Title of dataset Variables	**Ozone hole, 1979–2016** • Year: 1979–2016 • Mean maximum ozone hole area, in million square kilometres • Mean minimum ozone concentration: Total column ozone, in Dobson units
Environmental reporting topic	Atmospheric properties
Environmental reporting category	Supporting information
Environmental report	Our atmosphere and climate 2017
Relevant measure on the Environmental Indicators, Te taiao Aotearoa website	Ozone hole
Methodology (collection & analyses)	The ozone hole is an area of reduced ozone (below 220 Dobson units (DU)) that forms over Antarctica. In winter, low temperatures over Antarctica form polar stratospheric clouds. Ozone-depleting substances react with these clouds, producing reservoirs of chlorine and bromine. Sunlight transforms these chemicals into forms that are destructive to ozone, so the ozone hole grows when the sun rises over Antarctica at the end of winter. Mean ozone refers to total column ozone, measured in DU. One DU represents the amount of ozone molecules needed to produce a 0.01mm layer of pure ozone. Minimum daily ozone (DU) is taken from annual measurements over the period 21 September to 16 October. The mean ozone hole area (million km^2) is measured over the period 7 September to 13 October. In the 1970s, the US National Aeronautics and Space Administration (NASA, nd) began using satellite measurements to infer the depth and extent of the ozone hole. These estimates are validated against point observations, such as those from the Dobson spectrophotometer. Ozone-depleting substances are emitted through human activities, such as refrigerant and aerosol production. These substances can last up to several centuries, making their way up to the stratosphere and damaging the ozone layer. While the ozone hole does not directly affect ozone concentrations over New Zealand, when it breaks up in spring it can send 'plumes' of ozone-depleted air towards us. This briefly decreases column ozone levels by around 5 percent (Ajtić et al, 2004), about the same amount as normal daily variation. With the phasing out of ozone-depleting substances under the Montreal Protocol (UNEP, 2007), Antarctic ozone is expected to return to

	pre-1980 levels by around 2065 (UNEP, nd). The ozone hole also affects atmospheric circulation and has led to an increase in the occurrence of positive phases of the Southern Annular Mode climate oscillation (Thompson et al, 2011).
Limitations to data & analysis	
Changes to time series	
References	Ajtić, J, Connor, B J, Lawrence, BN, Bodeker, GE, Hoppel, KW, Rosenfield, JE, & Heuff, DN (2004). Dilution of the Antarctic ozone hole into southern midlatitudes, 1998–2000. *Journal of Geophysical Research: Atmospheres*, *109*(D17). National Aeronautics and Space Administration (NASA). (nd). History of the ozone hole. Retrieved from http://ozonewatch.gsfc.nasa.gov. National Oceanic and Atmospheric Administration (NOAA). (2002). Unusually small antarctic ozone hole this year attributed to exceptionally strong stratospheric weather. Retrieved from www.noaanews.noaa.gov. Thompson, DWJ, Solomon, S, Kushner, PJ, England, MH, Grise, KM, & Karoly, DJ (2011). Signatures of the Antarctic ozone hole in Southern Hemisphere surface climate change. *Nature Geoscience*, *4*(11), 741–749. http://doi.org/10.1038/ngeo1296. United Nations Environment Programme (UNEP) (nd). Montreal Protocol – Achievements to date and challenges ahead. Retrieved 5 June 2017 from www.ozone.unep.org. United Nations Environment Programme (UNEP) (2007). The Montreal Protocol on Substances that Deplete the Ozone Layer. Further adjusted by the Nineteenth Meeting of the Parties, Montreal, 17–21 September 2007. Retrieved from http://ozone.unep.org.