# Building a global, operational, cloud-free biomass data product

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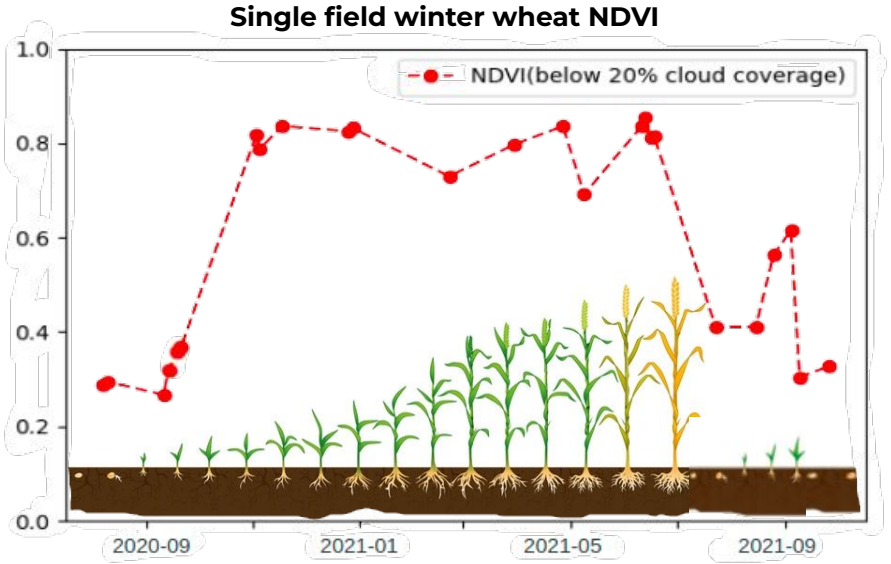
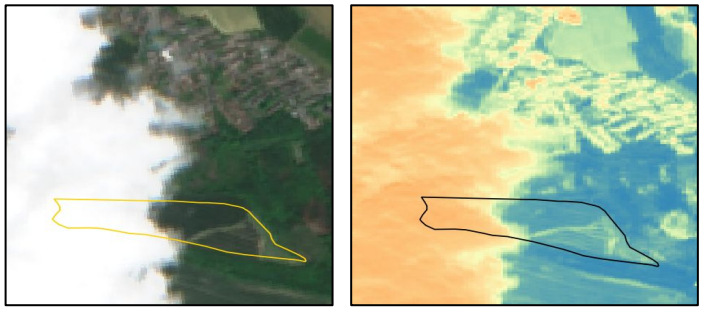
# How to serve the agricultural industry with remote sensing services?

| Identified customer needs | Data product requirements |
| --- | --- |
| ➔ A steady and consistent information supply | → Continuity of output |
| ➔ Always having the latest information | → Near real time production, low latency |
| ➔ Anywhere | → Scalability of the algorithm and production |
| ➔ At a relevant scale | → Resolution that supports field level decisions |

# Vegetation monitoring with NDVI (Sentinel 2)



## Temporal challenges

- ➔ Long periods without observations
- ➔ Saturation of the signal

## Spatial challenges

- ➔ Cloud cover may give partial observations

**Core strength: Spatial Accuracy**

# Is NDVI the ideal data product for vegetation monitoring to support agricultural decision making?

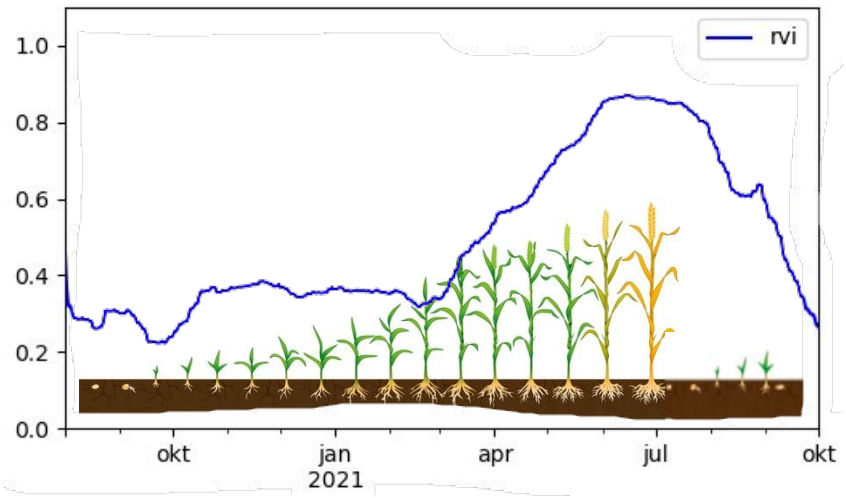
It's good but not ideal!

