Centrum Modelowania Meteorologicznego

Ensemble forecasts in hectometric scale – comparison of results for 7, 2.8 and 0.7 km resolution model runs – case study.

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Introduction

On August 11th, 2017, roughly at 20:30 UTC, a very strong storm passed over the northern part of Poland.

The consequences are analyzed to this day. At least two people died at the scout camp in Suszek, and many were injured as a result e.g. of being hit by broken trees.

This entire event has been analyzed many times in terms of synoptic forecasts and warnings. Still, this presentation tries to assess what the forecast might look like if very high (hectometric) resolution ensemble forecasts were used to support it.

Assumption – increased resolution **was the only change** comparing the setup of 2.8km and of 0.7km (→ basically due to our not very impressive experience with the hectometric scale modeling)

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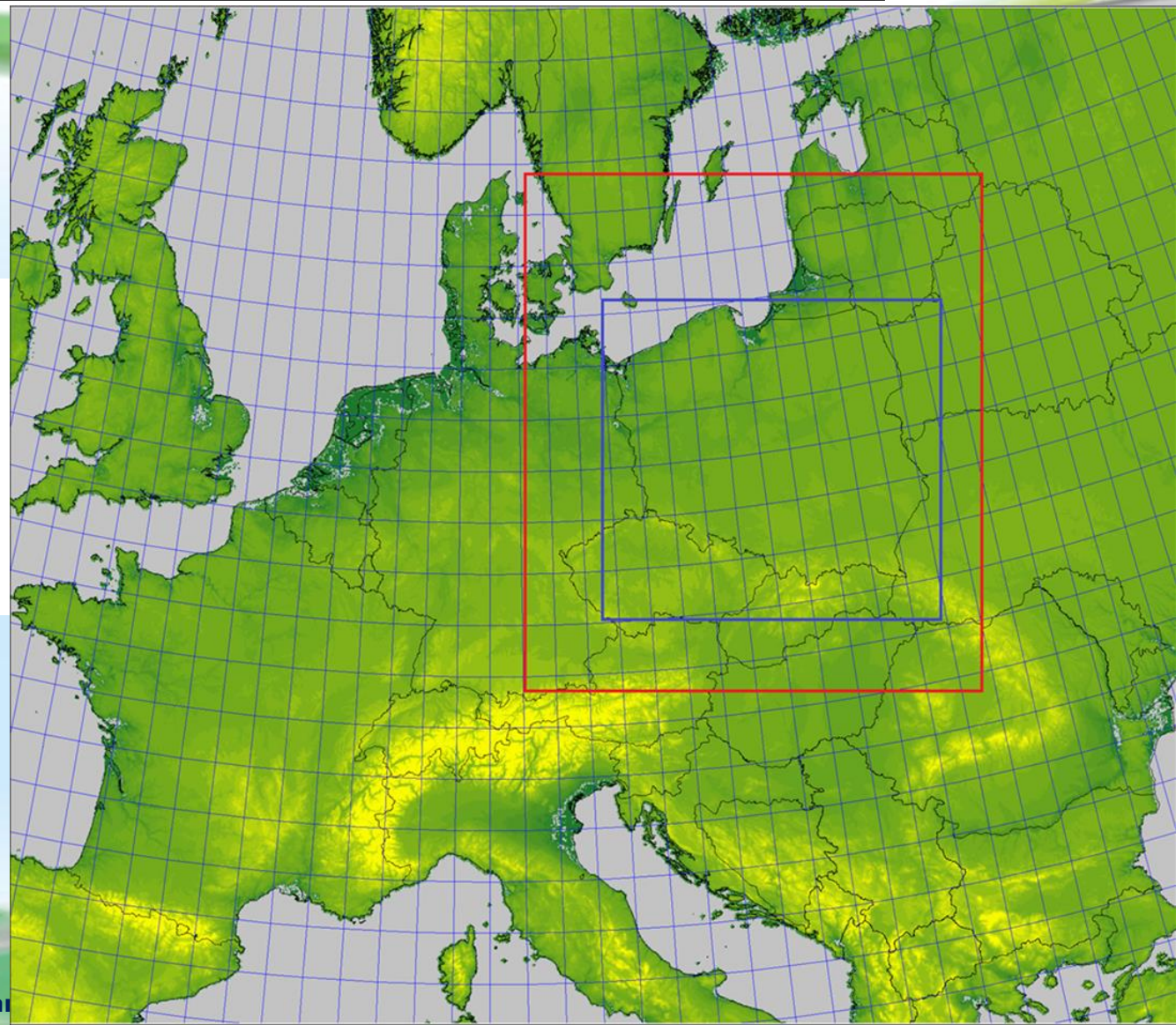
Setup

Details of configuration of models

Model	Res. (km)	Grid size	Fcst length [h]
ICON (DWD)	13	2949120	96
COSMO	7	415x460x40	24
COSMO	2.8	380x405x50	24
COSMO	0.7	1140x1020x50	24



