The EarthCARE Multi Spectral Imager cloud products

Anja Hünerbein [1],Jan-Fokke Meirink [2], Gerd-Jan van Zadelhoff [2] ,

and Hartwig Deneke[1]

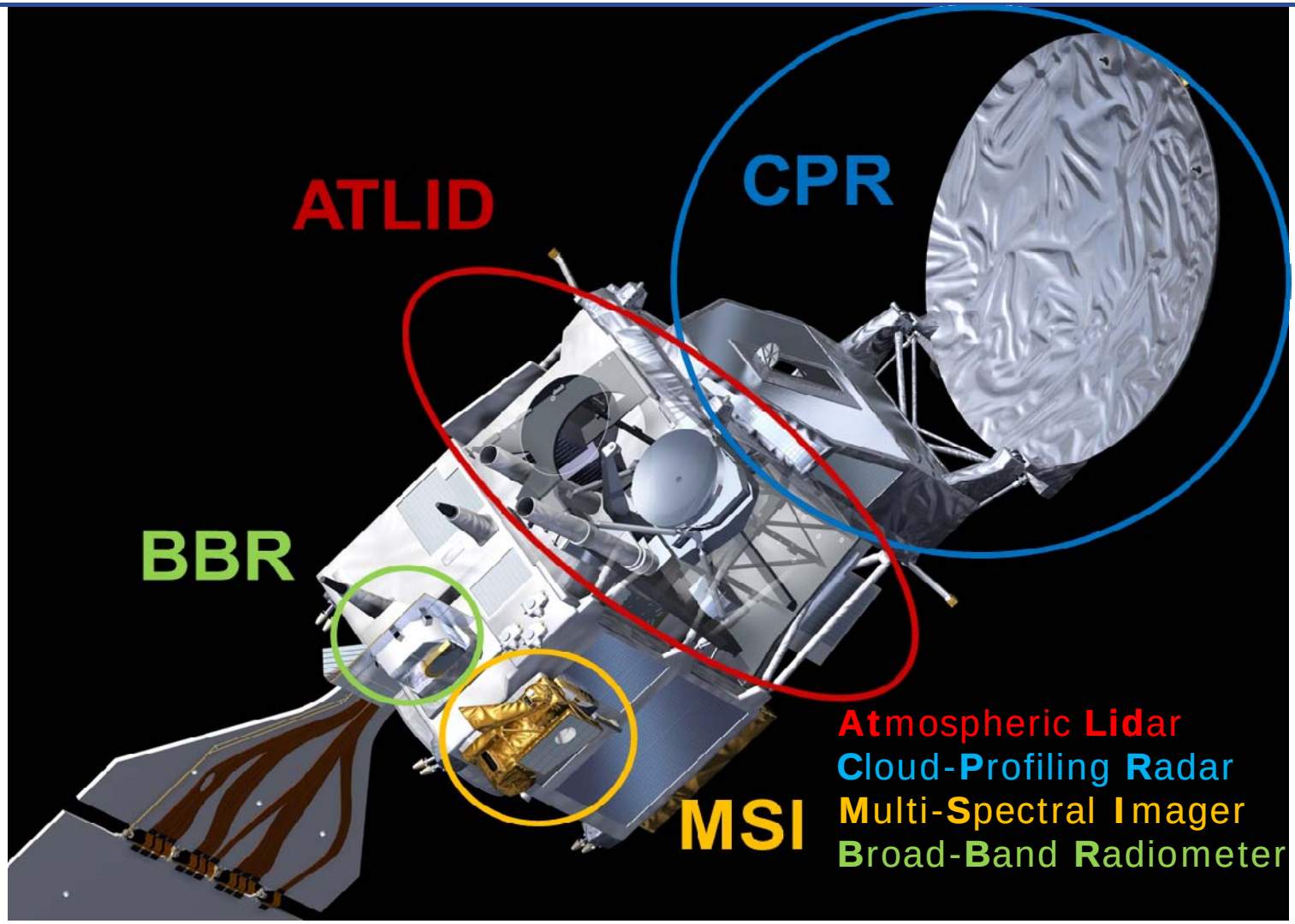
[1] Leibniz Institute for Tropospheric Research (TROPOS), Leipzig, Germany

[2] Netherlands Meteorolocical Institut (KNMI), DeBilt, Netherland

Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

TROPOS
Leibniz Institute for Tropospheric Research

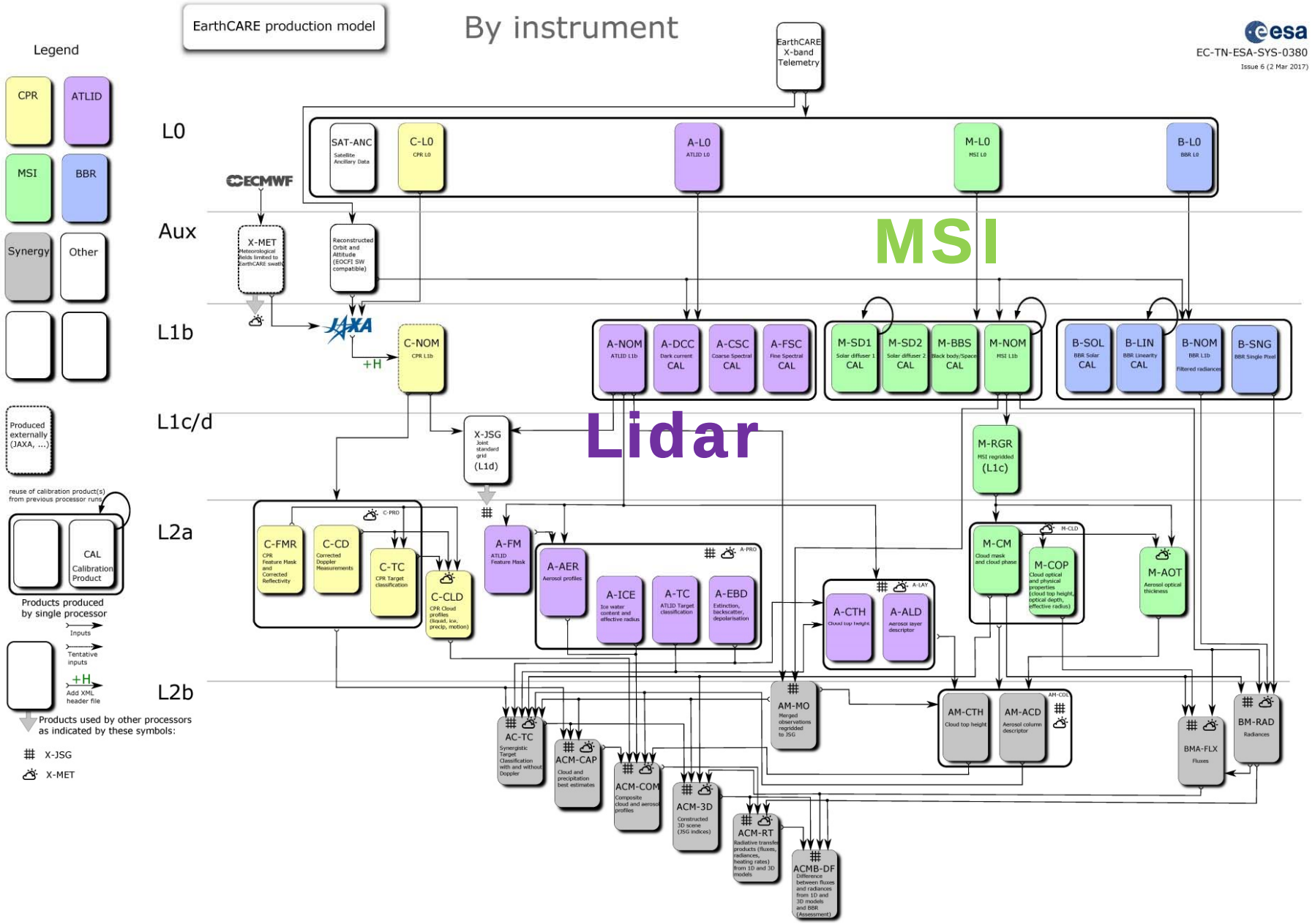
Earth Cloud, Aerosol and Radiation Explorer



