

# *MFG/MVIRI potential for aerosol retrieval*

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SESSION 17: Long-term satellite-based time series

14<sup>th</sup> AeroCom – 3<sup>rd</sup> AeroSat joint meeting

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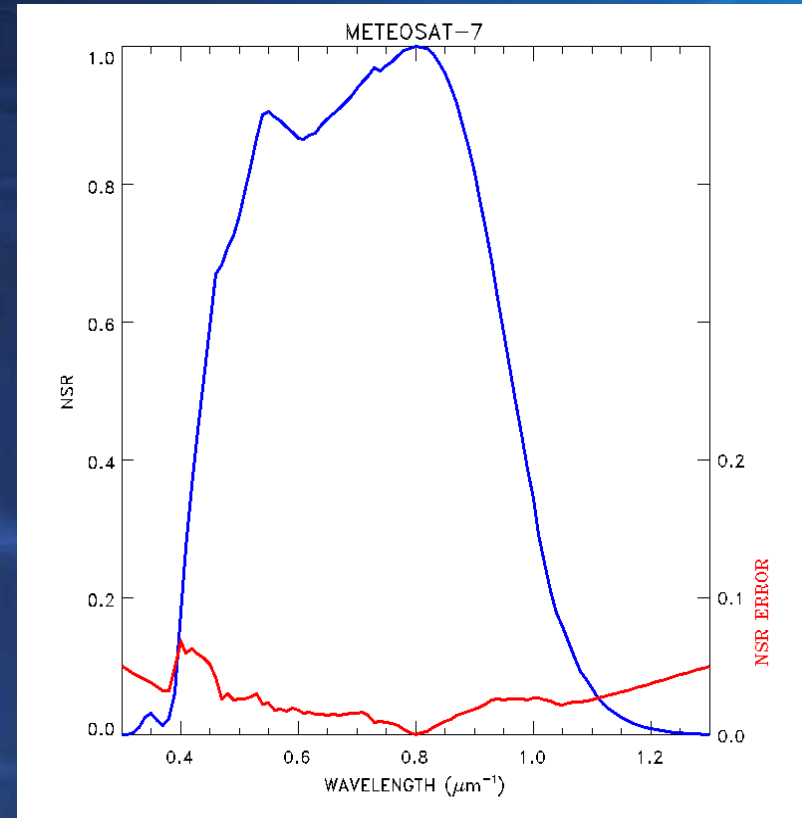


# OVERVIEW

- Meteosat First Generation characteristics;
- Aerosol property retrieval from geostationary observations;
- PROS and CONS;
- Contributions of geostationary observations to aerosol ECV generation;
- Expected results.

# METEOSAT FIRST GENERATION

- One image acquired every 30 min;
- One “broad” spectral band in VIS region;
- Sampling distance of 2.5km at SSP;
- 8 (6) bits;
- Continuous time series since 1982!



# AEROSOL RETRIEVAL FROM GEO

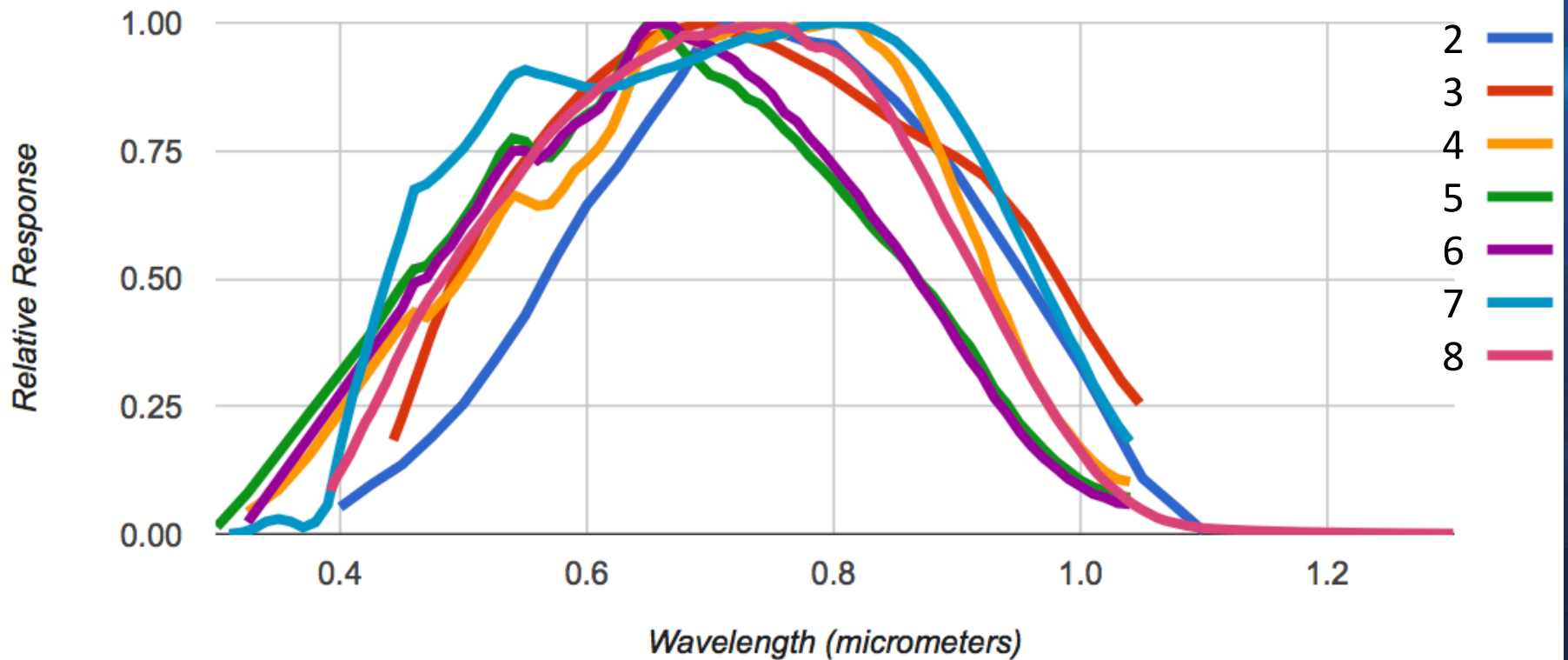
- As for any satellite data, the issue is to separate the contribution from surface and atmosphere;
- Frequent observations allow to accumulate data during the course of the day to document surface BRF and aerosol daily cycle;
- Inversion of the physically-based RTM for the joint retrieval of surface BRF and aerosol properties.

