Norwegian Meteorological Institute

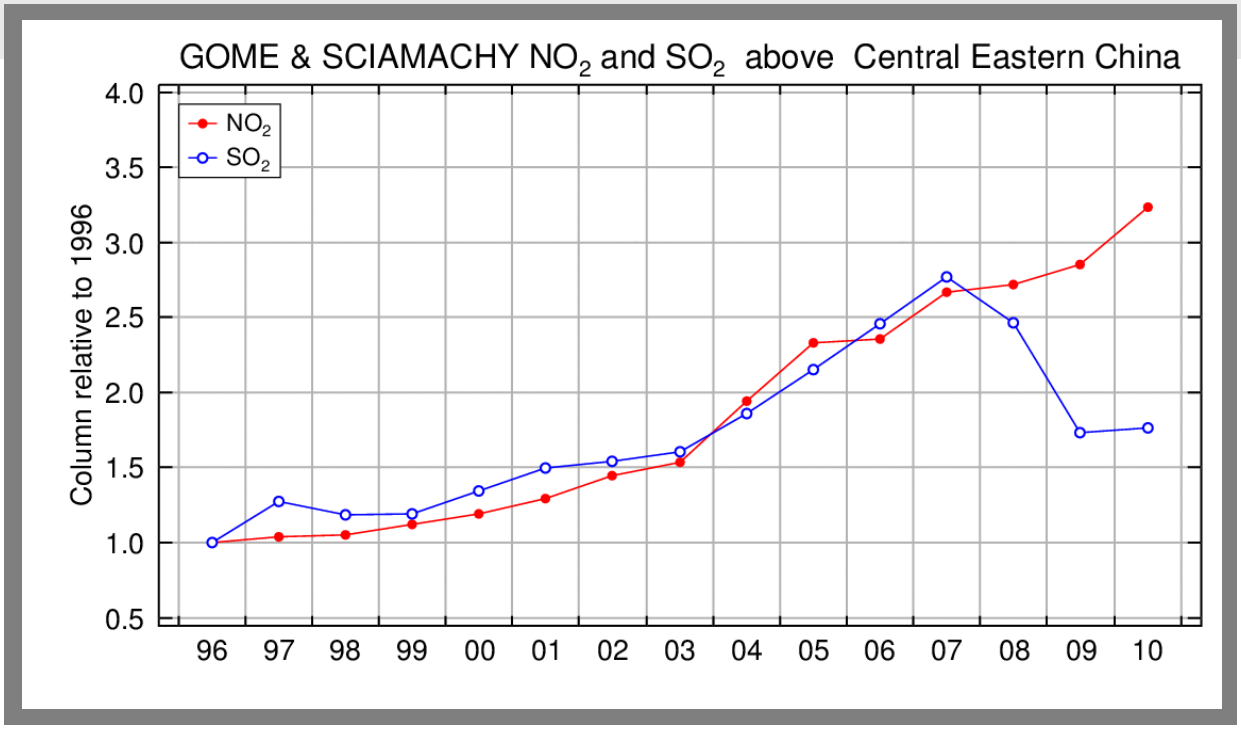
# Use of satellite observations in EMEP MSC-W modelling

