PROPHECY activities at IMGW –

bow echo/derecho case study, August 11th, 2017

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Contents

1. Introduction
2. Setup
3. Fields/indices...
4. EPS vs. deterministic forecasts
5. Skill/spread relations etc.
6. Conclusions

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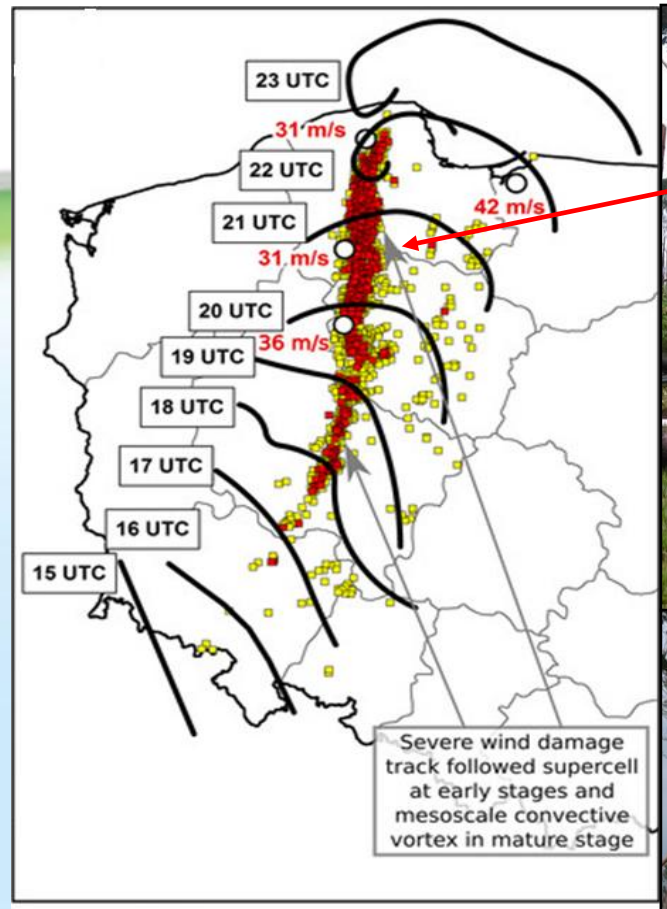

Source: Taszarek et al., 2019: Derecho Evolving from a Mesocyclone — A Study of 11 August 2017 Severe Weather Outbreak in Poland: Event Analysis and High-Resolution Simulation., Mon. Wea. Rev. 147, 6

Source: dzienniklodzki.pl/tragedia-w-suszku-na-pomorzu-zgineli-harcerze-z-lodzkiego/ar/12358927