# PROS

- Continuous and consistent observation since 1982;
- Possibility to retrieve daily cycle of aerosol load;
- Operational system, ie, well maintained.

# CONS

1. Spectral response of MVIRI/VIS band has been extremely poorly characterized pre-launch;



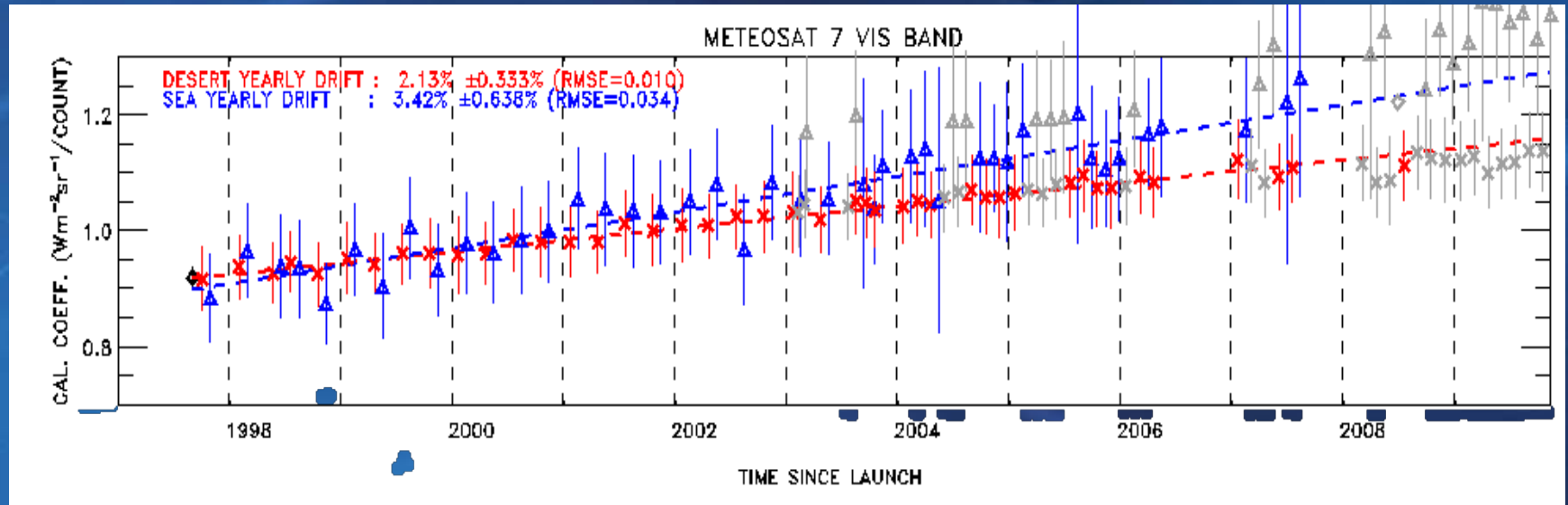


# CONS

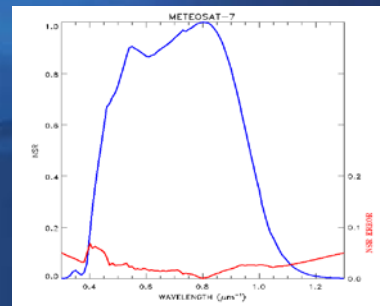
- There are evidences that these poor characterization lead to inconsistent calibration results;
  - Govaerts (1999) showed that M-5 and -6 SRFs VIS bands are erroneous and lead to inconsistent calibration results;
  - Decoster (2013) showed that M-7 SRF VIS band has some deficiencies in the blue part of the spectral region.

