Meteorological and Hydrological Service

Analyses and source identification of PM10 concentrations during episodes of air pollution in Eastern European areas

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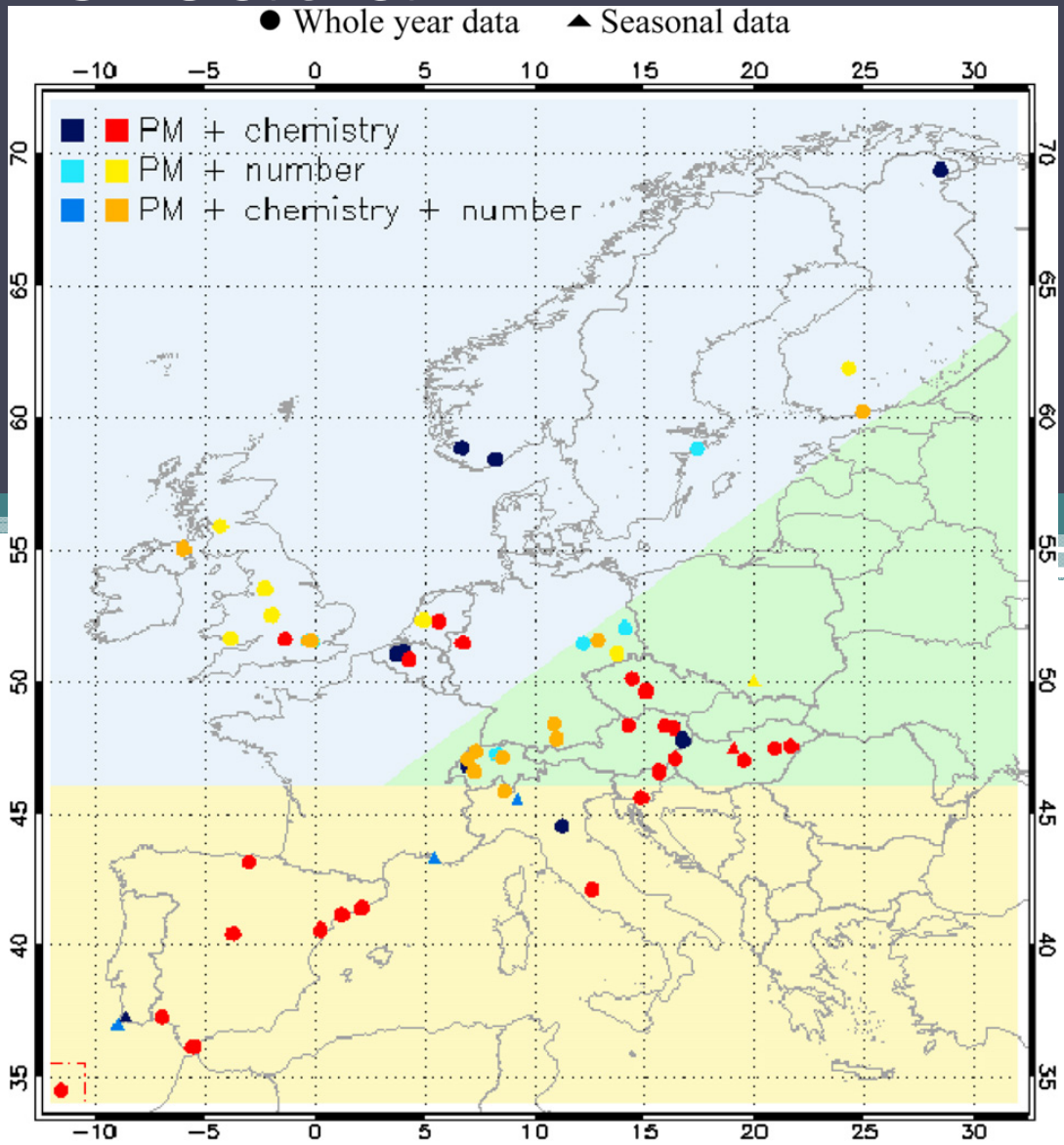
OUTLINE

- Background
- PM analyses - Croatia
  - Gap in knowledge
  - Trends and status of complience
  - Baseline urban/rural PM10, PM2.5 measurements
- Source identification during episodes
  - Hungary, Croatia, Serbia
  - Trajectory, WRF, satelite data
- Conclusions

Background

- PM – one of major AQ concernes-adverse health effects
- Complex mixture: solid and liquid part., OM, CE, SIA, TM
- Sources: direct-antropogenic, natural & SOA
- Many EU countries report exceedances of allowed 35 of daily PM limit value 50 μg/m3 or even yearly average 40 μg/m3
- Harmonized application off source determination/apportionment techniques is essential for efficient mannagement and planning

