Engaging users in the development and delivery of climate projections: the UKCIP experience of UKCP09

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UKCIP

The views in this paper reflect those of the authors and not necessarily those of any of the delivery bodies included in the funding, production or delivery of UKCP09. This report reflects UKCIP's experience of delivering UKCPO9 up until the summer of 2011. UKCP09 support is now delivered through the Environment Agency as part of its enhanced role in climate change adaptation.

1. Introduction

The most recent set of climate change information in the UK is the UK Climate Projections 2009 (UKCP09) (Murphy *et al*, 2009) launched in June 2009. They are the first set of probabilistic projections for the UK. The UKCP09 projections were developed through a consortium and were fully funded and commissioned by the Department of Environment, Food and Rural Affairs (Defra) in 2003 (Met Office, 2006). The consortium responsible for the development of UKCP09 involved:

- UK Met Office
- Newcastle University
- University of East Anglia
- British Atmospheric Data Centre
- Environment Agency
- Tyndall Centre
- Proudman Oceanographic Laboratory,
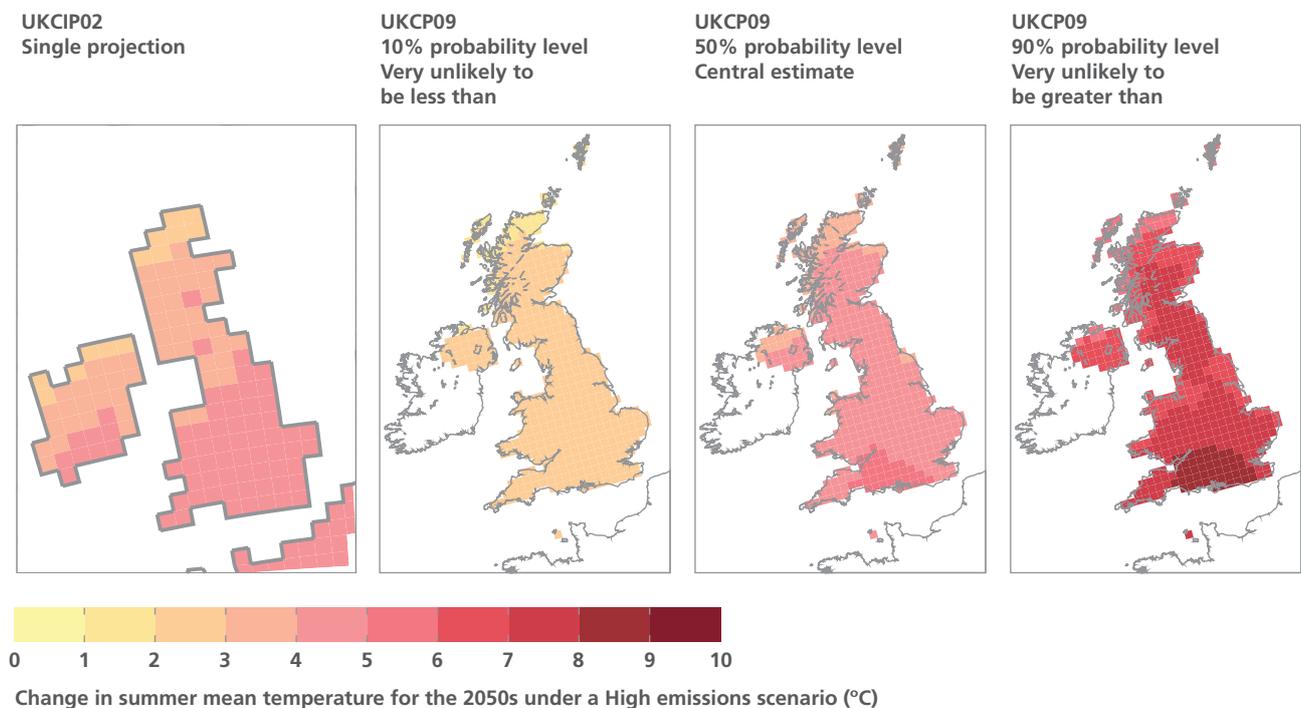- Marine Climate Change Impacts Partnership
- UKCIP

UKCIP's primary role in UKCP09 was to engage users in the development, dissemination and application of the projections. UKCIP fulfilled this role until October 2011 when responsibility for supporting UKCP09 transferred to the Environment Agency as part of its enhanced role on climate change adaptation.

