

# COSMO-ART

Status - Development - Application

Aerosols and Climate Processes, Institute for Meteorology and Climate Research - Troposphere



# Take home messages

**Development of COSMO-ART is almost finished**

**Happy days of applications are arising**

**CLM-ART runs are on their way**



**is on the horizon**

# COSMO-ART users

IMK-IFU: Dust storms over China

IMK-AAF: Pollen as IN

IMK-ASF: Troposphere-Stratosphere Exchange

EMPA, Switzerland: Aqueous chemistry, Validation

Rosshydromet, Russia: Air quality above Moscow, Vegetation Fires

NCMS, United Arab Emirates UAE: Dust storm forecast

Georgia Tec, USA: Aerosols and cloud formation

Carnegie Mellon, USA: Soot impact on regional climate

Meteoswiss, Switzerland: Operational pollen forecast

DWD, Germany: Operational forecast of pollen, mineral dust and volcanic ash

National Observatory, Greece: Forest fires, air quality

Weather service of Romania: Air quality

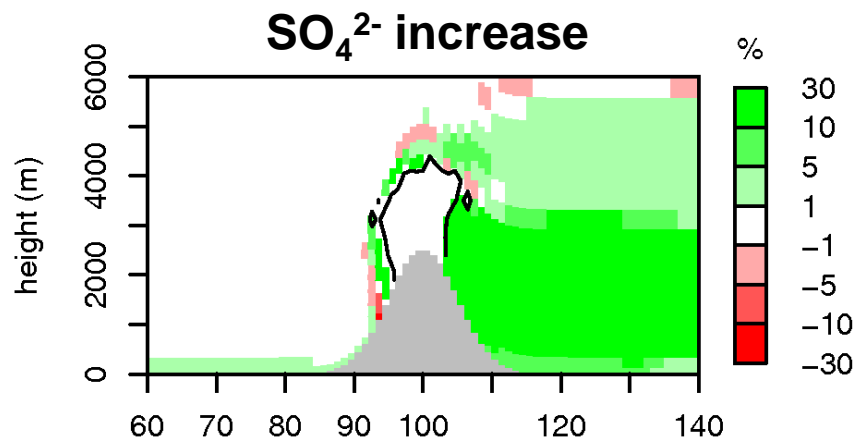
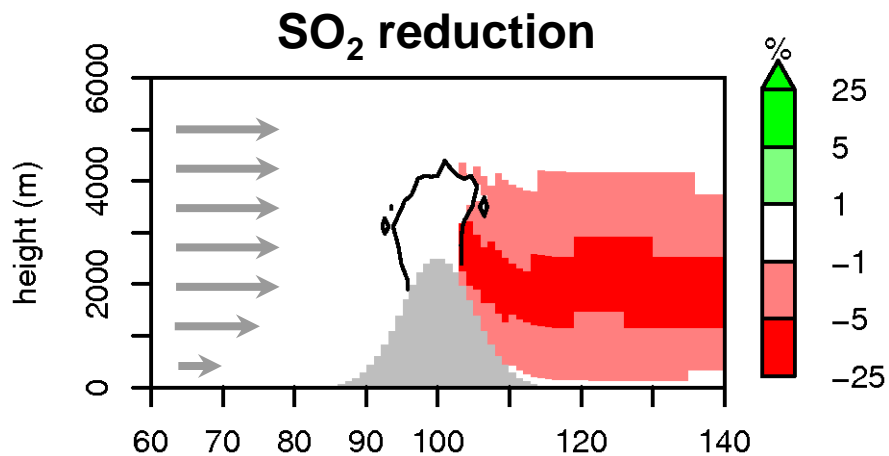
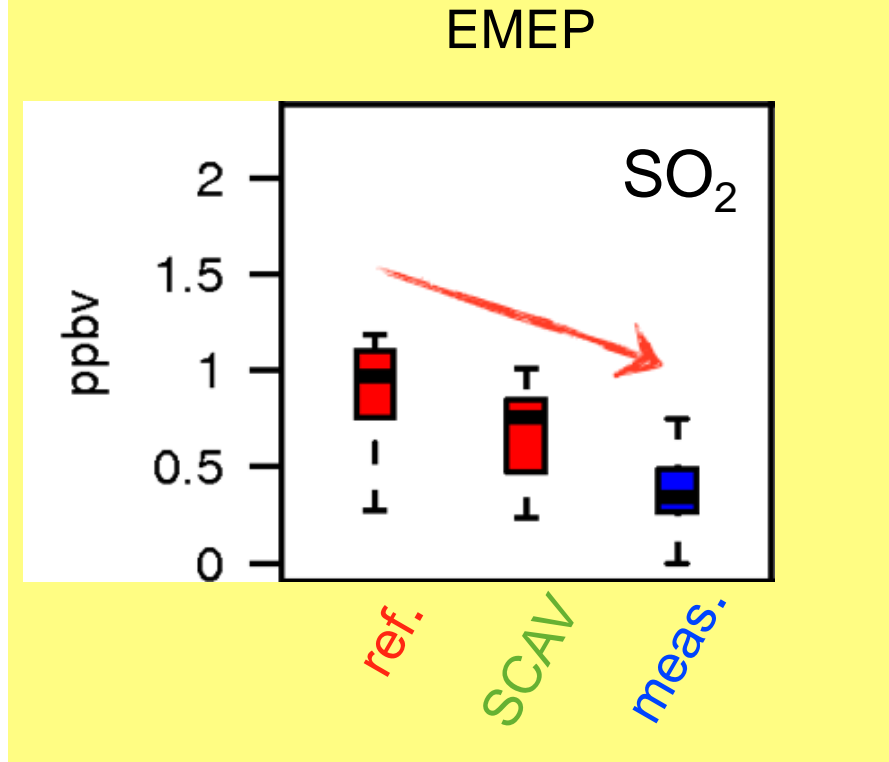
New users:

BTU Cottbus, Germany

# Aqueous phase chemistry

Knote, 2012

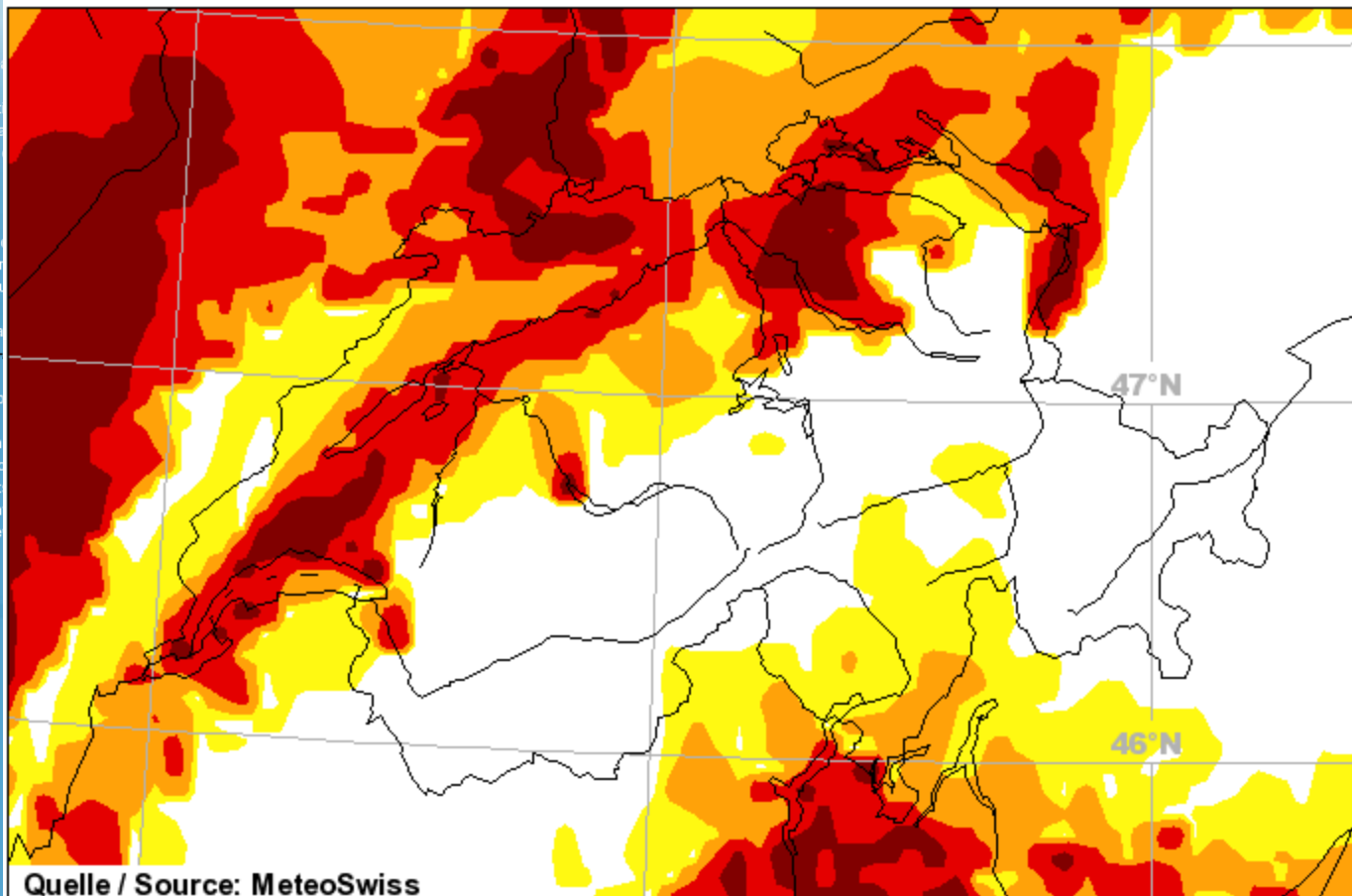
SCAV, Tost et al., 2006





**COSMO-7 Analysis for: Sun 3 Apr 2011 00 UTC** **Version: opr 7km (897)**  
**Birch Pollen Concentration** **Maximum: 1534.3m-3** **Run: 03.04.2011 00UTC+0h**

- Weather
- Overview We...
- General situat...
- Detailed forec...
- Current weath...
- Ozone layer
- Health
- ↓ Pollen
  - Pollen m...
  - Pollen-Pr...
  - Backgrou...
  - Links
  - Ambrosia...
- COSMO-...
- Heat
- UV Index Fo...
- Ozone
- Meteorosen...
- Development o...
- Model forecast...
- Weather even...
- Weather revie...



