

Formaldehyde (HCHO)

Formaldehyde (HCHO) is the most abundant carbonyl compound in the atmosphere, produced in the oxidation chain of VOCs (Volatile Organic Compounds). HCHO, being source as well as sink of radicals, plays a key role in the atmospheric chemistry. It also contributes to the formation of tropospheric ozone and aerosols, influencing the air quality and climate.

While methane is the main precursor of HCHO in remote regions, VOCs are the major source over the continents. VOCs emitted from vegetation, biomass burning, fossil fuel combustion, and industrial processes are responsible for production of HCHO. Thus, elevated levels of HCHO are readily observed over dense forests and regions with strong biomass burning and anthropogenic emissions. Its major removal processes include photolysis, reaction with hydroxyl radical, and dry/wet deposition.

Lifetime of HCHO is of the order of a few hours and hence higher concentrations are typically observed near the sources of HCHO and its precursors (VOCs). Since the natural biogenic emissions (e.g., of Isoprene) strongly depend on the temperature and sunlight, HCHO exhibits substantial seasonal changes, particularly near the vegetation/forest.

Tropospheric formaldehyde (HCHO) 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 $3.5\text{ km} \times 5.5\text{ km}$ (across x along track for ultraviolet band), swath of $\sim 2600\text{ km}$ and equator crossing time $\sim 13:30$ local time. Differential Optical Absorption Spectroscopy (DOAS) technique is used to retrieve HCHO from two spectral windows 328.5-359 nm and 328.5-346 nm, taking account of interfering species (mainly O₃, BrO, O₄, and NO₂). Level-2 near-real time (NRTI) tropospheric column of HCHO (molecules cm⁻²) is spatially averaged to uniform $10\text{ km} \times 10\text{ km}$ 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 = tropospheric column of HCHO over i^{th} pixel. Negative or zero values are omitted for daily map over the Indian region.