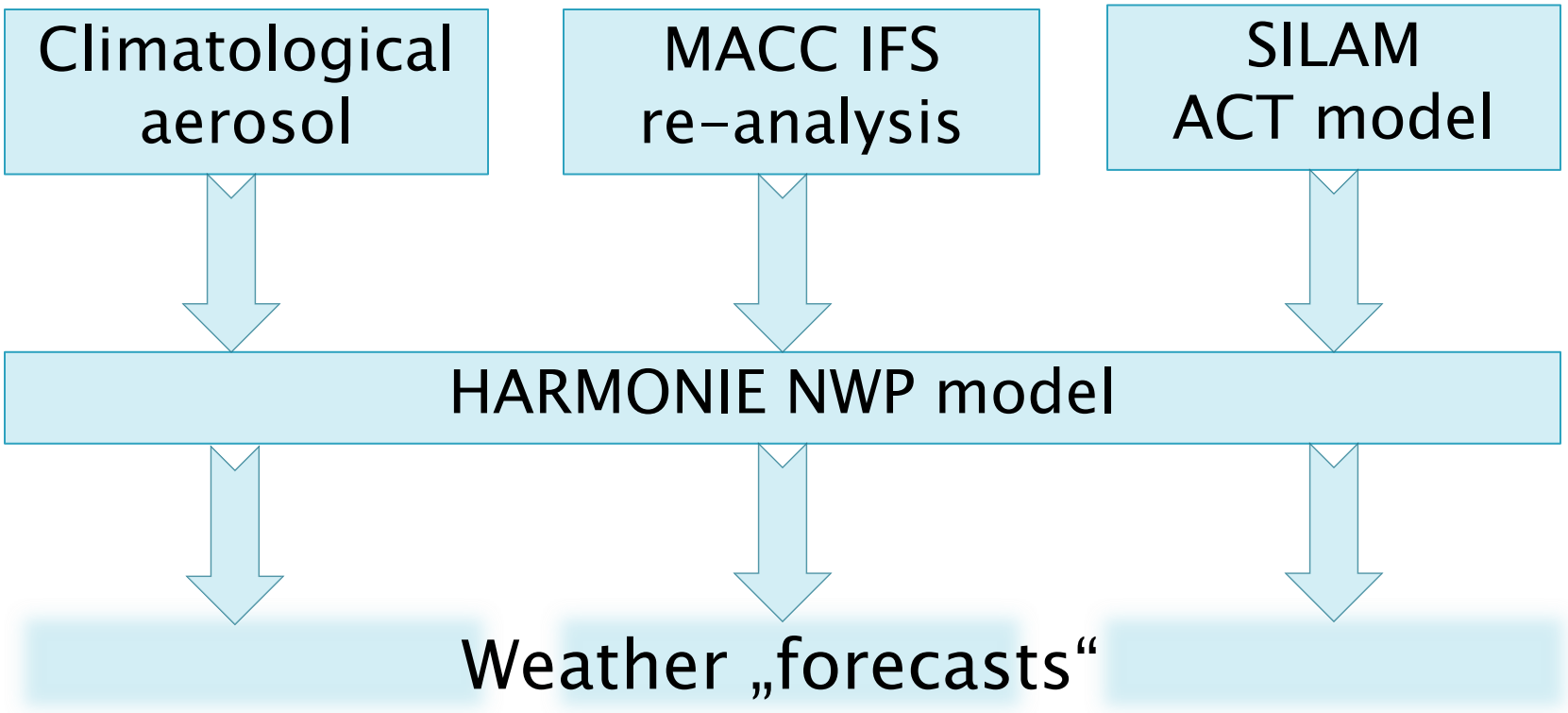
# SILAM and MACC IFS output used for simulating the aerosol direct radiative forcing with HARMONIE model for summer 2010 wildfire case in Russia

*Marko Kaasik*[1], *Velle Toll*[1], *Ketlin Reis*[1], *Riinu Ots*[1,2], *Aarne Männik*[1], *Mikhail Sofiev*[3], *Marje Prank*[3]

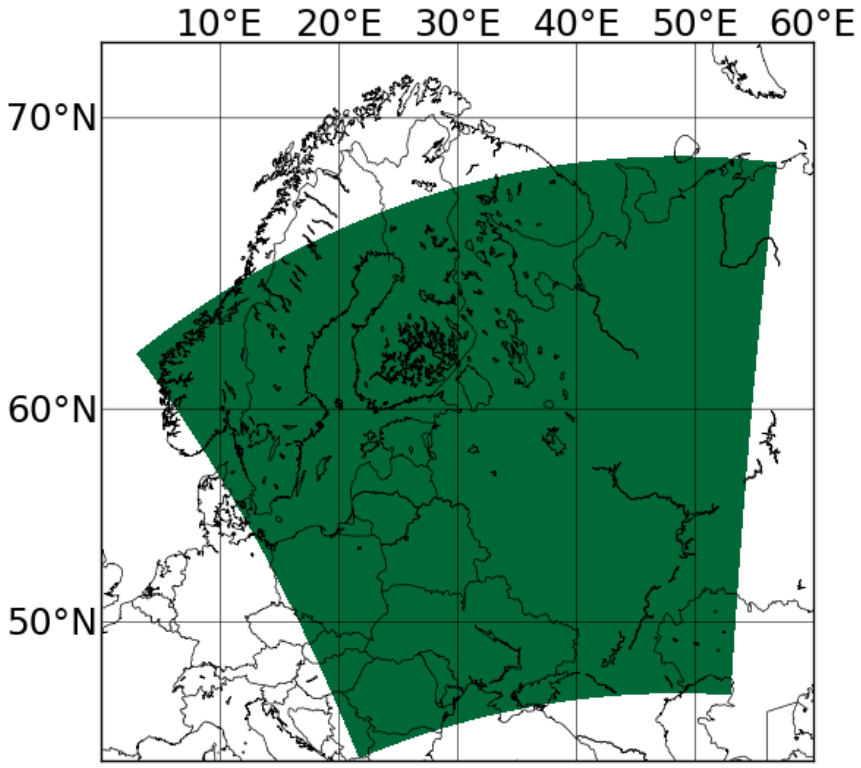
[1]Institute of Physics, University of Tartu, Estonia
[2]Edinburgh University, Edinburgh, UK
[3]Finnish Meteorological Institute, Helsinki, Finland

