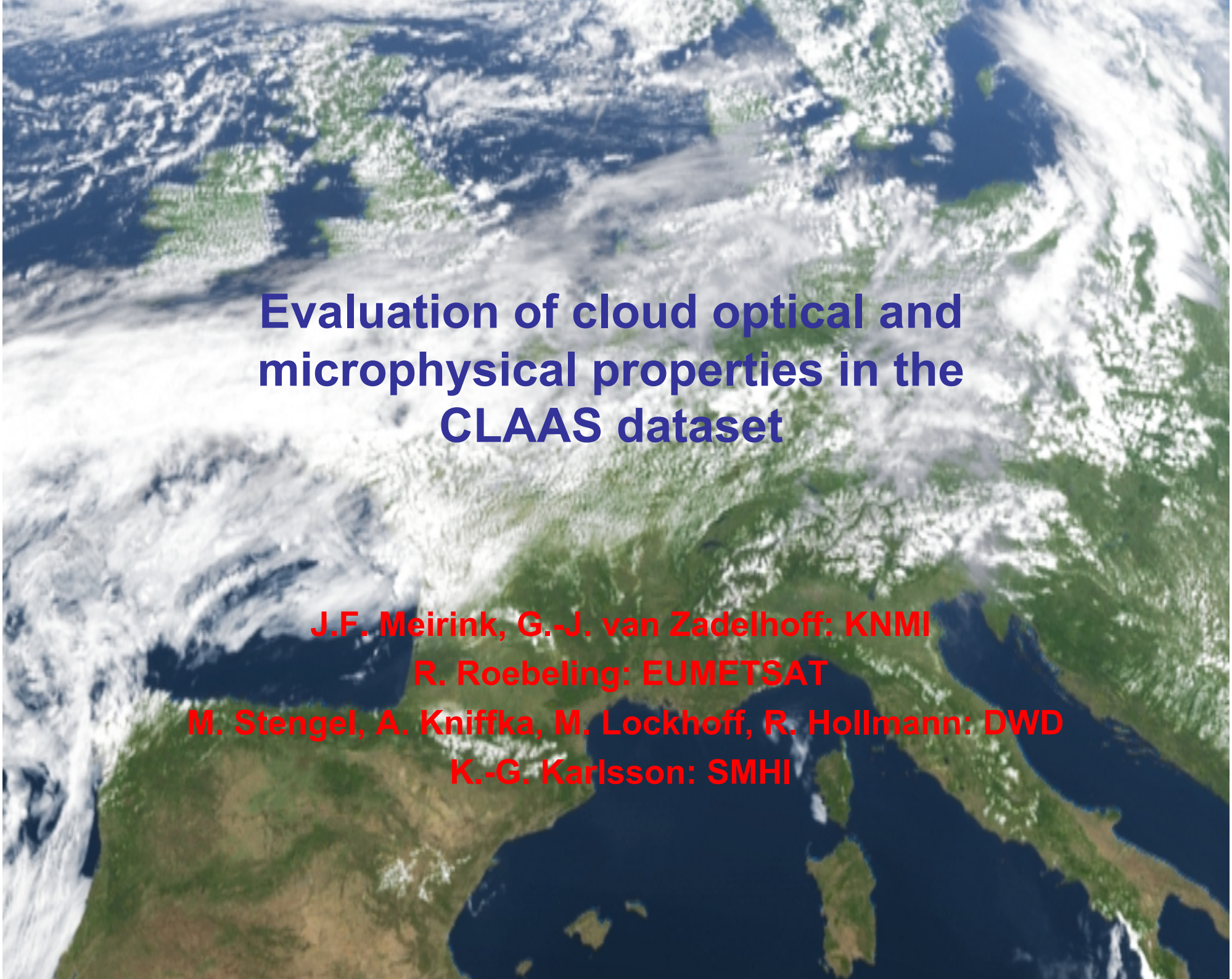


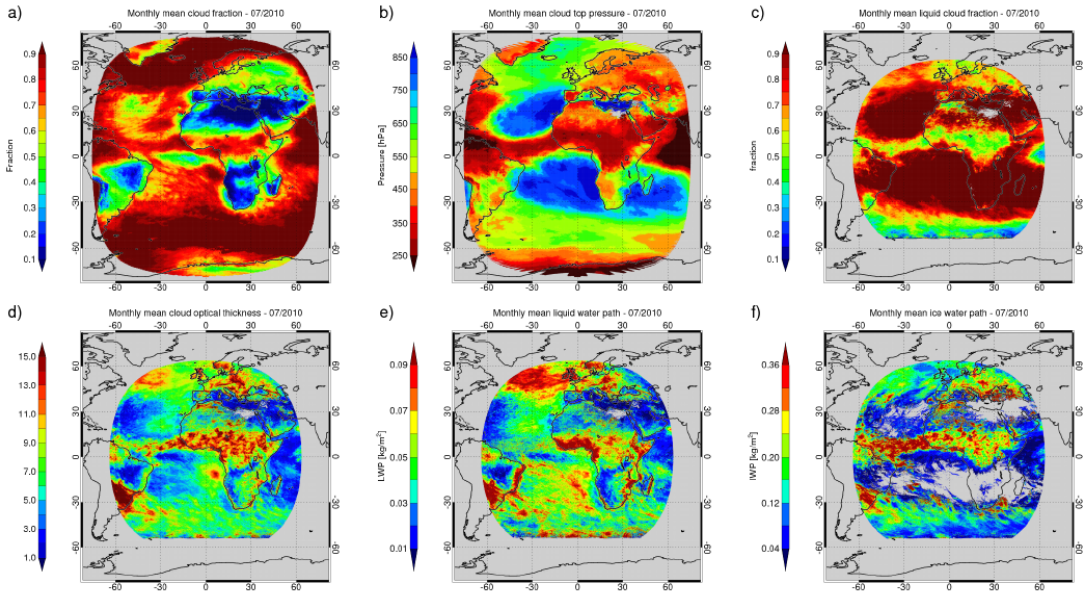
Evaluation of cloud optical and microphysical properties in the CLAAS dataset

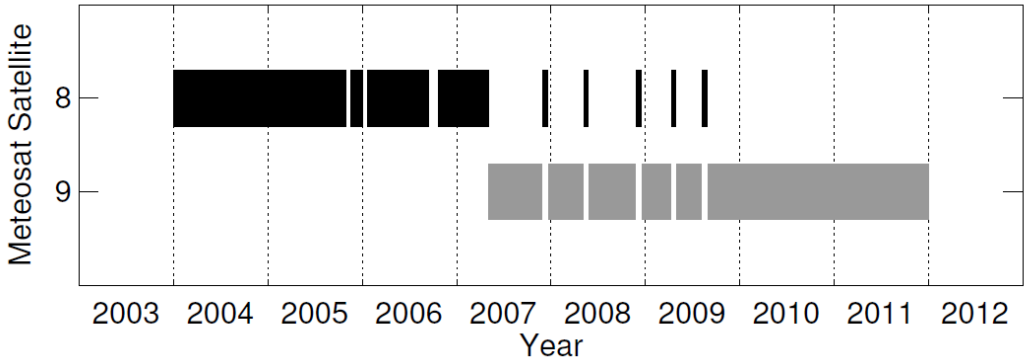
J.F. Meirink, G.-J. van Zadelhoff: KNMI
R. Roebeling: EUMETSAT
M. Stengel, A. Kniffka, M. Lockhoff, R. Hollmann: DWD
K.-G. Karlsson: SMHI

