

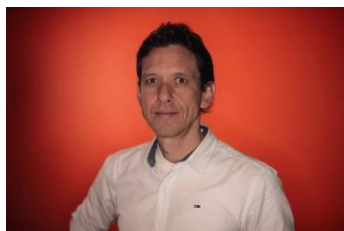


**Pandemic and Disaster
Preparedness Center**

PDPC

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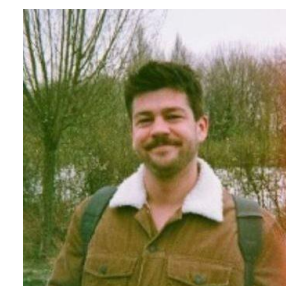
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And a lot more...

Presentation outline

- Mosquitoes are coming?
- Land use change scenarios/Climate modeling
- Evaluation Flake
- Inundation experiment



Bzzzzzz...



Are they coming?



'Airport malaria' on the rise in Europe, new study suggests: Here's what travelers should know

Tiger mosquitoes behind dengue fever rise in Europe

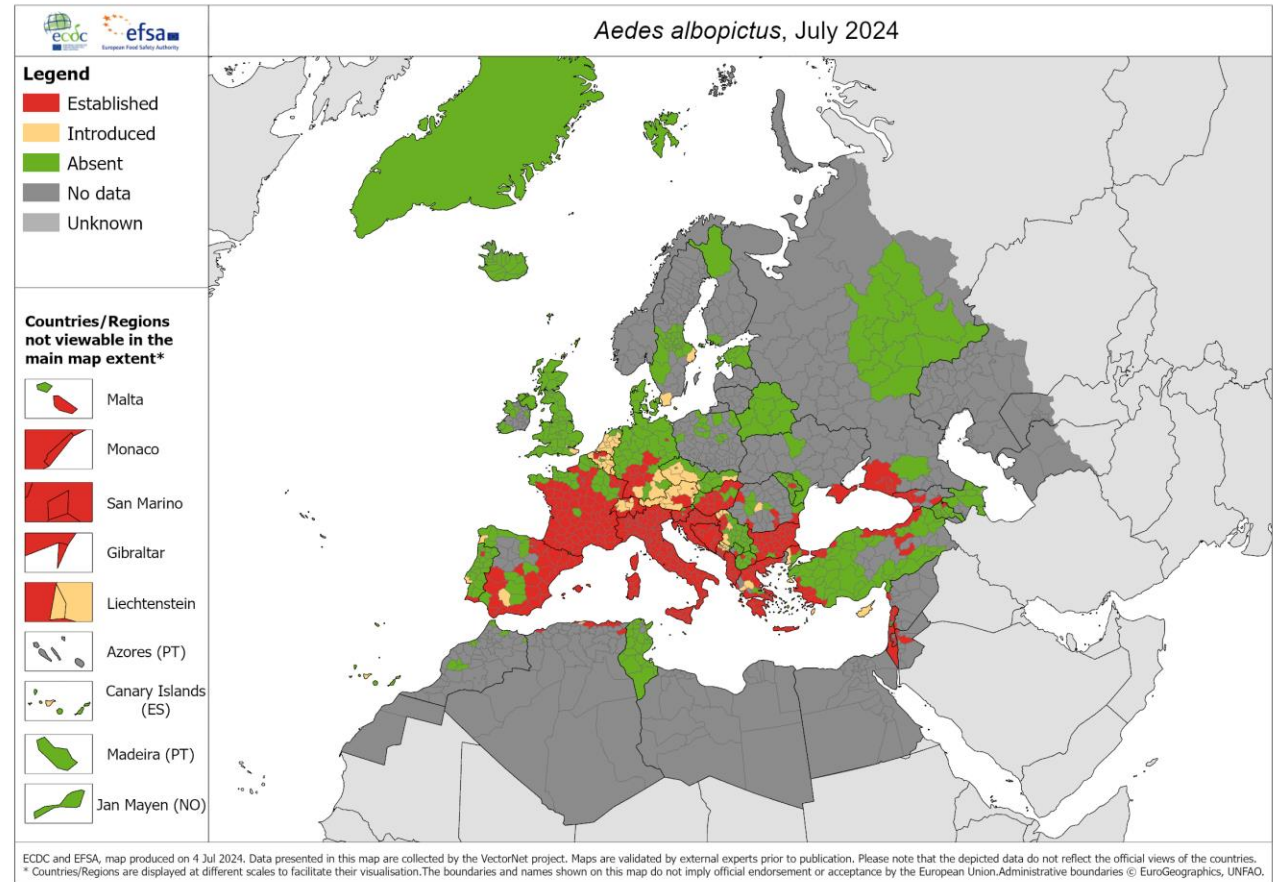
Mosquito-borne diseases spreading in Europe due to climate crisis, says expert

West Nile virus death toll and cases continue to soar in Italy. This is what we know so far

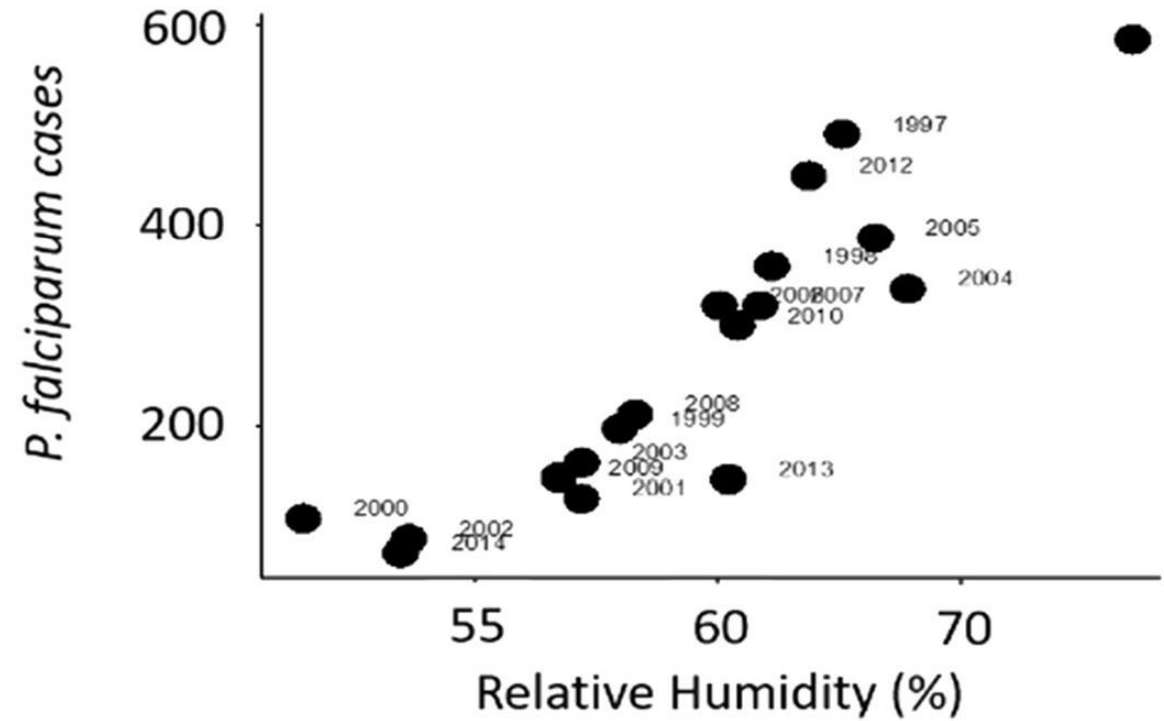
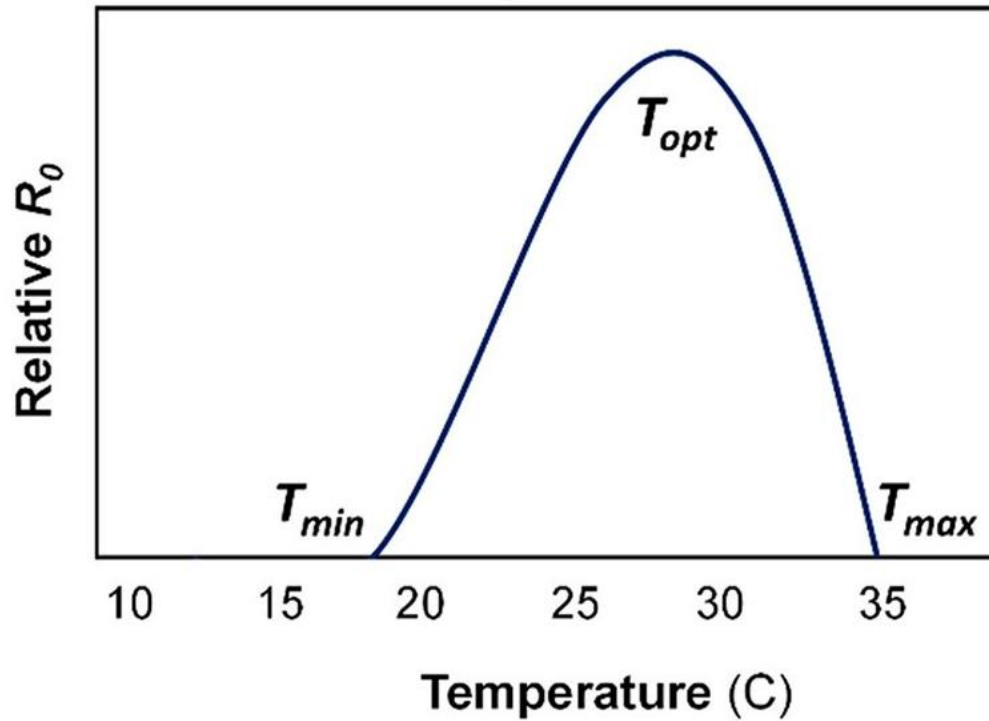
Dengue fever: Popular European holiday hotspots at risk of being hit by tropical disease, warn UK scientists

Are they coming?

