ALADIN in Poland

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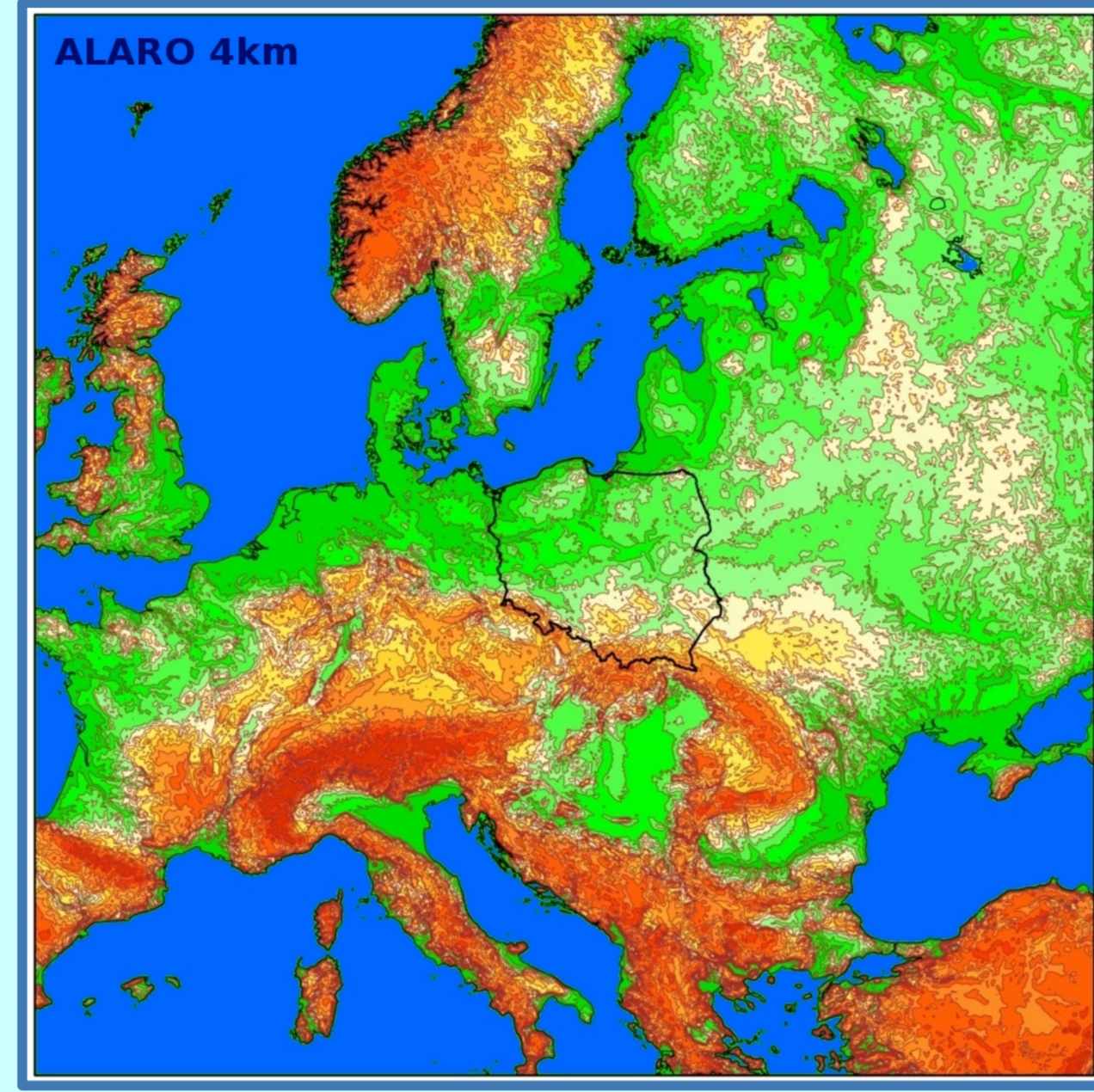## OPERATIONAL

ALARO-v1B (CY43T2) Operational Domain:

E040 domain:

4.0 km horizontal resolution, 789x789 grid points,

70 vertical model levels on a Lambert projection with 3h

coupling frequency and 3h output, coupling zone with 16

points; Runs 4 times per day (00,06,12 and 18) with 72

hours forecast range; LBC from ARPEGE with 9.4 km

horizontal resolution;

AROME Operational Domain:

P020 domain:

2.0km horizontal resolution, 799x799 grid points,

70 vertical model levels on a Lambert projection with

1h coupling frequency and 1 hour output

4 runs per day (0000,06,12 and 18) with 30 hours
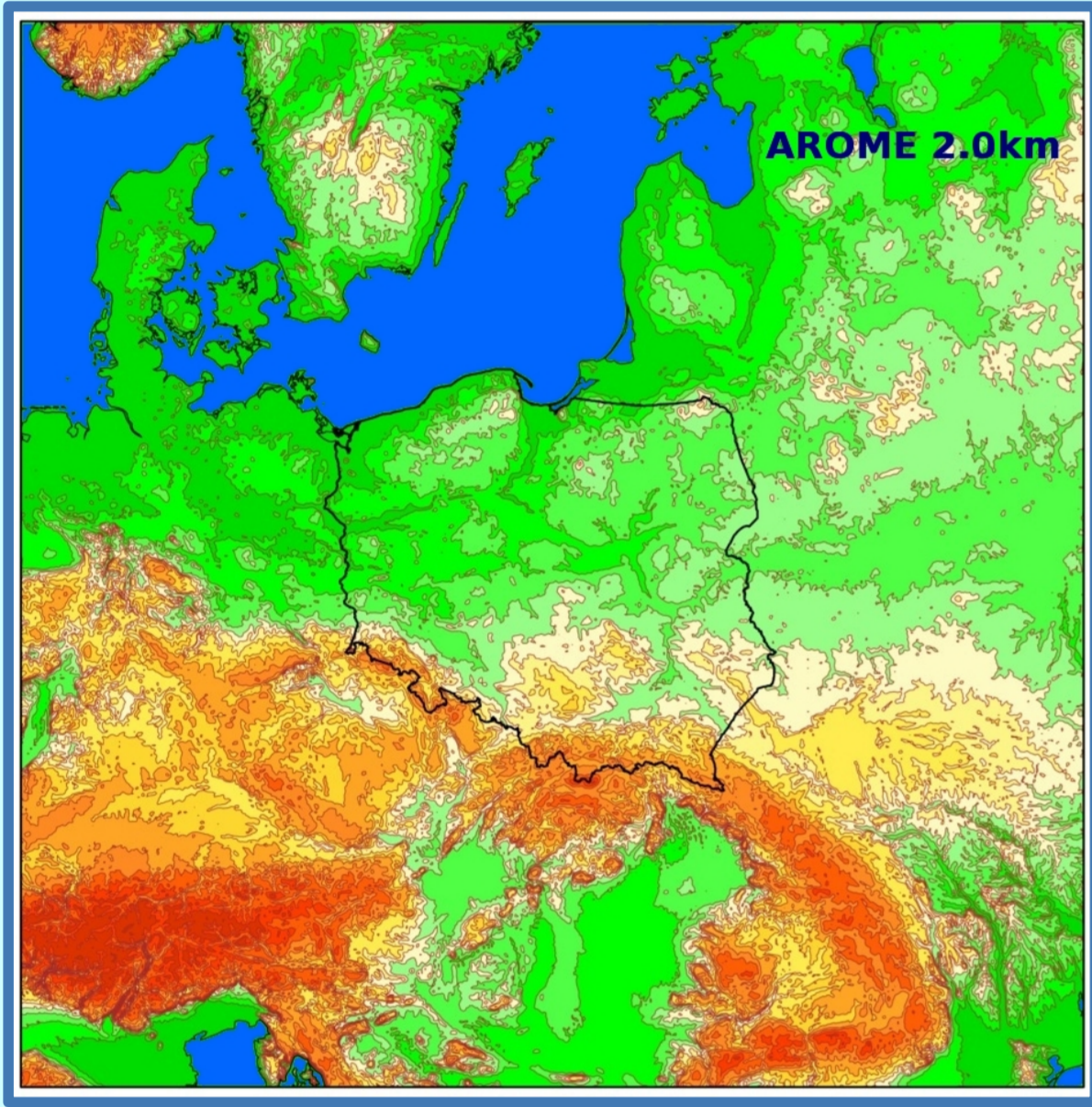
forecast range; LBC from ALARO;

ALARO 4km

Operational machine characteristics

Cluster of HP BL460c_GEN8 servers connected with Infiniband network, OS Scientific Linux 6, Intel Xeon E5-2690 processors – with maximum 1552 cores (97 nodes with 16 cores each), each core RAM 128 GB, disc array – 64 TB.

