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Fire activity and its influence on Aerosol Optical Depth and Green-House Gases over PEEEX area for the last two decades

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The Pan-Eurasian Experiment Program (PEEX) is an interdisciplinary scientific program bringing together ground-based in situ and remote sensing observations, satellite measurements and modeling tools aiming to improve the understanding of land-water-atmosphere interactions, feedback mechanisms and their effects on the ecosystem, climate and society in northern Eurasia, Russia and China. In a view of the large area covering thousands of kilometres, large gaps will remain where no or little ground-based observational information will be available. The gap can partly be filled by satellite remote sensing of relevant parameters as regards atmospheric composition.

Biomass burning is a violent source of atmospheric pollutants. Fires and corresponding emissions to the atmosphere dramatically change the atmospheric composition in case of long-lasting fire events, which might cover extended areas. In the burned areas, CO₂ exchange, as well as emissions of different compounds are getting to higher levels, which might contribute to climate change by changing the radiative budget through the aerosol-cloud interaction and cloud formation. In the boreal forest, after CO₂, CO and CH₄, the largest emission factors for individual species were formaldehyde, followed by methanol and NO₂ (Simpson et al., ACP, 2011). The emitted long-life components, e.g., black carbon, might further be transported to the distant areas and measured at the surface far from the burned areas.

In the boreal forest region, fires are very common, very large and produce a lot of smoke. Boreal areas have been burning regularly for thousands of years and is adapted to fires, which happen most often between May and October. In boreal ecosystems, future increases in air temperature may lengthen the fire season and increase the probability of fires, leading some to hypothesize a positive feedback between warming, fire activity, carbon loss, and future climate change (Kasischke et al., 2000).

During the last few decades, several burning episodes have been observed over PEEEX area by satellites (as fire counts), specifically over Siberia and central Russia. The following information available from satellites will be utilized to reveal a connection between Fire activity and atmospheric composition for the period 2002-2020 over the PEEEX area:

- - Fire count, FRP and burned areas from MODIS
- - Absorbing Aerosol Index (AAI), multi-instrument (GOME-2, OMI, TOMS) product
- - CO from MOPPIT
- - HCHO and NO₂ from OMI

Monthly temperature and humidity fields from ERA5 re-analysis will be also utilized to reveal if a connection exist between climate variables and occurrence and intensity of the forest fires.

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