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How does Downward Planetary Wave Coupling affect Polar Stratospheric Ozone in the Arctic winter stratosphere?

Sandro Lubis[1], Prof. Katja Matthes[1], Vered Silverman[2], Prof. Nili Harnik[2], Dr. Nour-Eddine Omrani[3], Dr. Sebastian Wahl[4]

[1] GEOMAR - Helmholtz Centre for Ocean Research Kiel

[2] Tel Aviv University, Israel

[3] [3]Bjerknes Centre for Climate Research

4 GEOMAR – Helmholtz-Zentrum für Ozeanforschung Kiel

slubis@geomar.de

Variability in planetary wave forcing from the troposphere to the stratosphere is the key factor in changing the magnitude of ozone transport into the Arctic polar vortex during winter. Depending on the stratospheric dynamical state, two kinds of vertical wave coupling between the stratosphere and troposphere can occur. In one state, most of the wave activity gets absorbed in the stratosphere, resulting in strong wave-mean flow interaction, while in the other state, wave activity is reflected back down to the troposphere, which results in downward wave coupling (DWC). It is well established that stronger wave absorption in the stratosphere leads to a stronger residual mean circulation, resulting in more ozone transport to the polar vortex in winter. However, the mechanism by which the wave reflection influences Arctic ozone levels remains unclear and is the goal of our study.

We will assess the impact of DWC on the Arctic ozone levels by using a combination of ozone products from the NASA's Modern-ERA Retrospective Analysis for Research and Applications (MERRA), the Microwave Limb Sounder (MLS), and a 145-yr "Natural" run from a fully coupled chemistry-climate model (CESM-WACCM). We further evaluate contributions of dynamical and chemical processes to ozone changes associated with DWC, by examining the explicit time tendency products given by MERRA and CESM-WACCM.