EUMETSAT NWP SAF
NUMERICAL WEATHER PREDICTION

METEO FRANCE

MAIA a software package for cloud detection and characterization for VIIRS and AVHRR imagers

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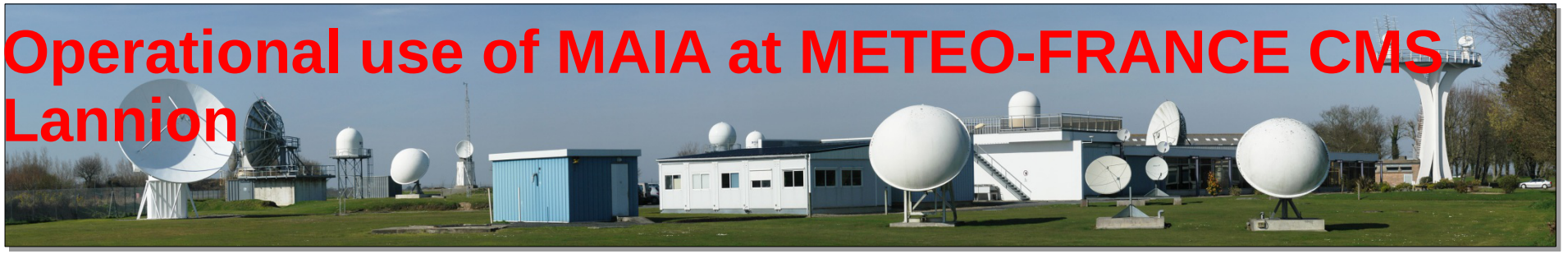
CSPP/IMAPP USERS' GROUP MEETING 2017 – 27-29 June 2017

Outline

- MAIA : description
  - history and use at Meteo-France
  - description of the algorithm
  - use description
  - performances
- Application to hyper-spectral sounders
  - IASI
  - CrIS
- What for Geostationary satellites ?
- Summary

- Developed by **Lydie Lavanant** at METEO-FRANCE CMS Lannion
- Cloud detection and characterization at pixel resolution (Cloud Mask, Cloud Type...) algorithm for LEO satellite imagers
- Part of the AAPP package
- History :
  - 1998 maia AVHRR
  - 2000 maia 2 AVHRR AAPP V 3
  - 2007 maia 3 AVHRR AAPP V 6
  - 2013 maia 4 VIIRS AAPP V 7.5
  - 2015 maia 4.2 VIIRS AAPP V 7.9 *(possibility to use GFS as NWP)*
  - 2016 maia 4.3 VIIRS AAPP V 7.14
  - 2017 maia 4.4 VIIRS AAPP V 7.15
  - 2017 maia 4.5 VIIRS + AVHRR **AAPP V 8**

Operational use of MAIA at METEO-FRANCE CMS Lannion



direct broadcast
VIIRS CSPP
MAIA
processing

direct broadcast
AVHRR
NOAA/METOP
MAIA
processing

global
(EUMETCast)
METOP AVHRR
MAIA
processing

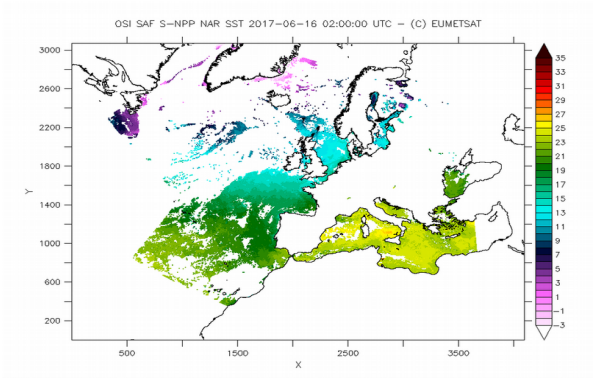
direct broadcast
IASI processing
with MAIA
AVHRR
CLOUD_INFO