Michael Gauss

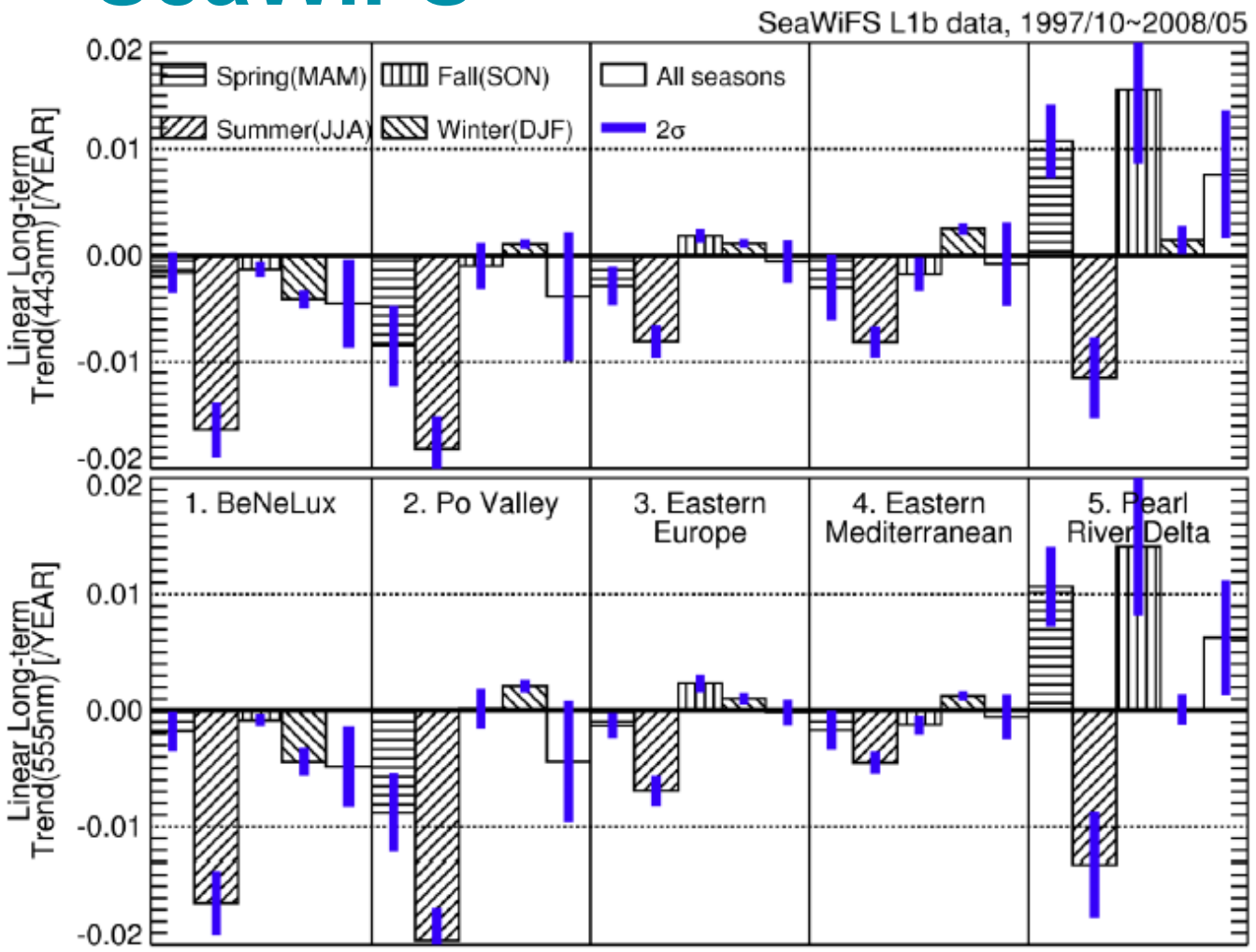
16.05.2013

# Observing trends (satellites)

# CityZen partner University of Bremen



# SeaWiFS




**Linear trends in AOT at two wavelengths as derived from SeaWIFS data from Oct 1997 to May 2008 using the BAER algorithm. Trends are separated by season and shown for 5 regions. Top: AOT at 443 nm, bottom: AOT at 555 nm. [*from* Yoon et al., 2011]**

# The modelling community

What do we need from satellites?

- ‘the best possible’?
- or: it depends on the purpose

16.05.2013

# Satellites for EMEP

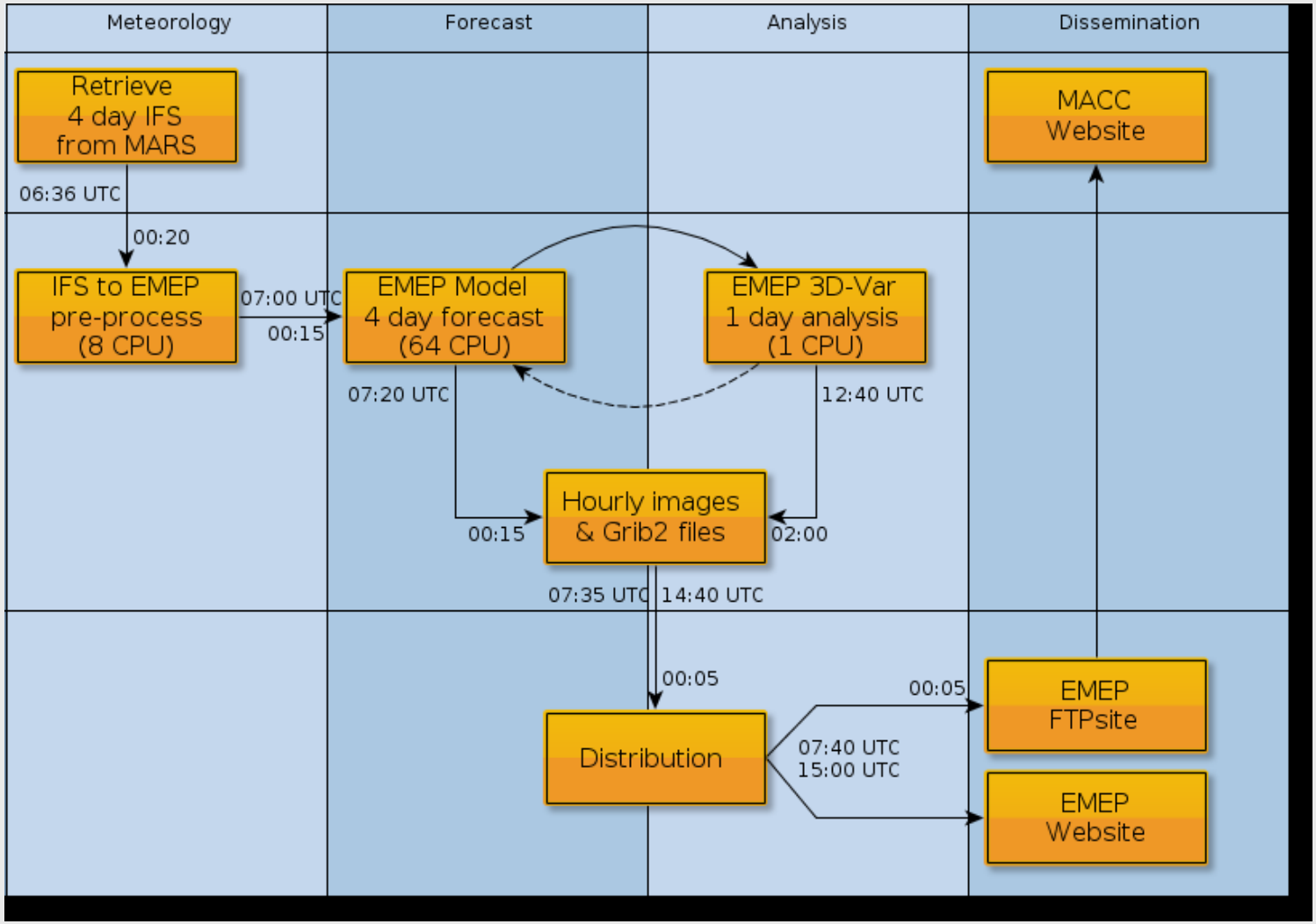
- Assist our work for the UN Convention on Long-range transported air pollution
- Chemical weather forecasting and annual assessment reports in MACC-II
- Prepare for the unexpected: ‘eEMEP’
- Evaluating the EMEP model in AeroCom (http://aerocom.met.no/)