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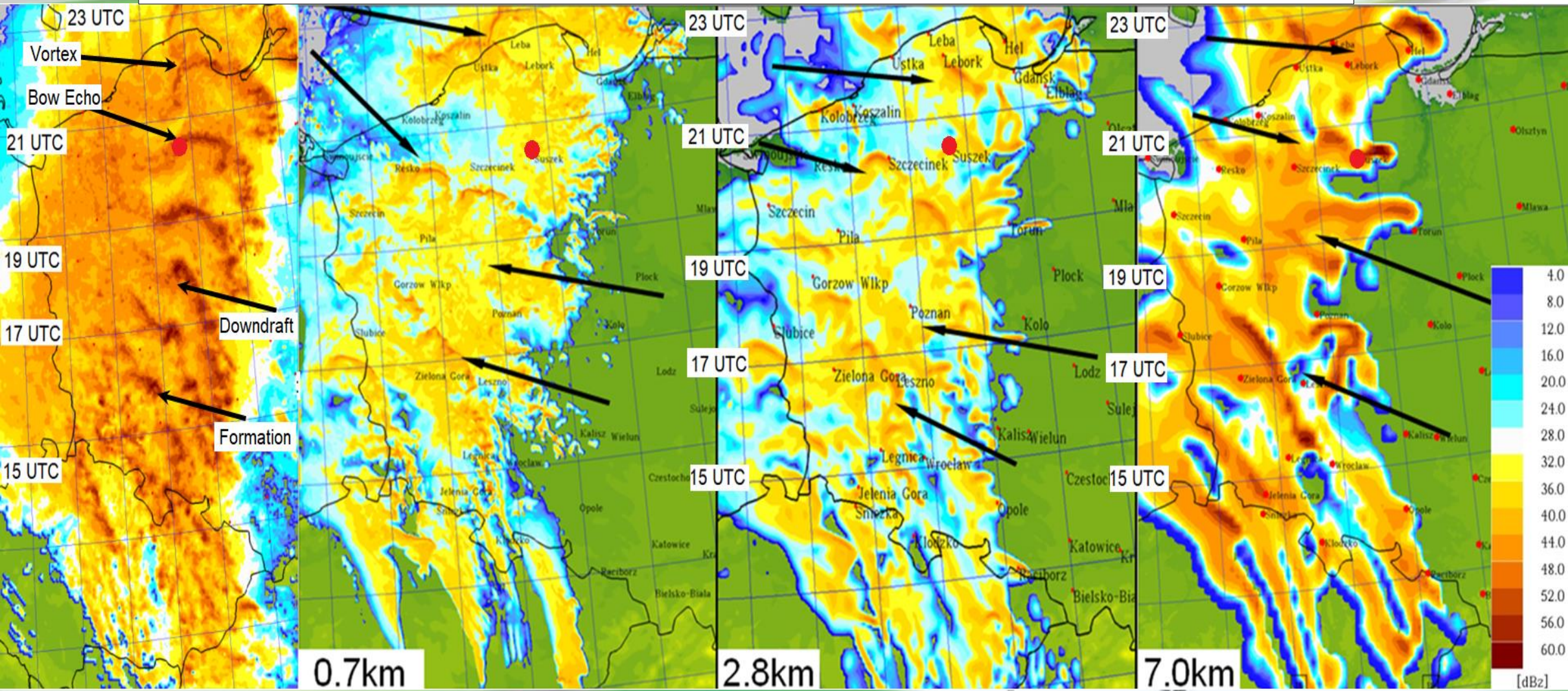
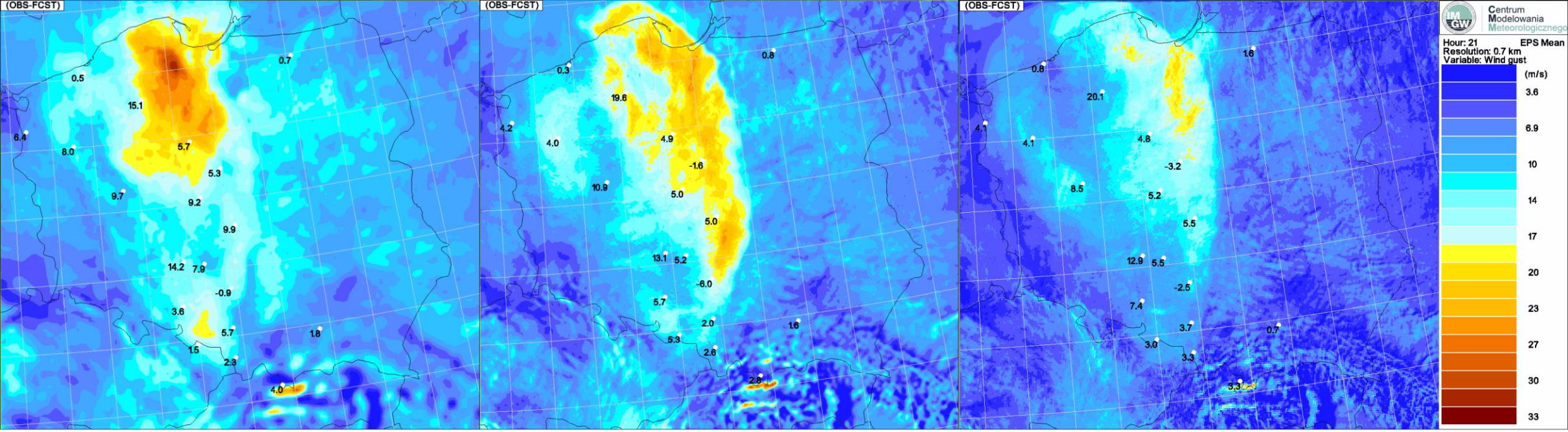
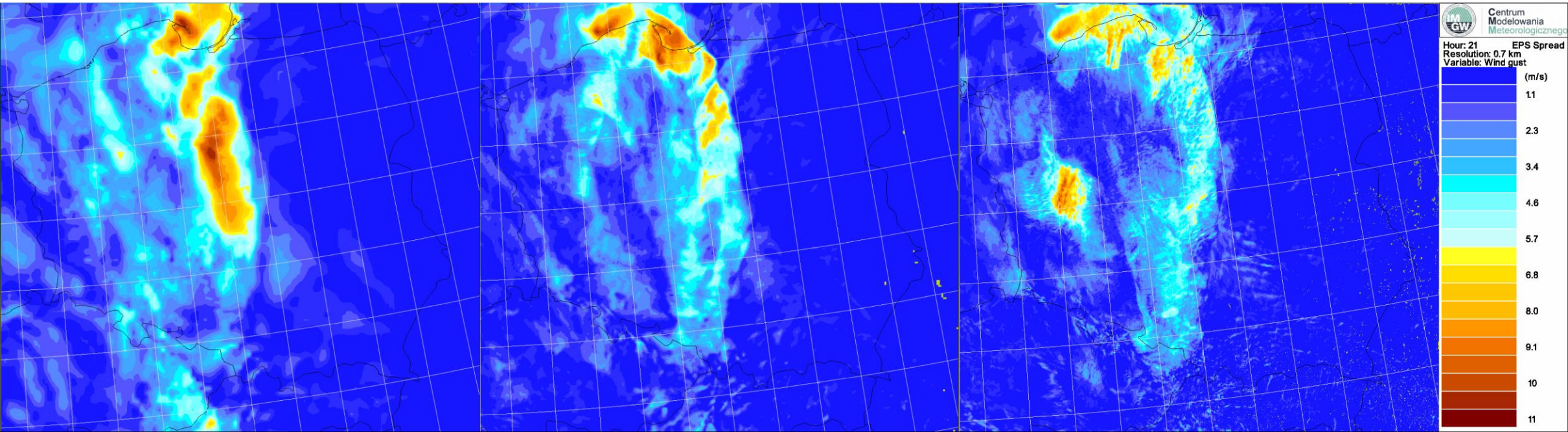
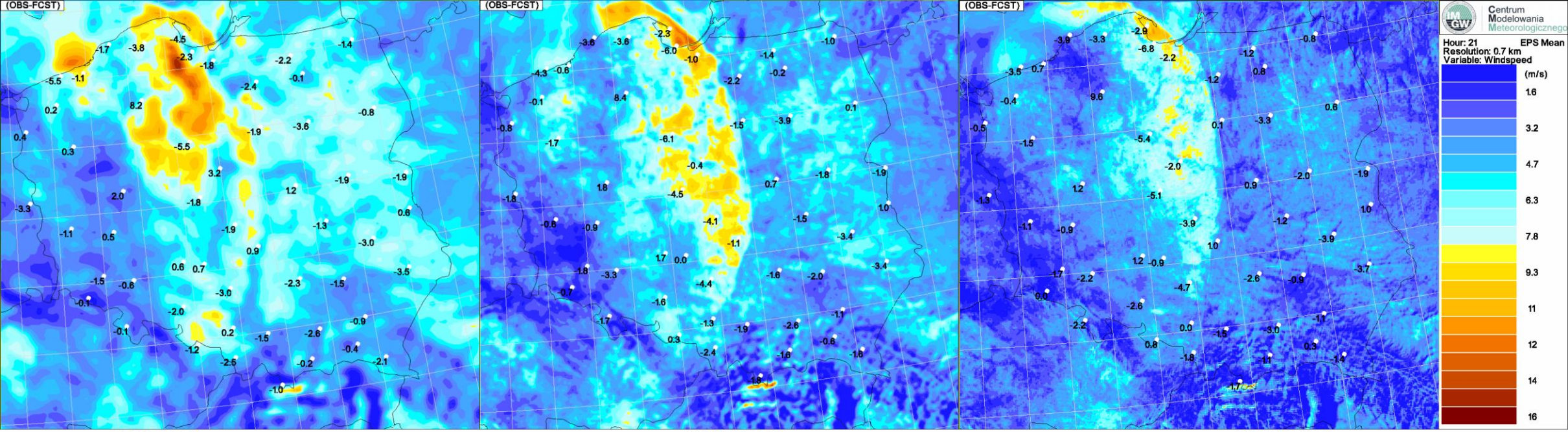
dBZ – forecasts vs. observations