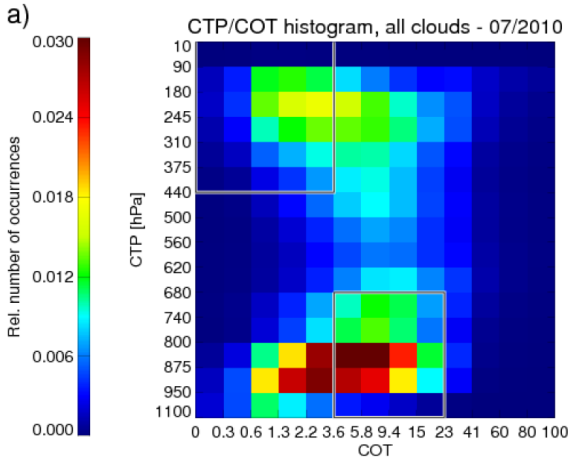
Goal

- Evaluate/characterize daytime cloud properties of a new MSG-SEVIRI based dataset
- Use MODIS as main reference
  - Stable, well-calibrated instrument
  - Mature cloud algorithms, much-used products
  - Terra+Aqua somewhat resemble daily mean
- Use Microwave-based LWP for marine Sc clouds in addition

CLAAS (**Cl**oud property d**a**t**a**set using **S**EVIRI)







- 2004-2011
- Instantaneous (hourly)
- daily/monthly mean
- m.m. diurnal cycle
- www.cmsaf.eu

Stengel et al., ACPD, 2014

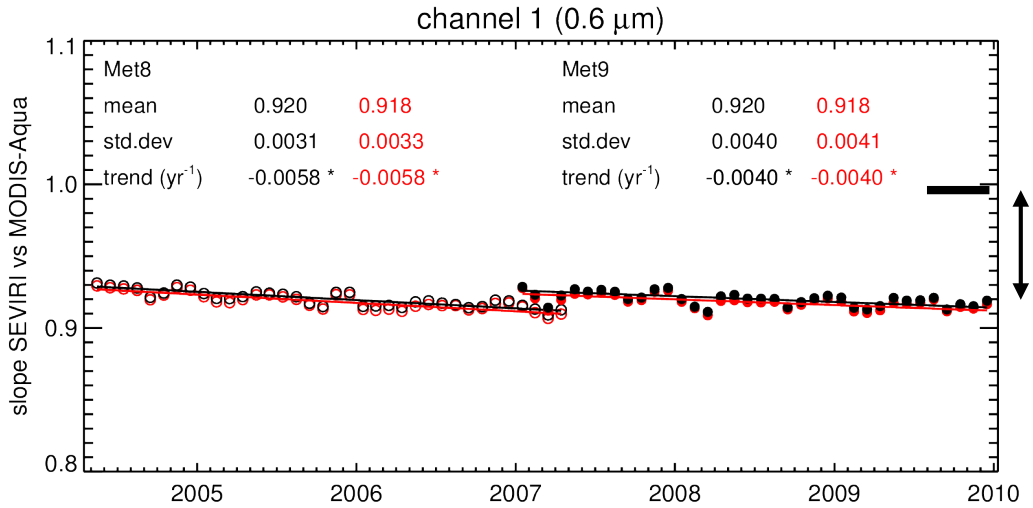
Algorithms

- NWC SAF MSGv2010 (Meteo France)
  - Cloud fraction
  - Cloud-top height
- CPP (KNMI)

  Classical Nakajima-King using 0.6 and 1.6 μm
  - Cloud-top phase (uses also 10.8 μm)
  - Cloud optical thickness
  - Cloud-top particle effective radius
  - Liquid / ice water path

