New climate scenarios – implications for water management

Findings and notions • 4–5 June 2014, Wageningen, the Netherlands

On 4–5 June 2014 the Netherlands Hydrological Society (NHV), together with the Dutch Foundation for Applied Water Research (STOWA), organized a symposium on the implications of the new climate scenarios for water management. The symposium «New climate scenarios – implications for water management» was set in the framework of global developments regarding future scenarios on climate variability and change, and their impact on hydrology and water resources. It built on the presentation of new scenarios for the climate of the Netherlands for the periods 2036–2065 ('2050') and 2071–2100 ('2085') by the Royal Netherlands Meteorological Institute (KNMI) in April 2014. The following summarizes the main findings, notions and recommendations of discussions of the symposium.

- The impacts of climate change will be most evident in the hydrological cycle. Hydrological models need input from climate (change) models in order to make estimates of future changes in hydrological parameters such as water volumes and water levels, including the variability and uncertainties of the values of these parameters.
- The water community appreciated the interaction with colleagues from the climate science community to enhance understanding of the meaning of the new scenarios, and commended the organizing parties for an inspiring and enthusing meeting.
- In this respect it was useful to zoom in from the global scale models, via the continental scale models (such as those by JRC) to the national climate models and the regional and local hydrological models. A scale mismatch between the models makes the use of statistics unavoidable and inevitable.
- KNMI has summarized 245 different climate scenarios into 4 possible climate scenarios for the Netherlands. Small differences in initial values of parameters may easily lead to large changes. The predictability of parameters has changed, meaning that sometimes shorter lead times than before are possible.
- It was shown that worldwide water demand will rise by 20%, while the amount of renewable water will reduce by 20%. The various processes operate and interact on different timescales, sometimes leading to enormous nonlinearity and variation.
- Due to a reduction in the amount of aerosols, the level of radiation in the Netherlands has increased significantly. KNMI has aimed to say something about the weather of the future rather than about the climate, with pragmatic models that are nevertheless based on an increase of CO_2 levels.
- The Netherlands has committed to a 2 °C degrees warming limit, however, many top scientists claim that 2 °C is too much to prevent disaster. Moreover, KNMI scientists noted that the majority of the climate models clearly point out that the global temperature will already rise

beyond the 2 ˚C limit around 2050, even with a strong reduction of CO_2 emissions. (We are now already close to 1 °C warming.)[1]

- The new scenarios provide more information on short-duration extreme precipitation. New climate data are available with continuous series of precipitation, evaporation and wind for 800 years, enabling statistical quantification of possibilities of hydraulic failures due to coincidences. Water managers will use the new scenarios in their calculations for the decades ahead. The largest developments were not featured in the new scenarios, however, but rather in the way water researchers (hydrologists) have developed ways to handle hydrometeorological uncertainties, new model approaches and new ways to focus on the important data rather than on all data.
- The most important part of the new scenarios is that dry and wet extremes are expected to be more distinct. At the same time it will be difficult to use this new information, particularly in the case of wet extremes, as the time and spatial scales of the events make it almost impossible to model and forecast as they are too small for the climate models. We know that the events happen, but the resolution of the climate models is not sufficient to capture them. This means that some of the most important events for water and disaster management are among the most difficult or even impossible to forecast, and are not shown in the output of the climate models.
- The new scenarios describe more climatological parameters than before: the expected future climate is more complete.
- Sea-level rise is faster than expected, leading to an expected extra influx of salty water into the inland freshwater system.
- There was no consensus on whether to (a) use all the new data to make new and more complex models for large areas, for example all approximately 100 polders, involving many parameters and calculations for many decades or (b) start with a relatively small selection of representative polders or catchments and run in detail a couple of different models on them a view to translating and extrapolating the results to the rest of the country: there will always be errors involved so the water systems should be robust anyways. A majority of the participants favoured using 'quick and simple' models rather than models that require supercomputers.
- New statistical approaches and insights are promising in order to eliminate 'nonsense' (in hindsight) research projects and to focus on uncertainty for water management, thereby opening up new ways for water management and governance. Calculations over long timescales allow for improved insight into probabilities, e.g. of droughts. For the Rhine River the inclusion of all eight models, rather than focussing on the details of one specific model, would generate enhanced information and improved insight into the probabilities, which would further benefit adaptation strategies.
- Although most regional water managers (water boards, provinces and regional directorates) participated, it was noted that the national government was largely absent despite invitations to all levels. There is an apparent mismatch between the new scenarios (at national scale) and the interest (at regional level). It was suggested that this is also due to a lack of expertise at the national level (i.e. within ministries, with the exception of the secretariat of the Delta Commissioner). It was also noted that the national government is doing significantly less than was advised by the Delta Committee in 2008[2]: response is still to the weather, not to the climate. An increase of the water level of the IJsselmeer was deemed unnecessary after all.
- Coincidence – simultaneous occurrences of events that until now (erroneously) have been seen and handled as independent – leads to (much) higher return periods and hence to higher chances of disasters and associated water-related problems.

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1 http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0081648.

2 http://www.deltacommissie.com/en/advies.

- Socio-economic developments largely generate similar responses as climate change on river discharges. This is not the case for local extreme events and extreme events of short duration, which operate on different (spatial and temporal) scales than socio-economic developments.
- Despite the Dutch national government's three-part-process mantra of 'Retention, Storage and Drainage', representatives of a number of water management authorities stated that they sometimes turn around the order to get rid of a surplus of water, adding that "Ideas from civil servants in the west of the country, that sit behind a desk and have no interaction with reality, are not always the best."
- The precision of hydrological models was hardly a matter of discussion. Nevertheless the lack thereof might be more important for decision-making than the uncertainty and bandwidth of climate model results.
- Hydrological scenarios should not only include climate change scenarios, but also scenarios for spatial planning, food patterns, population growth and changes in land use and water management. For example, we see an increase in irrigation and sometimes far-reaching measures against 'verdroging' (desiccation) which both affect the response of hydrological systems.
- It was recommended to make direct use of climate models instead of 'generating a climate' that is based on data from past periods: past weather will not happen again in exactly the same manner. The new time series need some correction, though, for example for extreme precipitation.

▶ The presentations can be downloaded from www.nhv.nu.

This summarizing overview has been compiled by Michael van der Valk. It is based on the input from participants, with additional contributions by Frank Smits (Waternet) and Rudolf Versteeg (HKV$_{\text{LIJN IN WATER}}$).