Illingworth et al., BAMS, 2015

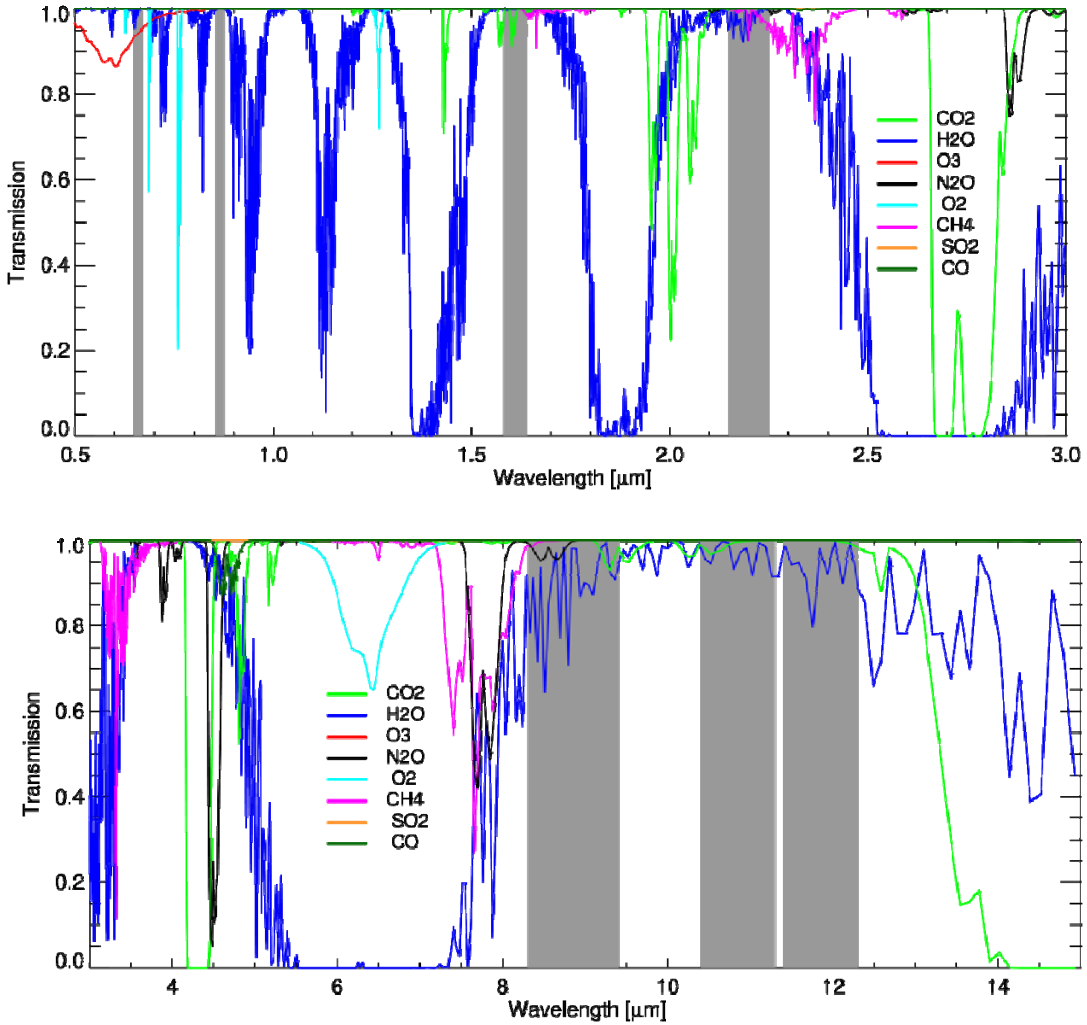
contact: anjah@tropos.de

EarthCARE algorithm development



Multi-Spectral Imager - MSI

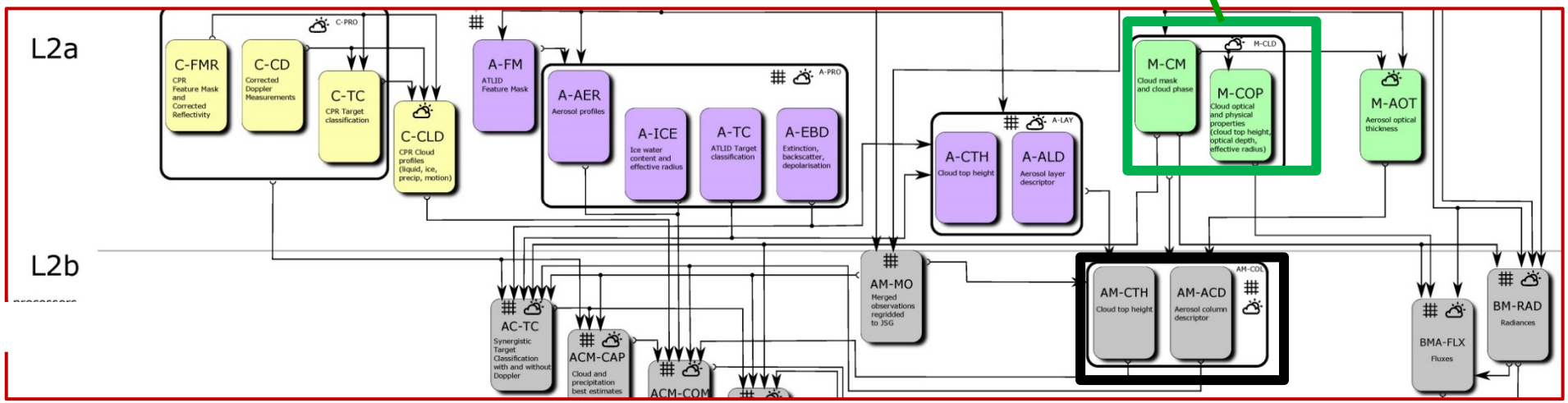
MSI Λ [µm]	**MSI** Δλ [µm]	**Atmospheric purpose**
0.67	0.02	**Cloud optical thickness over land**
0.865	0.02	**Cloud optical thickness over sea**
1.65	0.05	**Cloud effective radius**
2.2	0.1	**Cloud effective radius**
8.8	0.9	**Cloud properties**
10.8	0.9	**Cloud top temperature**
12.0	0.9	**Cloud top temperature**
Tab.1 MSI channels with the characteristics and the comparable channels from MODIS		