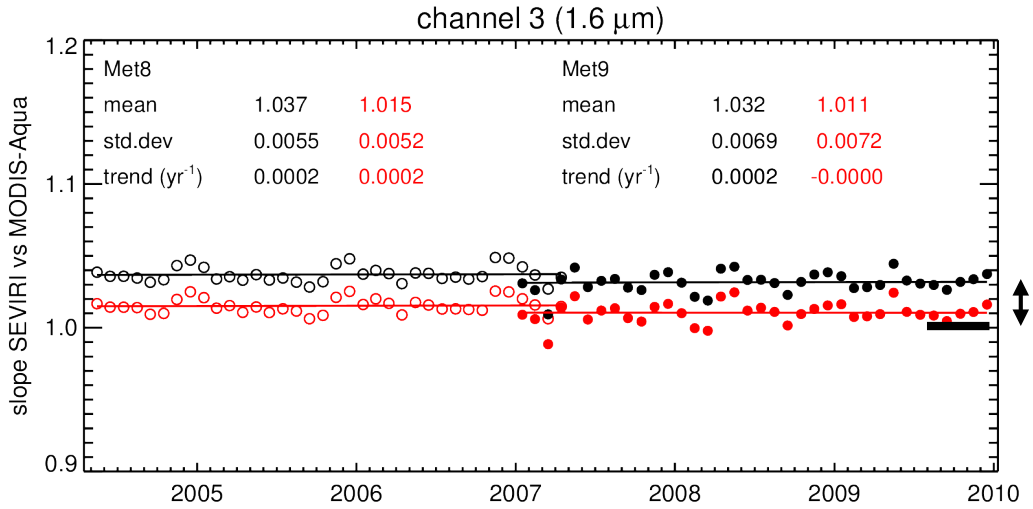
Calibration shortwave with MODIS-Aqua

0.6 μm



-8 %

1.6 μm

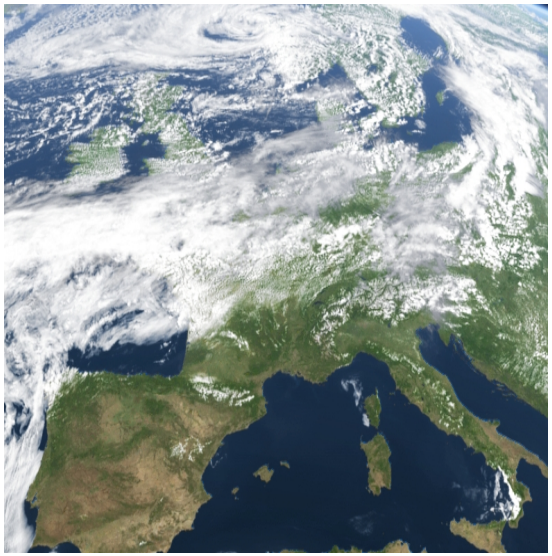


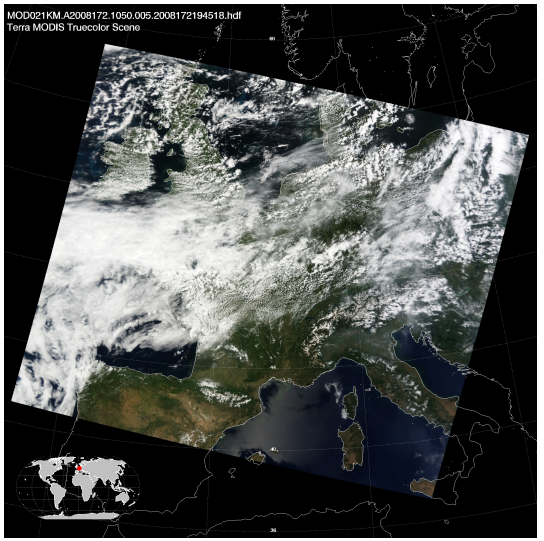
+3.5 %

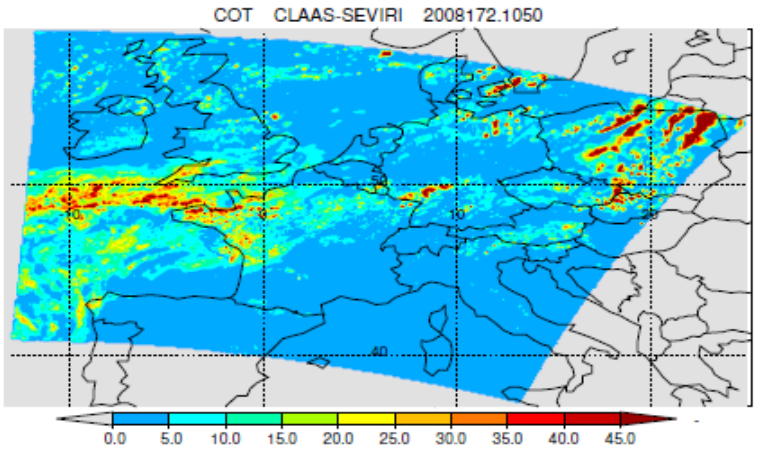
Meirink et al., AMT, 2013

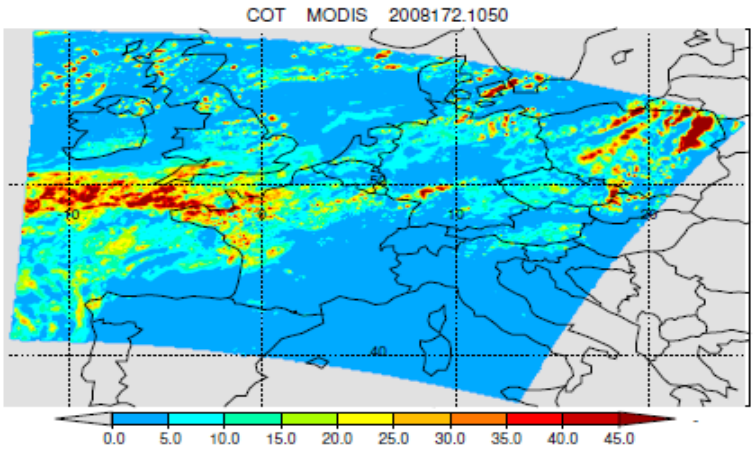
Evaluation with MODIS: level-2 example

SEVIRI 20/06/2008, 10:50 UTC MODIS

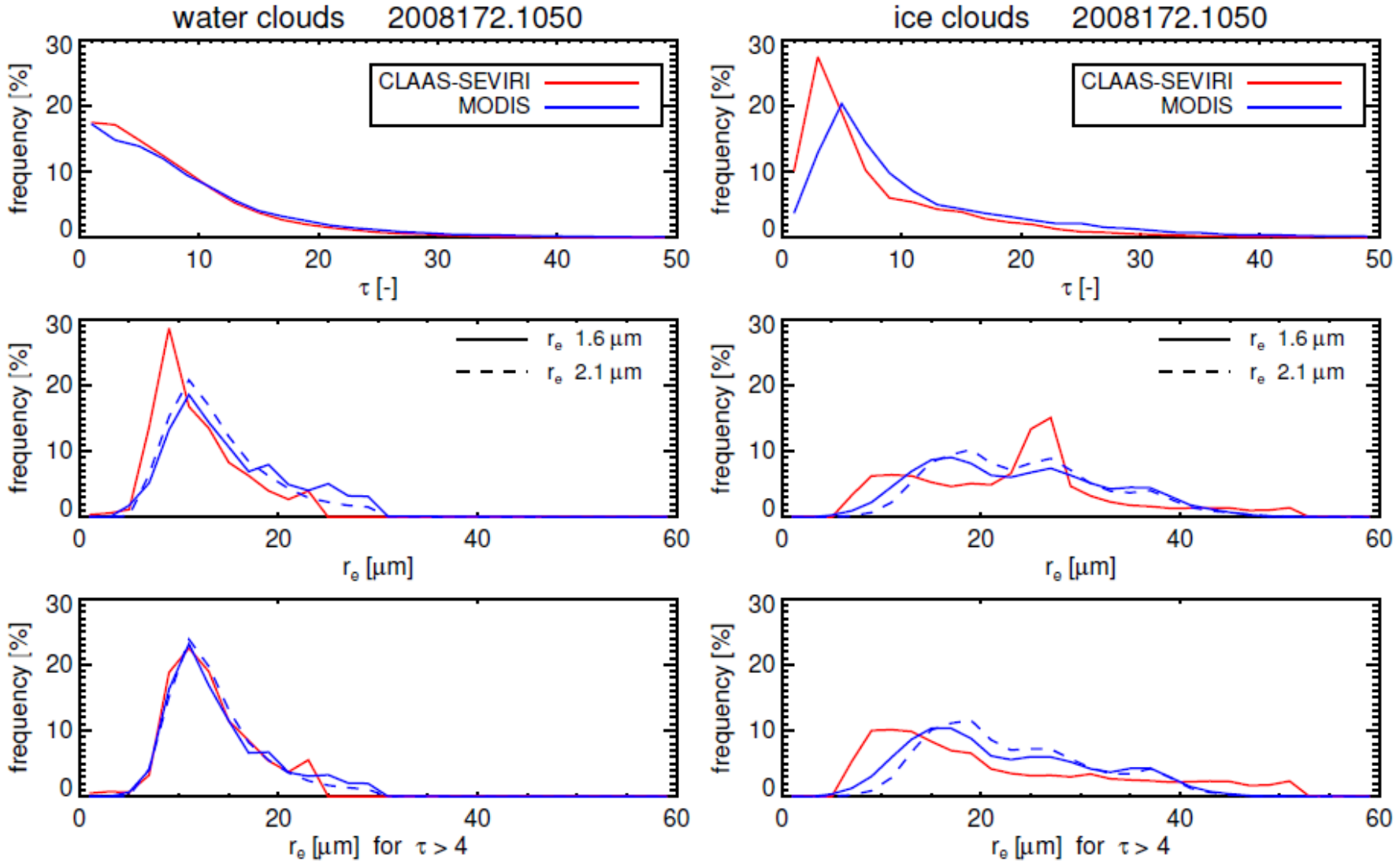






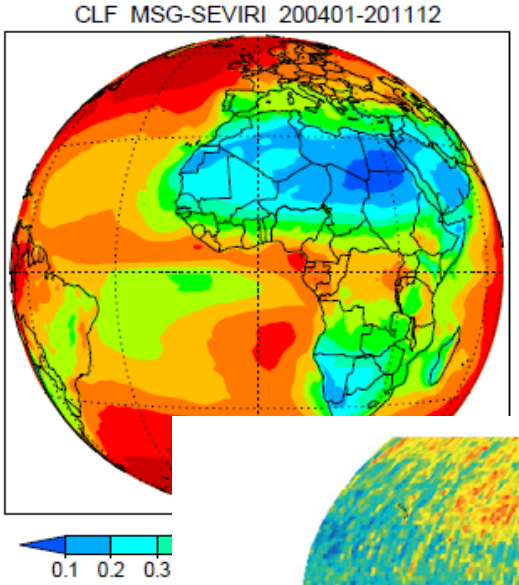


Histograms

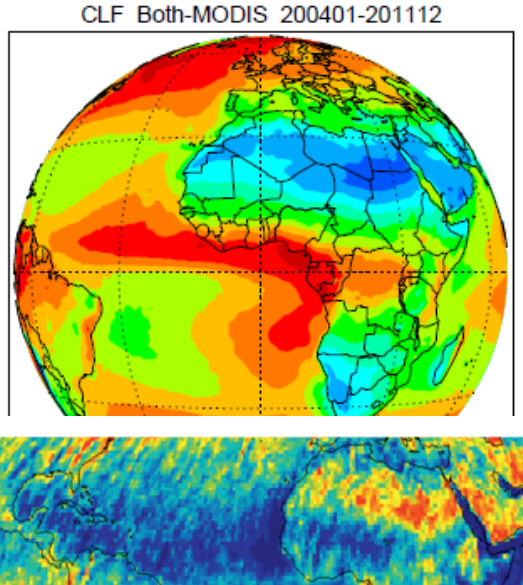

water clouds 2008172.1050
ice clouds 2008172.1050
CLAAS-SEVIRI
MODIS
frequency [%]
τ [-]
r_e 1.6 µm
r_e 2.1 µm
r_e [µm]
r_e [µm] for τ > 4

Averages 2004-2011

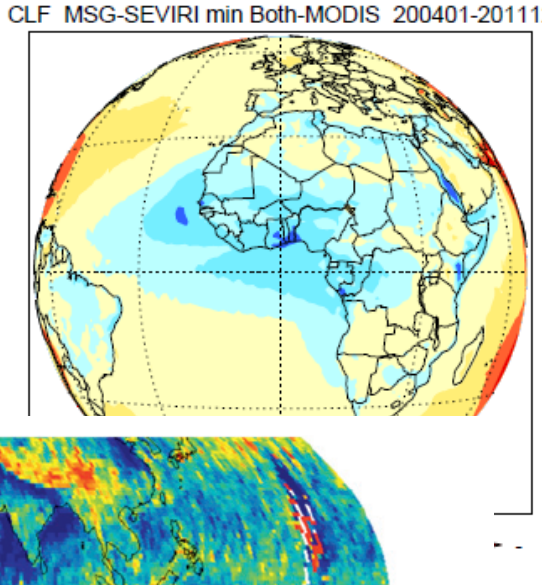
SEVIRI



MODIS ('mask')



