2

Introduction to the Stratospheric Ozone Depletion Boundary

SIMON P. MEISCH

The Earth is covered by five atmospheric layers, composed mainly of nitrogen and oxygen, but also of other gases. In the stratosphere, the second lowest of these layers, a high concentration of the gas ozone (O_3) absorbs most of the sun's ultraviolet radiation, which, unfiltered, would be most harmful to biological organisms on the planet's surface. The planetary boundary on stratospheric ozone is, therefore, concerned with the ability of this ozone layer to filter UV radiation. This ability is measured in Dobson Units (DU), which is the concentration of a gas in a column of air. To determine the ozone concentration, imagine taking out all the ozone in a column of air over a given area, creating standardized conditions (of temperature and air pressure) and checking how thick this layer of pure ozone would be (European Environment Agency 2023). Under these conditions, 100 DU are 1 millimetre, which is the equivalent of a stack of 10 sheets of writing paper. The planetary boundaries framework takes the pre-industrial Holocene baseline of 290 DU as a reference and, assuming a range of uncertainty of less than 5 per cent of this baseline, sets the limit at 276 DU. In 2023, the actual value was 284.6 DU, making the ozone boundary one of three that have not been crossed (Richardson et al. 2023: 5). 220 DU or less is considered an ozone hole, which, contrary to its name, is not the complete absence of ozone in an area, but a concentration so depleted that it does not absorb enough UV radiation (European Environment Agency 2023).

Of all the planetary boundaries, stratospheric ozone depletion stands out because it is associated with an oft-repeated success story in international environmental politics. In the mid-1980s, scientists discovered a hole in the ozone layer over Antarctica and identified groups of halogenated hydrocarbons as the cause of stratospheric ozone depletion. Back then, many of these gases were found as chlorofluorocarbons, or CFCs, in everyday items such as refrigerators and air conditioners. Alarmed, the global political community moved quickly to negotiate and ratify the 'Vienna Convention for the Protection of the Ozone Layer' (signed

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 15:40:32, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009443586.004

in 1985, entered into force in 1987) and the 'Montreal Protocol' (signed in 1987, entered into force in 1989). In essence, the treaties set out a process by which substances defined as harmful to stratospheric ozone are phased out and the resulting burdens are shared equitably. The Vienna Convention and the Montreal Protocol were the first international environmental treaties to be signed by all member states of the United Nations. Furthermore, this ozone regime has proven to be effective, as stratospheric ozone concentrations have increased. Against this background, Rockström et al. (2009: 12) concluded that '[o]n balance, the case of stratospheric ozone is a good example where concerted human effort and wise decision making seem to have enabled us to stay within a planetary boundary'.

This narrative has been challenged on epistemological and ethical grounds. Grundmann (2006), for example, stresses that the scientific consensus was not as great as the subsequent success story makes it appear. Despite initial scientific uncertainty, decision-makers recognized the moral importance of the ozone hole for human survival and acted anyway. Gareau (2013) points out that the ozone regime follows a neoliberal logic. As a result, it struggles to respond adequately to questions of global justice.

In their respective contributions, Louise du Toit and Christine Winter add to and transcend these critiques. While recognizing the pioneering nature of the ozone regime, they raise ethical questions about the nature of its success. Louise du Toit stresses the importance of creating political institutions with the mandate and capacity to protect morally relevant goods such as the ozone layer. However, du Toit also raises the issue of 'problem-shifting' in the context of the ozone regime. Such problem-shifting occurs when the successful resolution of some moral or empirical problems within the regime's legal framework creates other problems outside the scope of that framework. She goes on to explain the tensions that arise when contested ethical principles, such as the precautionary principle or the principle of sustainability, need to be specified by legal systems. She critically discusses the narrow utilitarian and anthropocentric moral bias of the ozone regime, which fails to assess the full extent of the problems associated with the ozone hole.

Writing from a relational and anti-colonial perspective, Christine Winter advances an approach to justice that seeks to truly grasp planetary relations. Winter argues against thinking of ozone merely as a bounded and delimitable molecule, as the planetary boundaries framework does. Instead, she argues for understanding and relating to ozone in all its natural relationships with living and non-living matter. She then asks what moral rights and obligations arise in and through these relationships. Winter also points to the colonial implications of planetary boundaries in general and ozone in particular. In her view, the concept of planetary boundaries provides an argument for enclosing and 'colonizing' a

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 15:40:32, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009443586.004

common good. In doing so, it creates the right for some people to use and pollute the stratosphere at the expense of others. Instead, Winter argues for 'an anticolonial planetary justice [that] proposes a planet on which a life sustaining planetary net of overlapping (local) relationships are the subject of justice'.

References

European Environment Agency. (2023). What Is the Current State of the Ozone Layer? www.eea.europa.eu/en/topics/in-depth/climate-change-mitigation-reducing-emissions/current-state-of-the-ozone-layer

Gareau, B. J. (2013). *From Precaution to Profit: Contemporary Challenges to Environmental Protection in the Montreal Protocol*. New Haven, CT: Yale University Press.

Grundmann, R. (2006). Ozone and Climate: Scientific Consensus and Leadership. *Science, Technology, & Human Values*. 31(1), 73–101. DOI: 10.1177/0162243905280024.

Richardson, K., Steffen, W., Lucht, W., et al. (2023). Earth beyond Six of Nine Planetary Boundaries. *Science Advances*. 9(37), 2458. DOI: 10.1126/sciadv.adh2458.

Rockström, J., Steffen, W., Noone, K., et al. (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology & Society*. 14(2): article 32. DOI: 10.5751/ES-03180-140232.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 15:40:32, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009443586.004