# CONS

2. Spectral ageing of the spectral response, i.e., the blue part is degrading faster than the NIR one;



Drift of Met-7 MVIRI/VIS band over bright desert and sea surface (after Govaerts et al., 2004)



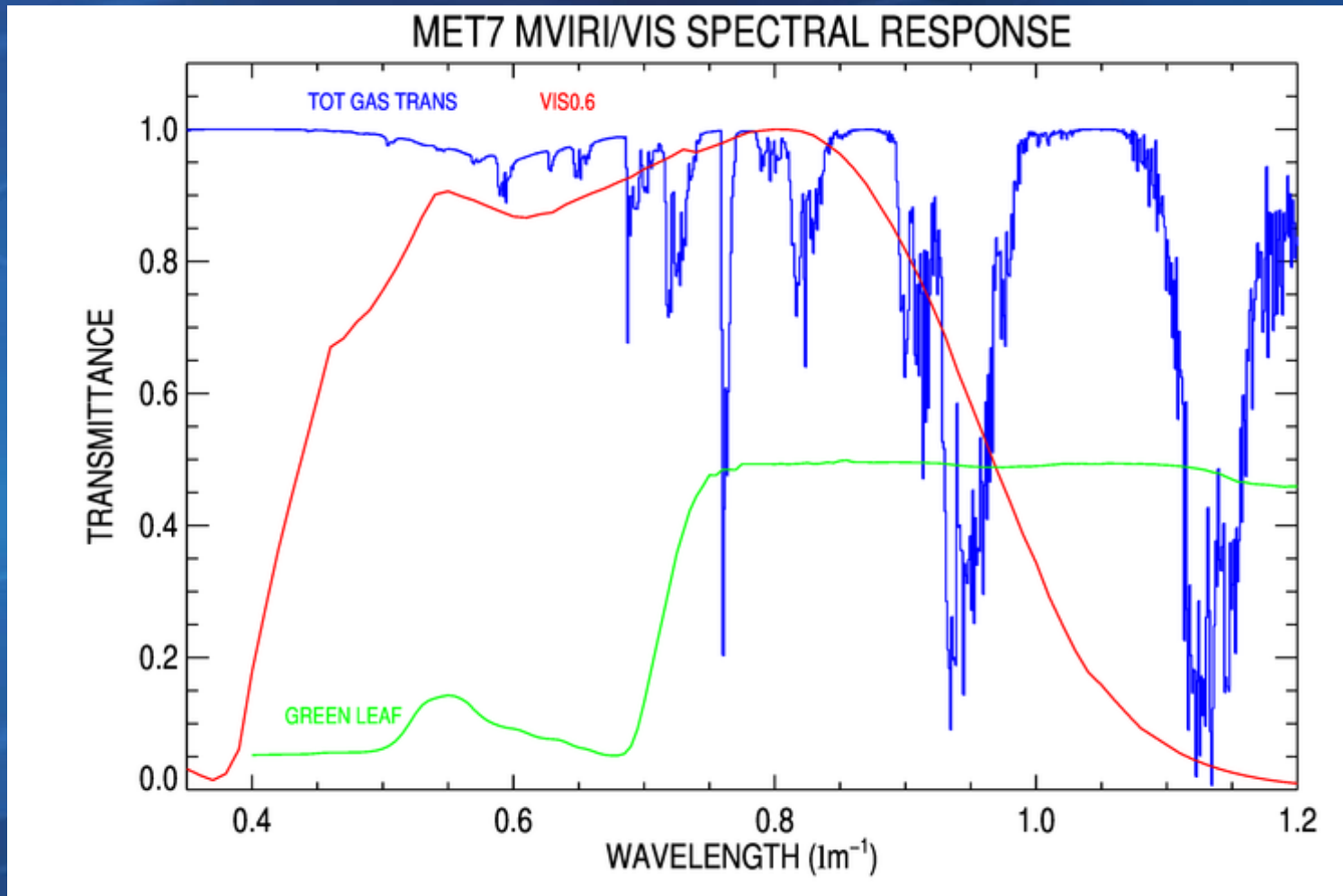


# CONS

- Issues 1 and 2 are currently being addressed in the framework of the FIDUCEO H2020 project (2015 - 2018);
- Development of a reverse engineering method to recover the spectral response and its spectral ageing;
- Based on accurate TOA spectral radiance simulation over pseudo-invariant calibration sites.

