何が南極成層圏でオゾン層破壊物質以外に長期的なオゾン変化をコントロールするか

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What controls long-term Ozone changes other than Ozone-Depleting Substances in the Antarctic stratosphere?

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In the upper stratosphere the inter-annual variability of ozone is mostly controlled by chemical reactions and is strongly influenced by the anthropogenic ozone-depleting substances (ODS). While at middle latitudes the ODS reached the maximum in the stratosphere by the end of 1990s, at high latitudes the turning in the growth rate of the ODS has been delayed by several years. Analysis of Umkehr observations helps to understand the influence of the ODS on ozone in the middle and upper stratosphere. We investigated the long-term trend in the upper stratospheric ozone over the Antarctic using re-processed Umkehr data at Syowa station (69.0 S, 39.5 E). The long-term variability and trend observed in Umkehr ozone profile data is in good agreement with the station's overpass subset of the SBUV V8.6 Merged Ozone Dataset. The long-term trend is affected by the changes in the polar vortex position and its persistence relative to the geophysical location of Syowa station. We have found a high correlation between the Equivalent Latitude (EqLat) at 850K (10 hPa or 32 km) and stratospheric ozone. The Southern Hemisphere Annular Mode (SAM) is also considered as one of the explanatory parameters in our analysis of ozone variability over Syowa. High correlation is found between stratospheric ozone and SAM during high solar activity years (HS, 1978-1982, 1988-1992, and 1998-2002). The largest variability in the Antarctic stratosphere related to the SAM signal is observed from September to December. Since the SAM and upper stratospheric ozone are both affected by planetary wave propagation, their correlation reflects their response to the same mechanism, especially during HS.
In this presentation, we describe attribution of ozone variability to the proxies and discuss differences in factors that affect upper, middle and lower stratospheric ozone over Syowa.

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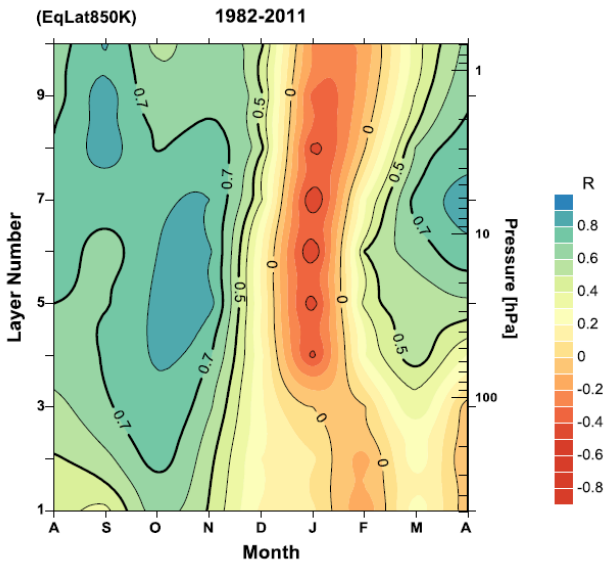

Figure 1. Plots show correlation (R) between ozone and the Equivalent Latitude (EqLat 850K) as function of altitude (Umkehr layers) and month. Umkehr ozone and EqLat 850K data are coincident within 24 hours.