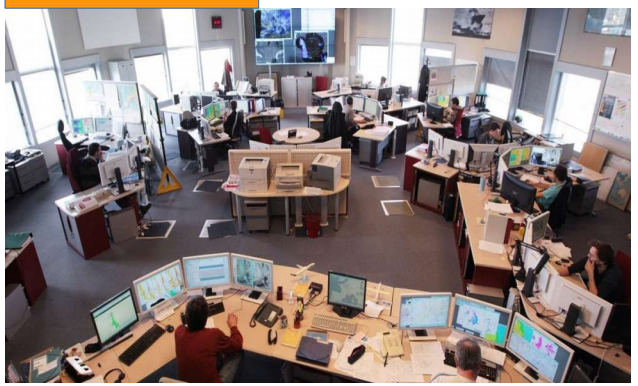
OSI SAF
NAR SST

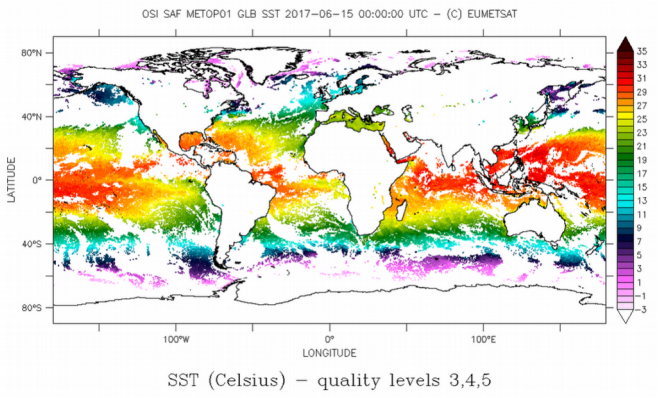
forecasters

OSI SAF
GLOBAL SST

NWP







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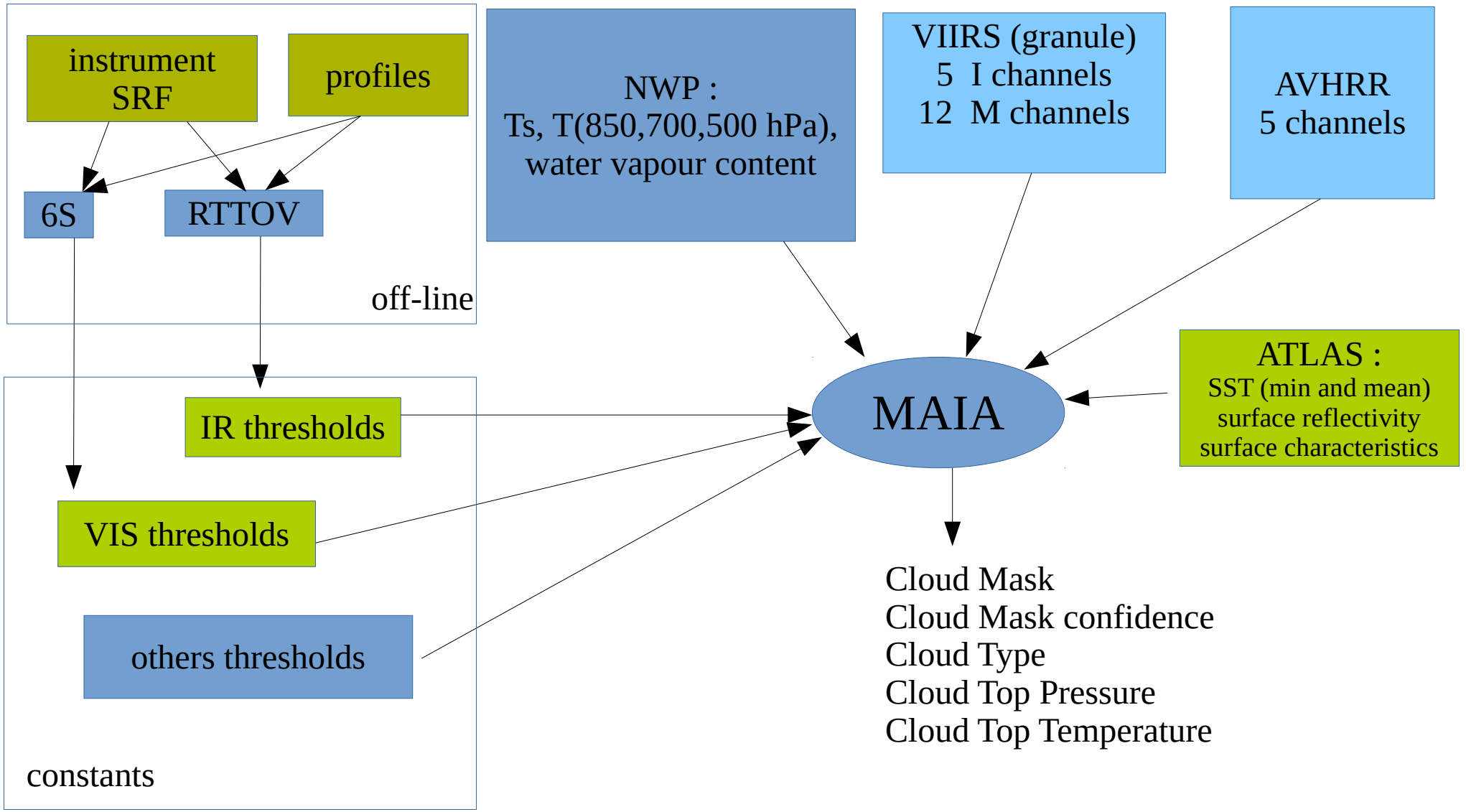
OCEAN AND SEA ICE

