# Survey for assessment of proper verification of phenomena

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## Contents

## Introduction

Every weather has its impact!

Since every weather has its impact, each weather element can be treated as an impact source. It's just a question of scale and intensity.

1. ”regular” elements – temperature, precipitation, windspeed…
2. ”specific elements” – visibility limitations, thunderstorms, tornadoes, …

The verification method may be/could be/should be adapted (and specific) for each element.

To be done in this task:

- Brief researches (case studies) to assess applicability of particular method(s) (in progress/partially done);
- Comparison and judgment whether continuous or discrete methods may/should be applied (in progress…)
- Overall final recommendations (2-b done…)

Survey on (basic) methods applicable to the problem:

1. Neighborhood-based approaches *)
2. Coverage–Distance–Intensity (CDI) verification*)
3. **SAL (Structure/Amplitude/Location) Verification****)
4. **FSS (Fraction Skill Score) verification*****)
5. **Standard evaluation at the grid scale**
6. **Categorical analysis (Contingency tables and predictands)**
7. **Cross- (space-lag) correlation approach and verification**

*) Wilkinson, 2017: A technique for verification of convection-permitting NWP model deterministic forecasts of lightning activity. Wea. Forecasting, 32, 97–115

**) Wernli *et al.*, 2008, SAL – a Novel Quality Measure for the Verification of Quantitative Precipitation Forecasts, Mon.Wea.Rev.136(11):4470–4487,https://doi.org/10.1175/2008MWR2415.1

***) Blaylock and Horel, 2020: Comparison of Lightning Forecasts from the High-Resolution Rapid Refresh Model to Geostationary Lightning Mapper Observations, Wea. Forecasting 35, 402-416

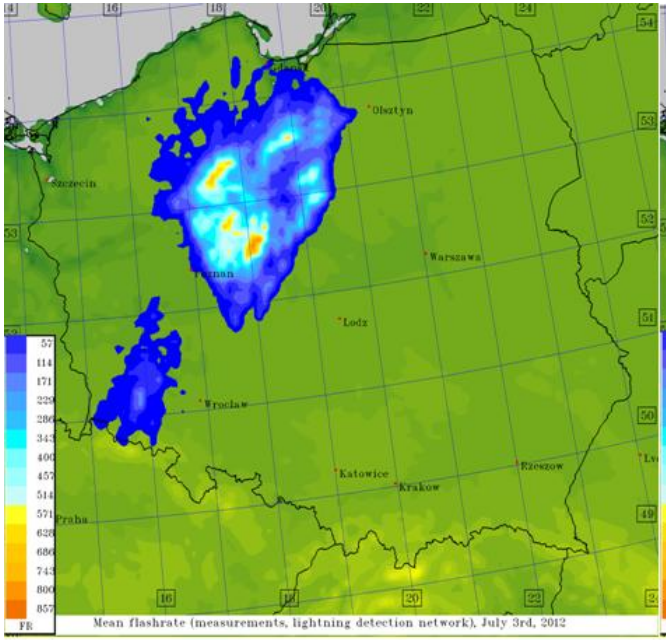
## Categorical analysis based on contingency tables

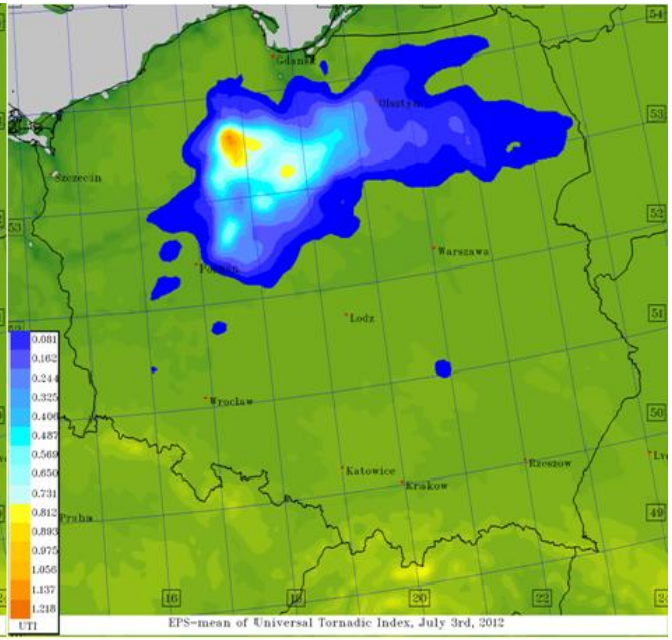
Contingency tables:

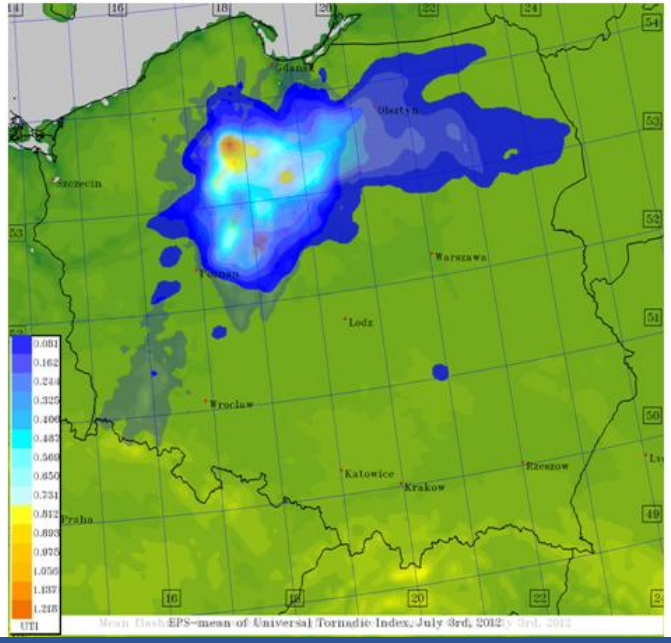
| Forecast given | Event observed | |
|---|---|---|
| | Yes | No |
| Yes | Hit (a) | False alarm (c) |
| No | Miss (c) | Correct non event (d) |

| Basic predictands used: | def. n=a+b+c+d | range | perfect |
|---|---|---|---|
| Frequency Bias Index | (a+b)/(a+c) | -inf to +inf | 1 |
| False Alarm Ratio | b/(a+b) | 0 to 1 | 0 |
| Probability Of Detection | a/(a+c) | 0 to 1 | 1 |
| Probability Of False Detection | b/(b+d) | 0 to 1 | 0 |
| Threat Score | a/(a+b+c) | 0 to 1 | 1 |
| True Skill Statistics | (ad-bc)/((a+c)(b+d)) | -1 to 1 | 1 |
| Equitable Skill Score | (a-ar)/(a+b+c-ar); ar=(a+b)(a+c)/n | -1/3 to 1 | 1 |
| Proportion Correct | (a+d)/(a+b+c+d) | 0 to 1 | 1 |
| Success Ratio | a/(a+b) | 0 to 1 | 1 |

