AGU MEETING OF THE AMERICAS

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Streamflow forecast in the Alto do Rio Doce watershed in Brazil, using hydrological and atmospheric model

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INTRODUCTION AND OBJECTIVE

- In Brazil, the hydropowers accounts for up to 74% of the total electrical energy installed capacity → streamflow forecasts are very important tools.
- Currently, real-time operation of these reservoirs is based on medium range streamflow forecasts produced by statistical models which do not utilize information on precipitation whether observed or forecast.
- SWAT (Soil and Water Assesment Tool) + MM5 for daily forecasts into four Reservoirs in the Alto do Rio Doce Watershed, in Southeast of Brazil, with a drainage area of 20.957 km².

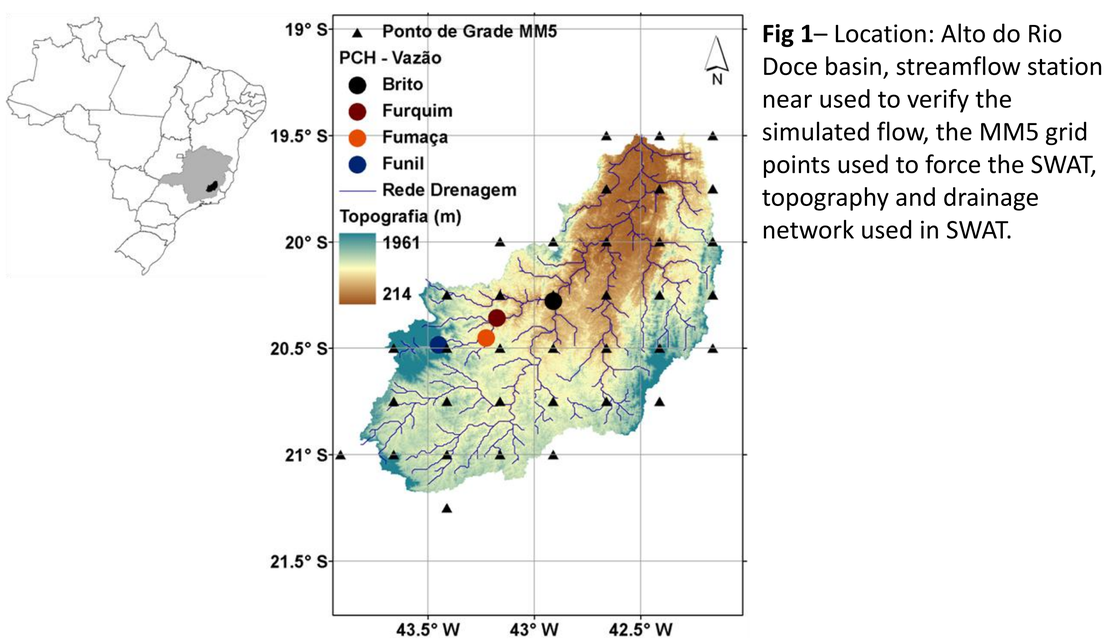

Fig 1– Location: Alto do Rio Doce basin, streamflow station near used to verify the simulated flow, the MM5 grid points used to force the SWAT, topography and drainage network used in SWAT.

METHODS

- SWAT – developed to predict the impact of land management practices on water, sediment and agricultural chemical yields in large complex watersheds with varying sails, land use and management conditions over long periods of time.
- Regional meteorological model MM5 →Temperature, solar radiation, wind velocity and relative humidity.
- Model run for the **2010-2012** period – **apr/2010-set/2011** period used for calibration conducted manually, specially the *surlag* and *alpha_bf*, respectively the surface runoff lag coefficient and the baseflow recession constant.
- The performance analysis was realized using two statistics methodos: Nash – Sutcliffe model efficiency coefficient (NSE) and PBIAS.

$$NSE = 1 - \left[\sum_{i=1}^{n}\left(Y_i^{obs} - Y_i^{sim}\right)^2 \Big/ \sum_{i=1}^{n}\left(Y_i^{obs} - Y_i^{mean}\right)^2\right]$$

$$PBIAS = 100\left[\frac{\sum_{i=1}^{n}\left(Y_i^{obs} - Y_i^{sim}\right)}{\sum_{i=1}^{n}\left(Y_i^{obs}\right)}\right]$$

- Where Y_i^{obs} is the observed streamflow, Y_i^{sim} is the simulated streamflow and Y_i^{mean} is the average streamflow. n represent total number of days of simulation.

