Deltares

Spatio-temporal point clouds in water management

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Full name

Full name

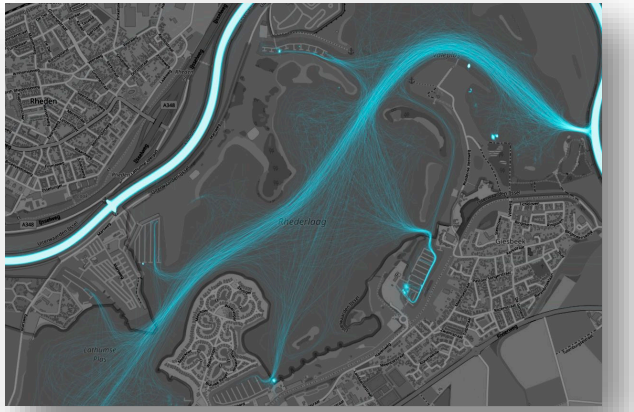
Full name

Pointclouds in water research

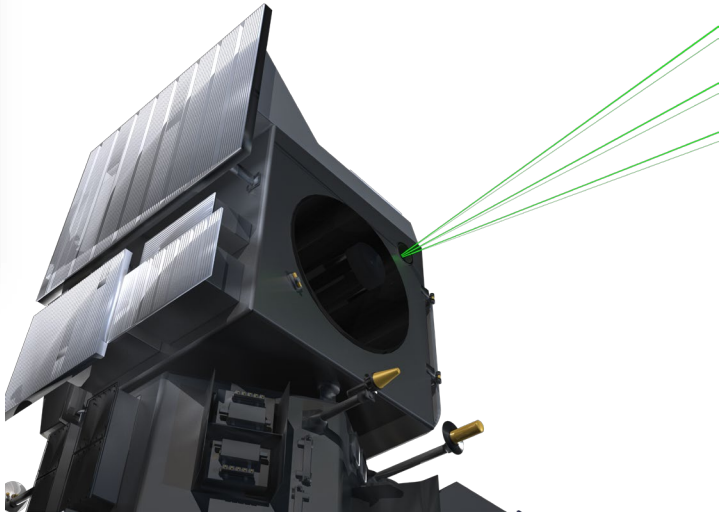
Data sources

- ICESat
- LIDAR (airborne, static)
- Photogrammetry
- ADCP
- AIS

src: Informatiehuismarien.nl



src: ESA



src: tripadvisor

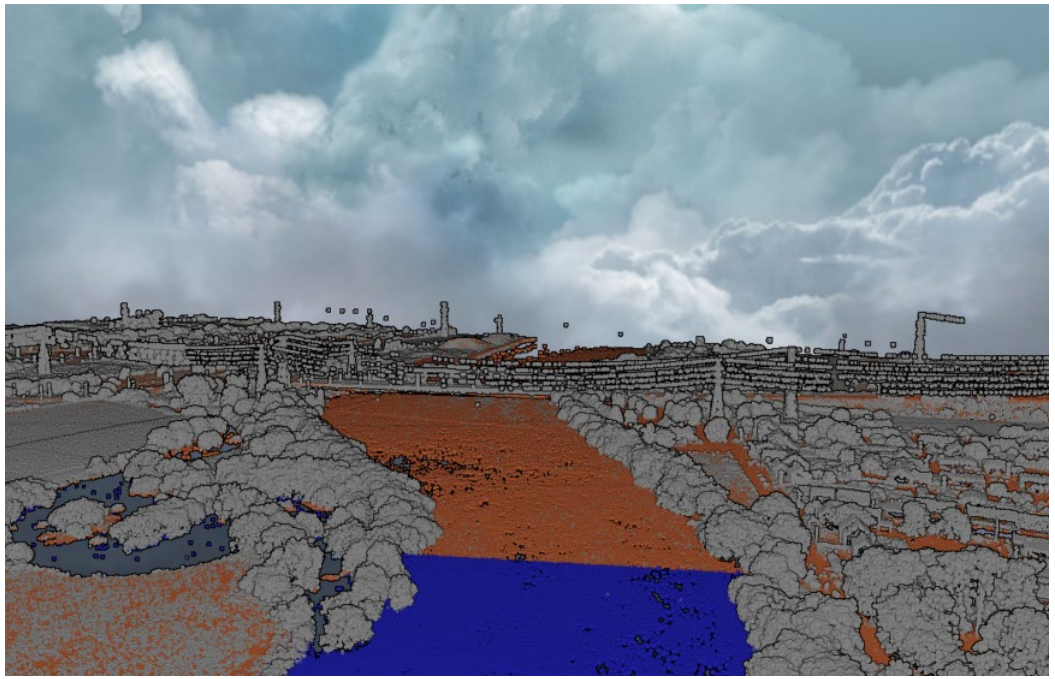
Use case

