ALADIN in Poland

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OPERATIONAL

ALARO-v1B (CY40T1) Operational Domain:

E040 domain:

4.0 km horizontal resolution, 789x789 grid points, 60 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 66 hours forecast range; LBC from ARPEGE with 15.7km horizontal resolution;
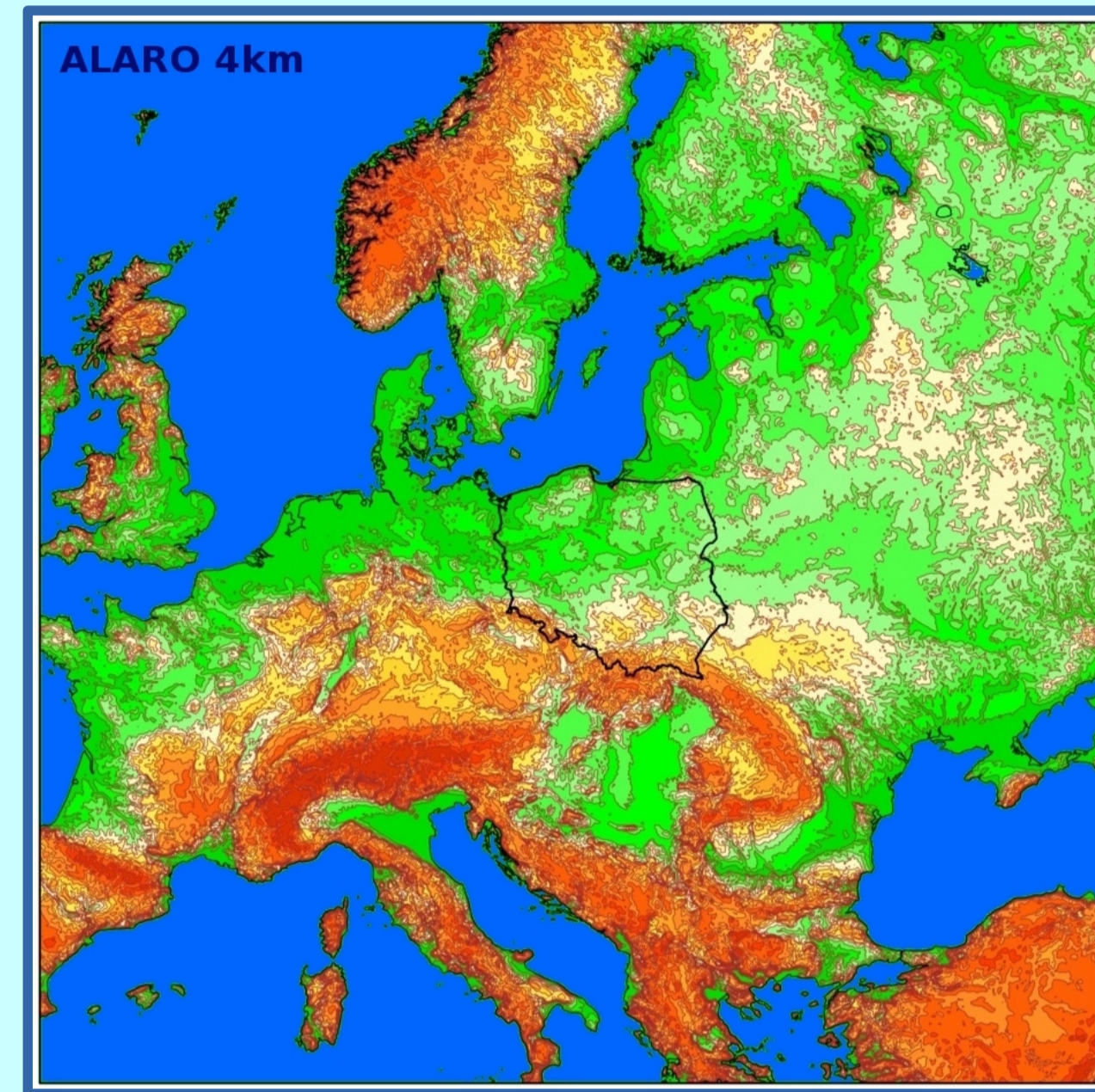
AROME Operational Domain:

P020 domain:

2.0km horizontal resolution, 799x799 grid points, 60 vertical model levels on a Lambert projection with 3h coupling frequency and 1 hour output 2 runs per day (00 and 12UTC) with 30 hours forecast range; LBC from ALARO-1; GRIB format, every 1h – for LEADS system;

ALARO 4km

AROME 2.0km
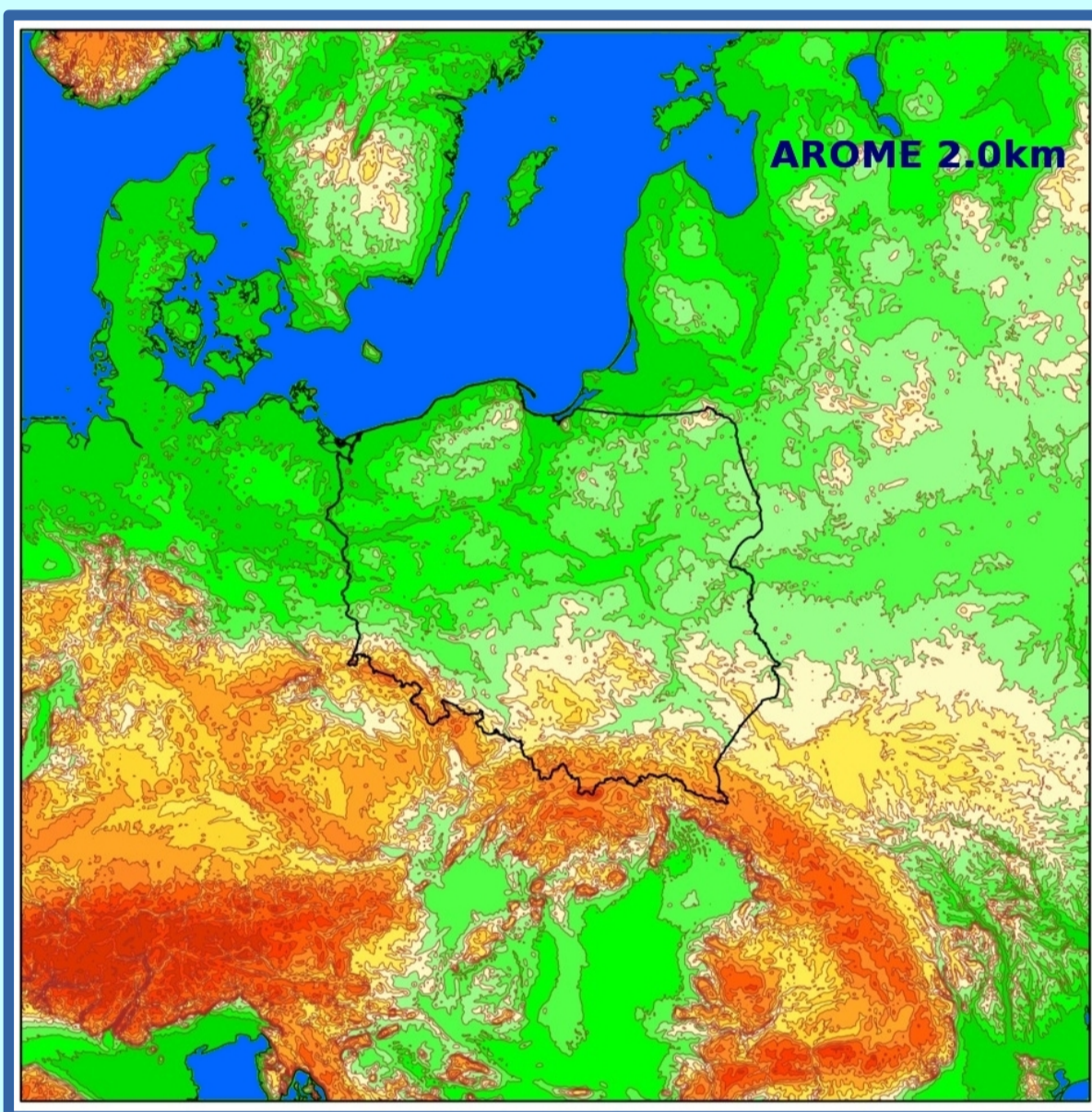
Operational machine characteristics

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.