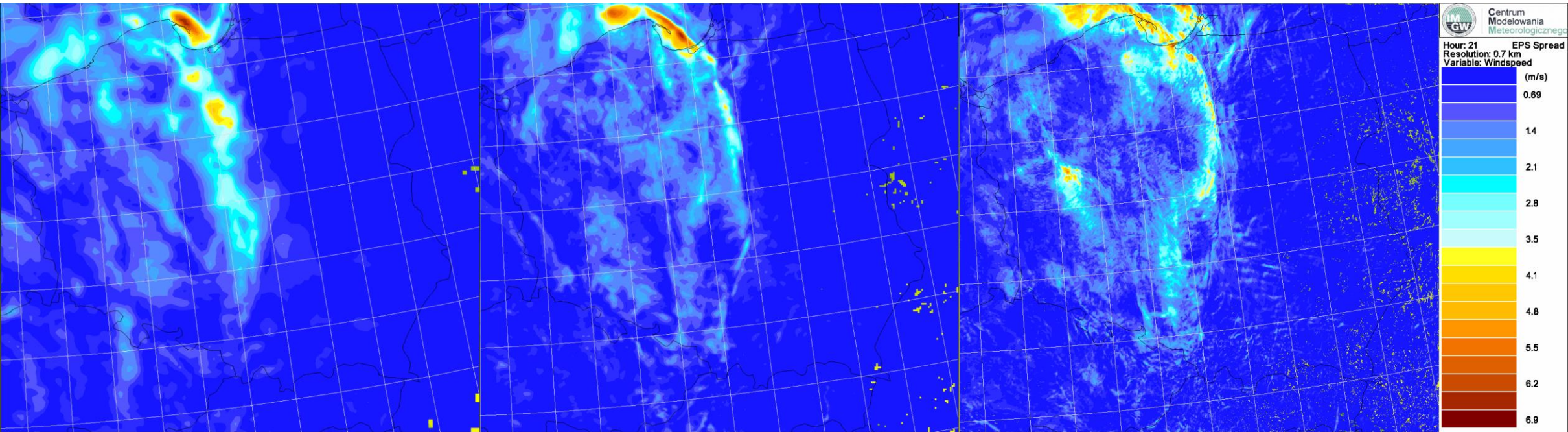


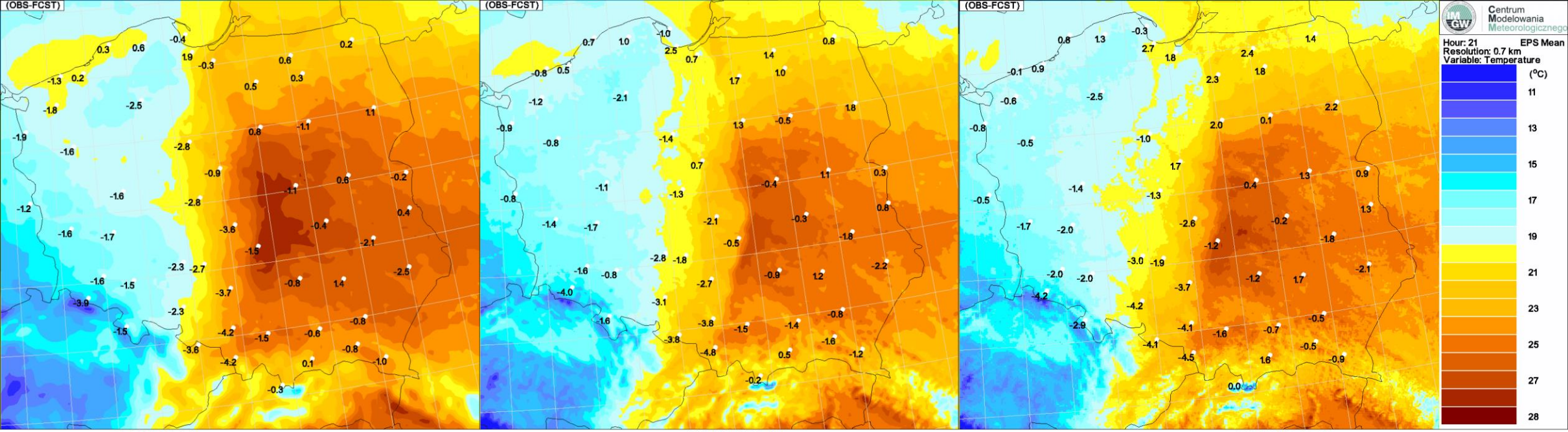
COSMO-7 km COSMO-2.8 km COSMO-0.7 km



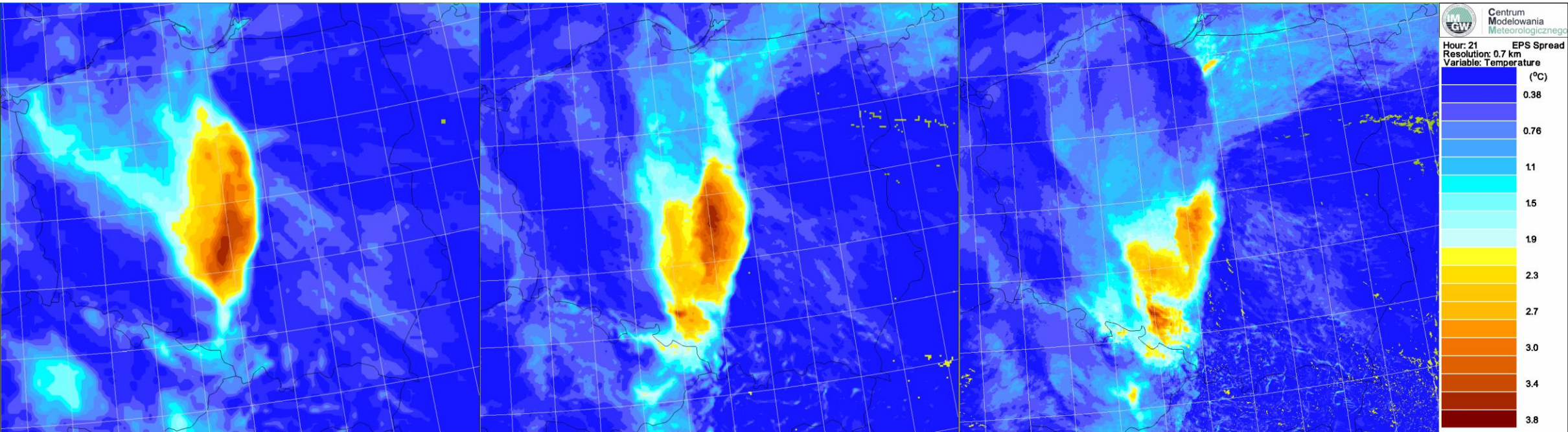


COSMO-7 km COSMO-2.8 km COSMO-0.7 km

