Daily variations of COSMO precipitation and air temperature forecasts quality in Ukrainian Carpathian Mountains

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In Ukrainian Carpathian Mountains cases of heavy precipitation are observed very often. In some places such precipitation can reach 100 mm per day and more. In summer time in mountains regions heavy rainfall can lead to fast formation of surface runoff and dangerous floods and mud flow in result. Accordingly to this, necessity of usage of modern meteorological methods and numerical weather prediction models with detailed spatial and temporal discretization is apparent.
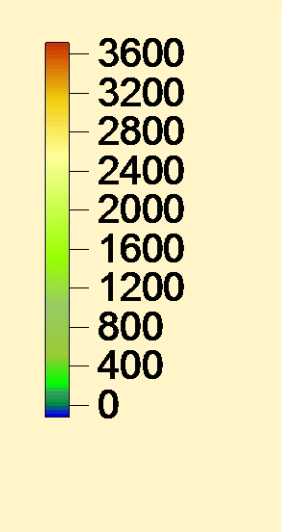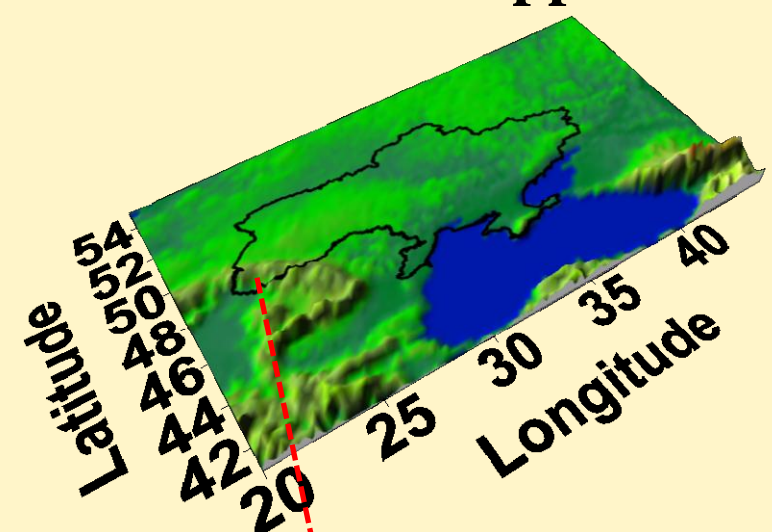
Model domain contains 209 x 101 points; horizontal steps are 14 km; number of vertical levels is 50.
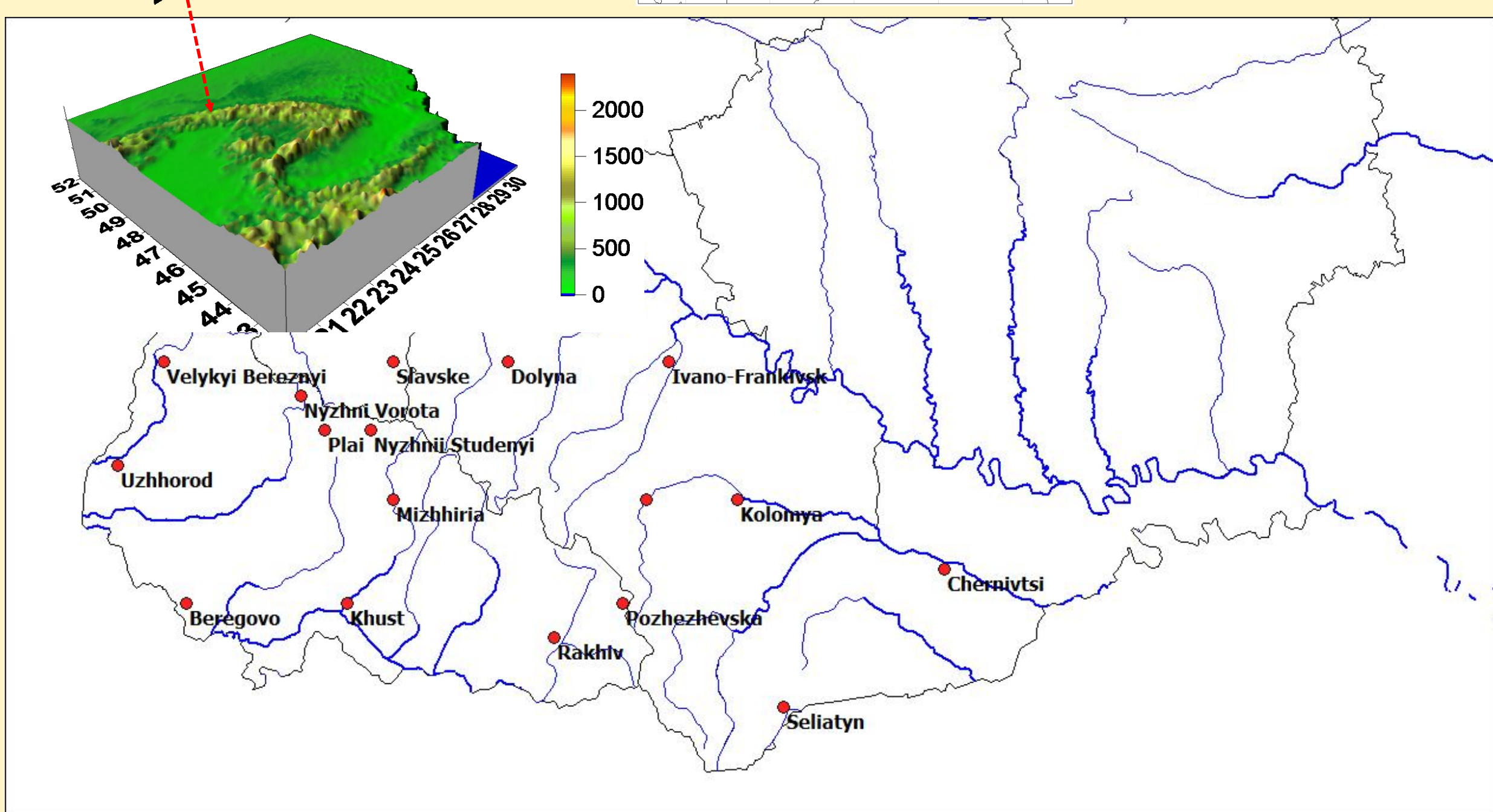
Network of Ukrainian meteorological station in Carpathian region and neighborhood areas