contact: anjah@tropos.de

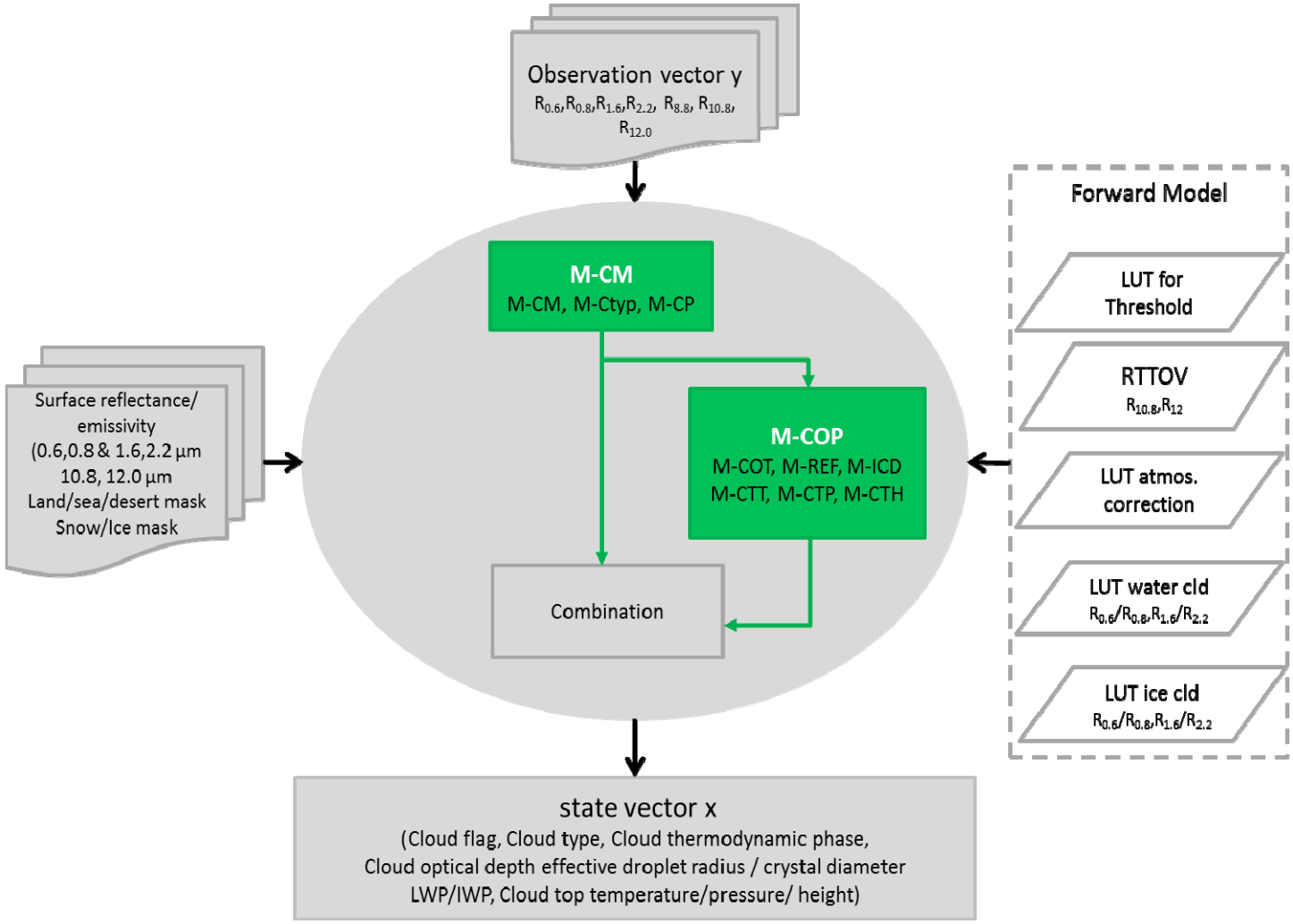
MSI cloud products

MSI Column Products
M-CM: Cloud Mask
M-COP: Cloud Optical Properties



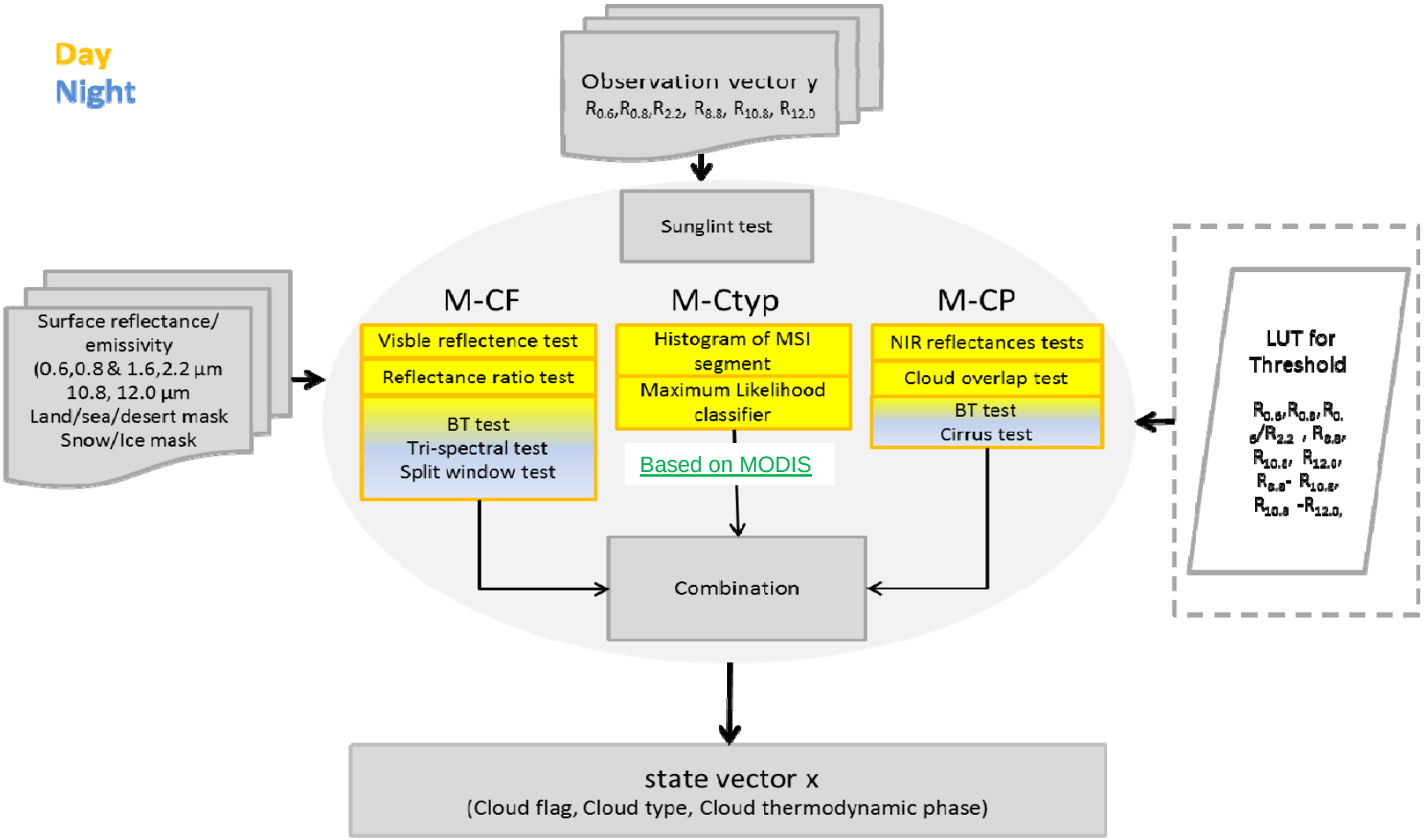
contact: anjah@tropos.de

MSI cloud processing chain



contact: anjah@tropos.de

MSI cloud mask



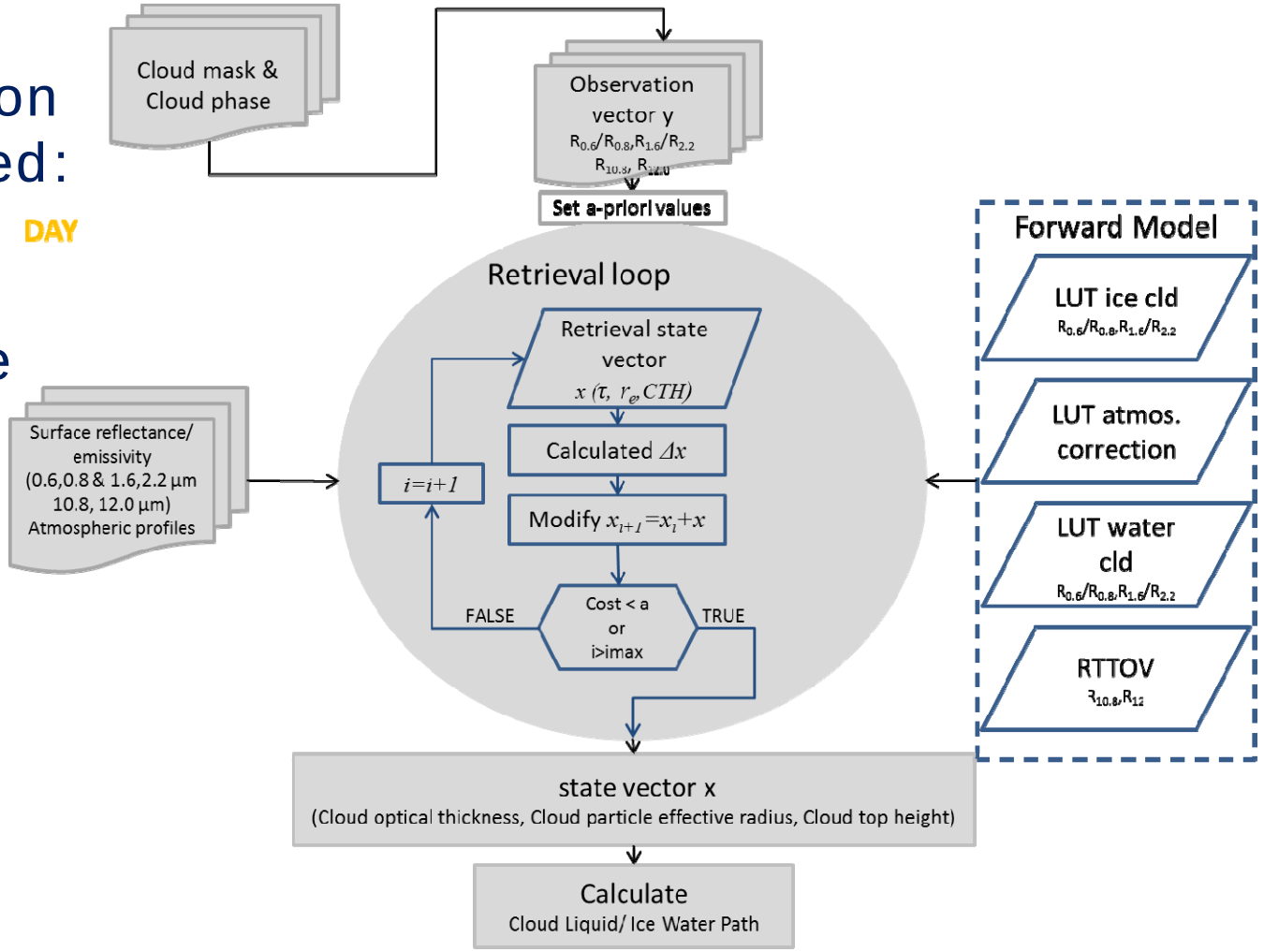
contact: anjah@tropos.de

MSI cloud optical and physical properties (COP)

