

Varsling af oversvømmelse og hydrologi på DMI

Michael Butts, Flooding and Hydrology, DMI

Varslingsmyndigheder – før 2022

Skybrud



Oversvømmelser fra vandløb



Stormflod



Skybrud Østerbro © ColourBox – Nina Benixen

Gudenå, Bjerringbro, feb 2020 © Michael Butts

Horsens Stormen Malik, 2022 © COLOURBX 53465501

Feb 2020



Foto/Video © Michael Butts, Gudenå , ved Bjerringbro

Foto: Jensen Aerial Photography, Oversvømmelser i Ryå

Credit:

Jonas W Pedersen et al. (2022),

Database af oversvømmelse fra et media arkiv,

DANVA Dansk Vand Konference 23.-24. november, 2022

645 flooded locations (2015-2020)

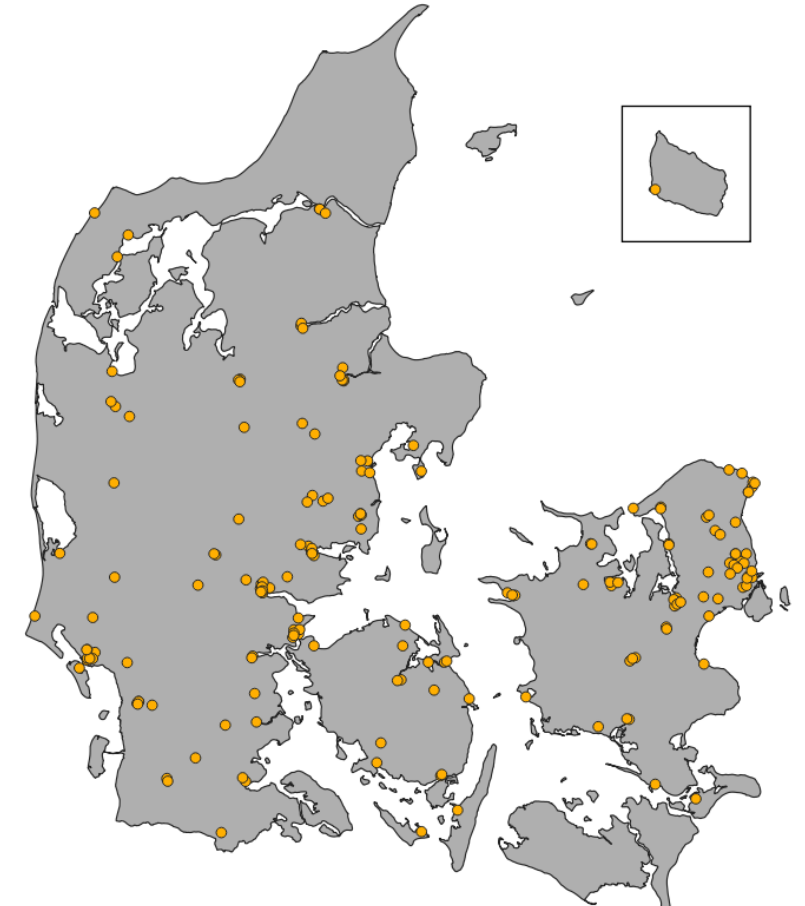
Storm surge (coast)



Fluvial (river/lake)

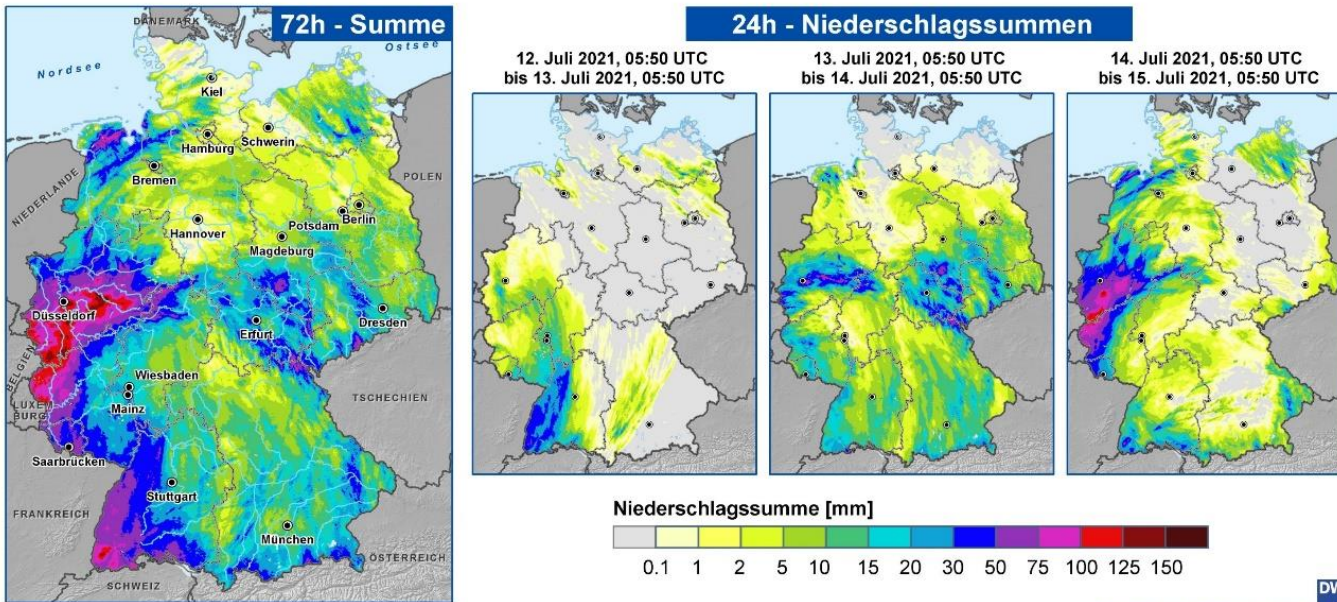


Urban pluvial



Forfærdelige oversvømmelser i juli 2021 i Centraleuropa

Tief Bernd über Deutschland,
 Summe des Niederschlags aus Radar: 12. Juli, 05:50 UTC - 15. Juli 2021, 05:50 UTC



Klimadaten und Darstellung: © Deutscher Wetterdienst 2021 (Stand: 15.07.2021); Geodaten: © GeoBasis-DE/BKG 2020 (Stand: 01.01.2020).



Oversvømmelser i Tyskland
 © iStock-1329068252

<https://confluence.ecmwf.int/display/FCST/202107+-+Rainfall+-+Germany+and+Belgium?desktop=true¯oName=show-if>

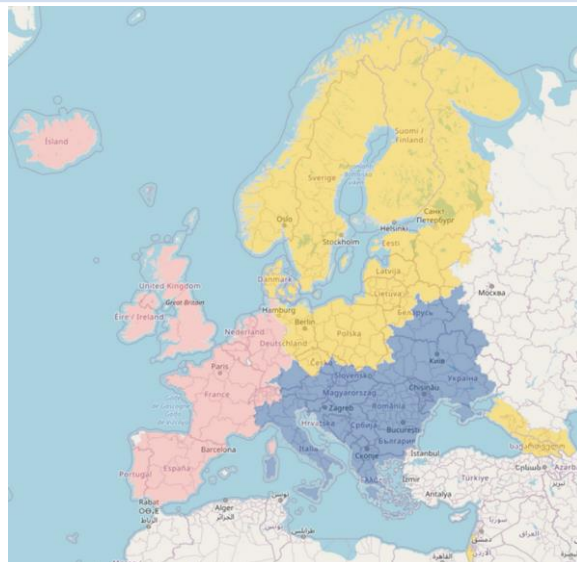
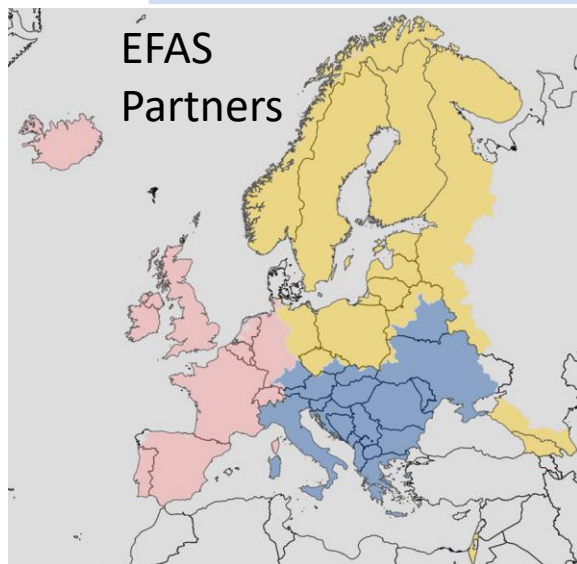
EFAS – European Flood Awareness System

Juli 2021
**Oversvømmelser i
Tyskland m.fl.**

Januar 2022
**DMI udpeget til
hydrologisk
varslingsmyndighed**

Maj 2022
**Risikomeldinger til
beredskaber**

Medio 2023
**Manuelle varsler til
beredskaberne**



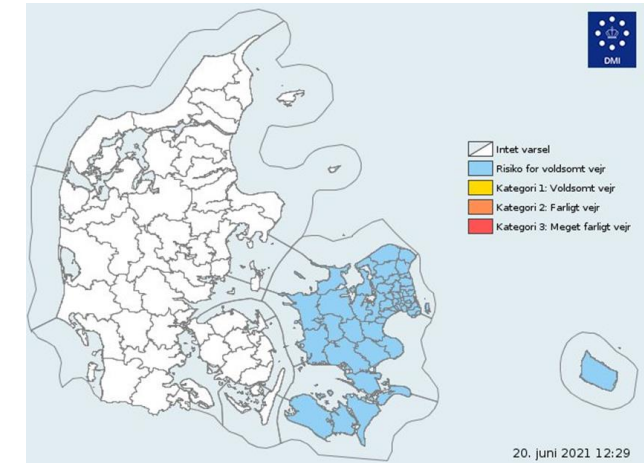
Data



Information



Beslutning



Krav til data:

- Rettidig
- Robust
- Pålidelig



Kraftig regn



Snestorm /
kraftig sne /
snefaldning



Vind



Forhøjet
vandstand



Is



Torden og
skybrud

Varsling for oversvømmelser fra vandløb

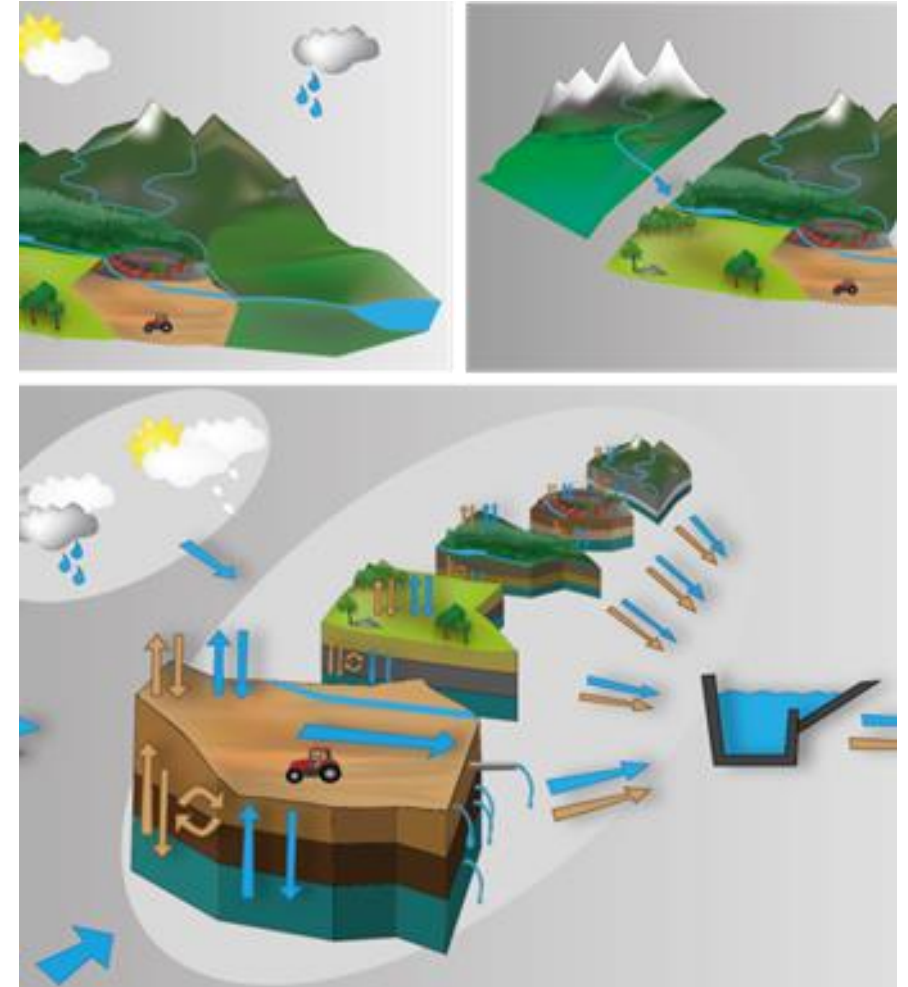
Trin 1: Manuelle varsler til beredskab

Varsling baseret på manuelle sammenstilling af data

Trin 2: Prognoser baseret på hydrologiske modeller

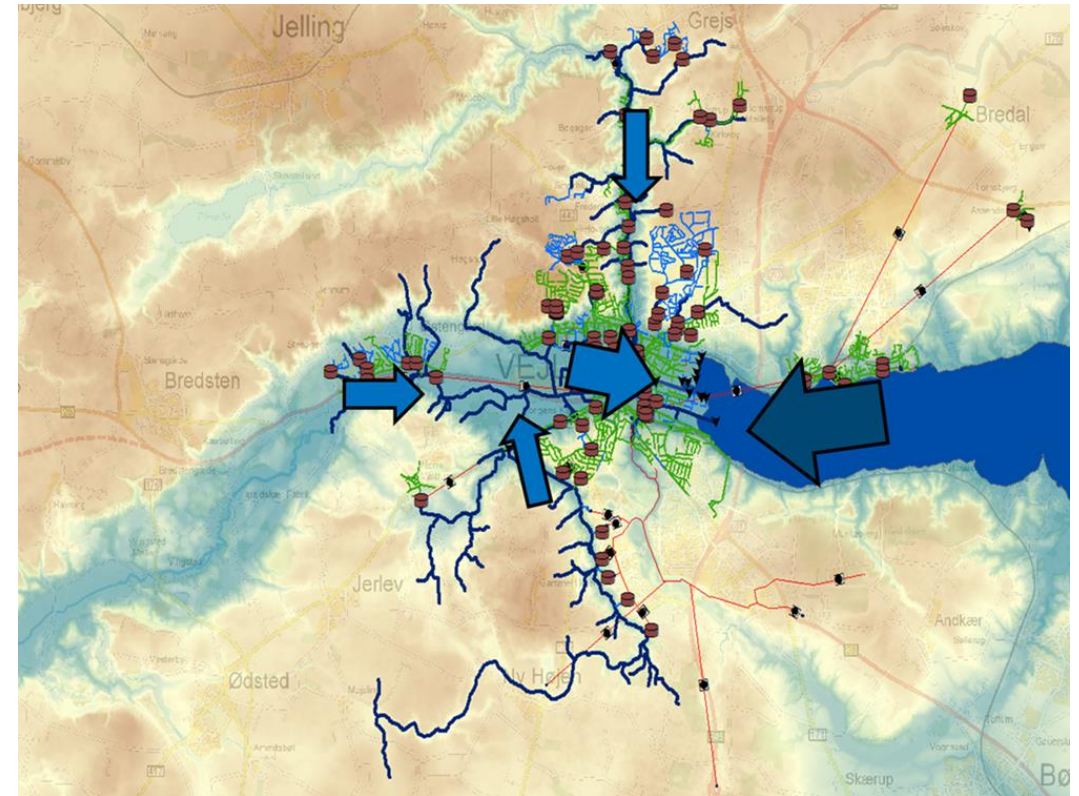
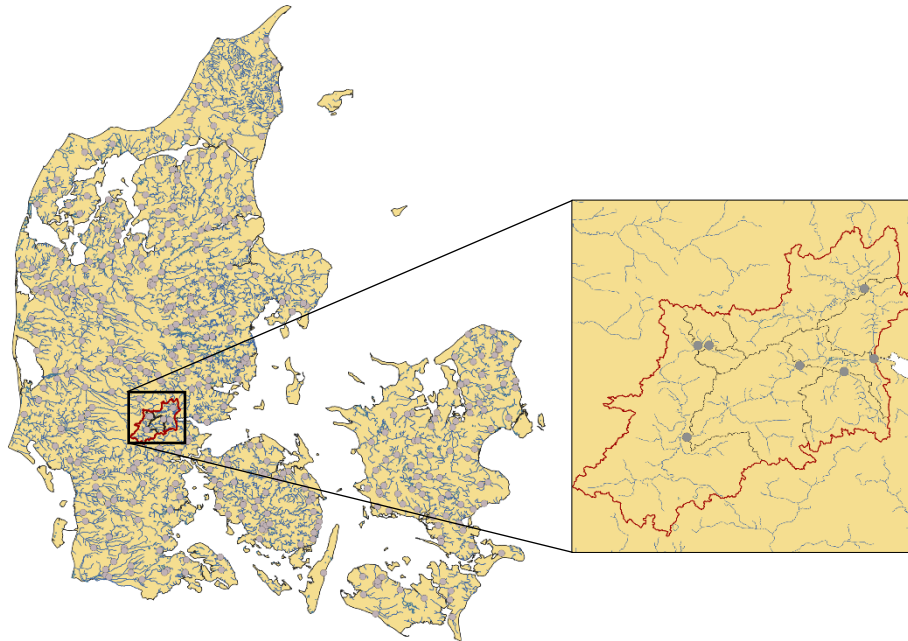
Krav til modeller

