Overview of IMGW-PIB tasks within PP AWARE

Andrzej Mazur, Joanna Linkowska, Grzegorz Duniec

Institute of Meteorology and Water Management
National Research Institute

Contents

1. COSMO-PL failures
   a) Setup
   b) Results
2. Case study – HIW event
   a) From 7 to 0.7km
   b) Verification
3. … other HIW events

COSMO-PL ”failures”

Setup

To assess (more-less automatic) ‘poor’ forecasts surface parameters were used.
T2M, TD2M, RH, U10M, SFC Press. and PMSL were selected to assess the questionable forecasts and their quality.
The values of all elements have been normalized as follows:

$$N_{Val} = \frac{|OBS - FCST|}{maxdif\,(OBS, FCST; \Delta t)} \; ; 0 \leq N_{Val} \leq 1$$

with Δt being the period (climatological, 2012-2018), *maxdif* - maximum difference between observations at SYNOPs (OBS) and forecasts (FCST) in a given period.
For all terms the sum of N_{Val} from the above elements was determined. The worst forecasts were determined – those for which this sum was the highest over all stations.

COSMO-PL ”failures”

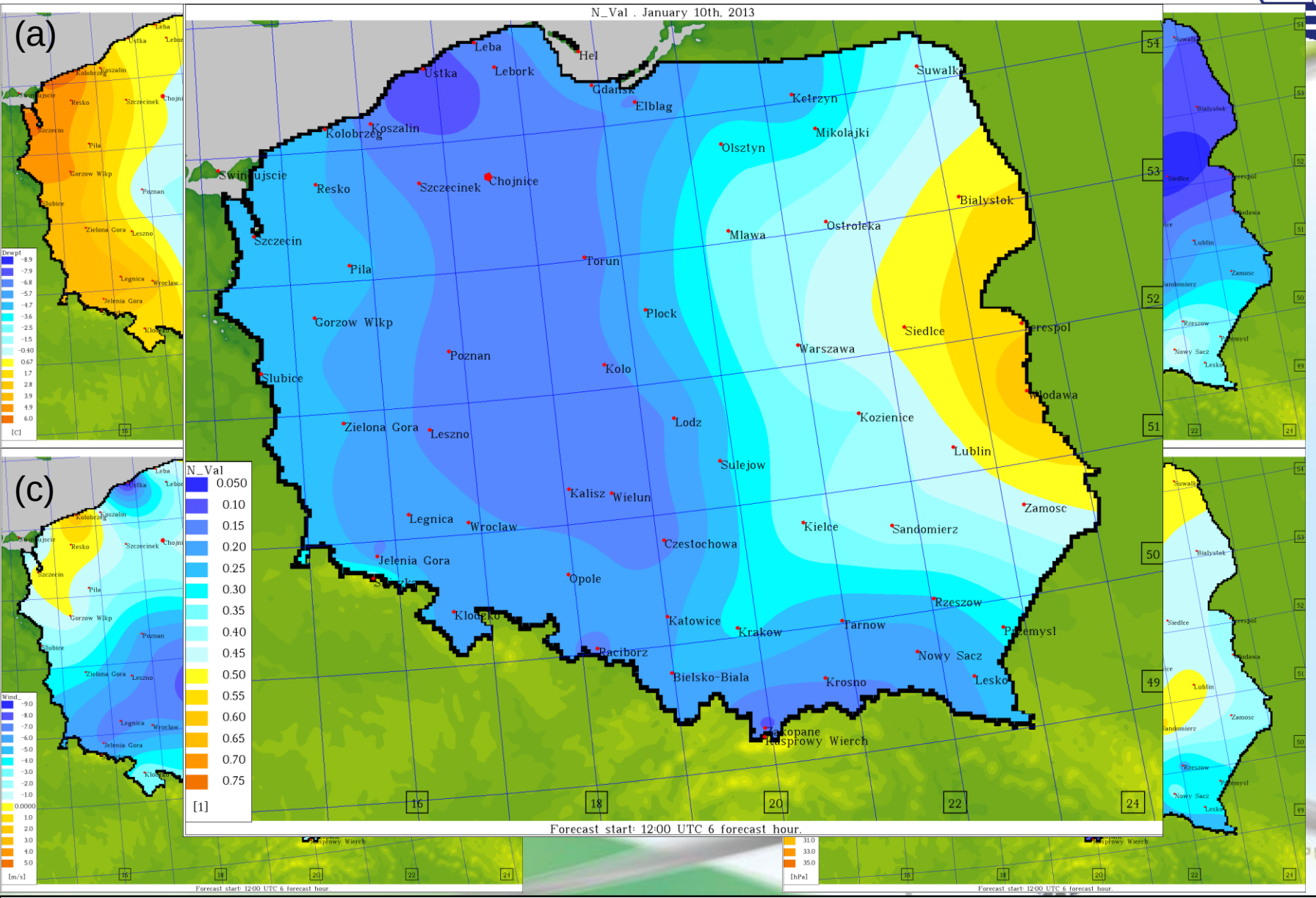
Results

One situation was selected for each year for which the forecast deviated most from the measurements.

2018.06.08.00 (two consecutive poor forecasts)
2017.02.13.12
2016.09.25.06
2015.03.20.00
2014.05.29.00 (two consecutive poor forecasts)
2013.01.10.12 (three consecutive poor forecasts)
2012.10.12.06

For ‘good’ forecasts the overall (for all sfc elements and stations) FORFEIT was less than 0.1, while for ‘poor’ ones was greater than 0.25.

COSMO-PL ”failures”



COSMO-PL ”failures”

Results

In addition, two terms related to HIW, and especially to intense convective phenomena, were selected to the complete set.
2017.08.11 – most likely supercell moving from south to north, caused major material damage; two deaths in a scouts camp, prosecutor's investigation and allegations against forecasters.
Key question: given a forecast, should a top-level warning be issued?
Orange (not red) alert was given out!

The event was examined in both EPS and deterministic approaches using increasing resolution in nested domains from 7 km through 2.8 to 0.7.