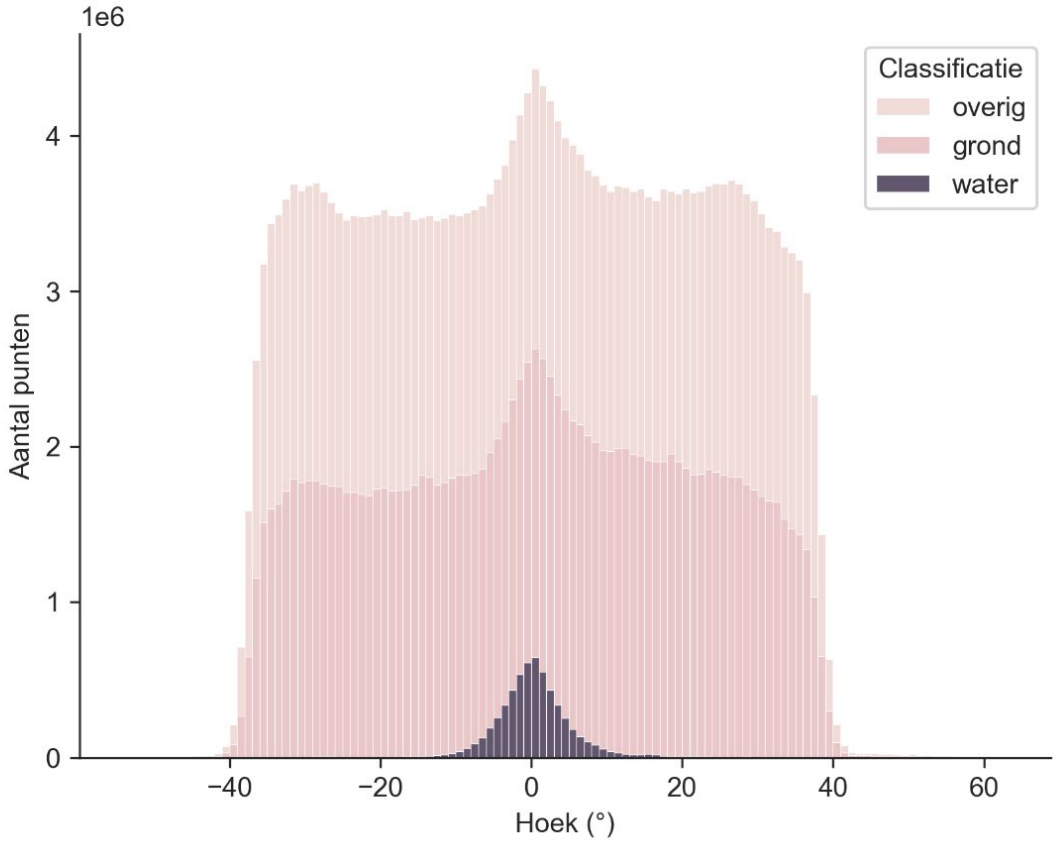
Quick Reaction Force: Limburg Flood

Frans Buschman

Water level and terrain height from LiDAR

1 Classification terrain, water and other
2 mapping points to a grid (0.5 m)





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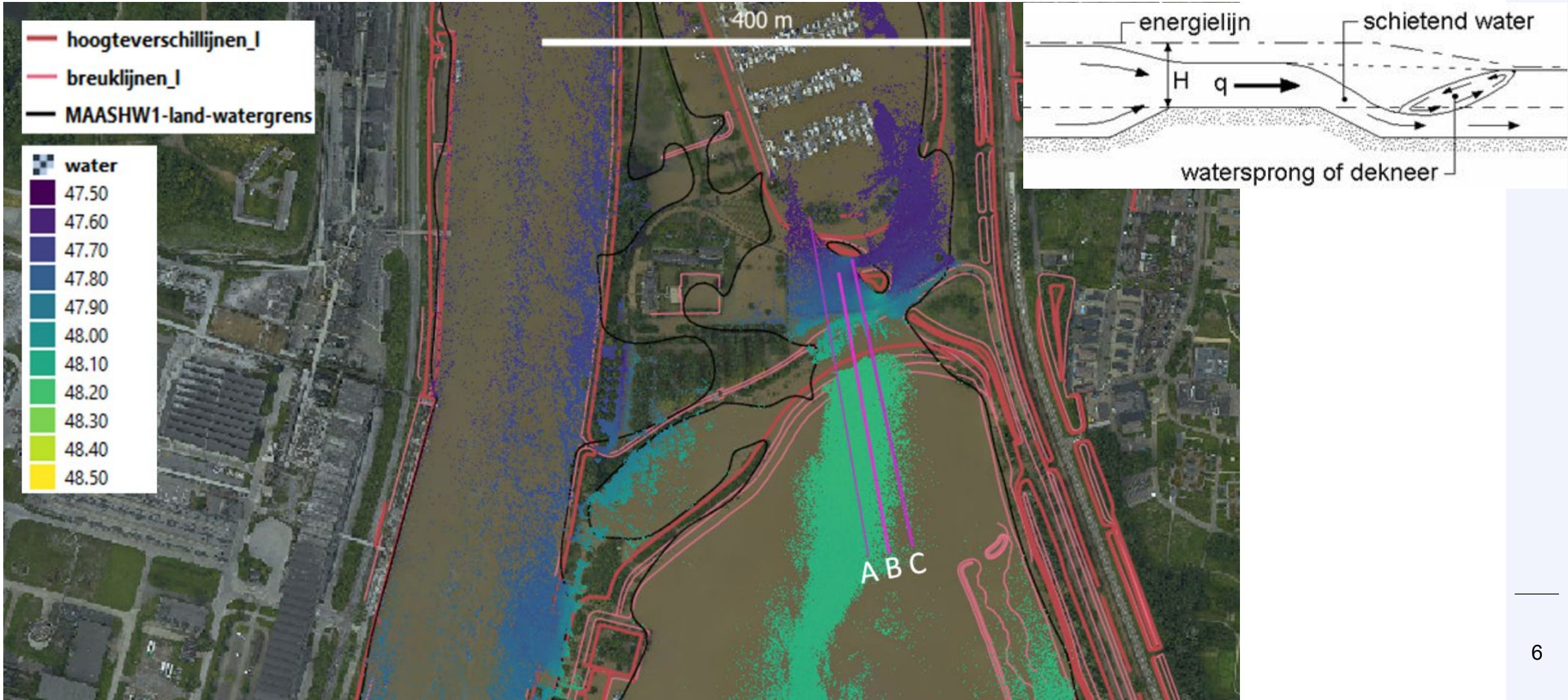
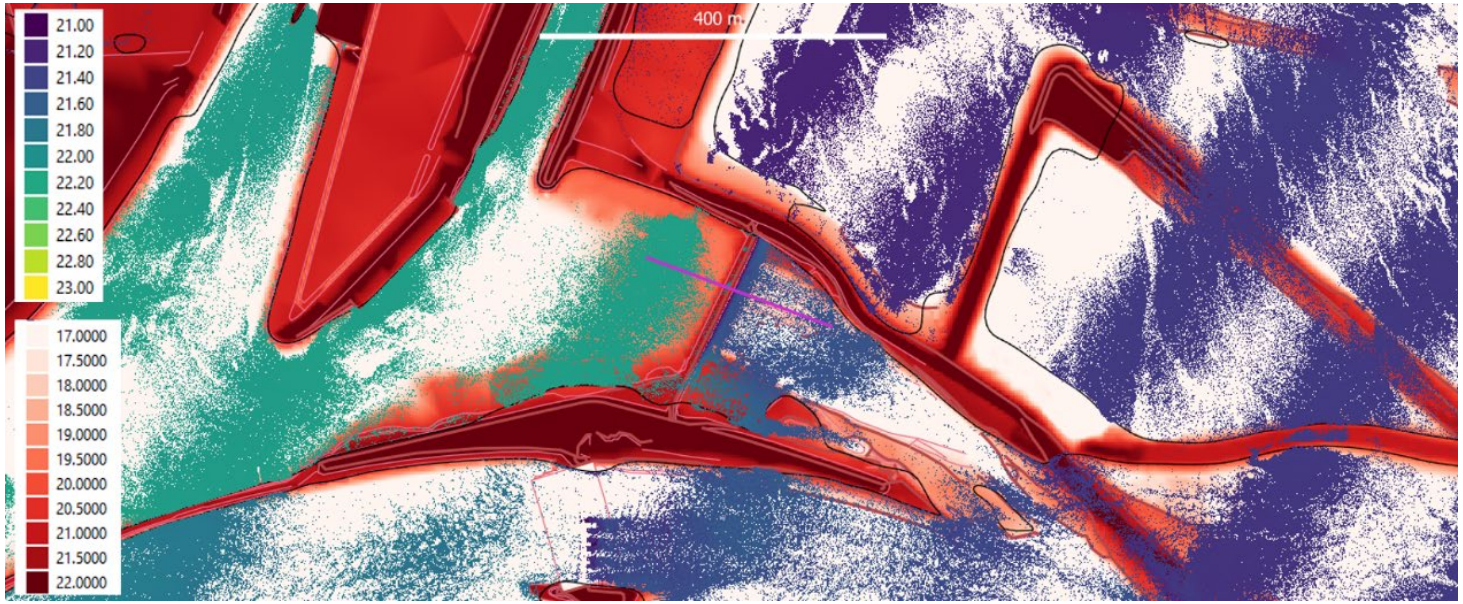
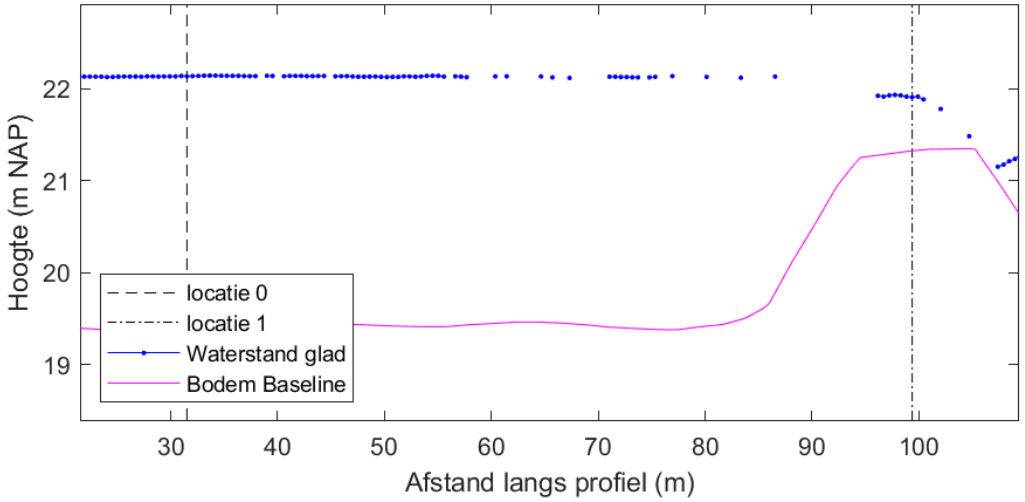
Application to an obstacle in flood plain with critical flow (Maastricht Pietersplas)