Quelle / Source: MeteoSwiss

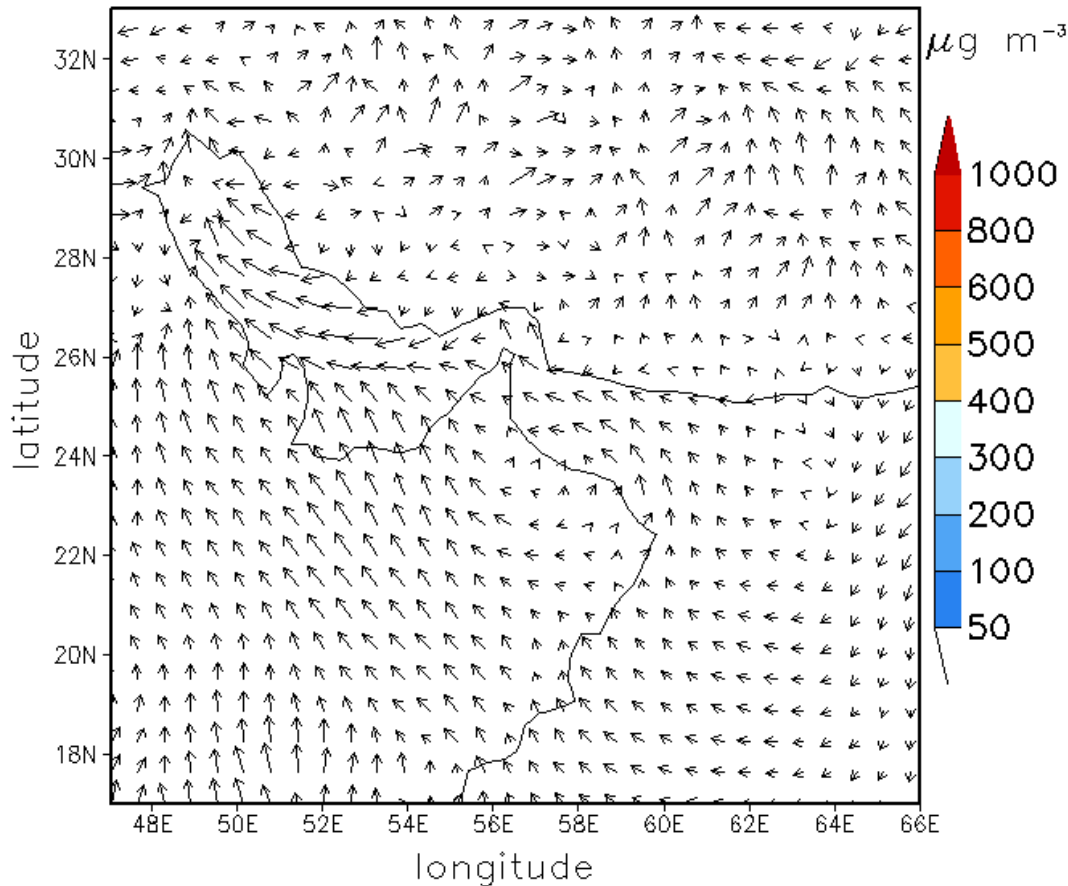
season is taken into account, too. Towards the end of the pollen season less pollen are emitted. The end of flowering is calculated using a temperature model as well.

The important advantage of the new birch pollen forecasts is the complete spatial coverage of Switzerland

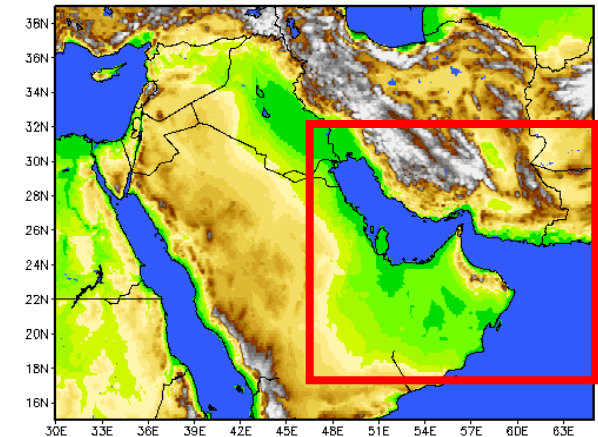
# Operational use of COSMO-ART for UAE

Simulated mass concentration, 4-6 February 2010

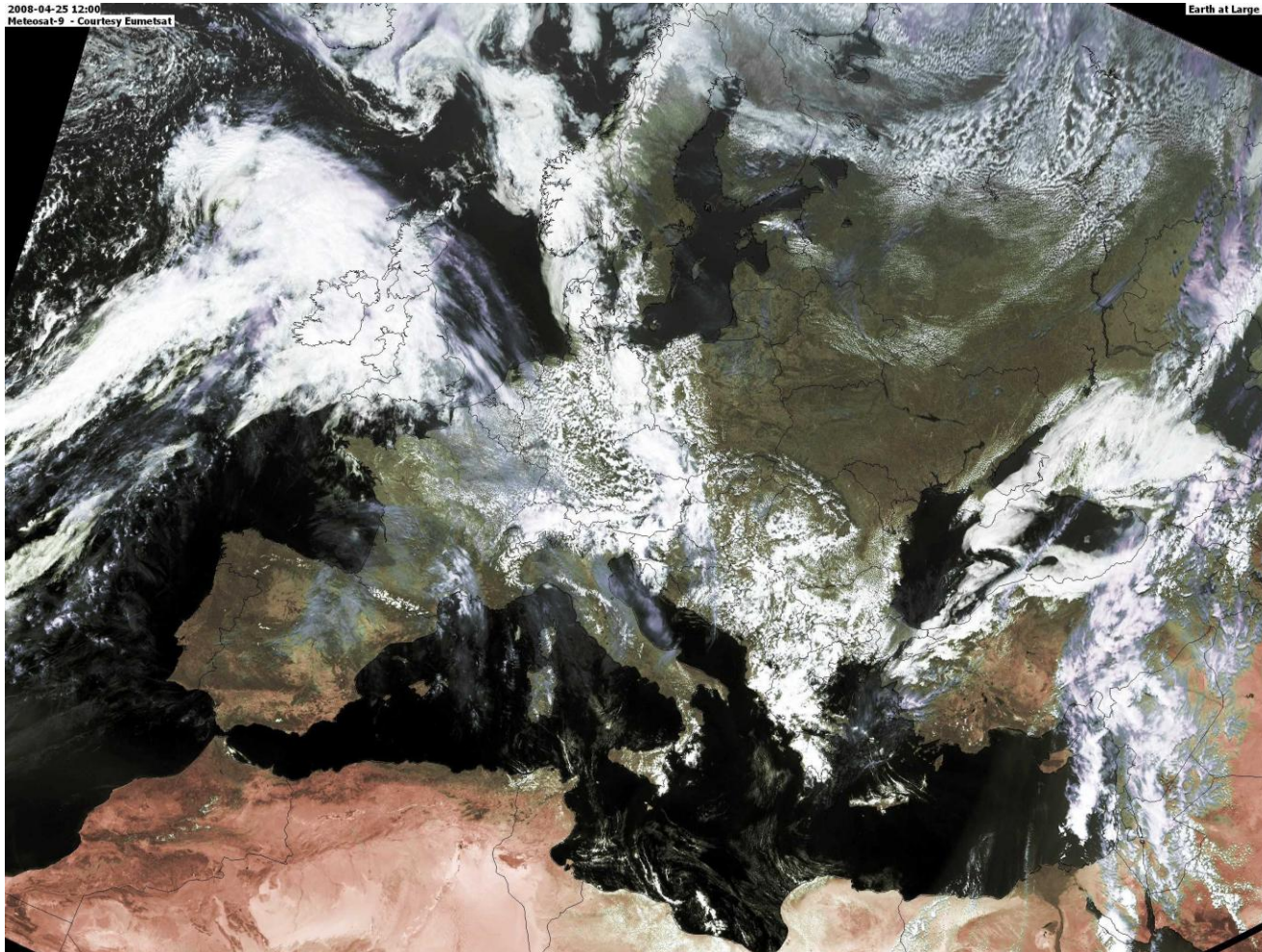
04. FEB 2010, 00 UTC



COSMO-ARAB Domain



# Post frontal convective clouds, 25 April, 2008



# Setup of the model runs

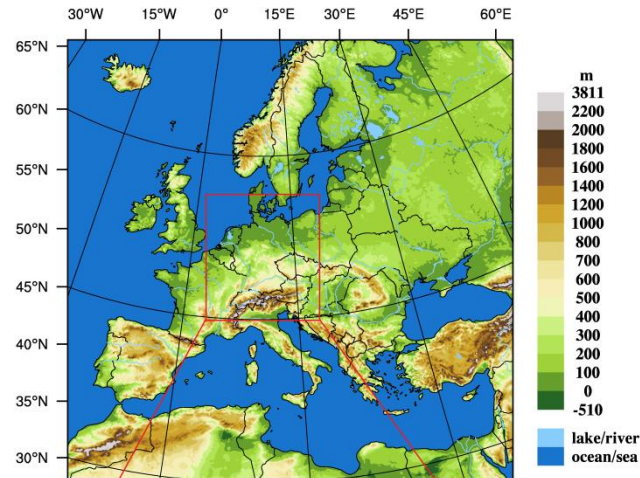
## Scenarios:

C: continental sea salt, fixed

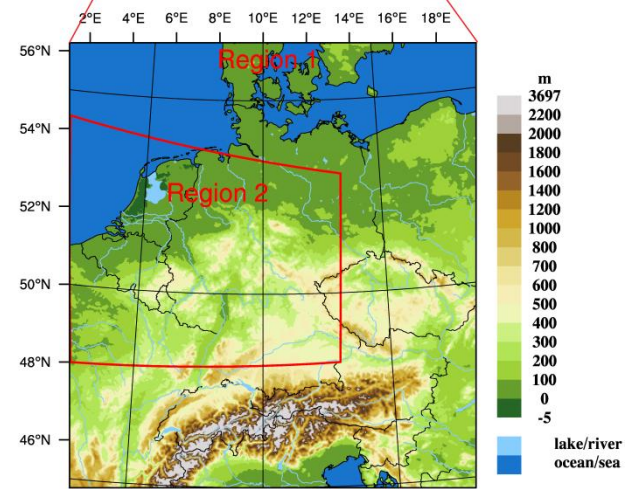
M: maritime sea salt, fixed

EM: extreme maritime, sea salt, fixed

FI: fully interacting run



7 km grid

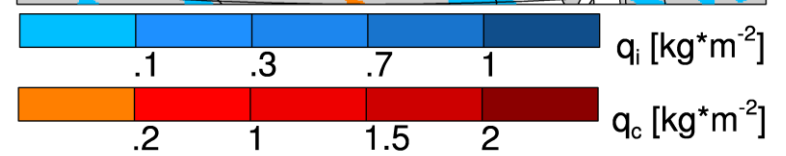
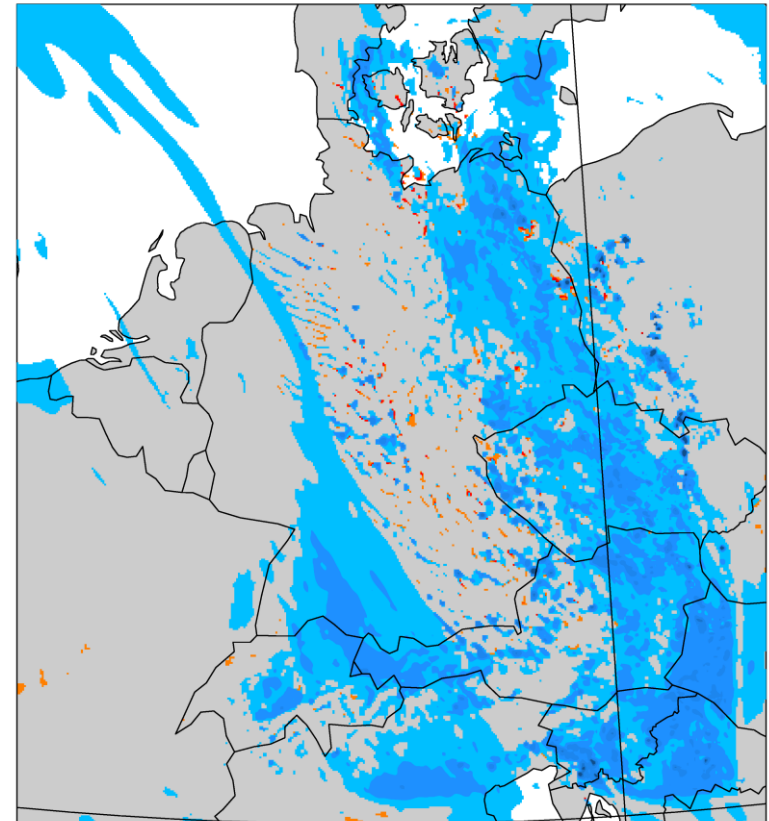
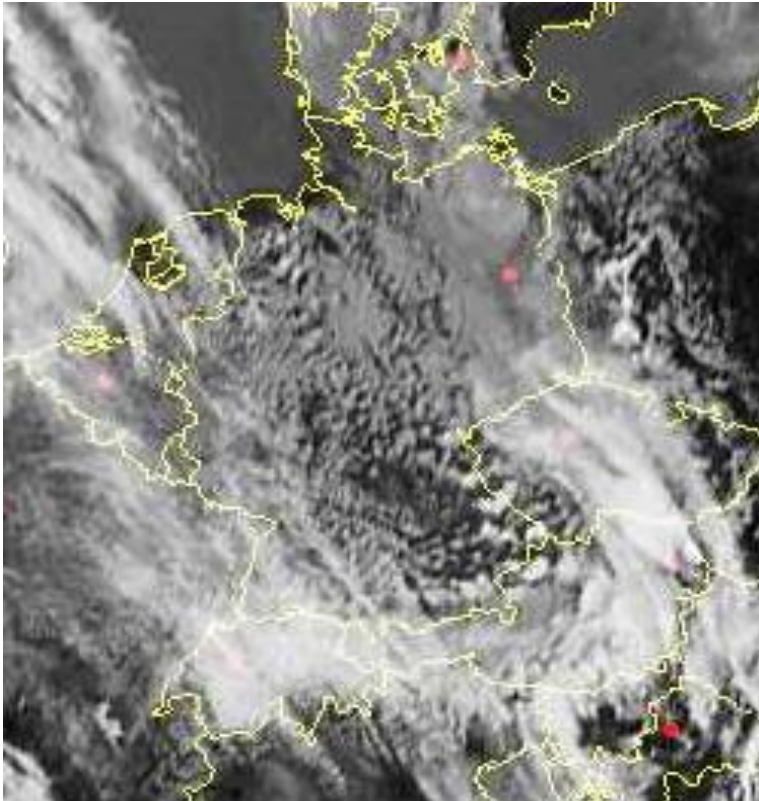


2.8 km grid



# Comparison with sat pic

25.4.2008 12 UTC



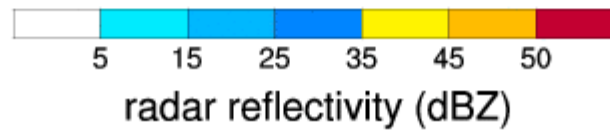
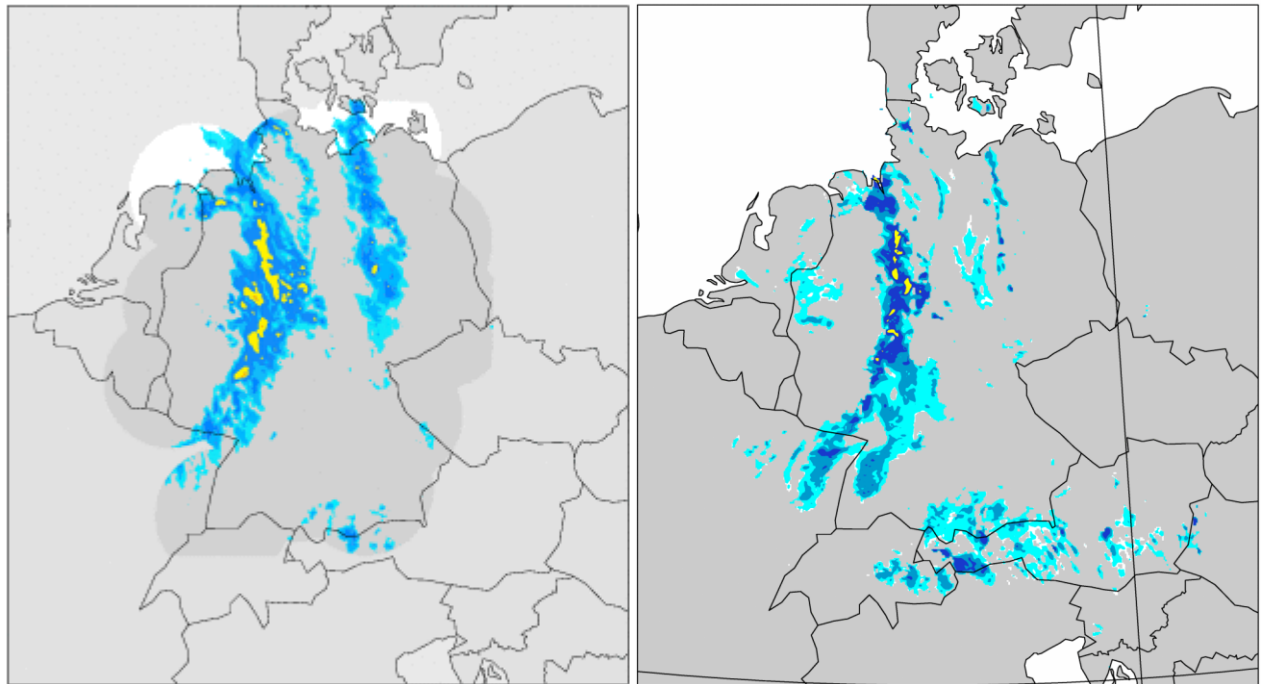
# Comparison with radar