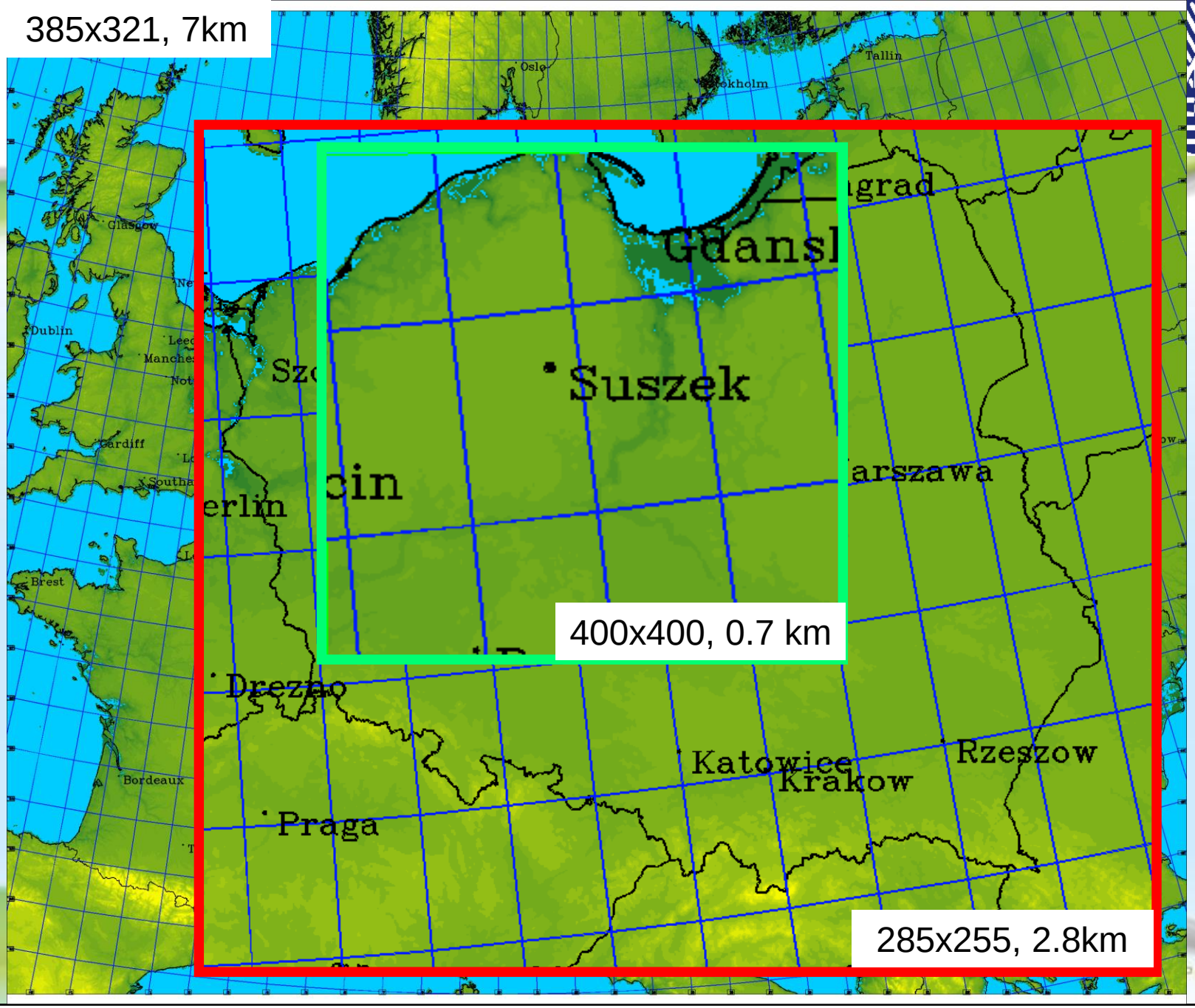
2019.08.22 Intensive thunderstorm in the Tatra Mountains, the most tragic in the last 80 years – 4 people killed, >100 wounded.

Case study – HIW event from 7 to 0.7km

Key question: given the forecasts, should a top-level warning be issued?

Suszek, August 11th, 2017, 21:00 UTC

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

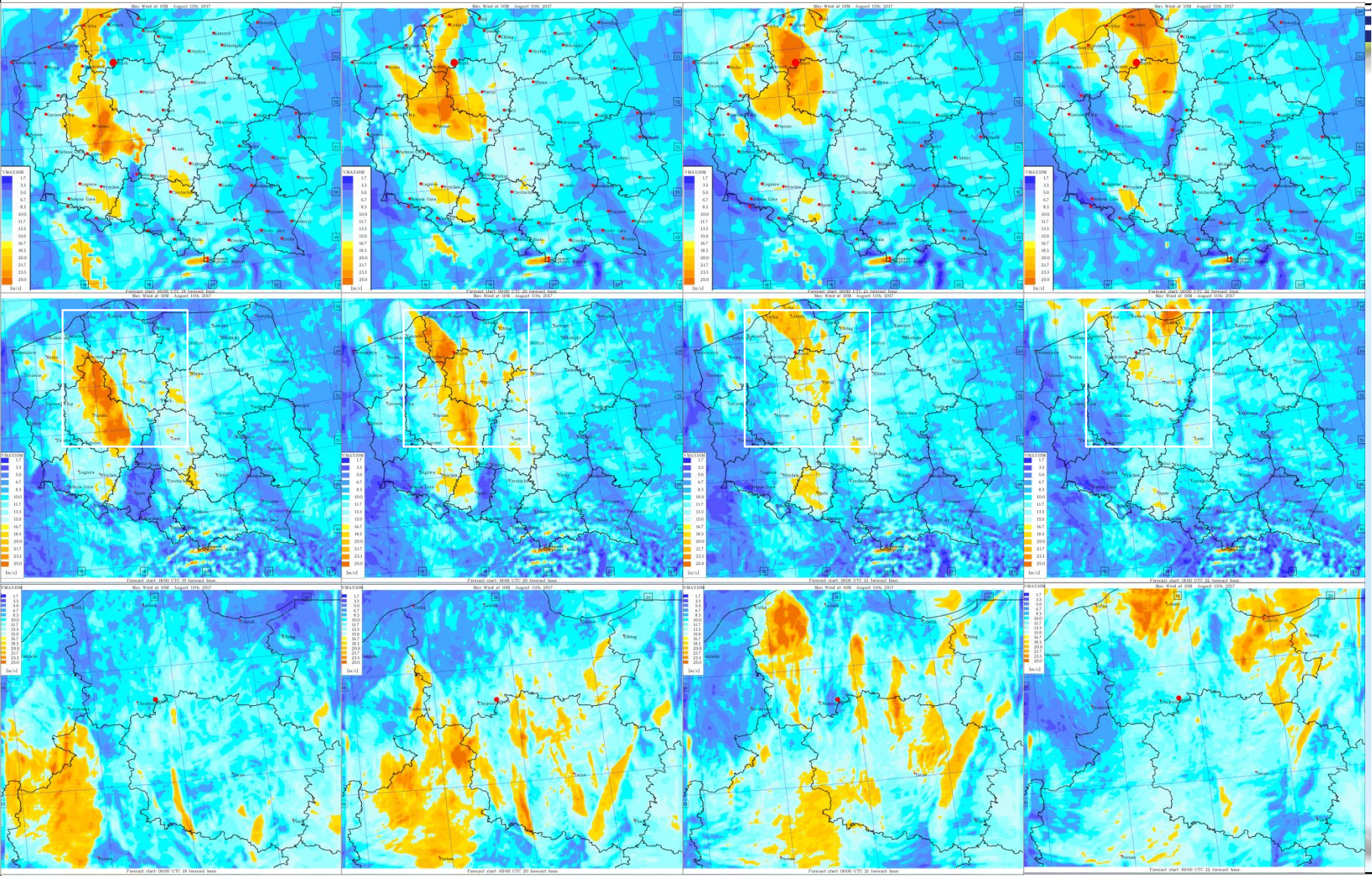

385x321, 7km
Setup: nested domains 7km → 2.8km → 0.7km
400x400, 0.7 km
285x255, 2.8km
Oslo
Tallin
Glasgow
Dublin
Cardiff
Brest
Bordeaux
Suszek
Drezno
Praga
Katowice
Krakow
Rzeszow
Static fields (terrain, land cover etc.) for 0.7km interpolated from 2.8km