Verification methods

$$Mean\ Error = \frac{1}{N}\sum_{i=1}^{N}(F_i - O_i)$$

$$MAE = \frac{1}{N}\sum_{i=1}^{N}|F_i - O_i|$$

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(F_i - O_i)^2}$$

$$POFD = \frac{false\ alarms}{correct\ negatives + false\ alarms}$$

$$TS = CSI = \frac{hits}{hits + misses + false\ alarms}$$

where F_i is forecast and O_i is observation.

$$Accuracy = \frac{hits + correct\ negatives}{total}$$

$$BIAS = \frac{hits + false\ alarms}{hits + misses}$$

$$ETS = \frac{hits - hits_{random}}{hits + misses + false\ alarms - hits_{random}}$$

$$POD = \frac{hits}{hits + misses}$$

$$FAR = \frac{false\ alarms}{hits + false\ alarms}$$

$$hits_{random} = \frac{(hits + misses)(hits + false\ alarms)}{total}$$ where

$$HK = \frac{hits}{hits + misses} - \frac{false\ alarms}{false\ alarms + correct\ negatives}$$
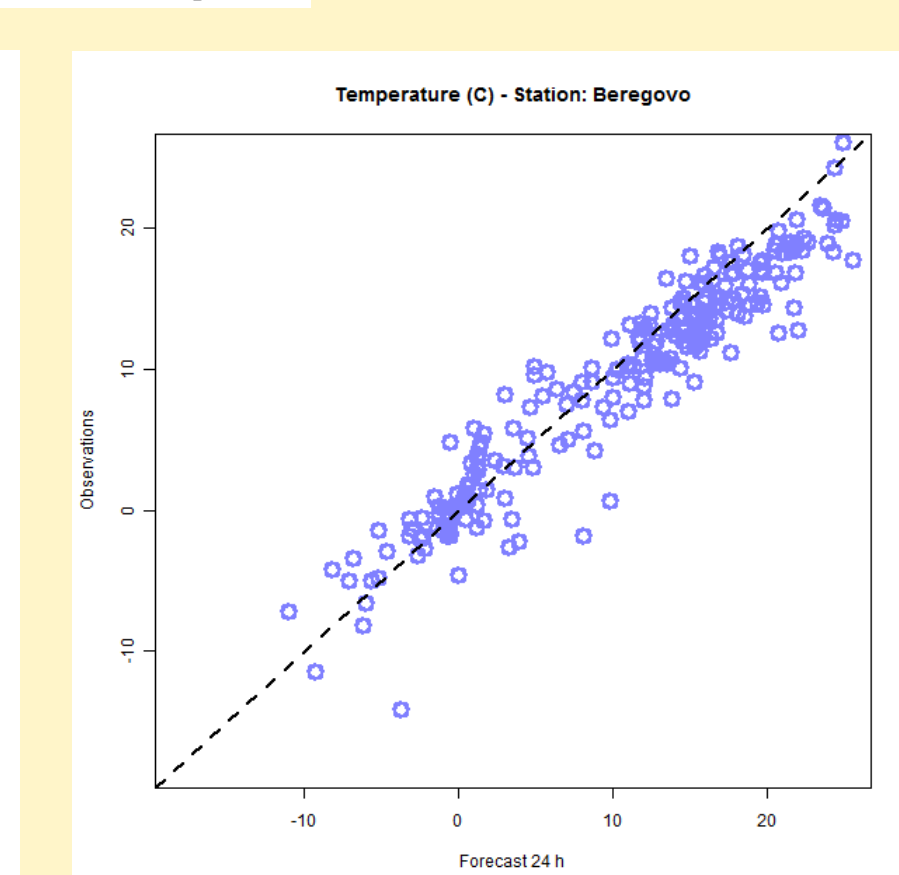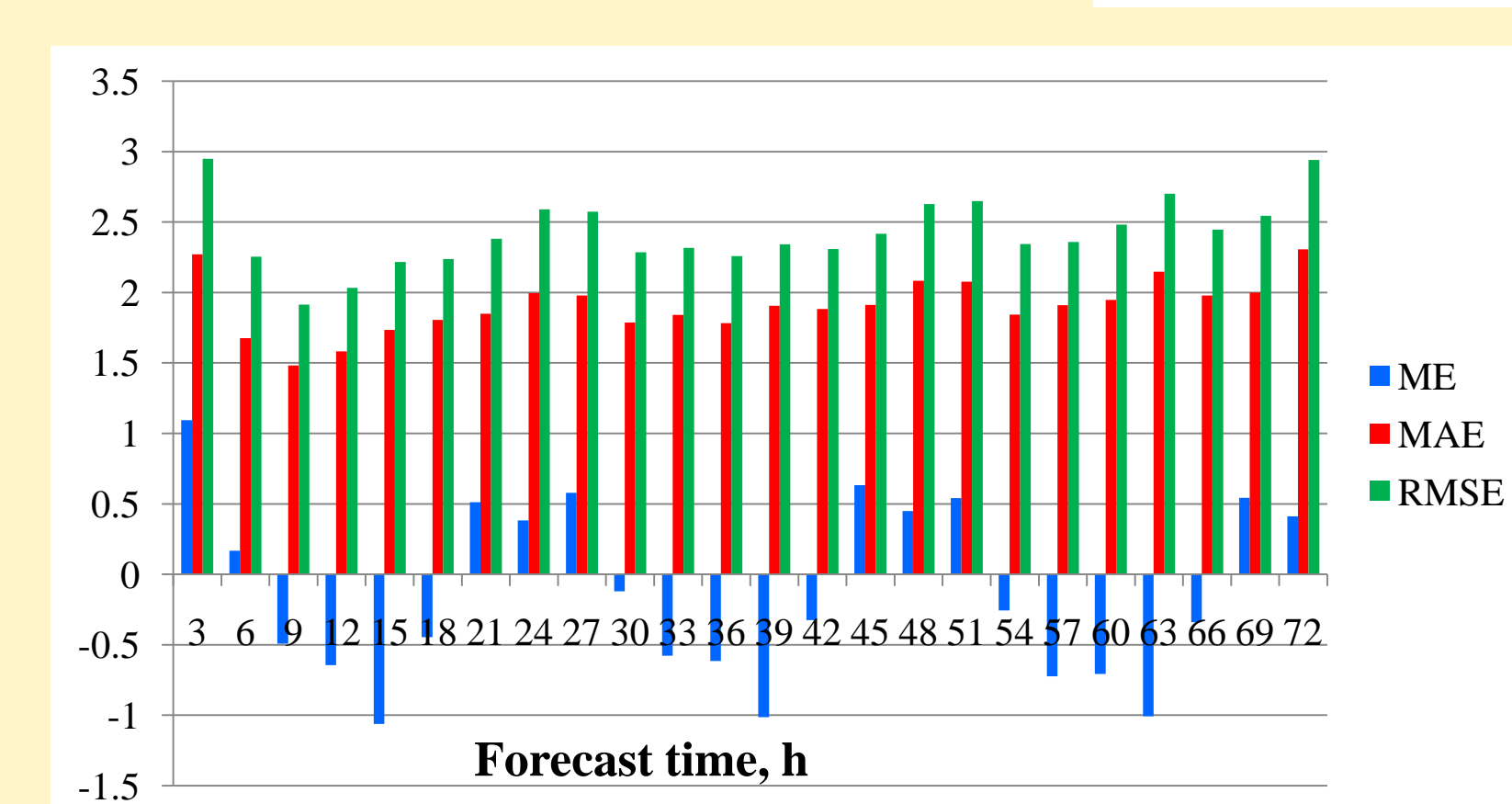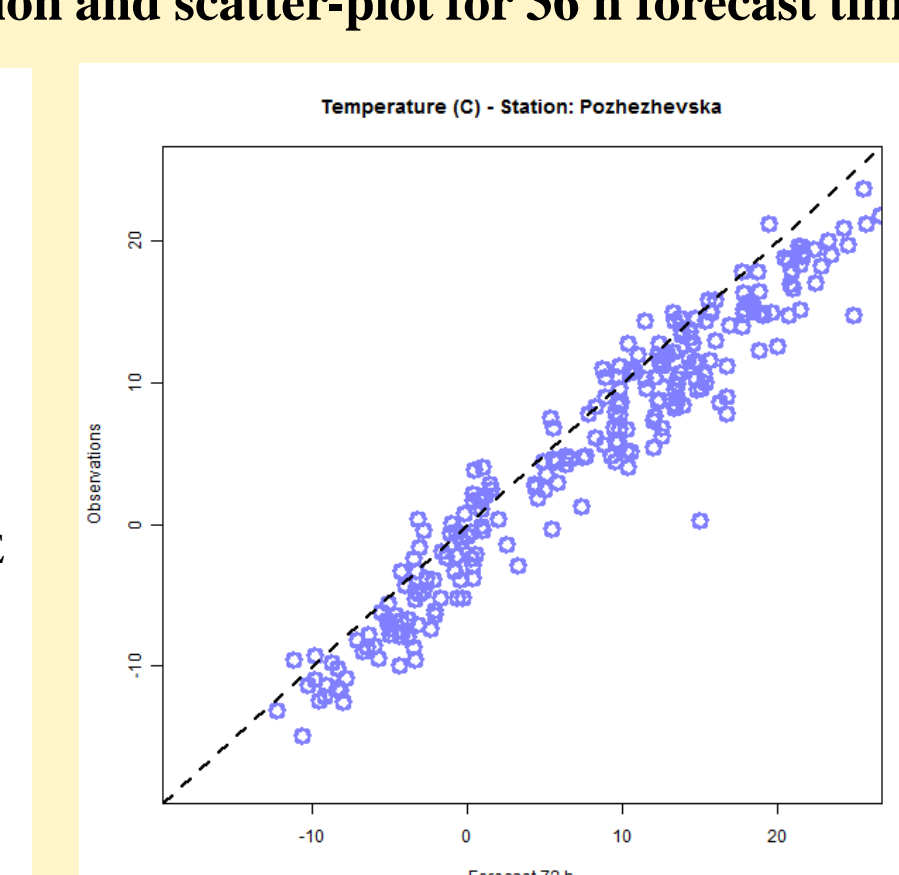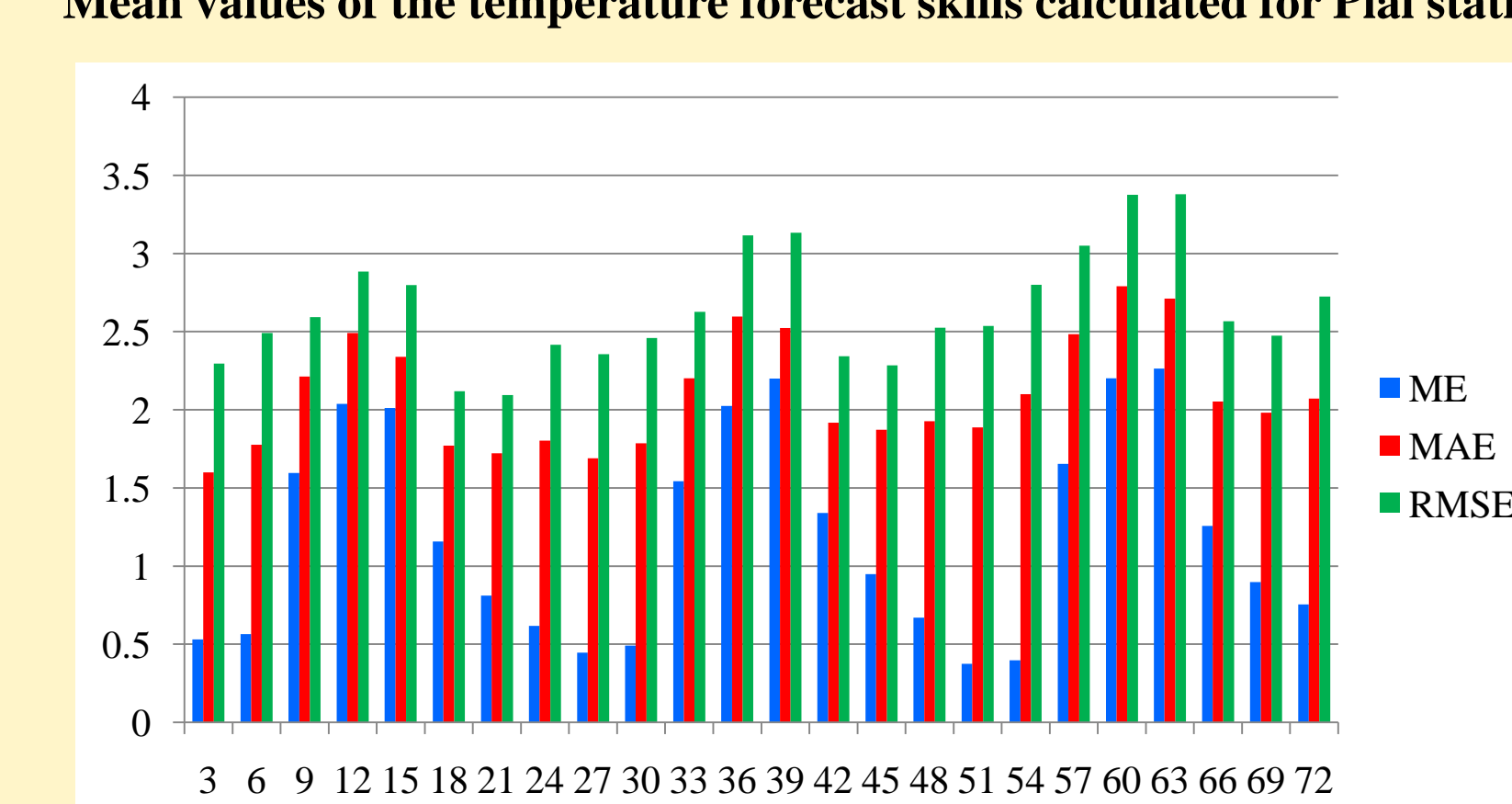