- "Open source", community modeller
- Hurtig
- Robust



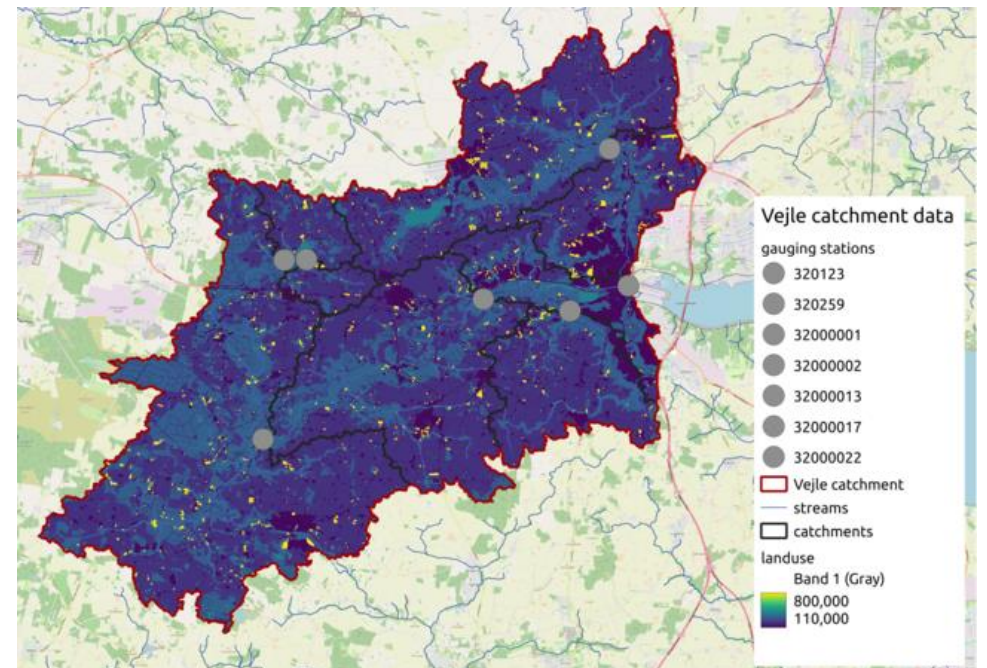
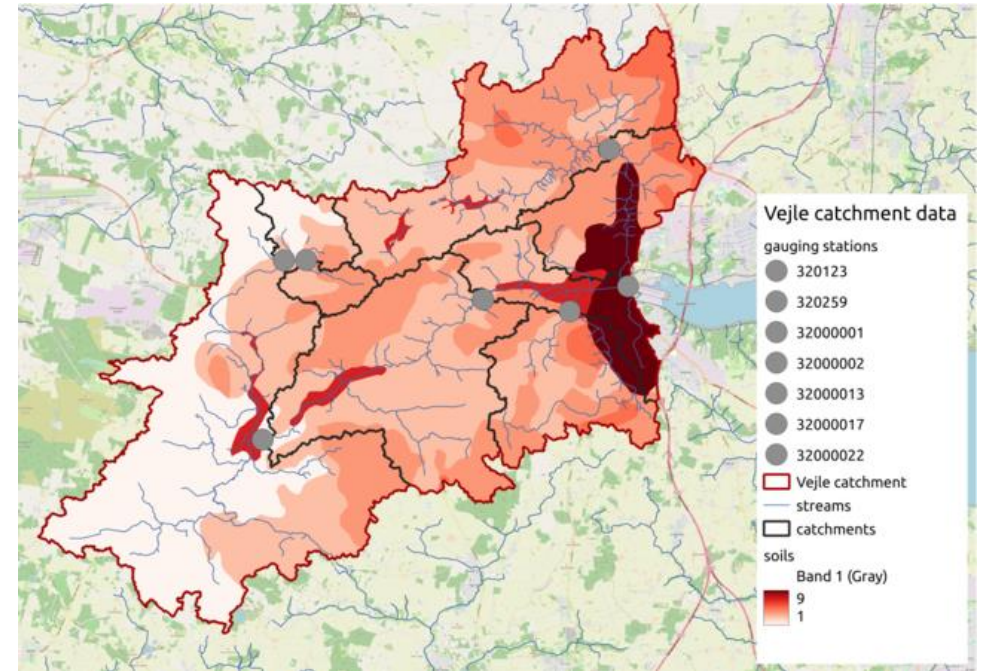
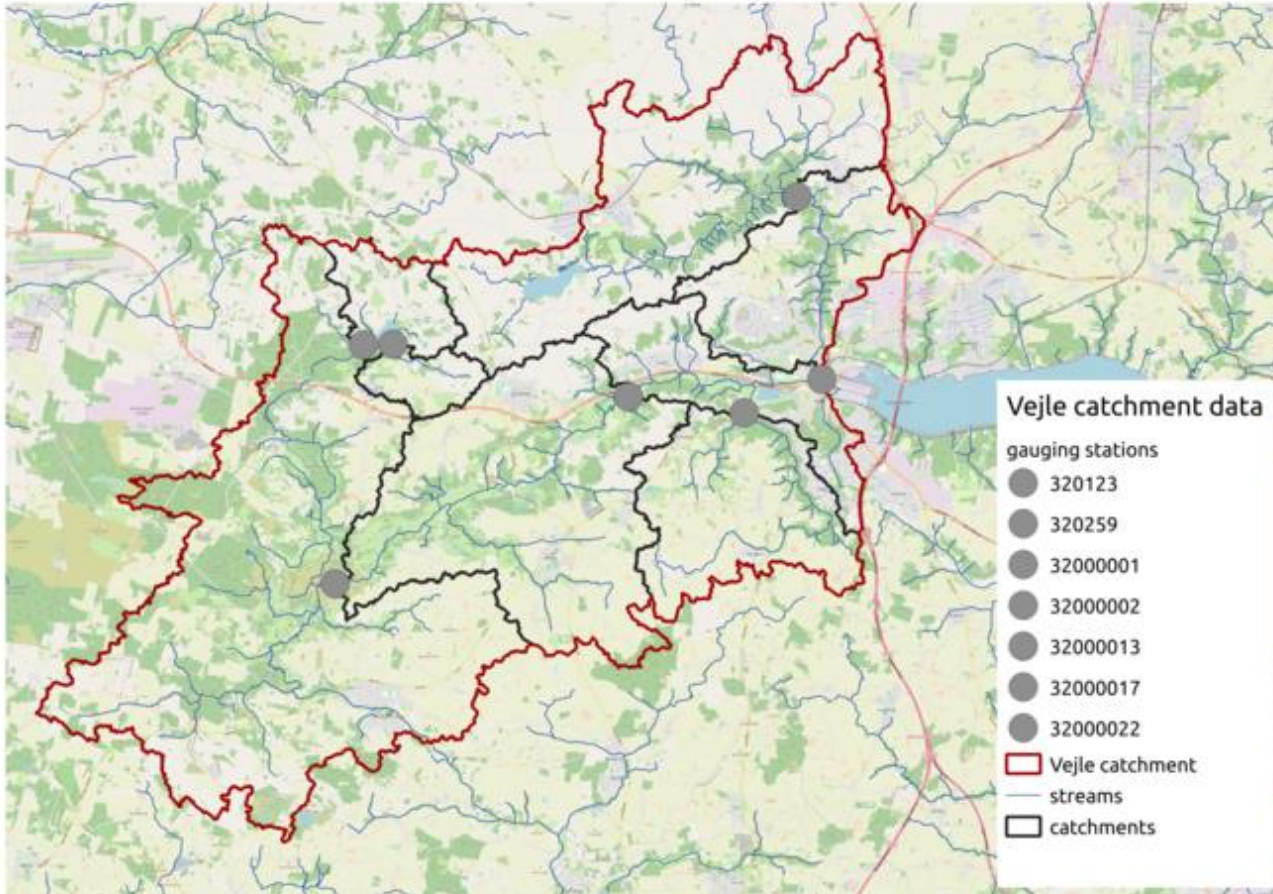
Pilot test case: Vejle

- Udsæt for oversvømmelse fra
 - Vandløb
 - Stormflood (forhøjet vandstand)
 - Skybrud



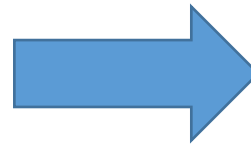
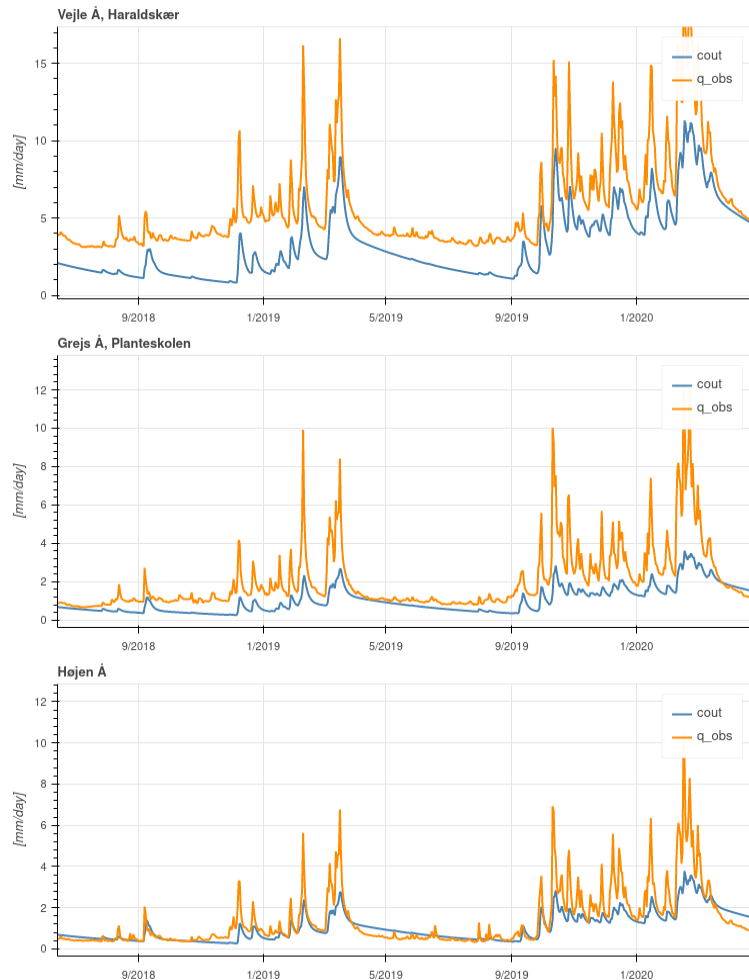
Figur med tilladelse af Paul Landsfedt
Vejle Kommune