- Climate change and land use change: effect on the distribution of mosquitoes, such as Tiger mosquito (*Aedes Albopictus*)?
- Relation salinity and malaria mosquito (*Anopheles Atroparvus*)?
- Birds are long-distance carriers of West Nile Virus

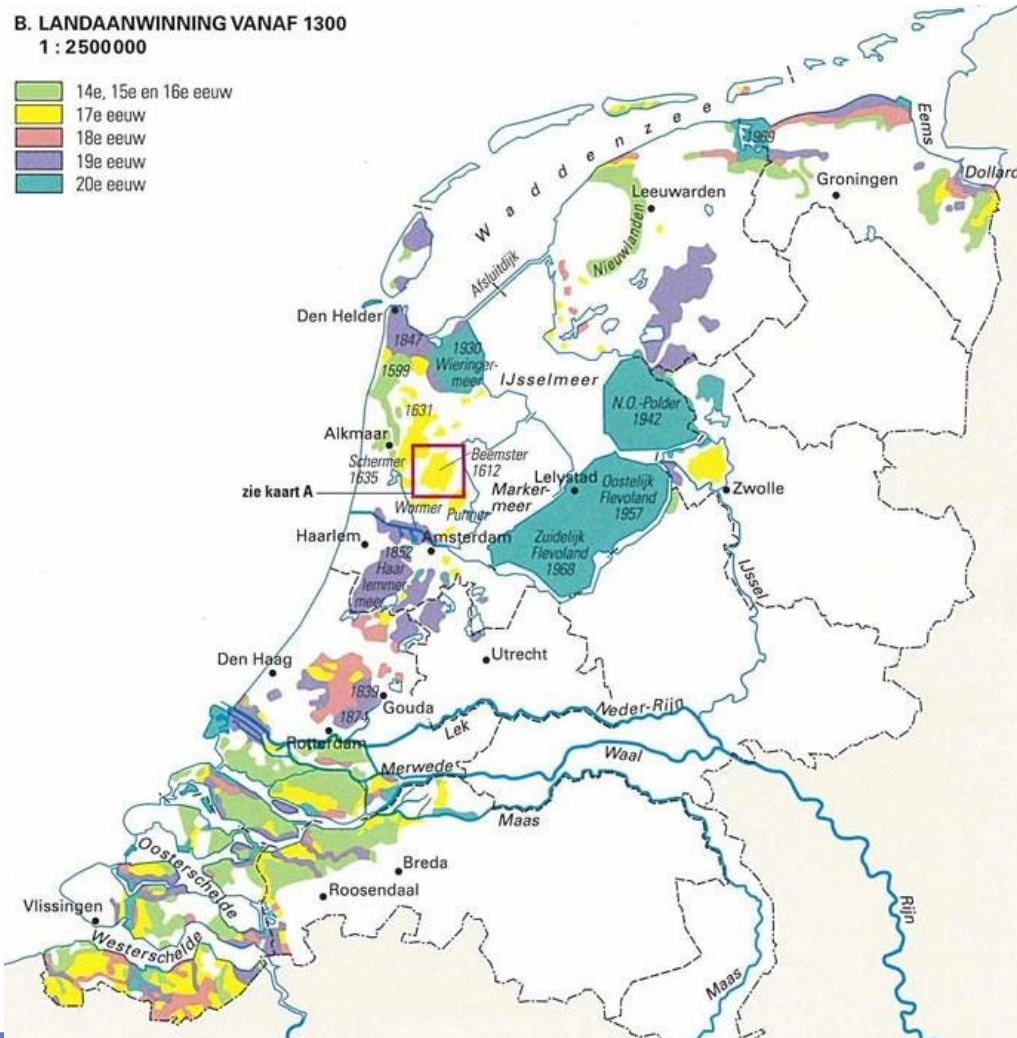


What do mosquitoes like?



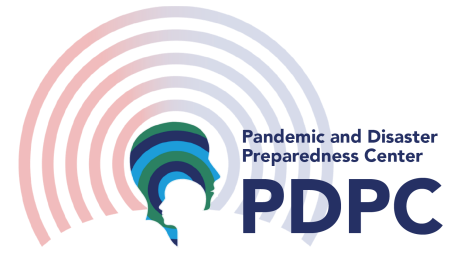
Short history of Dutch water management and mosquitoes

B. LANDAANWINNING VANAF 1300
1 : 2500000



- Swamps are ideal habitats for mosquitoes → Mal - Aria
- Malaria until mid 20th century
- DDT campaigns
- Or ... land reclamation??

Now: creating wetlands!



- Climate adaptation: water buffer
- Recreation

Methods: Climate modeling

- Harmonie Climate (KNMI)
- 1 km resolution
- Convection permitting
- Lake model: FLAKE
- Land use input: ECOCLIMAP-SG

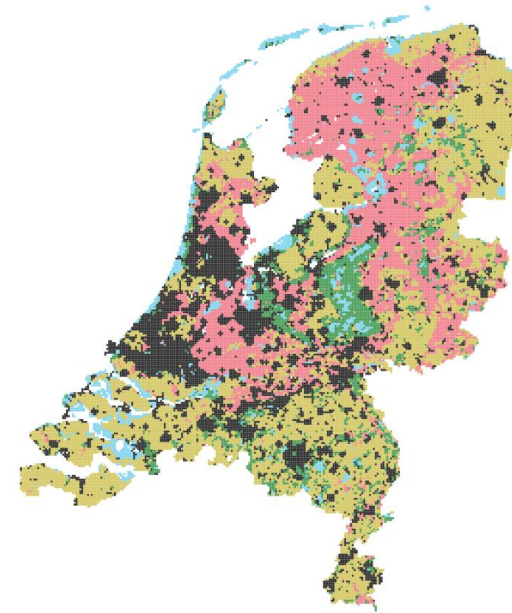
- Now running: 2018-2022
- Double nested set-up:
RACMO → HCLIM → HCLIM



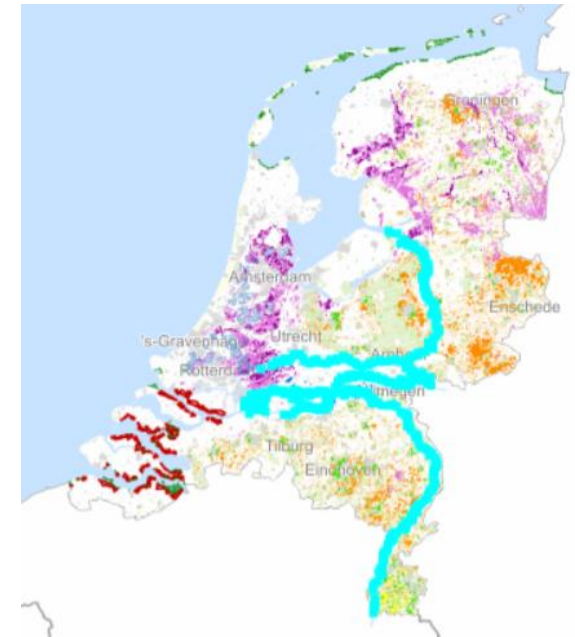
Methods: Land use scenario

- SSP scenarios Martha Dellar
- Water storage possibilities from Climate Adaptation Services (CAS)
- (Nieuwe Deltascenario's)

