Flood risk in The Nederlands

Triple A, Seminar Capital Generation

3 December 2024, Driebergen-Rijsenburg

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Proprietary & Confidential

Flood Events and Flood Risk Milestones in the Netherlands

1916 — Flood disaster that took place around the Zuiderzee in the Netherlands from 13th to 14th Jan 1916

1953 — 1953 North Sea flood was a major flood caused by a heavy storm that occurred on the night of Saturday, 31th Jan and morning of 1st Feb. The floods struck the Netherlands, Belgium, England and Scotland

1955 — A binding decision of the Association of Fire Insurers (a precursor of the Dutch Association of Insurers) followed. Fire insurance was no longer allowed to provide cover against flooding

1993 — In 1993, high water levels of the Maas came after a period of continuous rain and flooded large parts of Dutch Limburg

1995 — The river Meuse flooded again in 1995 with peak discharge as well as the flooded areas were comparable in magnitude with 1993 event

1997 — In 1997 the completion of Hartelkering construction the Delta works project (Deltawerken) is assumed to be completed

2000 — Neerslagclausule Verbond

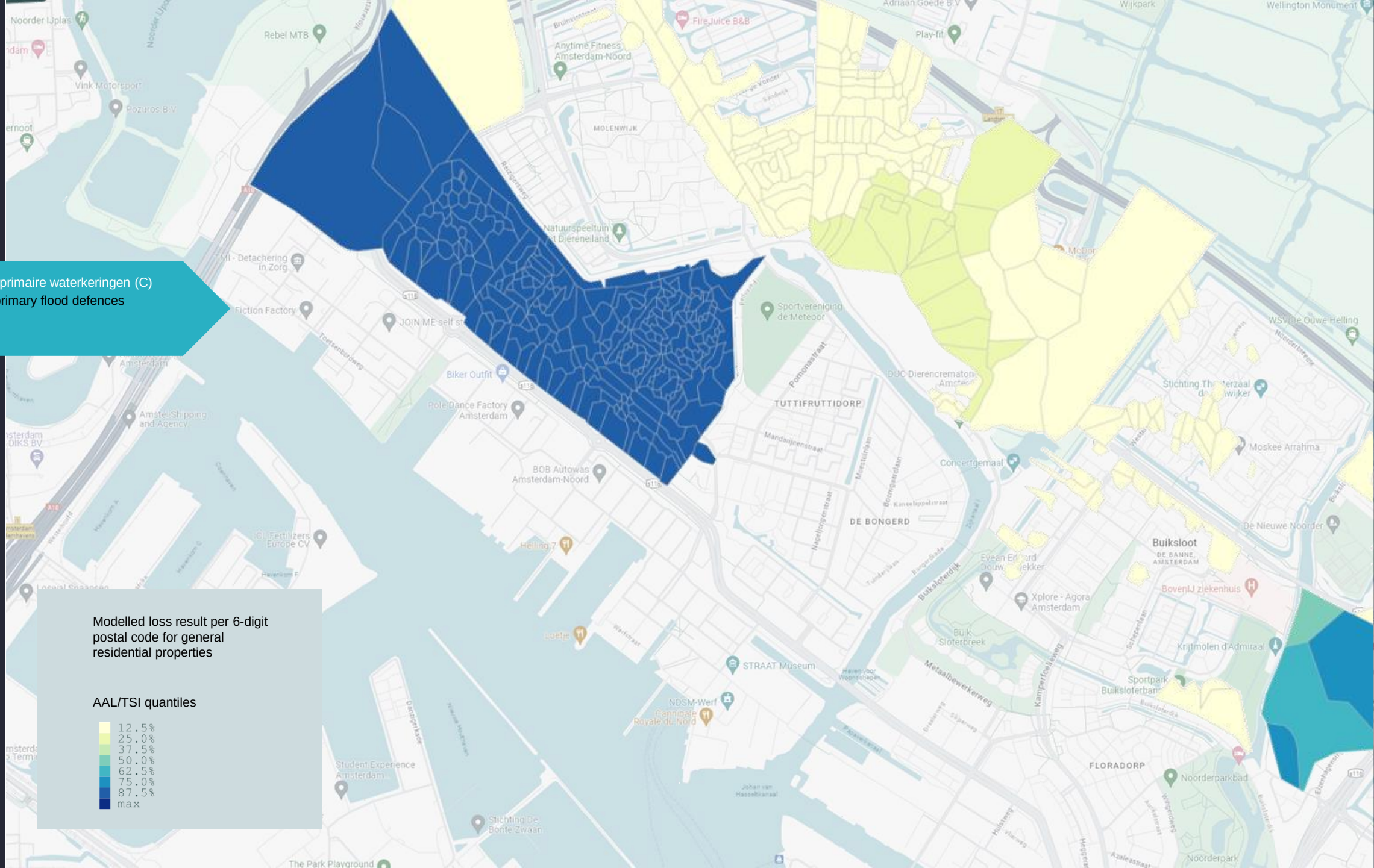
2013 — IF Primary Dyke Dutch Flood Model Release

2017 — Waterwet 2017. Preparation of new safety standards (dyke sections, failure models)

2018 — Adviesrapport Overstromingen, Verbond

2021 — Severe material damage after river Geul and Maas flooded following extreme precipitation

2024 — IF Comprehensive Dutch Flood Model Release


Doorbraak niet-primaire waterkeringen (C)
Failure of non-primary flood defences
Modelled loss result per 6-digit postal code for general residential properties
AAL/TSI quantiles
12.5%
25.0%
37.5%
50.0%
62.5%
75.0%
87.5%
max
TUTTIFRUTTIDORP
DE BONGERD
FLORADORP
Buiksloot
MOLENWIJK
Rebel MTB
Anytime Fitness Amsterdam-Noord
Fire Juice B&B
Play-fit
Vink Motorsport
Pozuros B.V.
Natuurspeeltuin 't Dereneiland
Fiction Factory
Biker Outfit
Pole Dance Factory Amsterdam
BOB Autowas Amsterdam-Noord
Sportvereniging de Meteoor
DBC Dierencrematorium
Concertgemaal
Moskee Arrahma
De Nieuwe Noorder
BovenIJ ziekenhuis
Xplore - Agora Amsterdam
Krijtmolen d'Admiraal
Sportpark Buiksloterbanen
Noorderparkbad
Noorderpark
STRAAT Museum
NDSM-Werf
Student Experience Amsterdam
Stichting De Bonte Zwaan
The Park Playground

