Kurzfassungen der Meteorologentagung DACH
Garmisch-Partenkirchen, Deutschland, 18.–22. März 2019
DACH2019-302

From correlation to causality: Investigating a QBO teleconnection with causal effect networks

Verena Schenzinger (1), Jakob Runge (2), Lesley Gray (3), and Scott Osprey (3)

(1) University of Vienna, Meteorology & Geophysics, Austria, (2) DLR Institute of Data Science, Climate Informatics Group, Jena, Germany, (3) Atmospheric, Oceanic and Planetary Physics, University of Oxford, UK

The Quasi-Biennial Oscillation (QBO) in the equatorial stratosphere is thought to influence the Northern Hemisphere winter stratospheric vortex, and in extension, the North Atlantic Oscillation. However, most studies investigating this phenomenon, also known as the Holton-Tan effect, use correlation or composite analysis, which cannot distinguish between causes and consequences, nor whether there is a third process acting as common driver.
A new method based on graphical networks and information theory promises to separate driving and driven processes and hence is applied to investigate the teleconnection between the QBO and the Northern Hemisphere winter circulation.
This approach has already been successfully implemented in a study investigating Arctic drivers of the NAO, which vary on a daily-weekly timescale (Kretschmer et al. 2016); looking at the Quasi-Biennial Oscillation as another possible driver extends the view to the tropical stratosphere, and longer timescales (months compared to weeks). Influences confounding the QBO-Vortex interaction, such as the El Nino Southern Oscillation, varying solar irradiance, and volcanic eruptions can easily be accounted for with this framework. Furthermore, potential interaction routes (via troposphere/stratosphere/both) and their relative importance can be analysed.
As the QBO has a long intrinsic period of about 28 months, medium range weather forecast of the European winter weather could be improved by a more accurate understanding of this long-range interaction.