Deltas in Depth scientific sessions		
Deltas in Depth Theme 10. Economic and finance of adaptation		
DD 10.2 Economic impacts of climate risks		
Chair	Stéphane Hallegatte, The World Bank, USA	
Presentations	•	Elco Koks, Institute of Environment Studies, VU University of Amsterdam, the Netherlands
	•	Sanne Muis, Institute of Environment Studies, VU University of Amsterdam, the Netherlands
	•	Brendan Jongman, Institute of Environment Studies, VU University of Amsterdam, the Netherlands

Elco Koks starts the session with his presentation on "The economy wide consequences of natural hazards: an application of a European interregional input-output model". Before Koks started working on his model, he looked at the damages resulting from each disaster in Europe. The main question was what the total economic consequences of natural hazards in the European Union were? To answer the question he created an IRIA-model. The model has five characteristics, coupling to biophysical model, supply and use framework, interregional, dynamic recovery modelling path and combining linear programming with input-output modelling. He created the IRIA-model, since the static models miss something what the 'step dynamic recovery modelling path' can offer. Koks started applying the model in Rotterdam asking himself what the impacts for the rest of Europe would be if the Rotterdam harbour would be struck by a disaster. The first risk refers to transport sector 1 - road and rail. Second risk is the carpenter sector 2 - little transport. When a flood in the harbour gets even higher and extremer, it affects Europe considerably. The model can distinguish between effects of flooding scenarios for Rotterdam and the effects for countries in Europe. So what means flooding in region A for region B. So working together is needed to come to a clear solution. This model can be used for other hazards and other types of disasters.

Sanne Muis presented "Future trends in flood risk in Indonesia. A probabilistic approach". Her research is to understand which factors drive increases in risk potential by using global scale models that assess flood risk in data scarce regions. The case study is flooding in North-Sumatra, Indonesia. She describes flood risks in three categories: 1 hazard, 2 exposure and 3 vulnerability. The three categories lead to a damage model which can project annual damage. Muis focuses on Jakarta and assumes that the results are comparable with other cities in Indonesia. Java's flood risk increases by 80%. The scenarios, she uses, include flood risk, but also damages in dollars. Climate change influences urban expansion, responses of the river systems, coastal flood risk, urban damages and urban planning. So Java is one of the hotspots for flooding. She looked at two adaptation measures, urban planning and urban adaptation. The effects of urban planning will be primarily to protect against flooding. So adaptation strategies can effectively reduce risks.

Brenden Jongman looked at datasets of rainfall and river discharges in his study "Increasing stress on disaster risk finance due to large floods". Hee sees a pattern; if flooding occurs in one country, also other countries will flood. In this way we can understand the dynamics of river flooding. For a river basin we modelled flood damages in asset values. Flood risk across countries is correlated due to atmospheric patterns and river systems. To make a good damage model it is important to first compare the protection

levels of the area. After that flood insurance data can be used. All this information can then be linked together. To reduce the risk, Jongman used physical flood protection measures, insurance and compensation. Physical protection measures, insurance schemes and public solidarity funding are complementary measures and should be optimized in harmony. But the question is who pays and who benefits in the future? Risk correlations should be taken into account in international risk reduction and risk financing initiatives. In short, it is important to know who is making the money and who is paying the damage.