Fields, indices and indicators used

- Windspeed at 10m agl.
- Maximum windspeed at 10m agl.
- CAPE_3KM
- CAPE_ML
- CAPE_MU
- DCAPE
- Derecho Composite Potential
- Supercell Detection Index 1
- Supercell Detection Index 2
- Showalter Index
- Lifted Index
- Universal Tornadic Index
- Total Precipitation
- Radar Reflectivity
- Wind Shear up to 6 km

Case study – HIW event from 7 to 0.7km

VMAX



7km

2.8km

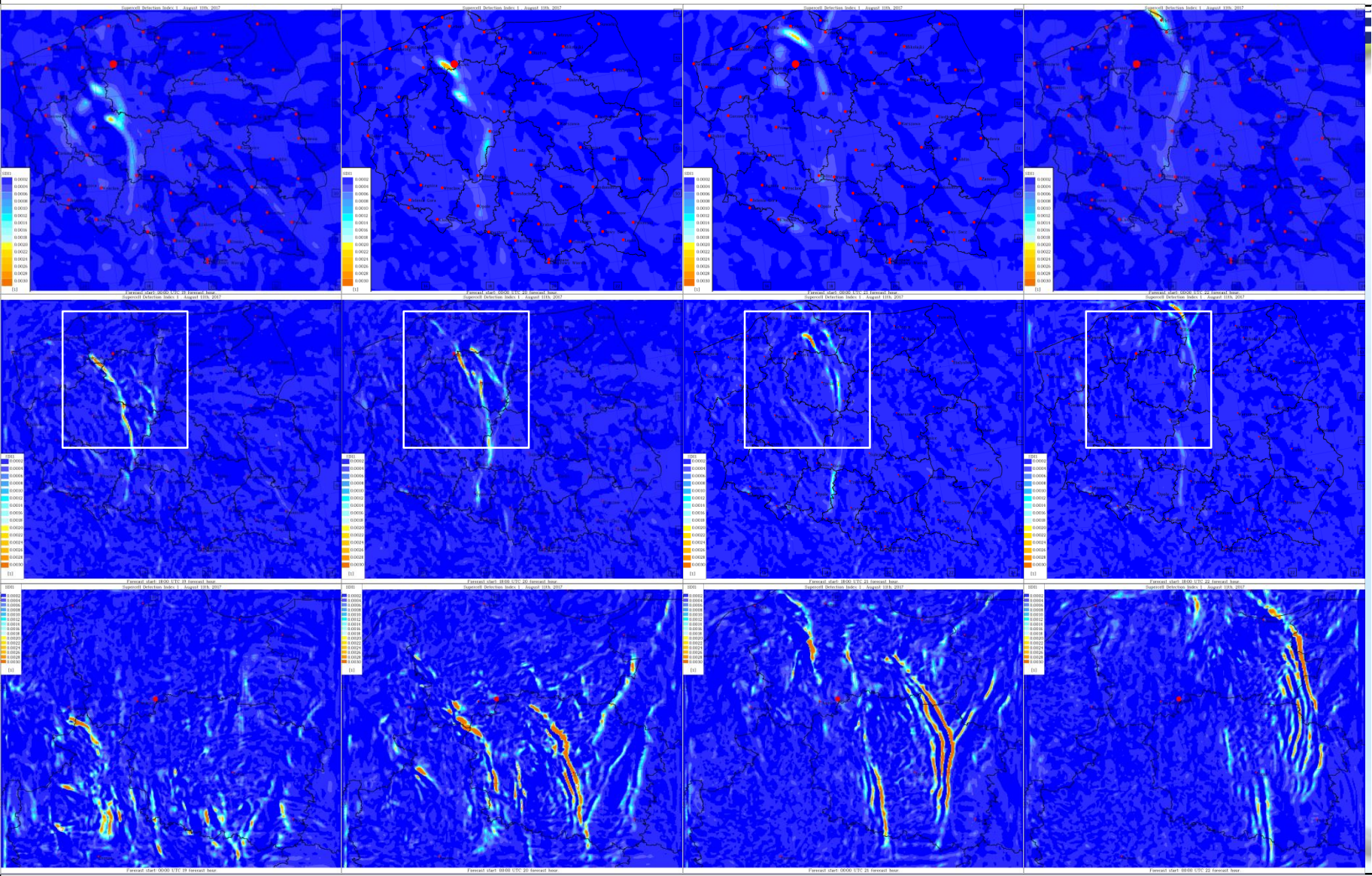
0.7km

19:00 20:00 21:00 22:00

Suszek, August 11th, 2017

Case study – HIW event from 7 to 0.7km

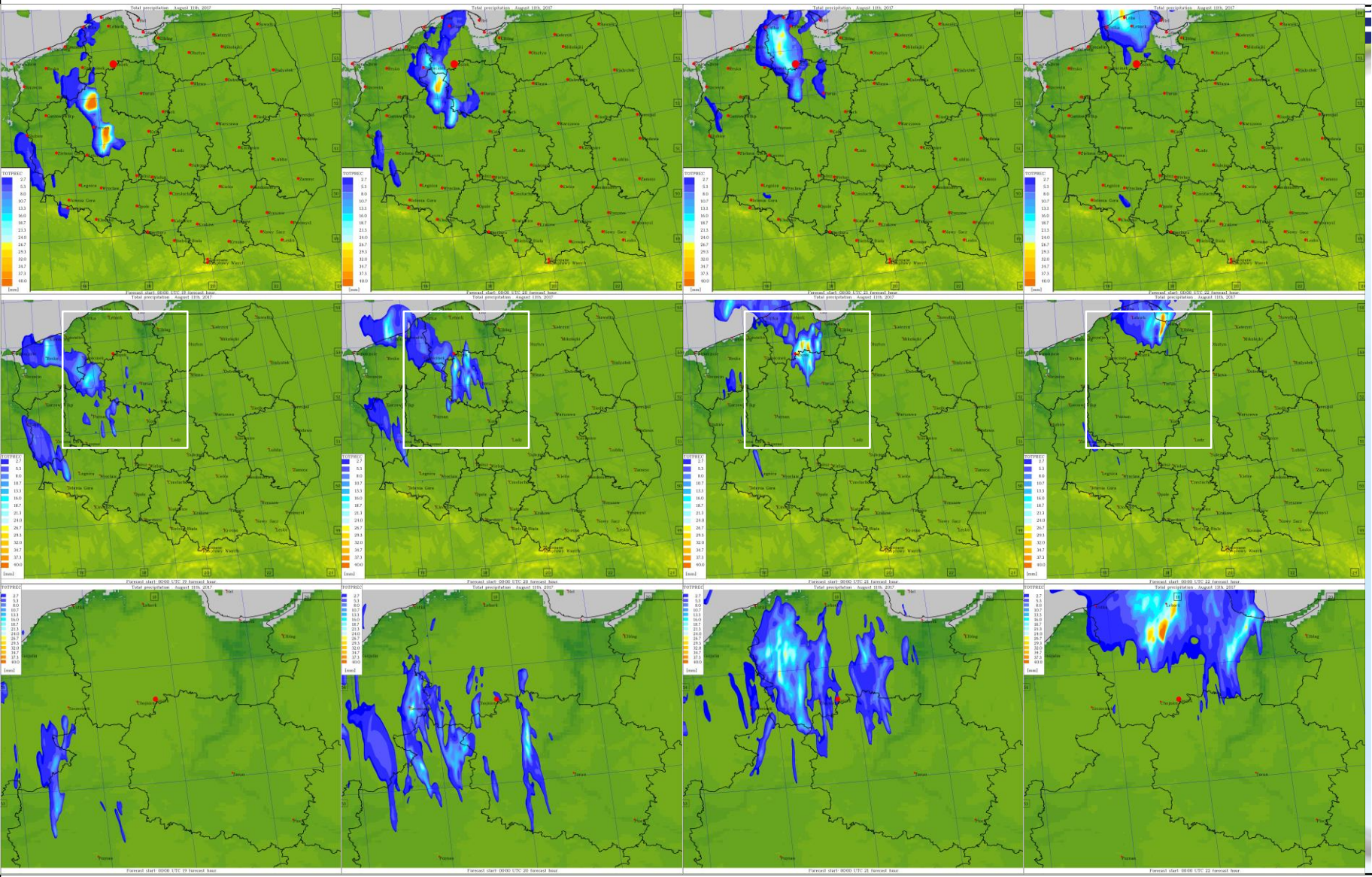
Supercell Detection Index (SDI)



