Ensemble Tropical Rainfall Potential (eTRaP)

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…and many others!
eTRaP Background

• eTRaP began in the 1980s with Tropical Rainfall Potential (TRaP), which was initially a manually-produced, point forecast of total rainfall from a tropical system
  – Initially based on its satellite-estimated diameter, speed, and average rain rate
  – Later based on gridded rain rates from microwave retrievals

NOAA-15 AMSU-A rain rates (0.01”/h) for Hurricane Georges at 0023 UTC 25 September 1998
eTRaP Background

- This eventually evolved into an automated, gridded forecast of 24-h rainfall from a tropical system by advecting the (gridded) satellite estimates of instantaneous rain rate forward along the operational forecast track.
eTRaP Background

• The next step was to create an ensemble of TRaPs from different sensors, forecast initialization times, and operational forecast tracks to get deterministic and probabilistic (threshold exceedance) rainfall forecasts.

18-00 UTC

00-06 UTC

06-12 UTC

12-18 UTC

Ensemble of TRaPs from Hurricane Rita, 23-24 September 2005
eTRaP Inputs

• eTRaP is produced every 6 h (initialization times 00, 06, 12, 18 UTC, data cutoff +3 h, latency 1 h) for tropical systems worldwide using TRaPs from
  – AMSU (NOAA-18/19, METOP-A/B)
  – SSMIS (DMSP F16/17/18)
  – 11 µm IR (Hydro-Estimator) (GOES-E/W, METEOSAT-8/10, Himawari-8)
  – ATMS (S-NPP)
  – AMSR2 (GCOM-W)
  – GMI (GPM)

• Rainfall CLImatology-PERsistence (R-CLIPER), which uses rain rates from conditional climatology in place of satellite estimates, will be added at the end of August.
eTRaP Example: Hurricane Gert
0-24 h forecasts initialized 1200 UTC 15 August 2017

Probability of ≥50 mm

Probability of ≥100 mm

Probability-Matched QPF
eTRaP Example: Hurricane Hermine
18-24 h forecast initialized 06 UTC 2 September 2017

2016HERMINE.pmqpf.09020600

Stage IV analysis 6h ending 20160903 6

No data
<1 mm
1–5 mm
5–10 mm
10–20 mm
20–50 mm
50–100 mm
100–200 mm
200–400 mm
400–600 mm

<table>
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<tr>
<th>Observed</th>
<th>≥12.7</th>
<th>&lt;12.7</th>
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<tbody>
<tr>
<td>8469</td>
<td></td>
<td></td>
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<tr>
<td>3835</td>
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<table>
<thead>
<tr>
<th>Statistics for rain ≥12.7 mm</th>
<th>Obs</th>
<th>Feb</th>
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<tbody>
<tr>
<td># gridpoints</td>
<td>10263</td>
<td>12304</td>
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<tr>
<td>Average rainrate (mm)</td>
<td>40.41</td>
<td>36.01</td>
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<td>Rain volume (km³)</td>
<td>42.09</td>
<td>37.51</td>
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<td>Maximum rain (mm)</td>
<td>202.11</td>
<td>81.68</td>
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Total number(≥0)=90769, grid=0.030°

Mean abs error = 19.44 mm
RMS error = 28.45 mm
Correlation coeff = 0.131
Bias score = 1.199
Probability of detection = 0.825
False alarm ratio = 0.312
Hanssen & Kuipers score = 0.778
Equitable threat score= 0.557
Questions?