Combining Copernicus and drone data for agriculture and forestry

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VITO RS in a nutshell

- VITO (Flemish Technological Research Institute)
  - ~ 700 people
  - Private but non-profit (shares in the hand of the Flemish government)
  - Bridge between universities and industry (very applied research)
  - 172 M€ turnover in 2017
  - Research domains : Energy, Chemistry, Materials, Health and Environment

- Remote Sensing Department
  - 85 people mostly working on (automated) image processing
  - Archiving and Data Processing Center > 7 PBy
  - More than 20 years operational satellite data processing
  - More than 10 years operations with RPAS (environment, agriculture, water, infrastructure, forestry and security)

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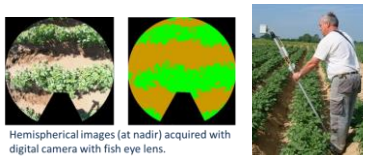
From High resolution research data to operational service using Copernicus

I-POT project (2014-2017)
Potatoes Yield forecast in Belgium
Belgian Science Policy (BELSPO) Stereo funding

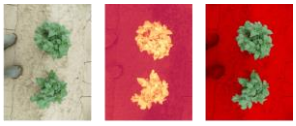
Aim : validate satellite (Sentinel-2 and Deimos) data using RPAS and FishEye imagery

- Ground true (Fish-Eye and standard handheld RGB cameras)
- RPAS (with RGB camera and with multispectral sensor)
- Sentinel-2 (A & B)
- DMC Deimos (22 m GSD) images

Combining knowledge and information from different sources

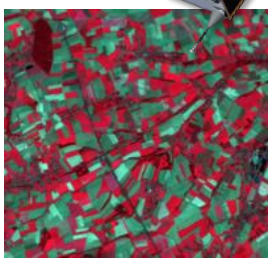


Hemispherical images (at nadir) acquired with digital camera with fish eye lens.

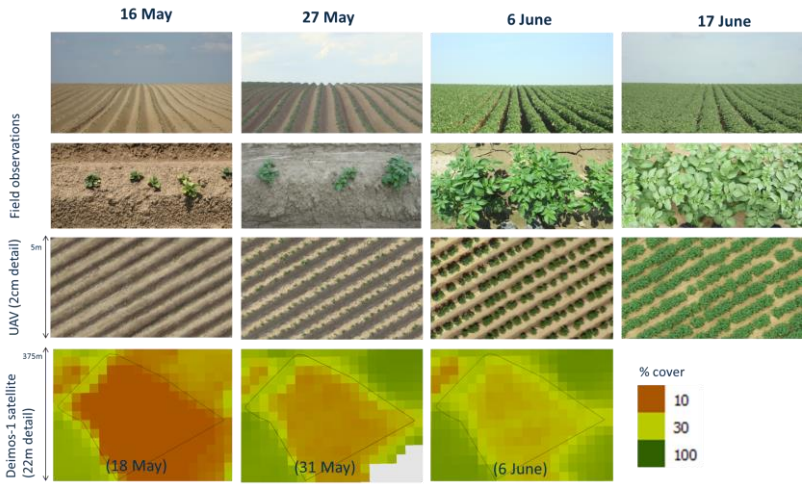


Images acquired with digital camera looking at the ground (at nadir).

Image acquired with RGB camera onboard of Sensefly eBee



Follow-up of the plant grow: fCOVER and fAPAR parameters



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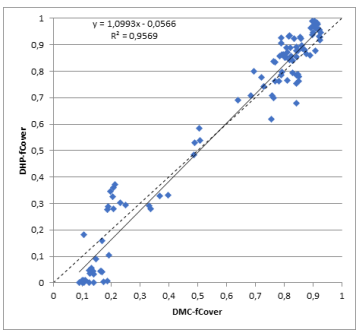
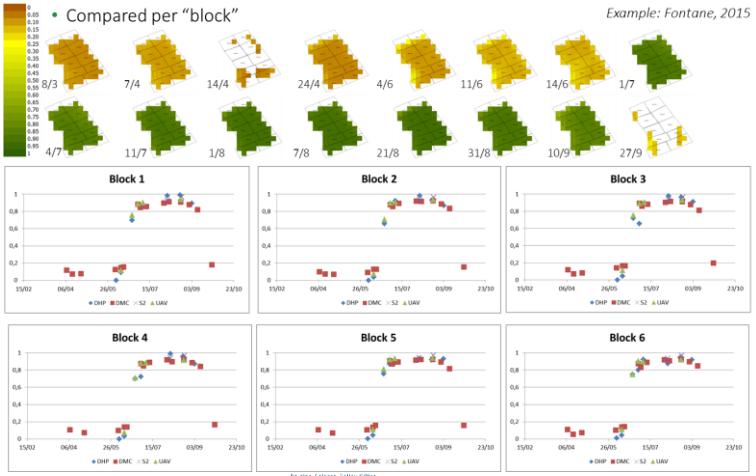
A good correlation was found at block level : Satellite versus RPAS versus DHP-fCover