Blerick
Eindhoven
Centrum
Duitsland
Nijmegen
N 271
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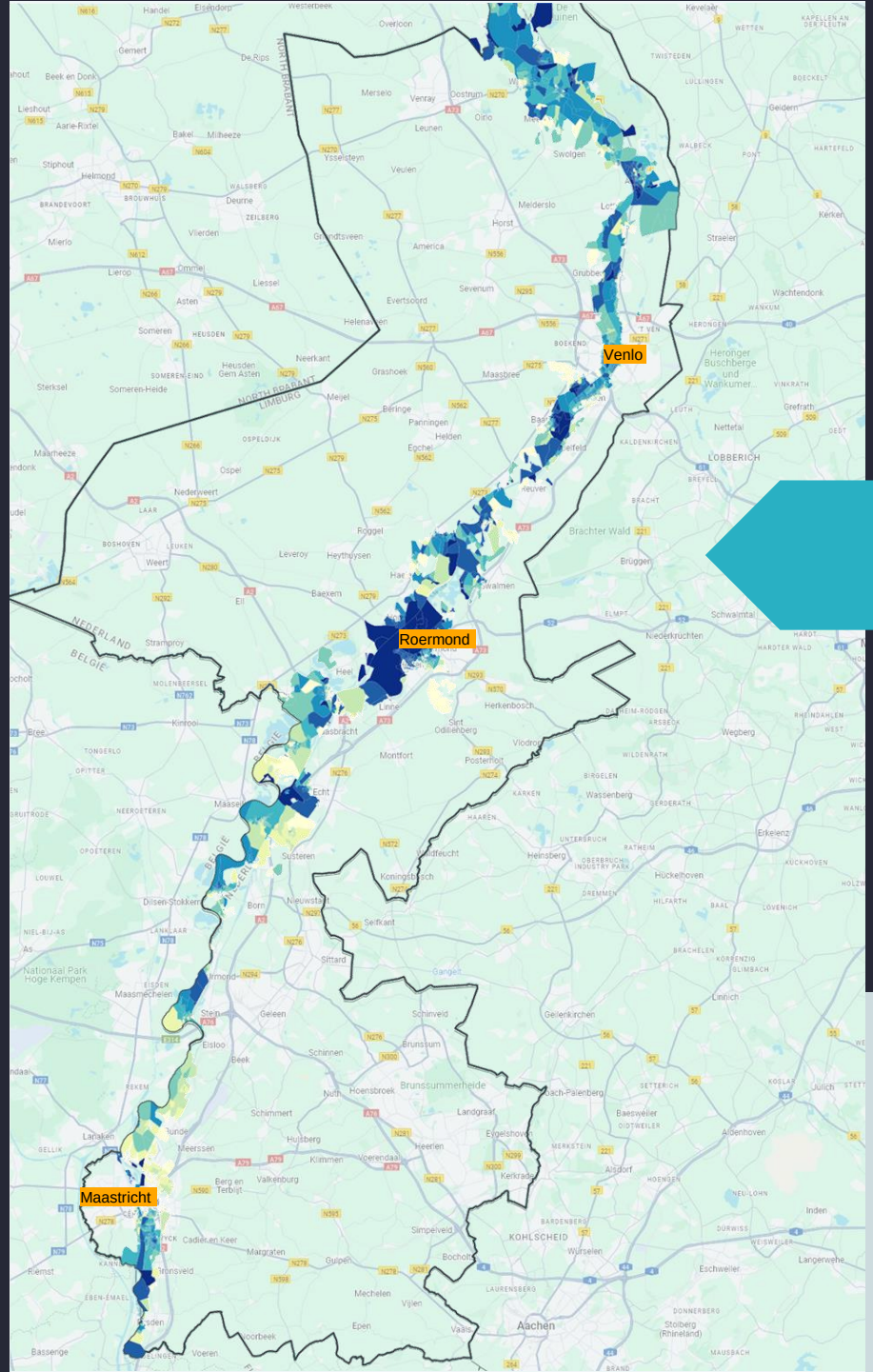


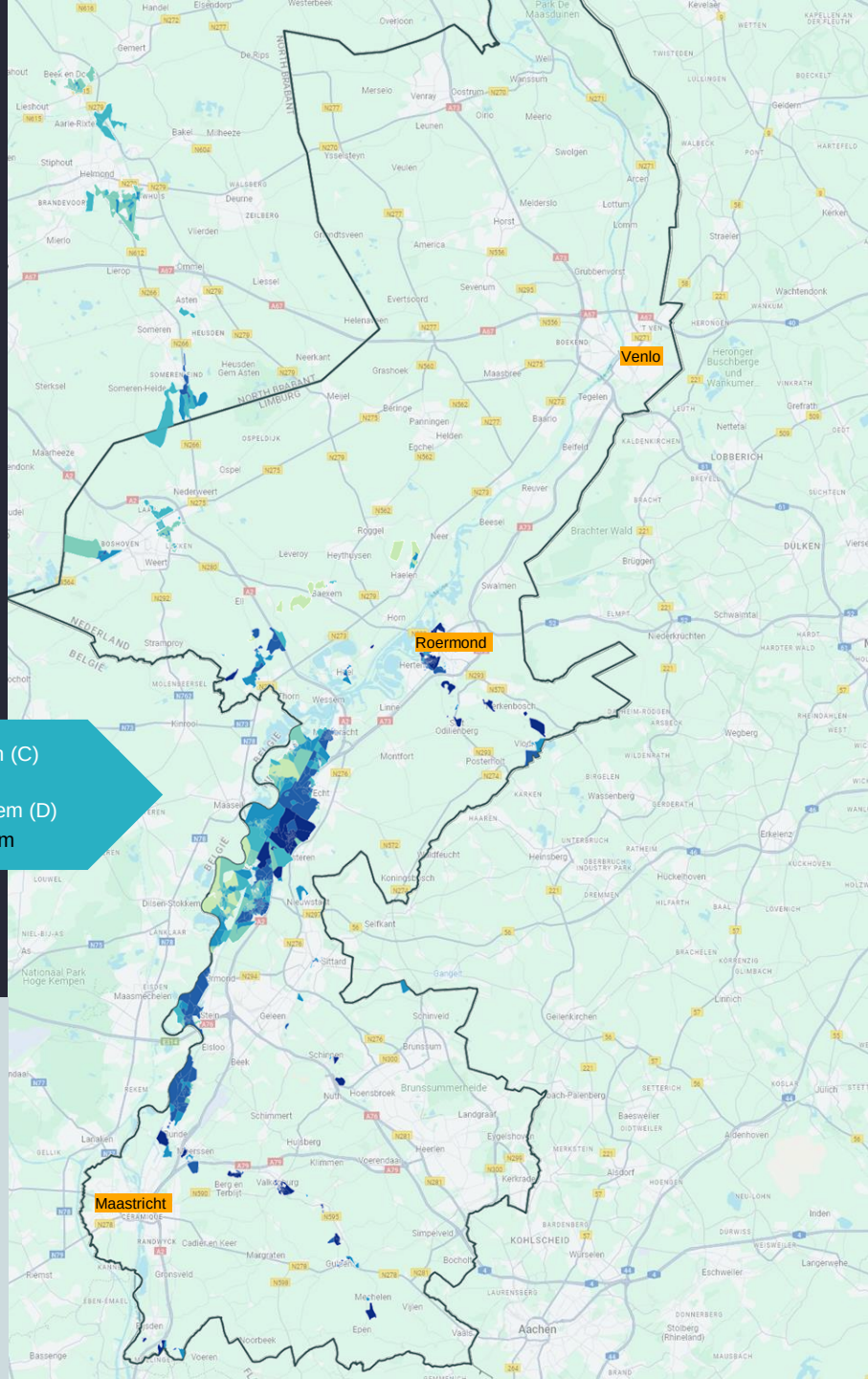
Inundatie buitendijkse gebieden (A)
Flooding of unprotected areas

