Deltas in Depth scientific sessions **Deltas in Depth Theme 2.Flood Risk Management**		
DD 2.5 Innovations in flood risk analyses		
Chair	Dr. Philip Ward, VU University, the Netherlands (replaced prof.dr. Jeroen Aerts, VU University, Institute for Environmental Studies, the Netherlands)	
Presentations	•	PhD Zachary Tessler, CUNY Environmental CrossRoads Initiative, USA
	•	Nathalie Asselman, Deltares, the Netherlands
	•	PhD Jeffrey Czajkowski, Wharton Risk Management Center, USA
	•	PhD Ferdinand Diermanse, Deltares, the Netherlands
	•	Dr.-Ing. Kai Schröter, GFZ German Research Centre for Geosciences, Section Hydrology, Germany

Introduction

Philip Ward kicks off the session by emphasizing the importance of flood risk analysis for effective adaptation. It is made clear that innovative risk assessment techniques could assist the development of effective and robust risk management strategies.

Dr. Zachary Tessler, Spatial and temporal patterns of rainfall and inundation in the Amazon, Ganges and Mekong deltas

This presentation focuses on the modelling of inundation – by both rainfall and river flooding – of the world's deltas. By using the Amazon, Ganges and Mekong delta as illustrative examples, Tessler discusses a modelling scheme and the implications of results. The quick summary of this work, as Dr Tessler put it himself, is: 'when it rains, it gets wet'.

Tessler explains that the SSWAMPS Surface Inundation Model is used for the computations in these example basins. The SSWAMS model is based on a microwave signal, which is used to detect water coverage on the land surface. In addition, information on precipitation, river discharge and waves is used to assess the inundation potential in the selected deltas. The results demonstrate that it is possible to assess the temporal and spatial harmonization of each of the driving forces of flooding. That way, one can answer questions such as 'what is the period of influence of rainfall, discharge and waves on surface inundation?' this could help identify seasonal influence and support developing detailed modelling tools.

Dr. Nathalie Asselman, How to obtain information on the effectiveness of potential flood risk management measures in only a few minutes?

Flood risk management in the Netherlands has traditionally had a strong tendency towards structural protection. In recent years, however, the concept of 'multi-layer safety' (i.e. a risk management approach combining physical protection; exposure and vulnerability reduction; and improved flood response) is becoming increasingly emphasized. So far, the implementation of multi-layered safety approach has been limited by the fact that little evidence exists on the effectiveness, costs and benefits of various risk management options.

In this presentation, Asselman shows a methodology for assessing the costs and benefits of a range of options, including dykes; stilts; mounds; floating houses; and wetproofing. By combining information on flood protection standards and a flood damage and fatalities assessment model (HIS-SSM) risk quantification with the different management options, it is demonstrated that the multi-layer safety strategy has a great potential for risk reduction in various locations across The Netherlands. The outcomes of the study include maps of the cost effectiveness (i.e. will you earn your investment back?) for different measures.

It is concluded that the cost effectiveness of secondary risk management options is increased by climate change induced intensification of flood hazard, and reduced by the amplified investments in physical protection measures that is recently agreed upon under the new Delta Plan.

Dr. Jeffrey Czajkowski, Hazard to loss: Modelling of inland flooding and associated economic losses in the Delaware river basin
Effective risk management for increasing flood risks requires a timely characterization of the hazard and its consequences. According to Czajkowski, methods for producing detailed maps of inundated areas and depths across large areas are still unavailable. In response to this, he presents a calibration-free multi-scale hydrological model able to simulate stream-flow across the entire river network. The result of this is a normalized flood index called the Flood peak Ratio (FPR), used as a proxy for flood intensity.

The research team had access to the entire portfolio of the National Flood Insurance Program (NFIP) for validation purposes. Comparison with empirical results for four large flood events in the Delaware basin showed that the FPR has a significant and positive relationship with flood claims, and that this model can therefore be applied successfully for predicting insurance claims from floods.

Dr. Ferdinand Diermanse, Brisbane river catchment flood study
The 2011 Queensland floods caused severe damages across large parts of eastern Australia and the Brisbane metropolitan area in particular. The Wivenhoe dam reservoir reached its limits and spillways needed to be opened, which resulted in extensive inundation downstream. After the floods, the Big Flood Inquiry was started, which comprised a study of hydrology and hydraulics, and the development of flood management plans. Diermanse explained the background and progress of this study.

The team of Diermanse estimated the probabilities of flood discharges and volumes, and analysed flood frequencies following the design event approach. Using a large number of synthetic events and a Monte Carlo analysis, the team quantified how often flood levels are exceeded in the current and future climate. The research applied a full probabilistic method, using probabilities of all input factors as well as the correlations between the different inputs. The results are not yet available for dissemination purposes.

Dr.-Ing Kai Schröter, Flood damage frequency estimation for flood risk analysis
The main question motivating the research presented by Dr Schröter is to what extent probability of flood peak discharge can be used a suitable proxy for flood damage. To answer this question, Schröter and colleagues developed a coupled modelling scheme – consisting of a weather generator, rainfall model, network routing, inundation mapping and flood loss estimation – for the Mulde catchment in Germany.

The team simulated 2,000 inundation events over a model period of 10,000 years, whereby flood risk for residential buildings was instantly computed for all model runs. The result clearly shows that one single probability level can have multiple simulated damages as well as the other way around, and the region-wide results therefore contain a lot of noise. The sub-basin level results are more consistent and on this level, a good regression can be constructed between river discharge and model damage. Schröter concludes that probability of discharge is of limited value for explaining flood risk. He suggests that more attention should be placed on including information on dike breach mechanisms and flood protection standards.