Cokriging to enhance spatial interpolation of rainfall distribution using SMOS satellite soil moisture data

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Rainfall data is essential for accurate description and assessment of the water budget, climate change research, flood modeling, drought management and irrigation scheduling. Conventional tools for quantifying the spatial distribution of precipitation on the surface of the land are rainfall gauges. As a rule, the gauges are sparsely located on the measurement network. The insufficient number of sampling points results in large errors in the estimation of rainfall in a given region. Therefore, methods are required to improve the accuracy of estimating the spatial distribution of rainfall.

The main objective of this study is to evaluate three methods of geostatistical interpolation, i.e. ordinary kriging and cokriging, and inverse distance weighting to improve spatial interpolation of quarterly precipitation in Poland. Particular emphasis is placed on the assessment of the effectiveness of the cokriging method, which uses soil moisture from the SMOS satellite as a secondary variable, in contrast to the other two methods. It is expected that this study will make an important contribution to improving rainfall assessment in Poland by using cokriging methods. Moreover, it will explain how the soil moisture from point to point changes with the rainfall.

We have shown that cokriging is the best method of spatial interpolation in estimating the quarterly distribution of rainfall in Poland. It has the smallest prediction error between the observed and estimated rainfall. This study clearly demonstrates that the use of SMOS product can substantially improve the estimation of the spatial distribution of rainfall in a given area.