Planetary Variables for Earth Observation

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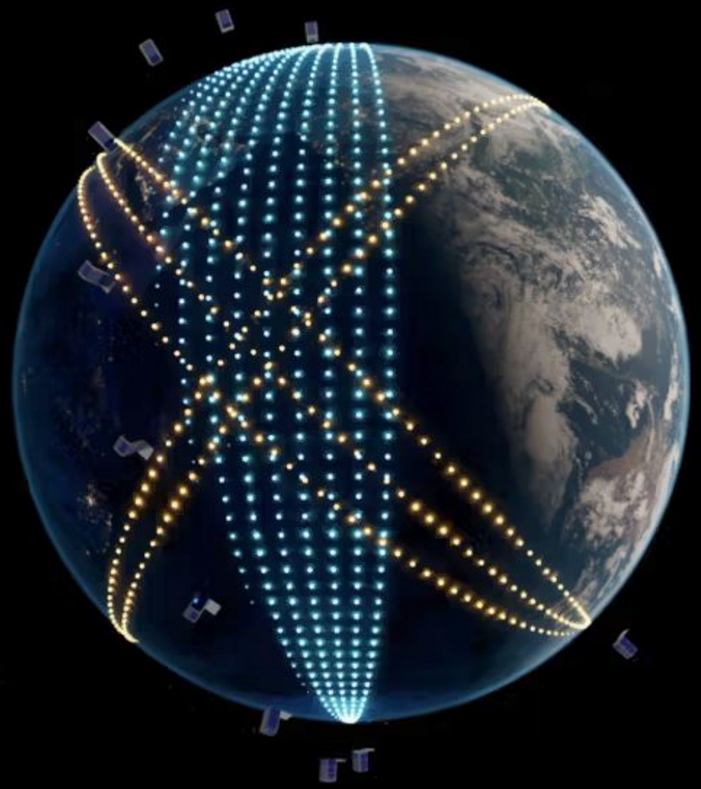
PlanetScope: monitoring

- Hundreds of satellites
- 3-meter spatial resolution
- Mapping the entire Earth, every day
- 8 spectral bands

SkySat: tasking

- Dozens of satellites
- 50-centimeter spatial resolution
- Imaging on demand
- 4 spectral bands

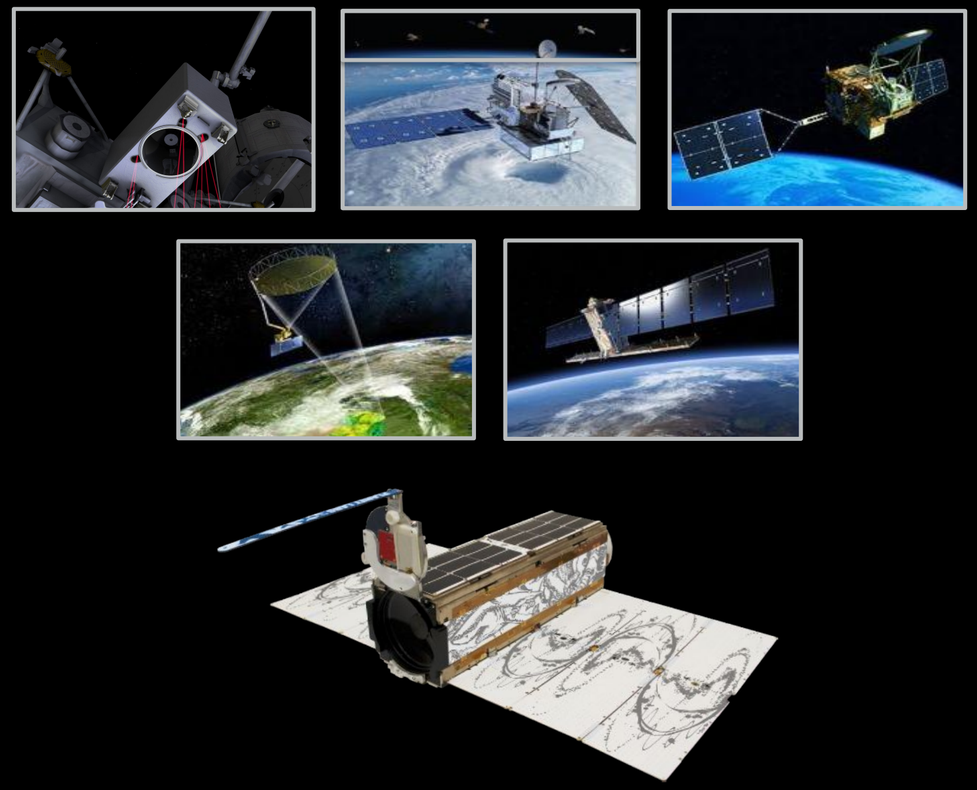


Tanager: hyperspectral

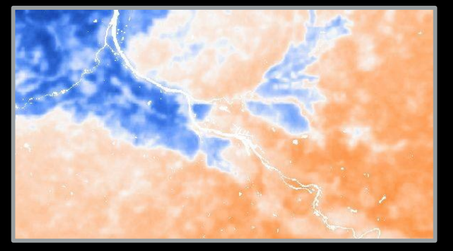
- First satellite launched 2024
- 420 spectral bands
- Weekly revisit

A Virtual Constellation of Planet and Public Sensors

Planetary Variables Measure Key Phenomena



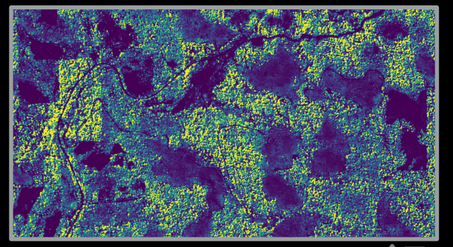
PLANET FUSION



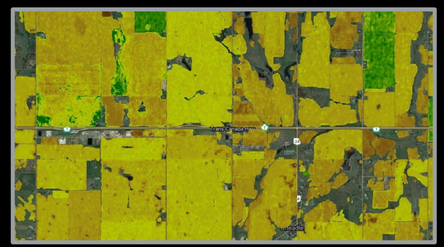
SOIL WATER CONTENT

LAND SURFACE TEMPERATURE

FOREST STRUCTURE



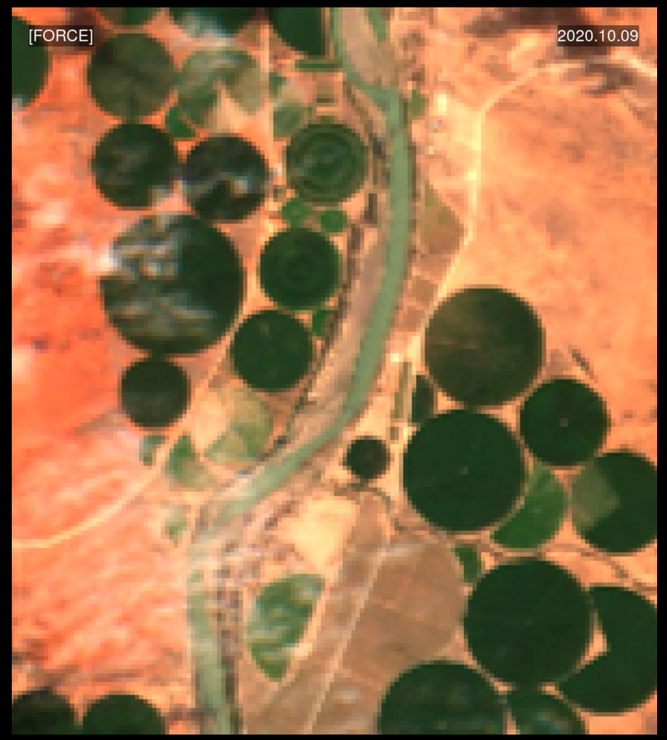
FOREST CARBON



CROP BIOMASS

Cloud-free harmonized optical data and indices

Planet Fusion



Sentinel-2 + LandSat 8/9 (FORCE)