Optimal estimation approach are used:

- Cloud optical thickness
- Cloud effective radius
- Cloud top temperature (height, pressure)

DAY



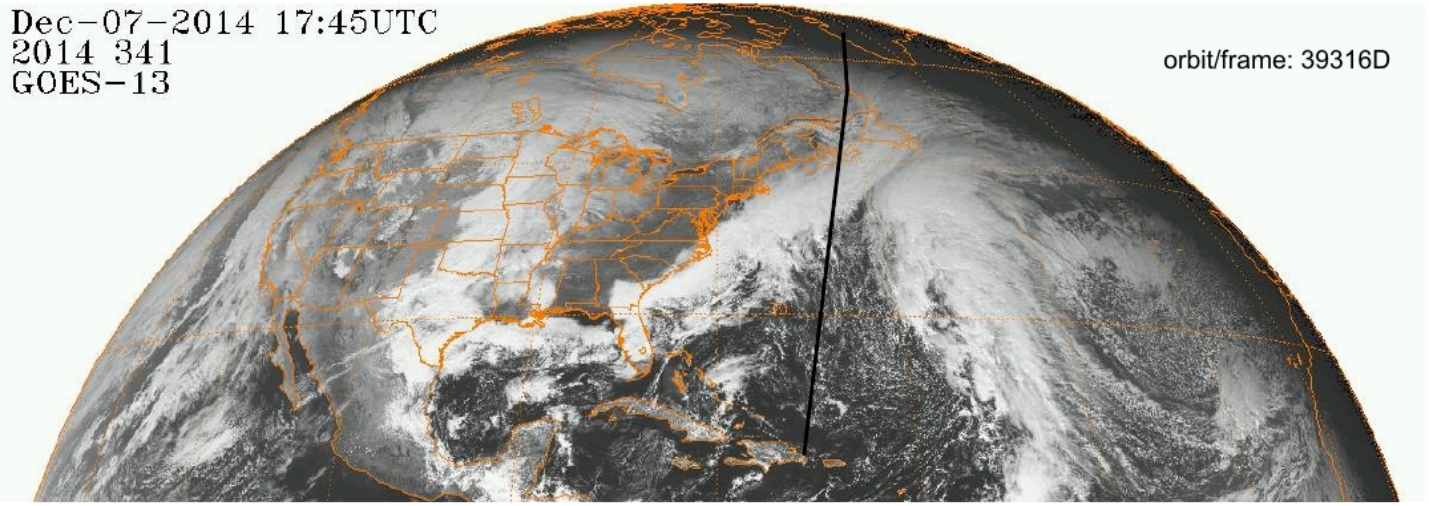
contact: anjah@tropos.de

EarthCARE simulated test scenes

Test scenes:

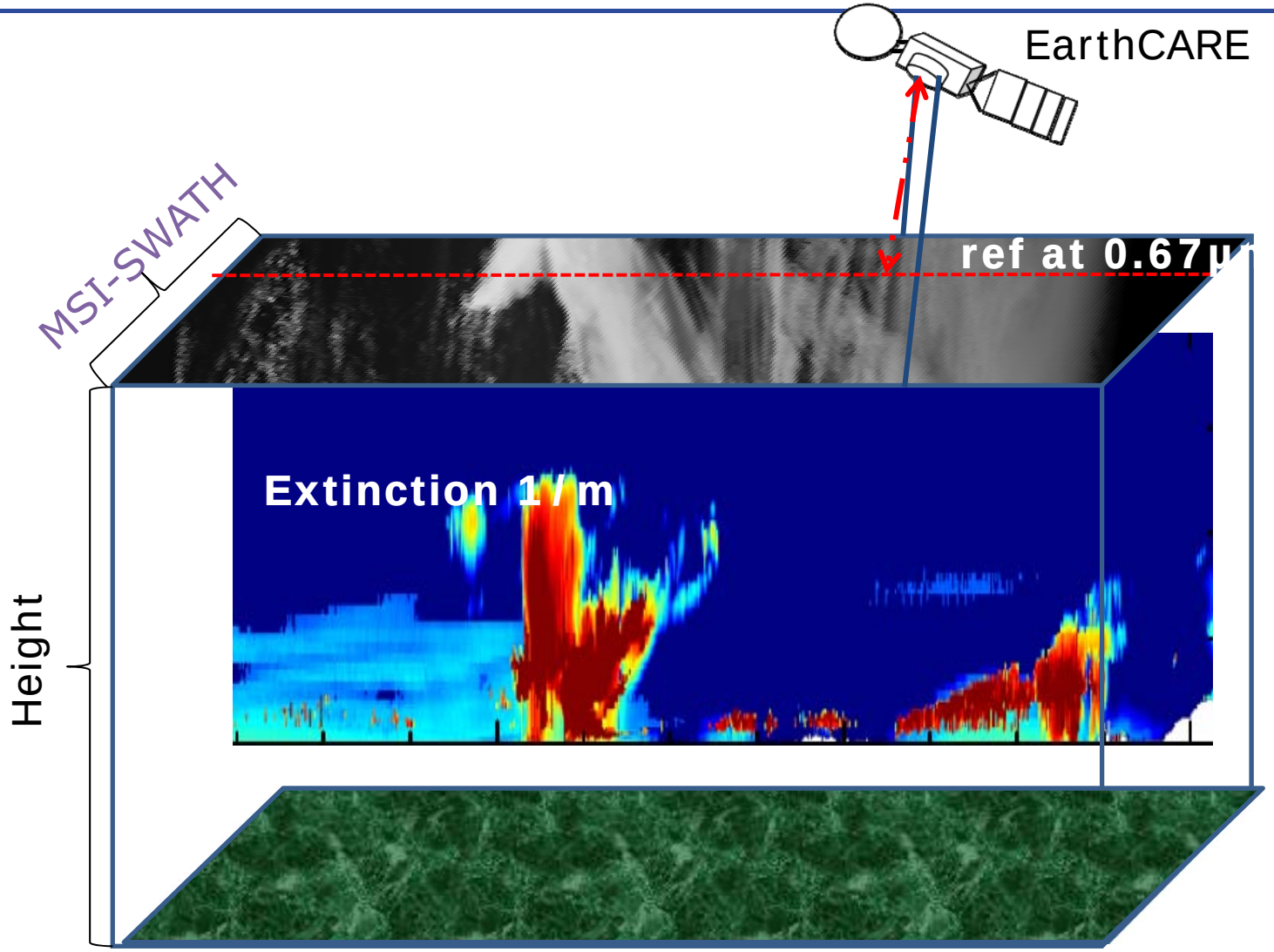
- instrument specific L1 simulation
- original frame size
- all EarthCARE instruments
- Possibility to test the entire flow of data through the production chains