Data assimilation

Surface data assimilation for ALARO-v1B model (e040 domain) with CANARI is ready, but not yet in operational mode. First tests are in progress, in test mode we do cycling every 6h, with full forerecast once per day for 00UTC. Work on validation of CANARI and on implementation of 3D VAR is still in progress.

AROME 2.0km

AROME cy43t2

Since February 2020 new version of AROME model is in operational suite. Verification scores shows improvement, especially in precipitation forecasts. Similar scores are observed for most of the meteorological fields. Previous version of AROME model often produced over forecasted precipitation sums. New version brings improvement as seen on SAL score (A component decreased from 0.5 to -0.1) and on same case study.
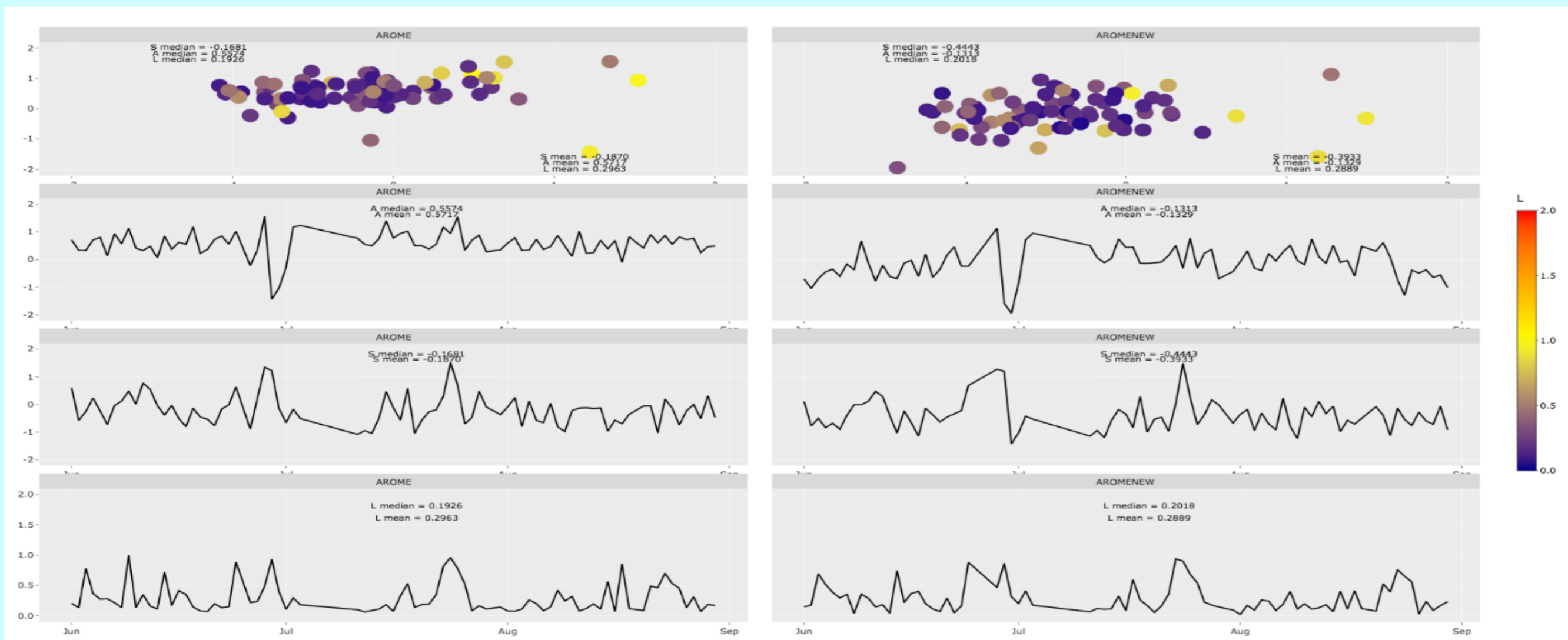
SAL score for AROME cy40t1 (left) and cy43t2 (right)

