PERSISTENT FLOOD THREAT

Thomas Mazza

National Weather Service, WFO Charleston, WV

Eastern Region Flash Flood Conference, June 2-4, 2010, Wilkes-Barre, PA

OBJECTIVE

Increase accuracy and lead time of Flash Flood Warnings via using GFE

- As a diagnostic tool to assess model information
- To identify areas where moisture content is high relative to 1-hour FFG
- To identify high flood threat potential areas as intersection of atmospheric forcing and high moisture content during the next 6 hours

Use model Information to

- Determine the highest potential for intense rainfall and its location
- Determine whether and where such areas persist over several hours
- Excessive rainfall is most likely where intense rain potential exists for three hours or more, particularly where moisture content is high relative to 1-hour FFG

TECHNIQUE

Dynamics Index

Assess hourly forecast data from locally-run near term models (wrf, RUC, HRRR)
Compute a Dynamics Index to identifies areas of forcing for lift
- Upper Level forcing
  - Divergence
  - Advection of negative divergence*
- Mid level forcing
  - Lift (result of forcing as output by model)
  - Deformation
- Low level forcing
  - Convergence
  - Advection of negative divergence*
  - Moisture flux convergence

Dynamics Index is a basically a middle ground value based on the upper, mid and lower level forcing, with enhancement option for light flow. Forcing in each level based on strongest factor in that level. *Catch slantwise forcing.

Moisture Index

Use either precipitable water or precipitation efficiency as a moisture parameter
- Precipitable water: absolute measure of moisture content in the column
- Precipitation efficiency: degree of saturation

Use FFG as a threshold for the moisture parameter
Moisture index is highest where moisture parameter is highest relative to 1-hour FFG
Moisture index is low or none where moisture parameter is low relative to 1-hour FFG

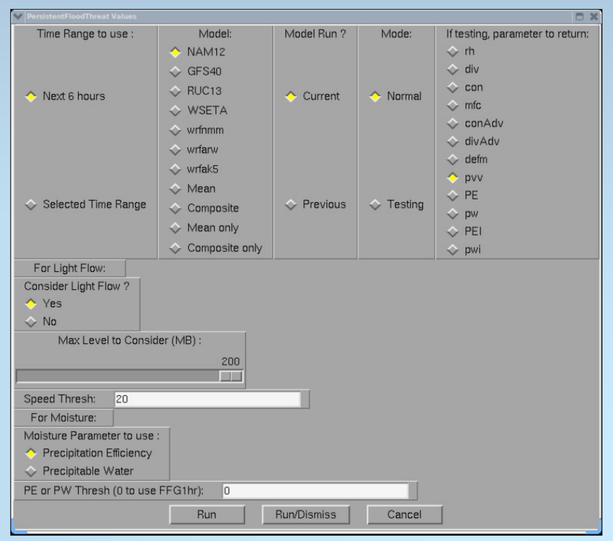
FLOOD THREAT INDEX ("Instantaneous")

Combine Dynamics and Moisture Indices
- Anticipate the potential for flooding where both indices are high
- Lowest of the two
  - More sensitive overall
- Divide the product of the two by 5
  - Most sensitive to the very highest threat areas