Radar

Model, Fi

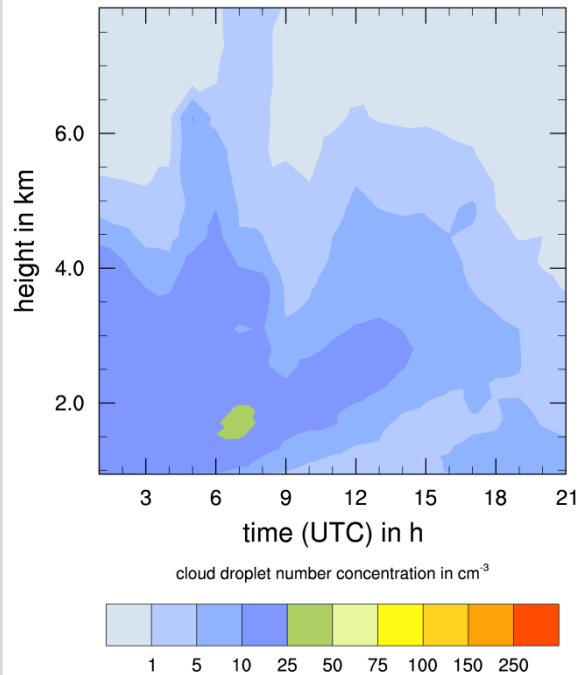
20080425, 00:00

SIM 20080425 00 UTC

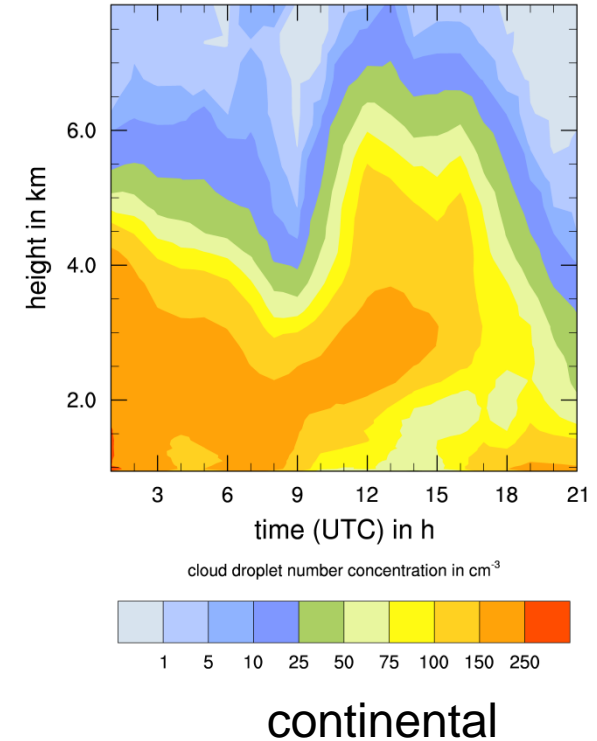
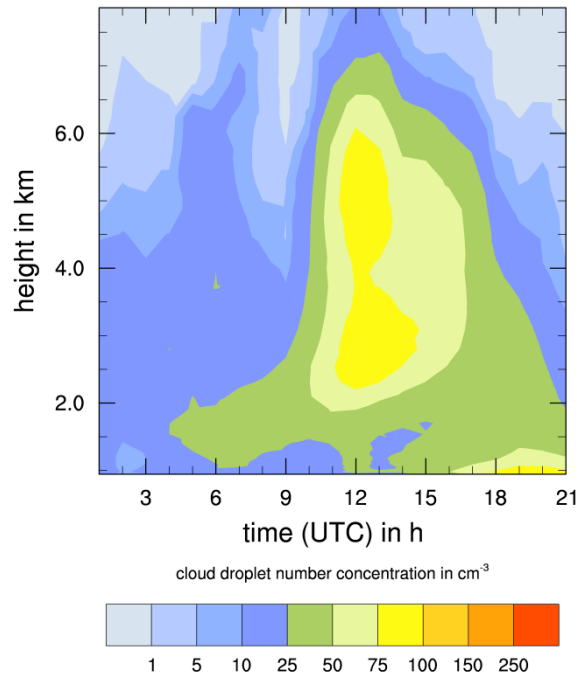


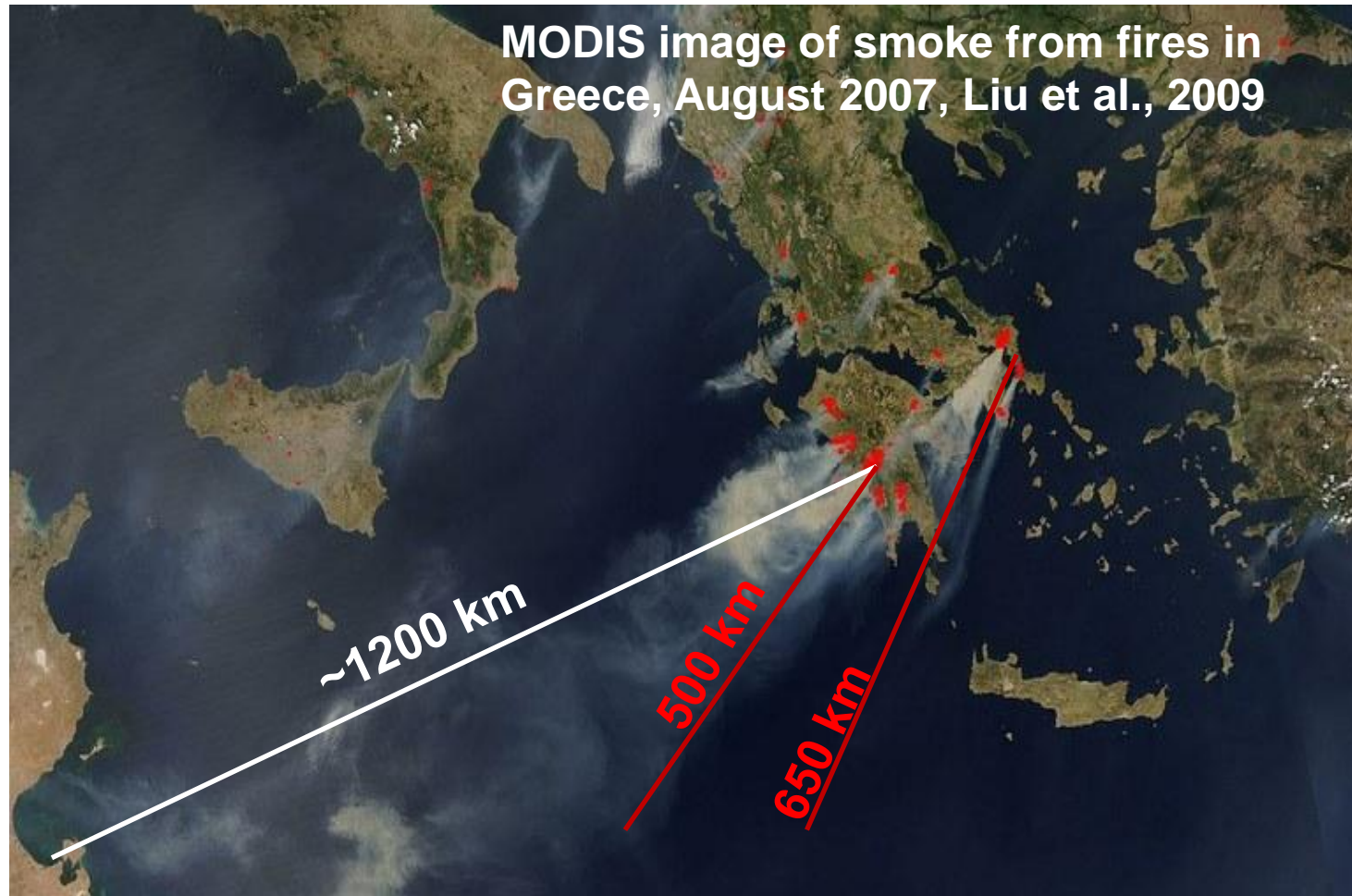
# Impact of aerosol scenario on droplet number

