Validation Planning for AATSR

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Abstract

The effective and useful validation of modern space sensors requires the use of carefully controlled procedures, together with robust and stable ground-based instrumentation. Procedures are also needed to ensure that the results of validation exorcises are properly taken into account in the treatment and management of the data and, in some cases, the instrument itself. These issues are being addressed in the context of the AATSR validation plan, which will be described and discussed in outline.

Introduction

The AATSR validation programme is currently being defined and developed on the basis of the AATSR validation plan, which can be seen at:

http://www.le.ac.uk/physics/research/eos/aatsr/val1.html

The document in its current form gives details of the requirements for AATSR validation. Those considering participation in the AATSR validation programme are therefore advised to use the document for reference. The document is concerned almost entirely with validation procedures only. In the case of AATSR, calibration of thermal infrared channels, as the AATSR is carried out pre-flight and is automatically maintained during flight by the on-board black bodies which are scanned continually as part of the instrument's normal operating cycle. Thus, ground measurements are not used as part of the routine calibration procedures for the thermal channels. In the case of the visible/reflected channels the on-boards calibration is carried out by the viscal system, using a brief view of sunlight scattered from an on-board diffuser

plate not more than once per orbit. This is an experimental system and more reliance is placed on ground reference targets (e.g. stable desert sites) in order to test the stability of the vis/cal system.

Validation, as defined by the CEOS Calibration and Validation working group, is "the process of assessing by independent means the quality of the data products derived from the system outputs". Calibration is defined by the same group as "the process of quantitatively defining the system response to known, controlled system inputs"

Requirements

AS this discussion is concerned with validation, it is useful, to provide a summary of the AATSR data products. The following information has been extracted from Annex B of the AATSR Flight Operations and Data Plan (FODP), which is a document jointly being produced by ESA and the AATSR provider.

Level	Product	Resolution	Comment	Validation Priority
0	• Instrument Source Packet			x
1b	• Gridded Brightness Temperature/Reflectance GBTR	1km		x
	• Browse	4km	Nadir view composite	x
2	• Spatially Averaged Surface Temperature AST	17km/10 arc-min 50km/30 arc-min	Switches between sea and land record	2
	• Gridded Surface Temperature GST	1km	Switches between sea, land and cloud records	1

The AST and GST over sea are commonly referred to as the Average Sea Surface Temperature (ASST) and Gridded Sea Surface Temperature (GSST). Priority of validation is discussed in the validation plan. Clearly, as AATSR's prime objective is to provide an accurate data set of Sea-surface temperature (SST), the retrieved values of SST must attract the highest priority. The top-of-the-atmosphere brightness temperatures (ToABTs) form the basis of this, of course, but if SST is properly validated, then the ToABT values must almost certainly be correct. Therefore the SST validation must take precedence. Also, ToABT is extremely difficult to measure from a ground-based system such as a high-flying aircraft or balloon, with very high demands on both accuracy and co-registration. Thus it is viewed as impractical to require validation of the ToABT products.

The main requirement is to do with the accuracy, the location and the timing of the measurements taken. These points are addressed in some detail in the validation plan and of these important factors the accuracy is probably the most demanding. AATSR aims to achieve an accuracy of ,3 - .5C in SST and in order to validate this an *in situ* radiometric measurement of SST with an accuracy closer to 0.1C is needed, which is not an easy requirement to combine with sea-worthiness! Regarding timing and location, this is discussed I the validation document, but position to within 1 Km (neared pixel) and timing within one hour of overpass are considered highly desirable, given typical ocean variability.

Procedures

There are a number of practical problems, which frequently arise in

satellite validation programmes. It could be argued that some aspects of this situation has its roots in the funding model which has been adopted for these programmes. However most validation data-providers are doing so within the framework of other activities, (for example, oceanographic research cruises) and the need to provide "scientific" output from the measurements naturally takes higher priority than passing the results to the data-provider as quickly as possible.

Thus it is important to establish a systematic means of obtaining validation data. Such data must be of the required accuracy and accompanied by the required subsidiary data. Also, it is necessary to ensure that the data are provided to the instrument provider in a timely manner and, in turn, that validation data are properly reviewed acted upon. Of course, the contribution of the validation data-provider must also be correctly acknowledged by the instrument-provider and by ESA.

In order to achieve this, the AATSR Validation plan proposes **a validation protocol**, which addresses the practical details and requirements of effective collection of validation data for AATSR. It6 is recommended that experimenters considering contributing data to the AATSR validation programme should consider this proposed protocol with care when planning field campaigns.

The AATSR PI Team will convene a "Product Control Board" whose responsibilities will include the carrying out of regular reviews of validation data and will establish appropriate routes for analysis and, if appropriate, remedial action. Such actions could be in the area of ground-proessing software or of instrument management and operation

Conclusions

The validation programme for AATSR will concentrate on the surface temperature products. Although ToABT validation is not required it is still desirable and useful if an experimenter has the means to carry out such measurements.

The same is true of other intermediate products of AATSR. The most important of these is arguably the AATSR cloud mask, which is a map of those pixels which have been identified as cloudy by the AATSR ground-processing system. No effective way of validating this directly has yet been identified.

Finally, it should be emphasised that any potential providers of AATSR validation data are urged to contact the AATSR team, or any of the co-authors of the AATSR validation plan. Their contributions will be vary welcome, including comments on the validation plan and proposals for ToABT or cloud-mask validation for AATSR.

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