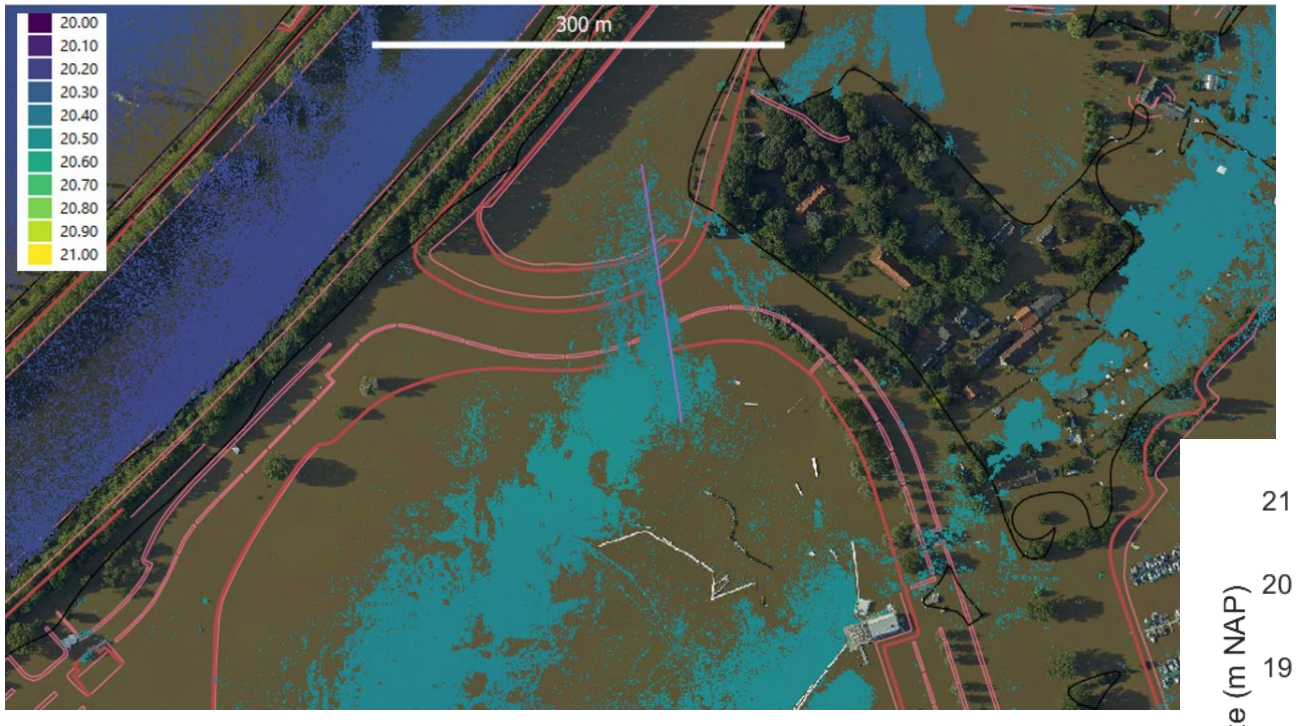
Sluisweg Heel

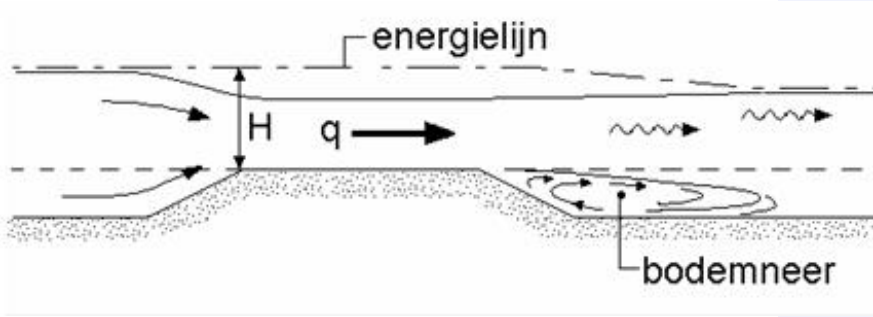


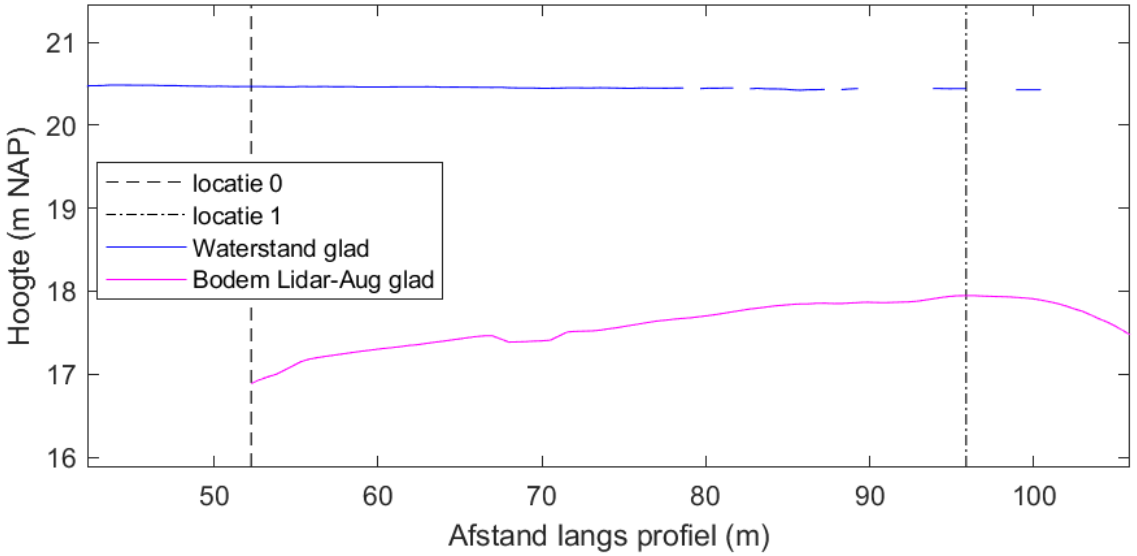


- Obstacle has more regular shape
- Specific discharge = 3.06 m^2/s (no additional assumption needed here)

Application at a submerged obstacle in flood plain: Roermond de Weerd







- Water depth at crest ~2.5 m and water level difference only ~0.03 m
- Specific discharge: 2.5 m^2/s
- sensitivity test: -0.2 and + 0.2 m water depth:
  - only 10% difference in q → pretty robust

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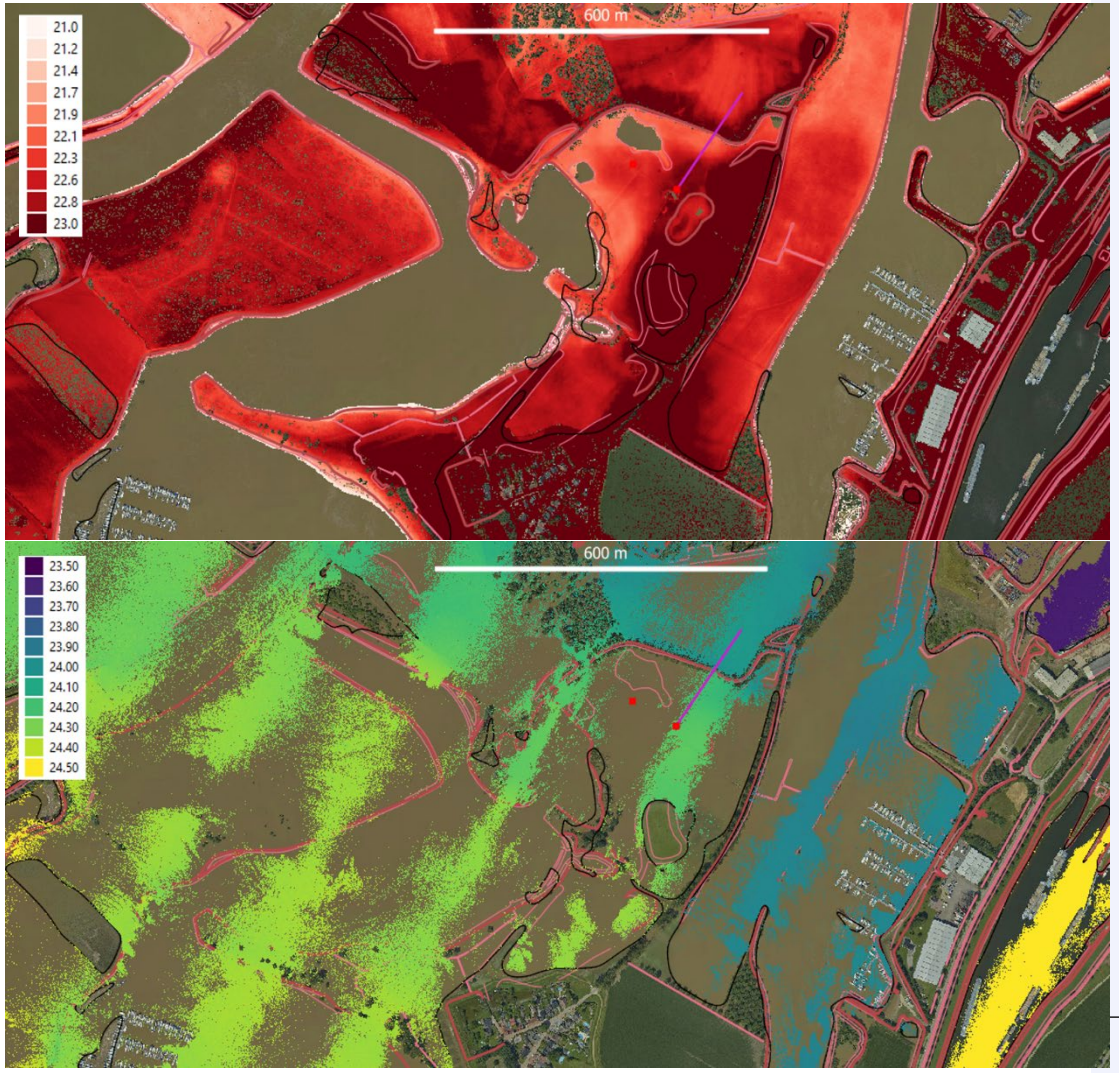
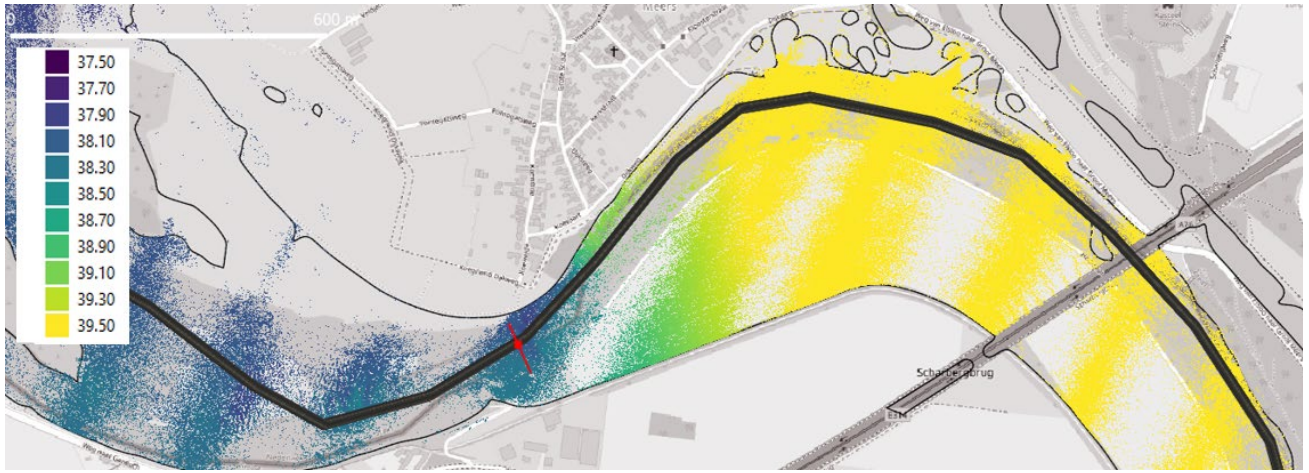
Conclusions on applying weir-formulations

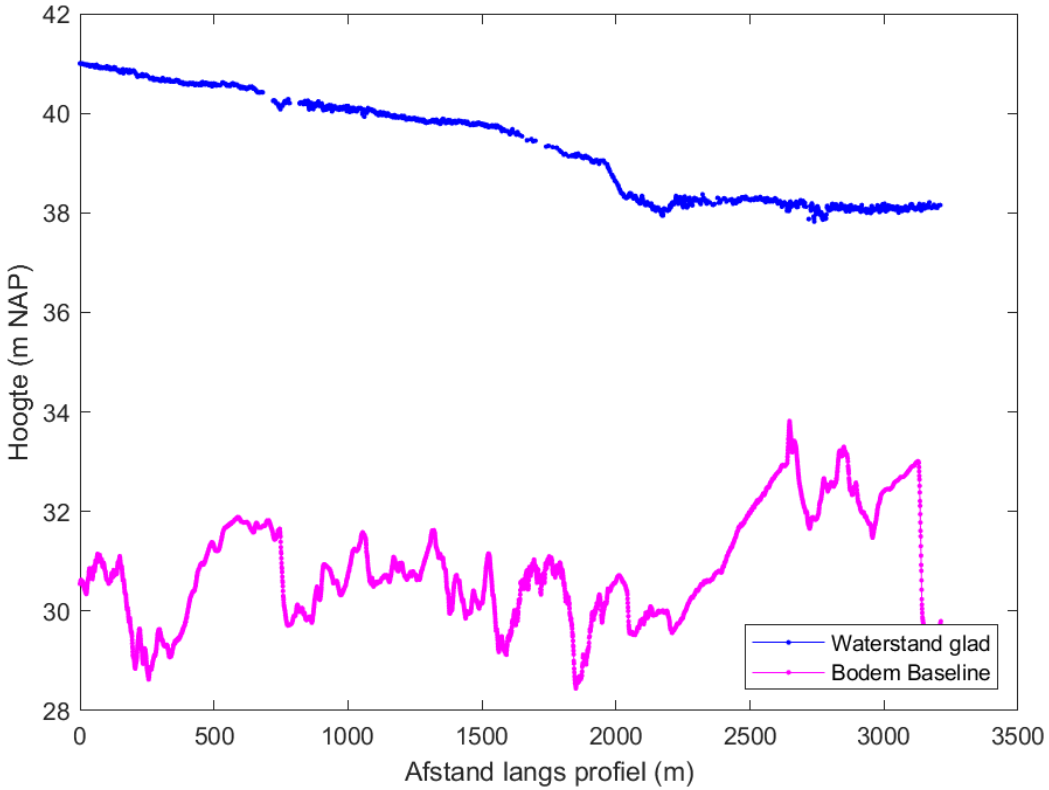
1) It is possible to estimate specific discharge using weir formula at obstacles from LiDAR observations during a flood + during a dry condition
    1) for obstacles with (super)critical flow higher uncertainty
    2) At submerged obstacles with a more regular shape potentially total discharge can be obtained



