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HYDRAULICS RESEARCH

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Detailed localization of potential victims in nuclei for superstorm events at the Flemish Coast

Introduction

The expected number of victims resulting from superstorm events at the Flemish Coast previously have been presented by tables listing total amounts, supplemented by small-scale maps that give an impression of the location of high-risk areas (e.g. Vanpoucke et al., 2009). These reports provide no quantitative details on the local geographical level. The present study is aimed at visualizing the spatial distribution of victim risks in so called 'victim nuclei' or 'victim core areas'. The study focuses on observation zones ('aandachtszones'), that are related to weak links in the coastal defence, and observation areas ('aandachtsgebieden'), that are flooded as a consequence of breaches or wave overtopping of the coastal protection constructions (+8m TAW, +7,5m TAW, +7 TAW and +6,5m TAW superstorm events). Seventeen weak links in the coastal defence along the Flemish coastline, as listed in Vanpoucke et al. (2009), were taken into account (Figure 1).

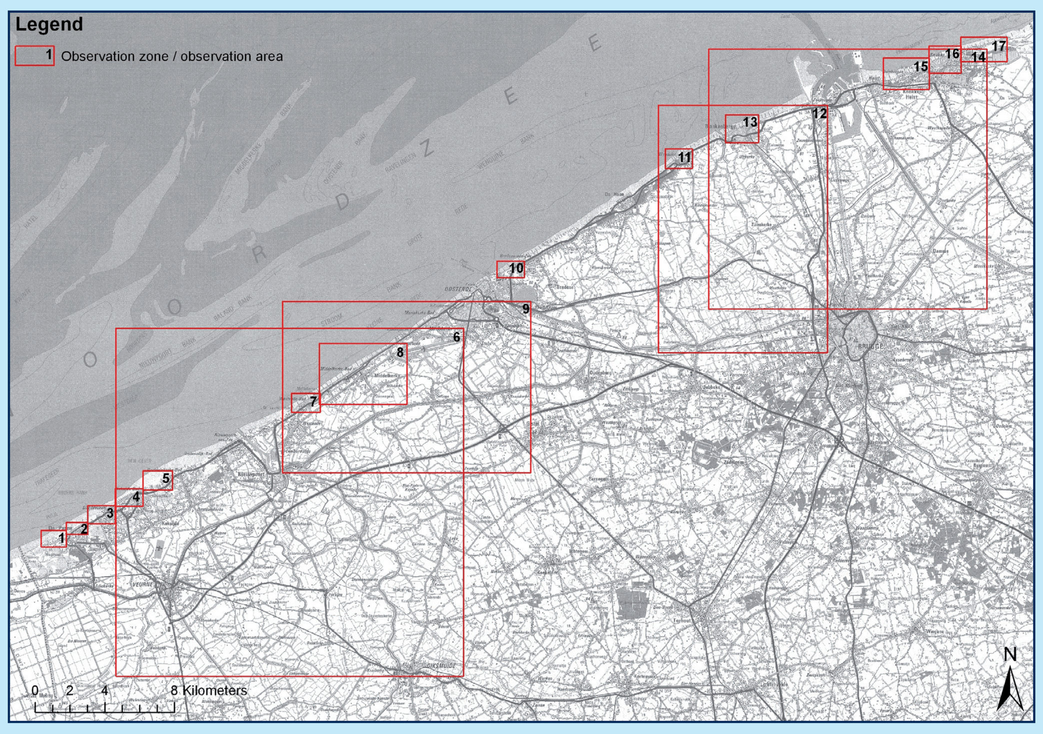

Figure 1 – Location map of the study areas or weak links in the coastal defence: Westhoek (1), De Panne Centrum (2), Sint-Idesbald (3), Area between Koksijde and Oostduinkerke (4), Koksijde-Bad (5), Port of Nieuwpoort (6), Westende-Bad (7), Middelkerke (8), Raversijde-Mariakerke-Oostende West (9), Spinoladijk (10), Wenduine (11), Port of Blankenberge, (12) Blankenberge-Bad (13), Port of Zeebrugge (14), Duinbergen and Albertstrand (15), Knokke-Zoute (16), Lekkerbek (17)
Background: Topographic Map of Belgium, 1:100.000, 1986-1990 (NGI/OC GIS Vlaanderen)
Source: Vanpoucke et al. (2009), own processing

