i> domains, primarily for climate applications. ATSRs should have a central role here, as already with SST. The UK team has established a leading role within Europe on the development and improvement of SST and other ST products.
Priority	High – The science activities are essential to the success of SLSTR
Urgency	Medium – The project needs to be in place by 31 March 2014
Project Description	<ol style="list-style-type: none"> 1. Continue to improve existing and develop new Surface Temperature (ST) products, playing a leading role in SST_cci, IPCC, GHRSSST, CEOS and other relevant organisations. 2. Continue to improve LST products, playing a leading role in GlobTemp, IPCC, IGBP and other relevant organisations; improved operational LST using dynamic vegetation information, and climate-quality LST. 3. Continue to improve fire products, based on fire radiative power and ATSR fire count approaches. 4. Develop Bayesian methods of cloud detection (currently successful for oceans) to all domains, to solve, <i>day and night</i>, the severely limiting errors arising from cloud detection failures. 5. Extend results of brightness temperature cross-referencing from ARC for SST into retrievals for LST and LSWT, to give stability. 6. Develop and test a range of radiative-transfer based retrievals (including optimal estimation methods) for land, ice/snow and urban domains. 7. Extend new L2P processor to implement the above and generate products. 8. Maintain the ATSR exploitation plan and extend it to include SLSTR capabilities. 9. Co-ordinate ST information and activities via science team meetings and a dedicated website. 10. Support QWG activities. 11. Prepare reports, presentations etc.
Project Schedule	Start on 1 March 2014 and continue core activities on a 2 yearly basis
Resources Required	Existing experts from the DECC, NERC and ESA projects
Budget	Annual budget £300k (TBC) from various sources
Funding Agency	NERC/Defra/DECC/UKSA



ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	“ATSR – The Story”
Application and/or Underpinning Activity	Education and Outreach
Objectives	To create a book which is interesting and accessible to the general public, to help improve public understanding of science and engineering
Maturity	The information exists on paper and in the heads of contributors to the ATSR programme.
Justification	The process of producing an instrument and a satellite remain mysterious to most people. By creating a minimally technical book that tells the ATSR story from a human perspective, it is hoped that a few more people will feel engaged with science and engineering.
Priority	Medium – this is not essential for the science but good for outreach
Urgency	High – the people who can contribute to the story are retiring
Project Description	The book would be composed of chapters written from different perspectives by individuals involved in the programme, so chapters could include the PI's story, the engineer's story, the validation scientist's story, the project manager's story, the civil servant's story, the designer's story, the climate scientist's story, the space agency story, the Australian story, etc. Each chapter could be a composite of experience's or just a single perspective, depending on who is willing to contribute. It should include high quality photographs and diagrams as appropriate and each chapter should include a box summarising the technical background of the chapter.
Project Schedule	Start early 2016, for about one year
Resources Required	Small editorial team, multiple contributors of several pages of material, small production team, external publisher
Budget	Writing to be self-funded with ESA support for publication costs
Funding Agency	PI et al / ESA

