

hoogheemraadschap
Hollands
Noorderkwartier

Watersecurity towards 2030

Adaptive to changes

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Outline

1. Current setting - Shifting world
 - Within Artificial Intelligence
 - Within the water world
 - Within the whole landscape
2. Water security in 2030 – A HHNK vision
 - Quick insight
3. Effective in developments
 - Sharing & collaboration

AI - Done with highschool & now

Shifts in Artificial Intelligence during my school years alone

Shift in

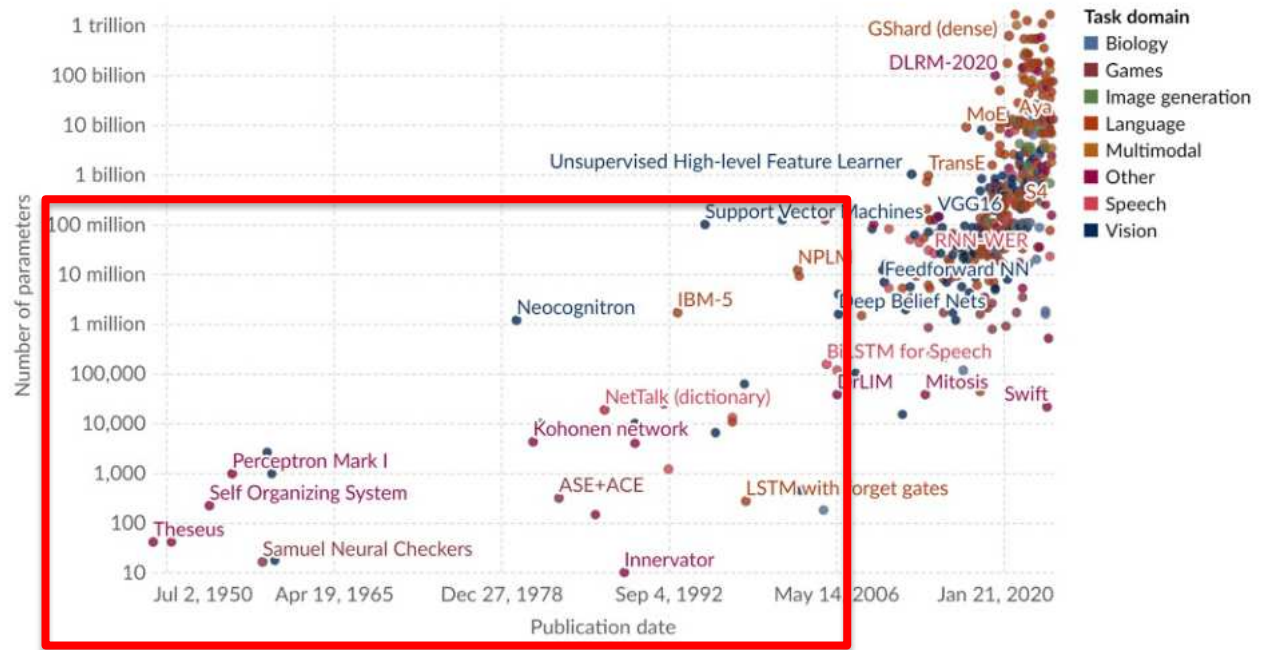
- Parameters
- Models
- Everchanging field
- Large models
- Foundation models

The future will bring more

Parameters in notable artificial intelligence systems



Parameters are variables in an AI system whose values are adjusted during training to establish how input data gets transformed into the desired output; for example, the connection weights in an artificial neural network.



Data source: Epoch (2024)

OurWorldInData.org/artificial-intelligence | CC BY

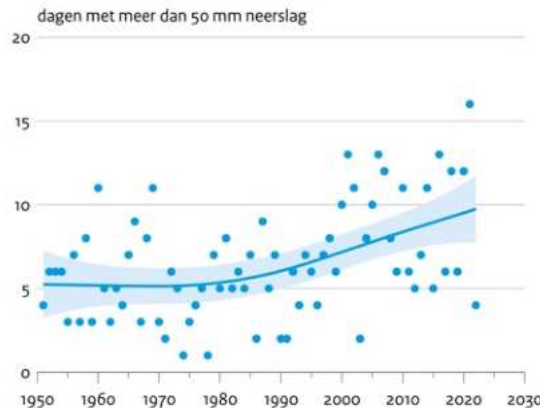
Note: Parameters are estimated based on published results in the AI literature and come with some uncertainty. The authors expect the estimates to be correct within a factor of 10.



Water world – Changes in climate

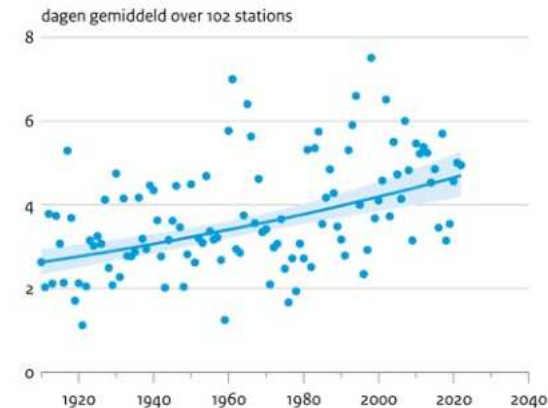
- Temperatures
- Precipitation peaks
- Precipitation total
- Droughts
- Extremes
- Storms

Aantal dagen met zware neerslag

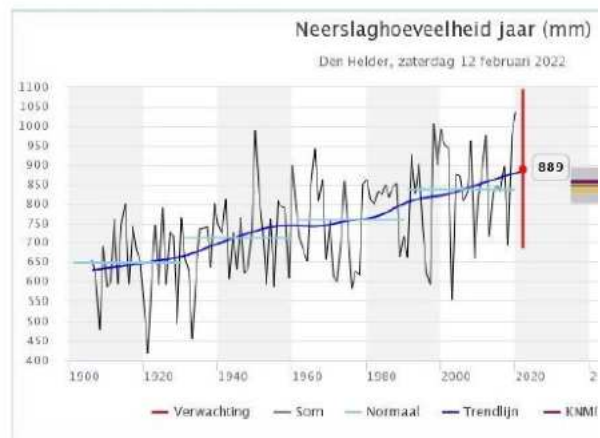


Bron: KNMI; bewerking PBL

Aantal dagen met meer dan 20 mm neerslag



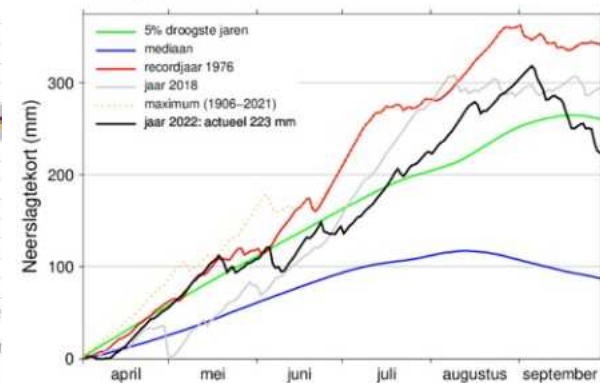
Bron: KNMI; bewerking PBL



Figuur 2-7 Jaarneerslagsom te Den Helder, 1908-2021. Bron: I

Neerslagtekort in Nederland in 2022

Landelijk gemiddelde over 13 stations



(c) KNMI, 2022-10-19

Work field - Perfect storm brewing

News article H2O

Changes in work force
Changes in work focus
Changes in work load
Changes in regulations