# FP7 MACC-II / use of data

- Main goal for met.no: Improve chemical weather forecasting through data assimilation and model evaluation
- Develop observation operators for satellite retrievals (tropospheric column data)
- Implementation of 3-D VAR assimilation
- Investigate value of different observation types for predictive skill improvement

# Chemical weather forecasting system

## *EMEP for MACC-II*




So far assimilated: NO2 columns from OMI and AOD from MODIS

# Daily RAQ forecasts from MACC-II

Monitoring atmospheric composition & climate

macc Monitoring atmospheric composition & climate

GMES

METEO FRANCE

HOME | NEWS | ABOUT THE PROJECT | SERVICES | DATA PRODUCTS | DOCUMENTS | EVENTS | CONTACT US

Home > Services > RegionalAirQuality > Ensemble

ENSEMBLE | EPSGRAMS | HOURLY ENSEMBLE

**Forecast base time**

Wed 15 May 2013 00UTC

**Model**

- ALL
- Ensemble
- CHIMERE
- EMEP
- EURAD
- MATCH
- MOCAGE
- LOTOS-EUROS
- SILAM

**Parameter**

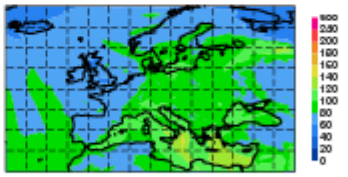
- Ozone
- Nitrogen Dioxide
- Sulfur Dioxide
- Carbon monoxide
- PM 10 aerosol
- PM 2.5 aerosol
- Birch Pollen in development

**ALL 20130515**

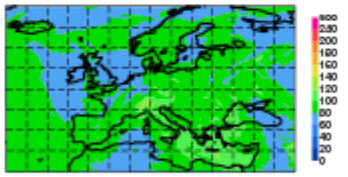
Day 0 | Day 1 | Day 2 | Day 3

**Wednesday 15 May 2013 00UTC MACC-RAQ Forecast D+0 VT: Wednesday 15 May 2013**
**Surface Ozone Daily Mean [ µg/m3 ]**

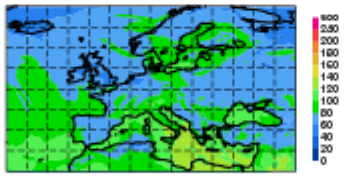
EMEP



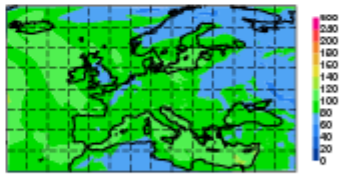
SILAM



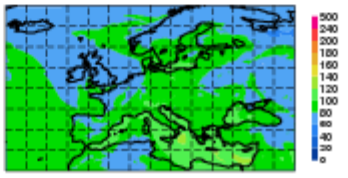
LOTOS-EUROS



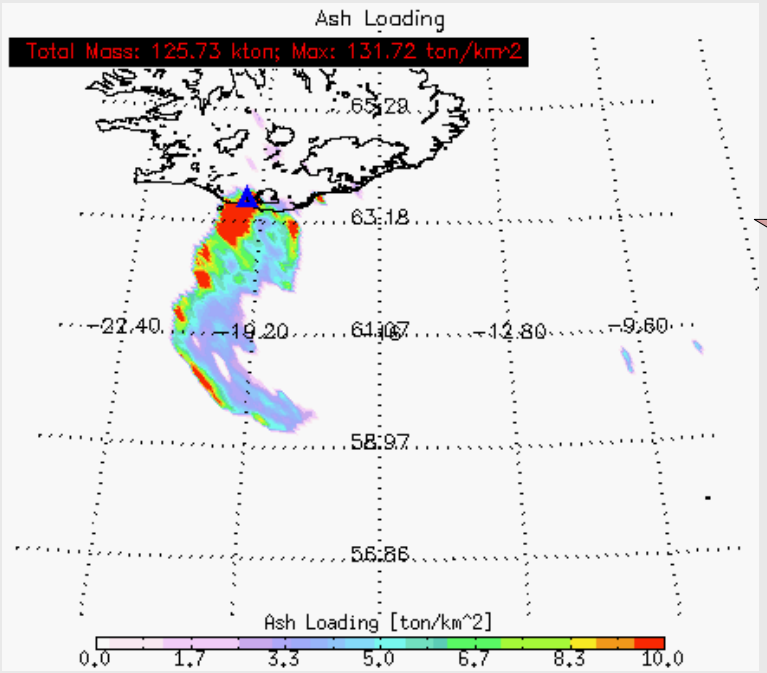
EURAD-IM



ENSEMBLE MEDIAN (N=4)