HALIFAX scene



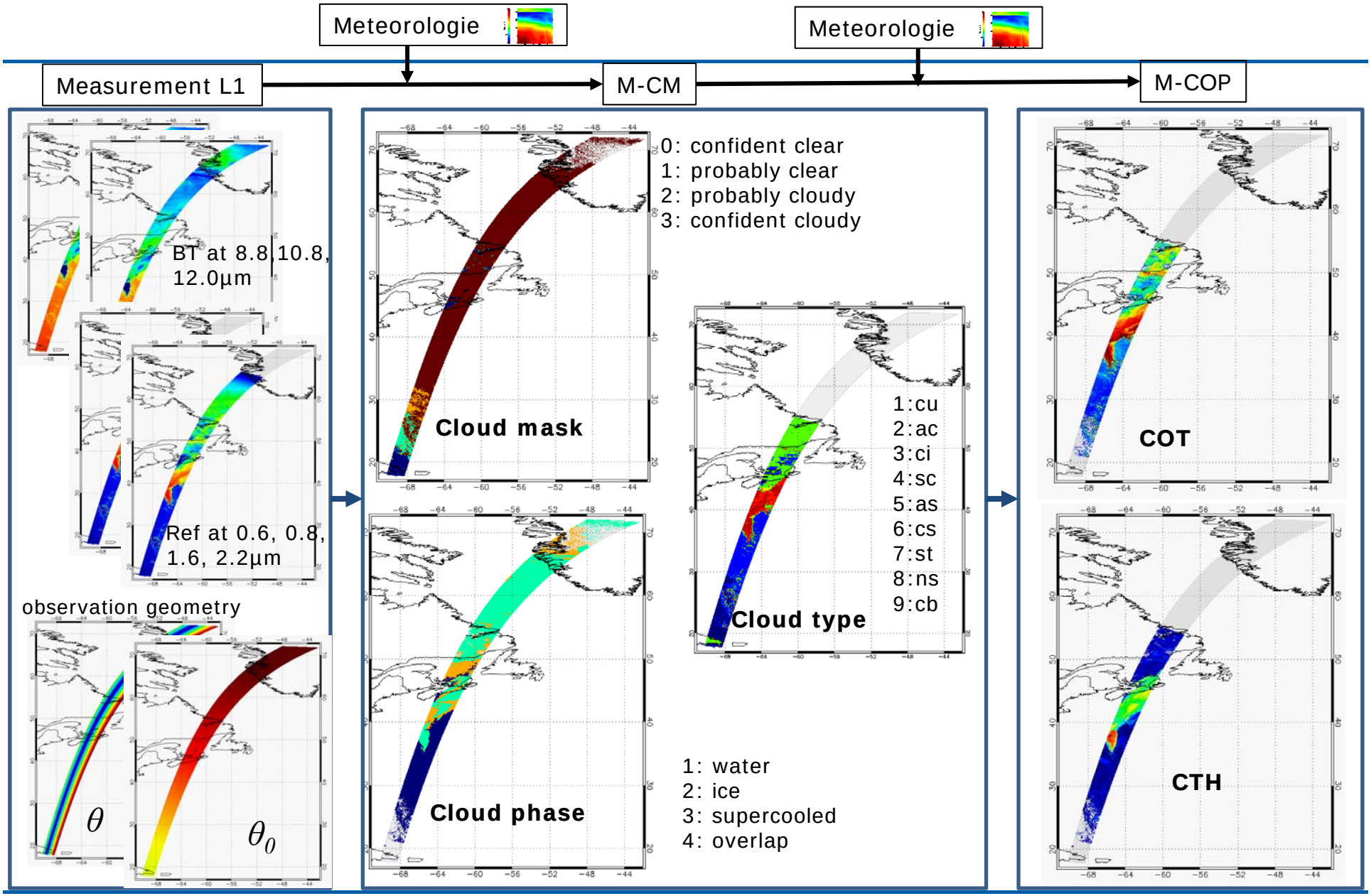
contact: anjah@tropos.de

HALIFAX - simulated measurments



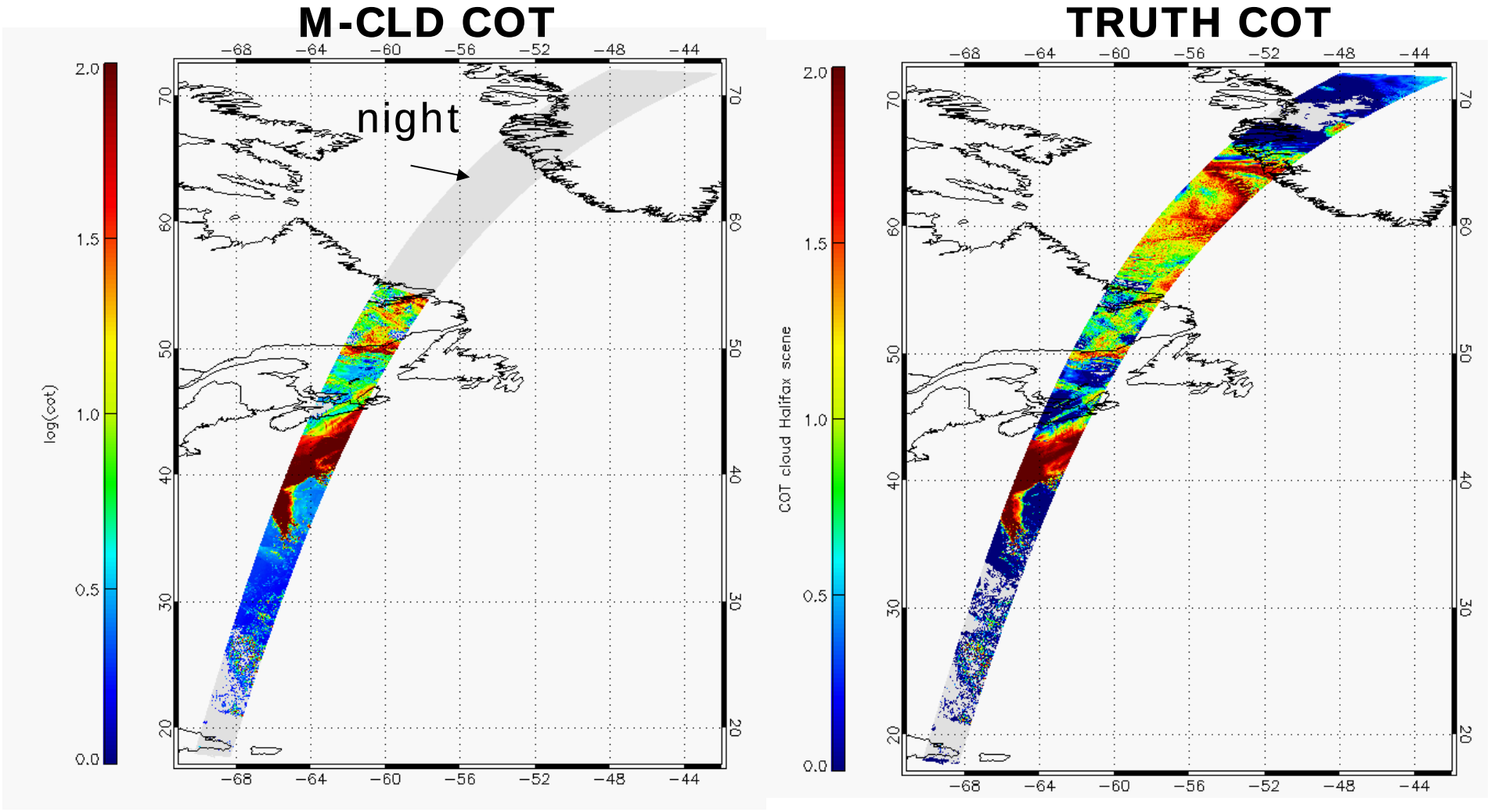
contact: anjah@tropos.de

HALIFAX scene for testing and validation



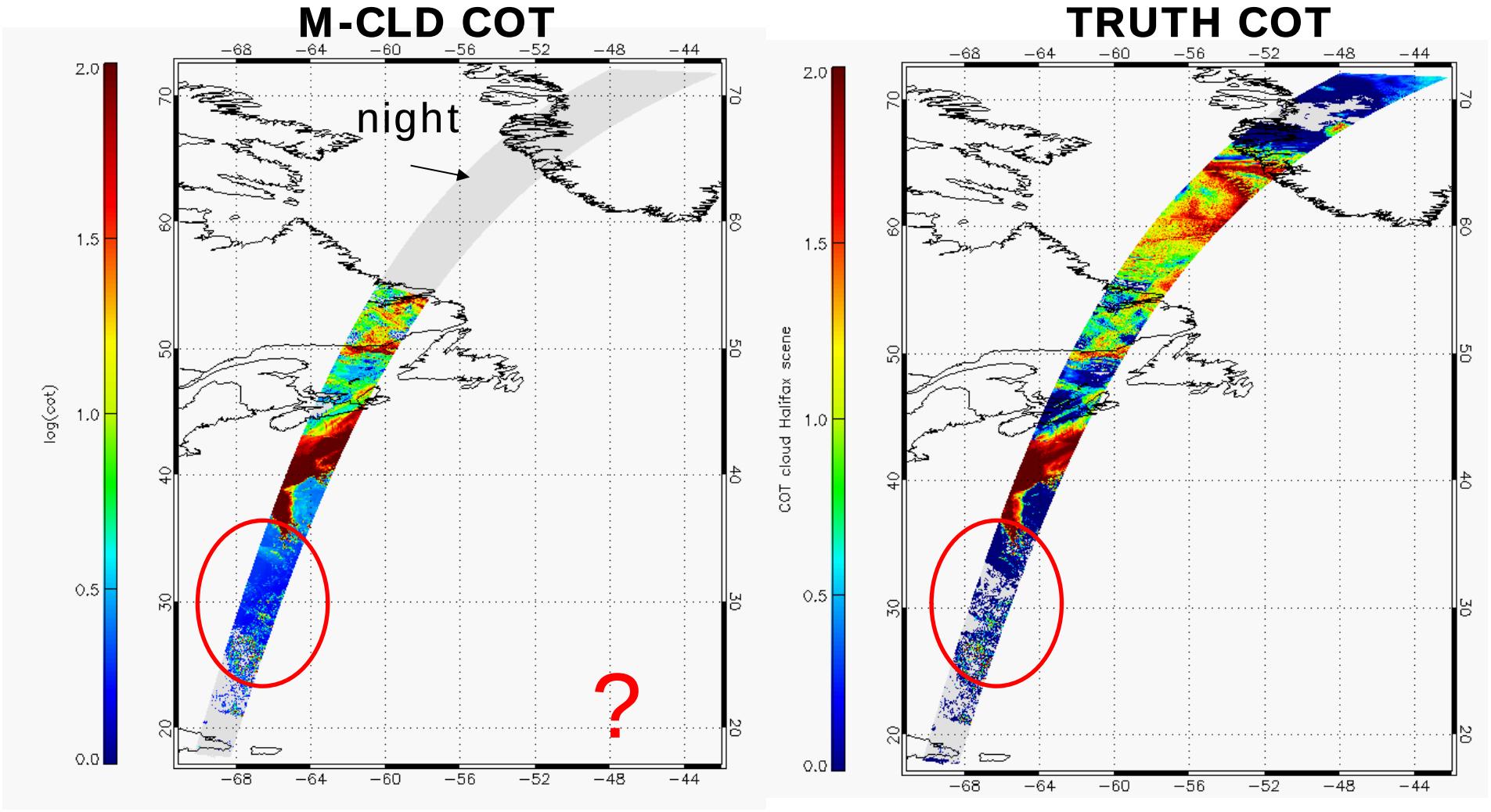
contact: anjah@tropos.de
