



Multivariate regional flood envelopes for design flood-estimation at ungauged sites

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Castellarin et al. [WRR, 2005] present a probabilistic interpretation of the regional envelope curve (REC), that relies on an extension of the index-flood hypothesis, and propose an estimator of the exceedance probability associated with an REC that accounts for the impact of inter-site cross-correlations of floods. A probabilistic interpretation of a REC avoids the need to extrapolate an assumed at-site flood frequency distribution when estimating a design event and it enables one to estimate the T-year flood for any ungauged sites in the region from the catchment area alone. A generalisation of that approach is presented, where the original assumption of dependence of a record flood on catchment area alone is relaxed, leading to a Multivariate Regional Flood Envelope (MRFE). MRFE are multivariate envelope surfaces that represent the bound of flood experience in a region in terms of geomorphologic and climatic characteristics that are determinants of the flood frequency regime (e.g., catchment area, morphological factors, climate indicators, etc.). We derive an empirical MRFE for a group of some 60 unregulated catchments located in northern-central Italy and, for the same case study, we discuss advantages and disadvantages of estimating the design flood at ungauged sites by using MRFE instead of traditional regional flood frequency analysis procedures.