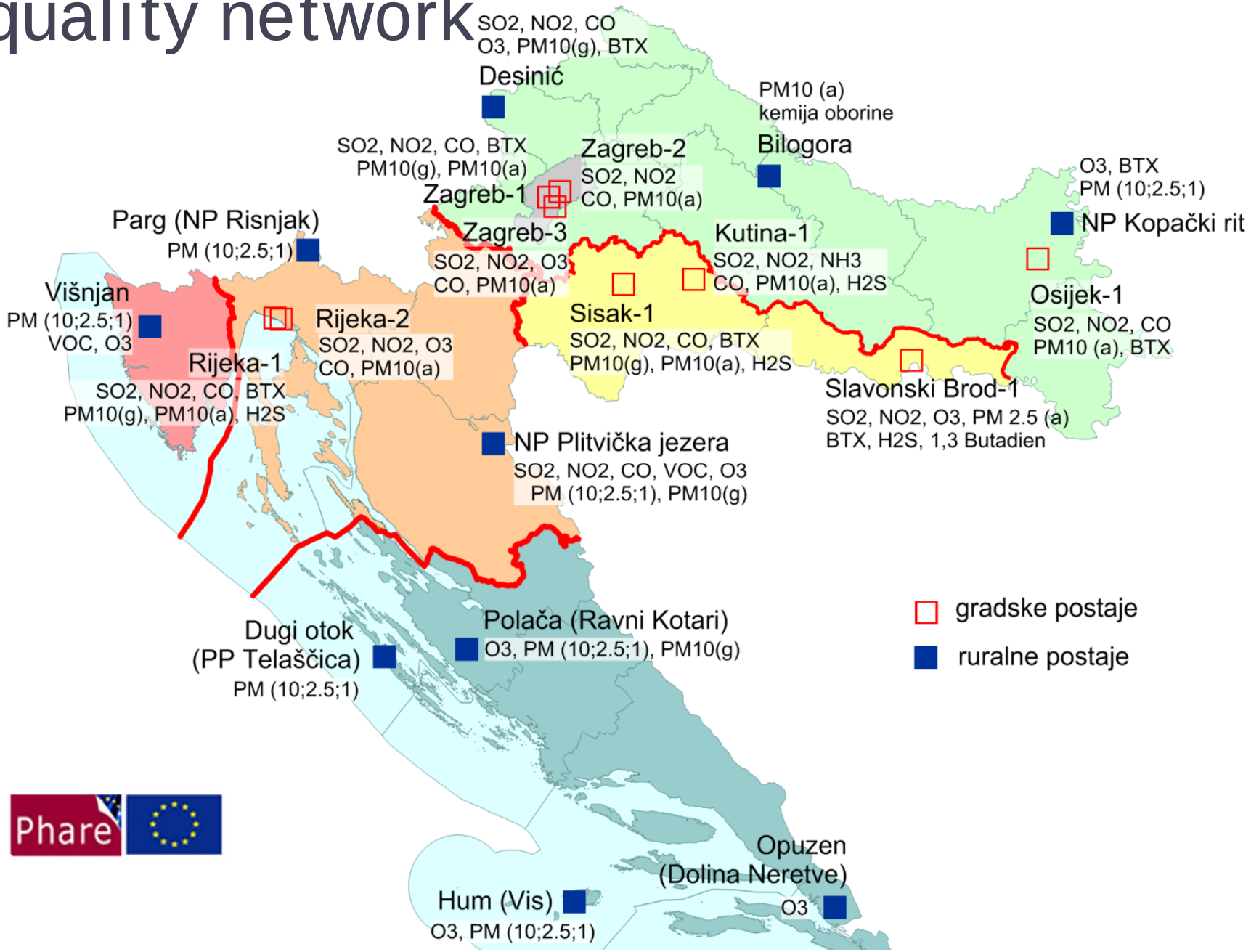
PM levels in Croatia



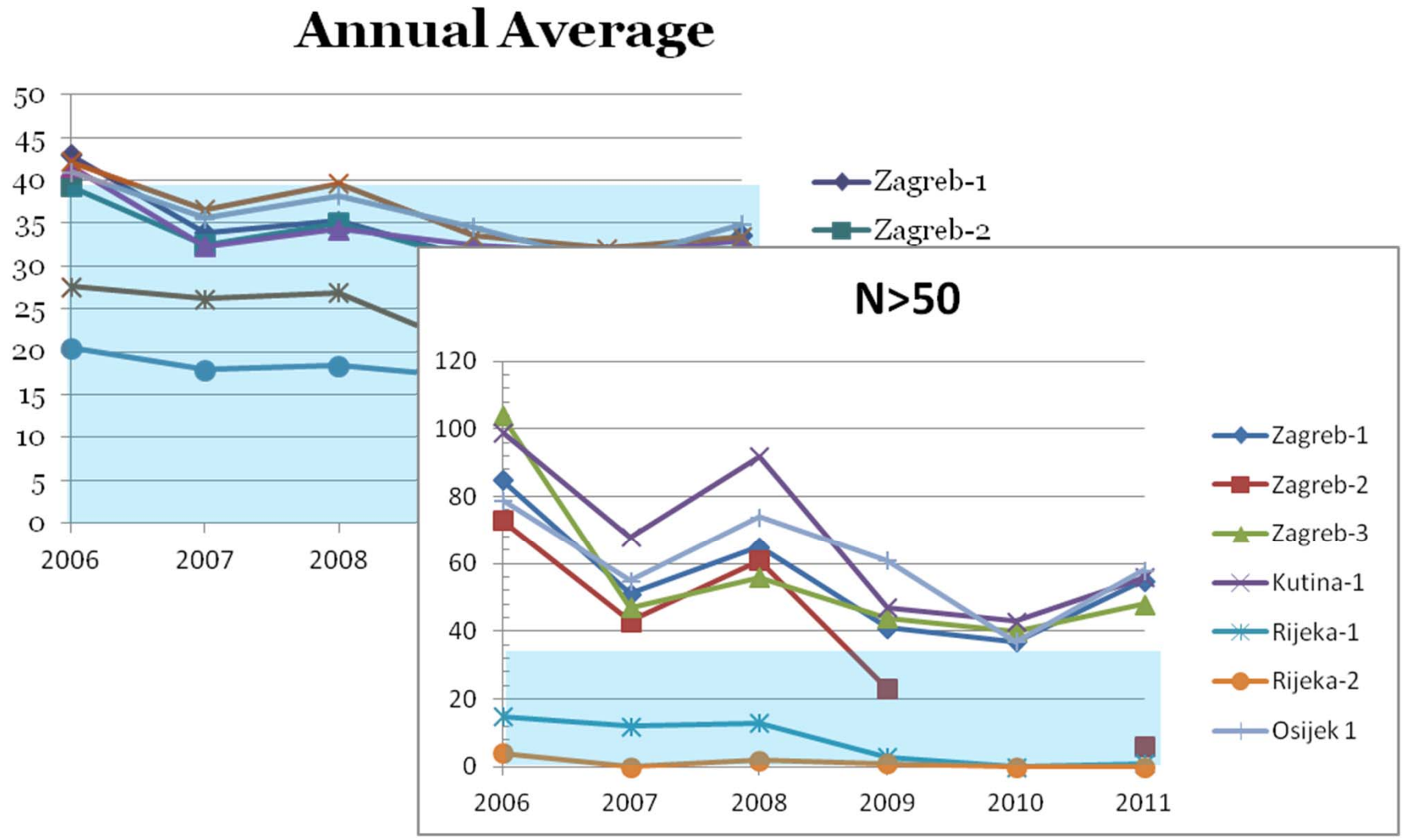
Putaud et al. 2010

A European aerosol phenomenology e 3: Physical and chemical characteristics of particulate matter from 60 rural, urban, and kerbside sites across Europe

