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Evaluating Global Reanalyses Datasets for Provision of Boundary Conditions in Regional Climate Modeling

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There is accelerated use of reanalyses products for various scientific endeavours including providing boundary conditions for regional climate modelling, forcing land surface models, and studying the climate system. Despite this, little has been done to assess suitability of alternate reanalysis data to serve as lateral boundary conditions (LBCs) for regional climate modelling. Choice of reanalysis to perform such downscaling has been made based either on convenience or on performance of the reanalyses within the regional domain for variables such as near-surface air temperature and precipitation. In dynamical downscaling, the only information passed from the forcing reanalysis to the regional model are the atmospheric temperature, moisture and winds at the location of the boundaries of the regional domain. Here we present a methodology to evaluate reanalyses derived LBCs for an example domain over southern Africa using Atmospheric Infrared Sounder satellite temperature and relative humidity for the years 2003 to 2012 inclusive. Overall, MERRA is preferred for generating lateral boundary conditions for this domain, followed by ERA-I. Downscaling these two best reanalyses, however, ERA-I is slightly better than MERRA. This change suggests that the regional model influence along with the wind LBCs, which were not evaluated play an important role in the performance of RCMs. Downscaled ERA-I, however, remains superior and inferior to downscaled MERRA in temporal variability and climate mean respectively. While a “better” LBC specification is not the sole precursor to an improved downscaling outcome, any reduction in uncertainty associated with the specification of LBCs is a step in the right direction.