



ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

# Retrieval of aerosol properties over land using AATSR data

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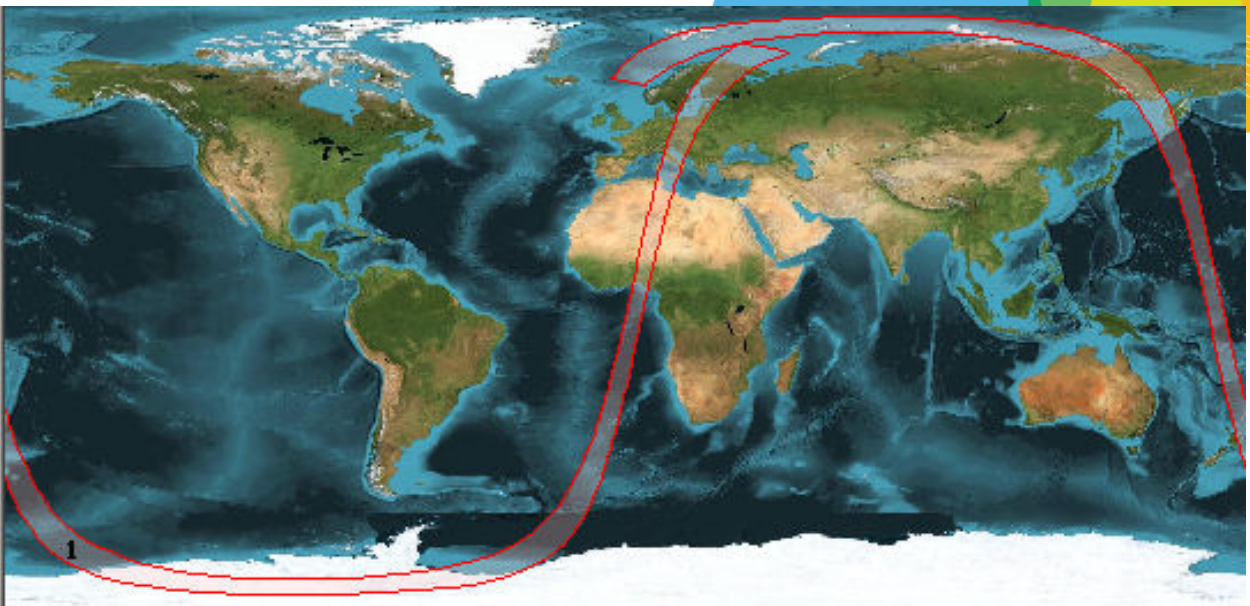
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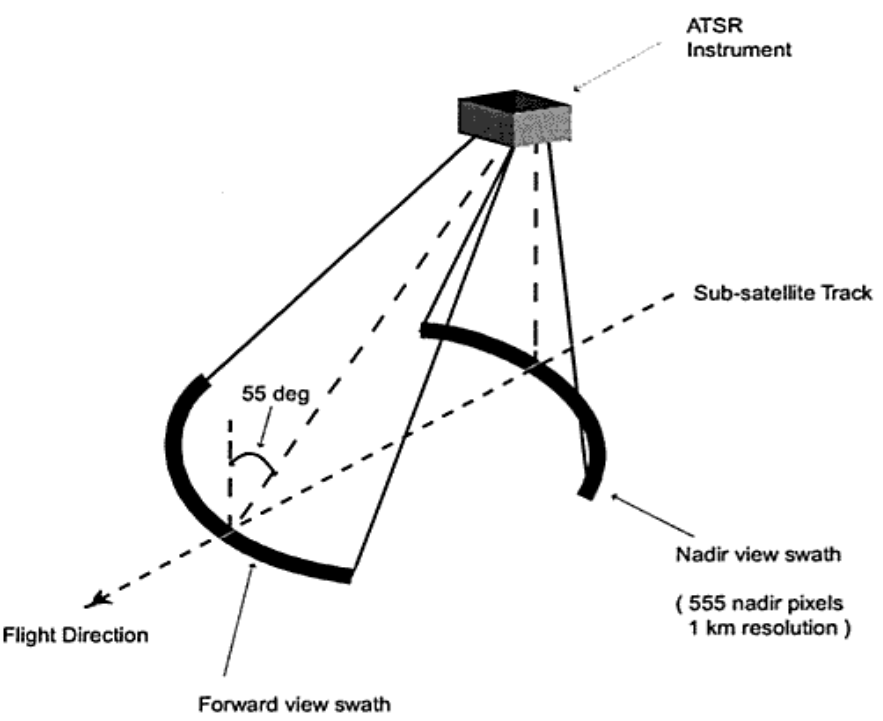
<sup>3</sup> TNO, Utrecht, Netherlands

Workshop on  
**"Observations and modeling of aerosol and  
clouds properties for climate studies "**

Paris, 12-14 September 2011



- Sun synchronous
- Equator overpass time 10:00
- Swath 500km
- Spectral Channels
  - IR: 1.6, 3.7, 10.85, and 12  $\mu\text{m}$
  - VIS: 0.555, 0.67, and 0.865  $\mu\text{m}$
- Spatial resolution 1 x 1 km