Doorbraak niet-primaire waterkeringen (C)
Failure of non-primary flood defences
Inundatie vanuit regionaal watersysteem (D)
Flooding from the regional watersystem

Modelled loss result per 6-digit postal code for general residential properties

AAL/TSI quantiles

- 12.5%
- 25.0%
- 37.5%
- 50.0%
- 62.5%
- 75.0%
- 87.5%
- max



Flood in The Netherlands

Primary

A **Inundatie buitendijkse gebieden**
Flooding of unprotected areas

B **Doorbraak primaire waterkeringen**
Failure of primary flood defences

Non-Primary and Pluvial

C **Doorbraak niet-primaire waterkeringen**
Failure of non-primary flood defences

D **Inundatie vanuit regionaal watersysteem**
Flooding from the regional watersystem

P **Wateroverlast bij hevige regenval**
Pluvial flood and cloud burst

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Exposure Geocoding
Precise coordinates

The Aon/ Impact Forecasting flood model for The Netherlands supports of the following input geocoding precisions:

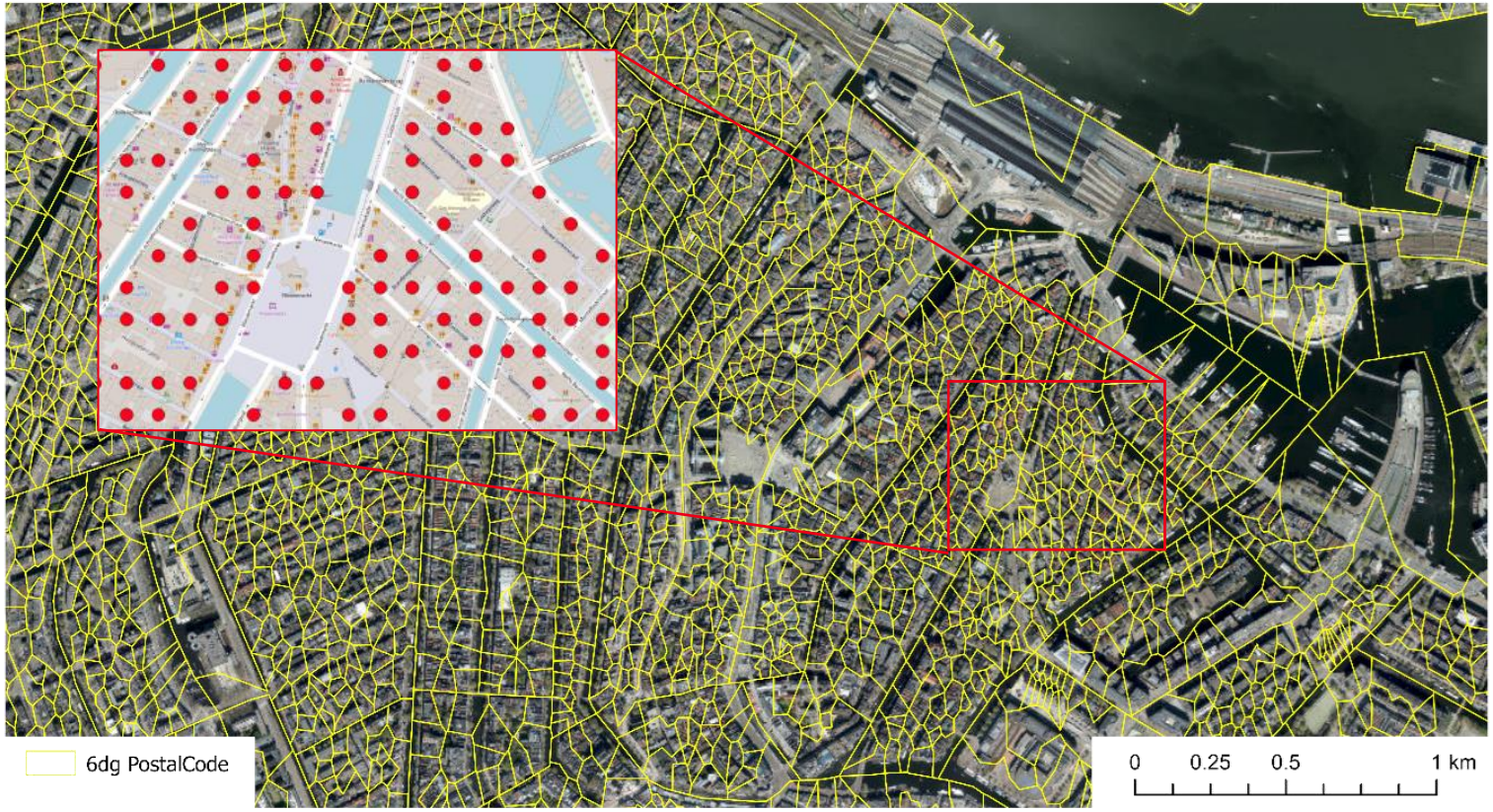
- Exact coordinates on 25 x 25m grid: WGS84 (Lat/Lon). Previous model: 100 x 100m. Street + house number

Geocoding illustrated: city of Amsterdam - center
25 x 25m grid (new released model, March 2023)

