

Combining data sources to characterise climatic variability for hydrological modelling in high mountain catchments

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Robust hydrological modelling of high mountain catchments to support water resources management depends critically on the accuracy of climatic input data. However, the hydroclimatological complexity and sparse measurement networks typically characteristic of these environments present significant challenges for determining the structure of spatial and temporal variability in key climatic variables. Focusing on the Upper Indus Basin (UIB), this research explores how different data sources can be combined in order to characterise climatic patterns and related uncertainties at the scales required in hydrological modelling. Analysis of local observations with respect to underlying climatic processes and variability is extended relative to previous studies in this region, which forms a basis for evaluating the domains of applicability and potential insights associated with selected remote sensing and reanalysis products. As part of this, the information content of recent high resolution simulations for understanding climatic patterns is assessed, with particular reference to the High Asia Refined Analysis (HAR). A strategy for integrating these different data sources to obtain plausible realisations of the distributed climatic fields needed for hydrological modelling is developed on the basis of this analysis, which provides a platform for exploring uncertainties arising from potential biases and other sources of error. The interaction between uncertainties in climatic input data and alternative approaches to process parameterisation in hydrological and cryospheric modelling is explored.