QOS2016-291-1, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

Change in Polar Stratospheric Ozone due to Dynamics, ODS and Climate Change

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The Brewer-Dobson Circulation (BDC) plays a major role in ozone transport from the tropics to the poles and by that it governs the global distribution of total column ozone. Climate models predict a strengthening of the BDC in times of climate change. This would lead to an accelerated recovery of ozone abundance in higher latitudes. The strength of the BDC is dependent on wave forcing which slows the meridional winds and by that disturbs the geostrophic balance of Coriolis force and pressure gradient force. A good measure for the wave forcing is the eddy heat flux in 100hPa. It is highly correlated with changes in the total ozone columns of the polar regions and the tropic. Another major driver of the global ozone distribution is the photochemical destruction of ozone, due to ozone depleting substances (ODS) such as chlorofluorocarbons (CFCs). A special case of this is the rapid depletion of ozone in the presence of polar stratospheric clouds (PSCs). These clouds build up inside the polar vortices, are highly temperature dependent and strengthen the efficiency of ODS. The temperatures in the stratosphere are depending on radiative heating and cooling and are due to that influenced by the change in greenhouse gas abundance. To analyse the different drivers of changes in polar stratospheric ozone, three time slice simulations with the chemistry-climate model EMAC are used and compared to reanalysis and satellite data.