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Estimating the spatial distribution of precipitation using remote sensing proxies and observed data in a tropical mountainous region

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Understanding the spatial and temporal variability of precipitation in tropical high mountain areas remains a key challenge. Point measurements are often not sufficient to capture the strong gradients in the multiple local factors that determine the distribution of precipitation. Remote sensing data is currently providing a new venue for a better quantification of rainfall patterns. Rainfall satellite products as those coming from the TRMM mission are being continuously improved and an ever increasing amount of high- and medium-resolution remote sensing data are becoming available on biophysical terrain attributes. A methodology is presented that combines two TRMM products and remote sensing data on vegetation and topography to quantify the spatial distribution of precipitation in areas where direct observations are lacking. The approach assumes that vegetation cover, the elevation and satellite-derived estimates of precipitation are reasonable indirect measures of ground-based precipitation. The methodology is evaluated for an area in the Andes of Ecuador. The results show that around 40% of the variance in weekly precipitation is explained by these proxies. During the drier periods of the year, vegetation is the strongest proxy. For the wettest areas, the relation between vegetative cover and precipitation saturates and the other proxies take over in the regression models. A leave-one-out cross-validation procedure was applied to test the performance of the methodology. The performance was satisfactory, and as expected related with the density of the weather station network and temporal rainfall variability. Overall we conclude the methodology is useful for areas with very high variable conditions, where sufficient ground-data is available to establish the relationships with the remote sensing proxy datasets.