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A GCM Study on the Roles of the Seasonal Marches of the SST and Land-Sea Heat Contrast in the Onset of the Asian Summer Monsoon

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The influences of the SST and land surface temperature on the seasonal march of the Asian summer monsoon are studied by using an atmospheric GCM, Global Spectral Model (GSM) of Japan Meteorological Agency (JMA). After examining the model performance on the Asian summer monsoon by five-year control run, we make two kinds of impact experiments, i.e. SST fixed run and solar fixed run focusing the Asian summer monsoon onset. In the SST fixed run, the model is run from April 1st until June 30th under the SST which is fixed at the value of April 1st. Ensemble average over five cases are compared with those of the control run. In the SST fixed run, the ITCZ does not jump from the southern hemisphere to the northern hemisphere, but stay in the southern hemisphere. It also considerably reduces the Somali jet and the Asian monsoon westerlies. In the solar fixed run, the model is run from April 1st until June 30th under the solar condition which is fixed at that of April 1st. The fixed solar condition suppresses the heat low over the continent and reduces low level westerlies in a geostrophic sense.

It is confirmed that the SST contributes to the onset of the Asian summer monsoon as much as the land-sea heat contrast does. The seasonal march of the SST induces the ITCZ jump from the southern to the northern hemisphere, strengthens the Hadley circulation, effectively transports the absolute angular momentum and then enhances the monsoon westerlies in the boreal summer. Furthermore, the land-sea heat contrast induces low-level wind surrounding the Eurasian continent and then strengthens the Asian monsoon westerlies.