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Uncertainties in future-proof decision-making: the Dutch Delta Model

Janneke IJmker, Edwin Snippen, and Erik Ruijgh
Deltars - Enabling Delta Life, Delft, The Netherlands (janneke.ijmker@deltares.nl)

In 1953, a number of European countries experienced flooding after a major storm event coming from the north-west. Over 2100 people died of the resulting floods, 1800 of them being Dutch. This gave rise to the development of the so-called Delta Works and Zuiderzee Works that strongly reduced the flood risk in the Netherlands. These measures were a response to a large flooding event. As boundary conditions have changed (increasing population, increasing urban development, etc.) , the flood risk should be evaluated continuously, and measures should be taken if necessary. The Delta Programme was designed to be prepared for future changes and to limit the flood risk, taking into account economics, nature, landscape, residence and recreation . To support decisions in the Delta Programme, the Delta Model was developed.
By using four different input scenarios (extremes in climate and economics) and variations in system setup, the outcomes of the Delta Model represent a range of possible outcomes for the hydrological situation in 2050 and 2100. These results flow into effect models that give insight in the integrated effects on freshwater supply (including navigation, industry and ecology) and flood risk. As the long-term water management policy of the Netherlands for the next decades will be based on these results, they have to be reliable. Therefore, a study was carried out to investigate the impact of uncertainties on the model outcomes. The study focused on “known unknowns”: uncertainties in the boundary conditions, in the parameterization and in the model itself. This showed that for different parts of the Netherlands, the total uncertainty is in the order of meters! Nevertheless, (1) the total uncertainty is dominated by uncertainties in boundary conditions. Internal model uncertainties are subordinate to that. Furthermore, (2) the model responses develop in a logical way, such that the exact model outcomes might be uncertain, but the outcomes of different model runs are reliable relative to each other. The Delta Model therefore is a reliable instrument for finding the optimal water management policy for the future.
As the exact model outcomes show a high degree of uncertainty, the model analysis will be on a large numbers of model runs to gain insight in the sensitivity of the model for different setups and boundary conditions. The results allow fast investigation of (relative) effects of measures. Furthermore, it helps to identify bottlenecks in the system. To summarize, the Delta Model is a tool for policy makers to base their policy strategies on quantitative rather than qualitative information. It can be applied to the current and future situation, and feeds the political discussion. The uncertainty of the model has no determinative effect on the analysis that can be done by the Delta Model.