

EGU21-10104

<https://doi.org/10.5194/egusphere-egu21-10104>

EGU General Assembly 2021

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Increased frequency of Eurasian double jets linked to summer heat extremes in Europe

Efi Rousi¹, Kai Kornhuber^{2,3}, Goratz Beobide Arsuaga^{4,5}, Fei Luo⁶, and Dim Coumou^{1,6,7}

¹Potsdam Institute for Climate Impact Research (PIK), RD1 Earth System Analysis, Potsdam, Germany (rousipik@potsdam.de)

²Earth Institute, Columbia University, New York, US

³Lamont-Doherty Earth observatory, Columbia University, New York, US

⁴International Max Planck Research School on Earth System Modelling, Hamburg, Germany

⁵Institute of Oceanography, Center for Earth System Sustainability, Universität Hamburg, Hamburg, Germany

⁶Institute for Environmental Studies, VU Amsterdam, Netherlands

⁷Royal Netherlands Meteorological Institute (KNMI)

Persistent summer extremes, such as heatwaves and droughts, can have considerable impacts on nature and societies. There is evidence that weather persistence has increased in Europe over the past decades, in association to changes in atmosphere dynamics, but uncertainties remain and the driving forces are not yet well understood.

Particularly for Europe, the jet stream may affect surface weather significantly by modulating the North Atlantic storm tracks. Here, we examine the hypothesis that high-latitude warming and decreased westerlies in summer result in more double jets, consisting of two distinct maxima of the zonal wind in the upper troposphere, over the Eurasian sector. Previous work has shown that such double jet states are related to persistent blocking-like circulation in the mid-latitudes.

We adapt a dynamical perspective of heat extreme trends by looking at large scale circulation and in particular, changes in the zonal mean zonal wind in different levels of the upper troposphere. We define clusters of jet states with the use of Self-Organizing Maps and analyze their characteristics. We find an increase in frequency and persistence of a cluster of double jet states for the period 1979-2019 during July-August (in ERA5 reanalysis data). Those states are linked to increased surface temperature and more frequent heatwaves compared to climatology over western, central, and northern Europe. Significant positive double jet anomalies are found to be dominant in the days preceding and/or coinciding with some of the most intense historical heatwaves in Europe, such as those of 2003 and 2018. A linear regression analysis shows that the increase in frequency and persistence of double jet states may explain part of the strong upward trend in heat extremes over these European regions.