남아시아 몬순강수량과 이산화탄소 농도증가의 관계

알 에이치 크리팔라니, 오재호

부경대학교 환경대기과학과

Impact of CO_2 increase on South Asian monsoon rainfall

R. H. Kripalani, and J. –H. Oh

Integrated Climate System Modeling Laboratory

Department of Environment and Atmospheric Sciences

Pukyong National University, Busan 608-737, South Korea

(Correspondence: krip@climate.pknu.ac.kr)

Climate modeling groups around the world have been performing an unprecedented set of coordinated 20th through to the 22nd century climate change experiments for the Inter-governmental Panel on Climate Change Fourth Assessment Report (IPCC AR4).

The 20th century simulated summer monsoon (June through September) precipitation over the Indian landmass and neighborhood for all the available models (22 to date) has been examined with respect to the annual cycle, spatial patterns and inter-annual variability. These simulated features are compared with the observed features. Based on this analysis three models viz. (i) Meteo-France / Centre National de Recherches Meteorologiques, France (CNRM-CM3); (ii) Center for Climate System Research (The University of Tokyo), National Institute for Environmental Studies and Frontier Research Center for Global Change (JAMSTEC): Model for Interdisciplinary Research on Climate, Japan (MIROC3.2) and (iii) Hadley Center for Climate Prediction and Research / Met Office, UK (UKMO-HadCM3) are selected to examine future precipitation projections.

Transient runs under the 1% per year compounded increase in CO2 until reaching double and held constant thereafter for the scenario years 2001-2170 are further examined. For all the 3 models runs for 80 years are available under the CO2 increase experiment. However for the model CNRM-CM3 only a further run of 90 years is available under the period when CO2 is kept fixed to stabilize and reach an equilibrium state. Time slices for the period centered at the time of CO2 doubling (i.e. idealized years

61-80 of the transient run) and 20 years at the end of the transient run are analyzed. These time-slice projections are compared with the mean simulated climatology for the last 20 years of the respective control runs.

Results reveal that for the Indian landmass (area-averaged precipitation) models CNRM-CM3, MIROC3.2 and UKMO-HadCM3 project an increase of 4, 8 and 18 % in precipitation at the time of CO2 doubling. All the three models project more rainfall over the land area in particular the areas of low rainfall i.e. northwest India and the southeast peninsula, and project low rainfall over the oceanic regions. Besides increase in quantum of rainfall, models also project increase in variability. Further the duration of the monsoon period is also likely to be extended in the warming world. Wavelet Analysis suggests that the low frequency Indian monsoon variability normally associated with the decadal Pacific Ocean variability may shift to high frequency variability related with the biennial Indian Ocean Oscillation.

Acknowledgements

We acknowledge the international modeling groups for providing their data for analysis, the Program for Climate Model Diagnosis and Inter-comparison (PCMDI) for collecting and archiving the model data. The visit of R.H. Kripalani to the Pukyong National University is supported by the Korean Federation of Science and Technology Societies (KOSEF).