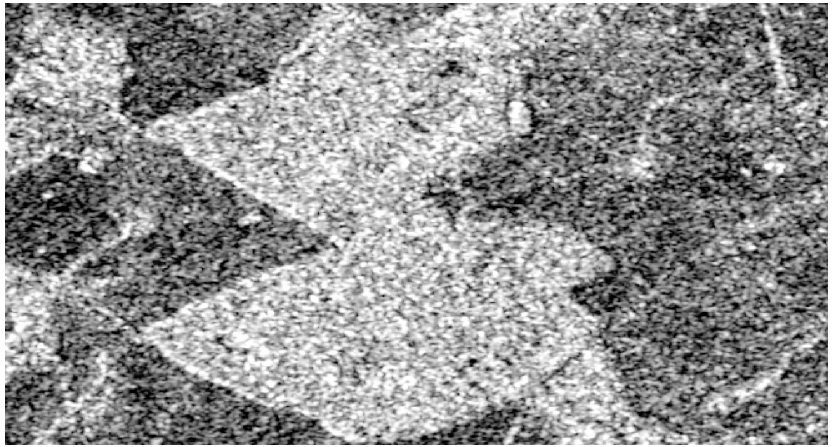
Data product requirements

- ➔ Continuity of output →
- ➔ Near real time production →
- ➔ Scalability of the algorithm →
- ➔ Resolution that supports field level decisions →

# Vegetation monitoring with RVI (Sentinel 1)

**Single field winter wheat NDVI**



Temporal challenges

- ➔ non global consistency of temporal coverage

**Core strength: Temporal resolution**

Spatial challenges

- ➔ High amount of noise/speckle restrict spatial interpretability
- ➔ different orbits/observation angles provide different patterns

# Is RVI the ideal data product for vegetation monitoring to support agricultural decision making?

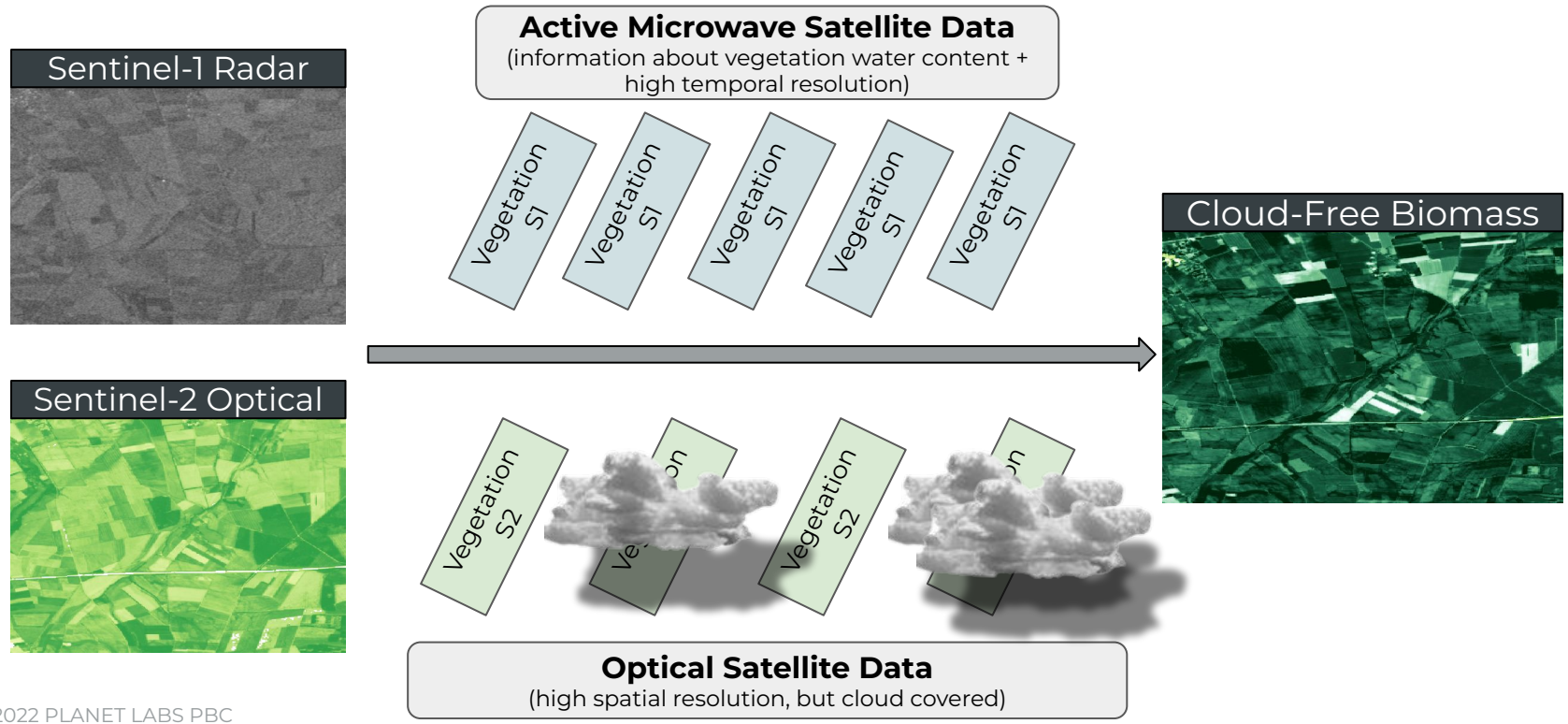
It's good but not ideal!

