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Constraints of resolution and spatial discretization of field experiments and models on process understanding in mountain catchments

C. de Jong (1), U. Strasser (2) and D. Lawler (3)

(1) Department of Geography, University of Bonn, Post Box 1147, 53001 Bonn, Germany (dejong@giub.uni-bonn.de, +49(0)228 73-7506), (2) Faculty for Geosciences, Ludwig-Maximilians University of Munich, Germany, (3) School of Geography, Earth and Environmental Sciences, University of Birmingham, UK

The value of integrating high-resolution, multi-point field monitoring of meteorological, hydrological, hydrochemical, geomorphological and seismological data for understanding the dynamics and significance of extreme hydrological events in mountain catchments can be demonstrated for many examples, including floods, mass movements, jökulhlaups or droughts. Due to a lack of high resolution monitoring and modelling, many features remain unexplained. It is often recognised that grid sizes of Digital Elevation Models (DEM) are too large for mountainous catchments. For example, if their resolution is too low (i.e. the resolution of the grids is too coarse), several problems can be encountered: key parts of the catchments, catchment boundaries and river confluences may not be well represented. High resolution DEMs are also important for determining the density of the river network. In mountain catchments that are typically highly incised, the density of first and zero order streams is very important for determining the runoff paths during storm flow. It is not so much the absolute height differences that are important but the relative height differences of the subcatchments, especially if these have steep slopes. Even if a high resolution means a large amount of data, these can be aggregated later into Hydrological Response Units and it is important to keep in mind that the spatial discretization usually only has to be carried out once at an early stage. The parameter files are incomparably smaller than their input layers. Both for discharge and evapotranspiration calculations, a high spatial resolution is necessary if the cumulative importance of highly contrasting different spatial units is to be correctly calculated. Abrupt breaks associated with cliffs, rock faces and

steep river embankments may not be represented in the digital terrain model unless the resolution is high enough. It remains without question that breaks in mountain catchments are often associated with zones that are highly impermeable and/or induce very fast overland flow. Depending on the geological stratification, steep areas can also contribute to fast interflow. Examples for mountainous catchments will be drawn from the Upper Draa above 1500 m in the High Atlas of Morocco, Durance catchment in the French Alps, and UK and Icelandic basins.