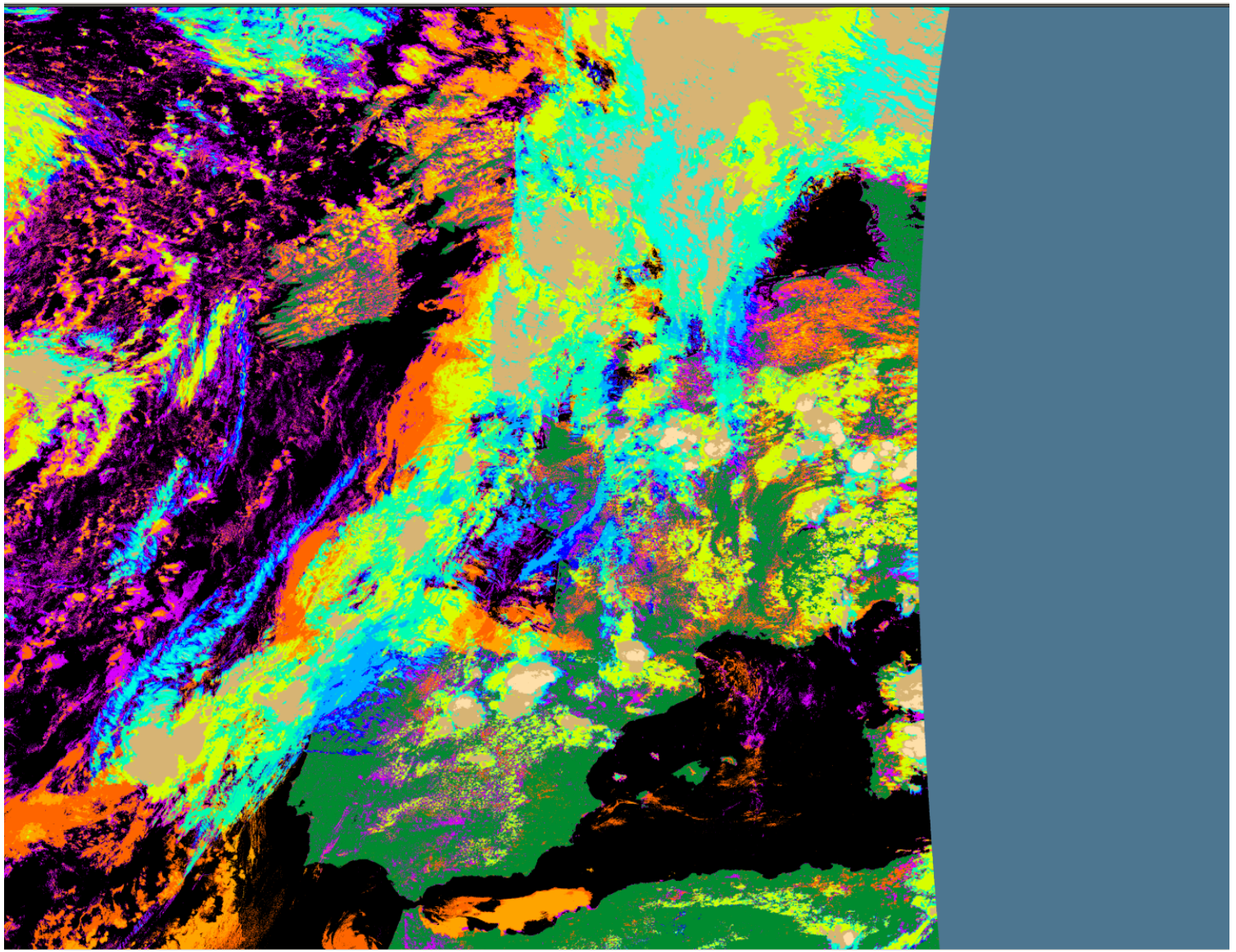
MAIA features



MAIA algorithm description

- Cloud Mask:
  - Multispectral threshold technique applied to each pixel
    - single channels
    - channel combinations
    - spatial local variances
    - ratio 0.8µ/0/6µ
  - For each test : quality Flag => summarized confidence level
- Cloud Classification:
  - 10 cloud categories
  - Threshold technique
- Sea Surface Temperature
- Cloud Top Pressure and Cloud Top Temperature *(with 10.8µ corrected from the atmospheric absorption)*