Suszek, August 11th, 2017

Case study – HIW event from 7 to 0.7km

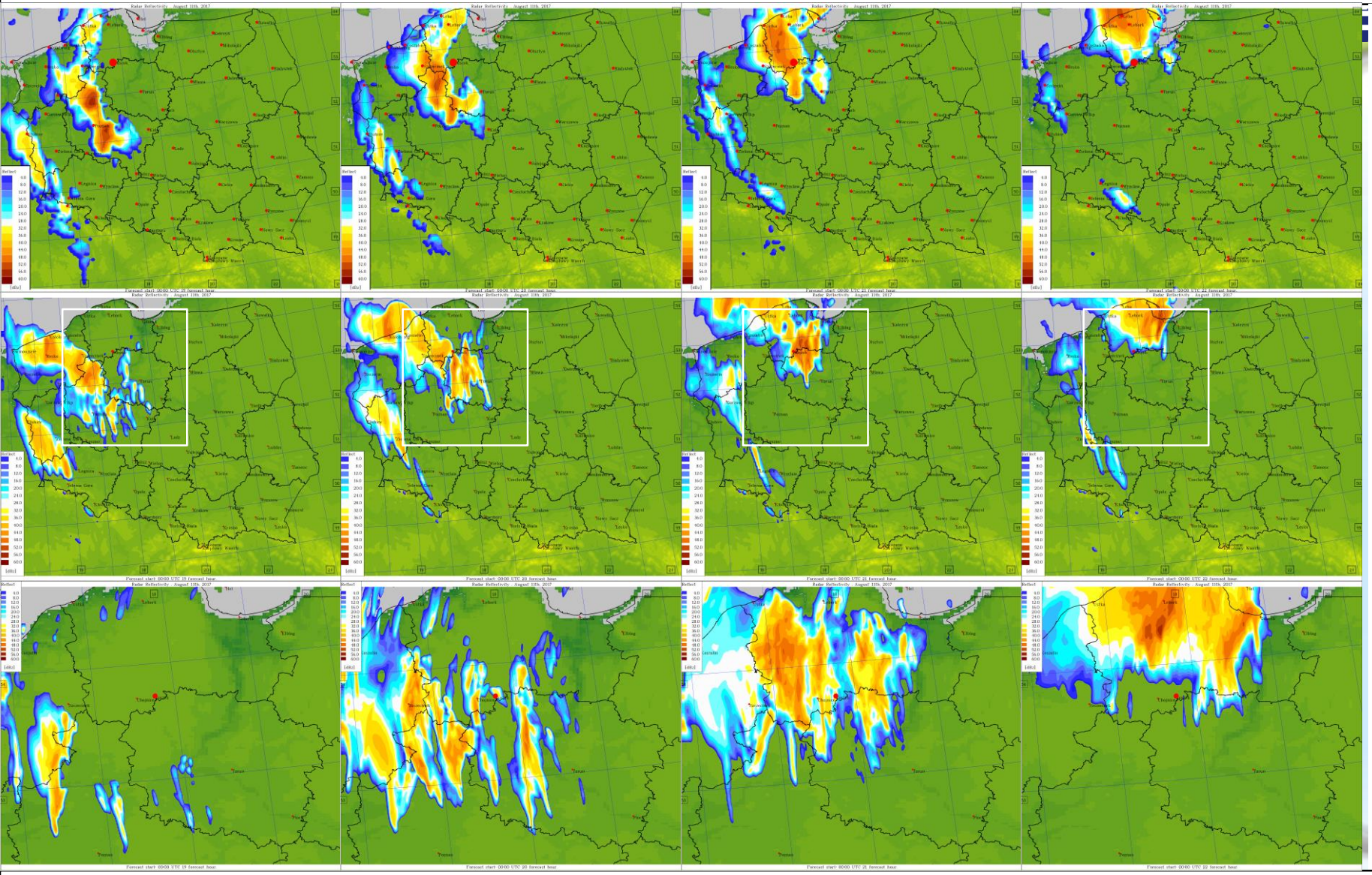
Total precipitation



Suszek, August 11th, 2017

Case study – HIW event from 7 to 0.7km

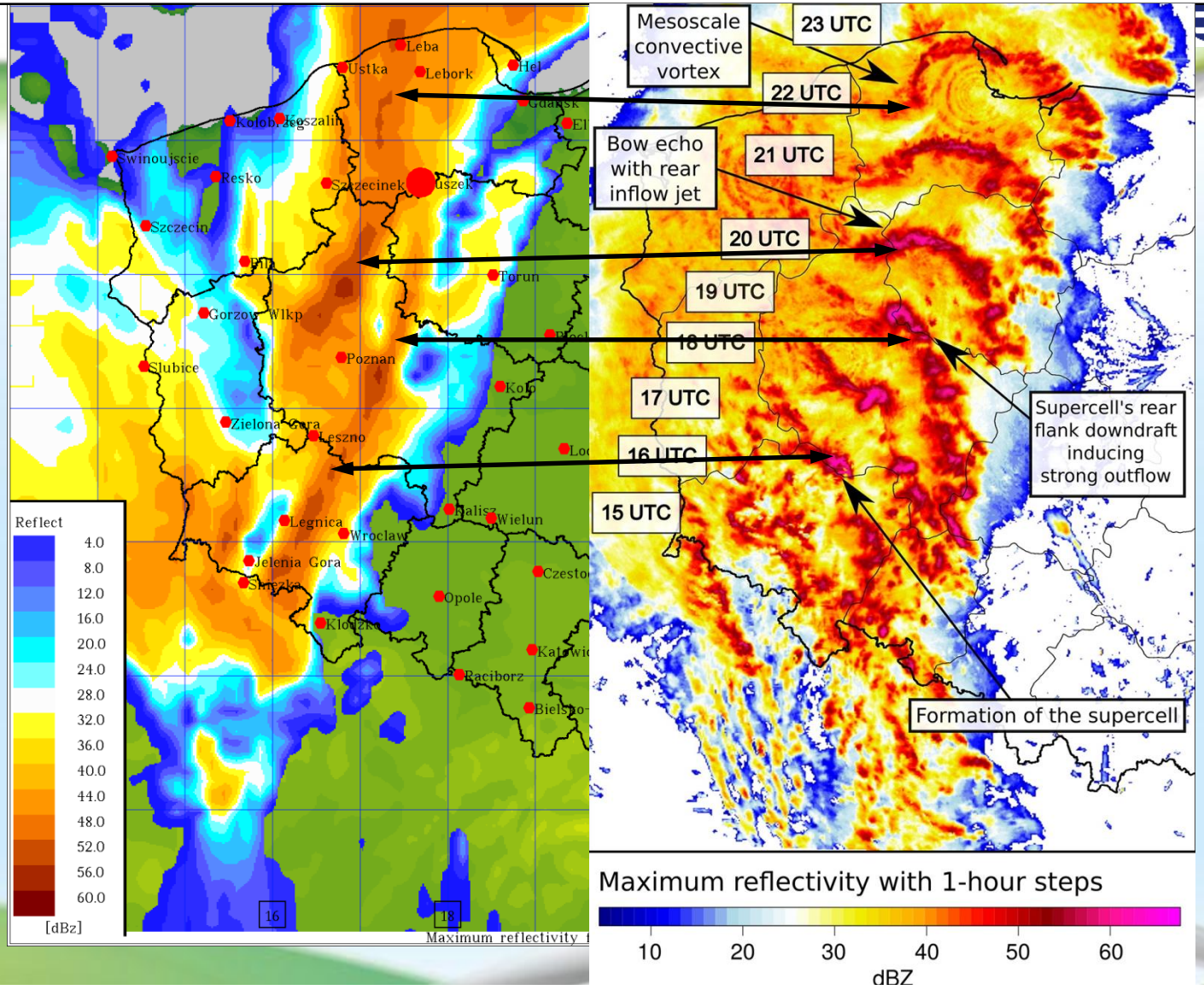
Radar Reflectivity forecast



