ECWS-8 2024 Conference

The 8th International Electronic Conference on Water Sciences

14–16 October 2024 | Online

MDPI

Semi-distributed hydrological modelling of streamflows in the Huancané river using Hidro-BID

Vladimir Guzman Mamani-Arizapana[1,2], Apolinario Lujano[3], Efrain Lujano[2]
[1]Administración Local del Agua Huancané, Autoridad Administrativa del Agua Titicaca, Autoridad Nacional del Agua, Huancané, Peru
[2]Escuela Profesional de Ingeniería Agrícola, Universidad Nacional del Altiplano, Puno 21001, Peru
[3]Autoridad Nacional del Agua, Peru

INTRODUCTION & AIM

Water resource modeling is a key tool in the planning, forecasting and evaluation of variables, policies and strategies, among many other factors. However, one of the main problems is the lack of information that provides sufficient and quality data to be used in hydrological models (Mena et al., 2021).

The Inter-American Development Bank (IDB) offers “the Hydro-BID simulation system that includes hydrological and climatic analysis modules to estimate the availability (volumes and flows) of fresh water at regional, basin and sub-basin scales” (Nalesso and Coli, 2017).

This research aimed to evaluate the semi-distributed hydrological modeling of the Huancané River flows using Hydro-BID.

METHOD

The Huancané River Basin (HRB) is located in southern Peru. Its area is approximately 3631.19 km² and has an altitude that varies between 3806 and 5138 m.a.s.l. The main river, Huancané, runs for 130.4 km from its source, and is oriented mostly from north to south. It is an important tributary of the Ramis River and Lake Titicaca.(Figure 1). The Putina River, one of its main tributaries, contributes its waters to the Huancané river and covers an area of 1,828.8 km²

