Geophysical Research Abstracts
Vol. 20, EGU2018-15174-1, 2018
EGU General Assembly 2018

Boreal summer weather becomes more persistent in a warmer world

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Global warming is leading to more frequent and more severe heat waves. Next to thermodynamics, changes in atmospheric circulation might contribute to this increase in heat wave intensity by altering their persistence. Also, very persistent warm periods might be prolonged by soil moisture feedbacks. Here, we analyze the climatology and changes in temperature persistence and evaluate the ability of state of the art climate models to reproduce this. We highlight potential shortcomings of these models and their projections of future extreme weather events.
We quantify persistence of local weather conditions by the length of periods of consecutive “warm” or “cold” days – warm (cold) days being days with temperature anomalies above (below) the grid-point and season specific median temperature anomaly.
We show that most regional features of warm- and cold-persistence climatology are reproduced by climate models. However, climate models underestimate the length of the most persistent events. This could be due to a poor representation of feedback mechanisms prolonging very persistent periods. Finally, comparing temperature persistence in a present-day climate scenario and in a +2°C above pre-industrial temperatures scenario, we find a significant increase in warm persistence in JJA for the northern hemispheric mid-latitudes.