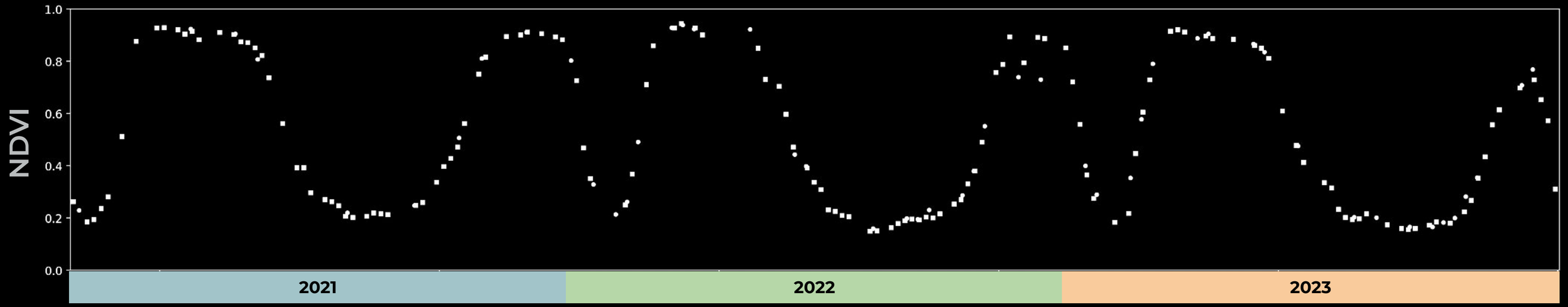
Planet Fusion

Combine PlanetScope, SkySat with radar and optical satellites to provide daily, cloud-free, and harmonized optical images

- Combine multiple un-harmonized input data, including SAR, and use machine-learnings method to harmonize.
- Global daily, cloud-free optical and near-infrared images at 3-meter spatial resolution.

Cloud-free harmonized optical data and indices

Planet Fusion



Cloud-free harmonized optical data and indices

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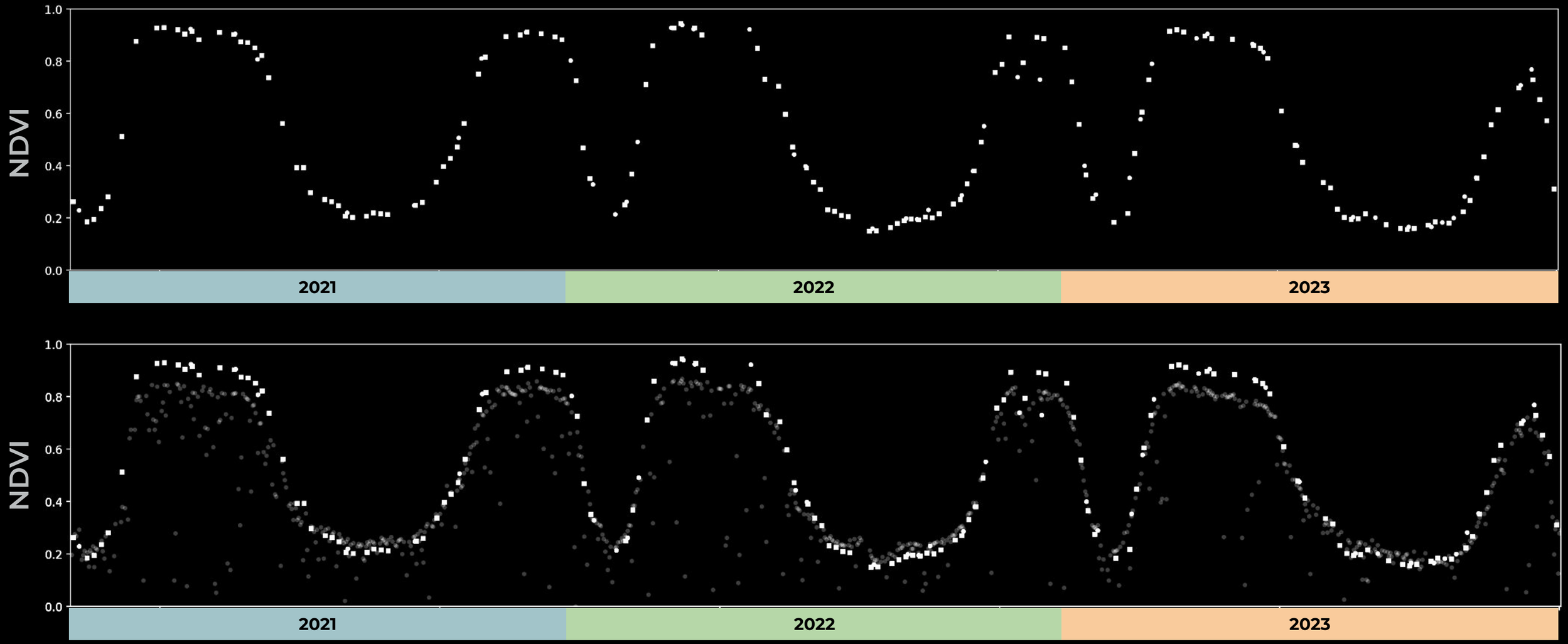

