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Modeling an extreme precipitation event over the Black Sea coasts: impact of SSTs and cumulus parameterization schemes

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There is general agreement that intensity and frequency of extreme events will become more common due to enhanced greenhouse gas concentrations and associated atmospheric warming. Indeed, General Circulation Model (GCM) climate change simulations for various emission scenarios point out an increase in extreme events in certain areas. However, extreme events such as heavy rainfall are difficult to demonstrate with low-resolution simulations especially over complex terrains. Anatolia, a peninsula in the eastern Mediterranean, is surrounded by Black Sea in the north, Aegean Sea in the west and Mediterranean Sea in the south. The terrain of the peninsula is quite complex, and together with its surroundings it shows some remarkable contrasting features in topography, land-sea boundary and landscape. Variations in sea surface temperatures (SSTs) of the surrounding seas may have important effect on intensity of the precipitation over the region. Long-term variations in seasonal SST anomalies of the surrounding seas of the peninsula indicate a striking warming period beginning from the early 1990's and the warming period is projected to continue in the future according to regional climate change projections. In parallel with the general agreement that intensity and frequency of extreme events will become more common due to enhanced greenhouse forcing and associated with atmospheric warming (IPCC AR4), a number of extreme precipitation and regional flooding events have been observed along the coasts of the peninsula, especially along the Black Sea coasts in recent years. The heavy rainfall episode over Istanbul and its surroundings on September 8-9, 2009 resulted in over 30 casualties and several million dollars damage. The first analysis indicates that a positive SST anomaly over the Black Sea enhanced the large-scale atmospheric circulation by providing substantial amounts of heat and moisture from the sea surface. This extreme event has been simulated by a high-resolution regional climate model, RegCM4 with a spatial resolution of 15 km. The Grell Scheme with Fritsch-Chappell closure and the Emanuel Scheme have been applied with monthly, weekly and daily SST input field. The model performance has been evaluated by comparing upper level circulations, moisture, and temperature with Reanalysis. The rainfall prediction was assessed by comparing rainfall from the Tropical Rainfall Measuring Mission (TRMM) products and the meteorological stations. Results indicate that simulation of Emanuel Scheme forced with the daily SST with diurnal cycle mostly captures the heavy rainfall over the southwest Black Sea coasts and the spatial pattern of the rainfall is consistent with the observations. In this on-going study, additional simulations will be done for another episode took place in eastern Black Sea coasts.