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Improvements to ATSR solar channel calibration
Application and/or Underpinning Activity	Calibration, Data Quality
Objectives	Continue comparisons of ATSR solar reflectance channels over natural targets to reduce uncertainties in long term stability and inter-comparisons with similar sensors.
Maturity	Vicarious calibration methods have been used to improve the calibration of the ATSR Level-1b reflectances to an uncertainty level of ~3%. Recent activities performed under CEOS-IVOS (Libya-4 workshop, inter-comparison working group 4) suggest that further improvements could be achieved with a better understanding of the systematic biases caused by differences in spectral response and geometric effects.
Justification	Climate studies using ATSR demand stable and consistent radiometric calibration of the solar reflectance channels to uncertainties below 1% (TBC). The ESA CCI programme in particular is driving demand for accurate analysis of long term stability of AATSR channels and the associated uncertainty in order to substantiate trends in derived products. It is also important to understand the biases between different derived products as a function of the absolute calibration accuracy of the instrument.
Priority	High
Urgency	Medium
Project Description	<ol style="list-style-type: none"> 1. Continue comparisons of ATSR solar reflectance channels over natural targets to reduce uncertainties in long term stability and inter-comparisons with similar sensors. 2. Introduce additional sites to extend the dynamic range over which comparisons are performed (for example darker targets). 3. Use dark targets to provide an offset calibration for ATSR-1 1600nm channel. 4. Improve uncertainty estimates on satellite inter-calibrations due to spectral response differences and geometric effects. This can be done using spectrometer data (e.g. GOME-2, SCIA) over specific targets to test assumptions about spectral corrections. Use CNES BRDF model of Libya-4 site to test uncertainties due to geometric effects. 5. Improve analysis of SNO measurements to account for spectral differences between sensors. 6. Provide end to end uncertainty budgets and estimates for each ATSR sensor. 7. Revisit AATSR pre-launch calibration data and investigate possible causes of systematic bias between AATSR and MERIS. 8. Disseminate results via publications and website portals. 9. Provide updated calibration tables and tools for users and as inputs to further reprocessing.
Project Schedule	18 months, starting in Summer 2014
Resources Required	TBD
Budget	TBD
Funding Agency	ESA



ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Aerosol effects on PAR (Photosynthetically Active Radiation) and direct-diffuse surface irradiance.
Application and/or Underpinning Activity	Improving our understanding of current and future atmospheric aerosol loads influence on radiation quality and quantity: Comparison of remotely sensed and modelled estimates of the influence of aerosol on direct and diffuse fractions of PAR for the UK models.
Objectives	Produce a PAR product from the AATSR instrument that is directly correlated with high accuracy aerosol and cloud products. AOD, together with cloud cover, influences PAR, with an increase of approximately 50% in the diffuse-to-direct PAR ratio from an AOD increase of 1. In turn, this will have implications for canopy photosynthesis and hence plant productivity. In this pilot study, global distributions of PAR will be produced by adding this parameter to the (ORAC) aerosol and cloud retrieval scheme. PAR and the down-welling diffuse-fraction retrieved from satellite observations can then be statistically compared with distributions of land surface type and leaf area index, and with TOMCAT-GLOMAP-DO3SE model estimates of aerosol optical depth (AOD) and PAR driven by meteorological analyses. Consistency will point to the feasibility of exploiting satellite data in the future for more advanced studies, of the influence of particulate pollution on plant photosynthesis and hence plant productivity (e.g. agricultural yields, forest and grassland biomass).
Maturity	Builds on current version of ORAC (Oxford and RAL Aerosol and Cloud), which is currently implemented in the ESA Aerosol and Cloud CCI projects. Technically feasible not yet demonstrated.
Justification	Significant advances in our ability to detect aerosol from space have been made in recent years. The AATSR instrument produces one of the most accurate satellite derived aerosol AOD and cloud products. There is a gap in our understanding between the occurrence of AOD and the influence this will have on vegetation growth and hence NPP (net primary productivity). This effect will be dependent upon the effect of AOD on direct and diffuse PAR and how this will translate into canopy photosynthesis. Given the importance of optimising productivity for issues such as food security, forest productivity, carbon sequestration and hydrology, an improved understanding of the influence of these aerosols on ecosystems is crucial to developing appropriate emission reduction policies. Space measurements are a particularly important in regions of developing countries with high pollution episodes and sparse surface networks co-occur. With the increased global and temporal coverage of the SLSTR instrument this has the potential become a widely used product providing new insights in conjunction with other atmospheric and surface ATSR products
Priority	Medium
Urgency	Medium
Project Description	<p>Tasks:</p> <ul style="list-style-type: none"> i. Addition of PAR to "ORAC" cloud & aerosol processor (RAL); ii. Comparison TOMCAT-GLOMAP-DO3SE model AOD and PAR with satellite data (Leeds, York, RAL). <p>Deliverables: ATBD on new AATSR PAR products. A test data set. Evaluation of the aerosol predictions and influence on PAR from TOMCAT-GLOMAP-DO3SE model.</p>
Project Schedule	1 year
Resources Required	1 man year across (RAL (4months) / Uni York (4months) / Leeds (4 months))
Budget	TBD
Funding Agency	UKSA/NERC/Defra/DECC to resolve.