This report reflects UKCIP's experience of delivering UKCP09 up to October 2011. This included consulting widely with a broad spectrum of users to establish an understanding of their requirements and expectations of climate change information, building on UKCIP's experience of developing and supporting the application of previous national projections, namely the UKCIP98 (Hulme and Jenkins, 1998) and UKCIP02 (Hulme *et al*, 2002) climate change scenarios). The user base engaged included central and local government policy-makers, researchers, private businesses, consultancies and NGOs. The engagement programme was designed to solicit a wide range of users' views so that they might influence the presentation and delivery of UKCP09. This included the online delivery interface, the projections themselves and the associated support materials, including online guidance and the UKCP09 website so that it met their needs as far as possible. An extensive training programme was also developed to familiarise users with the projections and facilitate their uptake. UKCIP's stakeholders were engaged post launch to enhance the utility of the information provided. Their engagement informed the further development of the UKCP09 guidance, resulted in enhancements to the information available through UKCP09, and improved the accessibility of UKCP09 products.

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2. UKCP09 represented a step change in climate projections

The probabilistic projections, delivered through UKCP09, were a major departure from the deterministic projections delivered in UKCIP02. Users of UK climate change information have consistently called for greater transparency of the uncertainties associated with climate change projections (e.g. Gawith *et al*, 2009), with such uncertainty often cited as a key barrier to organisations engaging in the climate change adaptation agenda. While greater transparency was desired, the delivery of probabilistic projections presented significant communication challenges that required careful thought to overcome. The UK have been forerunners in both delivering probabilistic projections and in involving users in the process. This report describes the processes that UKCIP went through during the development of the projections and the lessons learnt as a result.

UKCIP02
Single projection

UKCP09
10% probability level
Very unlikely to
be less than

UKCP09
50% probability level
Central estimate

UKCP09
90% probability level
Very unlikely to
be greater than

0 1 2 3 4 5 6 7 8 9 10

Change in summer mean temperature for the 2050s under a High emissions scenario (°C)

3. The context in which engagement in UKCP09 began

Analysis of user engagement in the production of the previous UK projections (UKCIP02) concluded that user engagement had led to the development of more useful products, but that the extent of their influence had actually been fairly limited (Hulme and Dessai, 2008a). Making information available and accessible is necessary, but is insufficient if the goal is to continue to supply decision-relevant information to support adaptation (Street, 2011). Scientists often assume that what they produce is useful for decision-making without necessarily checking this assumption (McNie, 2007; Tribbia and Moser, 2008). Indeed, it is recognised that there is no way to know what information people need without doing research that begins by listening to them (Pidgeon and Fischhoff, 2011). Empirical evidence suggests that the successful use of climate knowledge involves interaction between knowledge producers and users (Dilling and Lemos, 2011; Lemos and Rood, 2010). This interaction also elicits a level of trust and confidence in the information that is presented to users (Turnpenny *et al*, 2004).

Support for sustained user engagement in climate information development is being reinforced internationally. This is evident, for example, in the Report of the High-Level Taskforce for the Global Framework for Climate Services (WMO, 2011) which found that, to be useful, climate information must be tailored to meet the needs of users. The report notes that existing climate services are generally not well focused on user's needs and that the level of interaction between providers and users of climate services is inadequate.

While interaction between users and providers of climate science is desirable, evidence shows that tensions exist in meeting users desired information requirements with the development of credible and defensible climate science (Hoskins, 2009). Scientists can find themselves under pressure to deliver products in demand by users but which are not necessarily feasible, robust or scientifically credible (Dilling and Lemos, 2011). It is important to reconcile users' expectations with what climate science can realistically provide. This and our experience suggest that engagement of users and providers throughout the process can help to address this challenge/tension.