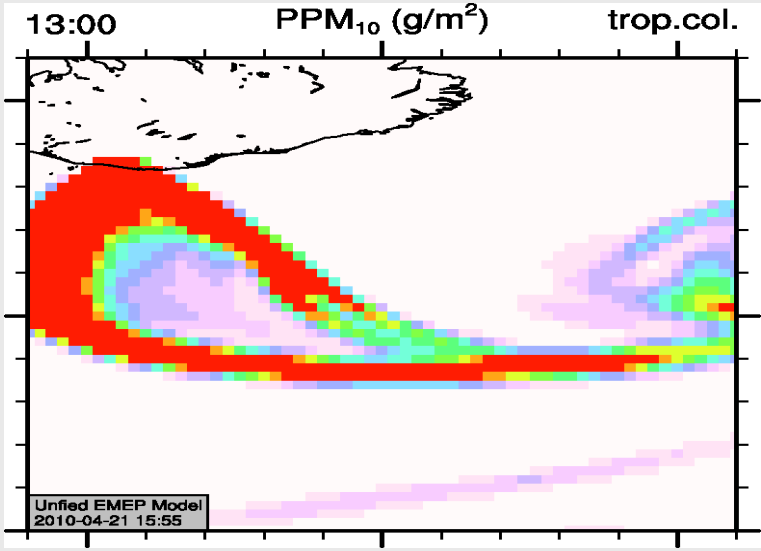
# Eyjafjallajökull: Emission Tuning

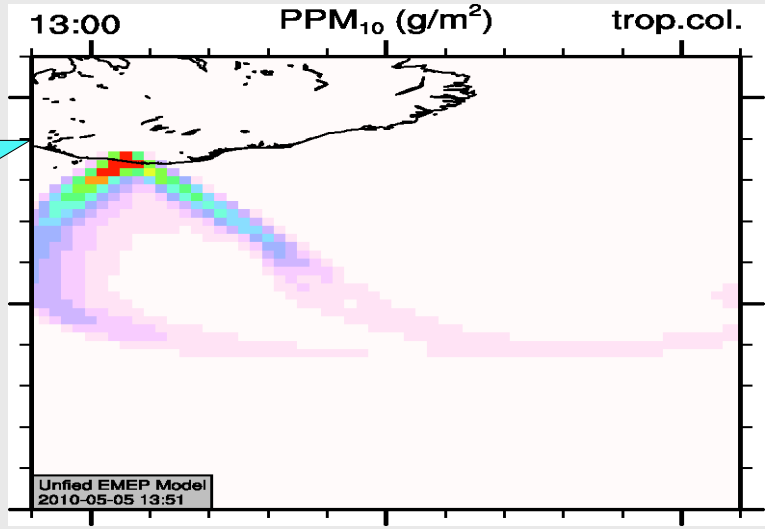



60

$PM_{10}$ [Mg/s]

7




SEVIRI Volcanic Ash Retrieval: 2010-04-19

http://cimss.ssec.wisc.edu/goes_r/proving-ground/geocat_ash/loops/iceland.html

Experimental product by Mike.Pavolonis@noaa.gov

# AeroCom

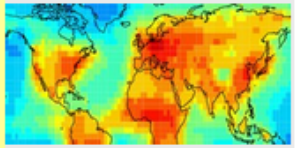
## Aerosol Comparisons between Observations and Models

# http://aerocom.met.no

AeroCom -> Aerosol Comparisons between Observations and Models ?

Home | Meetings | Data | Protocol | References | Tools

- Data Overview
- Phase II interface
- Database Explanations
- Benchmark data
- Acknowledgement

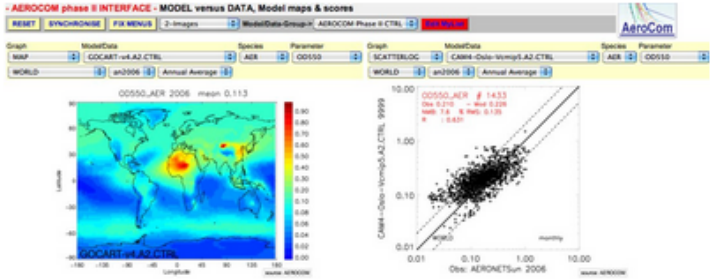


AEROCOM
is an international
science initiative
on aerosols and climate

supported by
EU Commission
ACTRIS
MACC-II
IS-ENES
EUCAARI
PHOENICS

Met.No
ESA-cci
Max-Planck Ges.
NASA
French CNES

## AeroCom Image Catalogues / Phase II Interface



- Phase II interface, comparison to observations according to project groupings (HTAP, EUCAARI, SATELLITES, AEROCOM phase I)
  (start here: " **Aerocom Phase II Interface**")
- Aerocom A&B 2D fields aerosol properties (start here: "**Phase I interface**")
- **Lidar Comparisons interface**

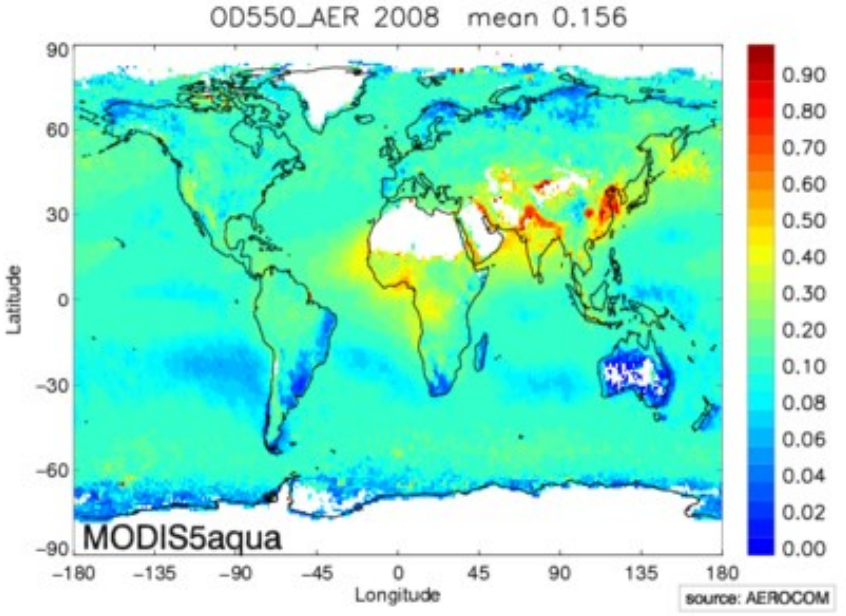
## AeroCom Database and User Server, Database Explanations

