Committee on Climate Change
7 Holbein Place
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Professor Ian Boyd
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Dear Ian,

UK Climate Projections 2018 (UKCP18): emissions scenarios

Your letter of 10th May asked for ongoing advice from the Adaptation Sub-Committee on the development of the next set of UK Climate Projections (UKCP18) in terms of the extent to which they will meet the needs of the user community.

Over the summer, Professor Jim Hall (ASC member) and Kathryn Brown (ASC secretariat) have taken part in a number of discussions and meetings with the project team on how to make the projections accessible to users, how to prioritise amongst the range of user needs and, importantly, the choice of emissions scenarios for strand 2 of the project. On this last issue, I wanted to set out in writing our advice following the decision to pursue a second emissions scenario at the most recent Governance Board.

To recap, strand 2 of the project will create a set of spatially coherent projections using the Met Office's HadGEM3 climate model. When I last wrote to you only a single emissions scenario was proposed, for a high emissions trajectory (RCP 8.5), but this would not have met the needs of users wanting to explore UK impacts in various climate futures. The decision made at the most recent Governance Board in September was to use a time-shifting approach (i.e. a scaling approach to generate a lower scenario from a higher scenario) to create data representing a second, lower emissions scenario.

I welcome the decision to generate a second (low emissions) scenario. At the same time, several questions remain regarding the design of the scenario and dissemination of the results. The annex to this letter sets out some issues that should be kept in mind from a user perspective in making these final decisions. We also note our ongoing concern about the need for users to have robust spatially coherent data on possible future climate extremes and the extent to which strand 2 may or may not deliver this. I would be happy to discuss any of these issues further as required.

Yours ever,

PROFESSOR LORD KREBS Kt FRS
Chair, Adaptation Sub-Committee

Annex – Issues to consider in developing UKCP18 Strand 2

As a starting point, it is assumed that Strand 2 will involve a continuous simulation of climate indicators through time based on the RCP 8.5 high emissions scenario. Two methods are under discussion for how to produce the second, scaled emissions scenario, which for ease of reference below we have called i) and ii):

i. a continuous scaled run from e.g. 1961 - 2100 for a single emissions scenario, such as RCP 2.6 or RCP 4.5. It would be useful for the Met Office to clarify how a time series could be generated using the time shifting approach, and what the format of the data would be, to better understand its exact utility to users.

ii. 20-year time slices of the climate that represent 20 years of data for different possible global temperature futures, such as 1.5°C, 2°C, 4°C and so on. Being temperature-, rather than time-dependent, these data could be used to represent any particular emissions scenario and time period in the future when such temperatures might be anticipated.

It is our understanding that the peer review panel views both approaches as scientifically valid, though there is a preference for option ii) given its simplicity and links to global temperature scenarios rather than RCP greenhouse gas concentration scenarios.

From a user perspective, the ASC sees benefits to both approaches. Using option ii) is easy to communicate as snapshots of global temperature are more straightforward than time series for given greenhouse gas concentration scenarios; we sought to use this approach for the 2017 UK Climate Change Risk Assessment Evidence Report. The smaller amount of data delivered may also be useful for simpler applications. However, it is not yet clear if those users who need a time series could interpolate between different 20-year time slices to generate this using option ii).

Option i) would provide a time series for the many users who need to understand the range of timescales over which given change is expected to take place. Examples of these kinds of applications include:

- Economists undertaking any type of cost-benefit analysis that involves discounting expected costs and risks at specified years in the future. For example, this approach has been adopted in the Environment Agency's Long Term Investment Scenarios for flood risk management.

- Water companies for future rounds of water resource management planning, who need a data series for at least the next 25 continuous years.

- Any analysis where the rate of change is an important consideration, for example to understand the impact of changes in biodiversity, agriculture, forestry, and human health. In such areas the ability of living organisms to keep pace with changing climatic conditions is a key consideration.

As part of her role as chair of the Government User Group, Kathryn Brown will be undertaking a more systematic review of the climate information needs of government organisations, which will provide you with further evidence on the benefits and drawbacks of the above approaches

for a wider range of different users.

An advantage of both option i) and option ii) is that they do not require time-consuming simulations on a super-computer; these methods simply require post-processing of the simulations for RCP8.5. We therefore also encourage the UKCP18 project team to clarify the resource implications of creating *both* options with three emissions scenarios i.e. a 'medium' emissions scenario (possibly RCP4.5) alongside the 'low' scenario (RCP2.6 or a scenario equivalent to the 1.5 degree target agreed in Paris).

We note, with concern, that the ongoing issue regarding the sampling of variability (in particular of extreme events), will not be addressed by the 20 proposed simulations in strands 2 and 3 (downscaled simulations form strand 2). The proposed scaling methods will not add any additional sampling of variability. The Peer Review Panel has recognised that because of the limited sampling of variability, the strand 2 simulations are best regarded as "story-lines... for possible futures" and that it will "be difficult to assign relative likelihoods to the 20 ensemble members". Limited sampling of extremes will mean that UKCP18 will not provide the data on extremes that are needed by some of the most significant users, such as national flood risk analysis and water resources planning. We therefore also suggest that Defra consider other ways of providing this information to users beyond the work that is currently planned in the UKCP18 project.