Modernisation of agricultural statistics

Overview of the Agri Sisa project and our future plans

Remco Paulussen

October 2nd, 2023

Project Agri Sisa

- Agriculture System Integration and Spatial Analysis
- Acronym is 2020-NL-AGRI-SISA, or short Agri Sisa
- Eurostat grant: Modernisation of Agricultural Statistics (ESTAT-2020-PA8-E-AGRI)
- Together with LUKE, Finland
- Contact at Eurostat: Johan Selenius
- Budget is 260K Euro: 219 CBS and 41 LUKE
- Reservation of 40K Euro for services by external parties
- Duration from November 1st, 2021 until December 31st, 2023

Work Packages and Organisation

WP1
Ger

System-to-System data communication applied to official crop yield surveys

WP2
Patrick

Spatial analysis of drought effects on crop yield

WP3
Arthur

Farm Management Information Systems

WP4
Remco
Martin (admin)
Maria (LUKE)

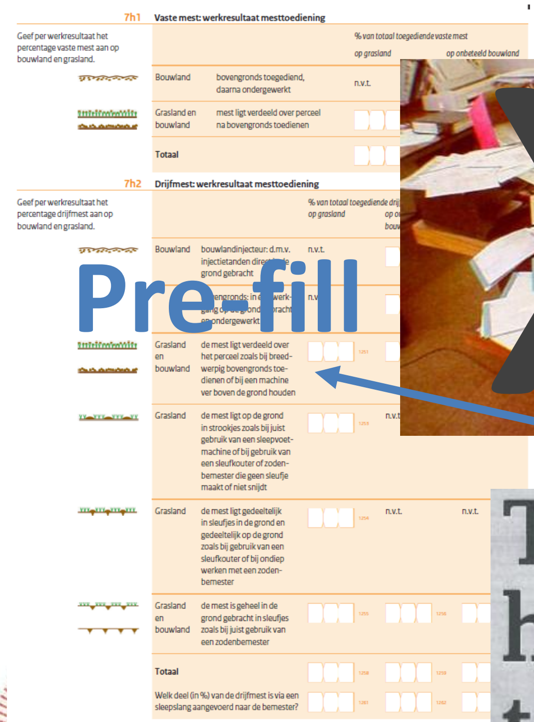
Coordination

(bi)monthly project meeting

WP1: System-to-System data communication applied to official crop yield surveys

Ger Snijkers

General idea


7h1 Vaste mest: werkresultaat mesttoediening

Geef per werkresultaat het percentage vaste mest aan op bouwland en grasland.

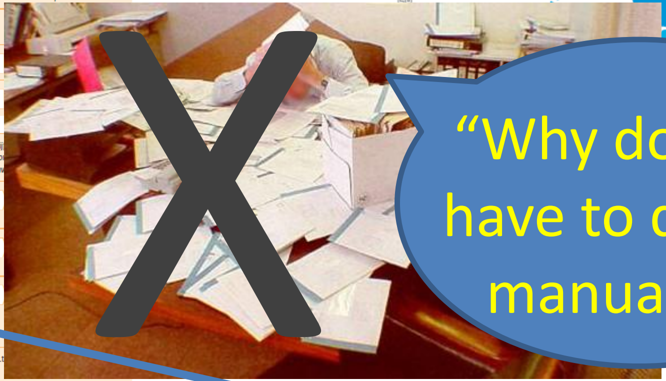
		% van totaal toegediende vaste mest op grasland	op onbeteeld bouwland
Bouwland	bovengronds toegediend, daarna ondergewerkt	n.v.t.	
Grasland en bouwland	mest ligt verdeeld over perceel na bovengronds toedienen		
Totaal			

7h2 Drijfmest: werkresultaat mesttoediening

Geef per werkresultaat het percentage drijfmest aan op bouwland en grasland.