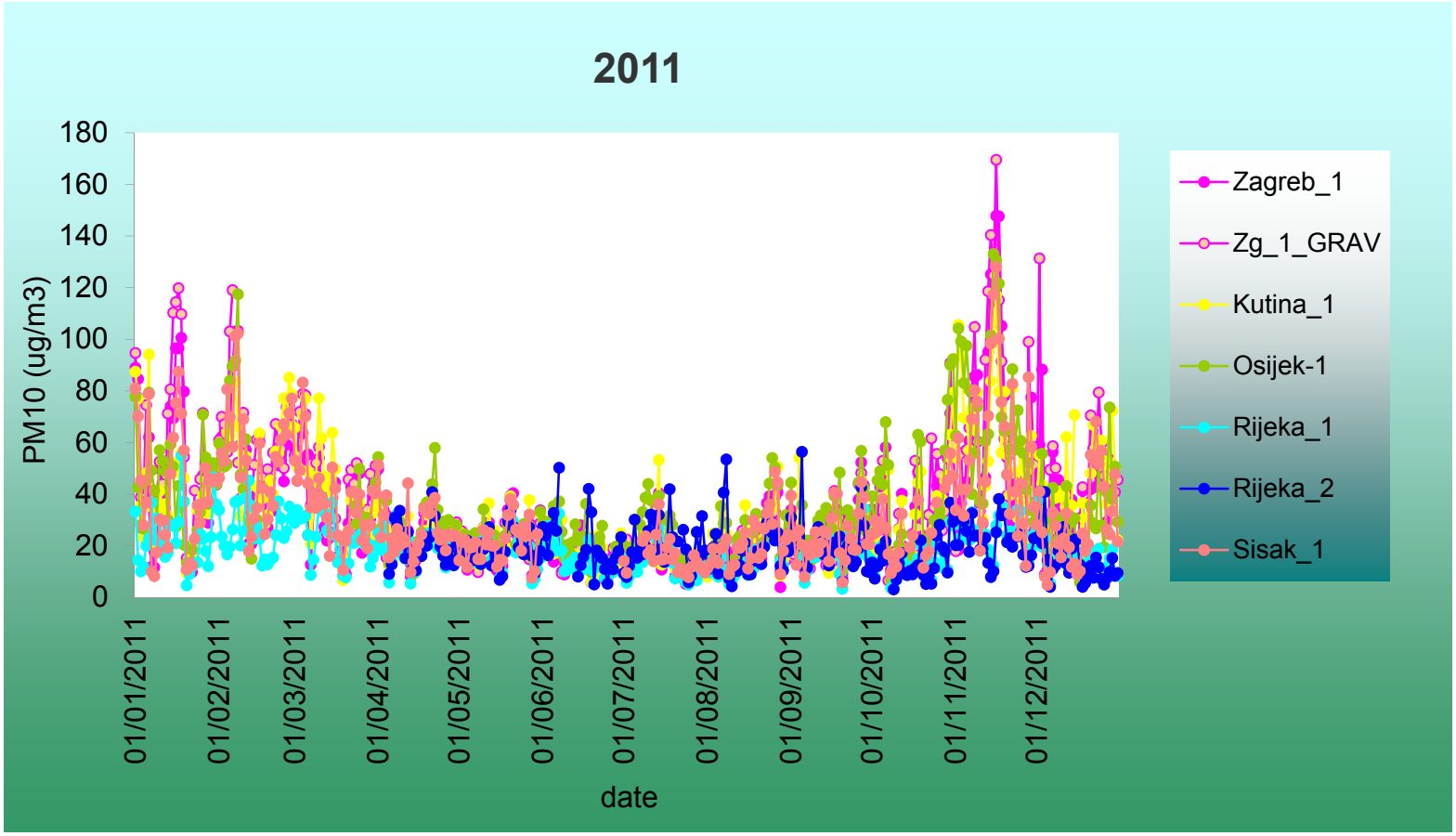
Air quality network



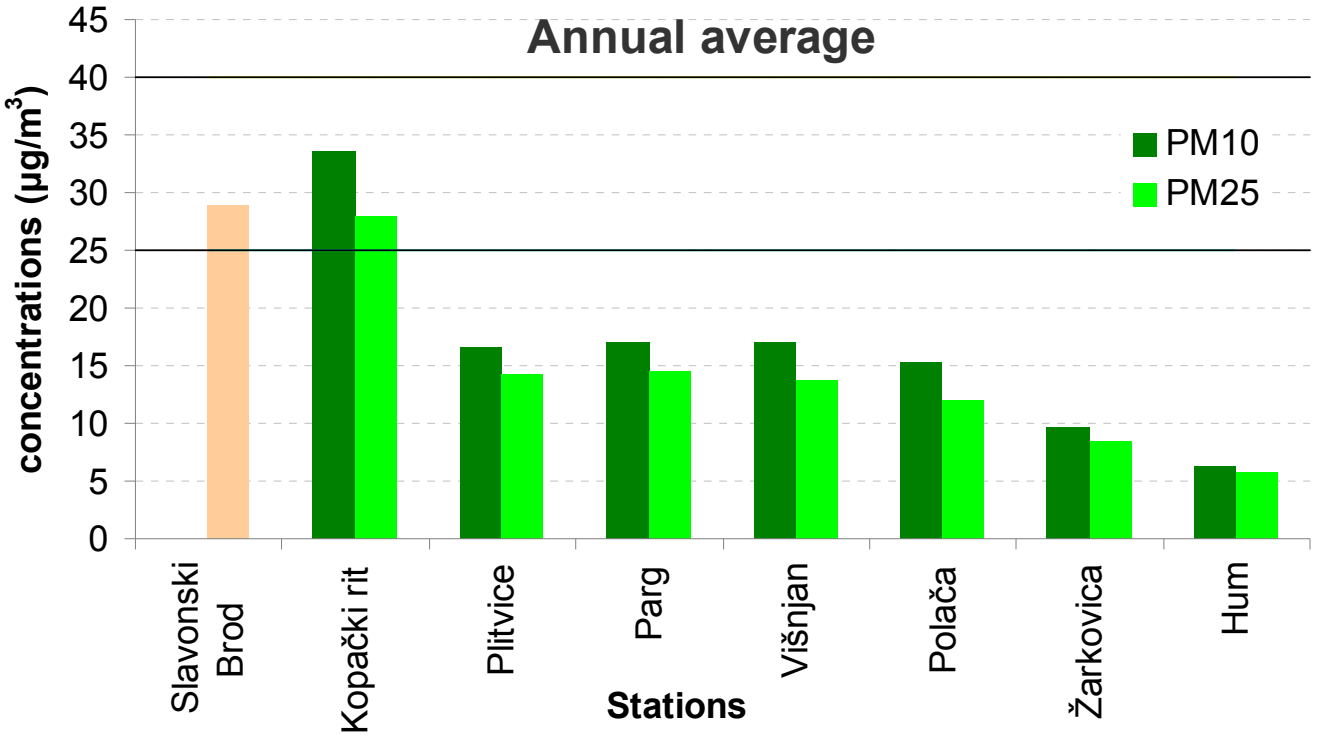
Urban stations-2006.-2011.



