

Simulation of Indian Summer Monsoon Rainfall and Circulations with Regional Climate Model

G. P. SINGH and JAI-HO OH

Dept. of Env. Atmos. Sci., Pukyong National University, Busan, Korea, jhoh@pknu.ac.kr

Abstract:

It is well known that there is an inverse relationship between the strength of Indian summer monsoon Rainfall (ISMR) and extent of Eurasian snow cover/depth in the preceding season. Tibetan snow cover/depth also affects the Asian monsoon rainy season largely. The positive correlation between Tibetan sensible heat flux and southeast Asian rainfall suggest an inverse relationship between Tibetan snow cover and southeast Asian rainfall. Developments in Regional Climate Models suggest that the effect of Tibetan snow on the ISMR can be well studied by Limited Area Models (LAMs). LAMs are used for regional climate studies and operational weather forecast of several hours to 3 days in future. The Eta model developed by the National Center for Environmental Prediction (NCEP), the Fifth-Generation NCAR/Penn State Mesoscale Model (MM5) and Regional Climate Model (RegCM) have been used for weather prediction as well as for the study of present-day climate and variability over different parts of the world. Regional Climate Model (RegCM3) has been widely used for various mesoscale studies. However, it has not been tested to study the characteristics of circulation features and associated rainfall over India so far.

In the present study, Regional Climate Model (RegCM-3) has been integrated from 1st April to 30th September for the years 1993-1996 and monthly mean monsoon circulation features and rainfall simulated by the model at 55km resolution have been studied for the Indian summer monsoon season. Characteristics of wind at 850hPa and 200hPa, temperature at 500hPa, surface pressure and rainfall simulated by the model have been examined for two convective schemes such as Kuo and Grell with Arakawa-Schubert as the closure scheme. Model simulated monsoon circulation features have been compared with those of NCEP/NCAR reanalyzed fields and the rainfall with those of India Meteorological Department (IMD) observational rainfall datasets. Comparisons of wind and temperature fields show that Grell scheme is closer to the NCEP/NCAR reanalysis. The influence of Tibetan snowdepth in spring season on the summer monsoon circulation features and subsequent rainfall over India have been examined. For such sensitivity experiment, NIMBUS-7 SMMR snowdepth data have been used as a boundary condition in the RegCM3. Model

simulation indicates that ISMR is reduced by 30% when 10cm of snow has been introduced over Tibetan region in the month of previous April. The existence of Tibetan snow in RegCM3 also indicates weak lower level monsoon westerlies and upper level easterlies.

Keywords: Indian summer monsoon, Tibetan snow, Regional climate model, westerlies, easterlies.