The need for INnovations for eXtreme Climatic EventS (INXCES), the progress of flood modeling case Bergen Norway

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Urban flooding has become a key issue for many cities around the world. With the continuing effects of climate change, this will become more acute and will add to the serious problems already experienced in dense urban areas. Therefore several international stakeholders are in the need of tools that can assess the vulnerability to floods and visualization tools that will contribute to international knowledge exchange. Years ago scientists started to use DEMs (digital elevation maps) as quick scans to indicate locations that are vulnerable to urban flooding and the effect of climate change. Now the datasets are getting bigger and stakeholders are becoming more demanding and require faster and more visual results. The technology using DEMs is becoming more common and improved, both with a higher accuracy and a higher resolution. As an example the flood modeling using DEMs is compared for the case Bergen in Norway (figure 1a and 1b) from 2009 and 2016.

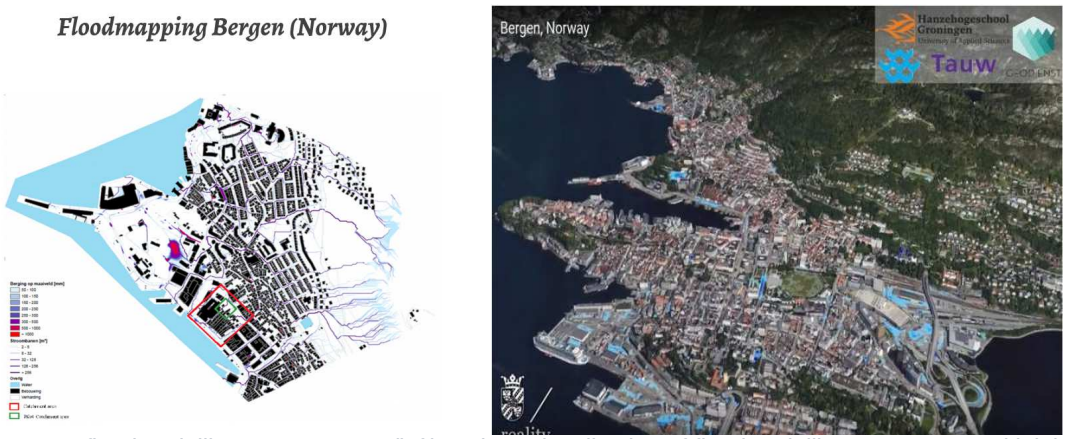

Figure 1a floodmodelling Bergen 2009 (left) and 3D visualization of floodmodelling Bergen 2016 (right)

Method: For the flood map analysis in Bergen in Norway, the Calamity Levels of Urban Drainage Systems (CLOUDS) was used. This is a 'quick-scan' method to simulate storm water floodings. CLOUDS is based on the assumption that for a cloud burst (> 60 mm/h) most of the stormwater will flow and stay above ground [3]. CLOUDS visualizes the streamlines and the depth of stormwater in depressions where water will accumulate. The quick-scan is based on only readily available data. The most important is an accurate DEM, which is freely available for the whole of the Netherlands (AHN2). With 9 points per square meter and a vertical accuracy of several centimeters this provides an insight in the surface elevation. Other data used are: GIS-maps with infrastructure and houses, the TOP10 (open data topographic data for the roads and waterways) and the BAG (open dataset with all buildings (2d) of the Netherland). Combining the elevation model, the dataset with buildings and aerial photographs a 3d model of the city is constructed to get a better overview of the outcomes of the model (figure 1b).The model can be shown in the 3D virtual reality theater on a cylindrical screen using 6 HD projectors to project an image with a resolution of roughly 5000x1800. To display this model on a big screen a special 3D viewer was used, based on the open source OpenSceneGraph 3D toolkit. The software was running simultaneously on 7 PC's, one master PC for the control of the model and 6 slave PC's to drive the projectors [4].

Recommendations: The accurate comparison of the results of the different models still needs attention. Challenges and further developments associated with floods and other climate related issues in dense urban areas are continuously growing. These maps could be further improved and used by urban planners and other stakeholders to assess the resilience and well-being of cities. The work presented shows that the combined analysis of such maps also has a strong potential to be used for the analysis of other challenges in urban dense areas such as air and water pollution, immobility and noise disturbance.

References

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