

SkyGeo

InSAR for climate change adaptation: risks of urban flooding

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Climate

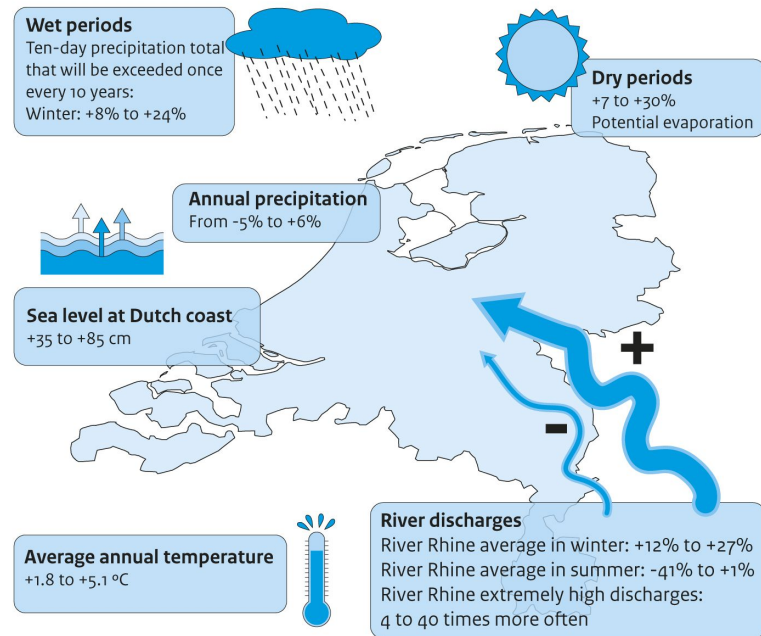
Climate change is already a reality in flood plains



Climate change effect on infrastructure

- Rising sea levels
- Increases in annual precipitation
 - For the period 1910 to 2019, a 35% increase in mean annual precipitation has occurred
 - Increased extreme rainfall events - 48mm/30min
- Unusual periods of drought

Possible climate changes for the 1990 – 2100 period, according to KNMI'o6 scenarios



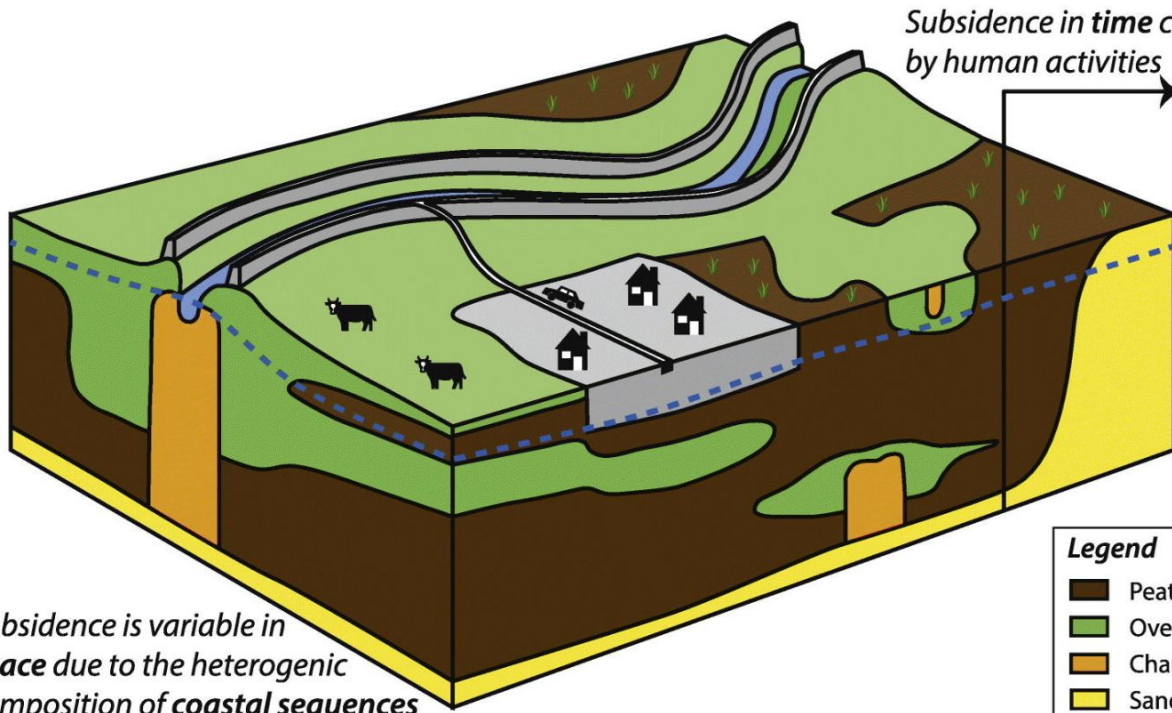
Source: KNMI (2006 scenarios).