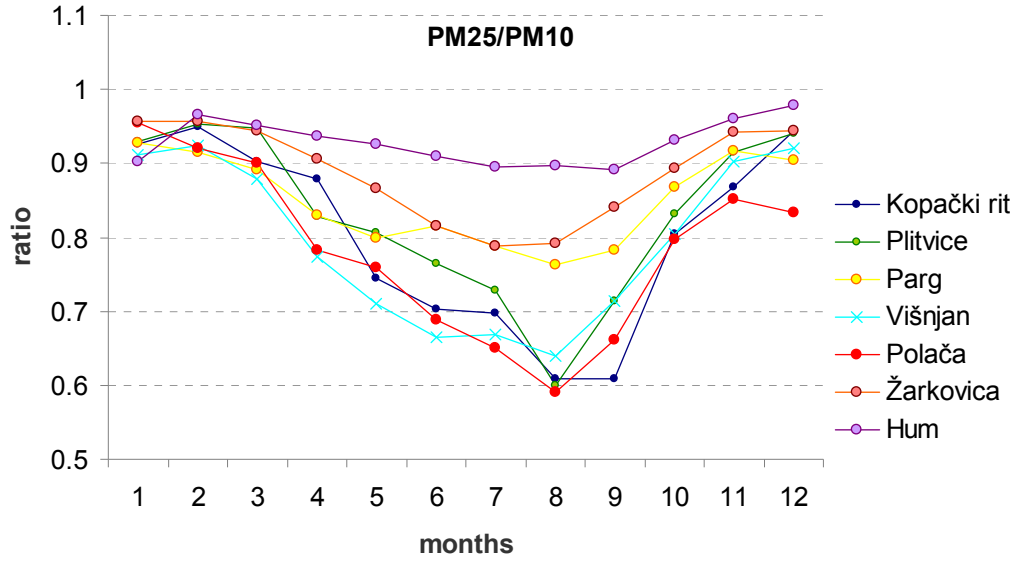
Annual course-urban stations

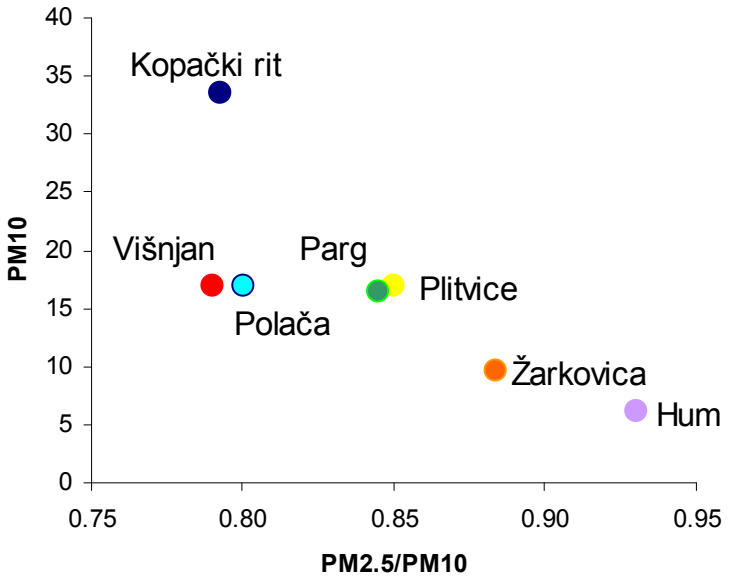


Rural background station+SB



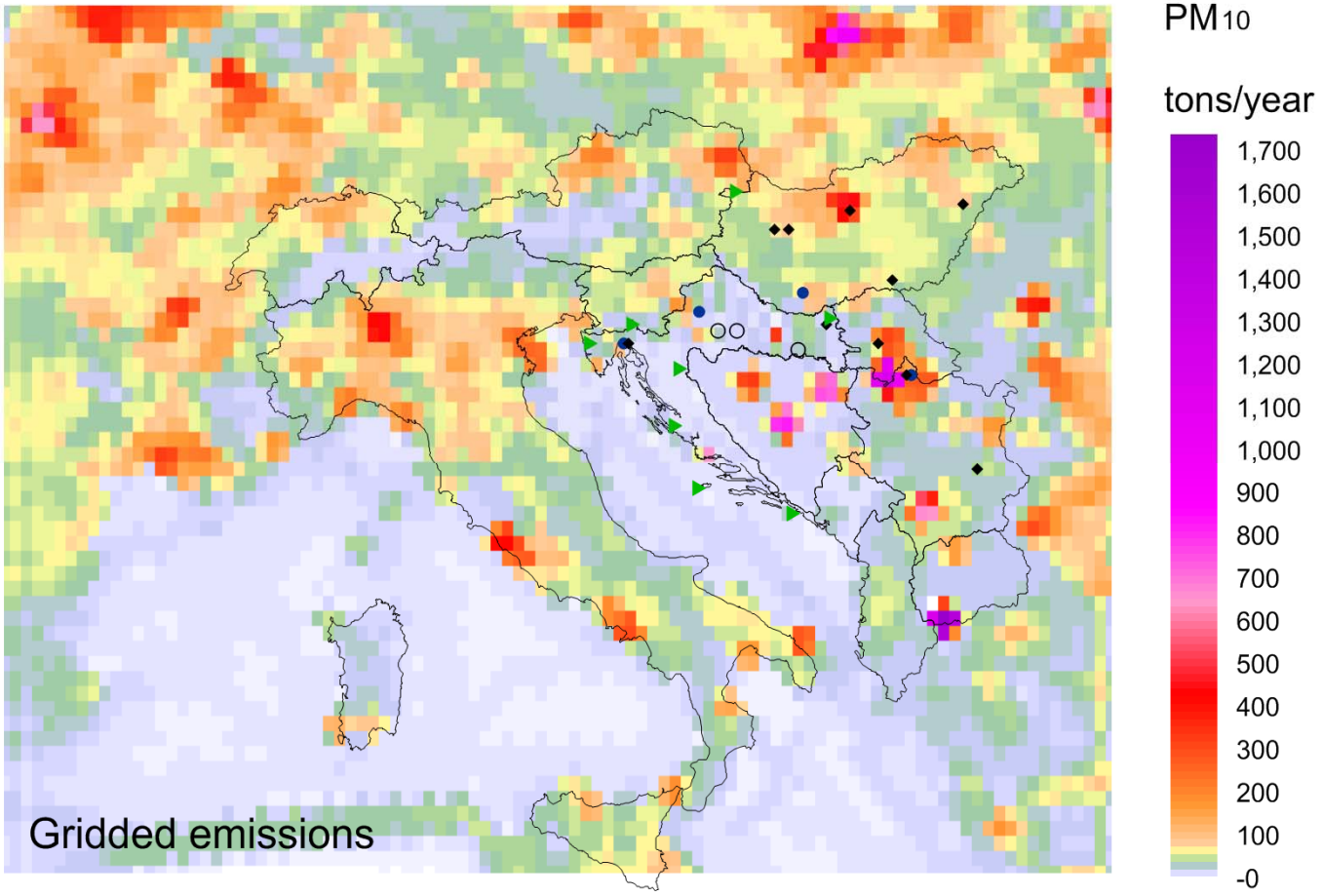
PM2.5/PM10 ratio-rural background stations

