

Dr. Onno Kuik

Institute for Environmental Studies - Instituut voor Milieuvraagstukken (IVM)  
Faculty of Earth and Life Sciences (FALW)  
VU University Amsterdam  
De Boelelaan 1085  
1081 HV Amsterdam  
The Netherlands

t + 31 (0)20 59 89513

f + 31 (0)20 59 89553

e onno.kuik@ivm.vu.nl

w [www.ivm.vu.nl](http://www.ivm.vu.nl)

w [www.environmentmaster.nl](http://www.environmentmaster.nl)

## **Selected IVM projects on adaptation to climate change**

### **Financial arrangements for disaster losses under climate change, 2004-2011**

Most adaptation strategies in the Dutch water sector relate to either implementing technical measures, such as building dikes, or to implementing new spatial policies, such as developing flood retention areas. It is widely recognised that existing adaptations in the water sector are insufficient to cope with climate change. Therefore, increased attention has been paid to explore financial and insurance arrangements to alleviate negative impacts of climate change and extreme events. Yet little research has been conducted in developing such tools and evaluating their efficiency in terms of costs and benefits. The proposed research examines whether and in what way financial arrangements can serve as strategies to adapt to climate change. The general approach followed in this research project is to develop sets of financial arrangements for flood related risk sharing for the Netherlands. The project is commissioned by BSIK, Klimaat voor Ruimte.

### **Cost of adaptation to climate change, 2006**

This project aimed to produce an inventory and assessment of research into adaptation to a changing climate, as a follow-up of the earlier study on the costs of climate change. Collaboration with FEEM, Ecologic, IREAS, and Paul Watkiss. Project commissioned by the European Environment Agency under the 6th Specific Agreement No 3602/B2005 EEA under the Framework Contract No. EEA/AIR/04/004.

## **Valuation of the environmental risks of climate change, 2007-2011**

Climate change will impose additional flood risks on flood prone areas in the Netherlands. In order to make these areas climate proof adaptation and mitigation programs need to be developed. Besides the prevention of material damages such programs also prevent immaterial damages and generate a notion of safety. The latter items often lack a market price. This project assesses how the valuation of such immaterial damages can be improved, because risk is an illusive concept to many people. This project aims at improving stated preference methodologies by examining the effect of information and uncertainties on an individual's risk perception and risk preferences. Project commissioned by BSIK and the project partners are Spatial Economics Department, VU, Wageningen University and ARCADIS.

## **ADAPTS: Adaptive Water Management at the Local Scale, 2007-2012**

Climate change is expected to increase the severity, duration and frequency of weather related extreme events, threatening water availability and food security for millions of poor people. It is clear that adaptation strategies have to be implemented from the level of farmers to communities to national governments. ADAPTS aims to increase developing countries' adaptive capacities by achieving the inclusion of climate change and adaptation considerations in water policies, local planning and investment decisions. This will be achieved by supporting local practical initiatives in climate proofing, influencing regional water management and if feasible in up scaling the activity to other regions.

## **Adaptation to Meuse Flood Risk, 2010 - 2012**

### **Introduction**

In 1993 and 1995 the Meuse overflowed its banks, leading to extensive flood damage in the Netherlands. Due to climate and land use change, the frequency of high-flows is expected to increase in the future. Furthermore, the potential damage of floods is expected to increase due to socioeconomic developments in flood-prone areas. Both of these factors can be assessed through the concept of flood risk (defined as probability of flooding x damage). In Europe, the flood risk management approach has been given added impetus by the European Flood Directive of 2007. However, there is currently a lack of knowledge internationally on the sensitivity of flood risk to long-term changes in physical and socioeconomic parameters.



Given the expected increases in flood probability and risk, research is needed to provide adaptation measures that can maintain future safety. Therefore, the steering committee IVM2 was set up to assess which measures will be needed post-2020 to ensure that the Meuse continues to comply with flood defence laws. However, the effectiveness of flood defence measures has traditionally only been assessed in terms of their contribution to reducing flood probabilities. The damages associated with low probability flood events are high, and hence adaptation should also aim to reduce potential damage. Flood risk modelling facilitates the assessment of the impacts of adaptation measures on flood risk, but is rarely used to assess adaptation measures at the basin-scale.

