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Satellite-based analysis of CO and Fires in the Arctic

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Climate change is proceeding fastest in the Arctic region. While human-induced emissions of long-lived greenhouse gases are the main driving factor of global warming, short-lived climate forcers or pollutants emitted from the forest fires are also playing an important role, especially in the Arctic. Forest fire emissions also affect local air quality and photochemical processes in the atmosphere. For example, CO contributes to the formation of tropospheric ozone and affects the abundance of greenhouse gases such as methane and CO₂.

During past years Arctic summers have been warmer and drier elevating the risk for extensive forest fire episodes. Satellite observations show, that during the past three summers (2018-2020) fire detections in Arctic, especially in Arctic Siberia have increased considerably, affecting also local emissions of CO. This work focuses on studying CO concentration and its variation at high latitudes and in the Arctic using satellite and ground-based observations. Satellite observations of CO from TROPOMI are analyzed for the 2018-2020 (NH) summer months. To assess the satellite retrieved columns the satellite measurements are compared to ground-based remote sensing measurements at Sodankylä. Also, ground-based in-situ measurements are used to see how the total column changes mirror the ground level concentrations. The fire characteristics are analyzed using observations from MODIS instruments onboard Aqua and Terra. Fire effects on seasonal cycle and interannual variability of CO concentrations at Arctic high latitudes are analyzed.