Discussion on Common frame of reference

Day 1: October 9 2012: Terminology and types of uncertainty

Discussion leader: Wil Thissen, TU Delft

- summary -

Is it important to take uncertainties into account?

All participants considered it important to take uncertainties into account, although the reasons could be different. The main reasons mentioned were:

- It is our scientific responsibility to indicate which uncertainties are present. It will enhance our credibility
- Taking into account uncertainties in decision making will improve the decisions
- Indicating and localizing uncertainties is the basis for improving our scientific knowledge

However, do not only focus on uncertainties, but also highlight what is certain. Only focussing on uncertainties could paralyze decision makers.

Reactions of participants:

- *There is always uncertainty and therefore uncertainty requires attention in decision making (although you can neglect it);*
- *Looking at uncertainties is a good way to find out how wrong you are and what to do about this (way to improve knowledge);*
- *Indication of "room" for surprises;*
- *It is our scientific responsibility to tell the truth (ethical);*
- *If you take uncertainty into account, you get more flexible decisions;*
- *By taking uncertainty into account, you improve the quality of the decision (although you make the decision making itself harder);*
- *Uncertainty is the "ignorance" part of the story;*
- *Be also careful not to overemphasise uncertainty (so much uncertainty that people believe nothing of what you have to say); balance what is certain and uncertain and focus on most important uncertainty (depends on what the information is or what it is used for);*
- *By also communicating the uncertainties, you become a reliable partner; it enhances your credibility;*
- *Uncertainty also has a direct application (risk oriented): know how close you are to a tipping point;*
- *In a democratic society you want people to be able to choose which scenario they think is most likely (and one way of taking uncertainty into account is by using scenarios);*
- *Be careful not to loose your audience (uncertainty is a difficult concept for most people to understand, which is what we often encounter in weather forecasting: do not tell me the risk of precipitation, just tell me if it is going to rain or not);*
- *Know where you are as a scientist (what do you know and what not): this can help you improve your model.*

Which typology of uncertainties is most useful?

Typologies of uncertainties:
- Levels
- Sources (lack of knowledge, different perceptions of the same knowledge)
- Locations (where? in input?, in model? in output?)

Levels of uncertainty indicate how difficult it is to describe uncertainty:
- Level 1: statistically quantifiable
- Level 2: know about possible outcomes, not easy to add probabilities (scenarios)
- Level 3: recognised ignorance (known unknowns), surprises, values of future societies (the last one?)

A common typology will improve communication among disciplines, although the below indicates that we should probably use a few common typologies.

Reactions of participants:
Which typology is most useful depends strongly on the purpose for which it is used:
- *For many researchers a typology that links to possible methods for dealing with uncertainties is considered most useful (on the basis of sources/nature and location of uncertainties): e.g. doing more research to diminish uncertainty or do more monitoring to describe uncertainties more accurately? For the social sciences it is more difficult to work with such a typology. For them also uncertainties related to human actions (e.g. due to differences in risk perception, framing) is important.*
- *For decision makers probably a typology based on level of uncertainty (how much uncertainty?) is most useful, although a typology based on sources of uncertainties may also be useful (wait with decisions and do first more research or monitoring?).*

Why a common uncertainty terminology?

- It improves communication, if we all use the same terminology (especially for people that are not very familiar with social sciences)
- Useful to know where uncertainty comes from
- The typology (level) gives directions how to deal with it: Useful to know whether it is an uncertainty that can be expressed in a probabilistic way
- You can refer to it in a paper (you can easily point out which uncertainties you have and have not addressed)

Reactions of participants:
- *I am working in risk assessment in which source and location uncertainties are important: address them to reduce them*
    - *Sources uncertainty: natural variability cannot be reduced (epistemic = lack of knowledge);*
    - *Location uncertainty: addressing uncertainty in input (data), model and output.*
- *We use a combination of levels and location of uncertainties*
    - *Location uncertainty: you need where to look for uncertainties;*
    - *Levels of uncertainties: They give a framework how to deal with uncertainties.*
- *It depends on where in the climate adaptation process you are working. So we cannot disconnect the question "which typology is most useful?" from "what is it used for?"*
    - *If you are a dealing with fundamental science/modelling, the source and location are of more value;*