Mean values of the temperature forecast skills calculated for Beregovo station and scatter-plot for 3 h forecast time
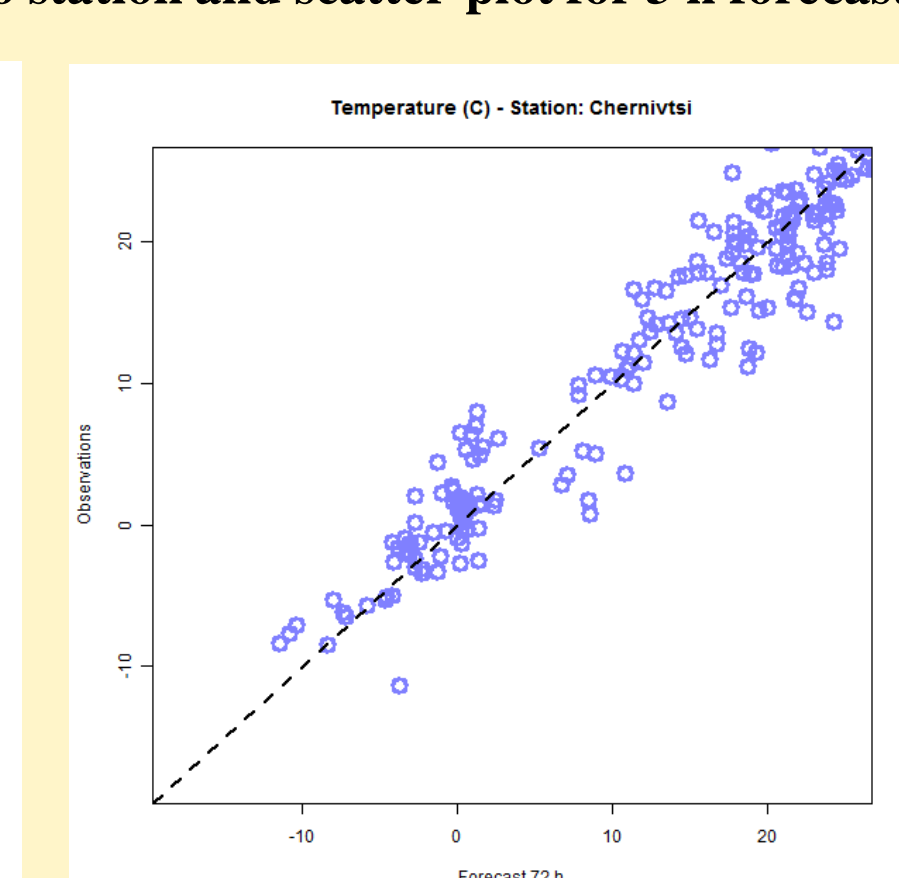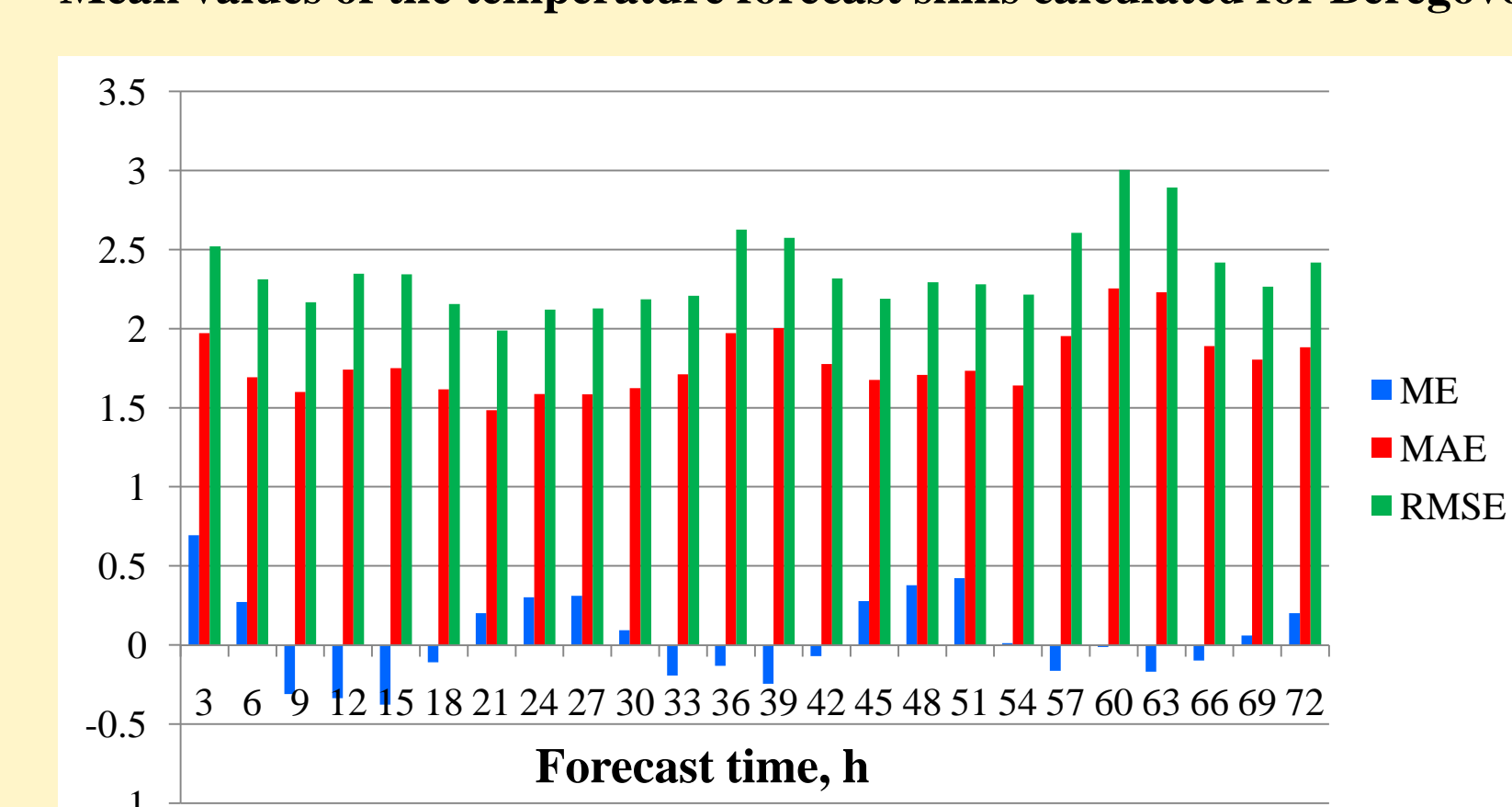