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Full assessment of atmospherically-corrected surface reflectance quality, errors
Application and/or Underpinning Activity	Land surface climatology, especially surface energy budget, albedo, detection of vegetation anomalies related to climate feedbacks, land cover.
Objectives	To validate atmospheric correction methods for the ATSR, assess errors and range of validity
Maturity	High maturity. Builds on funded research under ESA GlobAlbedo, and Aerosol CCI, which allowed development of simultaneous aerosol and surface reflectance retrieval from ATSR.
Justification	Correction for atmospheric effects are required for accurate surface reflectance, necessary for albedo, separation of anomalies due to surface change from climate or disturbance atmospheric anomalies in time series, and accurate mapping of surface cover and biophysical parameters. Methods have been developed under previous funding for ATSR and will be continued operationally on SLSTR (Synergy branch) but have not previously been validated.
Priority	Necessary to facilitate use of ATSR time series over land surface relevant to several Essential Climate Variables.
Urgency	Needed to allow further exploitation, and to prepare for long term time series including Sentinel-3
Project Description	<ol style="list-style-type: none"> 1. Establishment of database of surface reflectance measurements over ATSR lifespan, focussing on existing calibration sites, the AERONET-based Surface Reflectance Validation Network (ASRVN) developed for MODIS land validation (~160 sites, worldwide). 2. Development of scripts for automated correction of solar/view geometry and spectral transformation to allow comparison with existing estimates, based on methodology already developed under ESA ADAM project. 3. Derivation of surface directional reflectance from ATSR at visible channels for all cloud-free matches, using existing algorithms developed under ESA projects GlobAlbedo, Aerosol CCI and MERIS/AATSR Synergy. 4. Analyses of errors in comparison to estimated error, and establish range of validity including magnitude of impact of main factors on error (surface cover, aerosol optical thickness, geometric registration, cloud fraction in region).
Project Schedule	12 months, start date TBD
Resources Required	PDRA 12 months (North, Swansea University),
Budget	Approx £80-90k
Funding Agency	TBD

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Retrieval of cloud-top water vapour column (CTWVC) using AIRWAVE algorithm
Application and/or Underpinning Activity	Water Vapour, Climate, Instrument Calibration
Objectives	<p>The Advanced InfraRed WAtER Vapour Estimator (AIRWAVE) algorithm, developed in the context of the ALTS project (ESA), has proven to provide very good water vapour information from the ATSR TIR (thermal infra-red) measurements when applied to clear sky – sea surface scenes.</p> <p>The objective of this project is to include cloudy scenarios in the retrieval of water vapour columns using nadir and forward TIR measurements of the ATSR series.</p>
Maturity	New Proposal
Justification	<p>The knowledge of CTWVC would provide a more complete picture of the water budget on global scale.</p> <p>In addition, due to the sensitivity of AIRWAVE to instrument radiometric and spectral calibration, the time series of CTWVC could be used as proxy for possible instrumental drifts.</p> <p>Possible studies on UTLS water vapour content.</p> <p>The extension of AIRWAVE CTWVC to SLSTR measurements should be straight forward.</p>
Priority	High
Urgency	Medium
Project Description	<ol style="list-style-type: none"> 1. Assess the impact of the emissivity of different cloud types in the AIRWAVE retrieval scheme using up-to-date radiative transfer models (RTM) using cloud properties databases 2. Develop a method for identifying cloud types from dual view TIR measurements using a priori atmospheric information (e.g. ECMWF collocated profiles) and RTM simulations 3. Produce a CTWVC data set spanning from 1991 to 2012 4. Validation of CTWVC using sondes 5. Long term data analyses (e.g. trends, inter-instrument biases)
Project Schedule	24-36 months, starting summer 2016
Resources Required	Two persons: one at CNR-ISAC (RTM, cloud detection), one at SERCO (algorithm implementation, cloud detection, data processing, validation)
Budget	300-400 kEuro
Funding Agency	ESA

