Projections for future temperature and precipitation were developed using downscaled outputs from 33 global-scale general circulation models (GCMs) used in the Intergovernmental Panel on Climate Change Fifth Assessment report, in conjunction with two representative concentration pathways (RCPs; RCP4.5 and RCP8.5) (Moss et al., 2013). The approach uses monthly bias-corrected and spatially disaggregated (BCSD) climate projections at 1/8° resolution derived from the WCRP CMIP5 multi-model data set. The BCSD projections were obtained online. The output from the land-based grid box corresponding to each of the cities is used in the analysis. Projections are presented as averages across 30-year future year time periods, known as timeslices, and are expressed relative to the baseline period, 1971 to 2000. The timeslices are centered around a given decade. For example, the 2050s timeslice refers to the period from 2040 to 2069.

The combination of 33 GCMs and two RCPs produces a 66 (33 x 2)-member matrix of outputs for temperature and precipitation. For each time period, the results constitute a model-based range of outcomes, which can be used in risk-based decision-making. This approach gives equal weight to each GCM and to each of the two RCPs selected.

The results for future time periods are compared to the model results for the baseline period (1971 to 2000). Mean temperature change projections are calculated via the delta method. The delta method is a type of bias-correction whereby the difference between each model's future simulation and that model's baseline simulation is used, rather than 'raw' outputs from the models. The delta method is a long-established technique for developing local climate change projections (Gleick 1986; Arnell 1996; Wilby et al., 2004; Horton et al., 2011). Mean precipitation change is similarly based on the ratio of a given model's future precipitation to that model's baseline precipitation (expressed as a percentage change).

Because monthly output from climate models is considered more reliable than daily output (Grotch and MacCracken, 1991), a hybrid projection technique is used. Modeled changes in monthly temperature and precipitation are based on the same methods described for the annual data; monthly changes through time in each of the GCM-RCP combinations are then applied (added in the case of degrees of temperature change and multiplied in the case of percentage change in precipitation) to the observed daily 1971 to 2000 temperature and precipitation data from the weather station in each of the cities.

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