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A service platform was developed

Very good results were obtained when combining RS information with plant growth model and meteorological data

Valid for different types of potatoes

Sentinel-2 data gives equivalent of better results than Deimos

Sentinel-2 data offer a higher spatial resolution and are free

=> A preliminary platform based on Sentinel-2 data was developed

VITO offers an operational Potato survey service

» WatchITgrow (2018-…) https://watchitgrow.be/en

- VITO own funding
- Further develop the functionalities of Watch IT grow platform
- Offers an operational service for the potatoes yield forecast in Belgium

Currently ~ 600 users

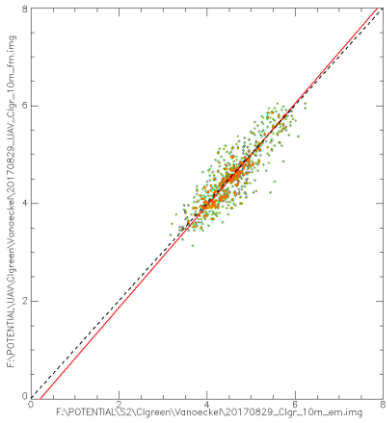
» Extension of the service to other countries (Italy, Netherlands) through the H2020 Databio project (https://cordis.europa.eu/project/rcn/206584_en.html)

"Potential" : Follow-up of fertilization and irrigation demand for potato fields

- ERANET(EU)-Vlaio (VL) project
- Started in 06/2017, for 3 years
- Based on existing service offered by the "Bodemkundigedienst"
  - 1 sample per field
- Enhance the existing service using high resolution RPAS data (RGB, Multispectral and thermal)

  => Provide for each investigated field spatial information (X,Y) on Nitrogen and water stresses
- Future : integrate these indices in a Sentinel-2 based service

Current results are promising



Chlorophyll index extracted from RPAS versus Sentinel-2 images for one plot

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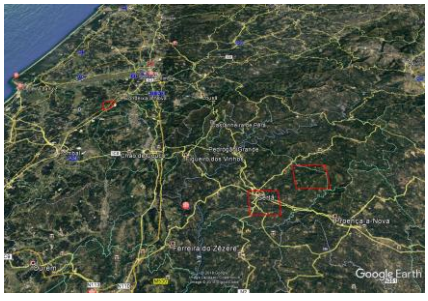
H2020 : Detection of Wild Pine Nematode disease in Portuguese forests

- 3 years project, started on 01/01/2018, https://cordis.europa.eu/project/rcn/212427_en.html
- Based on the existing Silvisense service (S&T company, https://silvisense.com/)
  - Delivery of different indices (land classification, forest drought, forest fire mapping, pine disturbance maps,…) based on Sentinel-2 images combined to state-of-the-art algorithmes.
- Idea : add a detection capacity of WPN to the existing Silvisense service
- Methodology : use multi and hyperspectral to calibrate/validate the sentinel-2 data
- Why : ***100 000 jobs in Portugal are dependent on Forestry***

H2020 : Detection of Wild Pine Nematode disease in Portuguese forests

- End-users requirements and legislation
- System requirements
- Definition of 3 main RoI
- Regular ground measurements
- Historical Sentinel-2 data collection on RoI
- First RPAS multispectral survey (05/2018)
- Preliminary data analyses



- Next step : extensive field campaign (10/2018):
  - Ground measurements
  - RPAS Multispectral, hyperspectral and thermal
  - Airborne hyperspectral (APEX)
  - All synchronized with Sentinel-2 (12 or 17/10/18)

Different exploitation service types/options are developed

- » Sentinel-2 based service
- » Additional operational RPAS based service
  - on-demand
  - Systematic (e.g. twice a year)
- » Extension of the services to other countries

On a longer term : HAPs survey

Main problems upscaling RPAS to Sentinel-2

- Sentinel-2 offers better Red-Edge band for these applications
  => need for Hyperspectral but than complexity increases
- RPAS acquisition takes time => variation in illumination
  ⇒ Need for correction using reference targets for each flight
- Blurring of RPAS images due to platform movement
- Difficult and costly to have good time series

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THANK YOU

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Sentinel-2 image Copernicus Sentinel data (2016)

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