		% van totaal toegediende drijfmest op grasland	op onbeteeld bouwland	
Bouwland	bouwlandinjecteur: d.m.v. injectietanden direct grond gebracht	n.v.t.		
	bovengronds: in een werkgang ondergewerkt	n.v.t.		
Grasland en bouwland	de mest ligt verdeeld over het perceel zoals bij breedwerpig bovengronds toedienen of bij een machine ver boven de grond houden	1251		
Grasland	de mest ligt op de grond in strookjes zoals bij juist gebruik van een sleepvoetmachine of bij gebruik van een sleufkouter of zodenbemester die geen sleufje maakt of niet snijdt	1253	n.v.t.	
Grasland	de mest ligt gedeeltelijk in sleufjes in de grond en gedeeltelijk op de grond zoals bij gebruik van een sleufkouter of bij ondiep werken met een zodenbemester	1254	n.v.t.	n.v.t.
Grasland en bouwland	de mest is geheel in de grond gebracht in sleufjes zoals bij juist gebruik van een zodenbemester	1255	1256	
Totaal		1258	1259	
Welk deel (in %) van de drijfmest is via een sleepslang aangevoerd naar de bemester?		1261	1262	

Pre-fill



“Why do I still have to do this manually?”

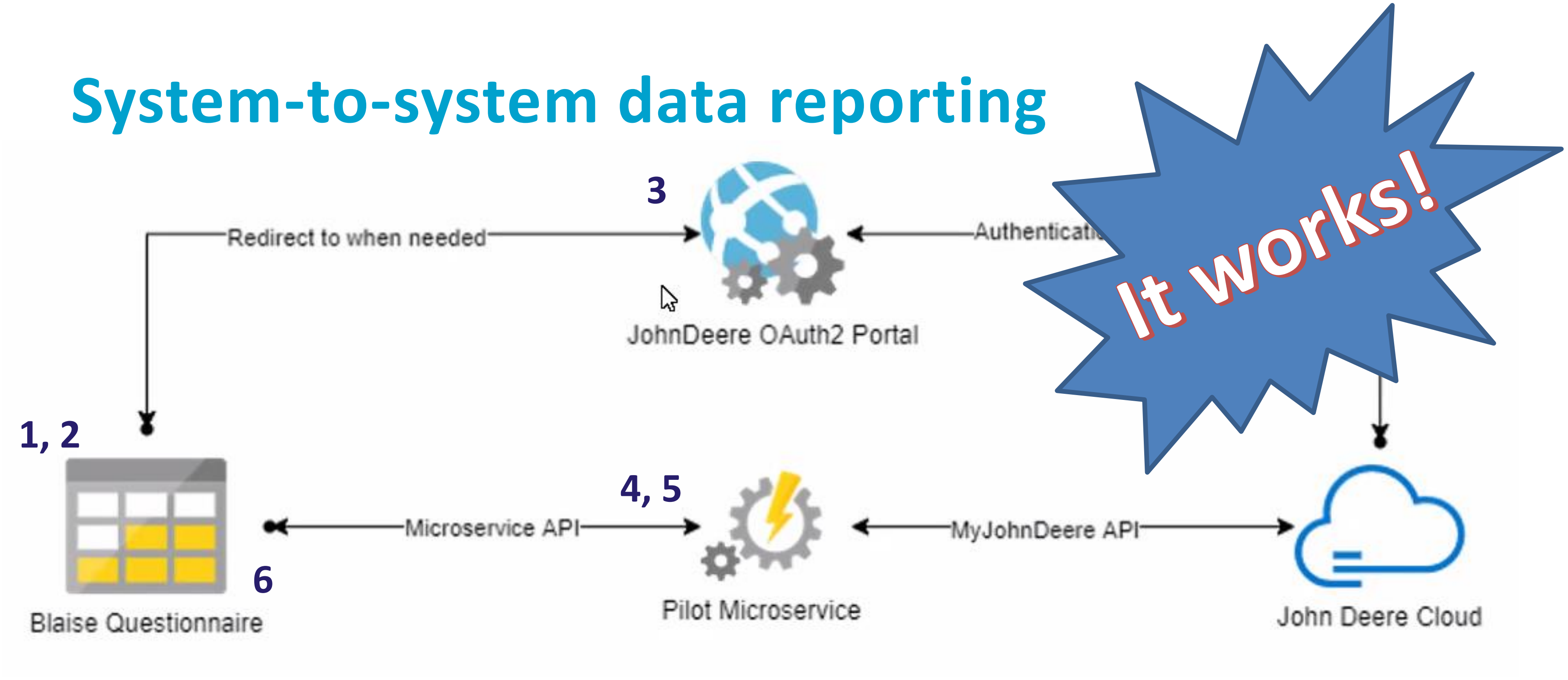
Pre-filling: How to make this work?