Hydrologiske Model for Vejle

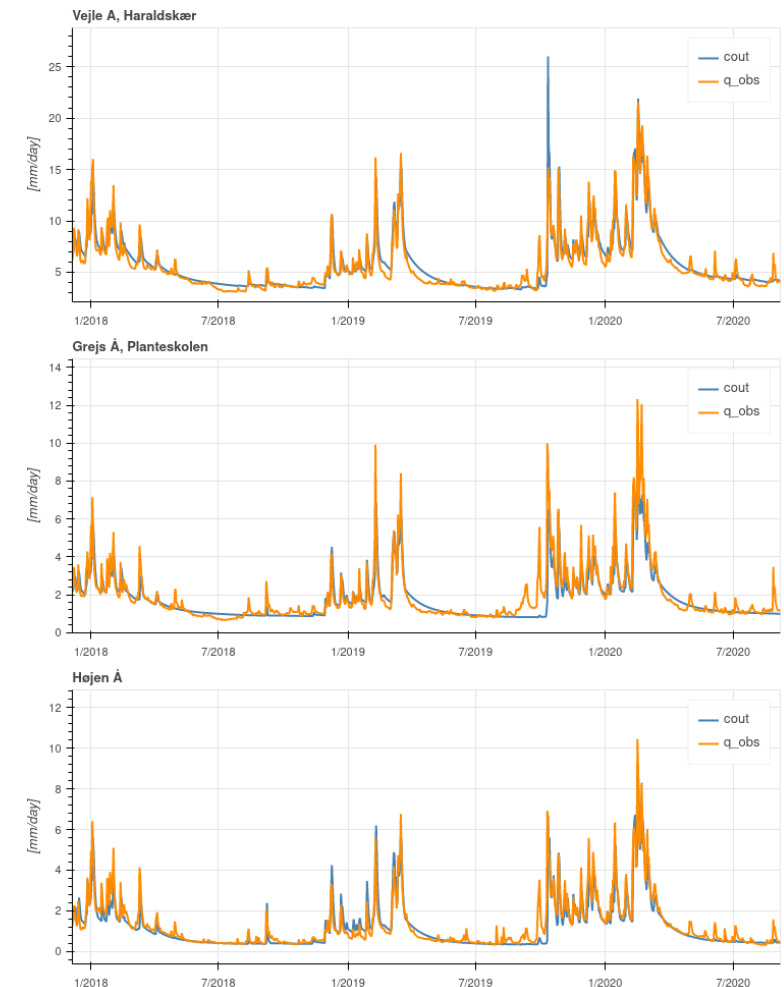


Surface water catchment \neq Groundwater catchment

First test with aquifer (manual adjustments)



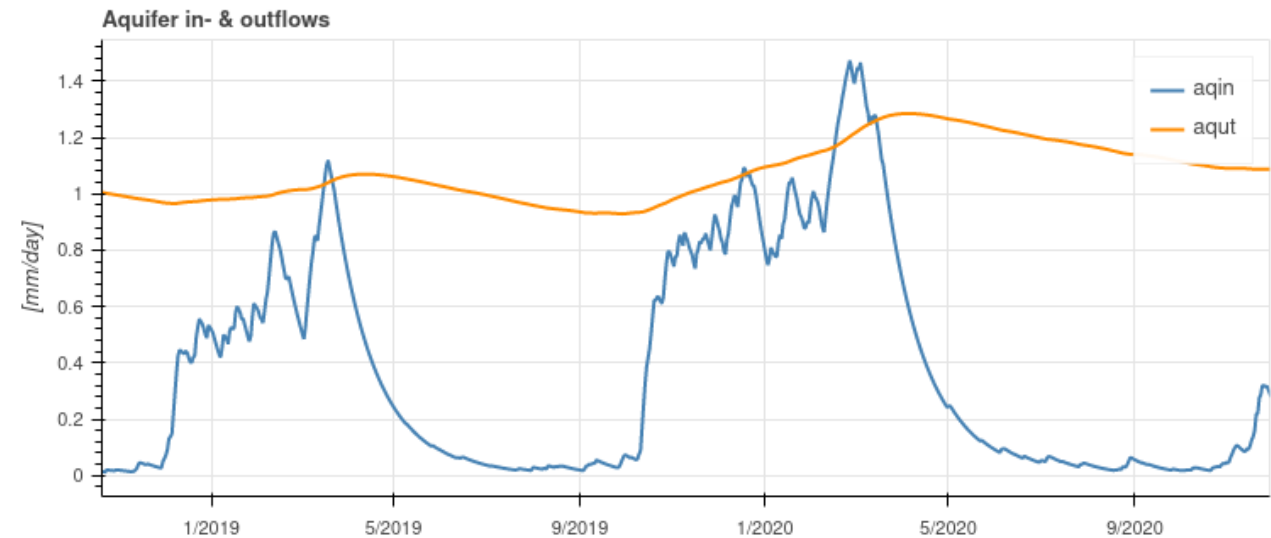
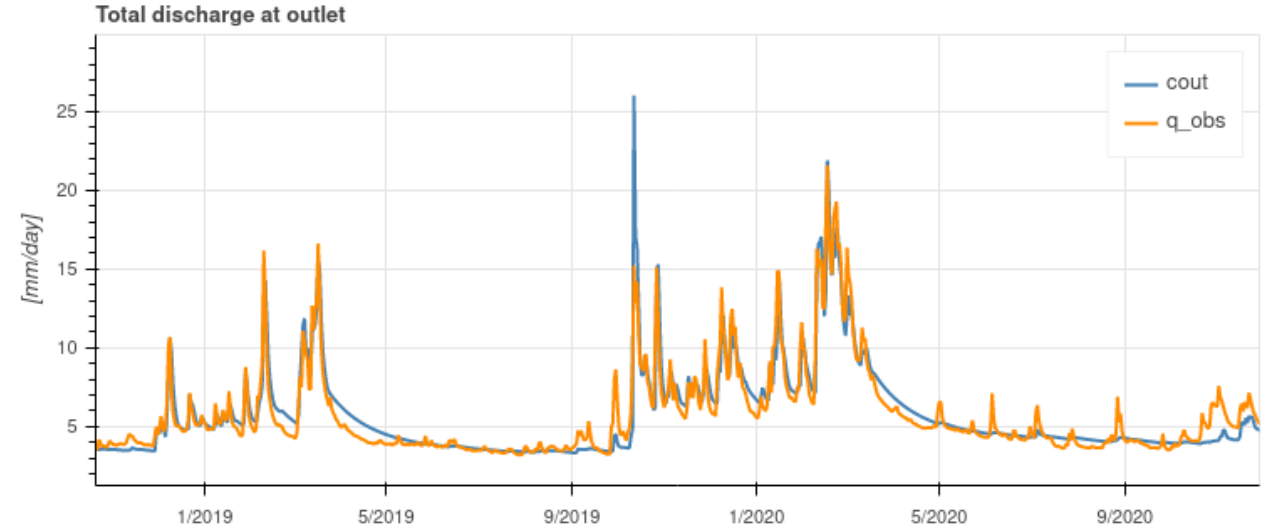
With aquifer, calibrated model with refrac manually calibrated