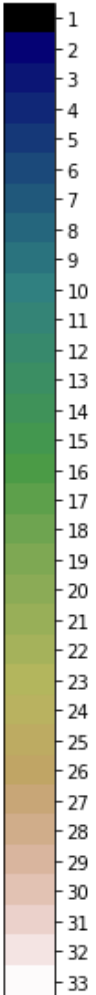
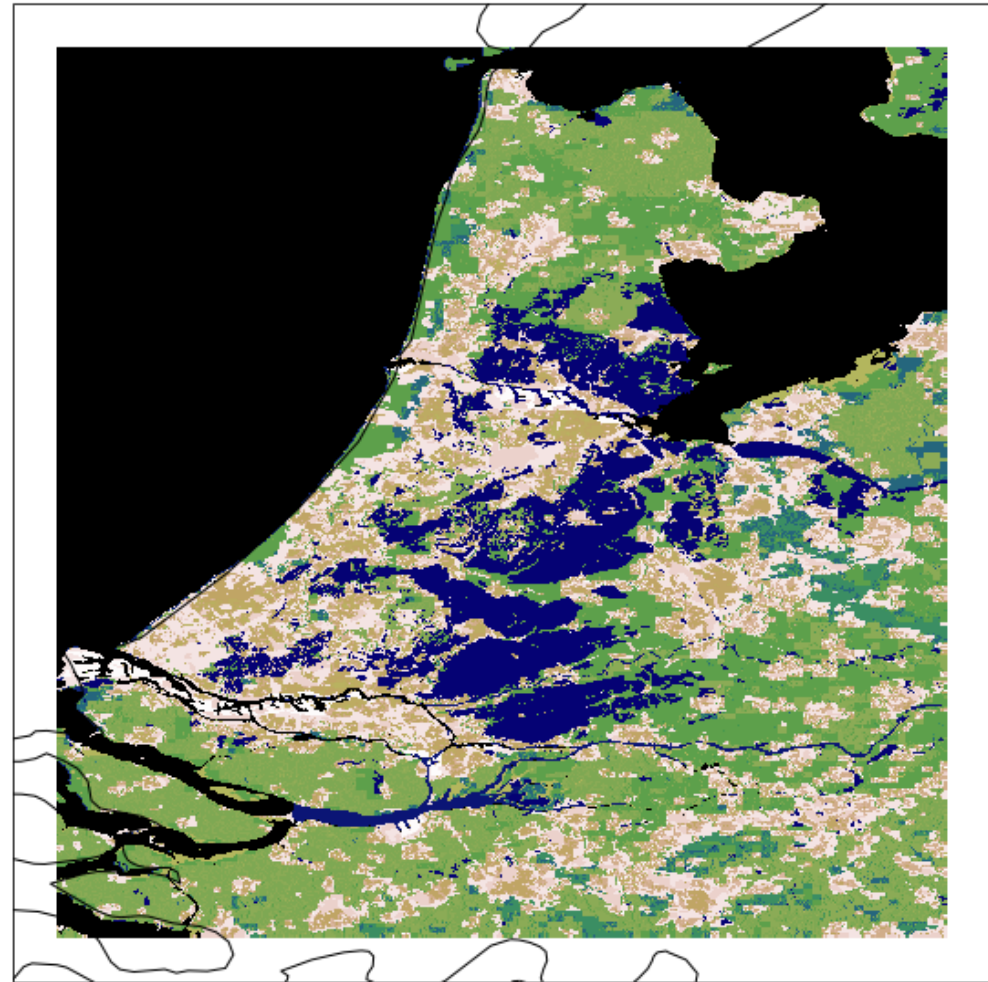
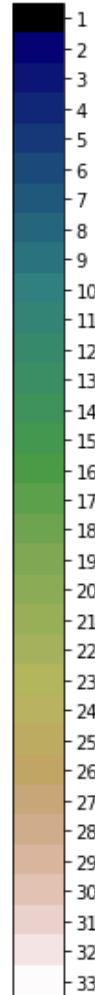
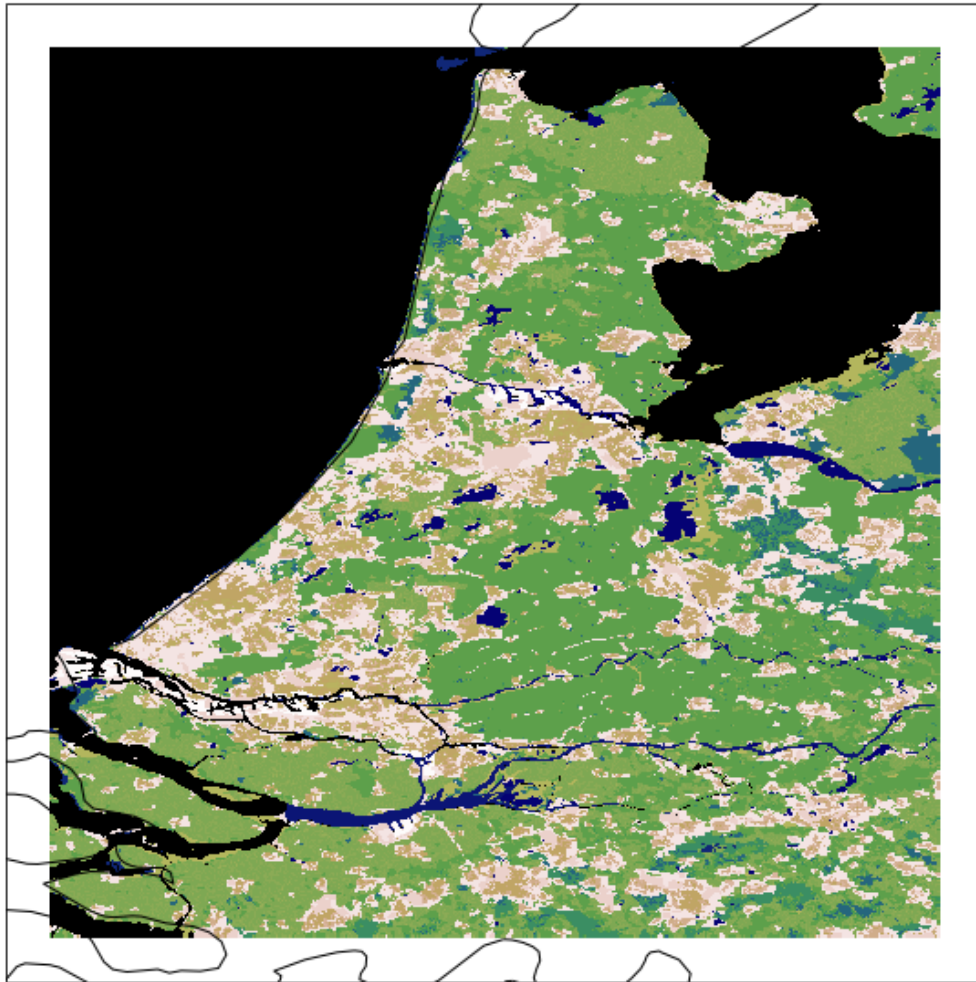
SSP5



