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Relationship between Arctic Sea Ice amount and PM_{10} Concentration in South Korea on January

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Abstract Text:

In this study, we investigated the possible teleconnection between PM_{10} concentration in South Korea and the Arctic Sea Ice concentration at interannual time scale using observed PM_{10} data in South Korea, NCEP-R2 data, and NOAA SIC data from 2001 to 2018. From EOF analysis we found a large-scale mode of the PM_{10} in South Korea as the first mode, which explained about 27.4% of total variability. Interestingly the large-scale mode is more dominantly influenced by the horizontal ventilation effect than the vertical atmospheric stability effect. The Potential Pollution Index (PPI), which is defined by weighted averaging of two ventilation effects, is highly correlated to the large-scale mode of the PM_{10} in South Korea with a correlation coefficient of 0.75, indicating that the PPI is a good measure for the PM_{10} in South Korea at interannual time scale. Regression maps show that the decrease of SIC over the Barents Sea is significantly correlated with weakening of the Ural high region and high pressure anomaly at 500 hPa over the Korean peninsula, indicating that weakening of Siberian High and Aleutian low were related to an decrease of SIC over the Barents Sea. Moreover, these patterns are basically similar to correlation pattern with the PPI, indicating that the variability of SIC over the Barents Sea can play an important role in modulating the variability of PM_{10} in South Korea through teleconnection from the Arctic Ocean to the Korean peninsula. In addition, global climate model experiments were used to confirm that changes in sea ice concentration over the Barents Sea induce to favorable atmospheric circulation patterns for increasing PM10 concentrations in South Korea.

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