A TOUR AROUND THE SHOWROOM: TAKING A SPIN WITH NEW HMT-WPC DEVELOPMENTS

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Accelerate the transfer of scientific and technological innovations into operations to enhance WPC products and services.

HMT-WPC: What do we do?

1. Identify the Problem or Need
2. Develop Solutions
3. Test & Evaluate
4. Implement & Train
The Need for Flash Flood Verification

- There is no consistent CONUS database of flash flood observations
- Mesoscale Precipitation Discussion (MPD)
  - Began April, 2013 (prototype 2012)
  - Event driven
  - Highlight regions where heavy rainfall may lead to flash flooding (1-6 hrs)
- Flash Flood and Intense Rainfall Experiments
  - Experimental Flash Flood forecasts
  - Development/evaluation of new forecast guidance and tools
There is no consistent CONUS database of flash flood observations.

Proper verification is very difficult.....
The Need for Flash Flood Verification

- There is was no consistent CONUS database of flash flood observations
- Proper verification is very difficult.....
# Three-Pronged Real-time Postgres Hydrologic Verification Database

<table>
<thead>
<tr>
<th>Postgres Component Database</th>
<th>Strengths</th>
<th>Weaknesses</th>
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<tr>
<td>NWS Local Storm Reports</td>
<td>- Official, accepted NWS product</td>
<td>- Subjective description</td>
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<td>- Relatively dense coverage</td>
<td>- Coverage depends on population density and time of day</td>
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<td>- Descriptive language</td>
<td>- Location, time, categorization errors</td>
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<tr>
<td>USGS Stream Gauge Observations</td>
<td>- Objective measure of stream condition (flow)</td>
<td>- Subset of gauges with actual flood stage limited</td>
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<td>- Official, accepted USGS stream flow data</td>
<td>- Differentiating flood/flash flood is subjective</td>
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<td>- Large number of gauges</td>
<td>- Regulation complications</td>
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<td>- Coverage can be sparse, limited to rivers</td>
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<td>mPING Crowd-Sourced Reports</td>
<td>- Potential for dense reports</td>
<td>- Subjective</td>
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<td>- Dependent on participation</td>
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<td>- Quality control issues given non-professional source</td>
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<tr>
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<td>- Differentiating flood/flash flood is not possible</td>
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<td>- Currently sparse coverage</td>
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</tbody>
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USGS Stream Gauges:
1) Flood stage exceeded? 2 year recurrence interval?
2) ‘Sharp’ rate of rise?
3) Basin <2000 km²?
Three-Pronged Real-time Postgres Hydrologic Verification Database

- Database updated every 15 mins
- Creates archive; can request data for user-defined time periods
- Allowed for advancements in FF verification:

Red – flash flood LSR
Blue – flood LSR
Orange – mPING
Magenta - USGS
**Three-Pronged Real-time Postgres Hydrologic Verification Database**

- Database updated every 15 mins
- Creates archive; can request data for user-defined time periods
- Allowed for advancements in FF verification:

  "Practically Perfect" Analysis Technique:
  - Converts point observations into probabilistic forecast areas via Gaussian weighted function
  - Consider including additional data:
    - Heavy rain LSRs
    - Flash flood warnings
    - QPE
  - Consider weighting datasets differently
Expansion of Winter Weather Guidance into Days 4-7

- 2013 Winter Weather Experiment: *Can we accurately predict winter weather at days 4 & 5?*
Expansion of Winter Weather Guidance into Days 4-7

- 2013 Winter Weather Experiment: Can we accurately predict winter weather at days 4 & 5?
Expansion of Winter Weather Guidance into Days 4-7 (2014)

- Day 4-7 Probability of >.1” of frozen precipitation
- 24 hour forecasts: day 4, 5, 6 and 7
- Develop Guidance:
  - Disaggregate WPC Day 4-5, Day 6-7 QPF
  - Use GEFS and ECENS to generate CDF (70 members) to extract probabilities of >.1” QPF
  - Combine with ensemble probability of frozen precipitation from GEFS and ECENS
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Tested in 2014 Winter Weather Experiment

Results were promising...but not perfect:
1) Predictibility diminishes toward day 7 (duh…)
2) Multi-ensemble approach is most effective
   - Guidance was under-dispersed
3) GEFS p-type was problematic
   - Conditional on precip caused problems
4) What else can be done?
   - Different thresholds? Freezing rain?
Expansion of Winter Weather Guidance into Days 4-7 (2015)

- Implemented Day 4-7 Winter Weather prototype (WFOs)
  - Positive feedback; calls for additional thresholds
- Improve probabilistic guidance:
  - Increase ensemble to 90 members (CMCE), consistent p-type

![Graphs showing observed frequency versus forecast probability for 2013-14 and 2014-15]

Courtesy of Mike Bodner, WPC
Expansion of Winter Weather Guidance into Days 4-7 (2015)

- 2015 Winter Weather Experiment:
  - >.5” liquid equivalent in the form of snow
  - > .01” freezing rain

![Map of Winter Precipitation](image1)

![Map of Liquid Equivalent Snow](image2)

![Map of Freezing Rain](image3)
Expansion of Winter Weather Guidance into Days 4-7 (2015)

• 2015 Winter Weather Experiment:
  • >.5” liquid equivalent in the form of snow
  • > .01” freezing rain

• Results were promising.........

![Graph showing the probability of >.50" liquid equivalent in the form of snow for days 4 to 7 in 2015 HMT-WPC Winter Weather Experiment.](image-url)
Expansion of Winter Weather Guidance into Days 4-7 (2015)

- 2015 Winter Weather Experiment:
  - >.5” liquid equivalent in the form of snow
  - > .01” freezing rain

- Results were promising………

![Bar chart showing the probability of >.01" freezing rain over days 4-7 of 2015 HMT-WPC Winter Weather Experiment.](chart)
Expansion of Winter Weather Guidance into Days 4-7 (2015)

- **2015 Winter Weather Experiment:**
  - >.5” liquid equivalent in the form of snow
  - > .01” freezing rain
- **Results were promising………..**
- **What’s next??**
  - Plans go to ‘experimental’ with Probability >.1” Frozen Precipitation product next winter
  - Continue development of additional thresholds
  - Continue development of snow (liquid equivalent) and freezing rain probabilistic products
  - Prototype??