Pilot with JOHN DEERE

Techno farmer has the future

Smart industries
Smart farming

System-to-system data reporting



Steps in process:

1. Online Q login
2. MyJohnDeere?
3. Authentication
4. Online Q <-> Microservice <-> John Deere
5. Prefilled questionnaire
6. Submit?

WP3: Farm Management Information Systems

Arthur Denneman

FMIS vendors The Netherlands

- Two most-used systems in Netherlands:

AgroVision AGRICULTURAL SOFTWARE

DACOM DACOM FARM INTELLIGENCE

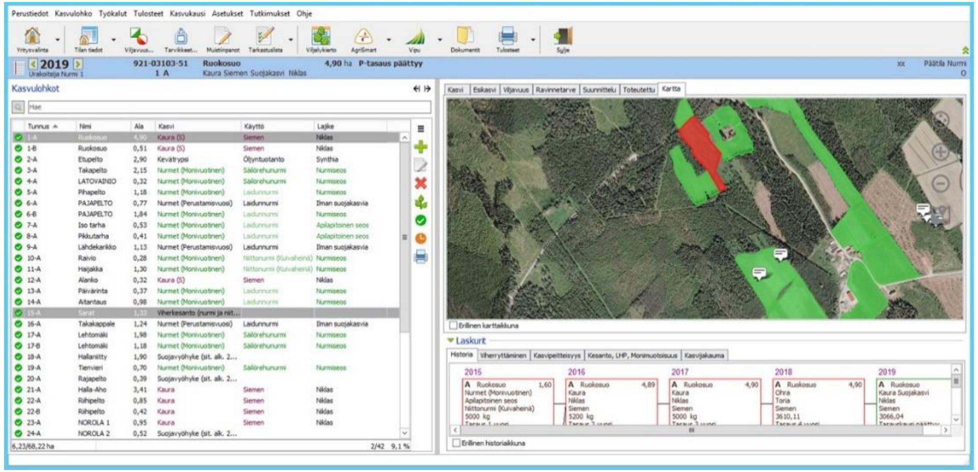
- Connection made using AgroConnect (EDI-Crop Standard)
- Data of some farmers analysed; results are very promising

FMIS vendors Finland

- Suonentieto
  - Agrineuvos
  - AgriSmart
- Mtech
  - Visu
  - WebWisu
  - MobiWisu
- Softsalo
  - Peltotuki Pro
- Datatech
  - Aktiivipelto
  - Aktiivikirjanpito

focus on arable farming

focus on dairy production



Lot of information, e.g. Suonentieto

Agrineuvos	AgriSmart
• Cultivation plan and cultivation notes • Soil sample and fertility studies • Parcel nutrient accumulation and nutrient demand (environmental commitment, nitrate regulation) • Farm inputs (manures, fertilizers, plant protection agents, seeds and crop products) • Plants and varieties • Industrial fertilizers • Domestic and industrial manures (manure analyses) • Soil conditioners • Plant protection agents	• Farming notes (planned/completed tasks, related supplies and parcel information) • Supplies (manures, fertilizers, plant protection agents, seeds and crop products) • Warehouses (material flows related to the location and the supplies in them) • Customers (connected to work area or route) • Work areas (field parcels, forest blocks and other work areas) • Notes (with location and pictures) • Yield maps • Satellite images • Work machines and their routes (tractors, connected devices, types of work) • Treatment zones (formation of ISOBUS tasks)

Conclusions and next step

- Results are very promising: crop statistics, pesticides (becomes annual), manure (to be analysed)
- System-to-system communication works!
- FMIS vendors are willing to support integration
- FMIS vendors have different interfaces
- FMIS landscape is scattered; many vendors European-wide
- NSI’s together are a *bigger fish* to support

Our proposal: let’s form a consortium to take this further as part of MAS2023

WP2: Spatial analysis of drought effects on crop yield

Patrick Bogaart

Main objective and information sources

Develop methods to quantify and map drought stress related crop yield reductions, using approaches that are consistent with the current agricultural crop yield statistics.

