Geophysical Research Abstracts
Vol. 20, EGU2018-9033, 2018
EGU General Assembly 2018

Stratosphere-Troposphere Coupling in the Northern Hemisphere analyzed with climate network measures

Catrin Kirsch and Reik Donner

Potsdam Institute for Climate Impact Research, Transdisciplinary Concepts & Methods, Potsdam, Germany (catrin.kirsch@pik-potsdam.de)

The Stratosphere-Troposphere Coupling (STC) is a climate phenomenon providing additional predictive skills for extended-range weather forecasting. The variability of the winter stratospheric polar vortex can particularly influence the tropospheric circulation and, hence, mid-to-high latitude weather for a few weeks or months by strong or weak vortex signals propagating downward with time.
This study investigates the STC with climate networks. For this purpose, we use the geopotential height field between 20°N and 90°N at 37 vertical levels from the ERA-Interim reanalysis data from 1979 until 2016. There are two main research questions: (i) Is it possible to define a new, more robust index of the variability of the polar vortex than the currently used NAM index by exploiting climate network properties? (ii) What additional information on STC is provided by climate networks?
By calculating the transitivity of evolving climate networks at 10 hPa height, we obtain a new characteristic measure for tracing evolving patterns in stratospheric variability. A higher value than the baseline transitivity indicates an anomalous (strong or weak) polar vortex. Displayed for all vertical levels, the transitivity also exhibits the downward propagation of pressure anomalies into the troposphere.
Beyond these findings, we observe additional peaks in the transitivity that does not coincide with weak and strong vortex events. These peaks could be used for identifying the change between winter and summer circulation, also called final warming. We will discuss how these results could potentially affect the predictability of tropospheric weather during boreal spring.