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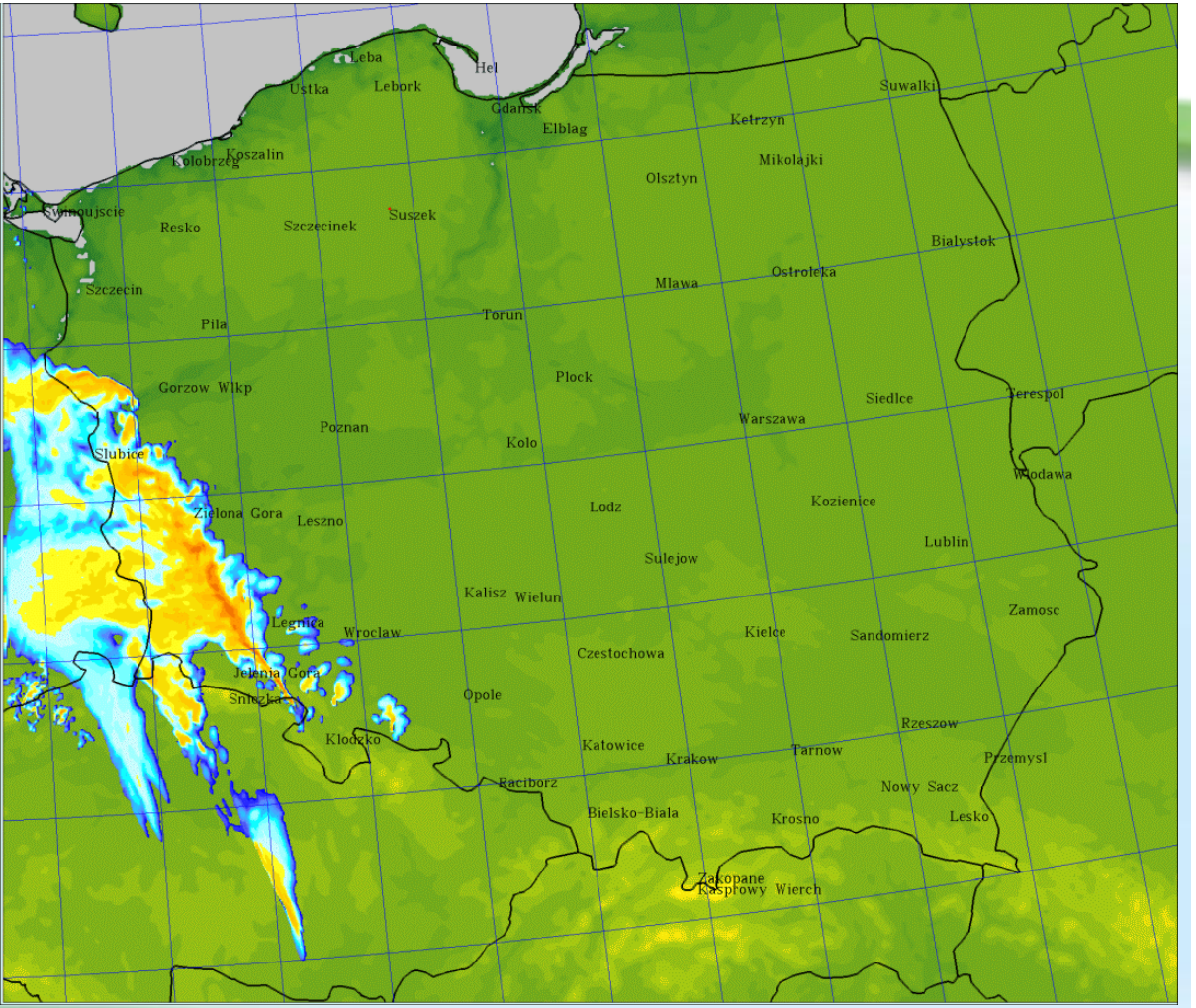
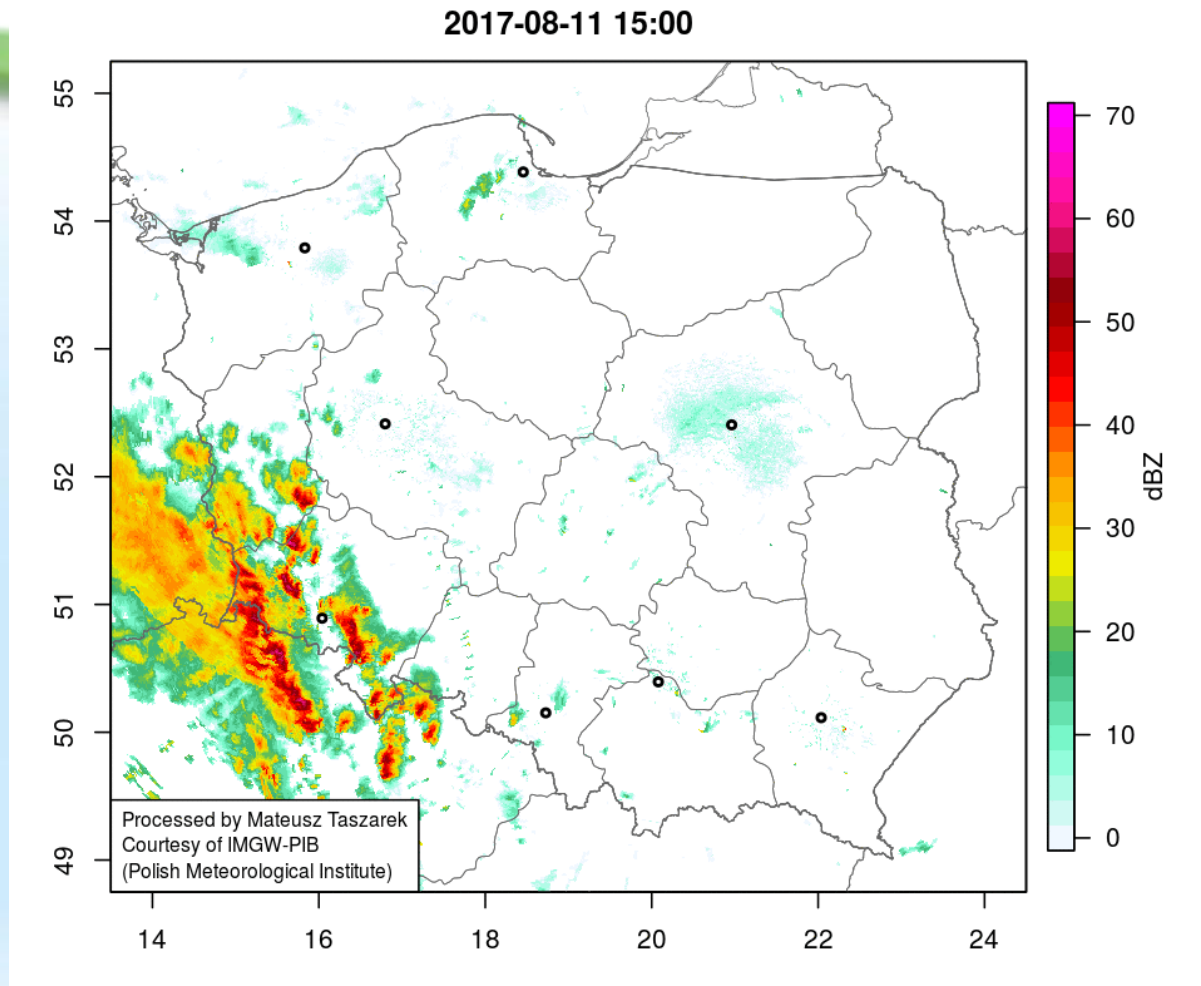
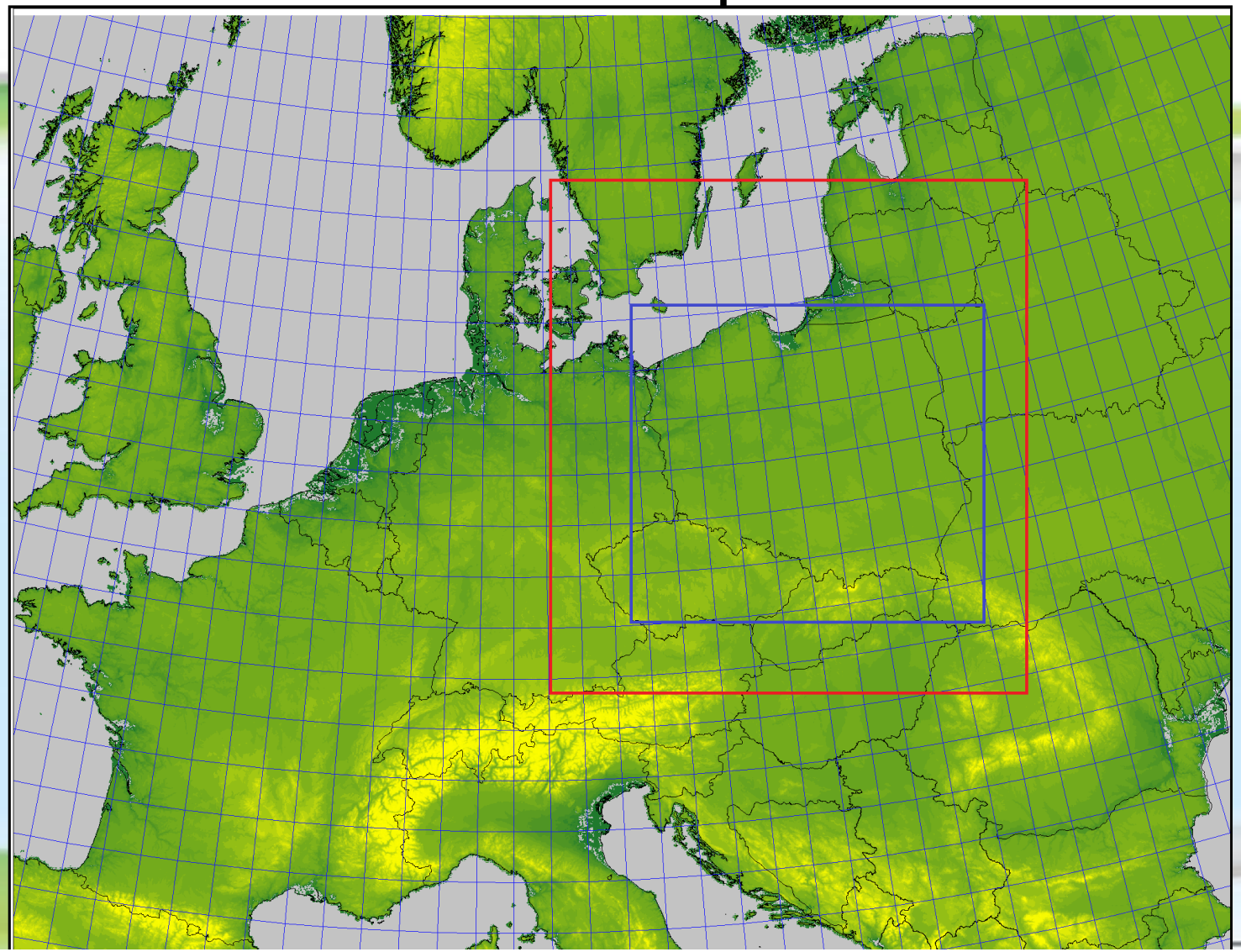




Setup



385x321 – 7km
380x405 – 2.8km
1140x1020 – 0.7km

Forecasts runs:
Aug.10, 12:00UTC
Aug.10, 18:00
Aug.11, 00:00
Aug.11, 06:00
Aug.11, 12:00

Perturbation – c_soil + eff_coef + soil temperature (profile) in IC/BCs.