## extreme maritime



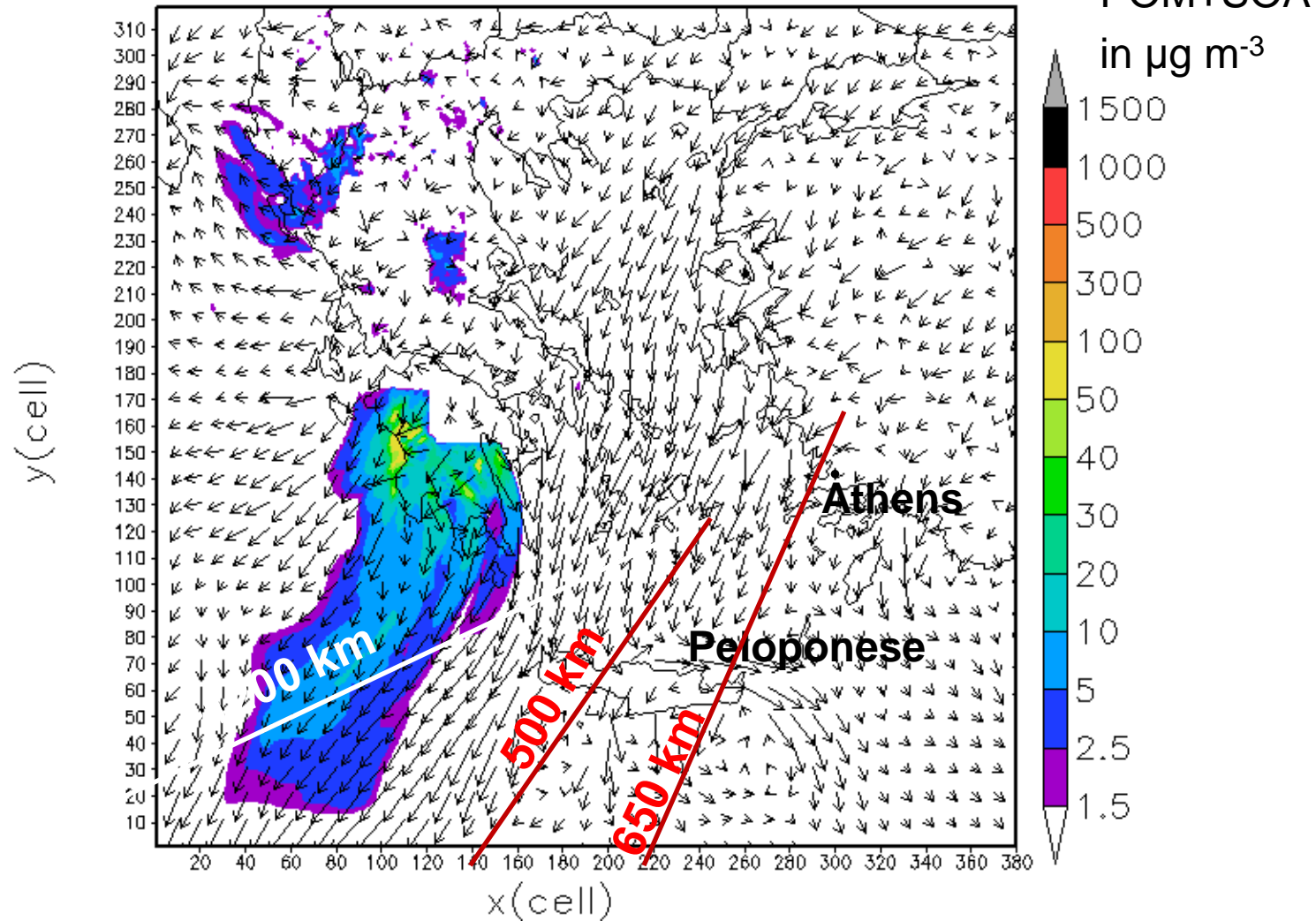
## fully interacting





24–29 August 2007

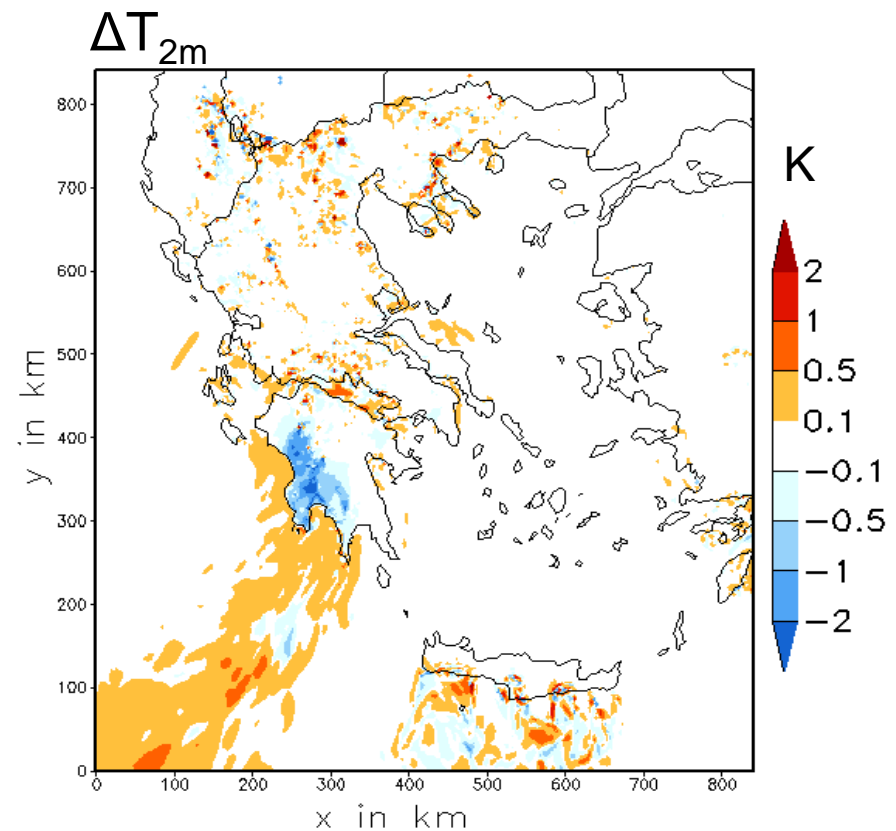
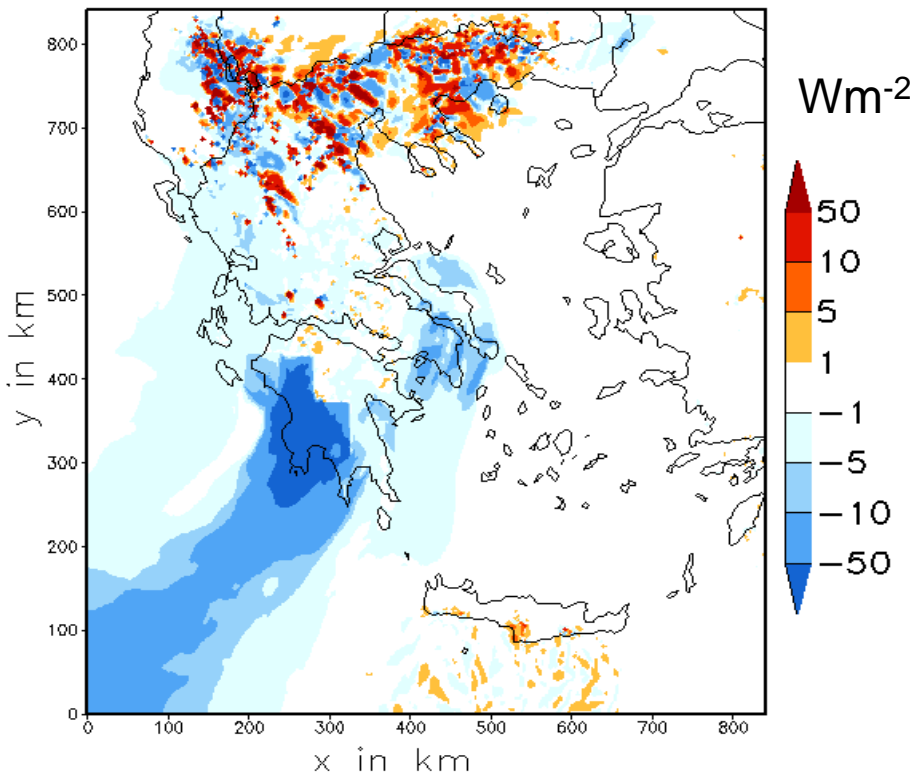
03Z24AUG2007



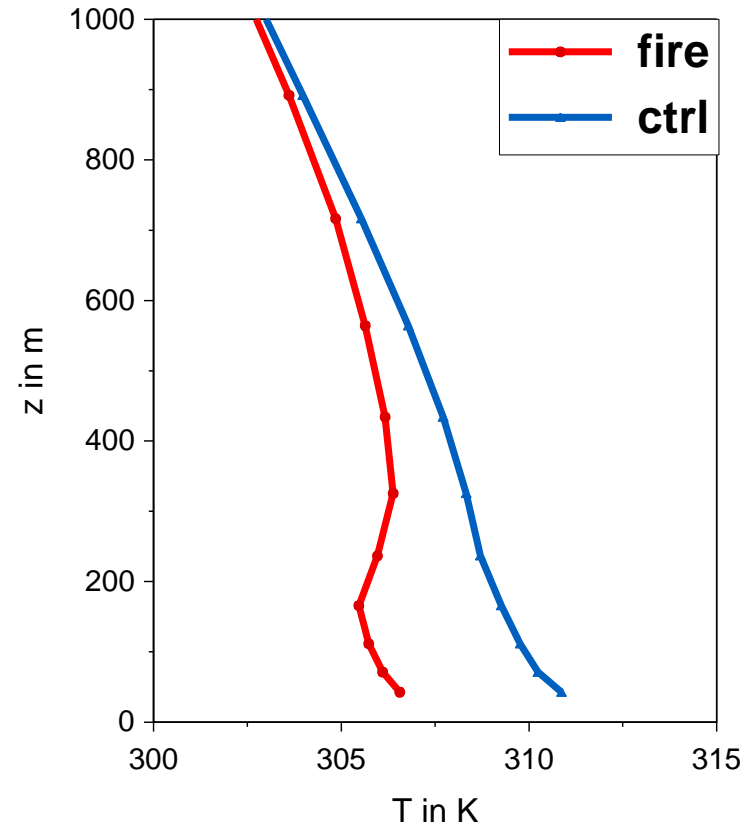
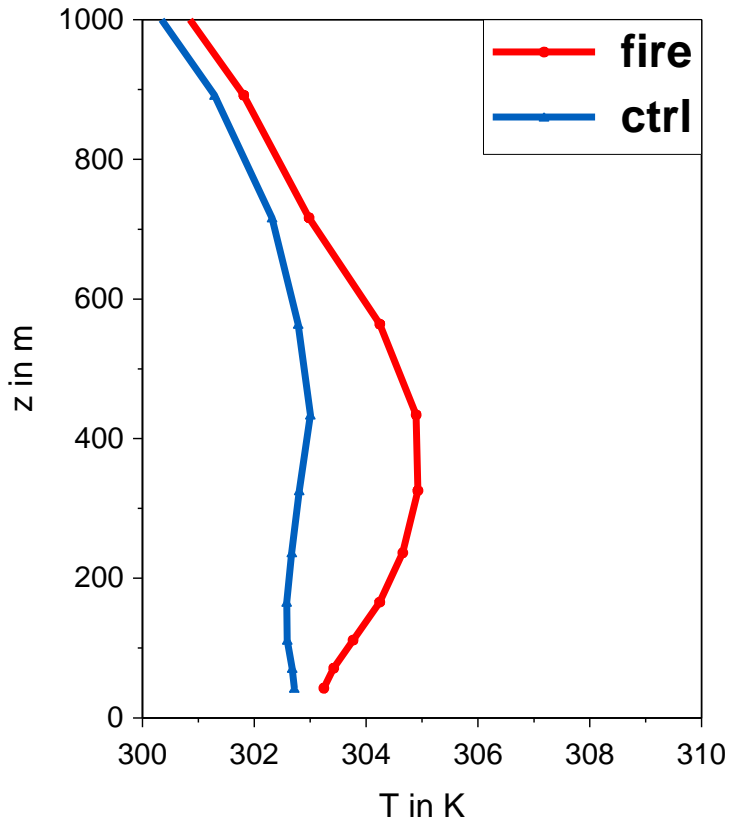
# Direct radiative effect of aerosols

differences from a scenario without fire emissions, 26.08.2007, 12 UTC

short-wave + long-wave



# Temperature profiles, 26.08.2007, 12 UTC



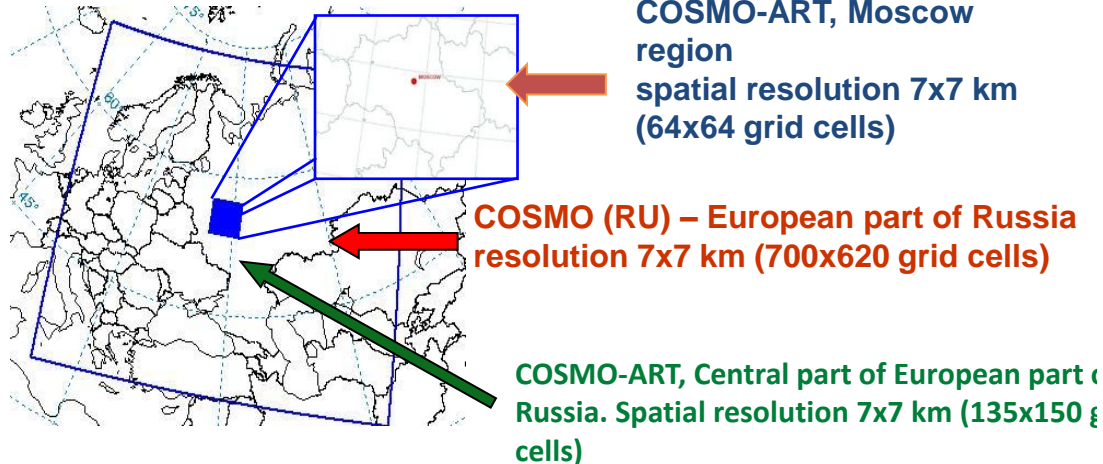
# COSMO-ART in Russia

COSMO-ART works as **quasi-operational** model: it runs automatically every day from 00 UTC for 24 hours.