The report of the High-level Taskforce particularly notes that further effort is required to help users incorporate the inherent climate modelling uncertainty into user decision-making (WMO, 2011). Uncertainty in climate science can be used, by some users, to justify inaction (Lemos and Rood, 2010). The probabilistic approach taken in UKCP09 provides a more explicit reflection of the uncertainty of the climate science and represents a big step forward for risk-based decision-making. However, the form and thus interpretation of probability they describe also presents a communication challenge that should not be underestimated (Nerlich *et al*, 2010; Patt and Dessai, 2004).
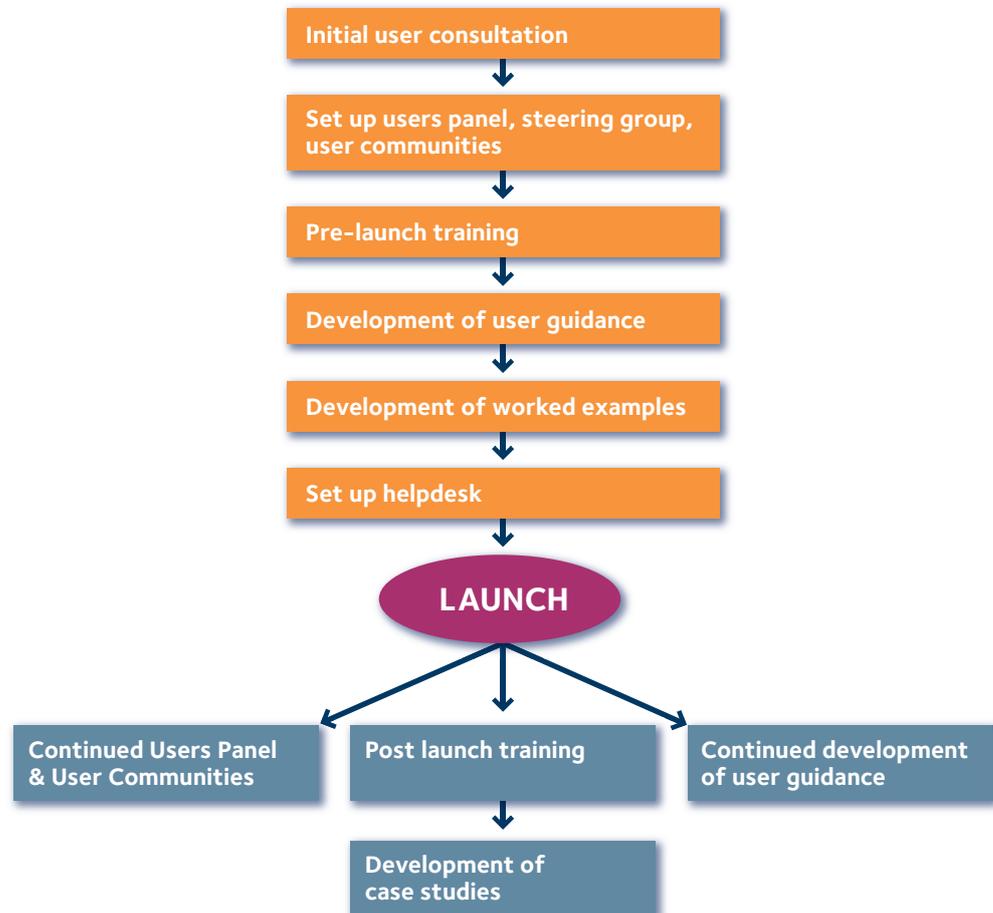
Experience within UKCIP is that sustained and informed engagement of users and providers can go a long way towards delivering decision-relevant information. This requires more than consultation with users and allowing them to provide feedback. By itself this activity has limited benefit in the provision of decision-relevant information. This is particularly the case when the supply of, and demands for, that information suddenly changes (new projections) (Street, 2011). It is within this context that there was comprehensive user engagement in the development of the UKCP09 information.

