

RWS
data lab



Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

Datavisualisatie

bij Rijkswaterstaat

Erik Boertjes, Petra Jeurissen, Jop van Roosmalen
15-11-2023

Even snel, zo ken je RWS misschien



Er werken veel mensen en we beheren veel

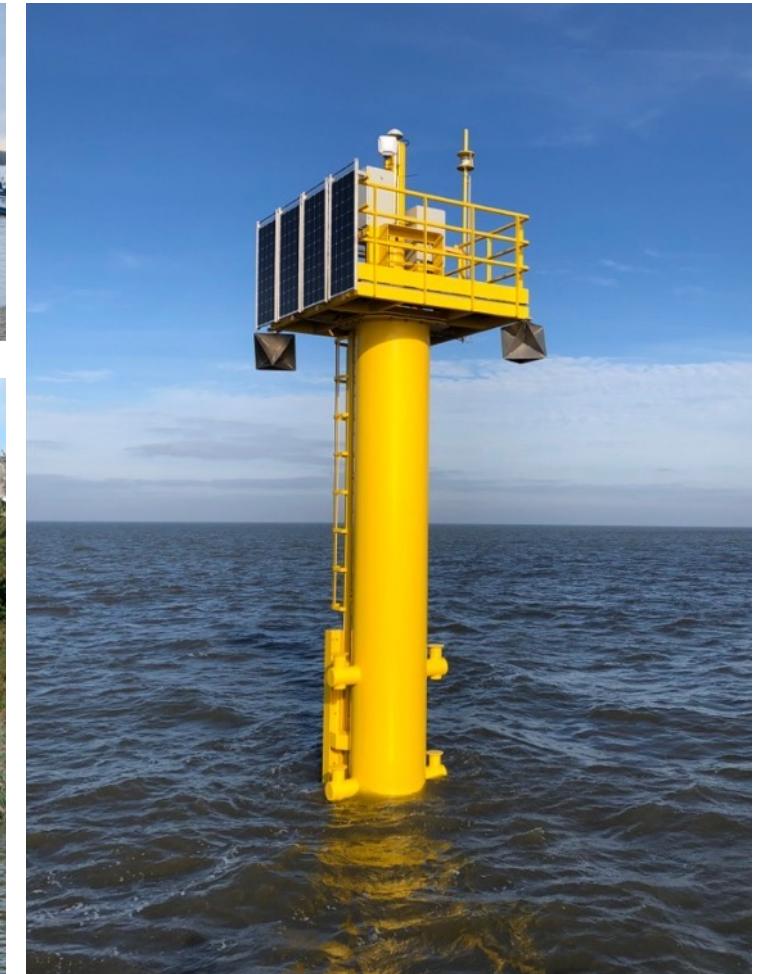


ruim 10.000

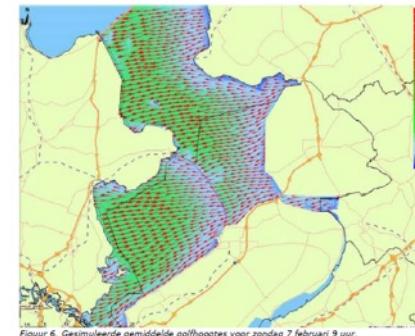
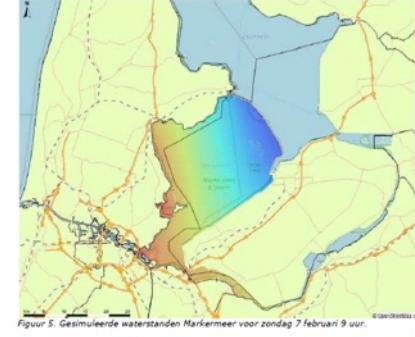


- 3.072 km snelweg incl. verkeerssignalering
- 1.677 km op- en afritten/verbindingswegen
- 321 km spits- en plusstroken
- 2.900 viaducten
- 784 beweegbare en vaste bruggen
- 49 ecoducten
- 27 tunnels
- 16 aquaducten
- 3.437 km kanalen en rivieren
- 130 sluiskolken
- 91 sluiscomplexen
- 332 bruggen
- 10 stuwwallen
- 90.191 km² oppervlaktewater
- 201 kilometer dijken, dammen en duinen
- 5 stormvloedkeringen
- Afsluitdijk en Houtribdijk

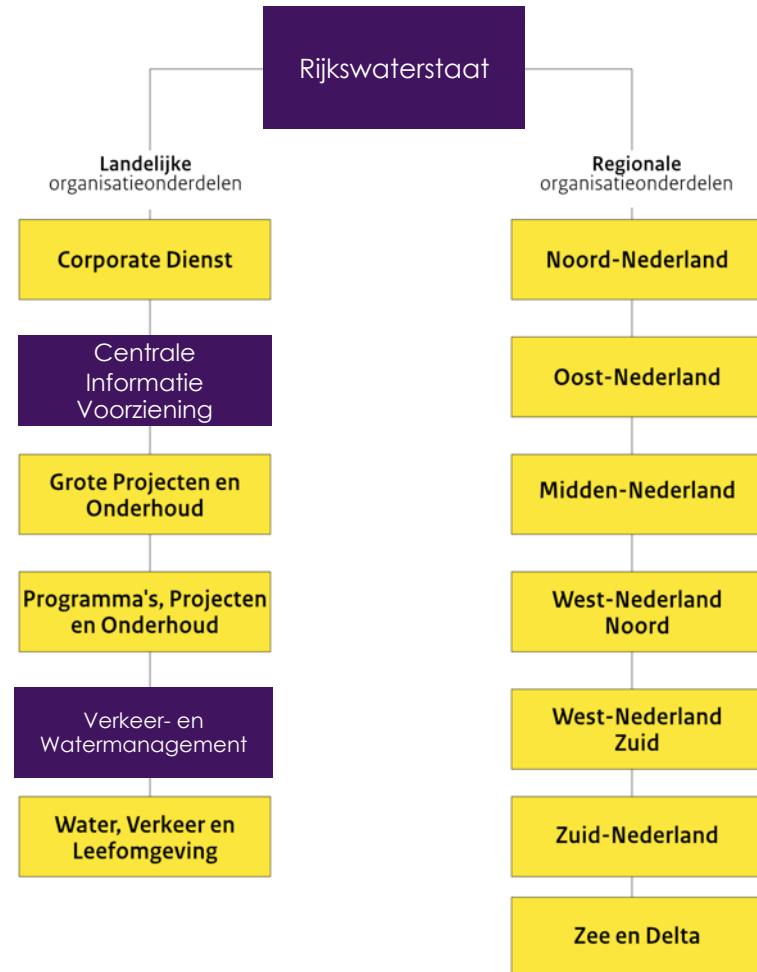
Dit heb je misschien ook wel eens gezien



En dit gebeurt er oa achter de schermen



Wij werken bij de Centrale Informatievoorziening bij RWS Datalab



Het Watermanagement Centrum Nederland van VWM stelde ons een vraag



De vraag van WMCN:

Kunnen jullie een datavisualisatie maken waarin duidelijk wordt wat een Stormvloed is?

Gebruik daarvoor data van storm Eunice 2022

Alvast de eindresultaten

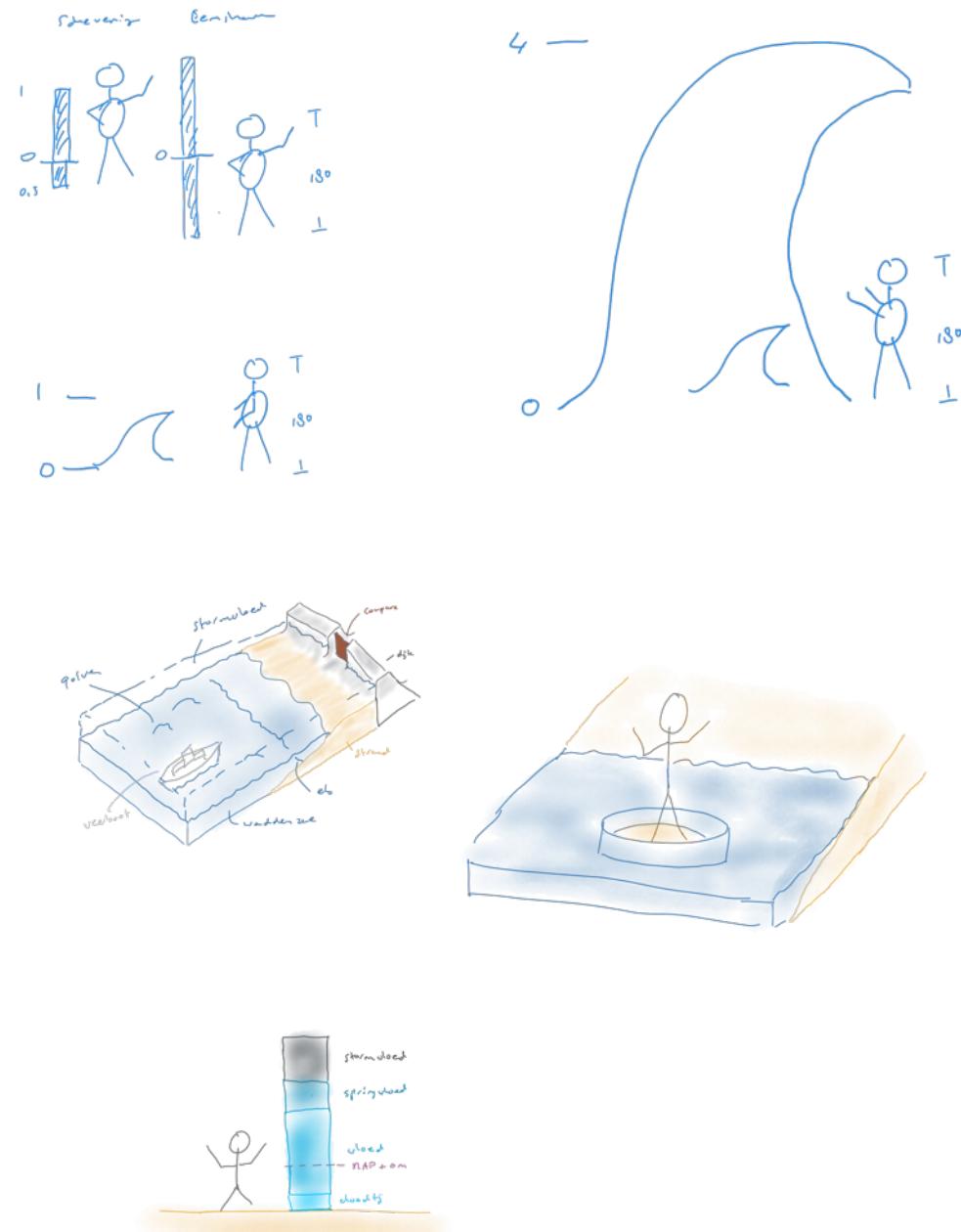
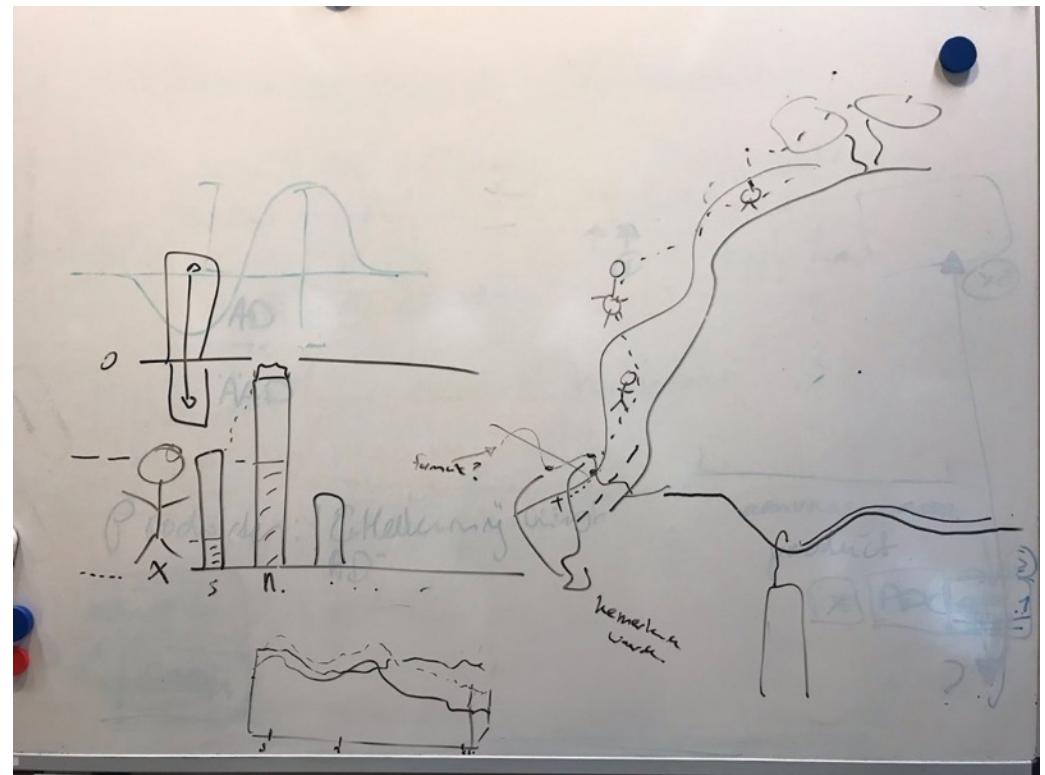


Wat is een Stormvloed?