Suszek, August 11th, 2017

Case study – HIW event from 7 to 0.7km

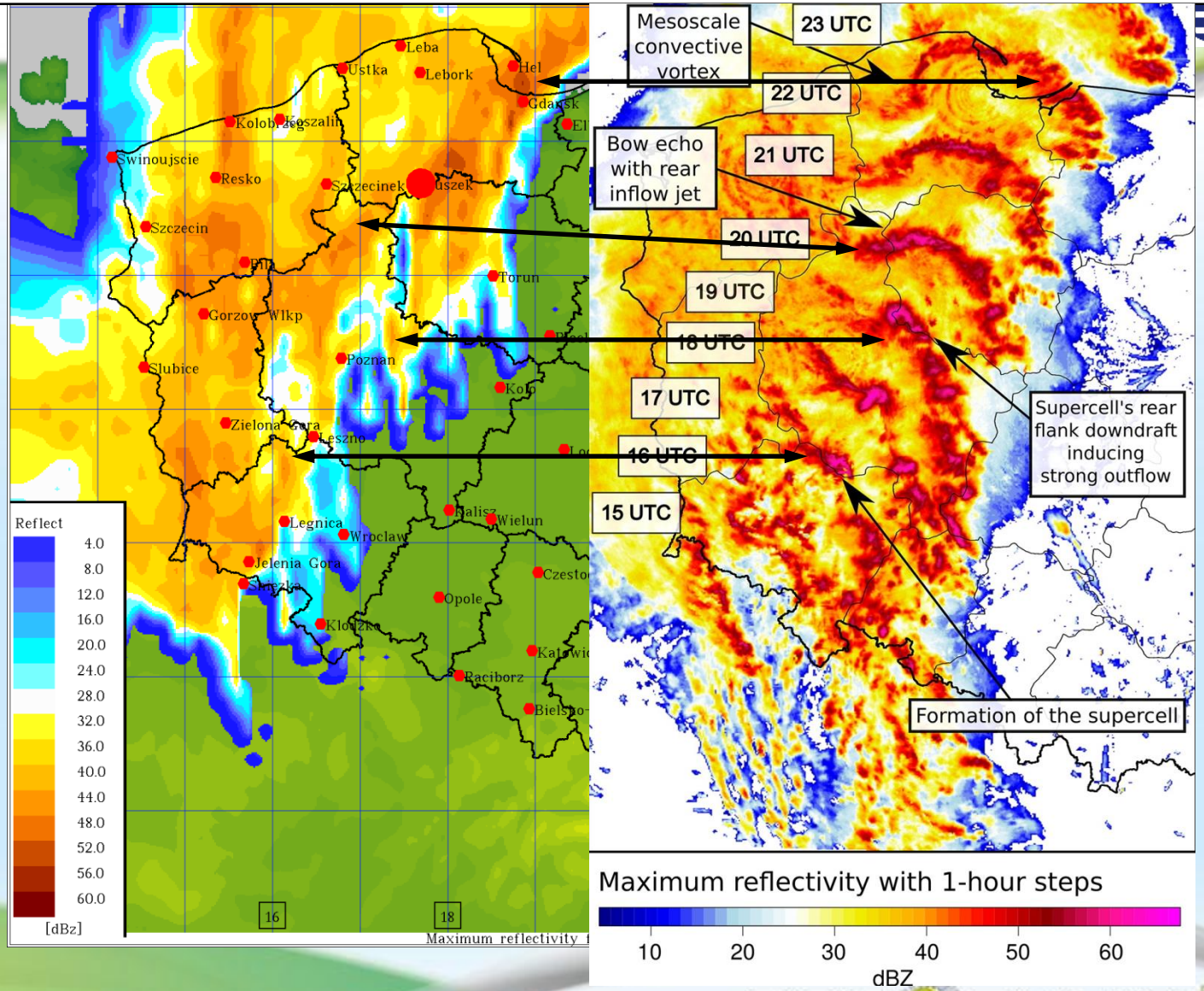
Radar Reflectivity forecast; res. 7.0km



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., https://doi.org/10.1175/MWR-D-18-0330.1). PL radar network.