Data product requirements

- ➔ Continuity of output →
- ➔ Near real time production →
- ➔ Scalability of the algorithm →
- ➔ Resolution that supports field level decisions →




# The Biomass Proxy: a fusion approach combining the strengths of Sentinel-1 and Sentinel-2 for crop monitoring



# Biomass Proxy algorithm key features

1. Signals preprocessing
2. Field level processing
3. Global scaling function to scale RVI into NDVI scale
4. Fusion with static and dynamic contribution of each signal in time and space

# 1. Signals preprocessing

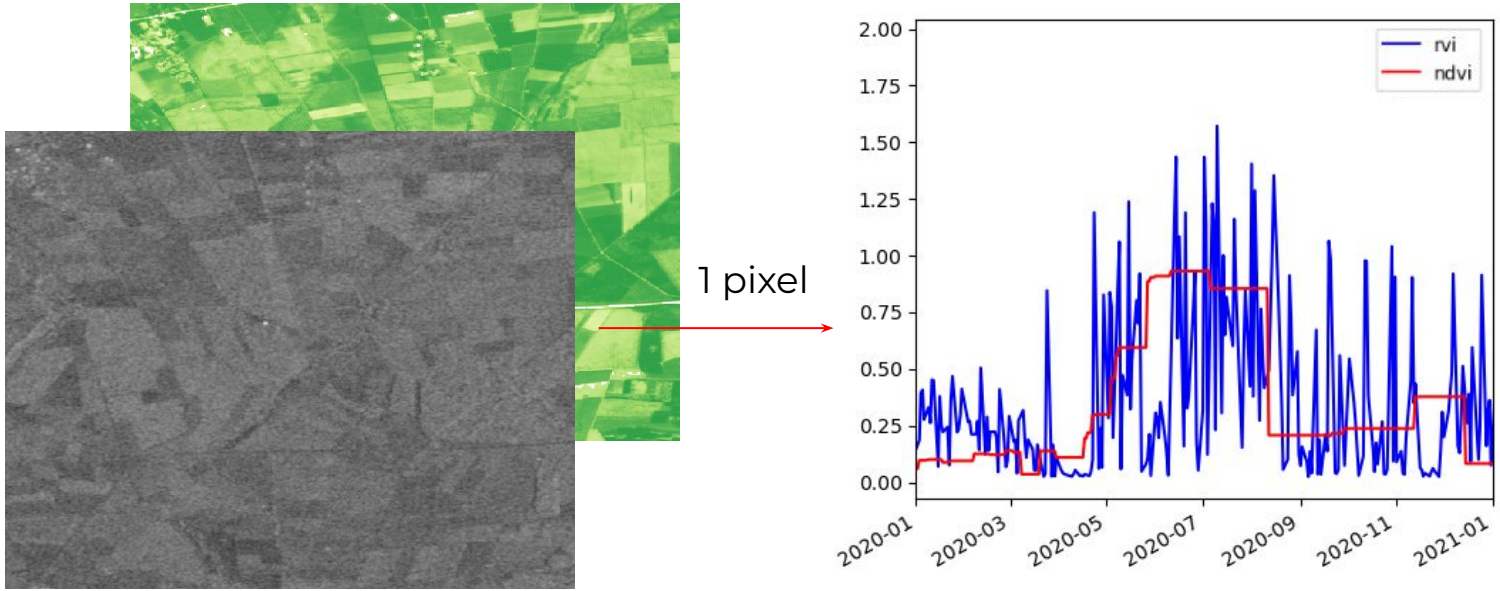
Sentinel 2 data preprocessing

- ➔ Process L1C to L2 data
- ➔ Combine 3 different cloud masks: FMASK, SEN2COR and S2CLOUDLESS
- ➔ Automatic detection and mitigation of false positives in the masking process

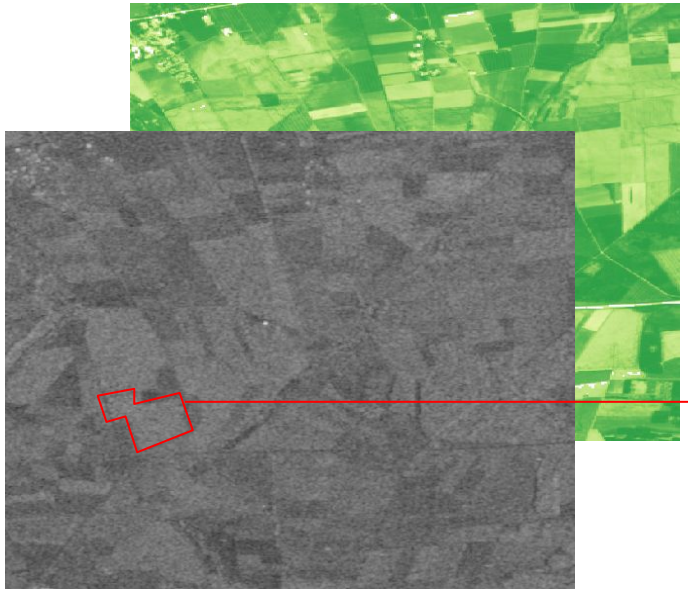
Sentinel 1 SAR IW GRD data preprocessing

- ➔ Process sigma backscatter in decibel using SNAP
- ➔ Apply multi temporal lee sigma filter + median filter
- ➔ Apply orbit correction at field level

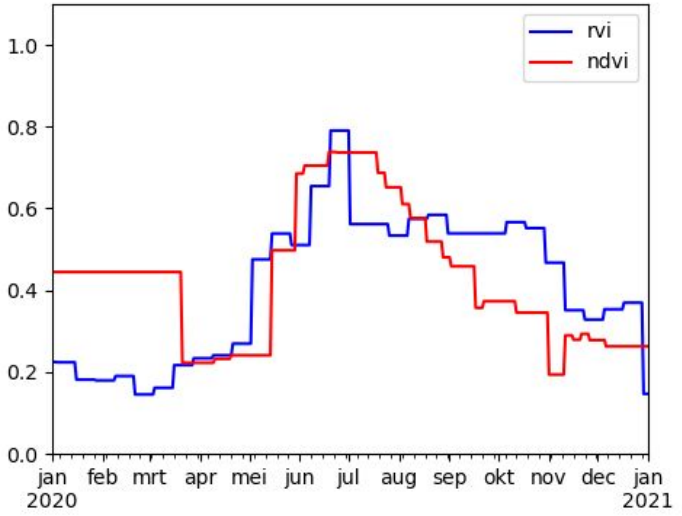
# 2. Field level processing:
# Fusion should <u>not</u> happen at the pixel level