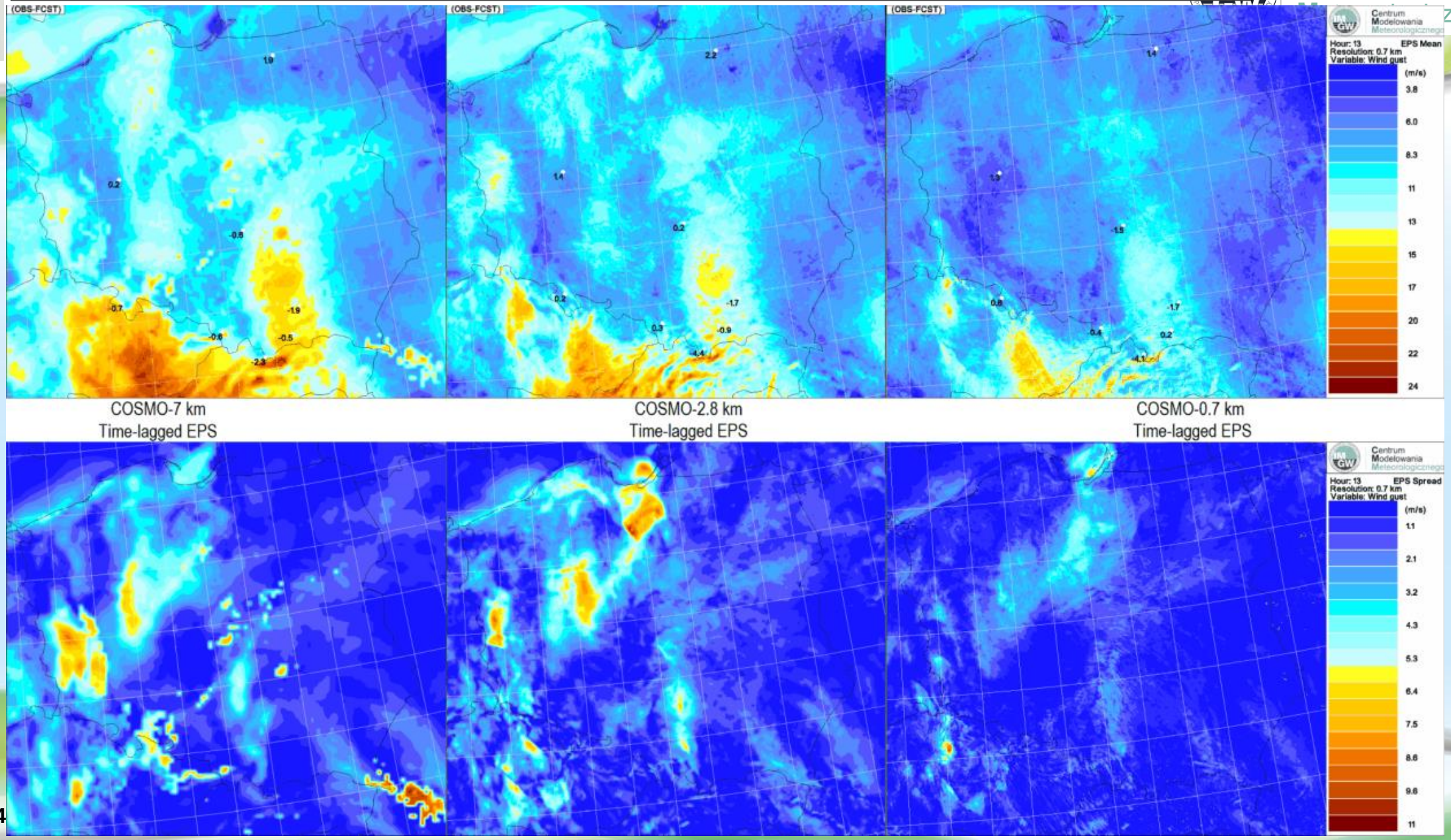




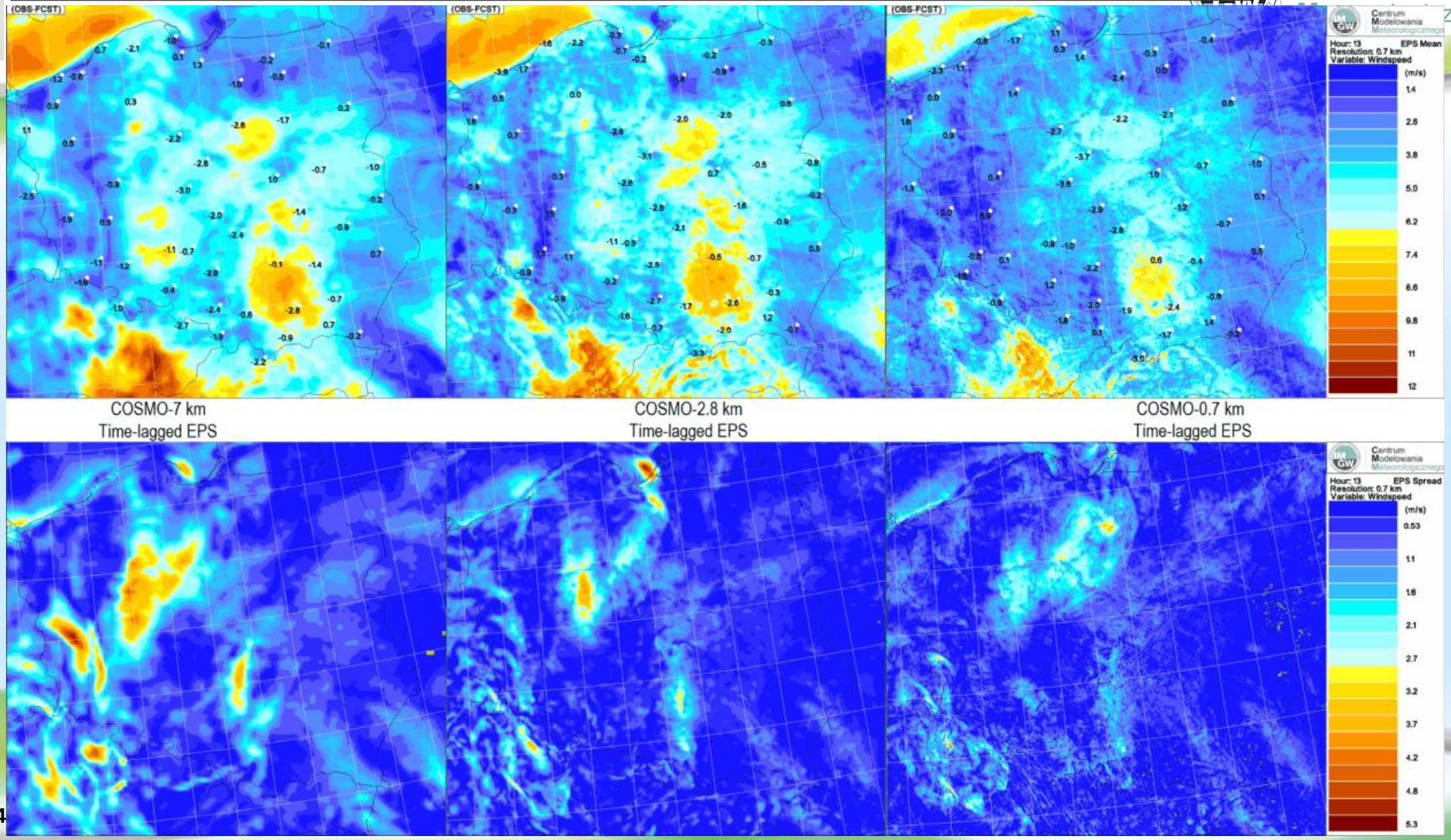
COSMO-7 km COSMO-2.8 km COSMO-0.7 km



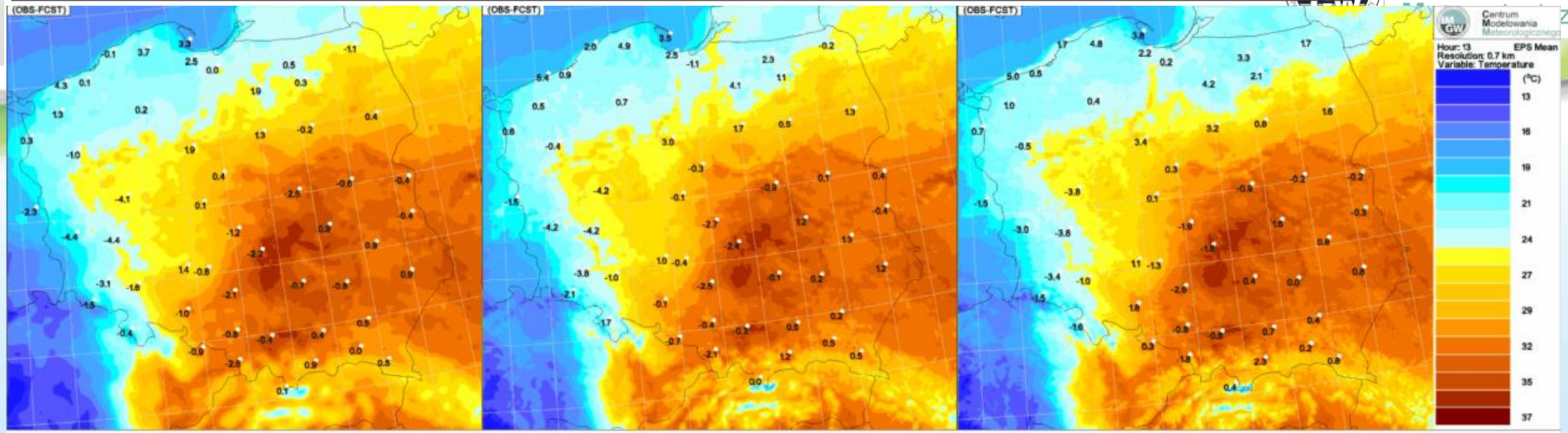