Radar data (left) AROME cy40t1 (centre) AROME cy43t2 (right) for storm on 2018-07-18 in South of Poland
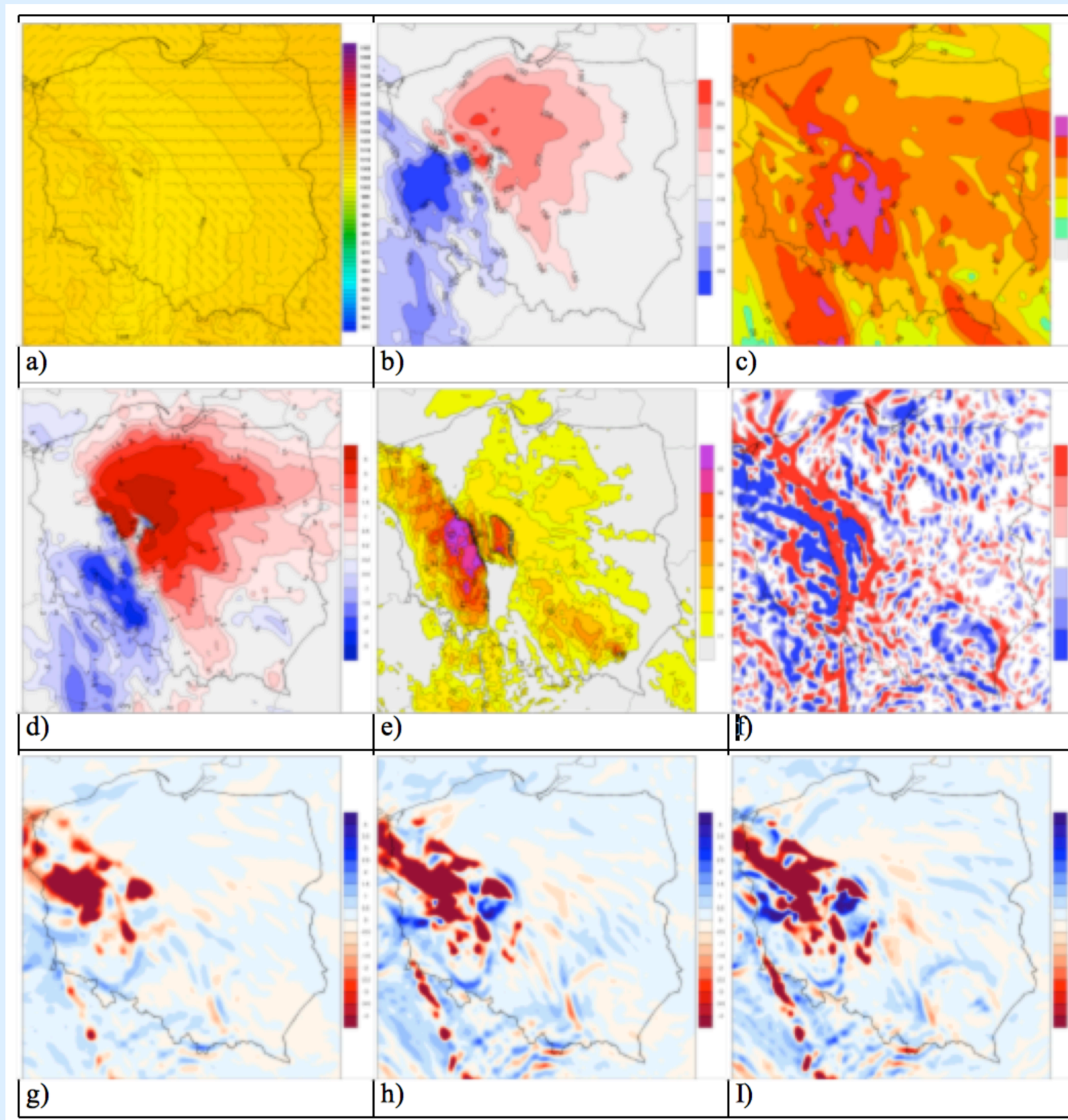
Case study of severe weather in Poland on 11 Aug 2017

Severe weather case for Suszek
The outbreak of bad weather in Suszek (northern Poland) noticed 6 fatalities, some of them children who were located in the forrests at scout camp. There was an issue concerning possible responsibility of forecast service and/or headquarters of the camp who switched mobile phones off and thus ignored a local alarm against strong (over 40 m/s) wind gusts for this region (Pomeranian voivodeship).