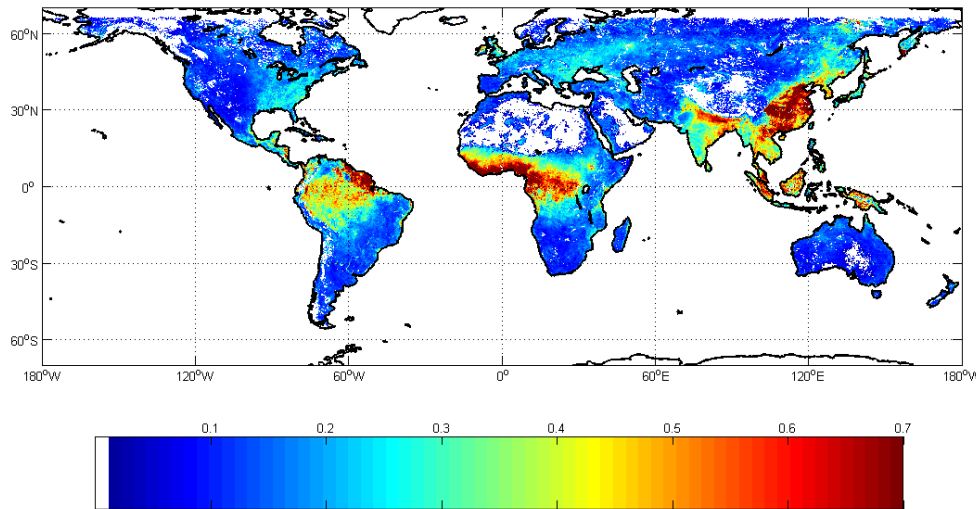


- **AATSR has two viewing angles; forward at 55° , and nadir**
- Two viewing angles allow to account for surface effects on TOA radiation
- Over land the dual view aerosol retrieval algorithm (ADV) is used
- Over ocean the two views are used separately: forward and nadir

Long time series started in 1995: ATSR-2, AATSR, SLST



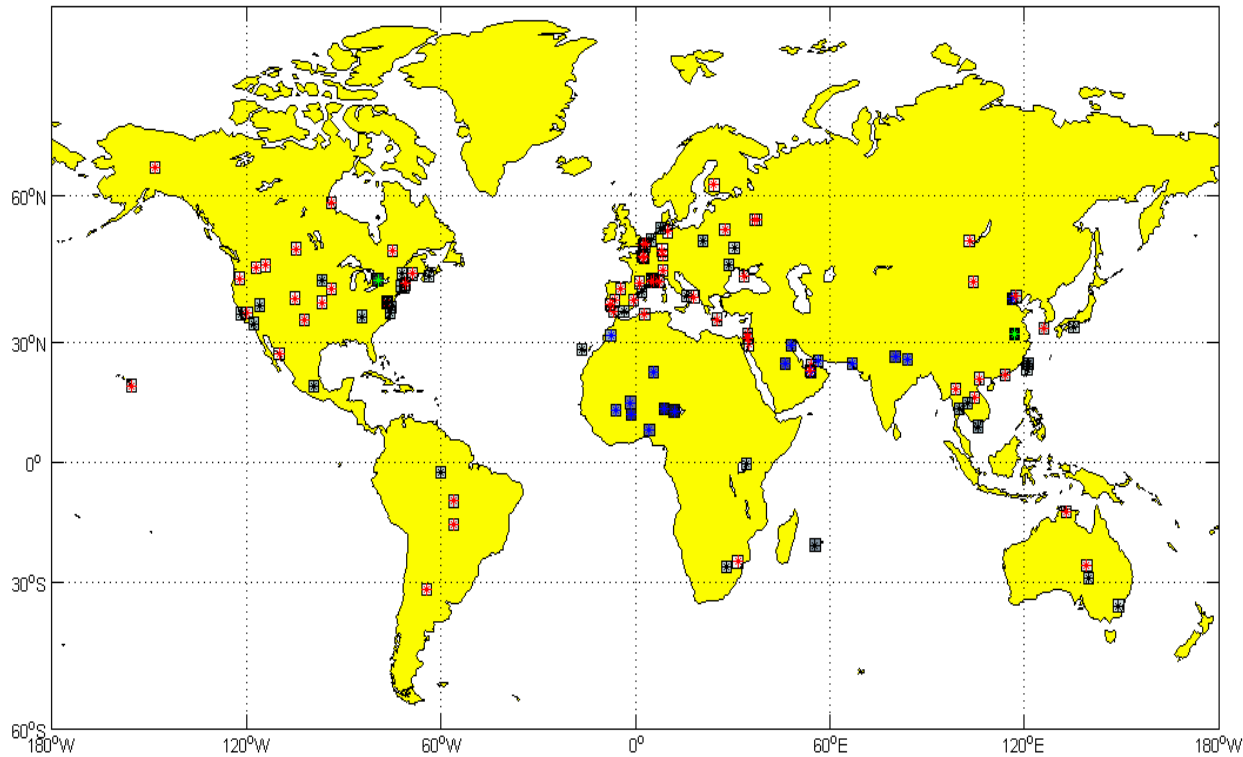
## AATSR (555 nm) over land (2008 aggregate)



- **AOD features as expected:**
  - High AOD over SE Asia, India, Central Africa , Amazone
  - Enhanced AOD over Western Europe and Eastern USA
  - Low AOD elsewhere
- **Desert regions are not reliable:**
  - e.g., Sahara, Arabia, China, Australia
- **Evaluation indicates focus regions for improvement :**
  - AERONET
  - Model
  - Other satellite
  - Aerosol-cci tests