Fields, indices and indicators used

- Radar Reflectivity
- Temperature/dew point temperature at 2m agl.
- Windspeed at 10m agl.
- CAPE_3KM
- CAPE_ML
- CAPE_MU
- Supercell Detection Index
- Maximum windspeed at 10m agl.
- Showalter Index
- Lifted Index
- Universal Tornadic Index
- Total Precipitation
- Wind Shear up to 6 km
- Lightning Frequency

... and more...

Setup (cntd.)

Best forecasts of the upper-air system (mesocyclone) – obtained for ”the newest” forecast (start from 12:00UTC).

Previous runs have shifted the start point of this phenomenon far to the west.

Moreover, the speed of displacement of the phenomenon was too low – with the exception of forecast starting at 6:00, which showed the beginning of the development of the bow echo too much to the west, but also predicted too high speed of the system eastward. This could be seen especially for 2.8km resolution run.

Therefore, we focused on the 12:00 UTC run.

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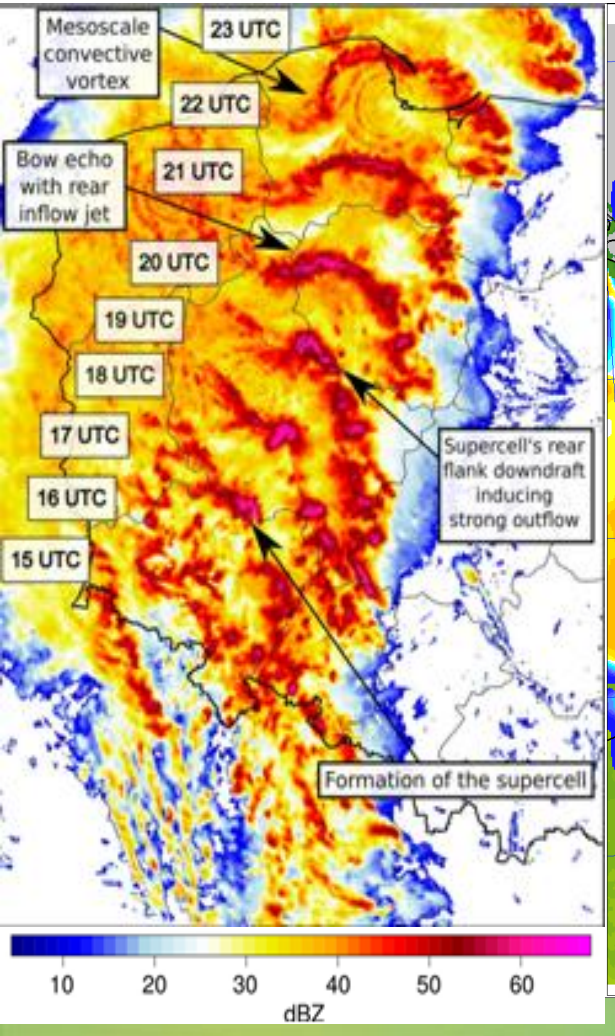
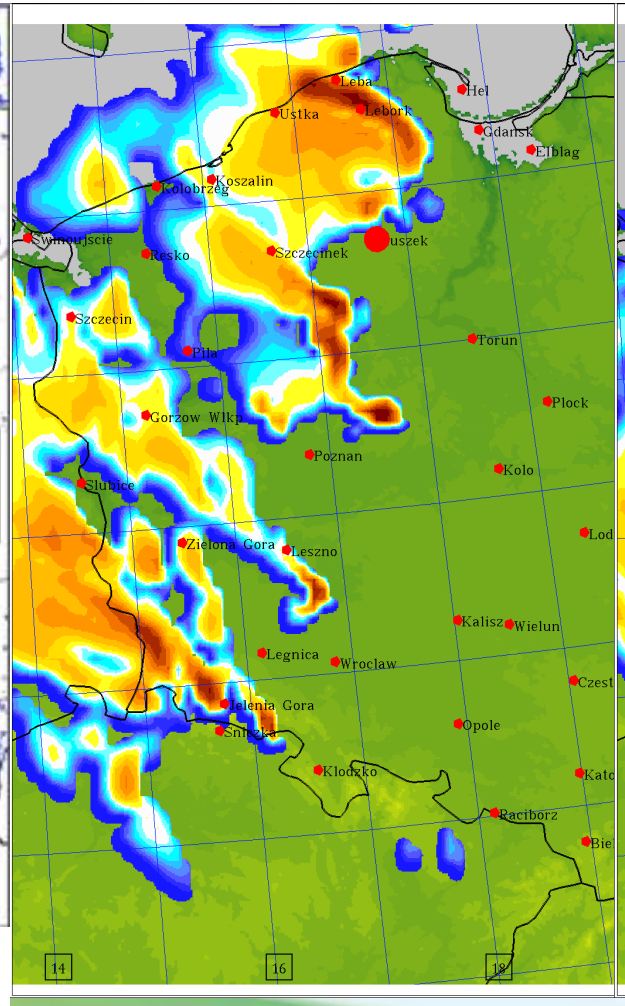
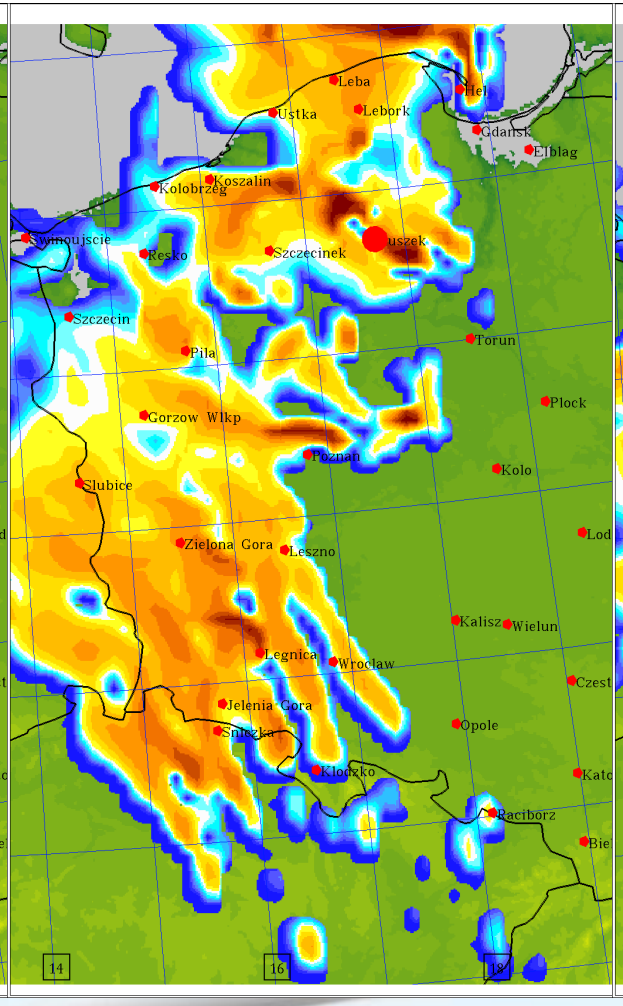
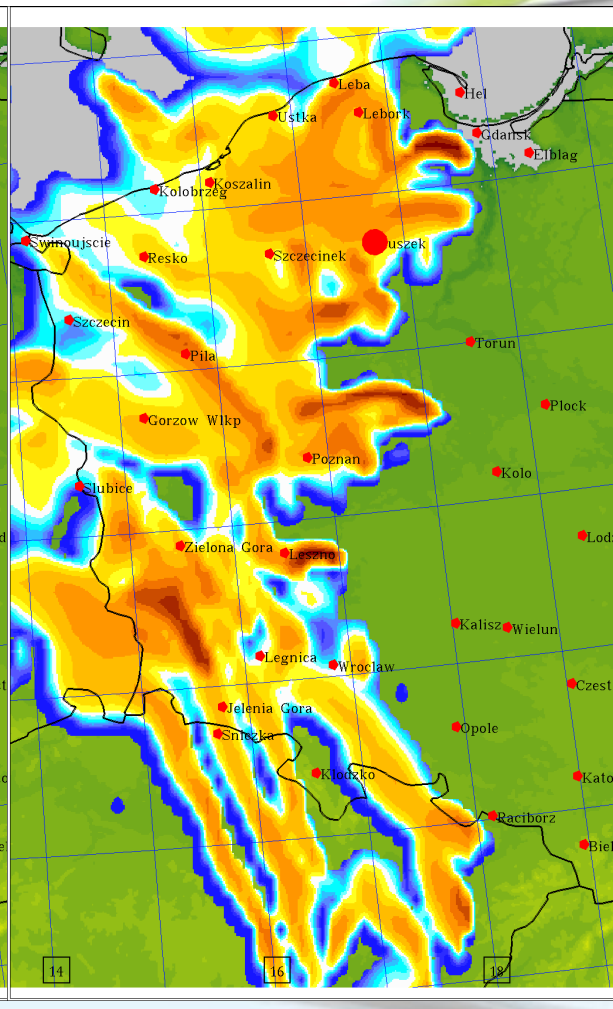
Maximum radar reflectivity, 15:00 to 23:00, 1-hour steps. Observations, forecasts from 00:00, 06:00, 12:00 run (left to right). 7km.