    - *If you are communicating/ for policymakers, the level is of more importance.*
- *You can not have one typology. In the typology the decision making point of view is missing, like risk acceptance, is risk a typology or does it depend on cultural values? Is society willing to take the risk? > see CFR, sources, varying perceptions;*
- *Consider not only climate uncertainties, but also societal/ human uncertainties (equity, cultural values) > see CFR, sources, varying perceptions;*
- *Do we need to create more typologies? No, we try to find the useful ones. There is still discussion about whether 'action uncertainty', 'future value uncertainty' and 'risk attitude' should be added to our CFR. We agree on Levels, Sources and Locations to be of main importance for typology.*

What does robust refer to and why is it important?

The term robust is used in different ways, which can be divided into:

- Robust systems: a system can withstand a large range of extreme events (due to natural variability and/or climate change).
- Robust decisions: the measures taken work well in a large range of extreme events and under a range of possible future climate change

A system and decisions can be robust for a large range of e.g. high river discharges, but they are not necessarily robust at the same time for low river discharges. It is important always to make clear what you are referring to when talking about robustness.

Discussion on Common frame of reference

Day 2: October 10 2012: Dealing with uncertainties

Discussion leader: Ekko van Ierland

- summary -

Combinations of types of uncertainties and methods: do's and don'ts?

- Difficult to give do's and don'ts besides some very obvious ones (e.g. do not average scenarios, they are meant to present uncertainties by giving different projections for the future).
- The table of Van der Sluijs & Dessai (2007; table on p. 60) gives a first indication of which methods to use when dealing with a certain type of uncertainty. However there is a large number of combinations of types of uncertainties and methods to deal with them: it would be useful to have some ranking, or a list with advantages and disadvantages of each method in order to determine which method to use when.
- The table mentioned above does not refer to uncertainties related to human actions (ambiguity, framing, perception, risk aversion). More information needed on methods that can be used for these types of uncertainties.
- Website with additional information on methods and examples: http://broceliande.kerbabel.net/KQA; the website of Climate-Adapt has several examples on climate change adaptation: http://climate-adapt.eea.europa.eu/sat)
- Community of users needed: a platform to discuss methods and exchange experiences in dealing with uncertainties. Not clear yet in which form this community should exchange experiences.

Reactions of participants:

- *Do we focus too much on model uncertainties?*
- *Ambiguity is missing under the types of uncertainties;*
- *Plenty of methods, which are difficult to grasp: possibility to rank them?*
- *Someone asked for a workshop on all methods presented in e.g. VD. Sluijs & Dessai (2007);*
- *Can we rank the methods presented in order to determine which method to use when? A list of advantages and disadvantages of each method could also help;*
- *Exchange of experiences with the methods needed, examples from own discipline (e.g. biodiversity). Experiences with adaptation strategies at EU/global level? No general approaches: depends a lot on geography, culture, legal systems, etc.;*
- *Official national strategies for climate change have not dealt with uncertainties;*
- *Community of practice? This autumn school is a first step;*
- *The term uncertainty is used loosely. If a probability density function (pdf) is known we could use the term risk;*
- *Can we average scenarios? The whole point of scenarios is that you should not consider only one.*

Differences in methods/tools between policy makers and researchers?

- Decision makers want to "put as much scientific knowledge in decision making as possible" (Pieter Bloemen). However, isn't there a risk that the use of expert elicitation gives a biased or at least a wrong feeling of existing "scientific knowledge"? What is scientific information: only if it is published, or also when scientist have a certain feeling?
- How far do you go as a scientist in providing "information" to decision makers? When are you implicitly taking over the tasks of decision makers?
- Do we focus too much on model uncertainties? Ambiguity (culture, values) may be as important for decision makers, especially at higher levels of decision making.
- Differences in tasks: scientists to deliver scientific information, policy makers to make decisions on adaptation measures.