Water level gradient along ‘axis’ at Stein



Trajectory	Water level gradient (m/km)	Water depth (m)	Specific discharge (m^2/s)
Upstream	-0.854	8.5	25.9
Downstream	-0.115	5.5	4.6



- These observations can be used to estimate specific discharge (Chezy), or roughness can be verified
- Many applications possible for verification models

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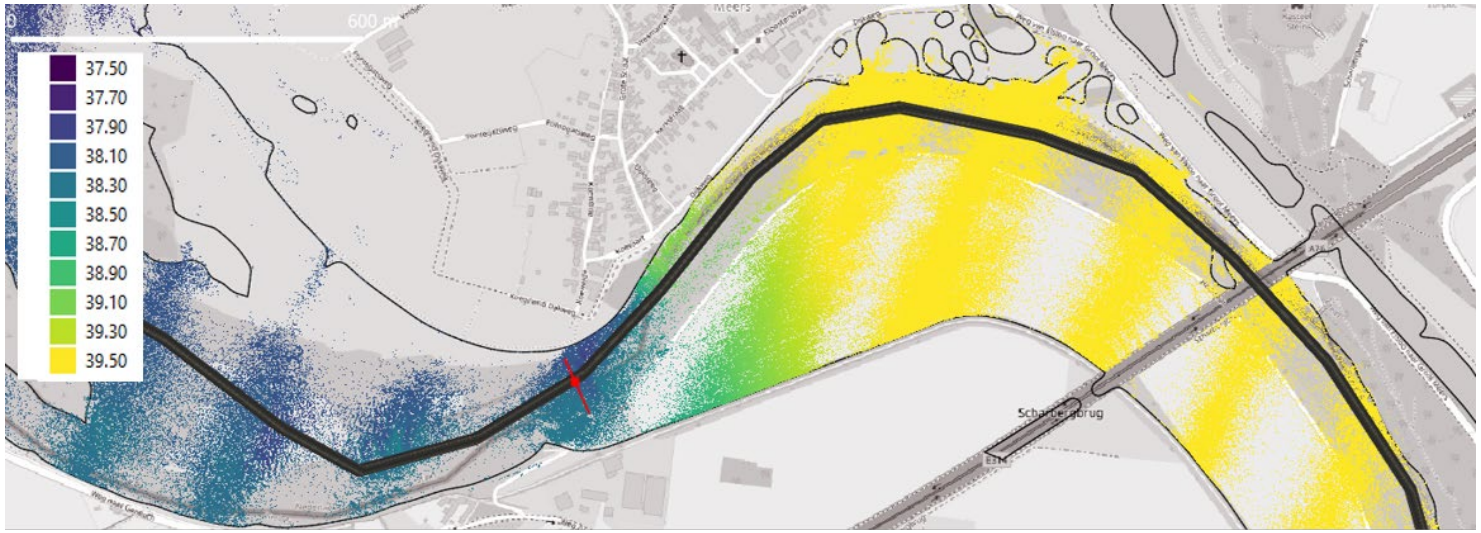
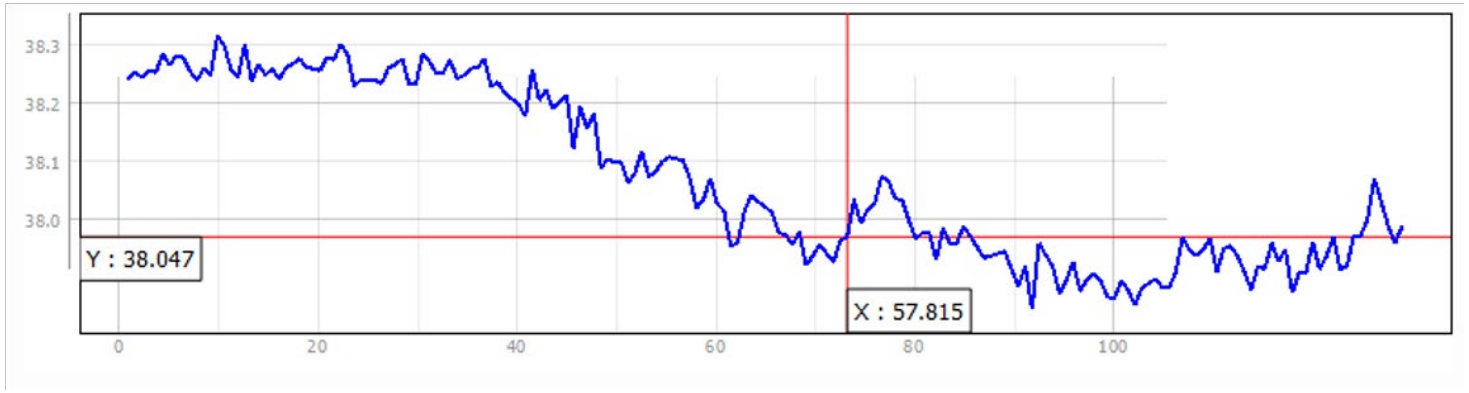
Water level gradient across at Stein