Exposure Geocoding
6-digit postal code

The Aon/ Impact Forecasting flood model for The Netherlands supports of the following input geocoding precisions:

- Exact coordinates on 25 x 25m grid: WGS84 (Lat/Lon). Previous model: 100 x 100m. Street + house number
- 6-digit postal code, re-shaped by IF (mapped to most prominent grid cell)



Geocoding illustrated: city of Amsterdam - center
6-digit postal codes

Exposure Geocoding
4-digit postal code

The Aon/ Impact Forecasting flood model for The Netherlands supports of the following input geocoding precisions:

- Exact coordinates on 25 x 25m grid: WGS84 (Lat/Lon). Previous model: 100 x 100m. Street + house number
- 6-digit postal code, re-shaped by IF (mapped to most prominent grid cell)
- 4-digit postal code (uses location sampling)

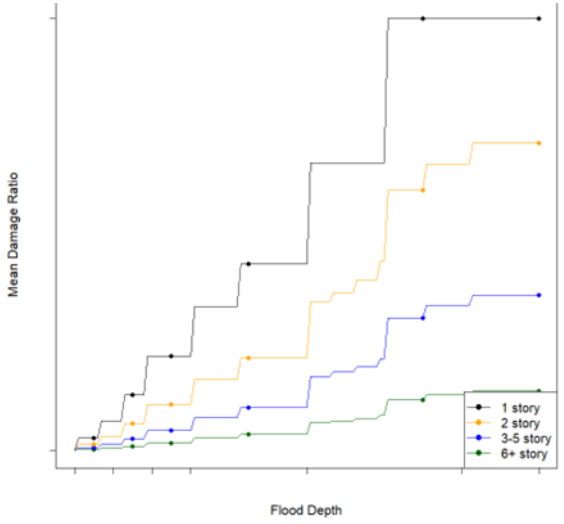
Various exposure location distributions (for 4-digit postal code) for residential, non-residential and agriculture property using CORINE Land Cover (CLC) and BAG building outlines and building purpose data

CLC: the 'Coordination of information on the environment' (Corine) is an inventory of European land cover and is available through the European Copernicus initiative.
BAG: Basisregistratie adressen en gebouwen, dienst voor het kadaster en de openbare registers

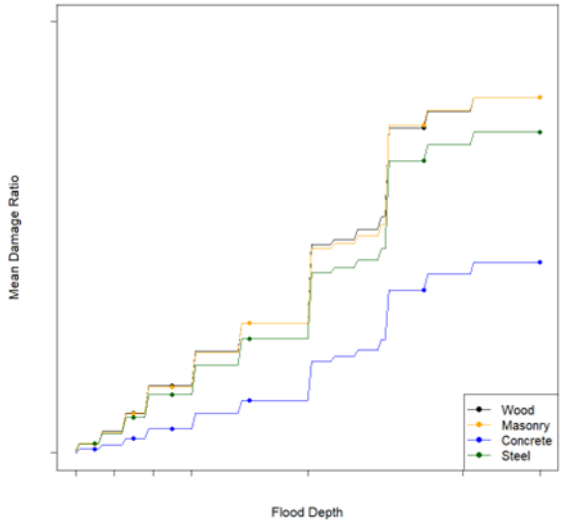
Geocoding illustrated: city of Amsterdam – center
4-digit postal code

Vulnerability
Effect of primary modifiers

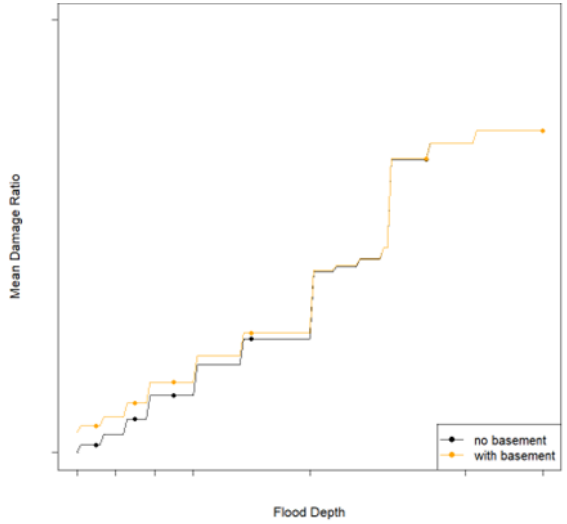
Building height effect



Construction effect (unknown story)



Basement presence effect



- Individual primary modifiers have effect on damageability
- Their effect is not independent (construction can affect building height and vice versa

Vulnerability
Insights from Bernd losses

- Experience based re-assessment of vulnerability loss curves
- Cooperation between Leuven University and Aon Belgium
- Information gathered from media (newspapers, tv, internet) and Streetview to estimate inundation depths
- Flood depth in 39 municipalities was studied
- Bernd case-by-case loss database from Aon for different occupancy types: Residential, Commercial, Municipality, Agricultural
- Insights have been ported to Aon IF Flood model for The Netherlands