# CONS

3. Molecular absorption (gas trans. = 0.92);
4. Broad band very far monochromatic.

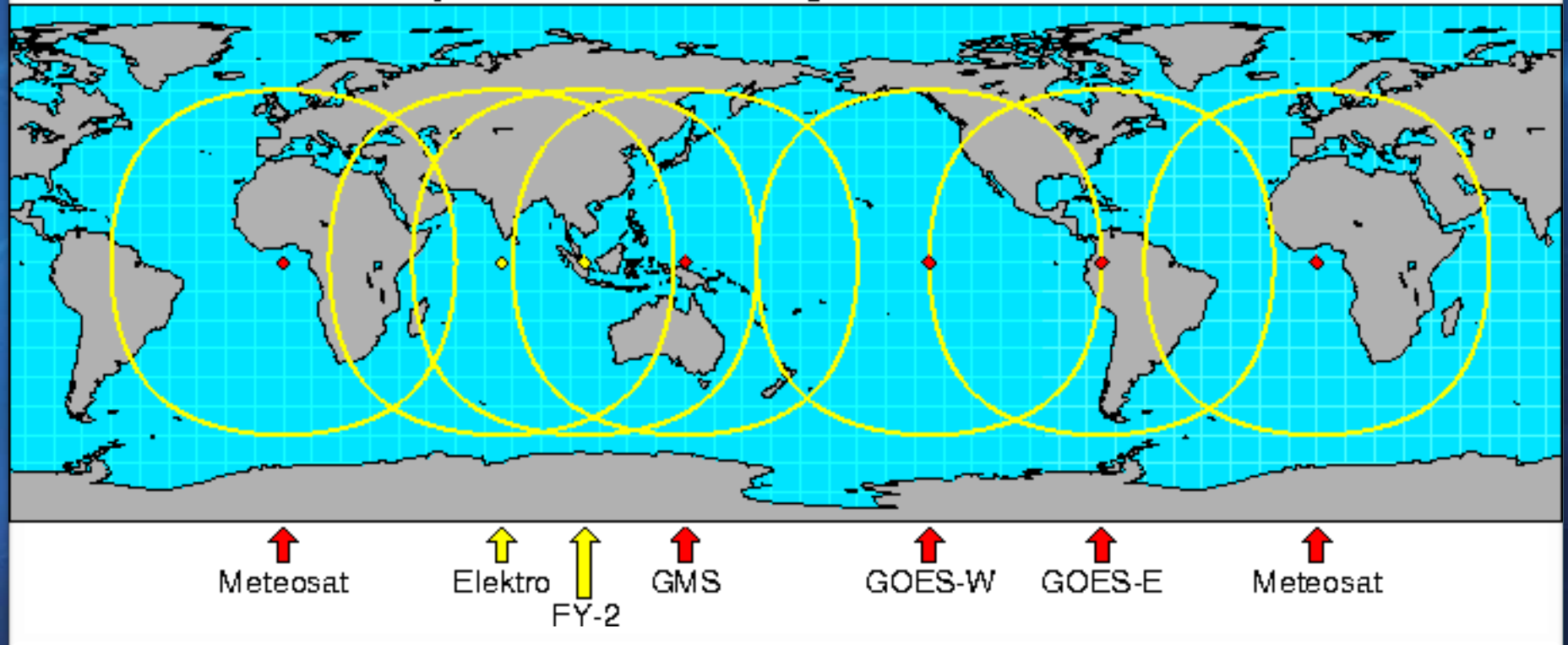


# CONS

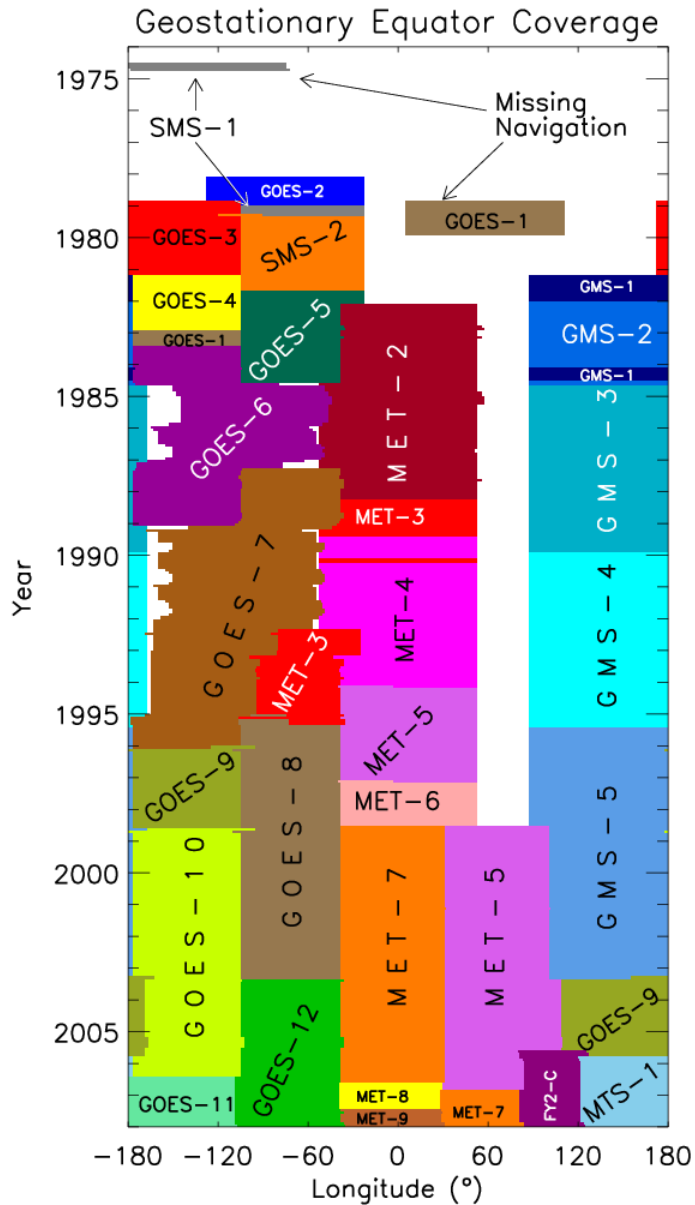
- To address issue 3, a fast RTM has been developed that ;
  - Include a correction for the spectral width of VIS band;
  - Specifically account for the radiative coupling between water vapour absorption and aerosol scattering.