www.pbl.nl

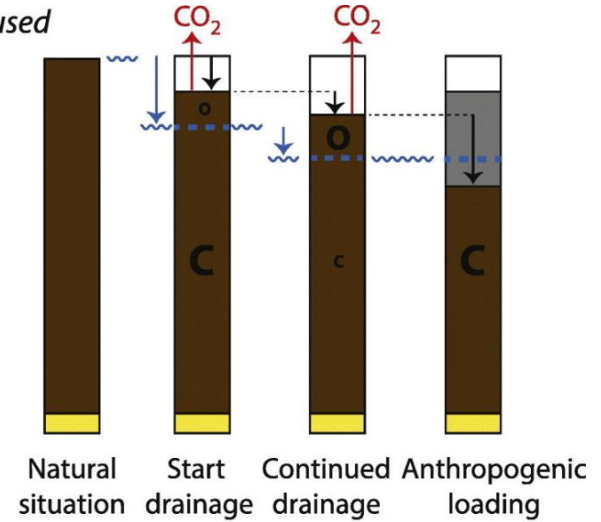
Municipal policymakers face trade offs in urban areas



Oxidation of peat soils



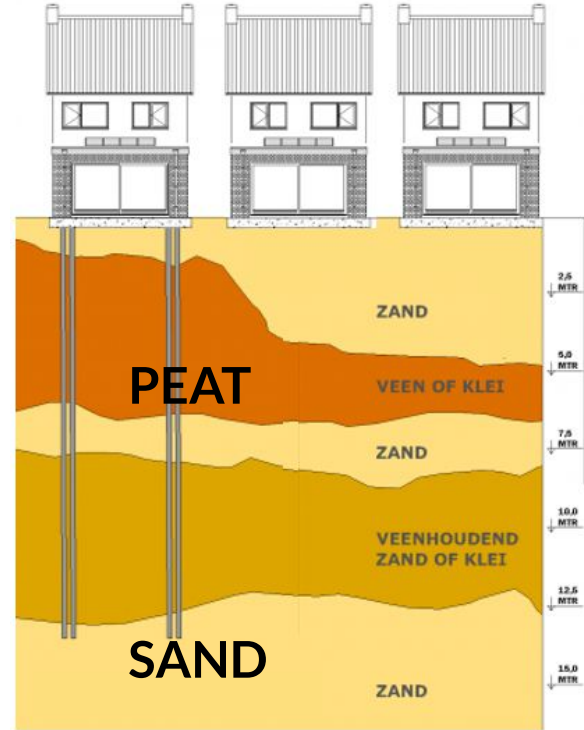
Subsidence is variable in space due to the heterogenic composition of coastal sequences



Legend

Peat	Anthropogenic
Overbank deposits	River
Channel deposits	Groundwater table
Sand	Compaction / Oxidation

(Asselen et al., 2018)



Location - Krimpen aan den IJssel

Between the Maas and IJssel rivers

Build on peat soil



1. Amsterdam
2. Rotterdam
3. Maeslant barrier
4. Eastern Scheldt barrier
5. Haringvliet barrier
6. Afsluitdijk
7. Gouda inlet
8. Bernisse inlet
9. Spijkernisse inlet

