

## Session DD 1.5: Climate change and health in delta areas

<b>Chair</b>	Prof.dr. Marcel Stive, Delft University of Technology, the Netherlands
<b>Keynote speaker</b>	Prof.dr. Robert Nicholls, University of Southampton, United Kingdom
<b>Speakers</b>	Marten Hillen, Royal Haskoning, the Netherlands Prof. Mohamed Abdrabo, Institute of Graduate Studies and Research - University of Alexandria, Egypt Dr. Valentino Ciriello, University of Bologna, Italy Freek van Leijen, Hansje Brinker, the Netherlands Prof.dr. Jan Vermaat, Institute for Environmental Studies, the Netherlands Prof.dr. Mohammed Rhaman, Chittagong University, Bangladesh Niels Roode, Rijkswaterstaat Waterdienst, the Netherlands Leo Kerpen, Province of Zuid-Holland, the Netherlands
<b>Rapporteur</b>	MSc. Kees Dorland, Climate changes Spatial Planning, the Netherlands

The threats within the three areas, explains Marten Hillen, are more or less similar. The costs of dikes per meter height vary (NL: 8 – 23 million euro, New Orleans: 5 – 8 million euro, Vietnam: 1 million euro). The message is: look at the costs at project data. Real data show that costs hardly go up for increased sea level rise, as design costs etc. are the majority of the costs and these do not increase. Costs per country can best be estimated using real costs and adjustments for local indicators, such as economic factors.

In the discussion the linearity of costs is questioned. It might be the assumptions used. It would be interesting to perform an analysis with different assumptions. Data from the Delta Committee also shows there might be a small non-linearity but not much.

Mohamed Abdrabo: Land use in the are of Danietta in Egypt a is diverse; living, agriculture, nature, etc. The study includes direct and indirect impacts of up to 0.45 m sea level rise with two population growth scenario's and two land use (built area) scenario's. Vulnerability goes up with higher population growth and more concentrated built up areas along the coast.

Subsidence is about 1 cm/year in the study area says Valentino Cirello. Analysis of the measures already designed has been done. The scenario for a sea level rise of 220 cm in 100 years include tides, storm surges and subsidence. The correlation between rainfall and tide is found to be significant. It is thus concluded that design expansions are needed to further reduce vulnerability. Current design plans include these required expansions. Furthermore, it is shown that subsidence is the most important factor for the effects of sea level rise.

Using radar, satellites are used to measure the deformations of dikes in The Netherlands in mm/year tells Freek van Leijen. This is a new technique to measure the security of defense systems. Up to now the security of the defence systems was measured using sensors in the systems and visual inspections. 'Old style' five yearly evaluation of the dykes of The Netherlands shows that 44% of the dikes are conform the norm, 22% is not and for the rest there is no information. The new satalite technique can cover all (above ground or sea) defence systems. Analysis of two years of data show deformations of -10 – -6.5mm to 7 – 10 mm per year. Moreover, deformation is shown to be a good indicator for dyke stability. The locations that show large deformations can easily be identified and after visual inspections measures can be taken very locally, saving expenses. The Dutch government wants to use this new technique for dyke monitoring. The technique is useful all over the world. It can also be used to measure upcoming landslides, etc.

Jan Vermaat: From a number of papers it can be concluded that flooding itself is not worsening, but the impacts / consequences are, due to an increase in capital in flood areas. The study also looks at subsidence and vulnerability using two socio-economic indicators: population density and land area. It shows that with only a few system indicators the vulnerability can be measured. It is concluded that not the flooding itself but the way we cope with flooding is decisive for the impacts.

In this knowledge exchange project of Niels Roode the focus is on coastal erosion and flooding. It can be concluded that the precautionary principle is much higher in The Netherlands than in the UK. More in general the perception of people defines what is perceived as a safe coast. Lessons learned are: focus on existing dykes; management and development of the foreland; and make use of secondary dykes to use a risk based approach. The messages are: learn more from other countries; don't forget the questions of today; reduce uncertainties and make them explicit; and Internalize probabilistic risk methods.

Leo Kerpel: The Netherlands is located for 26% below sea level and is protected by the Deltaworks. Parts of the province of South-Holland are about 6.5 meters below sea level, South-Holland is the most economic developed area in The Netherlands. There are six weak links in the dyke system that need strengthening. This is worked on now by using the sand engine, which not only protects the hinterland, but also creates new land in a natural way. This is done by placing a super dune of sand, positioned keenly in sea. The sea will spread the sand to where it is needed. It is important that in this project governments at different levels, universities, private companies and nature organizations cooperate. The sand engine will replace regular sand suppletion and uses more the natural forces instead of technical solutions. The sand engine creates new opportunities for recreation and nature. It is called 'building with nature'.