Observations: POLRAD network picture, in: Taszarek et al., 2019: Derecho Evolving from a Mesocyclone — A Study of 11 August 2017 Severe Weather Outbreak in Poland: Event Analysis and High-Resolution Simulation, Mon. Wea. Rev. 147, 6

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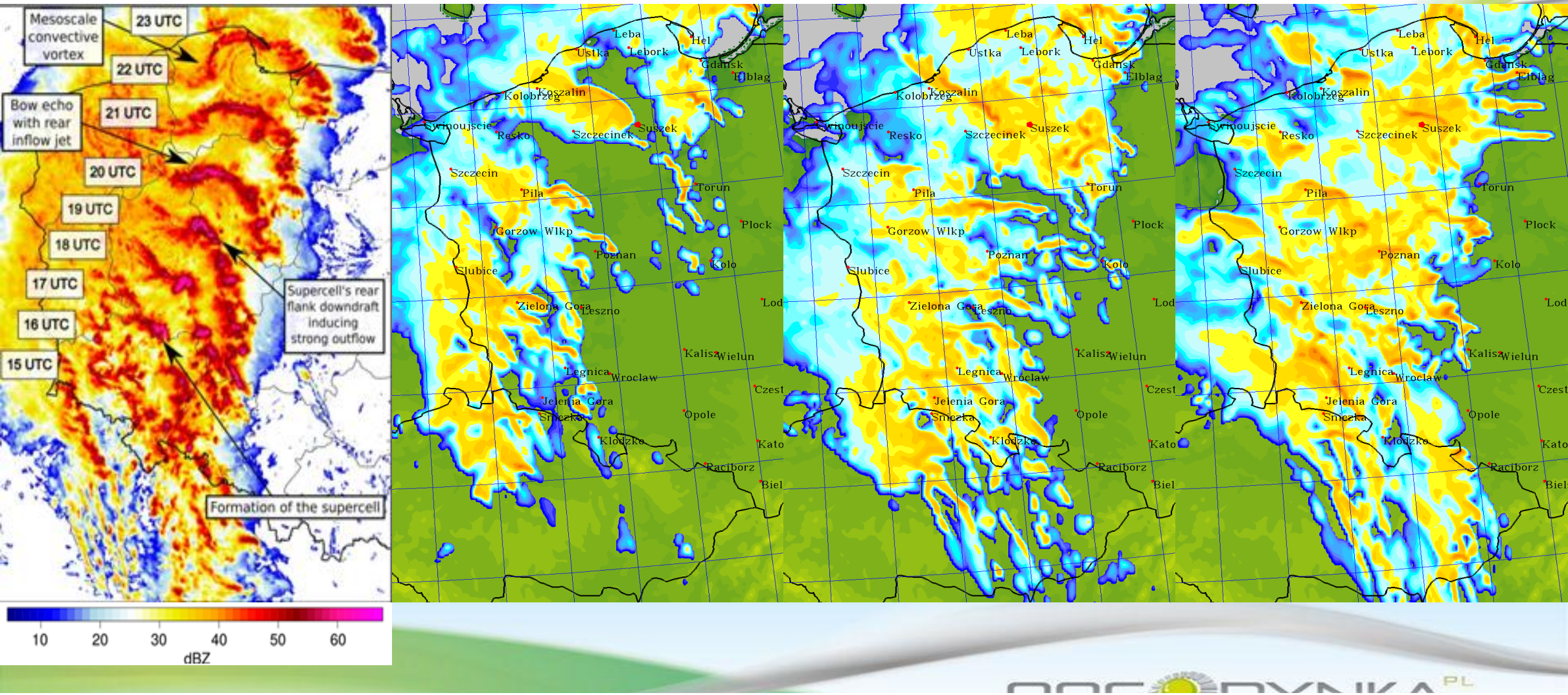
Maximum radar reflectivity, 15:00 to 23:00, 1-hour steps. Observations, forecasts from 00:00, 06:00, 12:00 run (left to right). 2.8km.



