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Large-scale distribution of greenhouse gases, aerosols and pollutants over Siberia: the summer 2017 YAK-AEROSIB aircraft campaign

Boris D. Belan (1), Gerard Ancellet (2), Kathy Law (2), Jacques Pelon (2), Jean-Daniel Paris (3), Philippe Nedelec (4), Yury Balin (1), Grigory Kokhanenko (1), Ioganes Penner (1), Sergey Nasonov (1), Dmitry Chernov (1), Mikhail Arshinov (1), Sergey Belan (1), Denis Davydov (1), Georgy Ivlev (1), Artem Kozlov (1), Valerii Kozlov (1), Denis Simonenkov (1), Gennadii Tolmachev (1), and Alexandr Fofonov (1)

(1) V.E. Zuev Institute of Atmospheric Optics, SB RAS, Tomsk, Russian Federation (bbd@iao.ru), (2) UPMC Univ. Paris 06; Univ. Versailles St-Quentin; CNRS/INSU, LATMOS-IPSL, Paris, France, (3) Laboratoire des Sciences du Climat et de l'Environnement/IPSL, CNRS-CEA-UVSQ, Orme des Merisiers, CEA Saclay, Gif-sur-Yvette, France, (4) Laboratoire d'Aerologie, CNRS-UPS, Toulouse, France

High-latitude terrestrial ecosystems of the Northern Hemisphere (NH) and Siberia, in particular, are highly sensitive to climate change. Siberia covers a vast area of the land surface of the NH. Its ecosystems are represented by steppes, forests of different types, wetlands, tundra and arctic deserts, so investigation of the atmospheric composition in this region is of great importance for understanding land-atmosphere exchange processes and possible feedbacks in the whole NH. In spite of recognizing the problem, comprehensive observational data are still lacking in this region. One of the main goals of the joint French-Russian YAK-AEROSIB program is to fill up this gap in data for better understanding what is happening with air composition over Siberia.

The 10^{th} YAK-AEROSIB aircraft campaign undertaken in June, 2017, was aimed to survey local and regional air pollution in West Siberia caused by emissions from oil and gas fields, as well as other anthropogenic sources. For this purpose, Optik Tu-134 research aircraft was equipped with in-situ and remote sensing (aerosol lidars) means to derive a spatial distribution of CO_2, CH_4, CO, O_3, black carbon and aerosols. The aircraft mission was conducted between roughly 55˚N and 70˚N along the following route: Novosibirsk-Surgut-Norilsk-Igarka-Bor-Novosibirsk (16^{th}-17^{th} June, 2017) and Novosibirsk-Surgut-Novosibirsk (18^{th} June, 2017). Flights were performed with changing altitude from 400 to 4000 m with 30-60-minute horizontal path segments at these heights.

Here, we present a measurement data set of the above atmospheric constituents sampled during the summer 2017 YAK-AEROSIB mission. Distinct pollution plumes have been recorded when the aircraft was flying over the areas of oil and gas production fields, as well as in the vicinity of the Norilsk industrial centre. Preliminary analysis shows that associated gas flaring may have a significant impact on the air composition and pollution in Siberia taking into account that oil and gas fields covers a significant part of its territory. On 18th June, when the mission was flown at 400-m height between Novosibirsk and Surgut, a strong natural release of methane from the Great Vasyugan Mire has been observed.

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