Manual estimates
of the water depth

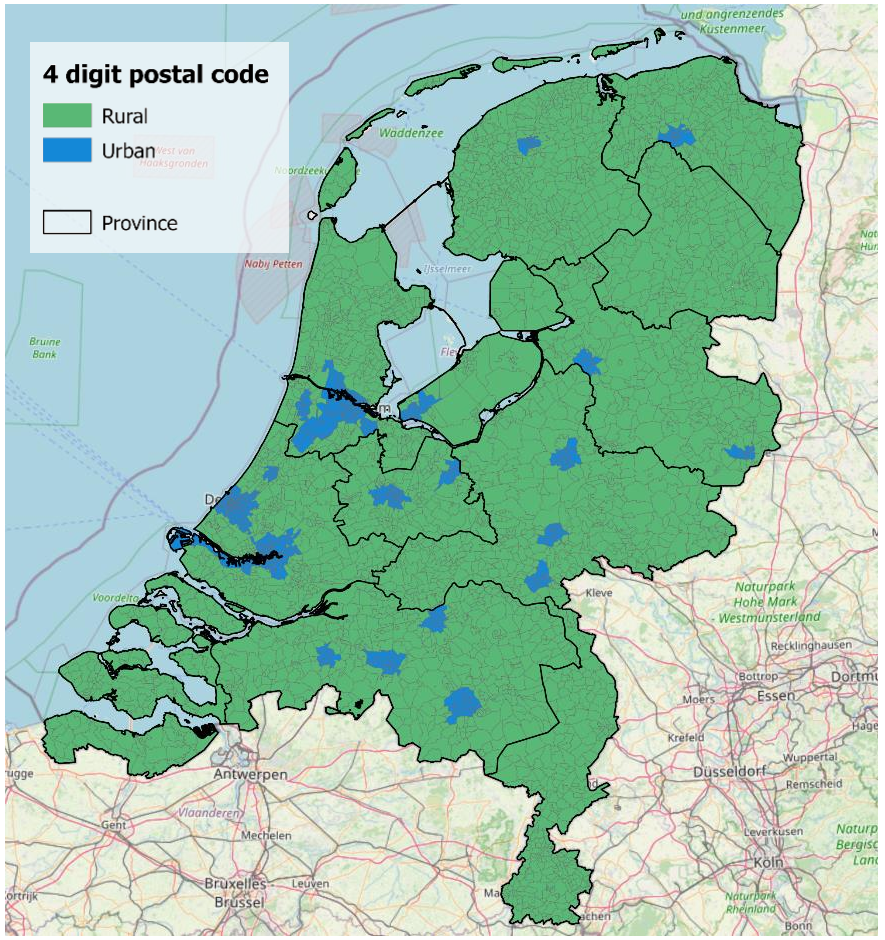
Geocoding and Unspecified Modifiers

IF classifies The Netherlands into 2 regions urban / rural when modelling general residential, industrial, commercial or agriculture line of business.

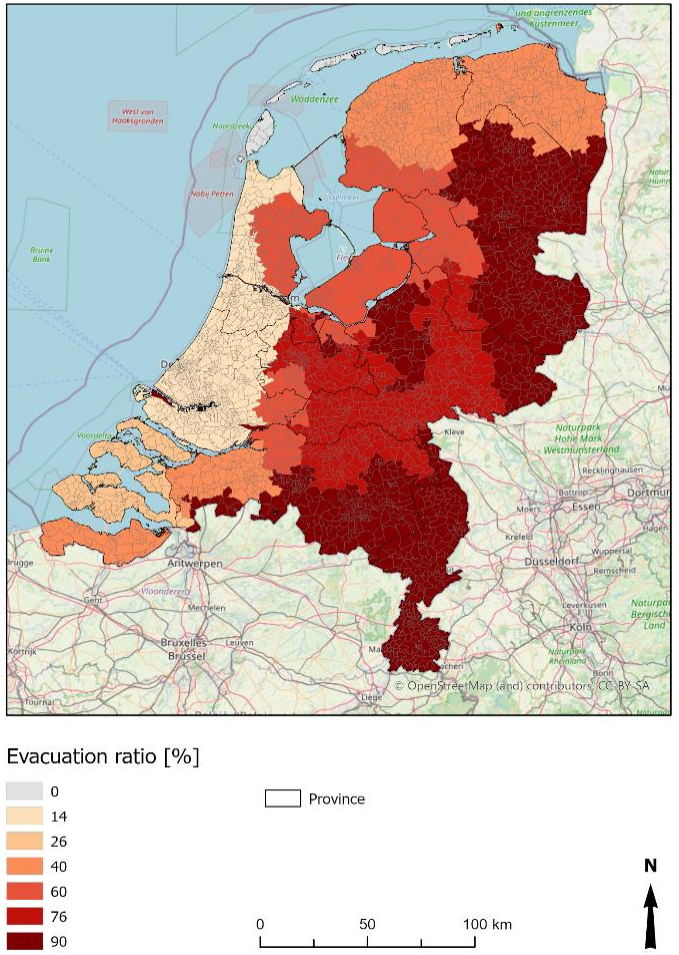
For Motor line of business IF now considers 7 tiers to model the evacuation rate when an event occurs (as per HKV, developed from LIWO)

These two modifiers are automatically assigned to the exposure (on corresponding PC4 level), and are reflected in the vulnerability

IFv2 Vulnerability regions



IFv2 Motor Hull evacuation rates



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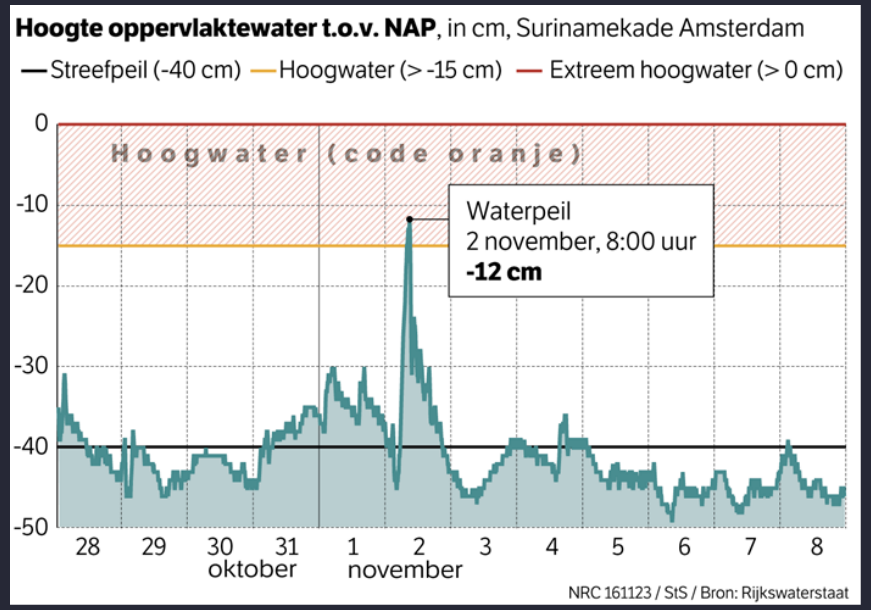
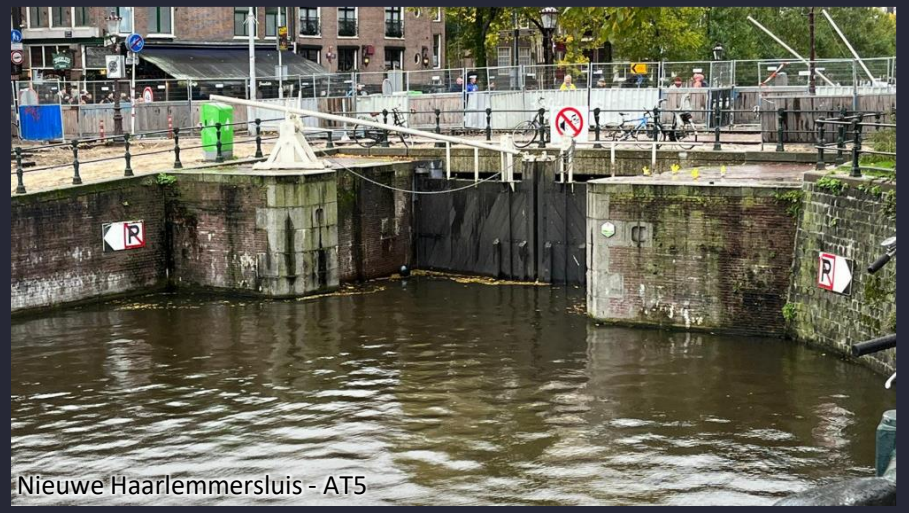
Amsterdam

