Record low temperatures in Arctic ozone layer - first signs of ozone loss

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The first signs of ozone loss have now been observed in the Arctic this winter, and large scale losses are expected to occur if the cold conditions persist. Overall temperatures in the ozone layer are the lowest for 50 years having been consistently low for the past two months.
Since late November large areas of polar stratospheric clouds (PSCs) - clouds in the ozone layer - have been present over the Arctic region at altitudes around 20 kilometres. They are now the largest in the last 20 years, the period when the ozone-depleting compounds have been high. These conditions could make ozone depletion very likely.

The chemical balance in the stratosphere is changed significantly by the presence of these clouds, altering the breakdown products from CFCs (chlorofluorocarbons) so that rapid chemical ozone destruction can occur in the presence of sunlight. If the Arctic stratosphere remains cold during February and March, large ozone loss is expected to take place as sunlight returns to northern latitudes. This could lead to increased levels of ultraviolet radiation in inhabited areas in the northern part of Europe.

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, with the aim of providing predictions of future ozone and other stratospheric changes as well as the associated UV and climate impact. 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.

The scientists are following the situation in the Arctic closely using a combination of measurements and atmospheric models. Measurements from the ground-based network of atmospheric observing stations and from satellites are being combined to investigate the ozone loss in the coming weeks.

The extreme conditions are of major concern and scientists will be addressing a number of questions: How large will the ozone loss be? What will be the impact on UV radiation? Are the conditions more favourable for large ozone losses than before?

"The meteorological conditions we are now witnessing resemble and even surpass the conditions of the 1999-2000 winter- when the worst ozone loss to date was observed," said Dr. Neil Harris of the European Ozone Research Coordinating Unit, Cambridge, UK, and one of the coordinators of the SCOUT-O3 project.
"However, it is still too early to predict the temperature development in February and March, which are the crucial months for ozone loss in the Arctic. We will watch the development closely from day to day, and will inform the public and our authorities if the situation becomes worrying," concludes Dr. Harris
The cold conditions have worsened during the month of January, and in the last few days the geographical extent of PSCs has reached values which are much larger than ever observed in the Arctic.

"Preliminary analysis of data from the international ozonesonde network shows the first signs of depletion at around 20 km altitude. Given the unusual situation we have intensified the measurements. It is not yet clear how the ozone layer will respond to the cold conditions, but we will find it out," said Dr. Markus Rex, from the Alfred Wegener Institute for Polar and Marine Research, who coordinates the Arctic ozone loss studies in SCOUT-O3.

"Overall, measured by the extent and persistence of conditions for PSC formation, the situation is now colder than anything I have seen in the Arctic before. In particular, the large extent of ice clouds gives reason for concern," added Dr. Rex.

Notes:

The degree of Arctic ozone loss varies greatly from year to year. For example, there were losses of 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.

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.

Source: University of Cambridge