# Experiment setup

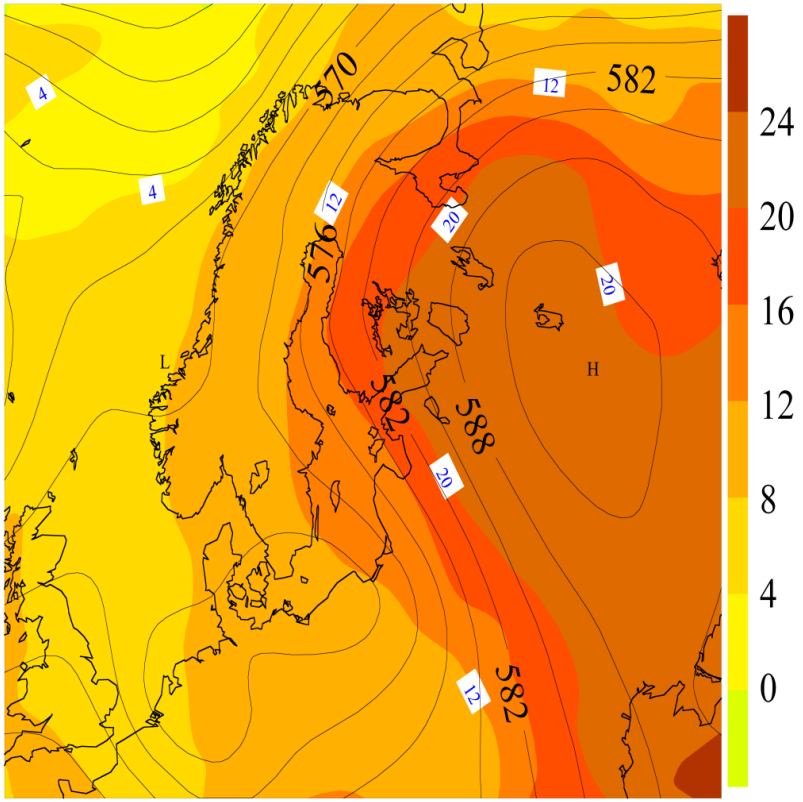


# HARMONIE model setup

- Hydrostatic dynamics, ALARO physical parameterisations
- 10 km grid spacing (4 min timestep)
- IFS radiation parameterisations
- Aerosol input from MACC and SILAM (AOD at 550nm wavelength)
  - MACC IFS – assimilated satellite data
  - SILAM – dispersion from sources
- ECMWF analyses as boundaries: 120 h long experiments



