Geophysical Research Abstracts
Vol. 17, EGU2015-9942, 2015
EGU General Assembly 2015

Spatial distribution of Northern Hemisphere winter temperatures during different phases of the solar cycle

Timo Asikainen, Ville Maliniemi, and Kalevi Mursula
University of Oulu, Department of Physics, University of Oulu, Oulu, Finland (timo.asikainen@oulu.fi)

Several recent studies have found variability in the Northern Hemisphere winter climate related to different parameters of solar activity. While these results consistently indicate some kind of solar modulation of tropospheric and stratospheric circulation and surface temperature, opinions on the exact mechanism and the solar driver differ. Proposed drivers include, e.g., total solar irradiance (TSI), solar UV radiation, galactic cosmic rays, and magnetospheric energetic particles. While some of these drivers are difficult to distinguish because of their closely similar variation over the solar cycle, other suggested drivers have clear differences in their solar cycle evolution. For example, geomagnetic activity and magnetospheric particle fluxes peak in the declining phase of the sunspot cycle, in difference to TSI and UV radiation which more closely follow sunspots. Using 13 solar cycles (1869–2009), we study winter surface temperatures and North Atlantic oscillation (NAO) during four different phases of the sunspot cycle: minimum, ascending, maximum, and declining phase. We find significant differences in the temperature patterns between the four cycle phases, which indicates a solar cycle modulation of winter surface temperatures. However, the clearest pattern of the temperature anomalies is not found during sunspot maximum or minimum, but during the declining phase, when the temperature pattern closely resembles the pattern found during positive NAO. Moreover, we find the same pattern during the low sunspot activity cycles of 100 years ago, suggesting that the pattern is largely independent of the overall level of solar activity.