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Daily rainfall and temperature estimation by kriging with external drift in an Alpine Catchment. Sensitivity analysis to the temporal scale adopted to define the variogram models. (southeast Spain)

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The knowledge of the climatic historical variables in a River Basin is essential for an appropriate management of the water resources in the system. Temperature and precipitation are the most important variables from the point of view of the assessment of water availability and its spatially and temporal distribution. The aim of this work is to estimate temperature and precipitation using kriging with external drift (KED). A grid with a spatial resolution of 1 km and a daily temporal resolution has been adopted to estimate values for the period 1980 to 2014 in the "Alto Genil" basin (southeast Spain). The altitude in the catchment changes from 530 to 3100 m a.s.l. The climatic variables depend of the altitude and this variable has been used as external drift. Data from 119 precipitation station and 72 temperature station of the AEMET have been employed. The relationship between the altitude and the variables has been analyzed using the regression function of daily mean precipitation and temperature for annual and monthly scale. Normally the temperature and precipitation increase linearly with the altitude. The relationship between temperature and altitude is clearly linear. In the case of the precipitation there is a value of altitude (approximately 1500 m) from which the precipitation decreases with the altitude (inverse rainfall gradient) for every months with the exception of July that has a linear relationship. This inverse rainfall gradient has been observed in other cases as Andes Mountains, some African high mountains, tropical or subtropical high mountains. Therefore, in the case of the precipitation we have a quadratic external drift and for the temperature we have a linear external drift. The monthly and annual climatic variograms were calibrated in order to study if the climatic variables have a seasonal conduct. The KED allows to obtain an estimation with both models (annual and monthly) for the two variables and we can quantify the sensibility of the obtained values to the variogram applied. The results obtained with both variogram (with external drift using a unique annual climatological variogram versus using twelve monthly climatological variograms) have been compared by using cross-validation. It can be used for checking the effect of different kriging neighborhoods, different types of kriging, different kind of variogram models or different sets of variogram parameters for the same type of model. These comparisons allow determine which variogram is the most adequate and which estimation is the most reliable in the case study. The cross-validation shows that the monthly model is slightly better than the annual model for the temperature and precipitation variables. However the estimated rainfall and temperature maps are similar using the two models.
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