Cloud-free harmonized optical data and indices

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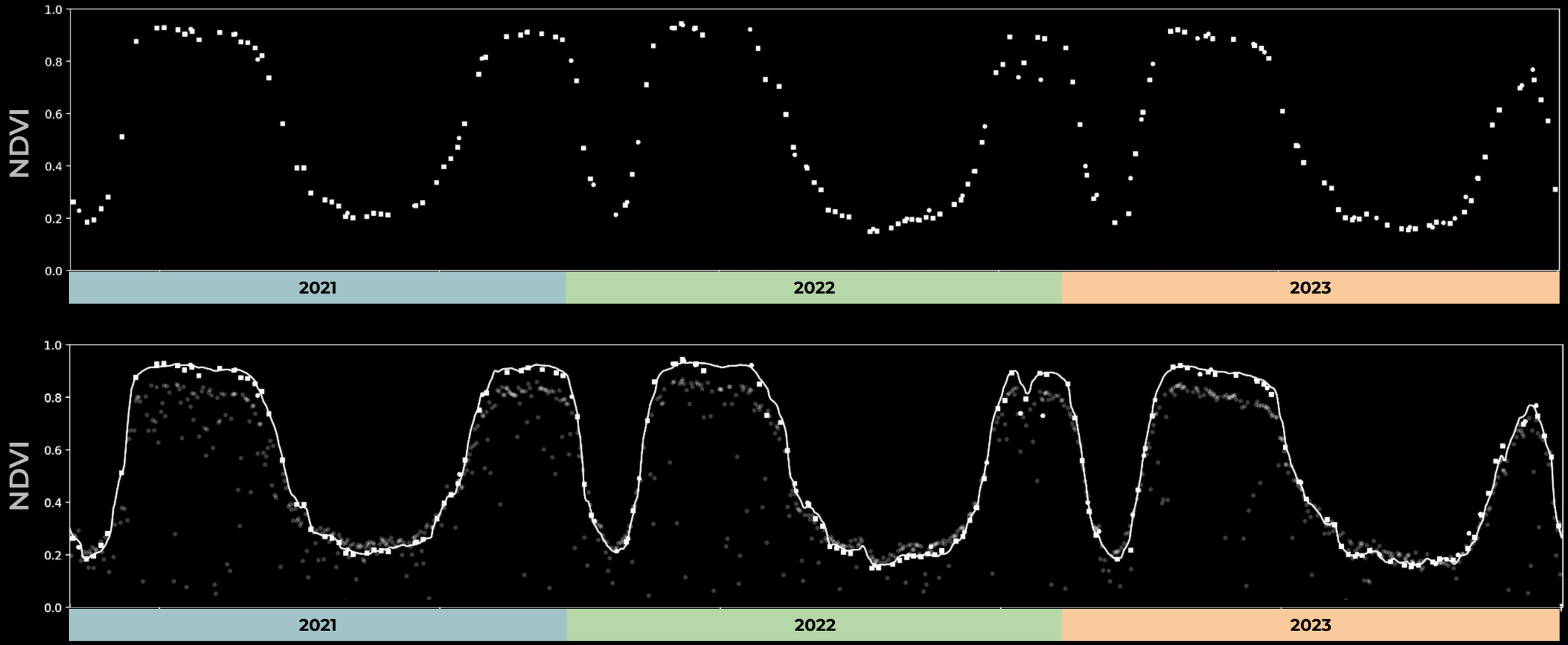
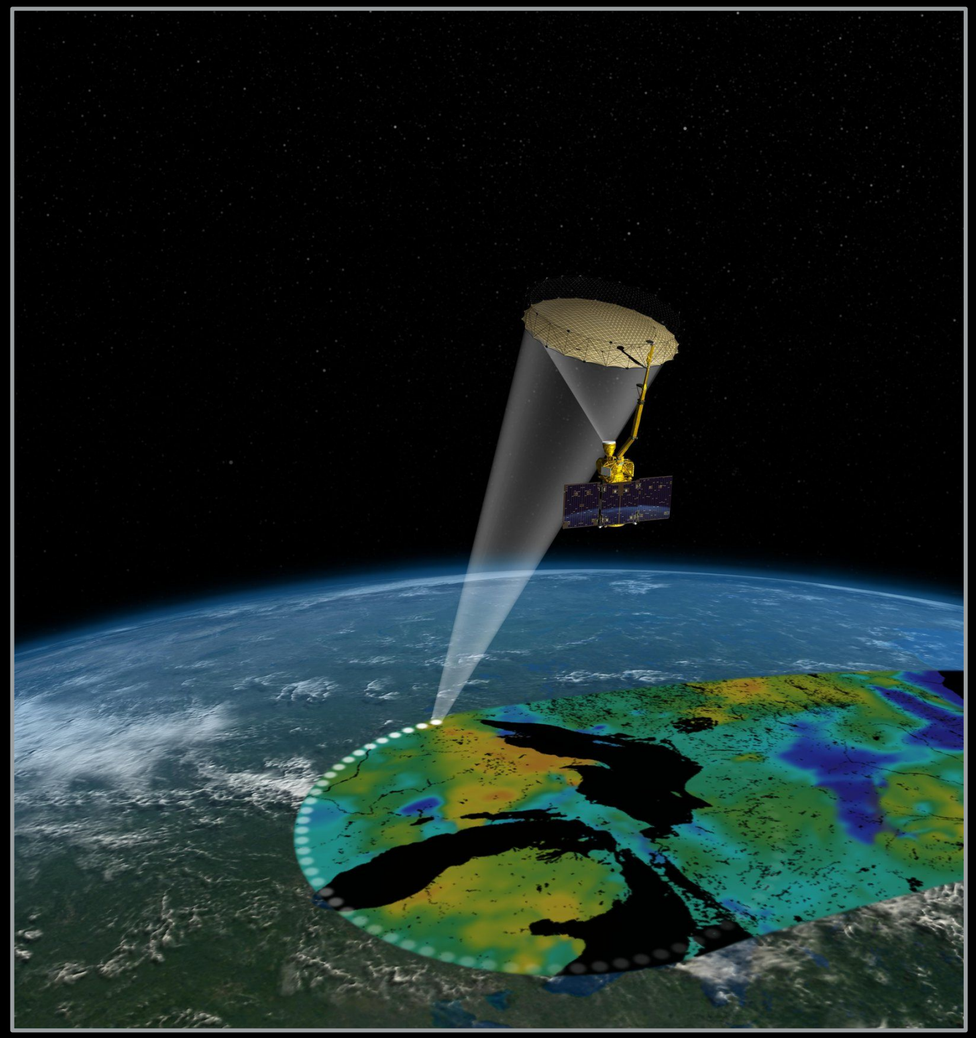


Real-time soil moisture conditions from space

Soil Water Content



Measuring soil water content using microwaves

Various satellites measure L-, C-, and X-band emissions from the Earth surface.

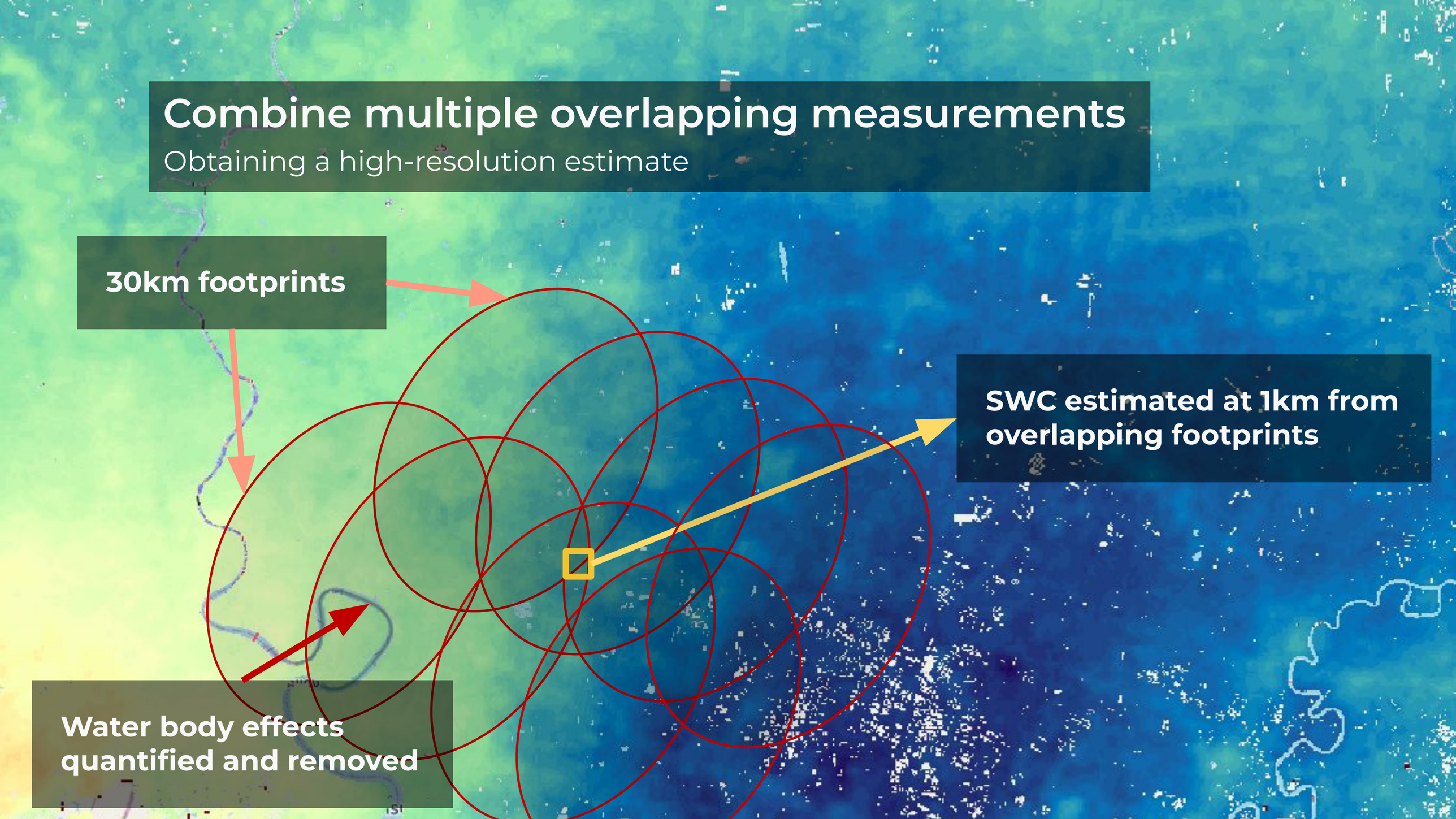
In these bands, a wetter soil emits less microwave energy.

