

Regional Climate Modeling (I)

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Regional climate models (RCMs) driven by observed boundary conditions in general have the ability to reproduce the observed mean climate at spatial scales approaching the model grid resolution. Also, they are able to reproduce observed variability from interannual to intra-seasonal timescales. Any given model may have deficiencies which compromise its ability to simulate certain aspects of the observed climate, e.g. for a certain variable or over a particular region. A model may also have particular strengths which allow it to have further qualities, e.g. accurate simulation of particular extreme events at its gridscale.

To ensure an RCM model reproduces the observed large-scale climatology, care may be required with the choice of the domain. An RCM with a domain including a region in which processes may have a substantial impact on large-scale circulation patterns may produce internal solutions which are inconsistent with the driving data. This may not invalidate the internal solution in a climatological sense but results from such a simulation will need careful interpretation and spurious behavior adjacent to part of the boundary is likely. Where the large-scale forcing is located outside possible domains, then the main constraint will simply be to ensure that the area of interest is not too close to the boundary rim.

When nesting an RCM in a GCM, errors in the large-scale climatology of the latter will be transmitted to the RCM. Thus when using an RCM to add regional detail to a GCM simulation, it is important to minimize such errors. An RCM used in such a context does not require the same formulation as the GCM, though if it has then explicit account should be taken of the scale dependencies in the common model formulation. However, with such a common formulation system, the RCM is clearly providing regional detail fully consistent with the GCM simulation and analysis of the behavior of the system is more straightforward.