Reactions of the participants:

- *For adaptation at higher levels cultural settings an values become more important;*
- *How to value biodiversity?*
- *The whole concept of best solution is not something science should come up with;*
- *When do we accept uncertainty and start to act? We should not wait until the uncertainties disappear;*
- *Expert opinion on probabilities for scenarios? What are the implications of using this type of information?*
- *Probabilities for scenarios? It is not extra information, it is deceptive information;*
- *How can decision makers decide which scenario to use (as the basis for taking decisions on adaptation measures)? For Dutch coastal management a "high" scenario is used for the long term (spatial reservations for dikes), and a "low" scenario is used for short term decision making (sand suppletions before the coast). Using more scenarios at the same time for decision making feels inconsistent for some people, not for others. It may avoid overinvestments (not directly increase dike heights, but make spatial reservations to do so when needed).*

Can we attach "probabilities" to scenarios?

Problem description: Decision makers and economists often use risk analyses, for which probabilities are needed. Scenarios are used in situations where no probabilities can be attached to projections (or where it is very difficult to do so). This means that there is a "mismatch" between the type of uncertainties present in studies and decision making about the future and the method used.

Probabilities we can give:
- (To a certain extent) (extreme) events within the scenarios/projections;
- (In some situations) qualitative information on which scenarios are more or less probable: perceived probability; a sea level rise of > 1 m up to 2100 (Delta commission Netherlands) is considered less probable than a sea level rise of 35-85 cm up to 2100 (KNMI'06 scenarios; when assuming a socio-economic development such as "business as usual" scenarios with high temperature rise are more probable).
- Depending on the user, we could give some first estimates and ranges of probabilities based on expert judgement and/or ensemble climate model runs. However the risk of misinterpretation is high. The user should be aware of the assumptions behind the estimates. A good explanation about the differences between the frequency distribution of a climate model ensemble for a certain emission scenario and the probability curve within this emission scenario (assumed probability) is needed.

Probabilities we can't give:
- Probabilities of the scenarios themselves.

> Science should not come up with a "best solution": when scientists are asked to give probabilities in situations where this is not possible, they are implicitly asked to take over the task of decision makers.

Reactions of the participants:
- *Make probabilities, because people ask;*
- *Just because people ask for probabilities is not enough reason to deliver them;*
- *There is no probability in climate scenarios. We can at best say that it is more/less probable that we are going in a certain direction;*
- *Best estimates of pdf's are they helpful? What does the intermediate step add to the decision?*
- *If you give probabilities, there is no extra information behind the decision made with these probabilities;*
- *The difference between statistical uncertainty and scenario uncertainty should be defined;*
- *We can give conditional probabilities: if you consider certain socio-economic scenarios more probable than certain climate scenarios become more/less probable;*
- *Decision makers often want an optimal solution, however, we should look for good solutions under a range of circumstances.*

Discussion on Common frame of reference

Day 3: October 10 2012: Communication about uncertainties

Discussion leader: Bram Bregman, KNMI

- summary -

What did participants consider most striking or an important message or question to bring home form the course?

1. We need to know our target audience and adjust the communication to the target audience;
2. We need to organize the interface. Together with other fields? How and with whom is not clear yet.
3. Information details: do not present all information, only what is relevant for the target audience.

Reactions of participants (collected at yellow notes posted at the white board):

1. *Knowing your target audience*
   - *Do we underestimate the capacity of the public/policy makers to understand climate change or is it unwillingness?*
   - *Science for impact: concentrate on robust adaptation, on strategies rather than more emphasis on reducing uncertainties;*
   - *Climate change also offers opportunities;*
   - *Visualization target buy-in contested knowledge ;*
   - *How to make sure that scenario outcomes are not used in the wrong way?*
   - *Climate change communication should be kept simple and in simple statements and target specific groups for better comprehension;*
   - *Don't think of yourself of being representative for the general public (in skills, knowledge, interest);*
   - *Climate change is "just" one of the challenges in the future, socio-economic developments are also important. Emphasize this in communication.*
   - *Communication of uncertainties to policy makers matters;*
   - *People frame uncertainties differently. It is essential to take that into account for A. the development of knowledge and B. decision-making;*
   - *How to really communicate the information on uncertainty to different audiences of different background?*
2. *Organization of interface*
   - *The relation between framing and communication about uncertainty;*
   - *We should try to team up with other fields of science with mutual goal to make our world more sustainable: better chance for success;*
   - *Role play game helps to understand different stakeholders;*
   - *How to communicate climate change to smallholder farmers?*
   - *Stress role play: Failure in adaptation measures and miscommunication of climate information;*
   - *Since communication depends on the target audience, should scientist primarily focus on communicating with their colleagues (which ultimately evaluate the quality of their work) or with policymakers/stakeholders?*
3. *Information details*
   - *Stakeholder and policymakers should be grouped based on their background in order to decide what and how uncertainty should be addressed from my point of view instead of trying to make the same information suitable for all kinds of public at the same time;*
   - *How to keep scientists image of ''credible'' professionals when the answer we can give is only 'I don't know'';*
   - *Ontological consistency;*
   - *Attempting to educate decision makers, so they can deal with complex graphs;*