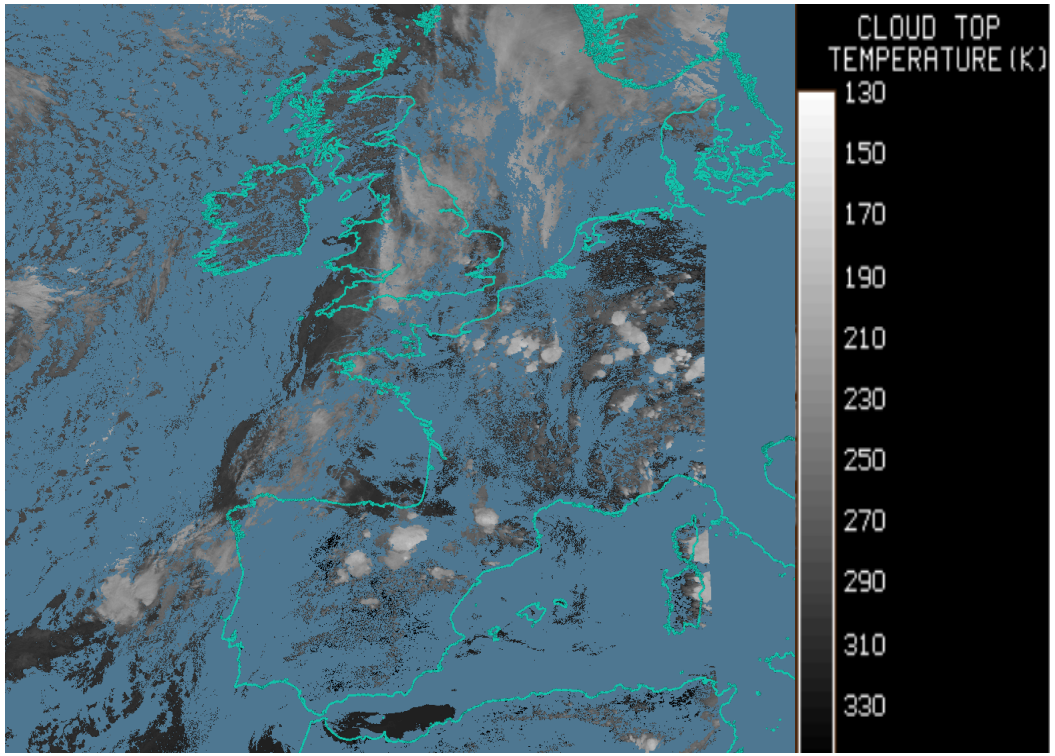
Maia Cloud Type



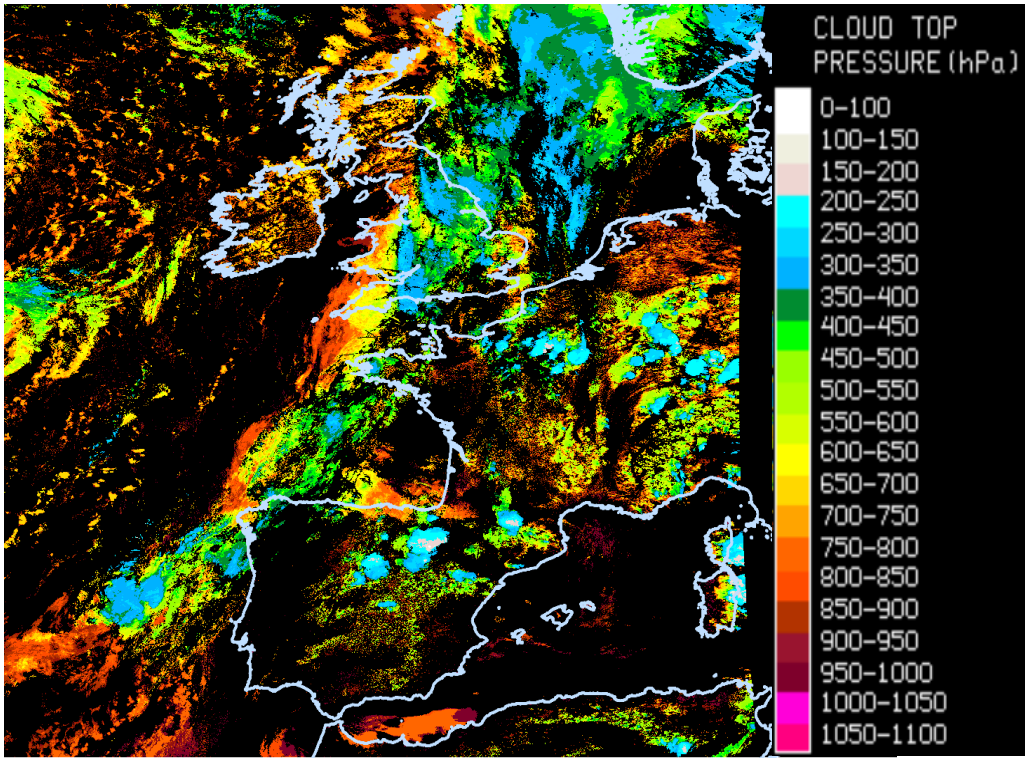
viiCloudTypeImg_npp_20170602_1335

- Unprocessed
- Cloudfree land
- Cloudfree sea
- Snow cover
- Sea ice
- Very low clouds
- Low clouds
- Medium level clouds
- High clouds
- Very high clouds
- Very thin cirrus
- Thin cirrus
- Thick cirrus
- Cirrus above low/medium
- Fractional clouds
- Unclassified

