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Radiation Effect of Different Energy : An Appication

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Abstract: *Some of us are already more vulnerable to climate impacts, such as people living in small island nations and other developing countries. Conditions like sea-level rise and saltwater intrusion have advanced to the point where entire communities have had to relocate, while protracted droughts are putting people at risk of famine. In the future, the number of people displaced by weather-related events is expected to rise. climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems. It covers current impacts and those likely in the future. Adaptation will be required everywhere but must be prioritized now for the most vulnerable people with the fewest resources to cope with climate hazards. The rate of return can be high. But climate inaction is vastly more expensive. One critical step is for developed countries to support developing countries so they can adapt and move towards greener economies...*

Keywords: *climate impacts*

I. INTRODUCTION

This year's ozone hole over the Southern Hemisphere had a maximum area of 21.9 million km² at the end of September , making it the smallest ozone hole since 2020. Data from the Copernicus Atmosphere Monitoring Service (CAMS) already indicated an unusually large and persistent ozone hole over the Antarctic in the period from 2020 to 2022 for which the drivers are currently still subject to research. While UNEP's scientific assessment report projects that global stratospheric ozone will return to 1980 levels around 2040, the behaviour of the southern ozone layer contrasts with observations in the past 40 years. Nonetheless, CAMS researchers expect to see a full recovery of the ozone hole by mid-century.

ncreasing concentrations of greenhouse gases (GHGs) cannot directly be attributed to a larger ozone hole, as they exert a dual effect. While GHGs are thought to lead to warmer temperatures, they tend to have a cooling effect in the middle and upper stratosphere which reduces the temperature exchange between the different layers of Earth's atmosphere. This stratospheric cooling effect is generally positively associated with ozone recovery, except for the polar regions. Here, very low temperatures can lead to an increase in the formation of polar stratospheric clouds, which facilitate ozone depletion as explained above.1

Finally, smoke-charged vortex (SCV) resulting from wildfires transport aerosols into the stratosphere, and this leads to both depleting and increasing the ozone layer stemming from different chemical reactions at different atmospheric layers, depletion being the bigger part (Max Planck Institute for Chemistry, 2024 - see the list of scientific references). With the increasing frequency and intensity of wildfires driven by global warming, the formation of SCVs and their impact on the stratosphere could become more common, posing a threat to the ozone layer.

The new findings by researchers of the Max Planck Institute highlight that natural events, exacerbated by climate change, pose additional risks to this fragile stratospheric layer. Since current observations show that the size and persistence of the ozone hole are largely dynamically driven, the urgence of continuing global efforts under the Montreal Protocol to ensure a swift recovery of the ozone layer and mitigating climate change remain key.2

Over the last few decades, emissions of human-made chemicals known as ozone-depleting substances (ODSs) have resulted in a the thinning of the ozone layer. This is most obvious over the Antarctic, where the chemical destruction of ozone constrained by the strong winds of the stratospheric polar vortex results in the 'ozone hole', but ODSs affect stratospheric ozone concentrations worldwide. On 1 January 1989, the Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) entered into force as an international treaty designed to protect the ozone layer by phasing out the production of numerous ODSs responsible for ozone depletion. As a result of this first universally ratified treaty in United Nations history the ozone layer is slowly recovering. To ensure the treaty is successfully executed over this long time period, policy makers need information about the amounts of ozone and related chemical species in the stratosphere.

The Protocol provides a set of practical ways to phase out ODSs – including through stringent measures worldwide to control products containing the chemicals.In 2016, the Protocol was amended in Kigali to also phase out the production and use of hydrofluorocarbons (HFCs) - which became a replacement for ODSs but proved to be more potent than carbon dioxide, and detrimental to the climate. According to the UN Environment Programme (UNEP), thanks to the agreement, there has been a substantial reduction in ODSs emissions over the last two decades, and there is evidence that the ozone layer is healing itself and can recover by the middle of this century.3