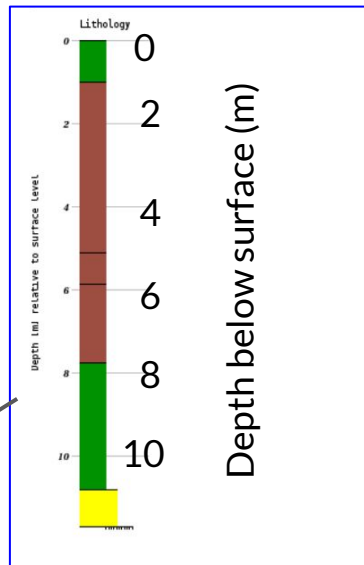
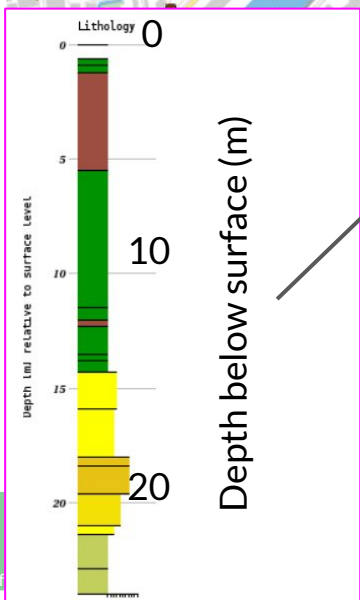
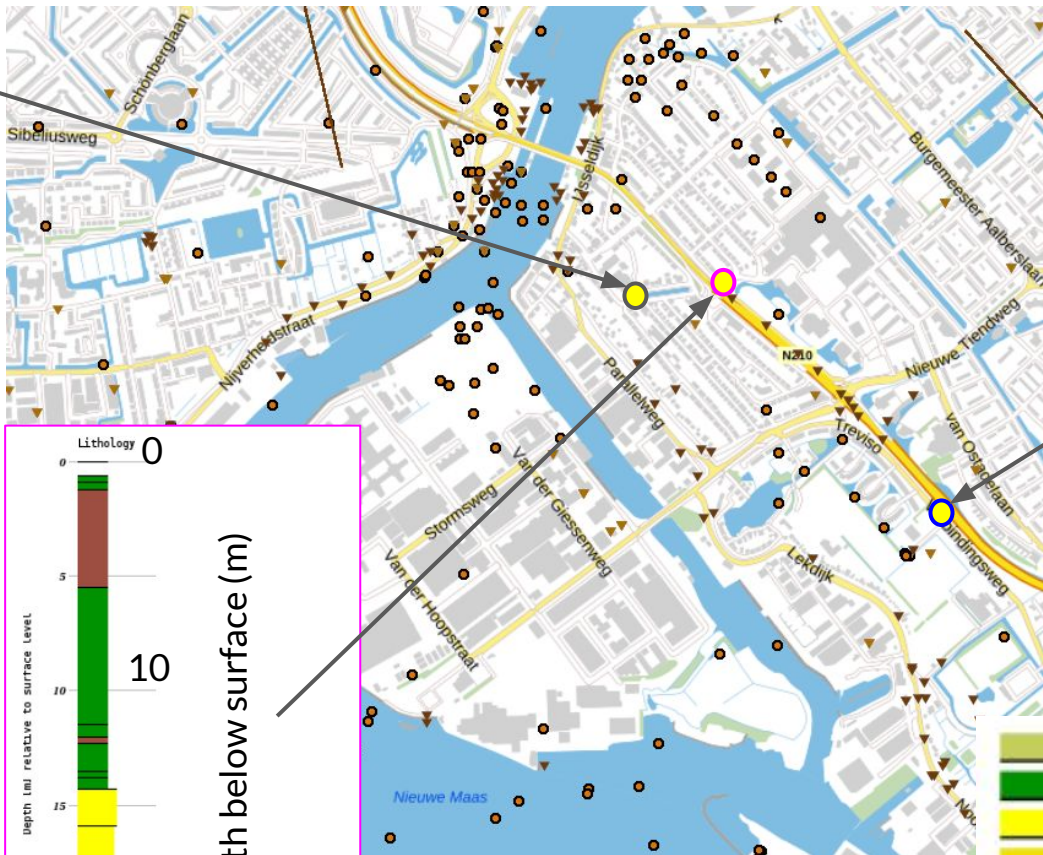
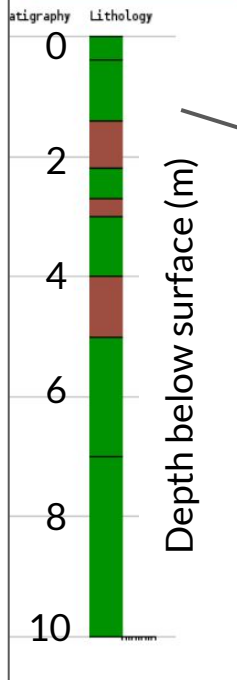
Within dike rings








- Below NAP
- Above NAP

Areas outside dike rings

Areas threatened by flooding along the river Meuse





-  Loam
-  Clay
-  Sand, fine category
-  Sand, medium category
-  Sand, coarse category
-  Peat
-  Not determined

Climate change effects

Increased extreme rainfall events result in high volumes of runoff exceeding storage capacity

Increased periods of drought accelerate the rate of peat oxidation → increased soil subsidence rates

→ **Result: hundreds of houses flood several times a year**



What can be done?

