Ozone (O_3)

Ozone (O_3), mainly present in the stratosphere, protects life on Earth from harmful ultraviolet radiation. However, a small amount (~10%) is present in the troposphere, sometimes referred to as 'bad ozone' due to its adverse impacts on the human health and vegetation. Tropospheric O_3 is a precursor of hydroxyl (OH) radical, thereby governing atmosphere's self-cleaning capacity. It is also a greenhouse gas and changes in concentration contribute to climate change. Total column O_3 is regularly monitored from space and ground to assess the state and recovery of stratospheric ozone layer.

O_3 is produced through photochemistry in the stratosphere involving ultraviolet radiation. Though its production is larger in the tropics due to intense sunlight, its concentrations are higher over the polar regions due to poleward transport under Brewer-Dobson circulation. Halogen containing compounds have contributed to the depletion of stratospheric O_3 and are therefore being regulated under the Montreal protocol.

Unlike tropospheric NO_2, SO_2 and HCHO which have strong spatial heterogeneity, total column O_3 typically shows more smooth distribution. Spatio-temporal variability in the total column O_3 is generally associated with the changes in ultraviolet radiation, dynamics and chemistry in the stratosphere.

Total column of ozone (O_3) from TROPOMI

TROPOMI (TROPOspheric Monitoring instrument) is a nadir-viewing spectrometer (ultraviolet, visible and shortwave infrared) onboard polar-orbiting ESA's Sentinel-5 Precursor satellite with high-spatial resolution of 3.5 km × 5.5 km (across x along track for ultraviolet band), swath of ~2600 km and equator crossing time ~13:30 local time. Differential optical absorption spectroscopy (DOAS) is used to derive total column O_3 from spectral band 325–335 nm (ultraviolet absorption in Huggins band). Level-2 near-real time (NRTI) total column of O_3 (Dobson Unit (DU) =2.69×10^{16} molecules cm^{-2}) is spatially averaged to uniform 10 km × 10 km grids for quality assurance of 0.5 and 0.75. Spatial averaging is carried out by $\sum (a_i \times y_i)/ \sum a_i$; where a_i=area of i^{th} pixel and y_i= total column of O_3 over i^{th} pixel.