- *Quantifying the impact of natural and anthropogenic process responsible for climate change;*
- *Bridge gap between being useful to decision makers and scientific integrity;*
- *The importance of simplifying uncertainties (both graphs + text);*
- *Quantification, visualization, ensembles;*
- *Uncertainty of output of multiple climate models;*
- *Communicating the non existence of level 2 uncertainties in a useful way;*
- *Communication of scenarios and the potential use of (subjective) probabilities;*
- *Given the large uncertainties involved everywhere, climate change numbers are much too precise (i.e. +2°C by 2100);*
- *Should we use more "emotional stories" in communication, or is the role of scientists to present ''the facts''? (of course depending on your audience);*
- *What message does the IPCC convey when the information in AR5 is basically the same as in AR4, just with larger uncertainties??*
- *Level of detail in the uncertainty that you communicate.*

Is visualization important to communicate uncertainty?

Visualization is a strong tool, but it is often difficult to present uncertainties. Always ask for feedback to check whether the visualization results in the right interpretation.

Reactions of participants:
- *Using maps and graphs is important but you need to know your target audience, you also have to deal with contested knowledge, thinking that our model is not better than anybody else' model;*
- *Bram: By visualization do you solve communication difficulties?*
- *There are many decision makers and consultants that don't read the results the same way. Coming from the government, private companies, their interests differ. How would you improve visualization to improve this issue?*
- *It is a matter of scale. It is helpful, it doesn't matter how much information you have, but the scale;*
- *People don't speak the same language. Despite the complexity, and difficulties, everybody needs to understand it. Scale is important but it is more important that we understand each other. We should educate decision makers;*
- *They should speak our language (laughs);*
- *Yes, like the game we played last Monday, it showed that.*

Should policy makers speak our language?

Policy makers and scientists both have a task in communication about science: scientists in trying to understand policy makers and explaining in a clear way their research, policy makers in making clear what is relevant to them and trying to understand scientists.

Reactions of participants:
- *I don't agree, we should understand each other;*
- *Even if the policy maker understands, they need to translate it for the voter;*
- *It is about the listening capacity of people. Not the sending? capacity. Math, social sciences, it will never work if you don't understand each other;*
- *The scientific knowledge gets lost in translation;*
- *Who's your audience? Well, it is a question of audience. You need to adjust to the audience. Same message, different language;*
- *Bram: You can throw away a line and your work is done then;*
- *You have to adjust to your peers, the public. Choose the language you use, that is the key;*
- *Why do research when every thing is simplified to one sentence?*

- *When there is too much simplification, it touches upon the integrity of the scientist.*

Should scientists be educated in communication skills?

> Although everyone wants scientific results to be used by decision makers, there is not agreement on how far scientists should go in communication. It ranges from limited efforts (too much simplification touches upon integrity of researcher), till much effort (societal responsibility).
>
> Communication between scientists and decision makers requires a lot of effort (from both the scientists and decision makers) due to the differences in knowledge, framing, …..

Bram: Who is educated in communication skills here? (Two people raise their hands).