Work required



UITGAVE VAN KNW

H2O ACTUEEL - H2O VAKARTIKELN H2O PODIUM - H2O MENSEN - H2O TECHNIEK H2O PREMIUM WATER MATTERS WATERAGENDA WATERVACATURES



Waterschapslasten: 'Er ontwikkelt zich een soort van perfect storm'

Shifts in water security tasks

Extreme peak situations

Waterheights

Waves

Precipitation

Drought

Shifts in endurance & extremities

Protection against peak floods & precipitation

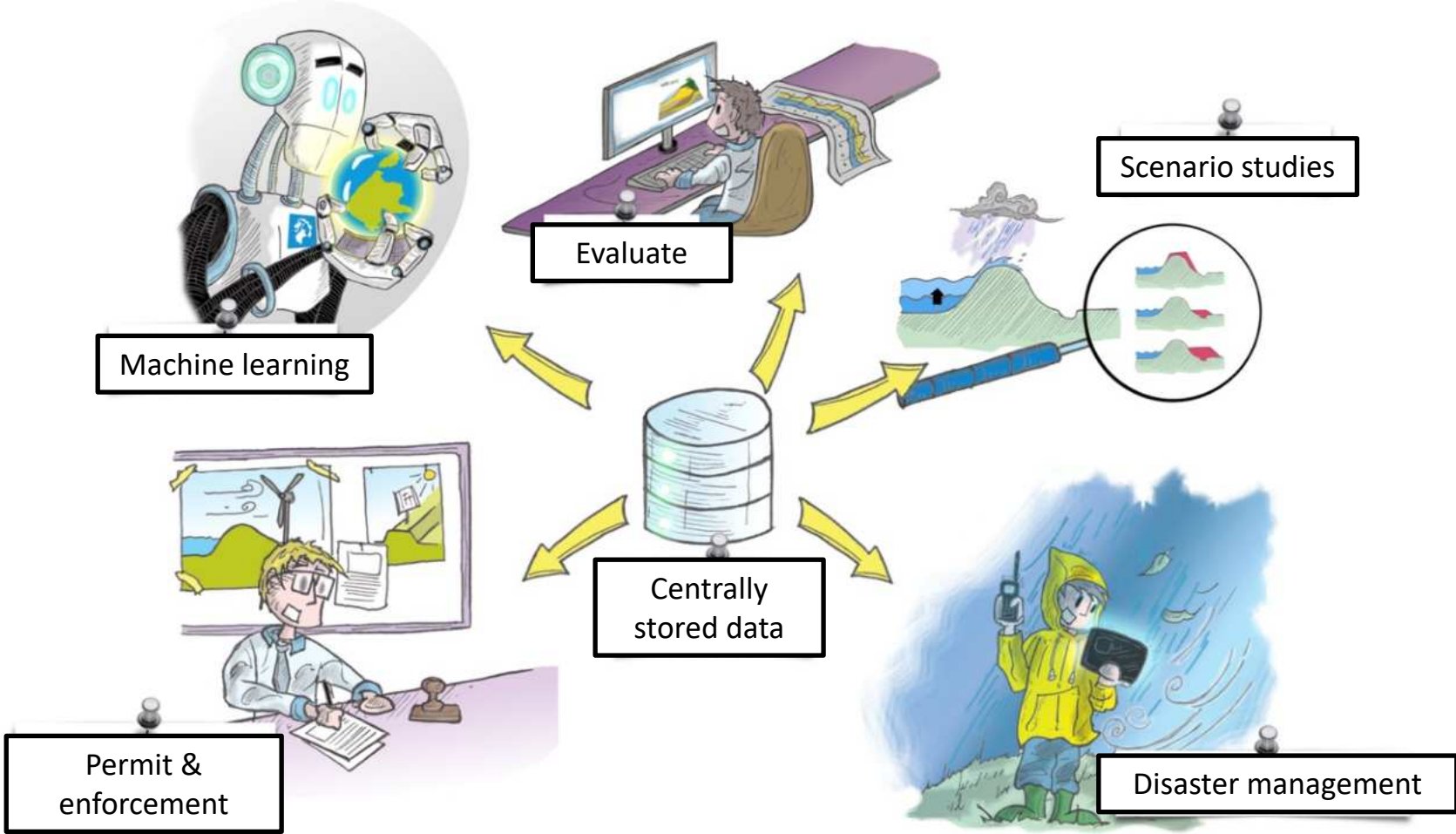
Water management during severe droughts

Shifts in possibilities

New data sources, technologies, boom in AI

Fulfill our duty of care in a shifting world

Deal with the changes – a datadriven approach



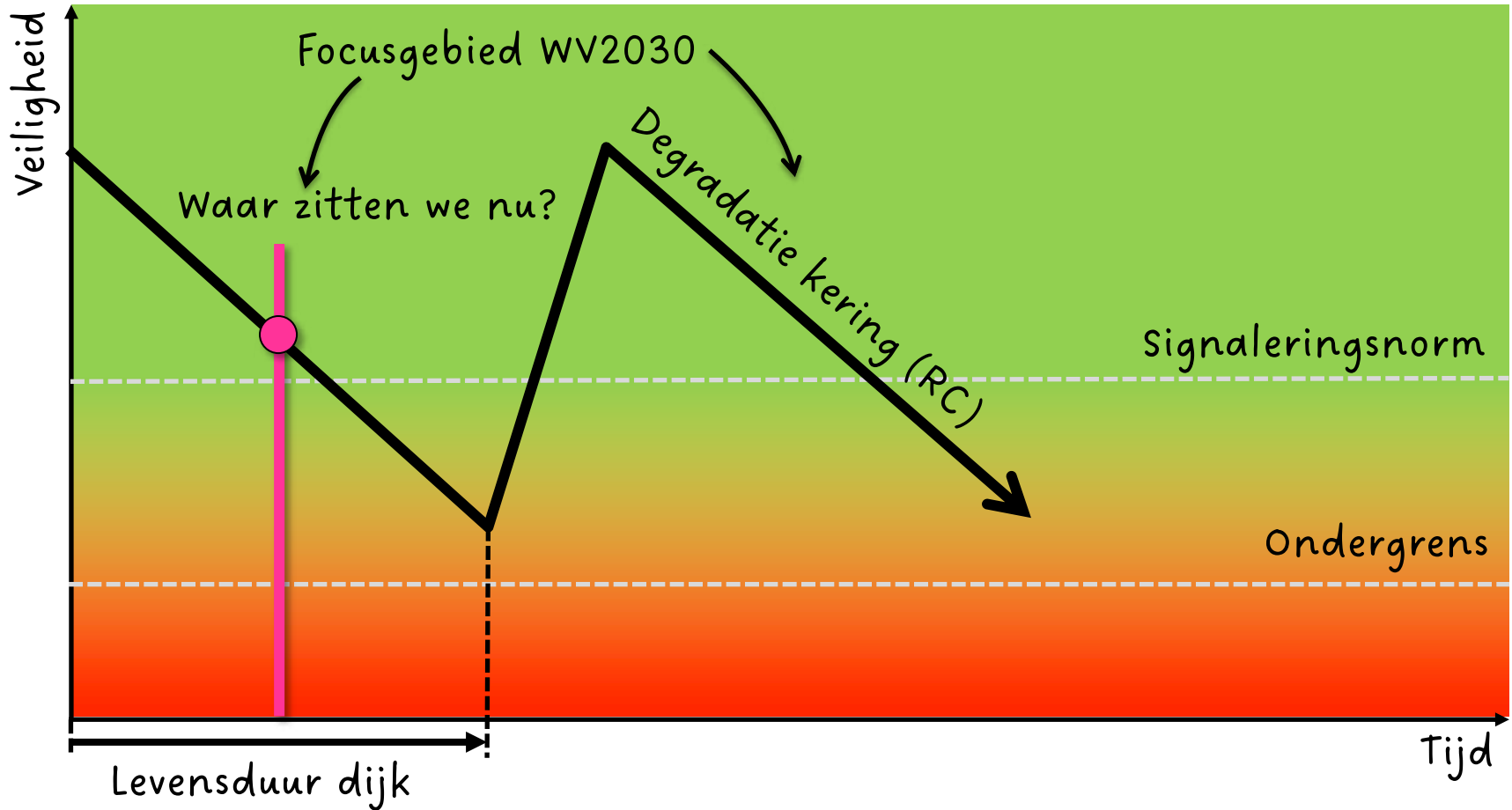
Have the value of measurements

- Continuous insight in climate
- **Use a data driven approach to get continuous insight into water security**



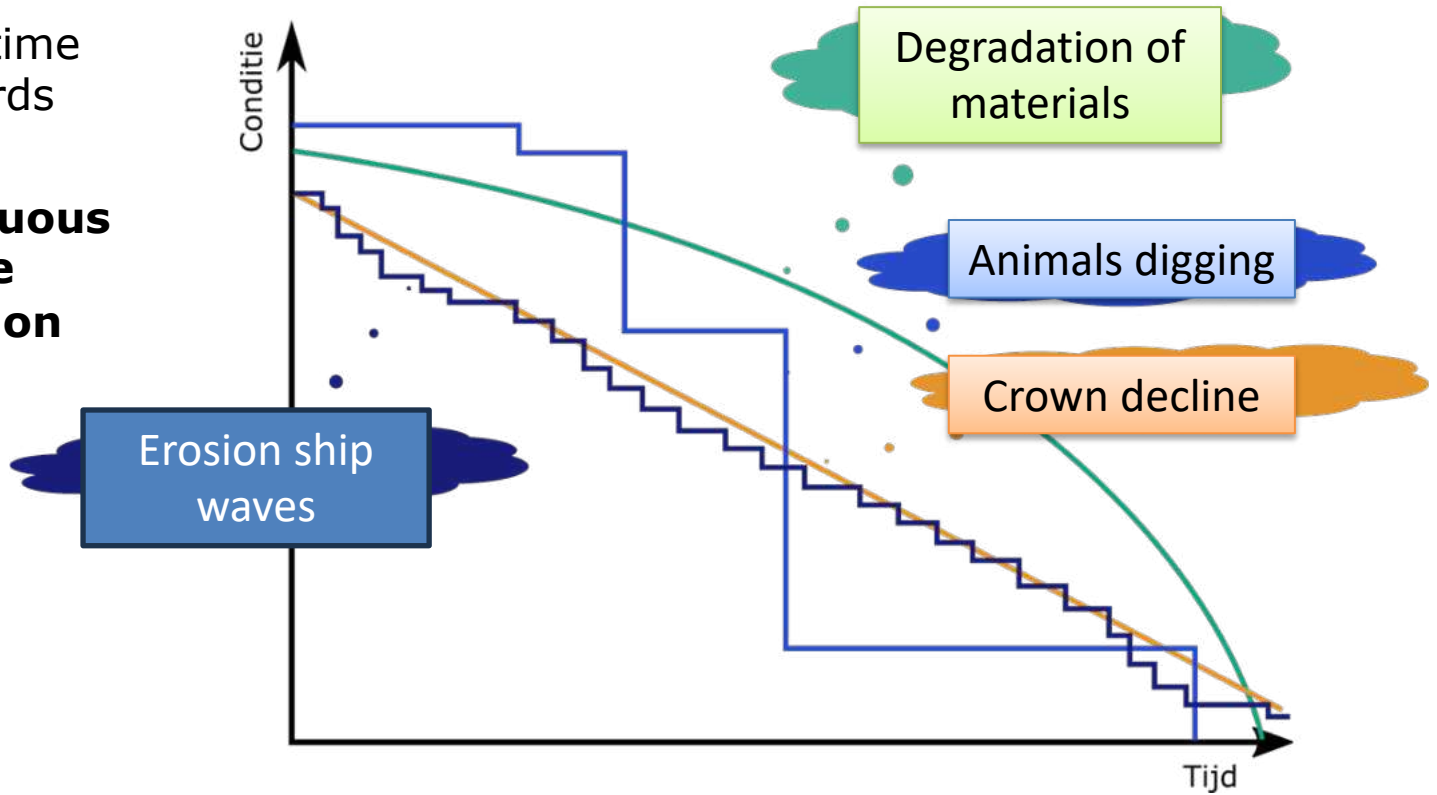
The image is a screenshot of the KNMI (Koninklijk Nederlands Meteorologisch Instituut) website. The header includes the KNMI logo and name, along with language options (English) and a high contrast mode link. The main navigation bar contains links for Home, Nederland nu, Klimaat, Producten & diensten, Kennis & uitleg, Research, and Over het KNMI. A search bar is located on the right side of the navigation bar. Below the navigation bar, there is a secondary menu with links for Over het KNMI, Bestuur, Kerntaken, Internationaal, Werken bij, Nieuws, Agenda, Pers, and Contact. The main content area features a breadcrumb trail: Home > Over het KNMI > KNMI Nieuws > De staat van ons klimaat 20... and a yellow 'Code geel' button. The central image shows a flooded landscape with several trees standing in water, their trunks partially submerged. Below the image, the headline reads 'De staat van ons klimaat 2023: warmste en natste jaar ooit gemeten' and the date '31 januari 2024' is displayed.

