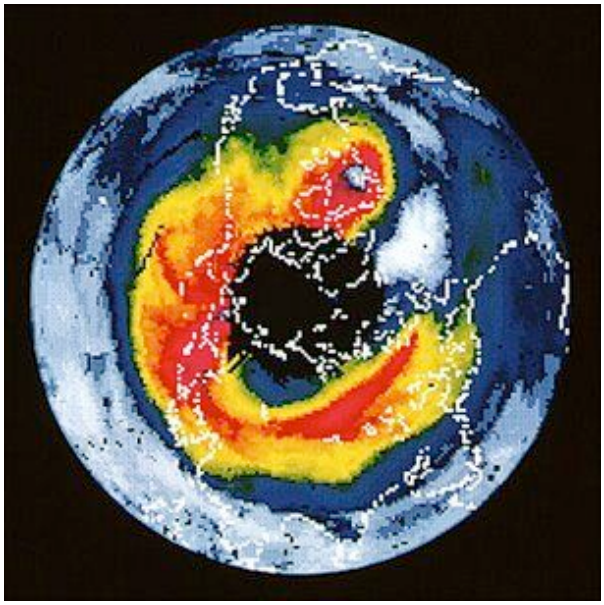
Arctic ozone loss at record level

By Richard Black Environment correspondent, BBC News



The Arctic ozone hole lay over over populated regions for parts of winter and spring

Ozone loss over the Arctic this year was so severe that for the first time it could be called an "ozone hole" like the Antarctic one, scientists report.

About 20km (13 miles) above the ground, 80% of the ozone was lost, they say.

The cause was an unusually long spell of cold weather at altitude. In cold conditions, the chlorine chemicals that destroy ozone are at their most active.

It is currently impossible to predict if such losses will occur again, the team writes in the journal Nature.

Early data on the scale of Arctic ozone destruction were released in April, but the Nature paper is the first that has fully analysed the data.

"Winter in the Arctic stratosphere is highly variable - some are warm, some are cold," said Michelle Santee from Nasa's Jet Propulsion Laboratory (JPL).

"But over the last few decades, the winters that are cold have been getting colder.

"Why [all this] occurred will take years of detailed study"
Michelle Santee JPL
"So given that trend and the high variability, we'd anticipate that we'll have other cold ones, and if that happens while chlorine levels are high, we'd anticipate that we'd have severe ozone loss."

Ozone-destroying chemicals originate in substances such as chlorofluorocarbons (CFCs) that came into use late last century in appliances including refrigerators and fire extinguishers.

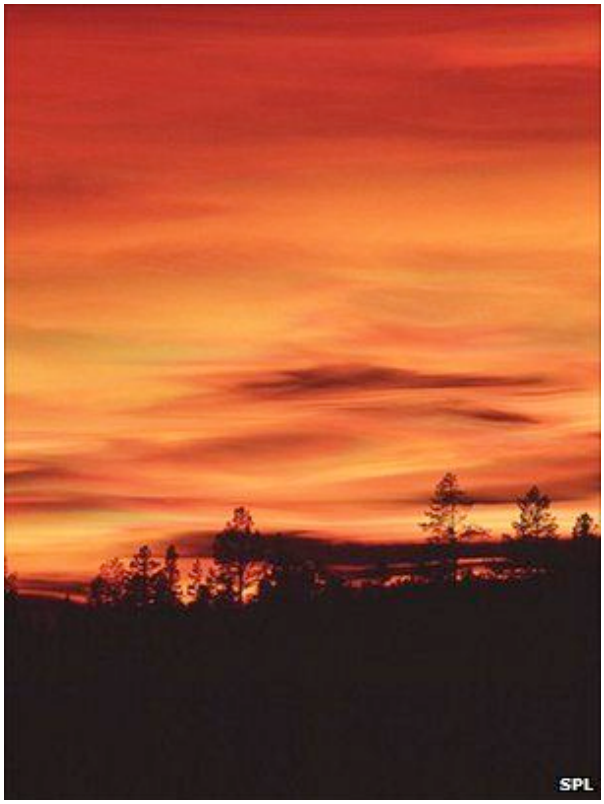
Their destructive effects were first documented in the Antarctic, which now sees severe ozone

depletion in each of its winters.

Their use was progressively restricted and then eliminated by the 1987 Montreal Protocol and its successors.

The ozone layer blocks ultraviolet-B rays from the Sun, which can cause skin cancer and other medical conditions.

Longer, not colder
Winter temperatures in the Arctic stratosphere do not generally fall as low as at the southern end of the world.



Ozone destruction takes place within polar stratospheric clouds, with chlorine the main culprit
No records for low temperature were set this year, but the air remained at its coldest for an unusually long period of time, and covered an unusually large area.

In addition, the polar vortex was stronger than usual. Here, winds circulate around the edge of the Arctic region, somewhat isolating it from the main world weather systems.

"Why [all this] occurred will take years of detailed study," said Dr Santee.

"It was continuously cold from December through April, and that has never happened before in the Arctic in the instrumental record."

The size and position of the ozone hole changed over time, as the vortex moved northwards or southwards over different regions.

Some monitoring stations in northern Europe and Russia recorded enhanced levels of ultraviolet-B penetration, though it is not clear that this posed any risk to human health.

While the Arctic was setting records, the Antarctic ozone hole is relatively stable from year to year.

This year has seen ozone-depleting conditions extending a little later into the southern hemisphere spring than usual - again, as a result of unusual weather conditions.