Reactions of participants:
- *You can improve your own behavior, which is for sure;*
- *No, you can try to explain taking a step towards decision making. It is a question of the time we live in. Everything is questionable;*
- *No, there are roles for everybody. There should be somebody specialized translating what I provided. If policy makers can't understand the information, they shouldn't be policy makers then;*
- *Anthony explained very well. Put yourself on the other people's shoes. That is important giving examples like the one of the farmer;*
- *There are different levels of abstraction. Yes, you can simplify many things but things like PDFs cannot be simplified. We should make people aware and understand the models in order to avoid them getting confused and biased;*
- *Ask for feedback, ask your target audience if they understand the message you want to convey;*
- *Politicians of today are going to retire, but people in 20 years will have the education. Education has improved, that is a reality;*
- *Bram. So in 20 years everything will be fine because people are better educated. Interesting statement;*
- *I have friends who studied sociology and they don't know anything about statistics. These people need to be trained to be policy makers;*
- *Well, we are specialists. I don't understand your research. Even we have a gap understanding each other's knowledge. This happened to me during the poster presentations. I didn't understand most of what you guys do;*
- *The PDF is not the problem, if we would have a PDF for everything, we would have so much knowledge.*

What kind of details do we provide to the target audience? Should we educate decision makers or should we use visualization?

> We should present only the relevant information. What information is relevant, we need to find out together with scientist and stakeholder. We also need to be aware of the question behind the question.

Reactions of participants:
- *I shouldn't give all the information, only the necessary information. I should decide on what they need;*
- *No, we should decide that together;*
- *You should ask them what they need the information for, you should know about their impact/problem: what is the question behind the question?*
- *How warm it will be in Gelderland in 2020? What would you give? Then you start giving scenarios;*

- *I couldn't say how warm it will be, but somewhere between this and this. 2020 is not that difficult;*
- *How can decision makers decide based on conflicting knowledge? How are they willing to change their position to improve the situation? There is much manipulation. Give them a number and see what happens;*
- *You have to find a balance between gaining more knowledge and being quick. I am a weather forecaster. For the right information I want to know many things (and wait longer). At some point however, I just need to make a decision. And then I give a number, for example, there is a 60% chance for showers. But people will still ask me: is it going to rain or not?*
- *Policies are a little bit based on the information available.*

Aren't we playing the consultant role?

Consultants and researchers play a different role. As a researcher you certainly have the task to inform about the uncertainties.

Reactions of participants:
- *They also face uncertainties, people need numbers and if they don't give them, they get fired;*
- *Yes, we hear it in the US government. The government hires consultants to give them information. It is easier to hire consultants. Parliaments are a clear example;*
- *Bram. Scientific integrity should be everywhere, whether you want to be a consultant or a scientist;*
- *Consultants are supposed to give numbers. For consultants, no numbers means bad results. There is hardly ever a bad researcher. At least, if you don't get the expected results you are not a bad researcher. Consultants face much pressure;*
- *What is the role of the scientist and what of the consultant? Do consultants know better how the target audience is thinking?*

Do you want to work with 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: it is in most cases a task for specialized persons.

Bram: Who of you worked with policy makers? (Very few)
Bram: How many of you would work with policy makers? (Few hands) Some people say no.

Reactions of participants:
- *People need to have the capacity;*
- *I think I am not the one with the skills for this;*
- *You have to grow into this role; you need someone who leads you;*
- *There is the risk of co creation in that you end up thinking too much as a policymaker instead of as a scientist;*
- *I want to. But for instance, in the KFC we have the co-creation. But it is not really happening although the willingness is there;*
- *Being a scientist gives you the responsibility to share knowledge. It is your job as a scientist;*
- *I disagree. As a researcher, we are trained to publish in a language and be reviewed at a higher level;*
- *It's our responsibility to inform people, society who is the end users of our knowledge (and are paying for it);*

- *Yes, I work in the KFC and many people ask me: what is the return of this research? How much money is it going to produce? Well, it should be a balance. Money is not everything;*
- *Doing research for the sake of research is very interesting and valid. You have two types of research;*
- *There is a feeling of rejection in case they don't apply your project. If a politician didn't implement what I propose, I get frustrated. They have their own agenda, I would like to keep on doing what is interesting;*
- *Bram. But still, the government is paying for your research;*
- *And I pay taxes! So we are supporting each other;*
- *If you can't agree about certain things, what you do doesn't make any sense. We need to invest in education and how to communicate;*
- *We should be able to explain our work to the general public. I always try to explain what I do to my grandmother; we need to work on general literacy;*
- *Bram: there are people who would like to cross the borders of the comfort zone, and some are not. I would like to remind you that. Without communication, you would end up alone and isolated.*