Mean values of the temperature forecast skills calculated for Chernivtsi station and scatter-plot for 60 h forecast time
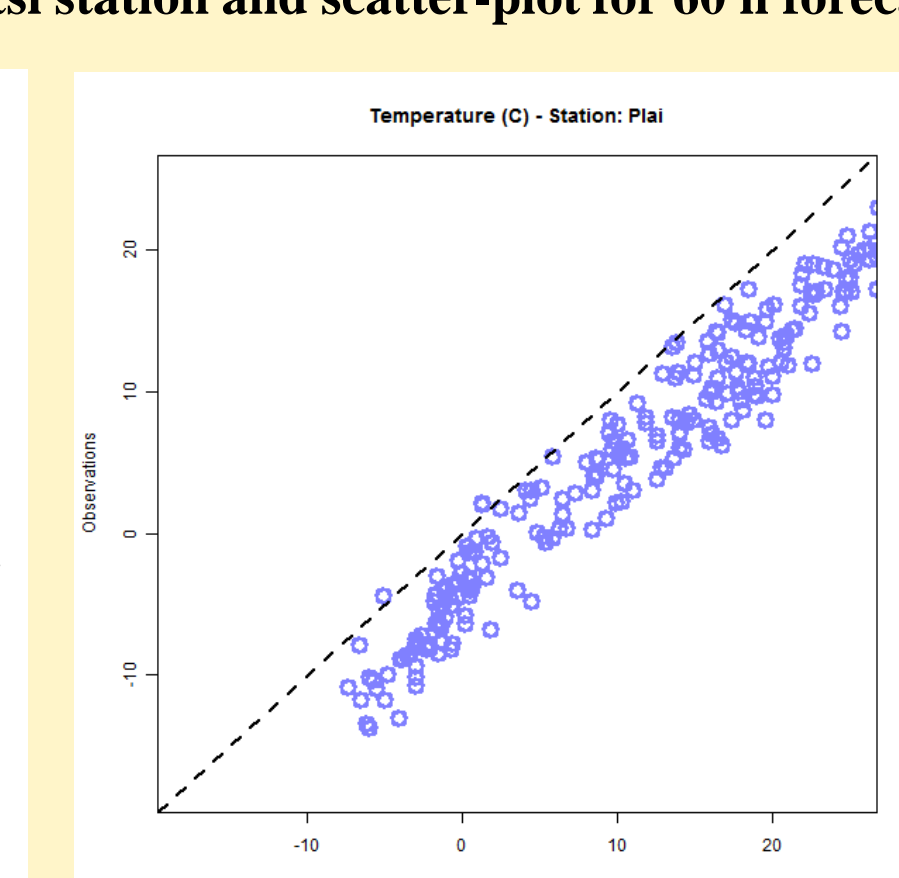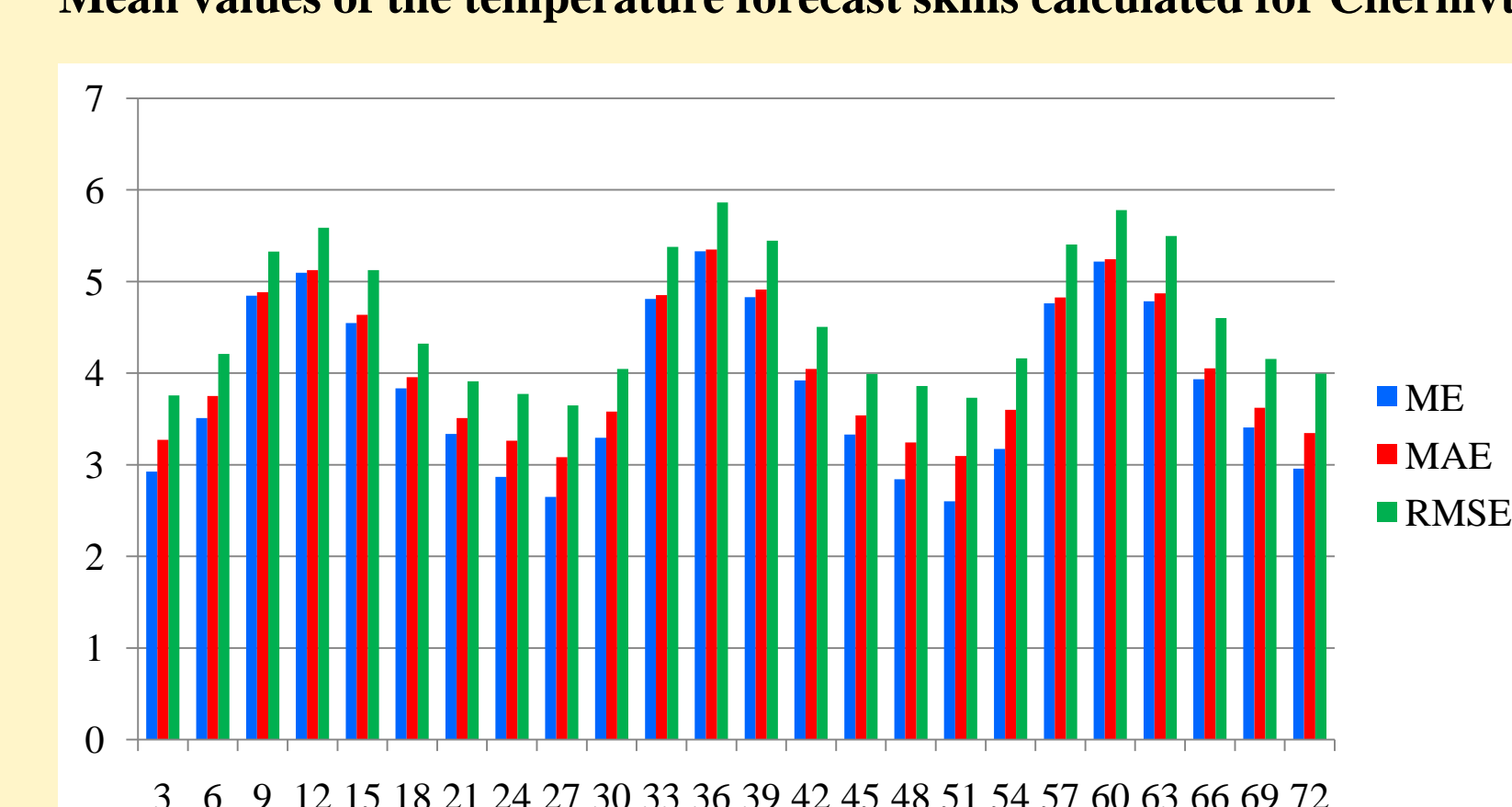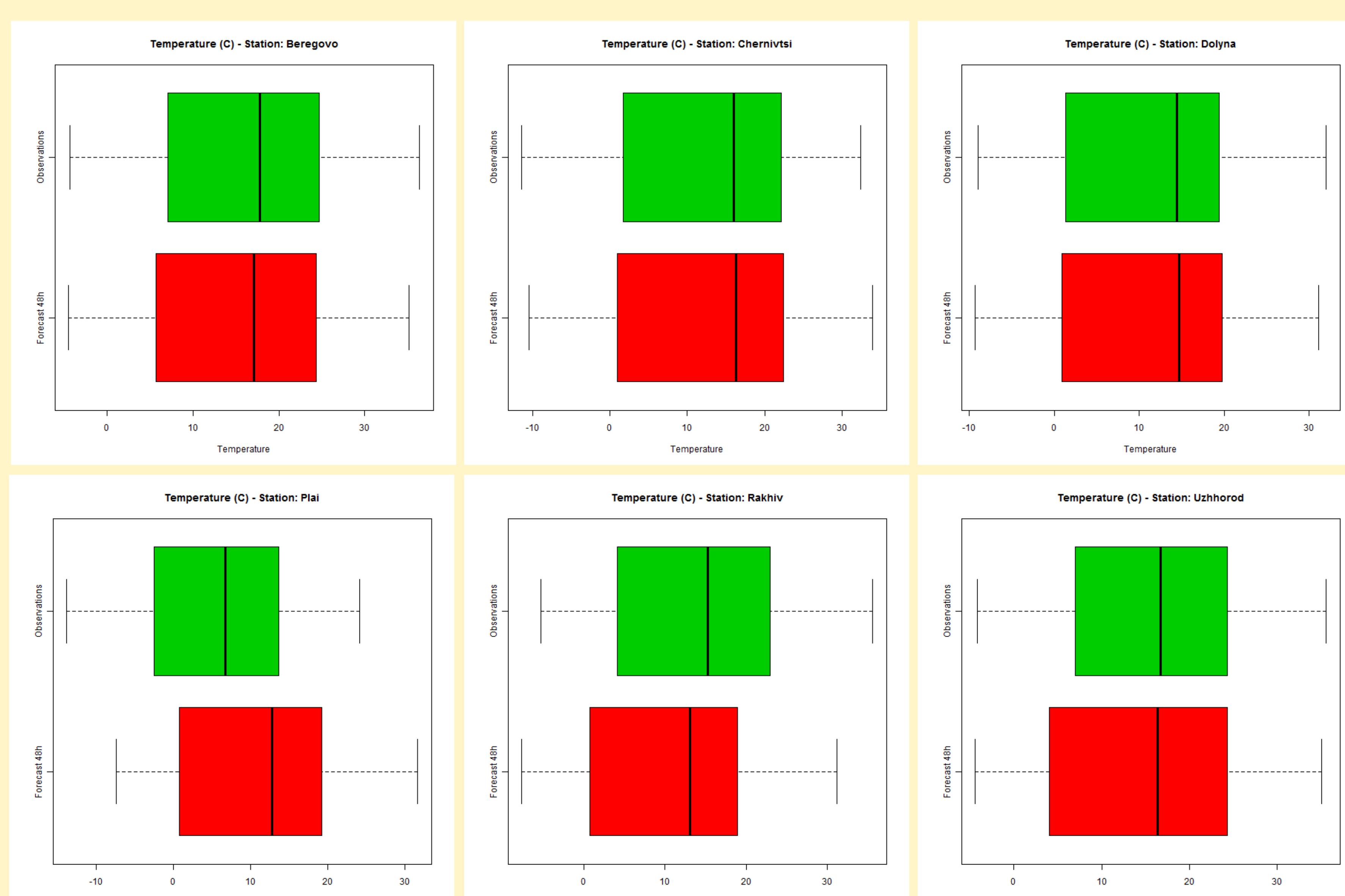

