Ensemble flood forecasting on the Tocantins River - Brazil

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The Tocantins River basin is located in the northern region of Brazil and has about 300.000 km2 of drainage area upstream of its confluence with river Araguaia, its major tributary. The Tocantins River is intensely used for hydropower production, with seven major dams, including Tucuruí, world′s fourth largest in terms of installed capacity. In this context, the use of hydrological streamflow forecasts at this basin is very useful to support the decision making process for reservoir operation, and can produce benefits by reducing damages from floods, increasing dam safety and upgrading efficiency in power generation. The occurrence of floods along the Tocantins River is a relatively frequent event, where one recent example is the year of 2012, when a large flood occurred in the Tocantins River with discharge peaks exceeding 16.000m^3/s, and causing damages to cities located along the river. After this flooding event, a hydrological forecasting system was developed and is operationally in use since mid-2012 in order to assist the decision making of dam operation along the river basin. The forecasting system is based on the MGB-IPH model, a large scale distributed hydrological model, and initially used only telemetric data as observed information and deterministic rainfall forecasts from the Brazilian Meteorological Forecasting Centre (CPTEC) with 7-days lead time as input. Since August-2013 the system has been updated and now works with two new features: (i) a technique for merging satellite TRMM real-time precipitation estimative with gauged information is applied to reduce the uncertainty due to the lack of observed information over a portion of the basin, since the total number of rain gages available is scarce compared to the total basin area; (ii) rainfall ensemble forecasts with 16-days lead time provided by the Global Ensemble Forecasting System (GEFs), from the 2nd Generation of NOAA Global Ensemble Reforecast Data Set, maintained by the National Center for Environmental Prediction (NCEP-NOAA) of the United States, are added in the system as additional inputs. This system is one of the first operational ensemble forecasting systems in Brazil, and it is also one of the first based on mixed satellite-telemetric data. This work presents the Tocantins forecasting system and some hindcasting analysis of how recent floods could have been predicted with the use of the ensemble forecasts.