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Long-term climate record from LST
Application and/or Underpinning Activity	LST is critical to multiple environmental, agricultural and health related monitoring applications to help assess and mitigate against extreme events such as heat wave events, drought stress in plants (due to the relationship between canopy temperature and transpiration) and fire risk from ignition potential due to changes in surface dryness. The production of a long-term archive would fulfil user needs in climate science, such as model validation, assimilation and land cover change detection; urban planning; and geothermal anomaly monitoring.
Objectives	Development of long-term LST record of climate quality, including validation of quantified uncertainties, across all the ATSRs and bridging the gap to SLSTR.
Maturity	Although not yet an ECV, this is a maturing variable of increasing interest to the climate community. Considerable effort is being made at present to work with GCOS on its reclassification to ECV (led by U Leicester)
Justification	The GlobTemperature Requirements Baseline Document (available from http://www.globtemperature.info/) records the needs of the user community of LST data and there is a clear demand for long-term data records of high quality. Furthermore the EarthTemp White Paper (http://EarthTemp.net/EarthTempWhitePaper2012.pdf) recommends independent, accurate, and stable surface temperature records for climate across all domains. A long-term data record from the ATSRs and bridging the gap to SLSTR would meet these needs over land. The UK has established a leading role in LST science on the international stage.
Priority	High
Urgency	High. A prototype LST CDR is being developed for ATSR-2 and AATSR within GlobTemperature, and there is now user demand for increased system maturity and extension through to SLSTR
Project Description	<ul style="list-style-type: none"> • Homogenisation of the BTs to remove radiometric bias and to harmonise the temporal differences between instruments • Understand and correct for the temporal difference in LECTs between instruments • Improve existing cloud clearing algorithm to minimise the risk of cloud contamination in the record • Develop an aerosol detection classifier at thermal wavelengths by adapting existing methodology for SST • Validation of the CDR time series against all available in-situ data; application of using radiance-based methods and intercomparison; validate uncertainties • Stability assessment of the CDR • Assessment of the product by climate science users • Add the final product to the collection of LST data sets available via the CEDA archive
Project Schedule	24 months starting January 2017
Resources Required	<ul style="list-style-type: none"> • Full-time resource at Leicester (LST algorithms, validation) • Resource at Reading (cloud detection) • Resources at RAL/STFC (radiometric calibration, support to Leicester on data production; data archiving) • Resource at Met Office (climate science user)
Budget	£500K
Funding Agency	NERC / DECC / ESA

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Snow/ice surface temperature product
Application and/or Underpinning Activity	Ice surface temperature (IST) is critical to understanding climate change in high latitudes. Model projections suggest that the polar regions have the largest climate sensitivity to increasing greenhouse gases. These changes in sea and land ice are not well predicted by climate models and therefore there is an urgent need to evaluate temperature change in the Polar regions in recent decades. The ATSRs are particularly appropriate to monitor surface temperature change at higher latitudes being highly accurate and providing observations over a period of twenty years.
Objectives	Development of long-term IST record of climate quality across all the ATSRs and through to SLSTR covering all domains
Maturity	As with LST, IST is not yet an ECV, although this is considered an important variable to the climate community. Considerable effort is being made at present to work with GCOS on reclassification of LST to ECV (led by U Leicester), which will include all non-sea surfaces
Justification	The GlobTemperature Requirements Baseline Document (available from http://www.globtemperature.info/) records the needs of the user community of LST data and there is demand for an improved surface temperature record over snow and ice; a long-term data record from the ATSRs would meet these needs. The UK is establishing a leading role in producing snow/ice surface temperature records over the Arctic and should now look to expanding to the Antarctic also.
Priority	High
Urgency	High. A prototype LST CDR is being developed for ATSR-2 and AATSR within GlobTemperature, and additionally a long-term Arctic surface temperature record from the ATSRs is being produced by U Leicester under a DECC-funded activity
Project Description	<ul style="list-style-type: none"> • Homogenisation of the BTs to remove radiometric bias and to harmonise the temporal differences between instruments • Understand and correct for the temporal difference in LECTs between instruments • Improve existing snow detection algorithms to correctly classify the surface type over both sea and land • Improve existing cloud clearing algorithm to minimise the risk of cloud contamination in the record • Validation of the time series against in-situ data; and where sparse use of radiance-based methods • Stability assessment of the CDR • Assessment of the product by climate science users • Add the final product to the collection of LST data sets available via the CEDA archive
Project Schedule	18 months starting January 2017
Resources Required	<ul style="list-style-type: none"> • Full-time resource at Leicester (IST algorithms, validation) • Resource at Reading (cloud detection) • Resources at RAL/STFC (radiometric calibration, support to Leicester on data production; data archiving) • Resource at Met Office (climate science user)
Budget	£300K
Funding Agency	NERC / DECC / ESA