# AATSR evaluation: cluster analysis



+ acceptable

+ AOD high

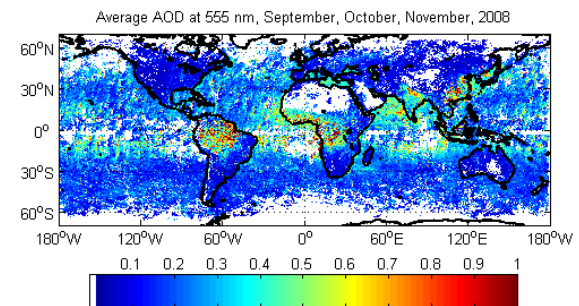
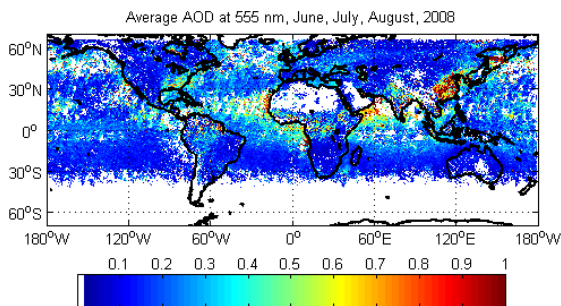
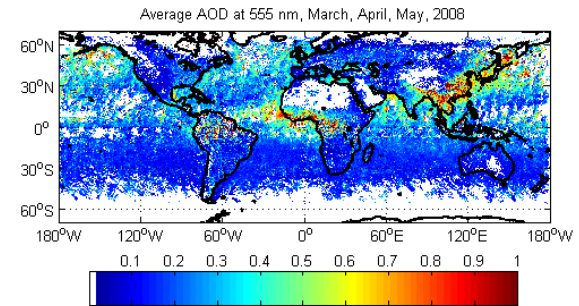
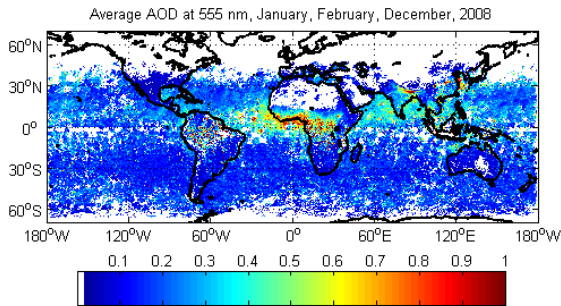
+ Severe  
overestimation

+ AOD low

Darkness of the box  
is a measure for the  
discrepancy

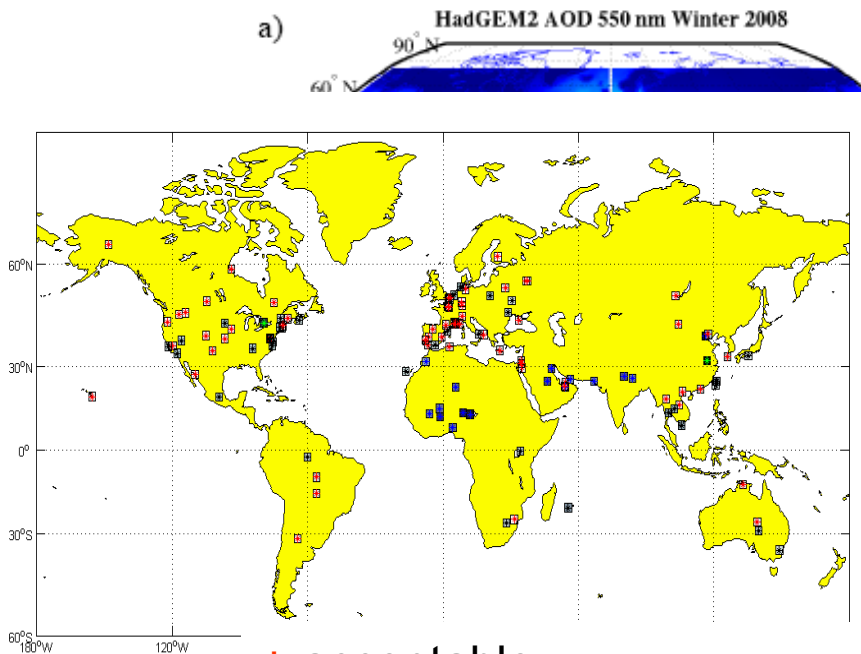


# AATSR AOD @ 555 nm global: 2008, seasonal aggregates

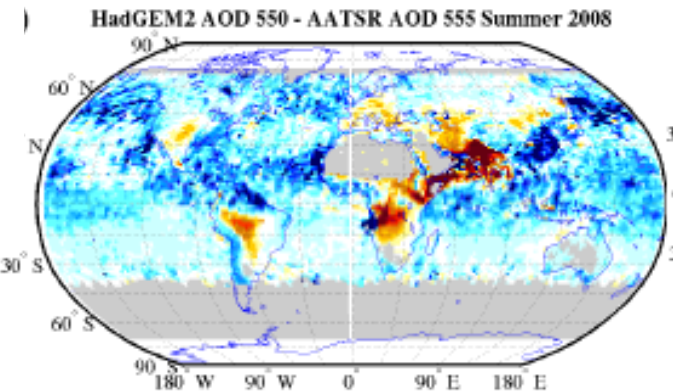
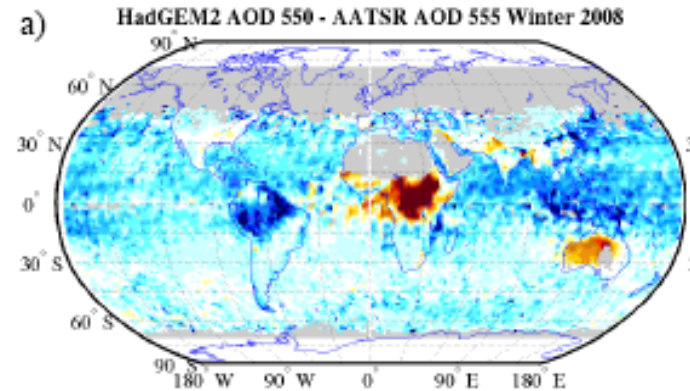