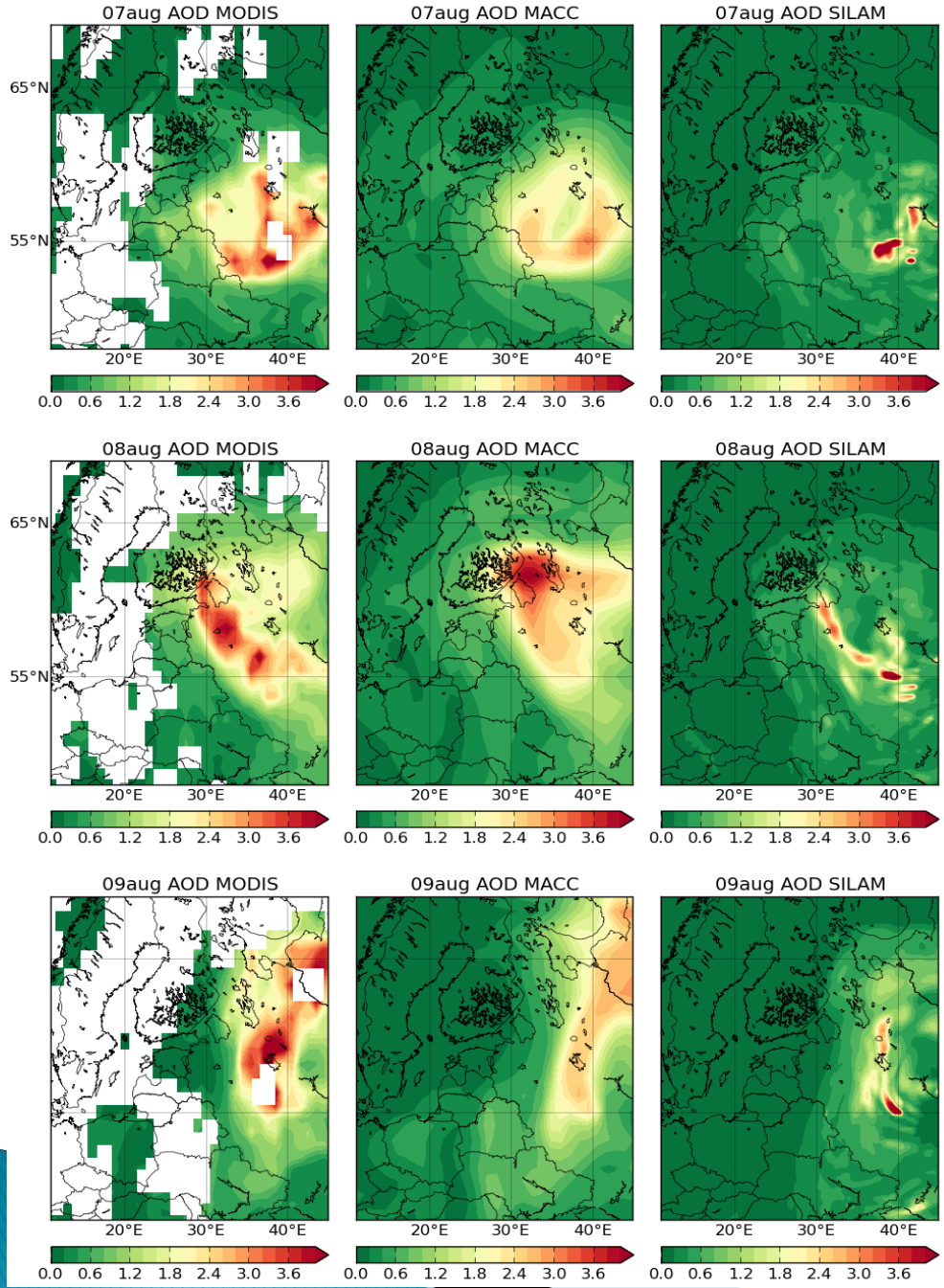

HARMONIE modelling domain.




ECMWF analysis: 500 hPa gph (dam) with contours and 850 hPa temperature (°C) shaded at 12 UTC on August 8, 2010.

