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Anthropogenic and natural sources affecting glyoxal global observations from space.

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The improvement of our understanding of air pollution in both urban and remote areas requires a detailed knowledge of the sources, sinks and distributions, of the pollutants such as the Volatile Organic Compounds (VOCs). Numerous VOC species, characterized by a large temporal and spatial variation, are present in the atmosphere. This complexity can be detoured by using indicators of VOC chemistry such as glyoxal (CHO.CHO), which is the smallest dicarbonyl organic compound. Its primary sources mainly from biofuel burning and vehicle emissions are highly uncertain. Glyoxal is known to be a key intermediate product of the oxidation of numerous VOCs emitted from anthropogenic activities, biogenic processes and biomass burning. Recently glyoxal has been detected in atmospheric aerosols and has been suggested to form a significant part of the missing secondary organic aerosols, which is not reproduced by the models.

In the present study, the CHO.CHO vertical column densities (VCDs) were retrieved from the data collected by the sensor SCIAMACHY on board of the ENVISAT satellite by applying the differential optical absorption spectroscopy (DOAS) technique. The spectral window between 435 and 457nm has been used for this purpose.

The global glyoxal composite figures reveal several photochemical hot spots over the continents affected by various sources. To distinguish between the impact of anthropogenic and of natural emissions on tropospheric chemistry, CHO.CHO retrievals have been analyzed in conjunction with other short-lived trace gases observations from space.

This study is complemented by 3-dimensional simulations of the global troposphere performed with the off-line chemical transport model (TM4). The chemical production and the lifetime of glyoxal are calculated to equal 56 Tg y^{-1} and 3 hours respectively, on a global scale. 70% of CHO.CHO is produced from biogenic VOC oxidation, 17% from acetylene and 11% from aromatics and the rest 2% from ethene and propene. The anthropogenic contribution to the CHO.CHO levels reaches 70% in the industrialized areas of the northern hemisphere.