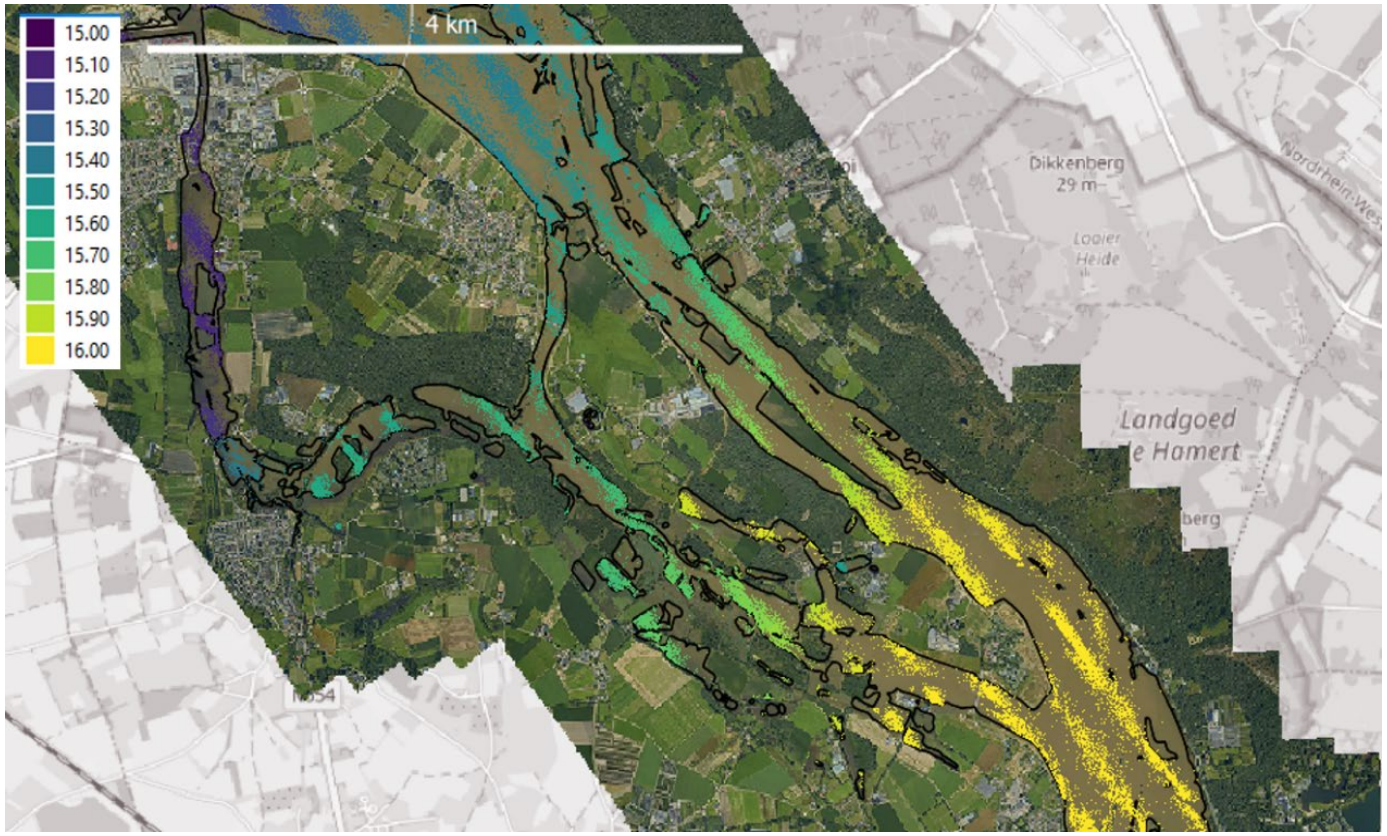




- Over ~100 m the difference is 0.3 m
- and for nearby transects across 0.2 m

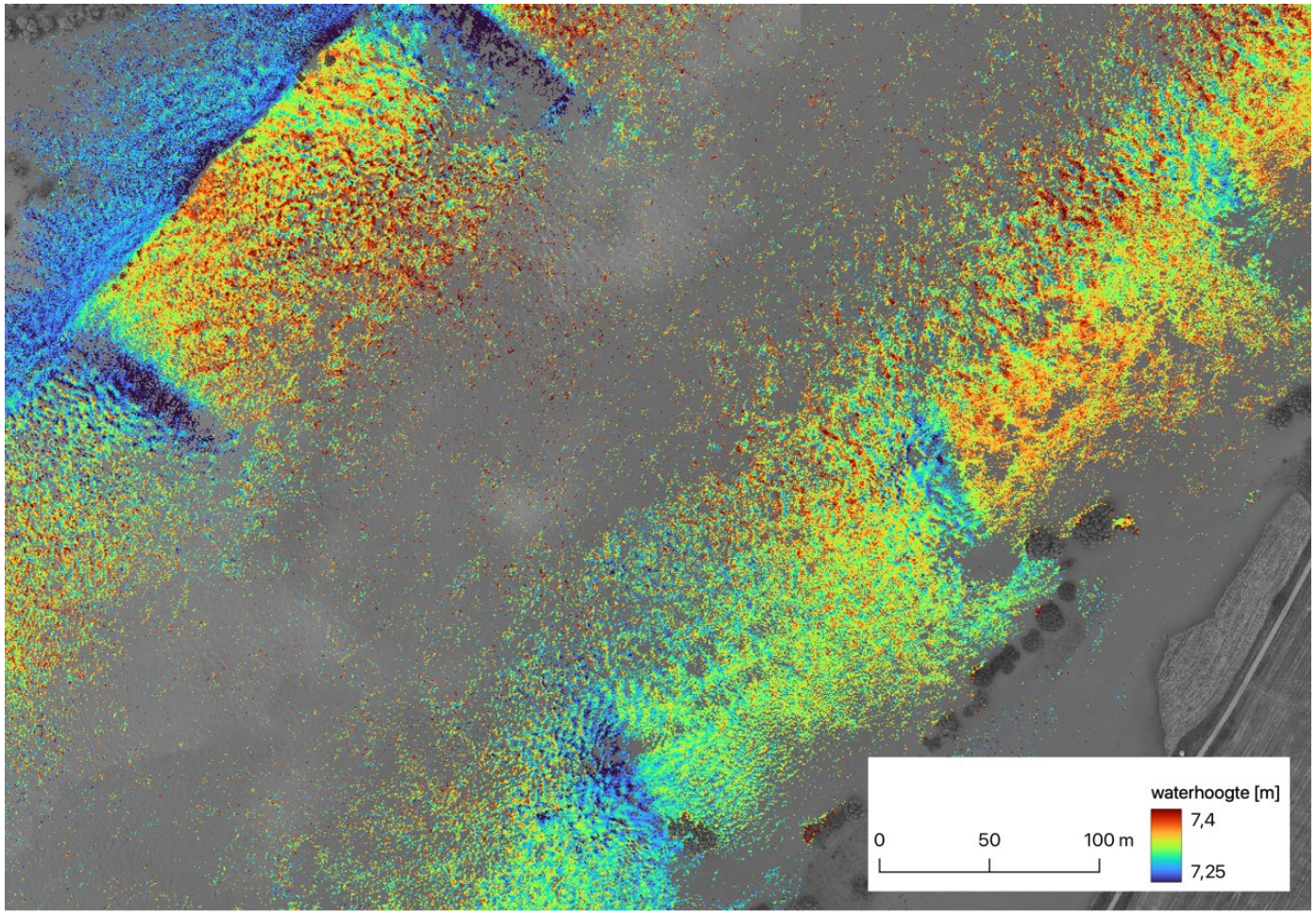
→ Pretty strong effect of bend

What part of the flood plains was inundated?



Aerial photo and the LiDAR water level + water-terrain border at Blitterswijck

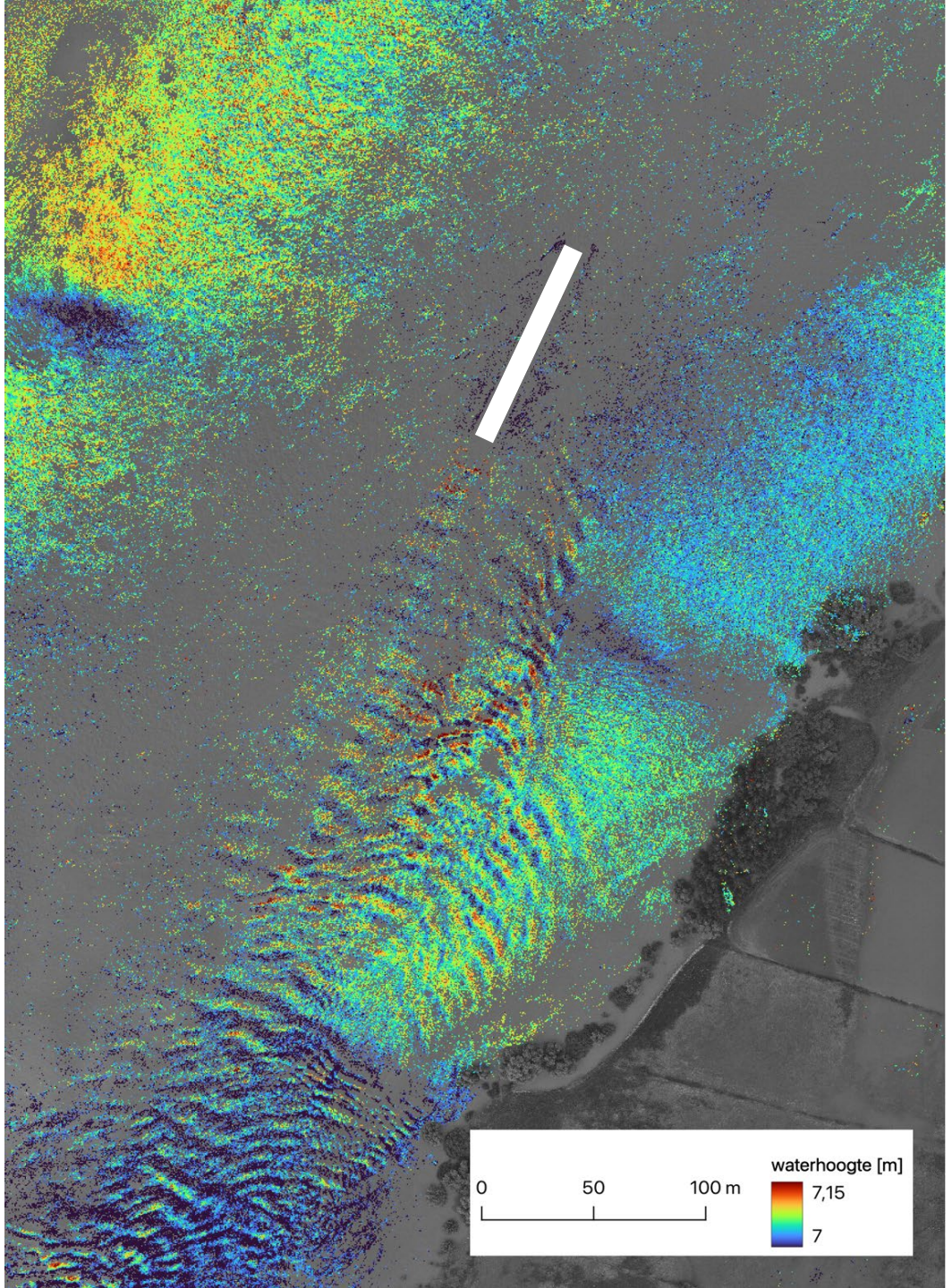
Acceleration of the flow over groynes



- LiDAR derived water level shows dips where flow accelerates
- Also other structures are likely to be visible: fixed layers, bottom vanes, dunes
- Perhaps also circulations

Waves

- In figure you can see waves from a ship and reflected waves
- We expect they can be observed, if higher than 0.05 m
  - Due to spatial coverage the damping can be observed as well (verification D-FAST BE)



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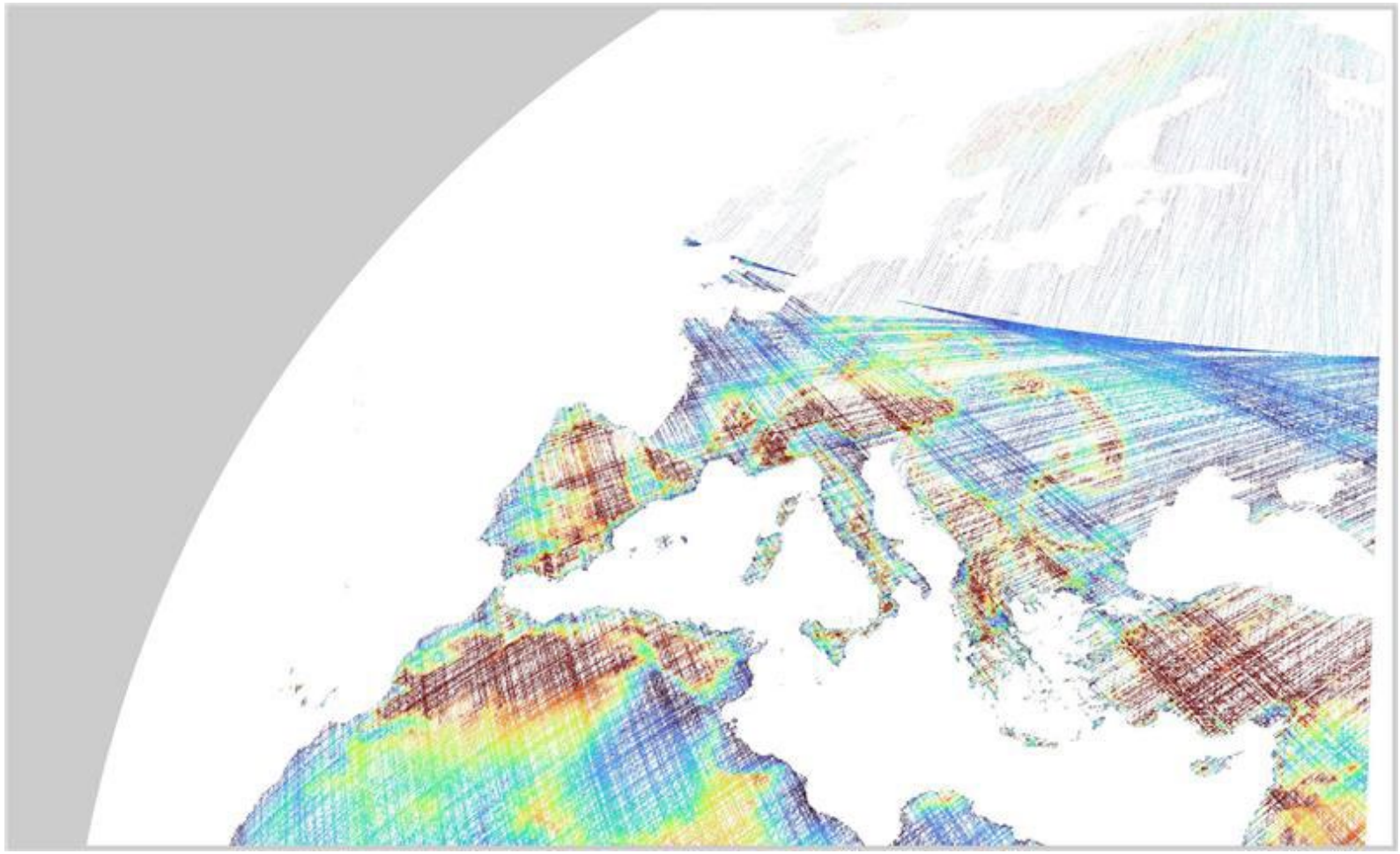
Use case: better coastal DEMs