Scientists have also noted that ozone protection efforts have evidently slowed climate change by avoiding an estimated 135 billion tons of carbon dioxide equivalent emissions from 1990 to 2010. A successful reduction in HFCs in the atmosphere can avoid up to 0.4 degree Celsius of global temperature rise by 2100, while continuing to protect the ozone layer. For humans, the Montreal Protocol has potentially helped to prevent up to 2 million cases of skin cancer globally each year by 2030 and resulted in an estimated US$1.8 trillion in health benefits, mostly in skin cancer treatment alone. "The Montreal Protocol stands ready to provide more: to protect all life on Earth, creating a cooler environment, and safeguarding biodiversity to help feed growing populations," said Inger Andersen, the head of UNEP, in her message for the day.

The primary cause is the release of man-made chemicals, specifically Chlorofluorocarbons (CFCs), halons, solvents, and foaming agents. When these rise to the stratosphere, they are broken down by sunlight, releasing chlorine atoms that destroy ozone molecules. Ozone layer depletion increases the amount of UVB that reaches the Earth's surface. Laboratory and epidemiological studies demonstrate that UVB causes non-melanoma skin cancer and plays a major role in malignant melanoma development. Of the human health effects from sun exposure, melanoma is the most lethal, causing nearly 8,500 deaths annually in the United States. In addition, UVB has been linked to the development of cataracts, a clouding of the eye's lens.

UVB radiation affects the physiological and developmental processes of plants. Despite mechanisms to reduce or repair these effects and an ability to adapt to increased levels of UVB, plant growth can be directly affected by UVB radiation.5

Indirect changes caused by UVB (such as changes in plant form, how nutrients are distributed within the plant, timing of developmental phases and secondary metabolism) may be equally or sometimes more important than damaging effects of UVB. These changes can have important implications for plant competitive balance, herbivory, plant diseases, and biogeochemical cycles.

Phytoplankton form the foundation of aquatic food webs. Phytoplankton productivity is limited to the euphotic zone, the upper layer of the water column in which there is sufficient sunlight to support net productivity. Exposure to solar UVB radiation has been shown to affect both orientation and motility in phytoplankton, resulting in reduced survival rates for these organisms. Scientists have demonstrated a direct reduction in phytoplankton production due to ozone depletion-related increases in UVB.

UVB radiation has been found to cause damage to early developmental stages of fish, shrimp, crab, amphibians, and other marine animals. The most severe effects are decreased reproductive capacity and impaired larval development. Small increases in UVB exposure could result in population reductions for small marine organisms with implications for the whole marine food chain.6

Increases in UVB radiation could affect terrestrial and aquatic biogeochemical cycles, thus altering both sources and sinks of greenhouse and chemically important trace gases (e.g., carbon dioxide, carbon monoxide, carbonyl sulfide, ozone, and possibly other gases). These potential changes would contribute to biosphere-atmosphere feedbacks that mitigate or amplify the atmospheric concentrations of these gases. Synthetic polymers, naturally occurring biopolymers, as well as some other materials of commercial interest are adversely affected by UVB radiation. Today's materials are somewhat protected from UVB by special additives. Yet, increases in UVB levels will accelerate their breakdown, limiting the length of time for which they are useful outdoors.

Ozone depletion is greatest at the South Pole. It occurs mainly in late winter and early spring (which is from August to November in that region) and peak depletion usually occurs in early October, when the ozone is often completely destroyed in large areas.

This severe depletion creates the so-called “ozone hole” that can be seen in images of Antarctic ozone, made using satellite observations. In most years, the maximum area of the hole is bigger than the Antarctic continent itself. Although ozone losses are less radical in the Northern Hemisphere, significant thinning of the ozone layer is also observed over the Arctic and even over continental Europe.

Most of the ozone-depleting substances emitted by human activities remain in the stratosphere for decades, meaning that ozone layer recovery is a very slow, long process. The hole grew in the years following ratification of the Montreal Protocol, due to the lag caused by the fact that ozone-depleting substances remain in the stratosphere for a long time. The maximum size of the ozone hole is now

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