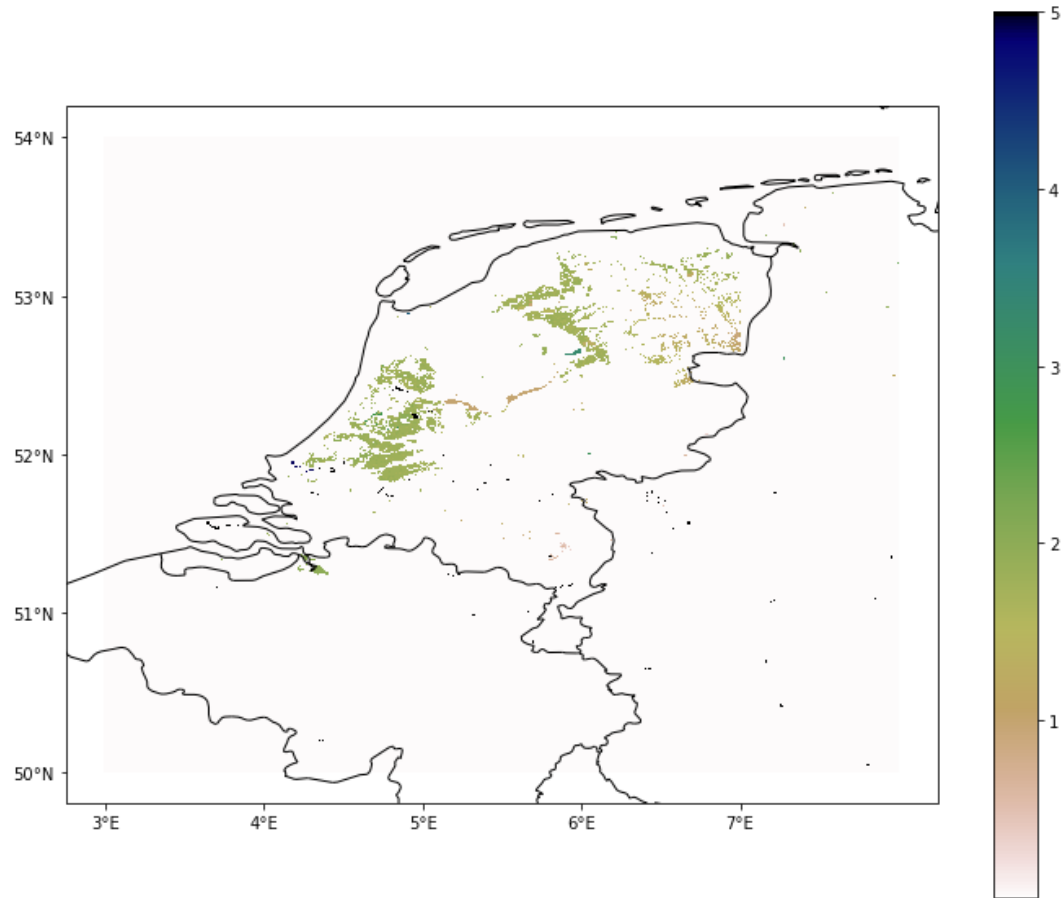
All land uses



ECOCLIMAP → SSP5+CAS



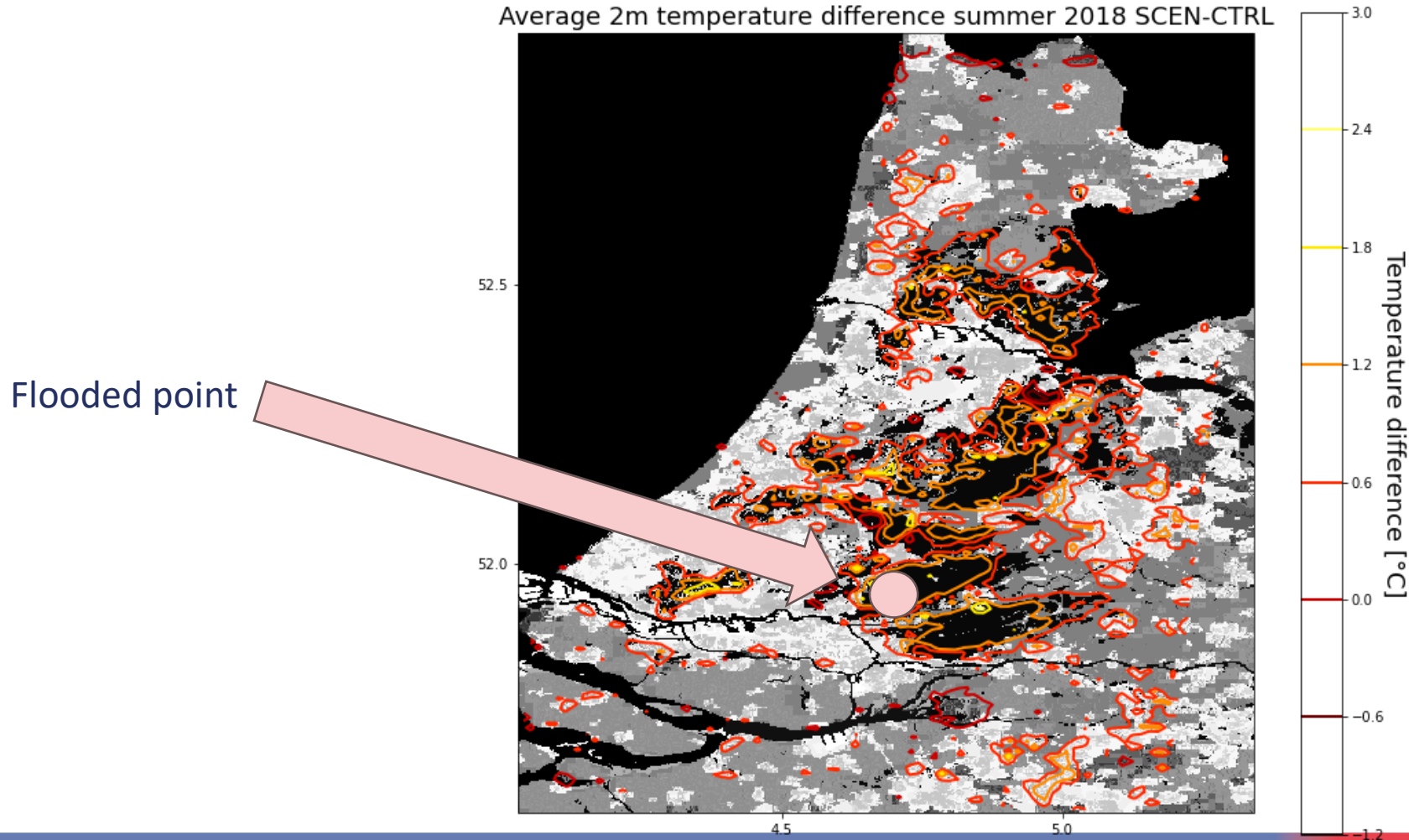
Methods: Land use scenario



- New depths between 10-210 cm
- Scaled with height map of the Netherlands

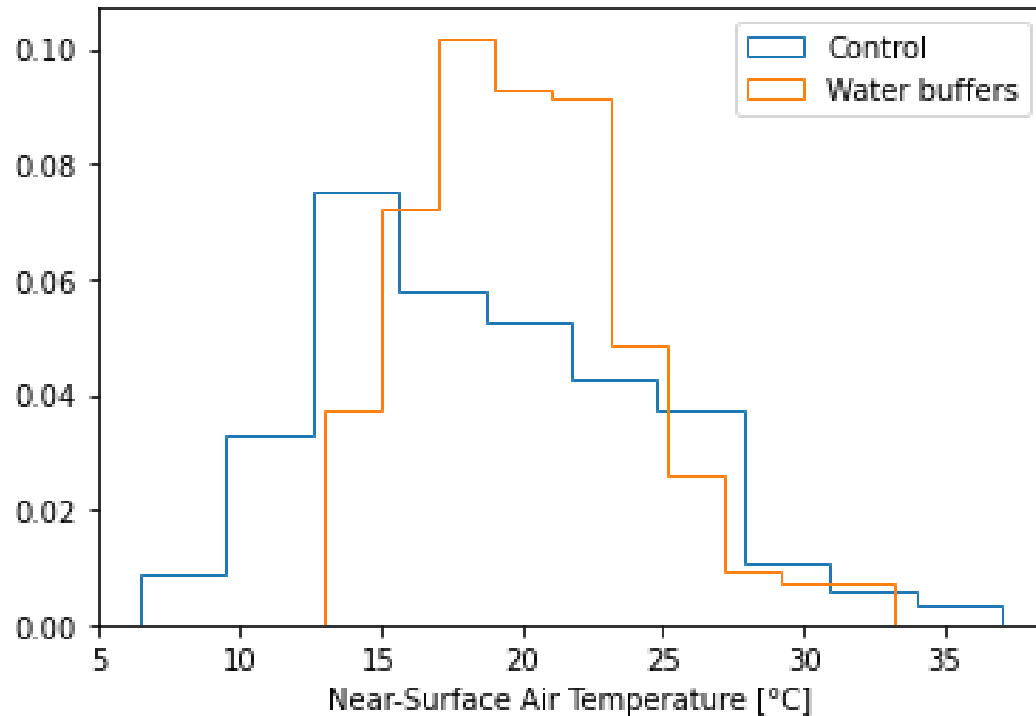
Sneak peek: what do we see?

Average 2m temperature difference summer 2018 SCEN-CTRL

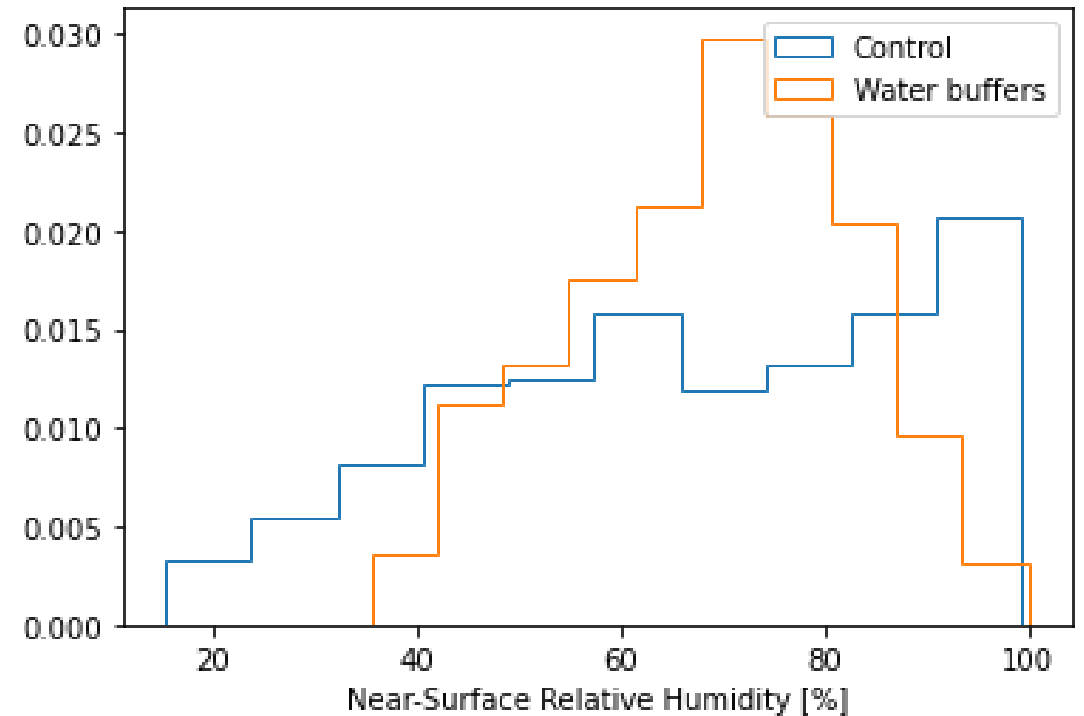


Sneak peek: what do we see?

