Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

AAS03-16 Room:101A Time:May 23 14:45-15:00

Baiu rainband termination in an atmospheric and coupled model

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The climatological termination of Baiu rainband is investigated using a stand-alone atmospheric GCM (AFES) with observed SST (AMIP run) and a coupled GCM (CFES) integration (CFES run). Baiu rainband over the North Pacific abruptly shifts northward and almost disappears in early July in the AMIP run, while in the CFES run Baiu persists around 40 degree N during summer with a slow northward shift. In another simulation of AFES forced with CFES-simulated SST (CFES-SST run), the rainband behavior is similar to that in the CFES run. The mid-troposphere westerly jet and its thermal advection explain this difference in simulated Baiu. In the AMIP run, deep convection in the subtropical Northwest Pacific sets in prematurely, displacing the westerly jet northward over cold ocean surface earlier than observations. Although the mid-tropospheric thermal advection and vertically integrated moisture convergence are similar in magnitude between the AMIP and CFES runs, sea surface evaporation under the westerly jet is much suppressed in the AMIP run as a result of cold ocean temperature. Therefore Baiu rainband abruptly weakens after the northward shift in the AMIP run. In contrast, Baiu rainband continues during summer in the CFES run because of a strong westerly jet and weak deep convection in the subtropics, which are in turn due to a cold SST bias. Colder SST biases cool the troposphere in high latitudes, strengthening the westerly jet. In addition a cold SST bias in the subtropics inhibits deep convection, slowing down the poleward march of the westerly jet. As a result, ascending motion induced by the strong westerly jet, and Baiu rainband persist over the northwestern Pacific through summer in the CFES run. Our analysis suggests that the local sea surface evaporation under the seasonal marching westerly jet is also important for the termination of the Baiu rainband.

Keywords: Baiu, AGCM, CGCM, atmosphere-ocean interaction, monsoon, Earth Simulator