We focus on two countries that have been experiencing a cool to temperate climate in the past, but now start to experience serious droughts: The Netherlands and Finland

Information sources

Hydrometeorological data

- Precipitation, (potential) evapotranspiration, etc.
- Station; gridded

Agricultural statistics

- Crops planned, yields;
- Local; Regional

Earth Observation

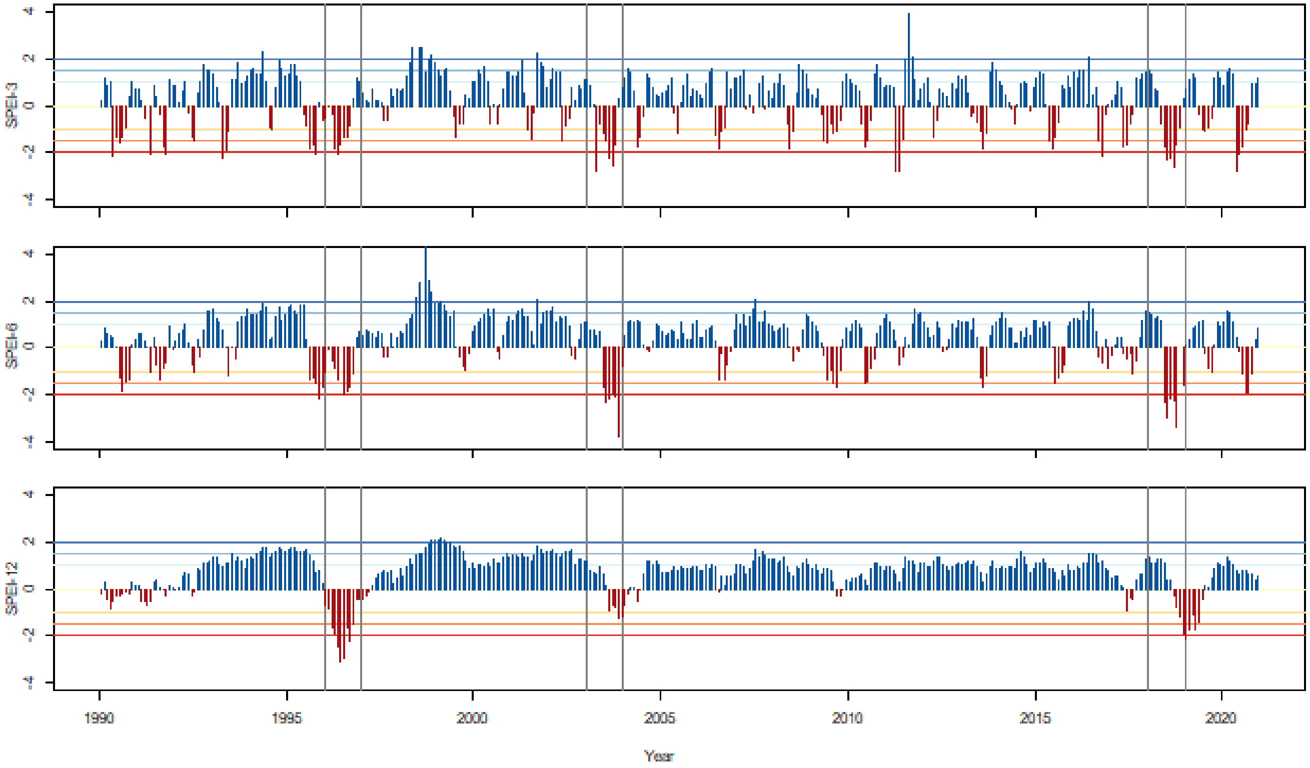
- Biomass; NPP; Soil moisture?
- Yield predictions

Mechanistic Crop-growth modelling

- SWAP / WOFOST

Standardized Precipitation-Evapotranspiration Index (SPEI)

Normalized (μ=0; sd=1) and smoothed (moving avg) difference between precipitation and potential evapotranspiration)