Chlorine compounds persist for decades in the upper atmosphere, meaning that it will probably be mid-century before the ozone layer is restored to its pre-industrial health.

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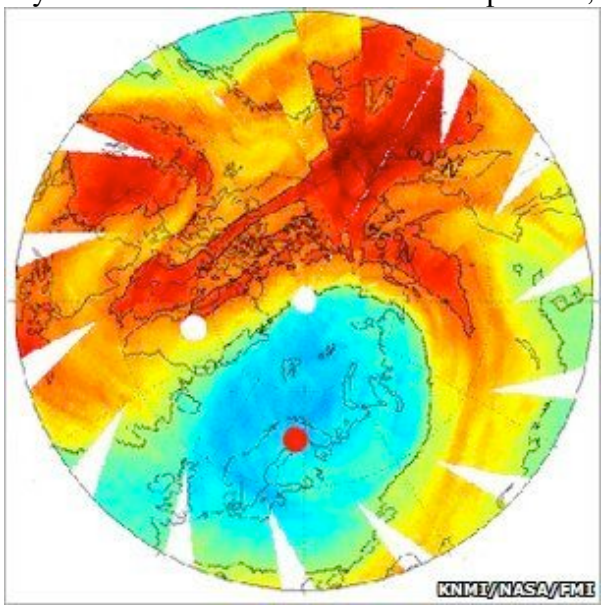
Arctic ozone levels in never-before-seen plunge

By Richard Black Environment correspondent, BBC News, Vienna



Long a consideration in the Antarctic, ozone levels in the Arctic are now a cause for concern

The ozone layer has seen unprecedented damage in the Arctic this winter due to cold weather in the upper atmosphere.

By the end of March, 40% of the ozone in the stratosphere had been destroyed, against a previous record of 30%.

The ozone layer protects against skin cancer, but the gas is destroyed by reactions with industrial chemicals.

These chemicals are restricted by the UN's Montreal Protocol, but they last so long in the atmosphere that damage is expected to continue for decades.

"The Montreal Protocol actually works, and the amount of ozone-depleting gases is on the way down, but quite slowly," said Geir Braathen, a senior scientist with the World Meteorological Organization (WMO), which co-ordinates ozone data globally.

"In the meantime, we have some winters that get much colder than before and also the cold periods last longer, into the spring," he told BBC News.

"So it's really a combination of the gases still there and low temperatures and then sunshine, and then you get ozone loss."

Dr Braathen was one of a number of scientists presenting the findings at the European Geosciences Union (EGU) annual meeting in Vienna.

'Sun screen'
The destructive reactions are promoted by cold conditions (below -78C) in the stratosphere.

While this is an annual occurrence in the Antarctic, where the annual depletion has garnered the term "ozone hole", the Arctic picture is less clear, as here the stratospheric weather is less predictable.

"With no ozone layer, you would have 70 times more UV than we do now - so you can say the ozone layer is a sunscreen of factor 70"
Geir Braathen World Meteorological Organization
This winter, while the Arctic was unusually warm at ground level, temperatures 15-20km above the Earth's surface plummeted and stayed low.

"The low temperatures were not that different from some other years, but extended much further into March and April - in fact it's still going on now," said Farahnaz Khosrawi, an ozone specialist at the Meteorological Institute at Stockholm University, Sweden.

Another, Dr Florence Goutail from the French National Centre for Scientific Research (CNRS), put the 2010/11 winter in context.

"Usually in cold winters we observe that about 25% of the ozone disappears, but this winter was really a record - 40% of the column has disappeared," she said.

The longer and colder Antarctic winters often see 55% of the ozone depleted.

However, this has hardly any impact on human health, as the region is largely uninhabited - only the southern tip of South America sometimes comes under the ozone hole.

But in the Arctic, the situation is different.

Over the last month, severe ozone depletion has been seen over Scandinavia, Greenland, and parts of Canada and Russia.

The WMO is advising people in Scandinavian countries and Greenland to look out for information on daily conditions in order to prevent any damage to their health.

Loss of ozone allows more of the Sun's harmful ultraviolet-B rays to penetrate through the atmosphere. This has been linked to increased rates of skin cancer, cataracts and immune system damage.

"With no ozone layer, you would have 70 times more UV than we do now - so you can say the ozone layer is a sunscreen of factor 70," said Dr Braathen.

Snow fall

Ozone depletion is often viewed as an environmental problem that has been solved.

The Montreal Protocol, established in 1987, and its successor agreements have phased out many ozone-depleting chemicals such as the chlorofluorocarbons (CFCs) that used to be in widespread use as refrigerants.

Ozone data were captured using satellites and weather balloons

Use of some continues at a much lower level, with poorer developing countries allowed more time in which to switch away from substances essential to some of their industries.

But even though concentrations of these chemicals in the atmosphere are falling, they can endure for decades.

In polar regions, the concentration of ozone-depleting substances has only fallen by about 10% from the peak years before the Montreal Protocol took effect.

In addition, research by Markus Rex from the Alfred Wegener Institute in Germany suggests that winters that stand out as being cold in the Arctic stratosphere are getting colder.

"For the next few decades, the [Arctic ozone] story is driven by temperatures, and we don't understand what's driving this [downward] trend," he said.

"It's a big challenge to understand it and how it will drive ozone loss over coming decades."

Projections suggest that the Antarctic ozone hole will not fully recover fully until 2045-60.