

ESTIMATING AND MAPPING THE TOTAL ECONOMIC COSTS FROM STORM SURGES IN WILHELMSBURG/HAMBURG

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Keywords: Damage assessment; indirect costs; risk mapping; storm surge.

EXTENDED SUMMARY

This paper estimates the economic costs from storm surge scenarios in a part of the Free and Hanseatic City of Hamburg, namely Wilhelmsburg. The port city located at the Elbe estuary is highly attractive for settlements and economic activity, which is the cause of the high damage potential in this area. This paper complements common risk mapping procedures by localizing not only direct but also indirect costs in the area under investigation. Direct damages result from the physical contact of tangible assets with the flood waters. Indirect damages occur days, weeks or months after the event and are a consequence from the destroyed productive capital. In general, they are caused by disruption of economic and social activities as a consequence of direct flood damages.

Two storm surge scenarios for current climate change regimes ("year 2010") with different peak water levels and exceedance probabilities were selected for the present analyses. The storm surge event causes a non-structural failure of the flood defence system. The approach to estimate the direct and indirect costs from storm flood events in the case study area consists of two steps. Firstly, direct damages to the residential and commercial sites in Wilhelmsburg are estimated by classifying the risk elements, defining depth-damage curves for building and inventory and calculating the spatial damages according to the respective storm surge scenario. The results are shown in Figure 1.

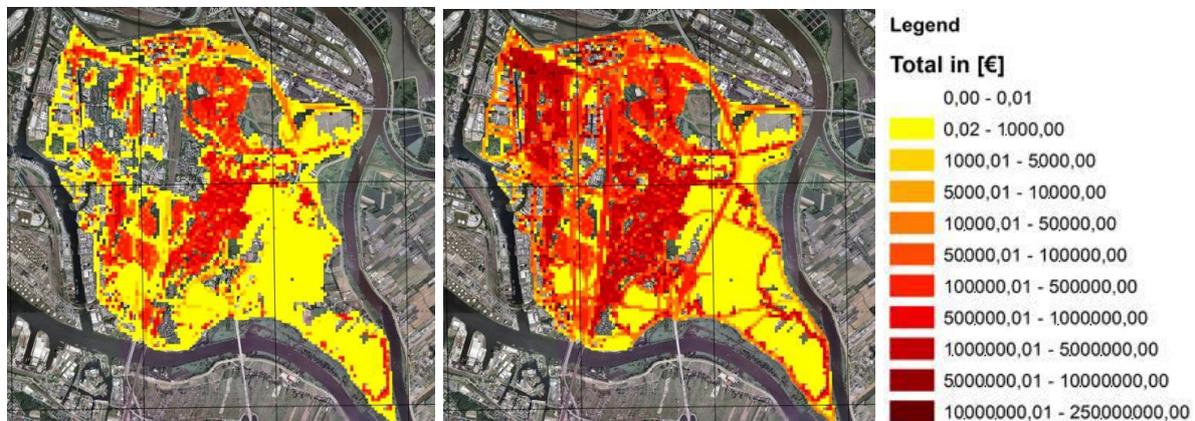


Figure 1. Direct tangible damages after flooding in scenarios XR2010A (left) and XR2010C (right).

Secondly, the data on direct damages are aggregated from the building level to the level of economic sectors so that they can be implemented in an economic modelling framework. Thus, the indirect costs of each disaster in the city of Hamburg and the time needed for reconstruction and reparation can be estimated. The applied economic model, developed by Hallegatte (2012), simulates the indirect impacts in Hamburg which are due to business interruption, production losses during the reconstruction period and service losses in the housing sector.

In both scenarios, the companies in the flooded area suffer from indirect losses summing up to 24 million Euro in the first (XR2010A) and 827 million Euro in the second (XR2010C) scenario. These losses are mainly due to the destruction of productive capital followed by business interruptions. In contrast, companies located outside of Wilhelmsburg predominantly gain from an increased demand for reconstruction so that a net benefit of 60 million for the city of Hamburg is observed in the first scenario. In the second scenario, in which all of the companies in Wilhelmsburg are affected by flood

waters, supply bottlenecks occur and some companies located outside of the flooded area have to reduce their production due to insufficient inventories. In this case, the gains from reconstruction activities cannot compensate for the enormous value added losses so that a net loss of 548 million Euro for the city of Hamburg is observed.

After the calculation of damages, indirect losses are assigned to each commercial building according to the degree of direct damages and the size, measured in terms of employees. Thereby it is accounted for losses from damaged productive capital, losses from supply bottlenecks as well as gains from an increase in reconstruction demand. Figure 2 shows the economic hotspots with regard to indirect losses in Wilhelmsburg.

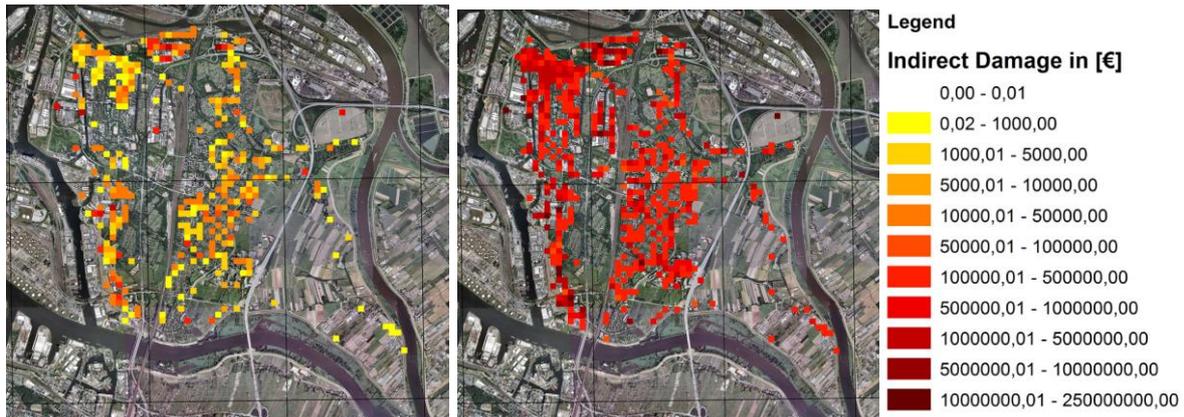


Figure 2. Localization of indirect losses XR2010A (left) and XR2010C (right).

Although the uncertainty in the estimation of economic losses from natural disasters is large, the results of this paper provide insight into potential flood losses and the reconstruction period as well as the relationship between direct and indirect damages. Furthermore, the interdisciplinary approach builds a basis for the future evaluation of possible flood protection measures in the city of Hamburg and is, generally, transferable to other regions.

ACKNOWLEDGEMENT

Research on the CORFU (Collaborative research on flood resilience in urban areas) project was funded by the European Commission through Framework Programme 7, Grant Number 244047.

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