[Youtube Rijkswaterstaat](#)



Start met schetsen



Verhaallijn bedenken met WMCN

Globale verhaallijn: algemene uitleg gecombineerd met (interactieve) datavisualisaties om gevoel te krijgen bij de data

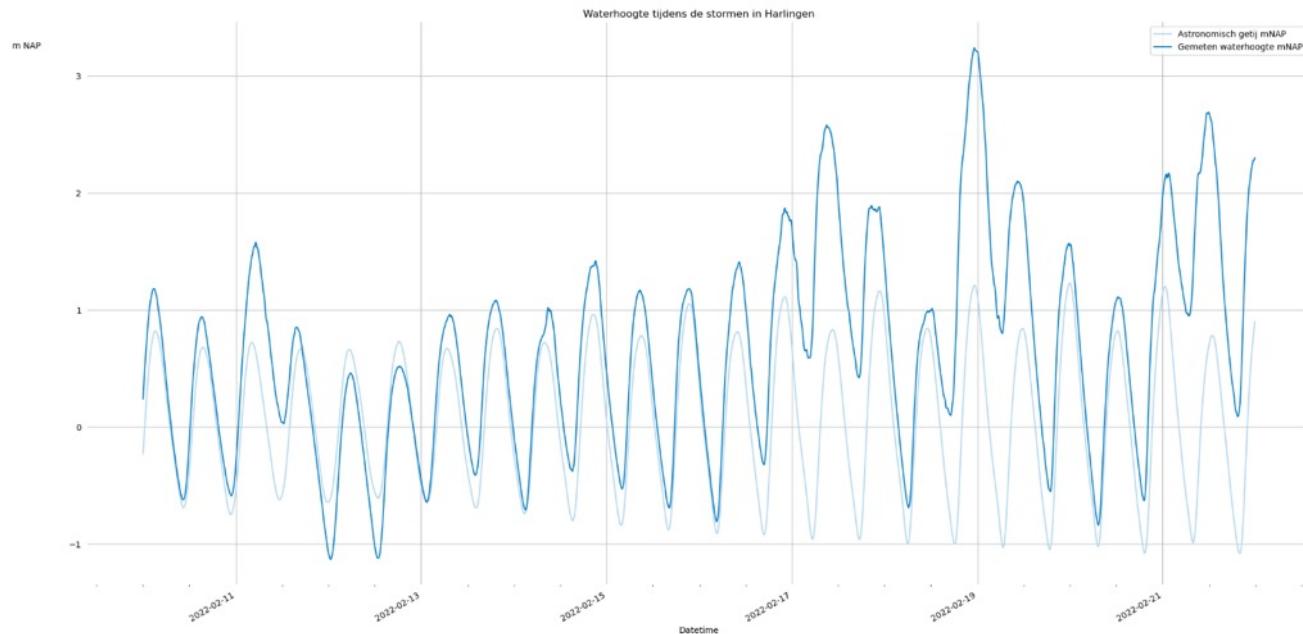


Data verzamelen

Meetlocaties- en waterdata:

waterinfo.rws.nl: waterstanden per meetlocatie, per 10 minuten

matroos.rws.nl: waterstanden per uur

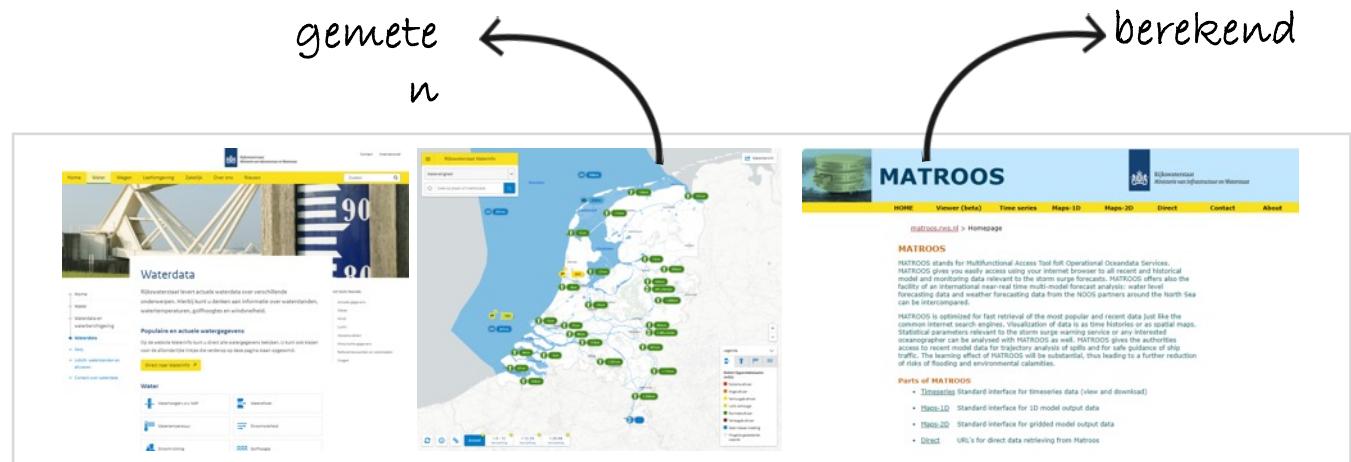


Data verzamelen

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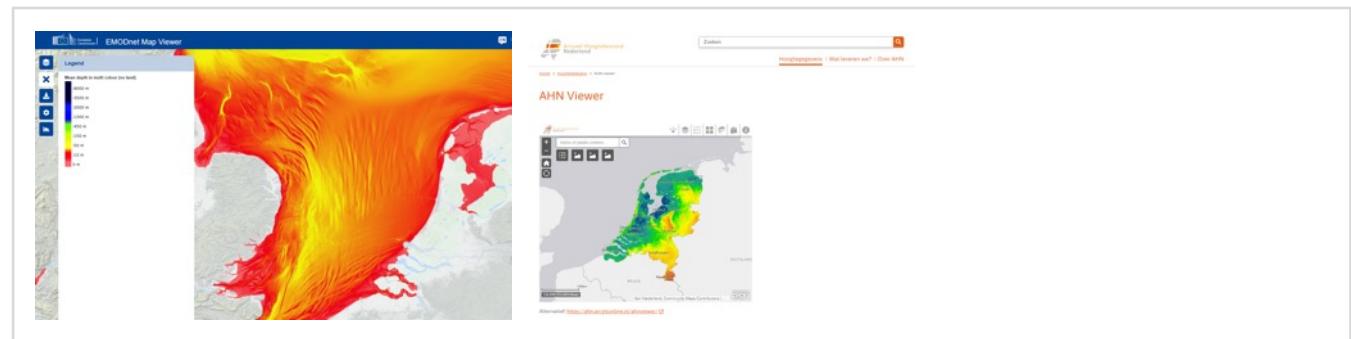
matroos.rws.nl: waterstanden per uur



Bodemligging nat en droog:

portal.emodnet-bathymetry.eu: bathymetry van Noordzee en Waddenzee

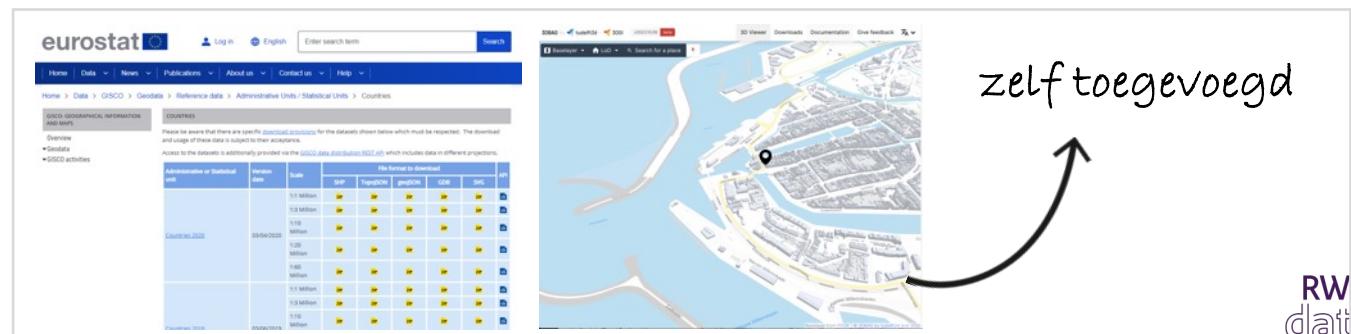
ahn.nl (Actueel Hoogtebestand Nederland): hoogteligging droog



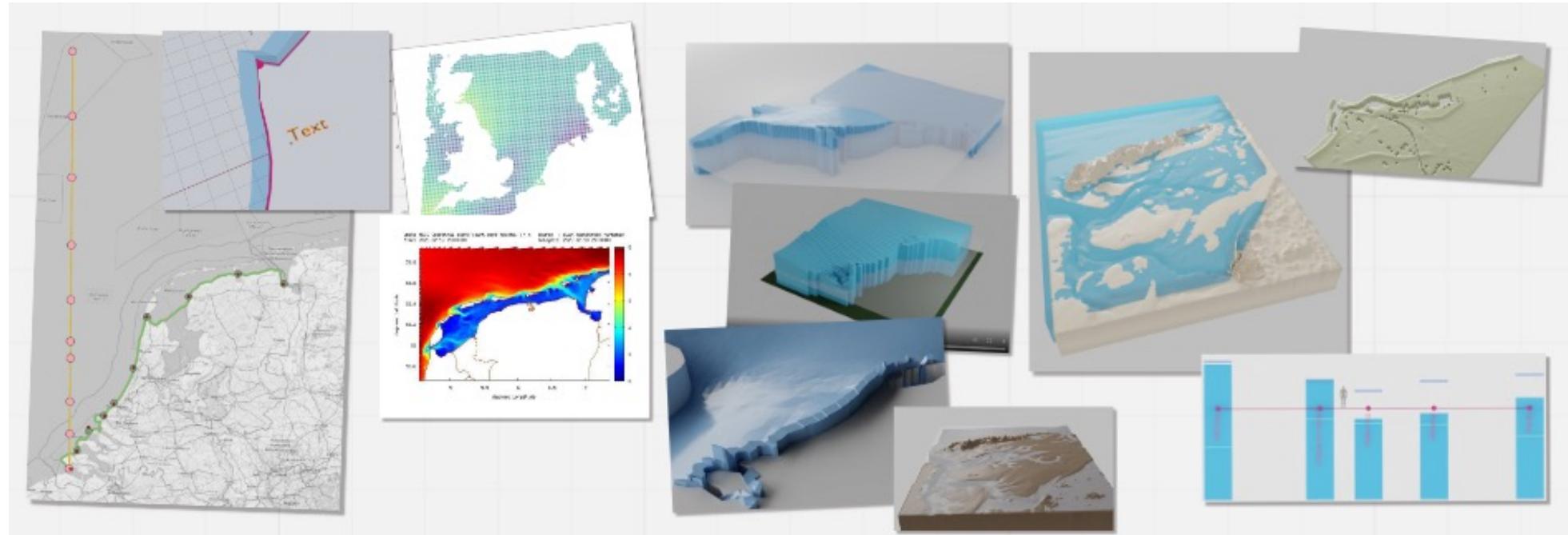
Oriëntatie:

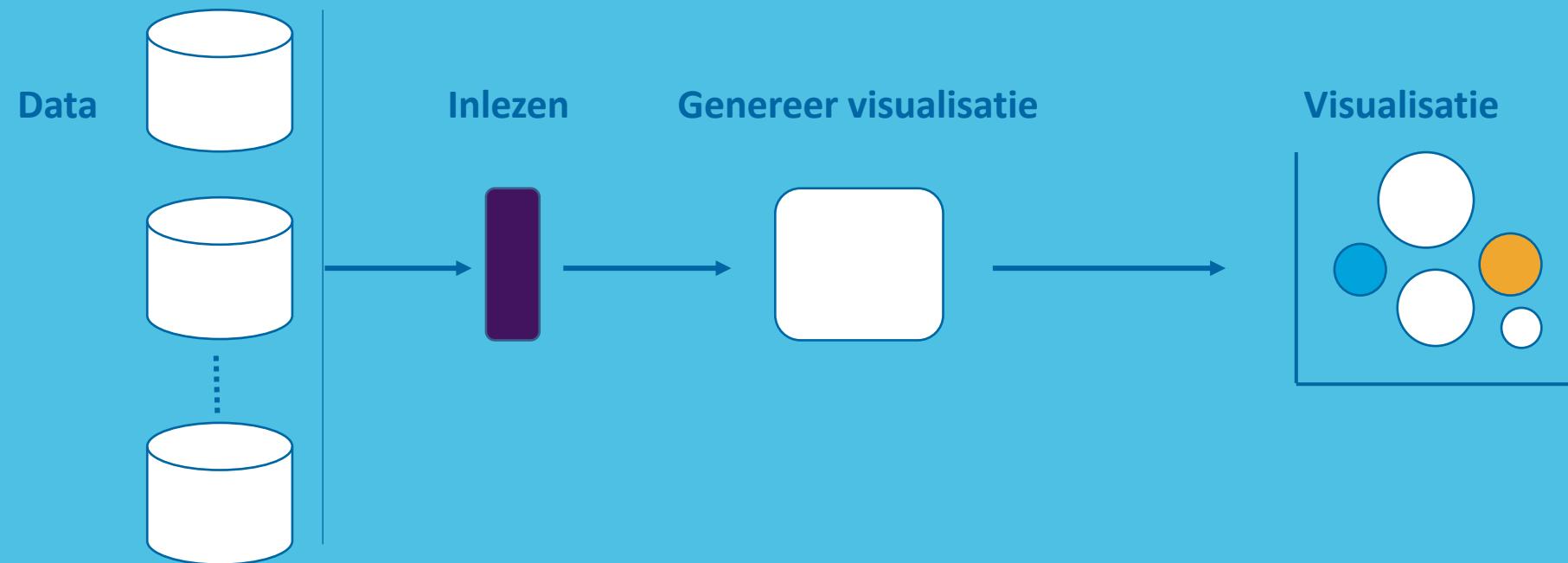
ec.europa.eu (Eurostat): shapefiles van Europese landen

3dbag.nl: 3d-modellen van gebouwen in Harlingen



En dan naar de volgende fase







Inlezen...

