Verification Testbed

Test Bed Leaders

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Test Bed Description

Cross-cutting test bed on verification methodology and software for hydrological ensemble prediction systems. Compare existing and emerging verification methods for atmospheric and hydrological ensemble forecasts for hydrology and water resources applications, using forecast datasets generated by existing test bed. In particular:

- Compare methods developed by the atmospheric and hydrologic modelling communities, including methods that link single-valued forecast verification and probabilistic forecast verification
- Consider separately the problem of improving the forecasting system, for which we need to evaluate the different sources of skill and uncertainty, from the problem of evaluating whether a forecasting system is useful, for which we need to know how a forecast is used to improve a decision-making process; this includes the selection of key verification metrics and summary scores that could effectively help forecasters and end user in their decision making, as well as techniques for verifying real-time forecasts (before the corresponding observations occur)
- Propose methods which are appropriate for multivariate forecasts (e.g. forecasts issued for more than one location and forecasts providing values for more than one time step) and methods to analyze forecast predictability on multiple space and time scales
- Propose methods to characterize timing error, peak error and shape error in hydrologic forecasts, and develop products for timing uncertainty information that are meaningful to forecasters and end users
- Define a optimal set of benchmarks to compute skill scores for hydrological forecasts
- Propose methods for verifying rare events and specifying sampling uncertainty of verifications scores
- Understand how to account for correlations in predictors and forcing variables
- Propose methods which take into account observational error (both measurement and representativeness errors)

This test bed will consider all time scales from hourly to seasonal forecasts. The focus will be primarily on point/area forecast verification since streamflow and stage forecasts are given at specific points on the river, using forcing input forecasts valid on the basin area. In the future, this test bed could also include grid based verification methods if the forcing inputs to the hydrological model are grid forecasts.

Key Scientific Questions

Which benchmark tests should be used

- To prove the value of a hydrological ensemble forecasting system compared to existing (deterministic or probabilistic) forecasting system

- To assess whether a hydrological ensemble forecasting system is useful for decision-making purposes
- To analyze the different sources of forecast uncertainty and their interactions to help improve forecasting systems

Key Objectives of the Research Project

The final goal of the test bed would be a documented set of algorithms and code for verifying atmospheric and hydrological ensemble forecasts for hydrology and water resources applications. Standard verification products would be proposed to effectively communicate verification information to modelers, forecasters, and end users. This will help improve collaborations between the meteorological and hydrological communities to advance forecast science based on rigorous verification. This will require engaging the community to obtain

1. Hydrological ensemble forecasts and verifying data from participants in other test beds
2. Methods, algorithms and code for verifying these forecasts

Data Resources

1. Test bed participants will have access to
    - Operational ensemble hydrological forecasts issued by Hydro-Québec on subbasins of the Ottawa river basin, which is part of the Great Lakes test bed. This datasets comprises of 46 subbasins and covers the period from March 8, 2006 to November 11, 2008. Daily forecasts are issued for lead times of one to one hundred days [1].
    - Experimental ensemble hydrological forecasts issued by Environment Canada for the same subbasins. Hourly forecasts will be available for lead times of one hour to fifteen days
2. Leaders from other test beds will be asked to contribute their datasets
3. Verification methodology and software will be contributed by:
4. the NOAA/NWS Office of Hydrology Development
5. Environment Canada
6. ECMWF
7. A web page will be set up to present the methodologies and software recommended as well with supporting datasets

Deliverables and Milestones

- June 2009: Progress report and web page
- June 2010: Report on recommended methodologies and software
- 2010: Organize verification sessions at the EGU meeting in Spring and the AGU Fall meeting
- June 2011: Algorithms/code package

Participants/Users

- Vincent Fortin, Environment Canada
- Luc Perreault, Hydro-Québec
- Florian Pappenberger, ECMWF

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[1] This data set includes 46 basins. All of these basins are subbasins of the Ottawa River. A map of the basin is provided on the web page of the Ottawa River regulation planning board: http://www.ottawariver.ca/.

Forecasts start on March 8, 2005 and end on November 11, 2008. Forecasts are daily ensemble forecasts out to 15 days, with 162 ensemble members. The meteorological inputs are generated by a stochastic method which combines a deterministic forecast with climatology. The hydrological outputs are obtained by running these inputs through a lumped precipitation->runoff model. Also available are observations of streamflow (or inflow to the reservoir), min temp, max temp, daily rainfall and daily snowfall from January 2, 1950 to January 5, 2009 for each basin.

Below is a list giving for each basin ID, name, basin area, and location of outlet.

IDBASSIN;NOM;SUPERFICIE;XCOORD;YCOORD
47453; Dozois; 7953;-77.307700;47.612900
47529; Kipawa; 5984;-79.269700;47.041900
47587; Cabonga; 2662;-76.468600;47.309900
47609; Baskatong; 13040;-75.983600;46.717400
47681; Lac Saint-Francois; 9871;-73.908900;45.314100
48200; Mistinikon; 1775;-80.741700;48.005000
48209; Lady Evelyn; 1362;-79.995300;47.460600
48222; Lower Notch et Indian Chute; 3391;-79.454200;47.137500
48239; Rabbit Lake; 737;-79.587200;47.028900
48273; Otto Holden; 2439;-78.723300;46.377800
48292; Riviere Dumoine; 3712;-77.815600;46.345800
48361; Riviere Coulonge; 5154;-76.685800;45.873900
48427; Bark Lake; 2703;-77.788100;45.416400
48443; Kamaniskeg; 3110;-77.515600;45.328100
48463; Mountain Chute; 1486;-76.918300;45.197200
48474; Madawaska-Arnprior; 1190;-76.347800;45.418100
48490; Riviere Mississippi; 2967;-76.123600;45.176400
48532; Chelsea; 1148;-75.777600;45.512800
48544; Riviere Rideau; 3723;-75.697800;45.381700
48631; Riviere Petite Nation; 1338;-75.091400;45.791700
48652; Riviere Rouge; 5470;-74.689700;45.736400
48684; Riviere South Nation; 3762;-74.978900;45.517500
48699; Carillon et Hull; 5583;-74.383700;45.567700
48769; Riviere Kinojevis; 2574;-78.853300;48.366700
48785; Temiscamingue a Angliers; 7299;-79.100300;46.711700
48812; Riviere Blanche; 1753;-79.879400;47.889200
48822; Des Joachims; 3565;-77.697700;46.183500
48847; Riviere Mattawa; 2294;-78.708300;46.316700
48861; Riviere Petawawa; 4065;-77.315300;45.886100
48910; Maniwaki; 4145;-75.966100;46.382800
48935; Paugan; 2790;-75.932000;45.810400
48952; Mont-Laurier; 4176;-75.313900;46.784200
48981; Mitchinamecus; 933;-75.177200;47.214200
48995; Lac du poisson blanc; 1818;-75.648300;46.101400
49017; Kiamika; 709;-75.133300;46.633300
49317; Rapide-2; 789;-78.576800;47.934200

49374; Lac Victoria et lac Granet; 2269;-77.549100;47.844000
49426; Rapide-7; 2820;-78.309700;47.768300
49478; Riviere du Nord; 1163;-74.012800;45.793100
49501; Riviere Chateauguay; 2572;-73.761900;45.331900
53968; Lac des Quinze; 6833;-79.239200;47.553900
53976; Riviere Bonnechere; 2312;-76.564700;45.496400
53977; Chute-des-Chats; 1374;-76.239100;45.475100
53978; Chenaux et Noire; 7537;-76.674100;45.584000
53984; High Falls; 1212;-75.646600;45.841100
53985; Masson; 669;-75.427000;45.578500