Mean values of the temperature forecast skills calculated for Plai station and scatter-plot for 36 h forecast time
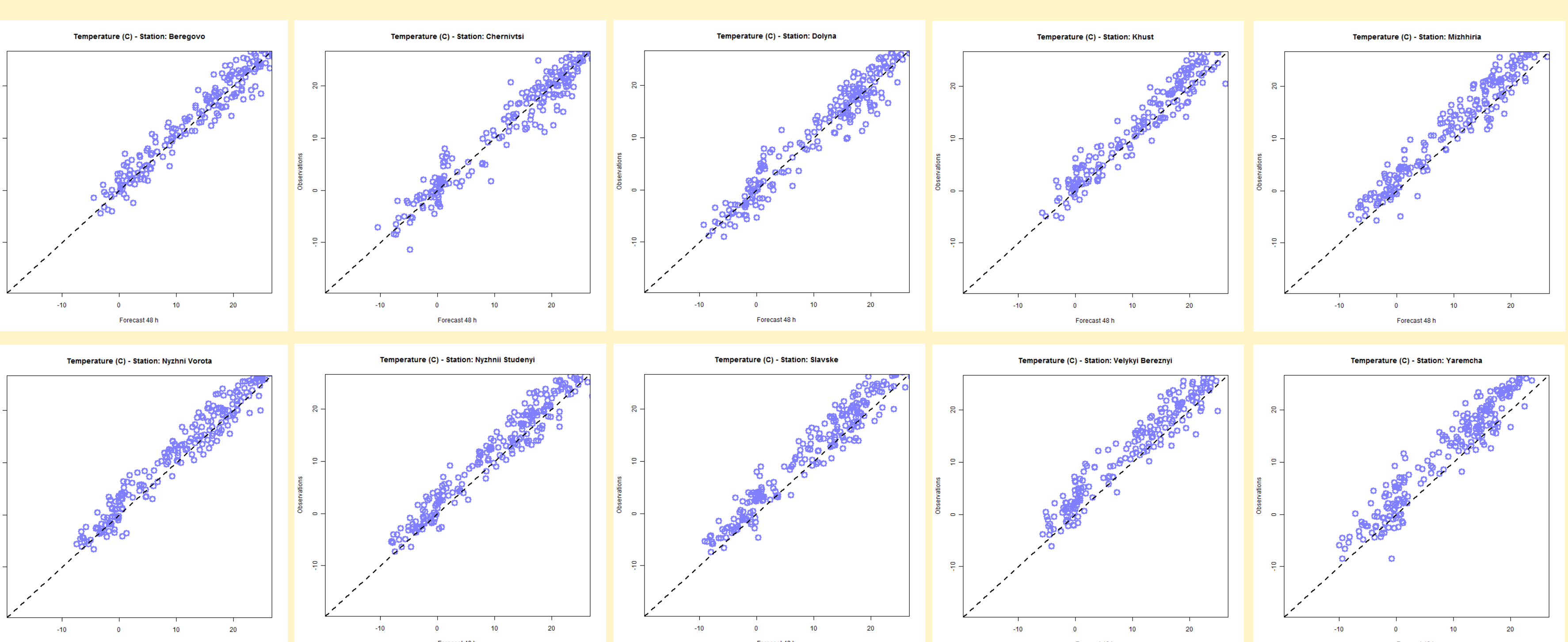