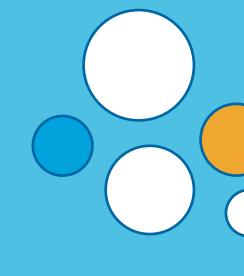
inlezen, opschonen, aggregeren, combineren, omzetten, interpoleren, uitlijnen, samplen, filteren

Data preprocessing

Genereer visualisatie



Visualisatie



Inlezen

text, csv, json, geotiff, ...

Filteren

Speciek gebied

Speciek tijdsinterval

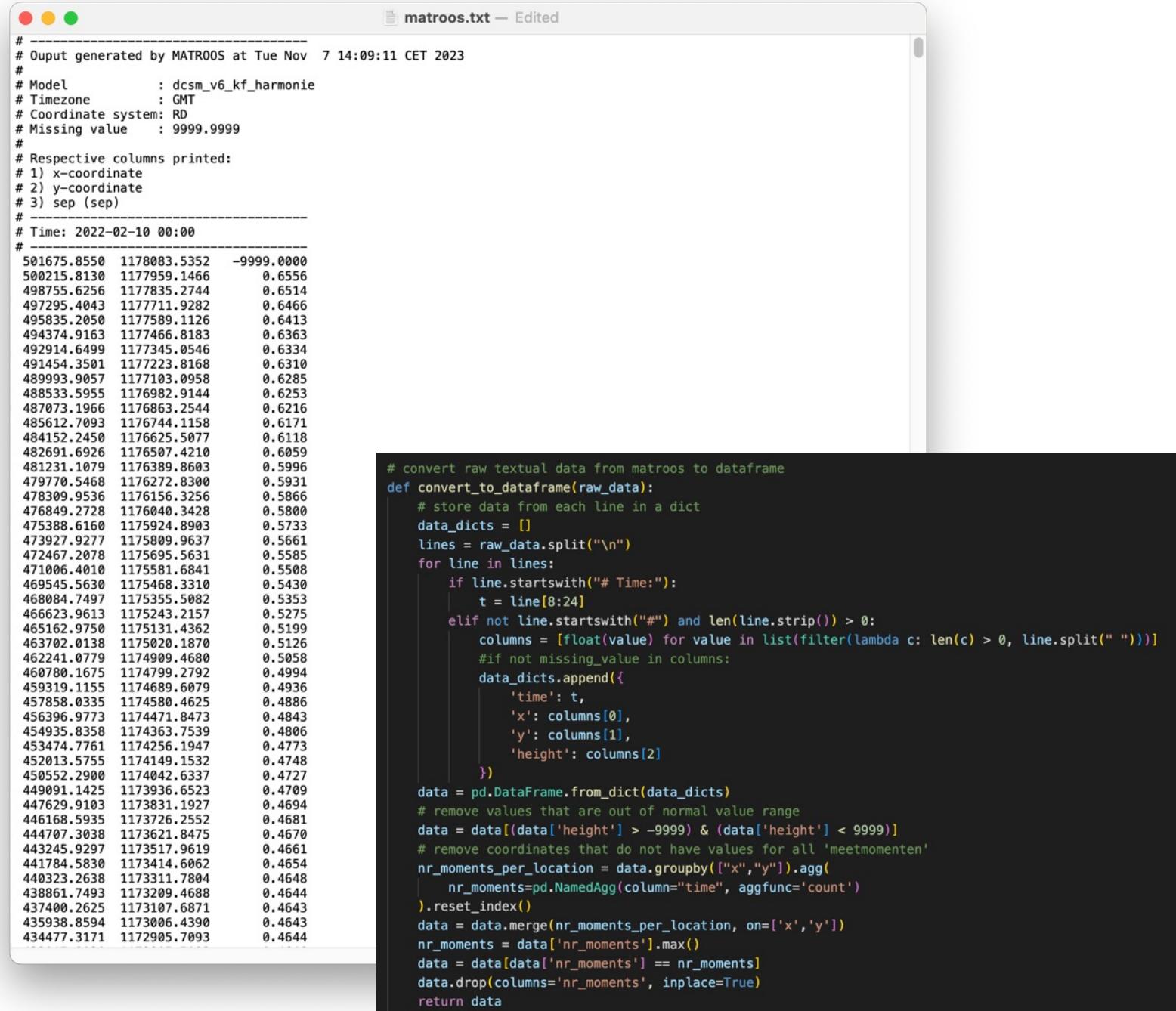
Omzetten

Nederlandse notatie: 1.000,00

naar Engelse: 1,000.00

Parsen van tijd-string: 5-8-2022

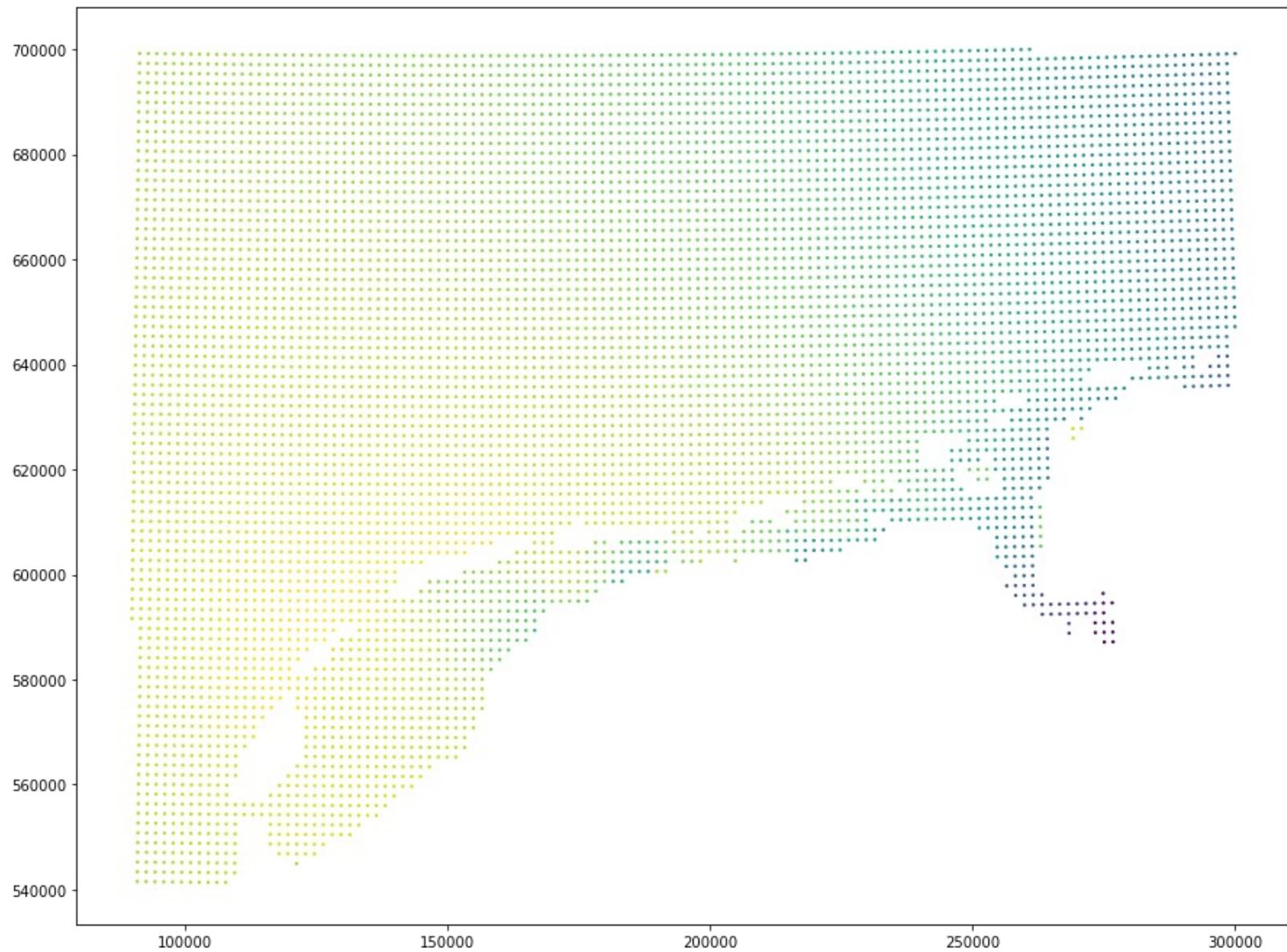
naar: DateTimeObject



```
# -----
# Ouput generated by MATROOS at Tue Nov 7 14:09:11 CET 2023
#
# Model          : dcsm_v6_kf_harmonie
# Timezone       : GMT
# Coordinate system: RD
# Missing value   : 9999.9999
#
# Respective columns printed:
# 1) x-coordinate
# 2) y-coordinate
# 3) sep (sep)
#
# -----
# Time: 2022-02-10 00:00
#
501675.8550 1178083.5352 -9999.0000
500215.8130 1177959.1466 0.6556
498755.6256 1177835.2744 0.6514
497295.4043 1177711.9282 0.6466
495835.2050 1177589.1126 0.6413
494374.9163 1177466.8183 0.6363
492914.6499 1177345.0546 0.6334
491454.3501 1177223.8168 0.6310
489993.9057 1177103.0958 0.6285
488533.5955 1176982.9144 0.6253
487073.1966 1176863.2544 0.6216
485612.7093 1176744.1158 0.6171
484152.2450 1176625.5077 0.6118
482691.6926 1176507.4210 0.6059
481231.1079 1176389.8603 0.5996
479770.5468 1176272.8300 0.5931
478309.9536 1176156.3256 0.5866
476849.2728 1176040.3428 0.5800
475388.6160 1175924.8903 0.5733
473927.9277 1175809.9637 0.5661
472467.2078 1175695.5631 0.5585
471006.4010 1175581.6841 0.5508
469545.5630 1175468.3310 0.5430
468084.7497 1175355.5082 0.5353
466623.9613 1175243.2157 0.5275
465162.9750 1175131.4362 0.5199
463702.0138 1175020.1870 0.5126
462241.0779 1174909.4680 0.5058
460780.1675 1174799.2792 0.4994
459319.1155 1174689.6079 0.4936
457858.0335 1174580.4625 0.4886
456396.9773 1174471.8473 0.4843
454935.8358 1174363.7539 0.4806
453474.7761 1174256.1947 0.4773
452013.5755 1174149.1532 0.4748
450552.2900 1174042.6337 0.4727
449091.1425 1173936.6523 0.4709
447629.9103 1173831.1927 0.4694
446168.5935 1173726.2552 0.4681
444707.3038 1173621.8475 0.4670
443245.9297 1173517.9619 0.4661
441784.5830 1173414.6062 0.4654
440323.2638 1173311.7804 0.4648
438861.7493 1173209.4688 0.4644
437400.2625 1173107.6871 0.4643
435938.8594 1173006.4390 0.4643
434477.3171 1172905.7093 0.4644
```

```
# convert raw textual data from matroos to dataframe
def convert_to_dataframe(raw_data):
    # store data from each line in a dict
    data_dicts = []
    lines = raw_data.split("\n")
    for line in lines:
        if line.startswith("# Time:"):
            t = line[8:24]
        elif not line.startswith("#") and len(line.strip()) > 0:
            columns = [float(value) for value in list(filter(lambda c: len(c) > 0, line.split(" ")))]
            #if not missing_value in columns:
            data_dicts.append({
                'time': t,
                'x': columns[0],
                'y': columns[1],
                'height': columns[2]
            })
    data = pd.DataFrame.from_dict(data_dicts)
    # remove values that are out of normal value range
    data = data[(data['height'] > -9999) & (data['height'] < 9999)]
    # remove coordinates that do not have values for all 'meetmomenten'
    nr_moments_per_location = data.groupby(['x','y']).agg(
        nr_moments=pd.NamedAgg(column="time", aggfunc='count')
    ).reset_index()
    data = data.merge(nr_moments_per_location, on=['x','y'])
    nr_moments = data['nr_moments'].max()
    data = data[data['nr_moments'] == nr_moments]
    data.drop(columns='nr_moments', inplace=True)
    return data
```