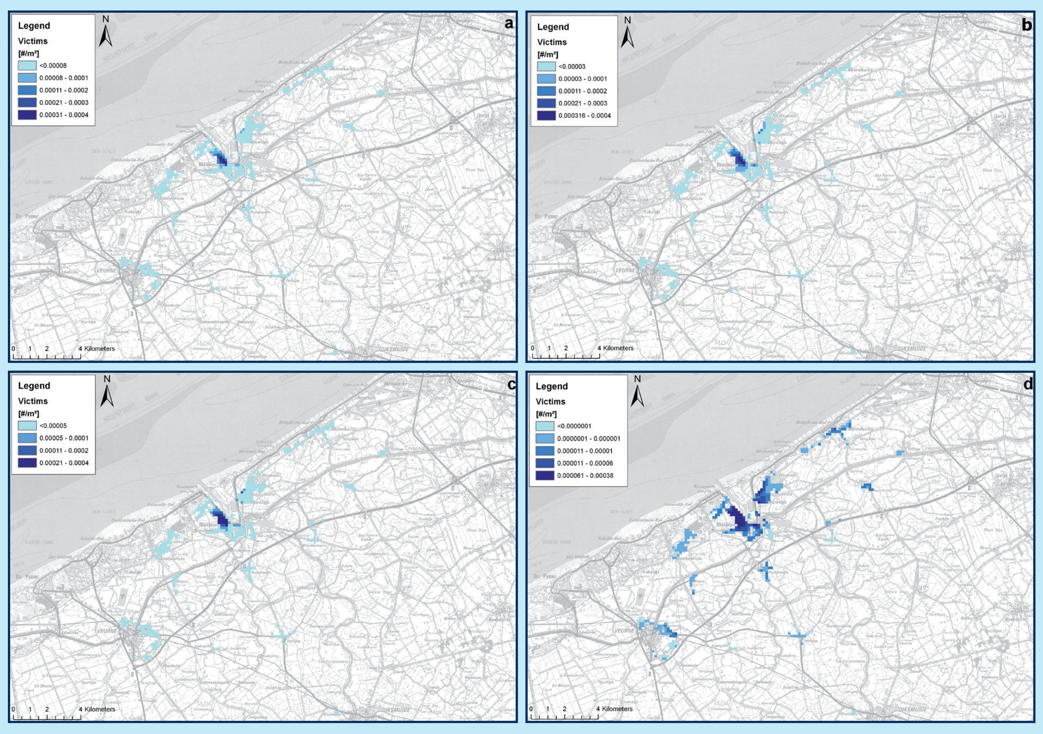

Figure 2 – Spatial distribution of expected number of victims in Nieuwpoort, resulting from the +8m TAW superstorm event, showing that different classification techniques lead to spatial variation of the map content (a: based on equal intervals, b: based on Jenks Index, c: based on standard deviation and d: based on geometrical intervals)
Background: Topographic Map of Belgium, 1:100.000, 1986-1990 (NGI/OC GIS Vlaanderen)
Source: Vanpoucke et al. (2009), own processing

Research input

Spatial victim distribution raster files corresponding to +6.5m TAW, +7m TAW, +7.5 m TAW and +8m TAW scenario's (LATIS-output), created for the research of Vanpoucke et al. (2009a, 2009b), were used as research input. It is assumed that:

- Population is situated in built-up area and industry zones
- Expected number of victims does not take evacuation into account

Methodology

The visualization of vulnerability differentiation within the inundated areas highly depends on the classification method applied to the available geographical data, as it leads to spatial variation of the map content (Figure 2) (note that raster resolution coarsing has been applied, cfr. 'Results'). The current data were processed in a GIS environment that offered seven discretization methods, allowing to identify none, one or various local subareas in which high victim concentrations could be found. The study aimed at defining 'optimal' victim nuclei, corresponding to the identification of 'optimal' class boundaries.

Core area victims were quantified as percentages of the total number of expected victims in the concerning observation area or zone. Therefore, it was needed to define (i) where the core areas were situated, (ii) the classes they consisted of, (iii) the expected number of victims in these areas and (iv) the core percentages as described above, for which a nine-step plan has been developed.