Wind gusts – EPS means and spread



Wind speed – EPS means and spread



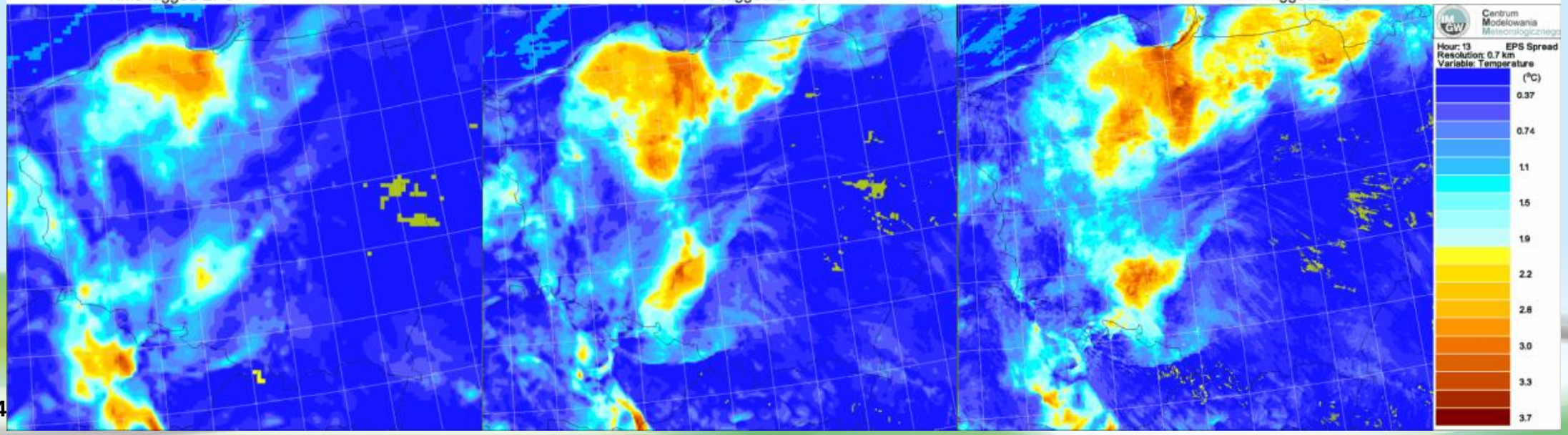
TE2M – EPS means and spread



COSMO-7 km Time-lagged EPS

COSMO-2.8 km Time-lagged EPS