HARP

SAL MEASURE

Harp package was employed to obtain SAL (S for structure, A for amplitude and L for location) quality measure for verification of precipitation. shiny package was use to show results of HARP work.

Results are plotted as scatter plots S vs A and dot colour for L and as variation of each of SAL components in period taken into account (AROME from March 2018, other models added successively).

Results are shown for given:
- model (AROME, ALARO, COSMO028, COSMO070, COSMO140, UM) or models (in order to compare the results)
- period (depending on the requirements)
- cumulation of precipitation (1h, 3h, 6h, 12h, 24h)
- model run (r00 for now)
- lead time

HARP spatial verification
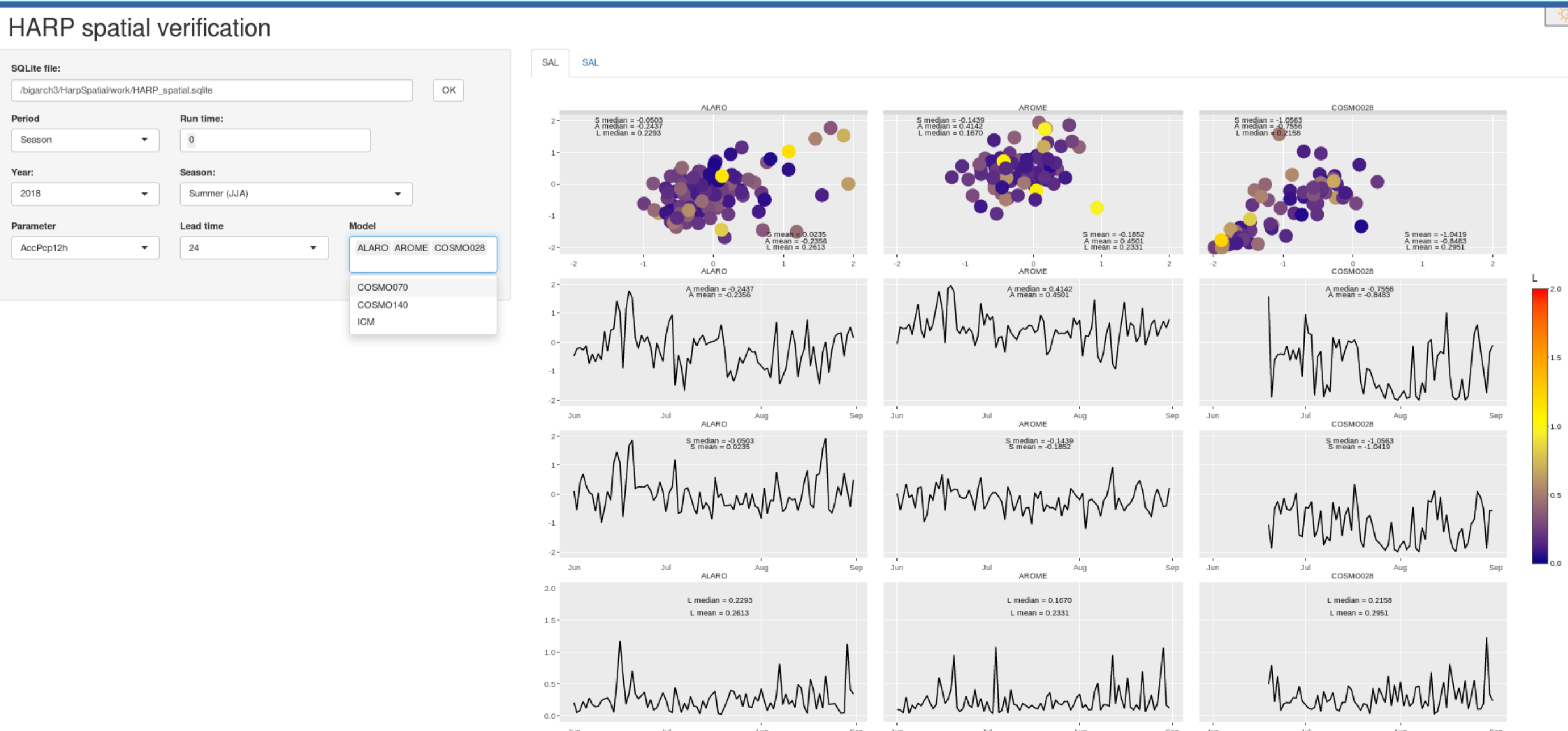
FUZZY VERIFICATION