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Surface radiation for the solar energy sector from ATSR
Application and/or Underpinning Activity	Modelling and monitoring efficiency of photo-voltaic (PV) solar energy generation.
Objectives	To develop and test an operational methodology for the production of down-welling solar radiation at the surface, with comprehensive characterisation of the overlying atmosphere, for the solar energy sector.
Maturity	Builds on NERC and ESA funded research developing a radiatively consistent aerosol and cloud retrieval scheme applied to ATSR, which provides a high-quality "atmospheric correction" for calculation of surface parameters.
Justification	<p>Increased utilisation of solar energy is in line with DECC's strategy.</p> <p>The ability to derive accurate and consistent aerosol and cloud properties from ATSR requires the calculation of up- and down-welling radiation at the surface. Accurate direct and diffuse down-welling solar fluxes are of critical importance for the solar energy sector as well as for biophysical processes, but this capability is not yet utilised. Calculation of direct and diffuse Photosynthetically Active Radiation (PAR) is already on AEB's list of proposed work topics, and the methodology to produce spectrally-integrated fluxes required for the solar energy sector would build directly on that.</p> <p>Informal discussions with a representative of one UK solar energy company have indicated that the sector could be interested in being involved in the specification and development of such a reliable, new satellite data product, and provision of validation data in the form of pyranometer measurements taken at potential UK sites for solar energy development.</p>
Priority	Will enable the production of an accurate long-term, global record (1km x 1km) of surface insolation, which has the potential to be of great utility in the solar energy sector.
Urgency	Techniques developed will be directly applicable to SLSTR.
Project Description	<ol style="list-style-type: none"> 1. Adaption/extension of PAR code to produce direct and diffuse solar irradiance over the over the spectral range over which photovoltaic cells produce energy 2. Consultation with representatives of the solar industry to determine specific requirements for a satellite based solar irradiance product – data format, resolution, access and included products. 3. Production of a test product, based on existing ESA Climate Change Initiative aerosol and cloud climate data records from (A)ATSR. 4. Comparison of (A)ATSR product against solar irradiance measurements from (for example) met-stations or pyranometers deployed by solar energy firms.
Project Schedule	12 months, start date to be aligned with PAR initiative.
Resources Required	6 staff-months at RAL-RSG.
Budget	£60k
Funding Agency	TBD