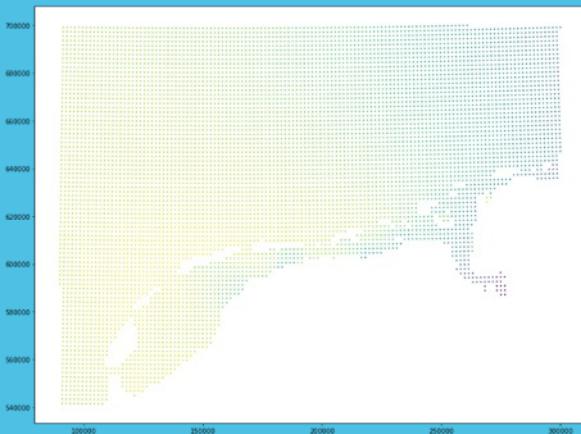
Exploreren



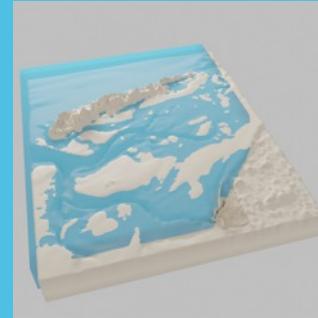


Data preprocessing

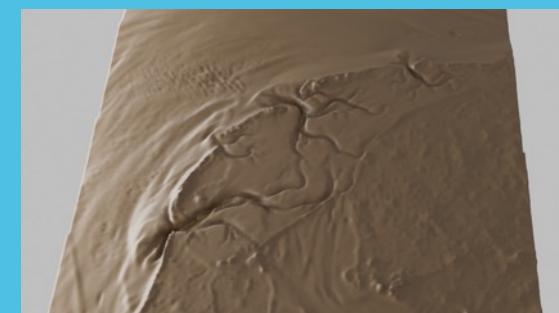
inlezen, opschonen, aggregeren, combineren, omzetten, interpoleren, uitlijnen, samplen, filteren



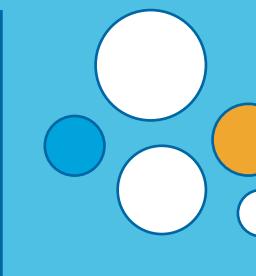
Exploreren



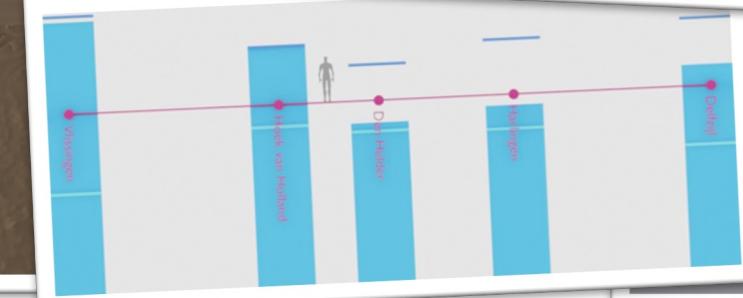
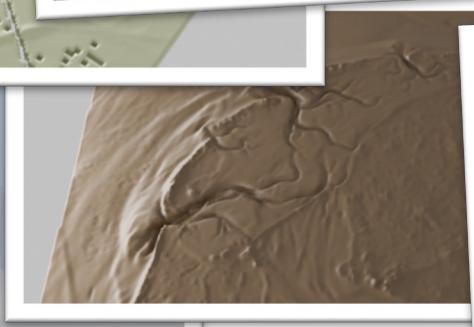
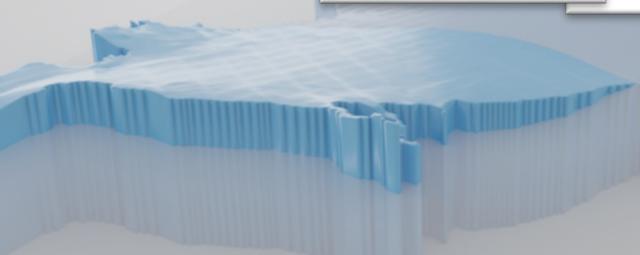
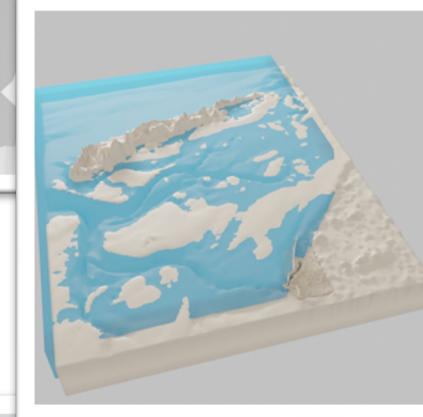
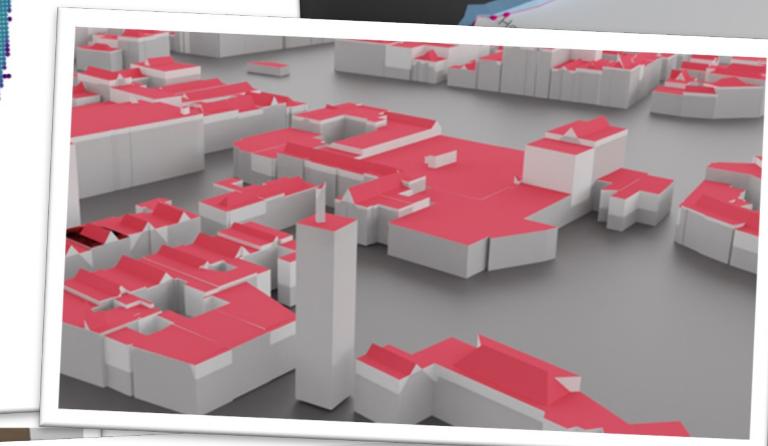
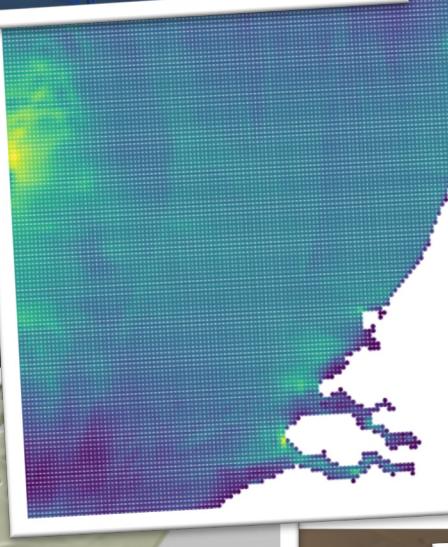
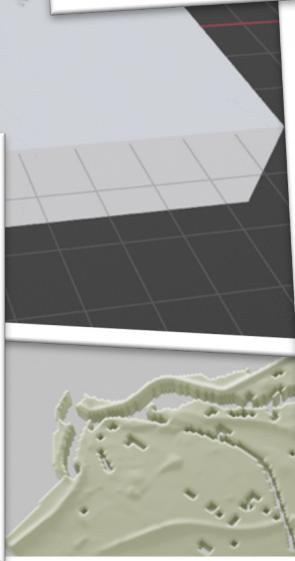
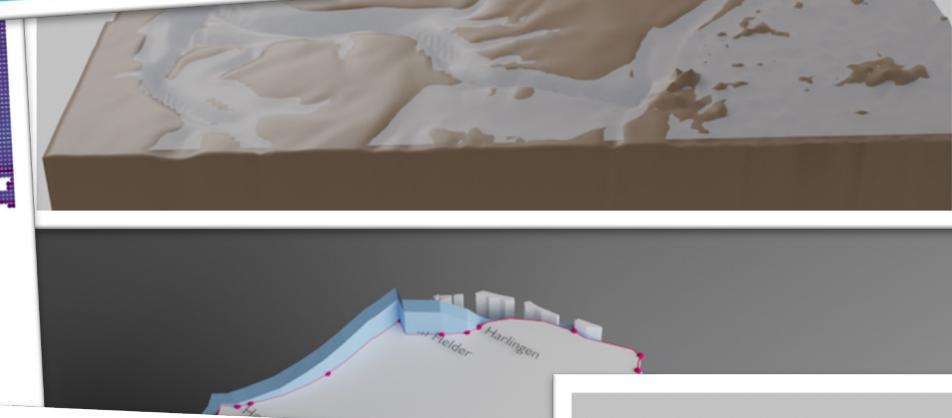
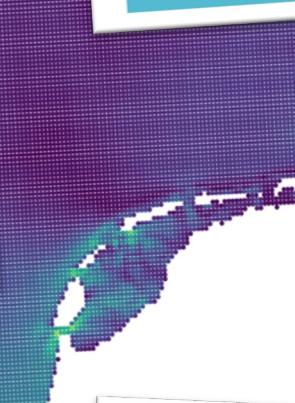
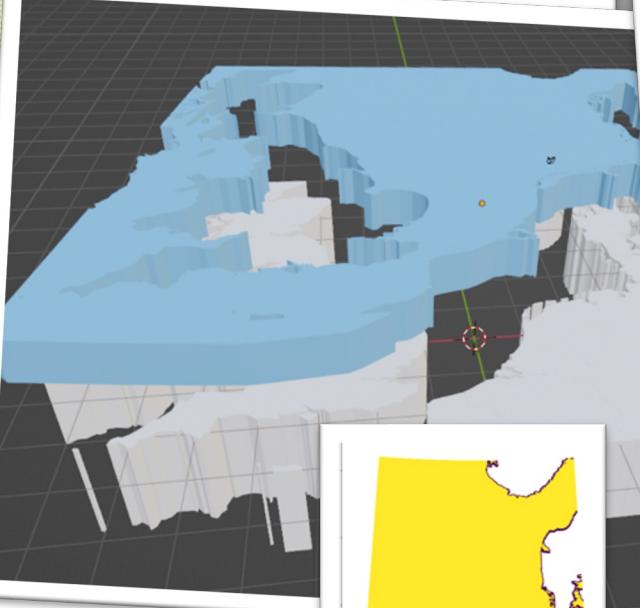
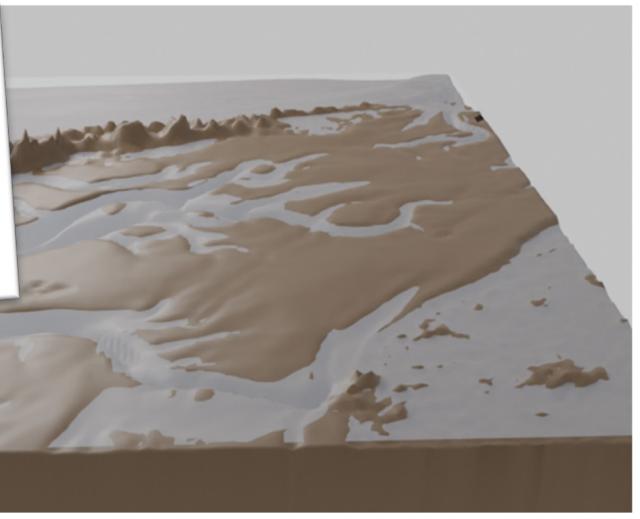
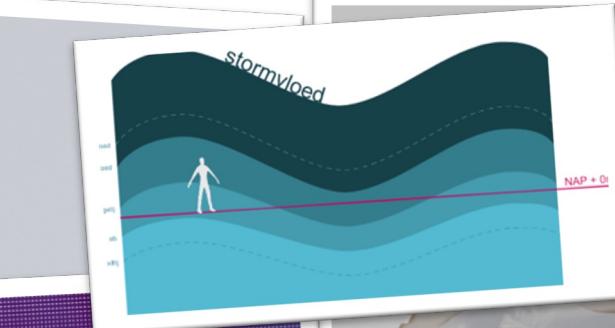
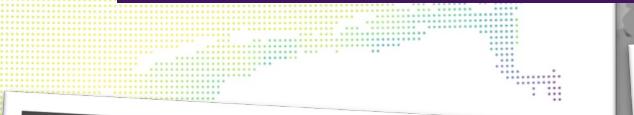
Genereer visualisatie

