WATER BUDGET USING REGIONAL HYDROLOGICAL MODELLING AND GIS TECHNIQUES IN PERUVIAN AMAZON: CASE STUDY IN YURACYACU WATERSHED-MAYO RIVER

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Abstract In a context of paucity hydrometeorological data in the Peruvian Amazon as one of the main problems for Peru, added that this doesn't allow to know the water yield of it's basins. We propose a regional hydrological modelling approach to estimate the water availability over to 1989-2015 period applied in the Yuracyacu watershed, tributary of the Mayo river. This allowed relating physical catchment characteristics with hydrometeorological variables, thus offering a regional perspective for ungauged areas (e.g. others catchment of the Altomayo region). Differential Tests are used to assess the regional hydrological modelling robustness, showing a satisfactory flow simulate.

Keywords: Regional hydrological modelling, Water budget, Water availability, Watershed.

Methods

Were established mathematical-deterministic models through simple and multiple regressions. The data was interpolate by Ordinary Krigging in 12.5 m x 12.5 m pixels considering altitudinals gradients.

- Potential evapotranspiration was calculate according to (Thornthwaite & Matter, 1967), (Turc, 1961)and runoff deficit regression functions.
- Streamflow were calculate using monthly water balance.
- KGE (Gupta, Kling, Yilmaz, & Martinez, 2009), Nash Sutcliffe (NSE) (Nash & Sutcliffe, 1970), Pearson Correlation Coefficient and BIAS percentage (PBIAS) metrics were evaluated between the observed and simulated series.

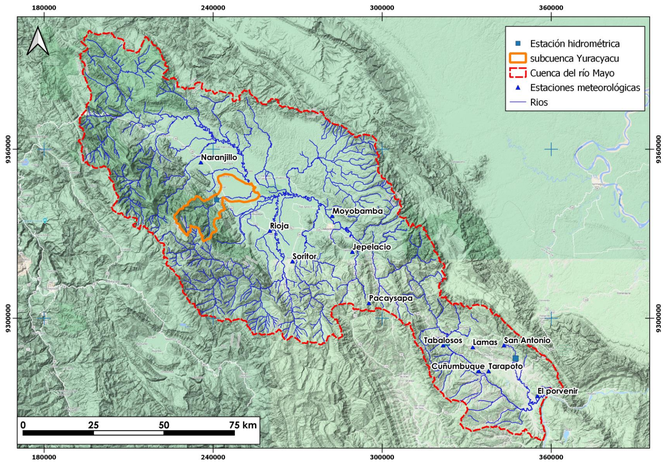

Figure 1: Spatial distributions of hydrometeorological stations – Mayo river basin

Results

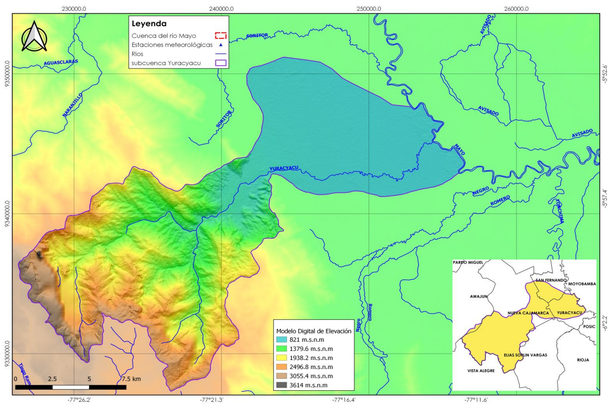

Figure 2: Study watershed

Table 1: Yuracyacu watershed characteristics

Metrics	Yuracyacu watershed
Drainage area (km²)	220.8
Average elevation (m)	1603
Elevation range (m)	900-3400
Average slope (%)	49%
Mainstream length (km)	32
Annual mean precipitation (mm)	1197.3
Annual mean ET (mm)	806.4
Annual mean air temperature (°C)	19.2
Annual mean flow (mm)	381.7

Regional hydrological modelling allowed equations to be defined to determinate annual and monthly values of the main hydrometeorological variables: $\mathbf{P = 252.39\ (H)^{-0.2579}}$, $\mathbf{T = 51.83\ (H)^{-0.117}}$, $\mathbf{E = 0.0002\ (H)^{2.0564}}$, where P is annual precipitation (mm) T is annual average temperature and E is annual runoff (mm).

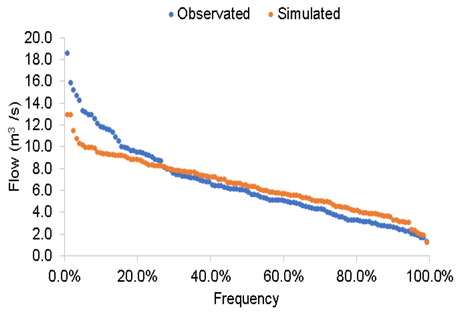

Figure 3: frequency curve

Table 1: Flows(m^3/s) to diferents frequency

Freq	Obs	Sim
5%	13.5	11.4
10%	12.2	10.6
20%	10.1	9.2
30%	8.3	8.0
50%	5.6	6.0
75%	3.5	4.2
85%	2.9	3.7
90%	2.6	3.4
95%	2.4	3.2
99%	2.2	3.0

Conclusions

Regional models can quantify mean values of hydrometeorological variables involved in the water balance with an error of 3%, which is acceptable in regional studies and can be used in hydrological similar regions.

Of the results it was observed that 50% of the precipitated volume is generate in the altitudinal range of 1600 to 2100 m asl. On the other side, our results show high robustness in regional hydrological modelling to produce streamflow, in terms of KGE and NSE acceptable.