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Development of long-term fire record via application of SLSTR fire algorithm to ATSR night-time 3.7 micron channel data
Application and/or Underpinning Activity	Fire Disturbance ECV, Climate, Data Continuity, Algorithms, Science
Objectives	To apply the active fire detection algorithm developed for Sentinel-3 SLSTR to the ATSR-2 and AATSR archives, to deliver a long-term, consistent active fire record for climate studies.
Maturity	The work will utilise the outputs of two other activities, the SLSTR Active fire detection & FRP algorithm definition (ESA & NERC funded) and the re-processing of ATSR data into SLSTR format. It is considered a mature application since ATSR has already been shown to indicate detectable active fire signals at night, the SLSTR algorithm exists and will need relatively little adjustment to apply to ATSR, and the re-processing of AATSR data into SLSTR format is not expected to prove problematic.
Justification	<p>The ESA World Fire Atlas (WFA) is the first and longest archive of global fire observations and has been used in numerous biomass burning studies. The WFA was derived from night-time ATSR data, and is extremely widely used, including as part of the contributing data to the Global Fire Emissions Database (GFED) - which has been cited over 1000 times. However, the algorithm used to derive the WFA fire detections from the ATSR data consists of a very simple thresholding approach of the 3.7 μm data, and this has been shown to be the cause of many false alarms (estimated to lie in the range 20-30%).</p> <p>Furthermore, other particular problems of time-vary biases exists for the WFA in northern latitude regions such as the boreal forests, where fire patterns are known to be changing under changing climates but where biases in the satellite data hinder accurate depiction and analysis of this. The uniqueness of the fire record present in ATSR, which extends far back before the current "MODIS era", and the wide use to which the WFA has been put attest to its value. However, the issue with its quality also preclude its use in certain science studies, and degrade its value to others. They also will prevent its data being optimally blended with that from SLSTR which will provide the equivalent active fire dataset after the late-2015 launch. We propose to capitalise on the new SLSTR fire detection algorithm and the ATSR reprocessing to optimise and apply the SLSTR algorithm to the ATSR archive, in order to develop a consistent climate quality fire dataset from ATSR that can also be in future blended with the ongoing record from SLSTR to assess trends in biomass burning. In addition to the simple "fire location" information the current WFA reports, we would also include cloud cover and overpass coverage information in the product, such that analyses can take these parameters into account when evaluating trends over time, as is done for example in the prototype Copernicus Atmosphere Service fire emissions estimation system.</p>
Priority	High
Urgency	Medium
Project Description	The SLSTR active fire detection algorithm would require very few adjustments to work with the ATSR data once in SLSTR format. After initial testing, any optimisation required would be made and routines also derived for mapping night-time gross cloud cover and scene coverage (also adapted from SLSTR versions). Using JASMIN-CEMS the algorithm would then be run on the entire global ATSR-2 and AATSR archive. In addition to the new dataset produced, which would become publically available, some analysis of trends shown in the new record would be conducted to demonstrate its potential value to users.
Project Schedule	Start end 2016, for around 6 months.
Resources Required	JASMIN-CEMS, one PDRA @ King's College London, ATSR Archive in SLSTR Format
Budget	TBD (estimated less than £50k)
Funding Agency	DECC/NERC/ESA?

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Derivation of vegetation parameters for ATSR
Application and/or Underpinning Activity	Vegetation productivity; modelling of energy, water and carbon balance; impact of climate change and extreme events (e.g. droughts) on land surface.
Objectives	To develop and test an operational methodology for vegetation products of leaf area index, fraction of absorbed photosynthetically active radiation (fAPAR), and vegetation fractional cover from atmospherically corrected ATSR visible channels.
Maturity	Builds on NERC and ESA funded research towards model retrieval for vegetation biophysical parameters and building on accurate surface reflectance estimation from dual-angle ATSR.
Justification	ATSR has potential for a valuable long-term record of land surface biophysical parameters, relevant to modelling of carbon, water and energy cycles, and detection of anomalies. Recent improvements in model inversion and atmospheric correction will allow a high fidelity dataset to be produced. Existing datasets (MODIS, VGT, and MERIS) do not have such a long series, and show large disagreements.
Priority	Will enable long term vegetation product suite, and addressing current uncertainty on vegetation response to climate change.
Urgency	Demonstration of techniques relevant to SLSTR.
Project Description	<ol style="list-style-type: none"> 1. Development of look-up table based on 3D radiative transfer model FLIGHT to provide simultaneous estimate of LAI, fAPAR and vegetation cover fraction from atmospherically corrected surface reflectance spectra, with uncertainty propagation. The LUT will implicitly account for BRDF effects. ATBD will be produced. 2. Validation of the method following protocols established in the GIO project. This will use the BEenchmark Land Multisite ANalysis and Intercomparison of Products (BELMANIP 2.1) , ~445 global sites, and DIRECT (113 further sites. Retrieval of (A)ATSR time series for 10 x0 10km regions centred on the global BELMANIP2.1 & DIRECT sites. Existing measured values of fAPAR, LAI and fractional cover will be compared with retrieved values. 3. Intercomparison with existing products (GIO, MODIS) for these sites to establish relative bias and highlight regions of agreement/disagreement. 4. Use of downwelling PAR product developed at RAL simultaneous with fAPAR generated to provide a first assessment of modelled GPP/NPP using a simple light use efficiency model. Assessment will be made for selected FLUXNET sites, comparison with MODIS NPP and focusing on areas of high existing disagreement between models.
Project Schedule	18 months, start date TBD
Resources Required	PDRA 18 months Swansea University (North), 3 months researcher at RAL (Poulsen)
Budget	Approx £150-160k
Funding Agency	TBD