The security during the lifespan of a dike



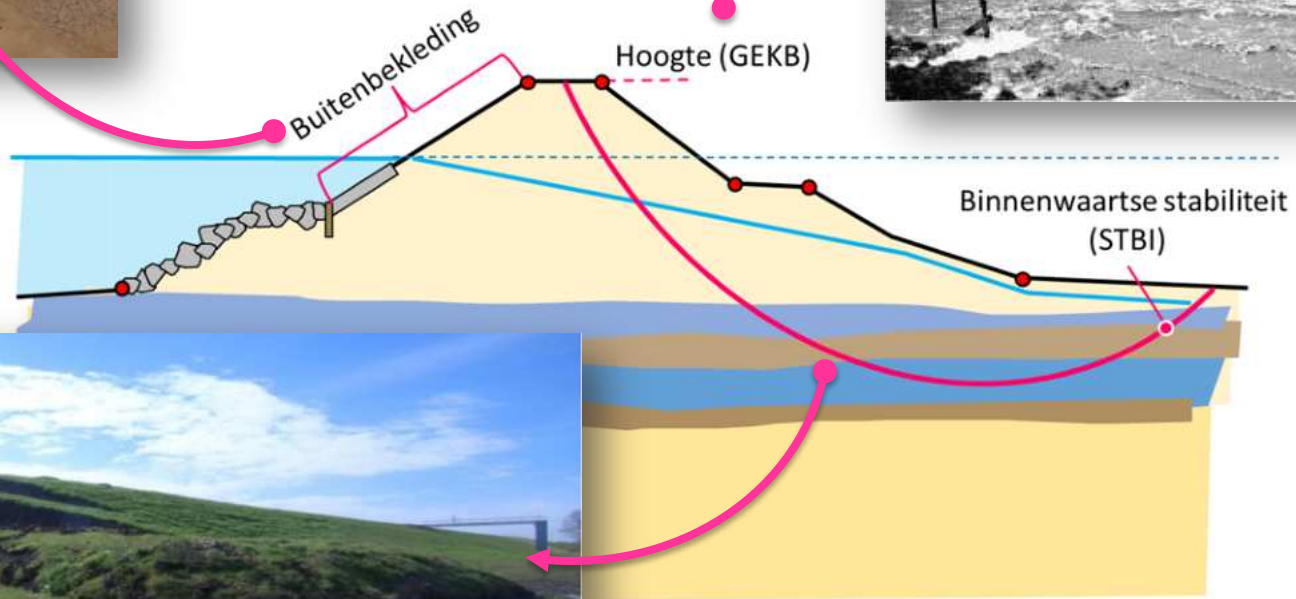
The condition of a dike is dynamic

- Move from one time evaluation towards
- **Gaining continuous insight into the current condition**



Dominant failure mechanisms HHNK

- Height/Overflow
- Erosion outer slope
- Micro instability



What is the focus on?

- **Continuous insight** and **risk based management.**
- Always have an **actual estimate**
- Find a way **to detect changes** from our base situation
- See **the effects** of these changes on our evaluations.
- Measure **effective parameters.**
- **At the center of it all the data story of our dike.**

How? Case study purmer

- Measure information needs
- Start small
- Proof of novelties
- Scale up green lights



Waterveiligheid 2030

Een casestudie naar de toepasbaarheid van continu inzicht voor HHNK: proeftuin Purmer

**hoogheermeenschap
Hollands
Noorderkwartier**

Auteurs
Niels Betten, Jannes Haanstra, Sem Jongejan, Inge Olijve, Michelle Schouten, Rens Stam, Erik Vastenburg, Hannes Versteegh, Sarah Wiggers

