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Press Release

The International Ozone Commission, on the 32th anniversary of the Montreal Protocol, reports success in healing of the ozone layer.

September 16th is International Day for the Preservation of the Ozone Layer, celebrating the 1987 anniversary of the Montreal Protocol on Substances that Deplete the Ozone Layer. This protocol is the first environmental treaty to achieve universal ratification. The Montreal Protocol's Kigali amendment, ratified on 1 January 2019, aims at mitigating the future impact on the Earth's climate of hydrofluorocarbons or HFCs, which are substitutes for ozone depleting substances (ODSs) and powerful greenhouse gases. Universal ratification and compliance with this amendment would avoid about 0.5°C global temperature rise by the end of this century.

The theme of the International Day for the Preservation of the Ozone Layer on 16 September 2019 is: "32 Years and Healing"

Total atmospheric Ozone Depleting Substances (ODS) levels continue to decrease around the world according to the findings of the Scientific Assessment of Ozone Depletion: 2018 [WMO/UNEP, 2018]. This decrease is observed despite recent publications[1,2] showing an unexpected increase of chlorofluorocarbon-11 (CFC-11 or $CFCl_3$) emissions since 2012. CFC-11 is both the second most abundant ozone-depleting gas, banned under the Montreal protocol since 2010, and also a powerful greenhouse gas. This unexpected finding reinforces the continued need for surface network observations to track global emissions of ODSs and monitor compliance with the Montreal Protocol.

The Earth's ozone layer continues to heal. Recent studies, as well as international reports on ozone trends indicate that ozone levels in the upper stratosphere are recovering in part, in response to the declines in ODSs. The SPARC report "Long-term Ozone Trends and Uncertainties in the Stratosphere (LOTUS)" found that upper stratospheric ozone has increased since 2000. Full stratospheric ozone recovery will take several decades due to the long lifetimes of ODSs in the atmosphere. Global ozone levels are expected to recover to 1980 levels in about 2050 based upon modeling results from the Chemistry Climate Model Initiative assessment[3].

The situation regarding Antarctic ozone hole is also improving. Total column ozone in early spring has increased over Antarctica since 2000. The ozone hole reappears every year and while its extent was fairly large in 2018, analyses show that it is less deep and extensive than in the period around the year 2000. This year's unusually strong weather systems in the Southern Hemisphere stratosphere have

greatly weakened the ozone hole. These types of weather patterns are naturally occurring phenomena, but rare in the Southern Hemisphere - occurring only once, in 2002, in the last 4 decades. The 2019 ozone hole is therefore expected to be small compared to most other years.

Our ability to follow the future trends of ozone levels is crucially dependent on satellite, balloon, and ground-based ozone observing systems. The recently identified sources of CFC-11 emission increases demonstrate the necessity of continuous, quality-controlled observations for monitoring progress. The maintenance and continuation of ozone observations is vital for improving our understanding of interactions between climate change and ozone depletion, for ozone layer recovery studies, and for research into the geoengineering impacts on the ozone layer. At the centennial International Union of Geodesy and Geophysics (IUGG) meeting in Montreal, Canada, in July 2019, the International Ozone Commission led a scientific discussion on the efforts needed at international level to monitor both ozone recovery and decrease of ODS levels. Based on this discussion, IUGG and the International Association of Meteorology and Atmospheric Sciences adopted a resolution [http://www.io3c.org/] that urges national and international agencies to continue their support of measurements of ozone and related species, in order to ascertain the success of the Montreal Protocol and assess the evolution of atmospheric ozone over the 21st century, see http://www.io3c.org and http://www.iamas.org/2019/09/14/ozone-commission-resolution-27iugg/.

The upcoming 2020 Quadrennial Ozone Symposium will be held in Seoul, South Korea (5-9 October 2020.

This text was last reviewed by the IO3C members on September 15th 2019

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- *IO3C: http://www.io3c.org*
- *WMO Northern Hemisphere Ozone Mapping Center: http://lap.physics.auth.gr/ozonemaps*
- *World Ozone and Ultraviolet Data Center: http://www.woudc.org*
- *O3 Global: http://www.temis.nl/protocols/O3global.html*
- *TEMIS Ozone and UV forecast: http://www.temis.nl/protocols/o3hole/*
- *Ozone Hole Watch: http://ozonewatch.gsfc.nasa.gov/*
- *WMO (World Meteorological Organization), Scientific Assessment of Ozone Depletion: 2018, Global Ozone Research and Monitoring Project–Report No. 58, 588 pp., Geneva, Switzerland, 2018. http://ozone.unep.org/science/assessment/sap https://www.esrl.noaa.gov/csd/assessments/ozone/2018/*
- *SPARC report "Long-term Ozone Trends and Uncertainties in the Stratosphere (LOTUS)", http://www.sparc-climate.org/publications/sparc-reports/sparc-report-no-9/*

[1]Montzka, et al. (2018), An unexpected and persistent increase in global emissions of ozone-depleting CFC-11, Nature, 557, 413–417, doi:10.1038/s41586-018-0106-2.

[2]Rigby et al (2019) Increase in CFC-11 emissions from eastern China based on atmospheric observations, Nature, 569,546–550, doi:10.1038/s41586-019-1193-4

[3]Morgenstern, O., et al..: Review of the global models used within phase 1 of the Chemistry–Climate Model Initiative (CCMI), Geosci. Model Dev., 10, 639–671, https://doi.org/10.5194/gmd-10-639-2017, 2017