COSMO-0.7 km Time-lagged EPS



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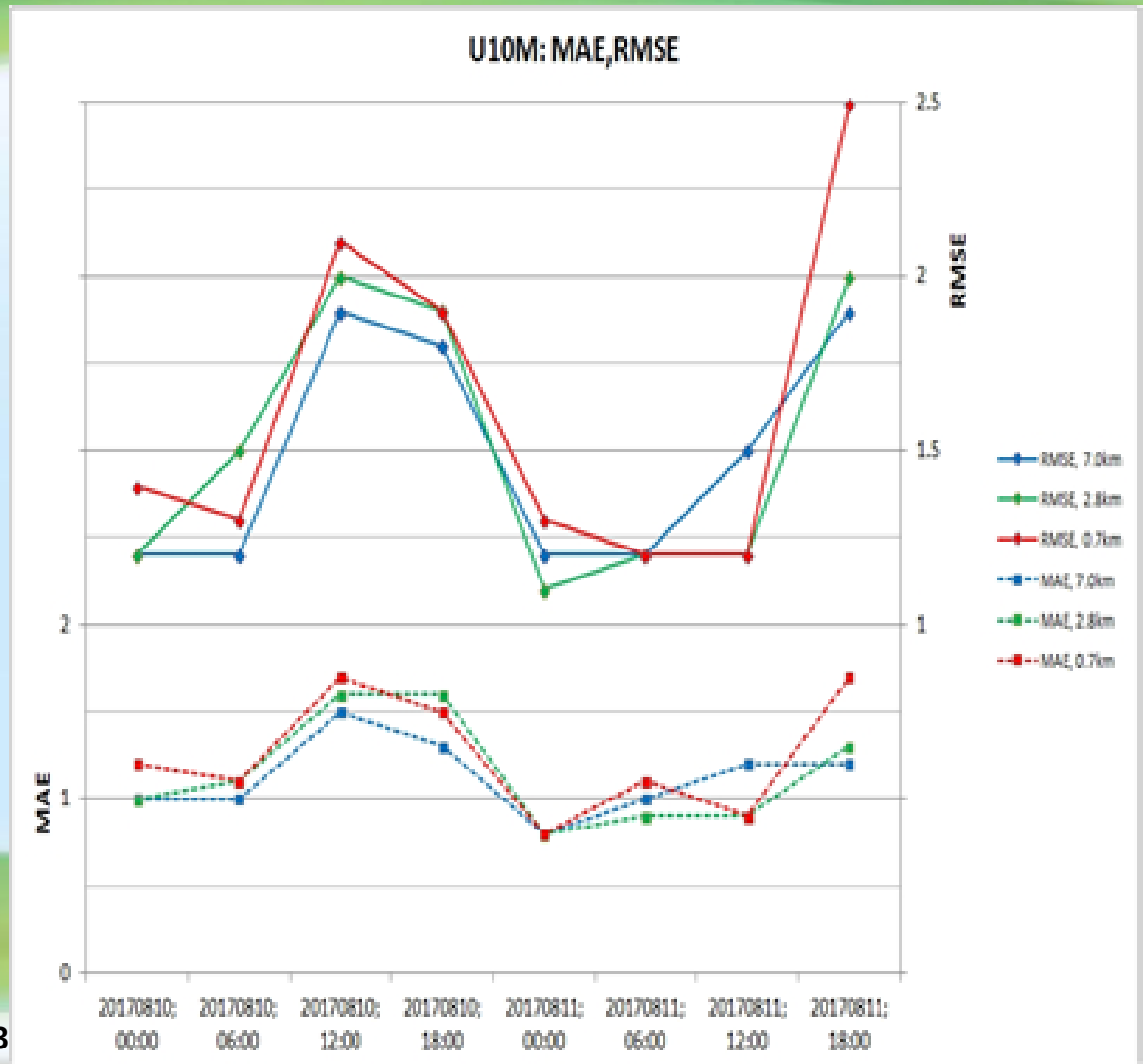
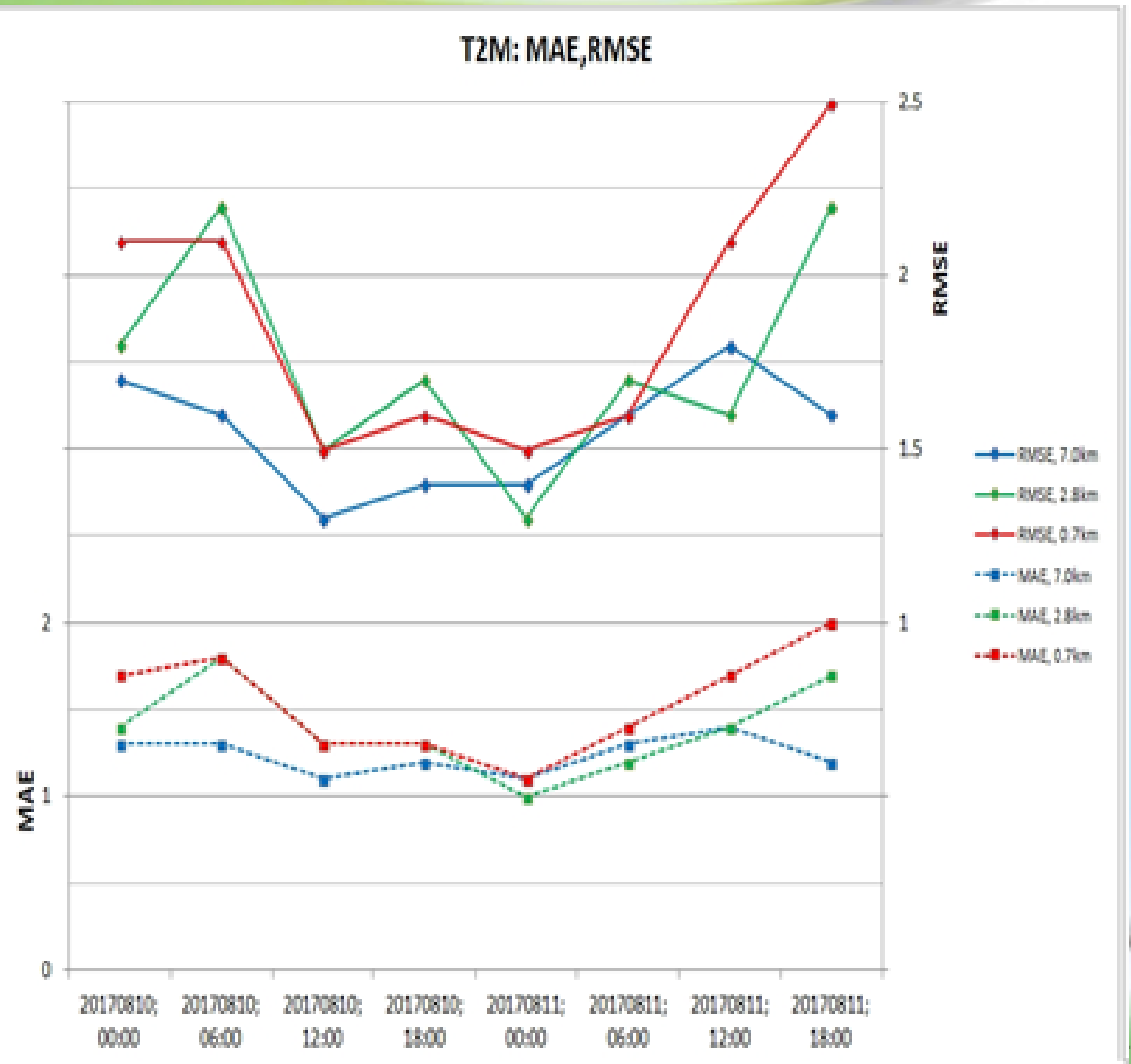
Forecasts vs. observations





