Assessing improvement of RCM with respect to GCM climate simulations over the Mediterranean region: mean monthly fields

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This study analyzes the monthly precipitation and temperature climatology produced by climate models in the Mediterranean region and compares it with the gridded observational CRU (Climate Research Unit) dataset of the East Anglia University. The purpose is to identify and quantify improvements obtained by RCMs (Regional Climate Models) with respect to the GCMs (Global Climate Models) that supplied the initial and boundary conditions. Data are provided by the GCMs and RCMs that were used in the PRUDENCE and ENSEMBLES European projects. RCMs are very good at compensating the GCM bias for temperature, but less successful for precipitation. They are less effective reducing the root mean square error, meaning that improvements during some months/areas is partially spoiled by deterioration during other months/areas. In general, though errors on temperature are smaller than errors on precipitation, unfortunately, improvements by RCM are larger for temperature than for precipitation. RCMs outperform GCMs quite convincingly in summer months for both variables, but not for precipitation in winter. RCMs are very effective at reducing systematic GCM errors in coastal areas and at high levels over complicated orography. It is shown that errors of GCM temperature can be only partially compensated by a simple correction based on a constant (both in space and time) lapse rate accounting for wrong elevation. For precipitation, RCMs do not always improve results over large continental areas, where individual RCM and also their ensemble mean can get worse than GCM. Ensemble mean for both RCM and GCM provides results that, though they are not always better than those of the individual models, are exempt from major problems. RCMs systematically outperform GCMs when considering climate type classifications.