4. Mechanisms by which the users were engaged in the development and delivery of the projections

Drawing on the lessons learnt from the delivery of UKCIP02 (Gawith *et al.*, 2009), especially in relation to user interaction, significantly more user engagement took place in the development of UKCP09 both through formal engagement mechanisms, and through the training and support offered by UKCIP. The objectives were to engage the users in the development process and ready them for use of the new set of climate information, as illustrated in the figure below.

Figure 2: Flowchart of engagement during development and dissemination of UKCP09.

Initial user consultation

Set up users panel, steering group, user communities

Pre-launch training

Development of user guidance

Development of worked examples

Set up helpdesk

LAUNCH

Continued Users Panel & User Communities

Post launch training

Continued development of user guidance

Development of case studies

4.1. INITIAL USER CONSULTATIONS

Following the commissioning of the UKCP09 projections in 2003, UKCIP embarked on a major consultation exercise to elicit the main features that users required from the next set of climate change information (UKCIP, 2006; UKCIP, 2011c). A broad range of existing users and new stakeholder organisations were engaged to capture the breadth and depth of the growing, and increasingly diverse, range of user needs. UKCIP organised more than a dozen meetings and workshops across the UK between 2004 and 2006 to establish users' preferences on the variables available, time periods, format, presentation and delivery of climate change information as well as what they found most and least useful about the previous (UKCIP02) scenarios. In the interests of making UKCP09 information as easy to use as possible, participants were asked to consider how they would like to see the information presented and what features were important to them. A web-based consultation was also undertaken from 9 June until 1 October 2006 with users invited to respond to a question-naire designed to elicit their views on the same matters. All registered users (i.e. licence holders) of UKCIP02 and all recipients of UKCIP's monthly e-news bulletin were invited to respond. In total, 130 responses were received.

Analysis of the user consultation results clearly demonstrated that different users had varying needs. It showed that design of the climate change information (and delivery mechanisms) could not assume a uniform audience, and from the user's perspectives, the package should appear only as complex as necessary. It was also considered important that the next package of climate information offered the same as or greater flexibility than UKCIP02 with respect to the way in which climate change information was presented and could be used.

Three over-arching requirements emerged from the user engagement process (UKCIP, 2006):

- Explicit presentation of the uncertainties and assumptions behind the climate information.
- Easier access.
- Higher temporal and spatial resolution.

The engagement process also elicited comment on more detailed aspects of the new climate information such as baseline period, areas of aggregation, time period length and dissemi-nation techniques (UKCIP, 2006). All of these expressed needs were communicated to the UKCP09 development team and were taken into account in the development and delivery of UKCP09. The engagement process thus yielded rich insights into the needs of the user community and confirmed known weaknesses of previous projections. The engagement process also consolidated the important relationship that existed between UKCIP and the user community to help develop a range of products that would support climate adapta-tion decision-making.

4.2 USERS' PANEL, STEERING GROUP, USER COMMUNITIES

UKCIP's experience shows that engaging providers and users of climate information in a sustained and informed dialogue is imperative to bridging the gap that can lie between them, and can go a long way towards creating projections that are able to inform decision-making.

A UKCP09 Steering Group was established in March 2006. The primary remit of the Steering Group was to oversee the development and delivery of UKCP09 while ensuring that the delivered projections met users' requirements and were fit for purpose.

Approximately six months after the first Steering Group meeting, UKCIP/Defra established a UKCP09 Users' Panel to formalise user engagement in the development of the new projections. The creation of a permanent panel of users that could usefully inform the process of development of the projections was a novel concept. The remit of the Users' Panel was to provide input into the usability of the UKCP09 documentation, including its supportive user interface and training. They also worked closely with the development team to inform them of the information needs of specific user communities. Topics that the Users' Panel were concerned with and were able to influence included:

- Which aggregation regions to provide in the projections.
- The structure of the user interface.
- Data structure and format.
- The guidance structure, format and terminology.
- The pre-launch and post-launch training workshops structure and delivery.
- Review of the science reports.
- Which marine outputs to provide.