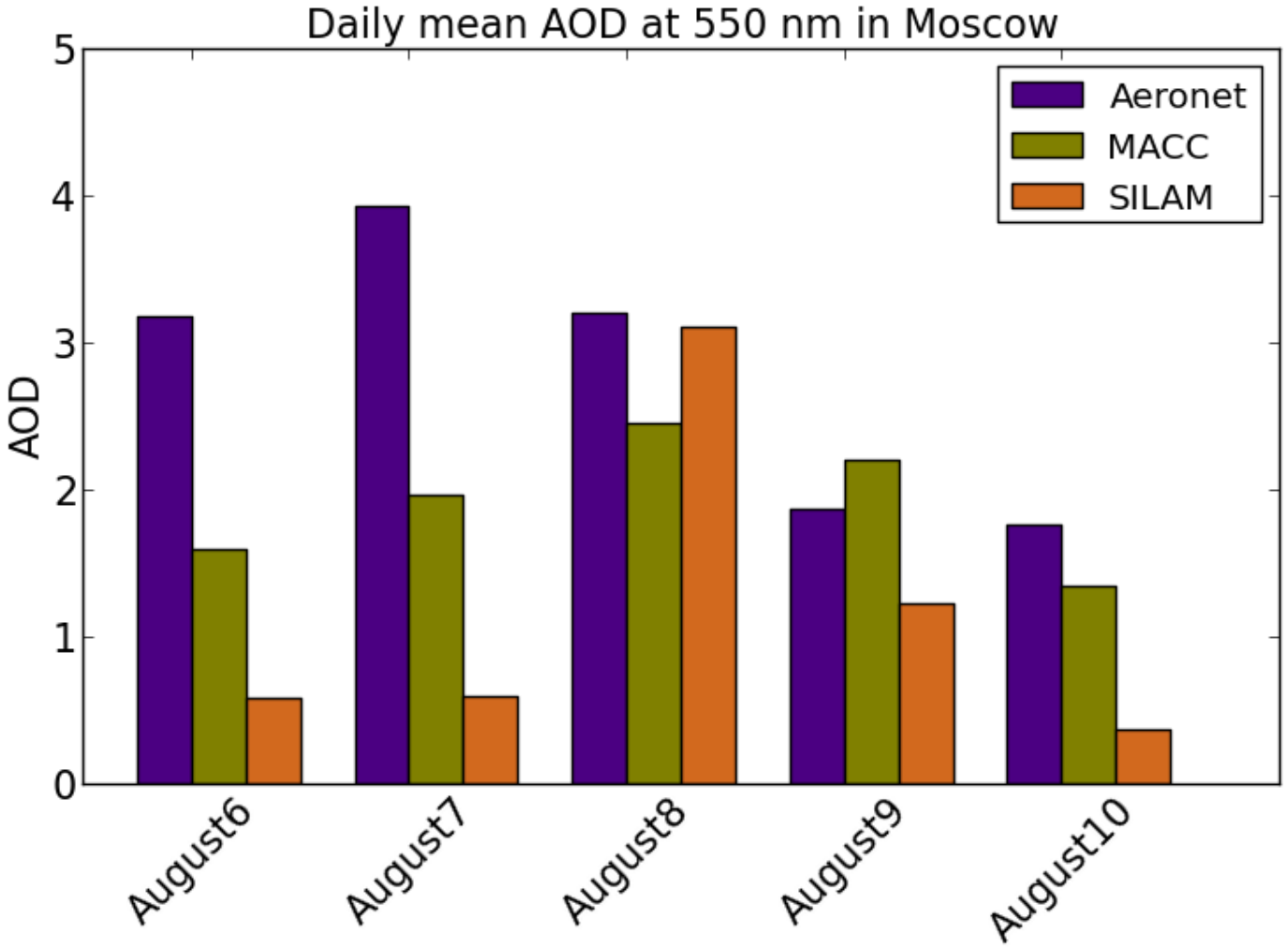
# SILAM model setup

- Horizontal resolution 0.2 degrees.
- 7 layers up to 2600 m height.
- Meteo driver: ECMWF analysis.
- AQMEII2 emission inventory & boundary fields.
- Fire emissions: FMI http://is4fires.fmi.fi
- Sulphate, sea salt, ground dust.




**Aerosol input:**

AOD on August 7, 8 and 9 2010 measured by MODIS (daily product), from MACC-IFS re-analyses (12 UTC) and forecasted by SILAM (12 UTC).



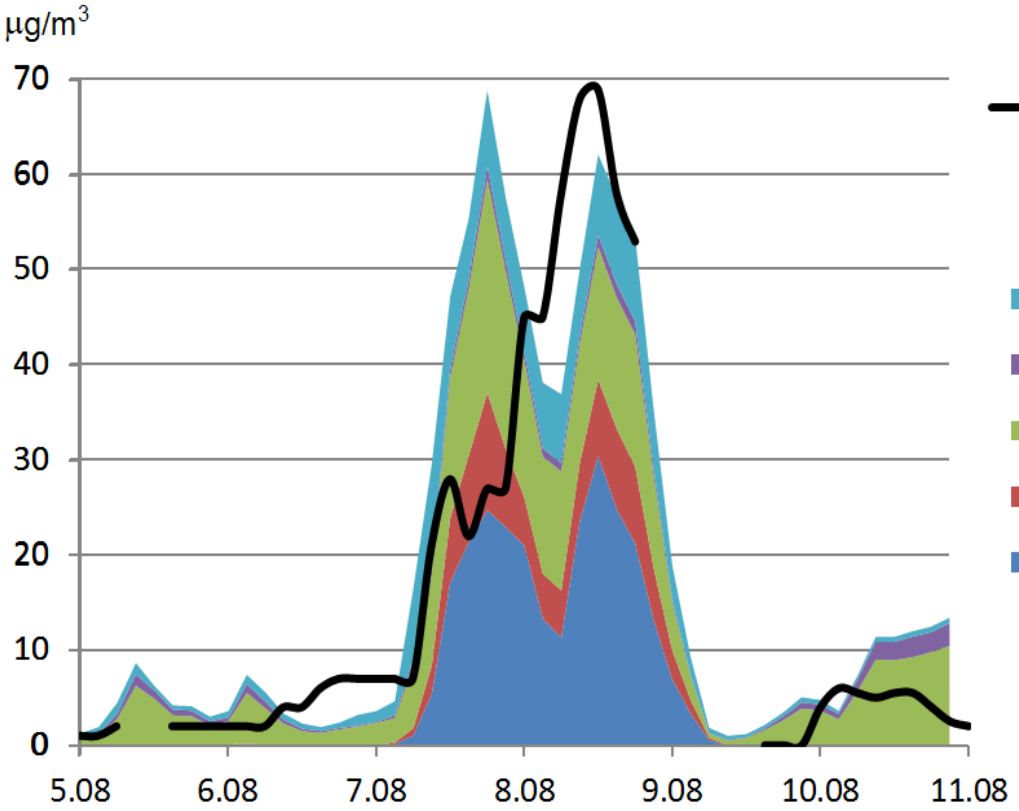

Daily mean AOD in Moscow measured in AERONET station, from MACC-IFS re-analyses and forecasted by SILAM.

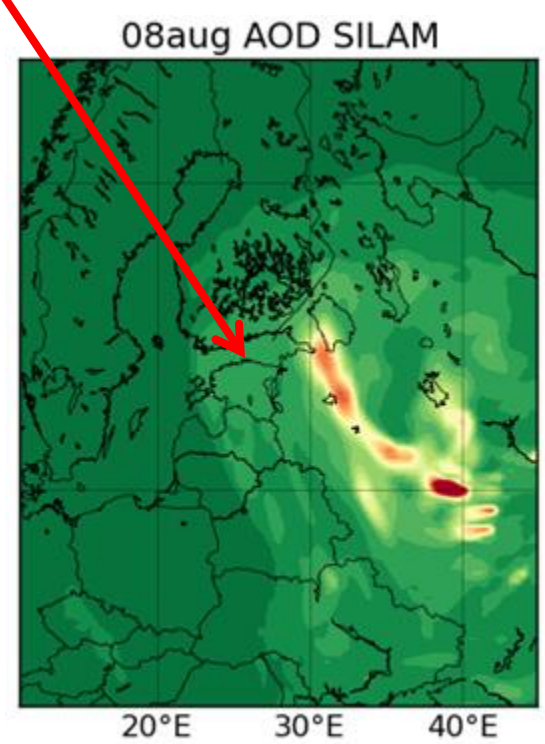
# Why SILAM underestimates AOD?

- Size distribution is highly unknown – if mean diameter of PM2.5 is smaller than assumed 1.5 μm, then the same mass scatters more.
- MODIS does not detect the mouldering peat fires – can be a rather big smoke contribution.
- Perhaps the ceiling of modelling domain was chosen to low – a part of mass leaves upwards. Next run with 6000-meter ceiling is started.