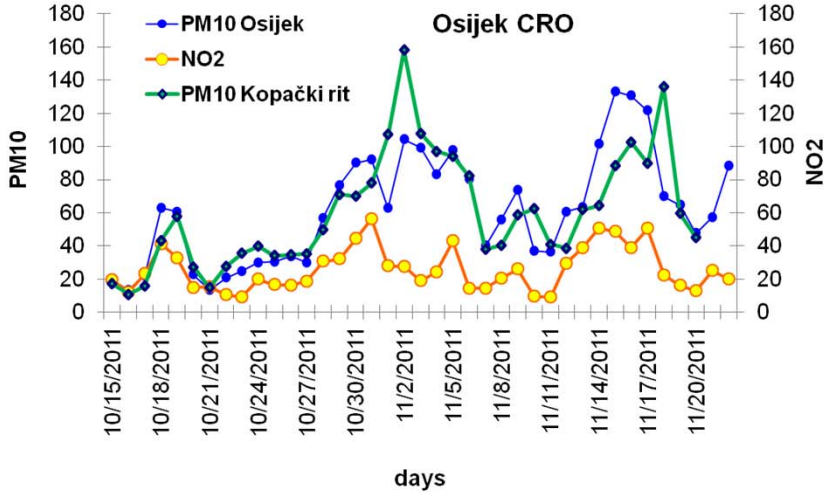


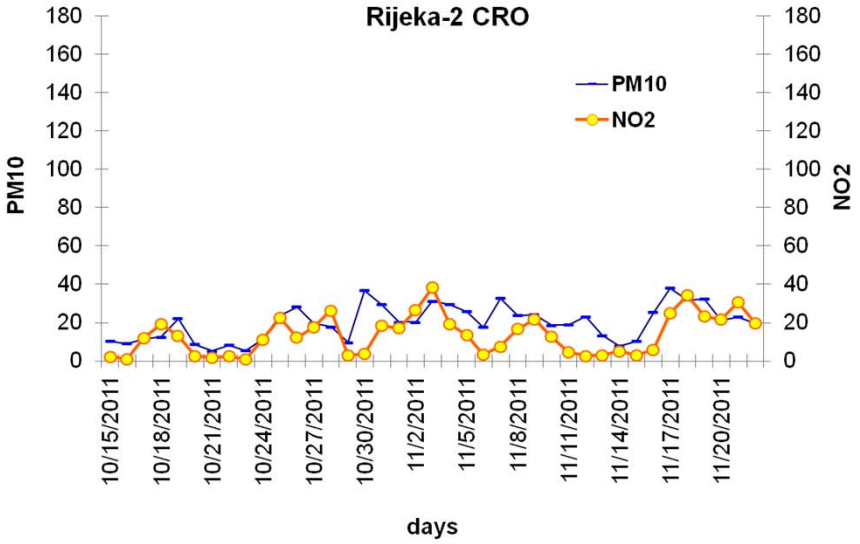


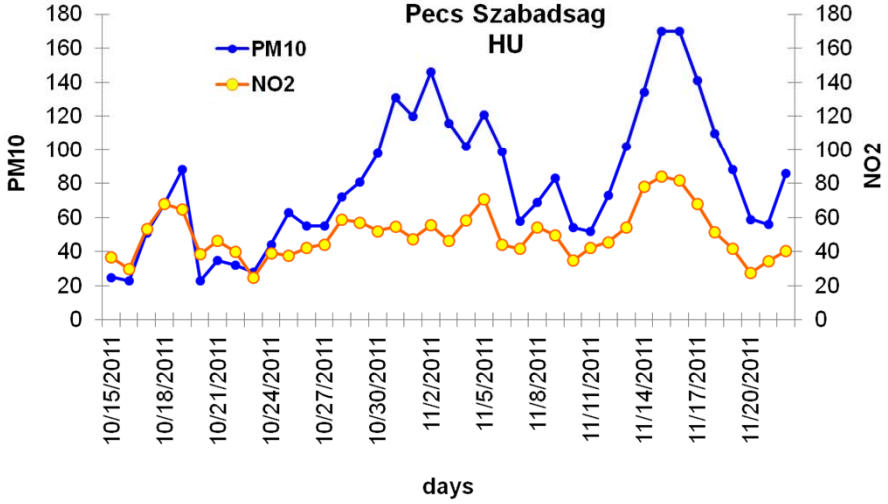
PM episode Eastern Europe

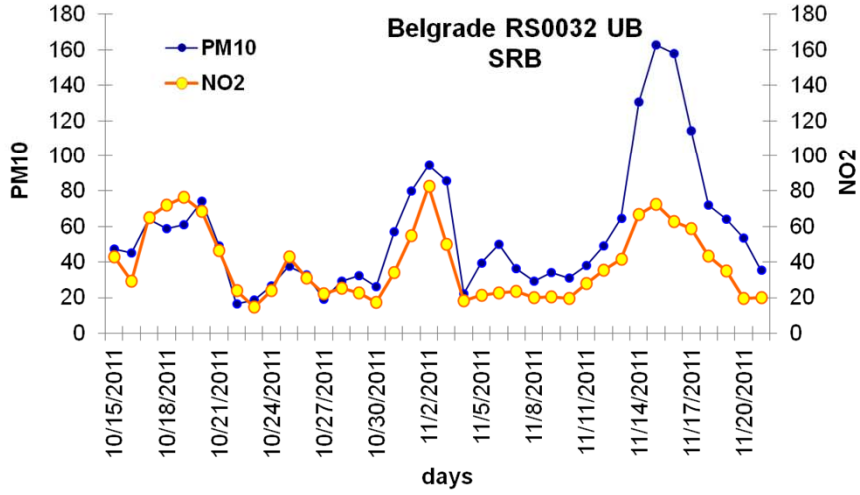
Stations used in the analyses



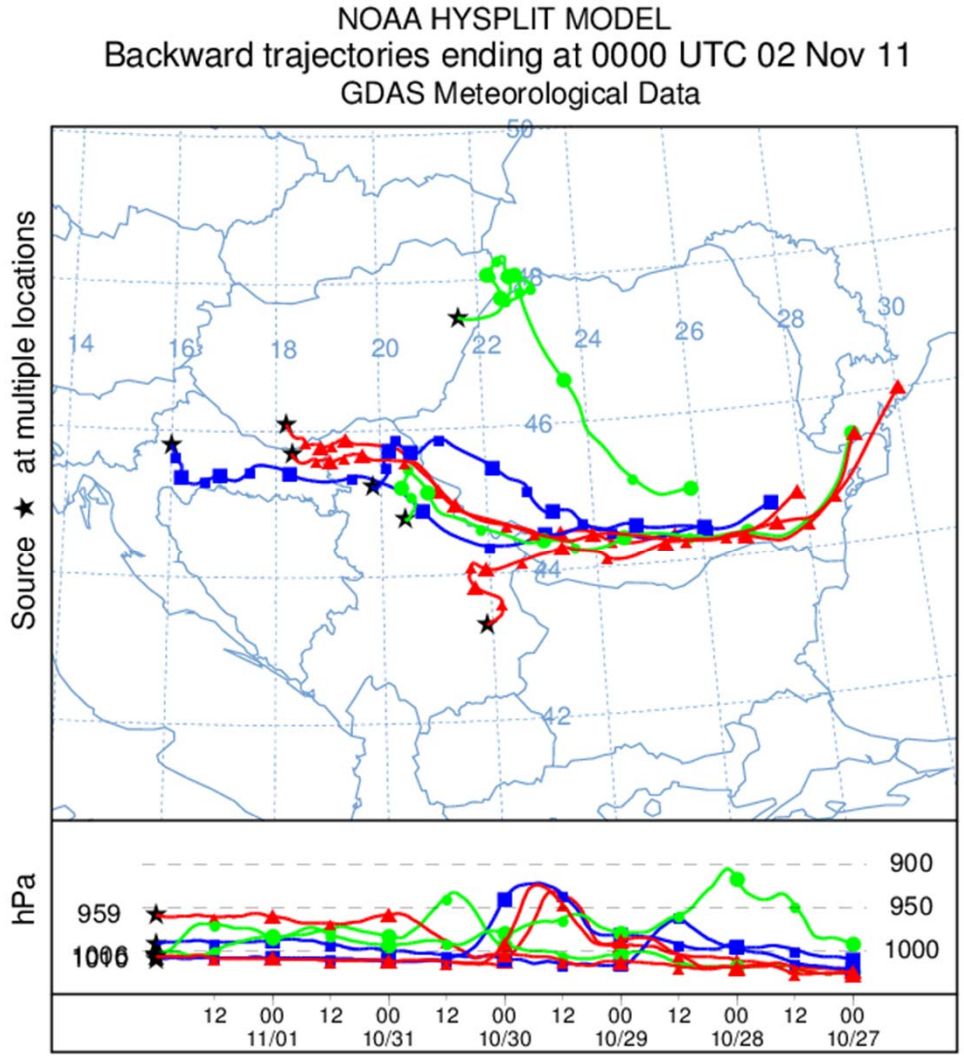

Osijek CRO
PM10 Osijek
NO2
PM10 Kopački rit
PM10
NO2
days


Rijeka-2 CRO
PM10
NO2
days

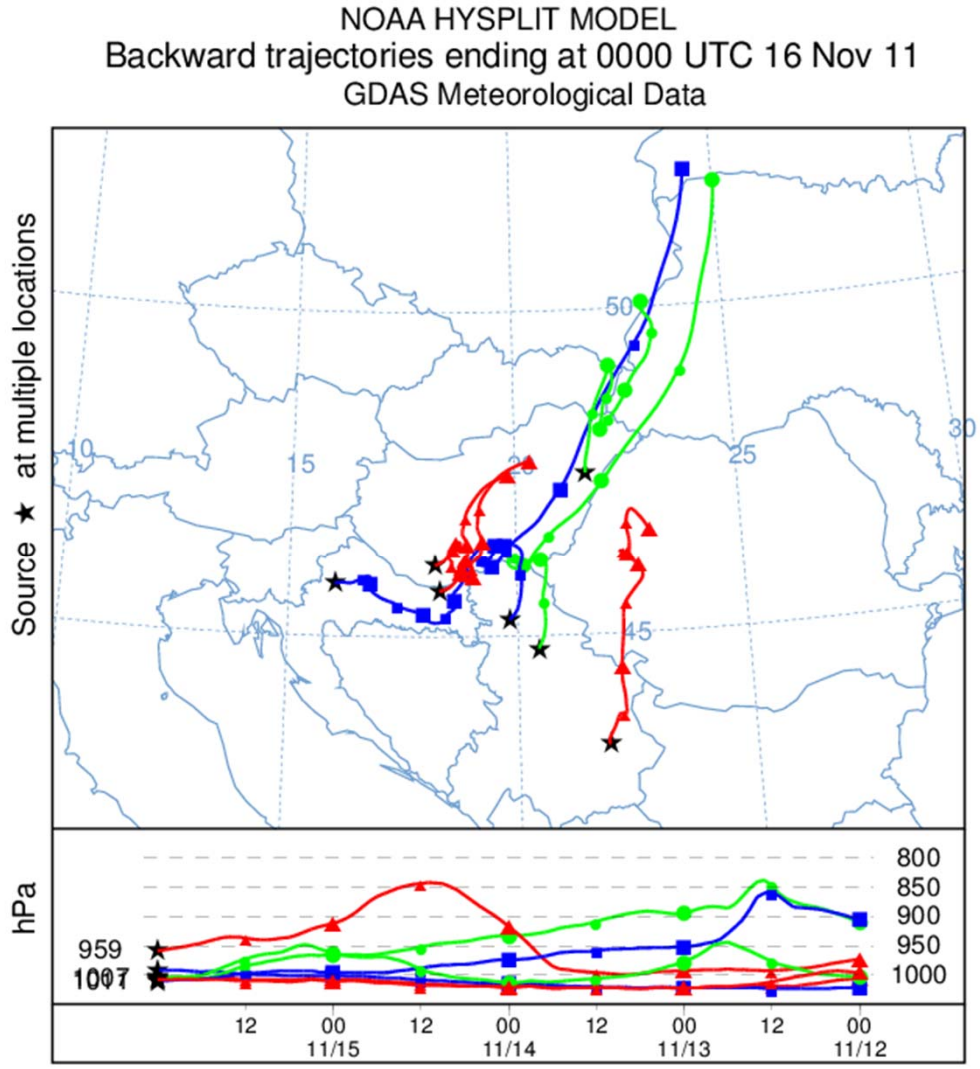

Pecs Szabadsag
HU
PM10
NO2
days


Belgrade RS0032 UB
SRB
PM10
NO2
days

Trajectories - 2. November 2011



Trajectories-16 November

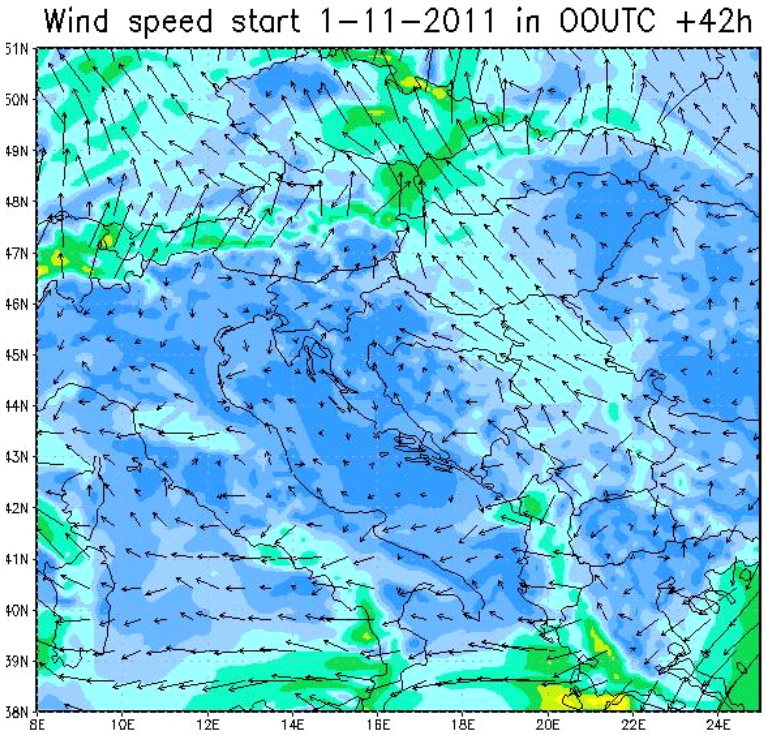