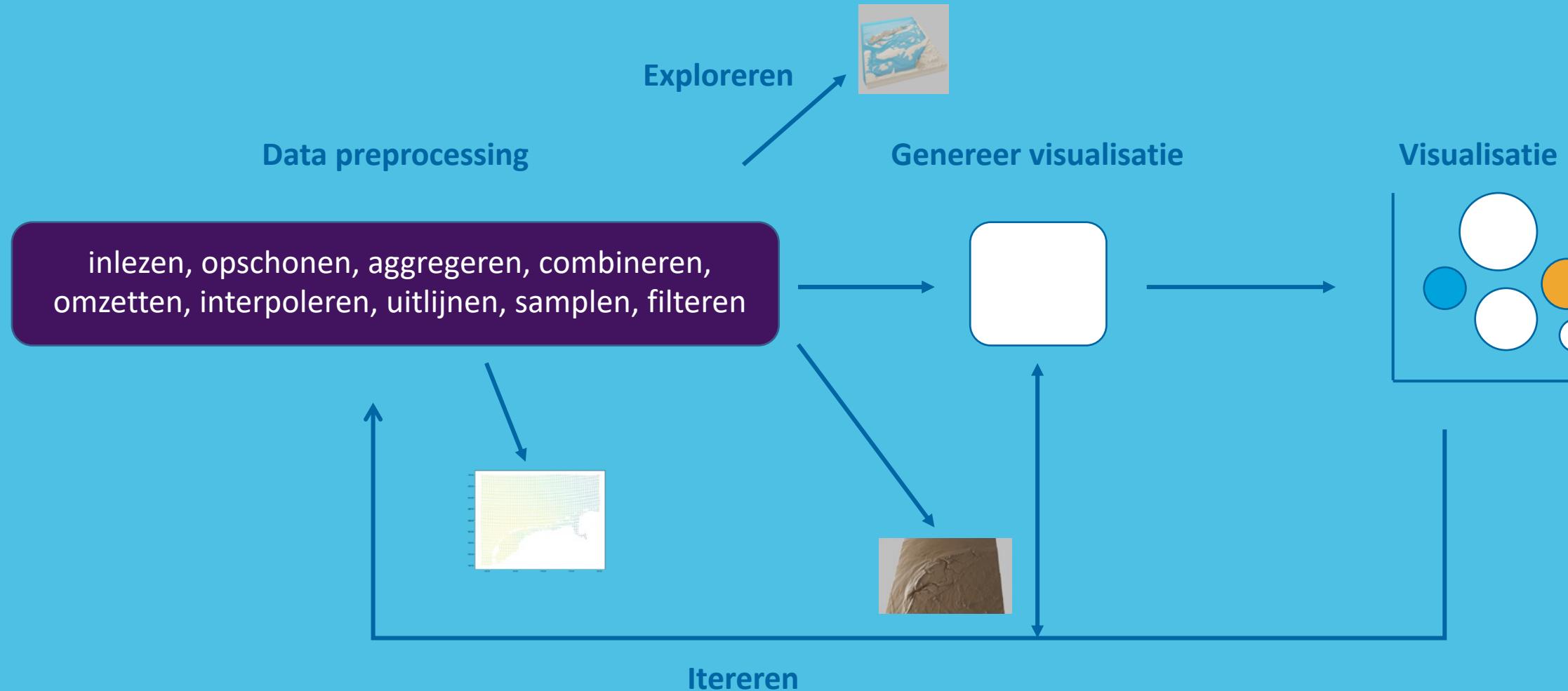


Visualisatie



en nog meer proberen



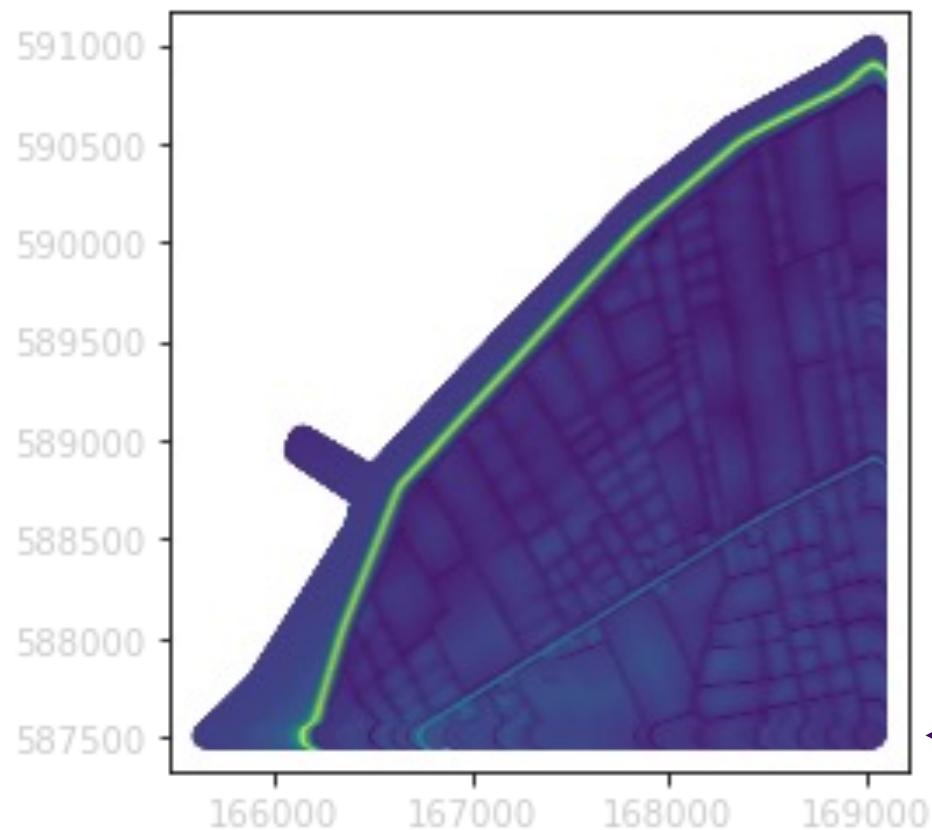


Opschonen

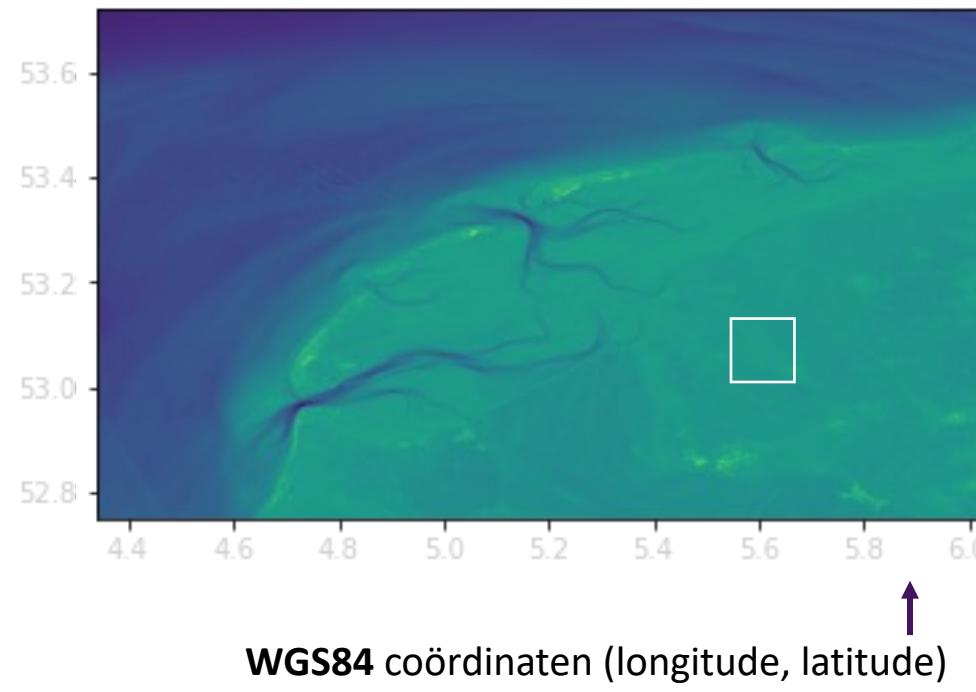


Omzetten, combineren

Algemeen Hoogtebestand Nederland
(bodemligging droog)



European Marine Observation and Data Network
(bodemligging nat)



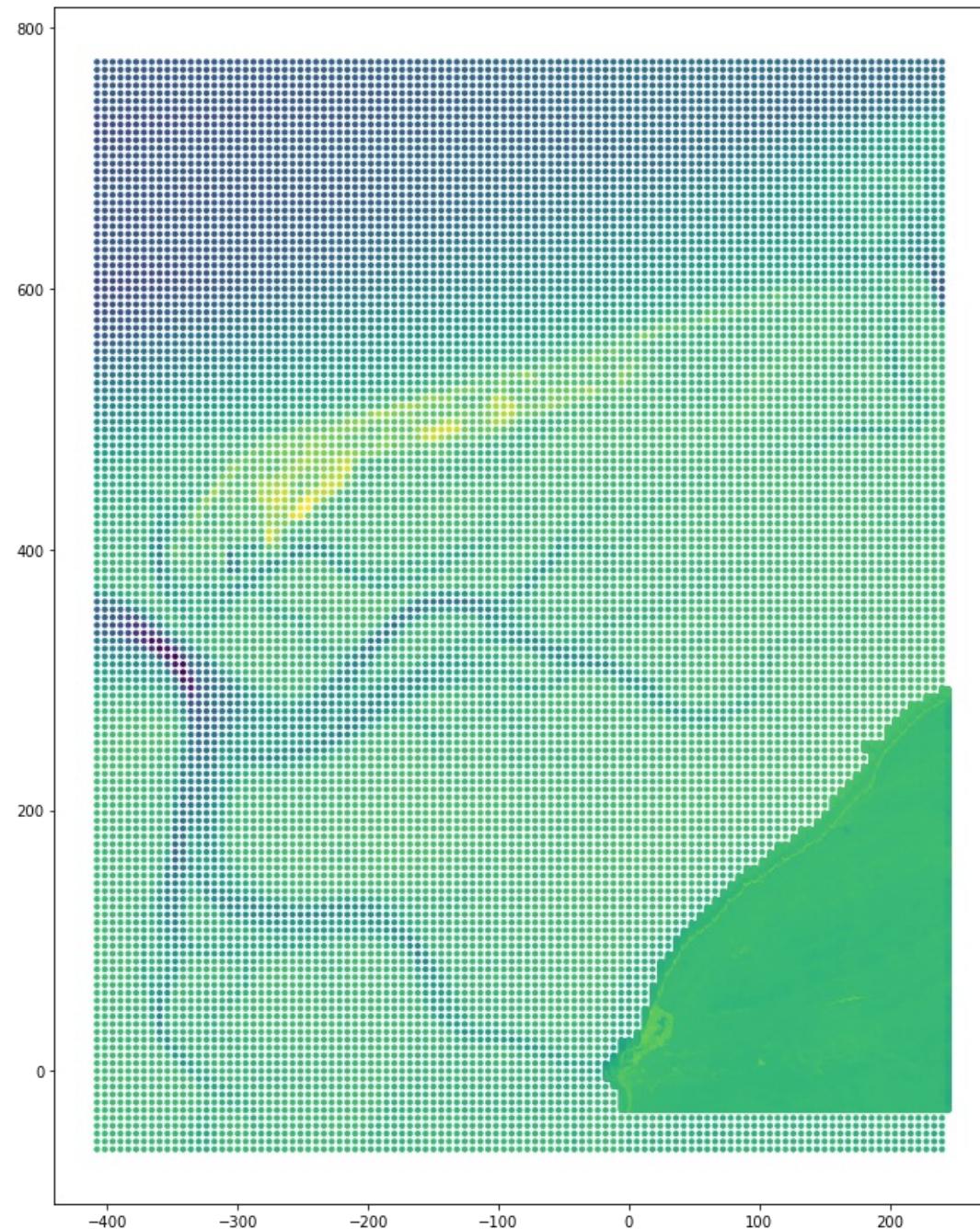
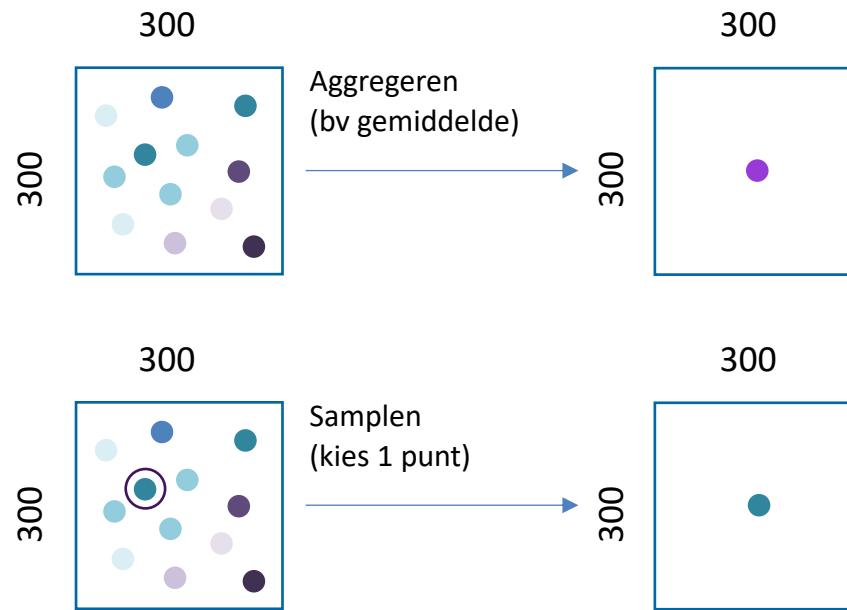
← **RijksDriehoek** coördinaten (x,y)

WGS84 coördinaten (longitude, latitude)