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Polar Surface Temperature – next stage
Application and/or Underpinning Activity	<ol style="list-style-type: none"> 1. Application <ol style="list-style-type: none"> a. Climate monitoring b. Operational product for NWP c. Model verification 2. Underpinning Activity <ol style="list-style-type: none"> a. DECC funded work on ATSR Arctic ST dataset b. GlobTemperature output c. ARC/CCI_SST output
Objectives	To derive a Polar Surface Temperature time series and a combined high spatial resolution ATSR/SLSTR Polar All-Surface Temperature data product.
Maturity	Good maturity for SST component provided ATSR L2P v2.1 (1 km resolution) ARC is produced. Will require verification in the Arctic and Antarctic. Medium maturity for LST (non-ice). Lower maturity for ice-ST and sea-ice ST. Lower maturity for cloud clearing and sea-ice/ice/snow detection. Status of SAR data needs to be established.
Justification	<ol style="list-style-type: none"> 1. Improvements to our understanding of recent climate change in the polar regions. 2. Launch of SLSTR on Sentinel 3 will enable continuation of the time series and requires solving the problem of the AATSR-SLSTR data gap. Availability of high resolution/high coverage SAR data from Sentinel 1 will allow improvements to the product through higher accuracy of ice masking which will feed into improved cloud detection. 3. Production of a high resolution, long (in satellite terms) data set will be a valuable tool in model verification.
Priority	High
Urgency	High
Project Schedule	3 person years. Recommend 6 month pilot study to determine suitability of SAR data for ice/snow masking and extent of work required.
Resources Required	Knowledge of sea-ice mapping with SAR. Leicester.
Project Description	<ol style="list-style-type: none"> 1. Improvements to masking of cloud and snow/ice. 2. AATSR-SLSTR gap-filling and gap-bridging. 3. Improvements to ST retrieval over snow and ice 4. Extension of product to include Antarctic 5. Extension into SLSTR era. 6. Development of operational Sentinel Arctic [and Antarctic] ST product.
Budget	£300K
Funding Agency	DECC/NERC/ESA?