2 November 2023



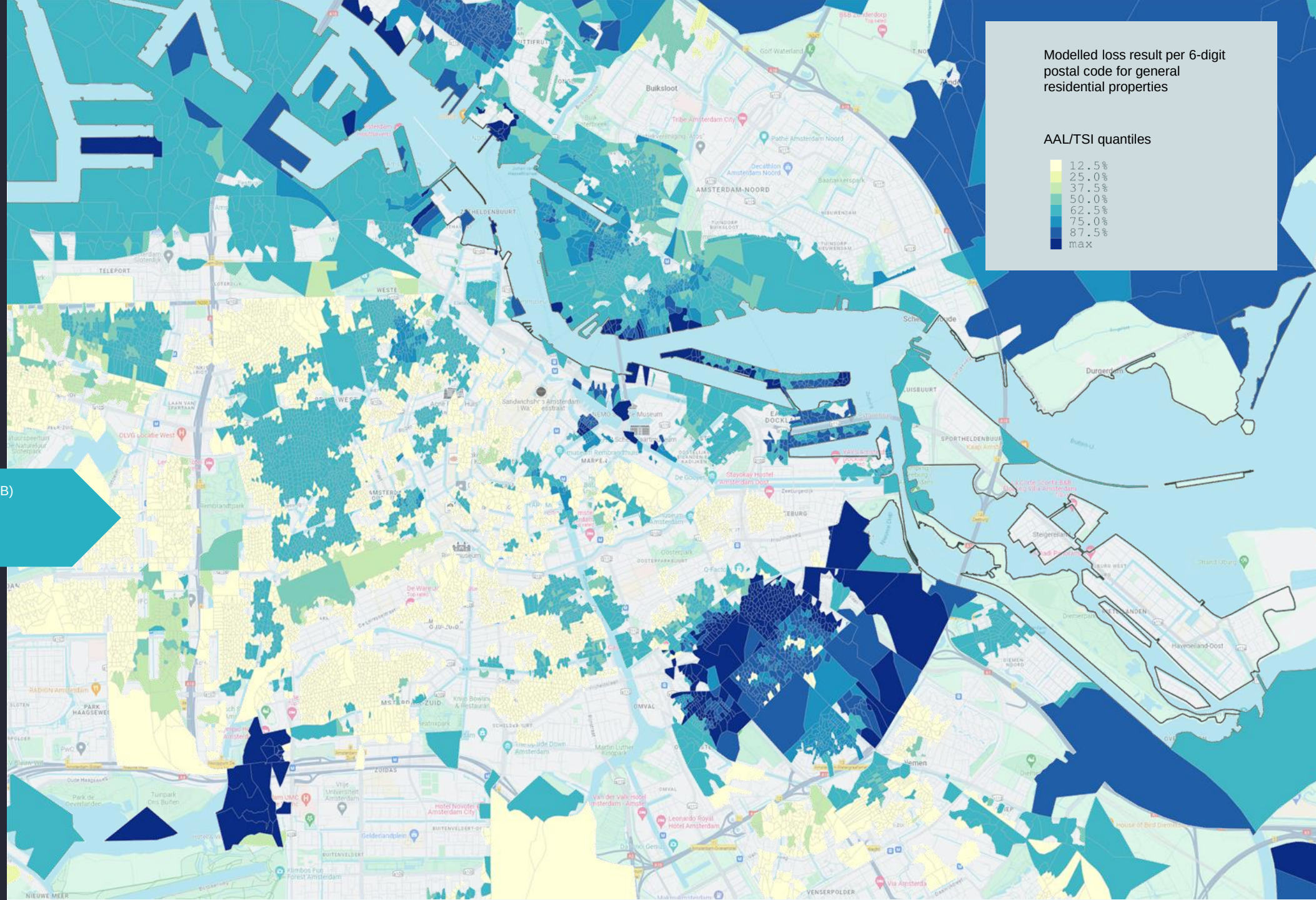

Nieuwe Haarlemmersluis - AT5

Combination of

- Large volume of rainfall in preceding days
- Failure of IJmuiden sluiceway: after low-tide the valves refuse to close. When the tide turns, water from the North sea flows land-inwards.
- Effect elevated by upcoming storm Ciaran

Resulting in

- Wave of water rolls from IJmuiden to Wijk bij Duurstede
- Risk of streets Amsterdam flooding, sewage system overflowing, salinization of the regions fresh water (drinking water) system
- Closing of the 'IJ-front'
- At 7.26 sluice at IJmuiden repaired and closed



