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# Effects of time-series length and gauge network density on rainfall climatology estimates in Latin America

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Despite recent advances in the development of satellite sensors for monitoring precipitation at high spatial and temporal resolutions, the assessment of rainfall climatology still relies strongly on ground-station measurements. The Global Historical Climatology Network (GHCN) is one of the most popular stations database available for the international community. Nevertheless, the spatial distribution of these stations is not always homogeneous and the record length largely varies for each station. This study aimed to evaluate how the number of years recorded in the GHCN stations and the density of the network affect the uncertainties of annual rainfall climatology estimates in Latin America. The method applied was divided in two phases. In the first phase, Monte Carlo simulations were performed to evaluate how the number of samples and the characteristics of rainfall regime affect estimates of annual average rainfall. The simulations were performed using gamma distributions with pre-defined parameters, which generated synthetic annual precipitation records. The average and dispersion of the synthetic records were then estimated through the L-moments approach and compared with the original probability distribution that was used to produce the samples. The number of records (n) used in the simulation varied from 10 to 150, reproducing the range of number of years typically found in meteorological stations. A power function, in the form RMSE= f(n) = c.na, where the coefficients were defined as a function of the rainfall statistical dispersion, was applied to fit the errors. In the second phase of the assessment, the results of the simulations were extrapolated to real records obtained by the GHCN over Latin America, creating estimates of errors associated with number of records and rainfall characteristics in each station. To generate a spatially-explicit representation of the uncertainties, the errors in each station were interpolated using the inverse distance weighting method. Furthermore, the effect of the density of stations was also considered by penalizing the interpolated errors proportionally to the station density in the site. The results showed a large discrepancy on rainfall estimate uncertainties among Latin American countries. The uncertainties varied from less than 2% in the Southeastern region of Brazil, to around 40% in regions with low stations density and short time-series at Southern Peru. Therefore, the results highlight the importance of international cooperation for climate data sharing among Latin American countries. In this context, projects aiming at improving scientific cooperation and fostering information based policy such as EUROCLIMA and RALCEA, funded by the European Commission, offer an important opportunity for reducing uncertainties on estimates of climate variables in Latin America.