WMO Antarctic Ozone Bulletin #4/2002

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1. **Meteorological conditions:** Meteorological data show that the 2002 Antarctic vortex continues to be the smallest observed in more than 20 years, while minimum stratospheric temperatures are similar to recent years. As expected during September, temperatures low enough to form polar stratospheric cloud (PSC) now cover only about 30% of the vortex area, down from the 50% reported for previous 2 week period. It is important to note that the unusually small vortex we are observing, is still within the range of natural variation, and that the intensity, depth and persistence of the ozone hole strongly depend upon these and other meteorological parameters in the stratosphere. As anticipated in earlier bulletins this year, the relatively weak vortex in 2002 is resulting in a less intense ozone hole than we have observed in recent years.

2. **Ozone observations:** Ground-based measurements of column ozone in Antarctica presently show a wide station-to-station variability that is dependent upon location. While Belgrano, Halley, Marambio, Rothera, and Vernadsky stations on the South American side of Antarctica have been generally within the ozone hole region for the past 2 weeks, Dumont d'Urville, Mirny, and Syowa stations, around the opposite side of the continental perimeter generally were not. During a brief period when the ozone hole extended toward South America, Ushuaia, a city on the southern tip of Argentina, was under the ozone hole. For two days, 9-10 September, measured ozone values at the WMO Global Atmosphere Watch station near Ushuaia were about 30% below the 1964-76 pre-ozone hole period norms. Satellite measurements indicate that the area with values more than 30% below norms is about 17 million square kilometers, and covers most of Antarctica.

3. **Ozone hole:** Most of the Antarctic continent is presently under the ozone hole. Due to the small vortex, the ozone hole remains one of the smallest in the past decade, currently with an area of only 15 million square kilometers compared to about 25 million square kilometers for the same period in 2000 and 2001. Using previous years as a guide, one would expect that the ozone hole will continue to increase in size (area) and deepen during late September and into October. A measure of the depth of the ozone hole is the "ozone mass deficit" (OMD), the mass of ozone destroyed within the ozone hole region each year, and is expressed in millions of tons (Mt) of ozone. OMD is estimated from the daily column ozone data available from satellites and ground stations and was described in more detail in last years WMO Antarctic Ozone Bulletins. The OMD during September has been almost constant at about 25 Mt. well below the 40 Mt observed by this time each year during the past decade. The size, depth and persistence of the ozone hole are expected to vary substantially from year to year, and as we have emphasised, are strongly influenced by corresponding natural meteorological variations. Considering that the year 2000 ozone hole was the largest on record, it is clear that a single year should not be used to infer a general trend in ozone hole size, depth and persistence.

4. **The Secretariat of the World Meteorological Organization (WMO)** distributes Bulletins providing current Antarctic ozone hole conditions during August-December each year. Bulletins are distributed via the WMO-Global Telecommunication System (GTS) and are also available through the Atmospheric Research and Environment Programme web page at www.wmo.ch/web/arep/ozone.html. In addition to the National Meteorological Services, the information in these Bulletins should be made available to the national bodies representing their countries with UNEP and that support or implement the Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol.

5. **Acknowledgements:** These Bulletins use provisional data from the WMO Global Atmosphere Watch (GAW) stations operated within or near Antarctica by: Argentina (Comodoro Rivadavia, Ushuaia), Argentina/Finland (Marambio), Argentina/Italy/Spain (Belgrano), France (Dumont D'Urville and Kerguelen Island), Germany (Neumayer), Japan (Syowa), New Zealand (Arrival Heights), Russia (Mirny), Ukraine (Vernadsky), UK (Halley, Rothera), and USA (South Pole). Satellite ozone data are also used and provided by NASA/TOMS, by NOAA/ TOVS and by ESA/GOME. Potential vorticity maps are provided by ECMWF and their ERA-15 and daily T106 meteorological fields are analysed by the Norwegian Institute for Air Research (NILU) Kjeller, Norway, to provide vortex extent and extreme temperature information. Ozone data analyses are prepared in collaboration with the WMO World Ozone and Ultraviolet Data Centre in Toronto, Canada through the co-operation and support of the Meteorological Service of Canada (MSC). UV data is provided by the U.S. National Science Foundation's (NSF) UV Monitoring Network. For supporting graphics and information go to http://exp-studies.tor.ec.gc.ca/cgi-bin/selectMap (MSC) and http://www.nilu.no/projects/nadir/o3hole (NILU).

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