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Analysis of remote sensing and in situ datasets to estimate spatial precipitation in high mountain areas: case study Cordillera Blanca, Peru

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The Santa River basin has a climatology that is characterized by strong spatial gradients in precipitation. The influence of topography becomes increasingly important when smaller time scales are considered and convective and orographic processes have a more profound influence. This makes its estimation complex and of relevance for research on precipitation estimation in high mountain environments.

This study focused on estimating precipitation for the Santa basin located north of the capital of Peru, assessing spatial patterns and temporal variation. Precipitation products were used at a daily temporal resolution obtained from remote sensing datasets, including CHIRPS, PERSIANN-CCS, GPM and PISCO, altitude and vegetation products as NDVI-BOKU and GDEM. Also ground-based precipitation data from weather stations were collected from 35 meteorological stations (2012 -2019).

The in situ precipitation data was reviewed, cleaned and quality-checked for processing. The following operations were applied to the raster data: Gaussian filter, resampling at 1km, temporal homogenization (monthly) by accumulating the precipitation products until obtaining the monthly values, and averaging. Afterwards, a linear regression model was built based in which various of the remote sensing datasets served as predictions. The model was validated using the mean square error and the coefficient of determination.

The developed regression model provides a better estimate of the precipitation than the individual precipitation dataset. Overall, the resulting model performs relatively low in the dry season (May-September) but improves considerably in the wet season (October-April), with correlations that go up to 0.95. The outcomes of this research can be used to improve the estimation of precipitation patterns in high mountain regions with complex orography.

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