Classical retrieval methods have two major issues:

1. Low spatial resolution
2. Water bodies pollute the solution

Combine multiple overlapping measurements

Obtaining a high-resolution estimate



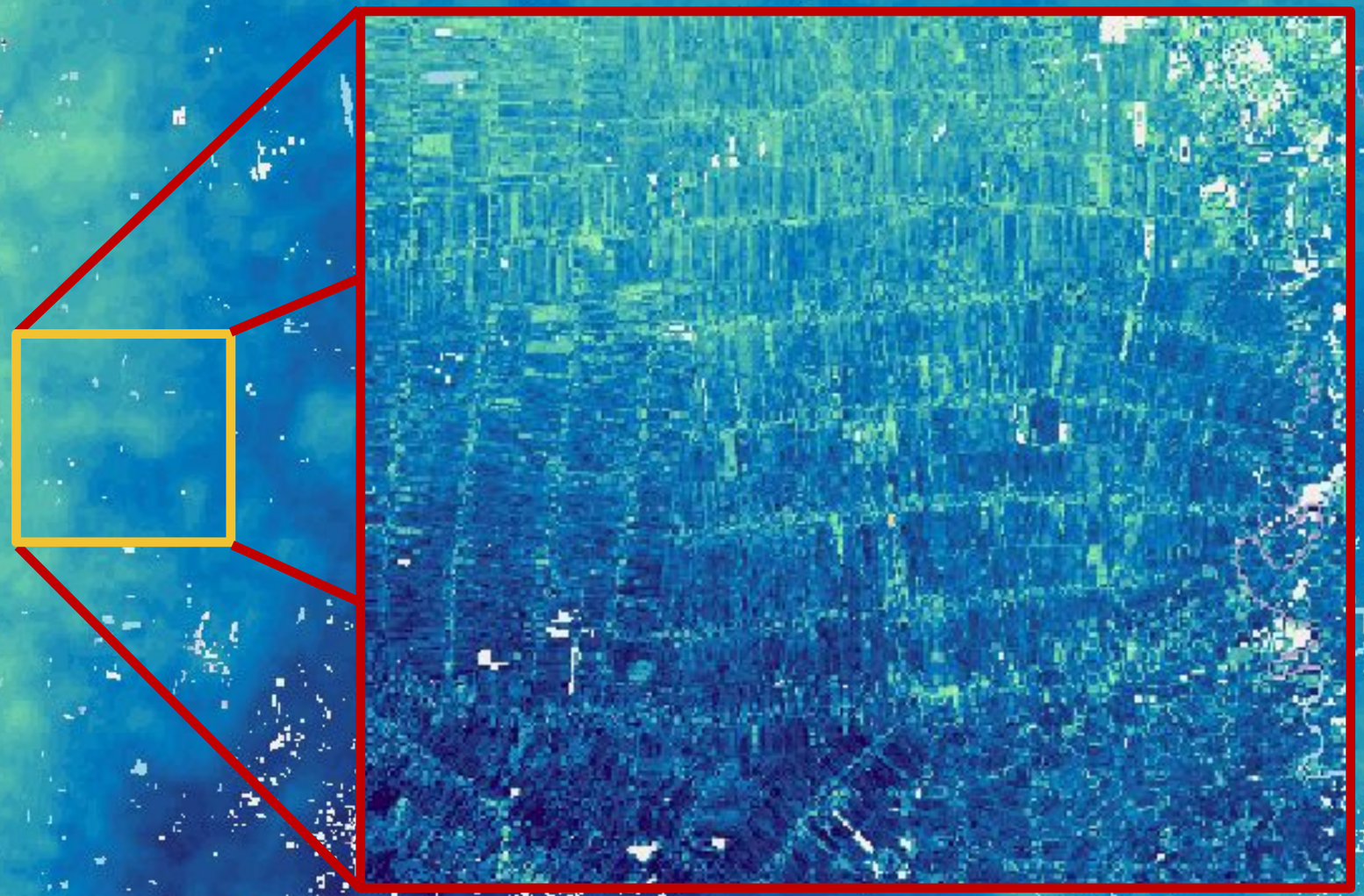
Downscaling to 100 meter and beyond

Including infrared observations

To further increase the resolution we use infrared images.

We combine the microwave observations with infrared images from Sentinel-2.

This combination provides SWC at 100-meter resolution and allows us to estimate field-scale SWC.