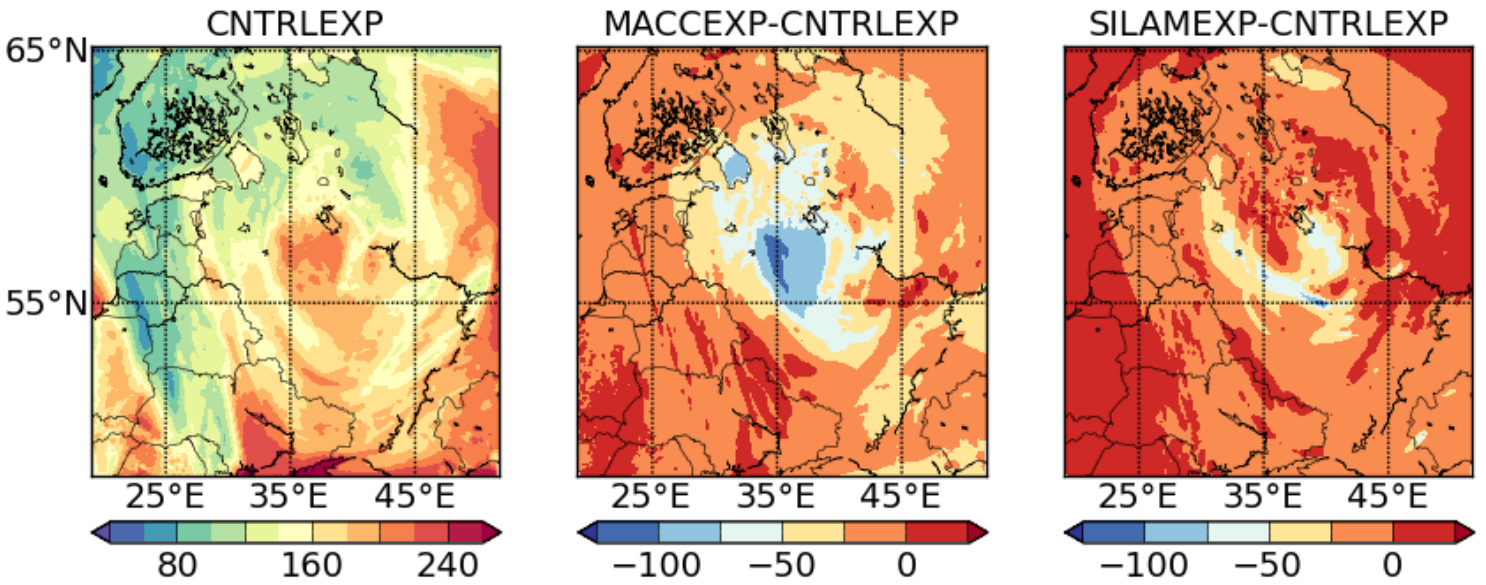
# In periphery of the plume other aerosol types were important, too

Lahemaa monitoring station, Estonia

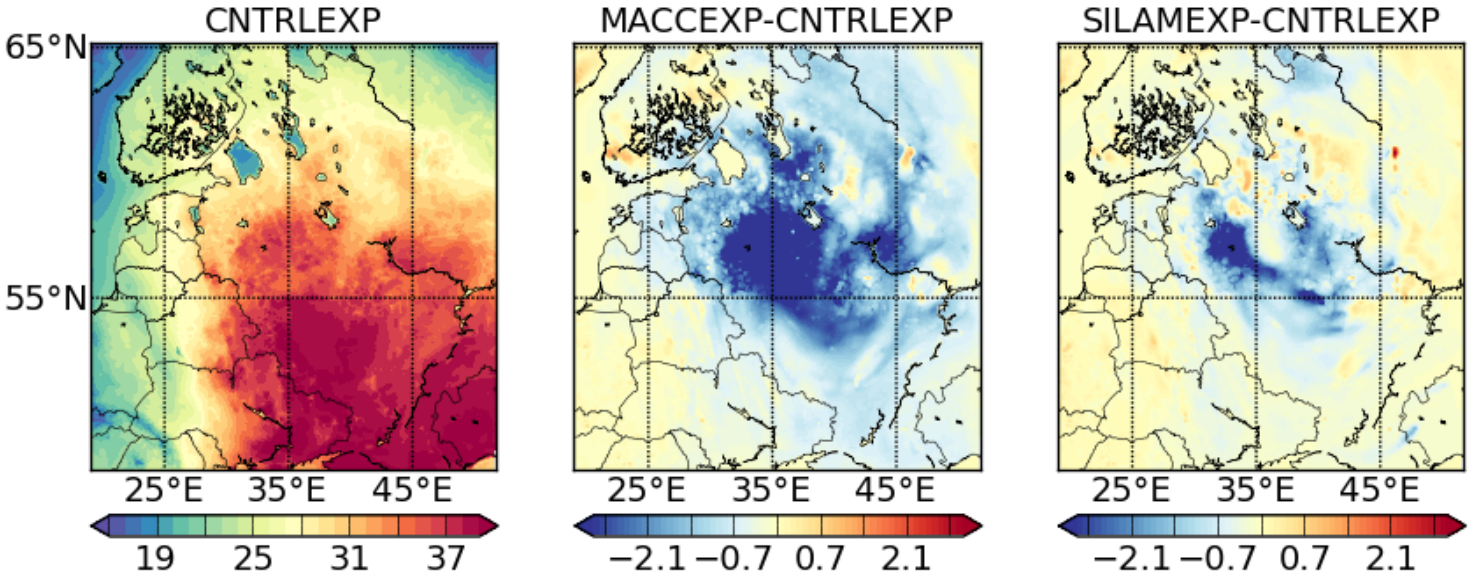


24h average net shortwave radiation flux ($W/m^2$) at the surface 08.08.2010




2m temperature (°C) at 12 UTC 08.08.2010.