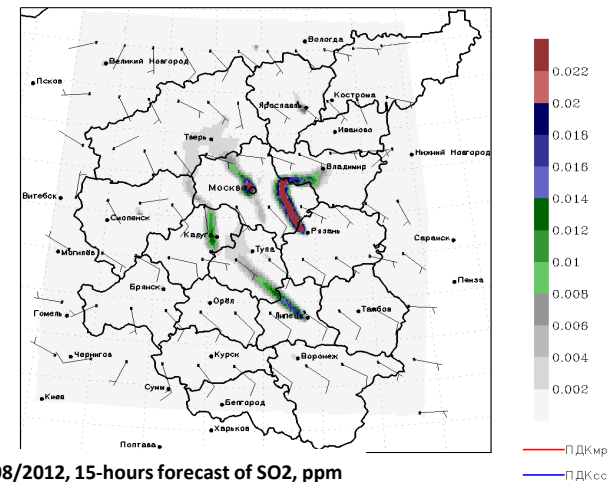
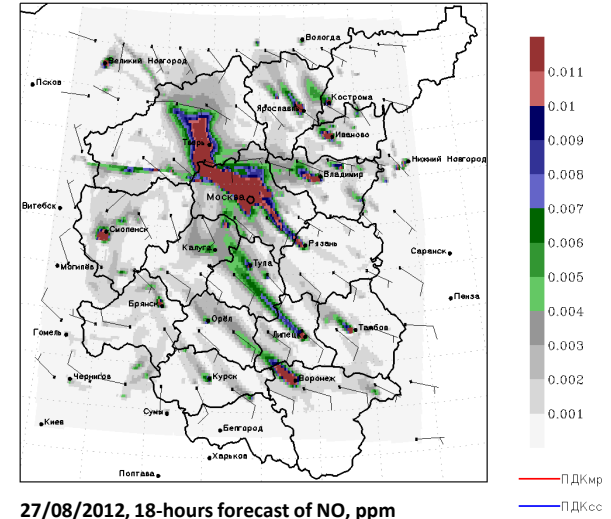
## Current work:

- 1) Every day 24-hours forecast of air pollutant's concentration over center of the European part of Russia
- 2) Model runs for certain time periods in order to verify model over Moscow region
- 3) Fires forecast: episode of summer 2010 in European part of Russia
- 4) Developing of operational method of emissions calculations

Domains:

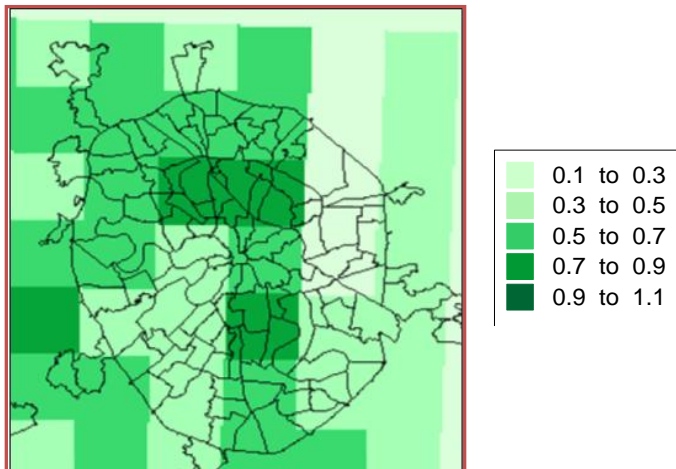
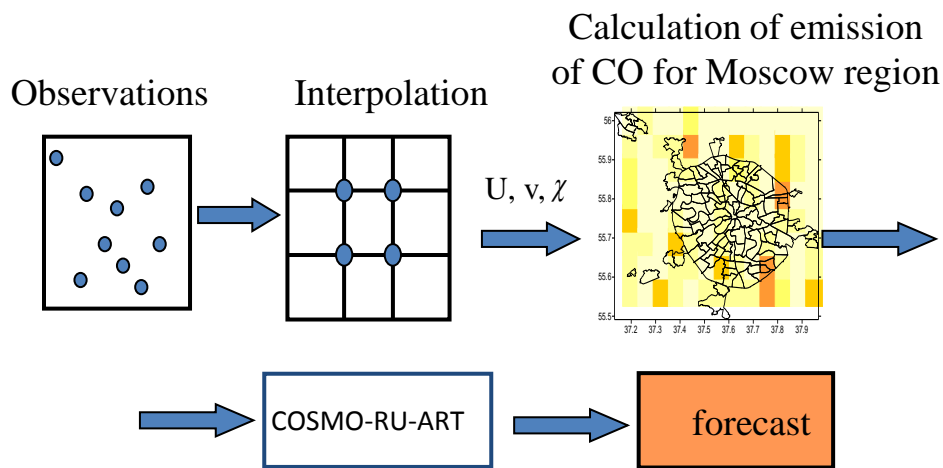


## Examples of 24-hours forecast



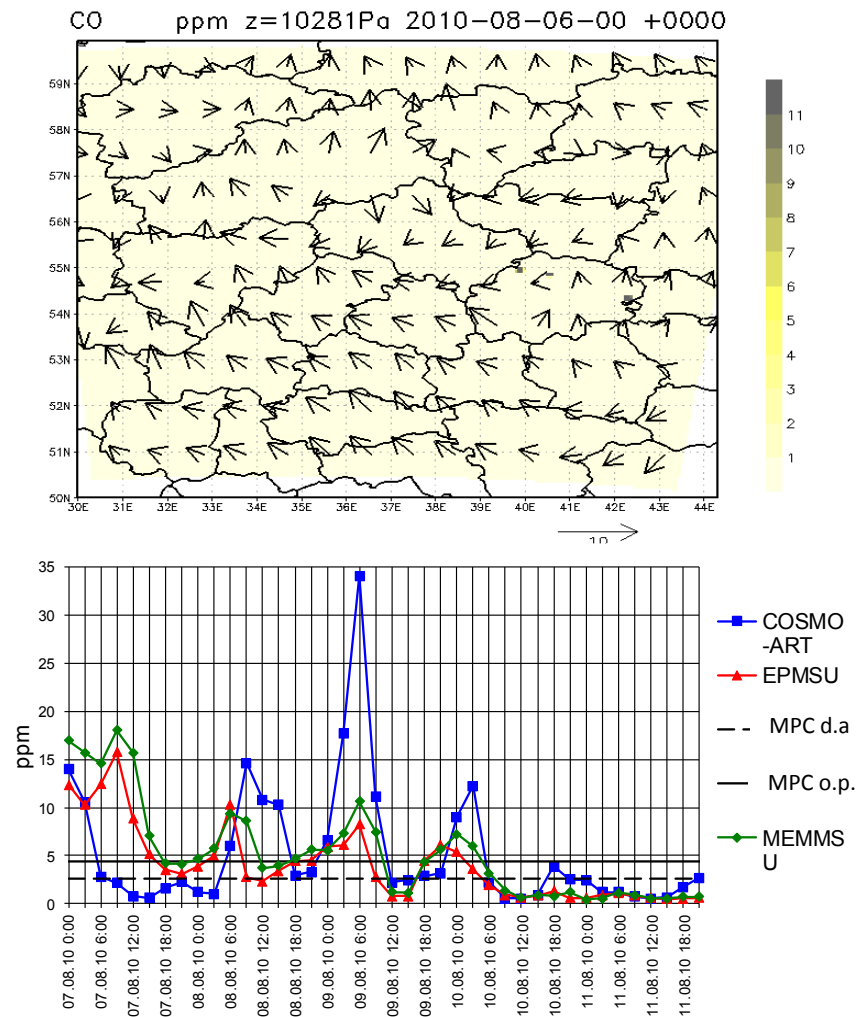


# Operational method of emissions calculations



Forecast of CO concentrations over Moscow at the 8 a.m., 12 of August 2011, units – mg/m<sup>3</sup>.