### **Research aims**

In the proposed research we aim to assess the sensitivity of Meuse flood risk to changes in climate, land use, and socioeconomic development. This will be carried out by combining a number of models developed partly under the KvR-ACER and AvV projects. Thereby, we will contribute to the emerging scientific discourse in this field, whilst also providing concrete risk estimates for the Meuse. Moreover, we will develop new spatial planning based adaptation strategies, in a multi-stakeholder workshop setting. Next to scientific advances made in this research, we will provide usable results for stakeholders Rijkswaterstaat Waterdienst, Provincie Limburg, Waterschap Roer en Overmaas. To realize this *Kennis voor Klimaat Project HSGR06*, IVM cooperates with Deltares.

## **RESPONSES: European responses to climate change, 2010-2103**

EU action on climate change is now focused on accelerating mitigation efforts, while seeking to reduce risks associated with climate change impacts. To achieve the multiple goals of cutting greenhouse gas emissions, reducing vulnerability to climate impacts, and building mitigative and adaptive capacities, climate action needs to be mainstreamed across all EU policy sectors. As the scale of European policy grows, mitigation and adaptation need increasingly to be integrated. These policies have strong international dimensions. The RESPONSES project addresses EU policy challenges by: developing new global low emissions scenarios, placing EU efforts in a global context; building an approach for assessing EU policies against mitigation and adaptation objectives and for developing alternative policy options; applying this framework in five EU policy sectors (water and agriculture, biodiversity, regional development/infrastructure, health

and energy), linked by a set of cross-sectoral integrative activities; and synthesizing the results to new policy strategies. The main outputs of the project will be: a set of global low emission scenarios, differentiated by key countries; options and strategies for integrating mitigation and resilience to climate impacts into EU policies; a validated strategic climate assessment approach. The RESPONSES consortium brings together seven leading European research institutes working on climate change scenarios, modelling, analysis and policy, combining the necessary disciplinary and sectoral expertise. Chinese, Indian and US partners and associates will also participate in the project. The consortium builds on partners' experience in other EU and national projects, including the ADAM project, and will foster close relationships with policymakers. Research outputs will be of direct relevance to the IPCC and to post-2012 international negotiations, as well as supporting implementation of the EU White Paper on Adaptation.

The project is sponsored by EU DG Research, FP 7.

## Selected publications:

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Bosello, F., Kuik, O.J., Tol, R.S.J., Watkiss, P. (2007). "Costs of Adaptation to climate change: a review of assessment studies with a focus on methodologies used", Report for the European Environment Agency, 6th Specific Agreement No 3602/B2005.EEA under the Framework Contract No. EEA/AIR/04/004,. Ecologic - Institute for international and European Environmental Policy, Berlin.

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Botzen, W. J. W. (2010). *The Economics of Insurance against Climate Change*. Doctoral Thesis. Faculty of Economics and Business Administration, VU University Amsterdam, pp. 340 (ISBN 978-90-8659-417-7).

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- Bouwer, L.M. & Aerts, J.C.J.H. (2006). Financing climate change adaptation. *Disasters*, 30(1), 49-63.
- Brouwer, R., Akter, S., Brander, L. & Haque, E. (2009). Economic valuation of flood risk exposure and reduction in a severely flood prone developing country. *Environment and Development Economics*, 14(3), 397-417.
- Brouwer, R., Akter, S., Brander, L. & Haque, E. (2007). Socio-economic vulnerability and adaptation to environmental risk: A case study of climate change and flooding in Bangladesh. *Risk Analysis*, 27(2), 313-326.
- EEA (2007). Climate change: the cost of inaction and the cost of adaptation, EEA Technical report No 13/2007, European Environment Agency, Copenhagen, [http://www.eea.europa.eu/publications/technical\\_report\\_2007\\_13](http://www.eea.europa.eu/publications/technical_report_2007_13)
- Warner, K., Bouwer, L.M. & Ammann, W. (2007). Financial services and disaster risk finance: examples from the community level. *Environmental Hazards*, 7(1), 32-39.