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Investigating chemical composition of the troposphere over the Russian Arctic using the "Optik" Tu-134 aircraft laboratory

Boris D. Belan, Pavel N. Antokhin, Mikhail Yu. Arshinov, Sergey B. Belan, Denis K. Davydov, Georgii A. Ivlev, Artem V. Kozlov, **Igor V. Ptashnik**, Denis E. Savkin, Denis V. Simonenkov, Gennadii N. Tolmachev, and Alexandr V. Fofonov

V.E. Zuev Institute of Atmospheric Optics, SB RAS, Tomsk, Russian Federation (bbd@iao.ru)

The need to undertake a comprehensive investigation of the atmospheric composition over the Russian segment of the Arctic is caused by a serious lack and irregularity in obtaining observational data from this regio of the Earth. In addition, a comparison of the aircraft in-situ measurements with satellite data retrieved for the Kara Sea region in 2017 revealed large uncertainties in determining the vertical distribution of greenhouse gas concentrations using remote sensing methods. The development and improvement of the last ones needs at least their periodic verification by means of undertaking precise in-situ aircraft measurements.

The general scheme of the proposed experiment is as follows (map is attached): flight from Novosibirsk to Naryan-Mar via Sabetta. From Naryan-Mar, flight to a water area of the Bering Sea (up to 1000 km). Flight from Naryan-Mar to Sabetta. From here, flight to a water area of the Kara Sea (up to 1000 km). Then, flight to Tiksi. Flight from Tiksi to a water area of the Laptev Sea (up to 1000 km). Flight to Chokurdakh or Chersky. From there, flight to a water area of the East Siberian Sea (up to 1000 km). Flight to Cape Schmidt. Flight to a water area of the Chukchi Sea (up to 1000 km). Return route: Cape Shmidt–Chersky (or Chokurdah)–Yakutsk–Bratsk–Novosibirsk. It will take about 100 hours of flying time to implement the entire aircraft campaign. Campaign period is about 2-3 weeks. It is better to undertake the campaign during summer when the ocean is open. Flights over the land surface are assumed to be undertaken from 0.5 km to 11 km above ground level while above the sea from 0.2 km to 11 km. The flight profile is variable from the maximum possible height to the minimum allowed one. Vertical profiles of gas and aerosol composition will be obtained, including black carbon and organic components, as well as basic meteorological quantities.

Satellite data will be verified that do not yet provide acceptable accuracy. For the first time, unique information will be obtained over the least explored region of the Arctic, which is crucial for the whole planet in terms of climate formation and the impact of global warming.