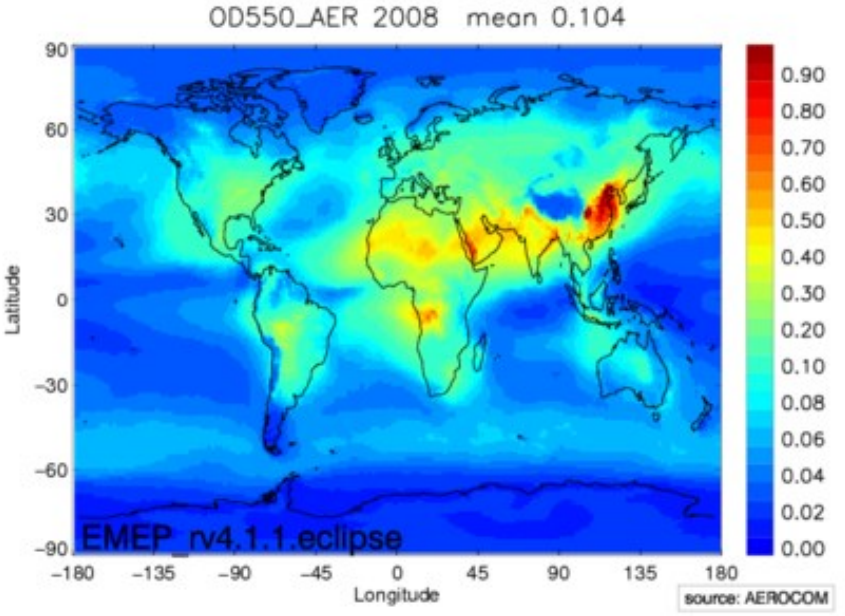
An specific data server (aerocom-users.met.no) allows users to access AeroCom model data directly. Condition for access to the AeroCom data server:

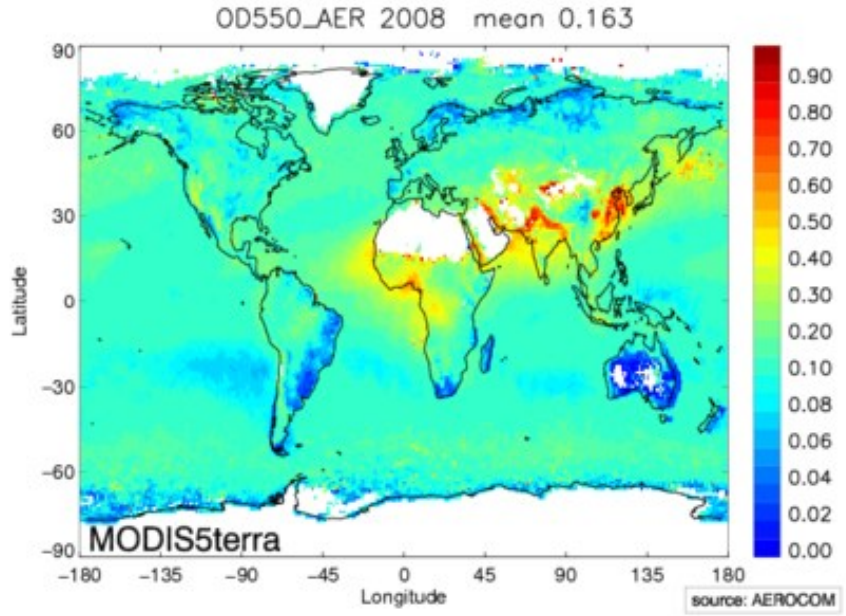
- A short project description of the planned analysis is send to AeroCom contact (michael.schulz@met.no)
- An account is opened upon sending a request for an account to michael.schulz@met.no and jan.griesfeller@met.no
- The project description is made available to AeroCom participants via the **wiki page**
- Results from analysis are reported to AeroCom workshops
- Publication-Coauthorship is offered to model and data author. See **data policy**

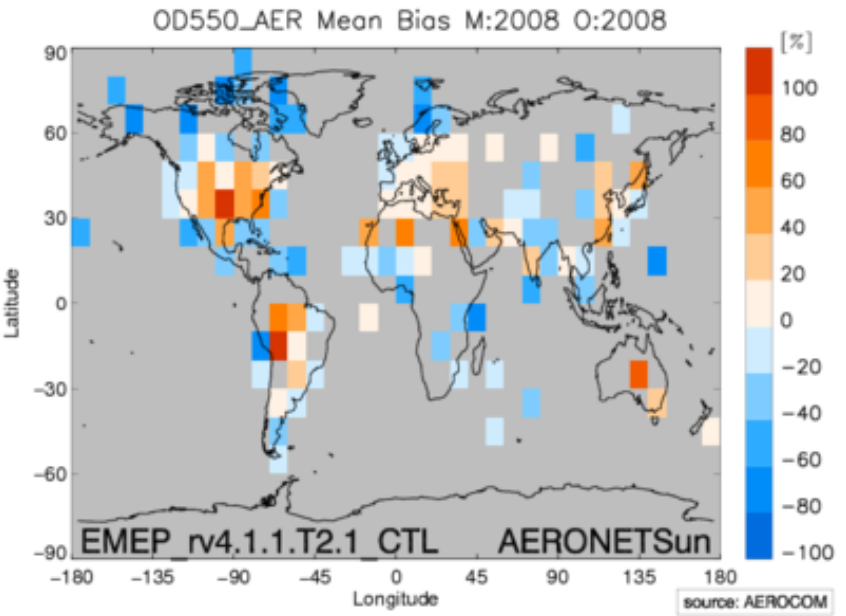
Data user server and format of data is further explained on the **Database Explanations** page
and further help for processing data is found in **Tools** section.
Variable names in files correspond to the **AeroCom Protocol**