# Space lag (cross-) correlation (reminder)



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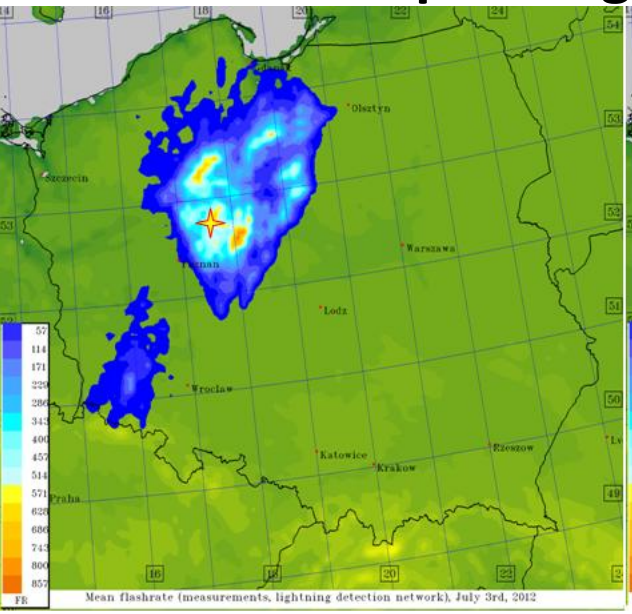
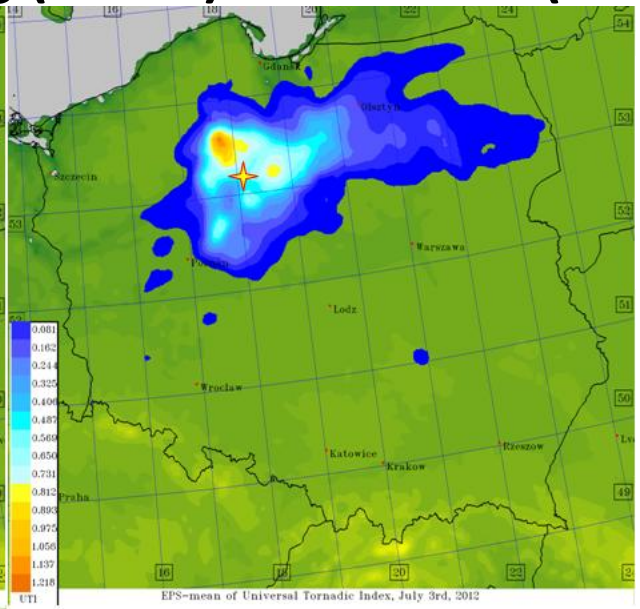
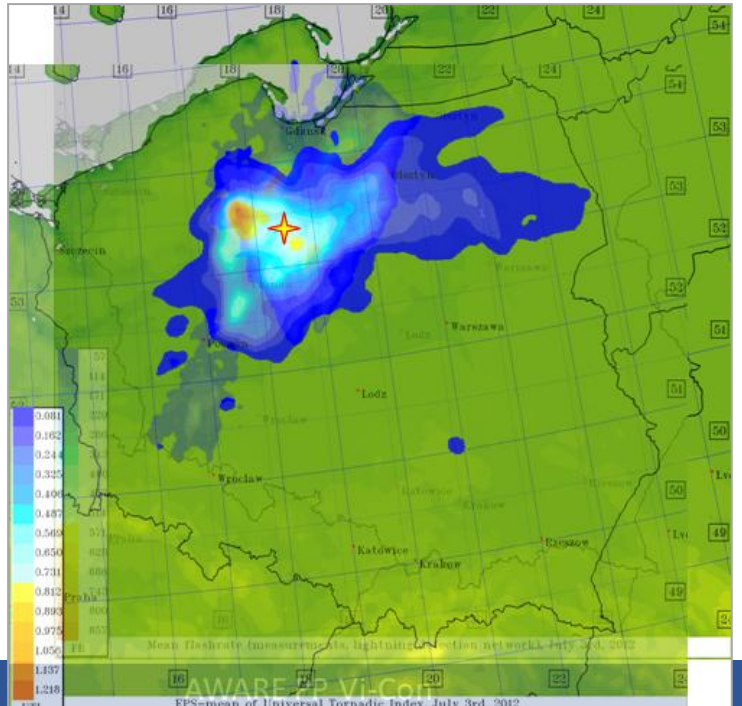