Registratienummer
21.1043786

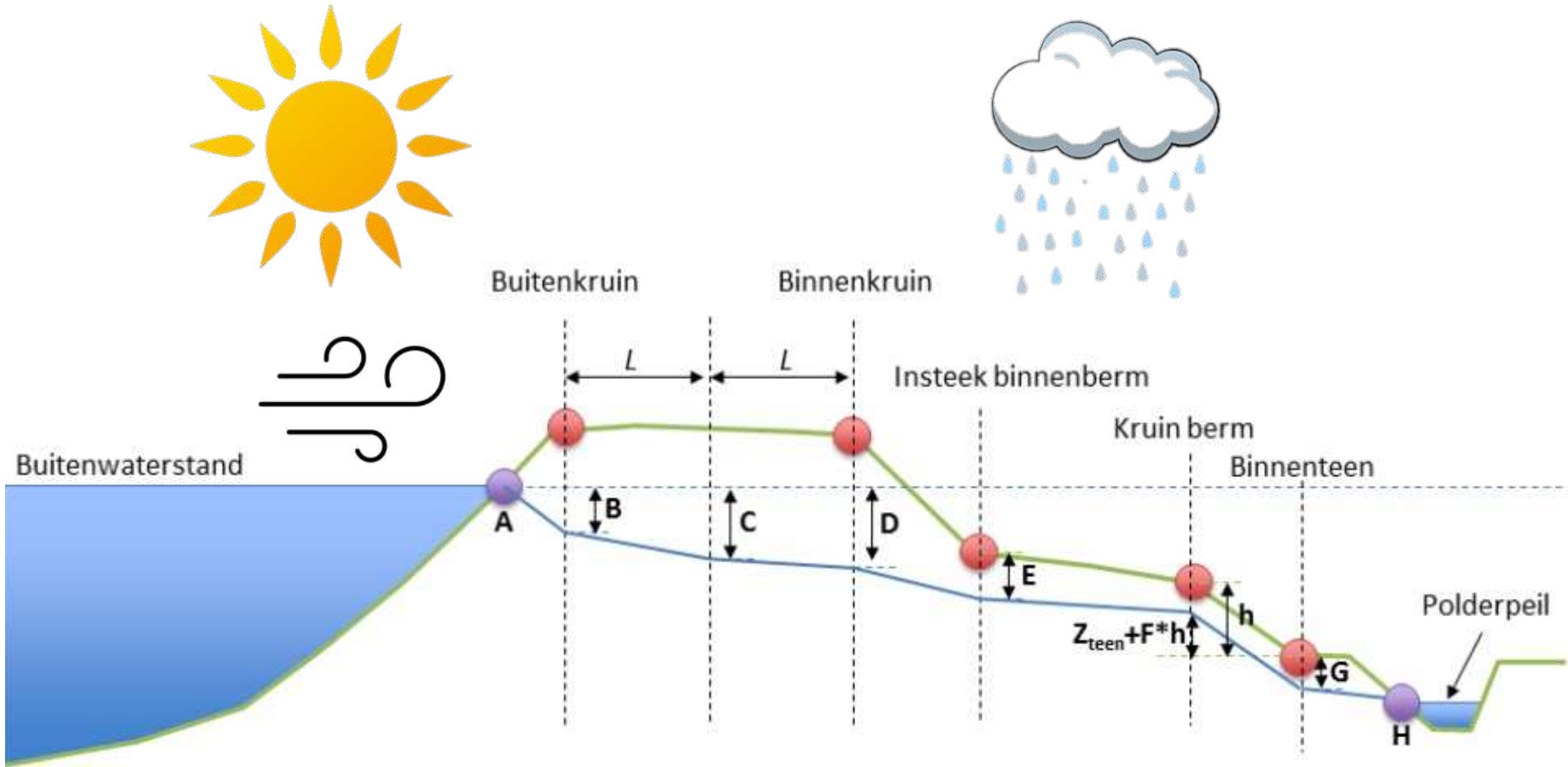
Datum
25 juli 2023

Versie
1.1

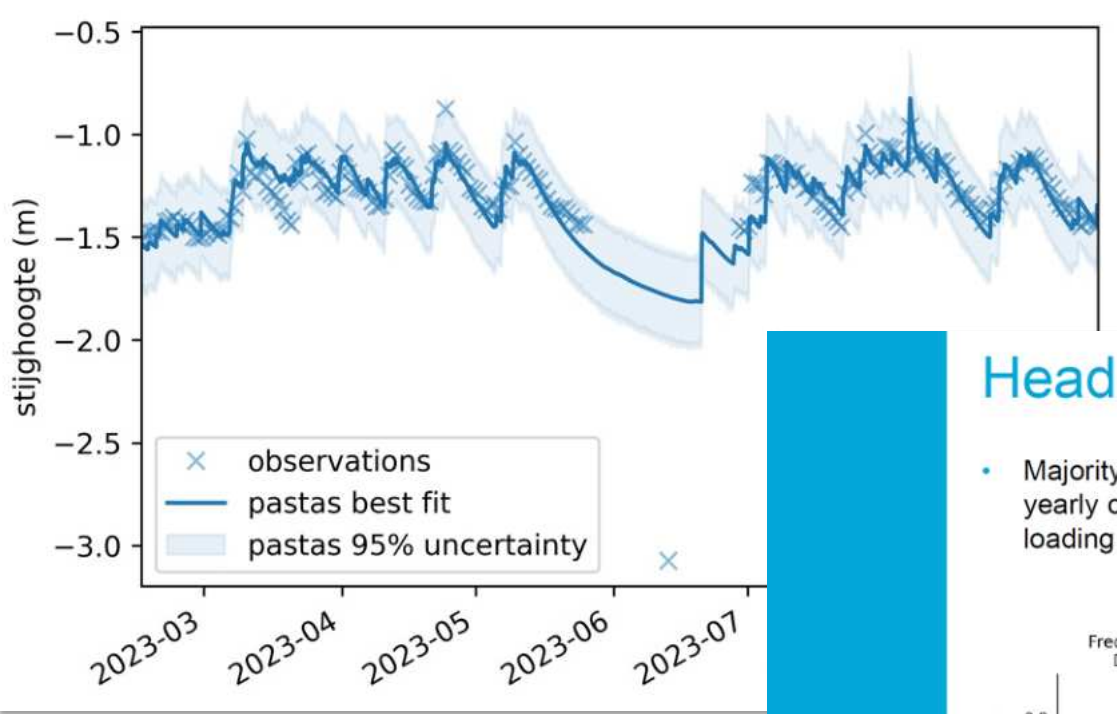
Status
Concept

Afdeling
Waterveiligheid en (vaar)wegen

Timeseries – Continuous insight phreatic line

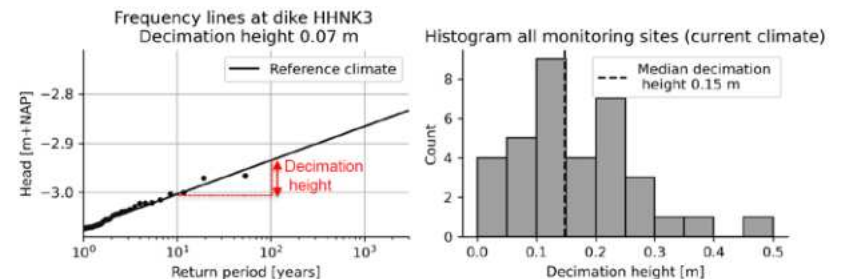


Timeseries - Pastas* fit groundwater time series



Head level statistics

- Majority of dikes have small decimation heights, indicating that yearly occurring load conditions are relatively close to extreme loading conditions



TU Delft

* Pastas: open source software for the analysis of groundwater time series.

Timeseries - Continuous insight drought



Een nieuwe grondwater droogte-indicator voor boezemkaden

Een statistische maat die de extremititeit van de grondwaterdroogte in de dijk weergeeft