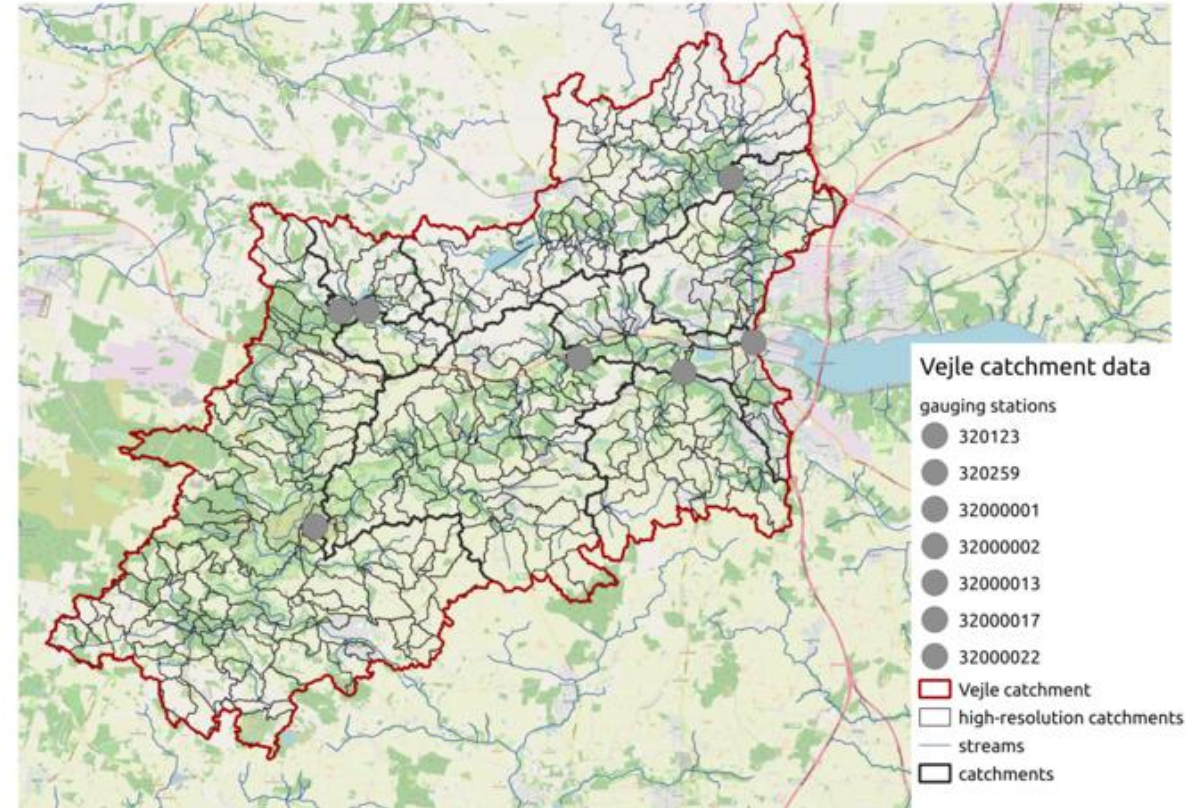
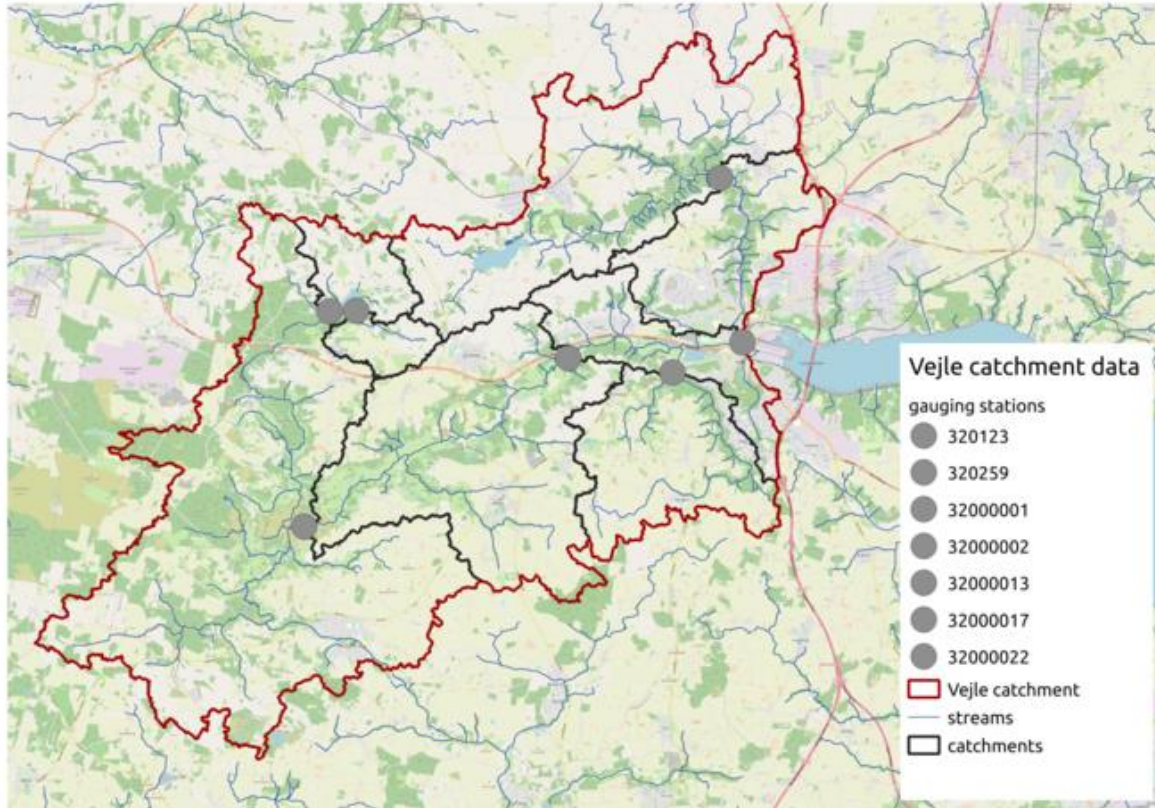
Calibration and validation

- Calibration period: 5.5 years, Validation period: 2.5 years (not overlapping)
- Catches most peaks
- Still work to be done

Station	KGE_cal	KGE_val	NSE_cal	NSE_val
Grejs Å	0.82	0.60	0.77	0.68
Haraldskær	0.91	0.85	0.83	0.83
Højen Å	0.83	0.80	0.72	0.68