SEVIRI - MODIS



Maddux et al., JTECH, 2010

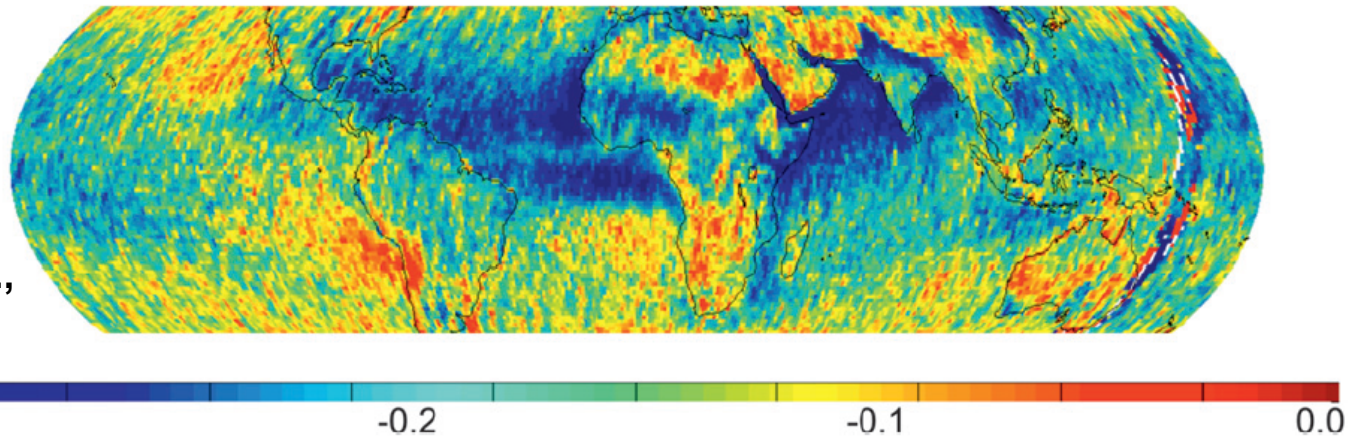
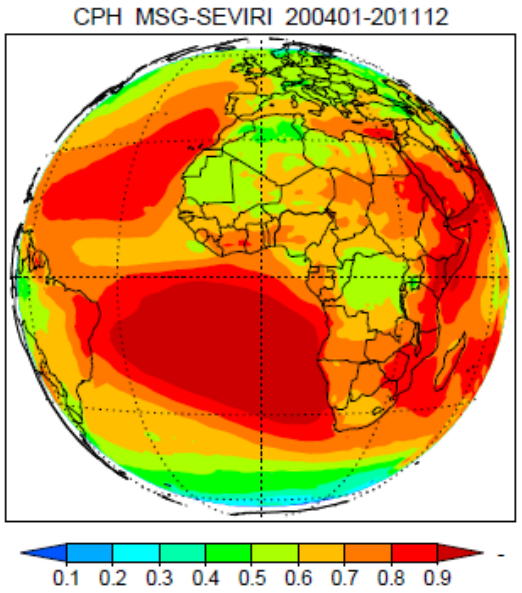


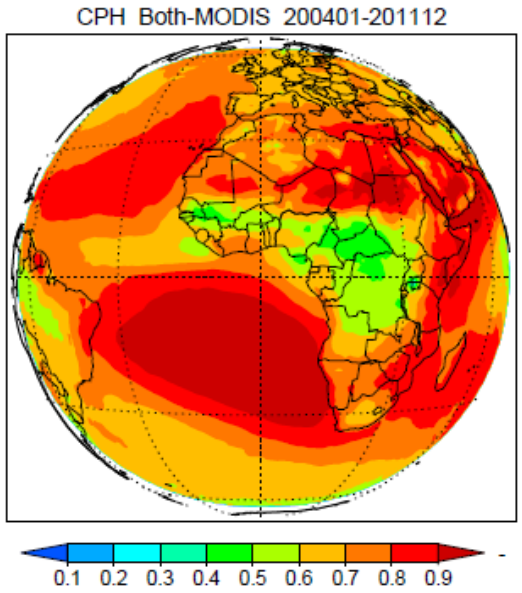
FIG. 3. The difference between the cloud fraction mean for 5 yr of *Terra* data from 2003–2007 for pixels observed for sensor zenith angles between nadir and 10° and pixels observed between 60° and the edge of scan.

Averages 2004-2011

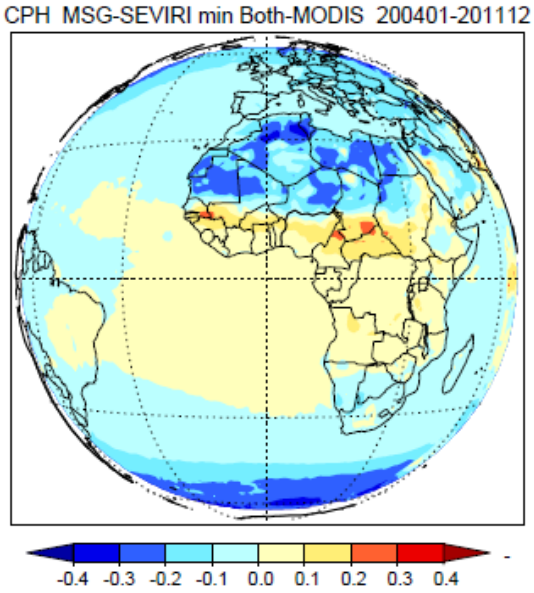
SEVIRI



MODIS (IR phase)



