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A hybrid GCM - historical scaling method for improved climate projections to 2100

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It is well known that GCM based projections for the next century suffer from a wide model to model dispersion and hence uncertainty. In addition, we have recently shown that when compared to the historical record, the multimodel mean of 32 CMIP5 simulations also has a warm bias of about 15%. We recently proposed a historical based method that exploits the scaling symmetry of the dynamics and its near linearity to make historical based projections with much smaller uncertainties. When these empirically determined historical Scaling Climate Response Functions (SCRFs) are applied to the CMIP5 models, the method is generally quite accurate but nevertheless has small scenario dependent biases.
In this presentation, we introduce a hybrid GCM-SCRF method that combines the CMIP5 GCMs with the scaling historical method. In effect, the historical data corrects the GCM biases while the future GCM projections correct for the SCRF biases. The overall result has both lower uncertainty as well significantly reduced biases. Following the Representative Concentration Pathway scenarios, this hybrid approach allows us to make improved global and regional surface temperature projections up to the year 2100.