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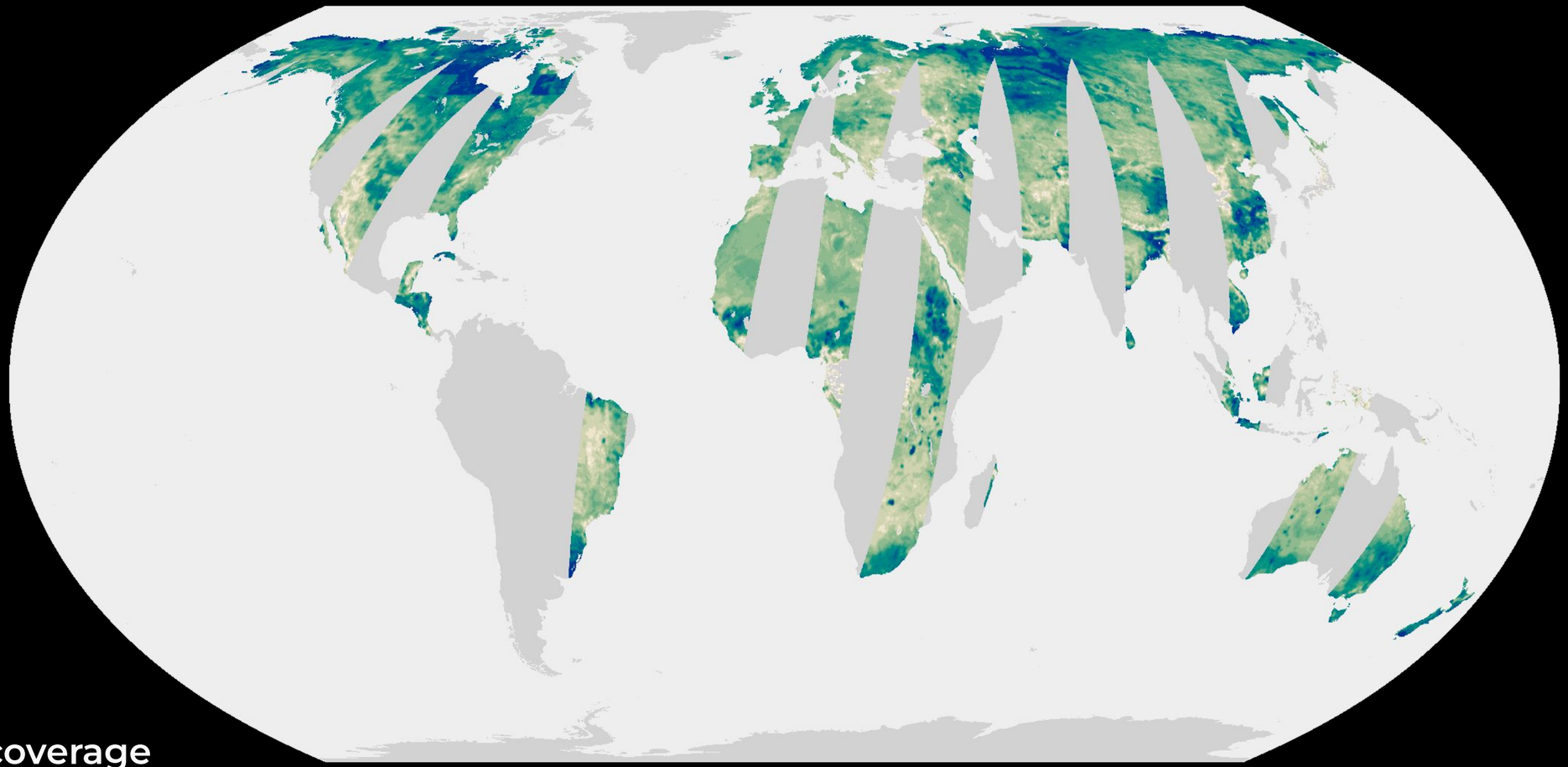
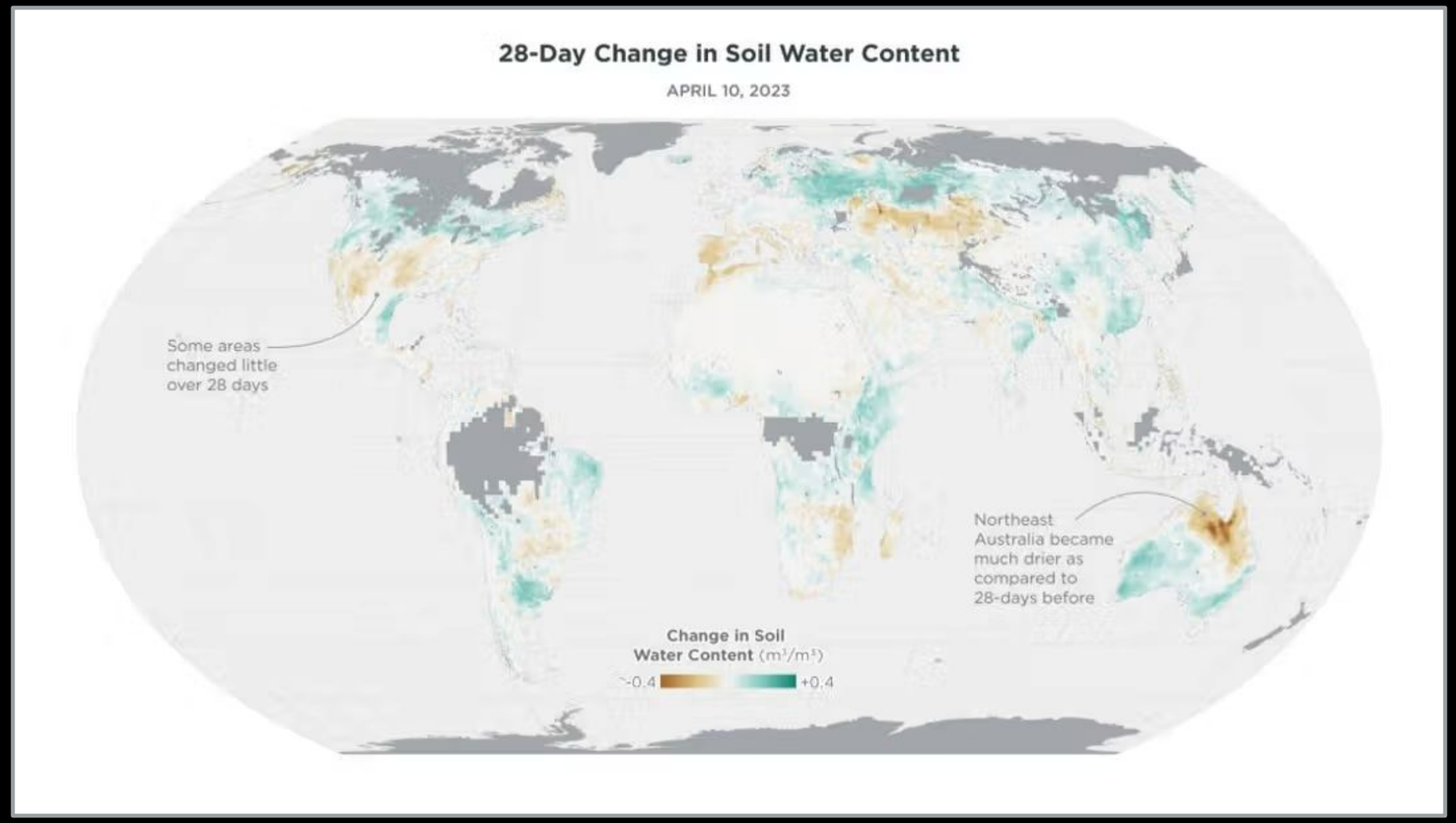