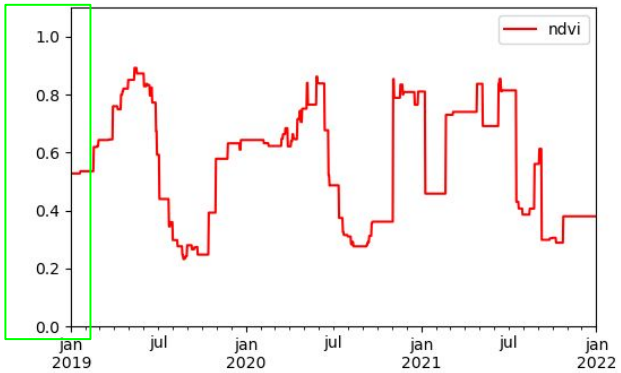
# 2. Field level processing: Fusion should happen at field level

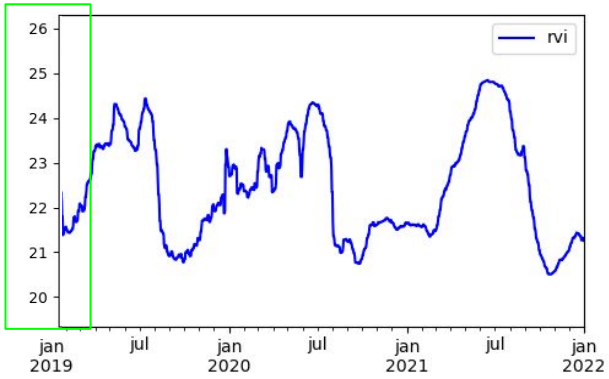


1 field



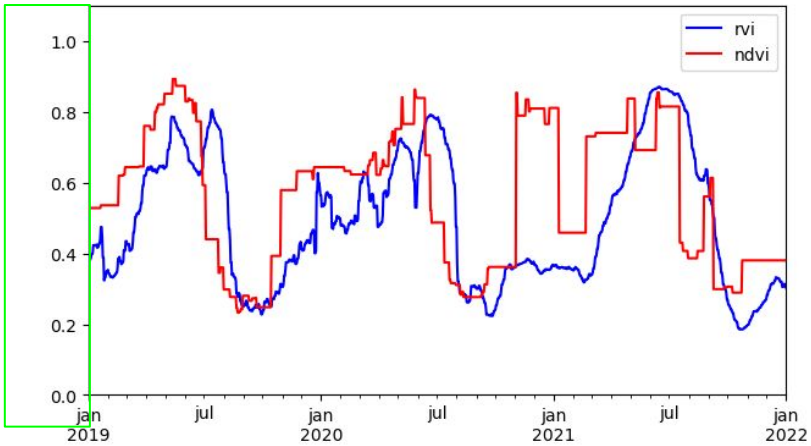
# 3. Scaling: two time series at field level, how to fuse them?



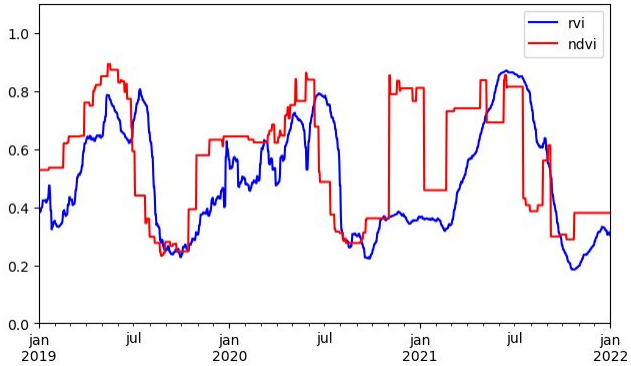

Fusion requires signal scaling

?

