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An inventory of glacial lakes in the Austrian Alps

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The formation of lakes is one of the consequences of glacier retreat due to climate change in mountain areas. Numerous lakes have formed in the past few decades in many mountain regions around the globe. Some of these lakes came into focus due to catastrophic hazard events especially in the Himalayas and the Andes. Glacial lake development and lifetime is controlled by the complex interplay of glacier dynamics, geomorphological process activity and geological boundary conditions. Besides the hazard potential new lakes in formerly glaciated areas will significantly contribute to a new landscape setting and to changing geomorphologic, hydrologic and ecologic conditions at higher alpine altitudes.

We present an inventory of high alpine lakes in the Austrian Alps located above an altitude of 1700 m asl. Most of these lakes are assumed to be of glacial origin, but other causes for development, like mass movements are considered as well. The inventory is a central part of the project FUTURELAKES that aims at modelling the potential development of glacial lakes in Austria (we refer to the presentation by Helfricht et al. during the conference for more details on the modelling part). Lake inventory data will serve as one basis for model validation since modelling is performed on different time steps using glacier inventory data. The purpose of the lake inventory is to get new insights into boundary conditions for lake formation and evolution by analysing existing lake settings. Based on these information the project seeks to establish a model of lake sedimentation after glacier retreat in order to assess the potential lifetime of the new lakes in Austria.

Lakes with a minimum size of 1000 m^2 were mapped using multiple aerial imagery sources. The dataset contains information on location, geometry, dam type, and status of sedimentation for each lake. Additionally, various geologic, geomorphic and morphometric parameters describe the lake catchments. Lake data is related to glacier inventories and paleo-limnologic information to get an idea of the lake formation time.

Within the Austrian Alps 1619 lakes were mapped covering an area of more than 25 km^2. The largest natural lake recorded has an area of 40,000 m^2. A majority of lakes is classified as bedrock-dammed (48%). 28% of the lakes are moraine-dammed, 21% are embedded in till and 2% landslide-dammed lakes exist. Only three lakes are dammed by existing glacier ice. About 13% of the mapped lakes are considered to be completely silted up. 262 lakes have formed since deglaciation from the maximum glacier extent of the Little Ice Age (LIA, Mid-19th century). The average annual number of lake formation increased significantly since the end of the LIA. Between the different available glacier inventories (1850, 1969, 1998, 2006) this number has grown from 1.1 lakes per year between 1850 and 1969 to 5.6 lakes per year between 2006 and 2014. However, mean lake area decreased from 15,000 m^2 (1850 - 1969) to 2,500 m^2 (2006 - 2014).