Near-real-time global coverage

Real-time soil moisture conditions from space

Soil Water Content

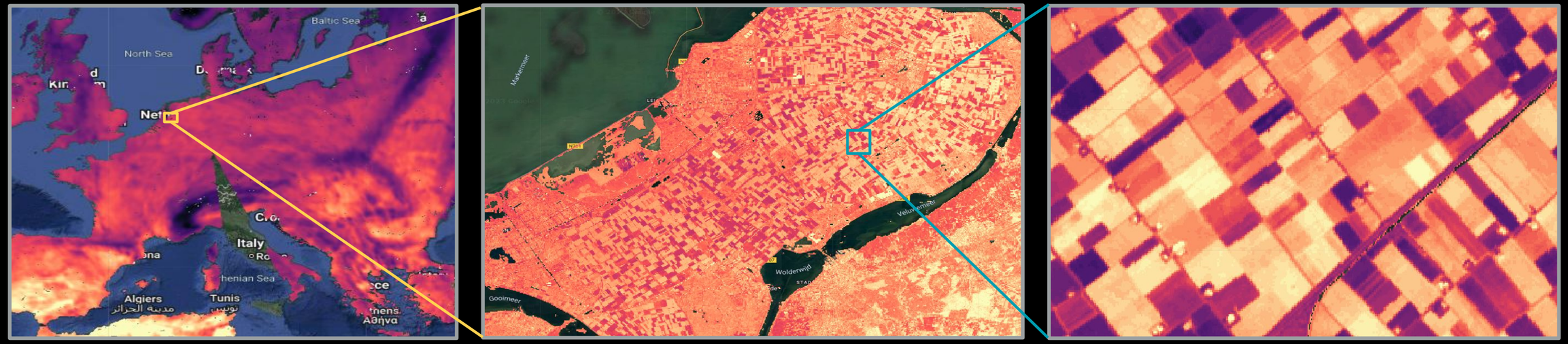


Example use case: track flash droughts

- Because we have near-daily global coverage, we can detect rapidly-evolving drought situations.
- These maps can be computed in near-real-time and can thus be incorporated into decision-making frameworks

Near-daily global coverage not hindered by clouds

Land Surface Temperature



Global near-daily LST

- Measured using Ka-band microwave sensors
- Not hindered by clouds
- Daytime and nighttime
- Pixel size 1km
- Available 2002 - present

High-resolution LST

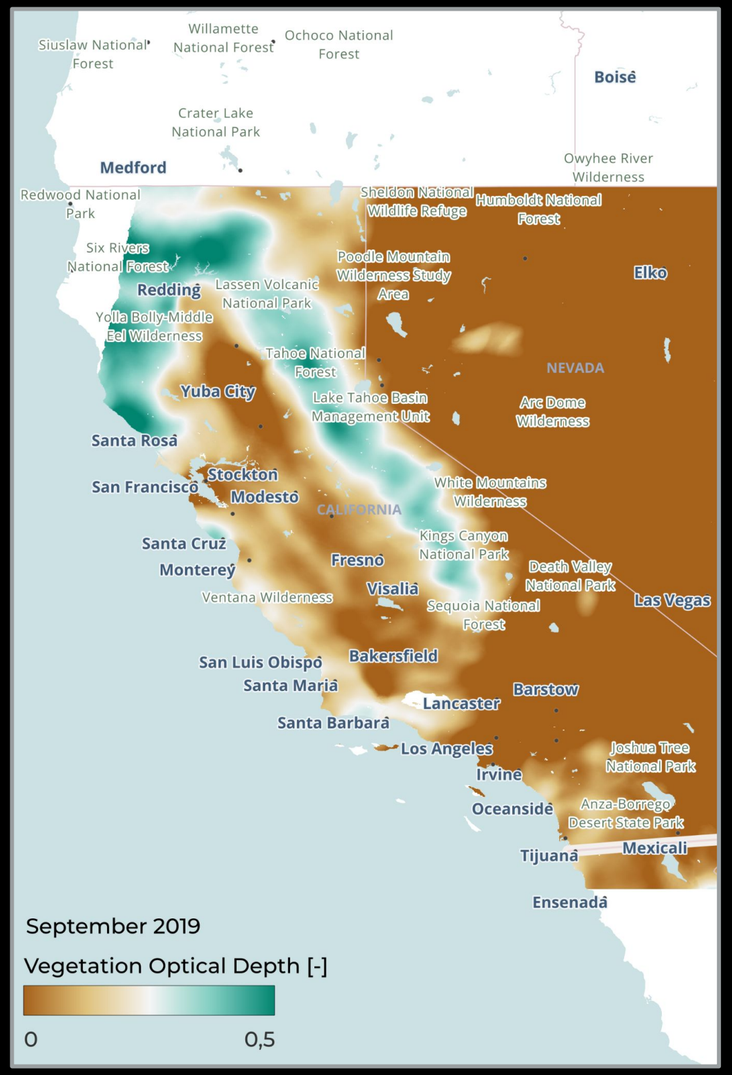
- Combine microwave observations with infrared imaging
- Downscaled to 100m
- Available 2017-present