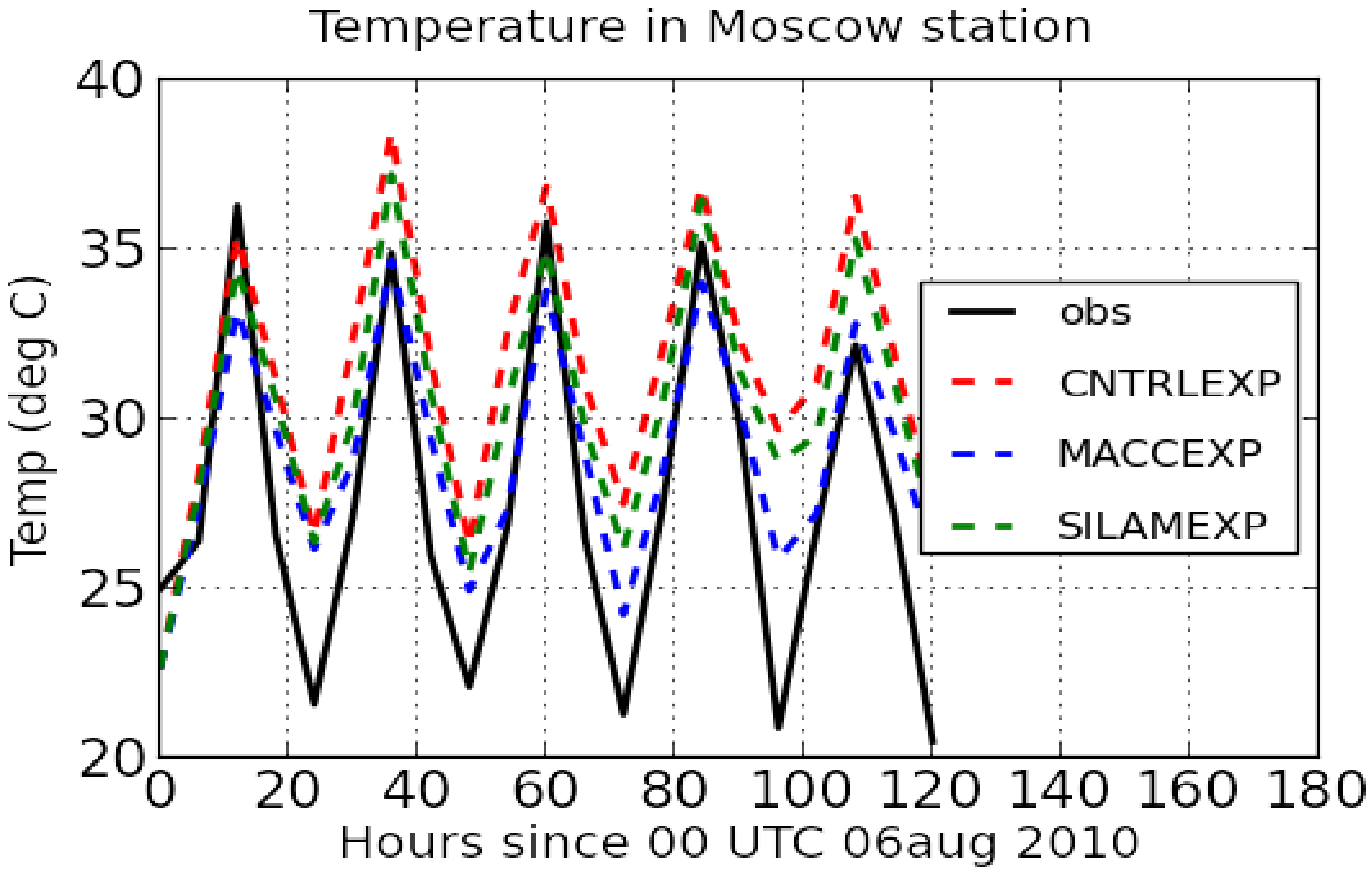
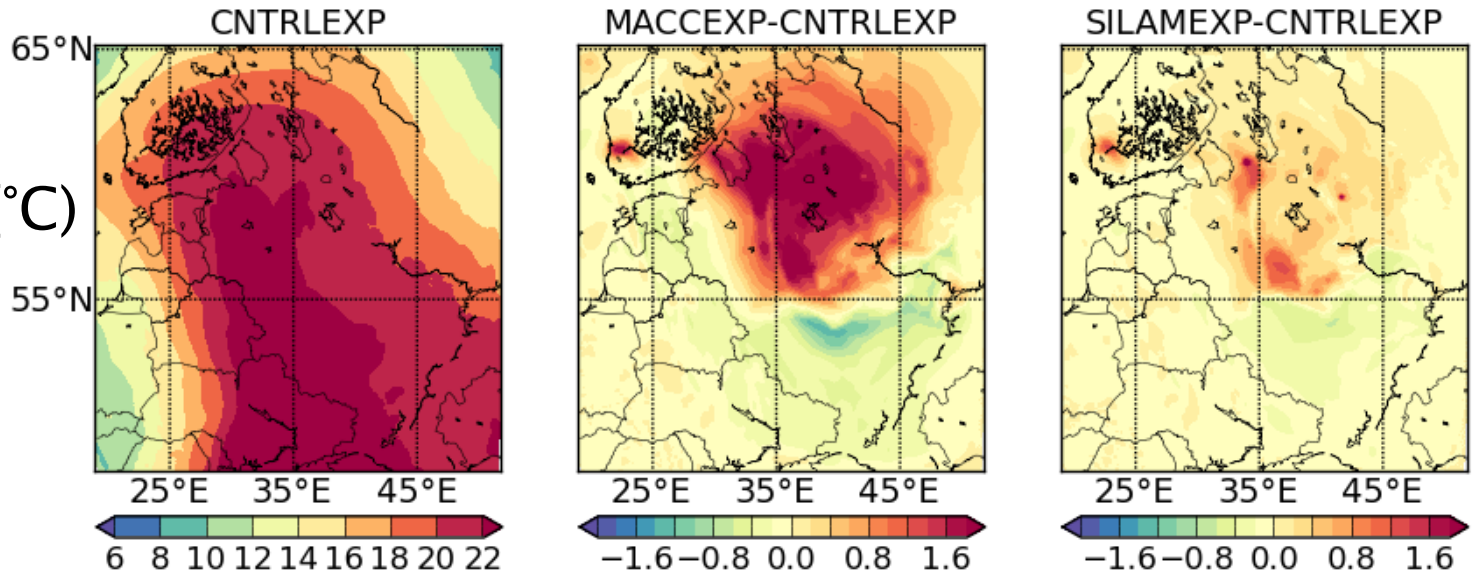