# Comparison with HadGEM2



- + acceptable
- + AOD high
- + Severe overestimation
- + AOD low





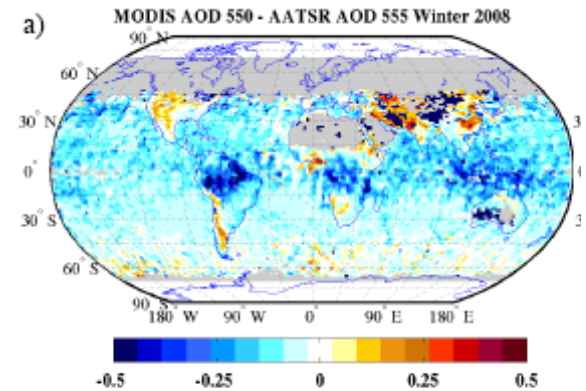
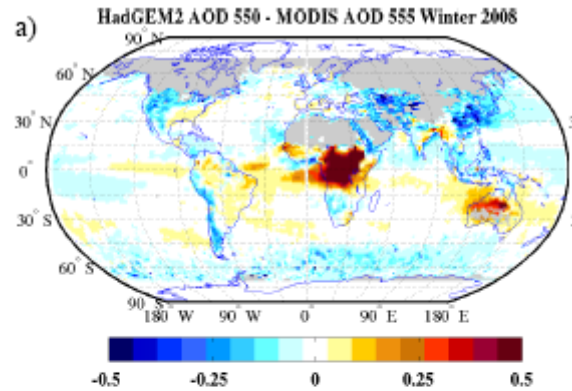
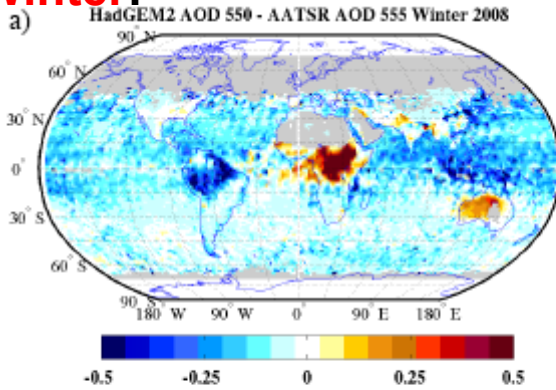
# Comparison with HadGEM2 / MODIS

## HadGEM2-AATSR

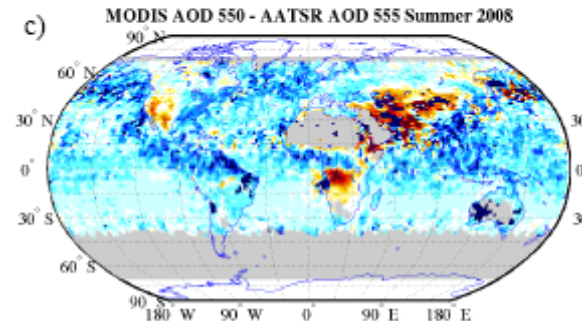
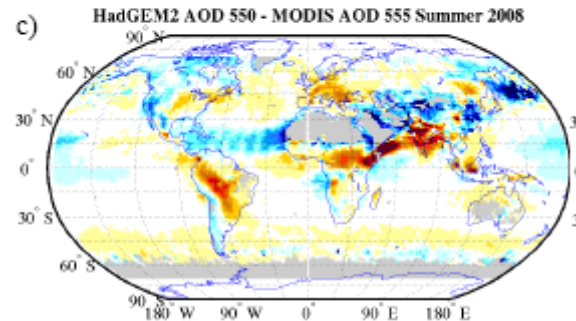
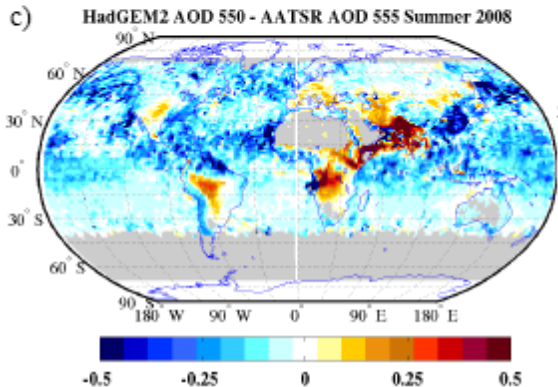
## HadGEM2-MODIS