Pdf over summer 2018 at (51.95, 4.7)

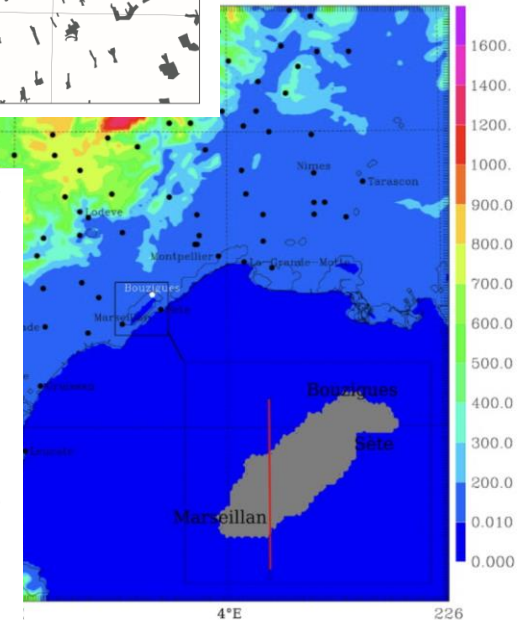
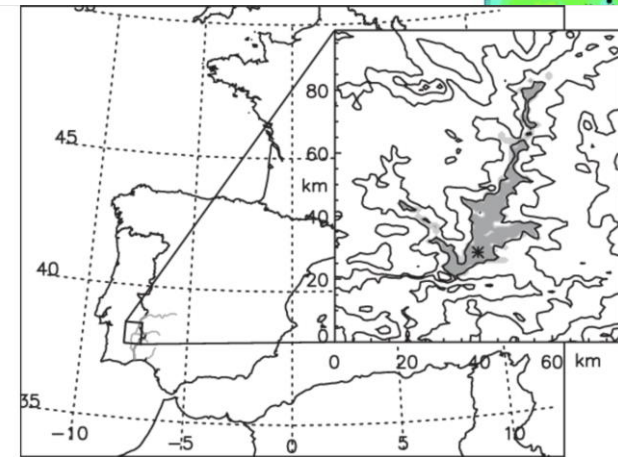
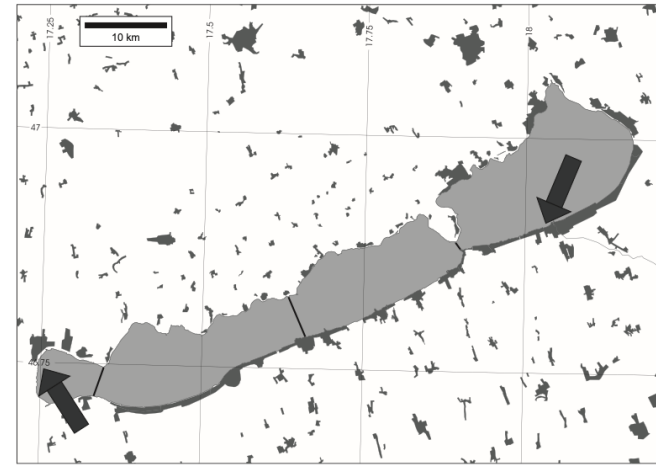


Pdf over summer 2018 at (51.95, 4.7)



At the moment: evaluation of Flake

- Evaluations done in France¹, Hungary³, Portugal² show Flake performs well
- But: lakes of different size, depth and location, compared to the Netherlands

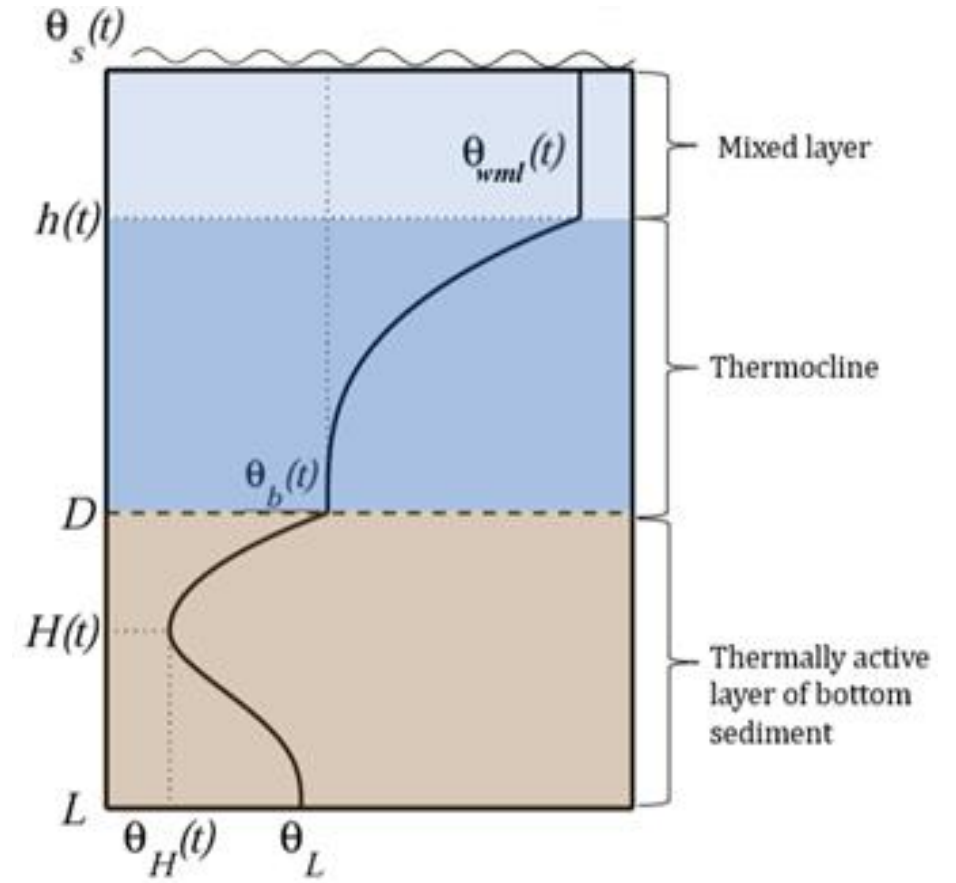


1. Le Moigne, P, et al.. "Evaluation of the lake model FLake over a coastal lagoon during the THAUMEX field campaign". *Tellus A: Dynamic Meteorology and Oceanography*, vol. 65, no. 1, 2013, pp. 209-252.
 2. Potes, M, et al.. "Lake-atmosphere interactions at Alqueva reservoir: a case study in the summer of 2014". *Tellus A: Dynamic Meteorology and Oceanography*, vol. 69, no. 1, 2017, p. 1272787.
 3. Vörös, M. & Lstvánovics, V. & Weidinger, Tamas. (2010). Applicability of the FLake model to Lake Balaton. *Boreal Environment Research*. 15. 245-254.

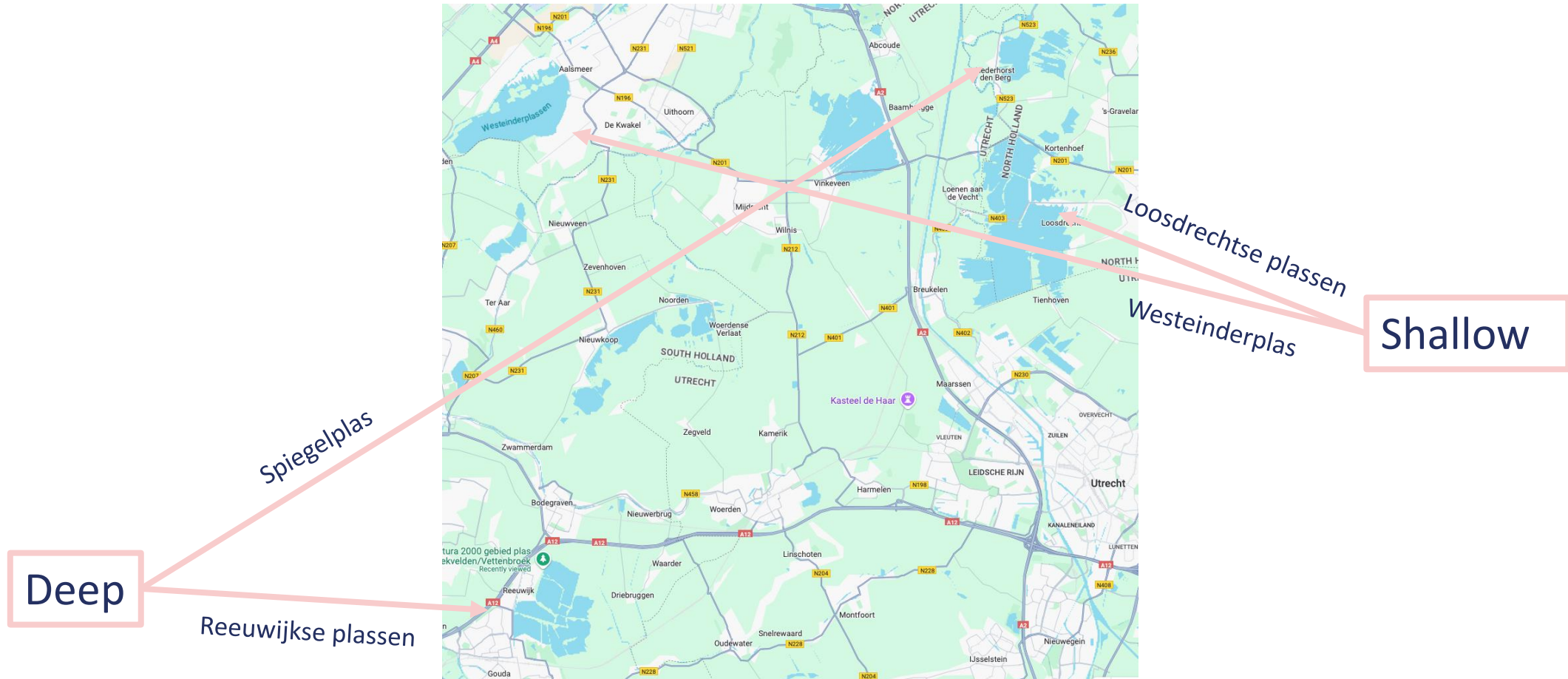
This study: evaluation of FLAKE in the Netherlands

Comparison to lake observations by water boards:

- Monthly measurements of surface temperature
- How well does Flake simulate surface temperature, depending on season and depth?

