Motivation

• The new generation of numerical weather models at convection resolving scales (i.e., ≤ 5 km grid spacing) resolve small convective features.
• However, traditional methods for precipitation forecast verification often heavily penalize small displacements of these convective features (e.g., correlation coefficient and equitable threat score).
• Neighborhood verification methods such as fractions skill score (FSS) consider grid cells within a prescribed distance and partially compensate for small displacement errors.

Methodology

• FSS (Roberts and Lean 2008) is a variation of Fractions Brier Score (FBS; Roberts 2005) that utilizes the fraction of neighboring grid cells exceeding a specified accumulation threshold from the forecast (P_F) and observation (P_O) fields:

\[
\text{FBS} = \frac{1}{N} \sum_{i=1}^{N} (P_F(i) - P_O(i))^2
\]

\[
\text{FSS} = \frac{1}{\text{FBS}_{\text{worst}}} - 1
\]

where:

\[
\text{FBS}_{\text{worst}} = \frac{1}{N} \sum_{i=1}^{N} (P_F(i)^2 + P_O(i)^2)
\]

• FSS divides this FBS by the hypothetical worst FBS from the forecast and observed fractional probabilities (P).
• We compute fractional probabilities (P) within a 60 km radius of the forecast origin.
• 6 h precipitation observations are from the NCEP Stage IV dataset (~ 4 km) derived from gauges and radar estimates.
• Bias score also computed:

\[
\text{Bias} = \frac{\sum_{i=1}^{N} P_F(i)}{\sum_{i=1}^{N} P_O(i)}
\]

Real Time Forecast Probabilities

• The fractional probabilities for various six-hour precipitation accumulation thresholds can be a useful field for forecasters.
• Fine scale details of high-resolution forecasts (whose exact placement is often devoid of skill) are smoothed, but indications of the chance of localized heavy accumulations are preserved.

Model Comparison of Precipitation Forecast Skill: FSS (r=60 km)

Models Compared:

- High-Resolution Rapid Refresh (HRRR; ~3 km horizontal grid spacing)
- NCEP High-Resolution Window (HIRESW) using WRF/ARW core (~4.2 km)
- NCEP HIRESW using WRF/NMM core (~3.6 km)
- High-Resolution North American Mesoscale (HR-NAM; ~5 km)
- North American Mesoscale (NAM; ~12 km)
- Short Range Ensemble Forecast (SREF) using WRF-ARW core (~16 km; 7 members)
- SREF using WRF-NMM core (~16 km; 7 members)
- Equally weighted average of fractional probabilities from all 11 models
- Equally weighted average of fractional probabilities from all 4 high-resolution models

Warm Season (April-Sept. 2015) FSS

<table>
<thead>
<tr>
<th>Precipitation Accumulation Threshold</th>
<th>CONUS West of 104° W</th>
<th>CONUS East of 104° W</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mm</td>
<td></td>
<td></td>
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<tr>
<td>10 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 mm</td>
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</tbody>
</table>

Cold Season (Oct. 2014 - March 2015) FSS

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See More Results Online at: http://fuelberg.met.fsu.edu/~marchand/apcp/pcpveri.html

Precipitation Verification over the United States

2015052706z 12-18hr Precip. Fst from HR-NAM

20150504-09 FSS r=60km