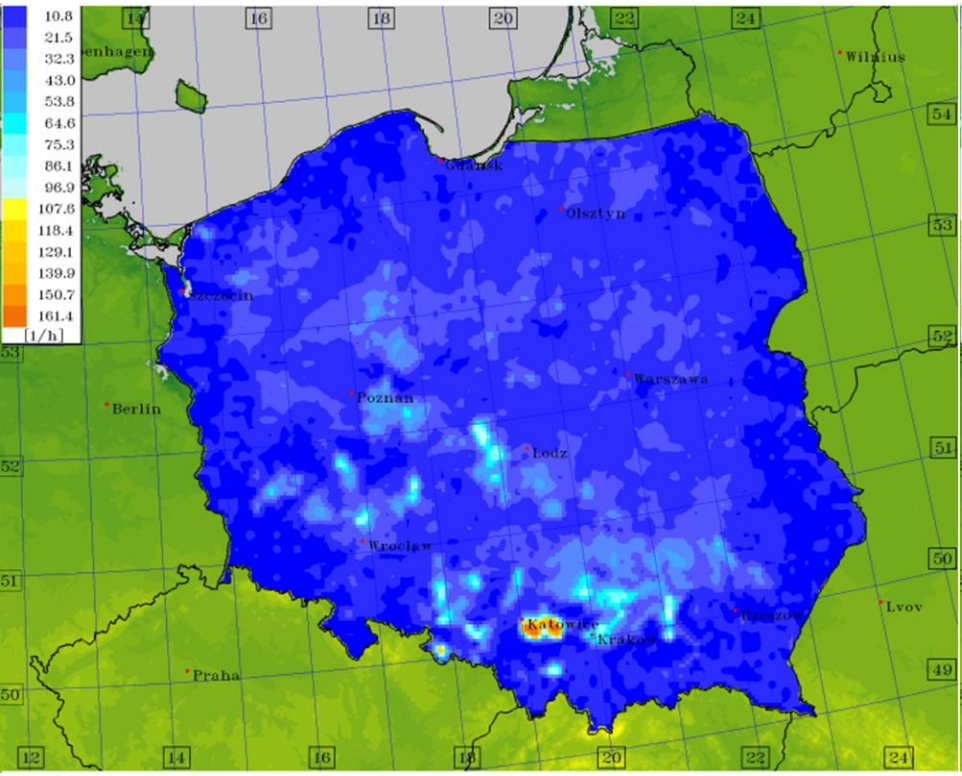

Calculate coordinates
of ”centres of mass”
for both distribution patterns
(obs. vs. fcst)