Mean values of the temperature forecast skills calculated for Pozhezhevska station and scatter-plot for 63 h forecast time
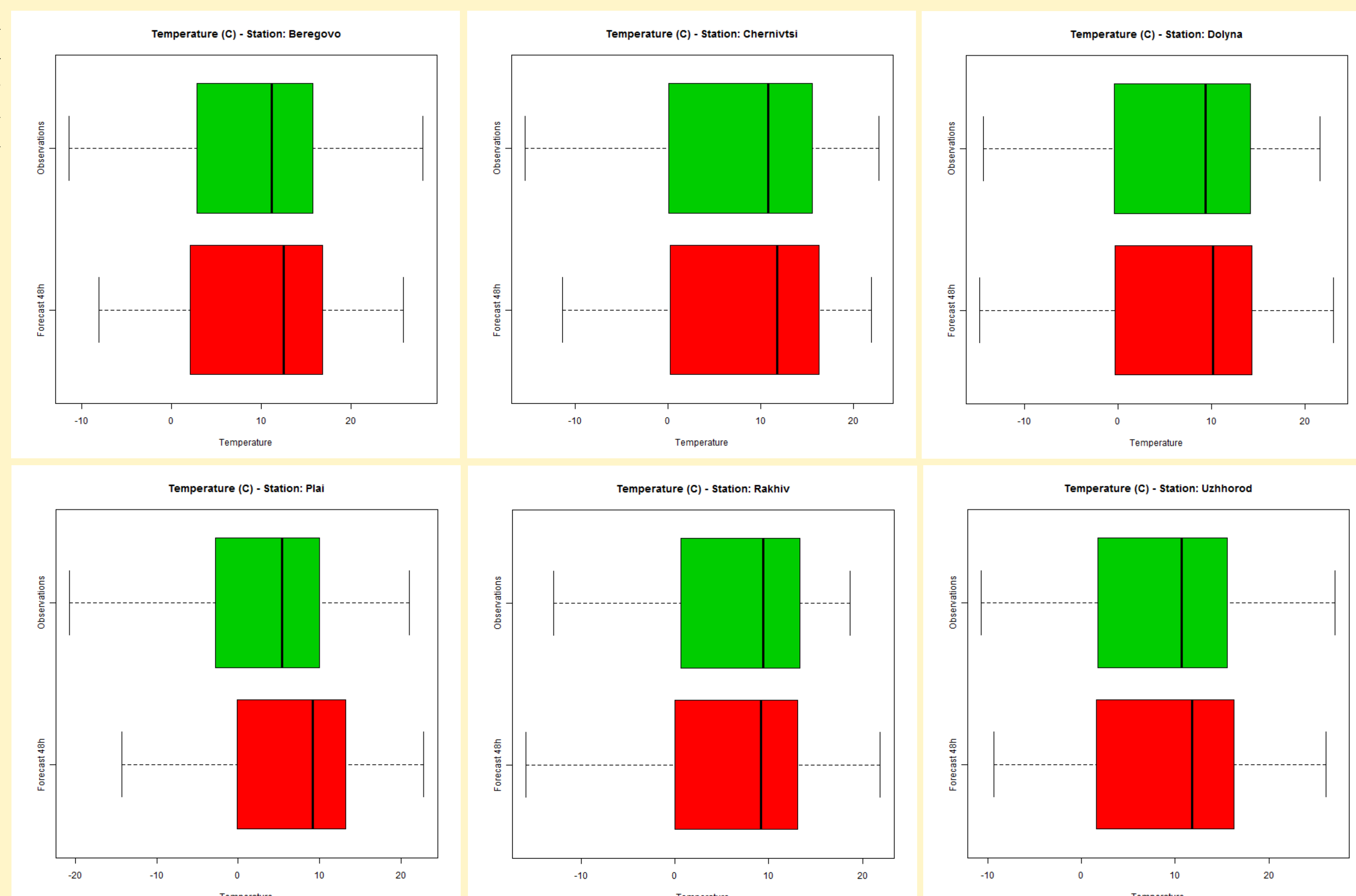
Box-plots of midnight of second day of forecast (48 h) for different stations for period from January to October of 2013