Maarten Pronk

ICESAT2

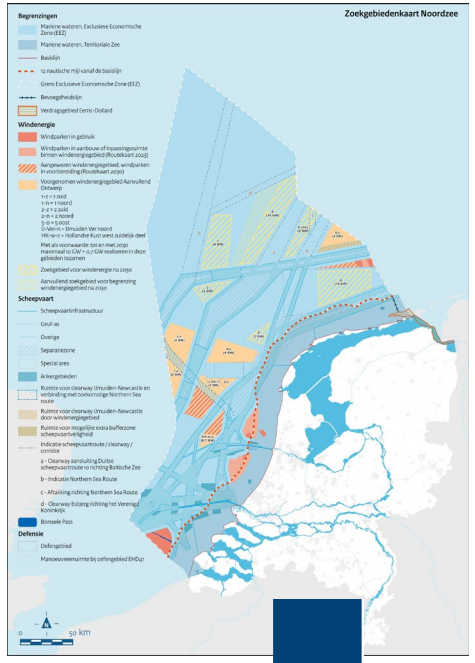


Improving delta terrain models

Including ICESat-2 en GEDI improves DEM quality in Delta, src: Pronk et al in prep 2024

Use case: AIS maps

North Sea safety



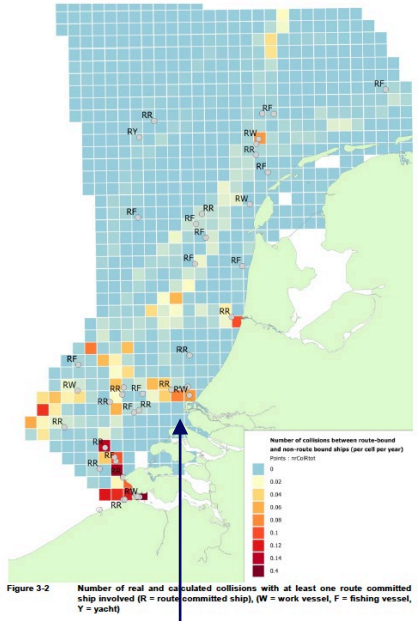


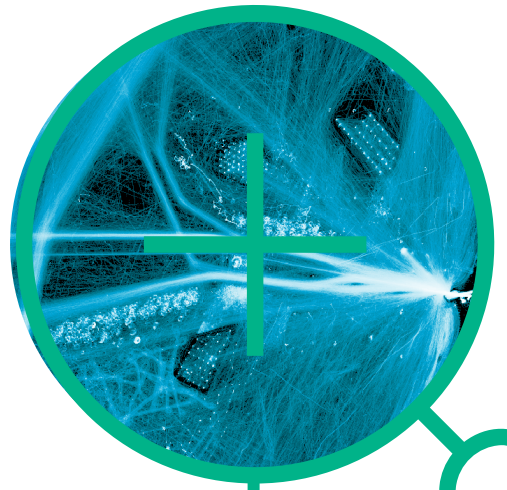
Figure 3-2 Number of real and calculated collisions with at least one route committed ship involved (R = route committed ship), (W = work vessel, F = fishing vessel, Y = yacht)

Rijkswaterstaat
Ministerie van Infrastructuur en Milieu

Where?

Why?
How?

Where?



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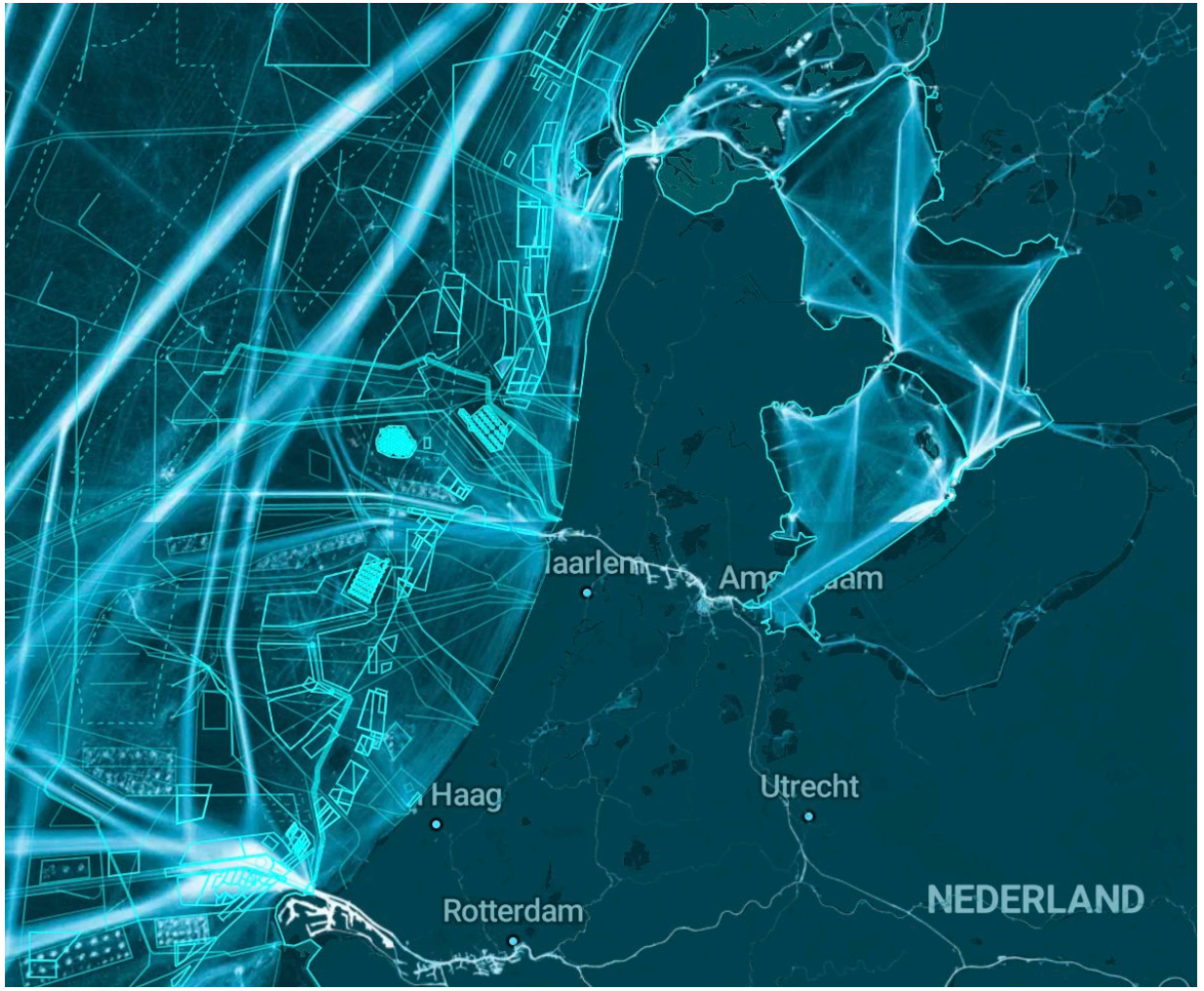
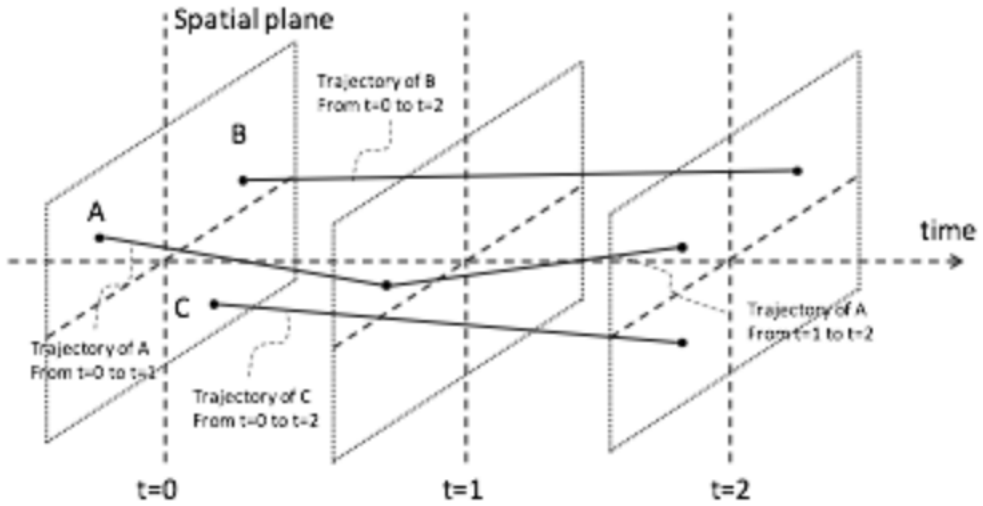
Pointclouds on the move….

