Ozone Change at the South Pole: A 40-Year Record of Observations

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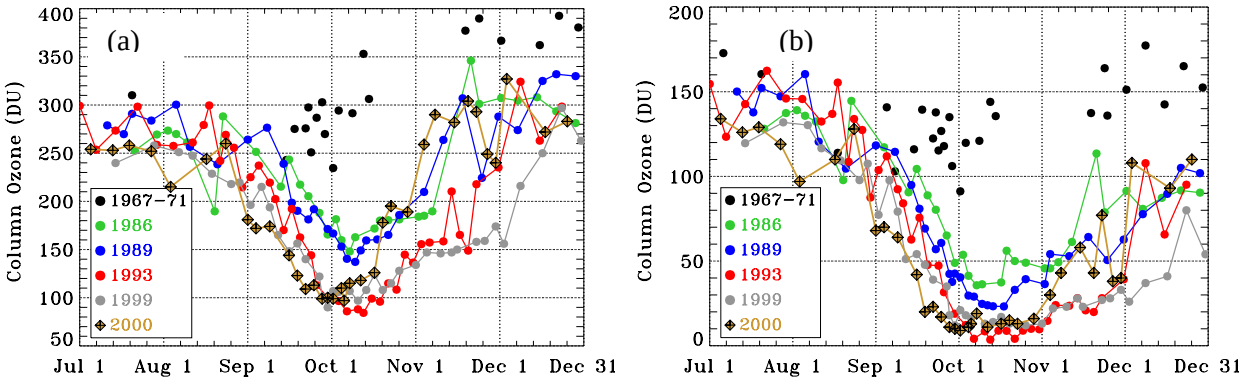
Observations of total column ozone were begun at South Pole, Antarctica, in 1961 and have been made continuously since. Even during winter months, Dobson spectrophotometer measurements are made using the moon as a light source. Although these nighttime measurements are less frequent and of somewhat lower quality, they provide a seasonal record of ozone change. Ozonesonde measurements of the ozone vertical profile were done sporadically from 1967-1971 and have been done regularly since 1986. Because nighttime moon observations are limited and the optical measurements cannot be made at all during periods of twilight, total ozone from integrated ozonesonde profiles are merged with the Dobson data to form a data set that gives good year-round coverage. A new technique for describing long-term ozone changes that fits a tendency curve to residuals from which "explained" variations have been removed and produces ozone "growth rates" is used to show the development of ozone loss over the Antarctic in the 1970s with accelerating losses after 1979.

From the ozone profile data, the changing character of the springtime stratospheric ozone distribution is readily seen by comparing the data from 1967-1971 with more recent data. Since the reestablishment of the ozonesonde program in 1986, the loss of ozone in the 15-20 km region has gradually increased with essentially complete destruction seen after 1996. Although total column ozone amounts show year-to-year variations associated with ozone changes outside of the ozone destruction region, the primary ozone loss region is much more consistent in showing declines in ozone until 1997 and very low amounts since. Because chlorine amounts in the atmosphere have stabilized, further erosion of the ozone-hole region is not expected, although year-to-year variations in temperature may lead to small increases in the vertical extent of ozone depletion. In the spring of 2000, ozone in the stratosphere began its rapid decline about 1 week earlier than in recent past years but minimum values were similar to those seen earlier. Because of the noncircular shape of the Antarctic vortex, ozone also recovered much more quickly at South Pole during 2000 than any year since 1988. Total ozone rose above 225 DU by October 28, 2000, at South Pole in contrast to 1999 when this value was not achieved until December 5, a typical date for the disappearance of the "ozone hole" for the period 1996-1999.



(a) Total and (b) 12-20 km column ozone at South Pole from ozonesonde observations for various years.