Compute vector of displacement
of fcst to obs.
as a difference of the two above

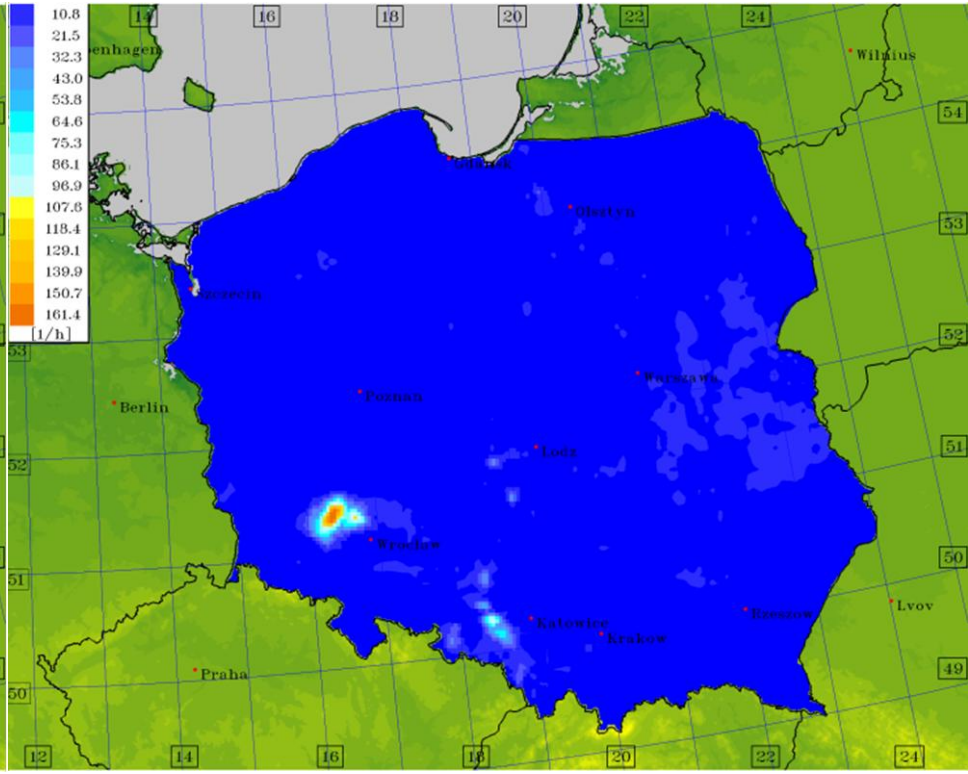


# Space lag (cross-) correlation

Forecast – observation; lightning frequency



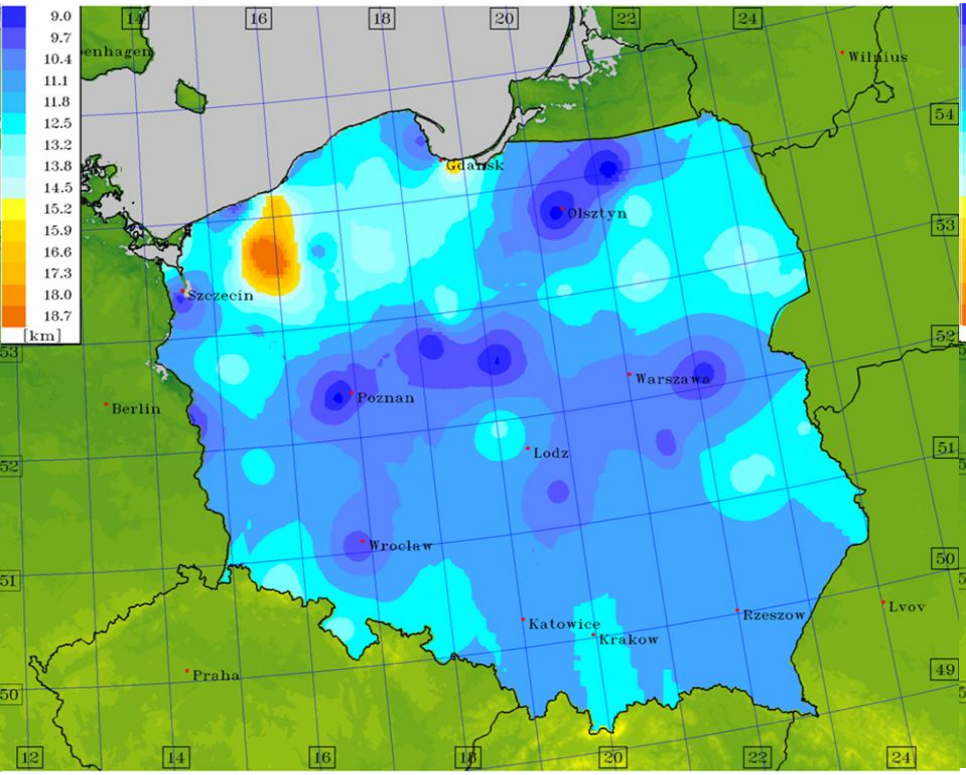

Raw FLR



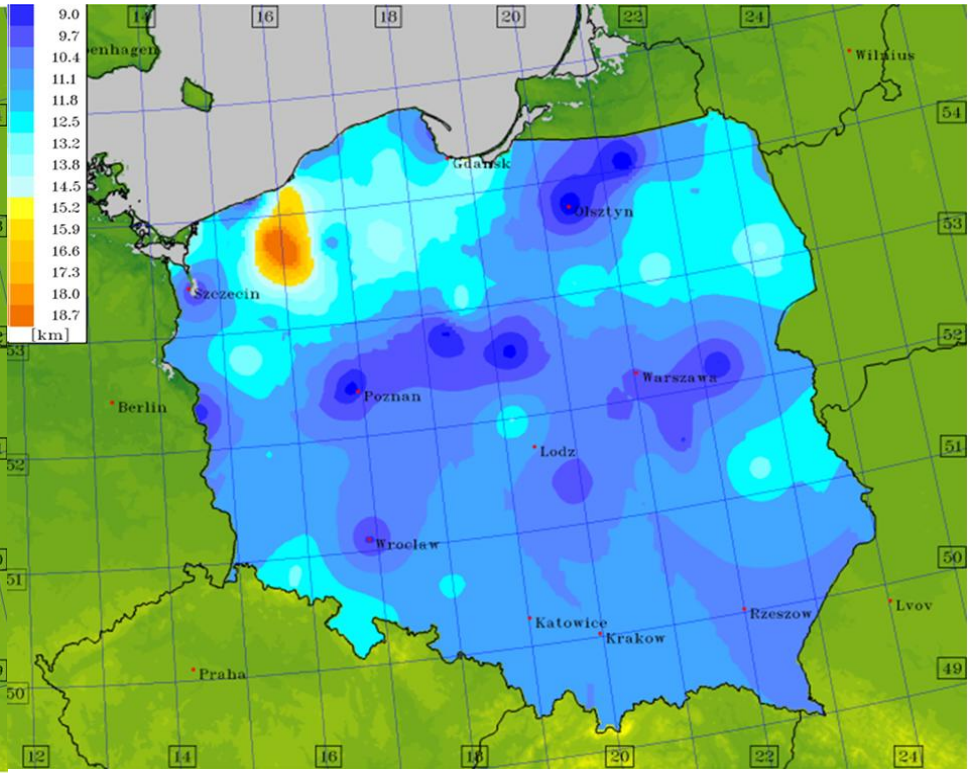

VOD FLR

# Space lag (cross-) correlation

## Forecast – observation; Visibility Range




Raw VIS




VOD VIS

## Conclusions/To-dos

1. Test period for direct- and VOD-verification extended to 2011-2017

2. SAL and/or FSS and/or categorical verification for the above period has been applied (both for direct and VOD approach).

3. Continuous and discrete verification – done, to be in details compared with each other.

4. Connect the results appropriately to subtasks 3.1 and 4.2

Results will be shown. Very soon.
And further conclusions to be drawn. Soon…