

The Recovery Of the Earth's Ozone Layer

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Lets first understand what is Ozone? According to the WMO (World Meteorological Organization) Ozone is a special form of oxygen with the chemical formula O_3 . And the oxygen we breathe which is totally vital to life on earth is O_2 .

Ozone constitutes a very small part of our atmosphere, but its presence is nevertheless vital to human well-being. Most ozone resides high up in the atmosphere, between 10 and 40km above Earth's surface. This region is called the stratosphere and it contains about 90% of all the ozone in the atmosphere.

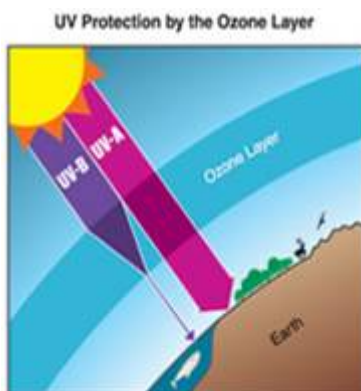


Image courtesy WMO

So, why do we humans need to care about atmospheric ozone ?

The Ozone in the stratosphere absorbs some of the Sun's biologically harmful ultraviolet radiation. Because of this beneficial role, stratospheric ozone is considered "good" ozone. In contrast, excess ozone on the Earth's surface that is formed from pollutants is considered "bad" ozone because it can be harmful to humans, plants, and animals. The ozone that occurs naturally near the surface and in the lower atmosphere is also beneficial because ozone helps remove pollutants from the atmosphere.

A decade or so ago the world was woken up rudely to the fact that the earth's protective ozone layer had developed a huge hole through which harmful cancer causing UV rays were being emitted.

Scientists sent alarm bells ringing and countries took steps to help reduce the problem and try to recover or repair the hole. Thankfully the Assessment for Decision-Makers, a summary document of the Scientific Assessment of Ozone Depletion 2014, a new assessment by 300 scientists, is being published by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO), and is the first comprehensive update in four

years on the issue. The document says that the ozone layer is well on track to recovery in the next few decades thanks to concerted international action against ozone depleting substances.

The stratospheric ozone layer, a fragile shield of gas, protects the Earth from harmful ultraviolet rays of the sun. Without the Montreal Protocol and associated agreements, atmospheric levels of ozone depleting substances could have increased tenfold by 2050. According to global models, the Protocol will have prevented 2 million cases of skin cancer annually by 2030, averted damage to human eyes and immune systems, and protected wildlife and agriculture, according to UNEP.

The phasing-out of ozone depleting substances has had a positive spin-off for the global climate because many of these substances are also potent greenhouse gases. However, the assessment report cautions that the rapid increase in certain substitutes, which are themselves also potent greenhouse gases, has the potential to undermine these gains. The assessment also notes that there are possible approaches to avoiding the harmful climate effects of these substitutes.

“There are positive indications that the ozone layer is on track to recovery towards the middle of the century. The Montreal Protocol – one of the world’s most successful environmental treaties – has protected the stratospheric ozone layer and avoided enhanced UV radiation reaching the earth’s surface,” said UN Under-Secretary-General and UNEP Executive Director Achim Steiner.

“However, the challenges that we face are still huge. The success of the Montreal Protocol should encourage further action not only on the protection and recovery of the ozone layer but also on climate. On September 23, the UN Secretary General will host Heads of State in New York in an effort to catalyse global action on climate. The Montreal Protocol community, with its tangible achievements, is in a position to provide strong evidence that global cooperation and concerted action are the key ingredients to secure the protection of our global commons,” he added.

“International action on the ozone layer is a major environmental success story,” said WMO Secretary-General Michel Jarraud.

“This should encourage us to display the same level of urgency and unity to tackle the even greater challenge of climate change. This latest assessment provides solid science to policy-makers about the intricate relationship between ozone and climate and the need for mutually-supportive measures to protect life on earth for future generations.”

“Human activities will continue to change the composition of the atmosphere. WMO’s Global Atmosphere Watch programme will therefore continue its crucial monitoring, research and assessment activities to provide scientific data needed to understand and ultimately predict environmental changes, as it has done for the past 25 years” said Mr Jarraud.

