Cyclones and their Effect on the Hydrologic Cycle in the Eastern Mediterranean for a Double-CO_2 Scenario: Dynamic Downscaling from Atmospheric General Circulation Model Output

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The Weather Research and Forecast (WRF) model is being used to downscale the changes in the cyclonic precipitation and other components of the water cycle that would result from a doubling of the atmospheric CO_2 in a low-resolution atmospheric general circulation model. The geographic focus area is the eastern Mediterranean and the adjacent countries of the Middle East. The first step in this study is the use of the model to replicate the present-day hydro-climate of the area. To accomplish this, the model was run for several (10+) winter seasons using NCAR-NCEP (National Centers for Environmental Prediction) Reanalysis Project archived global analyses for lateral-boundary conditions. The comparison of the simulated and observed precipitation established the veracity of the modeling system for use in simulating the water cycle for this geographic area. For comparison, the WRF model is then run for the same period using lateral-boundary conditions from a simulation of the present global climate by the NCAR Community Atmospheric Model (CAM) driven by observed sea surface temperatures and land use. Lastly, the WRF model is run with the lateral-boundary conditions provided by a double-CO_2 experiment of the coupled ocean-land-atmosphere Community Climate System Model, CCSM. This WRF-model output is compared with the WRF simulation of the present climate in order to assess the impact of CO_2 doubling on Mediterranean cyclones and the components of the water cycle in that area. Comparisons of the three simulations are made in terms of cyclonic-storm properties, including precipitation. The focus of the study is limited to the winter season.