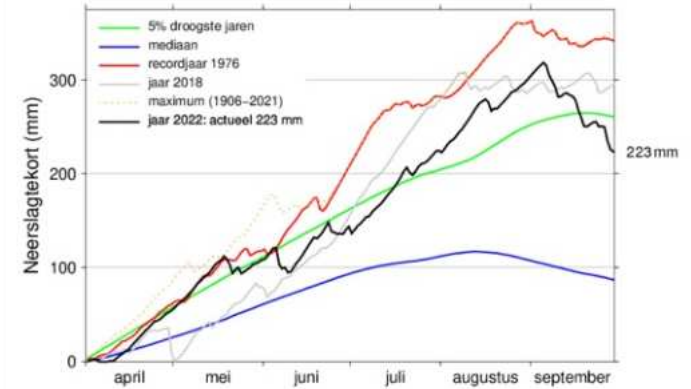
HKV
LIJN IN WATER

stowa

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Noorderkwartier

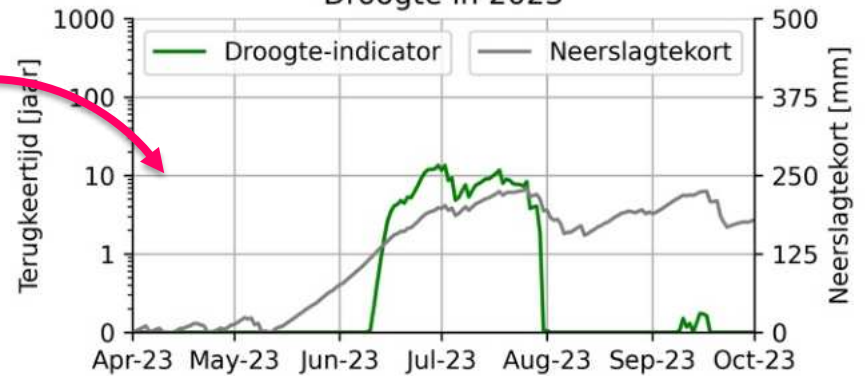
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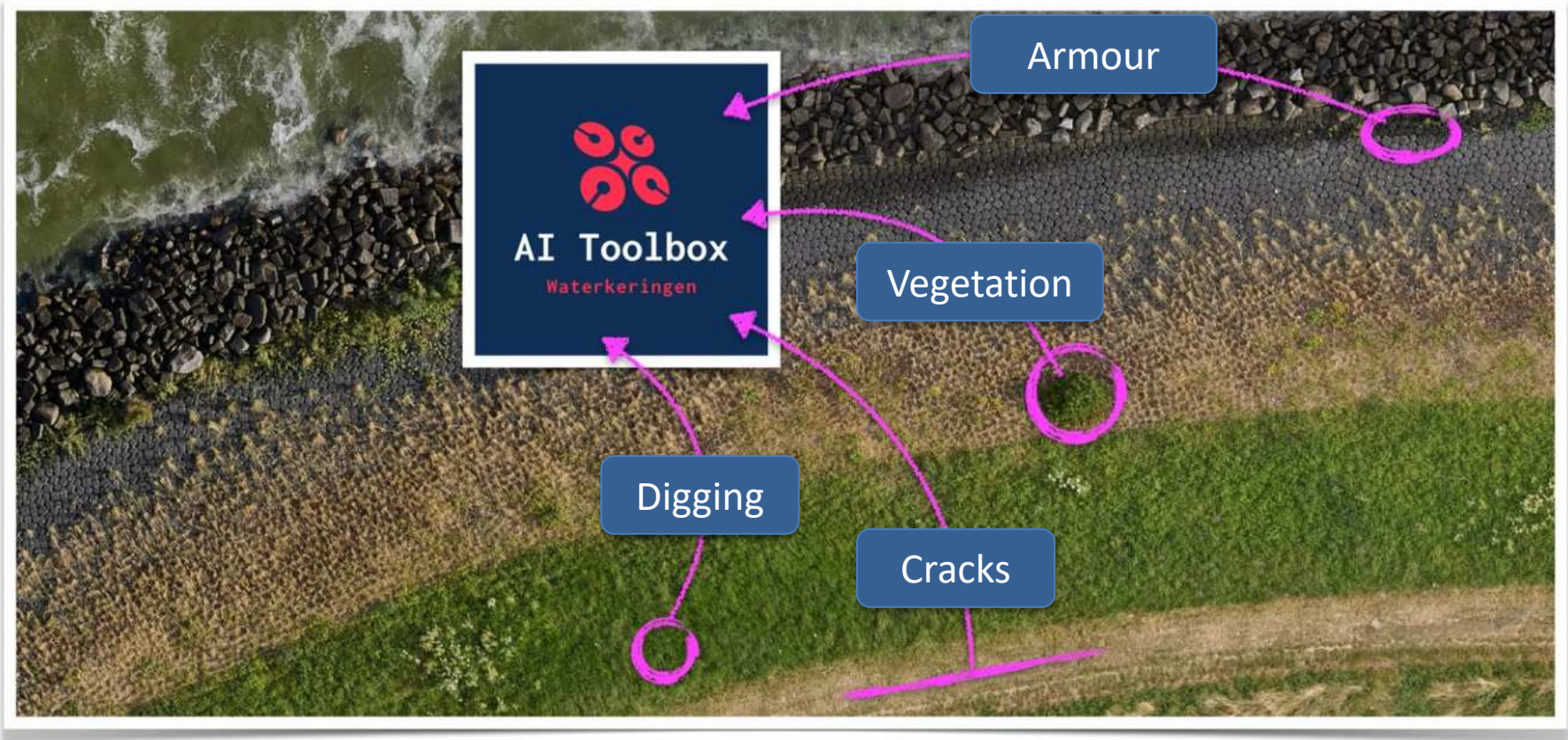
Droogte in 2023



Drone timeseries - Movement in armour

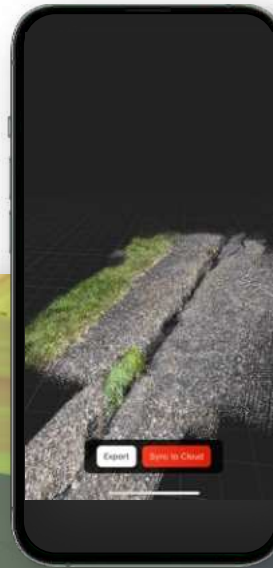
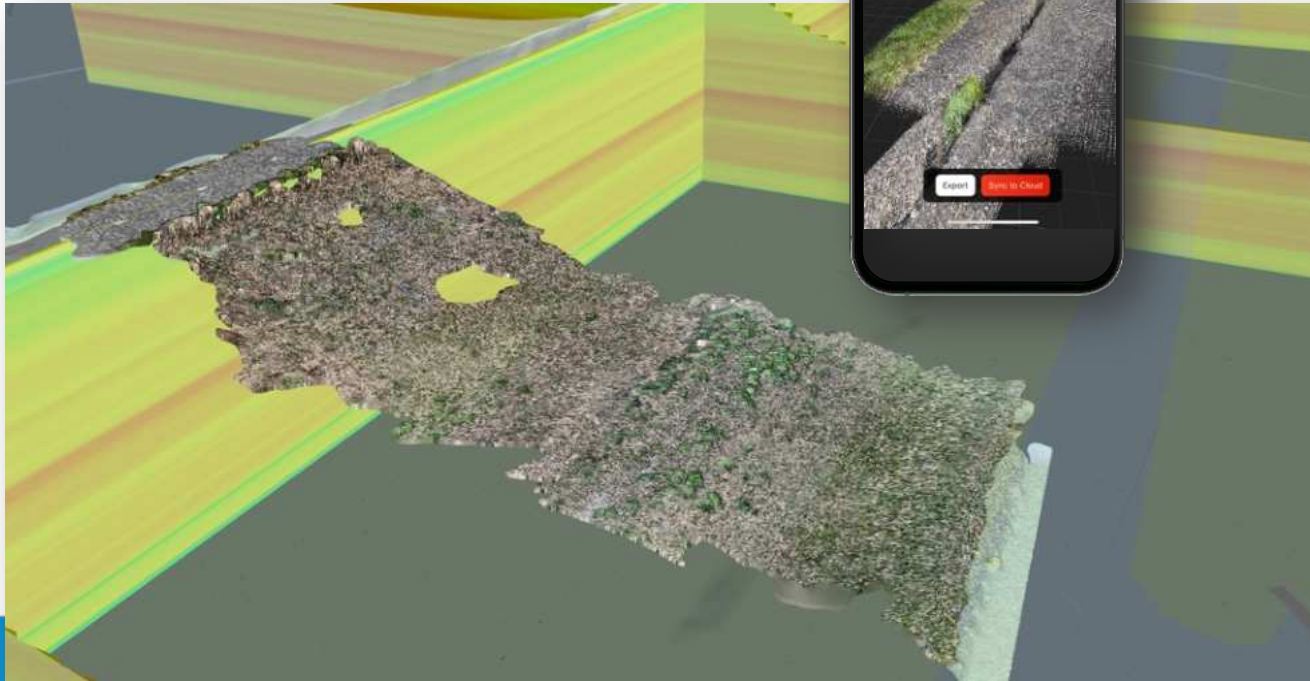