## MODIS-AATSR

**Winter:**



**Summer:**

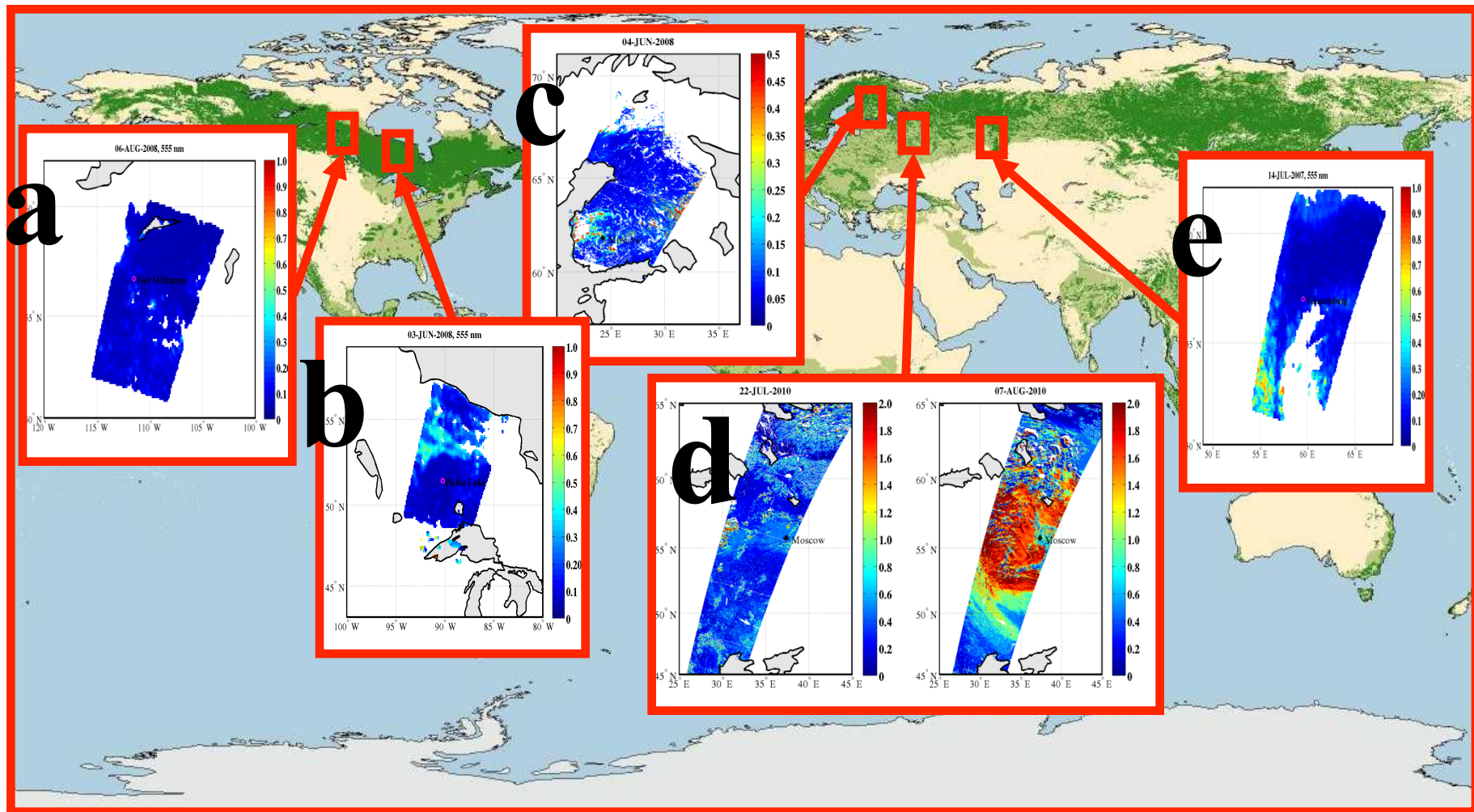


MODIS / AATSR features similar over land  
Differences over ocean: AATSR known to be less good

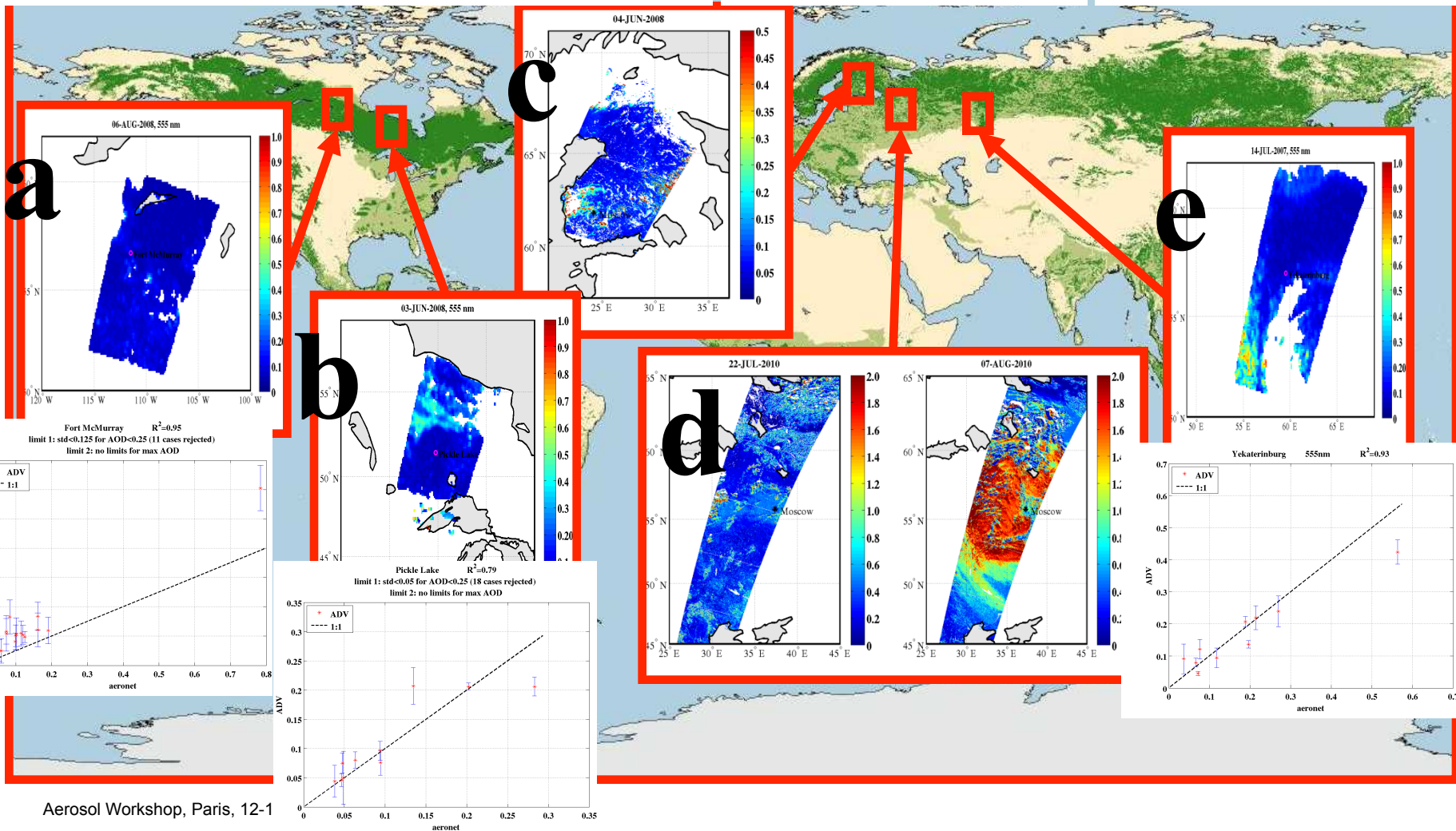
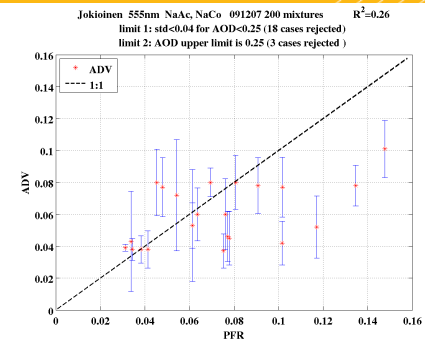
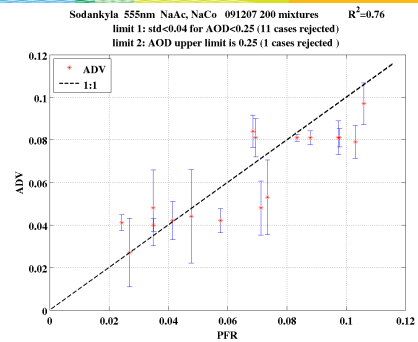
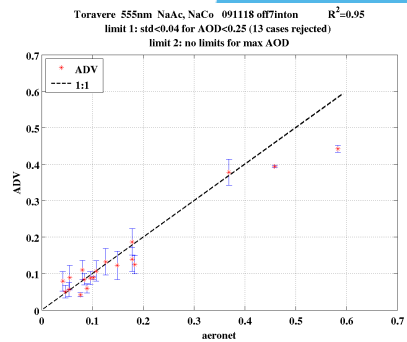
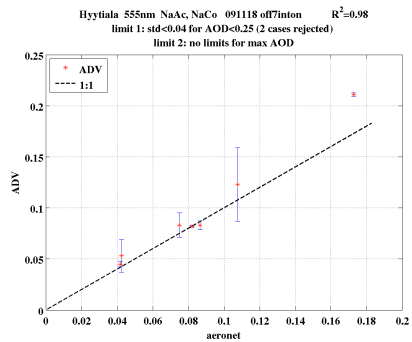
Large differences over several areas need further study