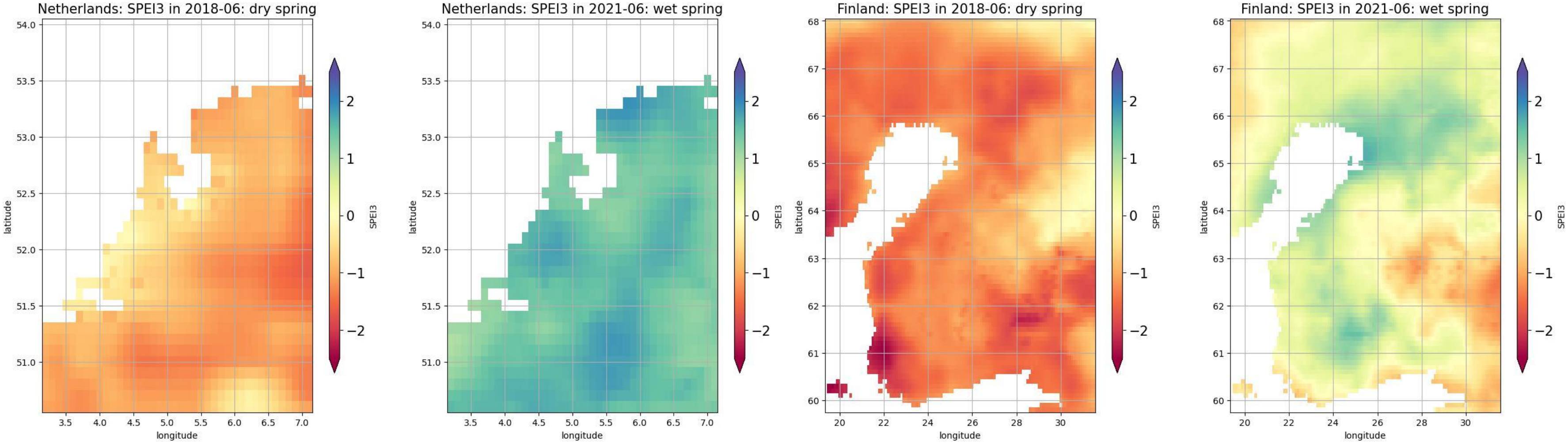


De Bilt region (NL)

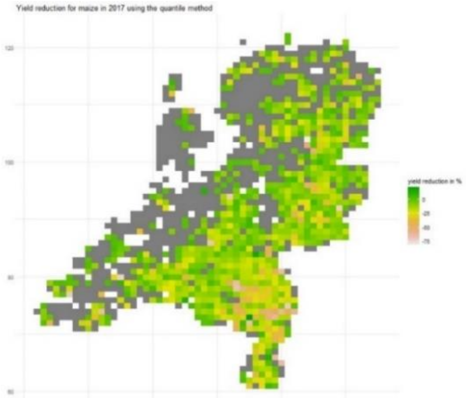
Value	Classification
2.0 or more	Extremely Wet
1.5 to 1.99	Very Wet
1.0 to 1.49	Moderate Wet
-0.99 to 0.99	Normal
-1.0 to -1.49	Moderate Dry
-1.5 to -1.99	Very Dry
-2.0 or less	Extremely Dry

SPEI maps for the Netherlands and Finland

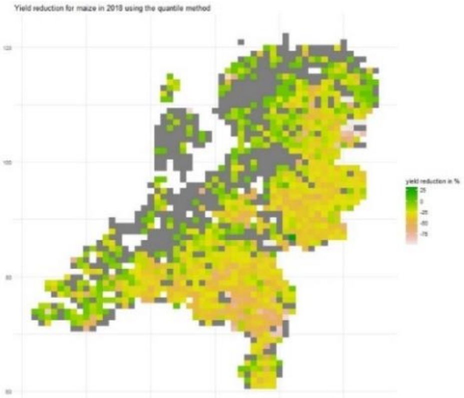
Data from (P) and based on (Etpot) ERA-5 renalysis



