End of Winter Statement on Arctic Ozone Loss in 2004/05 Winter (April 2005)

Press Release

Large ozone losses over the Arctic

Large scale ozone losses have occurred over the Arctic this past winter. At altitudes around 18 km, over 50% of the ozone has been destroyed. Overall temperatures in the ozone layer were the lowest for 50 years and were consistently low for over 3 months. From late November to late February, large areas of polar stratospheric clouds (PSCs) - clouds in the ozone layer- were present over the Arctic region at altitudes between 14 and 26 km. This is the largest in the 50 year record, and especially in the last 20 years, the period when the ozone-depleting compounds have been high.

The chemical balance in the stratosphere is changed significantly by the presence of these clouds, altering the breakdown products from manmade CFCs (chlorofluorocarbons) so that rapid chemical ozone destruction can occur in the presence of sunlight. The cold conditions affected the distribution of nitrogen oxides, allowing ozone loss to continue longer than usual.

The first signs of ozone loss were reported in our statement of 28 January 2005. As sunlight returned to northern latitudes the rate of ozone depletion increased and rapid destruction of ozone occurred throughout February and March. In the altitude range where the ozone layer usually reaches its maximum concentration, more than half of the ozone was lost. “Overall about 30% of the ozone layer was destroyed” says Markus Rex from the Alfred Wegener Institute in Potsdam, Germany. “This largely prevented the normal seasonal increase of the thickness of the ozone layer during winter and led to a thinner ozone layer in Arctic spring compared to warmer years.”

The overall degree of ozone loss this year was of similar magnitude to the record loss that was observed in the Arctic during winter 1999/2000. During late March the Arctic air masses drifted over central Europe and contributed to individual days of significantly increased UV-B radiation and sunburn risk in parts of Europe. The affected region reached as far south as northern Italy.

Emissions of ozone depleting substances are now largely banned worldwide by the Montreal protocol. As a first success of this milestone of international cooperation in environmental policies the atmospheric concentrations of CFCs started to decrease. But the atmospheric lifetime of these compounds is extremely long and the concentrations will remain at dangerously high levels for another half century.

Over the next few decades the fate of the Arctic ozone layer will mainly depend on the evolution of atmospheric temperatures at the altitude of the ozone layer. Over the past forty years the conditions there have become significantly colder. “The cooling was particularly pronounced for the cold Arctic winters. Unfortunately these are the winters that result in large ozone losses. In 2005 the average extent of conditions cold enough for the existence of polar stratospheric clouds was four times larger than it has ever been in the sixties or early seventies of the past century" says Rex. This continuous cooling trend is qualitatively consistent with what would be expected as a result of increasing concentrations of greenhouse gases in the atmosphere. However the coupling processes between climate change and temperatures in the polar ozone layer are complicated by feedback process that are currently not sufficiently understood to make reliable predictions for the future.

Scientists from the EU SCOUT-O3 Integrated Project have been studying the links between stratospheric ozone and climate change in the Arctic since May 2004. The project is co-ordinated at the University of Cambridge's Department of Chemistry and has 59 partner institutions with over 200 scientists involved from 19 countries. "Our aim is to improve the predictions of future ozone and other stratospheric changes as well as the associated UV and climate impact" says Neil Harris from the University of Cambridge, one of the coordinators of the project.

Harris: "Within SCOUT-O3 we have followed the meteorological conditions in the Arctic closely and a suite of atmospheric observations and model calculations was triggered on a very short notice. The Arctic ozonesonde station network started a campaign of coordinated measurements to monitor the chemical ozone destruction. ESA carried out additional measurements of the chemical composition of air in the Arctic ozone layer with the ENVISAT research satellite. The high flying research aircraft Geophysica made a deployment deep into Arctic air masses resulting in additional in-situ observations of key species." Preliminary results from all these studies are being presented at the European Geophysical Union meeting in Vienna this week.

Notes to Editors:

1. For photographs see www.ozone-sec.ch.cam.ac.uk.

2. SCOUT-O3 is a 5 year project receiving 15 million euros from the European Commission Research DG's Global Change and Ecosystems Programme and a similar amount of associated funding from national agencies. More information on the SCOUT-03 project can be found at: www.ozone-sec.ch.cam.ac.uk

3. The degree of Arctic ozone loss varies greatly from year to year. For example, there were losses of <10% in 1998/99 and >65% in 1999/2000 at altitudes around 18 km, and losses of 50% or more have been seen at around 18 km in several winters since the early 1990s. Chemical losses in the total column of ozone over the Arctic have varied between about 5 and 30% since the early 1990s. Overall a decrease in total ozone in the Arctic region has been observed since 1980, although there is considerable year-to-year variation in the observed values. This variability in the ozone loss is to be contrasted with the Antarctic where nearly complete ozone loss has taken place in all except one winter since the late 1980s at altitudes between about 15 and 20 km.

4. The use of halogen-containing substances, such as chlorofluorocarbons (CFC) and halons has led to an increase in the atmospheric concentration of chlorine and bromine. The

substances can cause ozone depletion. The destruction of the ozone layer by man-made chlorine and bromine is most effective under very cold conditions. Rapid ozone loss can occur when temperatures drop below about -78°C, a value that is sometimes reached in the Arctic ozone layer at about 20 km altitude in winter. Since ozone destruction also requires sunlight, the ozone loss process starts after a cold winter when the sun returns to polar latitudes in spring.

5. More information on the ozone layer problem can be found at:
   Ozone Hole Tour: http://www.atm.ch.cam.ac.uk/tour/index.html
   UN Environment Programme: http://www.unep.org/ozone/index.asp
   World Meteorological Organisation: http://www.wmo.ch/indexflash.html

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