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Ensemble-Based Simulations of Extreme Precipitation Enhanced by Warmer Sea Surface Temperatures over the Black Sea

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In this study, the extreme precipitation case over the coast of Eastern Black Sea has been studied by using numerical weather model WRF-ARW 3.8. The flood event caused by two days rainfall (August 23 and 24, 2015) killed 11 people. The station based observation is 255 mm for two days total precipitation. The one usual suspect of this excessive rainfall event is warmer sea surface temperature (SST) over the Black Sea. Increasing SST trend has been detected clearly for the last three decades. The monthly mean SST anomaly in August 2015 is higher than 3 °C with respect to the 1981-2010 period. We designed three sensitivity simulations by implementing the WRF in order to examine the impacts of the Black Sea over the extreme precipitation. The simulations have been driven by the ECMWF ERA-Interim and the NCEP NOAA SST data with three nested domains, 27-9-3km. In addition, initial conditions have been customized to produced ensemble simulations and nine different simulations are generated by modifying the initialization date which are 1, 3, 7, 15, 25, 25.5, 26, 26.5 and 27-days before the precipitation event. Satellite based observational data (Global Precipitation Measurement: GPM) have been applied to validate precipitation simulations. Reference simulations (Sim-0s) consistent with GPM data and 3-days simulation produced 185 mm for two days rainfall. In order to analyze of the SST sensitivity to the extreme rainfall event, the simulations have been forced by modified NCEP/NOAA SST. The modified SST (considering only the Black Sea) have calculated by subtracting 1 °C (Sim-1s), 2 °C (Sim-2s) and 3 °C (Sim-3s) from the 6 hourly SST data for the whole simulation period. The sensitivity simulations indicate that daily total precipitation rates for all simulations decreased progressively based on the reference simulations (Sim-0). However the rainfall intensity does not decrease in a same magnitude for all the simulations forced by modified SST. The ensemble-based sensitivity simulations have been analyzed extensively to define the critical SST threshold for extreme precipitation events.