

Ozone

ESSENTIAL CLIMATE VARIABLE (ECV) FACTSHEET



ECV IN BRIEF

- Domain:** Atmosphere
- Subdomain:** Atmospheric Composition
- Scientific Area:** Carbon Cycle and other GHGs
- ECV Stewards:** Dale Hurst, Paolo Laj
- Products:** Total column Ozone, Tropospheric Ozone, Ozone profile in upper troposphere and lower stratosphere, Ozone profile in upper strato- and mesosphere



Ozone (O₃) is a naturally occurring trace gas in the stratosphere that inhibits harmful UV radiation from reaching Earth’s surface. Ozone in the troposphere is a pollutant, harmful to all living things. Ozone is strongly linked to climate by its influence on Earth’s radiation budget. The amount of ozone in the global stratosphere began to decrease in 1980 due to catalytic reactions with chlorine and bromine from man-made CFCs and other halocarbons. Severe, seasonal depletions over Antarctica (“ozone hole”) have occurred annually since 1985. Thanks to the Montreal Protocol, an international treaty enacted to curtail the production and consumption of ozone-depleting substances, stratospheric ozone levels are expected to return to pre-depletion values.

ECV Product¹

PRODUCT	DEFINITION	REQUIREMENTS				
		FREQ.	RESOLUTION	REQUIRED MEASUREMENT UNCERTAINTY	STABILITY	STANDARDS/ REFERENCES
Total column ozone	Molecules of O₃ in the atmosphere from surface to TOA (Dobson units)	4hr	20-50km/ NA	Max(2%;5DU)	1%	
Tropospheric Ozone	Dry air mole fraction of O₃ in the troposphere (Mol/mol)	4hr	20-50km/ 5km	10-15%	2%	
Ozone profile in upper troposphere and lower stratosphere	Dry air mole fraction of O₃ in upper troposphere and lower stratosphere (Mol/mol)	4hr	100-200km/ 1-2km	10%	2%	

¹ Current Products and Requirements as in the Implementation Plan 2016 (GCOS-200). GCOS is reviewing and will update the requirements until 2022. More information on: gcos.wmo.int and climatedata.wmo.int.

Ozone profile in upper strato-and mesosphere	Dry air mole fraction of O₃ in upper strato- and mesosphere (Mol/mol)	daily	100-200km/ 3km/	5-20%	2%	
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Data Sources²

In Situ and Ground-Based Remote Sensing Data:

- ▶ World Ozone and Ultraviolet Radiation Data Centre (WOUDC)
<http://woudc.org>
- ▶ Earth System Research Laboratory Global Monitoring Division O₃ data
<https://www.esrl.noaa.gov/gmd/dv/iadv/>
- ▶ Network for the Detection of Atmospheric Composition Change (NDACC)
<http://www.ndsc.ncep.noaa.gov/>
- ▶ Southern Hemisphere ADDitional Ozonesondes (SHADOZ)
<https://tropo.gsfc.nasa.gov/shadoz/>
- ▶ World Data Centre for Reactive Gases (WDCRG)
<http://www.gaw-wdcr.org/>

Reanalysis:

- ▶ REANALYSES.ORG (Inventory for Reanalysis)
<http://reanalyses.org>
- ▶ Copernicus Atmospheric Monitoring Service (CAMS), MACC Reanalysis of global atmospheric composition, European Centre for Medium-Range Weather Forecasts (ECMWF)
<http://apps.ecmwf.int/datasets/data/cams-ghg-inversions/>
- ▶ Monitoring Atmospheric Composition & Climate (MACC), European Centre for Medium-Range Weather Forecasts (ECMWF)
<http://apps.ecmwf.int/datasets/data/macc-ghg-inversions/>

Satellite:

- ▶ Satellite ECV Inventory by the CEOS/CGMS Working Group on Climate (WGClimate)
<http://climatemonitoring.info/ecvinventory>

Global Ozone Change

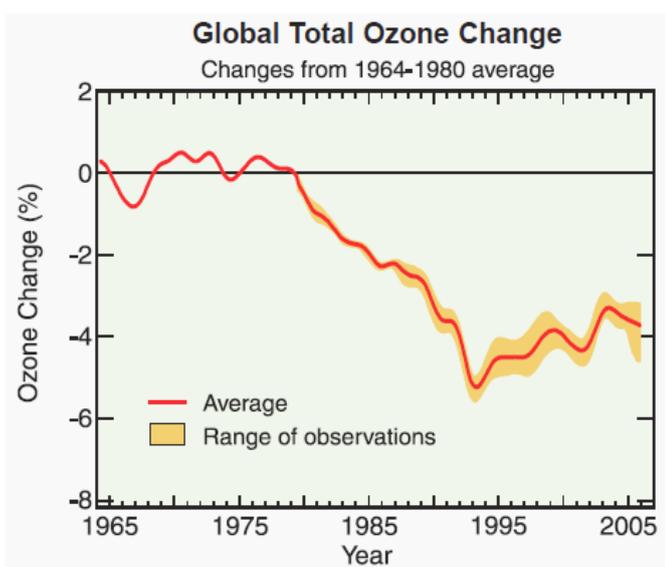


Figure: Changes in global total column ozone. Global total ozone measured by satellite instruments decreased by about 5% between 1980 and 1993, relative to the average value for 1964-1980. The steep drop during 1991-1993 is attributed to increased stratospheric aerosols injected by the eruption of Mt. Pinatubo in 1991. The aerosol effects slowly dissipated during the next decade, but global total ozone remained about 4% lower than in 1964-1980. Figure: Global total ozone changes. Global total ozone values decreased by an average of a few percent in the last two decades, as measured by satellite instruments. In the top panel, global ozone changes are compared with average global ozone found in the period of 1964 to 1980. Between 1980 and 2006, the largest decreases occurred following the volcanic eruption of Mt. Pinatubo in 1991.

Source: NOAA Earth System Research Laboratory.

² This list provides sources for openly accessible data sets with worldwide coverage for which metadata is available. It is curated by the respective GCOS ECV Steward(s). The list does not claim to be complete. Anyone with a suitable dataset who would like it to be added to this list should contact GCOS.