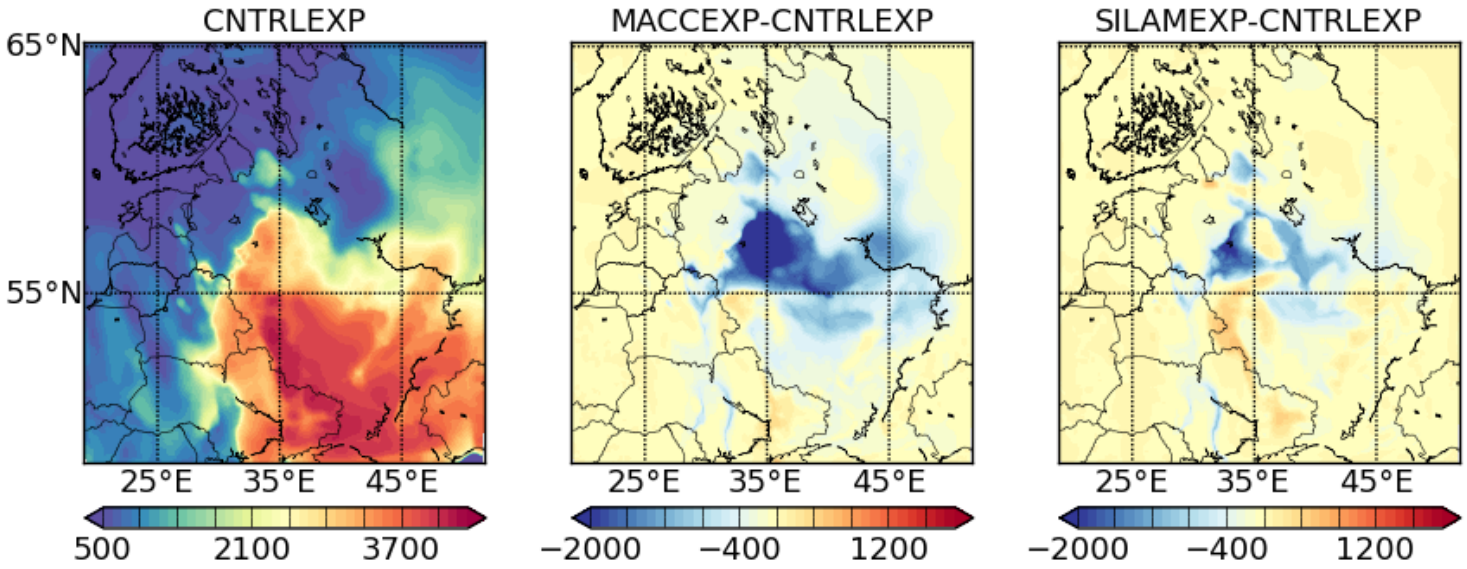



