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A well engineered implementation of Kriging tools in the Object Modelling Sisytem v.3.

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A well engineered implementation of Kriging tools in the Object Modelling System v.3.

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Abstract: Meteorological forcing data such as rainfall, temperature, solar radiation are the dominant controlling factors of the hydrological cycle. These data are the natural input to hydrological models and their quality and precision affect the accuracy of results.

This study presents a package that implements Kriging techniques for the interpolation of any climatological variables, such as temperature and precipitation.

One of the purposes of the study is to present a geostatistical software product that is easy to use and to plug-in into GEOframe-NewAGE, an open-source, Java-based and component-based semi-distributed hydrological model. Moreover, this work aims to show a practical example of an accurately designed software, in the perspective of reproducible research.

Ten theoretical semivariogram models and four Kriging algorithms were developed and parsed into OMS components. The package provides real time optimization for semivariogram and Kriging parameters.

The software was tested against temperature and rainfall data from 97 meteorological stations located in the Isarco River basin, Italy. For both variables, results showed good fit between model interpolations and observed data. R package, gstat, was then used for a comparison.

Several characteristics make the package a good competitor among the other tools available in literature, since: it can be used as a stand-alone; it can plugged-in the hydrological modelling system GEOframe-NewAge; it can be used with all the OMS compliant components, such as the calibration tools for the optimization of the parameters; it is included a tool for the automatic estimation of errors; results are presented in data formats directly visualized by GIS; it is faster than gstat in every-day use routine.

From the programmer perspective the implementation of Java design patterns, i.e. well described solution to a common software problem, makes the package easily maintainable and suitable for future improvements, such as the possibility of integrating other types of Kriging.

Keywords: GEOframe-NewAge; Kriging; Java; open-source; Reproducibility of research.