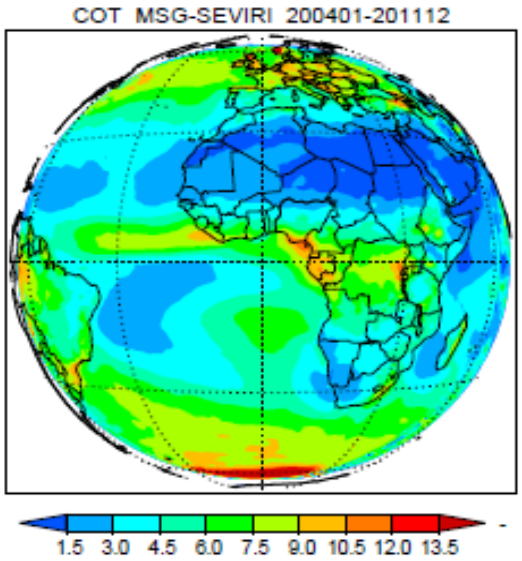
SEVIRI - MODIS



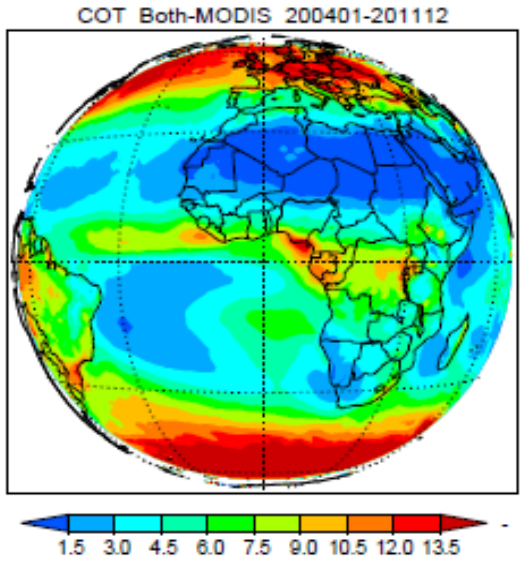
Daytime fraction of liquid water clouds

Averages 2004-2011

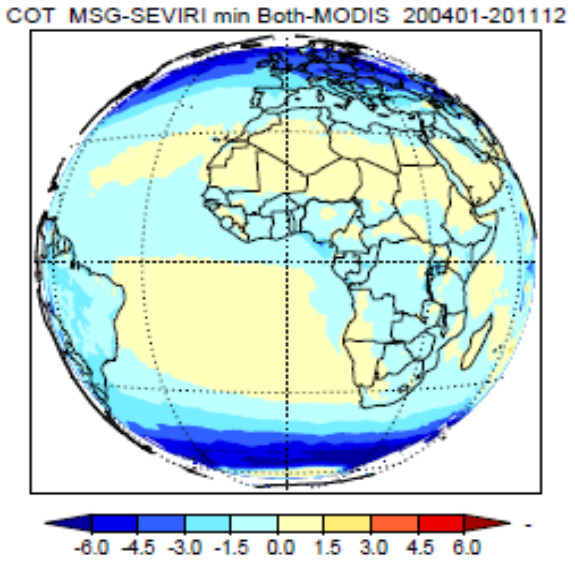
SEVIRI



MODIS

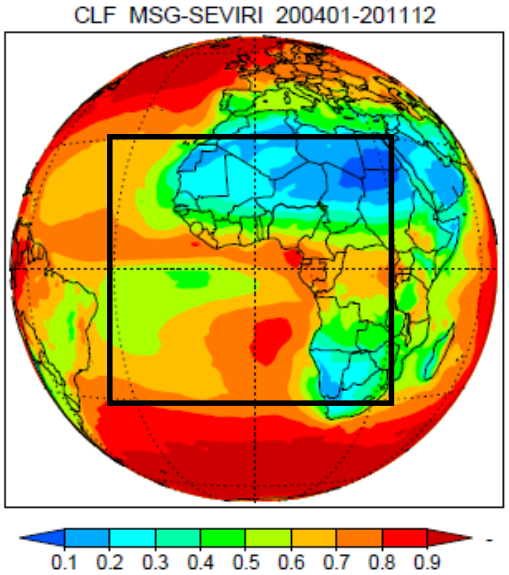


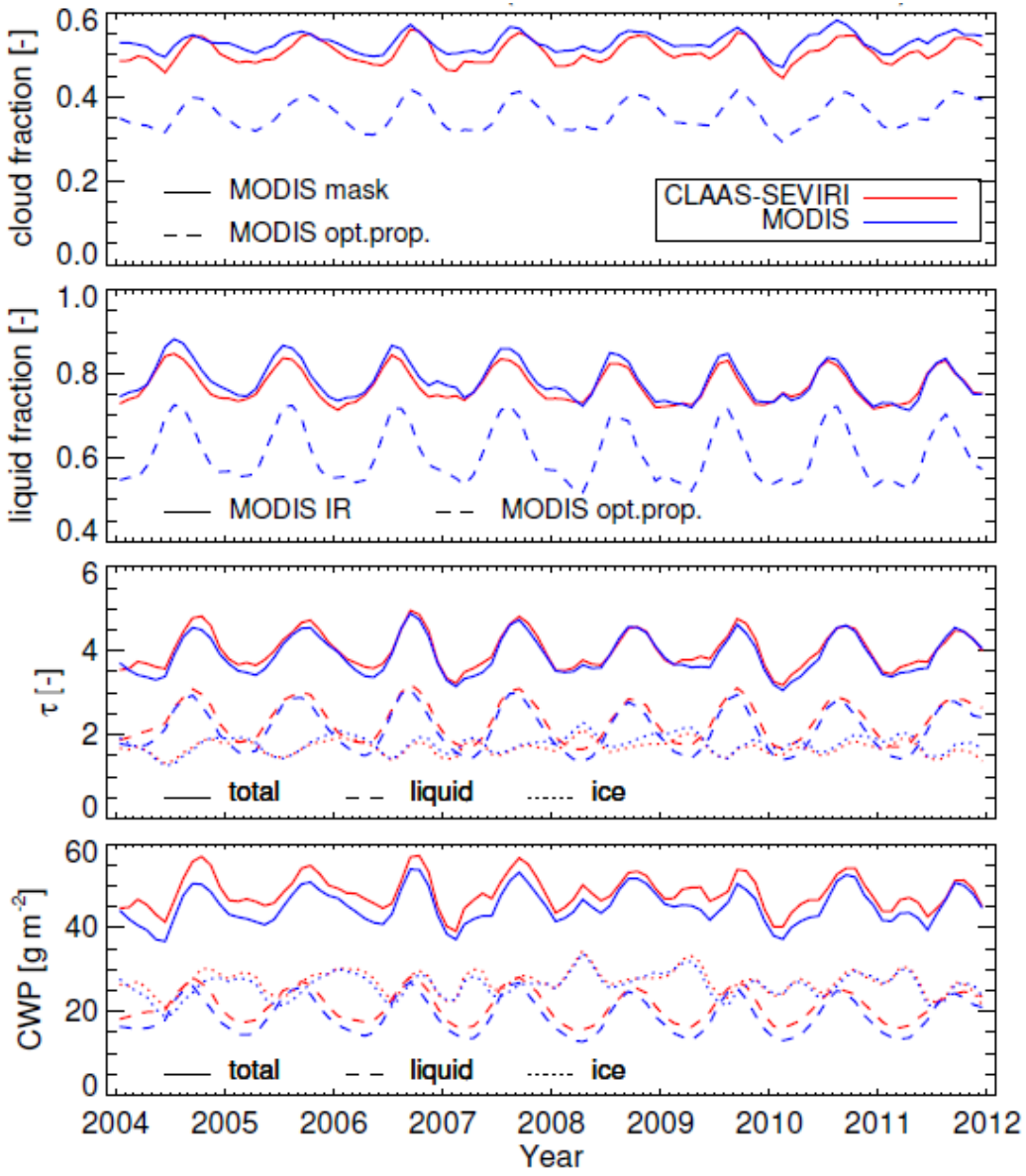
SEVIRI - MODIS



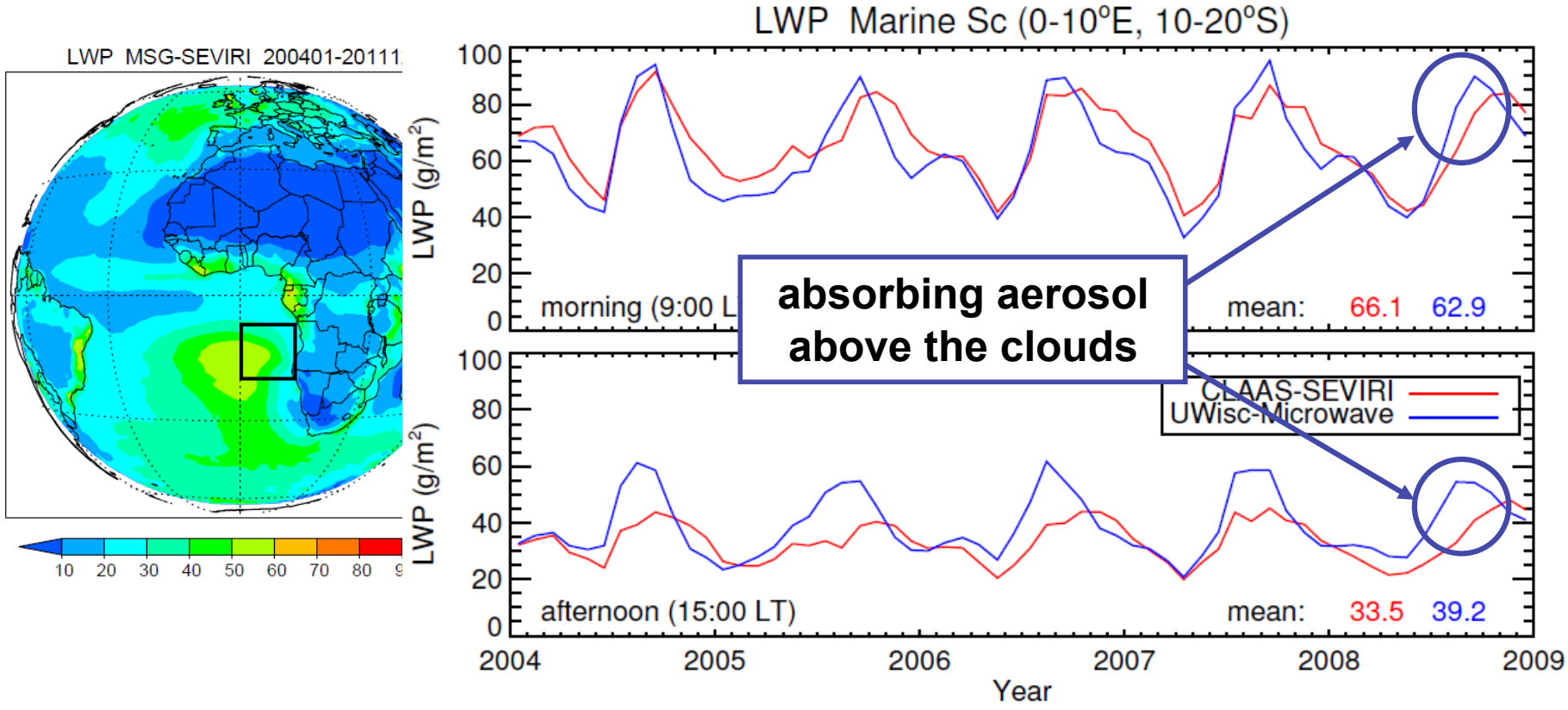
Cloud optical thickness (all-sky)

