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Modelling Ecuador's rainfall distribution according to geographical characteristics.

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It is known that rainfall is affected by terrain characteristics and some studies had focussed on its distribution over complex terrain. Ecuador's temporal and spatial rainfall distribution is affected by its location on the ITCZ, the marine currents in the Pacific, the Amazon rainforest, and the Andes mountain range. Although all these factors are important, we think that the latter one may hold a key for modelling spatial and temporal distribution of rainfall. The study considered 30 years of monthly data from 319 rainfall stations having at least 10 years of data available. The relatively low density of stations and their location in accessible sites near to main roads or rivers, leave large and important areas ungauged, making it not appropriate to rely on traditional interpolation techniques to estimate regional rainfall for water balance. The aim of this research was to come up with a useful model for seasonal rainfall distribution in Ecuador based on geographical characteristics to allow its spatial generalization. The target for modelling was the seasonal rainfall, characterized by nine percentiles for each one of the 12 months of the year that results in 108 response variables, later on reduced to four principal components comprising 94% of the total variability. Predictor variables for the model were: geographic coordinates, elevation, main wind effects from the Amazon and Coast, Valley and Hill indexes, and average and maximum elevation above the selected rainfall station to the east and to the west, for each one of 18 directions (50-135°, by 5°) adding up to 79 predictors. A multiple linear regression model by the Elastic-net algorithm with cross-validation was applied for each one of the PC as response to select the most important ones from the 79 predictor variables. The Elastic-net algorithm deals well with collinearity problems, while allowing variable selection in a blended approach between the Ridge and Lasso regression. The model fitting produced explained variances of 59%, 81%, 49% and 17% for PC1, PC2, PC3 and PC4, respectively, backing up the hypothesis of good correlation between geographical characteristics and seasonal rainfall patterns (comprised in the four principal components). With the obtained coefficients from the regression, the 108 rainfall percentiles for each station were back estimated giving very good results when compared with the original ones, with an overall 60% explained variance.