High-energy solar protons and electrons (solar cosmic rays – SCR) and solar UV irradiation are traditionally regarded as the most powerful agents of solar activity influence on the Earth’s atmosphere. Nevertheless, the detailed analysis of the aerological data from Vostok station (Antarctica) made it possible to find a strong influence of the interplanetary electric field $E_{KL}$ on atmospheric processes in central Antarctica, where the large-scale system of vertical circulation is formed during winter seasons. The influence is realized through (1) acceleration of the air masses, descending into the lower atmosphere from the troposphere, and (2) formation of cloudiness above the Antarctic Ridge, the cloudiness being increased under the influence of the electric field $E_{KL}$. The cloudiness formation results in the sudden warmings in the surface atmosphere, since the cloud layer efficiently backscatters the long wavelength radiation from the ice, but does not affect the adiabatic warming process of the descending tropospheric air masses. The warming is observed at ground level and cooling at $h > 10$ km when the electric field $E_{KL}$ is enhanced (usually when the IMF $B_z$ is southward). There is a linear relationship between the value of $E_{KL}$ changes and ground temperature at Vostok station: the larger is leap in the $E_{KL}$ the stronger is temperature deviation. The effect (sudden warming) can reach $14^\circ$ within one day. The acceleration is followed by a sharp increase of the atmospheric pressure in the near-pole region, which gives rise to strengthening the “katabatic” wind flowing from the Antarctic ice dome toward the Antarctic periphery. As a result, the circumpolar vortex surrounding the Antarctic continent decays, the surface easterlies at the coast stations are replaced by southerlies, and the cold air masses flow out from Antarctica over the Southern Ocean. The latter phenomena evidently destroy the regular relationships between the sea level pressure fluctuations in the Southeast Pacific high and the North Australian-Indonesian low. The El-Niño beginnings are related exactly to the anomalous atmospheric processes in the winter Antarctica.

As for the solar UV irradiation, measurements carried in zenith of free atmosphere at Novolazarevskaya station (70.46 S, 11.49 E) with use of Spectrometer AVASpec-2048 during summer seasons of 2008-2015, revealed short-time (from 3 to 100 min) fluctuations of the solar UV irradiation intensity in range of 297-330 nm. It is suggested that these fluctuations, as well as the corresponding fluctuations in the total solar irradiance (TSI), are related to the solar oscillations ($p$-mode), occurring in the interior of Sun. Fluctuations of UV irradiation ionizing the Earth’s upper atmosphere produce a crucial influence on the structure of atmosphere.