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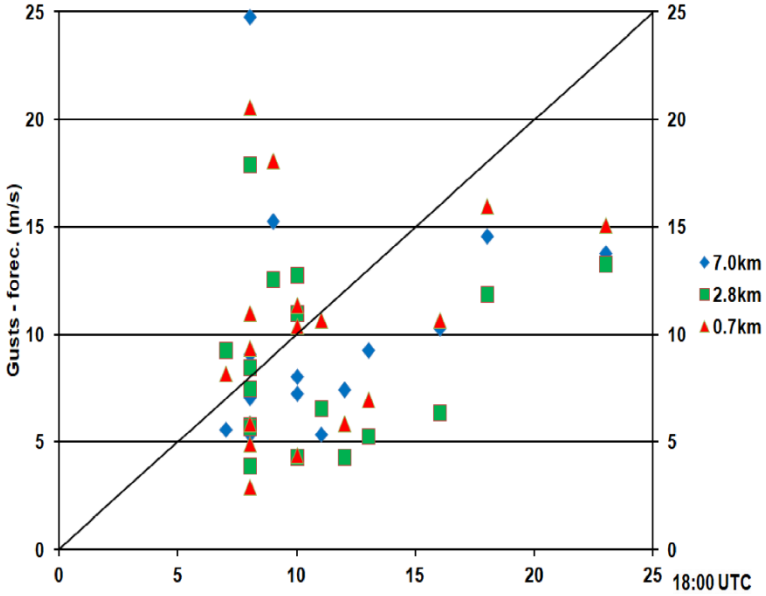
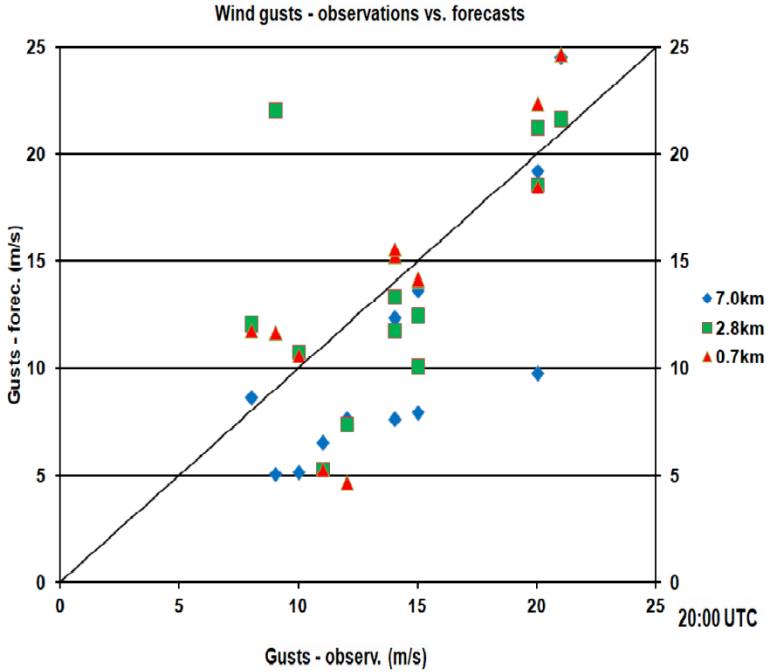
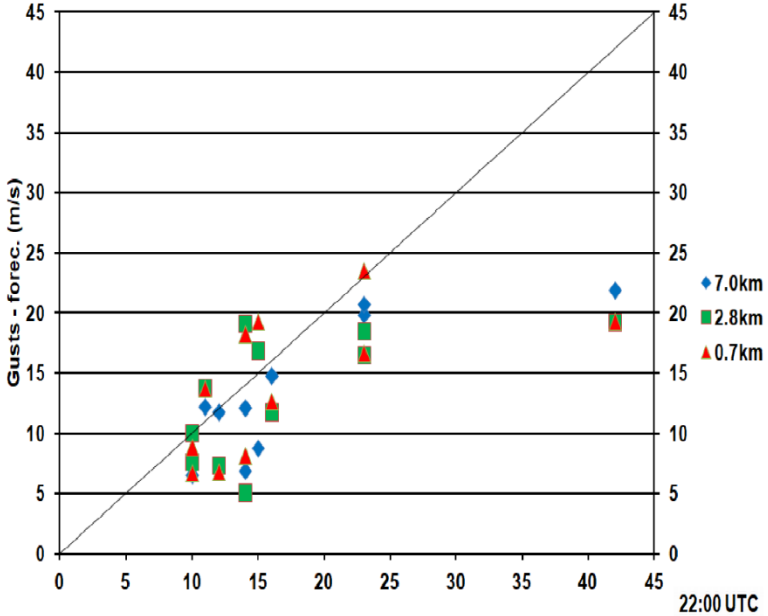
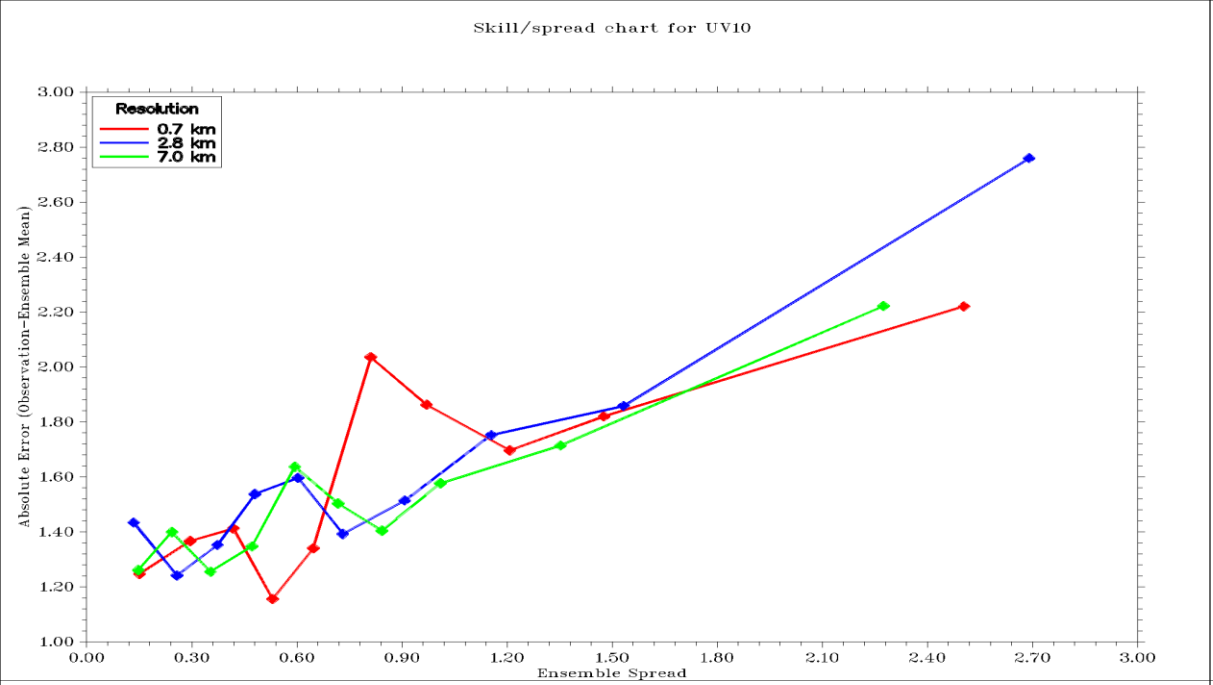
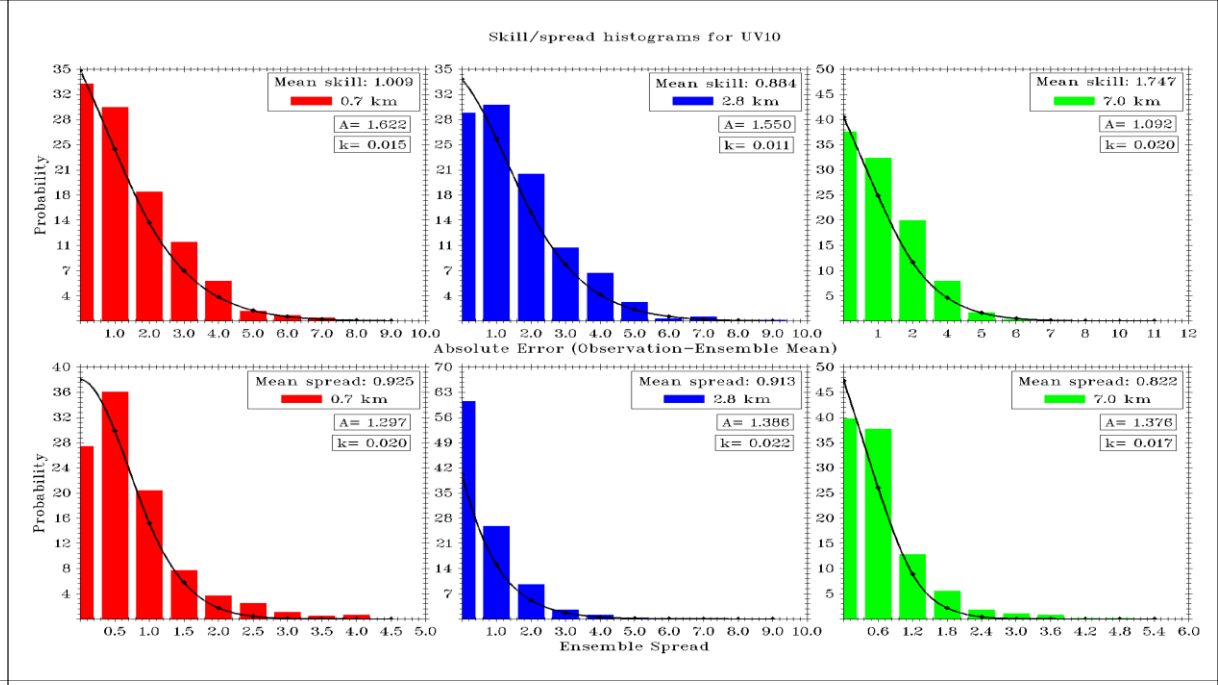
Wind gusts – forecasts vs. observations