Drone timeseries - AI Toolbox Waterkeringen

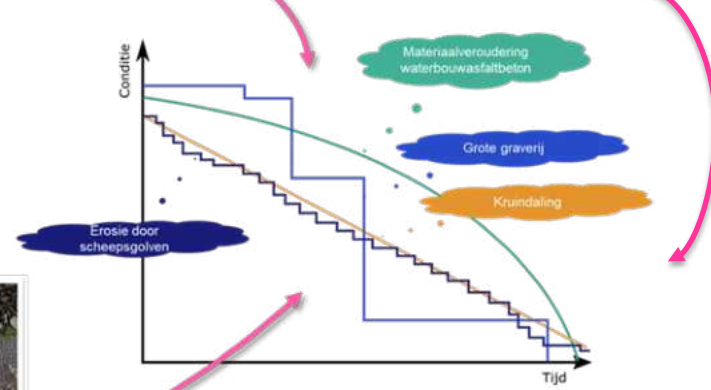
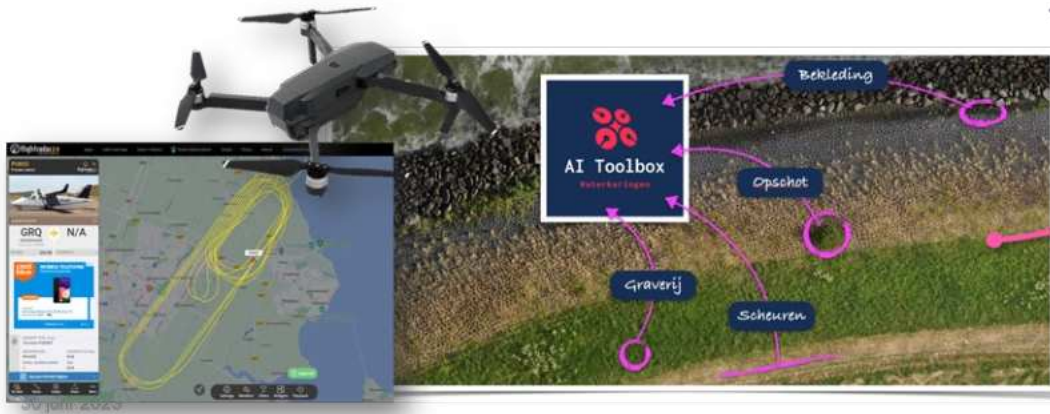
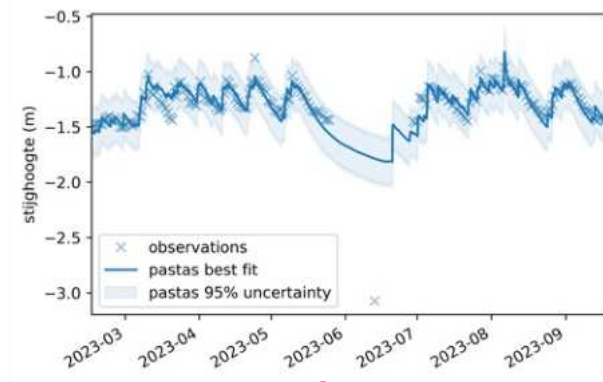
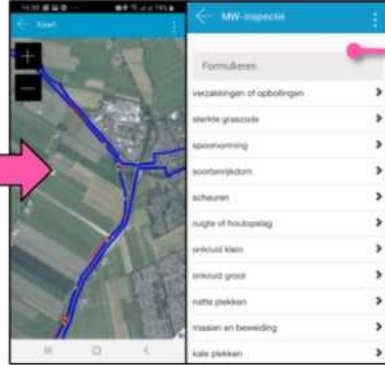


Inspection - Lidar iPhone

- **Detail on request**



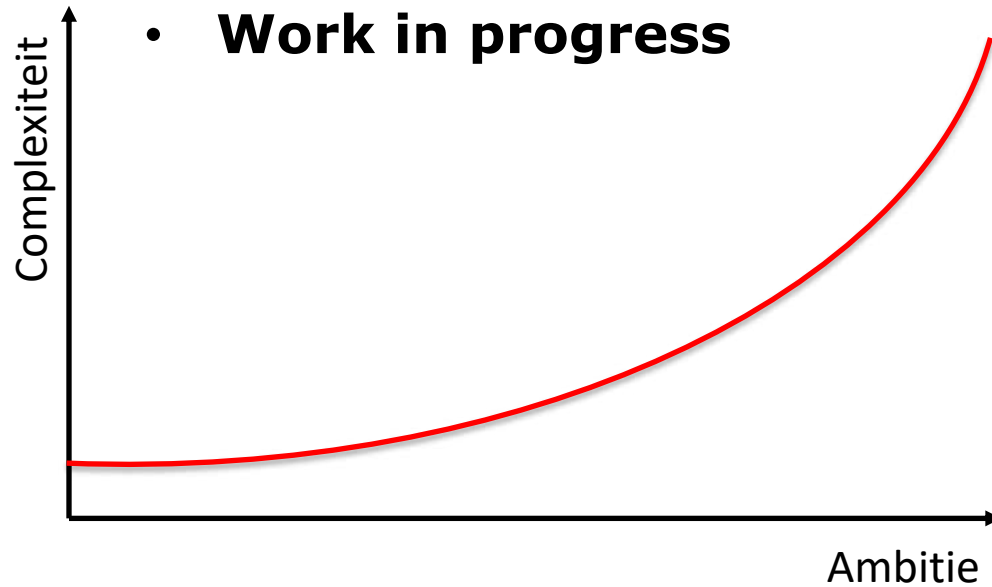
Continuous insight



- **Strong combination of data & information**
- **Combine for continuous insight & on demand**

Phased approach – We are in control

- **Vision for 2030**
- **Plan of approach**
- **Small pilot done**
- **Work in progress**



We turn this button.



AI – Insights during these ambitions & control

Creating our vision while getting up to speed

Build from proof to deployment pipeline

Open as baseline

Open source

Shareable solutions

Shareable approach

Shareable insights

Scaleable & shareable standard

Mlops standardization

Templates

Robust framework for deployment

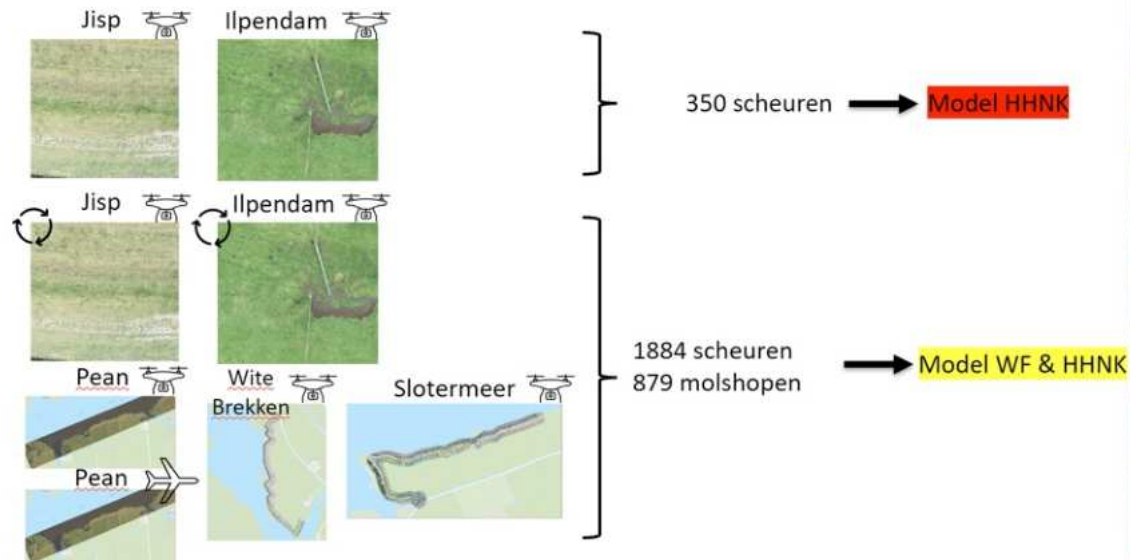
Always ready!