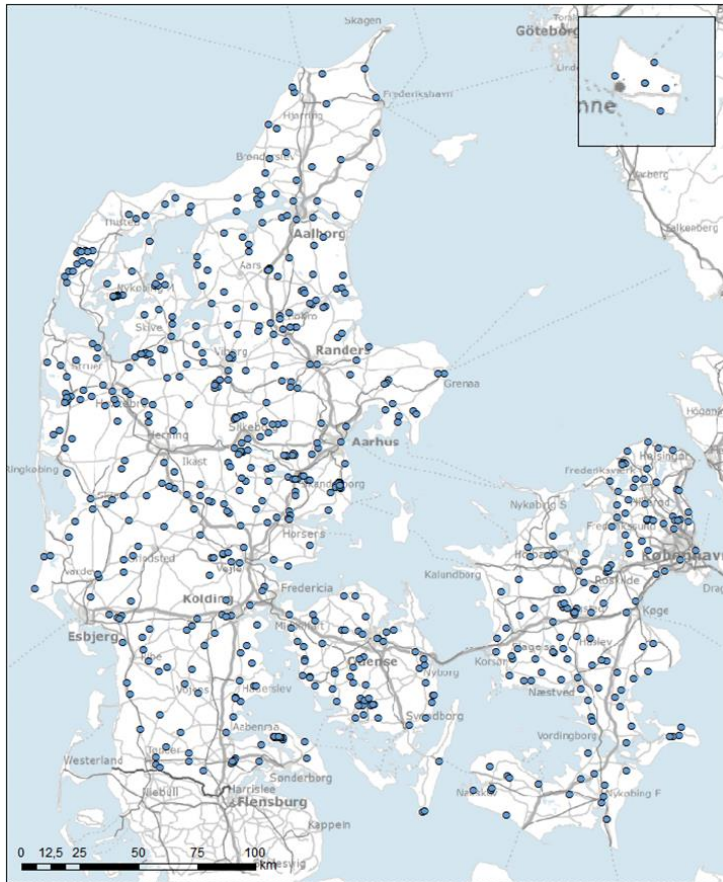


Hydrologiske Model for Vejle

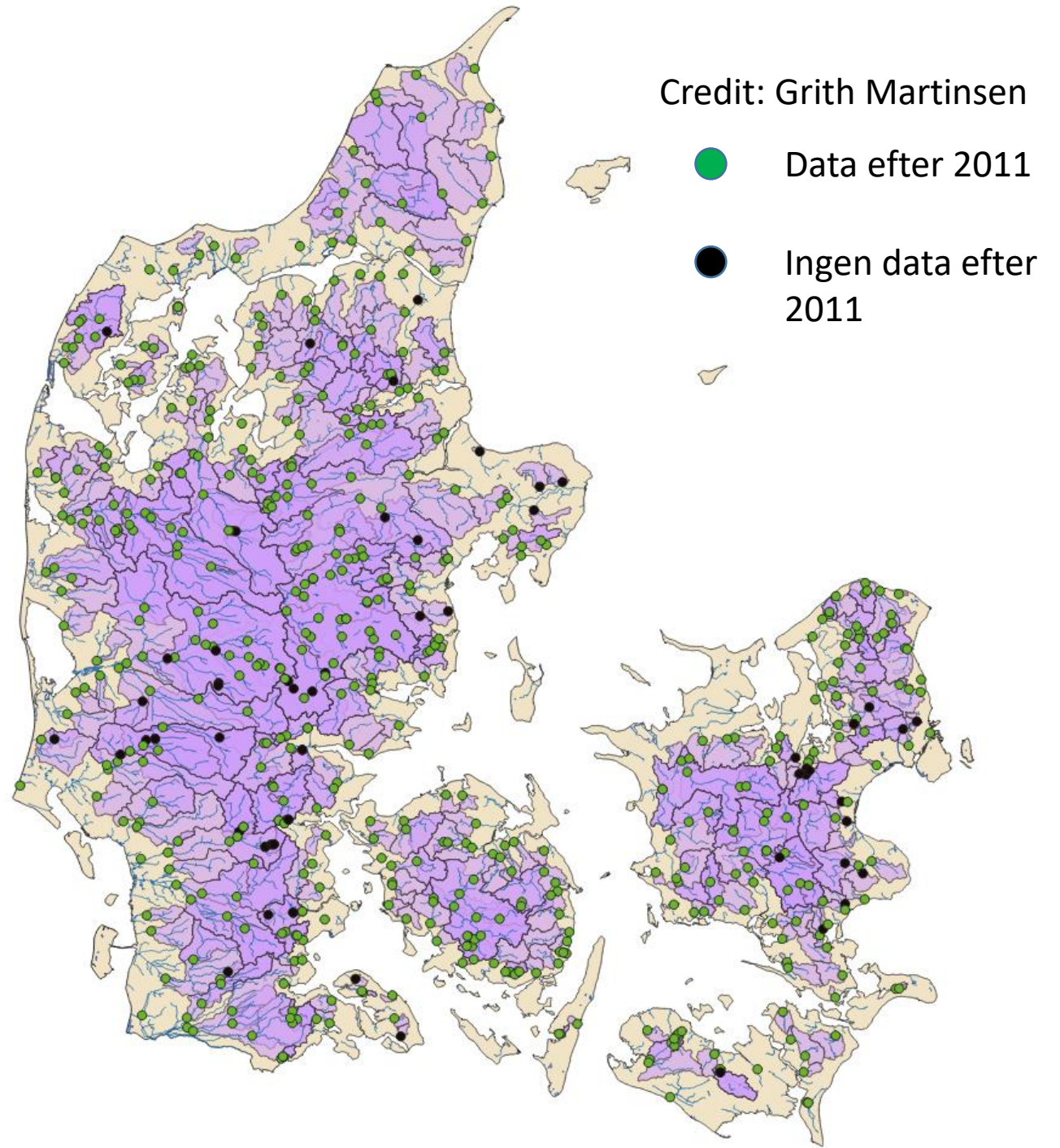




Vandløbsdata i realtid

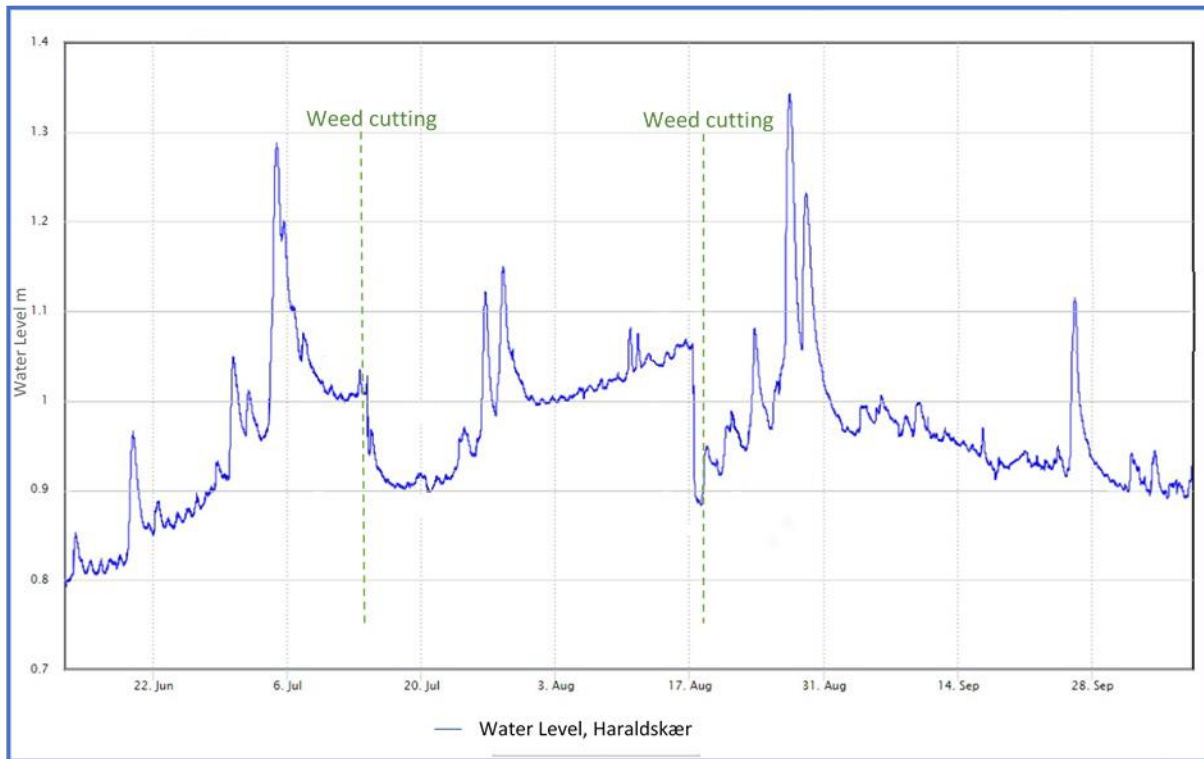


Miljøstyrelsen (MST) ~ 500 (450) gauges
Svarende til ca. 62% af Danmarks areal

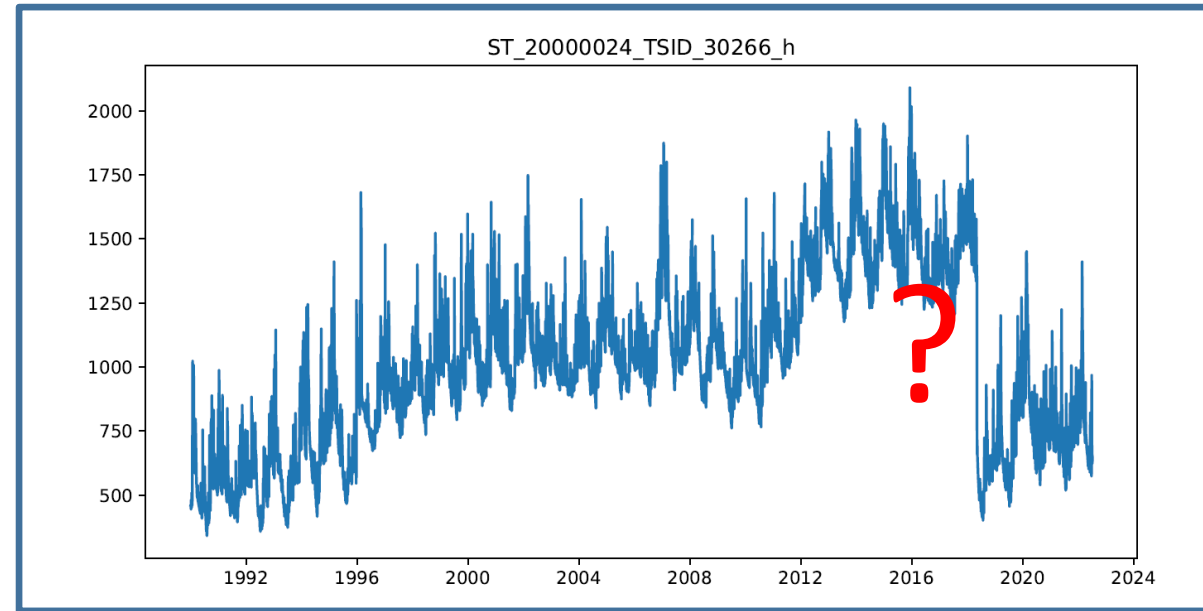
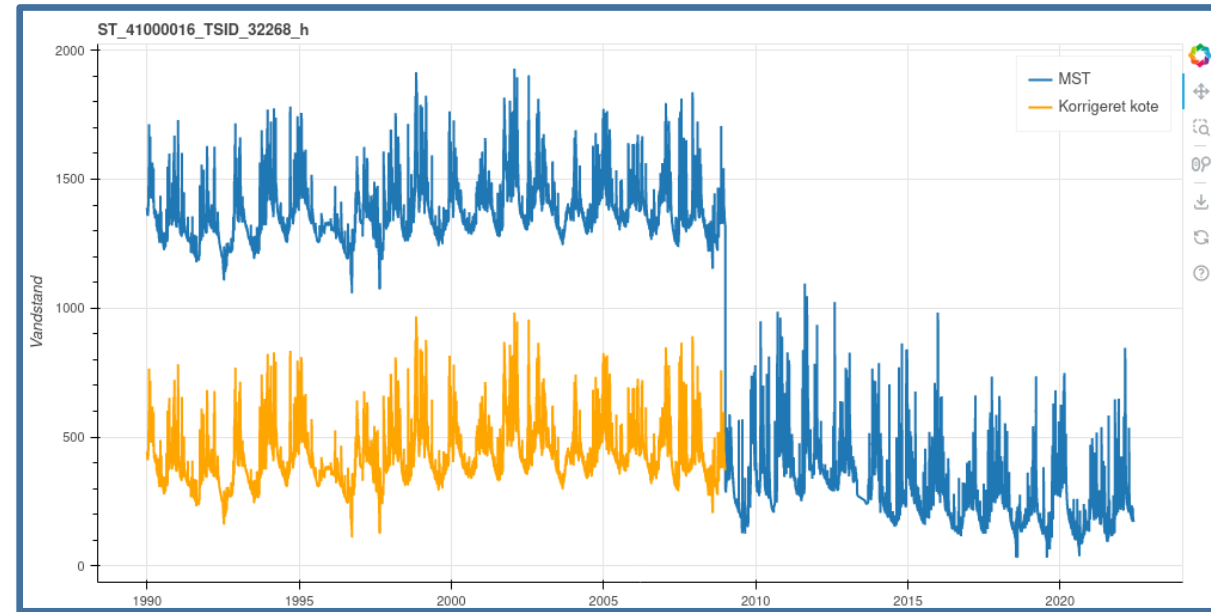