RESULTS

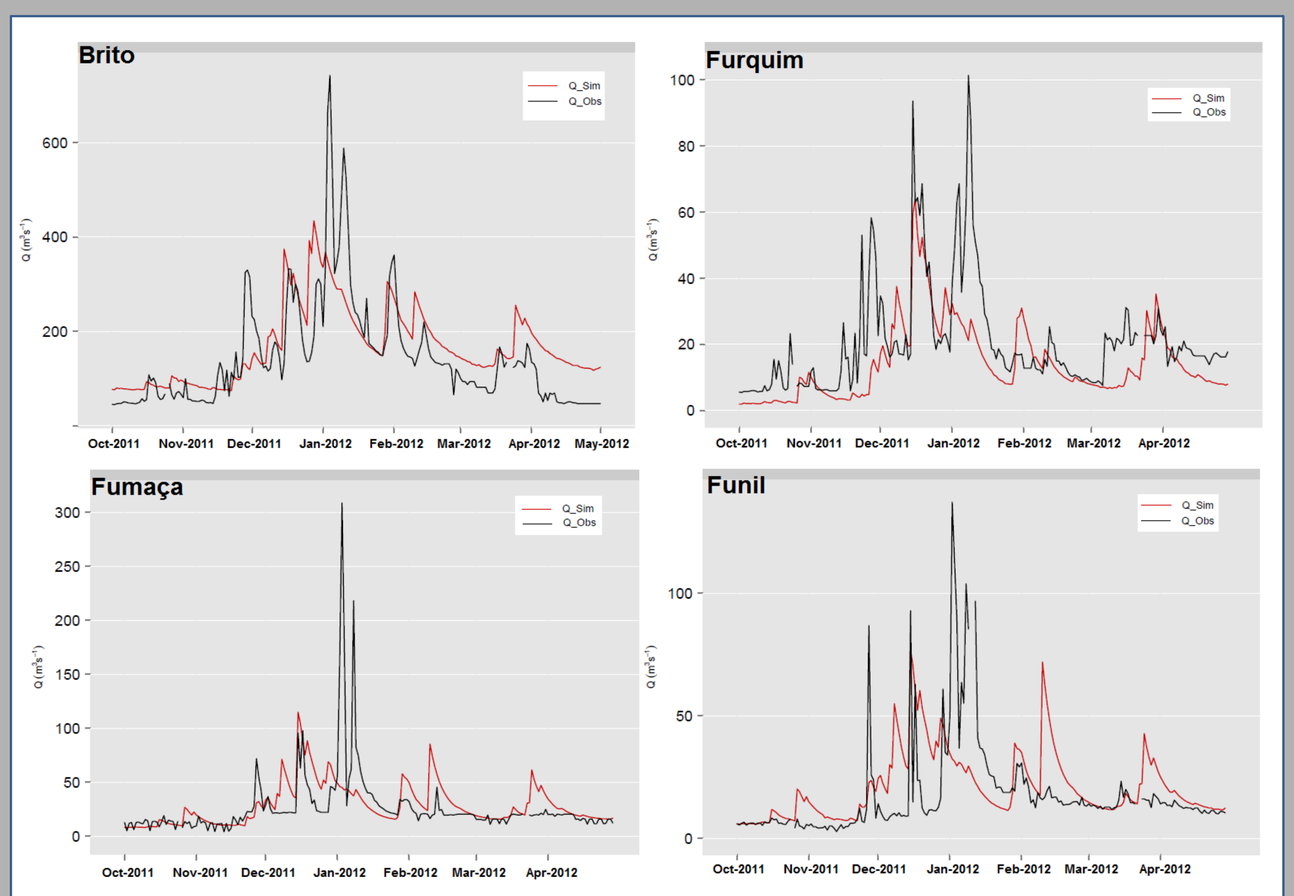

Fig 2– Simulated and observed streamflow for the stations Brito, Furquim, Fumaça and Funil during the evaluation period.

Table 1 – Statistics indices used in the comparison of simulated streamflow and observed in daily and monthly time scale for the four stations located in the Alto do Rio Doce basin.

Station	NSE	PBIAS(%)	NSE	PBIAS(%)
	Daily series(m^3s-1)		Monthly series(m^3s^{-1})	
Brito	0.45	16	0.55	22.7
Furquim	0.25	-31	0.09	-31.1
Fumaca	0.08	9.1	0.05	9.8
Funil	0.13	15.8	0.24	1

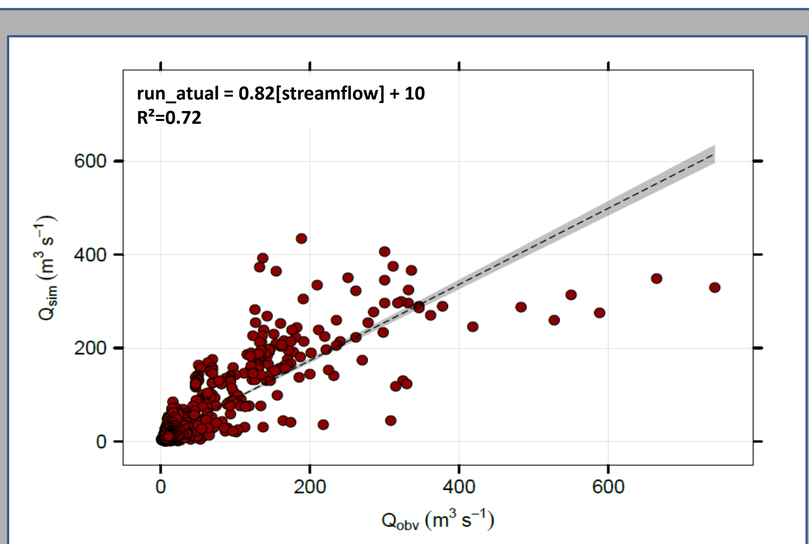

Fig 3 – Dispersion betwen the stations of the simulated and observed streamflow during the evaluation period.

DISCUSSIONS

- Results showed that streamflow forecast was very similar to observations, except in reservoirs with lower drainage areas, where the model did not simulated the beginning of the flood (Dec-Feb).
- The simulated streamflow at Brito Satation was the best represented, in the monthly scale NSE ans PBIAS were 0.55 e 22.7%.
- Model underestimates the observations, generally above 300 $m^3\ s^{-1}$, while for flows below 200 $m^3\ s^{-1}$ model shows a slight overestimation of the observations.
- Events where the model overestimated flow occurred during the recession of the flow, probably associated with the base flow, which should're overestimating the flow.

CONCLUSIONS

- Overall, SWAT model underestimates the streamflow during floods, probably due to rainfall events during this period are not well represented by the atmospheric model.
- No correction in the simulated rainfall by the MM5 model and no automated calibration method was applied to the parameters of the SWAT the streamflow → forecast was shown to be a tool of great potential for real-time operation of reservoirs.