maintains an extensive and long-term commitment to ozone measurement, including programs of ozonesonde launches at Macquarie Island and Melbourne, and ozone total column abundance measurements at Macquarie Island and five Australian centres. Importantly, Macquarie Island is the only subantarctic site from which ozonesondes are launched.

The Davis ozone study has three main aims;

- To investigate the influence of atmospheric gravity waves and planetary waves on ozone depletion, and the climatology of ozone above Davis. Although there is a broad understanding of the processes that lead to ozone depletion, there are still discrepancies between observations and model predictions. This limits the usefulness of models in predicting future ozone levels. Aspects of these discrepancies may relate to small-scale thermodynamic processes associated with the action of natural wave processes in the atmosphere. The ozone measurements at Davis combined with data from the lidar and the recently commissioned VHF radar will provide new data on these processes.
- To provide local ozone data to aid in the derivation of temperature profiles from the Davis lidar, and to provide in-situ temperature measurements in the upper stratosphere for comparison with lidar observations. These measurements will contribute to assessing the long-term climatology of the stratosphere above Davis.
- To contribute to international efforts in the understanding of ozone depletion through participation in the European Union program 'Qualitative Understanding of Ozone Losses by Bipolar Investigations' (QUOBI), and contribution of data to the World Ozone and Ultraviolet Radiation Data Center.

The ozonesondes are currently being flown monthly, and from mid-June to mid-October the flights will be made at weekly intervals to coincide with the time of maximum interest in ozone levels. The launch schedule will be coordinated with operation of the Davis lidar and activities of the QUOBI program. QUOBI is an international effort led by Germany's Alfred Wegener Institute for Polar and Marine Research that involves regular ozonesonde launches by Antarctic and Arctic stations during their respective winter and spring seasons. The ozonesondes launched by stations in the QUOBI program attempt to sample the ozone concentration in parcels of air that are carried from one observing site to another by the stratospheric flow, thereby providing information for the refinement of chemical models of the atmosphere.

A further important aspect of the Davis program will involve collaborative research with Chinese scientists who are operating a program of ozone total column abundance measurements using a ground-based spectrophotometer at Zhong Shan station near Davis. Comparison of data from the two sites will enable calibration and consistency checks for the different measurement techniques that are employed.

The first ozonesonde was successfully launched on 20 February 2003, and we look forward to the exciting new data to follow.

Andrew Klekociuk, Space and Atmospheric Science Program, AAD

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Further information:
Description of the QUOBI project; <http://www.nilu.no/quobi/>
Ozone monitoring by the Bureau of Meteorology; <http://www.bom.gov.au/inside/oeb/atmoswatch/aboutozone.shtml>

Beautiful, mysterious polar stratospheric clouds

Polar stratospheric clouds (PSCs) play a central role in the formation of the ozone hole in the Antarctic and Arctic. PSCs provide surfaces upon which heterogeneous chemical reactions take place. These reactions lead to the production of free radicals of chlorine in the stratosphere which directly destroy ozone molecules. Despite two decades of research, the climatology of PSCs is not well described, and this impacts on the accuracy of ozone depletion models. The timing and duration of PSC events, their geographic extent and vertical distributions, and their annual variability are not well understood. The AAD's Space and Atmospheric Sciences group encourages people travelling south to keep a lookout for these clouds, and to report any sightings. This information is potentially useful to compare with observations by the Davis lidar, satellite measurements and predictions of atmospheric models.

MALCOLM LAMBERT

Type I PSC veil at Davis, July 2001

PSCs form poleward of about 60°S latitude during the winter and early spring in the altitude range 10km to 25km. The clouds are classified into Types I and II according to their particle size and formation temperature. Type II clouds, also known as nacreous or mother-of-pearl clouds, are

JOHN INNIS

Type II PSC wave clouds at Mawson, July 1993.

composed of ice crystals and form when temperatures are below the ice frost point (typically below -83°C).

Type I PSCs are optically much thinner than the Type II clouds, and have a formation threshold temperature 5–8°C above the frost point. These clouds consist mainly of hydrated droplets of nitric acid and sulphuric acid.

The PSC season at the ANARE continental stations typically runs from mid-June to mid-October each year. At the subantarctic sites of Macquarie Island and Heard Island, stratospheric temperatures rarely reach the frost point during winter, but observations are still encouraged.

The best viewing time is when the sun is between about 1 and 6 degrees below the horizon (during civil twilight), when the troposphere is in shadow but the stratosphere is illuminated. This increases the contrast of the PSCs against the background sky, and helps to differentiate against any tropospheric cloud which will appear much darker. The clouds will generally be visible in the twilight arch portion of the sky. It may also be possible to discern the clouds in strong moonlight.

During the PSC season at the ANARE continental stations, the sky is generally covered by a thin yellowish veil of Type I clouds. The veil can be hard to identify, being easily confused with cirrostratus clouds or tropospheric haze. You may notice fine horizontal structures in the veil near the horizon, as well as a bright patch of light a few degrees above the horizon scattered from the sun.

The Type II clouds are a less common phenomenon. There is anecdotal evidence that Type II clouds are more prevalent at Mawson compared with the other stations, possibly due to the influence of the nearby mountains. These clouds look distinctly different to tropospheric clouds. They have an overall pearly-white appearance (due to forward-scattering of sunlight), and may also show some delicate interference colours (pinks and greens). A polarising filter may enhance their visibility. Reports of these clouds are the most valuable as they indicate the occurrence of special atmospheric conditions.

The PSCs will generally be travelling in the stratospheric flow, which is predominantly from west to east, and this may help in identification. For example, at Davis the wind direction in the troposphere generally rotates with altitude from north-easterly near the ground, through southerly to be westerly at the tropopause. The motion of the tropospheric clouds may therefore be quite different to the motion of the PSCs. Type II clouds formed by mountain lee-waves may appear at discrete spacings across the sky, and appear quasi-stationary.

Digital images and reports of PSCs can be emailed to <sas_cloud@aad.gov.au> with information on the observer's name, location, viewing direction, the date and time (accurate to the nearest few minutes if possible), the focal length setting of the camera lens, and noting if any filters were used. It is also helpful if the horizon is in the photograph, and the location of the camera is roughly known (eg 'clouds photographed while standing on the front steps of the LQ'). Past observations, even a few years old, may be useful.

The clouds and twilight will usually be reasonably bright, so normal camera exposure metering should be adequate. Normal daylight type film is suitable - ISO 400 film will give you more scope for reducing the exposure time.

Further information on observing PSCs can be found at <http://www.aad.gov.au/default.asp?casid=11200>.

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