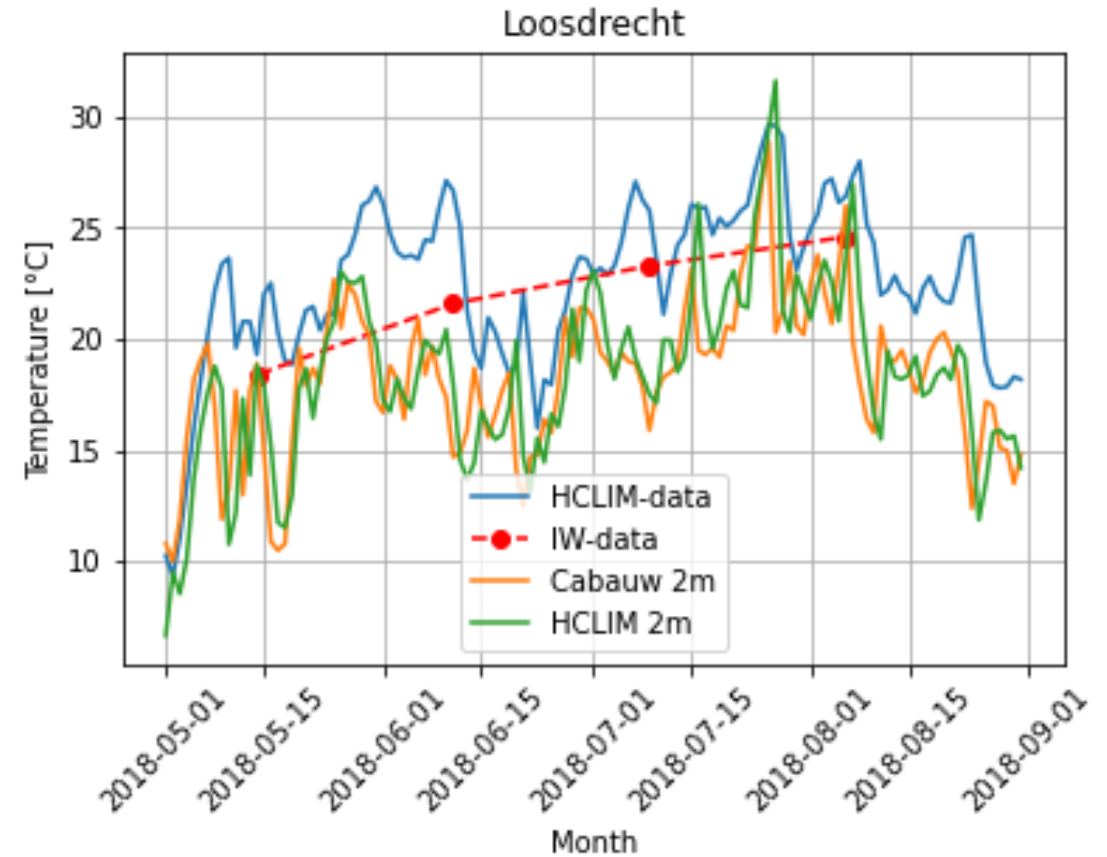


Cases: deep and shallow

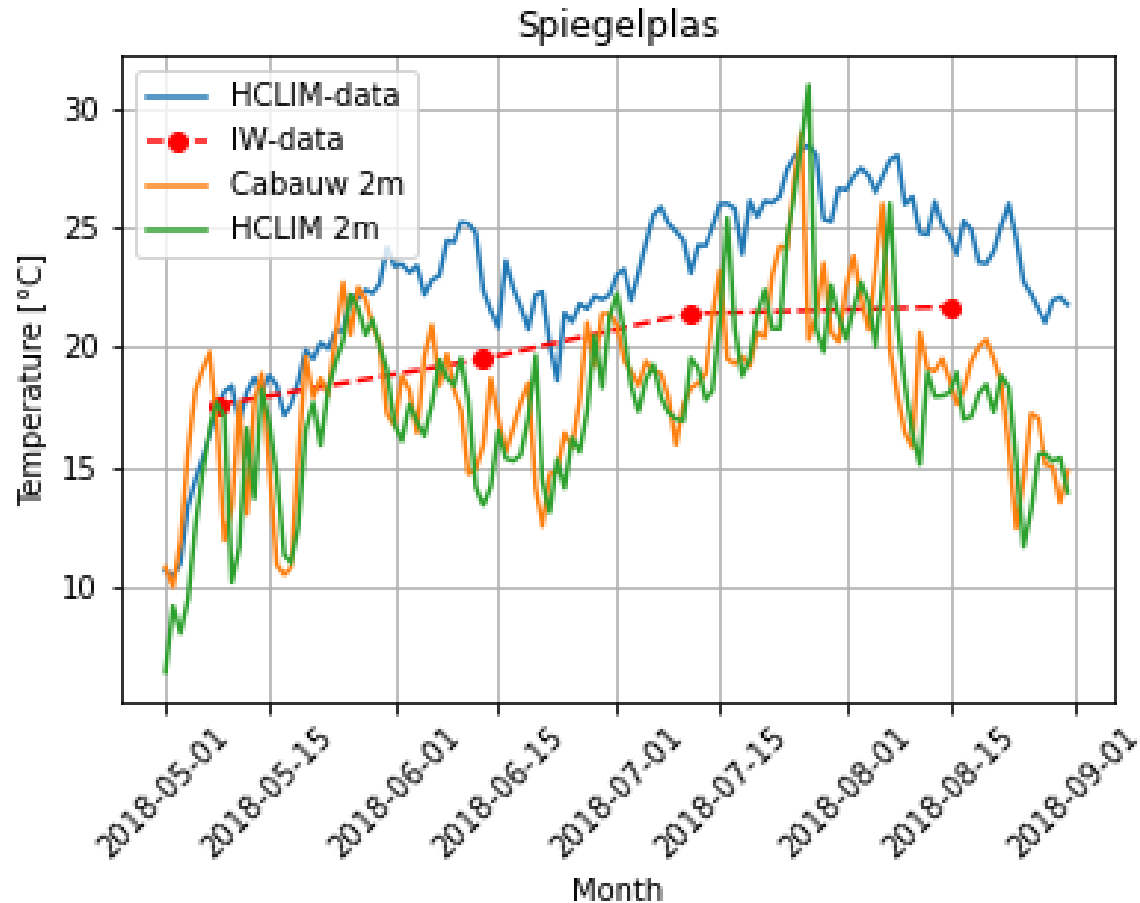


Summer 2018 cases: shallow

- Atmospheric 2m temperature simulated well by HCLIM
- Water temperatures Flake significantly higher

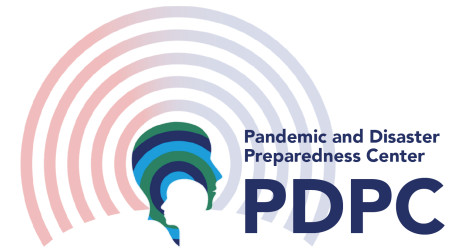


Summer 2018 cases: deep



- Atmospheric 2m temperature simulated well by HCLIM
- Water temperatures Flake significantly higher
- Difference model-observations even higher for deep lakes

Surface energy budget

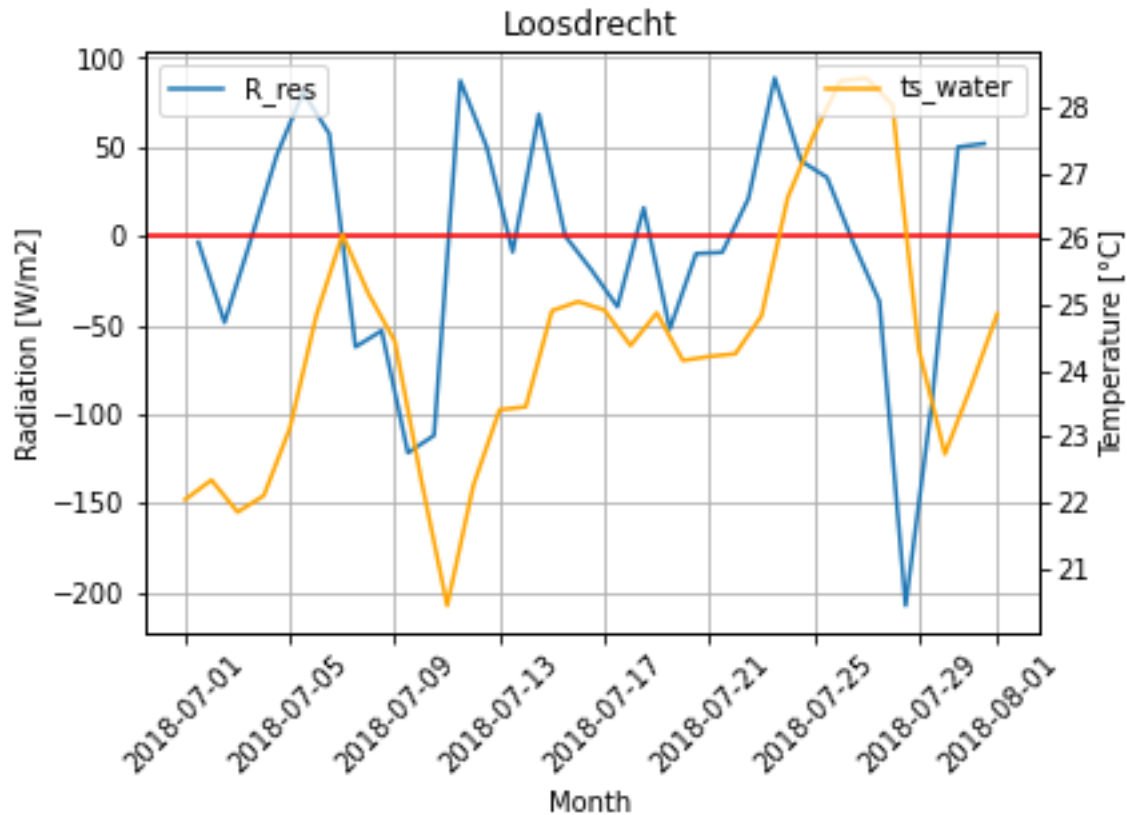


$$R_{\text{res}} = SW_{\text{down}} + LW_{\text{down}} - SW_{\text{up}} - LW_{\text{up}} - LHF - SHF$$