TROPOS

HALIFAX scene for testing and validation



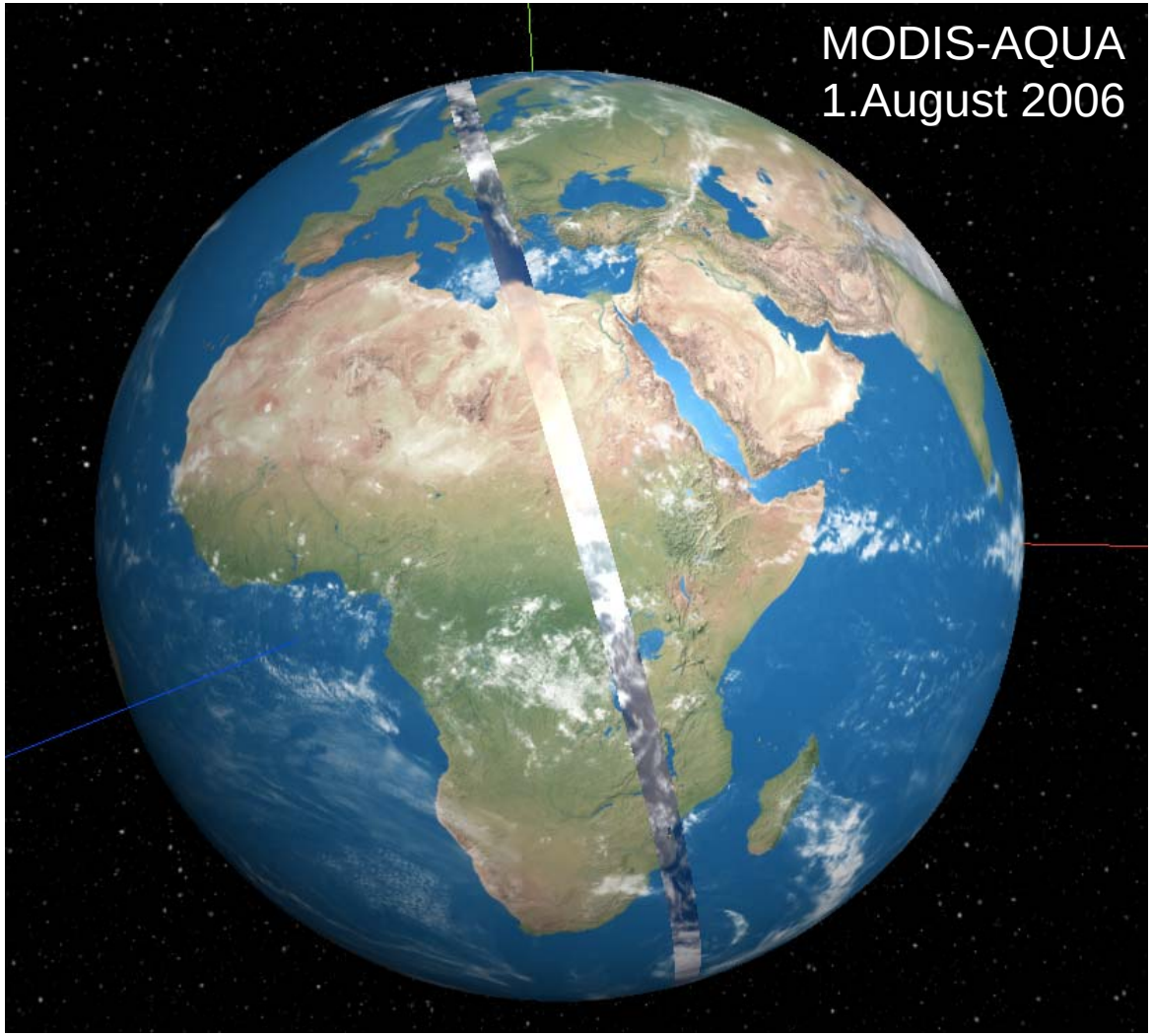
contact: anjah@tropos.de

HALIFAX scene for testing and validation



contact: anjah@tropos.de

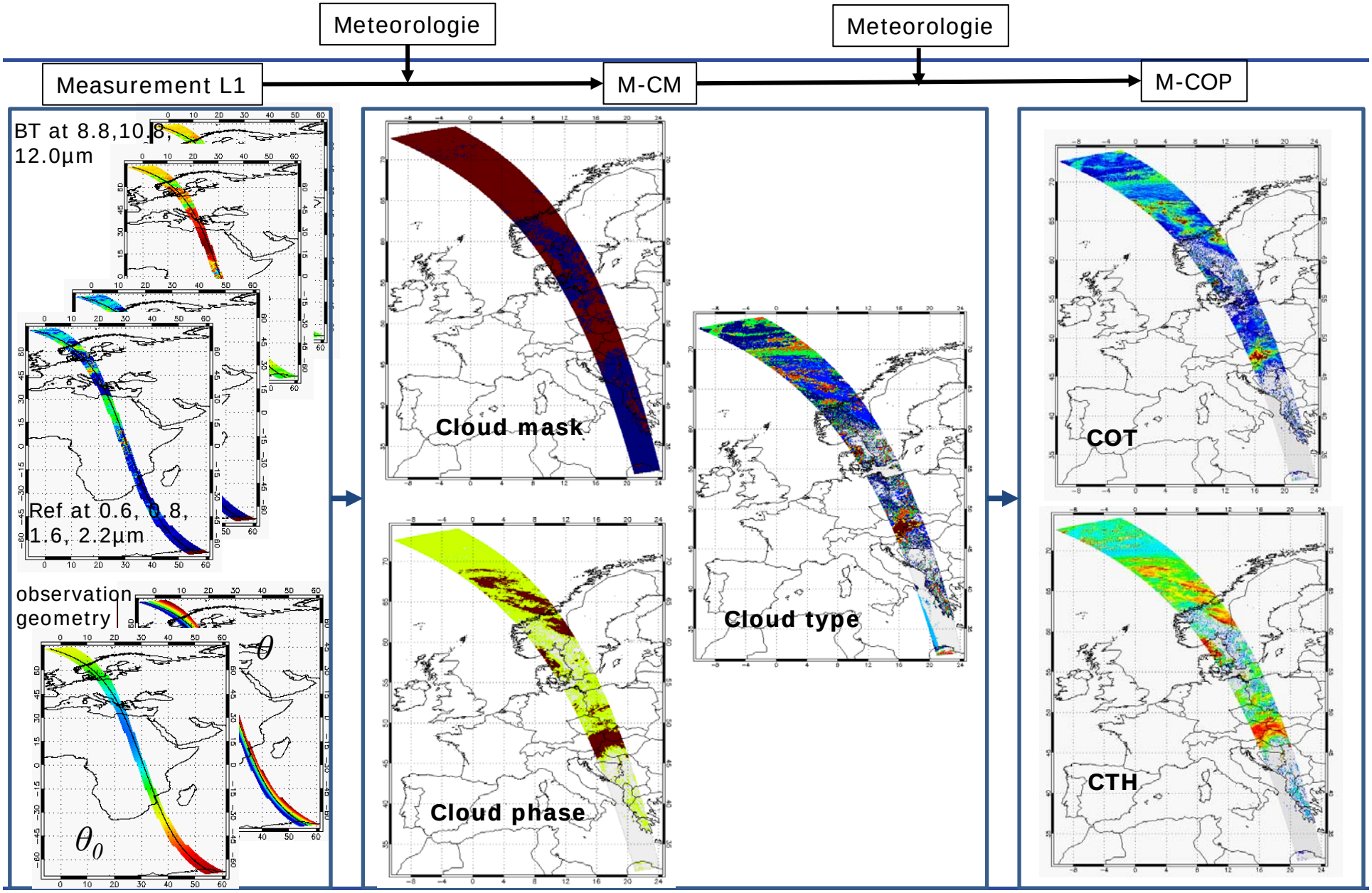
MODIS measurement for testing and validation