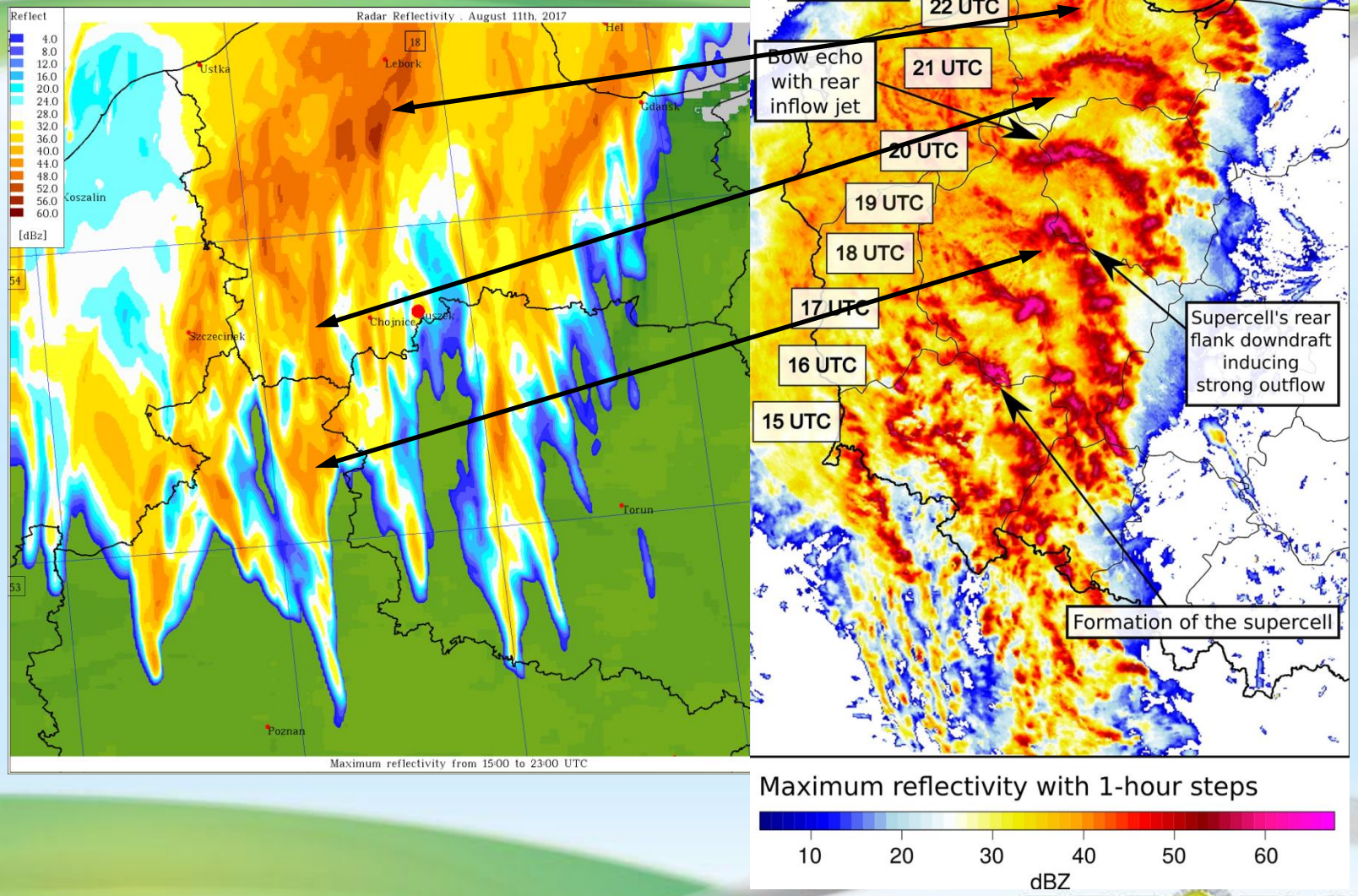
Case study – HIW event from 7 to 0.7km

Radar Reflectivity forecast; res.2.8km



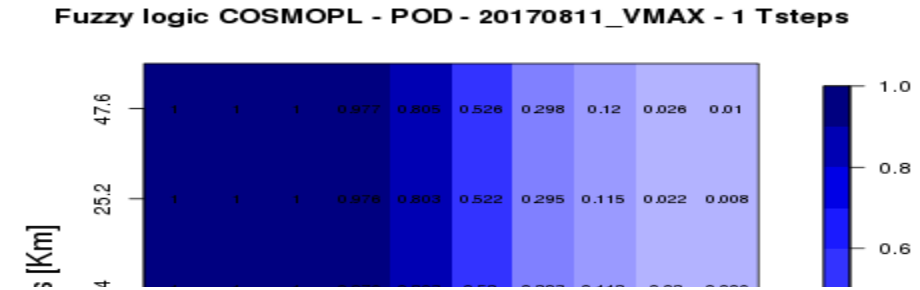
Case study – HIW event from 7 to 0.7km

Radar Reflectivity forecast; res. 0.7km

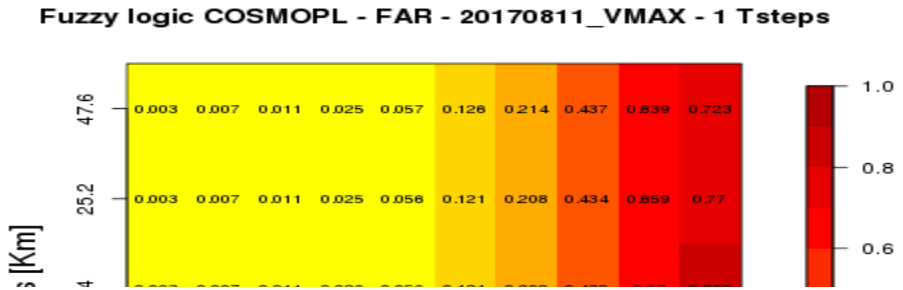


Case study – HIW event

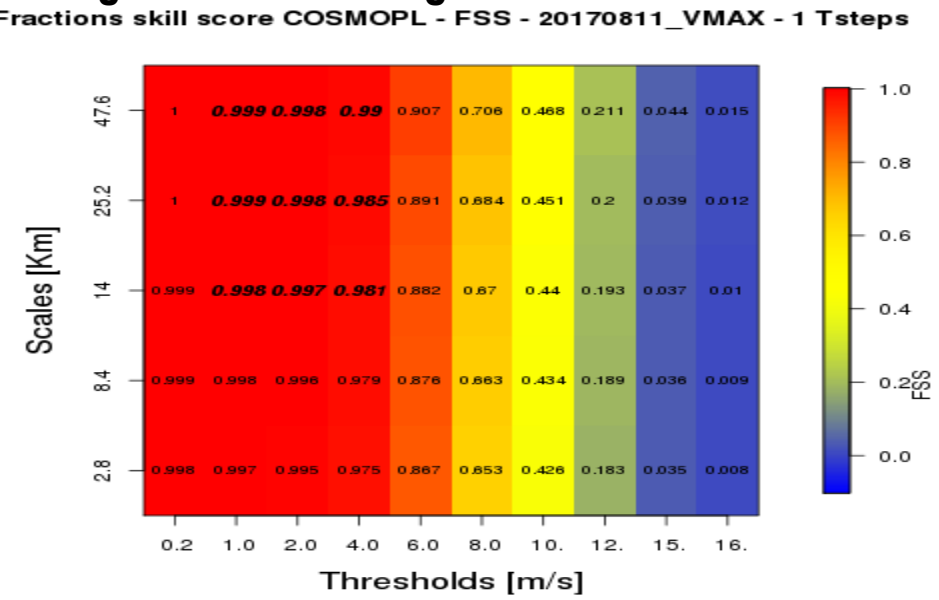
POD

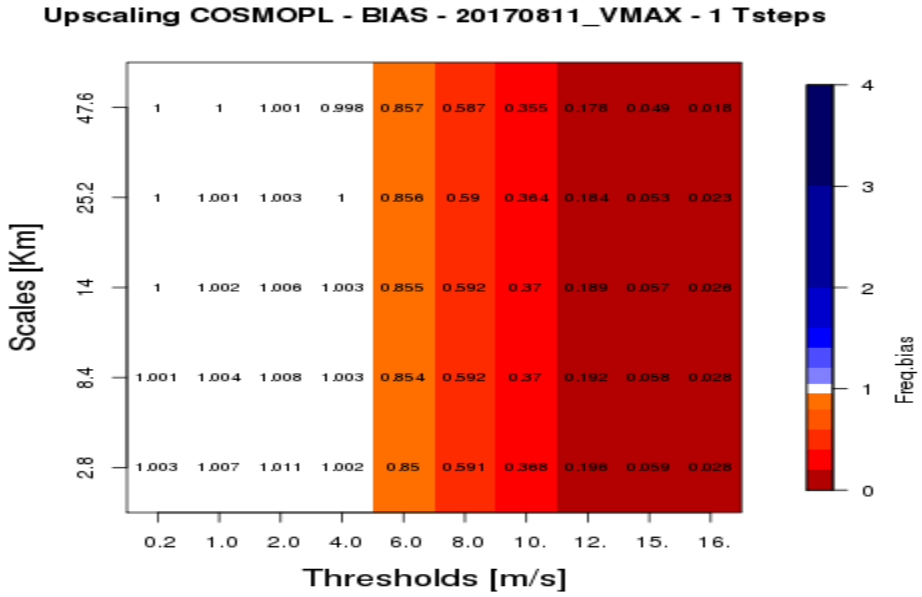


FAR



Wind gusts above 6m/s are underestimated, the degree of underestimation increasing with gust speed. FSS – a greatest skill for low wind gust speeds. A small variation in skill with spatial scale, with greater skill at larger scales.