Diagram illustrating the Surface Energy Budget equation with components grouped by brackets:

- R_{res} : Net downward radiation
- $SW_{\text{down}} + LW_{\text{down}}$: Downward shortwave radiation
- LW_{down} : Downward longwave radiation
- SW_{up} : Upward shortwave radiation
- LW_{up} : Upward longwave radiation
- LHF : Latent heat flux
- SHF : Sensible heat flux

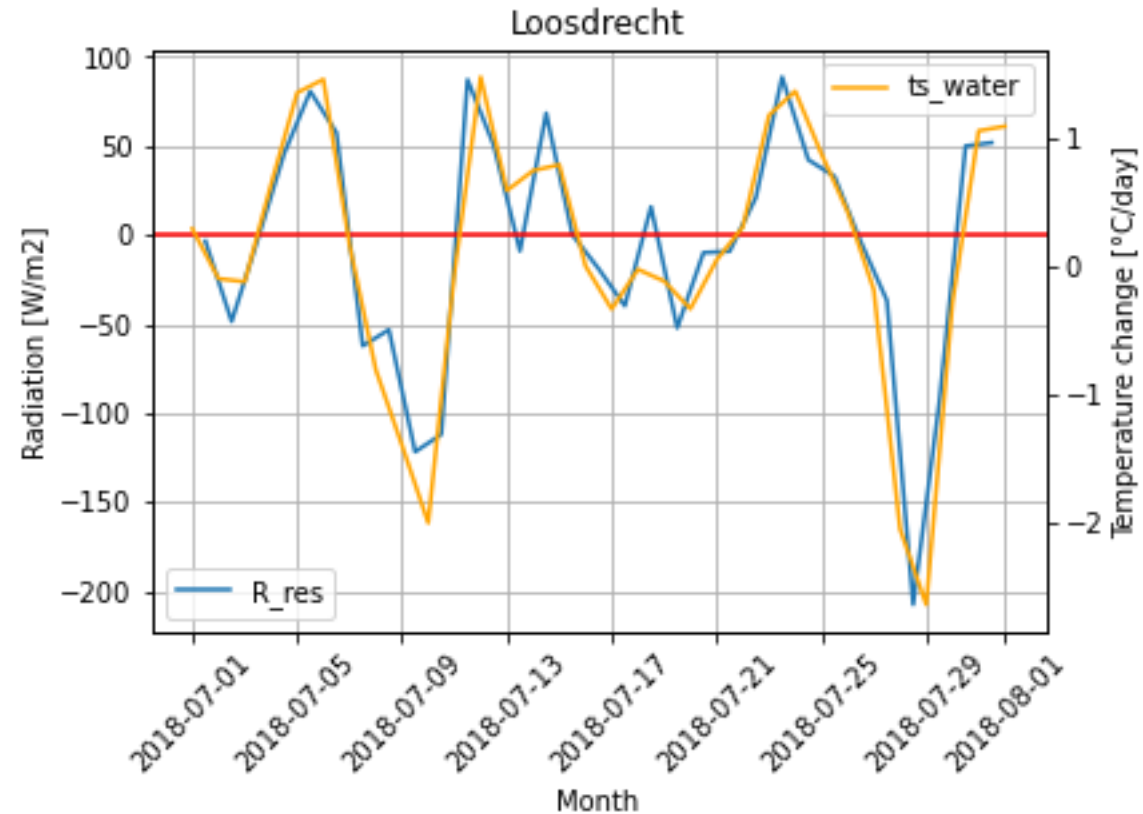
Surface energy budget: July 2018



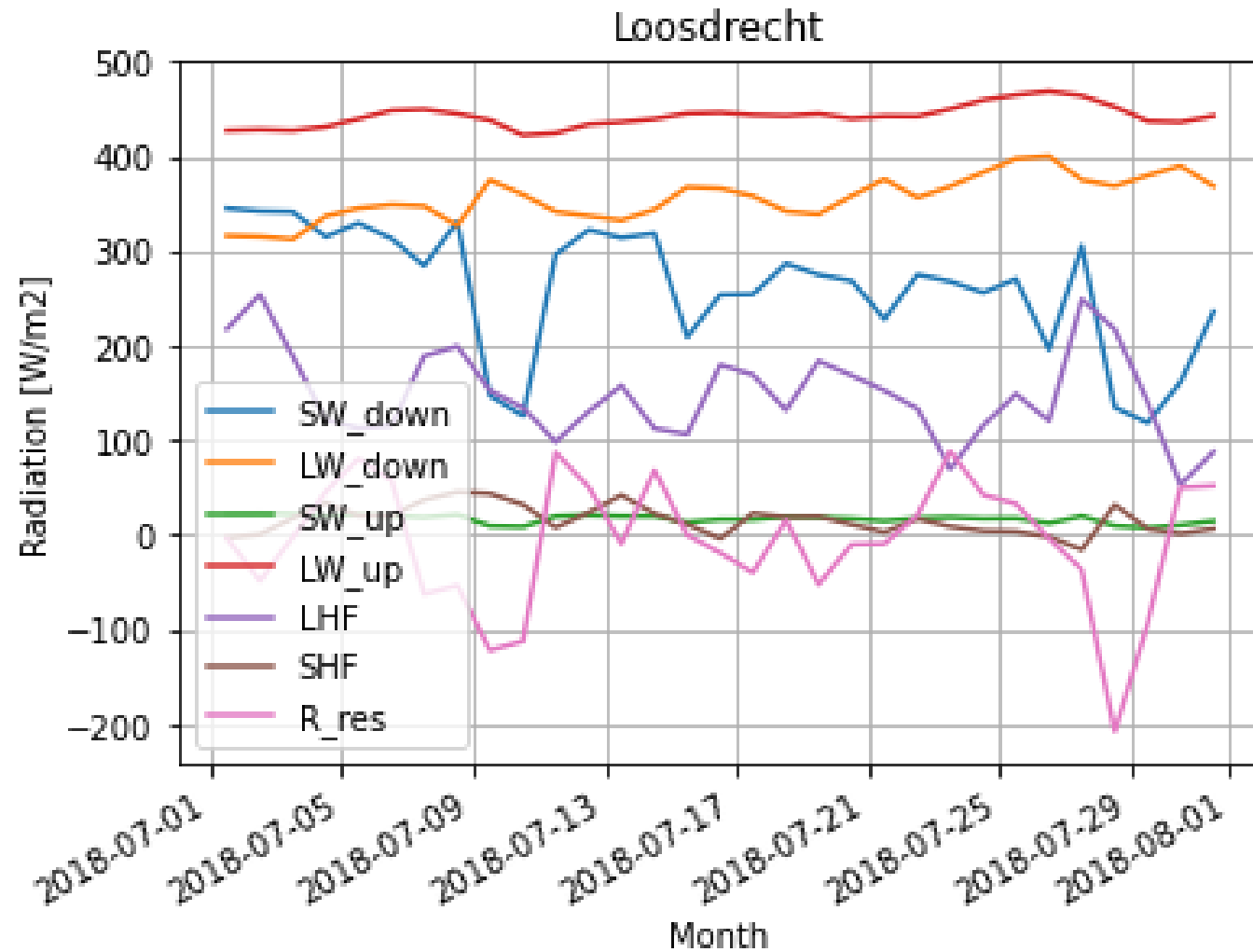
- Temperature rising when $R_res > 0$, decreasing when $R_res < 0$

Surface energy budget: July 2018

- Netto inward radiation and derivative of water temperature are closely correlated

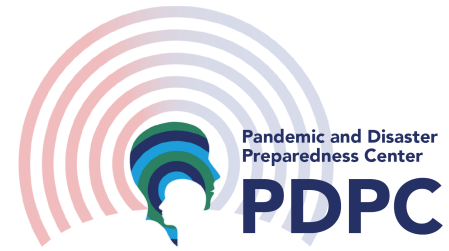


Surface energy budget: July 2018



To be continued...

- Roughness length $\sim 10^{-5}$ \rightarrow LHF too low?
- Mixing layer too shallow?
- Similar experiences?



Inundation experiment (Aug 2024 – Aug 2025)

Aims:

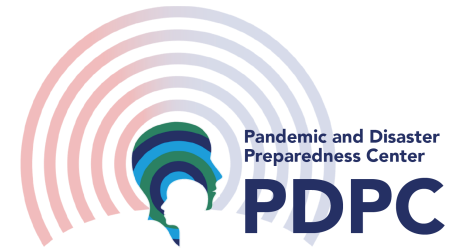
- Baseline/test experiment for inundation next year
- Measure abiotic factors during the mosquito/bird sampling
- Evaluation lake model FLAKE

Equipment:

- Davis weather station: **shortwave radiation, temperature, relative humidity, precipitation, wind speed and direction** at 2m
- Self-logging thermometers, TidbiTs: vertical **water and air temperature** profile at 20 cm resolution
- Outlook: distributed temperature sensing: coil of optic cable enables measurement of vertical **water and air temperature** profile at <3cm resolution



PDPC contact details



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Interested in finding out more about the PDPC?

