

Solar Activity Asymmetry and Atmospheric Circulation

KATYA GEORGIEVA

Solar-Terrestrial Influences Laboratory

All mechanisms proposed to account for the possible solar influences on weather and climate are trying to explain why, as evidenced by the observations in the XX century, increasing solar activity both in the 11-year solar cycle and in the secular solar cycle leads to increasing surface air temperature. However, a well established fact is that in the XIX century the temperature was actually anticorrelated to the sunspot number in the 11-year solar cycle, and probably also in the secular solar cycle. Our previous studies have demonstrated that the sign of the correlation between solar activity as expressed by the sunspot number and the terrestrial climate as expressed by the surface air temperature in the 11-year sunspot cycle changes in consecutive secular solar cycles, and is determined by the north-south asymmetry of solar activity – that is, the two solar hemispheres affect the Earth in different ways. Here we study the response of the large-scale atmospheric circulation to solar activity depending on what solar hemisphere is more active. We find that the long-term variations of the circulation are strongly correlated to the secular solar activity variations and the correlation at low latitudes does not depend on the solar asymmetry, while at mid and high latitudes the sign of the correlation changes in consecutive secular solar cycles, coinciding with the change in the solar activity asymmetry. We demonstrate how this is related to the intensity and location of the atmospheric centers of action, and speculate what effects it may have on climate.