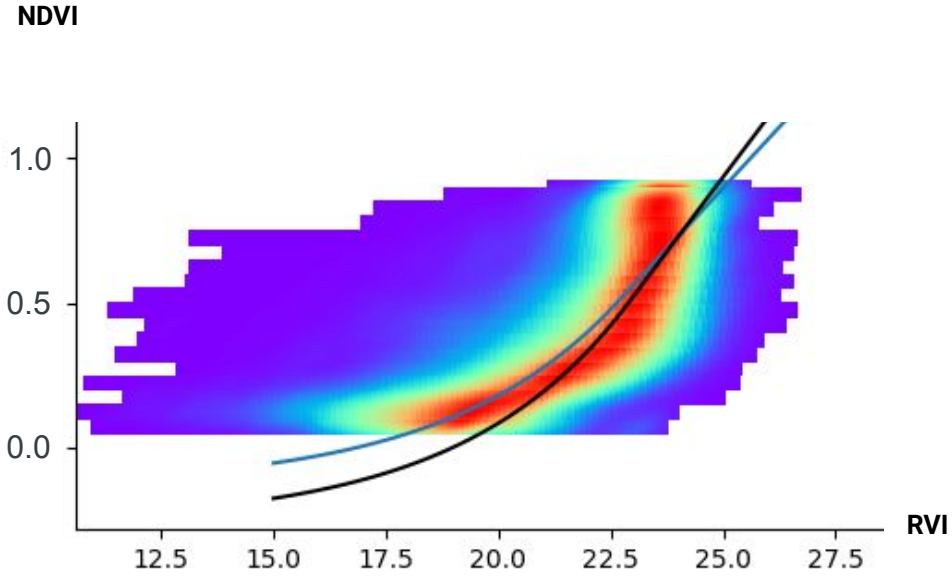


# 3. Scaling: How do we map s1 index values to s2 ndvi scale?

Process the time series..




.. of many agricultural fields

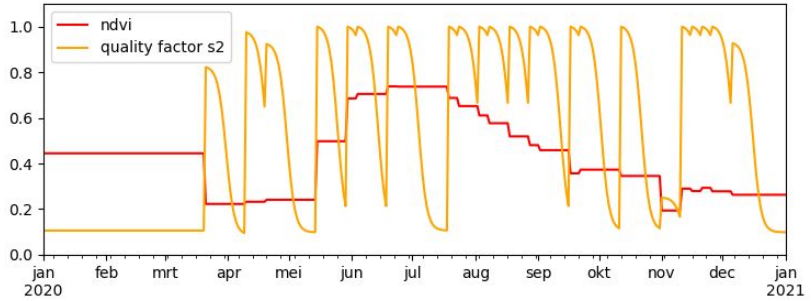


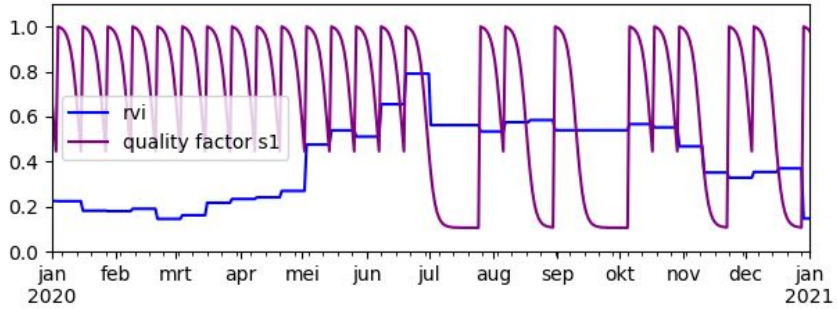

.. and one finds a power relationship

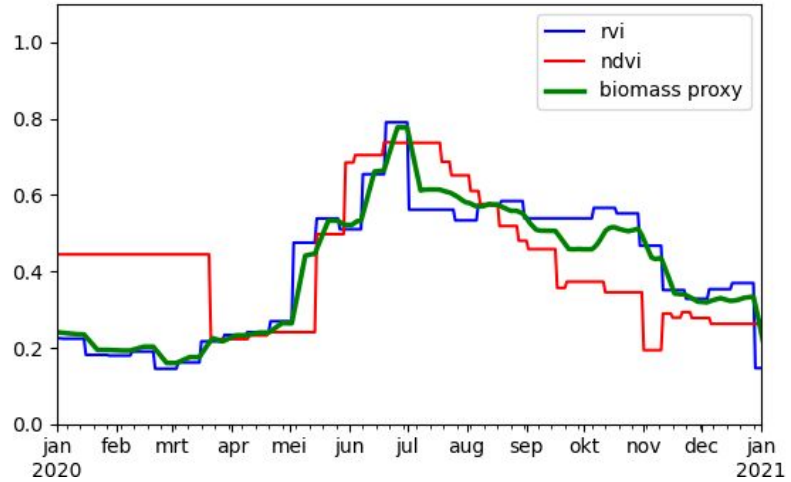
# 4. Dynamic contribution of each signal in time and space

- Fusion in **time** with specific static and dynamic weights for each signal
- Fusion in **space** with specific static and dynamic weights for each signal