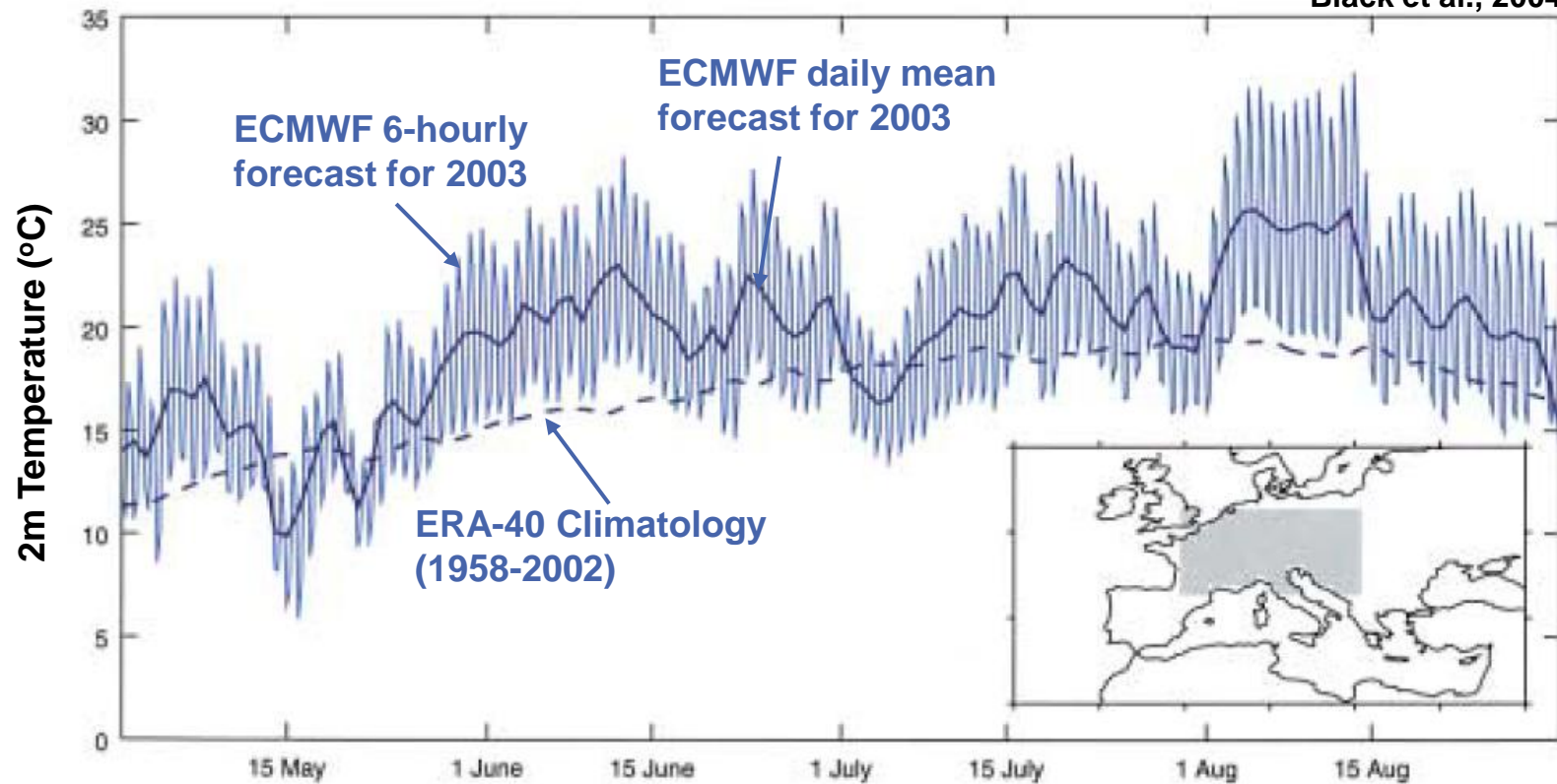
# Fires forecast



Temporal variation of the CO concentration during wild fires 2010

# Summer 2003: Exceptionally warm and dry

Black et al., 2004



# Model setup

$\Delta x = 14 \text{ km}$

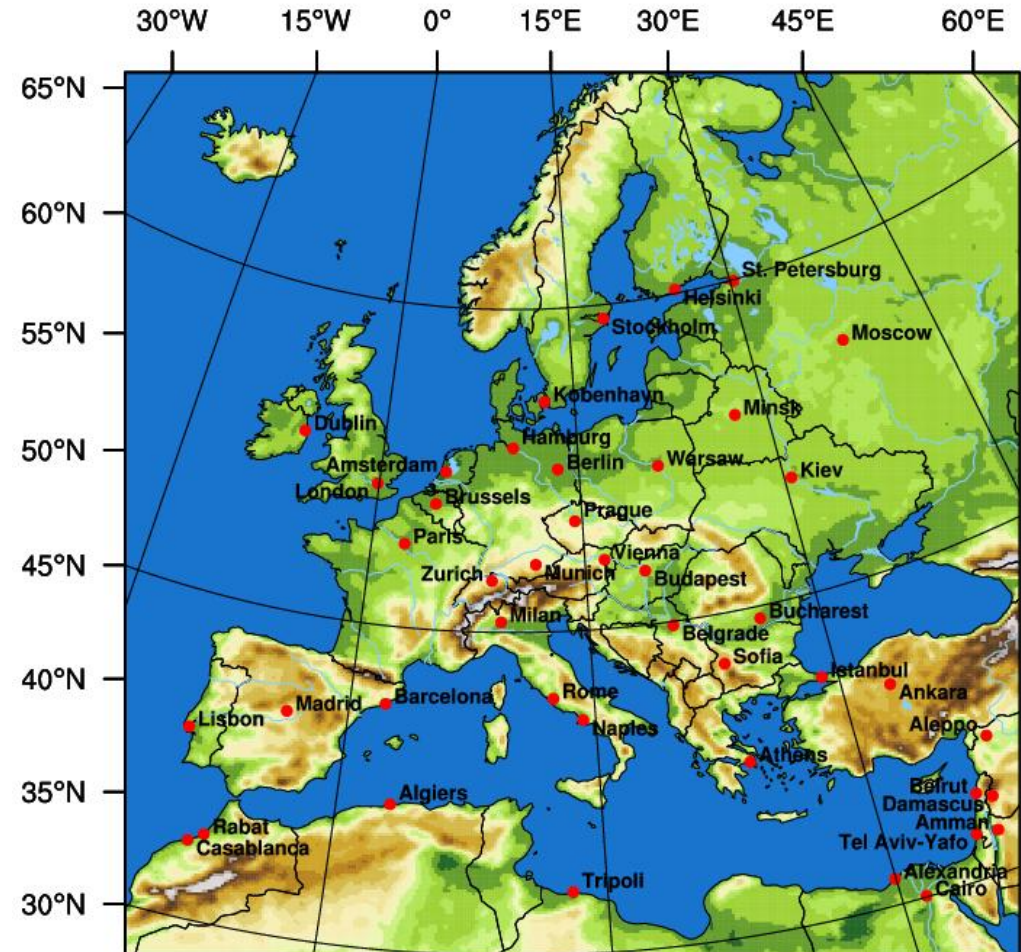
$\Delta t = 40 \text{ s}$

Forcing: ERA-interim

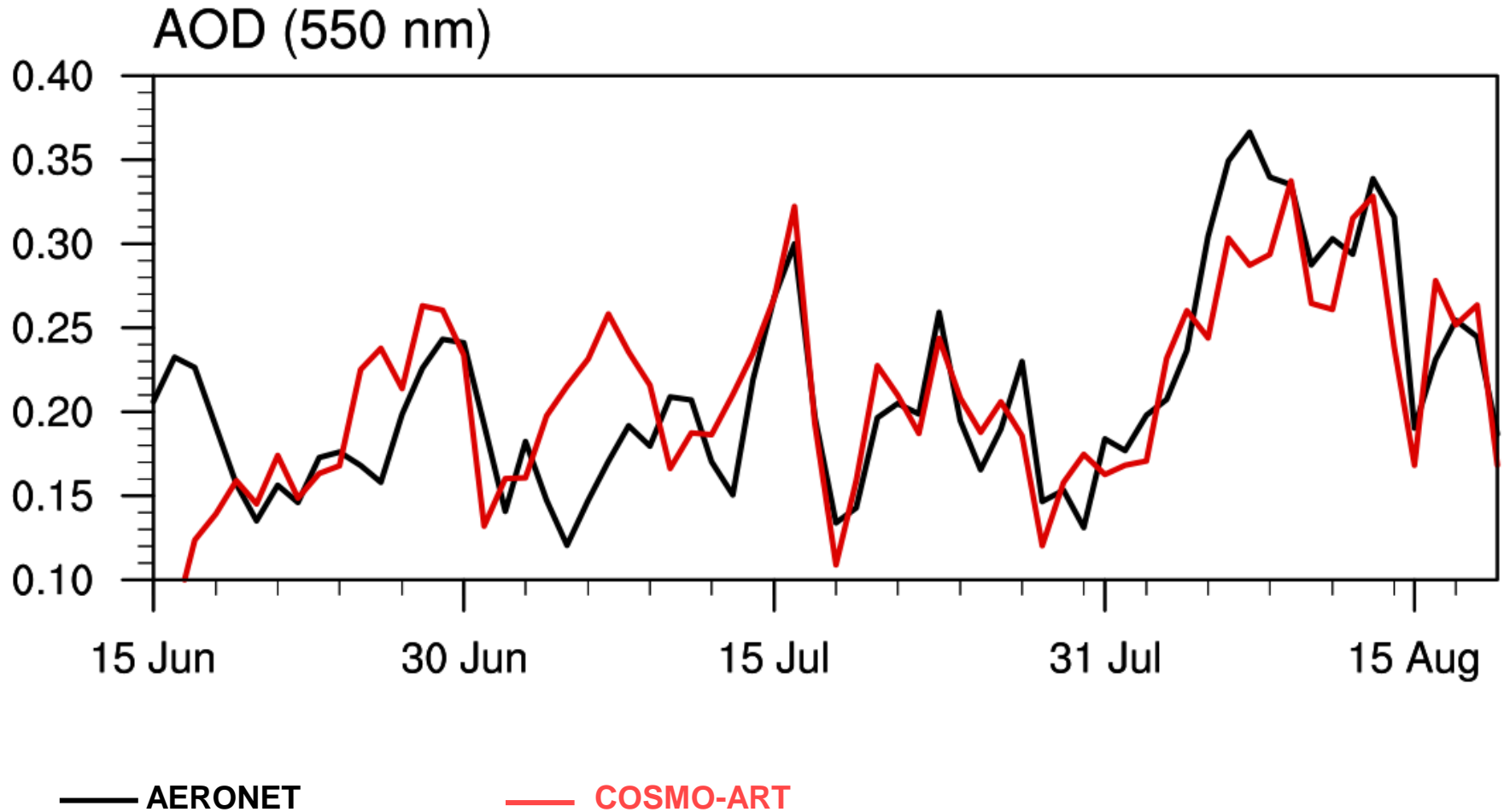
15<sup>th</sup> June to 20<sup>th</sup> August 2003