Cloud Top Temperature and Cloud Top Pressure



VIIRS MAIA CloudTopTemperature 20170602 13 :35



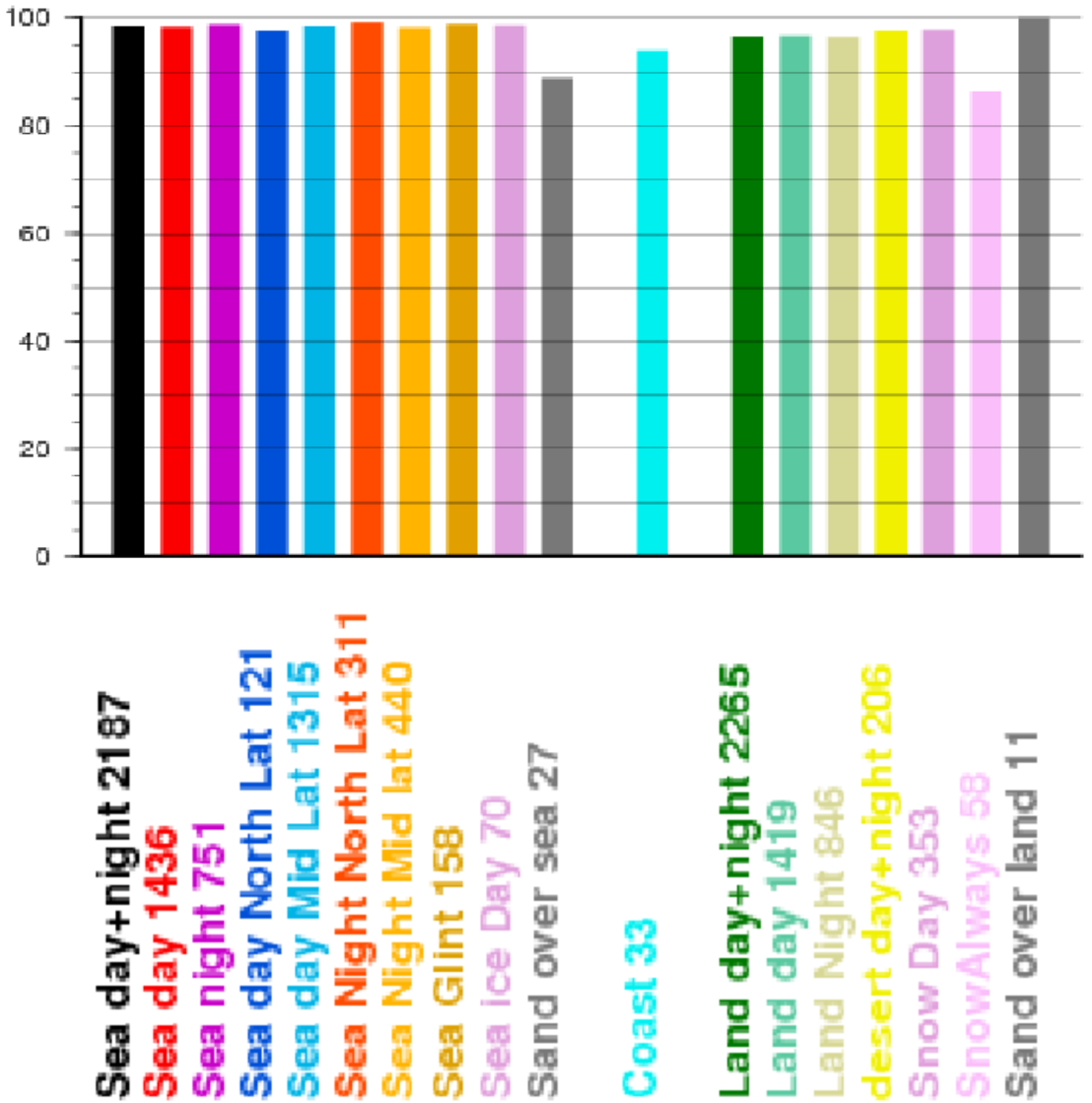
VIIRS MAIA CloudTopPressure 20170602 13 :35

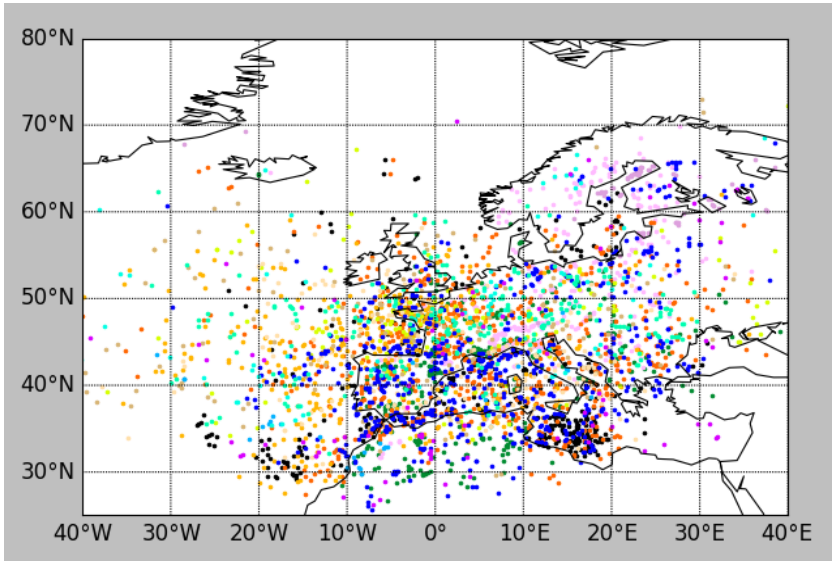
MAIA Usage

- Register to NWP SAF on https://nwpsaf.eu/site/
- Software user preferences : choose AAPP version 8
- Download and install AAPP (+ data_maia4) (requires hdf5 and ecCodes fortran libraries)
- set your environment
- VIIRS :
  - input : SDR files (in INPUT_DIR)
  - run MAIA :
    - `MAIA4_RUN INPUT_DIR`
- AVHRR :
  - input : « aapp » AVHRR level 1B file
  - run MAIA :
    - `AAPP_RUN_NOAA/AAPP_RUN_METOP` => avhrr.1b
    - `MAIA4_RUN_AVHRR avhrr.l1b [output_file]`

MAIA4_RUN_AVHRR also accepts metop PFS L0 and PFS L1B format

MAIA 4 performance (VIIRS)