Municipality has ongoing effort to design for improved storage of rainwater

Predict and quantify the risk to houses to help the municipality plan their climate adaptation strategy by understanding when these houses will flood and which houses are most at risk

Ultimately: do we need to abandon these structures?

'Future proof' neighbourhood design



The approach

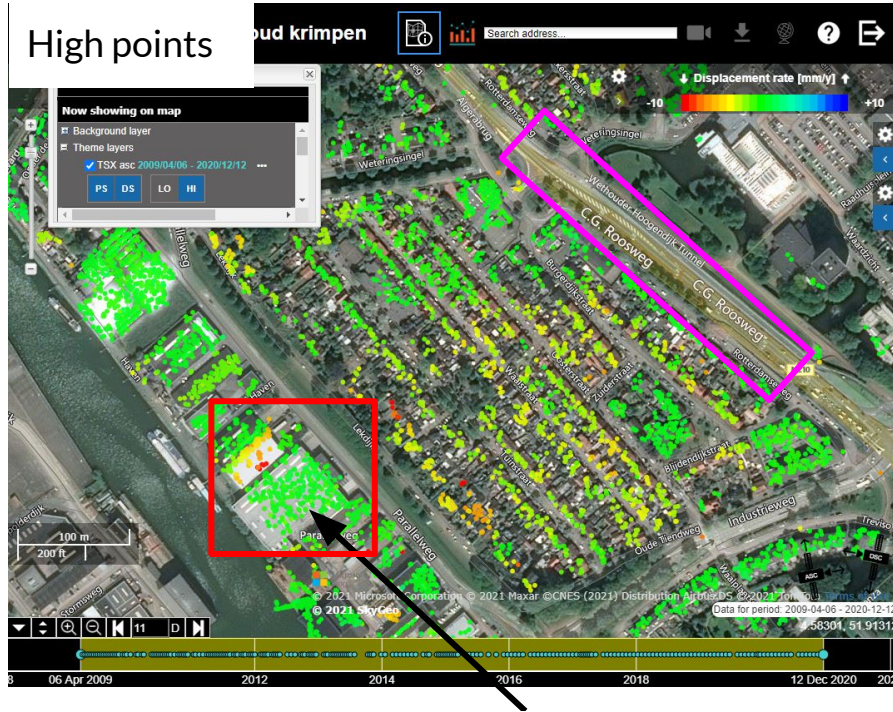
- Goal, insight into current subsidence rates and extrapolate those in to the future
- Using a combination of remote sensing data + ground-based data
 - High resolution SAR imagery (TerraSAR-X)
 - LIDAR DEM (AHN)
 - Building shapes (BAG)
 - Front door sill height



The start - InSAR 'coloured dots'

