Ozone Distribution

The ozone distribution was studied using measurements from the POAM III satellite instrument. POAM is a solar occultation instrument, so it measures relatively sparse locations. However, by assuming ozone is constant as a function of PV (in effect, that ozone is a conserved tracer), the POAM data can be used to derive that function on each potential temperature surface. This was done and the functional (quadratic) fit between ozone and PV was used to derive ozone throughout Southern mid- and high latitudes (Randall et al., 2001).

Figure 4 shows the low-resolution PV field on the 600 K isentropic surface on 14 December 1998, and the corresponding low-resolution 'proxy ozone' field. The proxy ozone field was generated using all the measurements in a seven day period centred around the day of interest.

The POAM proxy ozone was tested by comparison to ozonesondes from Lauder (45.04 S, 169.7 E), New Zealand. Figure 5 shows a comparison to the sonde on 24 December 1998. Except on 600 K, the agreement is excellent. Figure 6 summarizes the comparisons for the period 15 November – 31 January of the years 1998, 1999 and 2000 (31 ozonesonde flights).

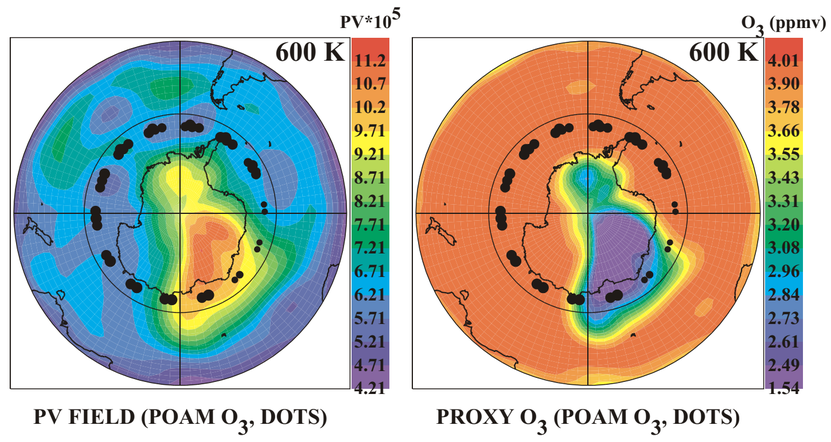

Figure 4: Polar stereographic (30-90 S) low-resolution absolute PV (in $Km^2kg^{-1}s^{-1}$) and proxy ozone fields on the 600 K isentropic surface, on 14 December 1998. PV values are from the United Kingdom Meteorological Office. Dots represent the actual POAM measurement locations.

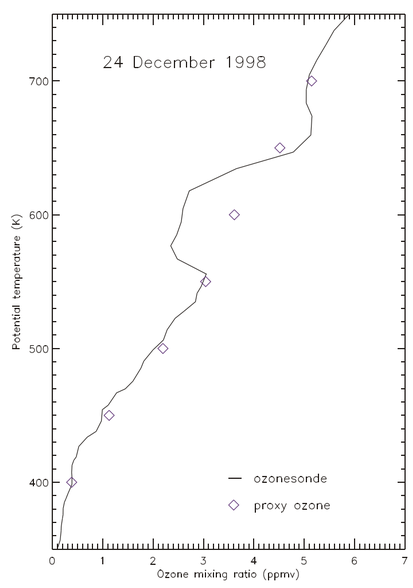

Figure 5: Lauder ozonesonde and proxy ozone comparison for seven isentropic surfaces (400 – 700 K) on 24 December 1998. The proxy ozone values for Lauder (45.04 S, 169.7 E) were bilinearly interpolated from the low-resolution proxy ozone field.

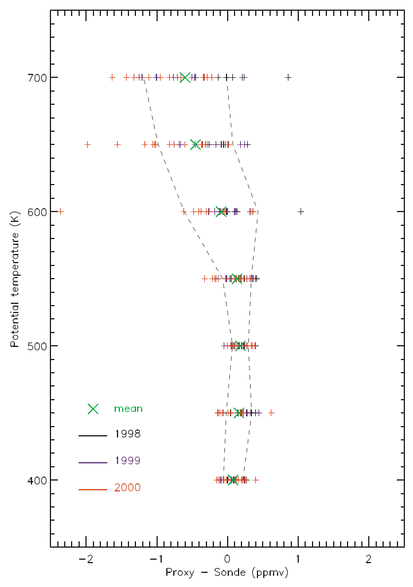

Figure 6: Summary of Lauder ozonesonde and proxy ozone comparison for 15 November – 31 January of the years 1998, 1999 and 2000 (31 ozonesonde flights). The hashed lines represent one standard deviation.

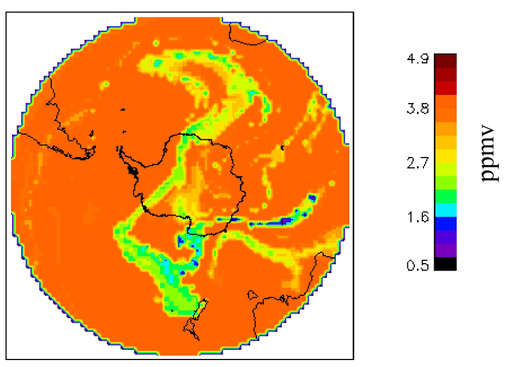

Figure 7: Polar stereographic (30-90 S) high-resolution proxy ozone image on the 600 K, on 24 December 1998.

High-resolution ozone maps

The POAM proxy ozone data was used in RDF calculations to derive high-resolution ozone fields.

The reason for the discrepancy of sonde and proxy ozone on 24 December on 600 K (Figure 5) is illustrated in Figure 7. A vortex remnant reached the South Island of New Zealand on this day, producing the sharp notch in the sonde profile (Figure 2), and also a strong horizontal gradient in the ozone field, which the proxy ozone does not accurately model.

A selection of high-resolution ozone maps for the month of December 1998, on the 500 K potential temperature surface, is shown in Figure 8. The very low ozone values contained in the Antarctic vortex are shown in the process of turbulent mixing into midlatitudes. Ozone poor filaments are seen throughout the month, while the background midlatitude ozone mixing ratios steadily decrease.