bit.ly/ais-map

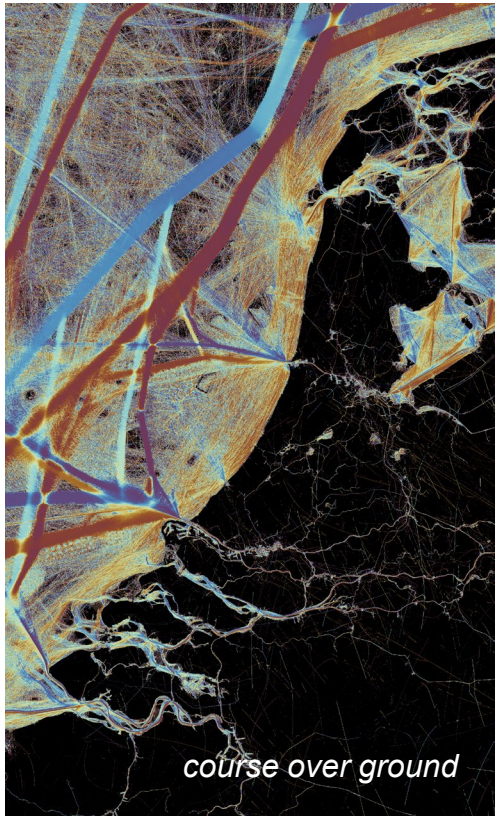


Trajectories



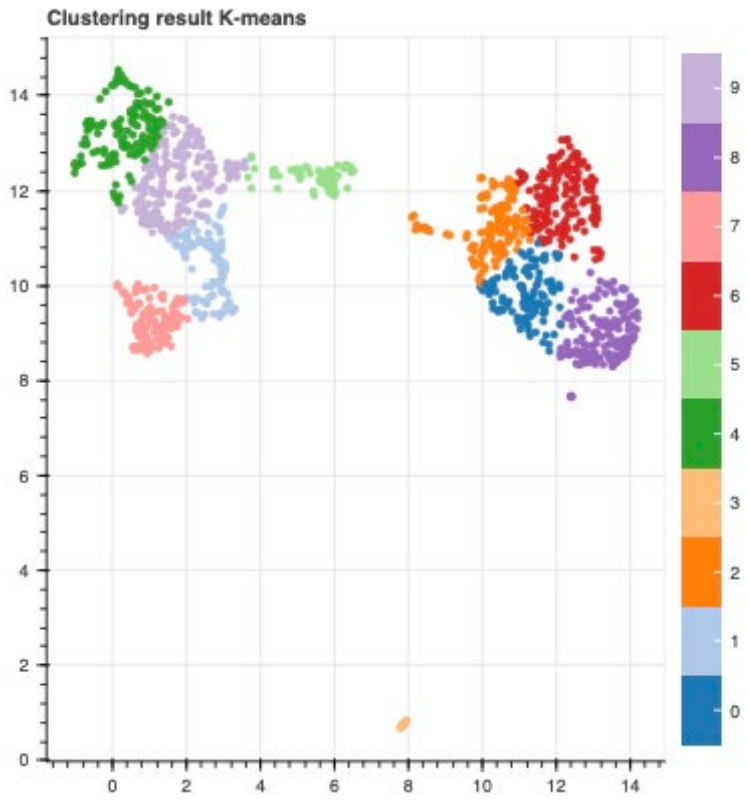
https://docs.ogc.org/is/18-075/18-075.html#5

Clustering (areas)

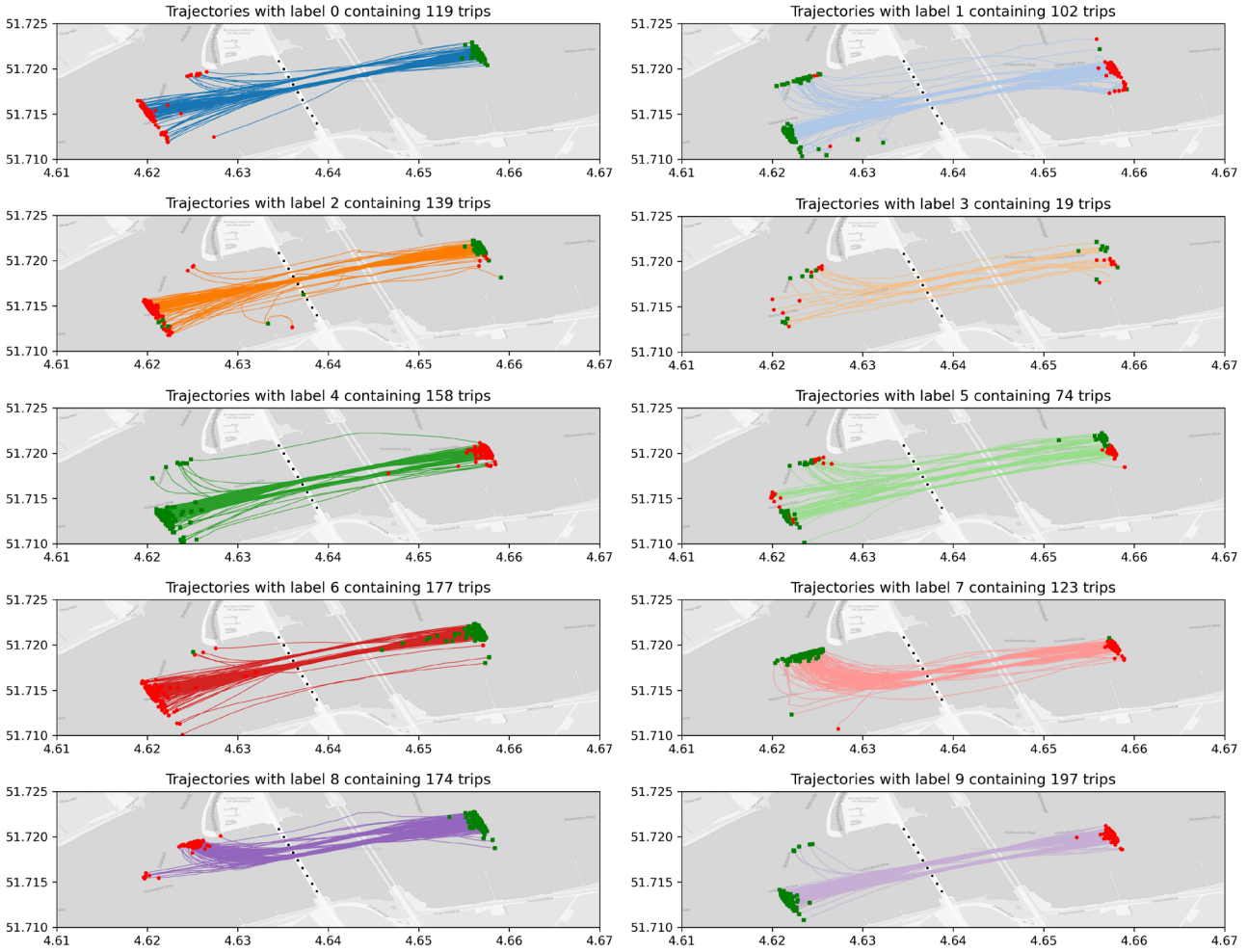


src: S.E. van der Werff

Clustering (vessels)



Bart van Engelen (2023)



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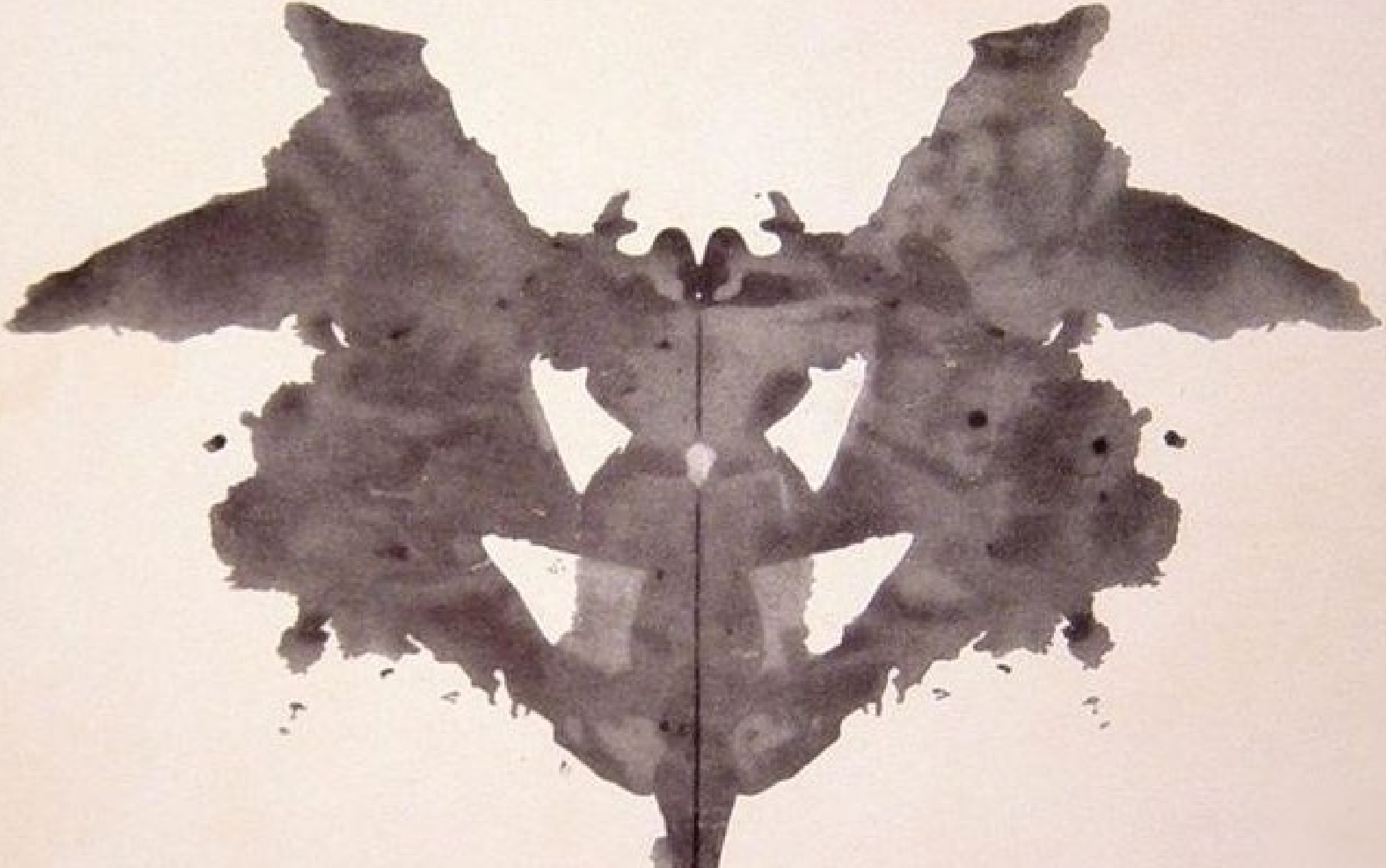
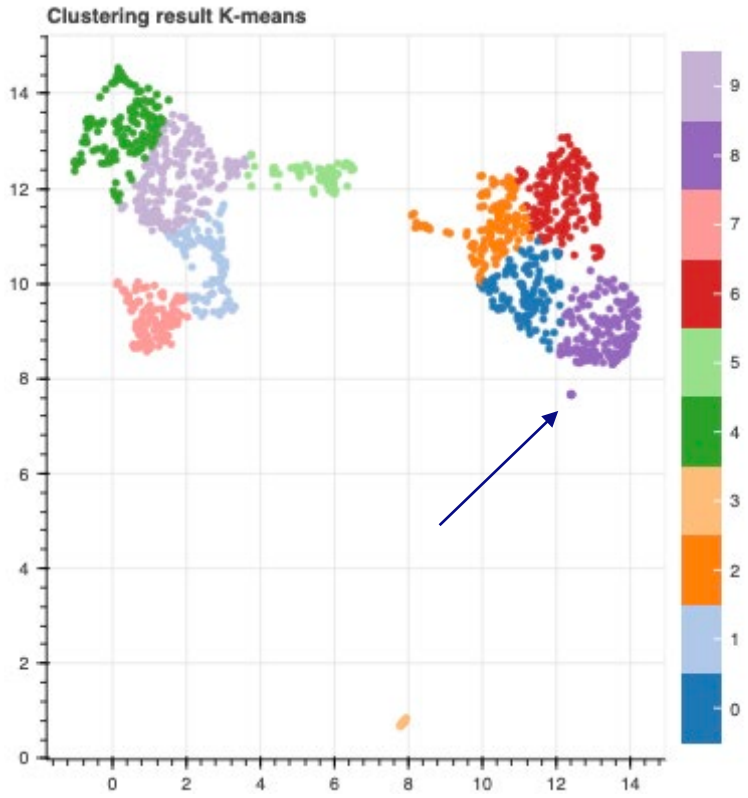
src: Bart van Engelen

