A New Look at Antarctic Ozone Hole Recovery

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There have been a number of estimates of when the Antarctic Ozone Hole will recover. These generally include two milestones following the cessation of ozone decline (which occurred about 2000), statistically significant evidence for the beginning of recovery (an ozone increase), and full recovery to 1980 ozone levels. The first attempt (Hofmann et al, 1997), using early estimates for the time evolution of Equivalent Chlorine (chlorine and bromine effects combined), gave approximately 2010 and 2050 for the two milestones. Improved estimates of Effective Equivalent Stratospheric Chlorine (EESC) levels for the future (Newman et al., 2006) indicated that the two recovery milestones for the area of the ozone hole (area within the 220 DU ozone contour) would be considerably later (2024 and 2068).

We have reanalyzed the ESRL Global Monitoring Division South Pole ozonesonde data for the 1986-2008 period (see figure 1 for 2006) and found that an exponential ozone loss rate during the September 7 to October 7 period best describes the data in most years. The exponential ozone loss rate (%/day) peaks sharply in the 16-18 km region (see figure 2), slightly below the observed active chlorine (ClO) peak of about 20-22 km. A parametric model using EESC and the stratospheric area of temperatures below the polar stratospheric cloud threshold was used to estimate ozone hole recovery from a South Pole ozone loss rate perspective. The model suggests a threshold EESC value (when ozone loss rate becomes >0) of about 2 ppmv and a saturation EESC value (above which the 16-18 km ozone loss rate does not increase any longer) of about 3.75 ppmv (which occurred about 1993). Two recovery milestones can be defined, when the 16-18 km ozone loss rate comes out of saturation and when full recovery is attained. These are, respectively, 2030-2032 and 2065-2070. It is estimated that the expected stratospheric cooling related to climate change will lengthen the recovery period by one to two years at most.

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Newman, P.A., E.R. Nash, S.R. Kawa, S.A. Montzka, and S.M. Schauffler, When will the Antarctic ozone hole recover? *Geophys. Res. Lett.*, 33, L12914, dot:10.1029/2005GL025232, 2006.

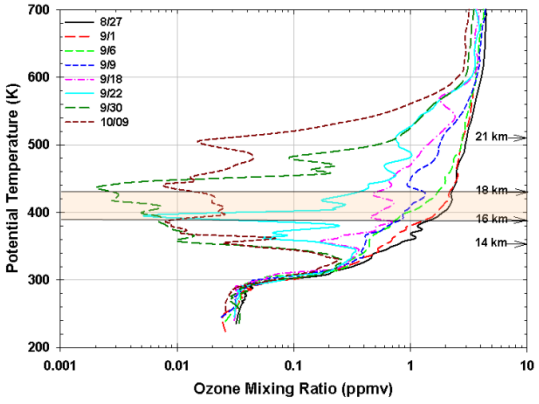

Figure 1. Ozone mixing ratio profiles at South Pole in 2006 during the formation of the ozone hole. The tan band marks the 16-18 km altitude region where the ozone loss rate is maximum.

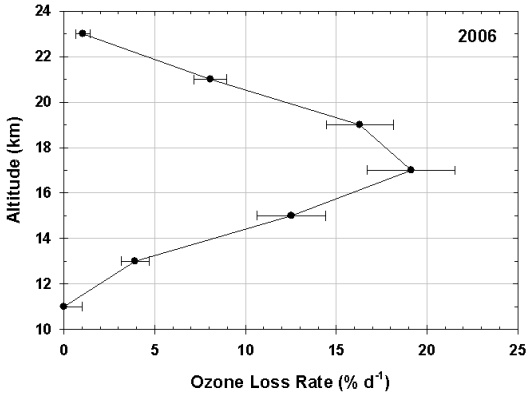

Figure 2. The ozone loss rate profile during September 7 to October 7 in 2006. The profile peaks at the astonishing rate of 15-20% per day in the 16-18 km region.