Box-plots of midday of second day of forecast (60 h) for different stations for period from January to October of 2013

Scatter-plots for 36 h forecast time for different stations in investigated region

Table. Precipitation skill scores (Uzhhorod)

Term	06	12	18	24	30	36	42	48	54	60	66
accuracy	—	—	0.832	0.773	—	—	0,796	0,796	—	—	0.760
biasscore	—	—	0.803	0.627	—	—	0.726	0.650	—	—	0.736
hitrate	—	—	0.515	0.398	—	—	0.438	0.438	—	—	0.361
FAR	—	—	0.358	0.365	—	—	0.396	0.327	—	—	0.509
POFD	—	—	0.080	0.086	—	—	0.091	0.076	—	—	0.116
TS	—	—	0.400	0.324	—	—	0.340	0.361	—	—	0.263
ETS	—	—	0.000	0.000	—	—	0.000	0.000	—	—	0.000
HK	—	—	0.185	0.135	—	—	0.146	0.157	—	—	0.098

Conclusions

• Forecast errors of air temperature undergo changes similar to oscillation

• At evening and night time model overstates value of air temperature, in day time it understates temperature values, with the exception of mountain stations with high altitude, where air temperature is overestimated.

• Values of errors growth with altitude of place where situated meteostation. Most their values are character for meteostations Plai, Pozhezhevska and Mizhhiria

• In common case model has good skill scores for precipitation