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Autumn school '"Dealing with uncertainties in research for climate adaptation"

B. Overbeek, J. Bessembinder,
(KNMI, the Netherlands)

Abstract— Climate adaptation research inevitably involves uncertainty issues - whether you build a model, use climate scenarios, or evaluate policy processes. Uncertainties propagate from one field of research (e.g. socio-economic scenarios) to the other (e.g. climate scenarios). It is therefore essential to look over the borders of ones own discipline and find out which uncertainties exist in ones input data and how results are used by others.

The Dutch research program Knowledge for Climate (KfC) noticed a need for exchange of information about dealing with uncertainties among the different disciplines in the program. Therefore the three day Autumn School Dealing with Uncertainties was organized in October 2012, which brought together 38 researchers in climate adaptation (PhDs/postdocs) ranging from governance, decision management, climate impacts and climate physics.

Aims of the Autumn School are 1) Active learning about uncertainties and dealing with uncertainties in research and decision making, 2) Obtaining insight in different approaches for communication about and visualization of uncertainties, 3) Constructing of common frame of reference (CFR) for dealing with uncertainties and communication about uncertainties to help researchers in climate adaptation to improve interaction between disciplines.

The mornings consisted of lectures about aspects of uncertainty and climate change. In the afternoon students worked with the information given in the morning, in case sessions and a serious game. The days were closed by a discussion. The lectures and discussions contributed to the "Common Frame of Reference", containing common definitions, do's and don'ts in dealing with uncertainties and communicating etc. Relevant literature is collected in a Digital Reader.

Index Terms— integrate climate and impact information, stakeholder consultations, dealing with uncertainties

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1 Background and aim

Climate adaptation research inevitably involves uncertainty issues - whether you build a model, use climate scenarios, or evaluate policy processes. Dealing with these uncertainties demands a lot of knowledge about types of uncertainties, methods for assessment, for determining the relevance and the propagation of uncertainties. Communication skills are needed to find out the actual information needs of the user and to tell the message fit to the user. Uncertainties propagate from one field of research (e.g. socio-economic scenarios) to the other (e.g. climate scenarios). It is therefore essential to look over

the borders of ones own discipline and find out which uncertainties exist in input data and how results are used by others.

The Dutch research program Knowledge for Climate (KfC) noticed a need for exchange of information about dealing with uncertainties among the different disciplines in the program. Therefore the three day Autumn School Dealing with Uncertainties was organized in October 2012 which brought together 38 researchers in climate adaptation (PhDs/postdocs) ranging from governance, decision management, climate impacts and climate physics.

The central theme of the Autumn School was dealing with and communicating about uncertainties, in climate- and socioeconomic scenarios, in impact models and in the decision making process. More specifically the aims were 1) active learning about uncertainties and dealing with uncertainties in research and decision making, 2) obtaining insight in different approaches for communication about and visualization of uncertainties, 3) constructing of common frame of reference (CFR) for dealing with uncertainties and communication about uncertainties to help researchers in climate adaptation to improve interaction between disciplines.

2 Organisation and set-up

The Autumn School was organised by KNMI in partnership with the other consortia of the KfC Research Programme. KNMI is consortium leader of KfC Theme 6 “High Quality Climate Projections”, but the aim of the Autumn School was to search for common ground between the different research themes (and outside of the KfC Programme) on the subject of uncertainties.

The mornings of the three day Autumn school consisted of lectures about aspects of uncertainty and climate change 1) terminology and types of uncertainty, 2) methods for dealing with uncertainties and 3) communiation about uncertainties. In the afternoon participants worked with the information given in the morning in case sessions and a serious game. The days were closed by a discussion. The lectures and discussions contributed to the “Common Frame of Reference”, which will be treated in more detail below.

All documentation, lectures, summaries of discussions, the Common Frame of Reference, etc. are made available through a website: http://www.knmi.nl/climatescenarios/autumnschool2012/.

3 Common Frame of Reference

The lectures and discussions contributed to the development of a Common Frame of Reference (CFR) for dealing with uncertainties. The CFR is meant to help researchers in climate adaptation to work together and communicate together on climate change (better interaction between disciplines). It is also meant to help researchers to explain to others (e.g. decision makers) why and when we agree and when and why we disagree, and on what exactly. The common frame contains the following:

1. common definitions;
2. common understanding and aspects on which we disagree;
3. documents that are considered important by all participants;
4. do's and don'ts in dealing with uncertainties and communicating about uncertainties;
5. recommendations.

3.1 Common definitions and typology

Participants used various descriptions of the term uncertainty, however all agreed that it can be defined as any departure from complete deterministic knowledge of the relevant system (based on Walker et al., 2003). Uncertainty is not simply a lack of knowledge, because an increase in knowledge might lead to an increase of knowledge about things we don't know, and thus increase uncertainty.

