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Simulations and Sensitivity Analysis of Heavy Rainfall Events over Northern Turkey using WRF-ARW

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This study aims to simulate two extreme precipitation events over Northern Turkey on dates between 13 July 2009 and 22 July 2009. During these events, synoptic scale flow moved from west cost to east coast of Black Sea interacted with warmer sea surface temperatures and complex orography. These events occurred over western coastline and eastern coastline have different characteristics. Three days of heavy precipitation were observed during the first case over the Northwestern part of Turkey. For the second case, a mesoscale event resulted in 12 hours of extreme precipitation was observed over the Northeastern part of Turkey. In this study, all simulations have been performed by WRF-ARW model. Initial conditions have been produced by ECMWF ERA-Interim data updated every 6 hours. More than 20 sensitivity analysis have been applied using different parameterizations of PBL, cumulus and microphysics using three nested domains with 27-9-3 km resolutions. Initial results showed that poor forecast skill has been performed because of the possible moisture loss through the nested domains. To overcome moisture loss problem over the boundaries, single domain runs with 9 km have been applied. Also, additional sensitivity runs have been made by forcing SST data to resolve hydrological process, by forcing MODIS data to get finer orography and by using GFS data to compare with ERA-Interim. Precipitation simulations have been verified with ground observations over 71 stations through the coastline and the inner regions. In addition, precipitation from model outputs and observations were compared for both windward and lee-side of mountains to understand the orographic forcing. Also, NASA Tropical Rainfall Measurement Mission (TRMM) 3-hourly data and radar data used for comparison of model results. For both events, Lagrangian trajectory models HYSPLIT and FLEXTRA have been used to determine source of moisture and moisture transport paths resulted in precipitation. Preliminary results from single domain simulations showed better forecast skill comparing to the nested simulations over western side.