# Potential for an aerosol ECV from geostationary observations

Global Geostationary Satellite Coverage



# Evolution of ECV from Satellites



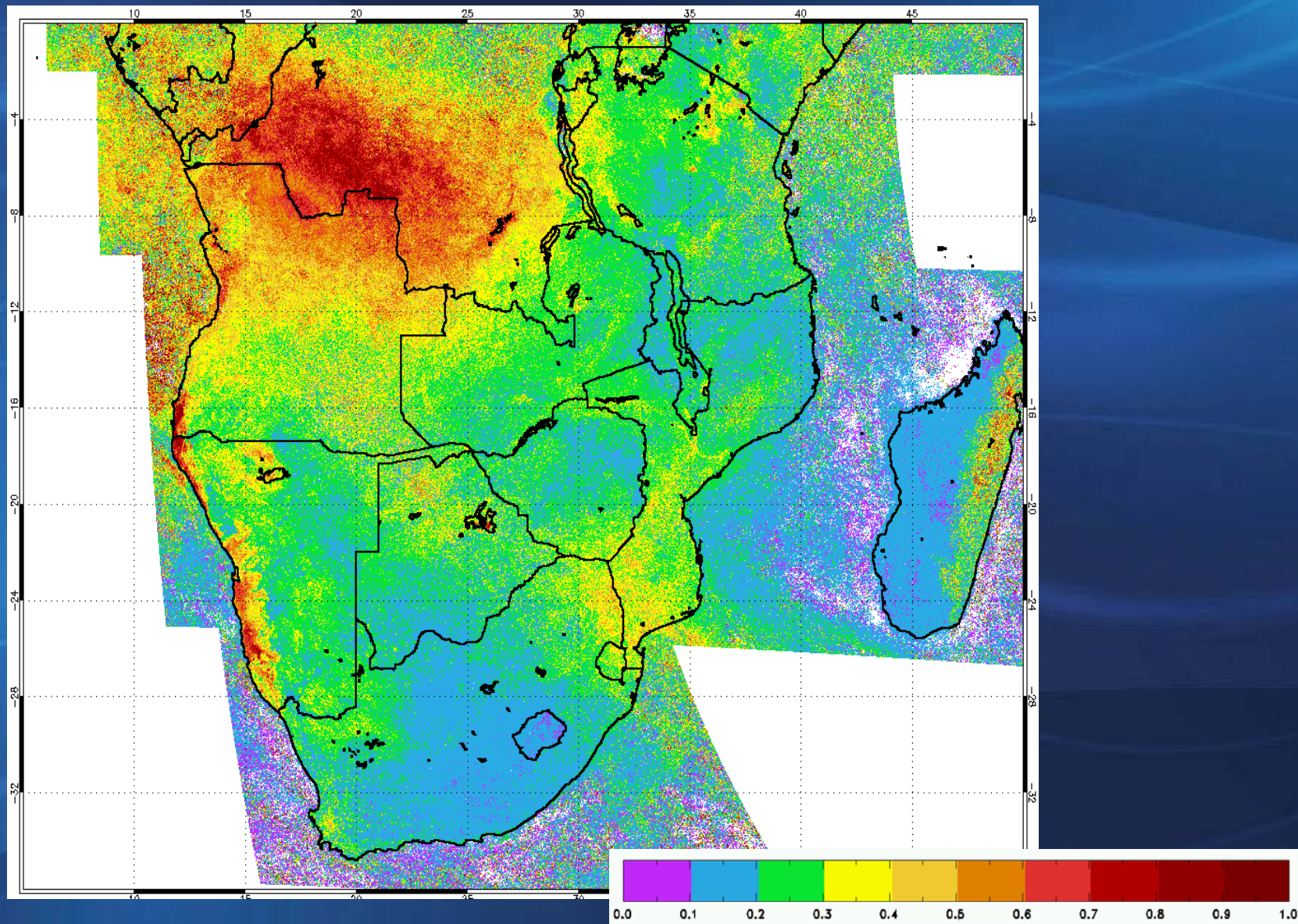
- MFG : 1980 – 2005
  - AOT
- MSG : 2005 – 2020
  - AOT: Fine and coarse
- MTG : 2020 – 2040
  - Concentration and micro-physical properties

# Expected results

- Eumetsat has already processed the entire MFG archive for surface albedo retrieval;
- Daily aerosol load derived as a side product of the joint surface aerosol retrieval;
- Not (yet) temporally consistent due to the previous listed issues.