**Figure 8.** 2m temperature (°C) in Moscow.

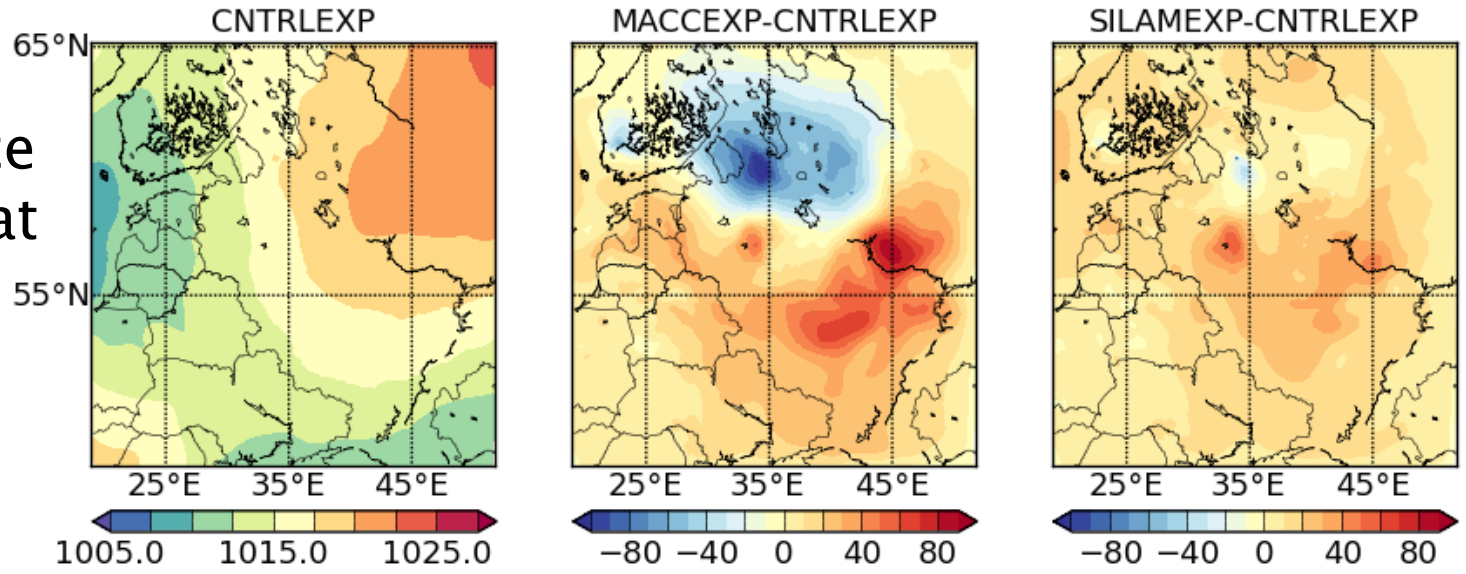
850 hPa temperature (°C) at 12 UTC 08.08.2010.



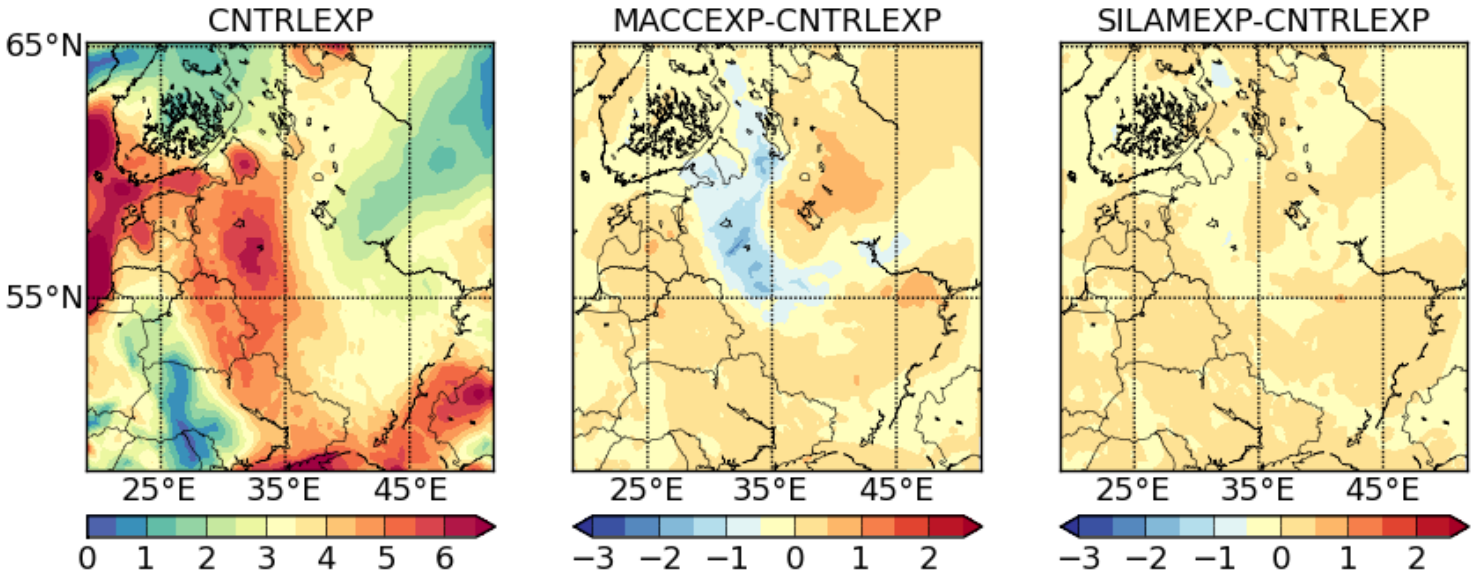

Mixed layer height (m) at 12 UTC 08.08.2010.



MSLP (hPa) and difference in MSLP (Pa) at 12 UTC 08.08.2010.




Horizontal wind speed (m/s) at the lowest model level at 06 UTC 08.08.2010



# Conclusions

- In August 2010 the smoke from wildfires in Russia influenced atmospheric conditions near the surface.
- Impact on large-scale atmospheric dynamics was rather weak.
- Influence of direct aerosol feedback in NWP can be of importance during cases with extreme aerosol concentrations, keeping in mind the near-surface temperatures and winds.

**Thank you!**