Useful typologies of uncertainties (Dessai & van der Sluijs, 2007) are based on distinctions between:

1. levels (indicate how difficult it is to describe uncertainty);
2. sources
    a. (natural) variability;
    b. lack of (system) understanding, inherent complexity
    c. varying perceptions, preferences (ambiguity)
3. locations (for model-based analysis).

For policy makers the levels also could be of most value as these indicate how difficult it is to describe uncertainty. The source and location might be less relevant for them. In scientific literature typologies for varying perceptions (also called ambiguity) is not given a lot of attention yet (Brugnach et al., 2011).

3.2 Common understanding

3.2.1 Why take uncertainties into account

The main reasons why the participants considered it important to take uncertainties into account are:

1. scientists' goal is to improve humanity's understanding of the World. That can only be accomplished when they communicate those factors that could make their findings limited or uncertain;
2. communicating uncertainty enhances credibility, in particular when that uncertainty diminishes the apparent importance of our work;
3. in many cases, decision-makers can achieve superior outcomes when they take uncertainties into account;
4. communicating the limitations and uncertainties inherent in sceintific findings helps other scientists to formulate important research questions.

3.2.2 Usefulness of a common typology

A common typology of uncertainties was rendered useful for the following reasons:

1. it could improve communication between people, both those engaged in research as in decision-making, if we all use the same typology, because we can be more specific;
2. useful to know where uncertainty comes from;
3. the typology could give directions on how to deal with it: Useful to know whether it is an uncertainty that can be expressed in a probabilistic way;
4. you can refer to it in a paper (you can easily point out which uncertainties you have and which you have not addressed).

Most participants agreed that a common typology will improve communication among disciplines, although we should probably use a few common typologies, as the usefulness of the typology differs per discipline and type of user. A common typology especially is useful for professional users. For the general public stories of uncertainties that illustrate the different types of uncertainties and which have a human element, might be more effective in that case.

3.2.3 Communication

From the discussions it was concluded that policy makers and scientists both have a task in communication about science: 1) scientists in trying to understand policy makers (e.g. their information needs and

how they use information) and explaining in a clear way their research and 2) policy makers in making clear what is relevant to them and trying to understand scientists.

Communication between scientists and decision makers requires a lot of effort (from both the scientists and decision makers) due to the differences in language, knowledge, framing, scales on which they operate usually (practical versus conceptual, short versus long term, local versus international) and lack of familiarity with each other's working environment.

Although everyone wants scientific results to be used by decision makers, there was no agreement among the participants on how far scientists should go in communication. It ranges from limited efforts (too much simplification touches upon integrity of researcher), up to much effort (societal responsibility). Emphasizing or de-emphasizing uncertainties can also be used strategically (by both scientists and policy makers). Results of scientific work should be communicated to decision makers and also the uncertainties included. However, not everyone has the skills (and willingness) to invest much time in communication. In general, it was felt that there is a need for specifically trained "boundary workers" to organize the interface.

3.2.4 Documents considered important and do's and don'ts

As part of the discussions at the end of each day, several do's and don'ts were formulated and a list of useful information was compiled. These can all be found on the web site. A few examples of the do's and don'ts are:

1. adjust the communication to the target audience. Sometimes it may be better to talk about risks or margins than about uncertainties;
2. persist to make sure the question of the target audience is clear. Be aware of the question behind the question;
3. don't take over the chair of the policymaker: scientists should deliver the scientific information, policy makers should make the decision;
4. don't only focus on uncertainties (model/perceptions), but also highlight what is certain. Only focussing on uncertainties could paralyze decision makers.

4 Recommendations

Based on the Autumn school and discussions afterwards when writing the CFR, the following recommendations regarding dealing with uncertainties were presented:

1. there is a need for a useful typology for social sciences including decision-making: it would be good to have a typology of ambiguity;
2. more guidance is needed in finding the right method to deal with uncertainties: there is a large number of combinations of types of uncertainties, methods to deal with them analytically, and (policy) strategies to follow in light of them. It would be useful to have some ranking, or a list with advantages and disadvantages of each method and a sort of matching of uncertainty situations, policy attitudes, and policy strategies in order to determine which method to use when. A description of pitfalls, strengths en limitations of a selection of analysis methods (error propagation, Monte Carlo analysis, sensitivity analysis, etc.) is given by van der Sluijs et al. (2004);
3. more information needed on methods how to deal with uncertainties related to human actions (ambiguity, framing, perception, risk aversion) (de Boer et al., 2010);
4. the participants of the Autumn school also expressed the need for a platform to discuss methods and exchange experiences in dealing and communication with uncertainties is needed. It is not clear yet which form of such a community is most effective.

5 References

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