High Resolution Projections of Indian Summer Monsoon Synoptic Activity in a Warming Climate

Sandeep Sukumaran (1), Ajayamohan Ravindran (1), Sabin Thazhe Purayil (1,2), and Praveen Veluthedathekuzhiyil (1)

(1) Center for Prototype Climate Modeling, New York University Abu Dhabi, United Arab Emirates (ss7675@nyu.edu), (2) Center for Climate Change Research, Indian Institute of Tropical Meteorology, Pune, India

The cyclonic systems of varying intensity, collectively known as Low Pressure Systems (LPS) are responsible more than 50% of the precipitation over Central India. Despite its importance, the future variability of LPS is poorly understood mainly due to the inadequate representation of these systems in global climate models. Insufficient spatial resolution of the current generation coupled models is a hindrance to resolve these storms properly. In order to overcome this problem, we use the Geophysical Fluid Dynamics Laboratory's (GFDL) High Resolution Atmospheric Model (HiRAM) to simulate current and future climate, with a model grid spacing of $\sim$50km. The time slice experiments for current (1981 – 2005) and future (2071 – 2095) climate are forced with bias-corrected SSTs from Coupled Model Inter-comparison Project (CMIP5) historical and RCP8.5 simulations respectively. Four ensembles of the experiments are conducted with SST forcing taken from four different CMIP5 models.

A benchmark simulation of the HiRAM model with observed SSTs shows that the model is capable of simulating the life cycle of the observed LPS reasonably well. In addition, HiRAM realistically simulates the observed LPS track density. Further, the track density in the historical ensemble is comparable with both observations and benchmark simulation. In the RCP8.5 simulations, an overall decline in the LPS activity is seen which is found to be related to the decrease in the high intensity systems in a warming environment. Consistent with the decrease in LPS activity, the seasonal mean monsoon precipitation is also declining in RCP8.5 simulations.