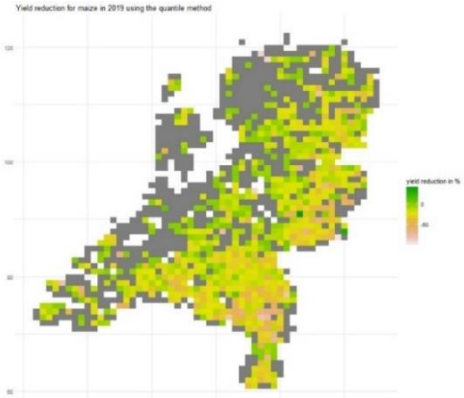
Yield reductions for Maize, 2017 - 2022



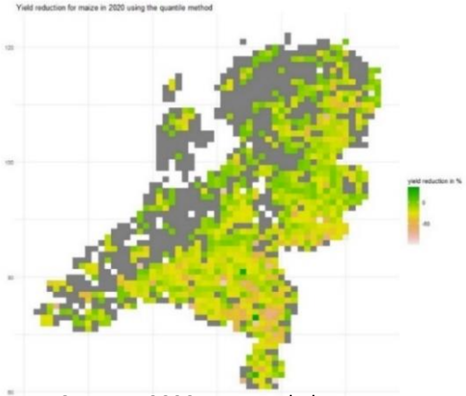
Summer 2017: from extremely hot to cooler temperatures



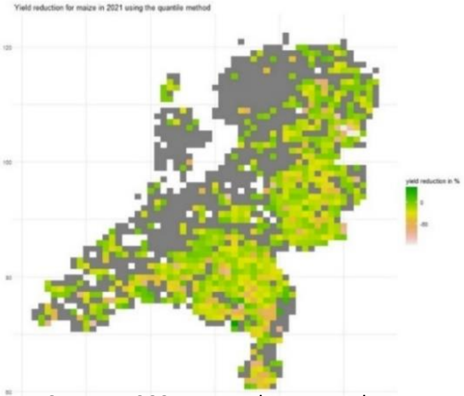
Summer 2018, extremely hot, very sunny and very dry



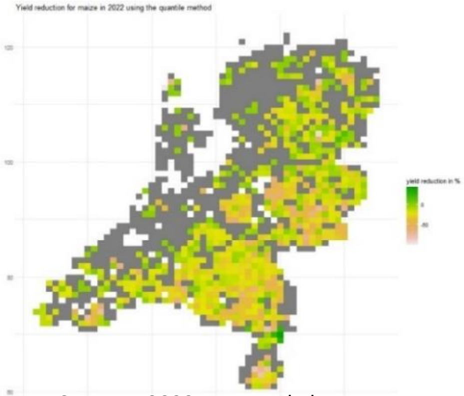
Summer 2019: extremely hot, very sunny and dry



