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Rainfall Interpolation and Uncertainty Assessment at different Temporal and Spatial Scales

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Spatial interpolation of rainfall over different time and spatial scales is necessary in many applications of hydrometeorology including (i) catchment modelling, (ii) blending/conditioning of radar-rainfall images and (iii) correction of remote sensing estimates of rainfall (for example using TRMM) which are known to be biased, to name three. The specific problems encountered in rainfall interpolation include:
• the large number of calculations which need to be performed automatically
• the quantification of the influence of topography, usually the most influential of exogenous variables
• how to use observed zero (dry) values in interpolation, because their proportion increases with shorter time scales
• the need to estimate a reasonable uncertainty of the modelled point/pixel distributions
• the difficulty of estimating uncertainty of accumulations over a range of spatial scales

The approaches used and described in the presentation employ the variables rainfall and altitude. The methods of interpolation, restricted to 10 controls neighbouring the target, include (i) Ordinary Kriging of the rainfall without altitude, (ii) External Drift Kriging with altitude as an exogenous variable, and less conventionally, (iii) truncated Gaussian copulas and v-copulas, both omitting and including the altitude of the control stations as well as that of the target.

It is found that truncated Gaussian copulas, with the target's and all control the stations' altitudes included as exogenous variables, produce the lowest Mean Square error in cross-validation and, as a bonus, model with the least bias. In contrast, the uncertainty of interpolation is better described by the v-copulas, but the Gaussian copulas have the computational advantage (by three orders of magnitude) which justifies their use in practice. It turns out that the uncertainty estimates of the OK and EDK interpolants are not competitive at any time scale, from daily to annual.