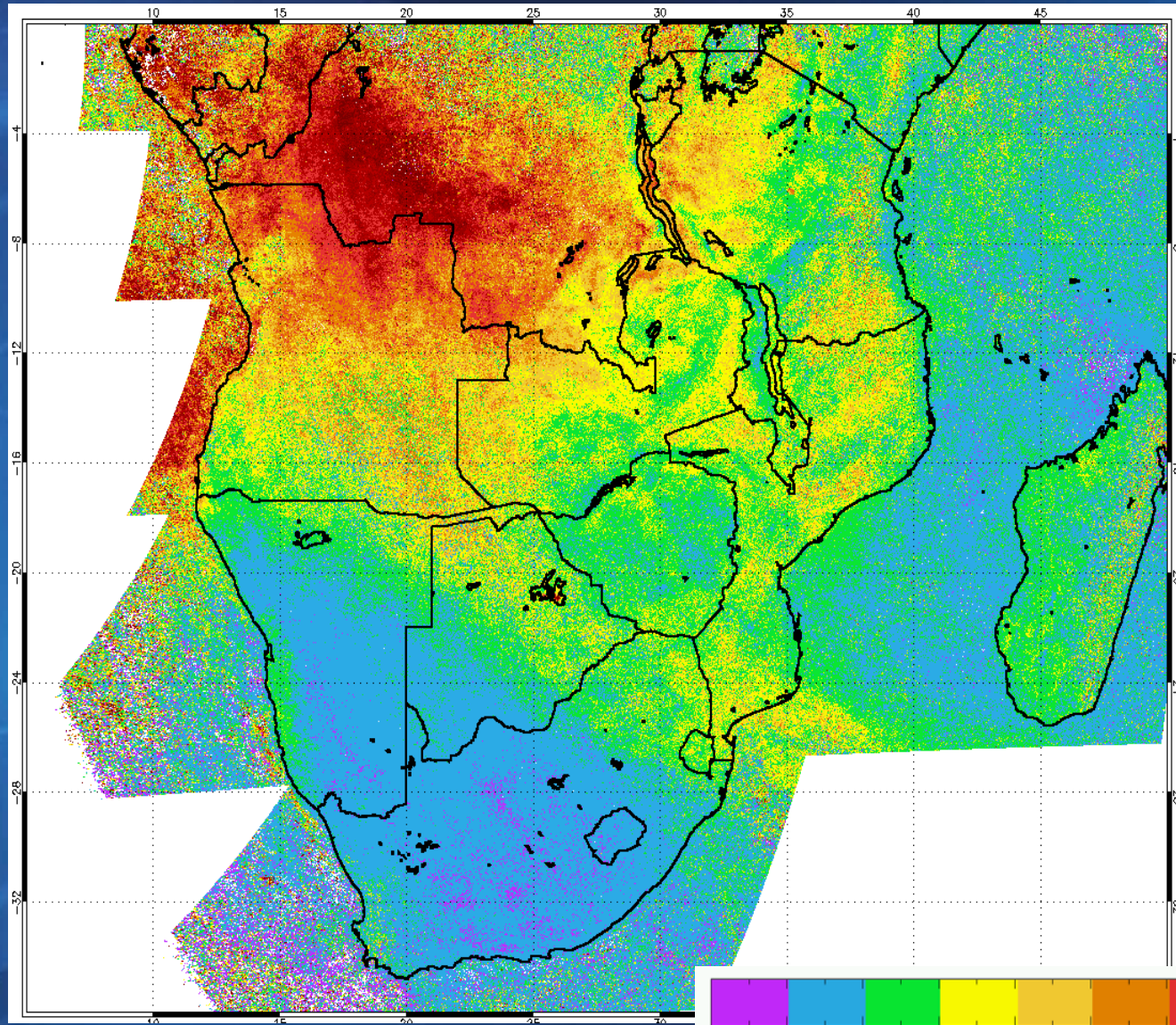
# MET-7 AUG 2001 MONTHLY MEAN AOD FROM GSA 0 degree





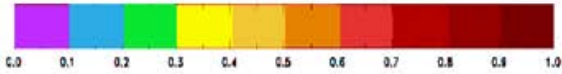
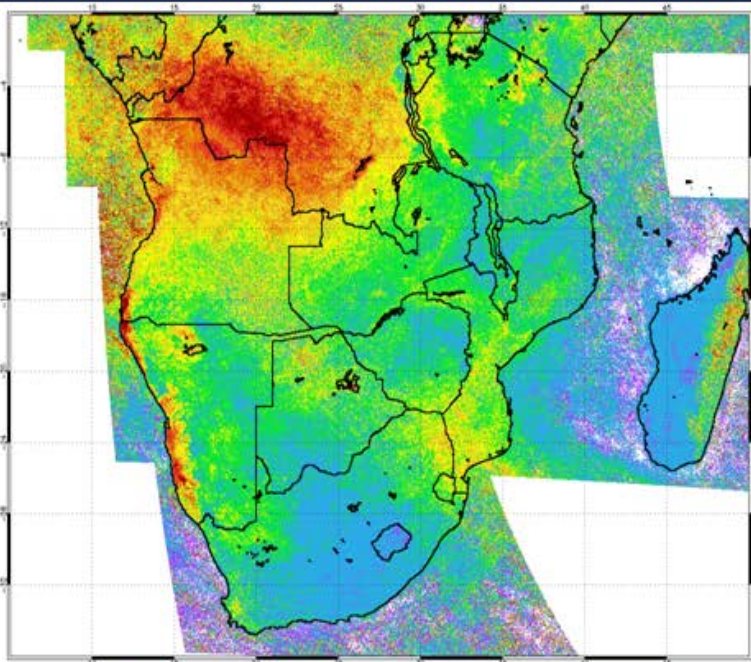
# MET-5 AUG 2001 MONTHLY MEAN AOD FROM GSA

