Minor gaseous and aerosol species, large-scale transport, photochemical processes, mass and heat exchange in the Arctic lower and middle atmosphere.

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Purposes of the investigations. Development of scientific knowledge about primary physical and chemical mechanisms influencing the balance of small gaseous and aerosol compounds in different atmospheric layers at high latitudes.

Brief substantiation. The distribution of small gaseous species observed in the Earth’s atmosphere is formed under influence of multiple factors whose space and time variability as well as their relative importance are still remained investigated insufficiently. Obtaining new experimental data on chemical composition and thermodynamic parameters of the atmosphere in the northern regions of the Russia which traditionally little comprised by complex measurements of atmospheric characteristics will give the opportunity to enhance our knowledge about the importance of local natural and anthropogenic sources of gaseous and aerosol emissions as well as about the influence of regional and trasboundary atmospheric transport on ecosystem of this area. Conduction of complex measurements of various characteristics in the middle and upper atmosphere at high and middle latitudes will also allow for investigation of the influence of enhanced geomagnetic and sun activity on chemical budget and energetic characteristics of the atmosphere in wide range of altitudes.

Expected results.

- Quantitative estimations of the influence of various dynamical and chemical factors on surface air chemical composition in the northern regions of European Territory of the Russia (ETR).
- Estimation of the influence of regional and transboundary transport of small species including those of anthropogenic origin on the ecosystem of Northern Eurasia.
- Estimation of relative importance of mesoscale dynamical processes in mountainous regions of the Northern Europe on vertical exchange and chemical transformation of the air in troposphere and lower stratosphere.
- Estimation of mesospheric odd nitrogen (NOx) source and its input into the balance of nitrogen compounds and ozone in the polar stratosphere. Definition of the role of NOx in the system of Sun-Earth connections. Obtaining new information about influence of solar activity on vertical distribution and total amount of nitrogen dioxide in stratosphere.
- Obtaining new data on thermalphysic, radiation and morphometric properties of snow, ice and open water at polar latitudes. Definition of statistical characteristics of atmospheric turbulence above different types of ice and open water surfaces. Obtaining quantitative estimations of the influence of ice-holes and patches of ice-free water on energy exchange between atmosphere and underling surface under different meteorological conditions.
- Modernization and improvement of measuring devices with account for specificity of the work in polar conditions.
- Creation of data base for various characteristics of energy exchange in polar regions using the data obtained in different regional experiments.
- Estimation of emission rates for chemically active species in the atmosphere. Development and approbation in climatic models of various parametric schemes describing interaction of surface air with different types of the surfaces typical for polar regions.
• Obtaining information about long-term temperature and chemical composition variances in mid-latitude and polar upper atmosphere.

**Basic kinds of the investigations.** Conducting of measurements of surface air chemical composition, vertical distributions of ozone and nitrogen dioxide in troposphere and stratosphere and temperature regime in mesosphere at scientific stations Appatity, Lovozero and Zvenigorod. Complex measurements of chemical and radiation characteristics of the surface layer are to be conducted on the base of mobile observatory TROICA in northern regions of ETR (Murmansk-Archangelsk-Vorkuta). Theoretical analysis of experimental data is to be performed on the basis of chemical and dynamical models. Investigation of energy exchange between atmosphere and surface layer on the base of instrumental measurements of heat, humidity and momentum fluxes within the surface layer under different background conditions. Spectrophotometric measurements of ozone and nitrous dioxide in troposphere and stratosphere using scattered solar radiation in UV and visual ranges.

**Time, places and resources of field works.** The observations are to be conducted at stationary stations of the institutes IAP RAS, AGI RAS, ISPI SD DAS as well as from mobile observatory TROICA.