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Seasonal and regional characteristics of carbon monoxide anomalies as seen by IAGOS between 2002 and 2019:

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IAGOS (www.iagos.org) is a European research infrastructure using commercial aircraft to measure the atmospheric composition. In particular, IAGOS provides regular carbon monoxide (CO) data since December 2001. In this study we use eighteen years of available data (from 2002 to 2019) to investigate CO anomalies throughout the entire flight i.e. vertical profiles over airports and upper troposphere/lower stratosphere (UTLS) at cruise altitude.

IAGOS flight track is divided into four distinctive vertical groups: boundary layer, middle troposphere, upper troposphere and lower stratosphere. The entire IAGOS data set has been split in 18 regions according to the geographical variability (e.g. continents over northern mid-latitudes, tropics, etc ...) and the different seasonal cycles of CO. CO anomalies are defined as air masses with CO mixing ratios above the 95th/99th percentile of the regional/seasonal/vertical distribution. This unique data set allows us to look at the variety of CO anomalies between regions and seasons.

Soft-IO module which couples emission inventories and Lagrangian modelling along IAGOS flight track is used to quantify in which proportion those anomalies are linked to biomass burning and anthropogenic emissions.

The origin of those events presents high seasonal discrepancies (drought season and cold season) but also inter-annual variabilities. Anomalies coming from anthropogenic sources hit the most heavily on the lower part of the atmosphere of densely populated areas. However, none of the region, whatever the altitude range, are spared by anthropogenic pollution. Anomalies coming from biomass burning present large regional variability caused by weather conditions and biomass differences. We quantified these local and temporal variabilities to better understand processes affecting CO anomalies in the troposphere and UTLS.