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Impacts of climate change on snow, ice, and permafrost in Europe: a review on observed trends, future projections, and socio-economic relevance

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There is rising concern among policy- and decision-makers about the impacts of recent and projected changes in climate on the cryosphere and about the societal relevance of these changes.

The European Topic Centre on Air and Climate Change, in close collaboration with the Department of Geography of the University of Zurich, the Institute for Snow and Avalanche Research Davos, and the Norwegian Institute for Water Research, prepared a Technical Paper on present state and changes of Europe's cryosphere, for the European Environment Agency (EEA). The paper was elaborated by more than 50 glaciologists from three dozen research institutions all over Europe. It provides key messages and graphs supported by thorough and more technical reviews of the corresponding scientific state of knowledge. The main messages and conclusions from the paper have already partly been included and will be further incorporated into EEA reports. Thus the paper can help to address the information needs of a wide audience, including policy-makers at the European, national and sub-national level, non-governmental organizations, and the wider public.

The aim of this presentation is to summarize the scientific findings of the technical paper. The analysis of the state of the cryosphere in Europe is based on in-situ and remote sensing observations, and modelling. The paper covers Svalbard, Iceland, Scandinavia, the European Alps, the Tatra Mountains, the Pyrenees, as well as the Baltic Sea. It assesses the primary impact of climate change on the cryospheric components such as snow cover, glaciers and ice caps, permafrost, lake and river ice, and sea ice; as well as related secondary impacts on avalanches, landslides and rock slope failures, and glacier floods.