Stratospheric drivers of extreme events at the Earth’s surface

Daniela I.V. Domeisen\textsuperscript{1} and Amy H. Butler\textsuperscript{2}
\textsuperscript{1}ETH Zürich, Institute for Atmospheric and Climate Science, Zürich, Switzerland (daniela.domeisen@env.ethz.ch)
\textsuperscript{2}National Oceanic and Atmospheric Administration, Chemical Sciences Laboratory, Boulder, CO, USA

The stratosphere, the layer of the atmosphere at heights between 10-50 km, is an important source of variability for the weather and climate at the Earth’s surface on timescales of weeks to decades. Since the stratospheric circulation evolves more slowly than that of the troposphere below, it can contribute to predictability at the surface. Our synthesis of studies on the coupling between the stratosphere and the troposphere reveals that the stratosphere also contributes substantially to a wide range of climate-related extreme events. These extreme events include cold air outbreaks and extreme heat, air pollution, wildfires, wind extremes, and storm clusters, as well as changes in tropical cyclones and sea ice cover, and they can have devastating consequences for human health, infrastructure, and ecosystems. A better understanding of the vertical coupling in the atmosphere, along with improved representation in numerical models, is therefore expected to help predict extreme events on timescales from weeks to decades in terms of the event type, magnitude, frequency, location, and timing. With a better understanding of stratosphere-troposphere coupling, it may be possible to link more tropospheric extremes to stratospheric forcing, which will be crucial for emergency planning and management.