Time series

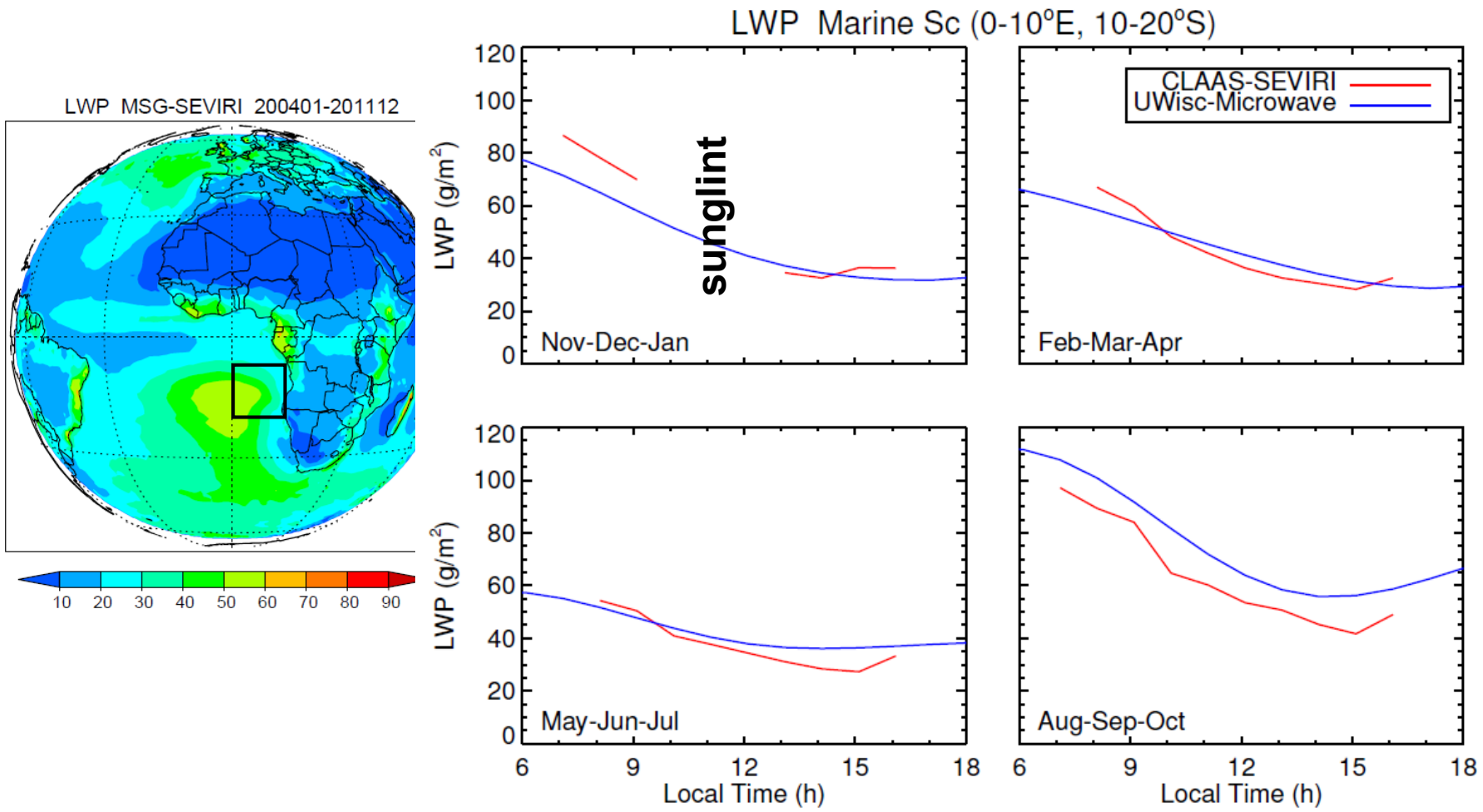

CLF MSG-SEVIRI 200401-201112
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9


cloud fraction [-]
MODIS mask
MODIS opt.prop.
CLAAS-SEVIRI
MODIS
liquid fraction [-]
MODIS IR
MODIS opt.prop.
τ [-]
total
liquid
ice
CWP [g m-2]
total
liquid
ice
2004 2005 2006 2007 2008 2009 2010 2011 2012
Year

