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Forecasting annual maximum water level for Negro River at Manaus

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Variations in water levels of the Negro River, that flows through the Port of Manaus, can cause considerable regional environmental and socio-economic losses. It is therefore critical to advance predictions for water levels, especially flood levels, to provide more effective and earlier warnings to safeguard lives and livelihoods. Variations in water levels in free-flowing river systems, like the Negro follow large-scale precipitation anomalies, which offers an opportunity to predict maximum water levels using observed antecedent rainfall. This study aims to improve the performance and extend the lead time of statistical forecasts for annual maximum water level of the Negro River at Manaus, relative to operational forecasts. Multiple linear regression methods are applied to develop forecast models, that can be issued in March, February and January, with the best possible combinations potential predictors: observed antecedent catchment rainfall and water levels, large-scale modes of climate variability and the linear trend in water levels. Our statistical models gain one month of lead time against existing models, but are only moderately better than existing models at similar lead time. Using European Centre for Medium-Range Weather Forecasts (ECMWF) seasonal reforecast data with our statistical models, further gains an additional month of lead time of skilful performance. Our models lose performance at longer lead times, as expected. Our forecast models can issue skilful operational forecasts in March or earlier and have been successfully tested for operational forecast of 2020. This method can be applied to develop statistical models for annual maximum water level over other free-flowing rivers in the Amazon basin with intact catchments and historical water level record.