Doorbraak primaire waterkeringen (B)
Failure of primary flood defences

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Unembanked North Sea shore

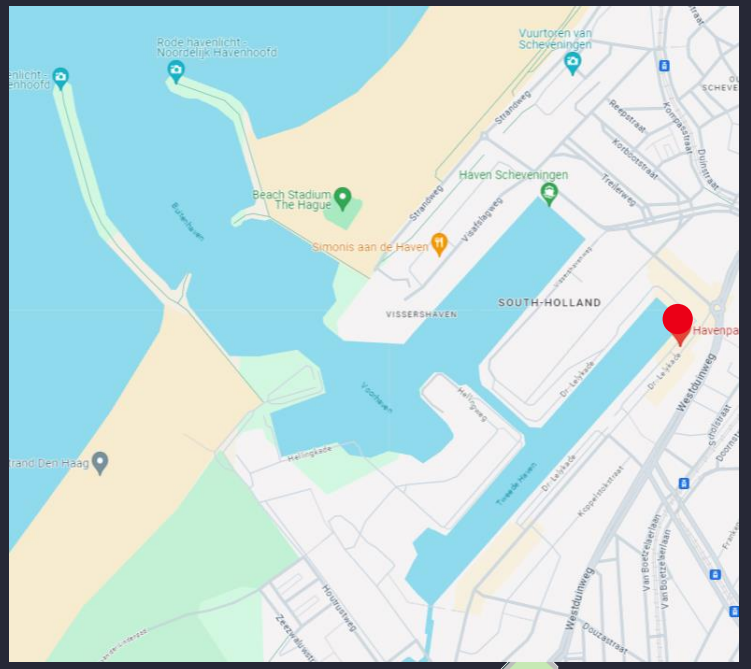
22 December 2023

Unembanked North Sea shore

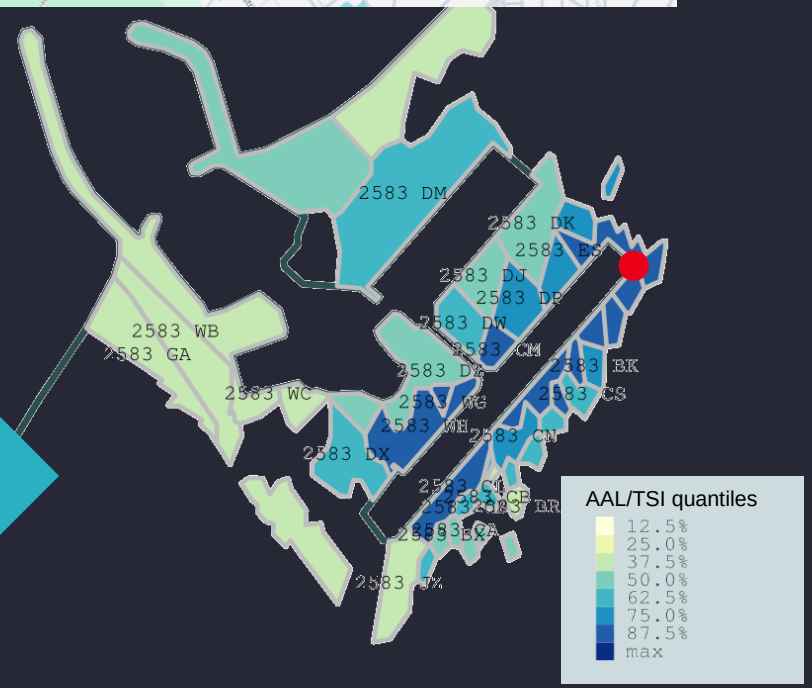
22 December 2023

Kade Scheveningen
Restaurant Havenpaleis

Dr Lelykade 1c



Inundatie buitendijkse gebieden (A)
Flooding of unprotected areas



Buitenpost

20 May 2024

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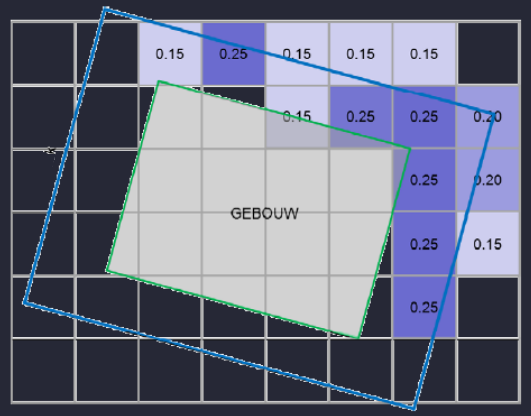
Buitenpost

20 May 2024

Wateroverlast bij hevige regenval (P)
Pluvial Flood and Cloudburst



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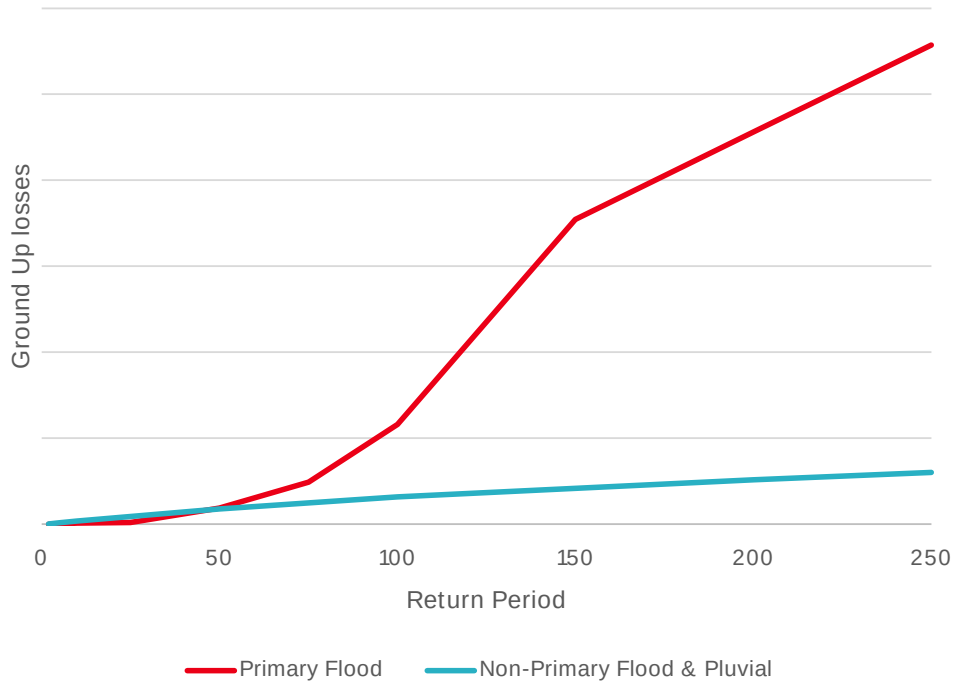
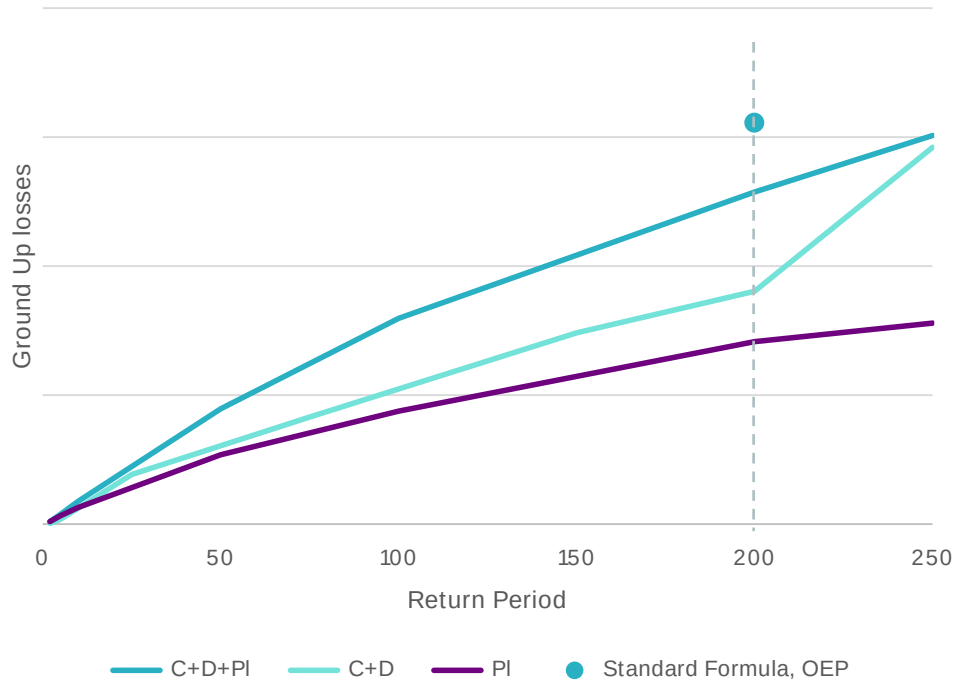
Netherlands Flood