PERSISTENT FLOOD THREAT INDEX

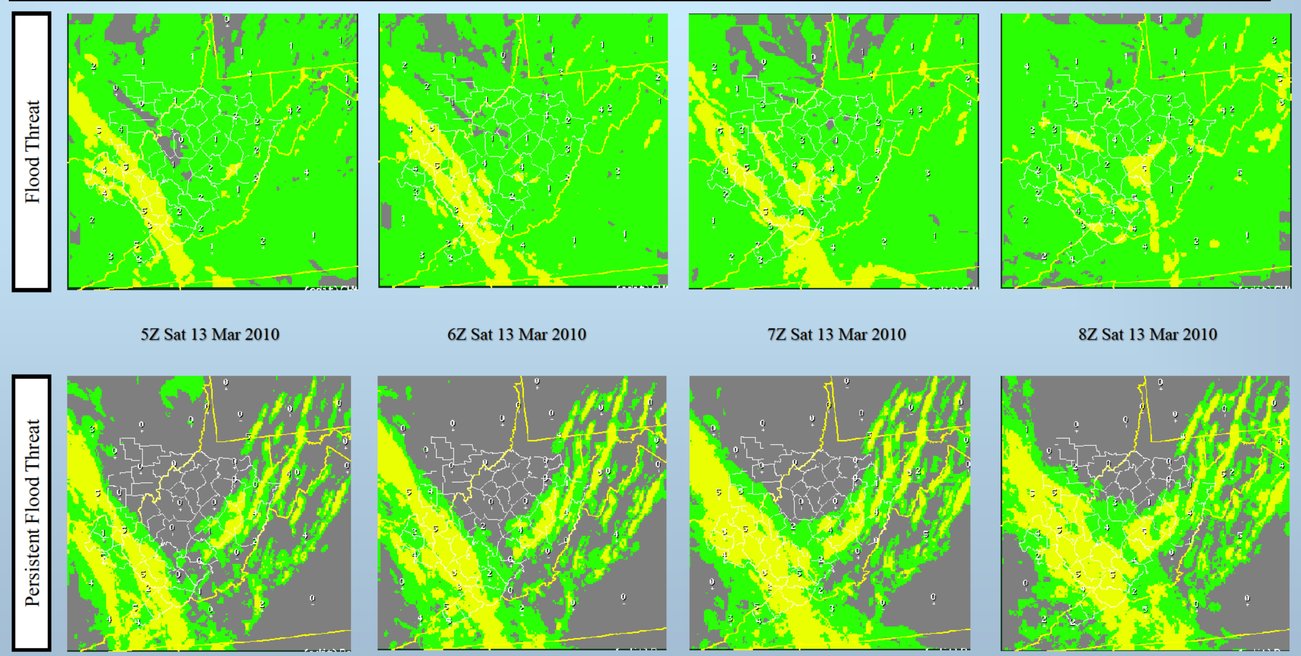
This is a function of the Flood Threat Index
- **current hour**
- **2 previous hours**
- **most recent weighed more heavily**

THE PERSISTENT FLOOD THREAT GRAPHICAL USER INTERFACE

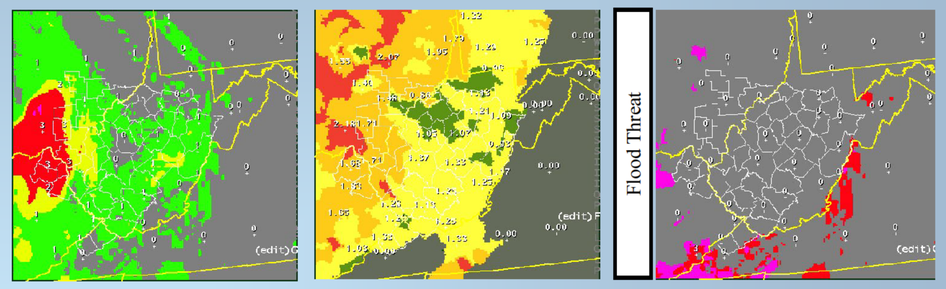


CASE 1

- **Sequence shows how flood threat potential over several hours in the same area leads to a persistent flood threat potential**
- **Models/Tool picked up well on forcing and heavy rainfall**
- **Tool still needed better integration of FFG at the time, which was lowest east, where the flash flooding occurred**



CASE 2



Dynamics Index
15Z Fri 21 May 2010

1-hr FFG
Thu 20 May 2010

15Z Fri 21 May 2010

- **Decent support in the west**
- **High FFG values in the west**
- **Flood threat and persistent flood threat non-existent**
- **Flood threat is high in VA, east of CWA, where Ohio Valley RFC domain ends**
- **FFG was better integrated into the Persistent Flood Index**
- **Low moisture content in relation to FFG wipes out flood potential even in areas of favorable dynamics – is this a good idea or should it just be tapered back some?**

RESULTS

- Have success in identifying forcing correlated with intense rainfall (+RA)
- Digital Small Basin (sub-county scale) low FFG intersected with high moisture content
- Flood threat area accurately shows intersection of dynamics and moisture parameters
- Persistent flood threat accurately tracks areas of flood threat potential over consecutive hours

TO DO

- Use additional cases to calibrate Persistent Flood Threat Index to actual flooding/flash flooding
- Enhance dynamics parameter via use of additional forcing variables
- Combine with Flood Basin Index to identify enhanced flash flood threat based on basin characteristics:
  - Static – slope, use of land, vegetation
  - Dynamic – Snow cover, antecedent precipitation, burn areas, seasonal vegetation state, Persistent Flood Threat (this project)

REFERENCES

1. **Roche, Andy, WFO Charleston, 2010: Atmospheric Favorability for Severe. Not yet published.**
2. Noel, Jim, Ohio River Forecast Center, 2009: Use of Precipitation Efficiency in Forecasting Heavy Rain Potential. NWA.
3. Webb, Nick, WFO Charleston, WV, 2010: Flood Basin Index. Not yet published.