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Role of vegetation feedback in spring warming over East Asia

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By analyzing long-term changes in station observed temperature and satellite-derived vegetation greenness data sets (i.e., normalized difference vegetation index and leaf area index) at a collocated region in spring over East Asia, slight warming occurred over regions that experienced large increase in vegetation greenness. On the contrary, strong warming occurred over regions that exhibited minor changes in vegetation greenness. It is demonstrated that changes in spring vegetation greenness in response to winter warming may reduce the increase in spring temperature. Observed inverse relationship between warming and greening from winter to spring is successfully reproduced by series of climate model simulations with and without coupling with a dynamic vegetation model. When vegetations are allowed to interact with temperature in a coupled experiment, insignificant (significant) increasing trends of temperature (vegetation greenness) are simulated in spring. Different results of the two experiments is attributed that changes in vegetation greenness such as earlier leaf emergence in response to winter warming is simulated only in the coupled dynamic vegetation experiment. Analysis on the surface energy budget certainly confirms that weaker spring warming results from evaporative cooling effect due to increased vegetation greenness. This suggests that the interaction between vegetation and temperature is crucial factor for the warming over East Asia.