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Future summer climate in the Mediterranean region, simulated with a high-resolution model: contributions of the local features and teleconnections.

Monika J. Barcikowska (1), Sarah B. Kapnick (2), Scott J. Weaver (3), and Lakshmi Krishnamurty (2)

(1) Environmental Defense Fund, New York City, United States, (mbarcikowska@edf.org), (2) Geophysical Fluid Dynamics Laboratory/NOAA, Princeton, (3) Environmental Defense Fund, Washington, D.C, United States

The summer climate of the Mediterranean region is to a large extent determined by midlatitude and subtropical atmospheric circulation, as well as this region's very complex orography. Therefore, the skill of CMIP3 and CMIP5 models in representing local–scale interactions, as well as impacts of the local and remote large-scale circulation, shapes to a large extent the fidelity of simulated future climate change.

The future climate projections of the summer Mediterranean with CMIP3 and CMIP5 models indicate a radical warming and drying. Nevertheless, most of the CMIP3 and CMIP5 – generation models have been shown to be deficient in representing hydrometeorological impacts of the summer teleconnections, e.g. the summer North Atlantic Oscillation (SNAO) and the Indian Monsoon. This questions the accuracy of the future projections derived for this region.

In this study we show that the GFDL high-resolution global climate model [Geophysical Fluid Dynamics Laboratory Climate Model version 2.5 (GFDL CM2.5)] reproduces both teleconnections more realistically than the lower-resolution model. Analysis of a control run, historical simulations, and future projections shows that the strengthening of the SNAO yields a correct hydroclimate response (in terms of magnitude and spatial pattern) over the northeastern Mediterranean. This response, absent in the simulations performed with low-resolution models, allows the GFDL CM2.5 model to offset partially the warming and drying projected in the region. On the other hand, a very intense response to the warming over the south-eastern Mediterranean and Asia Minor leads to bipolar seesaw circulation anomalies: an intensified cyclonic anomaly over the southeastern Mediterranean, and an anticylonic anomaly over the Central Mediterranean, the Balkans and Turkey. This local response amplifies drying in the central and northeastern Mediterranean and thus weakens the impact of the SNAO teleconnection in this region, pointing to the increasing influence of local circulation over a warmer Mediterranean.