VIIRS data targets : *5369 targets between October 2012 and October 2013*

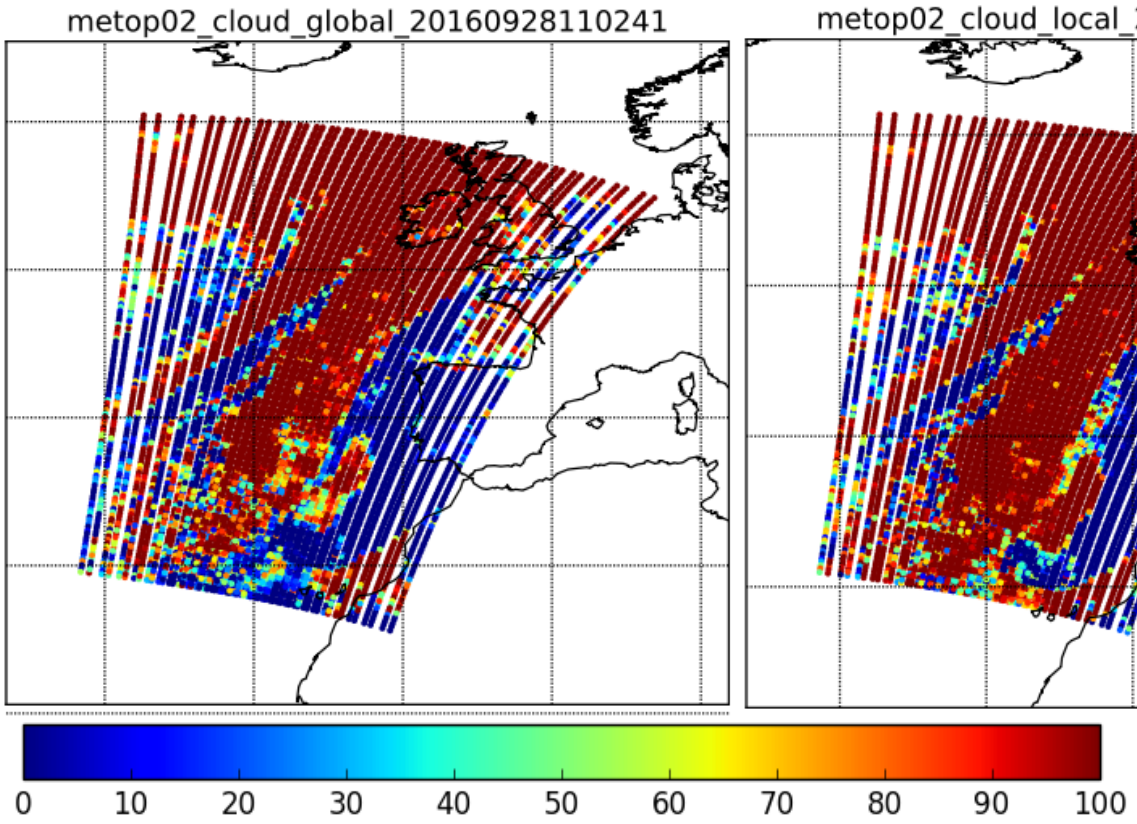
Application to hyper-spectral Sounders : IASI

Mapping AVHRR in IASI foot print with MAIA Cloud Mask

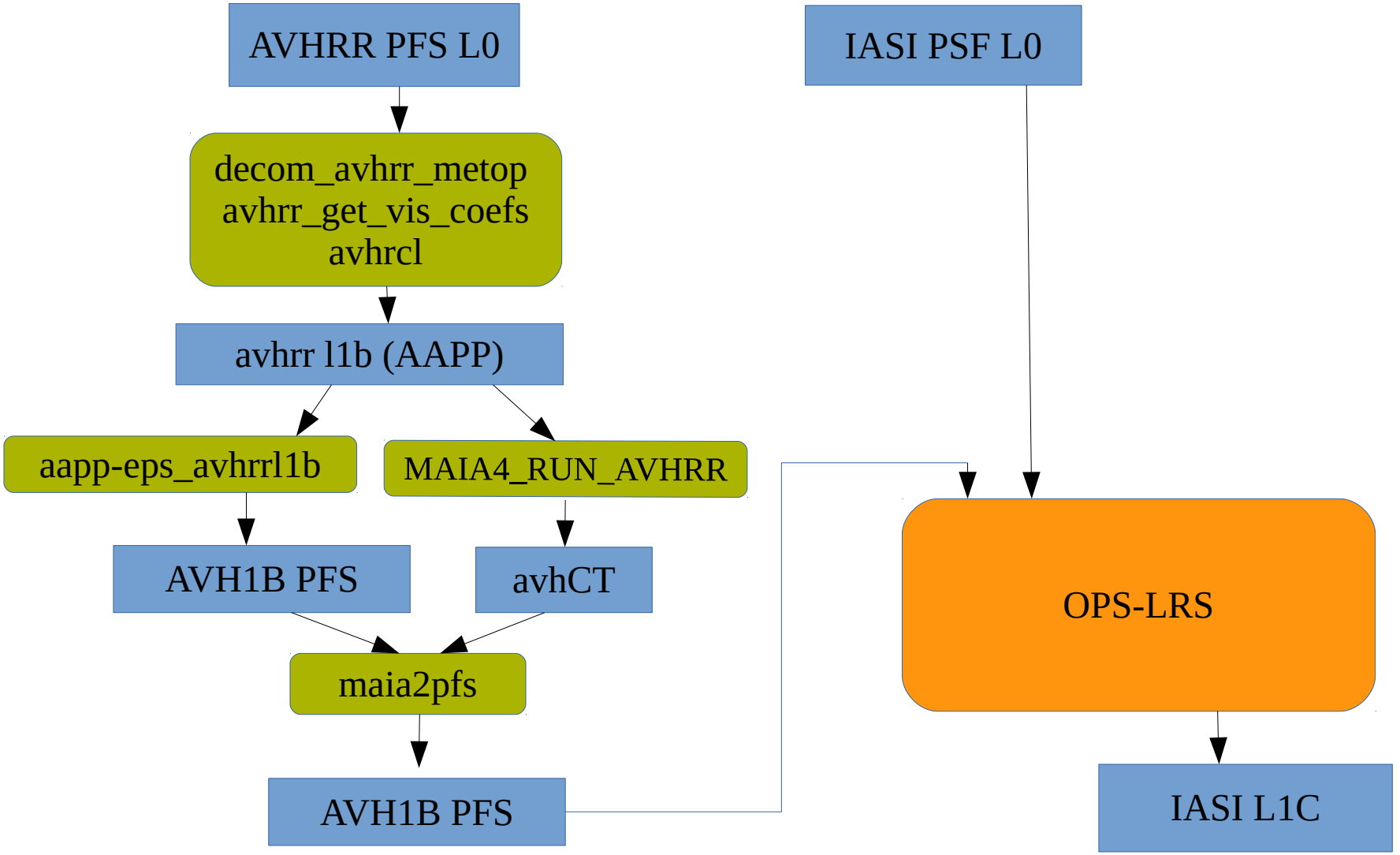
Global (EUMETCast)
IASI product
Cloud Fraction (%)

