

PROPOSAL ON INFORMATION TO BE INCLUDED IN A DATABASE FOR FUTURE SATELLITE DATA REPROCESSING ACTIVITIES

This paper presents preliminary considerations on the requirements for additional information to be available for future satellite data reprocessing activities:

- The considerations are based on the initial experience from the reprocessing of Meteosat-2 data performed by EUMETSAT.
- The focus is therefore on reprocessing of level-2 products from geostationary data.

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1 INTRODUCTION

This paper presents preliminary considerations of the requirements for “additional” information for future reprocessing activities. The term “additional” is used in the sense of supporting data describing the spacecraft orbit, the spacecraft environment or the state of the instruments, that affects the use of the instrument data, whether level 0 or level 1. It is implicitly assumed within this paper that the original imagery, including information concerning its quality and completeness, is readily available. Furthermore, as algorithms (e.g. geometrical or radiometric corrections, calibration) are prone to improvements it is envisaged to be conservative on data reduction as future requirements might not be foreseeable yet.

The discussion is based on the EUMETSAT Archive Reprocessing Project. The initial scope of this project is to reprocess Atmospheric Motion Vectors from Meteosat-2 data (1981-1988) in support of the ECMWF 40-year reanalysis project. Therefore the analysis is centred on data from geostationary satellites, and does not at this stage consider polar orbiting satellites.

2 ADDITIONAL INFORMATION REQUIRED FOR REPROCESSING

For climatological studies there are several types of requirements for archiving besides the original imagery, data that is required to perform the necessary transformations for the imagery data to be useful as physical observations. It is mandatory as the spacecraft usually outputs some kind of electronic signal, which is converted in physical meaningful information, either on board or on ground. The types of archived data can be gathered into the following classes: spacecraft, rectification, calibration and meteorological data.

2.1 Spacecraft Data

There are two types of data that should be archived: First there is static data about the spacecraft (e.g. radiometer) which is typically produced or measured before the launch of the spacecraft, second variable data from the spacecraft which indicate the present state of e.g. the radiometer.

Pre-Launch Data

Very important data are the spectral response data, including their accuracy, error analysis and the method of derivation. Additionally data about the optical system should be archived (reflectance of the lenses and mirrors, diameters of lenses, mirrors, detectors, etc.). All these pre-launch data should be readily available.

Post-Launch Data

This group of data represents the state of the spacecraft and more importantly of the optical system. Typically they should include data on black bodies (temperatures, measured observations of the black body), data on the optical system (e.g. temperatures of the various lenses). If the true observations are modified within the radiometer (e.g. the adding of offsets,

gain changes) these data should be archived too. The information within the images when viewing space should be archived in an easy accessible way. Although in theory the information is available in the existing imagery, it may be worthwhile to archive the space view observations in addition separate from the imagery.

2.2 Image Rectification

For any meteorological or climatological purpose it is important to have a good and stable geolocation system (rectification). The rectification should be reproducible, eventually using an improved algorithm, for which typically the following input data should be archived: the spacecraft orbit, attitude and spin. Furthermore, the mis-registration parameters and information on the focal plane should be available (the latter is typically already available from the pre-launch data).

2.3 Calibration

For any use of the image data, a calibration of the instrument is required. This can be performed by on-board black bodies, for which the data requirement is already discussed above, or by a vicarious calibration. A vicarious calibration implies that the spacecraft observation is calibrated with an external observation data source. The latter may be another spacecraft, or ground-based measurements like sea surface temperatures and radiosonde observations. Whereas in the former case this document applies for a different spacecraft operator, in the latter case there are specific institutions, responsible for archiving this type of observations. Only in the case that there is no centre for a specific type of observations, these should be archived by the spacecraft operator.

2.4 Meteorological Data

For the derivation of meteorological products there is of course an implicit requirement for the presence of rectified image data, the availability of spectral response data for the detectors, and an appropriate calibration. Important external data are radiosonde observations and forecasts from numerical weather prediction models (or their analysis), which have already been discussed.

2.5 Example

This section gives an example of the type of problems encountered, when designing a system for reprocessing Meteosat imagery and meteorological products. The aim of the system is to reprocess Meteosat-2 imagery to support the 40 year reanalysis Project of the ECMWF. The most severe problems were encountered with the rectification of these old image data:

- The mis-registration parameters between the two infra red detectors was not available in the original image data, and they had to be estimated and inserted during the rectification process
- The rectification depends on reading the deformation matrix stored with the original imagery. This deformation matrix is not recomputed for efficiency reasons.

Based on the continued reprocessing activity, EUMETSAT will gather more experience on any changes to the archive requirements for future reprocessing.