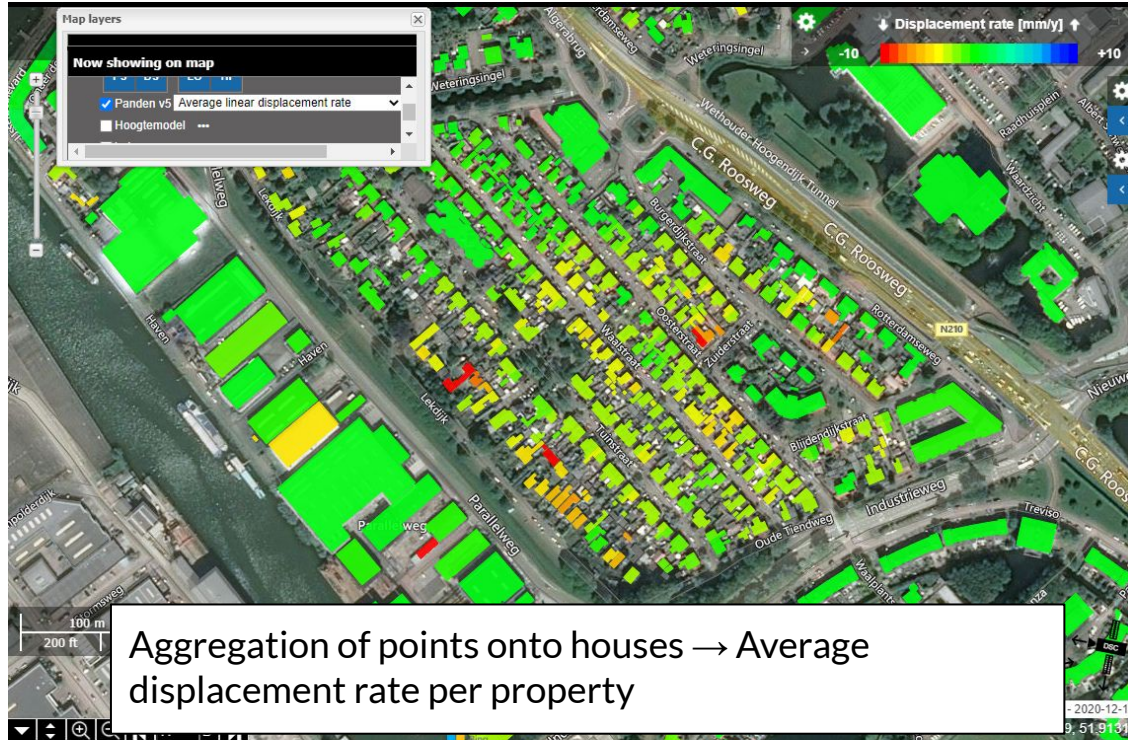


Sifting through the data



Separation of points on buildings vs ground

Quantify, visualise, communicate



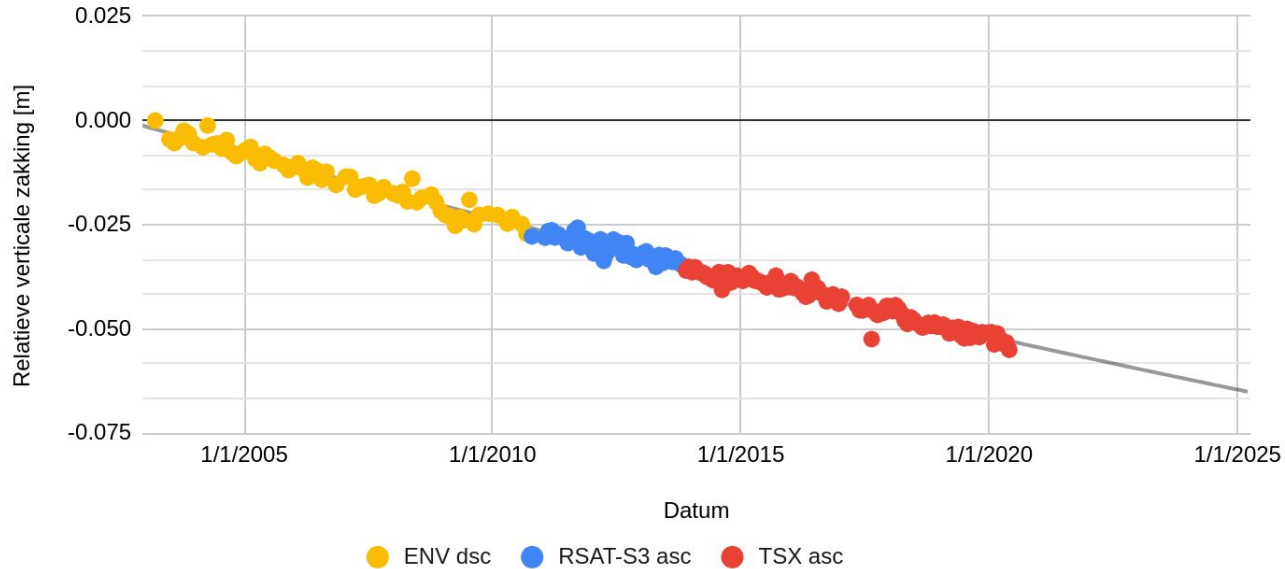
| Oud-Krimpen | Settlement rate per priority



Per gebouw

- Insufficient high quality InSAR estimates.
- less than 1 mm average settlement per year.
- 1 to 3 mm average settlement per year.
- 3 to 5 mm average settlement per year.
- more than 5 mm average settlement per year.

Extrapolate for future predictions



| Oud-Krimpen | Years until buildings are below -1.10m threshold



- Insufficient data or increasing property.
- More than 100 years in the future.
- 40 to 100 years in the future.
- 25 to 40 years in the future.
- 0 to 20 years in the future.
- Already below -1.10 NAP

-1.10 m = flooded crawl space



| Oud-Krimpen | Years until buildings are below -1.92 m threshold



- Insufficient data or increasing property.
- More than 100 years in the future.
- 40 to 100 years in the future.
- 25 to 40 years in the future.
- 0 to 20 years in the future.
- Already below -1.40 NAP

Summary

- Quantitative, data-based **insight** into locations and timings of risk.
- Support **budget allocation**
- Clear visualisation of results in a way that the city council can **communicate** the flooding problem to homeowners
- Information is an input for 50 year projections the municipality makes as part of their **climate strategy plan**