

Development of a medium-range ensemble streamflow forecasting system in a suite of Andean catchments

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BACKGROUND and PURPOSE

- Data scarcity is a constraint in mountain regions, hindering the development of hydrometeorological operational systems.
- We take advantage of recent developments of local and global products to build a medium-range forecasting framework.
- The pilot system is tested in four catchments between 35-37°S (Upper Maule River Basin).
- This system is aimed to provide weekly streamflow forecasts for agricultural purposes during the spring-summer seasons.



Figure 1. Aerial view of valley in upper Lontue basin, May 2020.

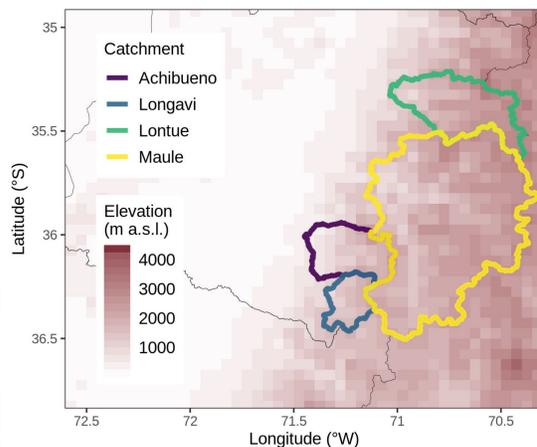


Figure 2. Upper Lontue basin, May 2020.

MODELING SCHEME

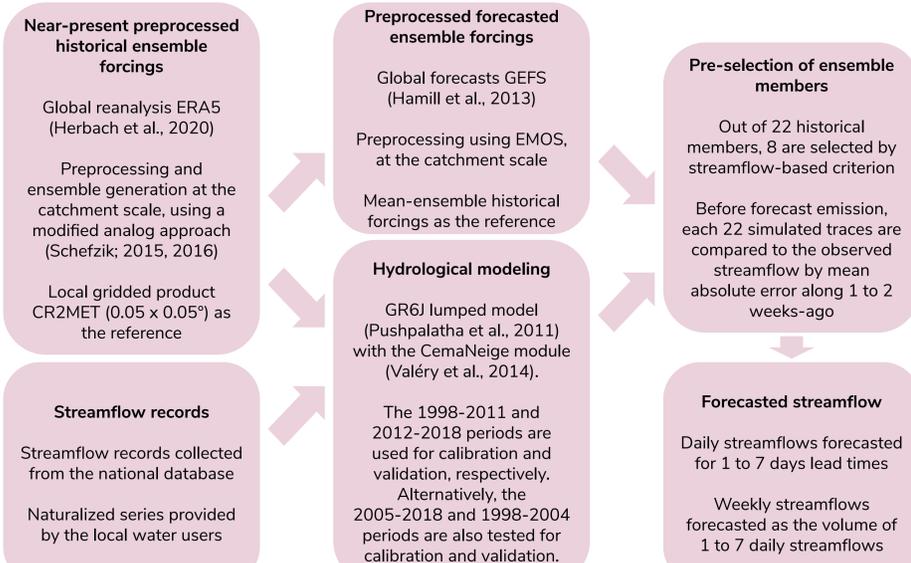


Figure 4. Scheme of the weekly forecasts methodology.

CALIBRATION with ADDITIONAL VARIABLES

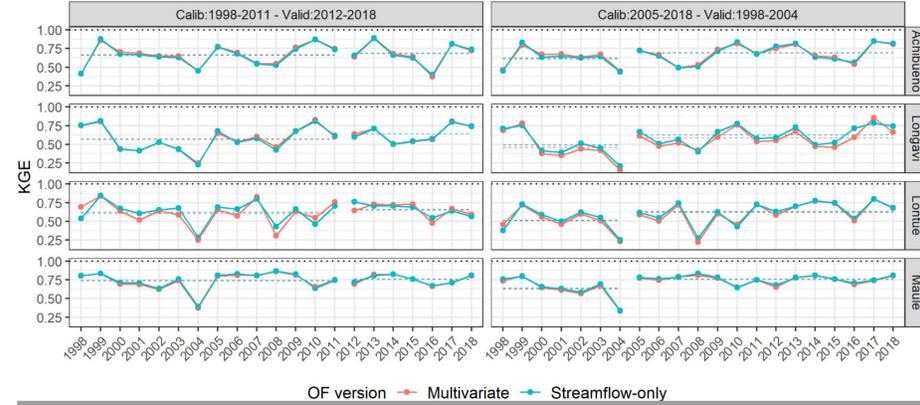


Figure 5. Split KGE for calibration and validation periods in two different arrangements.

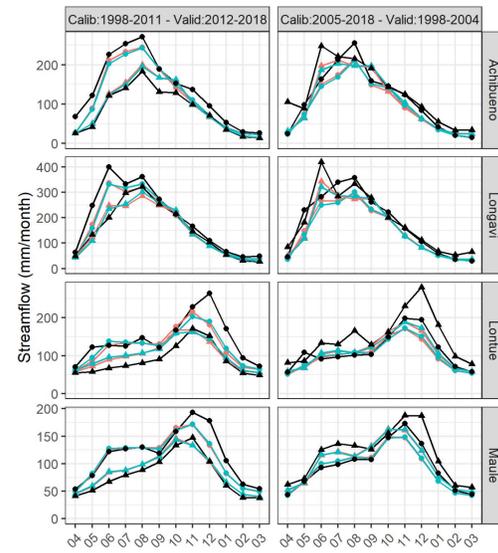


Figure 6. Streamflow seasonality, in two different arrangements for calibration and validation periods.