Forecast for 11 Aug 2017 afternoon
The wind gust maps and forecast of some storm indexes (such as EHI, SRH 0-3 km, Total Totals, K-index, moisture convergence and vertical speed) for the model (CY40 HYD) runs with the base 10 and 11 Aug 2017 anticipated (at least some of them) the presence of bow echo – meaning strong wind gusts (having the strength of F2-F3 tornado but without circular pattern of pressure). The example forecast maps of that phenomenon are presented below.

There is high sensitivity of storm indices to the extreme situation expected. Actually, it could be named "derecho" as the observed final effect was splitting the bow echo into many sub-centres all of which were sources of serious damage by high-speed horizontal winds.
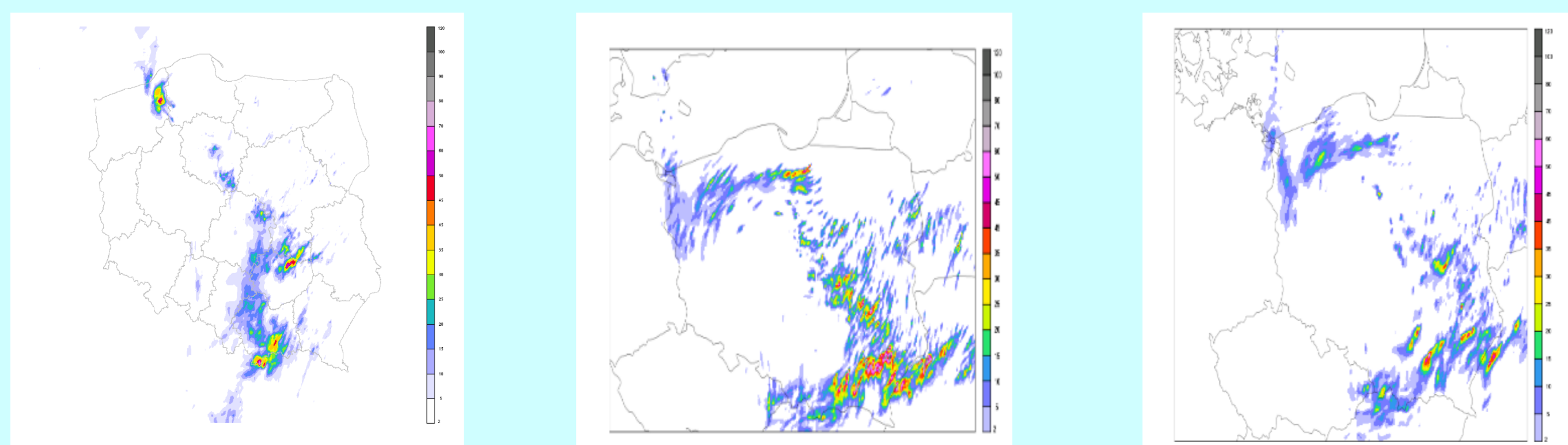

Example model maps fro the severe weather outbreak, 11 Aug 2017. Maps for the forecast base 10.08.2017 18 UTC. Upper row: a) Pressure and wind on the surface [hPa]+[kt], b) SRH 0-3km, c) K-index, middle row: d) EHI, e) wind gusts [kt], f) MOCON, bottom row - vertical speed [Pa/s] at: g) 700 hPa h) 850 hPa I) 925 hPa. All maps are results from non-hydrostatic version of ALARO CY43 model and the forecast period is 24h, thus for 11.08.2017, 18 UTC.