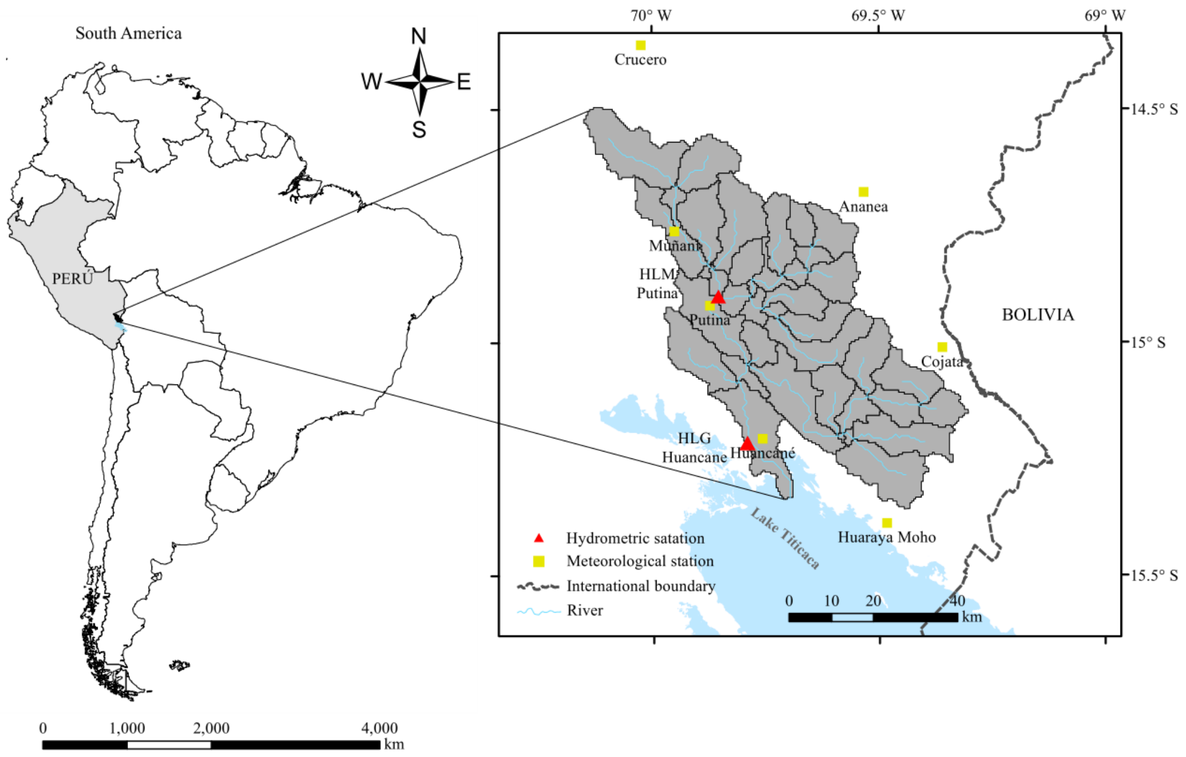

Figure 1. Location of the study area.

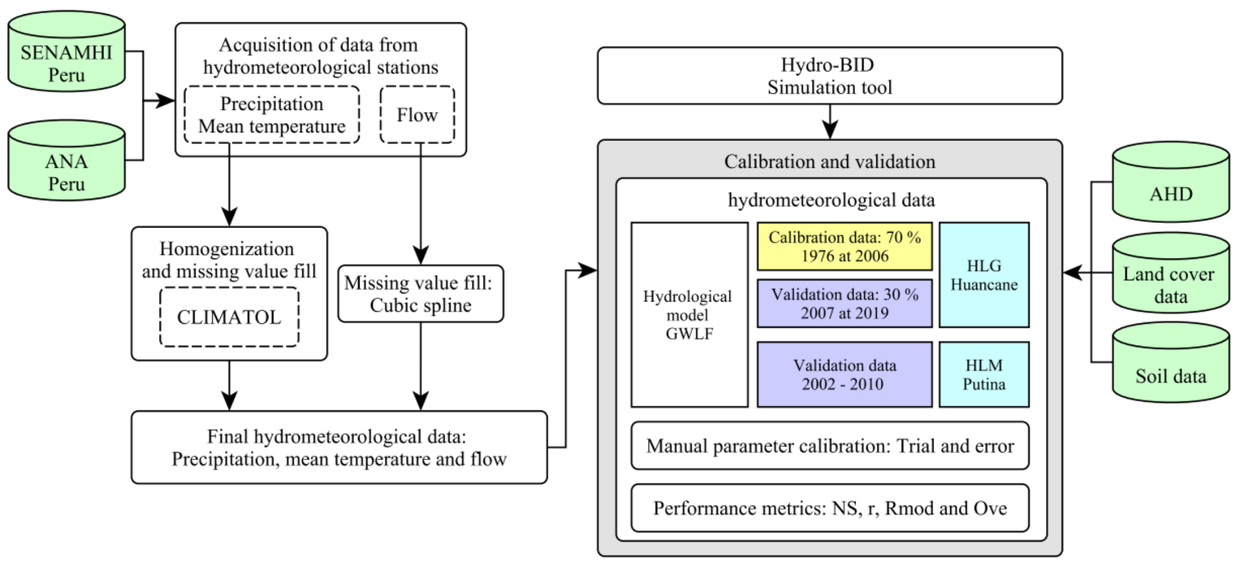

Figure 2. Methodological flowchart.