IED Property Modelled Losses – PML results

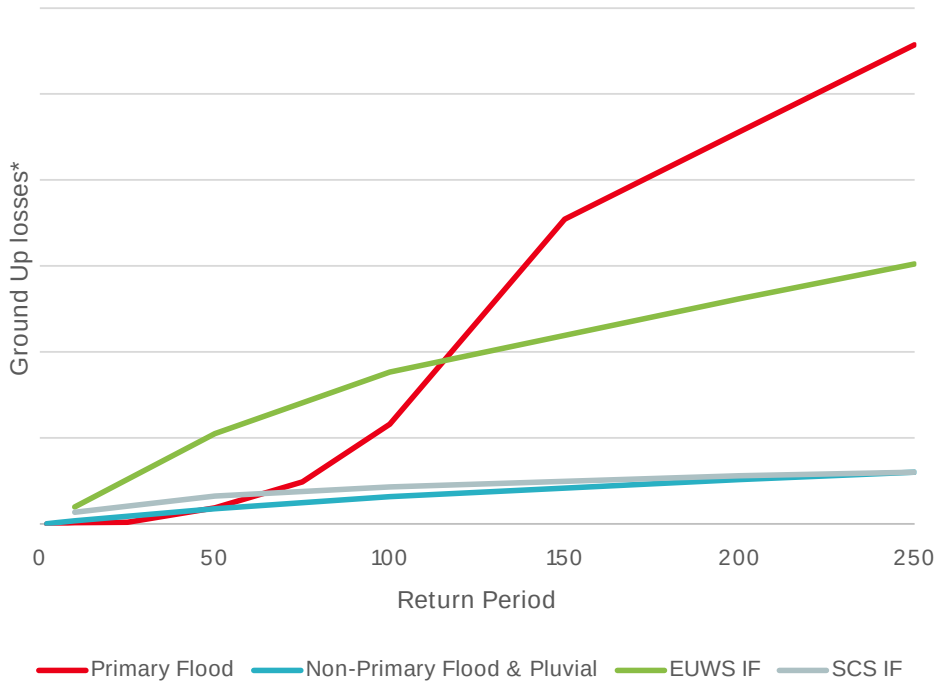




Occurrence Exceedance Probabilities

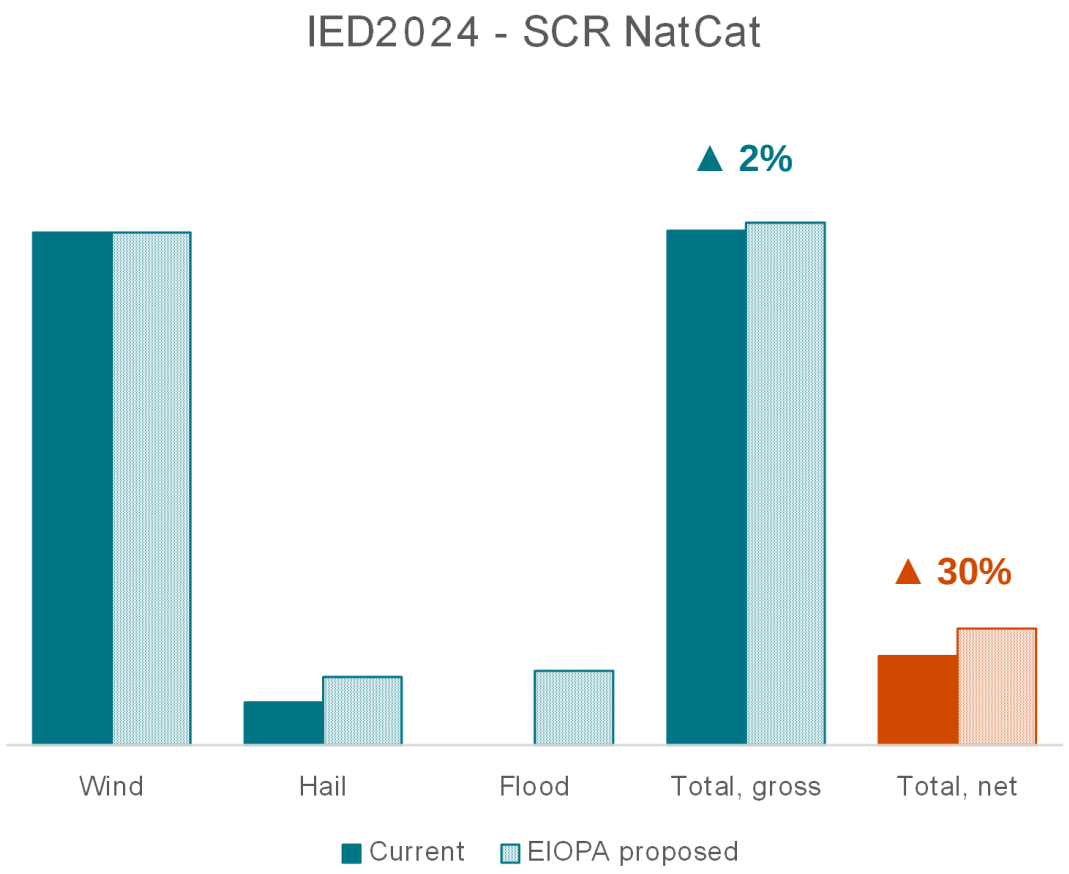
Weather Related Risks compared

IED Property Modelled Losses



Occurrence Exceedance Probabilities

*Except EUWS: Gross

Solvency II Standard Formula

IED Property and Motor Hull