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Statistical modelling for rainfall monitoring network optimization

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Monitoring networks efficiency are assessed in terms of estimates variance. Geostatistical models, such as Kriging, are able to assess both the estimates variance and the residuals variance, giving a measure of estimates accuracy and identifying networks' areas of low efficiency. In many cases it is necessary to transform the estimator in order to verify the hypothesis of linearity and rainfall fields structure identification is frequently complex because of rainfall extreme variability. The interaction between morphological features and wet air masses circulation is moreover an important factor to be accounted for in analysing rainfall fields. With reference to typical Mediterranean extreme precipitation events (baroclinic cyclo-genesis), rainfall non linearity can be described by a meteo-morphological model which account for both precipitation events dynamic and orographic effects (Tropeano et al., EGU 2005). It assumes rainfall amplification factors, compared with typical interpolation techniques, depending on the event type. We propose a methodology to assess monitoring networks estimation efficiency, using corrected estimation weights based on external variables, such as the average slope for upwind hillslopes and the distance from the crest line for downwind hillslopes. For a existing monitoring network and for a given estimates variance field, the procedure individuates optimal sites among existing ones and further optimal gauging sites, as a function of estimates accuracy, in order to plan network expansion. The methodology will be applied to an existing rainfall monitoring network in Southern Italy, where rainfall fields are strongly affected by orographic effects.