The estimation of QPF uncertainty on the basis of QPF spread

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• 5 (4+1) convective events (flash flood events)
• LM COSMO, 2.8km + Regional ensemble QPF
  – 13 ensemble members

• FSS (Fractions Skill Score, N.Roberts)
• FSS based skill and spread

• FSS-skill forecast, input:
  – FSS-spread
  – FSS-skill vs. FSS-spread regression (4 events)
Events

domain size about 500x300 km rainfall 10-22 UTC

13.7.2002
15.7.2002
10.6.2004
23.5.2005
30.5.2005
R+G
QPF – LM COSMO

- **LLM**: 231x175 g.p., \( \sim 11 \text{ km} \), 00UTC+24h, init. cond. ECMWF

- **SLM**: 251x191 g.p., \( \sim 2.8 \text{ km} \), 06UTC+18h, init. cond. LLM

- CZRAD - 2 radars
- QPF verification: R+G
- 5 local flash flood storms

Verification domain 165x95 g.p. \( (462x266 \text{ km}) \)
LM COSMO – „ensemble“

Modification of LLM initial conditions - shifting

13 initial fields for SLM

Ensemble of 13 SLM forecasts
FSS (Fraction Skill Score)

• FSS – „Fuzzy“ verification method
• FSS – fractional coverage of an elementary area by rainfall that exceeds a given threshold value;

\[
\begin{align*}
\text{FSS-skill} &= 1 - \frac{1}{N} \sum_{N} \left( P_{F} - P_{O} \right)^2 \\
&= 1 - \frac{1}{N} \sum_{N} P_{F}^2 + \frac{1}{N} \sum_{N} P_{O}^2
\end{align*}
\]

\[
\begin{align*}
\text{FSS-spread} &= 1 - \frac{1}{N} \sum_{N} \left( P_{F} - P_{CF} \right)^2 \\
&= 1 - \frac{1}{N} \sum_{N} P_{F}^2 + \frac{1}{N} \sum_{N} P_{CF}^2
\end{align*}
\]

• P_{CF} - observation, P_{CF} - control forecast, P_{F} - ensemble member forecast and N gives the number of grid points
FSS* - scale dependence

(Roberts & Lean 2008)
Skill forecast - simple numerical experiment

- Various lead times
- 4 even events
- Polynomial fit
- Spread of the forecast (5th day)
- Projection of the 5th day forecast spread on the fit
- Expected skill of the 5th day forecast
- Real skill of the 5th day forecast

Graph showing:
- Real skill of the 5th day forecast
- Expected skill of the 5th day forecast
Skill forecast - simple numerical experiment

• 5 events
• 9 (resp. 7) lead times for 1h, 3h prec. totals (resp. 6h)
• 4 prec. thresholds
  – 0.1mm, 1mm, 2mm, 5mm
• regression curves:
  • 1h, 3h and 6h acc. per.
  • 4 thresholds
FSS-skill-FIT – FSS-skill

1h rainfall, threshold 0.1 – 5mm, all situations together

5 situations
10 el. areas
9 lead times
FSS-skill-FIT – FSS-skill

3h rainfall, threshold 0.1 – 5mm, all situations together

5 situations
10 el. areas
9 lead times
FSS-skill-FIT – FSS-skill

6h rainfall, threshold 0.1 – 5mm, all situations together

5 situations
10 el. areas
9 lead times
Skill-FIT: Percent Correct

1h rainfall, threshold 0.1 – 5mm, all situations together

5 situations
10 el. areas
9 lead times
Skill-FIT: Percent Correct

3h rainfall, treshold 0.1 – 5mm, all situations together

5 situations
10 el. areas
9 lead times
Skill-FIT: Percent Correct

6h rainfall, threshold 0.1 – 5mm, all situations together

5 situations
10 el. areas
7 lead times
The range of FSS values are event dependent, so it is not possible to expect a given scale value to be a threshold of forecast skill in general.
Results and Future work

• Strong correlation between FSS-skill and FSS-spread
• FSS-skill forecast seems to be useful (in first experiments)
  – Low BIAS and rel. high Percent Correct value

• More events and new version of COSMO
  + COSMO EPS (SREPS) (if possible?)
• Better statistics
• Not all data in a „one cup“
Thank You