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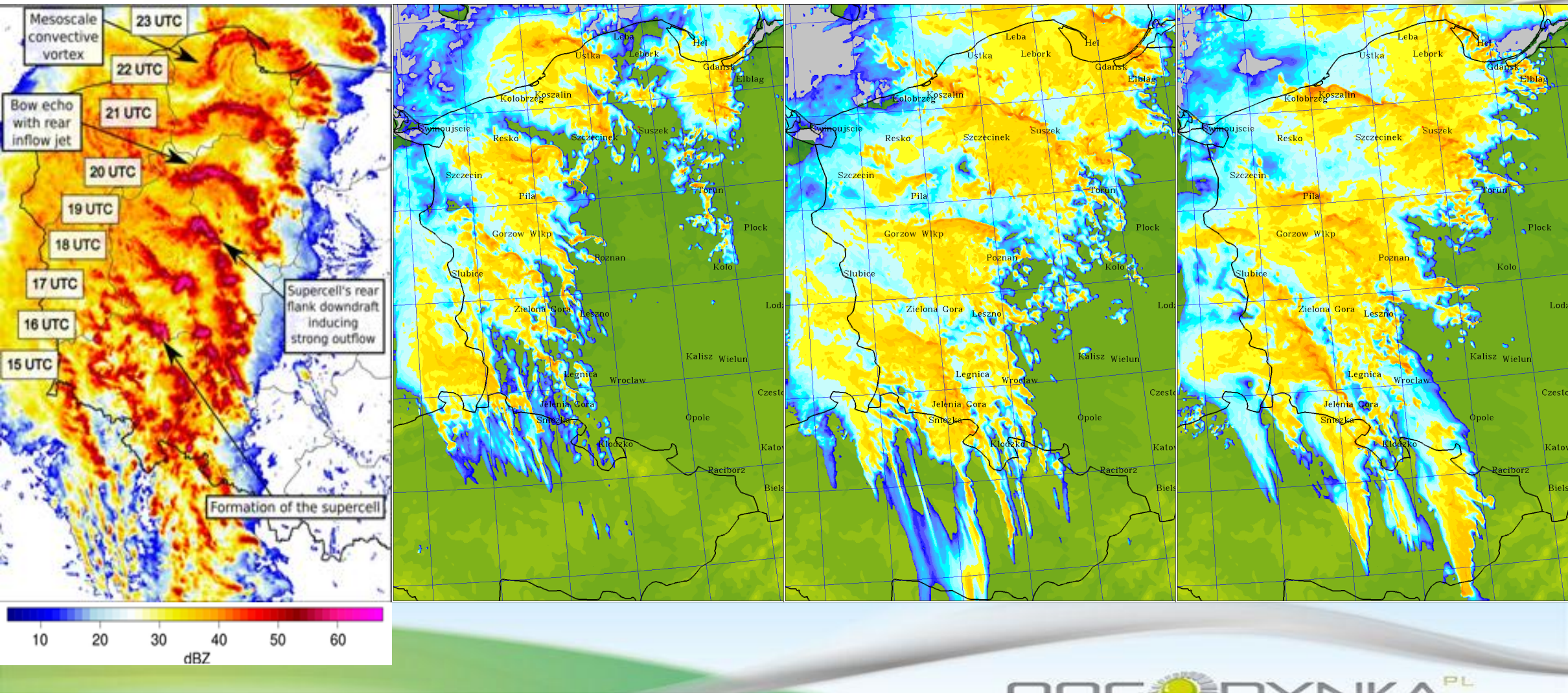
Maximum radar reflectivity, 15:00 to 23:00, 1-hour steps. Observations, forecasts from 00:00, 06:00, 12:00 run (left to right). 0.7km.



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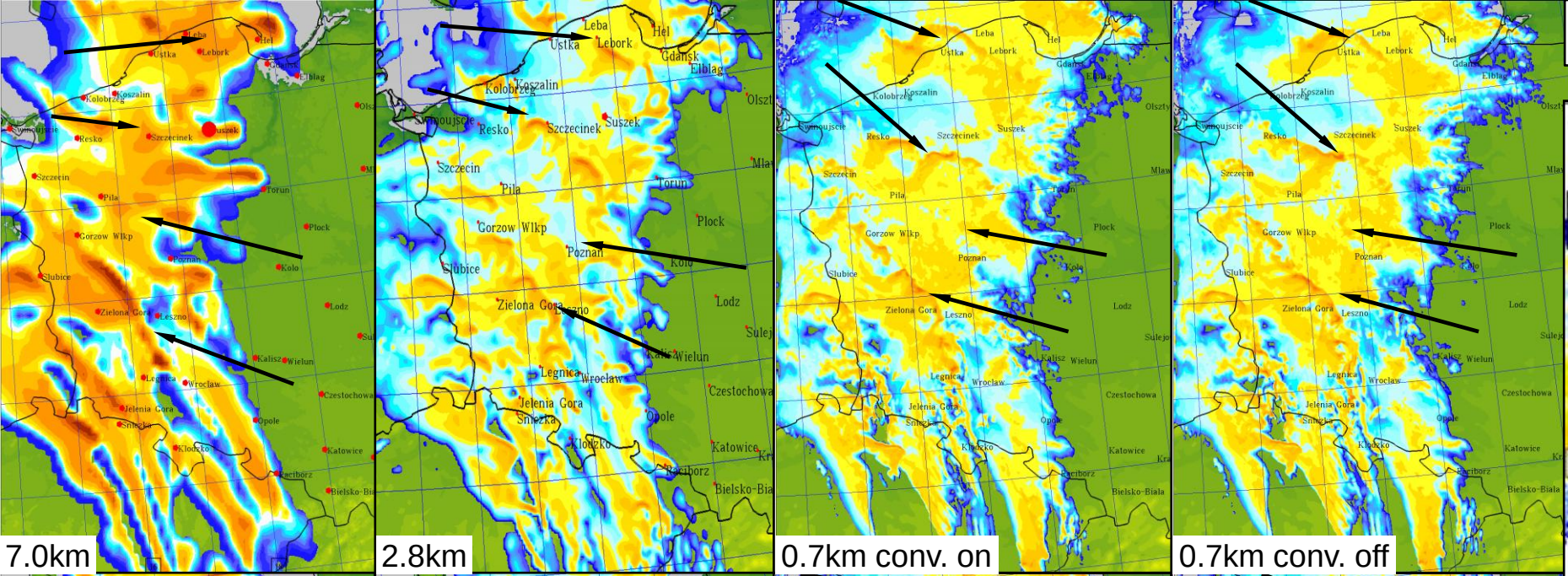
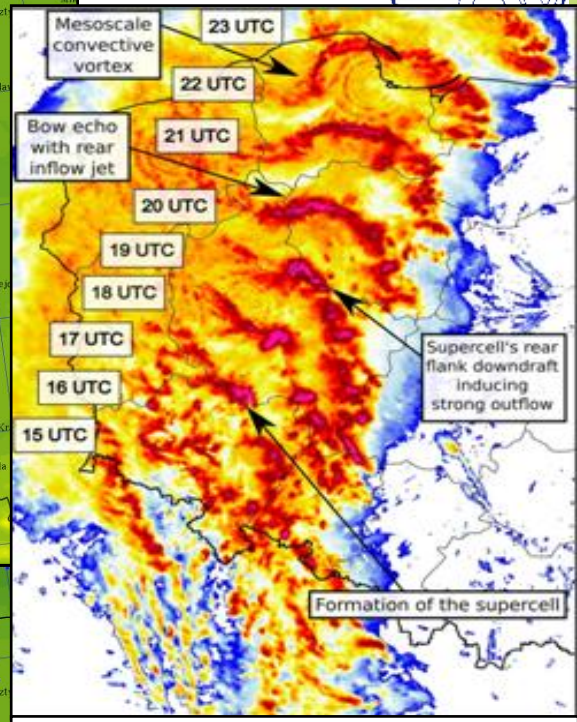
Setup (cntd. 2)

