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Sensitivity of ICTP Regional Climate Model (RegCM3) to Initial and Lateral Boundary Conditions

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Regional climate simulations require lateral boundary conditions. These are typically reanalysis of past observations or alternatively, output from climate general circulation models. Lateral boundary conditions are available at various temporal and spatial resolutions. At present, spatial resolution of reanalysis datasets ranges from few kilometers, for example, regional reanalysis limited to only single continent, to the coarser but global datasets like ECMWF 40 Years Re-Analysis. While these datasets represent reasonable analyses of 3-D atmospheric as well as surface conditions, their resolutions, the physics of the models used to generate them, and the means of assimilating data into them can produce very different results when used as boundary conditions for regional climate models.

The sensitivity of ICTP Regional Climate Model (RegCM3) to different lateral boundary conditions was investigated over the Alpine region. The model was run directly at 10km horizontal resolution as well as in one-way double nested mode, with a 30 km grid point spacing mother domain encompassing the Europe and a 10 km grid point spacing nested domain covering the Alpine Region. The simulations spans the one-year period of 1989. The boundary conditions used for various simulations were ECMWF Interim Re-Analysis (ERA-Interim, 0.75° and 1.5° grid spacings, 6-h intervals), the ECMWF 40 Years Re-Analysis (ERA40, 1° and 2.5° grid spacings, 6-h interval) and finally the 2.5°, 6-h NCEP/DOE AMIP-II Reanalysis (Reanalysis-2). Sea Surface Temperature for the simulated periods were obtained from a UK Met Office Global Ocean Surface Temperature (GISST), a set of SST data in monthly 1° area grids. When recently released ERA-Interim Reanalysis, which is based on a recent release of the Integrated Forecasting System (IFS Cy31r2) containing many improvements both in the forecasting model and analysis methodology, was used as lateral and boundary conditions, the simulated precipitation field was more closer to observations than simulated by the model driven with other boundary conditions.

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