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Responses of Ozone and Rainband over the East Asian Summer Monsoon Region to 11-yr Solar Cycle

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A rainband meridional shift index (RMSI) is used to statistically prove that the East Asian summer monsoon edge is significantly modulated by 11-yr solar cycle, i.e., more northward in the early summer of solar maximum years than that of solar minimum years. Throughout most of the 20th century, the significant decadal oscillations of sunspot number (SSN) and the RMSI are phase-locked and the SSN has led the RMSI slightly by approximately 1–2 years. Wind and Eliassen–Palm (EP) flux analysis shows that the decadal meridional oscillation of the June monsoon edge likely results from both two anomalous onsets of the South and East Asian monsoons and poleward shift of the subtropical westerly jet in high-solar May and June. As a result, southwesterly monsoon flow over the Yangtze River basin/South China is stronger/weaker during high-solar period. And the northward shift of the upper westerly jet also results in a westerly and easterly anomaly, respectively, to the north and south of it. They together result in an anomalous anticyclone in the lower and upper troposphere, respectively. Furthermore, the upper anticyclonic anomaly leads to an anomalous upper motion and then a decrease in ozone under and above the jet from the middle troposphere to the lower stratosphere. The effect can extend upward to 50hPa over the north boundary of monsoon.

Key words: Ozone, monsoon, solar cycle, decadal variability, EP flux, precipitation