Stakeholders that had some prior experience of, or familiarity with, climate scenarios, such as the previous UKCIP02 scenarios, were invited to join the Panel to represent a spectrum of informed users and applications. The Panel also included the development team (providers) and researchers more familiar in dealing with uncertainties in climate information. The Users' Panel proved a successful concept and a new set of users, not previously engaged with UKCIP, expressed interest and were invited to join. The Panel met formally five times before the launch and eventually consisted of 40 users, all enthusiastically engaged in the development and presentation of the new projections. Their professional roles ranged from researchers to policy makers and local authority representatives. UKCIP was careful to ensure that a range of sectors and types were represented on the Panel. Meetings proved popular and attendance rates were high, as evidenced in the minutes of User Panel meetings, even though members gave their time for free. Between meetings, members were continually engaged via email. In addition, dedicated Users' Panel pages were created on the UKCIP website to facilitate communication and information exchange. Notes of meetings and associated presentations were posted to this section of the site, increasing transparency.

The Users' Panel proved so valuable in the development phase that a decision was made to retain the Panel after the launch of UKCP09, but with a revised remit and membership. Along with the revised Panel (UKCP09 Users' Advisory Panel), users post-launch were also engaged through Users' Communities – users who had similar interests in using UKCP09. The overarching UKCP09 Users' Advisory Panel, whose members included representatives from the Users' Communities, met approximately annually from the launch of the projections. This panel continued to provide advice on the needs and priorities for further developments of UKCP09. On the advice of this panel, UKCP09 extras were developed to enhance the utility of the projections.

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The value of the Users' engagement

There is a common misconception that users will not engage with scientists of their own free will, particularly when there is no product to engage with. However, the UKCP09 proved differently with a consistently high participation rate.

The Users' Panel proved an extremely useful mechanism for enabling the scientists developing the projections to engage directly with representative users in order to discuss those aspects of UKCP09 that could be tailored to suit their needs, including the User Interface. Through the engagement process, providers indicated that they had gained a better understanding of the users' needs and priorities (Sexton, *pers. comm.*, 2010). This meant that the information delivered could be better directed at informing use rather than just describing the climate. Ideas that may have been dismissed if relayed through an intermediary were given due consideration and, in some instances, proved extremely valuable in enhancing the utility of the projections. Similarly if requests were not scientifically plausible, the Users' Panel provided scientists with the opportunity to offer users a thorough explanation concerning the limits of current science which informed use. Members of the panel also discussed less complex issues by email between formal meetings. Responses to these were fit for purpose but care had to be taken as to the nature of the issue and response required because they did not elicit as much discussion as face-to-face meetings.

The Communities of Users set up after the launch of UKCP09 offered users a further opportunity to share lessons in using the projections, and enabled UKCIP to consider what further guidance was required and to identify potentially informative case studies. Users expressed interest in continuing the communities. This was done via online discussion groups mediated by UKCIP (UKCIP, 2011a), informal stakeholder-organised meetings and formal UKCIP-driven meetings. Although take up of the online forum was not as hoped, UKCIP found it a useful way of maintaining the user interaction and support networks.

Both engagement mechanisms facilitated the exchange of information between and amongst the providers and users, giving users buy-in to the process and ultimately leading to a product that was of greater utility to them. Similarly it afforded users the opportunity to meet and form a support network with like-minded individuals which aided the uptake and use of the projections. For UKCIP, it significantly enhanced internal learning and influenced the dissemination of UKCP09 which was reflected in the guidance, training materials and interactions with users.

4.3. TRAINING

UKCIP recognised that applying the probabilistic projections would present significant new challenges to the user community. With this in mind, a comprehensive training programme was undertaken. Approximately 18 months prior to the launch of UKCP09, UKCIP commenced pre-launch awareness raising workshops with one workshop taking place in each English region and Devolved Administration. Approximately 30 attendees per region were invited by the Regional Climate Change Partnerships and represented a variety of sectors. Each attendee was comprehensively briefed on the forthcoming projections and encouraged to disseminate that knowledge and information amongst their own organisations.

