Hydrol. Earth Syst. Sci. Discuss., 6, C2019–C2021, 2009
www.hydrol-earth-syst-sci-discuss.net/6/C2019/2009/

Hydrology and Earth System Sciences Discussions

Interactive comment on "An evaluation of the canadian global meteorological ensemble prediction system for short-term hydrological forecasting" *by* J. A. Velázquez et al.

J. Schaake (Referee)

jcschaake@comcast.net

Received and published: 10 September 2009

General Comments

This paper presents a hydrologic application of precipitation ensemble forecasts from the Meteorological Service of Canada's GEM ensemble forecast model to make short term (0-3days) hydrologic ensemble forecasts for 12 watersheds in 5 river systems in Quebec, Canada. The hydrologic model operates at 3hr time steps. Three day, 20 member ensemble forecasts were made for each of 17 forecast days during a wet 20 day period in October, 2007.

The objective of the study was to show that GEM ensemble forecasts could be used to make hydrologic ensemble forecasts that were an improvement over an existing single-value deterministic forecast approach. The only source of uncertainty explicitly considered was uncertainty associated with the atmospheric forcing. Uncertainty in initial hydrologic conditions was not considered. Nor was hydrologic model uncertainty considered – although an objective procedure was used to adjust the forecast hydrographs based on the recent difference between the model simulated and observed hydrographs prior to the forecast period.

The primary measure used to evaluate forecast performance was the Continuous Rank Probability Score (CRPS). This score is a measure of the mean absolute difference between forecast and observed values. For the single-value deterministic forecast it is simply the mean absolute difference. For the ensemble forecasts it is equivalent to a probability weighted absolute difference. Ensemble forecasts that have at least some skill in accounting for the uncertainty that is present in existing single-value forecasts will, in expectation, have a better CRPS than the corresponding single-value forecast. I concur with the authors that the CRPS is a good (perhaps best) choice for the primary measure for this study.

The results clearly show that, by the CRPS measure, the ensemble forecasts are as good as or better than the single-value forecasts for all 12 watersheds. The improvement is greatest where the uncertainty accounted for is greatest (i.e. for longer lead times). For very short lead times there is little or no improvement because the short term forecasts for the first few time steps are dominated by the initial conditions. Although the results obtain from only a single wet period , a total of 14,688 separate, but not independent, forecast events were included in this study. Considering the size of this sample together with the general properties of the CRPS, I think the study succeeded in demonstrating the potential value of GEM ensemble forecasts for hydrologic ensemble prediction.

In this study the authors did not attempt to pre-process or downscale the GEM fore-

HESSD

6, C2019–C2021, 2009

casts. They simply used the raw GEM forecasts. They also did not attempt to post-process the hydrologic model output to account for systematic bias and hydrologic model uncertainty, except to consider the information contained in the most recent model error.

The authors also explore the reliability of the probabilistic hydrologic forecasts using rank histograms and reliability diagrams. But the results have little clear meaning because the sample size of independent information to support this was totally inadequate to be conclusive.

Specific Comment:

Units should be shown in the vertical axes in Figure 2.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 4891, 2009.