



Greenhouse gas aerosols and pollutants over Siberia: the YAK-AEROSIB French Russian Joint International Laboratory

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Despite the unique scientific value of better knowing atmospheric composition over Siberia, regional observations of the tropospheric composition over this region are still lacking. Large local anthropogenic emissions, strong ecosystem gas exchange across the vast forest expanse, and processes feeding back to global climate such as wetlands CH₄ emissions, seabed hydrates destabilization and degrading permafrost make this region particularly crucial to investigate.

We aim at addressing this need in the YAK-AEROSIB program by collecting high-precision in-situ measurements of the vertical distribution of CO₂, CH₄, CO, O₃, black carbon and ultrafine particles distribution in the Siberian troposphere, as well as other parameters including aerosol lidar profiles, on a pan-Siberian aircraft transect. Campaigns are performed almost annually since 2006 until now on this regular route, while special campaigns are occasionally arranged to sample the troposphere elsewhere (e.g. Russian Arctic coast).

We show the background tropospheric composition obtained from these surveys, the variability and the impact of large-scale transport of anthropogenic emissions from Europe and Asia, as well as the impact of biomass burning plumes both from local wildfires (2012) and from remote sources elsewhere in Asia. Long range transport of anthropogenic emissions is shown to have a discernible impact on O₃ distribution, although its lower-tropospheric variability is largely driven by surface deposition. Regional sources and sinks drive the lower troposphere CO₂ and CH₄ concentrations. Recent efforts aim at better understanding the respective role of CH₄ emission processes (including methanogenesis in wetlands and emissions by wildfires) in driving its large scale atmospheric variability over the region.

Generally, the YAK AEROSIB provide unique observations over Siberia, documenting both direct impact of regional sources and aged air masses experiencing long range transport toward the high Arctic.