Impact of foehn wind on PM10 concentrations and urban boundary layer structure in Kraków, Poland

With the increase of N-S advection observed, the frequency of foehn winds in the Carpathians most probably will increase, too. During the cold season at 2017-2018 and 2018-2019 were selected periods when foehn occured at Kasprowy Wierch to select mechanisms connected with foehn which affects on air pollution diurnal change.

Numerical forecasts of model AROME cy40t1r1 (87 vert. levels, res.1 km x 1 km) were used to understand meteorological conditions and dynamics of atmosphere at lowest part of troposphere.

Topographic map of Krakow and location of vertical profiles from model (plots on the rigth).
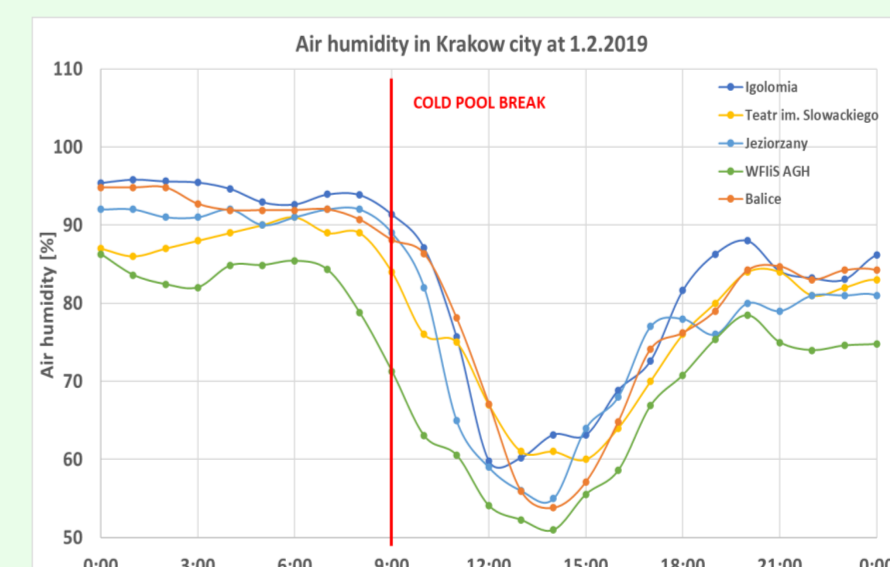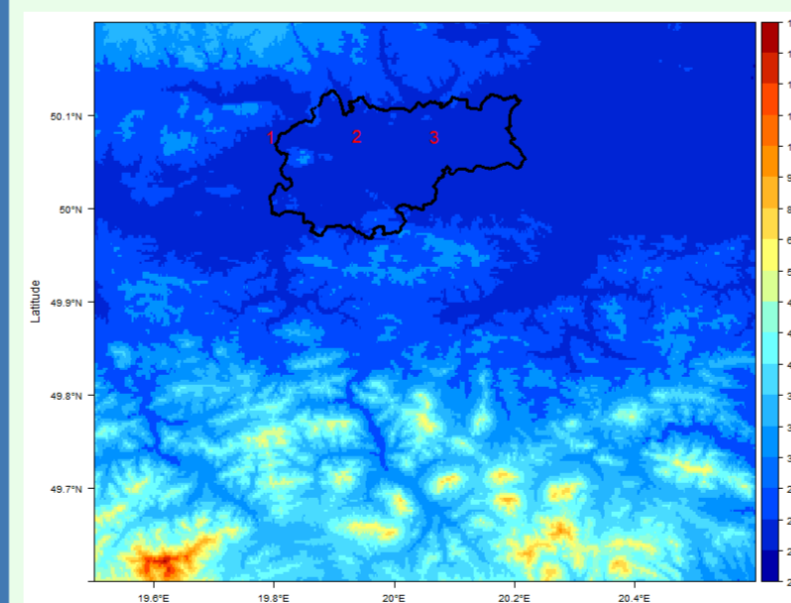
One of frequent situations was occurence of cold pool which was intesified by warm wind moving above the valley.

In the Vistula River valley were observed increased humidity, strong low inversion and significant wind turn between 0 and 200 m a.g.l.

Significant change of wind direction were mostly observed during nigth hours (21-23 UTC) and break of cold pool was gradual, starting from early morning (4-7 UTC).

Change of air masses in vally were connected with significant change of air pollutant concentartion.