The preferred discretization technique in combination with the classes that were selected for further research appeared to be deciding factors for the nucleus percentage calculation. Adding or dropping a class and comparing the final results have lead to the process of 'trial and error'. It was assumed that theoretically, a nucleus could be defined when more than 50% of the total number of victims was located in an area that, in proportion to the total flooded area, covered a smaller part (i.e. <50% of studied area or zone).

Results

Figure 3 presents the synthesis of the victim nuclei at the Flemish Coast, resulting from the entire scenario set (+6.5m to +8m TAW superstorms). It should be stressed that, in the framework of the poster presentation, it involves a coarser raster resolution (based on pixel aggregation) than managed in the research. Raster resolutions in the hinterland and in ports have been contracted by factor 30; raster resolutions on coastal protection structures have been made coarser 15 times. Floods have not been simulated yet for Port of Oostende, Oostende-Centrum and Het Zwin. These areas are therefore presented as shaded parts (Figure 3).

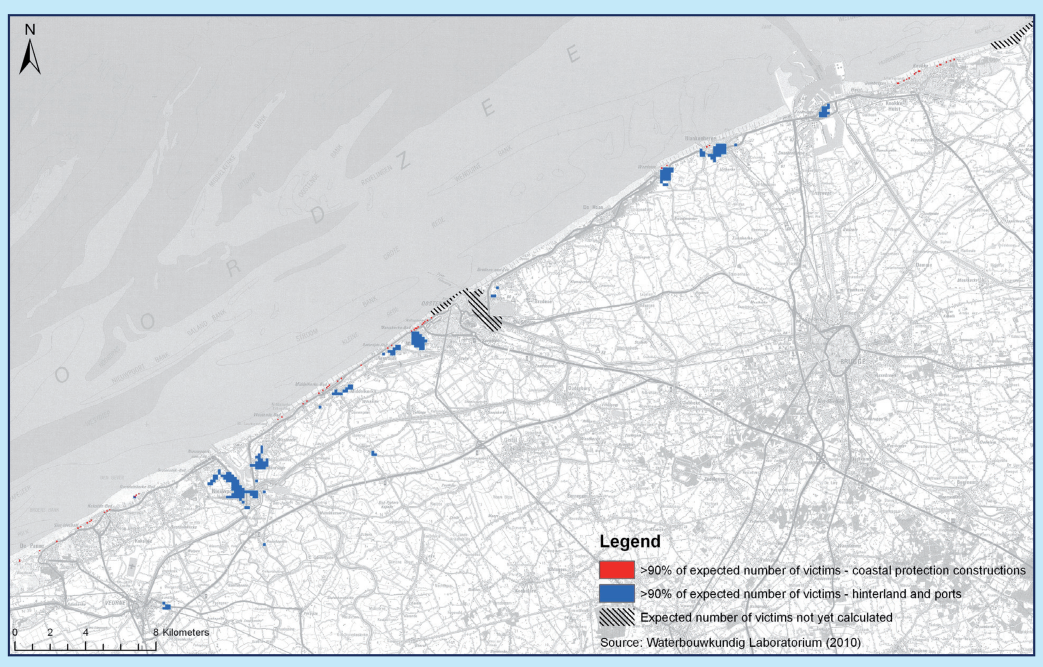

Figure 3 – Synthesis of victim nuclei (>90% of expected number of victims) at the Flemish Coast, resulting from +6.5m to +8m TAW superstorms
Background: Topographic Map of Belgium, 1:100.000, 1986-1990 (NGI/OC GIS Vlaanderen)
Source: own research

Discussion and conclusion

It should be noted that the percentages and respective nuclei are not to be interpreted as absolute results, as they give an indication of the most vulnerable subzones of the study areas. Given the time consuming character of victim core area determination (infinite number of possible combinations of classification method and number of classes), it can not be assured that each nucleus is the most 'concentrated' one, defining concentration as nucleus victim number/nucleus area ratio.

However, the elaborated methodology was applied in such a way that each victim nucleus took up equal to or more than 90% of the total expected number of victims in the respective study area. Such a refinement of victim variation without taking (spontaneous or organized) evacuation into account will make it possible in the future research phase to delineate priority evacuation areas. The sharp core area boundaries will however be transformed into fuzzy ones in order to obtain meaningful results.

References

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