# Case studies: Boreal

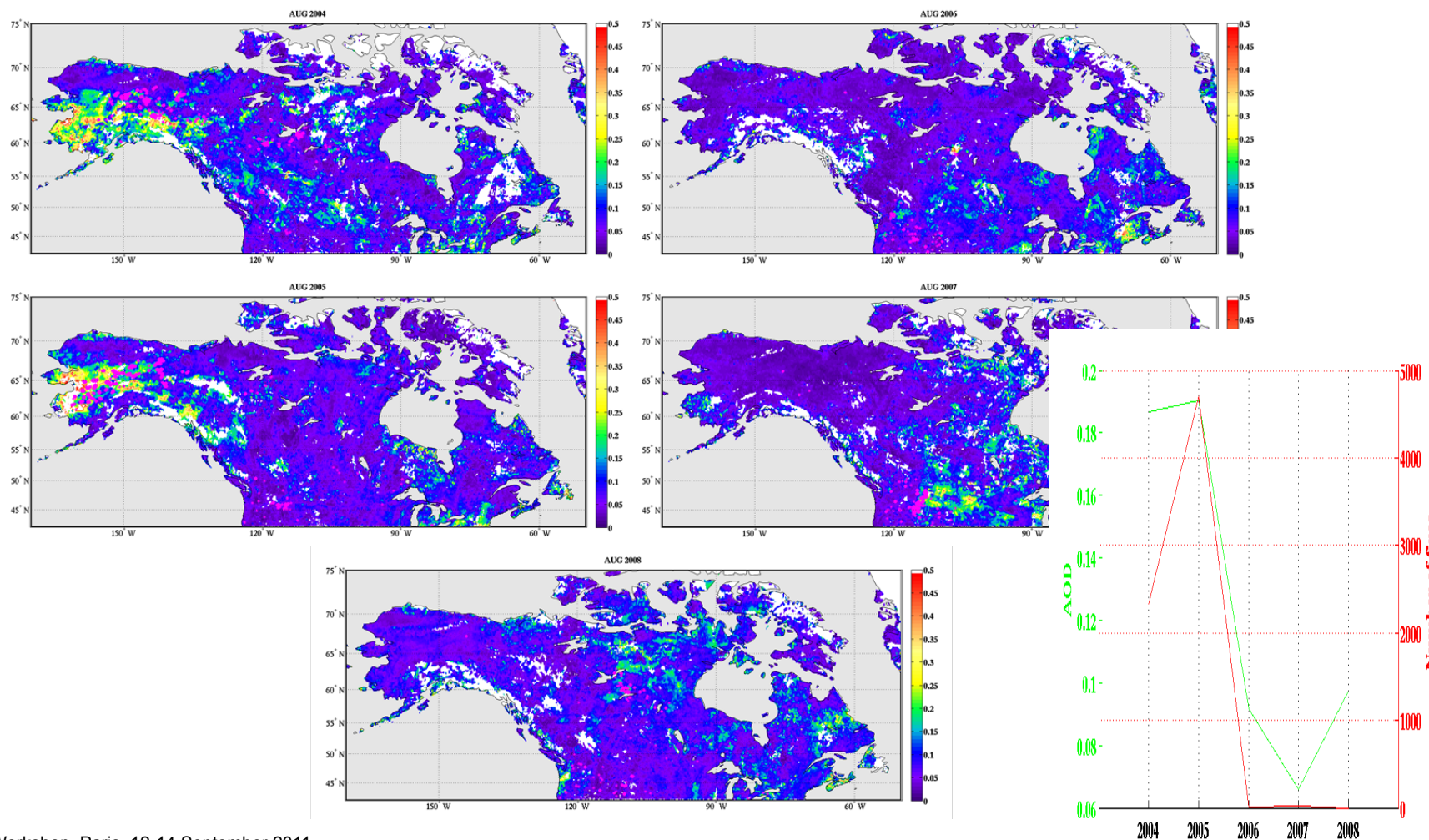






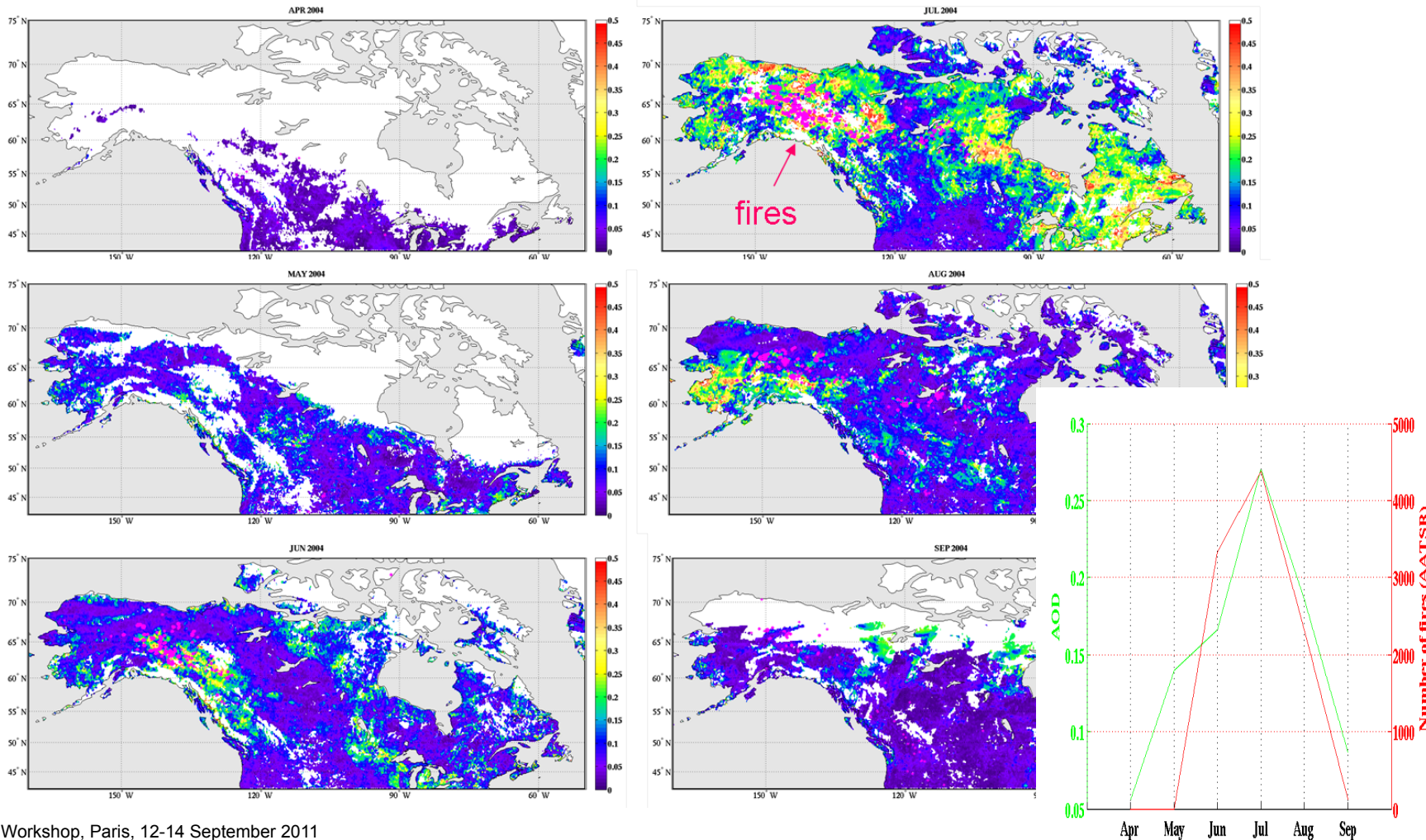


# August, interannual (2004-2008) variability



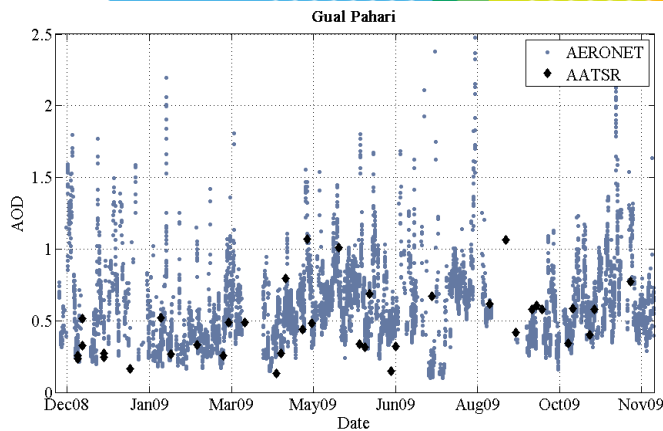


