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Investigation of European tropospheric ozone trends using multiple satellite records

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Tropospheric ozone is a harmful atmospheric secondary pollutant. It is produced by the oxidation of volatile organic compounds (VOCs) in the presence of nitrogen oxides (NOx) and sunlight. Tropospheric ozone has been shown to have a negative impact on human health (e.g. acute and chronic respiratory diseases) and a detrimental impact on plant health (i.e. reducing crop yields). Tropospheric ozone is also a short-lived climate forcer. As a secondary pollutant, the complex nature of tropospheric ozone formation highlights the importance of long-term observations needed to monitor and help understand changes in its abundance and spatial distribution.

Tropospheric ozone has been measured by satellite since the mid-1990s providing a powerful resource, in combination with other observations (e.g. surface, aircraft and ozonesondes), to better understand tropospheric ozone spatial and temporal evolution. However, recent studies e.g. Gaudel et al. (Elem Sci Anth, 6: 39. DOI: https://doi.org/10.1525/elementa.291, 2018), have highlighted substantial inconsistencies in the sign and magnitude of different satellite records both globally and regionally (including Europe). Therefore further study is required to look at these satellite trends in more detail using updated products. It is also important to investigate the causes of these trends to better understand the roles different factors play in affecting European tropospheric ozone abundance and distribution, e.g. precursor gas emissions, meteorology and stratospheric-tropospheric ozone exchange.

This presentation provides an comprehensive update of European tropospheric and sub-column (~0-6 km) ozone trends from satellite exploiting state-of-the-art records. These include records from the Ozone Monitoring Instrument (OMI) and the Global Ozone Monitoring Experiment-2 (GOME-2), developed by the UK Rutherford Appleton Laboratory (RAL Space), focusing on the

recent era (2005-2019). The trends across both Europe and smaller regions are investigated using a non-linear least squares fit regression model. Modelling studies using the TOMCAT 3-D model will help aid the interpretation of different satellite vertical sensitivities when retrieving ozone in the troposphere on trends and investigate the dominant processes driving them.