Fuzzy verification (FSS, HK, ETS) are calculated for models as above as well but problem with presentation (values are calculated properly but threshold vs spatial scale tables are filled in not proper way)

TEMPERATURE INVERSION IN SOUTH POLAND

Frequency and intensity of temperature inversion occurance in Voivodeship Malopolskie was on investigation. That territory has big topographic diversification. We compare the measurements of temperature gradient with AROME model results. There were used pairs of land stations (one in valley, second on top of the hill) to estimate tempereture gradient between them. Also vertical profiles from balloon soundings were used.

OBSERVATIONS

meteo-stations

balloon soundings

FORECAST

Stations representation in the model

model: AROME
resolution: 2km
run: r12
time-step: 1h
fc-time: 06h–30h

pairs of meteo-stations (valley / mountain peak)
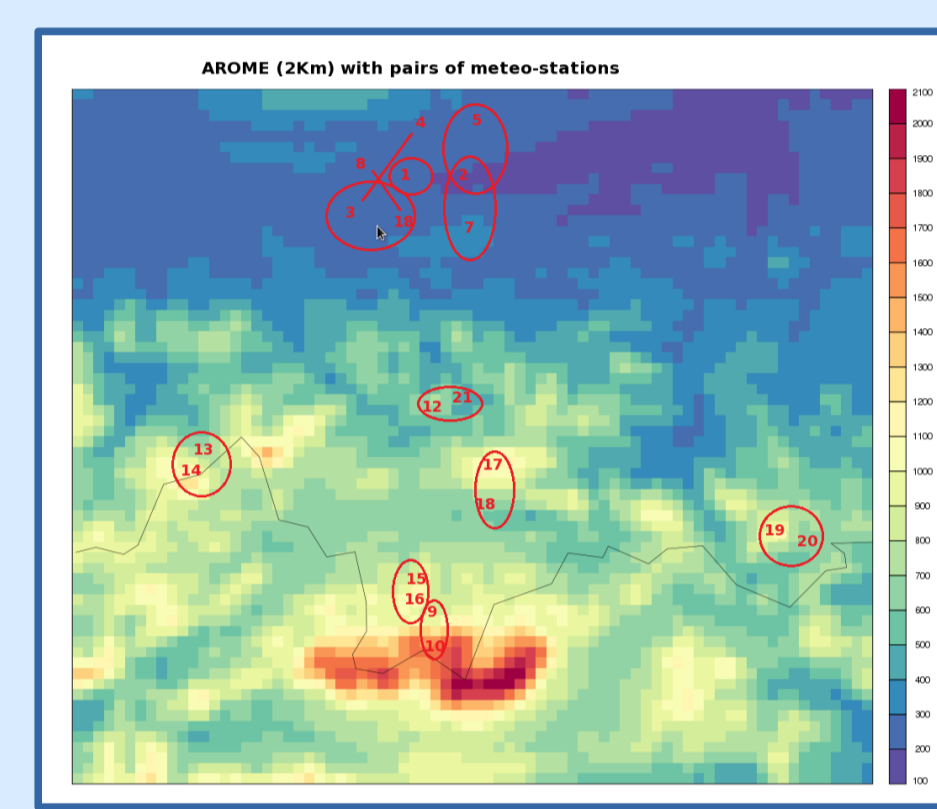
| "mountain" station no	"valley" station no	Distance between stations [km]	Difference of altitudes between stations [m]
16	15	4.6	620
18	17	3	628
12	11	7.3	1136
8	10	16.3	77
14	23	7.1	672
19	20	7.9	527
21	22	7.4	527
8	5	13.6	103
9	4	11.2	239
7	4	13.6	102
6	5		59
1 (mast)			0