## 57 degrees

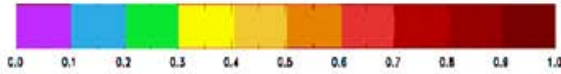
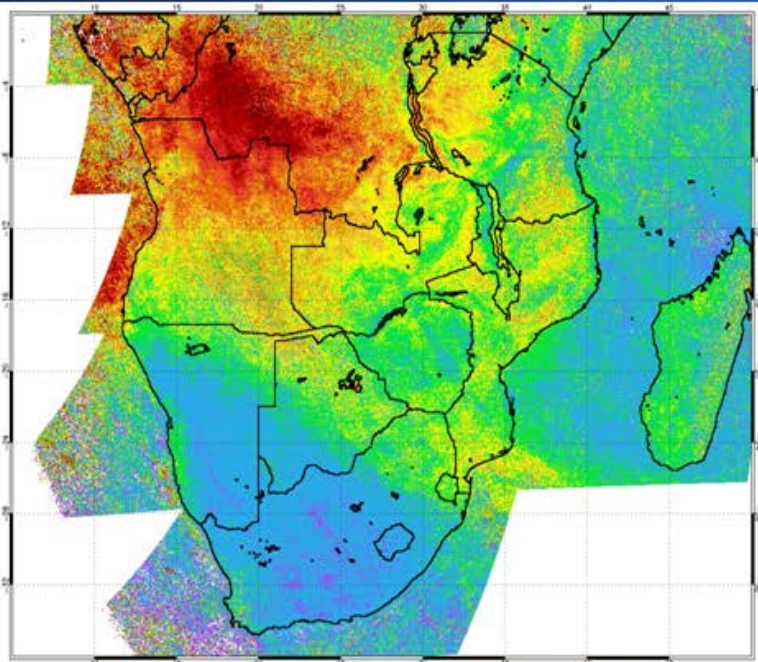




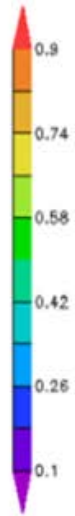
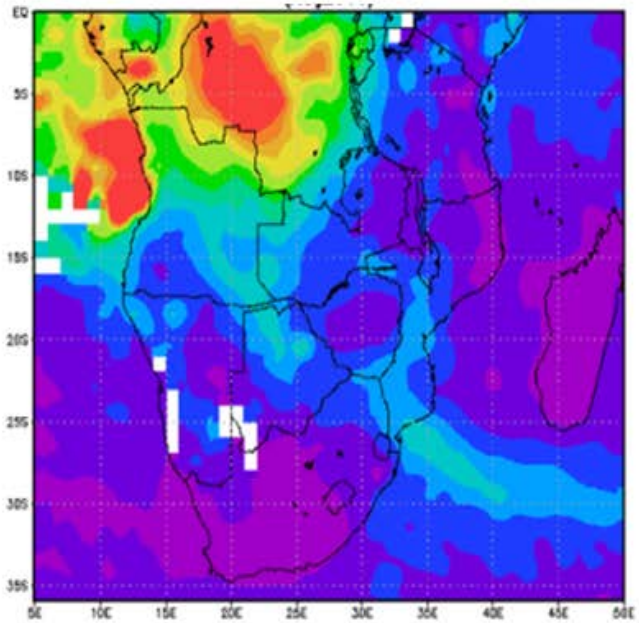
MET-7



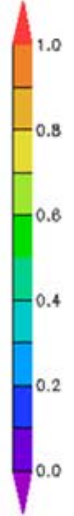
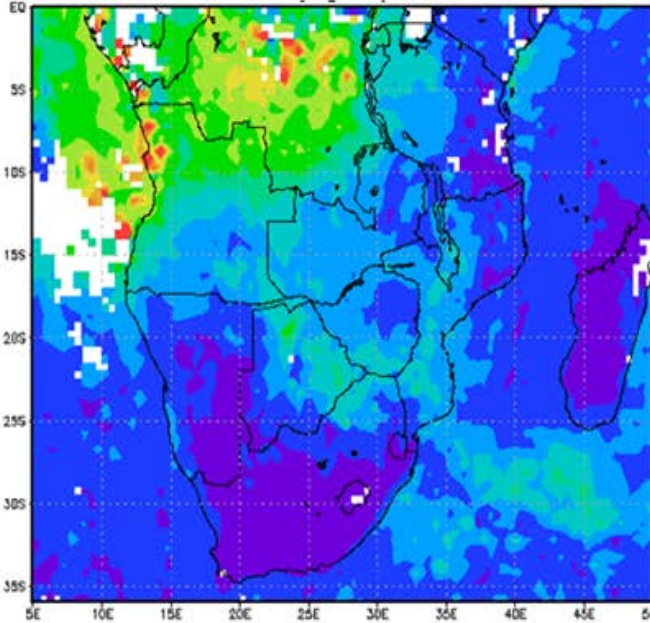
MET-5