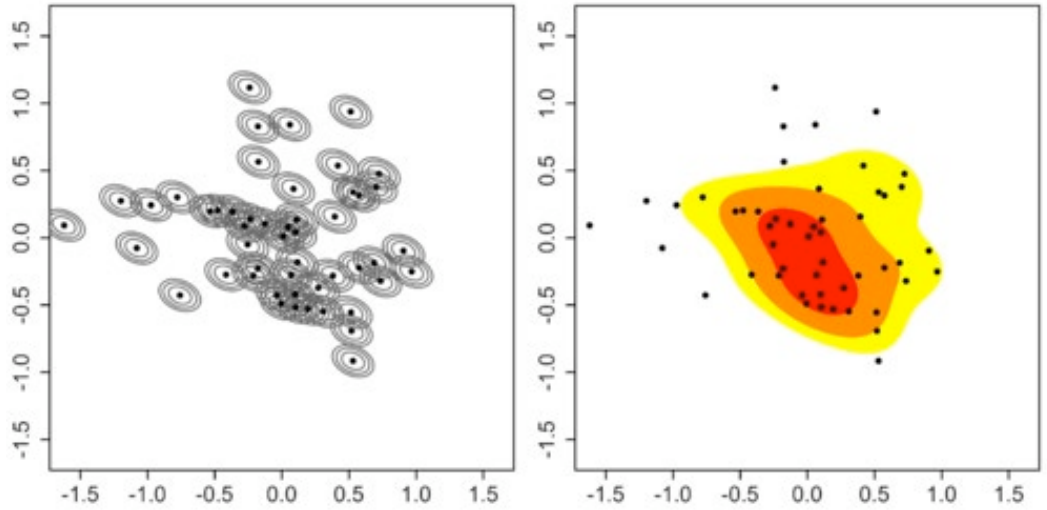


Anomalies



Bart van Engelen (2023)

Millefiori, 2016



Academic

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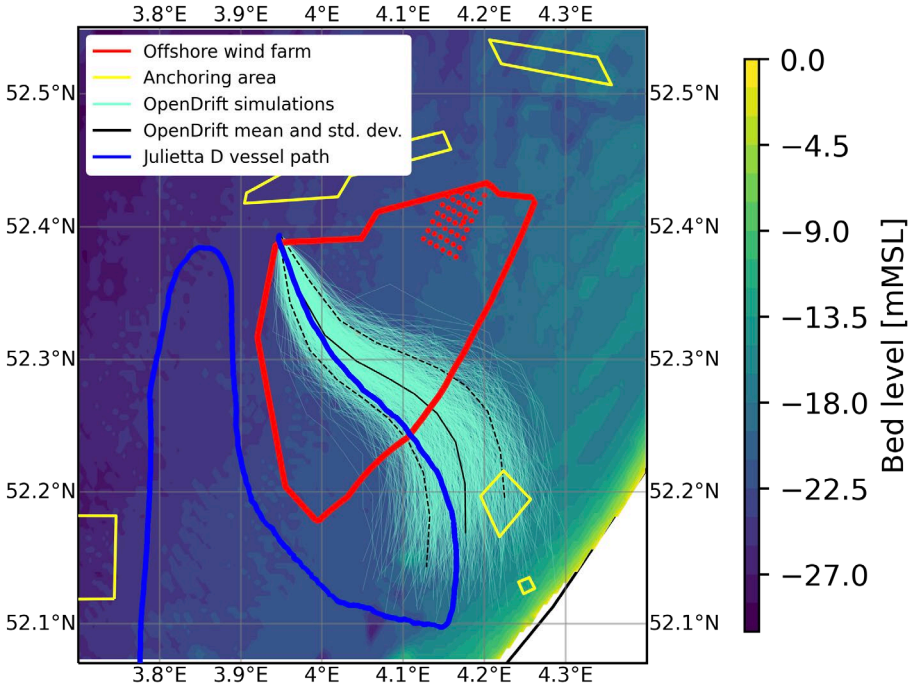
Drift path prediction

src: coastguard



src: MUDE students

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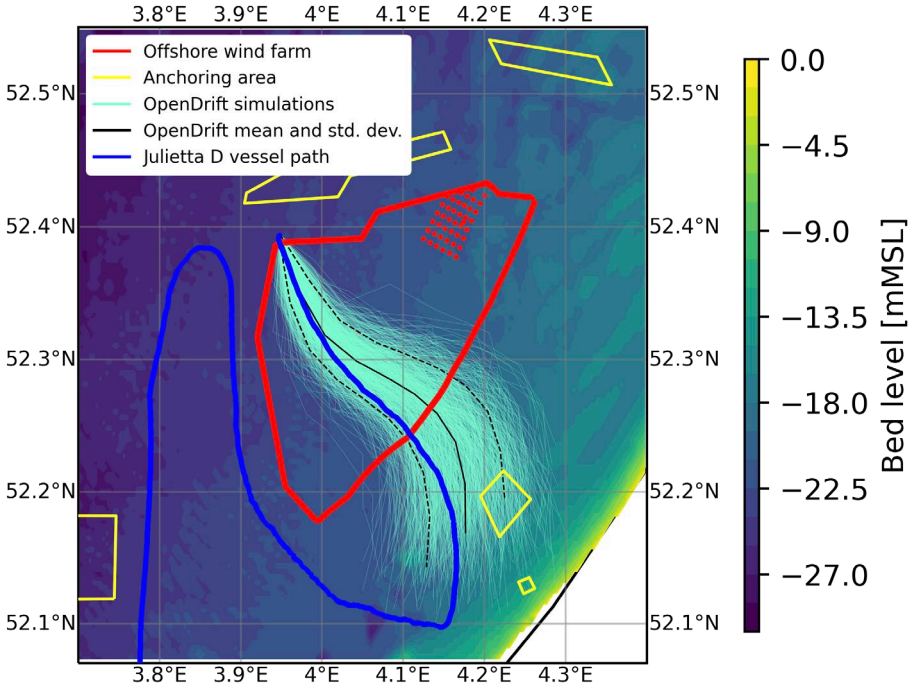
Drift path prediction



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Other topics


Scheveningen
0.09m NAP
potree.org
https://bit.ly/pointcloud4d-coast

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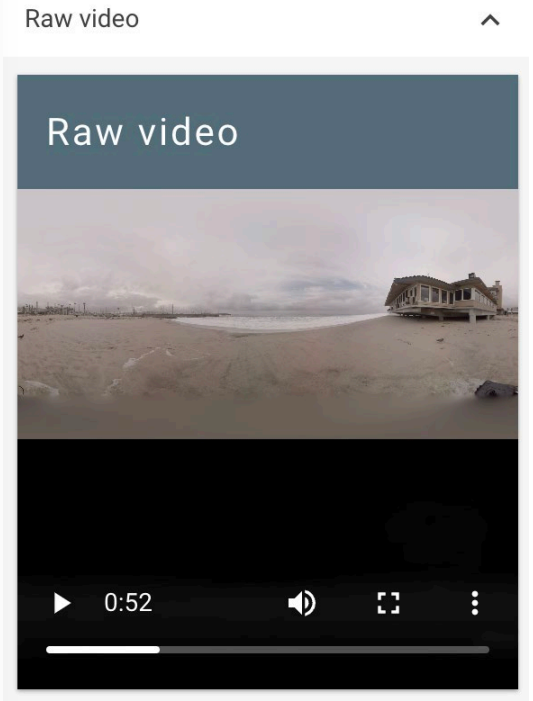

odyssey-demo.surge.sh

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Challenges

Challenges

- Data handling
  - Contributions to OSS tools (e.g. SpaceLidar.jl, GeoParquet.jl)
  - OGC Technical Groups
  - Coop with Big Tech
- Keeping perspectives

Contact

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