The effects of satellite-derived Eurasian snow water equivalent on flooding in Chao Phraya river basin in 2011

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Objectives

In the rainy season of 2011, flooding in Chaophraya River basin caused severe damage especially over industrial area in Thailand. Both lager amount of rainfall during entire rainy season compared with climatic average and landfall of tropical cyclones from September to October seemed to result in the flooding. Some previous studies indicated the effect of Eurasian snow amount on the Asian summer monsoon rainfall.

In this study, the effects of initialization using satellite derived snow water equivalent (SWE) on regional climate model simulations are investigated.

Methods

International pacific research center (IPRC) Regional Atmospheric Model (IRAM) was used as regional climate model. The model domain covers the area of 13.5°S-50.0°N, 65.0°E-145.0°E with horizontal grid spacing of 0.5°. The Japanese Re-Analysis 25 years available at every 6 hour intervals with a resolution of 2.5° × 2.5° in the horizontal and 17 pressure levels up to 10 hPa were used to provide the atmospheric initial and lateral boundary conditions. Weekly sea surface temperature (SST) over the ocean was obtained from the National Oceanic and Atmospheric Administration (NOAA), which has a horizontal resolution of 1° × 1°, was used as sea surface temperature.

The IRAM was used to conduct two ensemble simulations, each having 9 members with initial conditions spanning 9 days, centered on 0000UTC on 1 May 2011. The model was integrated continuously through 31 October for each run. The results are reported in terms of ensemble mean for each simulation. One of the ensembles uses the SWE

derived from AQUA AMSR-E averaged from April to May in 2011 to obtain the actual initial snow amount (designated as SAT). The other ensembles uses the 9 year mean (from 2002 to 2011) SWE averaged from April to May (designated as AVE).

Results

The ensemble mean of precipitation accumulated from June to July in SAT well reproduced the precipitation on Indochina compared with observed value in Global Satellite Mapping of Precipitation (GSMaP). The ensemble mean of precipitation accumulated in June and July in SAT was larger than that in AVE. The difference corresponded to the rainfall anomaly from 9 year average in GSMaP.

On the other hand, the difference in August and September dis not correspond well to the rainfall anomaly in GSMaP. This will be because the course model resolution cannot reproduce tropical cyclones in this season. It was expected that the effect of sea surface temperature (SST) anomaly was also large in this season.

Conclusion

In this study, an ensemble simulation considering the SWE observed in 2011 by satellite remote sensing and the other simulation considering the 9 year averaged SWE were conducted. From the comparison of those results, it was indicated that the larger amount of precipitation from June to July can be explained by the smaller SWE in the late spring in 2011. On the other hand, SWE cannot explain the precipitation anomaly in August and September well, and it was indicated that the effect of landfall of tropical cyclones and SST anomaly will be dominant in the period.