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Causes for the late 19th century European floods, as simulated in ECHAM5-HAM

A. Bichet, M. Wild, D. Folini, and C. Schär
ETH Zürich Institut f. Atmosphäre und Klima, Universitätstrasse 16, 8092 Zürich

In the late 19th century, an unusual large number of floods were recorded in central Europe, causing important damages. Different factors contributing to the occurrence of these floods have been discussed, including the anomalously high precipitation anomalies observed in central Europe. Based on the frequency and spatial pattern of these floods, previous studies suggest that changes in the large scale circulation payed a relevant role. We use an atmospheric Global Circulation Model forced with observed SSTs to test this hypothesis and identify causes for the associated atmospheric circulation pattern.

We find that the reproducibility of the central European high precipitation in the late 19th century is not deterministic but probabilistic. We also show that between 1875 and 1890, transient SSTs, as opposed to climatological ones, increase the probability for high precipitation anomalies in central Europe, whereas transient aerosol emissions and greenhouse gas concentrations have almost no impact. Finally, our results suggest that between 1875 and 1890, transient SSTs enhanced central European precipitation via their impact on the atmospheric circulation, by increasing the probability to develop pressure patterns favorable for high precipitation in central Europe (namely, a low pressure system over the British Isles and a high pressure system over the North Atlantic Ocean).