Geophysical Research Abstracts
Vol. 12, EGU2010-6662, 2010
EGU General Assembly 2010

Conceptual rainfall-runoff model with limited and low quality data in the Pirai River basin, Bolivia

Alvaro Gonzalez-Sanchez, Mauricio Villazon, and Patrick Willems
(algonzal@vub.ac.be)

In zones where limited data to apply a distributed hydrological model is available, a combination of lumped conceptual models with channel routing may be a useful tool in the support system for catchment planning. In this approach the whole basin is divided into sub basins, and for each sub basin a lumped conceptual model is built-up. In the present case study the lumped model is NAM and the GIS environment is performed by MIKE BASIN which introduces the hydrological modeling tools into ArcGIS 9.2.

Therefore in the Bolivian Amazon, specifically in the Piraí river basin, a confluent of the Amazon River, the MIKE BASIN has been applied for the hydrologic modeling of the gauged sub catchments at daily basis starting in January, 1st 1987 to December 31st 1995.

Nevertheless, due to the low quality data, routines in the data have been executed first. The temperature-based methods proposed by Thornthwaite and Hargraves-Samani have been calibrated to local conditions for the evaluation of the reference evapotranspiration (ETo). A rating curve analysis has also been performed in order to complete the discharge series and to correct clearly identifiable errors.

SEARPI (River Flood Channeling and Control Service) has been the main source for the data base, it consisted of hourly time series of precipitation for 16 stations and daily time series for 25 stations, 3 weather stations with full climatic data, 6 weather stations with only mean daily temperature values and hourly records of water levels for 4 gauging stations.

In general, Hargreaves yields to a more real ETo comparing with the FAO56 than the Thornthwaite method, and could be to the inclusion of the thermal amplitude. However, the aerodynamic factors cannot be fully approximated by the thermal amplitude as it is the case of Viru Viru station.

Calculating the maximum and minimum temperature based on other stations may lead to extra uncertainty, taking into account the local range of the mean temperature and latitude. In order to avoid this, it has been convenient to apply directly the Thornthwaite method with a local correction factor of 1.25.

Afterwards, a monthly correction factor has been introduced to enhance the prediction power of the simplified methods. However this correction factor is not constant throughout the year and whenever possible (at least Tmax and Tmin) the FAO-56 equation should be used.

Regarding the Rating curve, for Colorado gauging station 81 rating curves have identified whereas for Bermejo 26, for the period 01/01/1986 to 12/31/1998. In general the statistics are better for Bermejo than for the Colorado gauging station. Similar behavior is observed in the parameters of the rating curve, where the variability is wider in the Colorado gauging station.

Afterwards, the NAM model using Mike 11 has been calibrated for the gauged catchments of the Pirai River Basin (i.e.: Colorado, Bermejo, Espejos and Angostura) and finally, based on this completely lumped approach of the hydrological cycle the MIKE BASIN rainfall runoff has been calibrated and validated for the

study area.

Statistically, for the calibration period the model has shown NSE values around 0.55 whereas for the validation period this parameter was only 0.40 on the average. Since the model is basically for flood prediction, special attention to high flows has been addressed.

The models present more or less the same behavior at each of the four gauging station, with a general underestimation, a relatively good agreement in the global water balance, good agreement for high flows and an underestimation for low flows.

In general, it can be concluded that the parameters obtained from the lumped approach in the NAM model can be used as a base line for the hydrological model in the GIS environment.