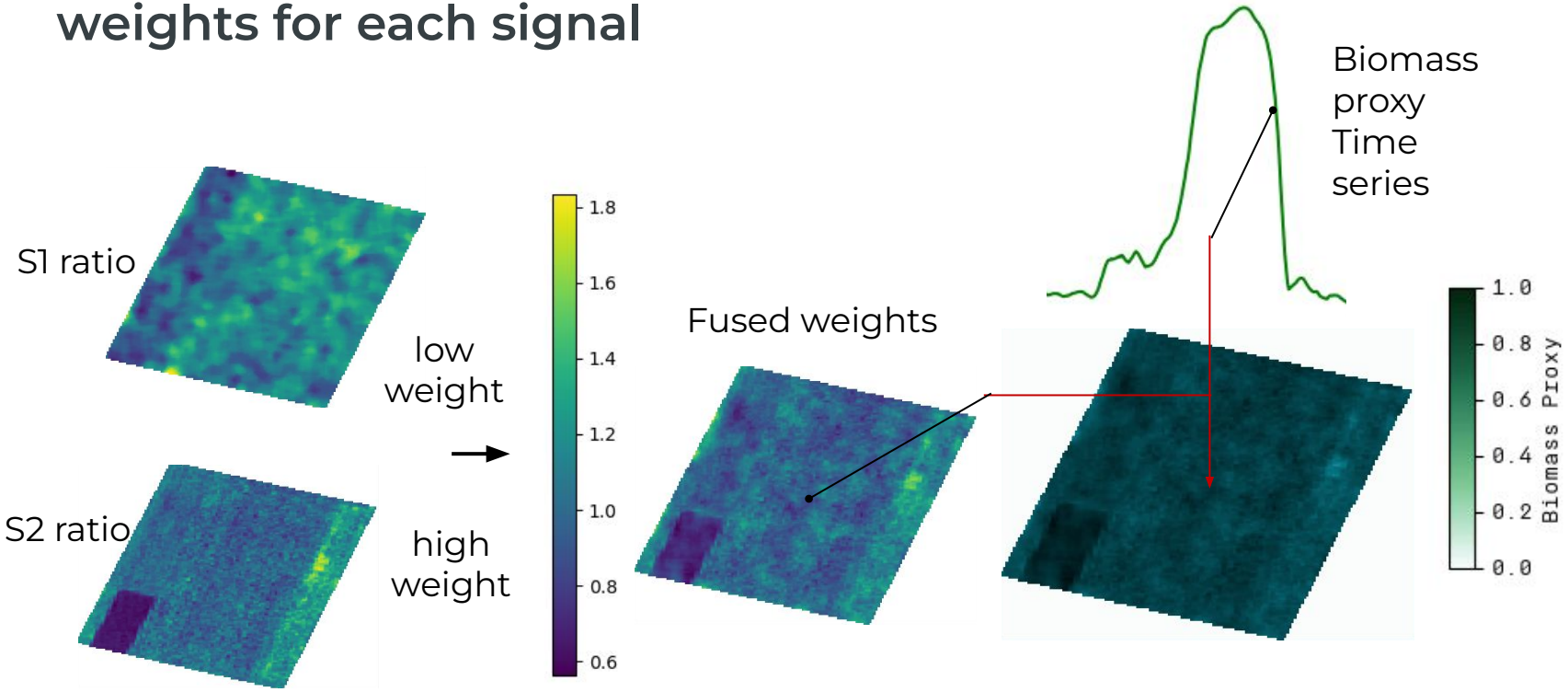
# 4. Fusion: in time with specific static and dynamic weights for each signal



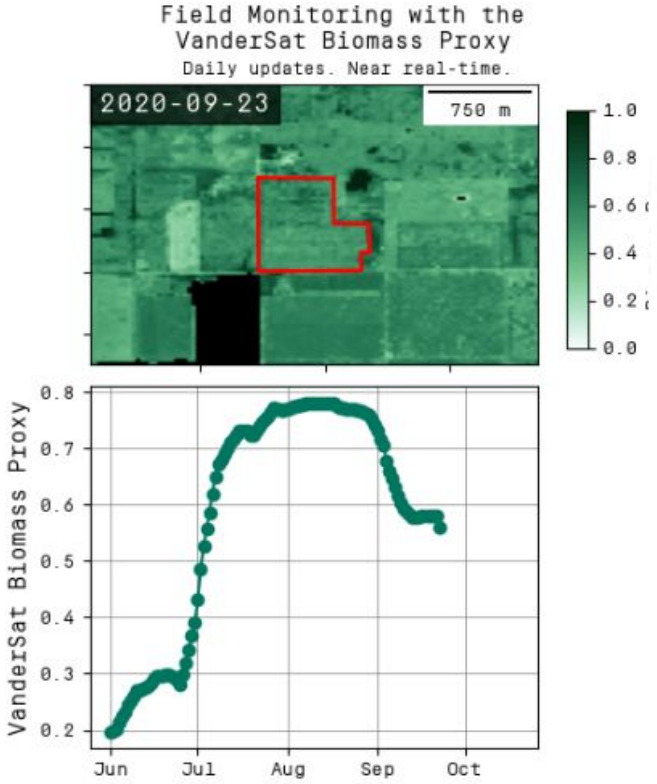



# 4. Fusion: in space with specific static and dynamic weights for each signal



# Summarizing the Biomass Proxy

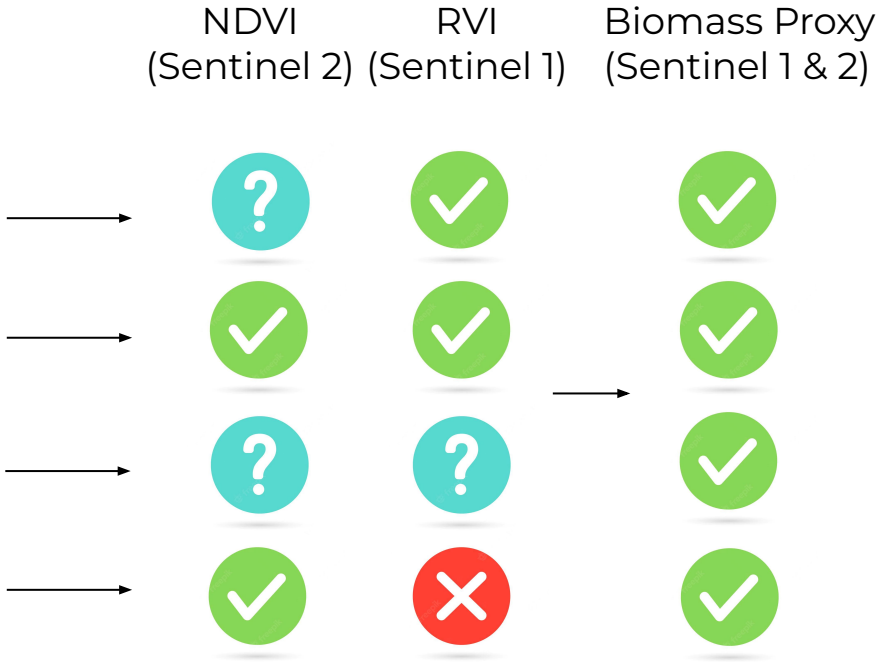
- Biomass Proxy (BP) was developed specifically for **crop monitoring.**
- Biomass Proxy (BP) combines Sentinel-1 (SAR) and Sentinel-2 (optical) data
- BP provides data that is:
  - **Daily**
  - **Cloud-free**
  - **10-meter resolution**
  - **Near Real Time**
- The Biomass proxy algorithm is flexible to other input microwave and optical data such as PlanetScope



