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Meteorological influence of the solar wind ? Correlation of the surface temperature and the aa index, and participation

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We have shown the correlation between the surface temperature and the aa index [1], and are examining possible mechanisms now. The followings are examples of observations obtained so far. 1) Correlation between the winter aa index and the spring temperature was positive and high (r = ca. 0.7) at Northern Europe for the period of 1960-2001. 2) Correlation between the Arctic Oscillation and the surface temperature was strong for the winter-winter pair, and the correlation maps resembled those for the correlation between the temperature and the aa index. 3) The OMNI2 solar wind data gave high correlations between Pa (rate of energy flow from the solar wind into the magnetosphere, which highly correlates with the aa index) and the surface temperature. 4) The correlation between Pa and the Arctic Oscillation was high, for instance, for the January-January pair. 5) The correlation was high when the QBO was at easterly phase in January.

Thus, we can conclude that there should be certain connection between the solar wind and the meteorology. In this presentation, we extend our current approach by using the aa index because it has been shown that the aa index is a good measure of the effect of the solar wind.

The months employed in the stratification based on QBO phase was found to largely affect the correlation coefficient values. For the combination of the winter aa index and spring surface temperature, the r values were 0.78 for January as the stratifying month, 0.82 for February, 0.91 for March, 0.9 for April and 0.92 for May. The other months gave smaller values.

Northern Europe and North Atlantic regions gave high positive correlation at QBO easterly phase, and central part of the North Pacific regions gave high negative correlation at QBO westerly phase.

While the QBO is spatially limited to the equatorial stratosphere, its wind direction can affect, for instance, the propagation of planetary waves from the troposphere to the upper atmosphere.

Thus, the fact that the QBO takes part in the correlation between the aa index and the surface temperature shows that large-scale atmospheric circulations participate in the meteorological influence of the solar wind.

The high correlation between Pa and the aa index, together with the physical meaning of Pa, suggests that the correlation between these factors and the surface temperature may relate to the auroral electrojet current. Hence, there should be a link between the magnetosphere and the middle atmosphere, which can explain the meteorological influence of the solar wind.

[1] Kiminori Itoh, JpGU, 2008, 2009, 2010, 2011.

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