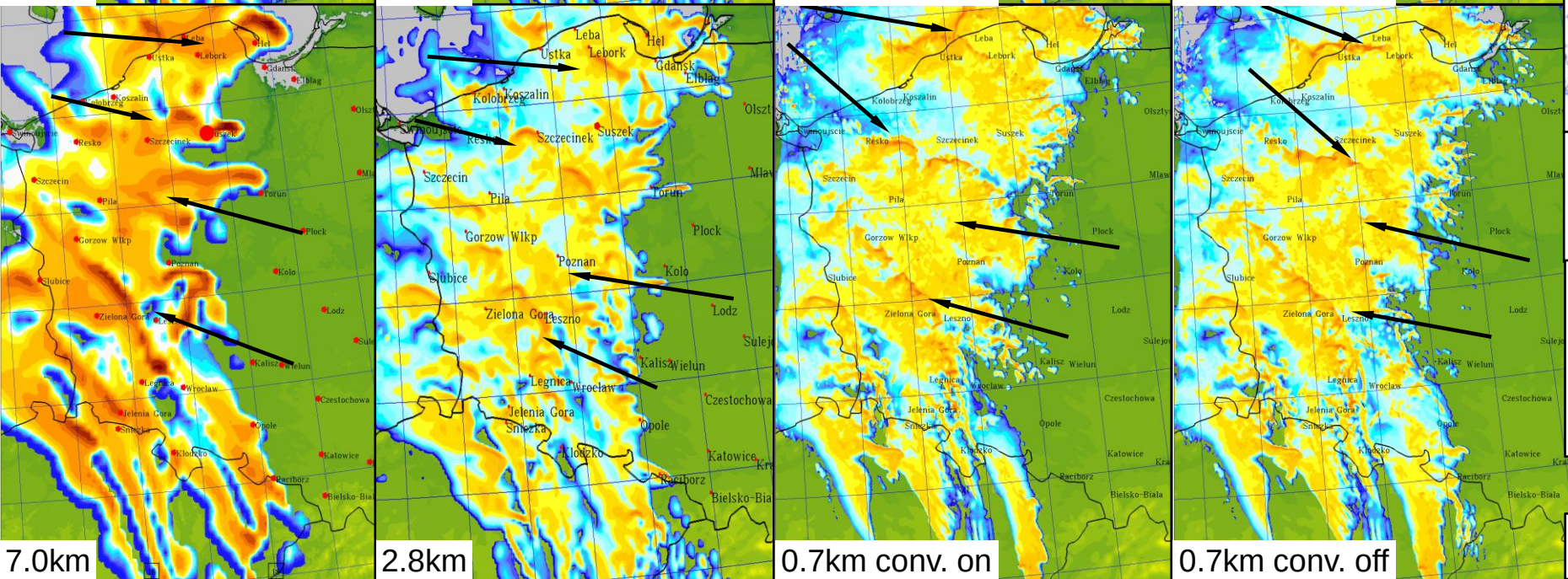
Working with the model with a resolution of several hundred meters, one can think about turning off parameterization of convection.

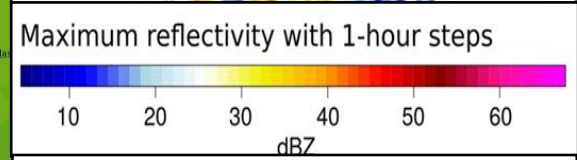
How significantly this modification would change the forecasts?