Summer 2020: extremely hot, very sunny , normal precipitation

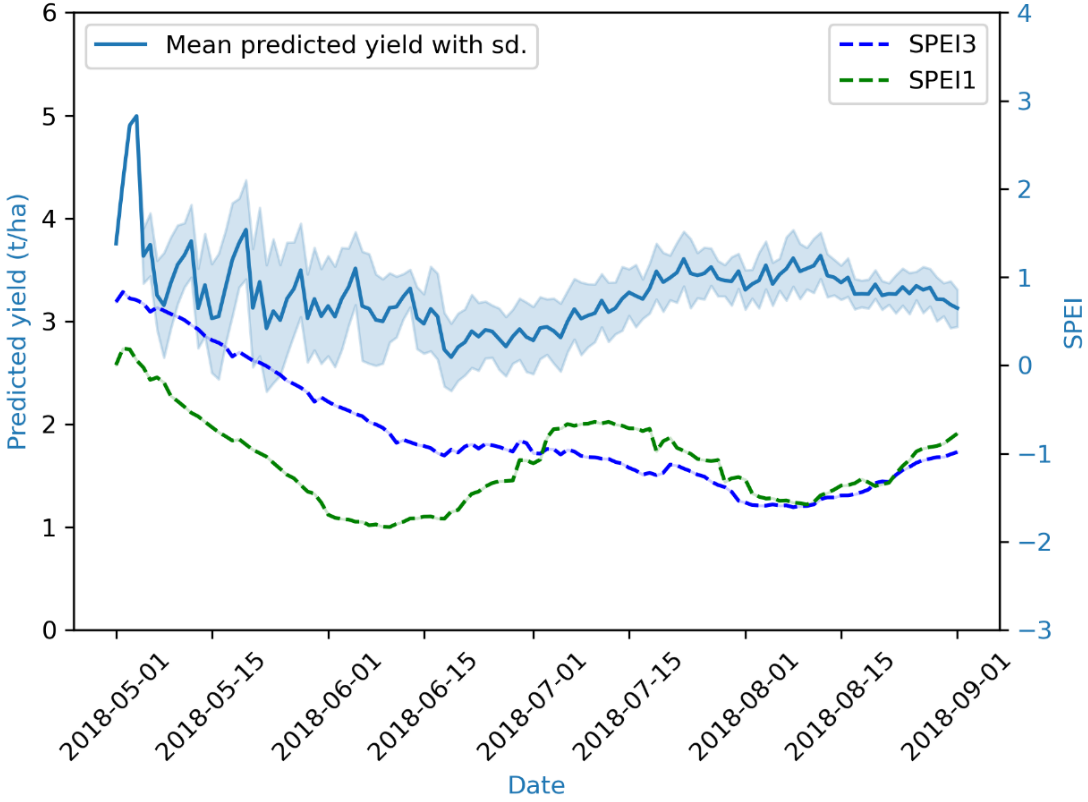


Summer 2021: normal summer, but a bit more precipitation than normal

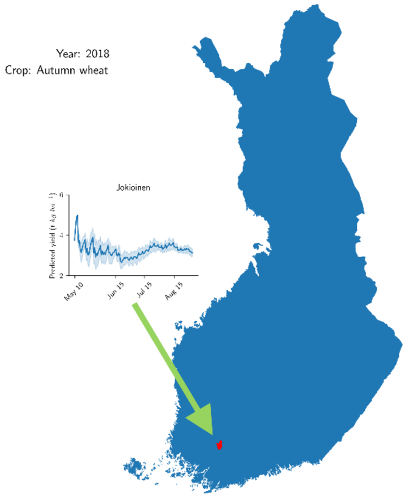


Summer 2022: extremely hot, very sunny and very dry

Using Machine learning to continuously predict yield



Jokioinen region (FI)

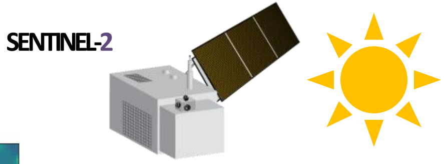


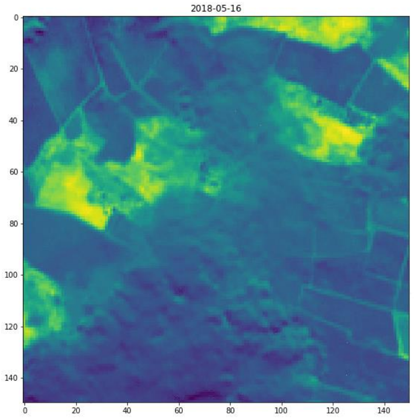
Conclusions and next steps (1)

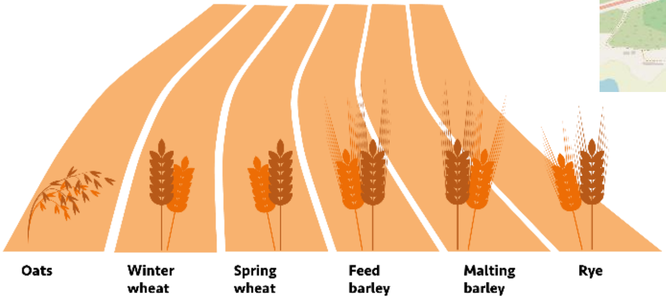
- Quantitative analysis of yields and yield reduction in terms of explanatory variables
  - Using stepwise linear regression
  - Using Temperature, SP(E)I (1,3,6,12), for each month
  - Two data sets:
    - Recent years: spatially distributed, 5x5km scale
    - Longer time series: regional scale
- First results indicate feasibility of approach

Illustrate one approach: Earth Observation

Earth Observation AI/ML model created by LUKE







Observations occluded by clouds:

Each crop type a separate prediction model

Input data: Sentinel-2

- Reflectance values from 10 bands
- Spatial resolution 10m
- Temporal resolution 2-3 days

Trained on farm-level yields

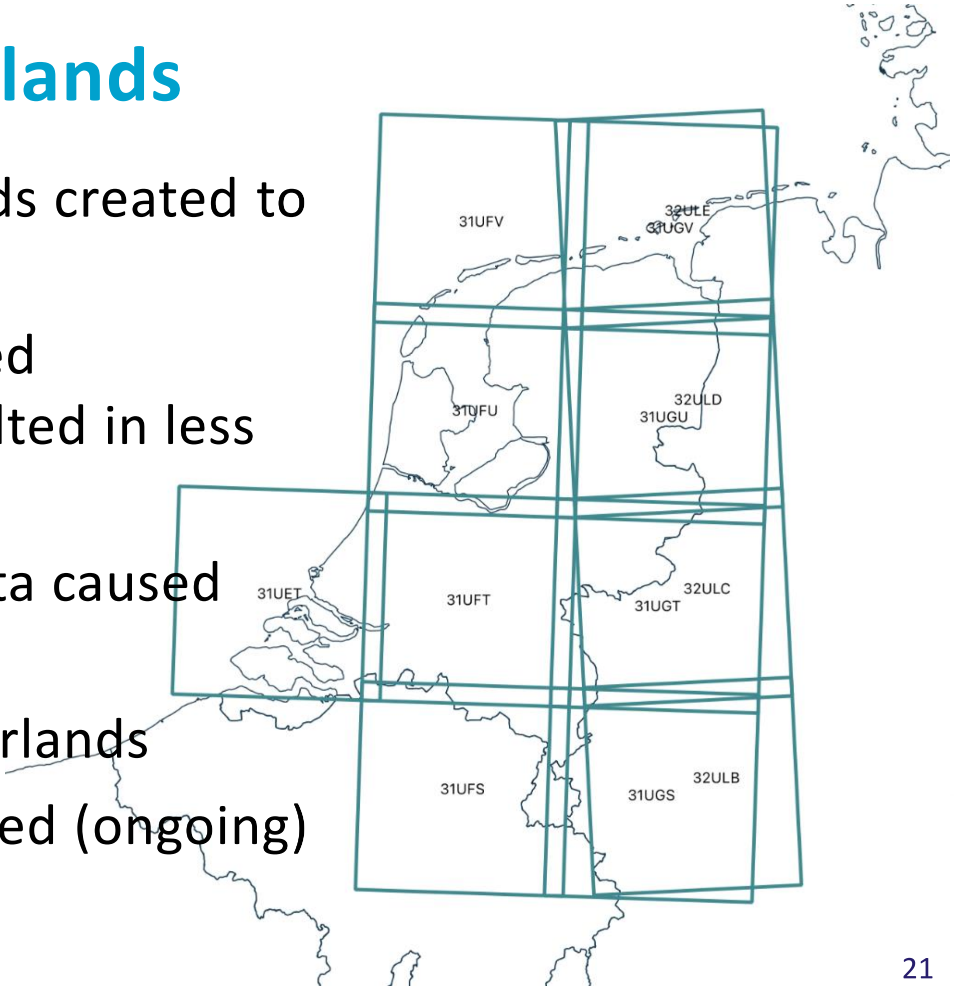
- From crop production survey

Output: Field-level predictions

- Field or any homogeneous spatial object

Applied to The Netherlands

- Dataset with farm-level yields created to re-train the model
- Dataset statistically protected (competition sensitive) resulted in less quality
- Training with less quality data caused model to perform less
- Model applied to The Netherlands
- Results retrieved and analyzed (ongoing)



Conclusions and next steps (2)

- Besides the interesting results on drought effects on crop yield, we see potential in generalizing and applying existing EO AI/ML models on other countries and time frames
- Proposal for AI/ML grant: One Stop Shop, WP7 on use case Earth Observation (start date April 1st, 2024)
- Idea is to use the Polish crop yield model (among others)
- Consortium created, consisting of AT, DK, FR, IE, IT (co-lead), NL (lead), PL and PT

Q&A