Long Term Changes in the Upper Stratospheric Ozone at Syowa, Antarctica

K. Miyagawa[1], I. Petropavlovskikh[2], C. Long[3], J. Wild[3], L. Flynn[3], G. Manney[4] and W. Daffer[4]

[1]Aerological Observatory, Japan Meteorological Agency, Tokyo, Japan; 8133211-4966, E-mail: koji_miyagawa@kousou-jma.go.jp
[2]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309
[3]NOAA Climate Prediction Center, Camp Springs, MD 20746
[4]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

Analyses of stratospheric ozone data recorded by Dobson Umkehr measurements since 1977 at the Syowa (69.0°S, 39.6°E), Antarctica station show a significant decrease in ozone above 4 hPa during the 1980s and 1990s. Ozone values over Syowa remain low since 2001. The time series of upper stratospheric ozone from the homogenized NOAA(/2) SBUV V8 overpass data (±4 degrees, 24 hours) are in qualitative agreement with Syowa Station data. Ozone recovery during the austral spring over Syowa Station appears to be slower than predicted by use the Equivalent Effective Stratospheric Chlorine (EESC) curve. The long-term changes in station's equivalent latitude are derived from MERRA analysis at ~ 3 hPa and ~50hPa. These data are used to attribute some of the upper and middle stratospheric ozone changes to the changes in vortex position relative to station location. In addition, high correlation of the Southern Hemisphere Annular Mode (SAM) with polar upper stratospheric ozone points toward strong relation between the strength of the Brewer-Dobson circulation and the Polar stratospheric ozone recovery. Detection of stratospheric ozone recovery in the Antarctic region requires careful consideration of counteracting contributions from chemical and dynamical processes.

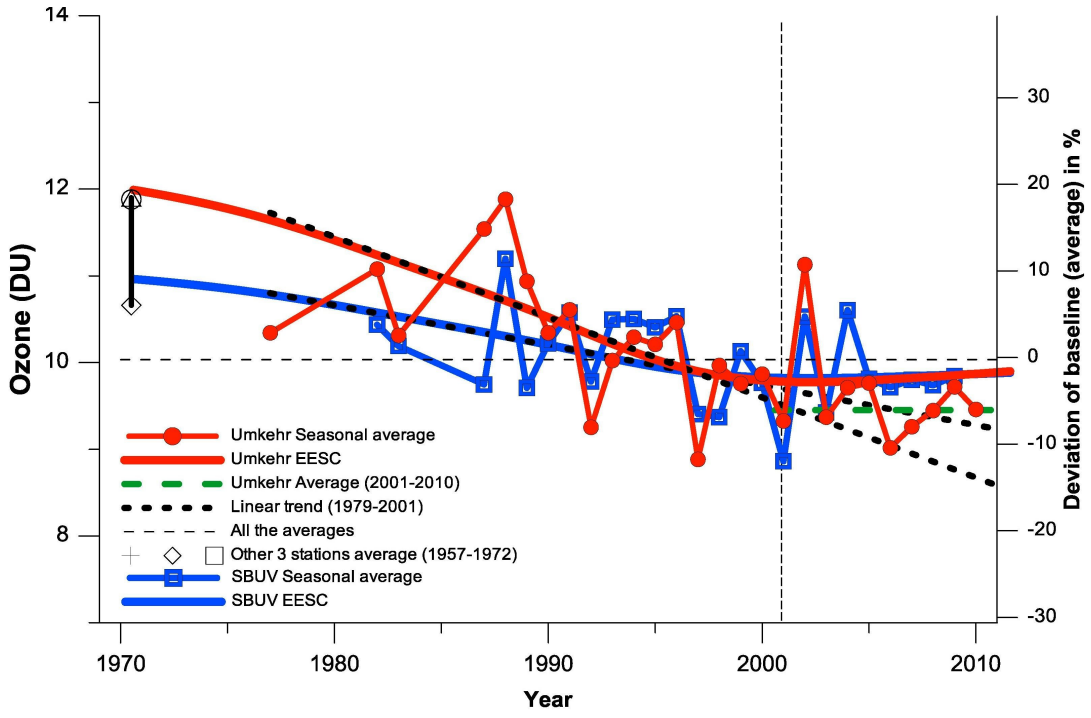

Figure 1. Long-term variations of ozone amount in layer 8+9+10 (above 4 hPa or 40 km altitude): Umkehr data (red circles) at Syowa and SBUV overpass data (blue squares). The red and blue lines show the EESC fit in Umkehr and SBUV data respectively. The dashed lines show linear ozone trends derived from 1979-200. The annual cycle, effects of solar activity, QBO, and SAM signals were removed from the data prior to the ozone record trend analysis. A symbol on the left edge of the plot represents averaged ozone from 3 stations, Faraday (65°S), King Baudoin (70°S), and Halley (73.5°S), measured between 1957 and 1972, and represents annual mean ozone.