Kvalitetskontrol af vandløbsdata

Grødeskæring

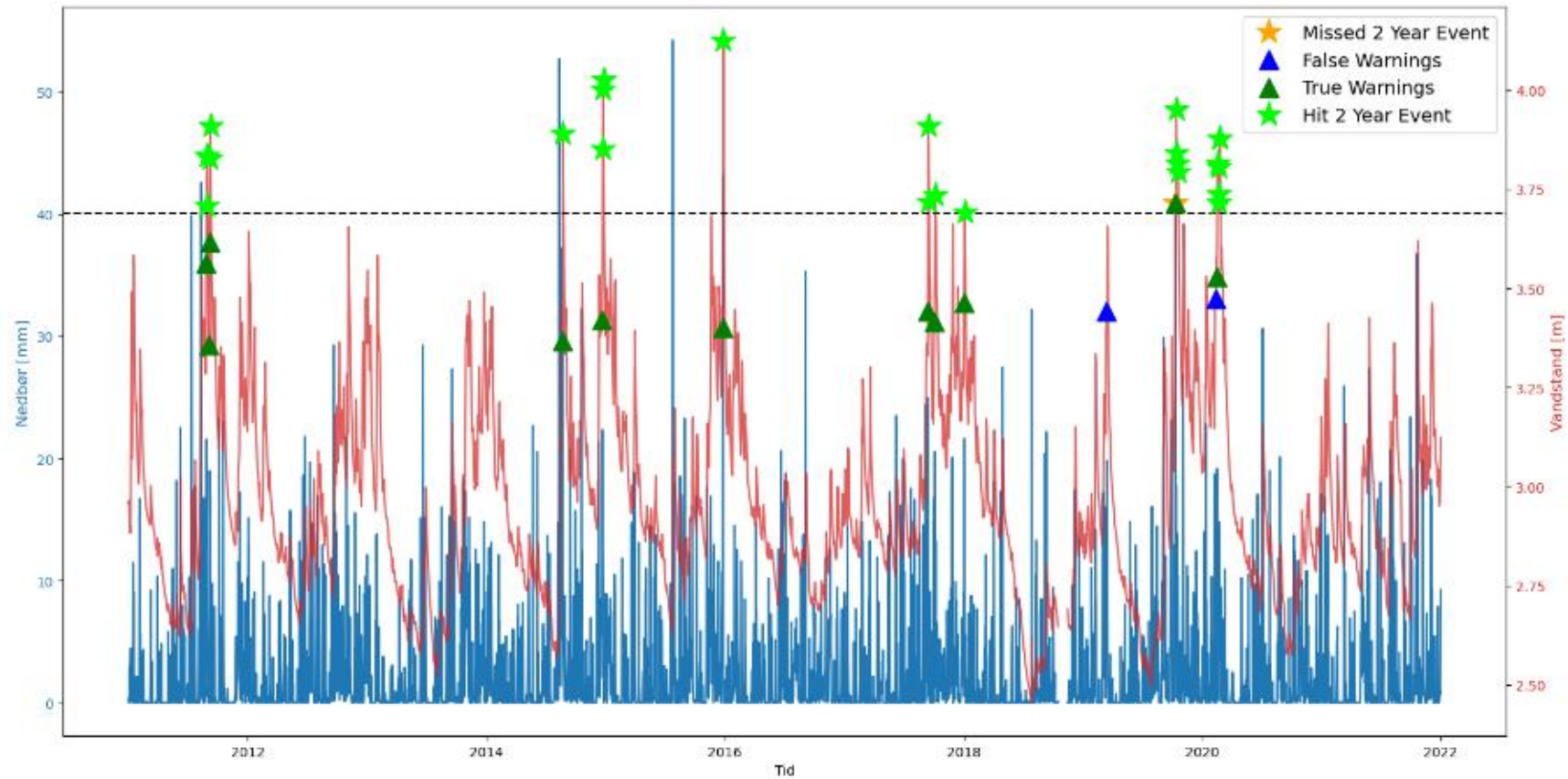


Kote korrektion



Varsling kriterier

Station: 42000021 optimal waterlevel_v: 3.35 Optimal precip_v: 15 #Events hit: 23 #False warnings: 2 #Events missed: 1



Varsling kriterier

Navn	ID	Koordinater (lat-long)	Vandløb	Beskrivelse	Varslings- kriterier 1	Varslings- kriterier 2	Varslings- kriterier 3

Kontakt: mbu@dmi.dk

Acknowledgements

Flooding & Hydrology Unit

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Kimberley Daphnée Suaris

Anne Prytz Henriksen

Mia Valentin Valdbjørn
Rønnelund

Patrick Krøll Brandt

Taus Esben Aabye Møller

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Vejle kommune

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Ulla Pia Geertsen

WaterITec

Dennis Trolle

Anders Nielsen

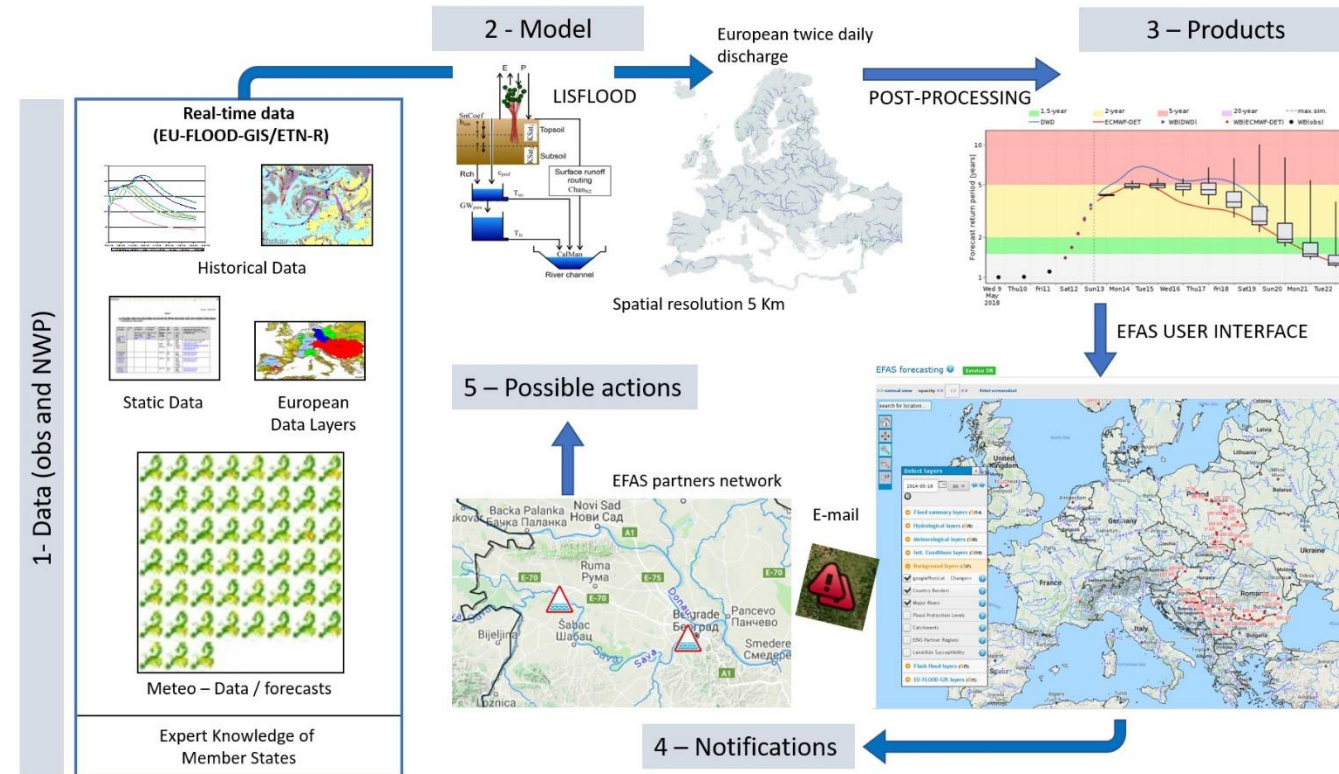
Hvor er vi nu ?

- Etableringen af et national varslings- og prognosesystem med et flerårigt sigte
- DMI har som det første fået til opgave at opstille et varslingsystem baseret på sammenstilling af data
- Fokus i begyndelsen er på varsling til beredskaberne
- Stiller krav til data:
 - Rettidig – nær realtid
 - Robust – 24/7 høj opetid
 - Repræsentativ – rigtig rumlig og tidslig oplysning
 - Både landsdækkende og lokalt
 - Pålidelig – tilstrækkelig kvalitet til varsling
- Fra 2023 (FL23) er vi i gang med udvide den samlede løsning med en national hydrologiske prognoser system, efter samme principper som vore meteorologiske og oceanografiske prognosesystemer
- Det videre arbejde vil kræve fortsat dialog med en lang række aktører og interessenter



EFAS – European Flood Awareness System

- Part of Copernicus Emergency Management Service
- Continental scale hydrological forecasting
- 24/7 operational service
- “Regional” flood notifications
- Does not stand alone, local interpretation and flood forecasting systems are needed