# AOD 550nm from MODIS on Aqua and Terra and calculated with the EMEP model for 2008



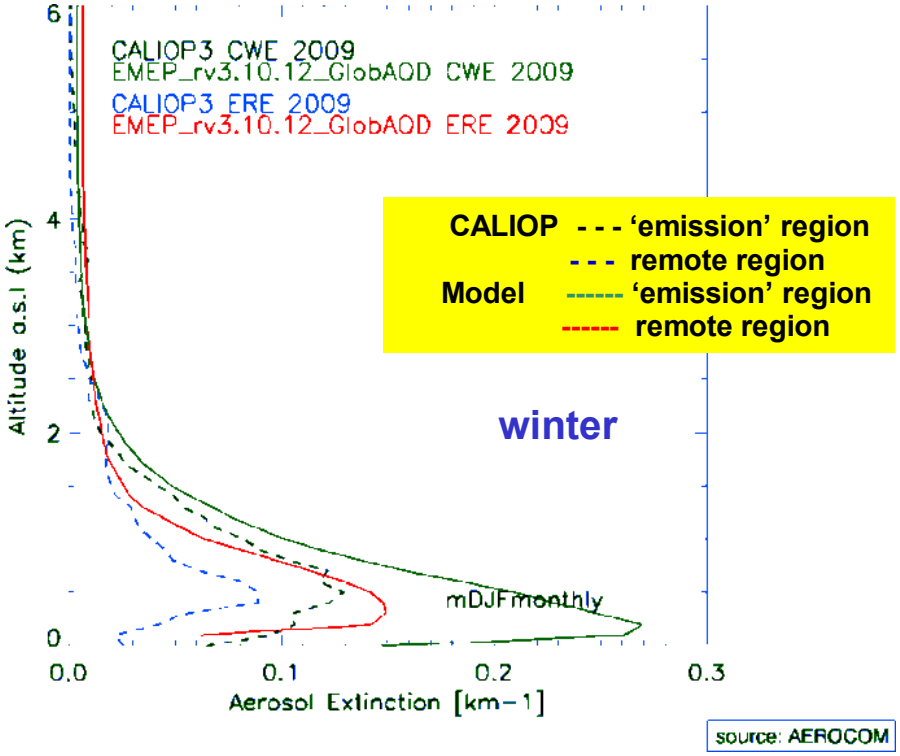



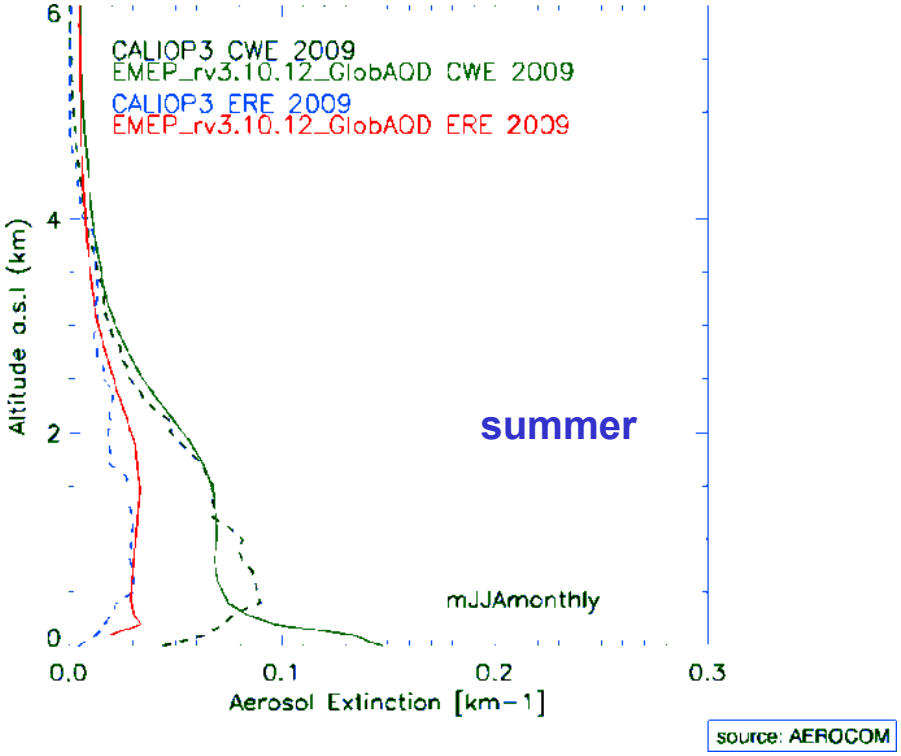



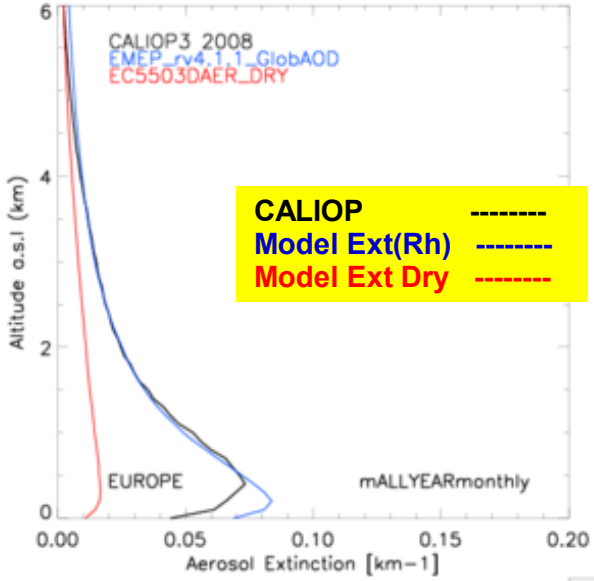
# The NRS PM-VRAE project: Comparison of modelled aerosol extinction profiles with CALIOP Lidar data

- **Facilitates the evaluation (for the first time) of aerosol vertical distribution and thus long-range transport**