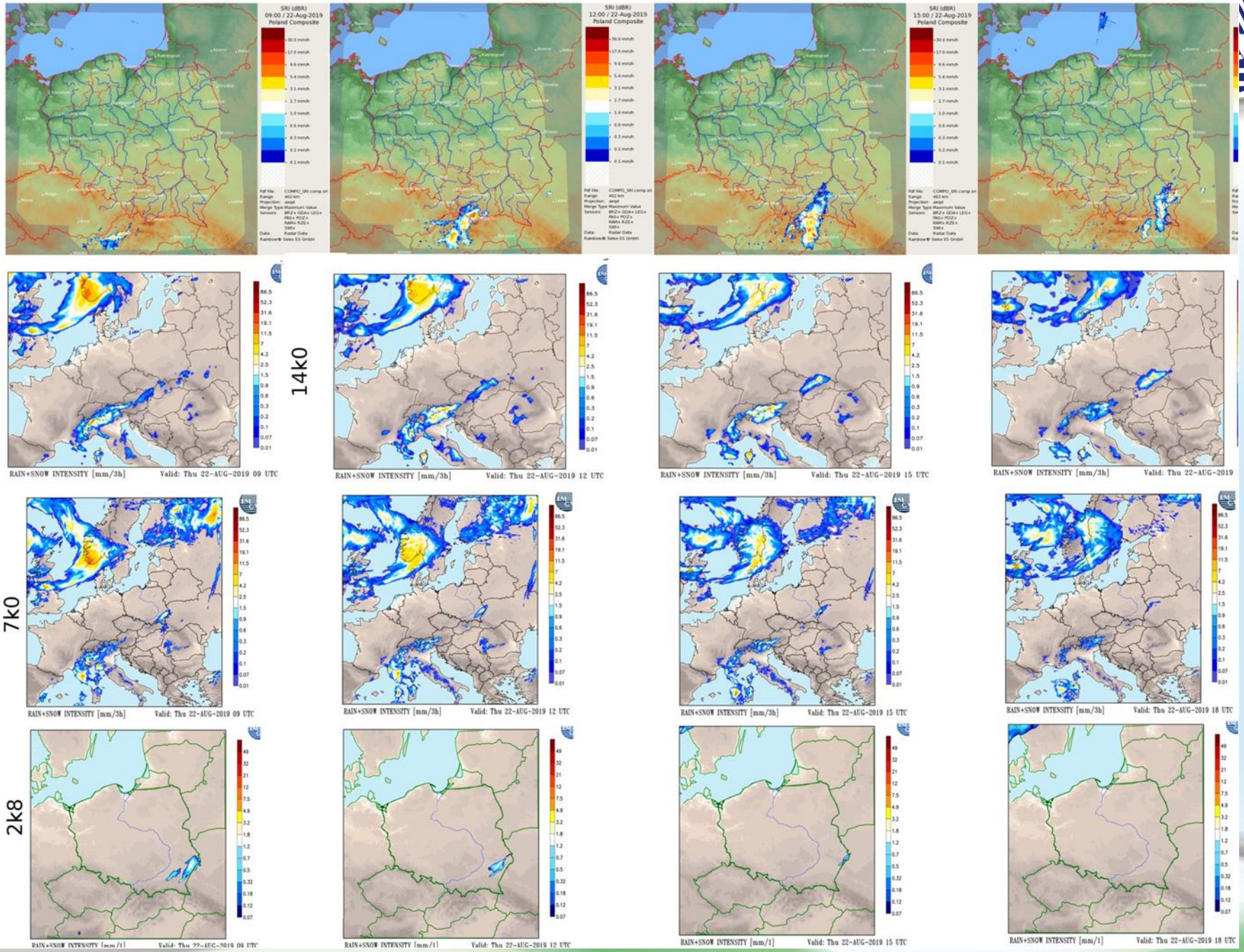


FSS

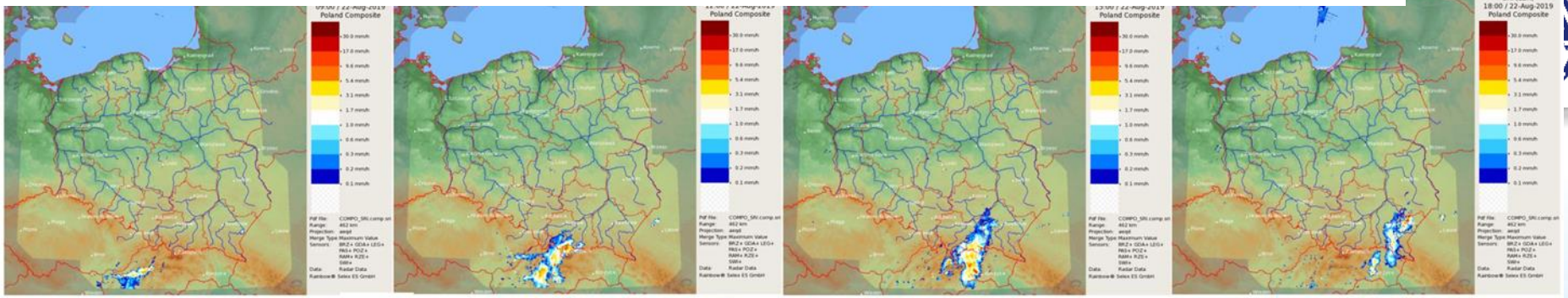
BIAS

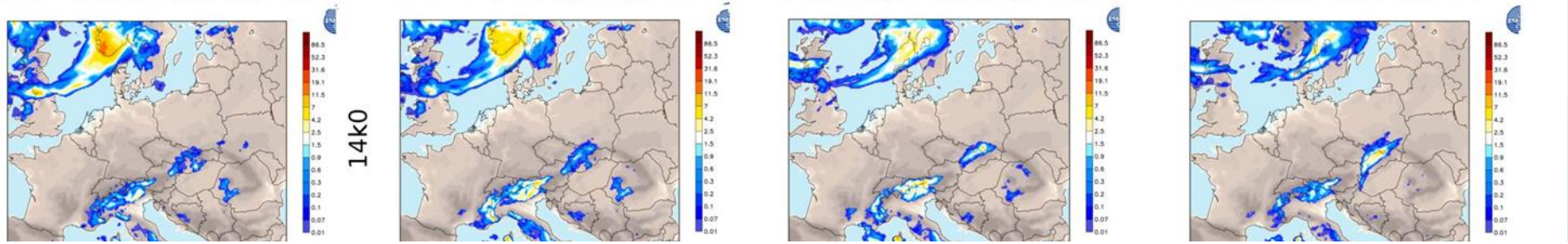
Wind gust, 2017.08.11

Another HIW event (2019.08.22. fcst start 00:00)