PERIODS:

I – IV 2017 (72% days with observed inversion)
IX – XII 2017 (58% days with observed inversion)
I – IV 2018 (63% days with observed inversion)

Inversion > 10h in 25% of events in all given periods

RESULTS:
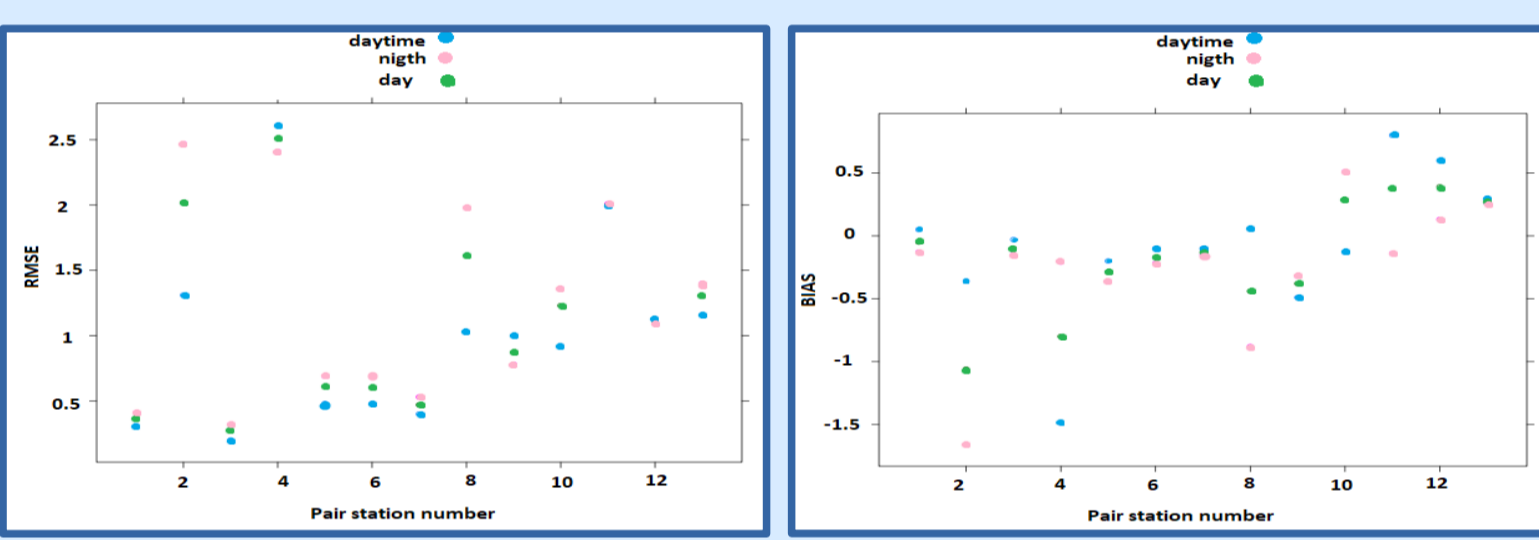
Bigger RMSE and BIAS of temperature gradient at nights than on days
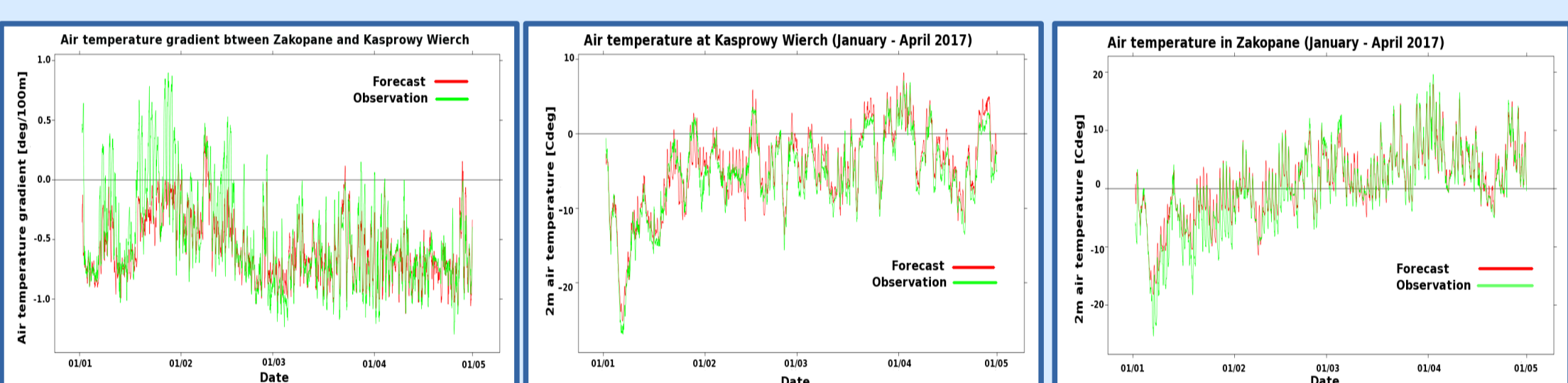
Underestimated inversion predicted by model in case of strong (>1°C/100m) inversion is associated with overestimated air temperature at 2m

