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Modelling future runoff and sediment transport in alpine torrents

Stefanie Peßenteiner (1), Clemens Dorfmann (2), Sebastian Gegenleithner (2), Joachim Götz (1), Paul Krenn (1), Oliver Sass (1), Josef Schneider (2), and Wolfgang Schöner (1)

(1) Karl-Franzens-Universität Graz, Department of Geography and Regional Science, Austria (stefanie.pessenteiner@uni-graz.at), (2) TU Graz, Institute of Hydraulic Engineering and Water Resources Management, Austria

Sediment-laden torrential floods are among the most important natural hazards in Austria. In 2016 almost 90% of all natural disaster events in Austria were directly linked to water in torrential catchments. Climate change in the Austrian Alps makes it necessary to expand and reassess protection measures. Future projections of the Alpine climate show increasing precipitation in winter and stronger convective precipitation events in summer, even if the aspired warming thresholds of the Paris Agreement were reached. However, the impact analysis of increasing extreme precipitation on flood events in small alpine catchments is still challenging and the knowledge of the subsequent effects on sediment transport is still deficient.

We present the recently started project RunSed-CC which aims at assessing climate change impacts on runoff and sediment yield in alpine catchments. The project brings together hydro-climatologists, hydraulic engineers and geomorphologists to model the hydrologic response of the torrential Schöttlbach catchment (71km^2) in the Niedere Tauern mountain range in Styria, Austria. A coherent model chain from rainfall-runoff to hydrodynamics with sediment transport is being developed. Output from the hydrological model WaSiM together with observed data on the evolution of sediment source areas will serve as drivers for the 2D depth-averaged numerical models Telemac-2D (hydrodynamics) & Sisyphe (sediment transport). WaSiM will be forced by the novel ÖKS15 dataset using a scenario coming close to the Paris Agreement (rcp4.5) and a high-end emission scenario (rcp8.5). The research on possible impacts of future climate change on the hydrologic regime, changes in sediment dynamics and sediment yield of the basin as well as associated model uncertainties constitute the core focus of this work.

At the start of our project period an exceptional torrential event (Aug 2017) mobilized huge amounts of sediments from loose glacigenic deposits in the lower reaches, altered slope-channel coupling and caused considerable damage. The event has probably induced a system shift towards quicker and stronger reaction to rainstorms in the future. We responded to the new situation by re-mapping the channel reaches and generating new surface models. With our transport models we will analyze and compare the pre-event and the post-event situation in the catchment.