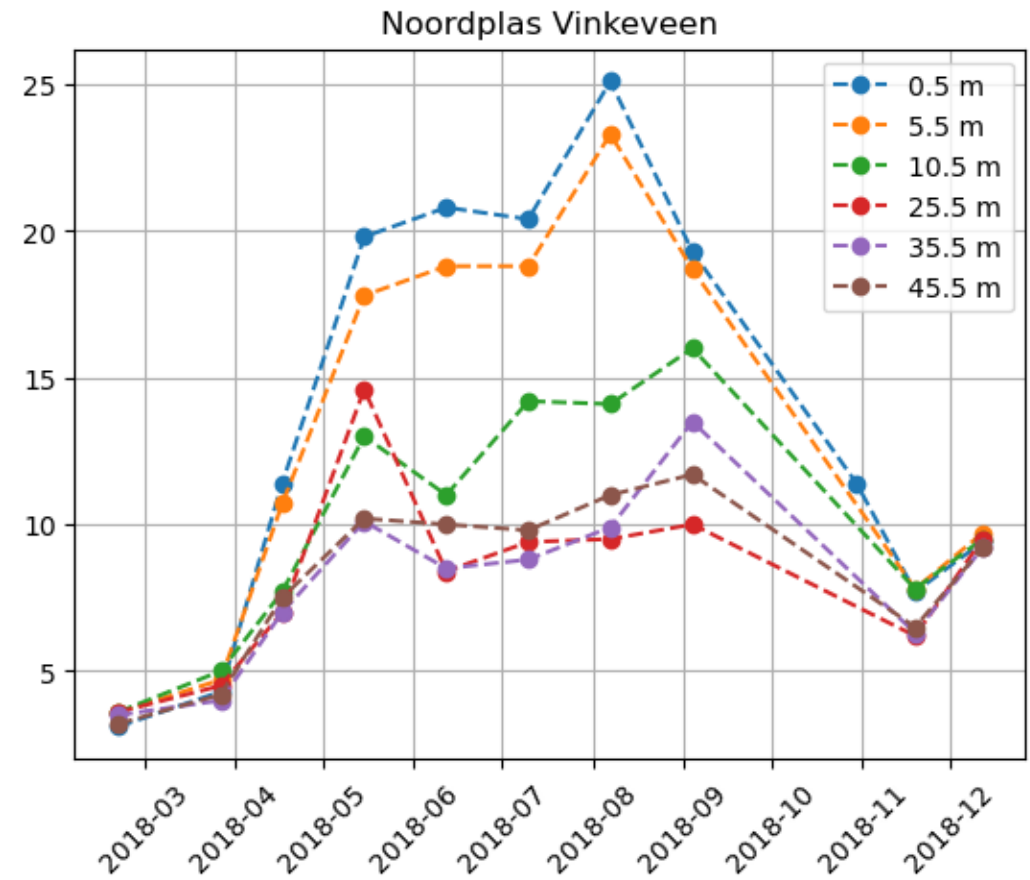
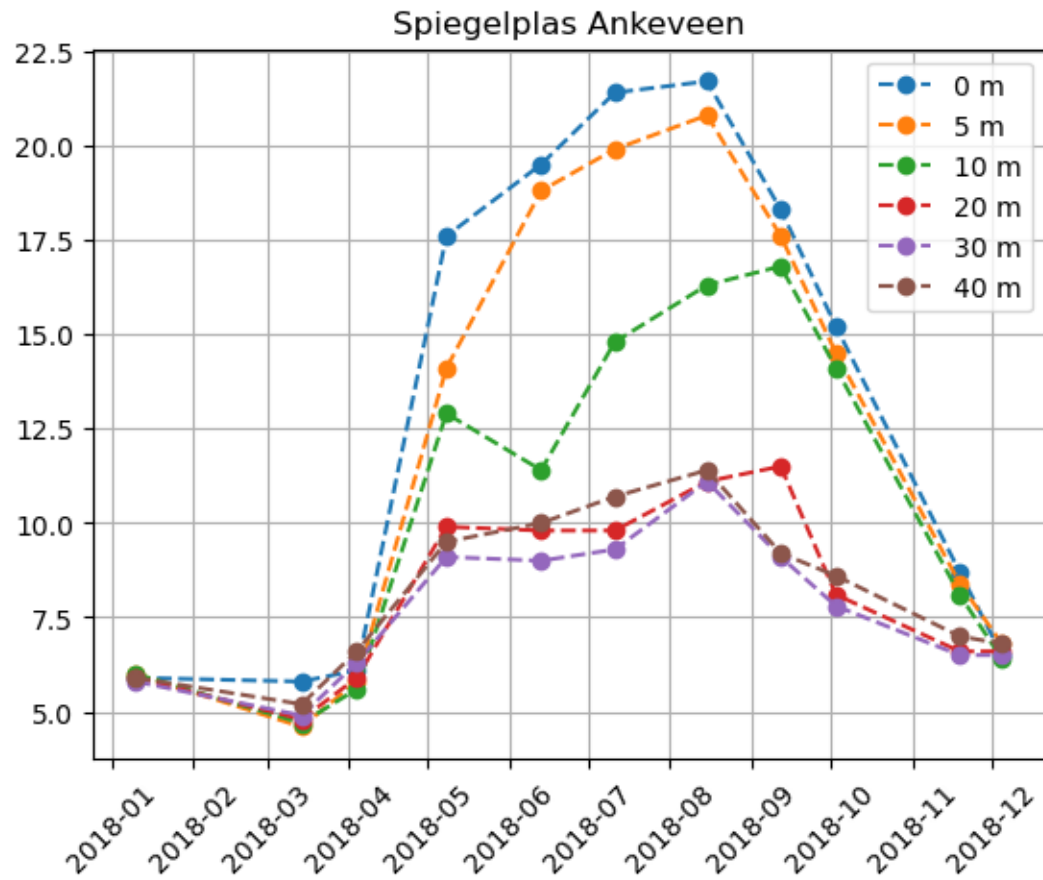
 PDPC@erasmusmc.nl

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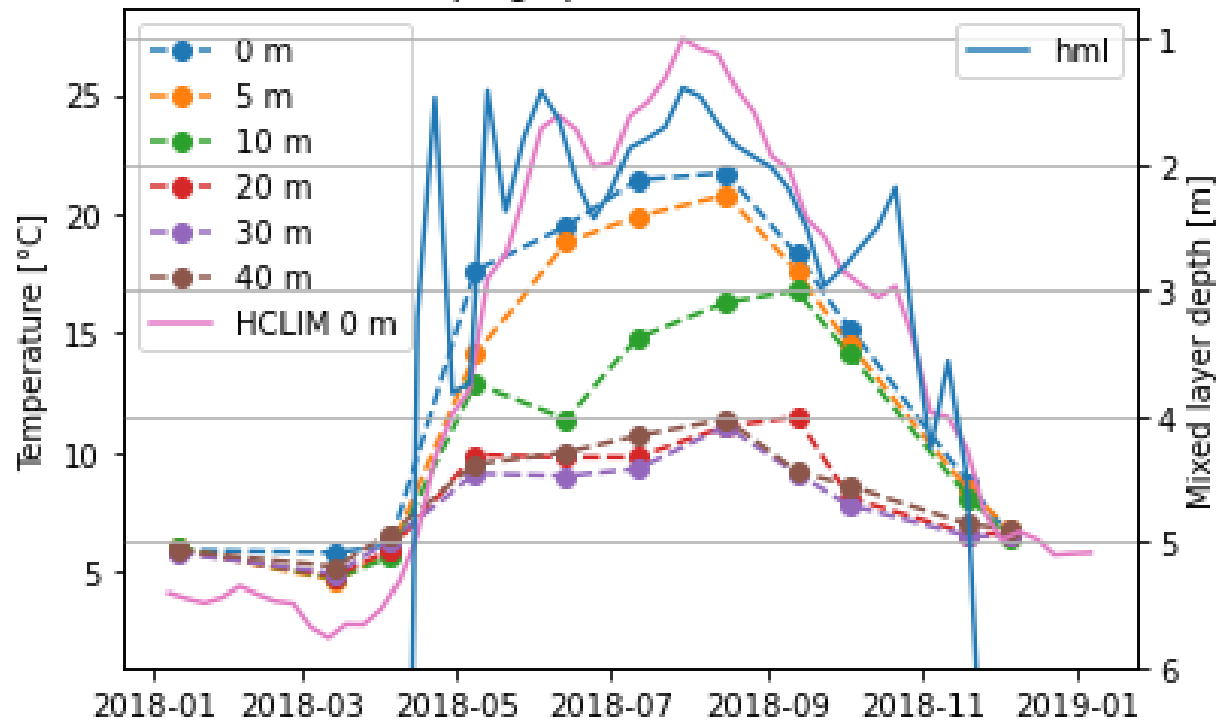
 Erasmus MC, Rotterdam

Observation of temperature profiles



Mixed layer depth FLAKE

Spiegelplas Ankeveen



Vettenbroek Vinkeveen