- **The aim: to improve the reliability of EMEP estimates of PM10, especially in regions with few measurement sites**

***CALIOP data have been provided by Brigitte Koffi (Koffi et al., JGR, 2012)***



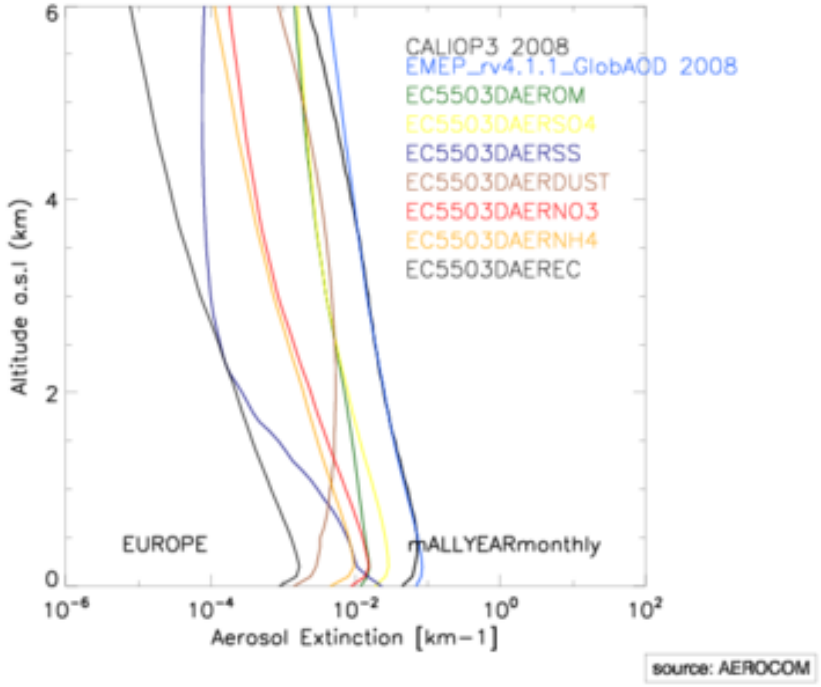



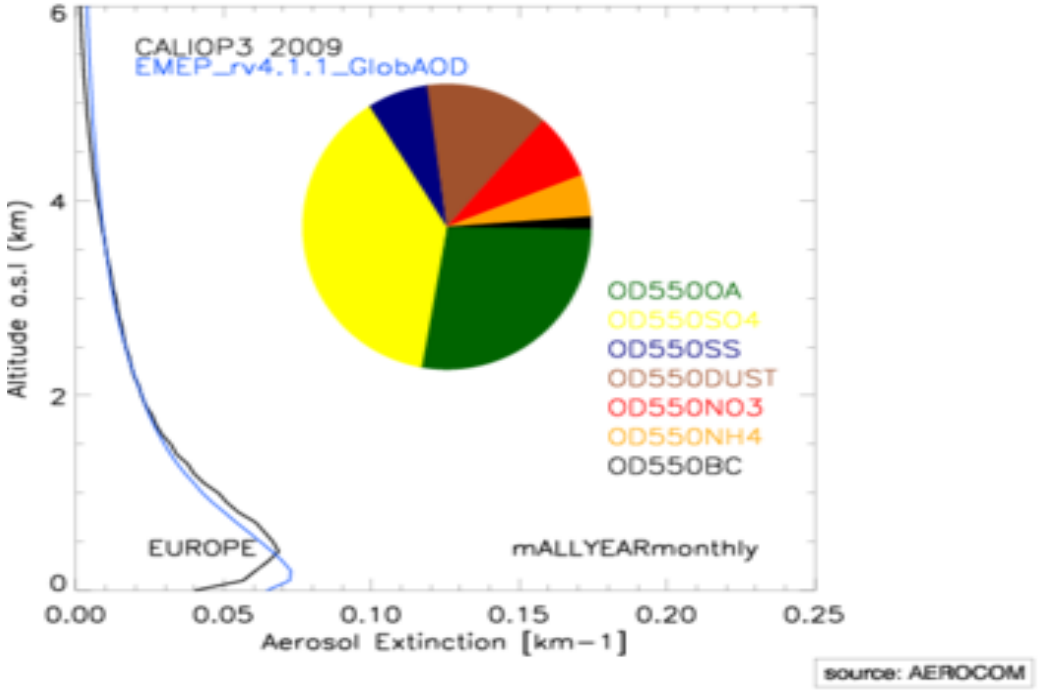

**Largest discrepancies between model and CALIOP extinction profiles found in the lowest 1km, esp. in 'emission' regions in winter –**
**How reliable CALIOP data in the lowest layers?**