The key findings of the report are in brief below: Actions taken under the Montreal Protocol on Substances that Deplete the Ozone Layer are enabling the return of the ozone layer to benchmark 1980 levels.

- Under full compliance with the Montreal Protocol, the ozone layer is expected to recover to 1980 benchmark levels- the time before significant ozone layer depletion- before the middle of the century in mid-latitudes and the Arctic, and somewhat later in the Antarctic.
- The Montreal Protocol and associated agreements have led to decreases in the atmospheric abundance of gases, such as CFCs (chlorofluorocarbons) and halons, once used in products such as refrigerators, spray cans, insulation foam and fire suppression.
- Total column ozone declined over most of the globe during the 1980s and early 1990s. It has remained relatively unchanged since 2000, but there are recent indications of its future recovery.
- The Antarctic ozone hole continues to occur each spring and it is expected to continue occurring for the better part of this century given that ozone depleting substances persist in the atmosphere, even though their emissions have ceased.
- The Arctic stratosphere in winter/spring 2011 was particularly cold, which led to large ozone depletion as expected under these conditions.

The climate benefits of the Montreal Protocol could be significantly offset by projected emissions of HFCs (hydrofluorocarbons) used to replace ozone depleting substances.

- The Montreal Protocol has made large contributions toward reducing global greenhouse gas emissions. In 1987, ozone-depleting substances contributed about 10 gigatonnes CO₂-equivalent emissions per year. The Montreal Protocol has now reduced these emissions by more than 90 per cent. This decrease is about five times larger than the annual emissions reduction target for the first commitment period (2008-2012) of the Kyoto Protocol on climate change.
- Hydrofluorocarbons (HFCs) do not harm the ozone layer but many of them are potent greenhouse gases. They currently contribute about 0.5 gigatonnes of CO₂-equivalent emissions per year. These emissions are growing at a rate of about 7 per cent per year. Left unabated, they can be expected to contribute very significantly to climate change in the next decades.
- Replacements of the current mix of high-GWP HFCs with alternative compounds with low GWPs or not-in-kind technologies would limit this potential problem.

The annual Antarctic ozone hole has caused significant changes in Southern Hemisphere surface climate in the summer.

- Ozone depletion has contributed to cooling of the lower stratosphere and this is very likely the dominant cause of observed changes in Southern Hemisphere summertime circulation over recent decades, with associated impacts on surface temperature, precipitation, and the oceans.
- In the Northern Hemisphere, where the ozone depletion is smaller, there is no strong link between stratospheric ozone depletion and tropospheric climate.

CO₂, Nitrous Oxide and Methane will have an increasing influence on the ozone layer

- What happens to the ozone layer in the second half of the 21st century will largely

depend on concentrations of CO₂, methane and nitrous oxide – the three main long-lived greenhouse gases in the atmosphere. Overall, CO₂ and methane tend to increase global ozone levels. By contrast, nitrous oxide, a by-product of food production, is both a powerful greenhouse gas and an ozone depleting gas, and is likely to become more important in future ozone depletion.

The Scientific Assessment Panel is expected to present the key findings of the new report at the annual Meeting of the Parties to the Montreal Protocol, to be held in Paris in November 2014. The full body of the report will be issued in early 2015.

The Scientific Assessment of Ozone Depletion 2014 was prepared and reviewed by 282 scientists from 36 countries (Argentina, Australia, Austria, Belgium, Botswana, Brazil, Canada, People's Republic of China, Comoros, Costa Rica, Cuba, Czech Republic, Denmark, Finland, France, Germany, Greece, India, Israel, Italy, Japan, Korea, Malaysia, New Zealand, Norway, Poland, Russia, South Africa, Spain, Sweden, Switzerland, The Netherlands, Togo, United Kingdom, United States of America, Zimbabwe.)

Co-Chairs of the ozone assessment are: Prof. Ayité Lô Nohende Ajavon, Université de Lomé, Togo; Prof. John Pyle, University of Cambridge and National Centre for Atmospheric Science, UK; Dr. Paul Newman, NASA/ Goddard Space Flight Center, USA; Prof. A.R. (Ravi) Ravishankara, Colorado State University, USA.

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