Best forecast while temperature gradient between -1°C /100m and 0°C/100m (no temperature inversion)

Strong inversion (gradient > 1°C/100m):
- cloudiness 0/8 – 3/8 in majority of events,
- no wind or wind (4m/s – 5m/s) from "privileged" direction i.e. S or SE or in case of Zakopane meteo-station N or NE

TESTS OF HIGH RESOLUTION FORECASTS

PERIOD: 1 Jan 2017 – 16 Feb 2017 (33 days)

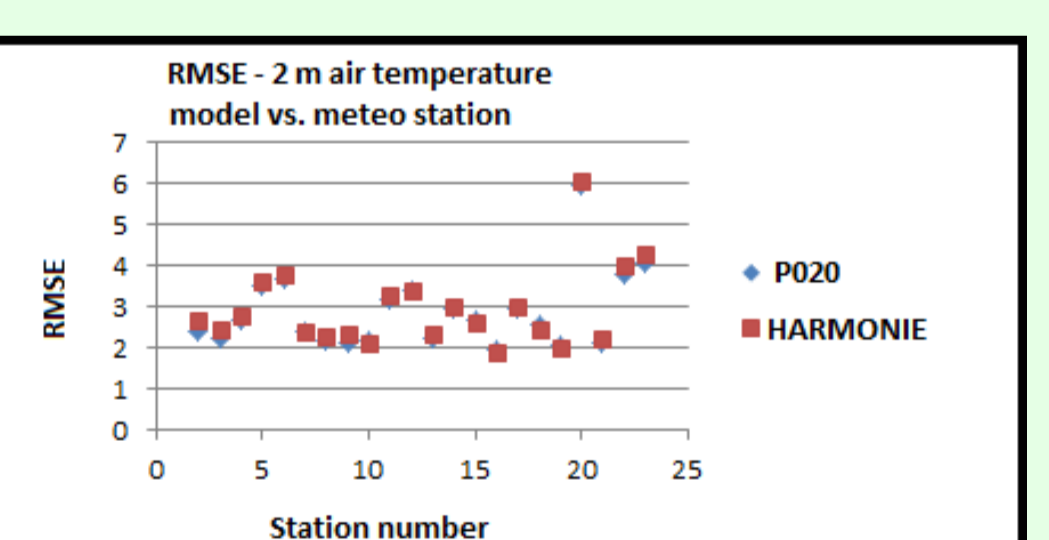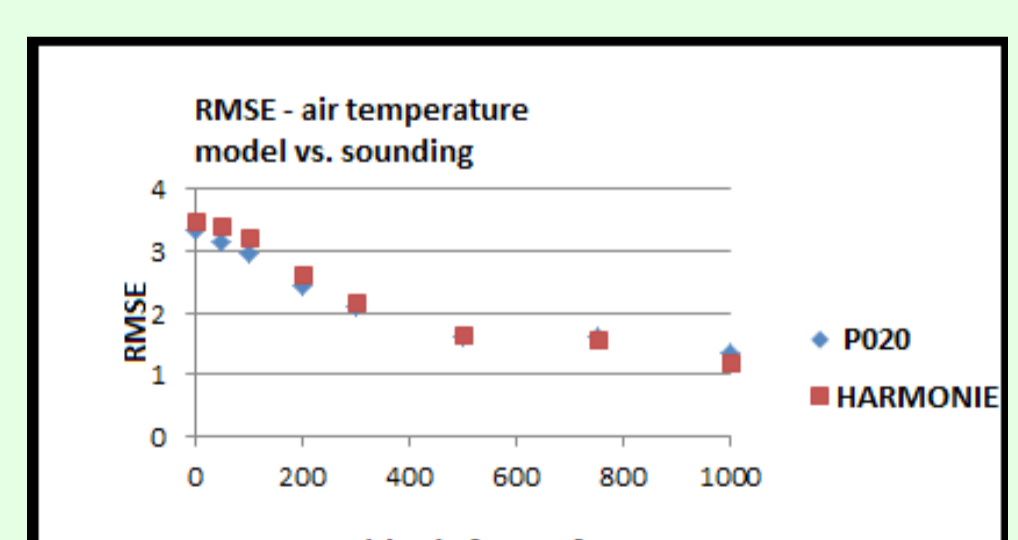### COMPARISON OF *AROME* AND *AROME HARMONIE* MODELS RESULTS

MODELS:

AROME HARMONIE
   resolution: 2km, fc-horizon: 30h, levels number: 60, run: r12, time-step: 1h, fc-time: 06h-30h
AROME (P020)
   resolution: 2km, fc-horizon: 30h, levels number: 60, run: r12, time-step: 1h, fc-time: 06h-30h

OBSERVATIONS:

BALOON SOUNDING (see above)
METEO-STATIONS (see above)

RESULTS:

There are not significant differences in results of both given models used in experiment

### COMPARISON OF *AROME 2km*, *AROME 1km* AND *ALARO nhyd* MODELS RESULTS

MODELS:

AROME (P020)
   resolution: 2km, fc-horizon: 30h, levels number: 60, run: r12, time-step: 1h, fc-time: 06h-18h
AROME (P010)
   resolution: 1km, fc-horizon: 18h, levels number: 105, run: r12, time-step: 1h, fc-time: 06h-18h
ALARO nhyd (E010)
   resolution: 1km, fc-horizon: 18h, levels number: 105, run: r12, time-step: 1h, fc-time: 06h-18h

OBSERVATIONS:

BALOON SOUNDING (see above)
METEO-STATIONS (see above)

RESULTS:

