

The causes and consequences of exceptionally strong stratospheric Arctic polar vortices and the associated ozone holes: from seasonal to long-term impacts (ENRICH)

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While the ozone hole is a frequently observed event in the Antarctic, the Northern Hemisphere counterpart has, until recently, never been observed. Two notable exceptions have been the severe Arctic chemical ozone depletion events in the years 2011 and 2020 where regional ozone losses over the Arctic were comparable to those in the Antarctic ozone hole. During both events, the Arctic stratospheric polar vortex was exceptionally strong, cold, and long-lasting during winter and spring. These events are unprecedented for the satellite era (1979/1980 to present); thus, the years 2011 and 2020 had the greatest Arctic ozone losses on record. As events like these have never been observed previously, they deserve particular attention.

The ENRICH project focuses on causes and consequences of such cold and persistent polar vortices and the associated ozone deficits on the thermodynamics, dynamics, chemistry and transport in the middle atmosphere and the troposphere. The project involves model experiments with the ICON model system. We will employ two configurations of the model: One for ensemble seasonal forecasting and another one for long-term climate simulations. The model simulations will be complemented with analyses of CMIP6 model simulations, ERA5 reanalysis data and GPS measurements.

ENRICH is a joint project of Leipzig Institute for Meteorology of Leipzig University and the Institute of Meteorology and Climate Research - Atmospheric Trace Gases and Remote Sensing of the Karlsruhe Institute of Technology.