WMO Antarctic Ozone Bulletin #7/2002

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1. **Meteorological conditions:** The vortex area has continued to remain well below season norms. Presently covering 10-15 million square kilometers, the vortex is less than half of its maximum size in late August and early September. The unexpected splitting of the vortex in late September has contributed to this year's vortex being the smallest in at least two decades. Accompanying the splitting was a substantial increase in temperatures within the vortex that practically eliminated polar stratospheric (PSCs) by 1 October. In all other years since 1979, on 1 October, at least 25% and up to 60% of the lower vortex area remained sufficiently cold to produce PSCs. Vortex temperatures have continued to increase during November and are unusually high when compared over the past two decades.
2. **Ozone observations:** Most of the ground-based stations in and around Antarctica have reported early November column ozone values that are near or above the pre-ozone hole norms of 1964-76. Only stations that are on or near the Antarctic Peninsula (Marambio, San Martin, Vernadsky, and Ushuaia) have reported average ozone values that are more than 30% below norms during the first week of November. These stations along with Halley have measured ozone hole values for a few days in November, although such low values have not been reported in recent days at any of the stations. Satellite measurements show that the area with ozone at least 30% below pre-ozone hole norms is now under 2.5 million square kilometers. This remnant of depleted ozone is presently located over the Southern Ocean east of the tip of South America where ground based-measurements are not available. Satellite data show that the zonal (latitude) averages of column ozone from 50S to 80S for September and October 2002 are almost identical to the 1988 zonal averages and not more than 10% below the pre-ozone hole norms. This compares with a 20-40% ozone deficit in zonal averages during all intervening years 1989-2001.
3. **Ozone hole:** Although the area with ozone hole values (about 30-40% below pre-ozone hole norms) increased during the first half of October, it slowly decreased in late October, then decreased substantially in the first week of November. During the past week, ozone hole values have not been observed by ground-stations nor by satellite, marking the end of the 2002 ozone hole season, the earliest occurrence since 1988. Additionally, this year's ozone hole is among the smallest, with average area for the month of September less than all years since 1993. Comparing monthly averages for October, this year's ozone hole was smaller than any since 1988. A measure of the depth of the ozone hole is the "ozone mass deficit" (OMD), a daily indicator of the mass of ozone that has been destroyed within the ozone hole region. Expressed in millions of tons (Mt) of ozone, the average OMD during September 2002 was 26 Mt and for October it was 21 Mt, both lower than any year since 1988. 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 variability. Consistent with measurements this year in Antarctica showing generally low UV at McMurdo, Palmer, and South Pole stations, the ozone hole during 2002 was the smallest, shallowest and shortest lived since 1988.
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, San Martin, Ushuaia), Argentina/Finland (Marambio), Argentina/Italy/Spain (Belgrano), Australia (Macquarie Is), France (Dumont D'Urville and Kerguelen Is), Germany (Neumayer), Japan (Syowa), New Zealand (Arrival Heights), Russia (Mirny), Ukraine (Vernadsky), UK (Halley, Rothera), and USA (South Pole). Satellite ozone data are provided by NASA/TOMS, NOAA/TOVS, NOAA/SBUV/2 and 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 (http://www.nilu.no/projects/nadir/o3hole). Ozone data analyses are prepared in collaboration with the WMO World Ozone and Ultraviolet Data Centre (WOUDC) in Toronto, Canada through the co-operation and support of the Meteorological Service of Canada (http://exp-studies.tor.ec.gc.ca/cgi-bin/selectMap). UV data is provided by the U.S. National Science Foundation's (NSF) UV Monitoring Network.

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