MODIS measurements on the a train

contact: anjah@tropos.de

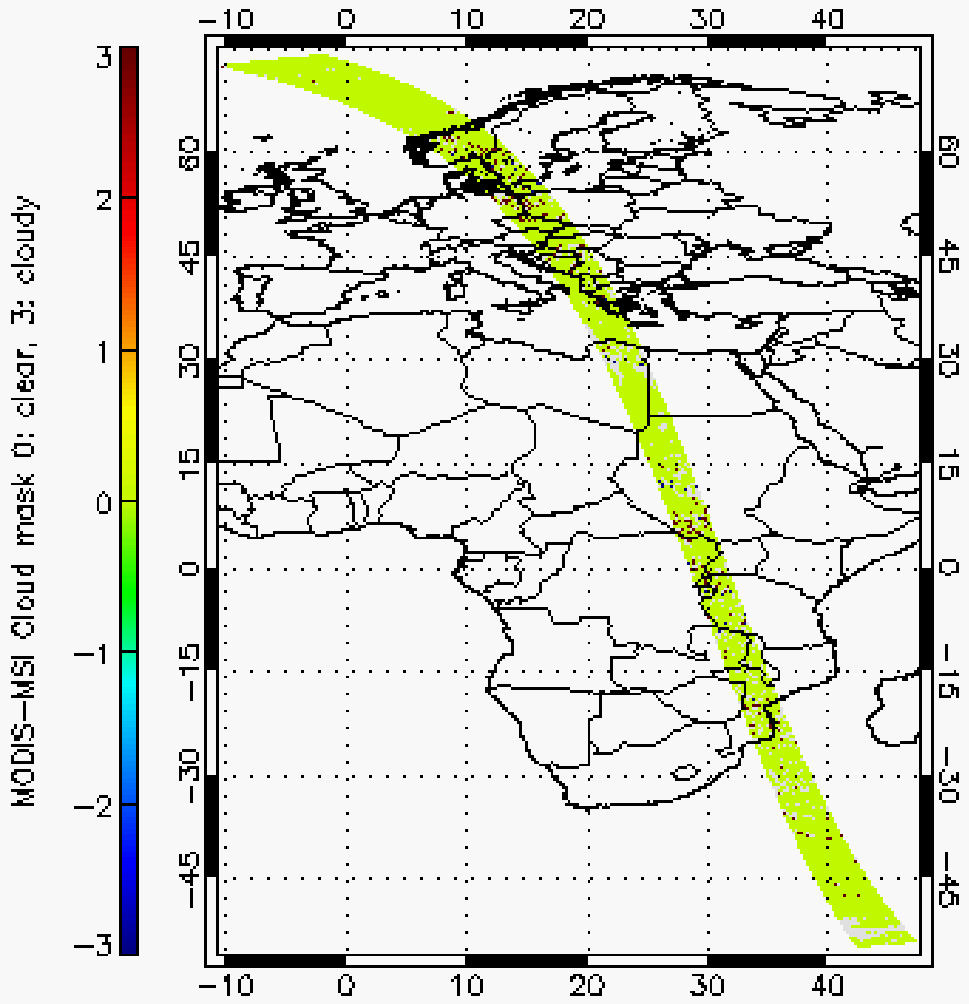
MODIS measurement for testing and validation



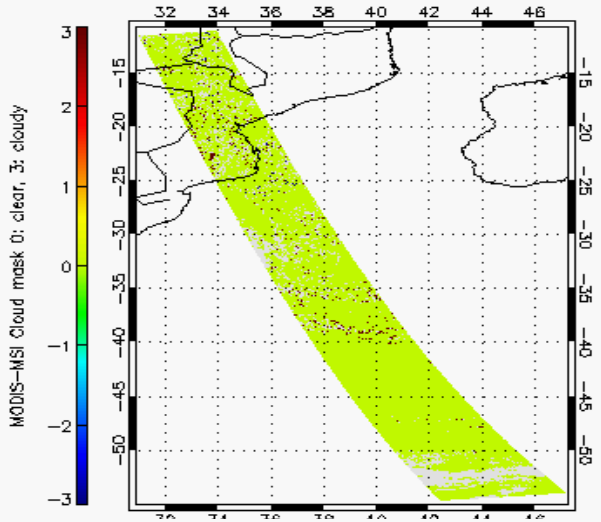
contact: anjah@tropos.de

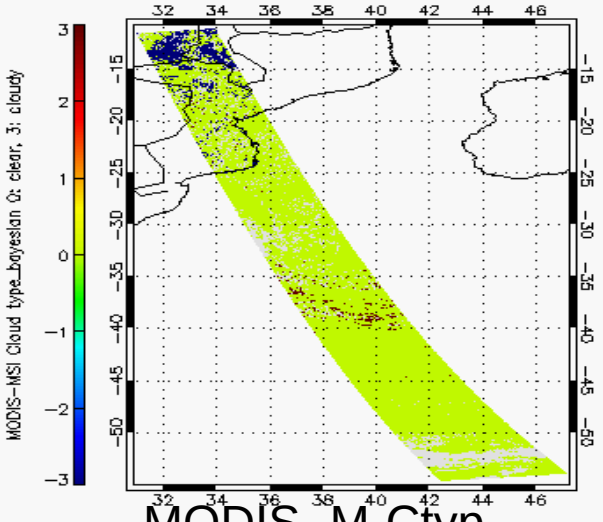
TROPOS

Comparison cloud masks with MODIS



MODIS-M-CF





MODIS- M-Ctyp

contact: anjah@tropos.de

Comparison cloud masks with MODIS

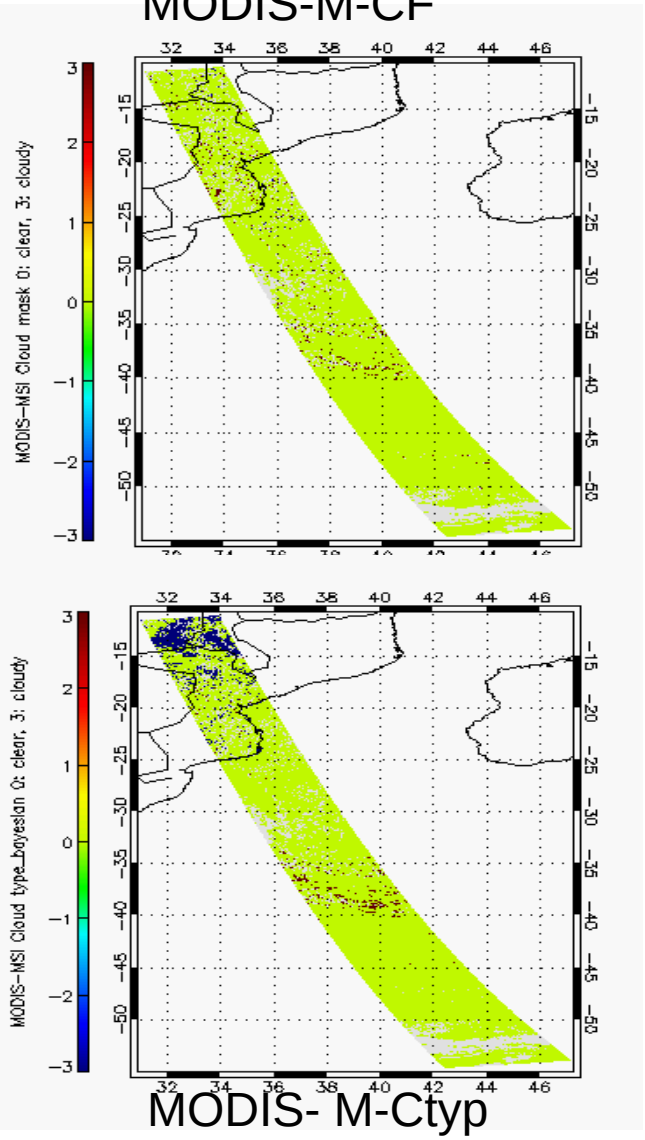
MODIS vs M_CF based
83,3% agreed (12.1 % MODIS uncertain)

M_CF vs M_Ctyp based
84% agreed
13.2% cloud while threshold based -> no cloud
2.5% no cloud while threshold based -> cloud
-> Bayesian more clouds

