A spatial daily rainfall model for interpolation of raingauge networks using artificial radar fields, for realistic hydrological modelling

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The inherent patchiness and intermittency of daily rainfall make interpolation of sparse point measurements over a catchment very challenging. Usual methods of interpolation of daily rainfall vary from simple numerical averaging through the use of Thiessen polygons to advanced statistical methods such as Kriging. This presentation treats the interpolation problem by conditioning plausible replicas of radar-rainfields on to the point observations and examines the effectiveness of the process by cross-validation. The issues addressed include:

* we use Kriging but we first Gaussianise the point rainfall data with special treatment of the zeros to eliminate skewness

* Kriging gives us estimates of error in the Gaussian domain to show how good/bad are the interpolations and also offers the standard deviation at each pixel in the field

* we choose the form of the [co]variogram to be used in Kriging so as to mimic nature, by using spatial observations given us by radar

* the spatial structure of radar rainfall images is peculiar to the accumulation time:

instantaneous radar images do not have appreciable spatial anisotropy

* by contrast, morphed hourly and daily accumulations of radar images exhibit strong spatial anisotropy

* we determine the characteristics of the daily accumulations of radar rainfall

and find the spatial correlogram characteristics [orientation, range and ratio of minor to major axes] in the chosen region are strongly related to the radar wetted area ratio: RWAR

* to proceed, we simulate correlograms for the chosen day based on the RWAR which is related to the gauge wetness ratio

* simulate Gaussian radar fields based on the RWAR with the same variance as the Kriged interpolations of the point values and conditionally merge them with the gauge values, be they observations or simulations

* to evaluate the worth of the process, we perform cross-validation of spatial field estimates against gauge values in 'leave-one-out' exercises

* the methodology is designed to give a measure of the hydrological response's sensitivity to the uncertainty of spatial interpolation of gauge network rainfall [observed or simulated] by simulating many conditioned spatial replicates, each of which is plausible