

GROWTH AND SIZE OF THE ANTARCTIC OZONE HOLE: THE INFLUENCE OF SOLAR ILLUMINATION AND POLAR STRATOSPHERIC CLOUDS

A.R. Klekociuk

Australian Antarctic Division, Kingston, Tasmania, Australia

During early August 2005, the size of the Antarctic ozone hole, as measured by the area enclosing the 220 Dobson Unit contour of the total ozone column, grew more rapidly than previously observed for that time of year.

Using global ozone and meteorological data, it is shown that the area of the ozone hole during its growth phase during the period 1998 to 2005 was strongly correlated with the inferred accumulated solar exposure of Polar Stratospheric Clouds (PSC) in the lower stratosphere, particularly near the 100hPa level. In particular, the early development of the ozone hole in 2005 can be attributed primarily to greater sunlight exposure of PSC in the lower stratosphere in comparison with other years. The higher exposure level was caused by greater coverage by PSC due to abnormally low stratospheric temperatures, rather than unusual asymmetry of the polar vortex.

Additionally, it is shown that total amount of column ozone lost during the life of the ozone hole is correlated with the summed daily PSC area near the 100hPa level. This is likely due to the close association between PSCs and ozone loss, and the extent of PSCs and the area and stability of the polar vortex during the recent epoch (since the mid-1990s), when the size of the ozone hole appears dictated more by characteristics of the vortex rather than the amount of anthropogenic halogen compounds in the atmosphere.

From this relationship, a forecast has been developed of the maximum area, total deficit and date of onset of the ozone hole. This uses inferred cumulative values of the southern hemisphere PSC area during the early part of winter. The skill of the forecast is illustrated for 2005 based on analysis for the period 1998 to 2004. It is suggested that forecasts of ozone hole metrics using this technique can be made with reasonable precision by mid-July or early August in a particular year.