M_Ctyp vs MODIS
77% agreed
7.2% cloud while MODIS -> no cloud
2.8% no cloud while MODIS -> cloud

M_CF+M_Ctyp combined vs MODIS
80% agreed
1.3% cloud while MODIS -> no cloud
0.5% no cloud while MODIS -> cloud
6.8% combined mask uncertain

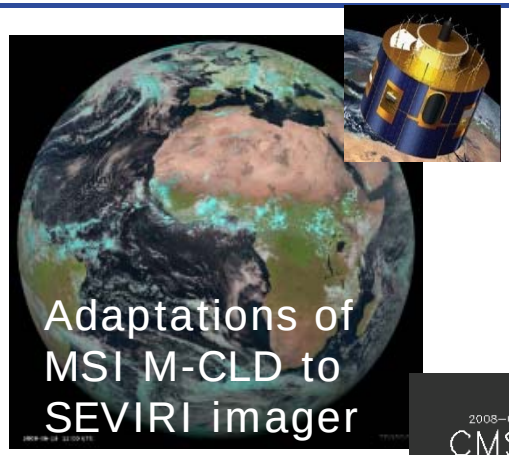
MODIS-M-CF



MODIS- M-Ctyp

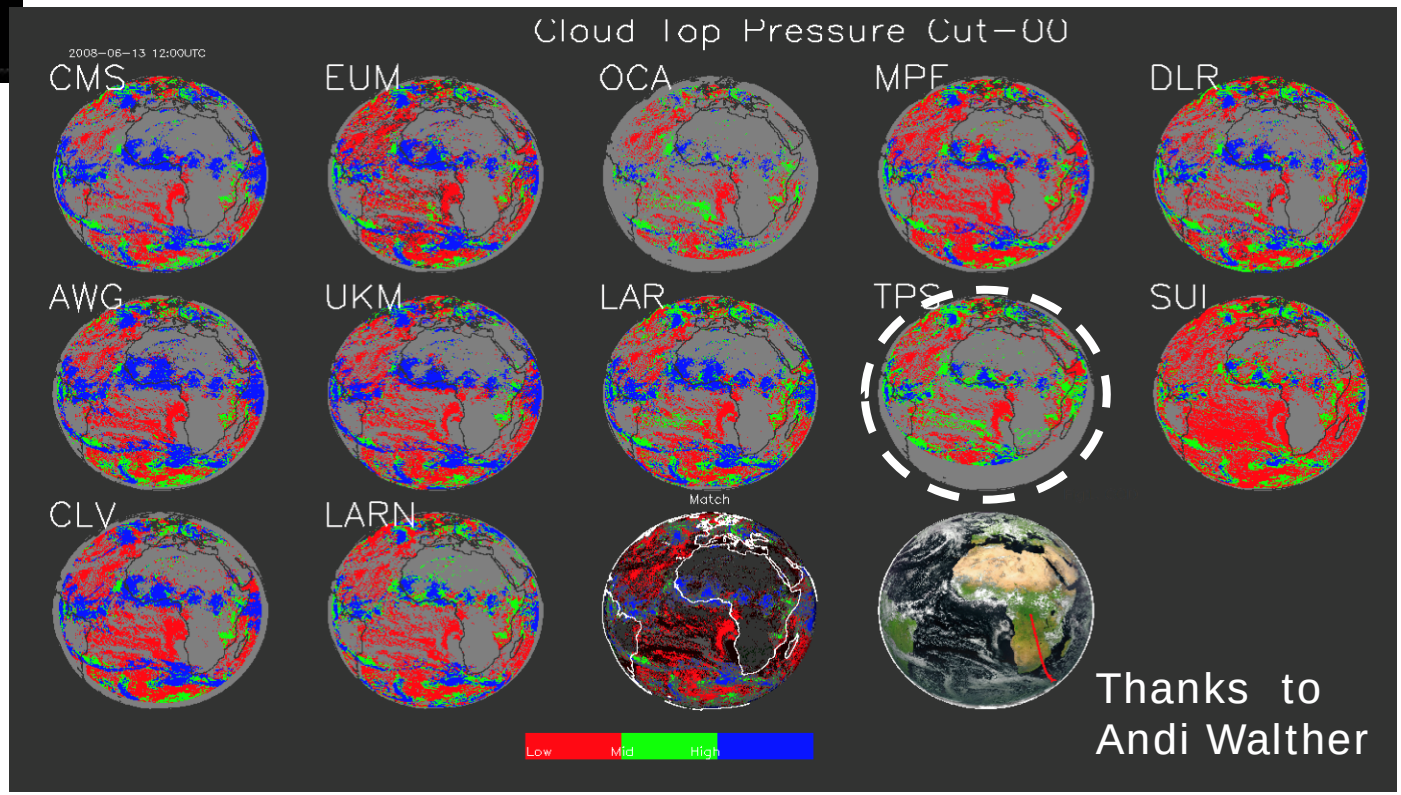
contact: anjah@tropos.de

SEVIRI, ICWG golden days



Used:

- ECMWF forecaste data
- Thresholds and LUT are not adapted
- Still the cloud mask -> sunglint detection not yet improved/adapted for SEVIRI



contact: anjah@tropos.de

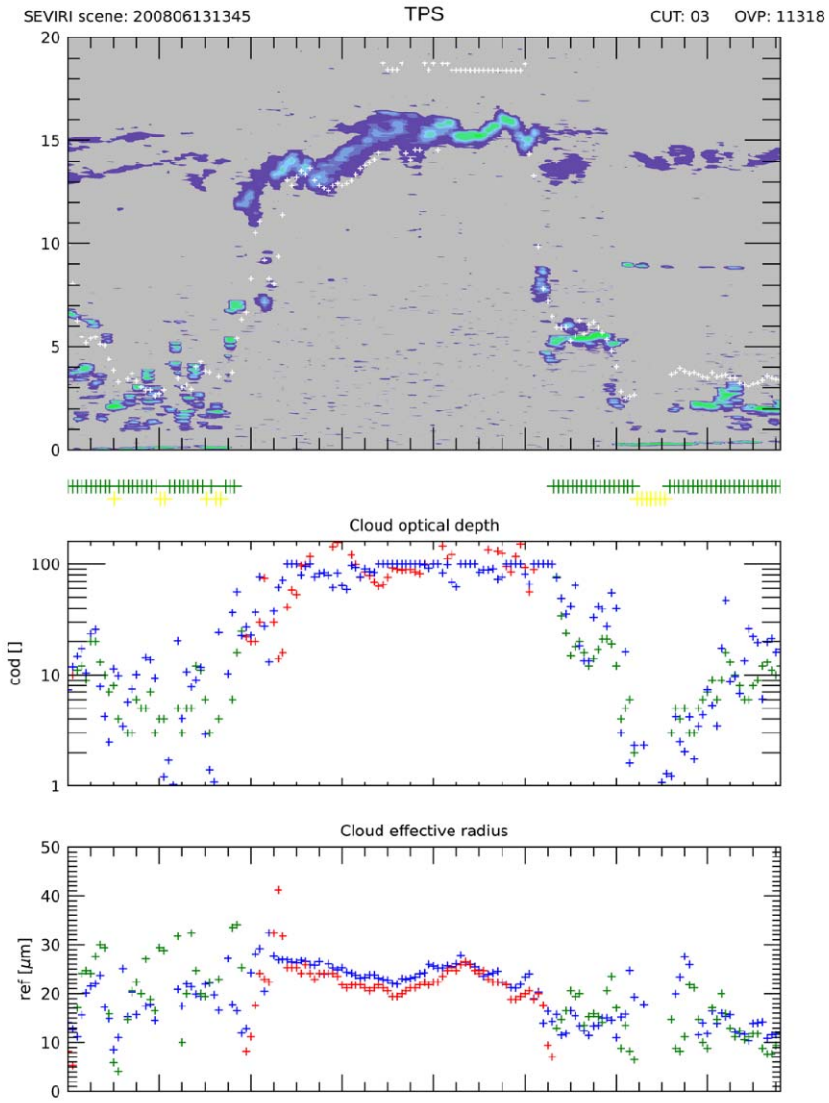
SEVIRI, ICWG golden days

M-COP on SEVIRI

MODIS

water

ice



contact: anjah@tropos.de

TROPOS

Summary

- Scenes generated by the GEM cloud-resolving model provide an invaluable opportunity to test algorithms and chain of EarthCARE
- Several further cases are being generated and will allow for other cloud types to be tested
  - But we should be careful not to tune the retrieval to the assumptions made in the GEM model!
- A lot of the efforts has go towards technical issues ➔scientific testing lagging somewhat

- Learning from ICWG Cloud retrieval assessment
- MODIS scenes for testing
  - Work on error calculation and quality flags
  - Improvement on the algorithm

contact: anjah@tropos.de