Possible climate and water balance changes in Karelia (Russia) during the first half of the XXI century

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With 8 figures and 2 tables in the text

Abstract: As a result of the statistical analysis of the meteorological and water balance data, and fluctuations of the water level in large lakes in the Karelia region for the period 1880–1999, noticeable changes were detected. Numerical experiments on the ECHAM-4 model show changes in the climate and hydrological regime. Received results allow assuming that in Karelia during the 2000–2050 period slow changes in the landscape ecosystems may start, including freshwater ecosystems. The climate and water regime changes, if occur, will put demands to the management of basic branches of economy in the region.

Materials and methods

The investigated region and grid points of a numerical model are shown in Fig. 1. Obtained long-term air temperature time series for Karelia for the 119-year period are shown in Fig. 2.

Considerable differences are observed also in the spectral structure of changes in the global and regional air temperature. Karelia is notable for a peculiar climate resulting both from some specific features of the atmospheric processes in the Atlantic Ocean, Arctic Ocean, and Siberia, as well as from the Large European Lakes (LEL) and White Sea effects on the drainage basins. The high percentage of coverage of the territory by surface waters, forests and wetlands influences the climate formation here. Total annual river runoff for the total territory of Karelia was re-calculated using measured runoff data (Shnitnikov 1966; Kuusisto 1992).

For the analysis the water balance equation was used,

\[ R = P - E \pm \Delta W \pm \epsilon, \]

where \( R \) is river runoff from the territory, \( P \) is precipitation, \( E \) is total evaporation, \( \Delta W \) is change in storage into the basin, and \( \epsilon \) is total error of calculation of the water balance elements.

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