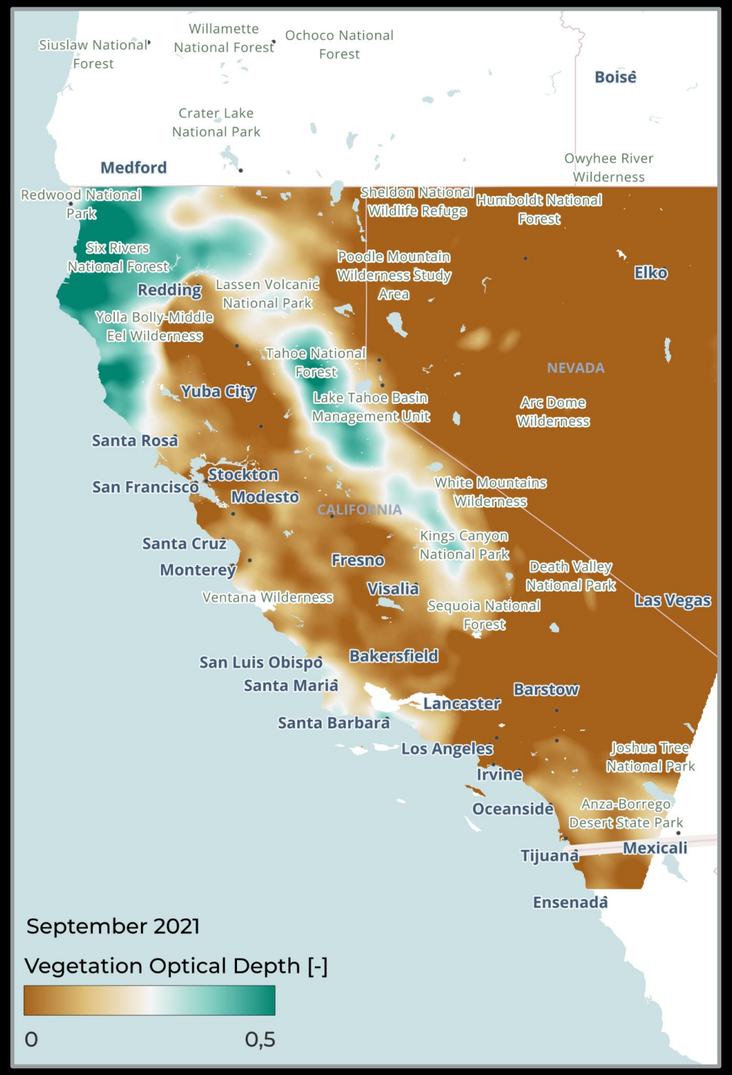
Experimental 20-meter LST

- Sub-field-scale temperatures
- Currently under development
- Prototype ready

Crop biomass and vegetation moisture

Vegetation monitoring



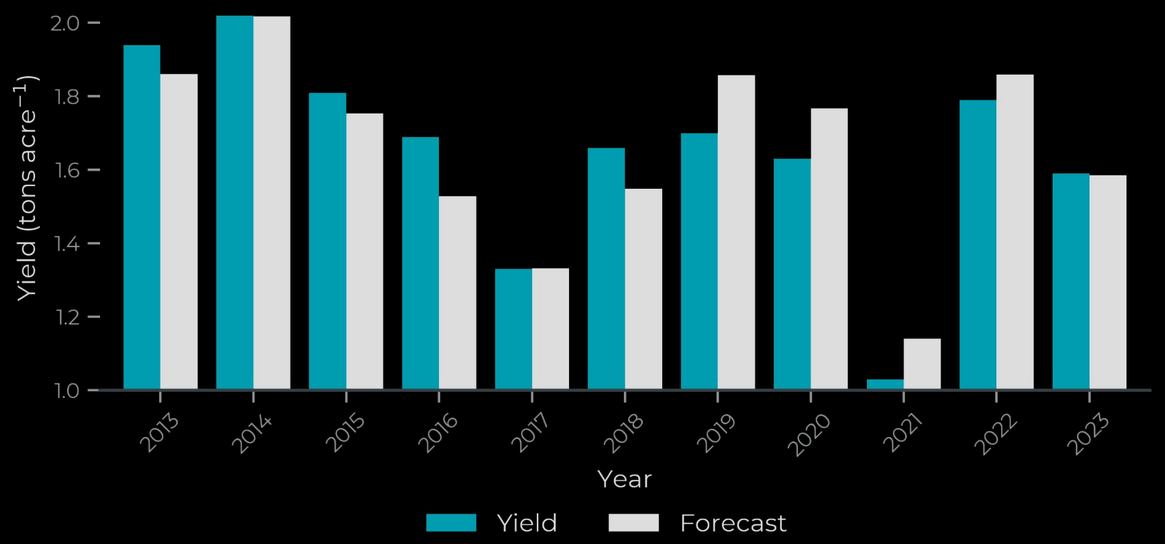


Vegetation Optical Depth

- Fraction of microwave soil radiation absorbed by vegetation
- Estimated from difference between vertically- and horizontally-polarized radiation
- Proxy for vegetation density and vegetation water content
- Track ecosystem health and development

Crop biomass and vegetation moisture

Vegetation monitoring

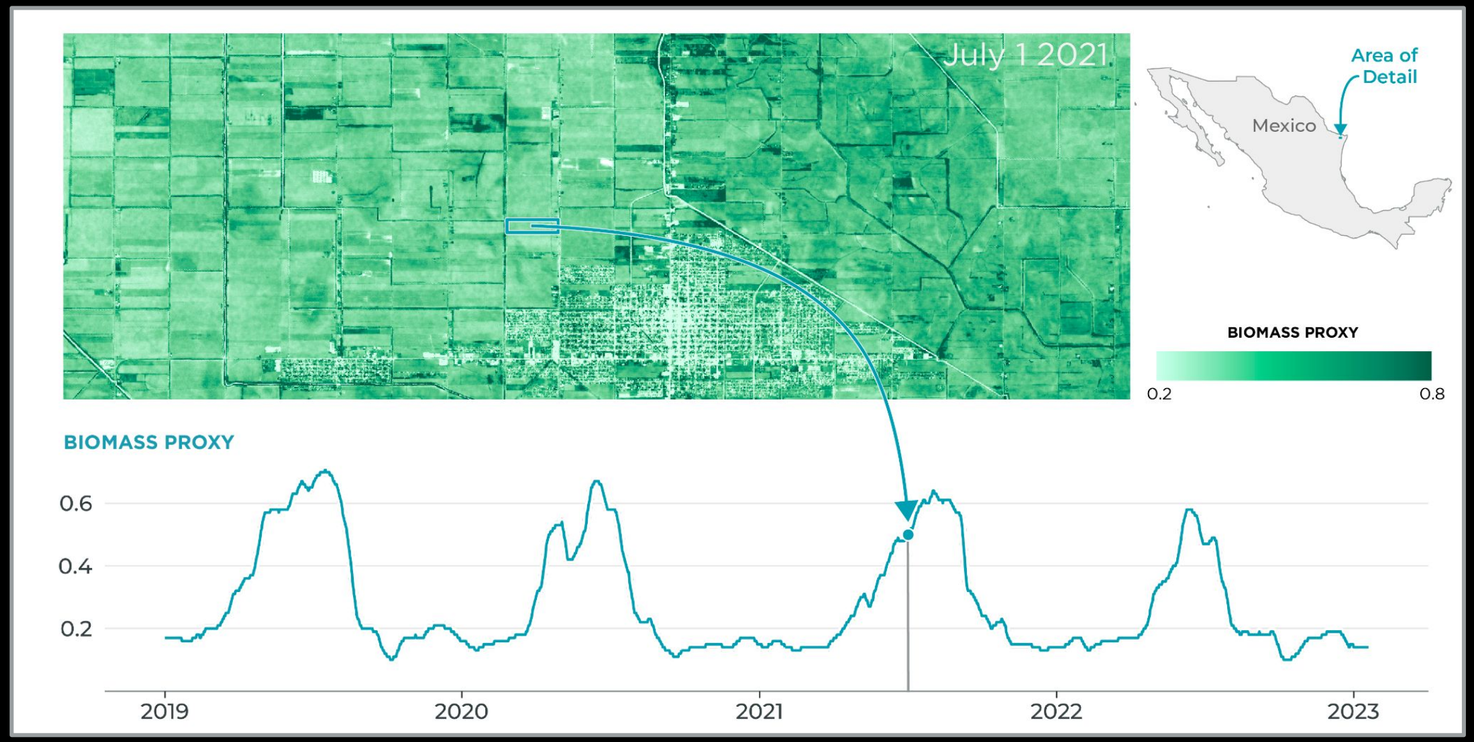


Example use case: predict crop yield in North Dakota

- Predict yield of hay from soil water content, land surface temperature, and vegetation optical depth
- We find a correlation coefficient of 0.92 between prediction and actual yield

