

IRS Test data L1 & L2 teams



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Context

- Test data are needed for:
 - Software implementation testing, data flow
 - Processing performance assessment
 - User familiarization
- That includes the generation of:
 - Synthetic data (no scientific content but realistic format)
 - Simulated data (with scientific content but not necessarily accurate format)
 - Proxy data (from precursor instruments e.g. IASI, CrIS...)
- All these as:
 - Level 0: interferograms
 - Level 1: spectra
 - Level 2: geophysical products









Test data generation tools

- The variety of the objectives imposes using an assortment of different tools:
- Available in-house:
 - IRASS
 - Radiative Transfer Models
- In development by TAS (delivery 2019?):
 - L0: Payload Data Generator (PDG)



IRASS

- IRASS has been developed as a IRS system performance simulator;
- It includes:
 - A scene generator;
 - Instrument simulator;
 - On-board-processing => L0;
 - On-ground processing =>L1a,b,c.
- It is the sole instrument and L1 simulator available to EUMETSAT for IRS, with sometimes ad-hoc parameterization due to missing or unclear information from industry;



IRASS: General design





IRASS: scene generator



- IRASS scene generator uses high-resolution spectra as input. This yields some shortcomings:
 - No realistic scene with geolocation
 - No RTM
 - No simulation of LOS
 instability
- The user has however the possibility to use externallygenerated spectra as input



IRASS: IRS Instrument Simulator

In charge of interferogram computation including phase errors, SRF convolution, CC speed variation, detection noise, amplification noise and non-linearity.



IRASS: IRS On-Board Processing

In charge of spike detection, IF resampling with field compensation, IF decimation, IF compression



Missing functionalities:
✓ No metrology equalisation
✓ NL never tested
✓ No spike correction
✓ No "3-point filter correction"



IRASS: Example of L0 output

Band 1 – Different targets (AT– BB – CS1)





BB - band 1

IRASS: IRS Level 1 Processing

In charge of IF decompression, apodisation, spectrum complex radiometric calibration, spectral calibration, resampling, removal of the ISRF





IRASS: Example of L1 output

Level 1b spectrum

HR spectrum



Band 1

Band 2



IRASS extension

- IRASS was not meant to generate large amount of data. Its capabilities are thus being extended for the generation of TDS:
 - generation of a full dwell along with the calibration views;
 - adaptation of the INS+OBP processing parameter for a better representation of the instrument;
 - Simulation of a user-defined sequence of dwells e.g. EV+EV+EV+DS2+DS2+DS1.



IRASS-L0: Example of ONB output

TDS overview

Mean value of level 0 EV decimated interferograms for all the superdetectors of the dwell



Single dwell L0 Target EW_AT Real Decimated IFG DC

Single dwell L0 Target EW_AT Imaginary Decimated IFG DC



The images exhibits clearly the radiometric noise



L2 test data

- L2 test data can be generated using RTMs (i.e. without instrument+L1 processing simulation)
- Available in house for the generation of "infinite" spectra:
 - (RTTOV not yet ready)
 - OSS
 - 4AOP
 - Testing of HT-FRTC will start in the near future
- L1 data for L2 testing can also be generated from IASI measurements



Purpose:

High spatial resolution

Realistic atmospheric scenes and surface elevation & types

Ultimately study effect of instrument effects:

- LWIR/MWIR misalignment
- Spread function → cross-talk with neighbouring pixel (e.g. cloud signal intrusion...)

Content:

RTM: OSS clear-sky

Geophysical State Vector:

- Météo-France high resolution (500m) T,q,Ts,Ps up to ~14 hPa
- ECMWF analyses above M-F model top + $O_3 @ 0.5^\circ$ resolution, oversampled

- surface emissivity: sea ISEM-6, land MODIS-ASTER atlas (U.Wisc.) Realistic viewing geometry and on-ground geolocations



HiRes dataset



Possible evolutions:

More scenes, e.g. Germany with DWD high-res. Model (~150m) Radiance simulation at high spectral resolution Cloudy radiances

16 IRS MAG meeting, 18-19 October 2017



Need for high-resolution NWP data

- The spatial extent of a single IRS pixel varies from 4 km at nadir up to 10 km at 60°
- All IRS simulations need to be fed with high spatial resolution NWP fields
- At global scale, only ECMWF at 0.125° can be used
- At dwell level simulations could make use of regional models (HARMONIE/AROME) with a resolution of the order of 1km





IRS Payload Data Generator (PDG)

- The PDG will simulate payload data as generated by the satellite at packet level
- The PDG is the main tool for payload data injection into the EUM ground segment for verifying and validating the
- instrument data processing chains
- It is developed externally and will be delivered in 2019





Users familiarization (MTG-UP)

- Project run by the OPS division
- Aims at supporting users in their preparation to make use of MTG data (in particular IRS) in particular with the provision of test data



- Generation of test data is a full part of the MTG project
- Tools are in place or are being prepared
- Comments, suggestions, questions are welcomed