# Combining the core strengths of NDVI and RVI, the Biomass Proxy can serve for commercial applications

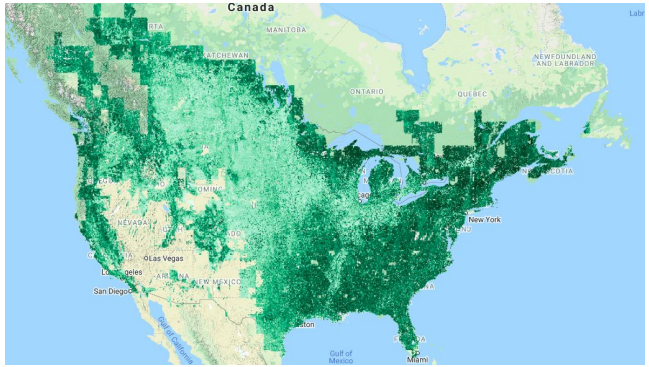
Data product requirements

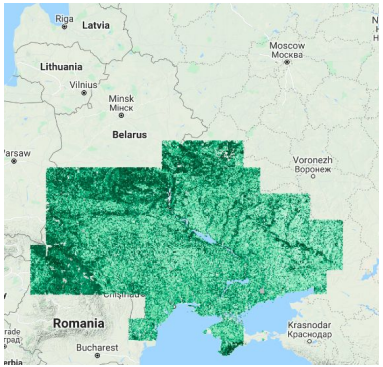
- Continuity of output
- Near real time production
- Scalability of the algorithm
- Resolution that supports field level decisions