# 2004, monthly (April-September) variation



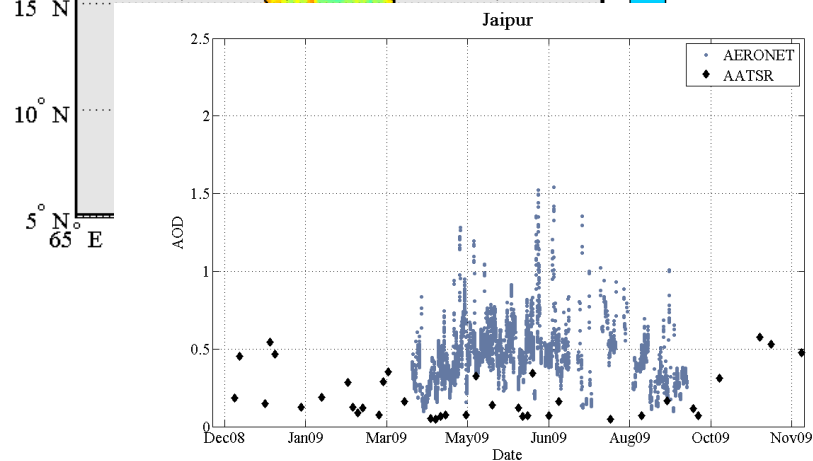
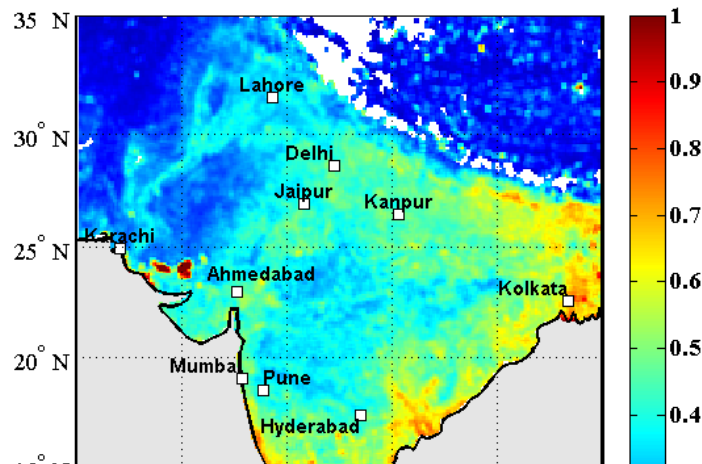
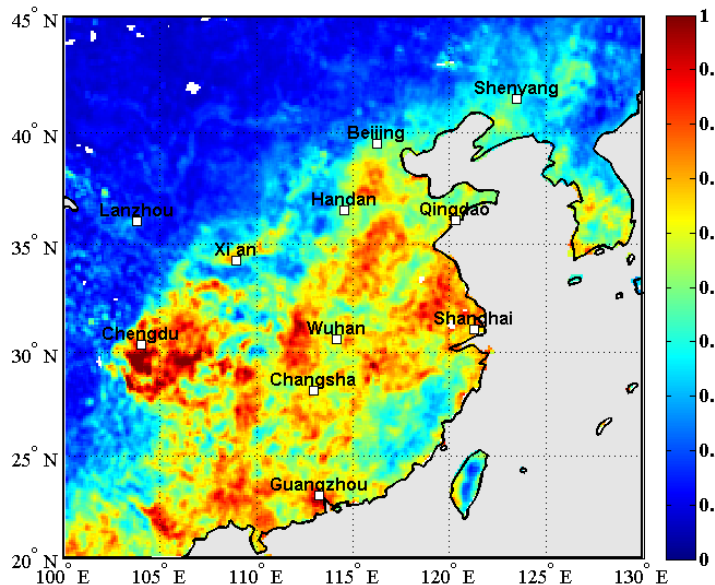