***Model: the dependence of extinction efficiency of relative humidity is probably too strong.***

***On-going tests and improvements.***

# Contribution of different aerosols to Extinction coefficient profiles



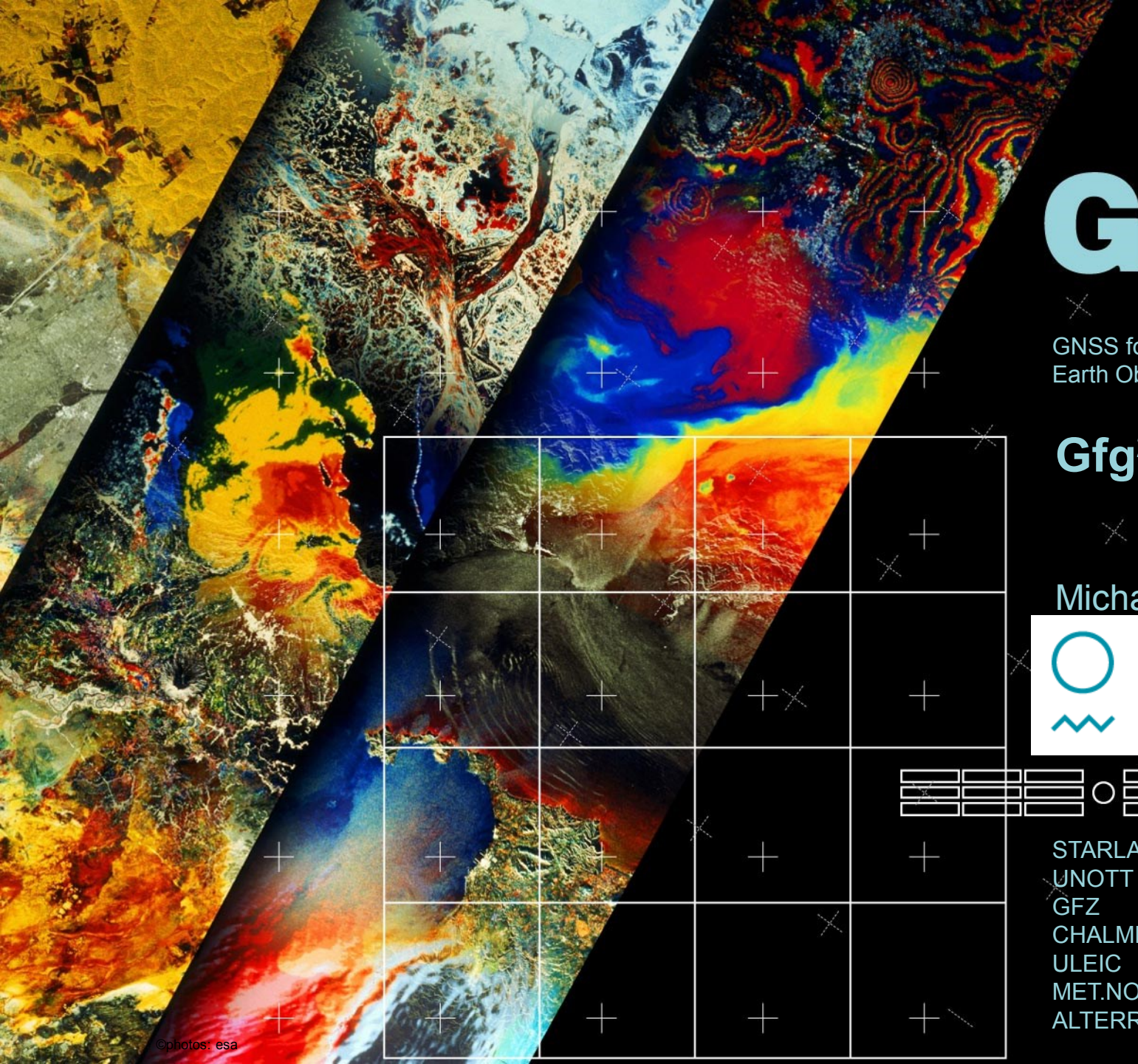




***Identification of dominant aerosol types in different regions***

***→ better understanding of modelled extinction profiles and their comparison with CALIOP data***

# Conclusions

- Our purpose of using satellite data:
  - Data assimilation - require operational (fast) data
  - Model evaluation - more focused on research
- Large interest in service-oriented projects
  - EMEP (LRTAP Convention / European AQ legislation)
  - MACC-II and beyond (Copernicus atmospheric core service)
  - Met.no's volcanic ash project
- User requirement depends on the purpose, but in any case:
  - Need error estimates (gridded if possible)
  - Fast data delivery for daily/monthly operational tasks
  - Vertical information very valuable
  - Long-term continuity
  - Combination of Geostationary and LEO very welcome for AQ studies



# Gfg²®

GNSS for Global Environmental Earth Observation and GEOSS

## Gfg²


Michael Gauss

Norwegian Meteorological Institute

STARLAB
UNOTT
GFZ
CHALMERS
ULEIC
MET.NO
ALTERRA

# What is Gfg²?

- The EU acknowledged the need to better assess the scientific value of GNSS beyond their classical positioning services
- Gfg2 - GNSS for Global Environmental Earth Observation (GEEO) and GEOSS
- Gfg2 is a 3-year coordination action funded by FP7 ENV, and coordinated by starlab.es (an SME based in Barcelona)
- Mission: to better assess the value of GNSS for Global Environmental Earth Observation (GEEO) and GEOSS
- For more information, see the poster on the wall behind you, and **Gfg2.eu** (from where you can join our twitter and Linkedin communities)

Meteorologisk institutt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