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These training workshops were considered crucial to the successful uptake of the new projections because UKCP09 represented such a step change from UKCIP02. This was reflected in comments made by delegates in formal feedback sessions after the event, including: "I came home from the workshop ...can I say excited about the opportunities of UKCP09"; "I found the workshop very informative, well presented and will be promoting UKCP09 for appropriate use throughout my function and organisation" and "the workshop has left me fully warmed up and ready for the appearance of the various UKCP09 tools" (UKCIP, unpublished data). In general the feedback suggested that users appreciated the opportunity to interact with the providers and fellow users in a reciprocal manner.

"I came home from the workshop ...can I say excited about the opportunities of UKCP09"

After the launch of the projections another series of training workshops was conducted: the "Projections in Practice" (PiP) programme comprised a series of awareness raising and hands-on training workshops. The UK-wide PiP programme was supported by Defra and the Devolved Administrations and delivered alongside UKCIP. Each English region and Devolved Administration dedicated at least one working week to the PIP programme, with each day focussing on a specific sector eg. local authorities, built environment etc. The workshops highlighted the key developments of the projections and encouraged delegates to consider what those meant for their own practice. In addition, representatives from Defra and the relevant sector provided detail on the policy implications of UKCP09 and what they could mean for the sector. In parallel with the workshop sessions, hands-on training showed delegates how to interrogate data using the UKCP09 User Interface and how to interpret a range of outputs.

During the regional roll-out of PiP, 1,794 people attended UKCP09 workshop sessions; 351 attended UKCP09 User Interface training sessions, and 163 attended UKCP09 webinars. A total of 2,308 users were thus engaged through this activity. Since completion of the PiP programme, e-learning materials such as online courses (UKCIP, 2011a) and webinars compiled by UKCIP continued to support ongoing learning.

The value of training

The training workshops had two objectives. First, they were to raise awareness of the nature of the new projections and the methodology behind them. Second, they provided an important opportunity for UKCIP to learn about users' needs before and during development of the guidance.

An advantage of running the early pre-launch workshops was clarification of terminology. In UKCP09, qualitative terms were used to describe quantitative values. It was therefore crucial to establish what users understood by various qualitative terms. An example of this was use of the term "central estimate", "best estimate" or "mid-range estimate" to represent the 50th percentile. Discussion around these issues directed UKCIP to use terms that users correctly interpreted and would not otherwise have been used. Interaction with users on the issue of terminology proved invaluable.

FAQs were also collated from these workshops. These questions formed the initial set of FAQs that accompanied the user guidance at launch, and which were added to and modified following launch, to reflect continued learning.

4.4 USER GUIDANCE

UKCIP developed a comprehensive package of online user guidance to support application of the UKCP09 climate information. This guidance was made available at the time of launch, and not, as in the case of UKCIP02, some time after. It was designed to be interactive so users could dip into and out of sections that interested them. It was also intended to be used when accessing any of the UKCP09 outputs in conjunction with the UKCP09 science reports and other supportive materials (Hoskins, 2009).

As there is no registration process for the UKCP09 website, the only means of tracking the number of people who used the guidance was by unique hits[1] on the site. Between May 2010 and May 2011, 353,317 unique hits were recorded on the UKCP09 website.

Users could dip into and out of sections that interested them.

The value of engaging users in the development of the user Guidance
An important component to the successful uptake of projections was the provision of adequate guidance (Hulme and Dessai, 2008b). Ongoing consultation and engagement through the Users' Panel, Communities of Users and training gave users the opportunity to influence the structure of the guidance and to review its content. This engagement provided UKCIP with insights into the terminology and concepts that needed clarification. The language and terminology used throughout the guidance was considerably improved, as was its overall accessibility. Involvement of users in this process thus resulted in a user-focussed end product.

4.5 WORKED EXAMPLES AND CASE STUDIES

During the pre-launch training workshops and various other mechanisms, UKCIP canvassed for people who would be willing to help develop some worked examples to accompany the guidance at the launch of the projections. These worked examples were developed with fictitious information because the real UKCP09 information was only available at launch. Users were given a set of information in the same format as that proposed for the final projections. They were only given information for one location, time period and emission scenario, and were invited to be very creative in developing a hypothetical application for the information.