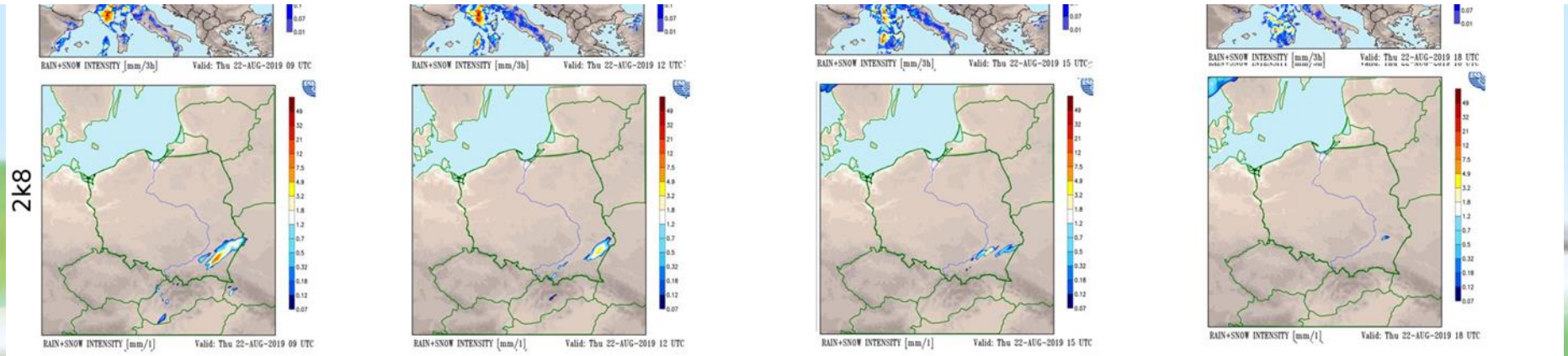


Another HIW event (2019.08.22, fcst start 06:00)





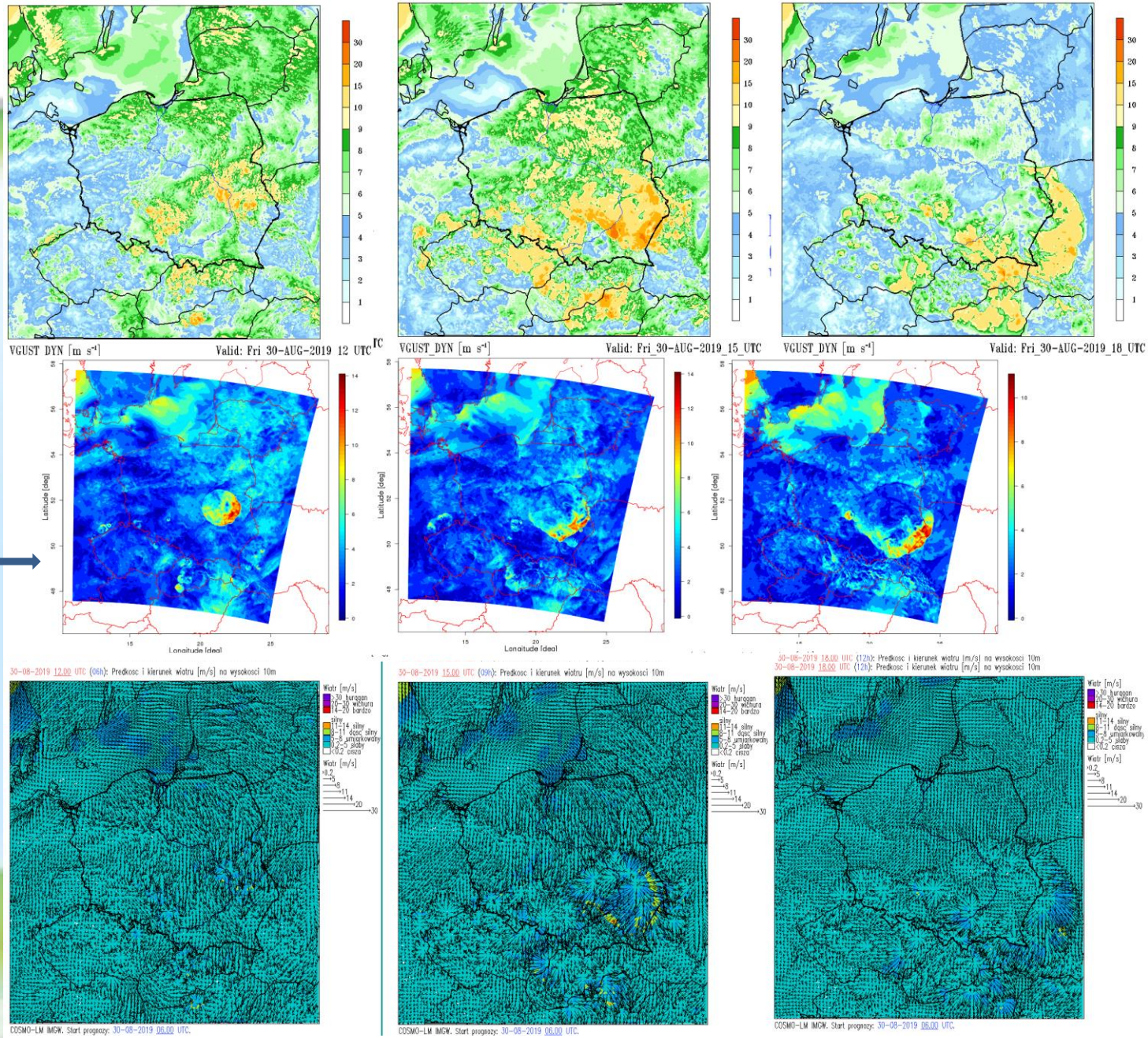
Heavy rain was also predicted in 2.8km TL-MV-EPS forecasts – because some members was calculated with ICs/BCs from previous day(s), not from current day…



…yet another HIW event (2019.08.30, fcst start 06:00)

Pictures from operational 2.8km COSMO-PL

Wind gust for aviation (oper. only)



Pictures from 2.8km COSMO-PL -CE

Conclusions

FORFEIT example (a general feature?):

The deeper into continental part of the domain, the worse results become…

Case study August 2017:

Most effective in very high resolution – Supercell Detection Index. (identifies the path of the supercell northward), VMAX (as DMO), reflectivity forecasts.

Deterministic forecast(s) much more ”noisy” than the ensemble mean(s).

Fuzzy logic verification – a tool to assess a quality of forecast.

Another HIW event (2019.08.22) – strange that only 14km (and EPS 2.8) COSMO-PL predicted precipitation correctly, regardless of the forecast’s start (this day!)…

And finally:

The huge VGUST bubble forecasted at a resolution of 2.8 km – definitely a very thorough investigation needed!

Motivation sentence:

DON'T STOP WHEN YOU'RE TIRED.

STOP WHEN YOU'RE DONE.