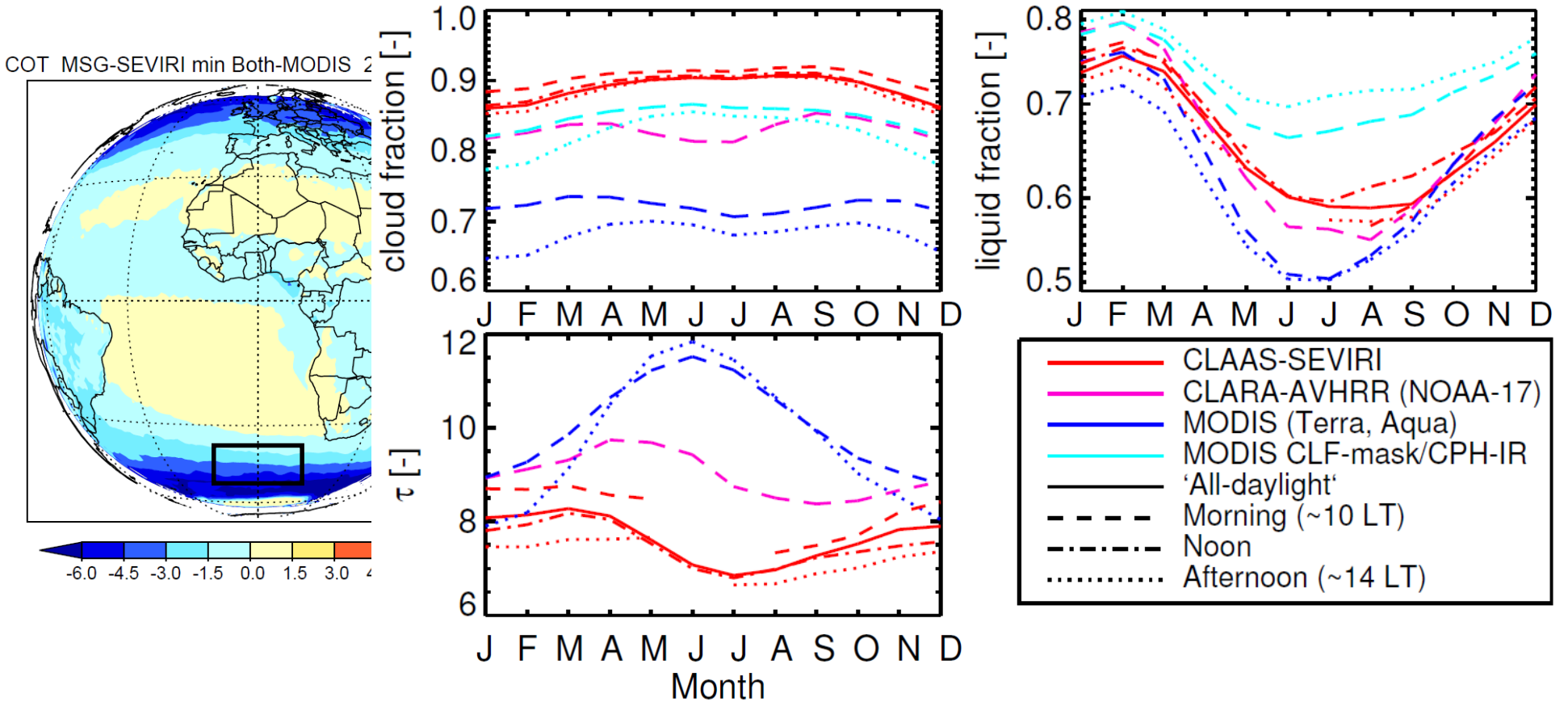
LWP stratocumulus



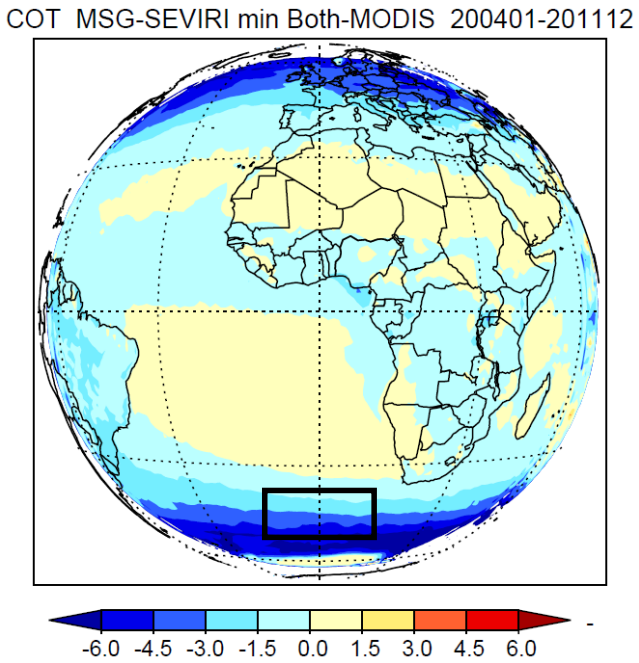
Diurnal cycle by season

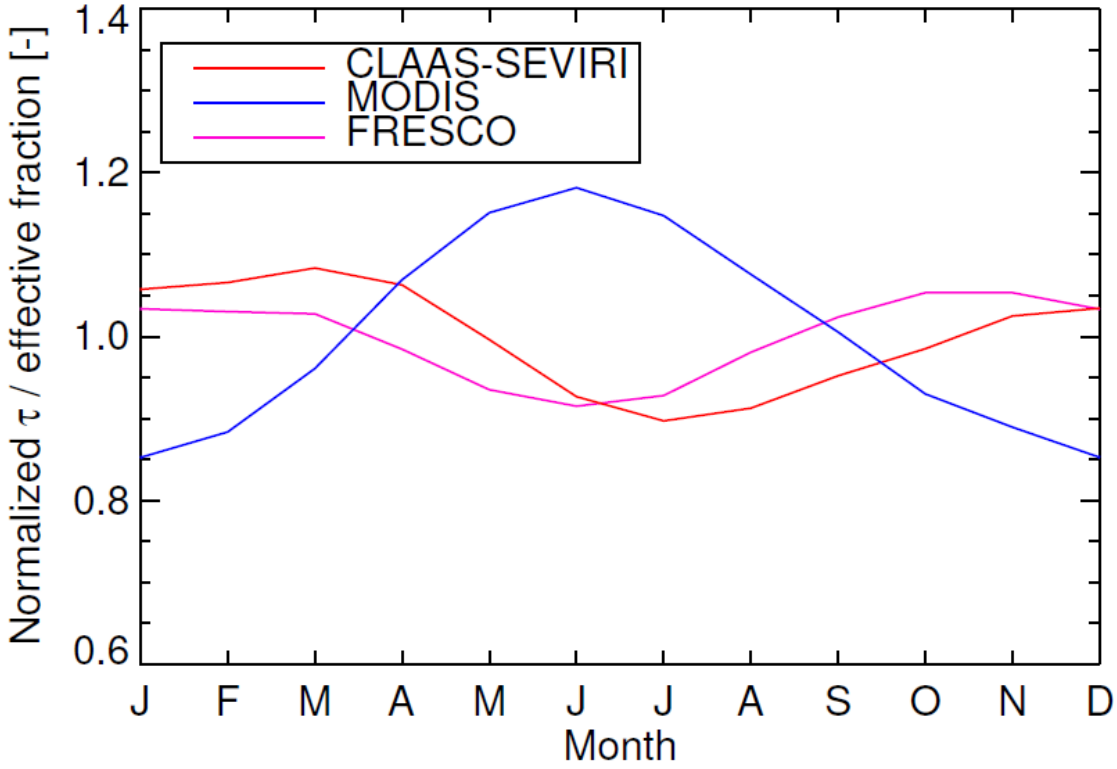


What's going on toward higher latitudes?



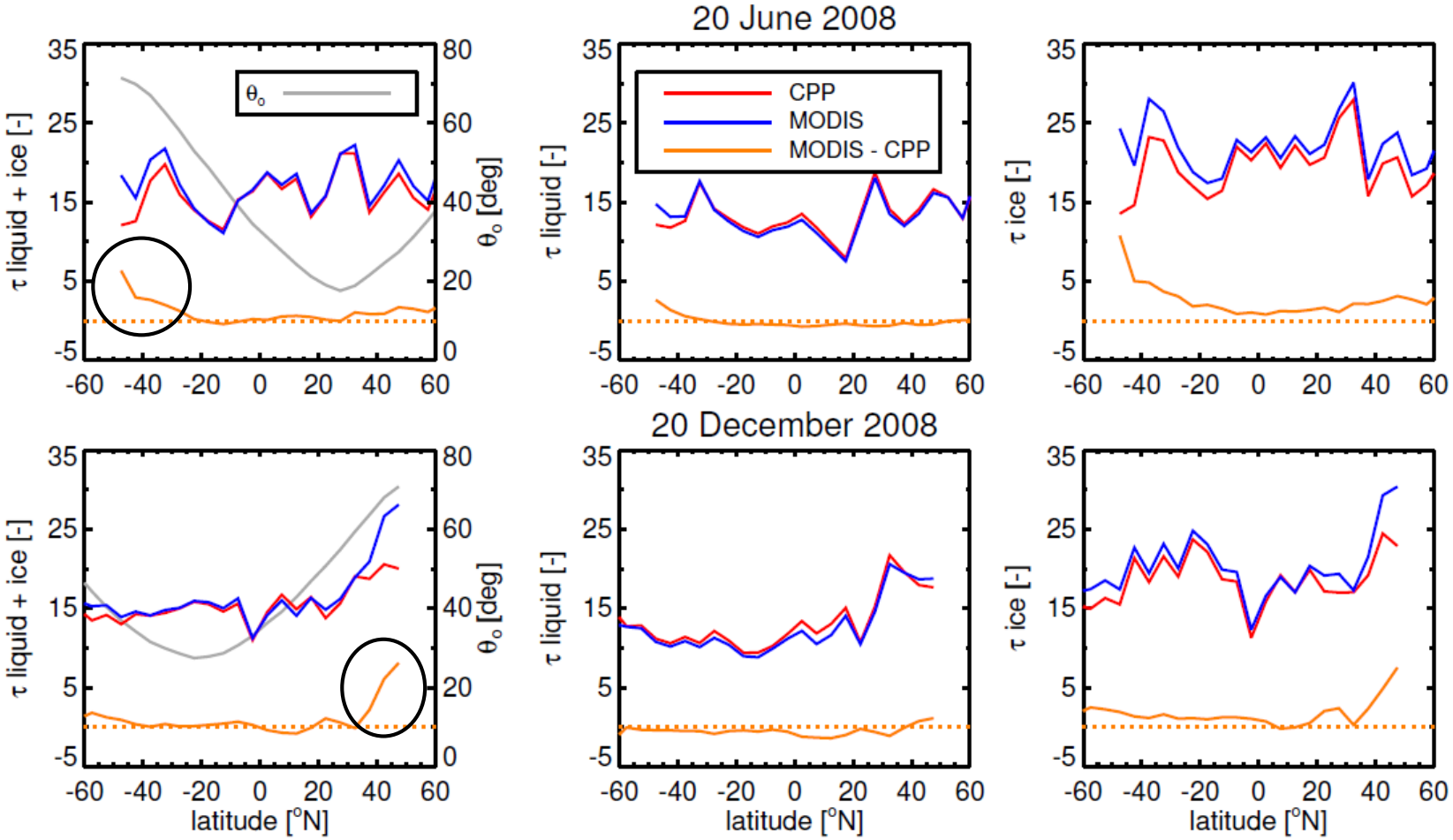
What's going on at higher latitudes?