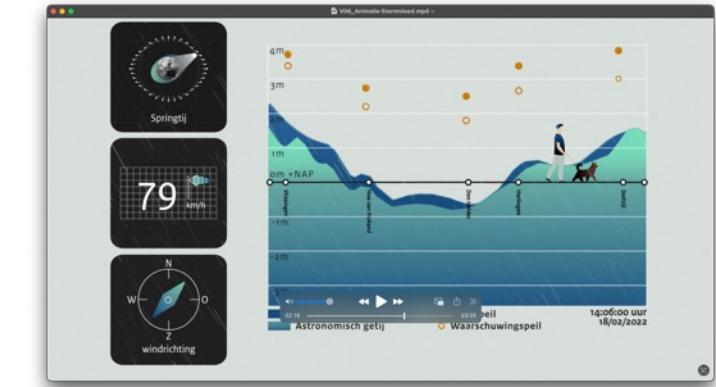
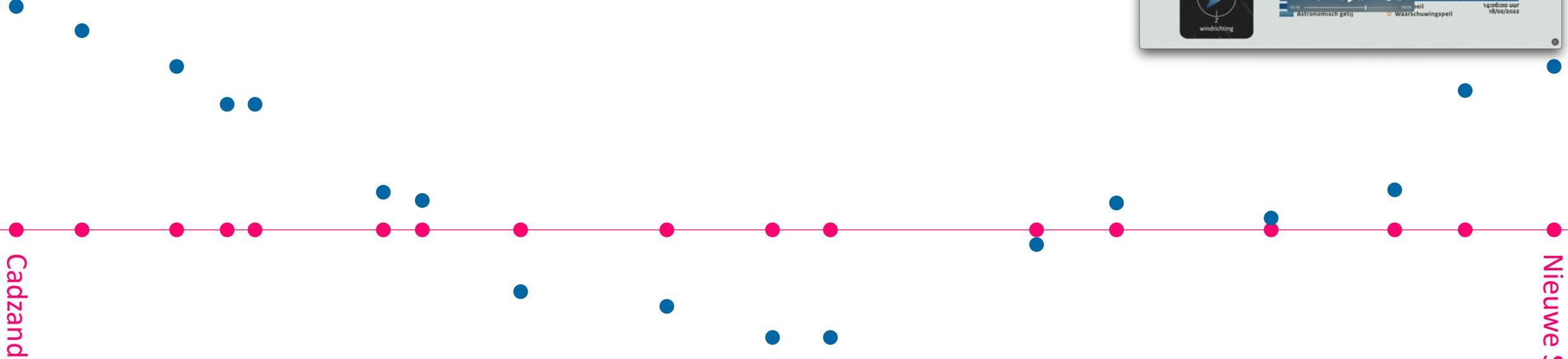
Aggereren, combineren

Emodnet -> 300x300m

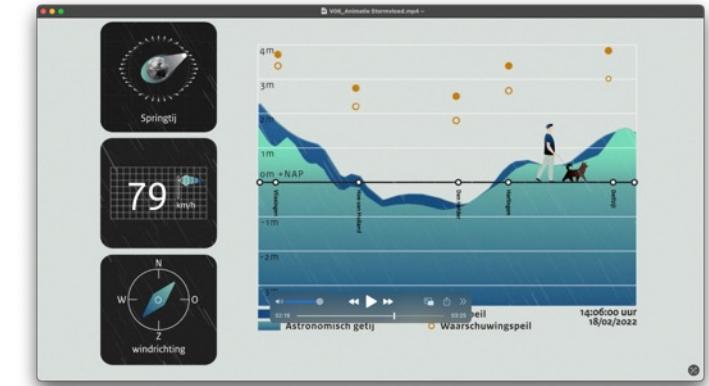
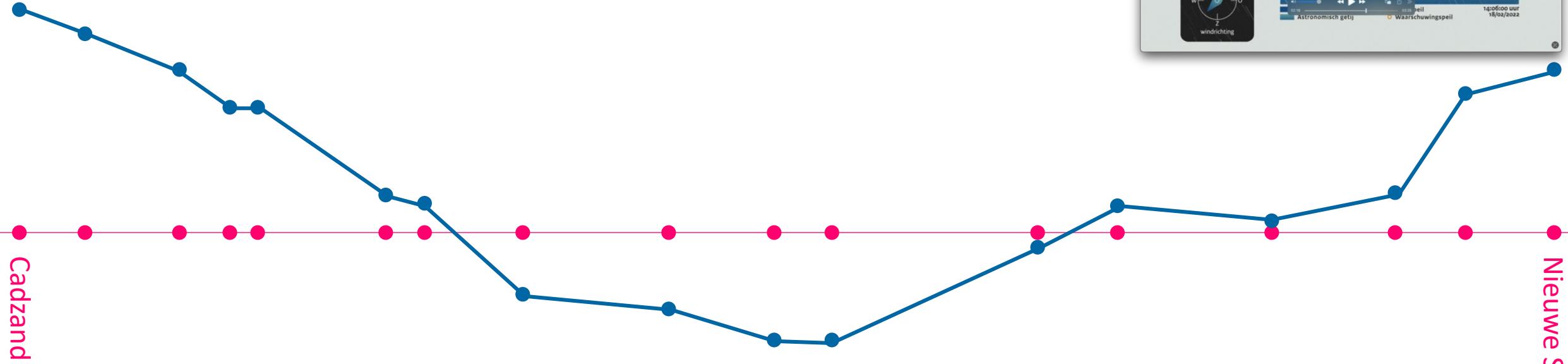
AHN -> 50x50m



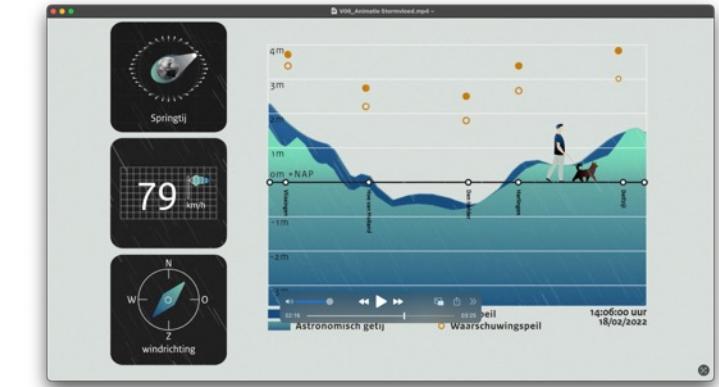
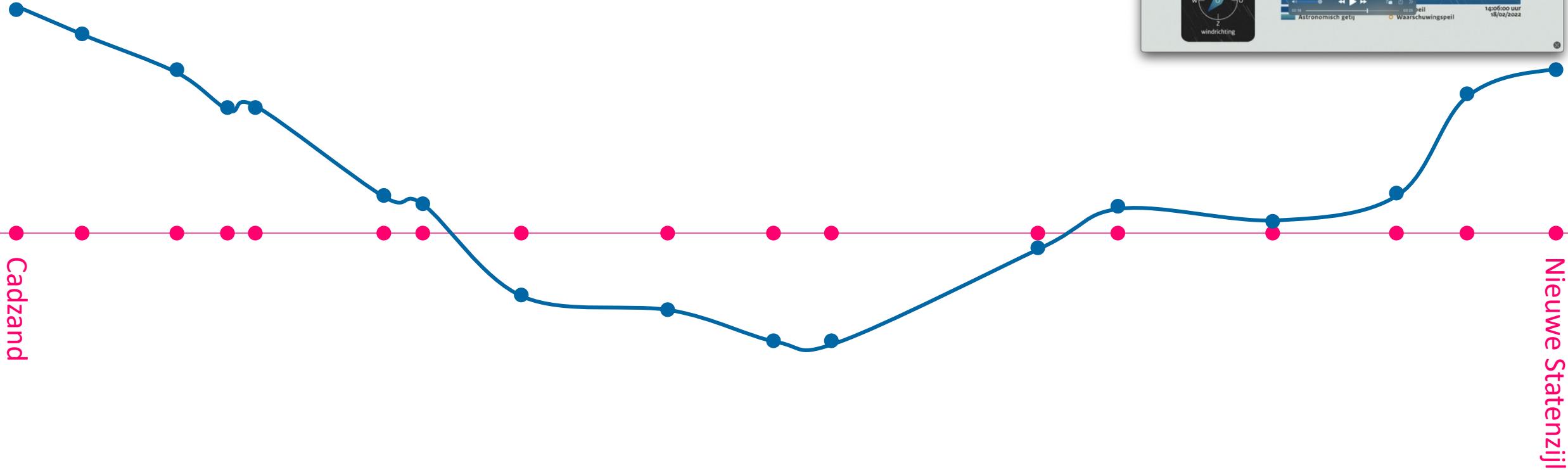
Interpoleren (in tijd en plaats)

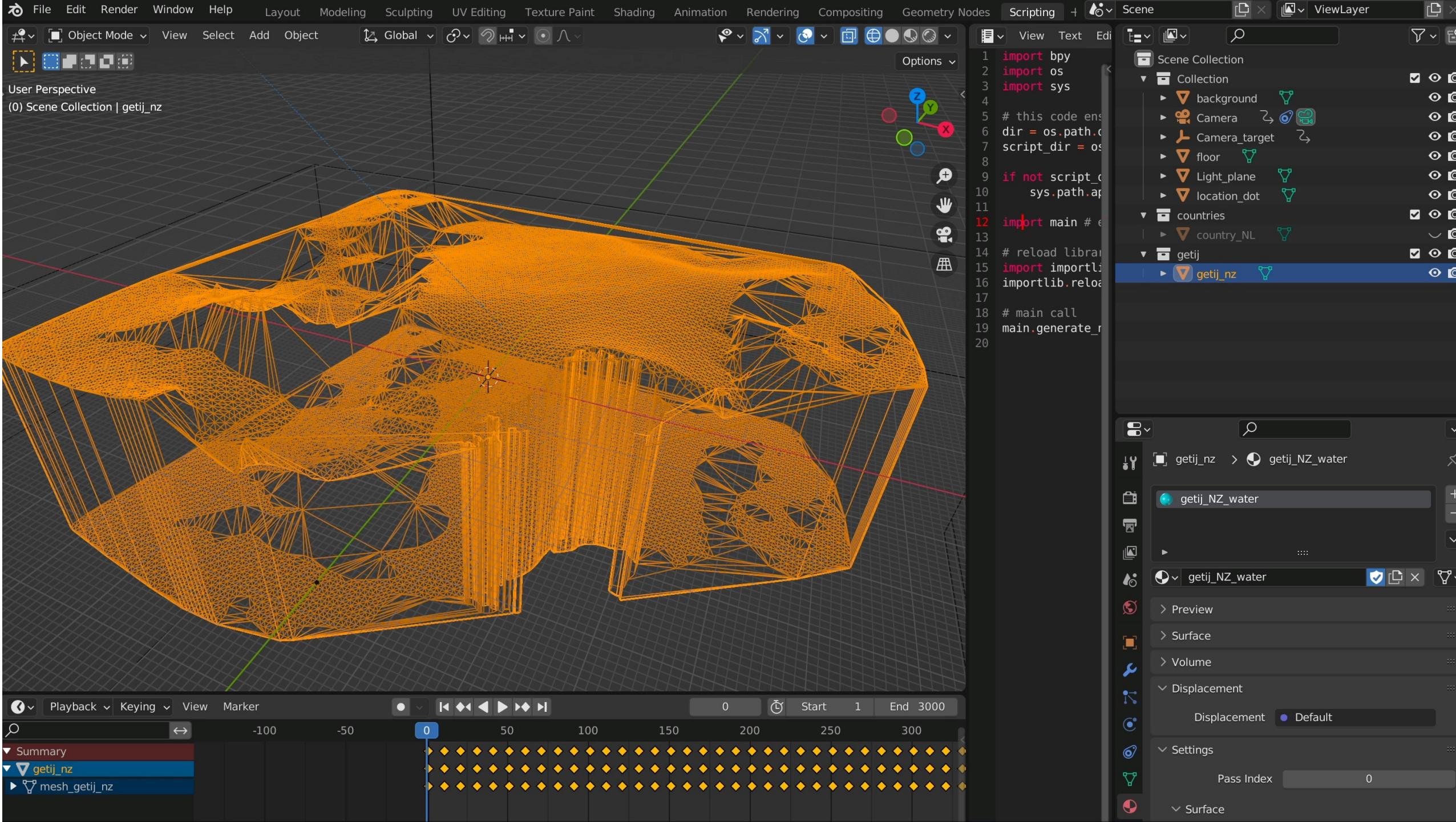


Interpoleren (in tijd en plaats)



Interpoleren (in tijd en plaats)

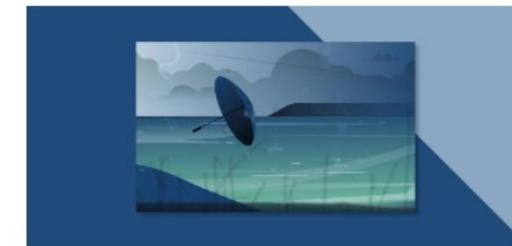




En dan is een video maken een ander verhaal...

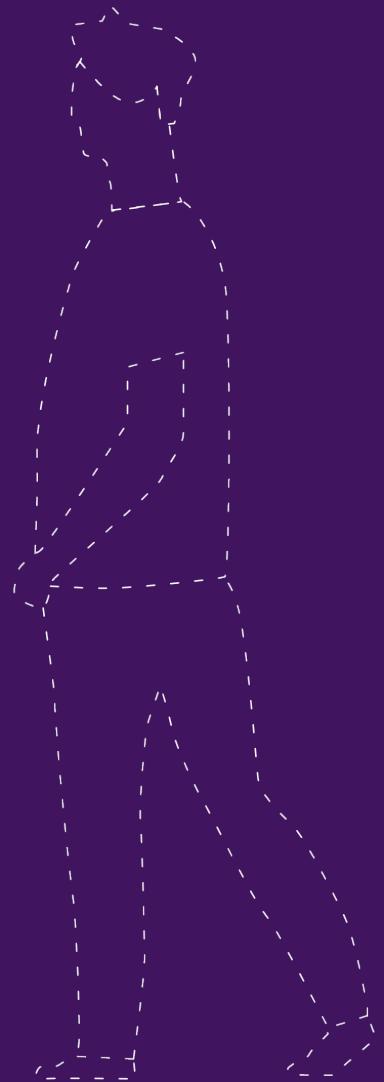


PUBLIC
cinema



Je weet wat een storm is,
en wat vloed is. Maar
wat is een stormvloed?

