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A DISTRIBUTED RAINFALL-RUNOFF MODEL FOR THE INVESTIGATION OF CLIMATE CHANGE EFFECTS ON RIVER FLOODS IN THE EUROPEAN ALPS

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Abstract

The worsening of global climate change has increased both the frequency and intensity of extreme weather events, significantly impacting the dynamics of flooding. This convergence of factors results in intensified and prolonged precipitation, leading to river overflow and catastrophic floods. Elevated temperatures and rapid snowpack melting further contribute to the increase of flood risk. These impacts are particularly pronounced in mountainous regions, where the combination of steep terrain and increased precipitation amplifies the risk of flash and snowmelt generated floods.

The *CLIM2FLEX* project aligns with this intricate and evolving context, aiming to assess, under potential climate scenarios, the variations in the frequency and intensity of river floods generated by various mechanisms, and the possible correlations with climatic indices. Within the project framework, a crucial aspect involves constructing a modeling chain, complete with a hydrological module. This component is dedicated to translating climate inputs into continuous discharge time series, enhancing the project's capacity for in-depth analysis and dynamic modeling.

To do so, the main idea is to use a “modified version” of the *"TUWmodel"* conceptual hydrological model to account for the inter-basin transfer of water and flood waves propagation (from upstream catchments to downstream catchments) through the implementation of a new routing routine based on the introduction of a Nash-Cascade module. Different calibration strategies are used at gauged sites to estimate the best model parameters. A machine learning based regionalization approach (*HydroPASS*) is then applied to infer model parameters at ungauged sites for hydrological streamflow predictions.

The focus of this study encompasses the entire Great Alpine Region (*GAR*), posing significant modeling challenges: the region is in fact predominantly characterized by mountainous terrain, consisting mainly of small catchments. Here, the effects of snow accumulation-melting cycles, as well as the presence of glaciers and other small-scale features, play a particularly crucial role.

The presentation will delve into preliminary findings concerning the applicability and reliability of the proposed hydrological modeling chain structure, into the availability and quality of the data for the region of interest (both discharge for calibration and distributed climate input products), and into the first results of the developed model.