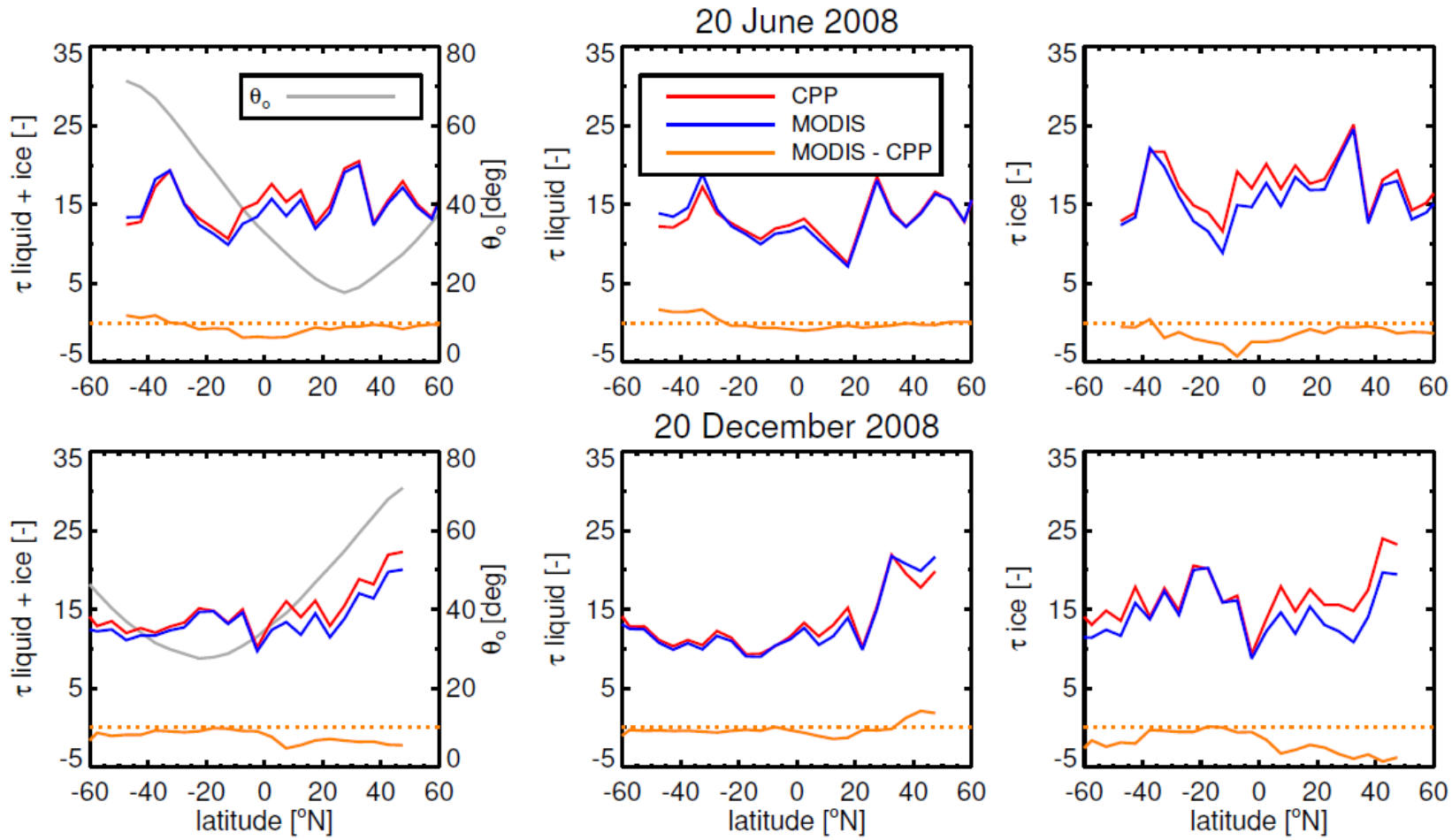
FRESCO: SCIAMACHY O2-A band retrieval of effective cloud fraction, assuming cloud albedo of 0.8. Is proportional to optical thickness.

CMSAF-CPP algorithm run on MODIS data



MODIS cloud optical thickness higher at high solar zenith angles (may be related to ice models: MODIS smooth vs. CPP rough ice crystals)

CMSAF-CPP algorithm run on MODIS data



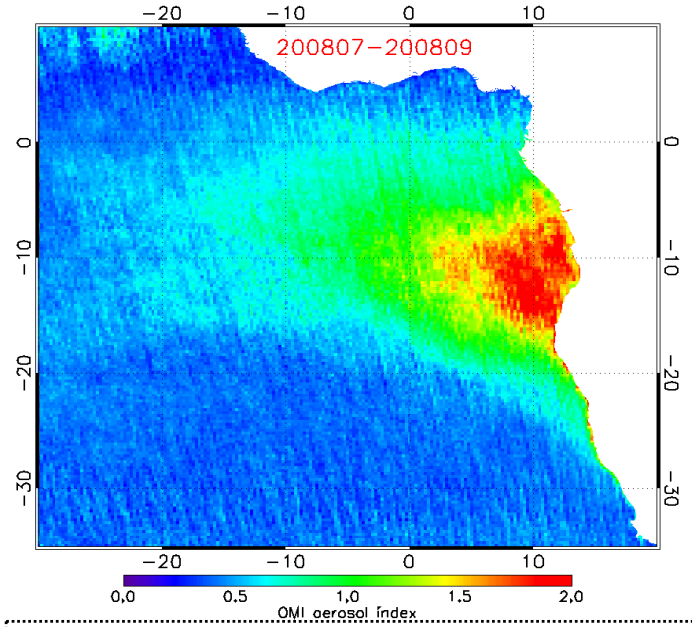
MODIS **Collection 6**: high-SZA bias goes away

… but now CPP has generally lower ice cloud optical thickness than MODIS …

Summary

- CLAAS: MSG-SEVIRI based cloud properties
- Daytime properties evaluation
  - Comparisons with microwave LWP for marine Sc favourable, except when above-cloud aerosol
  - Comparisons with MODIS C5 show overall consistency; some differences highlighted
  - Peculiar deviations optical thickness at high SZA: probably related to ice models (smooth vs. rough crystals)
  - Deviations disappear in C6 (but appear elsewhere ..)
- Dataset available at www.cmsaf.eu. Especially suitable for cloud diurnal cycle studies.

Absorbing aerosol effect



Underestimation up to 50 g m-2