ARW WRF simulations

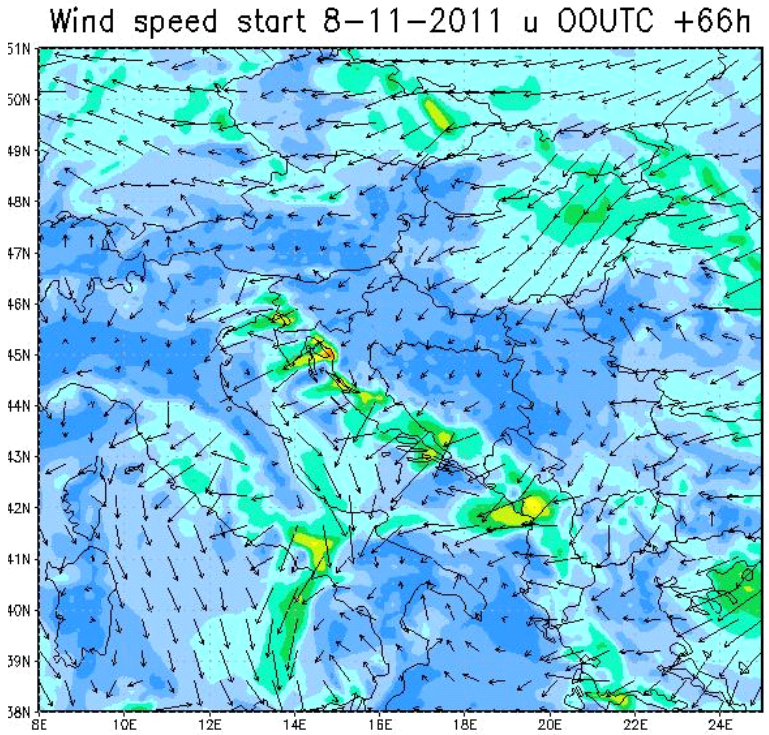
- Numerical weather prediction (NWP) simulations WRF – ARW 3.1.1 model
- Lambert conformal projection and a two-way nested grids with horizontal resolution of 9-km, 3-km and 1-km, respectively.
- vertical grid 28 terrain-following hydrostatic pressure coordinate levels with the top level located at 50 hPa.
- Initial and boundary conditions were updated every six hours with data form Global Forecast System (GFS) at a 1° resolution.
- The physical schemes used in this study are:
  - WSM 3-class simple ice scheme for microphysics (Hong et al., 2004),
  - Rapid Radiative Transfer Model – RRTM (Mlawer et al., 1997) for long wave radiation,
  - MM5 Shortwave scheme (Dudhia, 1989) for short wave radiation,
  - Monin-Obukhov scheme (Monin and Obukhov, 1954) for surface layer options, and
  - Yonsei University (YSU) planetary boundary layer (PBL) scheme (Hong and Dudhia 2003), w

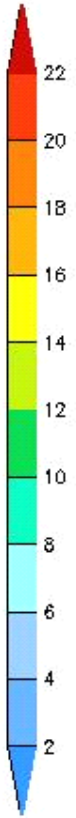
WRF wind fields

2 November 18 UTC



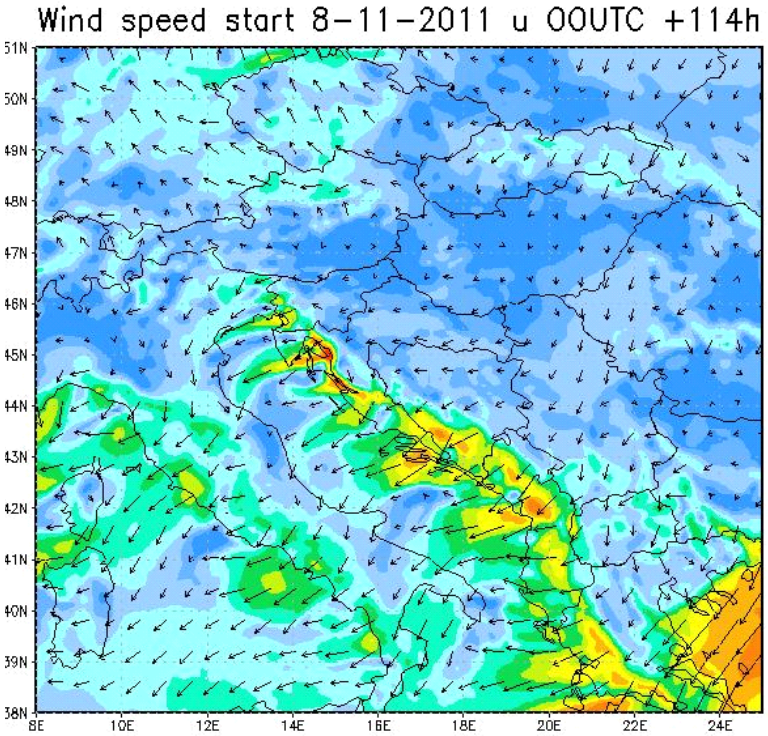
10 November 18 UTC



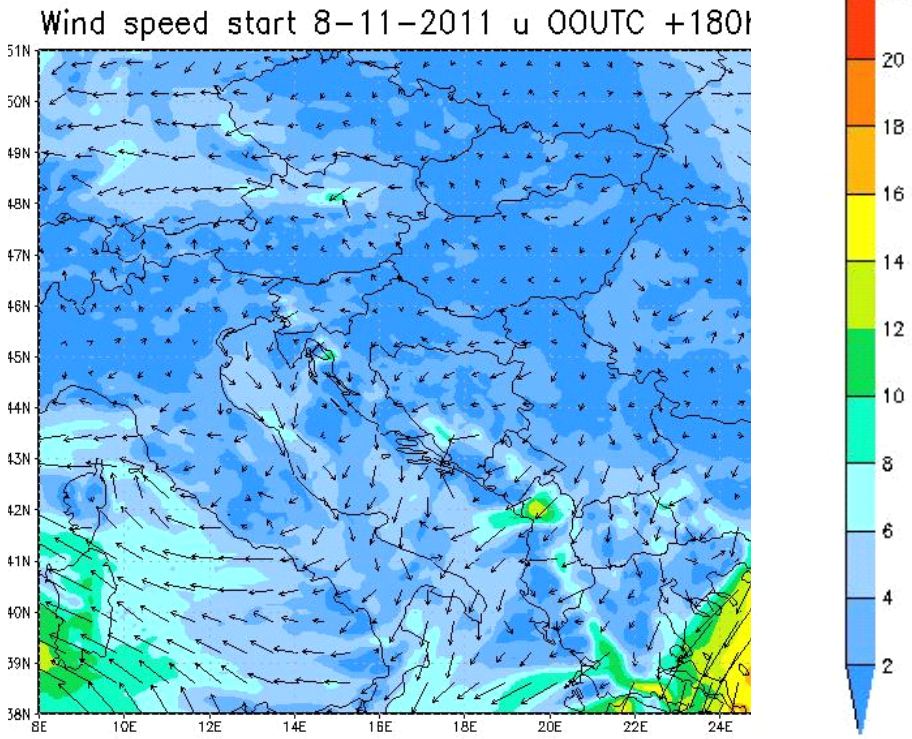


Wrf-wind-cont.