COSMO spin-up since 1<sup>st</sup> January 2002

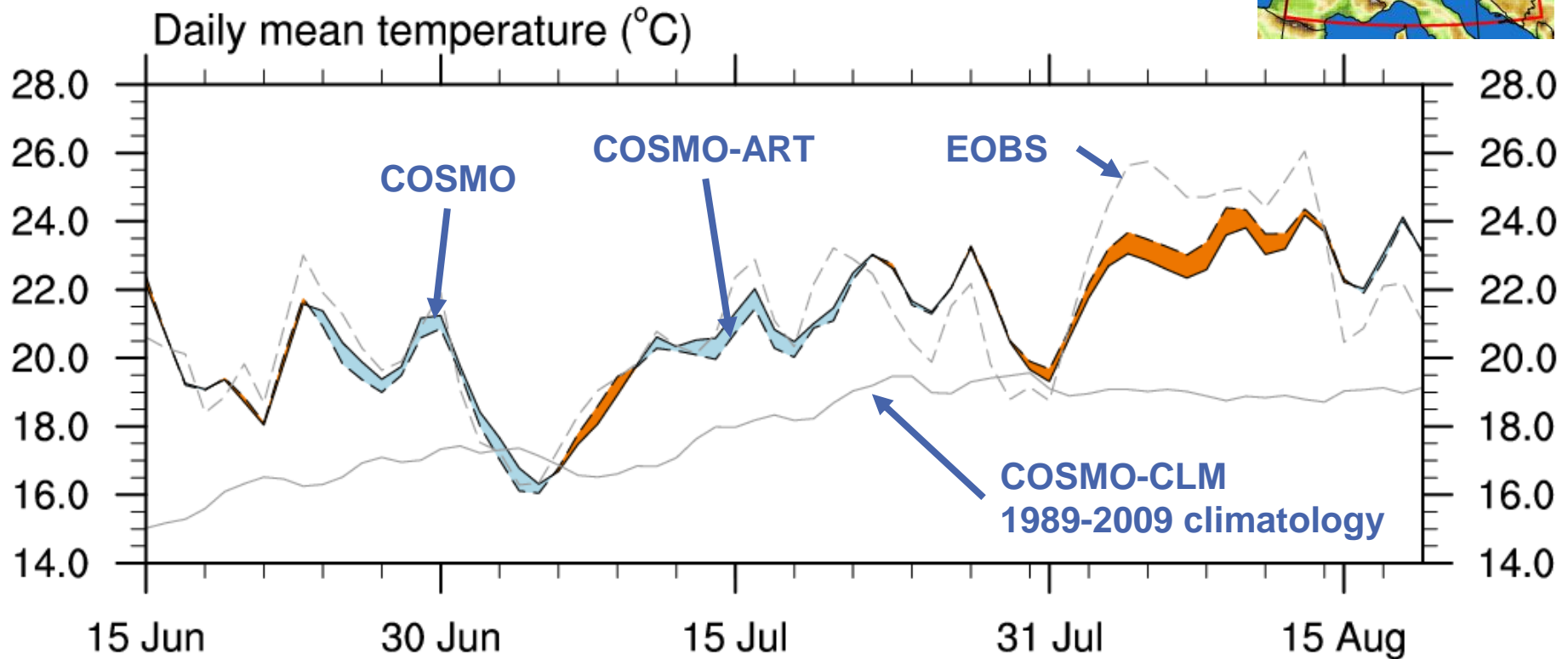
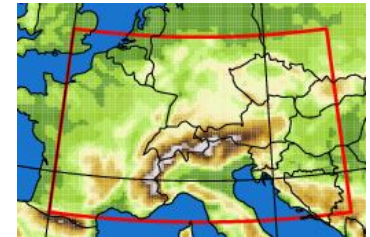
Anthropogenic emission data from TNO



# Comparison with observations

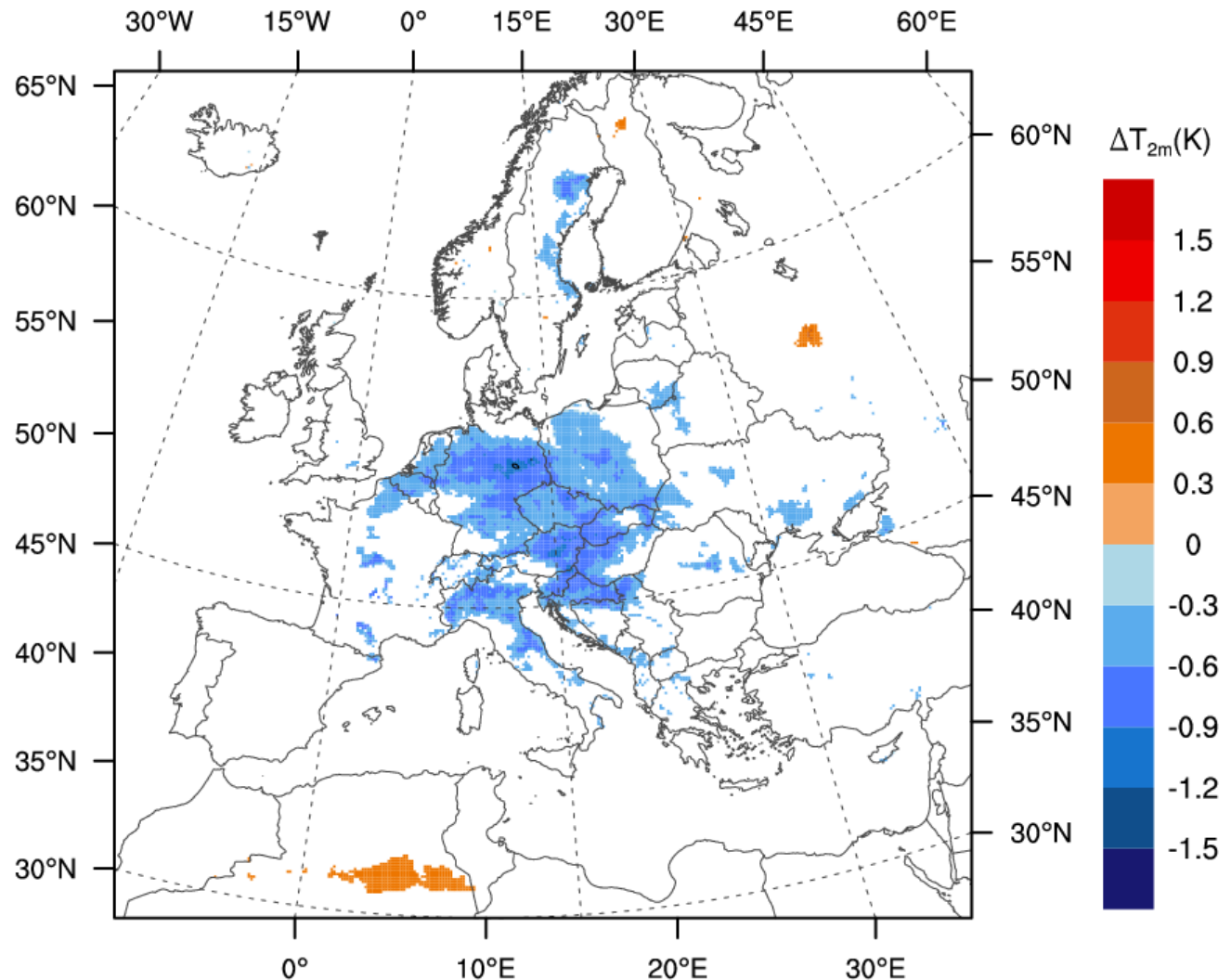


# Impact on 2 m temperature



# Impact on 2 m temperature

**Statistical  
significant**



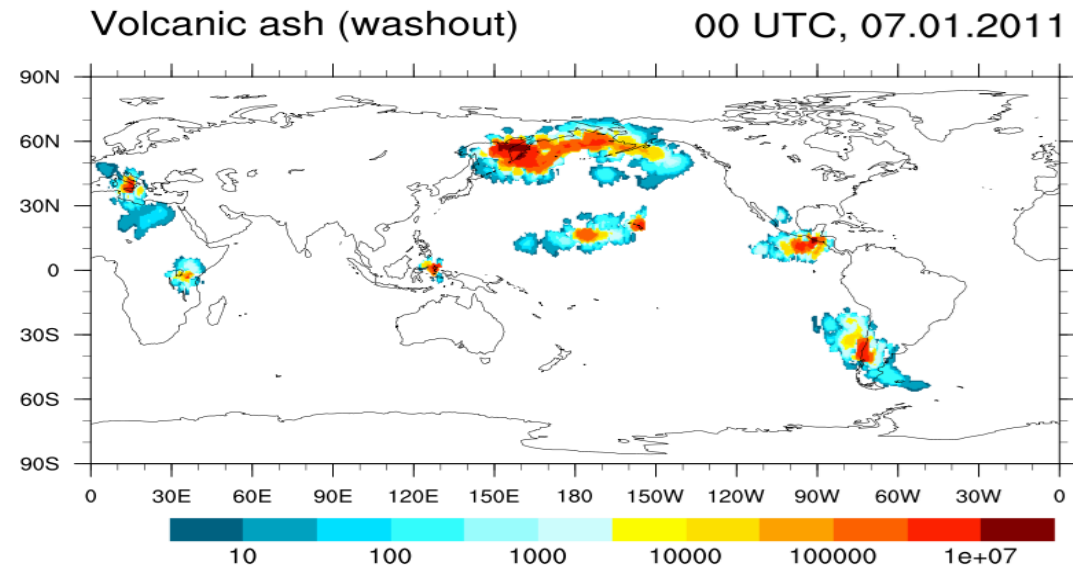
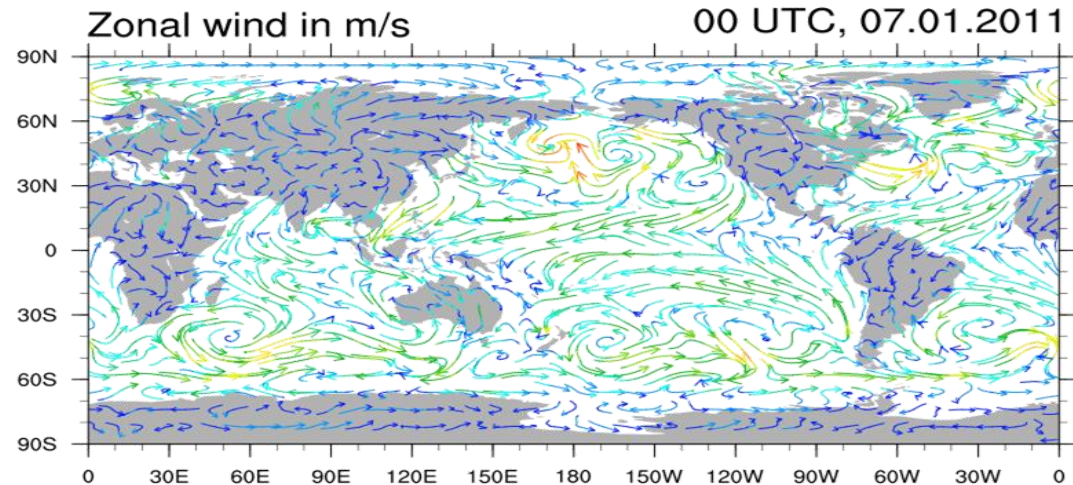
## **Acknowledgement:**

**We acknowledge all those who developed and are steadily improving the COSMO model**

**We appreciate the support by:**

**U. Schättler, M. Baldauf, J. Förstner, A. Seifert, U. Blahak**

# A look into the future





# Take home messages

**Development of COSMO-ART is almost finished**

**Happy days of applications are arising**

**CLM-ART runs are on their way**



**is on the horizon**