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Contribution of Asian emissions to upper tropospheric CO over the remote Pacific

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By analysing the global distribution of the highest 2% of daily CO mixing ratios at 400hPa derived from the MOPITT satellite instrument for 20 years (2000-2019), we detect very regularly regions with very high CO values (i.e. mixing ratios belonging to the globally highest 2%) over the remote northern hemispheric (NH) Pacific. Such events of elevated CO over the upper tropospheric NH-Pacific occur throughout the year, with a surprisingly high regularity and frequency (70% of all days during winter, 80% respectively during spring).

During winter, most of these pollution events are detected over the north-eastern and central NH-Pacific, during spring over the central NH-Pacific and during summer over the western NH-Pacific. We detect most pollution events during spring. To link each individual pollution event detected by the 2% filtering method with a specific CO source region, we performed trajectory calculations using MPTRAC, a lagrangian transport model. To analyse transport pathways and uplift mechanisms we combine MOPITT data, the trajectory calculations and ERA-Interim reanalysis data. It becomes apparent, that air masses from China being lifted along a frontal system into the free troposphere are the major CO source throughout the year. The contribution of other source regions and uplift mechanisms shows a strong seasonal cycle: NE-Asia in relation with upward transport of air masses in the warm conveyor belt of a midlatitude cyclone is a significant CO-source region during winter, spring and summer while India is an important source region mainly during spring and summer and SE-Asia mainly during spring.