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High Resolution Regional Climate Modeling for Lebanon, Eastern Mediterranean Coast

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The Eastern Mediterranean coast consists of Lebanon, Palestine, Syria, Israel and a small part of southern Turkey. The region lies between latitudes 30 degrees S and 40 degrees N, which makes its climate affected by westerly propagating wintertime cyclones spinning off mid-latitude troughs (December, January and February), while during summer (June, July and August) the area is strongly affected by the sub-tropical anti-cyclonic belt as a result of the descending air of the Hadley cell circulation system. The area is considered to be in a transitional zone between tropical to mid-latitude climate regimes, and having a coastal topography up to 3000 m in elevation (like in the Western Ranges of Lebanon), which emphasizes the complexity of climate variability in this area under future predictions of climate change.

This research incorporates both regional climate numerical simulations, Tropical Rainfall Measuring Mission (TRMM) satellite derived and surface rain gauge rainfall data to evaluate the Regional Climate Model (RegCM) version 4 ability to represent both the mean and variance of observed precipitation in the Eastern Mediterranean Region, with emphasis on the Lebanese coastal terrain and mountain ranges. The adopted methodology involves dynamically down scaling climate data from reanalysis synoptic files through a double nesting procedure. The retrospective analysis of 13 years with both 50 and 10 km spatial resolution allows for the assessment of the model results on both a climate scale and specific high intensity precipitating events.

The spatial averaged mean bias error in precipitation rate for the rainy season predicted by RegCM 50 and 10 km resolution grids was 0.13 and 0.004 mm hr-1 respectively. When correlating RegCM and TRMM precipitation rate for the domain covering Lebanon's coastal mountains, the root mean square error (RMSE) for the mean quantities over the 13-year period was only 0.03, while the RMSE for the standard deviation was higher by one order of magnitude. Initial results showed good spatial variability agreement for precipitation with the satellite-derived data with improved results for the 10 km grid resolution setup. Also, results show a larger uncertainty within RegCM for predicting extreme precipitation events. Future work will investigate the ability of RegCM to simulate these extreme deviations in precipitation. The results from this research can be helpful for the better design of future regional climate down scaling predictions under climate change scenarios.