After the launch of UKCP09, the same process was used to collect case studies of how the real climate information was used. The purpose of the UKCP09 case studies was to present generic examples which focussed on the process of using UKCP09, and not necessarily on the specific outcomes obtained. These were designed so that the case studies would have potential applicability and transferability to a broad spectrum of users, and would be an effective way of providing guidance on ways in which UKCP09 could be used. The demand for case studies could be monitored by unique hits on the website. The case studies page on the UKCP09 site was visited by 6,005 different users in the first 12 months post launch, showing a good appetite for case studies.

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1   The term 'unique hits' is defined as the number of visits to a page by different users.

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4.6 HELPDESK

After the launch of UKCP09, support in using the projections was offered through an email enquiries facility known as the UKCP09 Helpdesk (UKCIP, 2011b) which was launched shortly before the release of the projections and managed by UKCIP until September 2011. Users were invited to complete an online form outlining their UKCP09 related query and submit it to the Helpdesk. They were also encouraged to use this facility to submit suggestions for improvements to the projections and guidance material. Questions and/or feedback were all reviewed by UKCIP who either answered the query directly, or referred it to the relevant technical experts involved in the development of UKCP09 for an answer. The Helpdesk was bound by strict service level agreements which provided the user with confidence that their query would be answered in a timely fashion.

"The complex nature of the projections made the Helpdesk invaluable"

The Helpdesk proved popular and was well utilised. In the first two years after its launch 1100 queries were answered and closed. A survey conducted four months after the launch of the projections showed that all those who had used the Helpdesk to submit an enquiry or feedback found it "easy to use" or "moderately accessible", with one user indicating that the complex nature of the projections made the Helpdesk invaluable to them (UKCIP, 2009).

An online community was also set up as an informal extension of the Helpdesk to create and support a network of users (UKCIP, 2011a). Within the forum, groups were organised around product use or geographical region so users could discuss topics of concern with others.

5. Challenges in user engagement

Although there were a number of successes with UKCP09 there are also lessons to be learnt from the process. These are now discussed to inform similar processes to be undertaken in the future.

WHEN TO ENGAGE

It is our view that it would have been beneficial to involve users earlier in the development of UKCP09 than they were. Discussions related to the possibilities for modelling and associated analysis began in 2002 with the projections being commissioned in 2003 (Met Office, 2006). The scope and science behind the projections were largely formalised at that time. While UKCIP continued to seek information on users' requirements for the next package of climate information through meetings with the UKCIP02 user community from early February 2004, the first formal structure to oversee delivery of the projections and represent users' needs was not established until March 2006. The scope of the projections was designed to respond to users' requirements, but their somewhat belated engagement in the decision-making process meant that their influence was limited to shaping the presentation and delivery of the projections within the bounds of the adopted methodology.

It can be difficult for providers to involve users in developing a new set of climate information early on because of the timing of development and the focus of the users at that time. The timing of the development process is extended, usually beginning shortly after the release of a new set of climate information. At that time, users are focused on using the new information and understanding what that information can and cannot support. It can be distracting to engage users in looking beyond the current set to a subsequent set. This aspect of engagement is a challenge that currently has no definitive resolution, but supports the concept of informed and sustained engagement of users and providers.

BALANCING SUPPLY AND DEMAND

There will always be a tension between what the users desire and the limits of robust science. Balancing the two often ends in conflicting demands that need to be finely managed (Dilling and Lemos, 2011; Gawith et al., 2009). There is usually a trade-off in functionality when decisions are made to enhance an area of the climate information (Brown et al., 2011). These kinds of trade-offs need to be made clear to the users from the outset. Continued and sustained involvement of the users in climate projections development processes will go a long way to informing both the users on the constraints of the projections, and the providers on the needs of the users. That said, when users' requirements cannot be met, a full explanation should be given so users do not become disillusioned with the process.