De combinatie van datavisualisatie en
storytelling in een 2D/3D animatie voor
Rijkswaterstaat



Data is meer dan cijfers

Aantal flesjes

1,3 miljard



One day
1.3 billion bottles



<https://www.visualcapitalist.com/visualizing-the-scale-of-plastic-bottle-waste-against-major-landmarks/>

Beleef data met Augmented reality

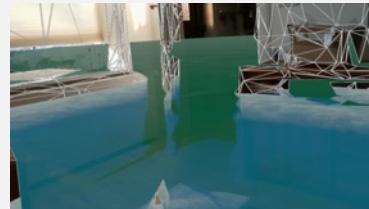


1 meter
=
1 meter

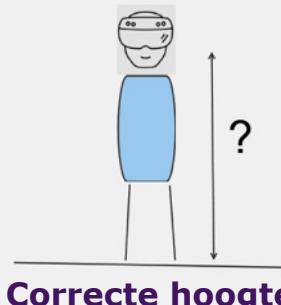
Correcte schaal



Tracking in ruimte



Clipping

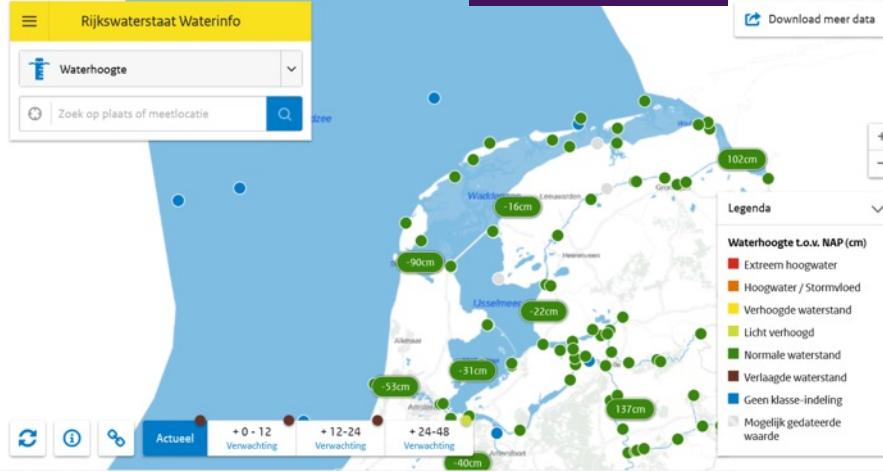


Correcte hoogte

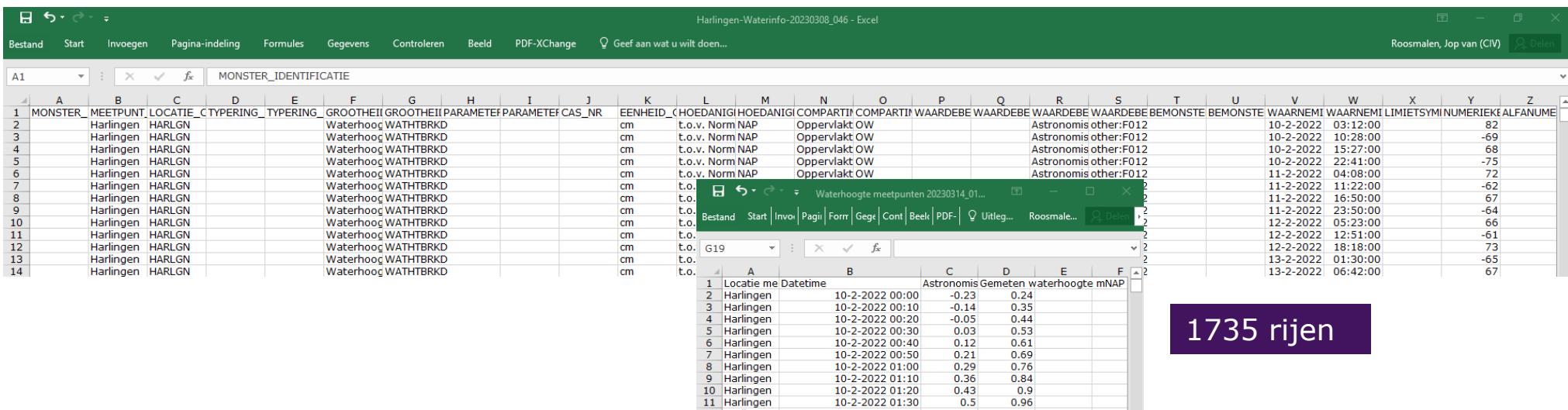
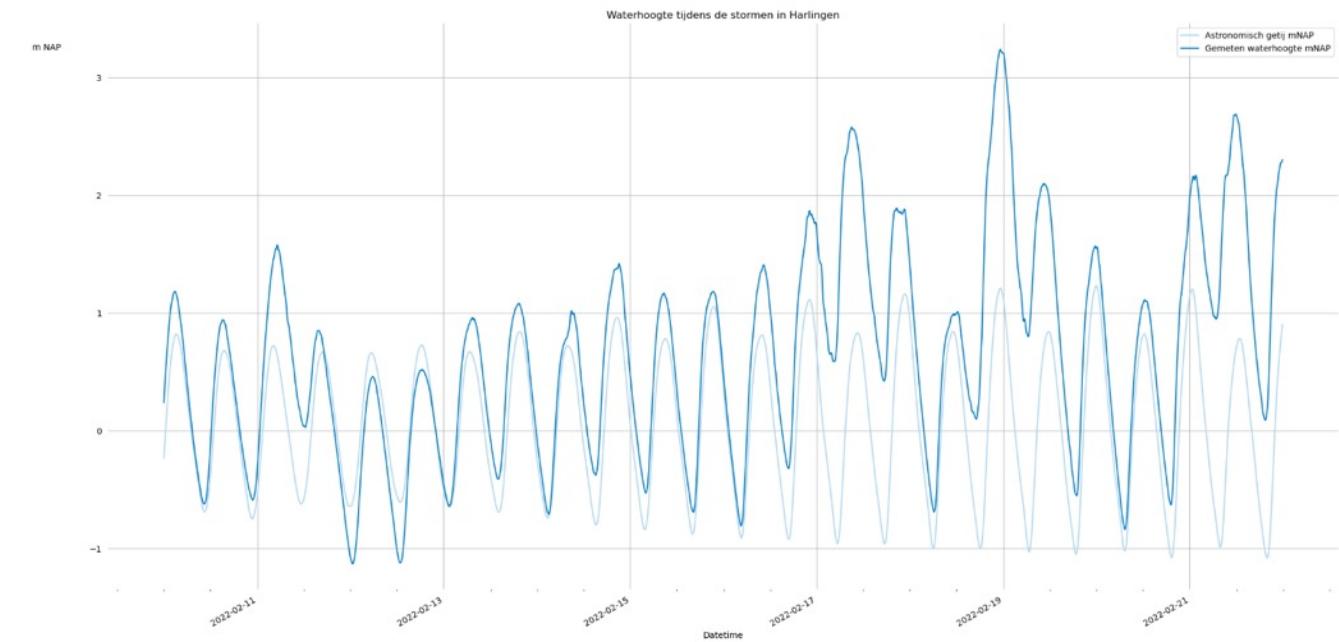


Vloeiende AR beleving

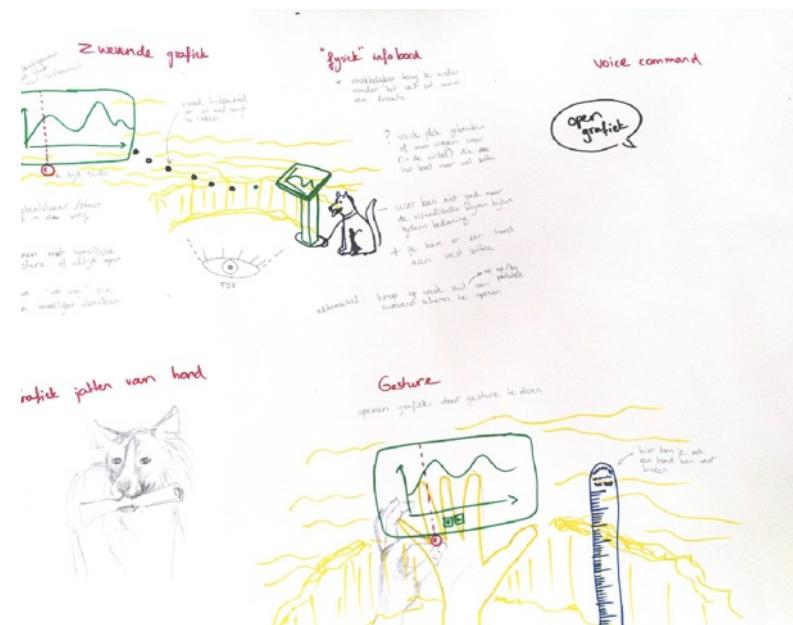
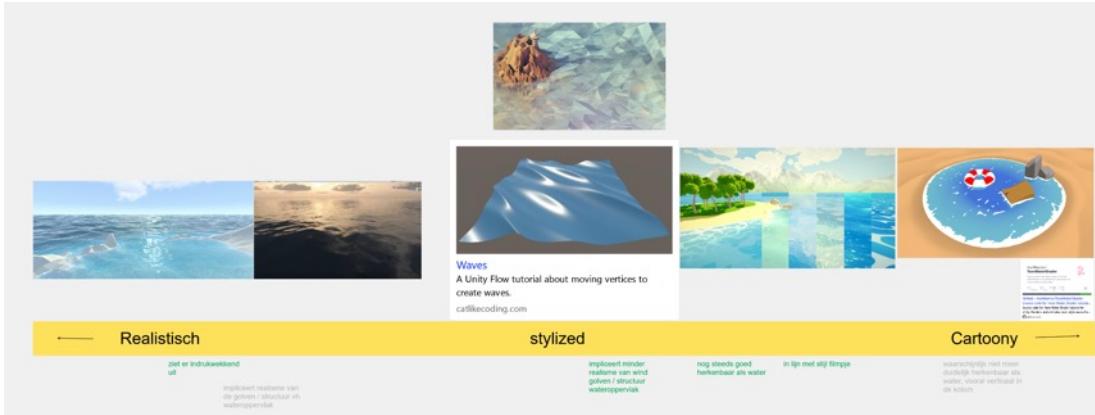
De data



Waterinfo

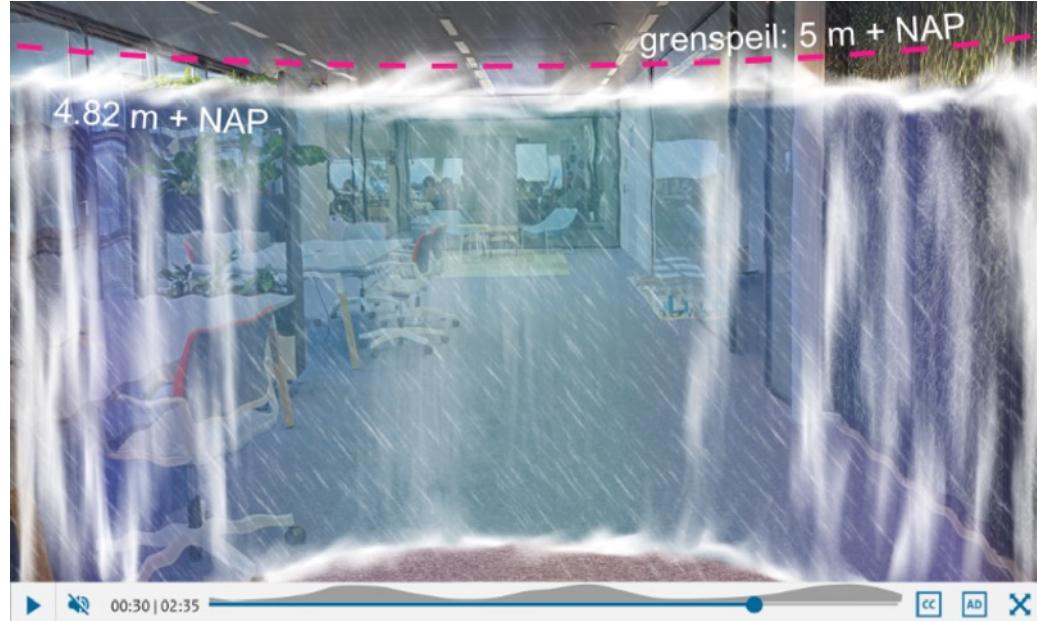
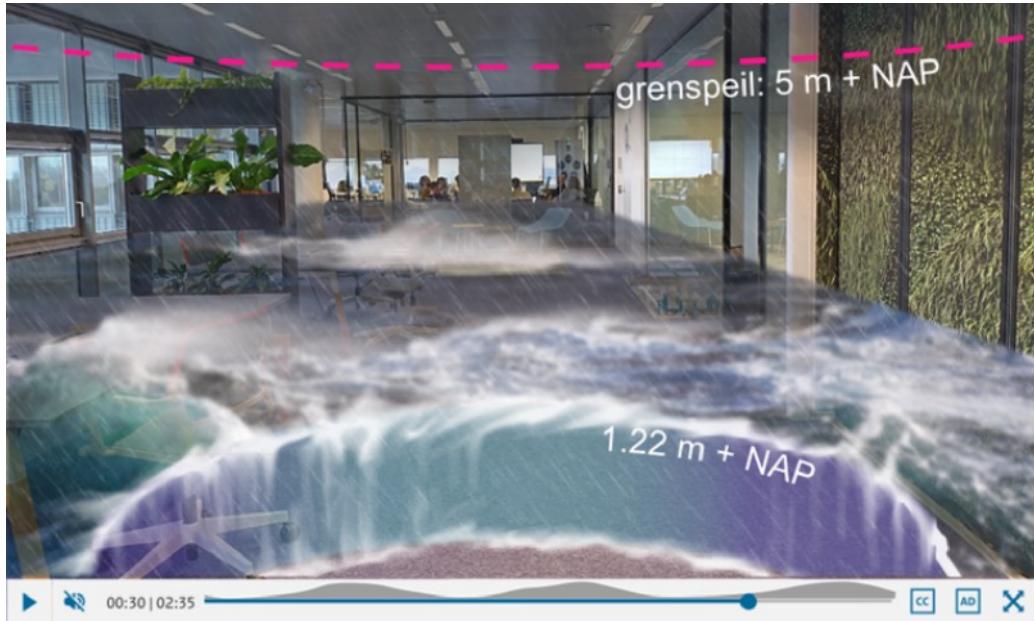


Ook nu eerst brainstormen en schetsen...

