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Using virtual reality to visualize extreme rainfall events derived from climate simulations

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Virtual reality (VR) is an emerging and powerful tool to visualize and explore complex scientific data sets in an intuitive, interactive and user-friendly manner. In this study, we explore the usage of VR to create an immersive visualization of hydrological extreme events based on climate simulations. We aim to make use of the added values of VR to promote the communication of scientific results on potential natural hazards to the public.

The visualization data are taken from climate simulations within the ClimEx project, which is an international collaboration between research facilities, universities and public water agencies in Bavaria and Québec. The project investigates the effects of climate change on meteorological and hydrological extreme events and implications for water management in the two regions. Within this project, an ensemble of 50 transient runs of the regional climate model CRCM5 were run at approximately 11 km spatial resolution for two domains in Europe and North America from 1950 to 2100. As each of these runs is initialized with only slightly altered starting conditions, this ensemble can be interpreted as modelled natural variability. From this data set, we extracted precipitation data regarding one historical flooding event, the Pentecost flood in Southern Germany and Austria in May 1999, as well as precipitation data for two designated future intense rainfall events in the 2060s and 2080s for the same region. Data for these three extreme rainfall events were visualized in VR using a 3D representation of topography of the region of interest as the background. This VR representation was enhanced with satellite images (on top of the topography), points of interest (for easier navigation) and images of the historic Pentecost flood event (for emphazising the impact of the flood event).

We will present the necessary steps to create this immersive virtual reality 3D visualization from the raw scientific data and discuss several aspects of the visual design and the adopted user interface.