RESULTS & DISCUSSION

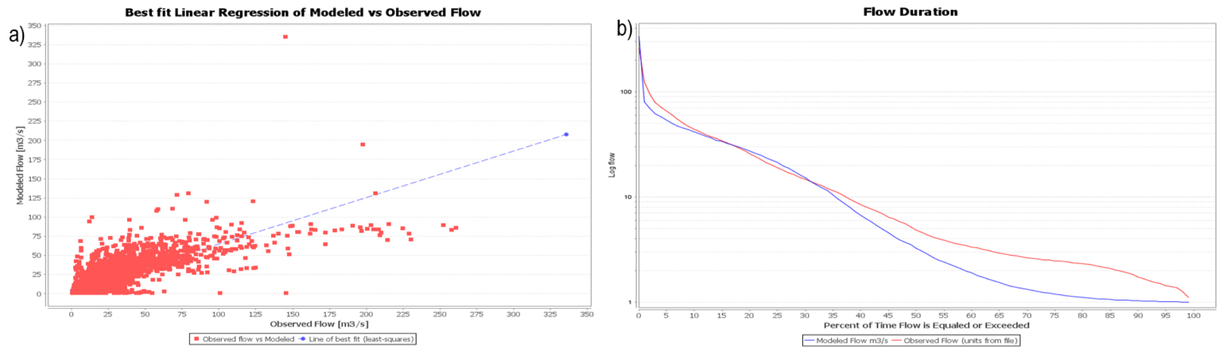

Figure 3. a) Scatter diagram between observed and simulated daily flows and b) duration curves of observed and simulated monthly flows, validation period 2007-2019 – HLG Huancane.

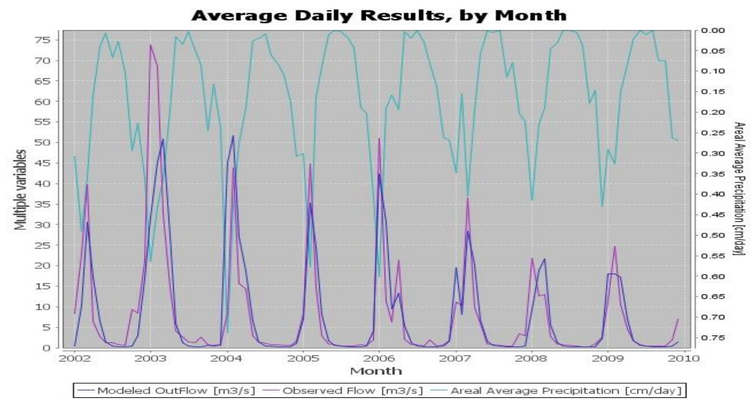

Figure 4. Hydrograph of observed flows and simulated monthly flows for the period 2002 - 2010 – HLM Putina.

During calibration, the model's performance ranged from good to very good, successfully replicating both daily and monthly flows. In the validation period, the metrics remained in the good to very good categories, with daily performance classified as good and monthly performance as good to very good, according to the criteria of Moriasi et al. (2007). Previous regional studies demonstrate the successful use of Hydro-BID in hydrological modeling (Mamani, 2018).

Table 1. Performance metrics calibration and validation period

Performance metrics	Und.	Calibration - HLG Huancane		Validation - HLG Huancane		Validation - HLM Putina
		Daily	Monthly	Daily	Monthly	Monthly
Ove	%	-7.23	-7.08	-12.48	-12.52	14.29
r	-	0.81	0.93	0.82	0.9	0.85
Rmod	-	0.66	0.79	0.62	0.68	0.82
NS	-	0.66 (G)	0.86 (VG)	0.67 (G)	0.79 (VG)	0.69 (B)

Note: G, good; VG, very good

CONCLUSION

The Hydro-BID tool demonstrated adequate performance for simulating flows, becoming a valuable resource for transferring information about flows and assessing water availability in unmonitored areas. This will enable efficient planning of water resources in the Huancané River basin.

REFERENCES

•Mamani Cosi, S. (2018). Modelamiento hidrológico semidistribuido con aplicación de Hydro-BID: caso río Verde Puno - Perú.

•Mena, D., Solera, A., Restrepo, L., Pimiento, M., Cañón, M., & Duarte, F. (2021). An analysis of unmet water demand under climate change scenarios in the Gualí River Basin, Colombia, through the implementation of Hydro-BID and WEAP hydrological modeling tools. *Journal of Water and Climate Change*, 12(1), 185–200.

•Moriasi, D. N., Arnold, J. G., Van Liew, M. W., Bingner, R. L., D., H. &. R., & Veith, T. L. (2007). Model evaluation guidelines for systematic quantification of accuracy in watershed simulations. Transactions of the ASABE, 50(3), 885–900.

•Nalesso, M., & Coli, P. (2017). Hydro-BID, Guia paso a paso. BID, 4.