12 November 18 UTC

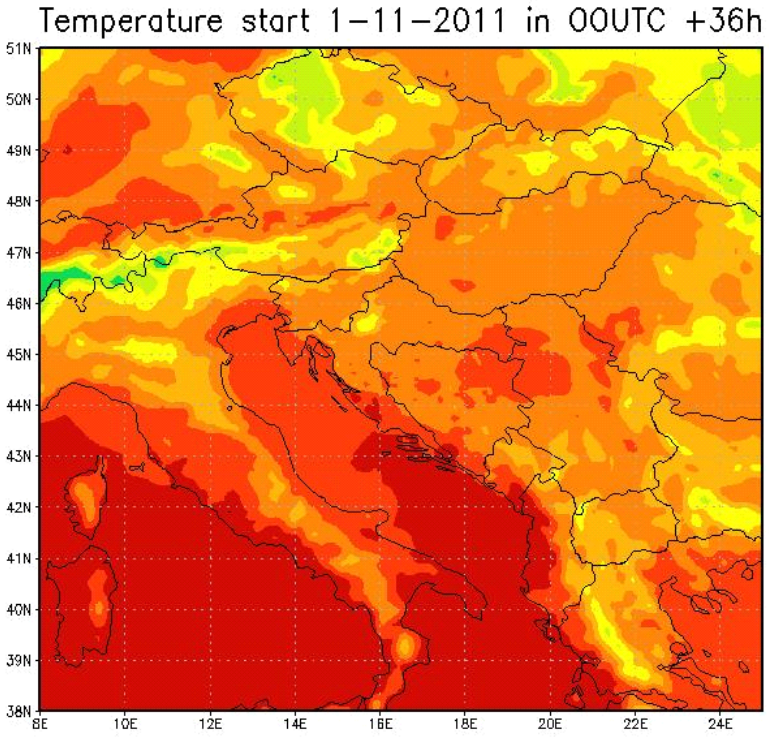


15 November 12 UTC

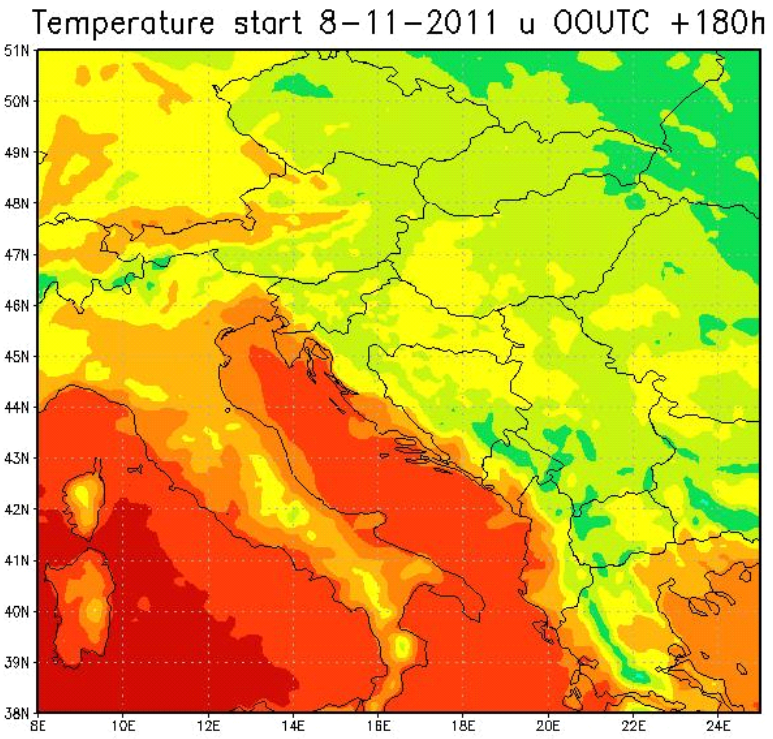


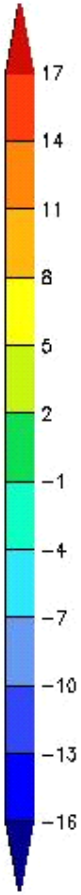
WRF -temperatures

2 November 12 UTC



15 November 12 UTC





Natural source

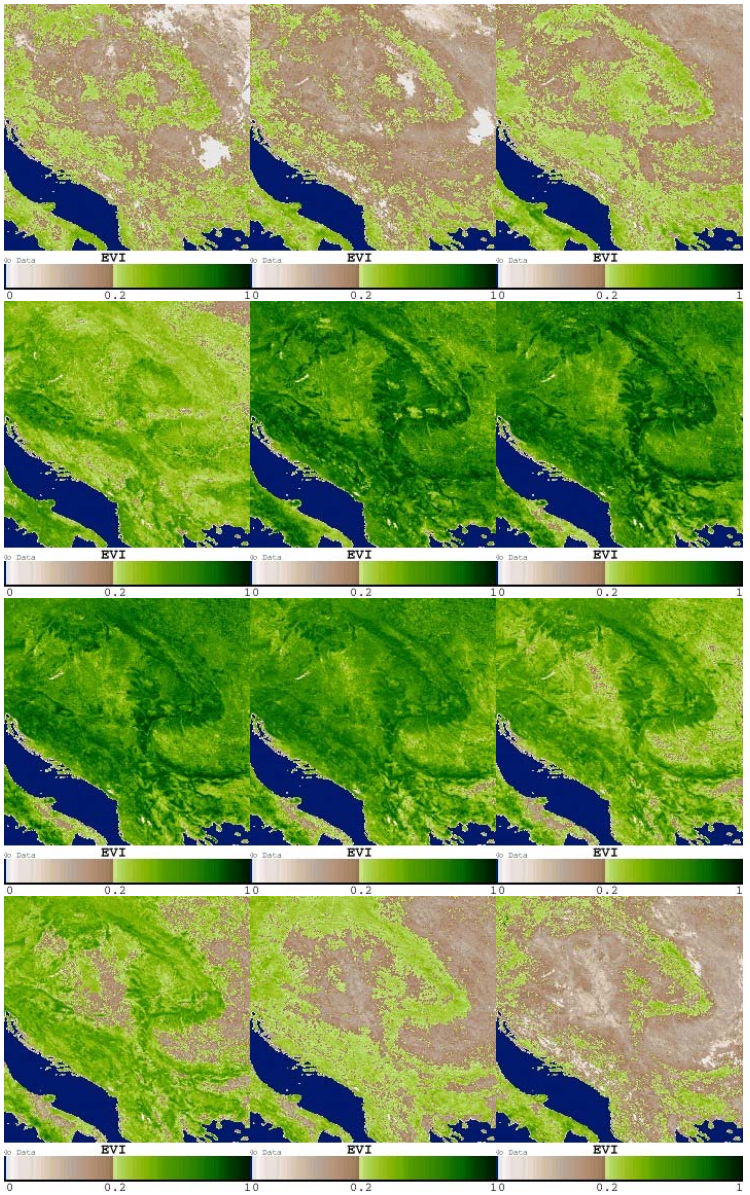
- Trajectories that conects high conentrations with air mases from area that represent natural source (Sahara, desert, bare land).
- High wind speeds that acts as a trigger for resuspension processess

Satelite data

Global MODIS vegetation indices are designed to provide consistent spatial and temporal comparisons of vegetation conditions.

Global MOD13Q1 data are provided every 16 days at 250-meter spatial resolution as a gridded level-3 product in the Sinusoidal projection.

The enhanced vegetation index (EVI) is an 'optimized' index designed to enhance the vegetation signal with improved sensitivity in high biomass regions and improved vegetation monitoring through a de-coupling of the canopy background signal and a reduction in atmosphere influences.



Conclusions

- Stable meteorological conditions over Eastern Europe under infl. of large high pressure system enabled the acumulation of PM which led to high regional concentrations over 2 periods in November 2011.
- Back trajectories all stations with peaks in PM10 concentrations were under the influence of the same air masses, eastern for the first episode and north eastern for the second episode.
- Elevated PM10 concentrations in the second episode are combination of local anthropogenic emissions, regional transport as well as the resuspension over the bare natural and agricultural surfaces in Hungary, Serbia and Croatia driven by the strong wind.
- Chemical analyses of the core elements would confirm this conclusion. Chemical speciation needed for SA studies.