

Downscaling

Test Bed Leaders

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Test Bed Description

- **Basins:** TBD; suggest a subset of the MOPEX basins, scattered across diverse climate regimes.
- **Space/time scales of interest:** Seek to produce forecasts at individual stations at lead times of 1-14 days. These would be used to produce streamflow forecasts at basins ranging in size from ~500 to 20,000 km²

Experimental Design

Participants will be asked to “downscale” the CDC MRF Reforecast Dataset to produce ensemble precipitation and temperature estimates at individual stations for the selected test basins. Participants should provide downscaled MRF output in a prearranged format (e.g., CF-compliant NetCDF files). The format may be a separate file for each station that has a structure with two variables (precipitation and temperature) with dimensions (forecast initialization time, forecast lead time, ensemble member).

The downscaled MRF output will be used as input to a hydrologic model to produce forecasts of streamflow (suggest using the distributed version of the SNOW-17/ Sacramento model, but any model can be used). This model will include a prearranged method to distribute the downscaled precipitation and temperature estimates across a basin. The model will be configured so it can be run as a “black box” by any of the testbed participants to produce NetCDF ensemble streamflow forecast output (i.e., with identical dimensions to the downscaled model input files produced by the participants). The hydrological model can be run by the testbed leaders, if desired.

Test-bed leaders will compute the following verification statistics

- Climatological Bias
- Climatological space/time/inter-variable correlations
- Reliability, Discrimination for different thresholds
- Brier Skill Score for different thresholds
- Ranked Probability Skill Score
- Ranked Histogram
- Relationships between ensemble spread and forecast skill

Note that participants have no responsibility to run the hydrological model and compute verification statistics themselves. If participants do perform these tasks as part of their methodological development, they are encouraged to document their modifications thoroughly.

Key Scientific Questions

What are the advantages and limitations of different methods for extracting information from Numerical Weather Prediction models, for the purposes of forecasting streamflow?

Key Objectives of the Research Project

- Identify the space-time scales for which forecast skill is present, for different variables, and develop methods to extract and combine information at different space-time scales
- Identify the MRF output variables that can be used to provide sub-grid information—for example, wind and humidity output can be used in a statistical model to replicate orographic precipitation processes, and provide local-scale information that is not present in the raw precipitation output [Clark and Hay (2004) have a table that summarizes the frequency that different variables are used in their regression equations].
- Identify of the sample size required to reliably forecast precipitation, temperature, and streamflow, for different thresholds.

Data Resources

Test-bed leaders will provide

- CDC Reforecast model output for the selected test basins, and example code to read it
- Station data for the selected test basins, and example code to read it
- Example code to define the NetCDF output files (i.e., those files produced by the test-bed participants, that contain ensemble downscaled output at individual stations)
- The hydrologic model, with wrappers around it, so it can read the NetCDF output files and produce forecasts of streamflow
- Verification code that reads the NetCDF output files and computes verification statistics.
- Plotting routines