Collaboration & open source

Labels from 350 cracks to 1884 cracks
Start in 2021, collaborate in 2023



Voorjaar 2023: Samenwerking HHNK & WF:
“Kunnen we het model verbeteren?”



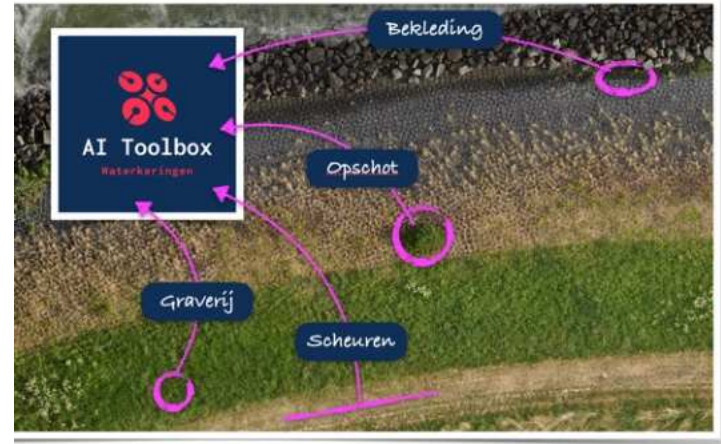
Collaboration & open source

AI toolbox

- Standardize solution
- Share data, labels, model and trained weights

Wetterskips of course also wants the model. Also beneficial for the whole field.

How to share, keep collaborating and keep each other up to date?

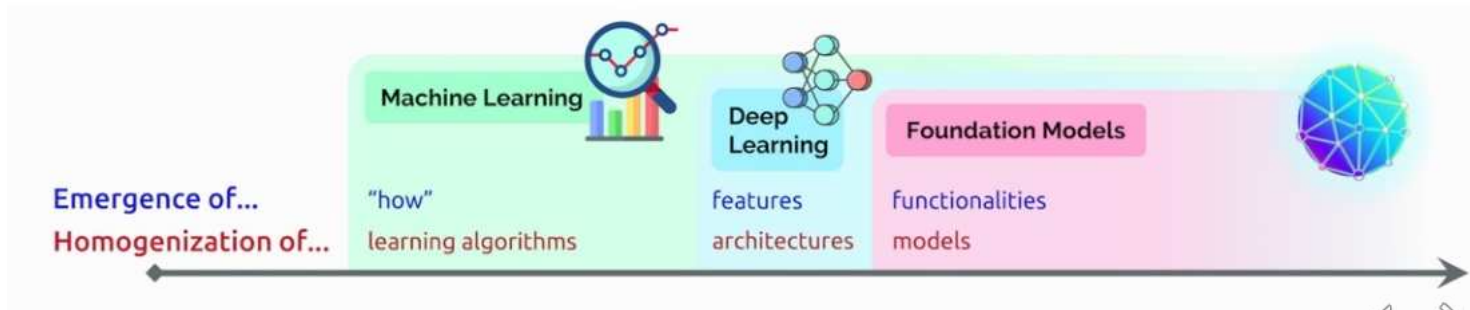
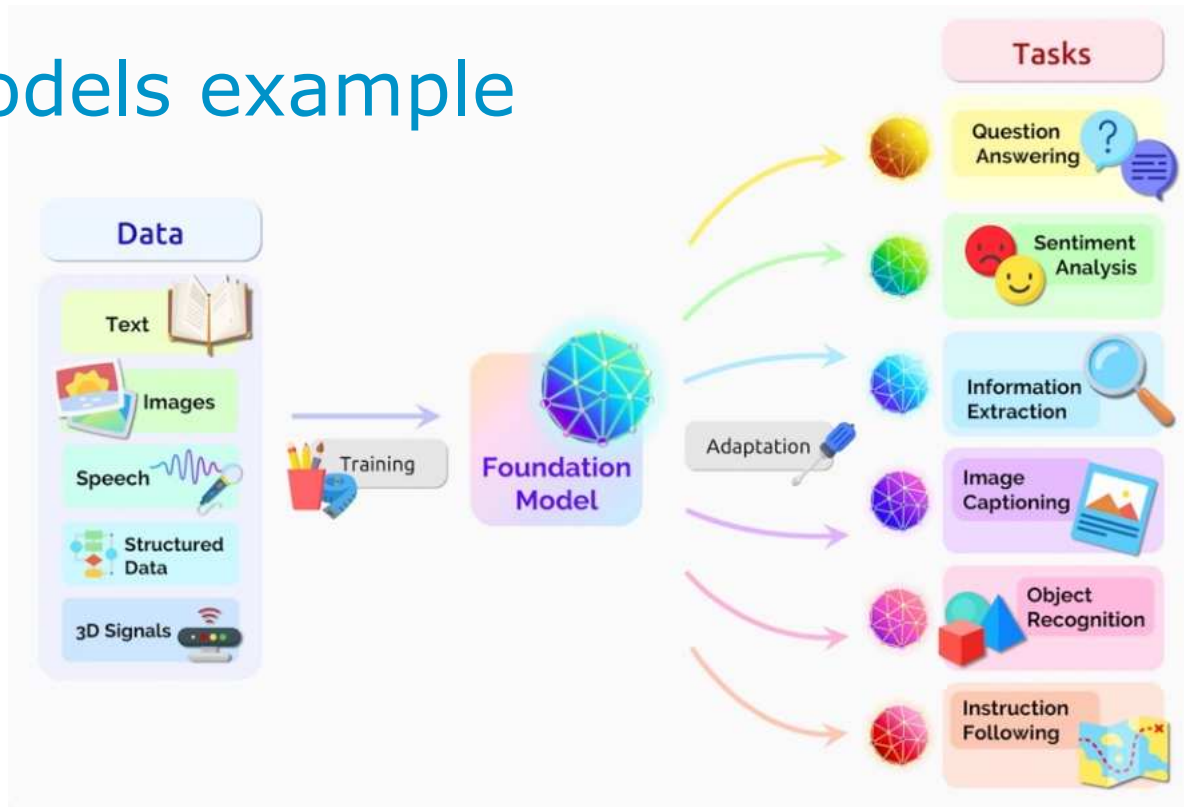


Foundation models example

Can't keep up with all the changes

See the fundamental changes happening

Inventive on how to implement these changes if effective



Foundation models example

Crack detection algorithm

2 year old model is possibly already a fossil

U-net versus SAM (Segment Anything Model)

Finetune foundation instead of train deep learning

How to also share this possible shift?



Shifting world

Changing climate

Changing workforce

Changing AI

Big ambitions for the future

Every waterboard has these challenges

Help together and work together

Don't reinvent the wheel

Sharing developments effective

How to share big shifts, data, trained models & standards?

How to find mutual interests and collaborate?