

## **Responses to the UKCP09 Science Peer Review March 2011**

Recommendations that were given by the peer review group are shown in boxes. This is with reference to the science review document available on the UKCP09 website at <http://ukclimateprojections.defra.gov.uk/content/view/1140/531/>. An update on progress against each of these (as of March 2011) is underneath each box.

1. The Report accompanying UKCP09 should succinctly emphasise the points made in this review on the cascade of confidence and the importance of the global model, and the underlying assumptions and nature of the probability projections should be clarified.

The project team took into account the useful suggestions from the review panel including the cascade of confidence in probabilistic projections. This is outlined in the science report and in the online guidance. There is also a page in the user guidance on what probability means in the context of UKCP09: <http://ukclimateprojections.defra.gov.uk/content/view/1205/531/>. The assumptions made in the modelling process are outlined in annex 3 of the climate change projections report and in chapter 5 and annexes of the weather generator report.

The cascade of uncertainty, assumptions made in the modelling and nature of the probabilities in UKCP09 have been emphasised throughout the training, delivered by UKCIP, on UKCP09.

2. There is a tension between using the more robust IPCC approach of employing only results or methods that have been tested through publication and peer evaluation with the understandable desire to satisfy the user requirements. In trying to fulfil the required scope in a timely fashion, important aspects of the UKCP methodology have not yet been published, and there are risks in this. Therefore as part of UKCP a more complete and formal description of the methods (plus a simple summary) should be provided, including in the material more comparisons with other methods where possible, and as many of the available evaluations and sensitivity tests as possible. It is also vital to produce journal papers on the methodology as soon as possible after the launch.

Journal papers outlining the methodology employed in UKCP09 have been submitted to appropriate journals. The links to the published articles will be announced on the UKCP09 website when they are published. These journal papers include:

- Sexton, D. et al. Multivariate Prediction Using Imperfect Climate Models Part I: Outline of methodology. Submitted to *Climate Dynamics*
- Sexton, D and Murphy, J. Multivariate Prediction Using Imperfect Climate Models Part II: Robustness of methodological choices and consequences for climate sensitivity. Submitted to *Climate Dynamics*.

There is also a published paper on the multi-level ocean projections:

- Holt, J., Wakelin, S., Lowe, J. A. and Tinker, J. (2010). The potential impacts of climate change on the hydrography of the northwest European continental shelf. *Progress In Oceanography* **86**(3–4): 361–379.

Subsequent to launch there has been a publication released on validation of the weather generator. This is available on the UKCP09 website at

[http://ukclimateprojections.defra.gov.uk/images/stories/Tech\\_notes/UKCP09\\_WGen\\_validation\\_V2.pdf](http://ukclimateprojections.defra.gov.uk/images/stories/Tech_notes/UKCP09_WGen_validation_V2.pdf)

3. In view of these risks, the Review Group recommended that users should also be provided with a version of the Land Projections based on a more traditional methodology. This would give a simpler, complementary picture for the users and could provide a more convenient first data set for many of them

A more traditional methodology has not been developed. After the review Bob Watson responded to this suggestion with the following: "I do have concerns as to whether producing an alternative dataset based on a simpler methodology is the optimal way to achieve this buy-in and transition from users, given that it could involve stripping out useful functionality from the current projections".

However, the 11-member RCM projections, produced as a by-product of UKCP09, are available as part of the overall UKCP09 product. These projections are at a daily timescale and are transient through time. They provide an alternative to using the UKCP09 probabilistic projections but do not cover the wider range of uncertainty space that is covered by the probabilistic projections.

After launch, a number of users were consulted on alternative ways of presenting the UKCP09 climate projections and a set of funded "extras" were developed. In terms of presenting the projections in different ways, these included:

- UK maps based on global temperature change  
<http://ukclimateprojections.defra.gov.uk/content/view/1177/500/>
- Maps of probability at a given threshold  
<http://ukclimateprojections.defra.gov.uk/content/view/1191/500/>
- Spatially Coherent Projections  
<http://ukclimateprojections.defra.gov.uk/content/view/1194/500/>
- Technical notes on fog, storms, lightning, snow and wind speed

UKCIP are continuing to work with the users on further development of the projections, specifically on increasing functionality and utility for the intended purpose.

4. The guidance that will be given to users of UKCP was not looked at by the Group, but it felt that the guidance must be very strongly advised by the science. The guidance should very clearly state the assumptions behind the approach, and the limitations of the data that the users are provided with.

Each section of the guidance includes: main assumptions and what the user should be aware of. There are also links throughout the guidance to relevant sections in the science reports. The science reports reiterate the assumptions and limitations in the projections. The guidance also went under a peer review before publishing. See point 8.

5. It should give very firm guidance as to the uses that should and should not be made of the data, with concrete examples where possible.

The guidance pages include theoretical examples of use of the projections (undertaken before the launch of the real data). <http://ukclimateprojections.defra.gov.uk/content/view/1794/521/>

There is also a comprehensive set of case studies of use of the real data.

<http://ukclimateprojections.defra.gov.uk/content/view/865/521/>

Together with these case studies is a set of “inappropriate uses” outlining what should not be done with the projections. Wherever possible each inappropriate use refers to an alternative means or more appropriate way of achieving the desired result, including by referring to a case study. These help users to avoid common misuses of the projections.

<http://ukclimateprojections.defra.gov.uk/content/view/1793/521/>

In addition, there are links to further information within the relevant science report and User Guidance, including FAQs.

6. In particular it should include a reference to the assumptions underlying the estimation of the projected probabilities (discussed in detail in the technical documentation), and detailed discussion of how the projected probabilities should be interpreted, and what they can and cannot be used for.

The overall decision was to make the assumptions and limitations explicit in the science reports and link to the guidance where necessary so as not to duplicate effort.

The user guidance is designed to aid the use of UKCP09, including, where appropriate, making transparent the underlying assumptions in the projections and what they can and cannot be used for. The guidance includes a section on guiding principles <http://ukclimateprojections.defra.gov.uk/content/view/633/531/> and probability in UKCP09 <http://ukclimateprojections.defra.gov.uk/content/view/1205/531/>. The addition of the decision tree also allows users to navigate through the user guidance to the most appropriate product for their use.

The electronic nature of the user guidance allows for information to be added and modified, allowing for users to receive the most up-to-date material. These also include new FAQs and guidance required, based on feedback from users.

7. Examples of analyses using projection products based on more traditional methodologies should be contrasted and discussed.

The focus of the UKCP09 user guidance is on the use of UKCP09, including the 11-member RCM projections. The use of more traditional methodologies is the focus of research and is not included in the UKCP09 user guidance due to the reasons in point 3. However, the user guidance includes examples of use of UKCP09 within the case studies. The case studies are continually evolving and will include examples of use of the newly available “Spatially Coherent Projections” and other enhancements to UKCP09.

8. The guidance must be reviewed by experts in the relevant scientific areas.

The guidance was reviewed by the UKCP09 steering group, project management group, Users' Panel and a number of identified experts in the field, some of whom were also on the peer review panel. Review comments informed the guidance.

9. The Group consider that an expert review nearer the beginning of any future UKCP process would enable a better compromise between the natural desires for information by the users and the current ability of the science to provide it, and a very helpful broad discussion of the methodologies that could be used.

This recommendation has been noted and will inform the process of developing and delivering any future projections.