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River ice regime in the lower part of the Danube river: variability, drivers and trends over the last 180 years

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The variability of the ice regime (sea ice, lake ice, river ice) is considered to be a sensitive indicator of climate change. River ice affects many of the world's largest rivers, and in the Northern Hemisphere, approximately 60% of rivers experience significant seasonal effects. The variations in river discharge can lead to severe situations, such as ice jams/dams (with an accompanying risk of flooding), or issues that affect the management of hydroelectric power plant infrastructures. Here we present a data set of the ice cover regime for the lower part of the Danube river, in the near vicinity of the Danube delta. The data set spans over the period 1837 – 2017, and its the longest one, on record, over this area. The results in this study emphasize the strong impact of climate change on the occurrence of ice regime over the last 180 years. The number of ice cover days over the lower part of the Danube river has decreased considerably starting at the beginning of the 1960's, due to an increase in the winter mean temperature over the eastern part of Europe. The period 1837 – 1960 is characterized by an increased frequency of ice cover days, throughout the winter, and extremely cold winters over the analyzed region. The ice regime, in the lower part of the Danube river, is controlled mainly by the winter temperature regime and the large-scale atmospheric circulation patterns. Ice covered days on the lower part of the Danube river and cold winters, tend to occur simultaneously with atmospheric blocking events over the British Isles and a low pressure system over the south-eastern part of Europe, a pattern which enhances the advection of cold and dry air from the north. The high correlation between the number of ice cover days and the winter temperature over the central and eastern part of Europe, reveals that the ice regime can be used as a proxy for the winter temperature over this region.