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A scale-invariant extreme value model of rainfall Intensity-Duration-Area-Frequency relationships in the Cévennes-Vivarais region

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In recent years, Mediterranean storms have caused serious damages to people and infrastructure in southern France. Preventing these damages requires knowing how likely such storms are, i.e. computing their probability of occurrence, or return period. Different temporal and spatial scales are usually involved in extreme rainfall events. Thus, complete risk evaluation in a region involves the computation of return levels as a function of duration and area. This is precisely what provide the Intensity-Duration-Area-Frequency (IDAF) curves. We propose in this presentation a regional study of IDAF relationships of annual rainfall maxima in southern France. For this we develop a regional extreme value IDAF model based on space-time scale invariance hypotheses and allowing to link the statistical distributions of rainfall maxima over any duration and area. This provides in particular an analytical expression of the Areal Reduction Factor (ARF) which expresses how the statistical distribution of rainfall maxima changes when the area increases, for any fixed duration. This model is applied to radar reanalysis data covering the Cévènnes Vivarais region in southern France with data back to 2008. We estimate the IDAF relationships around any radar pixel in the region in the range 3h-24h and 1km^2-2025km^2. We obtain in particular a spatial distribution of the ARF which allows to highlight different areal extreme regimes in the region. The overall IDAF model provides a regional quantification of areal rainfall risk for the continuum of area and duration.