MODIS



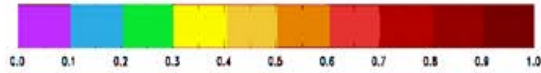
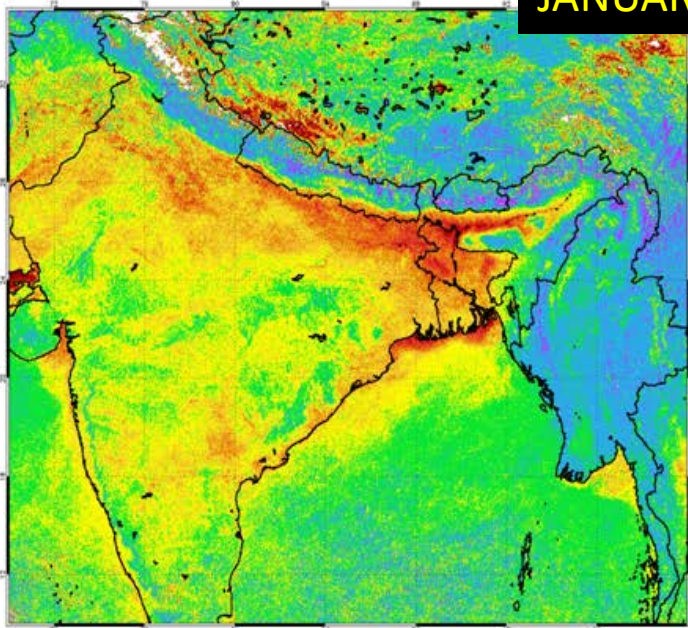
MISR



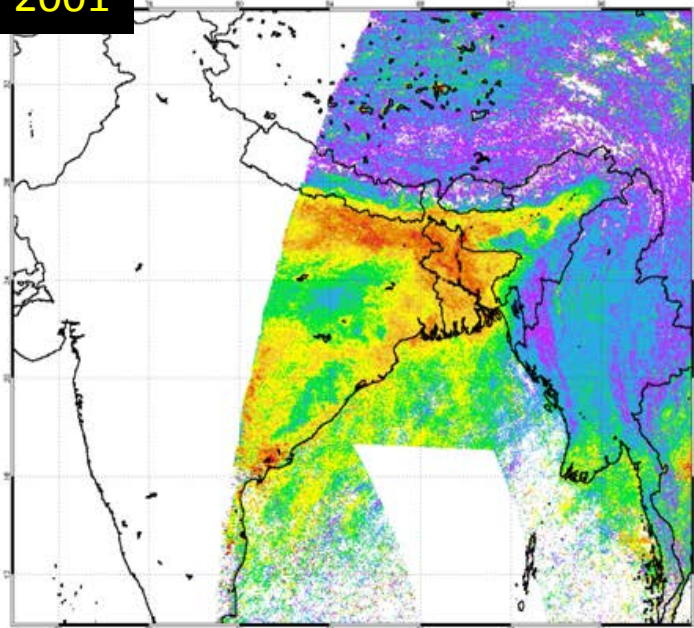


JANUARY 2001

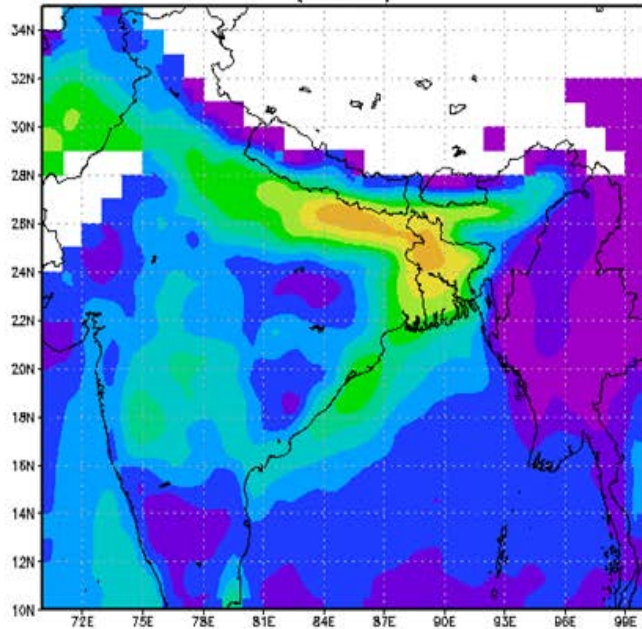
MET-5



GMS-5



MODIS



MISR

