Results of atmospheric electricity observations made at Apatity (geomagnetic latitude: 63.8) are presented. The observations consisted of measurements of atmospheric potential gradient, positive conductivity, and negative conductivity. The measurements were made by a high-latitude computer-aided complex installed at Apatity in 2001. It consists of three spatially placed microbarographs for measurements of atmospheric waves, a device for air conductivity measurement and a device for measurement of vertical component of atmospheric electric field. The computer-aided system permits to get information with a frequency of five times per second. The ground-level atmospheric electric field was found to have systematic local diurnal and seasonal variations. According to our results there is a well defined wintertime maximum in local atmospheric electric field variations. Diurnal variations of atmospheric potential gradient was found to have a departure from the Carnegie curve. A distinct difference in the diurnal variation of atmospheric electric field has been observed also between disturbed and extremely quiet geomagnetic conditions. These high-latitude electric field variations appear to be the result of solar wind-magnetosphere-ionosphere coupling. Besides, we have compared the diurnal course of the atmospheric electric field with the variation of calculated effective Bz component of the interplanetary magnetic field arising due to variation of the geomagnetic dipole axis inclination during the Earth's rotation. The effective Bz is responsible for the additional global electric field appearance in the magnetosphere.