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Short-term Ensemble Flood Forecasting Experiments in Brazil

Walter Collischonn (1), Adalberto Meller (4), Fernando Fan (1), Demerval Moreira (2), Pedro Dias (3), Diogo Buarque (1), and Juan Bravo (1)

(1) Universidade Federal do Rio Grande do Sul, IPH, Porto Alegre, Brazil (collischonn@iph.ufrgs.br), (2) Centro de Previsão de Tempo e Estudos Climáticos - INPE, (3) Laboratório Nacional de Computação Científica, (4) Agência Nacional de Águas

Flood Forecasting and issuing early warnings to communities under risk can help reduce the impacts of those events. However, to be effective, warnings should be given several hours in advance. The best solution to extend the lead time is possibly the use of rainfall-runoff models with input given by rainfall and streamflow observations and by forecasts of future precipitation derived from numerical weather prediction (NWP) models. Recent studies showed that probabilistic or ensemble flood forecasts produced using ensemble precipitation forecasts as input data outperform deterministic flood forecasts in several cases in Europe and the United States, and ensemble flood forecasting systems are increasingly becoming operational in these regions. In Brazil, on the other hand, operational flood warning systems are rare, and often based on simpli[U+FB01]ed river routing or linear transfer function models. However, a large number of global and regional meteorological models is operationally run covering most of the country, and forecasts of those models are available for recent years. We used this available data to conduct experiments of short term ensemble flood forecasting in the Paraopeba River basin (12 thousand km2), located in Southeastern Brazil. Streamflow forecasts were produced using the MGB-IPH hydrological model, using a simple empirical state updating method and using an ensemble of precipitation forecasts generated by several models, with different initial conditions and parameterizations, from several weather forecasting centers. A single deterministic streamflow forecast, based on a quantitative precipitation forecast derived from the optimal combination of several outputs of NWP models was used as a reference to assess the performance of the ensemble streamflow forecasts. Flood forecasts experiments were performed for three rainy seasons (austral summer) between 2008-2011. The results for predictions of dichotomous events, which mean exceeding or not flood warning thresholds, showed that the upper quantiles of the ensemble (e.g. 80th and 90th quantiles) over performed the deterministic forecast and even the ensemble mean. In most cases we observed an increase in the proportion of correctly forecasted events while keeping false alarm rates at low levels. This benefit was generally higher for higher flow thresholds and for longer lead times, which are the most important situations for flood impact mitigation. In parallel with the ensemble forecasts studies, a forecasting system platform fully coupled to a GIS tool (Mapwindow GIS) is being developed, which facilitates the system operation and interpretation of results. Currently, this system is being tested, however using only deterministic precipitation forecasts, in two large scale river basins in Brazil: the São Francisco River upstream of Pirapora (60 thousand km2) and the Tocantins River (300 thousand km2). Results obtained in the Paraopeba River are now motivating the incorporation of NWP ensemble outputs in these systems to make probabilistic predictions.