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The FAST-T approach for operational, real time, short term hydrological forecasting: Results from the Betania Hydropower Reservoir case study

Efraín Domínguez (1), Hector Angarita (2), Thomas Rosmann (4), Zulma Mendez (3), and Gustavo Angulo (4)

(1) Pontificia Universidad Javeriana, Departamento de Ecología y Territorio, Bogota, Colombia (e.dominguez@javeriana.edu.co), (2) Pontificia Universidad Javeriana, Doctorado en Estudios Ambientales y Rurales, Bogota, Colombia, (4) Pontificia Universidad Javeriana, Convenio PUJ-EMGESA, Bogotá, Colombia, (3) Emgesa S.A., Bogotá, Colombia

A viable quantitative hydrological forecasting service is a combination of technological elements, personnel and knowledge, working together to establish a stable operational cycle of forecasts emission, dissemination and assimilation; hence, the process for establishing such system usually requires significant resources and time to reach an adequate development and integration in order to produce forecasts with acceptable levels of performance. Here are presented the results of this process for the recently implemented *Operational Forecast Service for the Betania's Hydropower Reservoir* – or ***SPHEB***, located at the Upper-Magdalena River Basin (Colombia). The current scope of the **SPHEB** includes forecasting of water levels and discharge for the three main streams affluent to the reservoir, for lead times between +1 to +57 hours, and +1 to +10 days.

The core of the **SPHEB** is the *Flexible, Adaptive, Simple and Transient Time* forecasting approach, namely ***FAST-T***. This comprises of a set of *data structures, mathematical kernel, distributed computing and network infrastructure* designed to provide seamless real-time operational forecast and automatic model adjustment in case of failures in data transmission or assimilation. Among FAST-T main features are: an autonomous evaluation and detection of the most relevant information for the later configuration of forecasting models; an adaptively linearized mathematical kernel, the optimal adaptive linear combination or **OALC**, which provides a computationally simple and efficient algorithm for real-time applications; and finally, a meta-model catalog, containing prioritized forecast models at given stream conditions.

The SPHEB is at present feed by the fraction of hydrological monitoring network installed at the basin that has telemetric capabilities via NOAA-GOES satellites (8 stages, approximately 47%) with data availability of about a 90% at one hour intervals. However, there is a dense network of 'conventional' hydro-meteorological stages –read manually once or twice per day – that, despite not ideal in the context of real-time system, improve model performance significantly, and therefore are entered into the system by manual input.

At its current configuration, the SPHEB performance objectives are fulfilled for 90% of the forecasts with lead times up to +2 days and +15 hours (using the predictability criteria of the Russian Hydrometeorological Center S/σ_{Δ}) and the average accuracy is in the range 70-99% (r^2 criteria). However, longer lead times are at present not satisfactory in terms of forecasts accuracy.