## **Revisiting R<sub>GF</sub> - Insights to the Ratio of Glyoxal to Formaldehyde and its components**

Simon Bittner, Andreas Richter, Bianca Zilker, Sebastian Donner\*, Thomas Wagner\*, Mihalis Vrekoussis

(IUP)

\*Affiliated with Max Planck Institute for Chemistry, Mainz, Germany

## Abstract

The interactions between the surface and the atmosphere are numerous. Many different processes of different origin (e.g. biogenic, anthropogenic, pyrogenic) release a large number of different species to the atmosphere. These emissions are linked to air quality degradation and climate forcing amongst others. As the sheer amount of released chemical species is hard to study, proxies for the state of the atmosphere are of particular interest.

Two of these species are formaldehyde (HCHO) and glyoxal (CHOCHO), that both belong to the family of volatile organic compounds (VOC). Because of the similarity of their sources (direct emissions, secondary production from oxidation of other VOC) and their sinks (photolysis, oxidation by the hydroxyl radical (OH)), it was proposed that the ratio of glyoxal to formaldehyde, namely R<sub>GF</sub>, can provide useful information on the origin of emissions (e.g., anthropogenic vs. biogenic). Multiple papers investigated the ratio (R<sub>GF</sub>) and obtained disagreeing results for varying conditions.

To gain additional insights in to the drivers of the ratio, a MAX-DOAS (Multi Axis - Differential Optical Absorption Spectroscopy) instrument was installed close to Orleans (France) to investigate HCHO and CHOCHO in a biogenically dominated setting. The strong annual cycles of the ratio and its components as well as their temperature dependencies are reported. Analyzing additional datasets from other stations located in Athens (Greece), Seoul (South Korea), and at the Atto Tower (Brazil)) shows that there are little differences for the annual behavior as well as magnitude between anthropogenic and biogenically dominated environments. Contrary to the expectations, the annual peak value of CHOCHO is shifted by a few months compared to HCHO at the Atto Tower in Brazil, which results in a different annual cycle for  $R_{GF}$ .