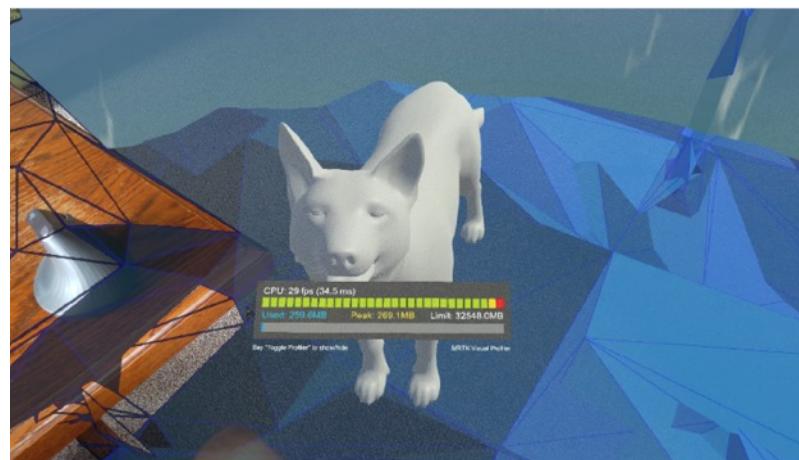
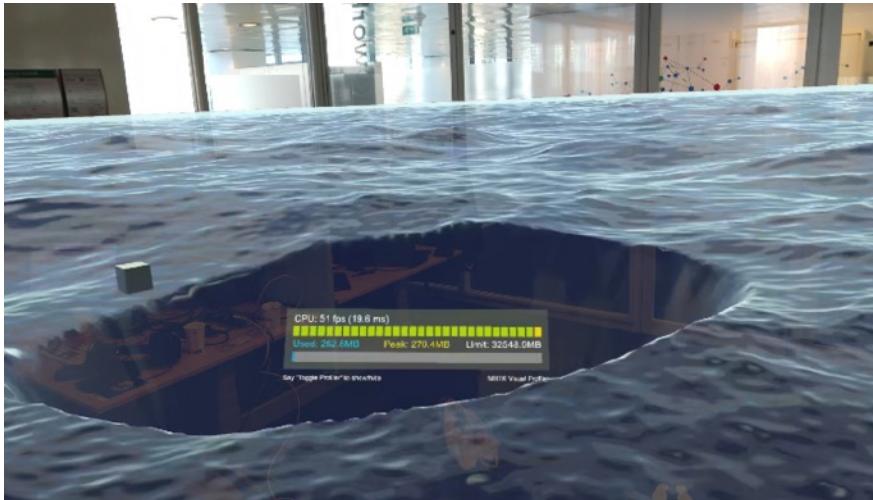
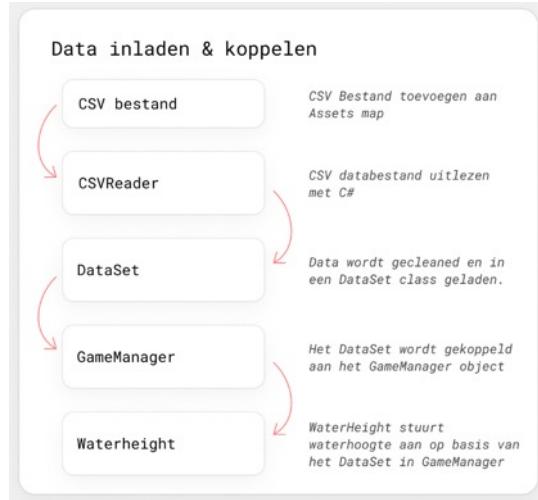


e van de schaal. Vraag of anders? Lijn is of de		Overzichtsgraf als menu dan naar detail 1 op 1		1 op 1 zee spelen, geloven in het minimap effect (alleen als de tijd ook 1 op 1 is)		
met hond						
I met video's		Kunnen we een foto van realisatie?				
stu) en regen awn bij mooi weer?		Bliksem	Donkere wolken	Bladeren	Meeuwen	Zon
n alarmpeil		Peilstok	Lijn	Vlak	Boei met beperkte lijn	Meetplatform
tijd kiezen				swipen op je hand / schermje dat tevoorschijn komt op je hand		
I animeren				In overzicht van NL, getijlijn kunnen zien (dus heel versneld), op specifieke locatie 1-op-1 tijd, met grafiek/tijdtijdlijn om door getijcyclus heen bewegen.		
locatie (plaatje)				wegwijzerpaal met andere locaties waar je naar toe kan teleporteren		
cherm,...) gen	Gyro	Teleporteren	Boost (zoals streetview)	Teleporteren	Fysiek bewegen	

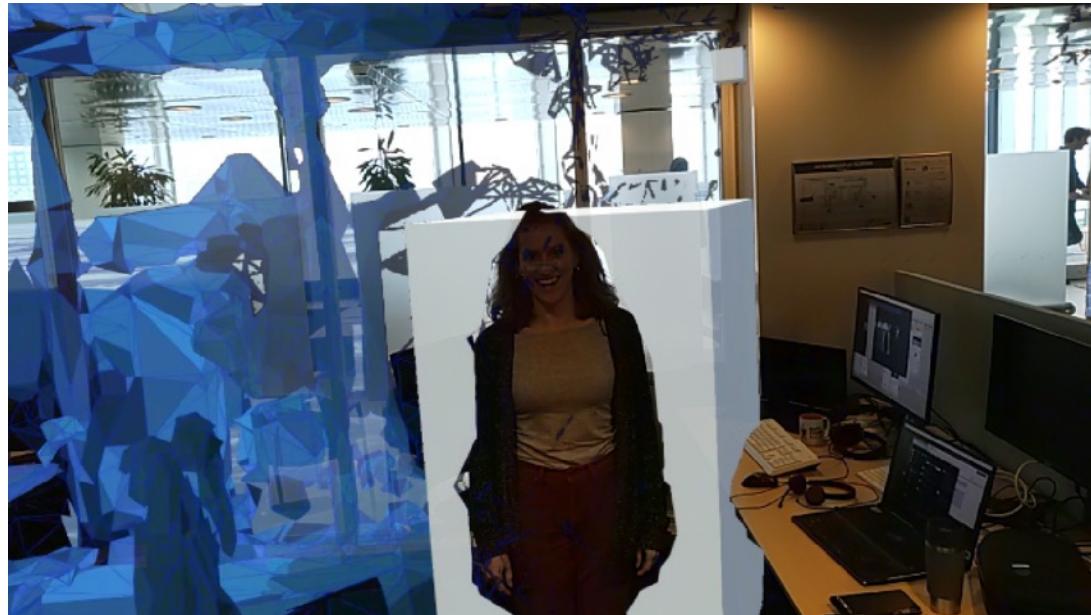
dan een concept uitwerken...



en vervolgens implementeren in Unity

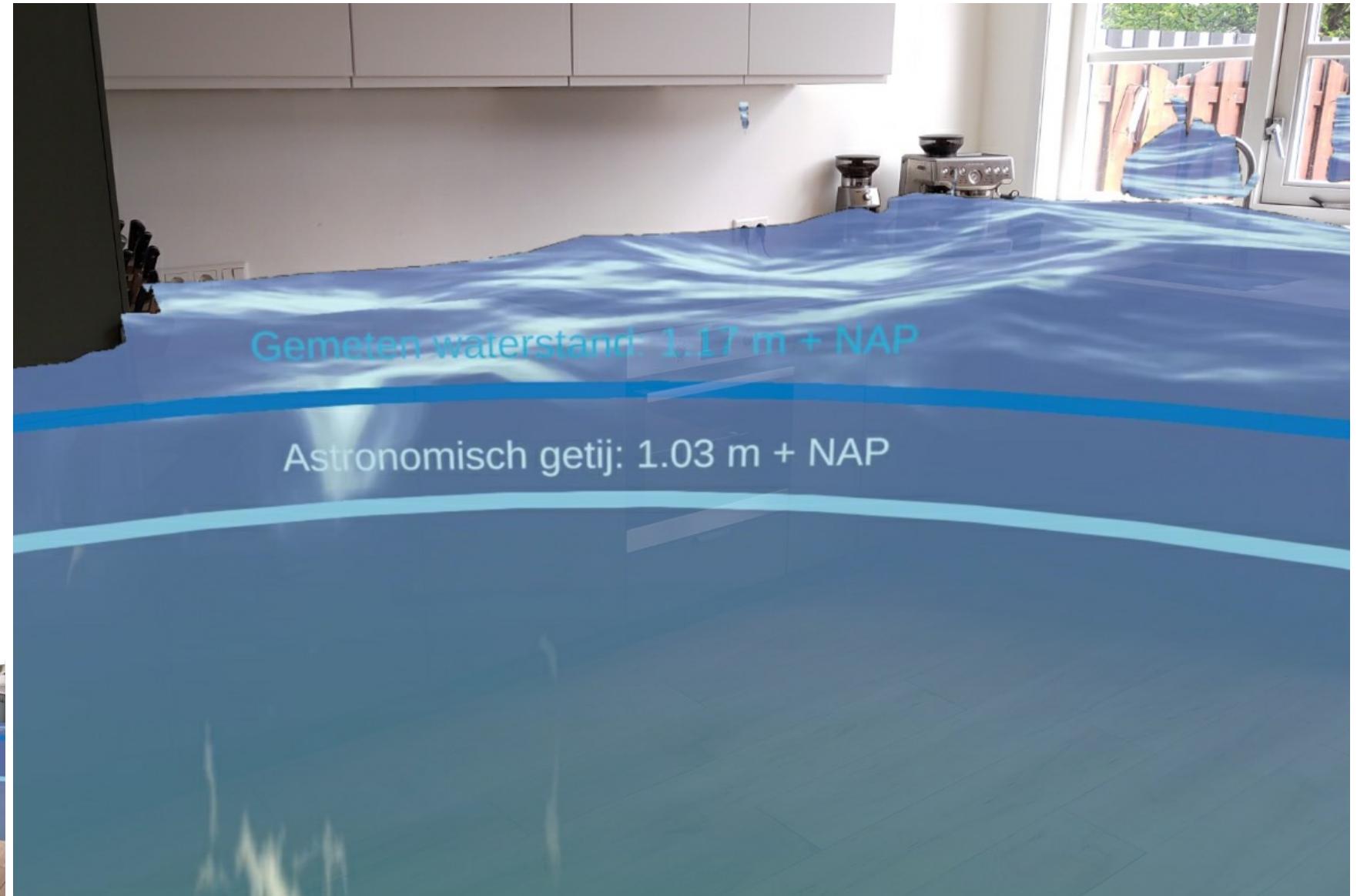
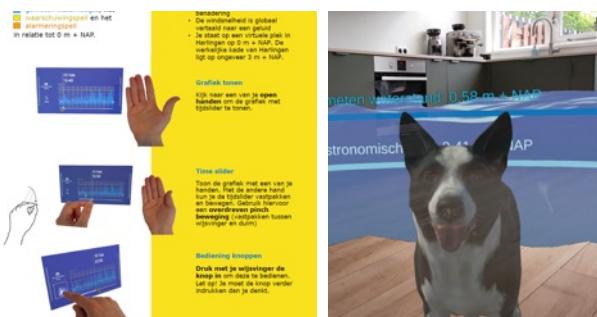


Tot het laatste moment klopte er iets niet



Het resultaat

*"Het komt heftiger over.
Je weet in theorie dat je
onder water staat, en
dat beleef je wel echt."*



Belangrijkste gebruikte software

Datavoorbewerking:  python™

Data-animate: 

Video: 

AR-app: 

Onze vraag:

Zin om bij ons stage te lopen?

Laat het ons weten:

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Jullie vragen?