Ensemble mean

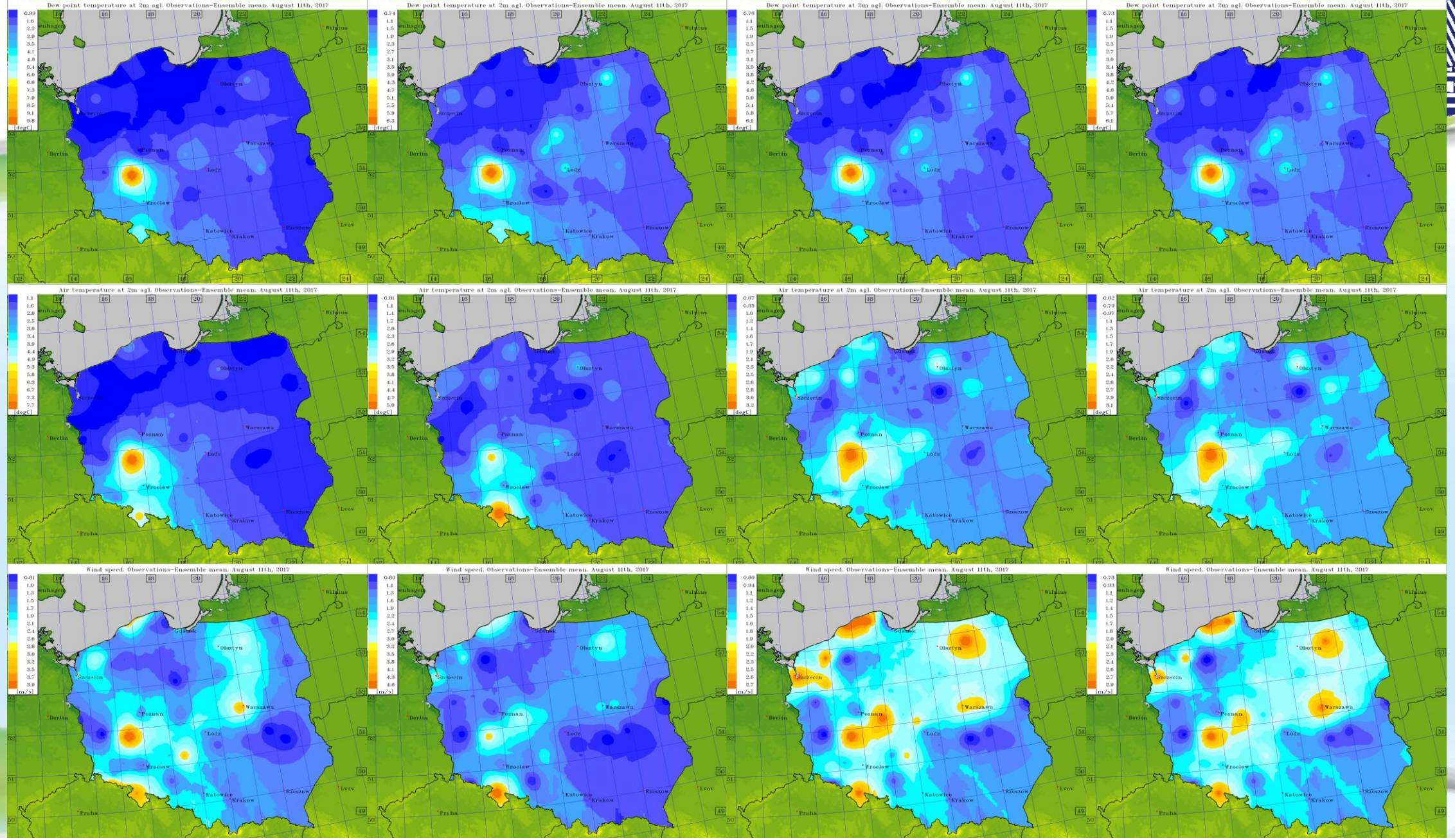




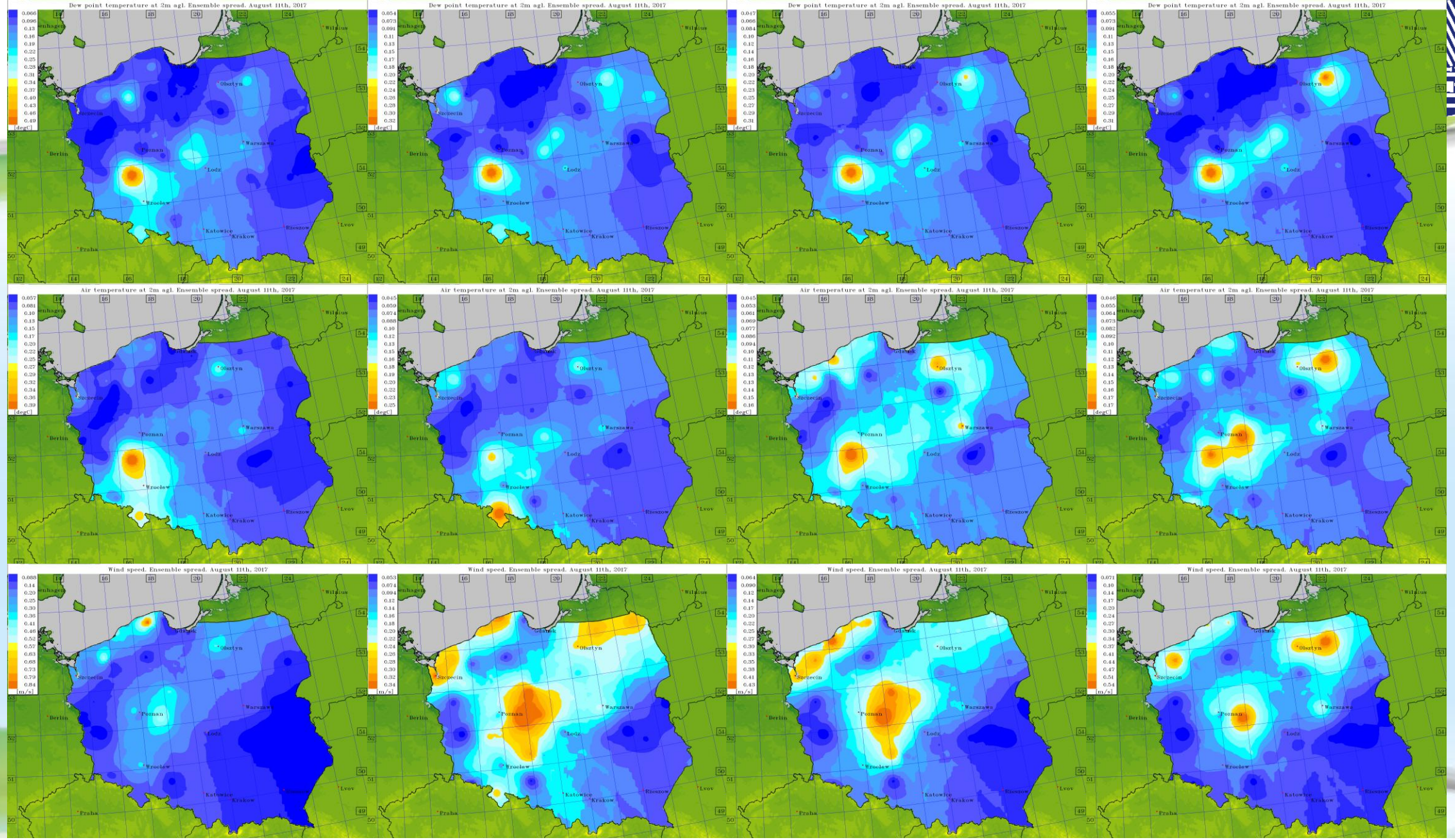


Source: POLRAD network picture, in: Taszarek et al., 2019: Derecho Evolving from a Mesocyclone — A Study of 11 August 2017 Severe Weather Outbreak in Poland: Event Analysis and High-Resolution Simulation, Mon. Wea. Rev. 147, 6