BALANCING THE SIMPLICITY OF THE MESSAGE AND THE COMPLEXITY OF THE SCIENCE

Users call for clear, concise, decision-relevant messages from the projections. This is an understandable desire although it is very difficult to strike an appropriate balance between communicating a clear, simple message that can be used by decision-makers and the robust use of the science. It is not always possible to provide clear and simple messages without glossing over very important complexities in the projections. This may ultimately lead to ill-informed uses of the climate information, or reluctance to use it. Future user and provider engagement activities could address this issue by highlighting the risks of delivering simple messages so that the users may then make an informed choice about what risks they are willing to accept when it comes to simplicity versus robustness (Brown *et al*, 2011).

ENSURING USERS' NEEDS ARE HEARD

Input from users could perhaps be even more effective if broken into smaller groups focused on particular sectors, regions, informed needs or organisation types, instead of a representative users' panel. This would require a larger pool of users to engage with, but might be a possibility in the future. A recognised weakness in the facilitation of the engagement of users in UKCP09 was that users who were able to eloquently express their needs or regularly attended meetings were afforded more attention and often had undue influence on the development process. Smaller groups and the use of specialist facilitators may enable all users to have more effective input on issues under consultation.

NEED FOR REAL DATA TO TEST

It would have been very beneficial if users had been able to access the real data before the launch of the projections, instead of using fictitious data. Due to timings and political constraints this was not possible. If real data had been made available to a sub-set of users before launch then small bugs in the presentation or delivery of the climate information could have been identified before the information was made public. It would also have enabled the guidance to contain real examples of use, at launch, rather than hypothetical examples using fictitious data.

TRANSPARENCY IN METHODOLOGY: THE NEED FOR PEER REVIEW

Review of the scientific basis to the projections should have been undertaken at an earlier stage in their development. UKCP09 used a ground-breaking methodology and it would have been desirable if the methodology had been peer-reviewed by means of journal papers before the launch. Due to time constraints this was not the case and, as an interim measure, the methodology was reviewed by an independent review panel before the launch (Hoskins, 2009). This late review of the methodology behind UKCP09, although found to be robust by scientific peers, engendered a significant communication challenge and had the potential to tarnish the credibility of the new projections before they were even launched.

FOCUS ON USABILITY, NOT JUST SCIENTIFIC ADVANCEMENT

Users surveyed across the South East region (Small, 2010) expressed a need for additional guidance and training in using the projections beyond that which was available through UKCIP. This suggests a need for additional resources to be allocated to providing the additional training and support that many users desire.

From the perspective of meeting users' requirements, it is important to bear in mind, when providing improvements to available information, that the focus should be on increasing the utility of information for users, rather than on undertaking developments purely for the sake of advancing the the climate science. This calls for climate science providers to keep abreast of the evolving and increasing requirements of the many user communities. Discrete, tailored products could, for instance, be developed to meet the specific needs of particular users.

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6. Way forward

The engagement activities outlined in this report made a valuable contribution to the successful uptake and improved utility of the UKCP09 Climate Projections. However, the engagement process successfully started by UKCIP in the development of UKCP09 needs to be continually refined and developed in future to reap the full benefits that engagement can offer. Early adapters or adaptation champions are key to promoting adaptation more widely (Lonsdale *et al*, 2010). Existing users need to remain engaged while alternative engagement models are explored and developed to reach those that are not already well engaged. One possibility is to encourage innovation and sharing of experiences within the current user communities. Such bottom-up partnership approaches have been shown to optimise resources in engaging the greatest number of users (Lonsdale *et al*, 2010).

It is important to acknowledge that other sources of climate change information besides UKCP09 are available to the UK user community. These are not detailed here, but given that other sources of credible climate information are available, consideration should be given to how best these sources can be used to support users' decision-making across different scales. Supporting user's needs could be better achieved by broadening the community of providers that are engaged in producing climate information.

This report has described the process of engaging users in the development and delivery of UKCP09 and reflected on lessons learnt. While user engagement has shown to have many benefits in terms of initial uptake of the projections, there is still scope for further analysis of how users have understood and are using probabilistic projections. This falls outside of the remit of this report but would provide a useful addition to the scientific literature. The level of impact the process of user engagement has had on how probabilistic projections are utilised would be of particular interest and is a subject for further examination.

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