Use of multi-model ensembles for regional climate downscaling

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Dynamic regional downscaling requires use of a regional model driven at its boundaries by the output from coarse-scale global climate models. But individual members from global multi-model ensembles often lead to contradicting answers, and the important question arises of which of the many global models to select for the downscaling work. The perhaps most obvious solution to downscale various models is usually too expensive. Numerous studies have shown that the performance of the multi-model mean of an ensemble is usually superior to that of any individual model. However, it is unclear how to employ the multi-model mean framework for regional downscaling. We propose a simple method that allows use of a multi-model mean for downscaling work. We demonstrate the performance of our method using the WRF regional model system coupled to CMIP5 output. The system is used to perform high-resolution climate change simulations over our prototypical study region of tropical South America. We use objective criteria to select three CMIP5 models that perform best in terms of simulating present day climate. The outcomes from using these three individual global models are contrasted against that from using the CMIP5 multi-model mean. We discuss the advantages and limitations of the new method, and conclude that it represents a promising and computationally inexpensive alternative to the traditional downscaling of individual models.