For temperature gradient from model compared with pairs of stations data the best results are obtained by AROME (P020) model.
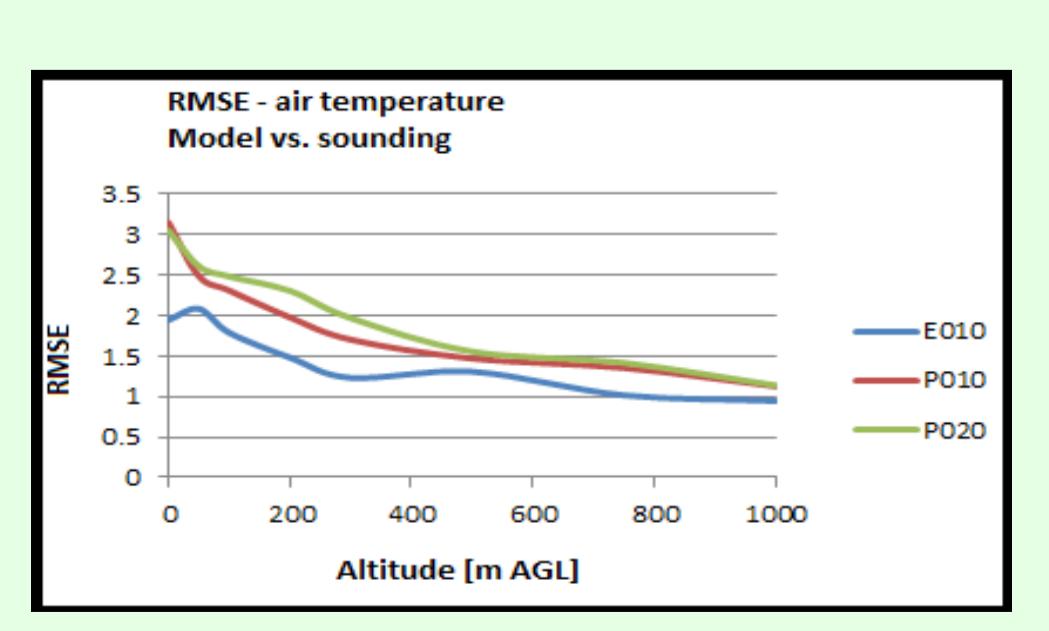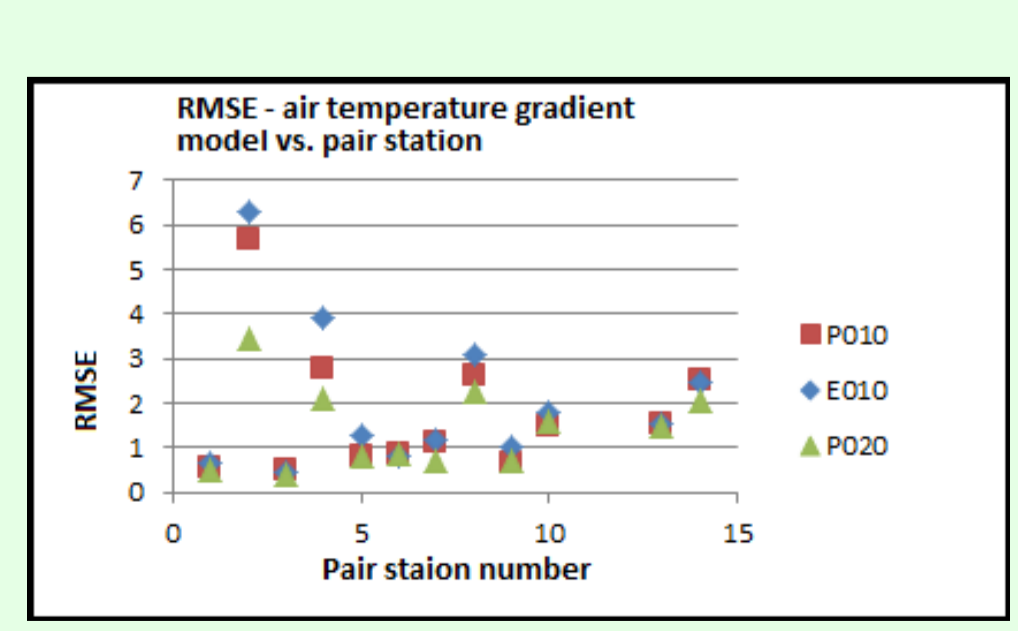
There are not significant differences in results while the resolution of model is enlarged (left). As for air temperature sounding the best results are obtained by ALARO nhyd (E010) (right).