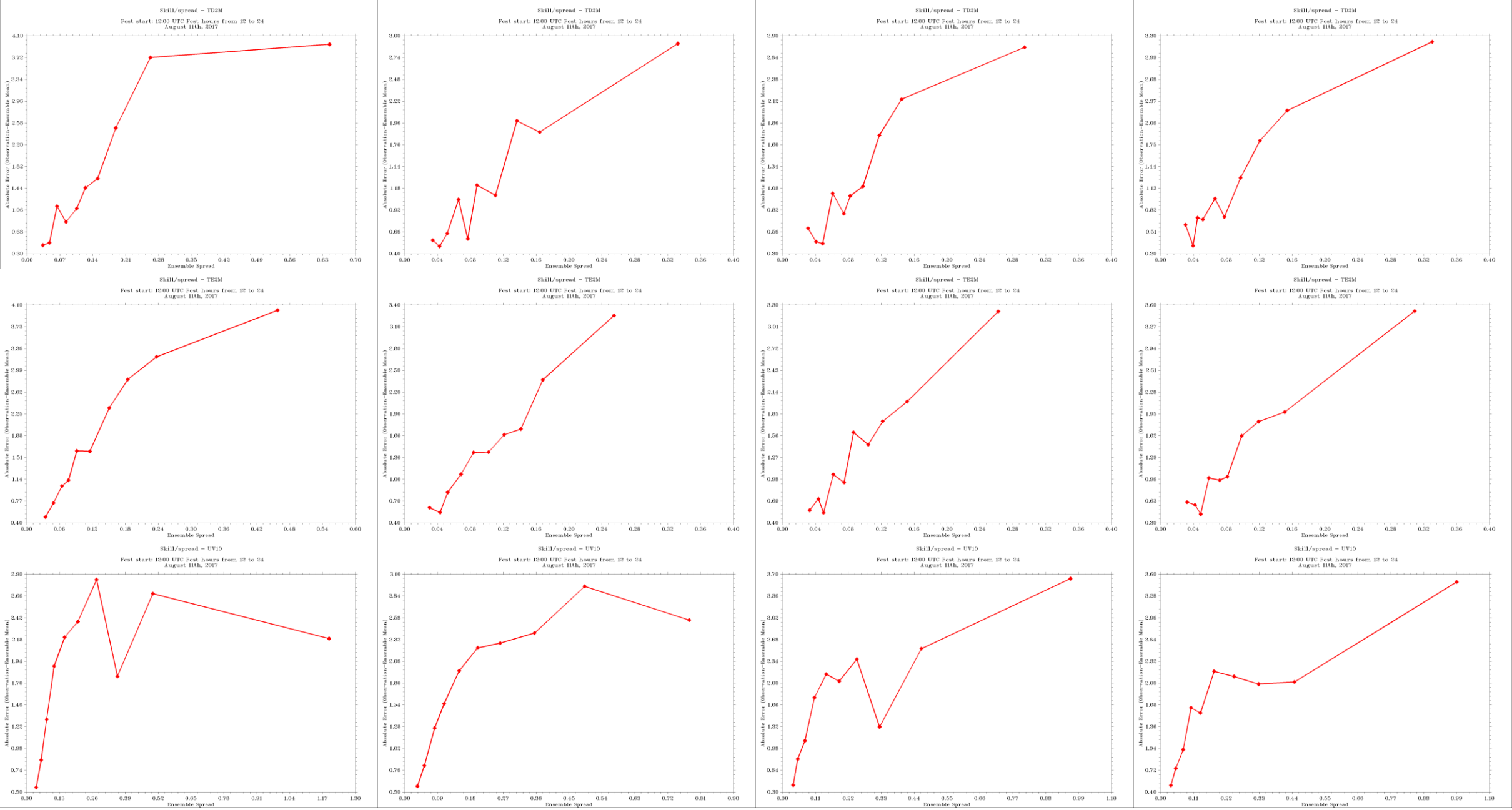
Deterministic forecast



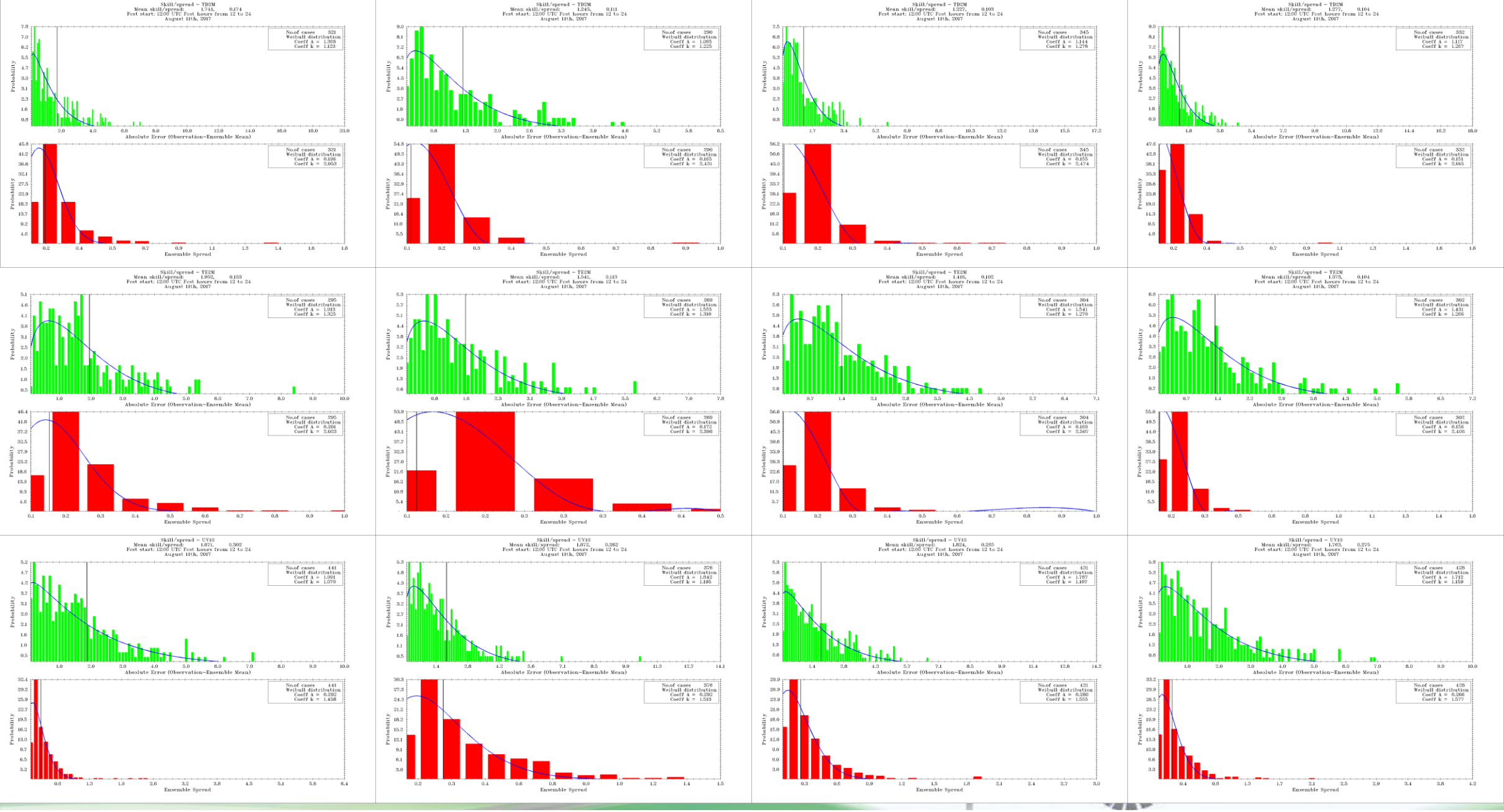
Skill. Top to bottom: TD2M, TE2M, UV10M. Left to right: 7.0km, 2.8km, 0.7km (conv. on), 0.7km (conv. off)



Spread. Top to bottom: TD2M, TE2M, UV10M. Left to right: 7.0km, 2.8km, 0.7km (conv. on), 0.7km (conv. off)



Skill/spread relations. Top to bottom: TD2M, TE2M, UV10M. Left to right: 7.0km, 2.8km, 0.7km (conv. on), 0.7km (conv. off)



Skill/spread relations. Top to bottom: TD2M, TE2M, UV10M. Left to right: 7.0km, 2.8km, 0.7km (conv. on), 0.7km (conv. off)

Conclusions

Bow-echo structure: best representation at the beginning of the forecast with 7km resolution; at the end – with 2.8km; throughout the forecast – 0.7km.

EPS means filtered out isolated noise (present in deterministic runs), especially high values of dBz.

The values of other indicators (e.g. DCP) support the guess of the "derecho" phenomenon occurrence – an unstable atmosphere over a large, elongated area.

Skill (forecast quality) best for 0.7km. Spread the smallest (worst?) for 0.7km as well.

Turning off convection parameterization forced the change of the forecast values by about ~ 3% and narrowed the distribution of spread (with its values decreased). Significant or not?