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Towards hierarchical process-based classification of runoff events

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A wide variety of processes controls the time of occurrence, duration, extent and severity of river runoff events. Classifying runoff events by their causative processes may assist in enhancing the accuracy of local and regional flood frequency estimates and support the detection and interpretation of changes in the occurrence and magnitudes of floods. Most of the existing causative typologies are based on classifications of lumped characteristics of runoff events, such as amount, duration, intensity and date of occurrence of their triggering event (i.e. rainfall or snowmelt). To make causative typologies more useful for understanding and estimating floods we attempt to develop an automated hierarchical classification framework exploring the potential of space-time characteristics of rainfall and snowmelt dynamics and additionally considering patterns of antecedent catchment wetness. A preliminary analysis is performed on national scale considering 400 catchments in Germany and more than 200,000 individual runoff events. We examine consistency of event classification catchment-wise (i.e. along river networks), to avoid obtaining diverse classification for runoff events triggered by the same atmospheric event, and account for possible mixing of different event types moving downstream. We explore the discriminative power of the characteristics used for classification purposes and compare the proposed framework with the most prominent multi-criteria classifications of causative typologies, which use both manual (i.e. expert-based) and automated methods, to assess the value of space-time characteristics used in the proposed framework for several river networks.