Hydrometeorological Testbed (HMT) Ensemble Modeling

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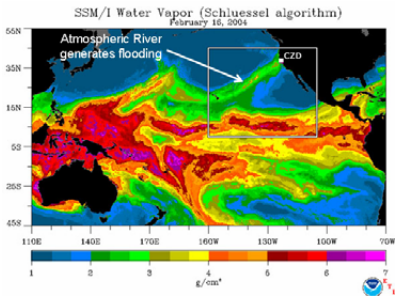
HMT GOAL AND BENEFITS

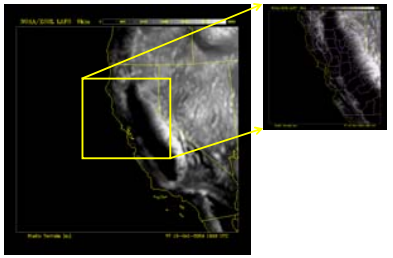
- **HMT Goal** is to improve forecasts of rain and snow and associated hydrology.
- **NOAA Goal** to improve weather forecasts, warning accuracy and increase the amount of lead time as well as to improve water resources forecasting capabilities.
- **Benefits:** impacts on transportation, ecosystems, emergency management, flood control and water supply.



- Significant precipitation events during winter season often caused by a land-falling atmospheric river (AR).

ENSEMBLE DESIGN

- Ensemble design was created by following results from the Factor Separation Method (Jankov et al. 2007)
- 2006 - 2009: High-resolution, multi-model (WRF-ARW and NMM), multi physics (Thompson, Ferrier and Schultz microphysics) and time-lagged ensemble
- 2009 - 2010: High-resolution, nested, multi-model-/physics, multi lateral boundary ensemble



Nested Domain

Outer/inner nest grid spacing 9 and 3 km, respectively. 6-h cycles

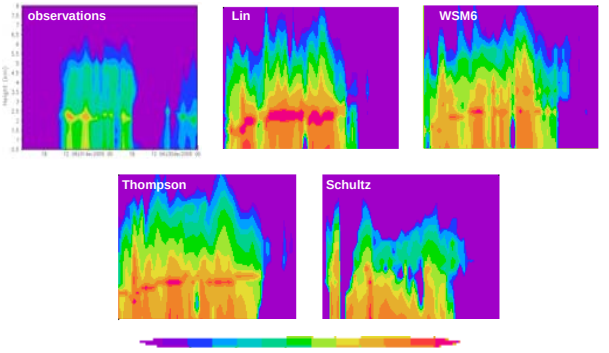
9 ensemble members

Outer nest: 120-h forecast hours

Inner nest: 12-h forecast hours

STUDY OF MICROPHYSICAL SCHEMES FOR FIVE AR EVENTS

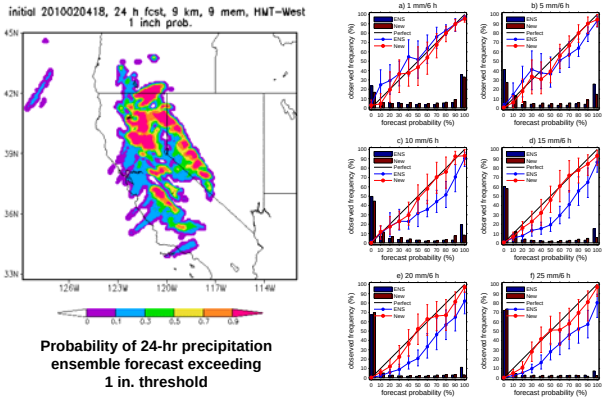
Hourly observed and simulated radar reflectivity (dBZ) at CZD (coastal mountains) for a 48-hour period starting at 00UTC 30 Dec. 2005.



- Bright band was detected by all microphysical schemes, except its intensity and depth were largely overestimated by most of them.
- Similarly, the precipitation accumulations largely differed among model runs using various microphysical schemes.

CALIBRATION OF PQPF

- Post-processing is critical for providing more reliable forecasts.

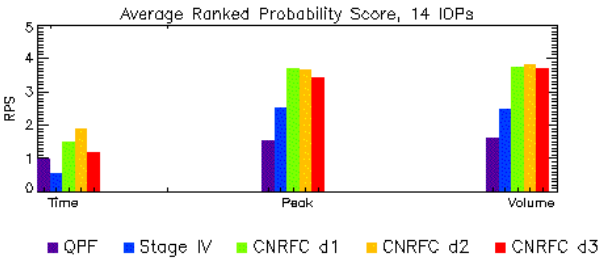


Probability of 24-hr precipitation ensemble forecast exceeding 1 in. threshold

An example of probabilistic QPF (PQPF) calibration by using linear regression. The reliability notably improved after the calibration. Several IOPs were used for training purposes.

APPLICATION IN RIVER FORECASTS

The high-resolution QPF input can add value to the streamflow simulations compared with using the QPE input in a distributed hydrologic model - (TREX) over the North Fork American River Basin.



Ranked Probability Score (RPS, the smaller the better) is computed for using the 0-6 h ensemble mean QPF, 6-h Stage IV, CNRFC day 1 to day 3 forecasts with 14 IOPs during three winters (HMT - 2006, 2007, 2008).

EFFICIENCY AND EFFECTIVENESS

- The QPF can provide forecasts earlier than the QPE, and benefit the decision makers for water resource management.
- All ensemble products are, conveniently for the forecasters, displayed on ALPS work station

SUMMARY

- ESRL/GSD worked collaboratively with the California Department of Water Resources Office of Hydrology, Western Region Weather Forecast Offices, the National Severe Storms Laboratory, and ESRL/PSD to establish the HMT.
- The purpose of the HMT is to design and support a series of field and numerical modeling experiments that help to better understand and forecast precipitation in California.
- The impacts of this effort cover the range of normal rainfall to severe flooding conditions, leading to significant information for improved water management and earlier warning times for flooding and associated landslide potential in surrounding areas.