Direct broadcast
IASI product
with MAIA 3 Cloud Fraction (%)

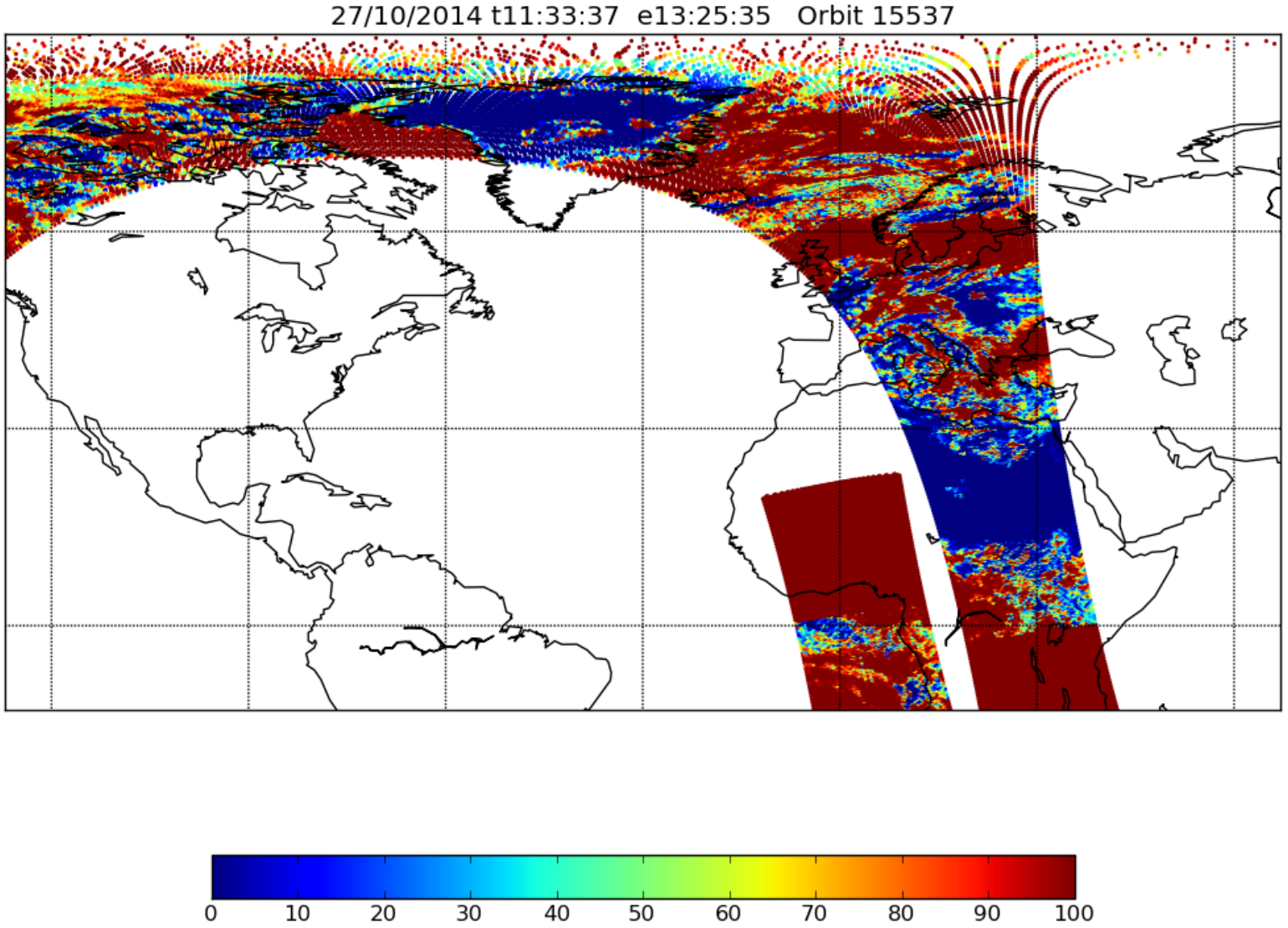
SEVIRI Meteosat
Cloud Mask
20160928 1100