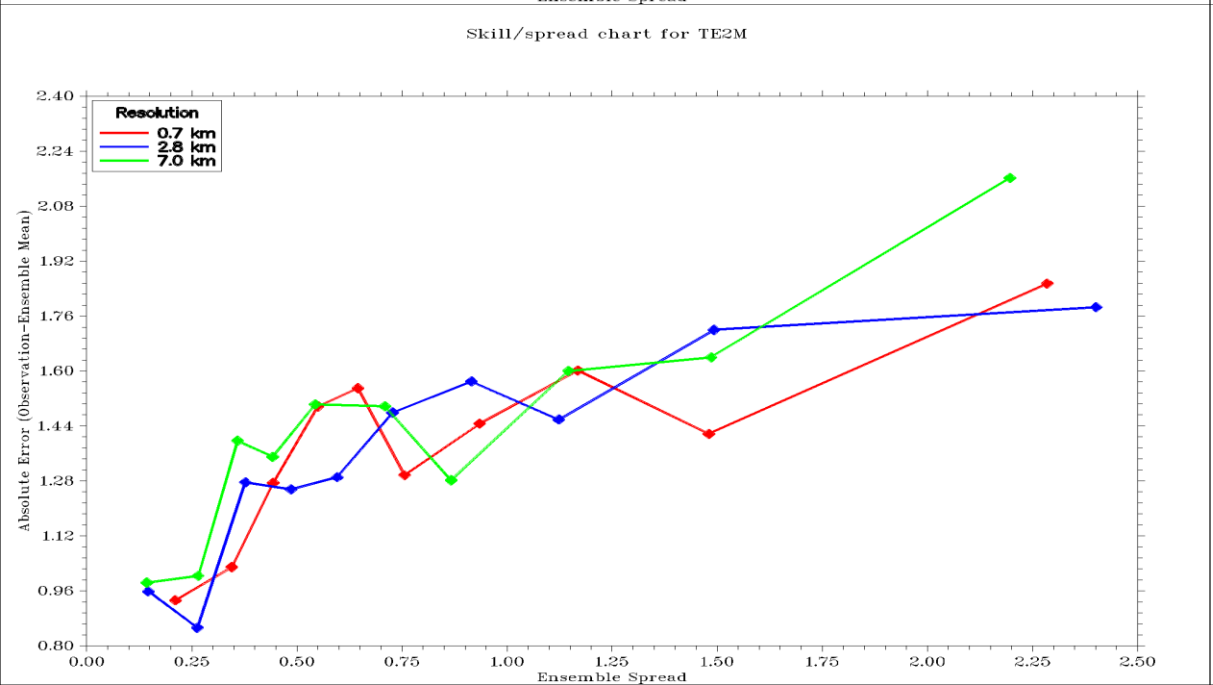


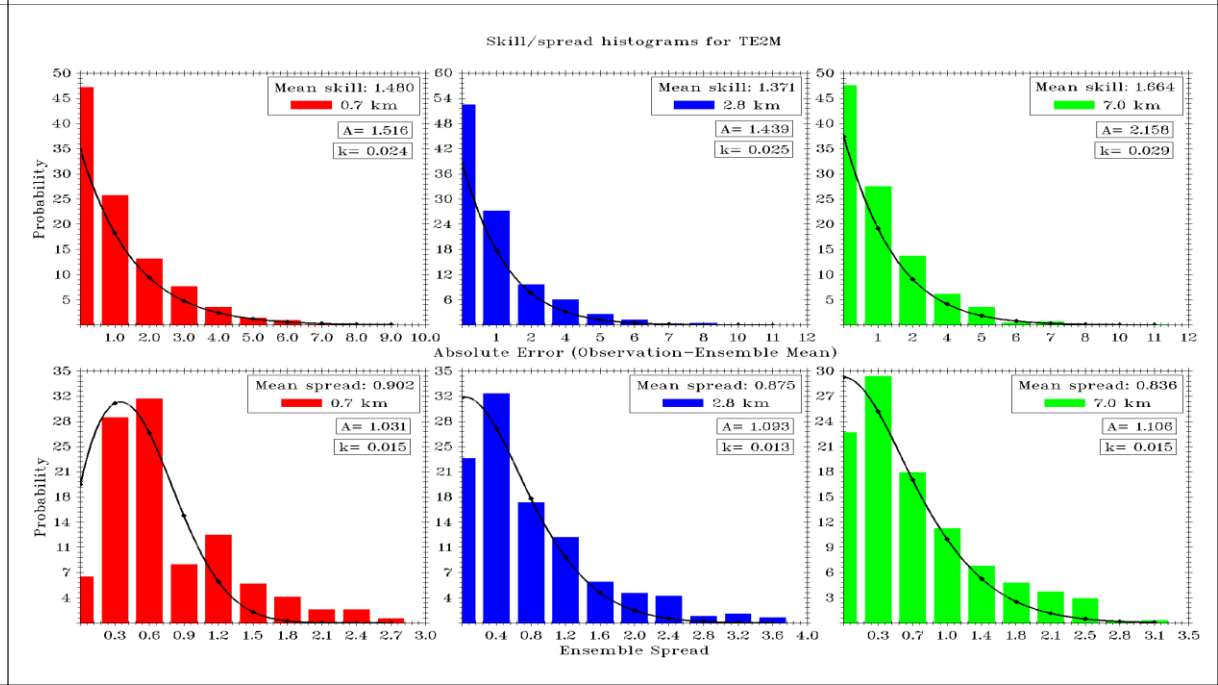





Skill/spread chart for UV10
Resolution
0.7 km
2.8 km
7.0 km
Absolute Error (Observation-Ensemble Mean)
Ensemble Spread


Skill/spread histograms for UV10
Mean skill: 1.009
0.7 km
A= 1.622
k= 0.015
Mean skill: 0.884
2.8 km
A= 1.550
k= 0.011
Mean skill: 1.747
7.0 km
A= 1.092
k= 0.020
Mean spread: 0.925
0.7 km
A= 1.297
k= 0.020
Mean spread: 0.913
2.8 km
A= 1.386
k= 0.022
Mean spread: 0.822
7.0 km
A= 1.376
k= 0.017
Probability
Absolute Error (Observation-Ensemble Mean)
Ensemble Spread


Skill/spread chart for TE2M
Resolution
0.7 km
2.8 km
7.0 km
Absolute Error (Observation-Ensemble Mean)
Ensemble Spread


Skill/spread histograms for TE2M
Mean skill: 1.480
0.7 km
A= 1.516
k= 0.024
Mean skill: 1.371
2.8 km
A= 1.439
k= 0.025
Mean skill: 1.664
7.0 km
A= 2.158
k= 0.029
Mean spread: 0.902
0.7 km
A= 1.031
k= 0.015
Mean spread: 0.875
2.8 km
A= 1.093
k= 0.013
Mean spread: 0.836
7.0 km
A= 1.106
k= 0.015
Probability
Absolute Error (Observation-Ensemble Mean)
Ensemble Spread

Conclusions

An attempt was made to analyze the case using results of COSMO model running at grid resolutions of 7 km, 2.8 km and 0.7 km.

To assess the nature of the event, various convective indices and meteorological variables were analyzed.

The key question to be answered was: “To what extent, if any, did the tenfold increase in resolution result in a change – an improvement? – in the quality of numerical forecasts?”

For example, as resolution increased, the predicted maximum wind gusts were also observed to increase from 25 m/s in the domain at 7 km resolution, to 35 m/s at 2.8 km resolution and to approximately 50 m/s at the highest resolution of 0.7 km.

However, the problem mentioned has not been finally resolved.

A very important conclusion that could be drawn from the results was that the model results at 2.8 km resolution were much closer to reality compared to the 7 km model.

Too bad, this effect could hardly be visible when comparing the results of the 2.8 km and 0.7 km models. The increase in resolution was not found to significantly improve the quality of the forecast.

Dataset used for verification – measurements in Polish SYNOP stations.

Thank you for your attention