# Asia



$\lambda=0.55 \mu\text{m}$   
dia 2009

AOD  $\lambda=0.55 \mu\text{m}$   
China 2009

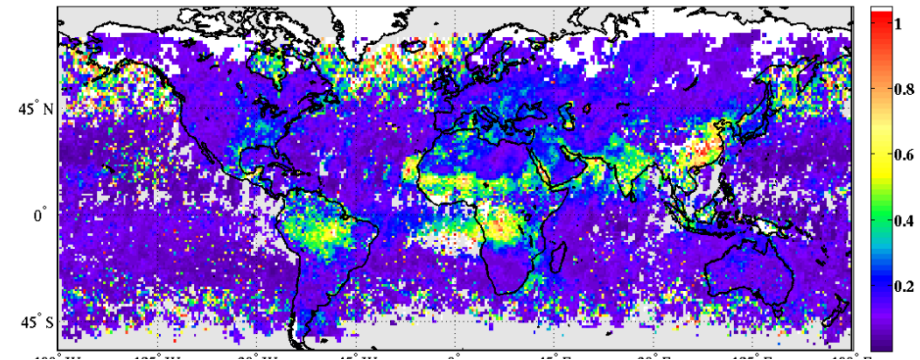




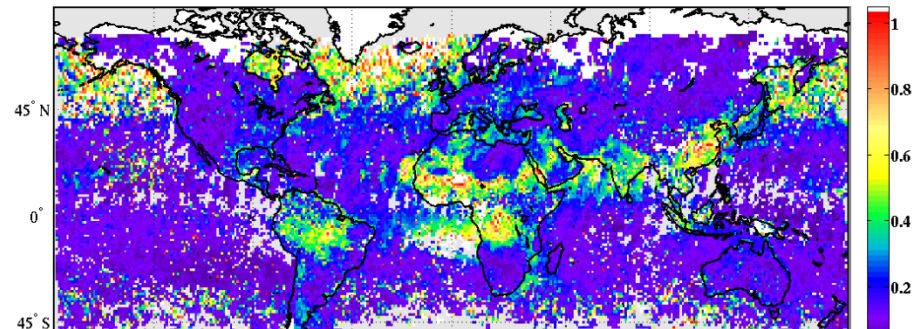
# Aerosol-cci

- **Systematic tests**
  - Aerosol models
  - Cloud mask
  - Surface correction
    - Land
    - Sea
- **Implementation non-spherical particles**
- **Validation and comparison**

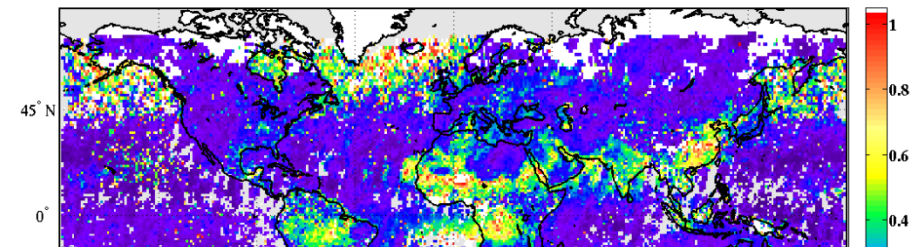
AATSR ADV Ver1.2 Set1, nonsph.dust, mean



AATSR ADV Ver1.2 Set2, nonsph.dust, mean



AATSR ADV Ver1.2 Set3, nonsph.dust, mean



Sets 1,2, 3 refer to how the fine and coarse mode models were combined



# Conclusions

- **The AATSR Dual view algorithms works over land in a variety of conditions**
- **No *a priori* info on surface needed, but could improve the results**
- **Comparisons with independent data sources show where AATSR is doing well and less well: improvements**
- **Implementation of non-spherical particles (Dubovik) leads to major improvement, especially over-ocean seems better**
- **Over ocean needs further improvement**
- **Comparison with models and with other satellites needs to be pursued to identify strenghts / weaknesses**
- **Next steps**
  - NRT figures for quick-looks
  - Data quality flags need to be further developed
  - Continued algorithm improvement, based on Aerosol-cci and other research projects
  - Science applications

Data: <http://aatsraerosol.fmi.fi/>