# Ensemble methods for NextGen projections

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Stakeholders across the Australian community want national climate projections to inform strategic decisions to reliably manage future risk. To be useful, projections information must:

* Be scientifically credible, based on the weight of evidence and available models.
* Frame and report on useful dimensions to understand the future climate – internal variability, a plausible range of emissions scenarios, a credible range of change for each emissions scenario and an assessment of confidence in projections.
* Present a credible range of change or a set of plausible scenarios – not overconfident and narrow so as to raise the real risk of maladaptive decisions, but not excessively broad where there is little value for decision-making.
* Relevant and easy-to-use in the full range of applied analyses in various arenas, including adaptation and mitigation questions.
* Be from an authoritative and trusted source to ensure legitimacy and effectiveness.

The primary source of information for previous Australian national projections has been the Coupled Model Inter-comparison Project (CMIP) ensemble of global climate models run for multiple future emissions scenarios. This has meant that traditional methods of generating ensembles could be tested and employed. Previous national projections supplemented the GCM projections with insights from available downscaling studies. State-based projects have primarily used *ad hoc* ensembles using a single method of dynamical downscaling to produce high-resolution projections that represent regional detail and processes. However, the landscape of both the uses for projections and the available data sources is changing. In response, the Earth Systems and Climate Change hub held the [NextGen Projections workshop](http://nespclimate.com.au/wp-content/uploads/2018/06/ESCC-R005-NextGen-projections-180629.pdf) as part of developing a thoughtful strategy to ensure future success.

Different applications of climate projections, including new and emerging uses, all need different types of information, guidance and datasets to suit their needs. Emerging applications include the finance sector, who require information relevant to financial risk and exposure, and national climate projections that are consistent with international scenarios. Also, the Paris agreement targets are now firmly in the public consciousness as a target for limiting climate change, so reporting on change at these targets is highly policy-relevant. There is also a question of whether to report on scenarios that include different types of negative emissions or geoengineering.

A variety of evolving and new data sources can be used and combined in novel ways to meet these changing needs, and to ensure that the most comprehensive and scientifically robust projections are available. The new [CMIP6](https://www.wcrp-climate.org/wgcm-cmip/wgcm-cmip6) ensemble run for future scenarios will of course be a crucial data source for the next generation of projections, but there will be more need than ever to consider and synthesise inputs from other sources. This presents challenges to ensemble generation – in model evaluation, assessing model independence and representativeness, then ultimately model rejection and/or weighting. Data sources include:

* [Non-scenario CMIP6](https://www.wcrp-climate.org/modelling-wgcm-mip-catalogue/modelling-wgcm-cmip6-endorsed-mips) simulations (e.g. HighresMIP, VIACS-AB, GEOMIP)
* [CORDEX2](http://www.cordex.org/) coordinated downscaling, and also existing *ad hoc* downscaling
* Large atmosphere-only ensembles, possibly including [Weather@Home](https://www.climateprediction.net/weatherathome/) and [BARRA reanalysis](http://www.bom.gov.au/research/projects/reanalysis/) run in projections mode
* Simulations specifically for Paris targets – [HAPPIMIP](http://www.happimip.org/), and [BRACE](http://www.cgd.ucar.edu/projects/chsp/brace.html)
* Comparison of different approaches to impact assessment (e.g. [ISIMIP](https://www.isimip.org/))