Systematization of statement and carrying out of instrumental measurements of greenhouse gases in the tasks of forecasting with use of mathematical models

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Study of the processes of emission and sink of atmospheric methane by tundra ecosystems is an important task in estimation of the contribution of natural sources in the global carbon cycle. Special actuality of this problem is connected with the expectations of significant climatic changes in the high-latitude regions of the Northern hemisphere (IPCC 2007). For the assessment of interaction of climate change and the natural ecosystems of these regions, as well as for the prediction of possible changes in the future it is necessary correspond mathematical models adequately reproduce the dynamics of the processes of emission and fixation of methane depending on the terms of the thermal and hydrological regimes of the underlying surface and the parameters of the external atmospheric impacts. Verification of such models should be carried out on joint measurements of methane emission, soil heat and hydro-physical characteristics and meteorological parameters (air temperature, precipitation, wind speed, air humidity). Proceeding from the tasks of calibration and verification of the IAP RAS model processes of temperature and moisture transfer in the ground and schemes of wetland ecosystems methane emission (Arzhanov et al., 2007; Denisov et al., 2011), carried out methodical work on choice of research sites for a full-scale measurements. The main characteristics of the sites were identified as follows:.

1. The presence at the research site dry areas of tundra and trivial tundra vegetation. This is general condition, as they occupy major part of tundra. These sites are considered as a sink of atmospheric methane.
2. The presence at the research site lakes of different types, including ice, flood and thermokarst. This requirement is presented in connection with the fact, that the genesis of lakes can indirectly influence on the intensity of methane emissions by means of difference of lake water properties (Bastviken et al., 2004).
3. The presence at the research site of wetland ecosystems. This is the most important requirement for estimation of the regional methane emission. Measurements need to get data by methane emissions from the most probable numbers of different types of wetland landscape. Estimation of regional methane emission could be obtained with methodology of the «Standard model» (Glagolev, 2008). For the most accurate estimation of methane emission from wetlands is required maximum coverage types of wetland landscapes in accordance with the classification proposed by Peregon (Peregon et al., 2009). Also, obtained data can be generalized for the study area using a dynamic model of methane emissions (Denisov et al., 2011).

Research sites were chosen using the remote sensing data. In particular, in this work were used Landsat 7TM satellite images, with high spatial resolution of 30m. (http://www.scanex.ru/ru/data/default.asp?submenu=landsat). This allows us to exactly classify types of wetland and tundra landscape. As the measurement begins in the spring season, when the underlying surface is maintained by snow cover, and there is no possibilities of on-site exactly identify the type of wetland landscape, the specific point for measurements are chosen by the satellite images. Moreover, during of experimental works the hypothesis on the maximum values of the methane emissions in the period of snow melting will be cheked on, at the basis of the data (http://aisori.meteo.ru/ClimateR) made estimates of the time for loss of snow cover for the study area (Fig. 1).

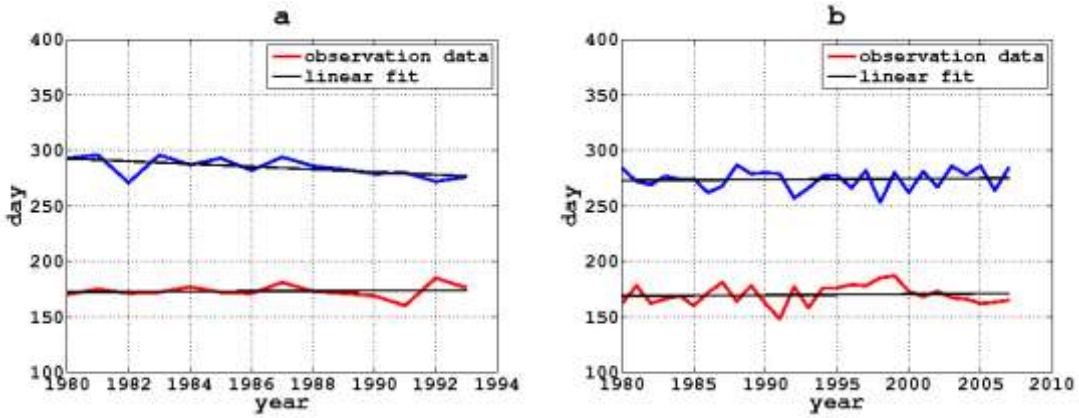

Figure 1. Interannual dynamics of periods of loss of snow cover (red line) and the formation of snow cover (blue line) by data of observations (http://aisori.meteo.ru/ClimateR) for Mis Kamennyi (a) and Dixon (b) meteostaitions. Also a linear interpolation is included for the observation (black line).

Measurements of the emissions of methane are made using a static chambers with dimming. In parallel studied environmental factors, which may influence on methane emission. For the measurement of methane emission from each type of the wetland landscape are selected few points. At each point measurements continue one day or half a day. The next day the camera is transferred to another point. Thus produces a maximum of various data sets, which gives the possibility of making the statistical processing of data and reduce the range of uncertainty in estimates of methane emissions due to the influence of ambient conditions.

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