Crop biomass and vegetation moisture

Vegetation monitoring

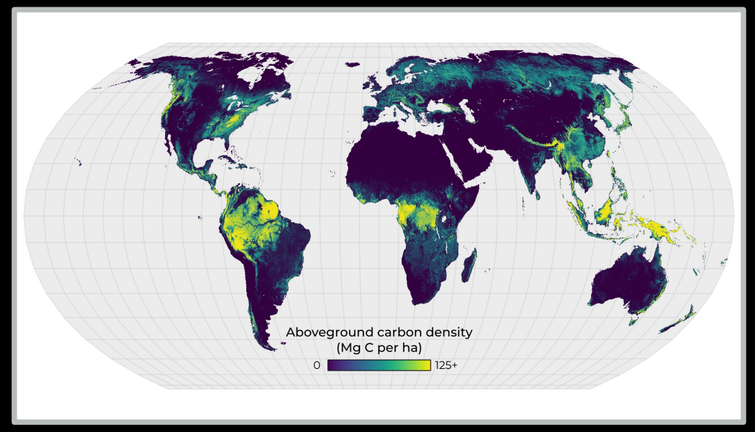


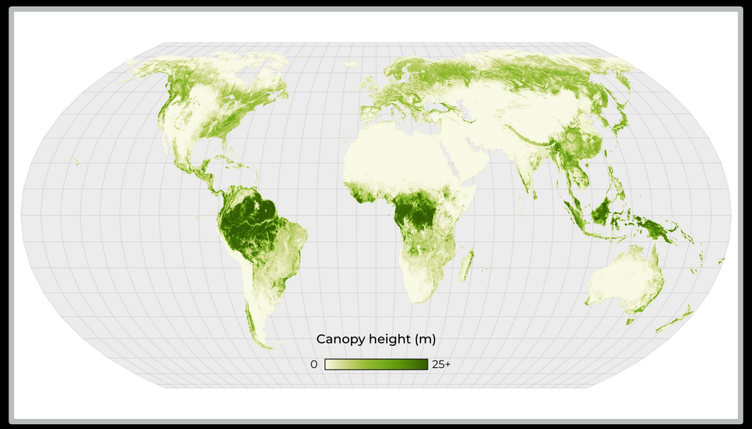
Crop biomass

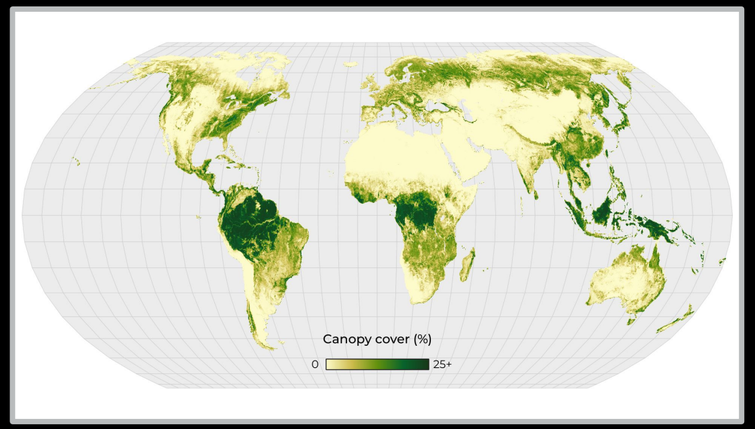
- Combine radar and optical data to generate daily cloud-free crop biomass estimates
- Track vegetation growth and harvesting

Global monitoring

Forest carbon and canopy





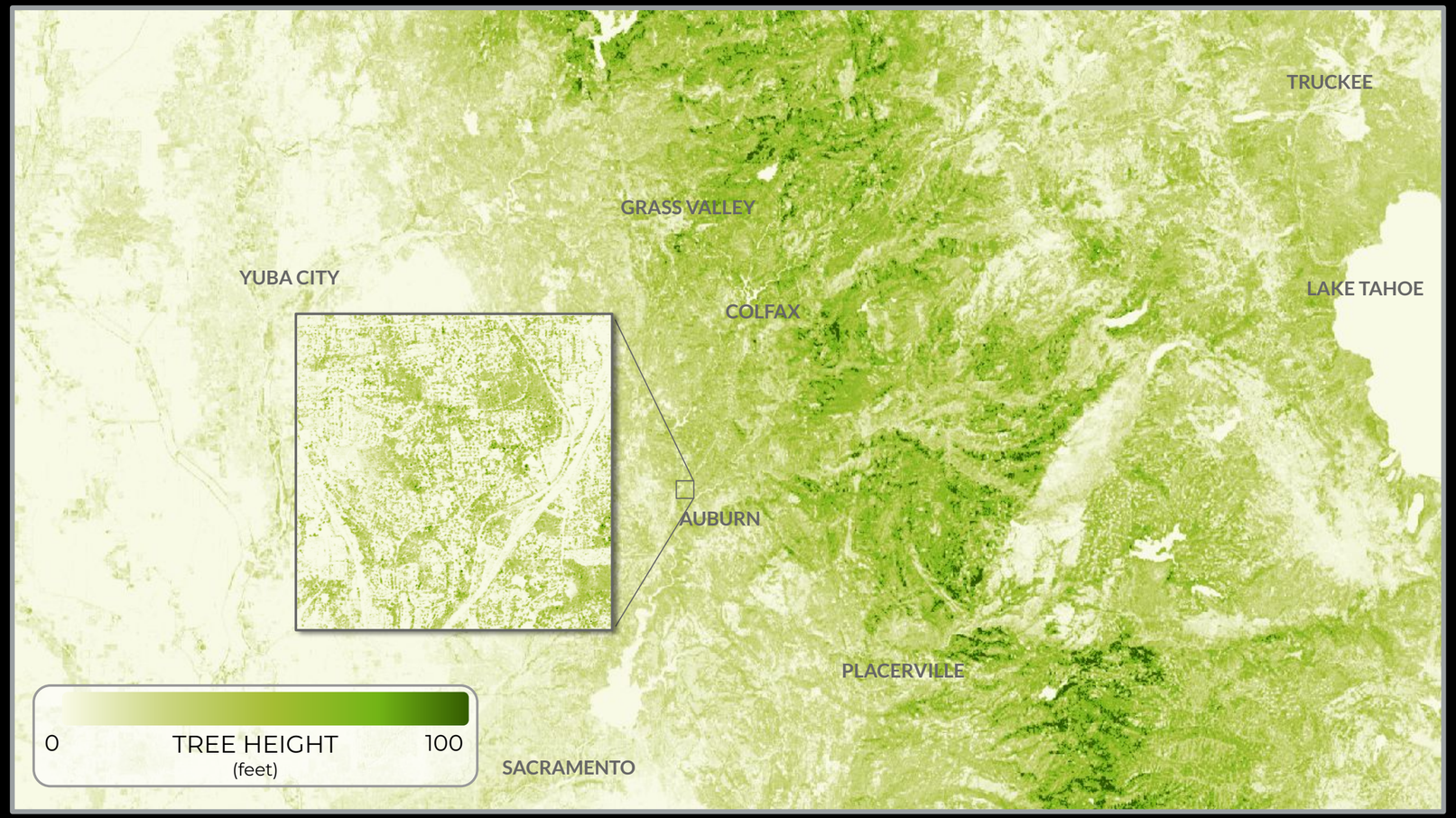


We combine high-resolution satellite measurements with lidar observations and deep-learning techniques to measure forest characteristics globally at 30-meter resolution

- Forest carbon density
- Canopy height
- Tree cover

High-resolution local estimates

Forest carbon and canopy

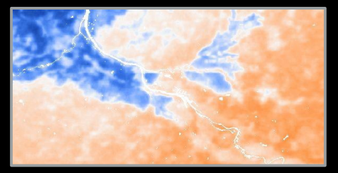
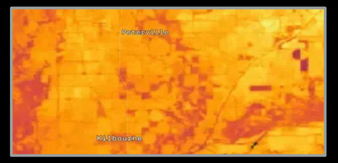


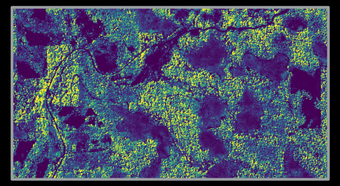
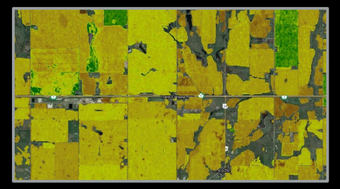
We can zoom in from global to hyper-local

- Forest products available at a 3-meter resolution
- Quarterly updates
- Track deforestation and forest management

A realtime eye on the Earth

Earth Observation portfolio


Planet offers a wide high-resolution near-real time EO portfolio:

- Planet Fusion
- Soil water content
- Land Surface Temperature
- Vegetation Optical Depth
- Crop biomass
- Forest structure and Carbon

THANK YOU

Questions?

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