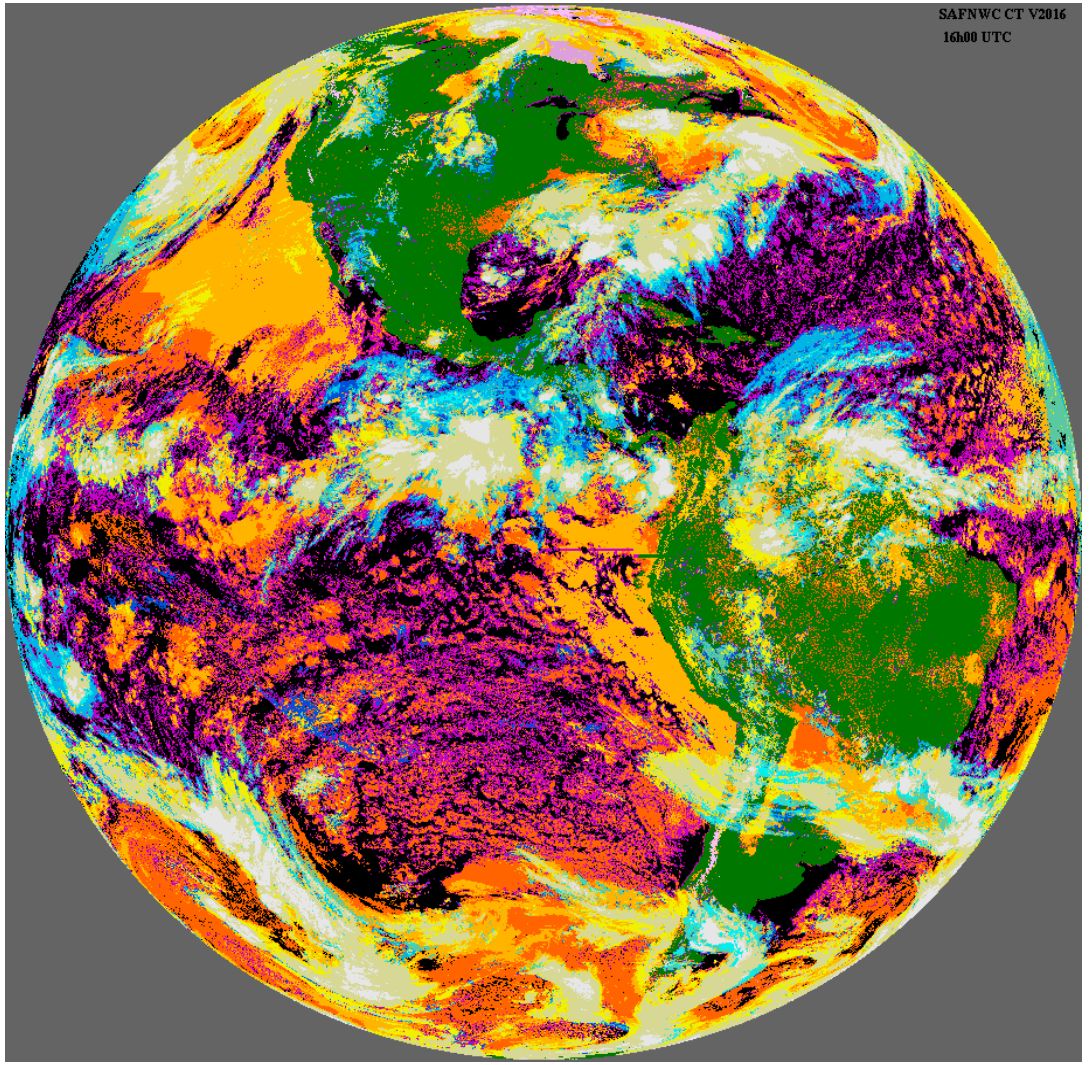
MAIA in IASI FOV



This can also be done with CrIS



What for geostationnary satellites ?



Cloud Type GOES-R 6 June 2017 16:00 UTC

- NWCSAF GEO software v2016

  http://www.nwcsaf.org/
- Cloud Products developed at METEO-FRANCE CMS Lannion
- Capability to process data from other satellites than MSG :
  - HIMAWARI 8-9
  - GOES 13,14,15

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SUPPORT TO NOWCASTING AND VERY SHORT RANGE FORECASTING

Summary

- MAIA is a software package for cloud detection and characterization at pixel resolution for LEO satellites NOAA, METOP, NPP and future JPSS imagers.
- AAPP version 8 : MAIA 4.5 for VIIRS and AVHRR/3 https://nwpsaf.eu/site/software/aapp/
- AAPP tools enable to compute imager cloud fraction in the hyper-spectral instrument FOV (IASI or CrIS)
- For geotationary satellites: NWCSAF GEO v2016 software http://www.nwcsaf.org/
- SST products: http://www.osi-saf.org/

bibliography

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Eumetsat documentation
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Operational cloud masking for the OSI SAF global /METOP/AVHRR SST product
L. Lavanant et al
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AAPP documentation

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Cloud mask via cumulative discriminant analysis applied to satellite
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Comparaison of METOP IASI
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L. Lavanant
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