VERIFICATION of DAILY FLOWS

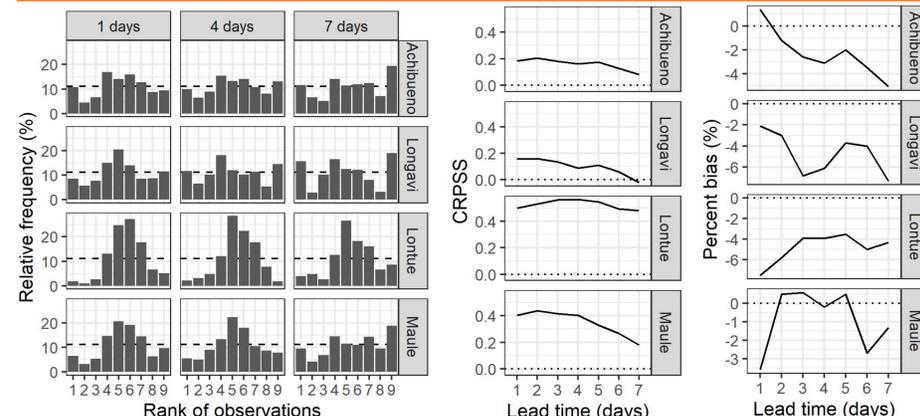


Figure 7. Rank histograms for October-March.

- The streamflow-only objective function (OF) includes efficiency indices (NSE, KGE) using (un)transformed Q, and monthly bias terms.
- The multivariate OF adds efficiency indices for SWE (from Cortés and Margulis, 2017), ET (GLEAM) and SM (ESA-CCI); and SWE monthly bias terms.
- The multivariate OF does not yield clear improvements in streamflow-based efficiency metrics.

VERIFICATION of WEEKLY-VOLUMES

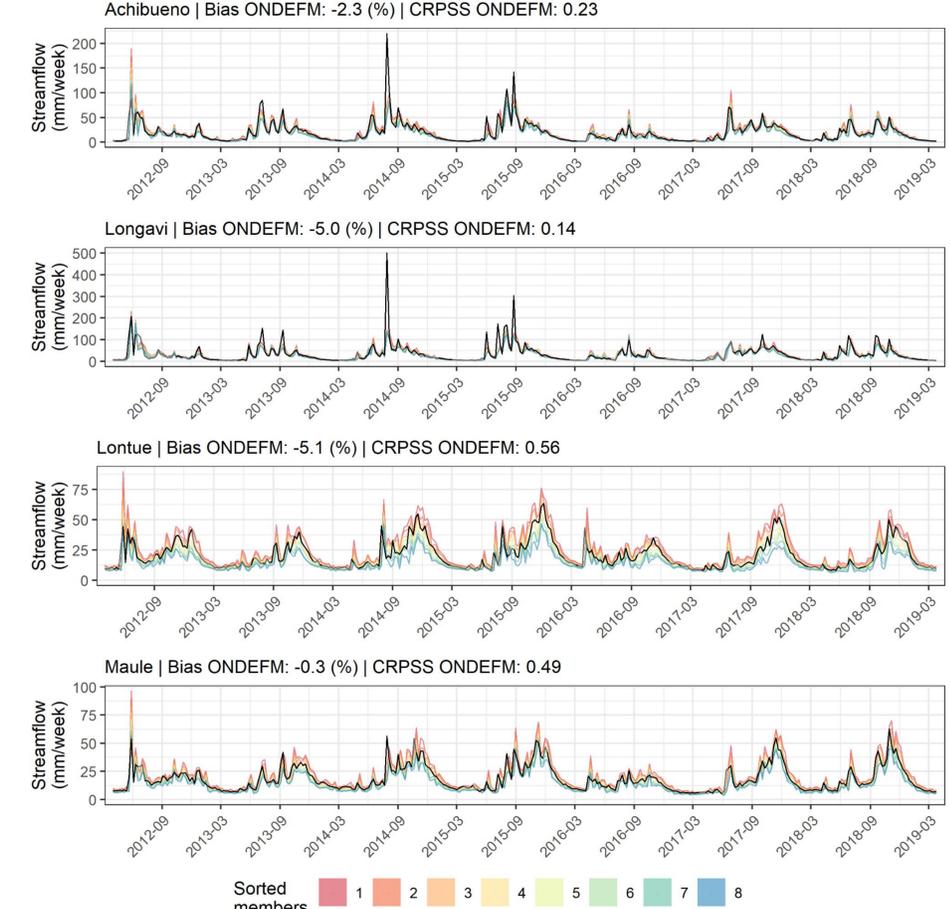


Figure 8. Time series for weekly streamflow forecasts, and results for percent bias and CRPSS during October-March. The black line represents the observed values. Colored lines represent ensemble members. For CRPSS, the reference is the ensemble without pre-selection.

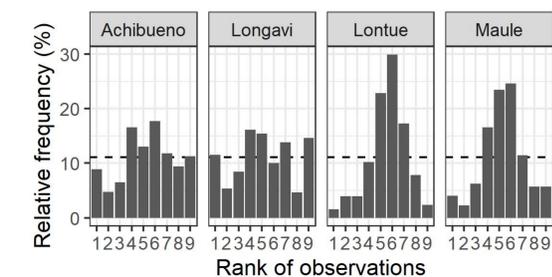


Figure 9. Rank histograms of weekly forecasts for Oct-Mar.

SUMMARY and FUTURE WORK

- Available local and global products have allowed to develop a modeling approach with satisfactory results for operational purposes, even during megadrought conditions.
- We obtain small negative biases for weekly streamflow forecasts during the October-March season (from -0.3 up to -5.1%).
- We are currently revisiting the forecasting approach (e.g., retrospective ensemble precipitation) for including additional basins across Central Chile region.

- Lontue and Maule yield over-dispersive distributions during spring and summer.