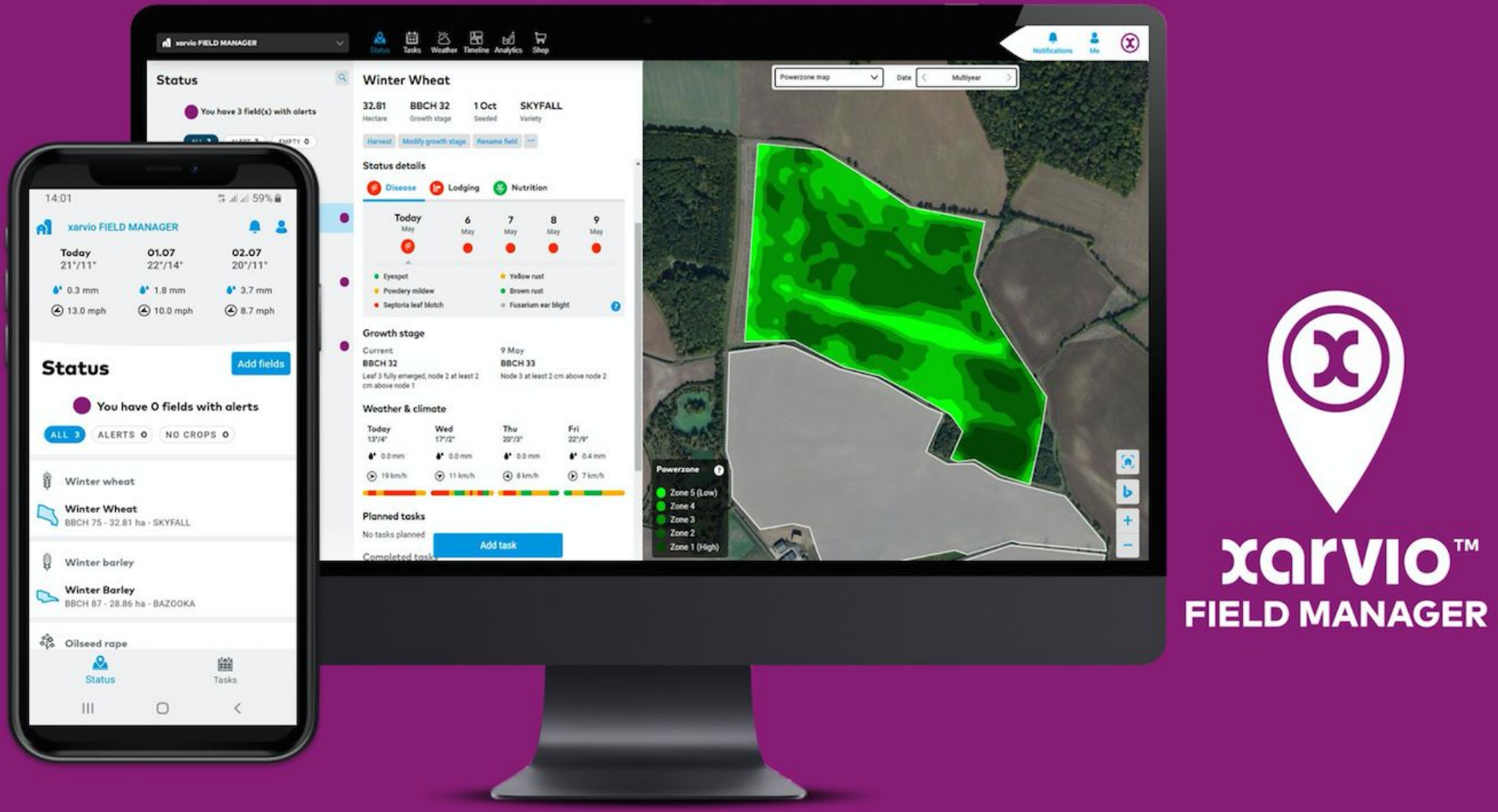


# Combining the core strengths of NDVI and RVI, the Biomass Proxy can serve for commercial applications

Now operational in over 20 countries, but can be generated anywhere in the world where sentinel 1 & 2 data is available



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# Thank You.

**Engage with Planet's Science Programs and apply here for Planet Data via ESA Earthnet**

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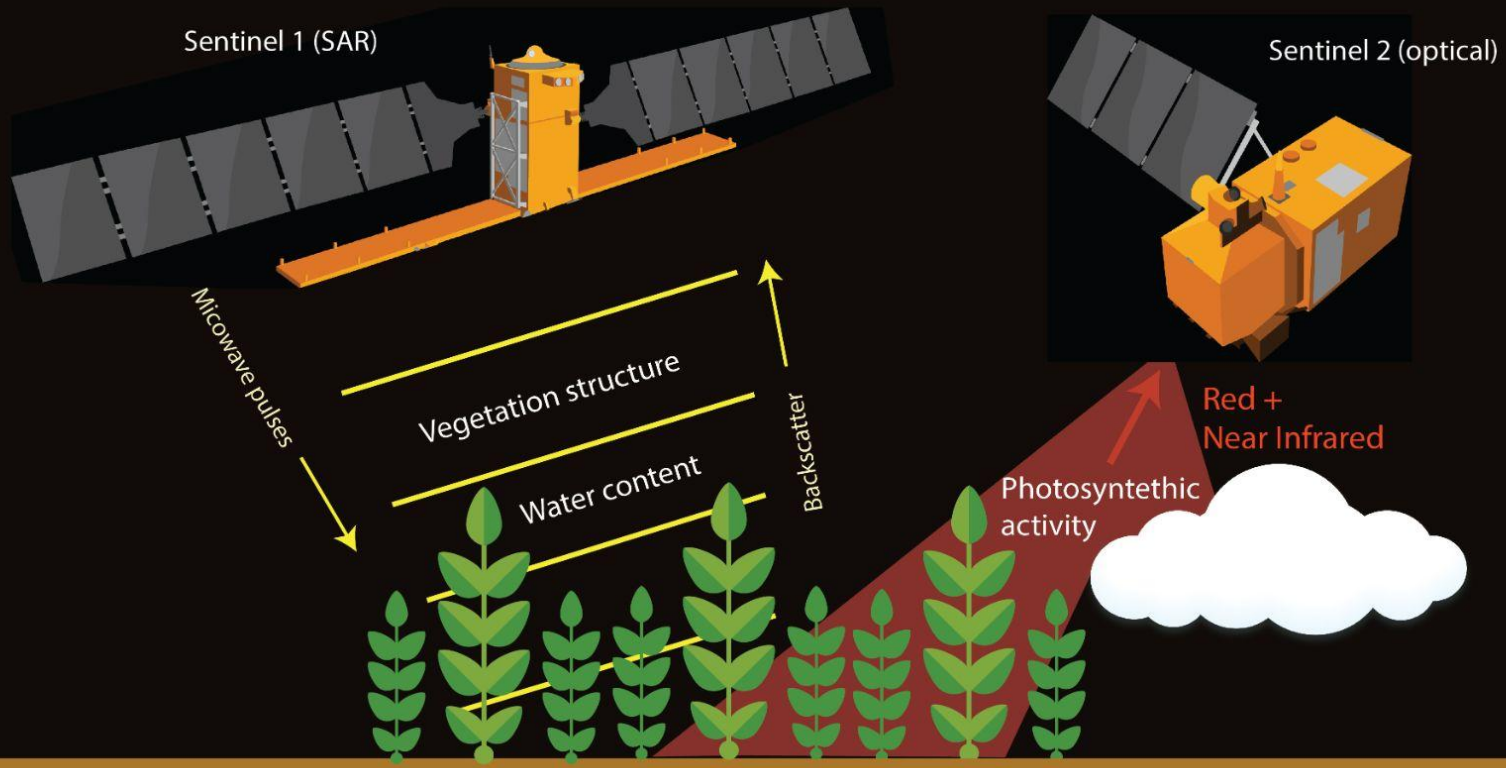
Sentinel 1 (SAR)
Sentinel 2 (optical)
Micowave pulses
Vegetation structure
Water content
Backscatter
Red +
Near Infrared
Photosyntethic
activity