DMI raingauge netværk

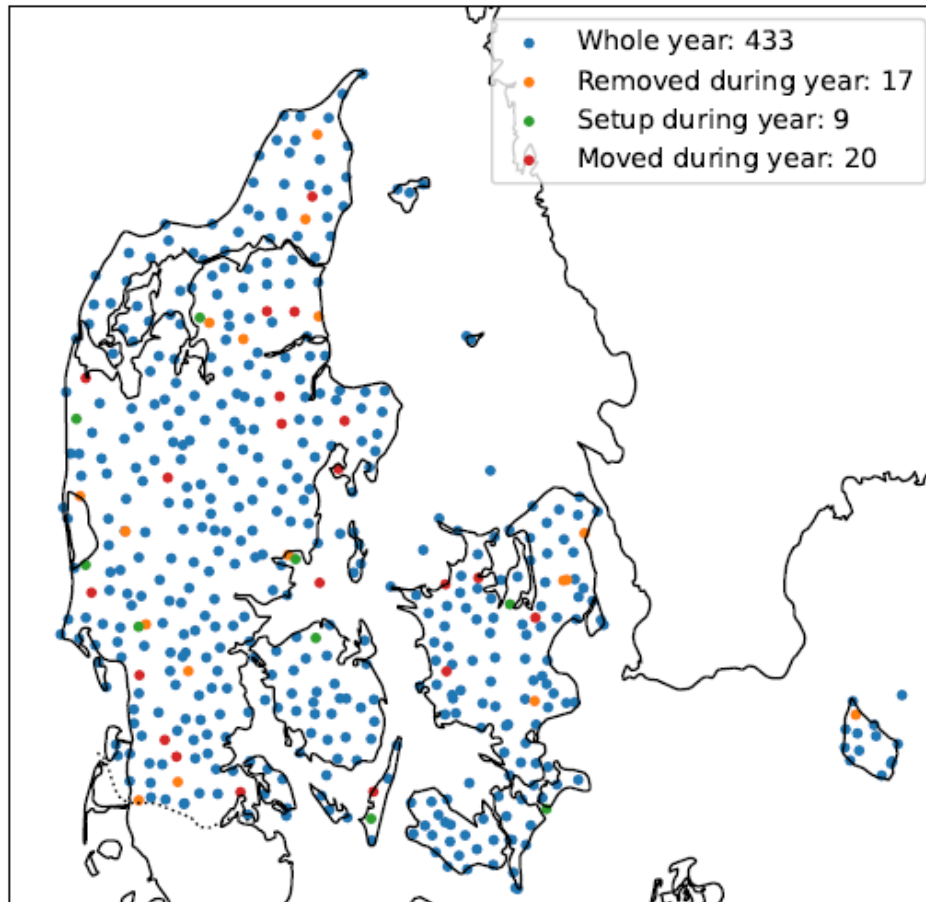
Credit:

Jonas Bruun Hubrechts & Rasmus Lau Thejlade Henriksen (2022)

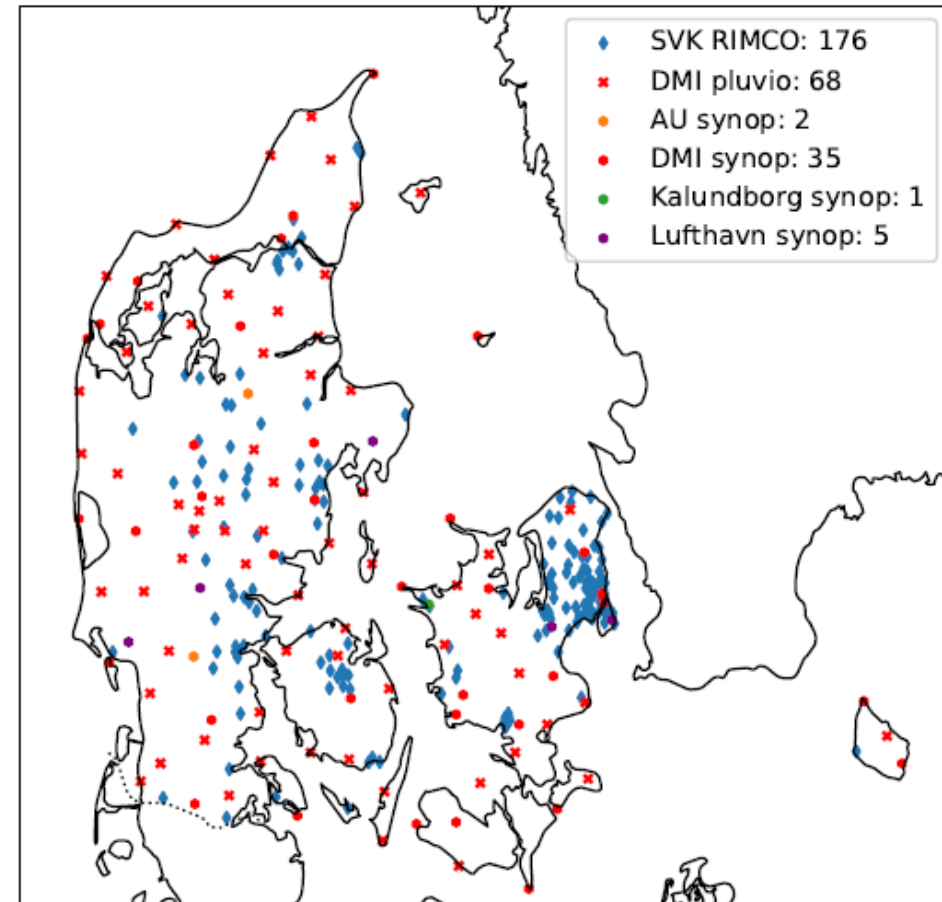
**Rain-gauge network evaluation and optimization
using geostatistics**

B.Sc DTU Compute & DMI.

Courtesy of Jonas W Pedersen



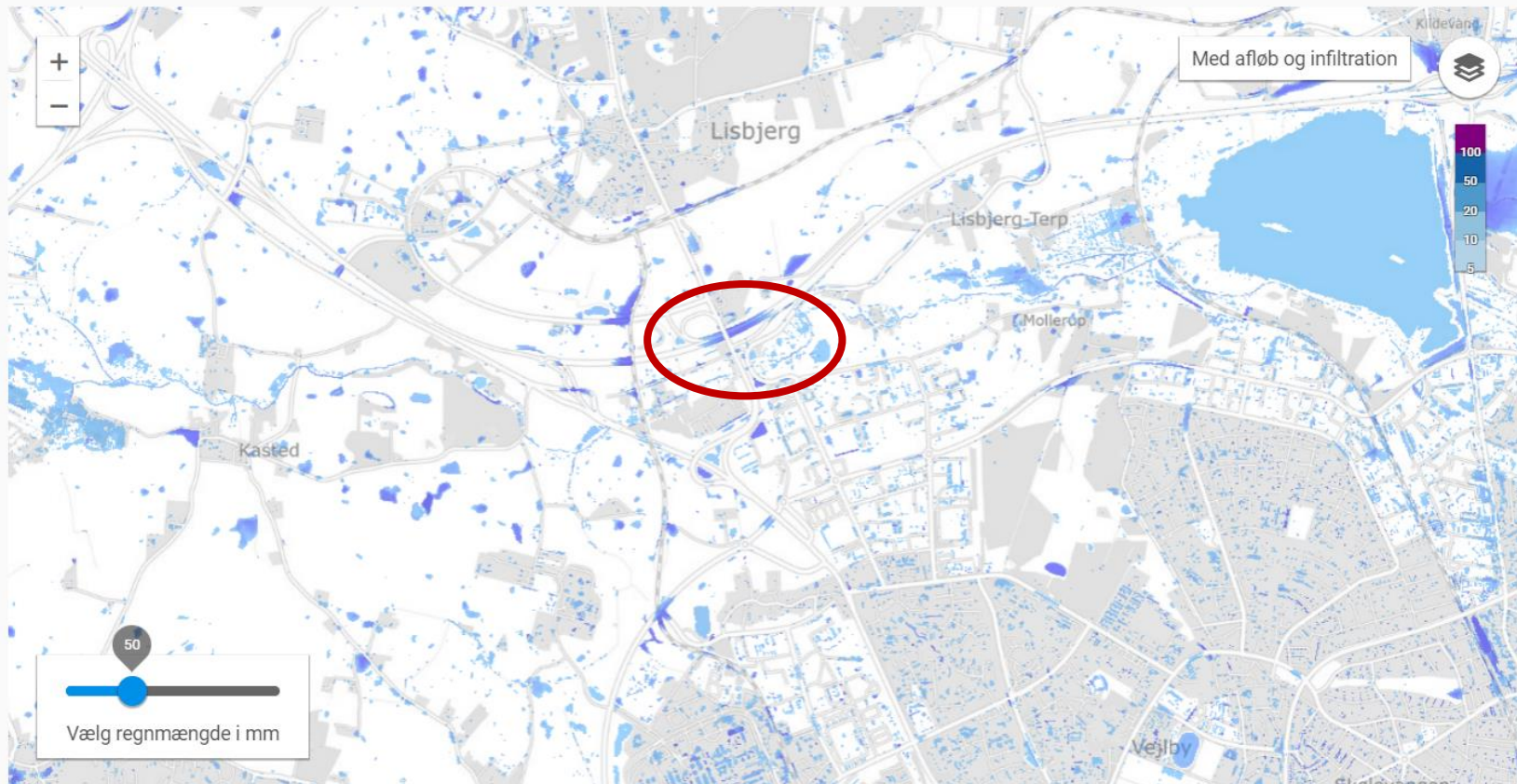
Daily rain gauge network 2006



Automatic rain gauge network Feb 2020

Skybrud - falde mere end 15 mm på 30 min

Oversvømmelseskortene er udarbejdet og leveres af Scalgo.



Baggrundskort © 2023 Styrelsen for Dataforsyning og Infrastruktur

Gammelt eksempel

Egå 24,4 mm/30 minutes

Total 51,6 mm/6h