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	Development of an ATSR broadband radiative flux retrieval for assessing and monitoring Earth's radiation budget.
Application and/or Underpinning Activity	Quantify radiative forcings from global distributions of aerosol, clouds, and associated indirect effects of aerosol on cloud optical properties.
Objectives	To develop and test an operational broadband shortwave and longwave radiative flux product to track and monitor changes in the Earth's radiation budget using 17 years of pre-existing (A)ATSR and upcoming SLSTR observations.
Maturity	Builds on the ORAC algorithm for aerosol and cloud developed for NERC and the ESA's Climate Change Initiative.
Justification	The forcing due to aerosol-cloud interactions ranks as the most uncertain among the forcings of anthropogenic climate change. The uncertainty is large in part due to "cloud contamination" in satellite retrievals caused by poor cloud masking and 3D effects. Cloud contamination hampers accurate estimates of aerosol optical depth in the vicinity of clouds. By utilising the dual view of the ATSR instrument within the optimal estimation retrieval scheme of ORAC we can limit cloud contamination and produce a highly accurate broadband radiative flux product needed to quantify the global aerosol indirect radiative forcing. Furthermore, this dataset would be used to study cloud feedbacks and changes in global cloud distribution that could be attributable to climate change over the observation period.
Priority	The IPCC (Intergovernmental Panel on Climate Change) uses state-of-the-art estimates of the anthropogenic aerosol indirect effect. This product would enable an accurate estimation of the Earth's radiation budget related to natural and anthropogenic forcings, the results of which could advance scientific knowledge in the next IPCC report.
Urgency	Techniques developed will be directly applicable to SLSTR.
Project Description	<ol style="list-style-type: none"> 1. Produce 1-km spatial resolution broadband radiative flux product by ingesting level-2 ORAC aerosol and cloud properties into the Edwards and Slingo radiative flux algorithm. Shortwave and longwave radiative fluxes will be provided for the top and bottom levels of the atmosphere. Separate calculations for all- and clear-sky conditions will be retrieved. 2. Production of a test product using standard ORAC instruments; ATSR, SEVIRI, and MODIS. 3. Validate product against several ground-based sites that measure the surface solar and thermal irradiance. 4. Assess the Earth's radiation budget over the observation period and quantify the global aerosol indirect radiative effect. 5. Put product online; disseminate results for publication in the IPCC report.
Project Schedule	12 months, start date to be aligned with launch of SLSTR
Resources Required	6 staff-months at RAL-RSG.
Budget	£60k
Funding Agency	TBD

ATSR Exploitation Board - New Work Items Status

AEB.MEM.004

Issue 12, 21 September 2016

Project Title	(A)ATSR L1b Traceability Chain
Application and/or Underpinning Activity	To demonstrate the traceability of the (A)ATSR level-1 radiometric data to SI units.
Objectives	Document the calibration uncertainty model and provide traceable uncertainty estimates for the L1 data.
Maturity	The 4 th reprocessing data will have per-pixel uncertainty estimates that are based on the radiometric calibration model implemented in the current L1 processing. The values used in the estimates will be based on the best available information from pre-launch calibration tests and some in-flight data.
Justification	<p>L1 uncertainty information is beginning to be routinely use by research groups creating to create more accurate and stable climate data sets.</p> <p>There is a clear requirement from user community to provide SI traceable satellite measurements for use in climate datasets. Conclusions from a recent workshop hosted by NPL "Metrology for Climate Change" stated the need for "...Metrologically rigorous re-development of the on-board calibration algorithms could improve the value of ATSRs and SLSTRs as SST-constellation reference sensors." The need is to demonstrate that (A)ATSR radiometric measurements are traceable to SI units.</p> <p>For thermal infrared channels, the traceability is achieved via internal blackbody (BBs) sources who's temperature is ultimately traced to fixed point cells via standard platinum resistance thermometers (S-PRT). However, the reality is not so simple as the data processing involves an algorithm with several steps to achieve the scene brightness temperature (BT). So the uncertainty estimate is not a single value but will be a function of scene temperature with several components. Similar issues also apply for the reflectance channels.</p> <p>For the radiometric calibration to be considered as traceable, the traceability chain must be published in reviewed literature. This is a key document that identifies the key sources of uncertainty, collates the known uncertainty estimates, and provides a record of the documents that link the uncertainties to standards. Much of the information already exists, but is in different formats, is difficult to access and not easily referenceable.</p>
Priority	High
Urgency	The (A)ATSR project is moving into a data preservation phase so access to key individuals and documentation will become difficult. Also, the 4 th reprocessing presents an opportunity to provide a meaningful uncertainty budget for L1 products.
Project Description	<ul style="list-style-type: none"> • Write the calibration model • Identify the key sources of uncertainty • Develop the calibration budgets • Collate documents providing sources of uncertainty e.g. test reports, calibration certificates • Identify gaps, for example the degradation model for BB electronics. • Review the calibration model + uncertainty estimates • Provide uncertainty estimates from calibration model • Prepare paper for review
Project Schedule	12 months
Resources Required	RAL – 3SM, NPL – 3SM (Estimated)
Budget	£100k
Funding Agency	TBD

