CLEAN ENERGY TRADING OPTIMIZATION THROUGH REMOTE SENSING SATELLITE DATA ANALYTICS

WEGAW

TODAY'S CLEAN ENERGY CHALLENGE

Trading relies on future energy production

Energy companies need to know future energy production to trade it at the right price.

30% error in forecasting

Energy utilities face typically up to 30% error when forecasting renewable energy output.

Imbalance cost are skyrocketing

This translates into an equivalent $ 15 Billion of lost potential revenue, due to imbalance, productivity and trading edge lost.

Hydropower energy production is challenging to predict

Fossil fuel energy production has typically been straightforward to forecast, however, due to climate change-induced environmental fluctuation, managing hydropower energy production is a far greater challenge.

PROVEN AND UNIQUE COMBINATION OF REMOTE SENSING & MACHINE LEARNING
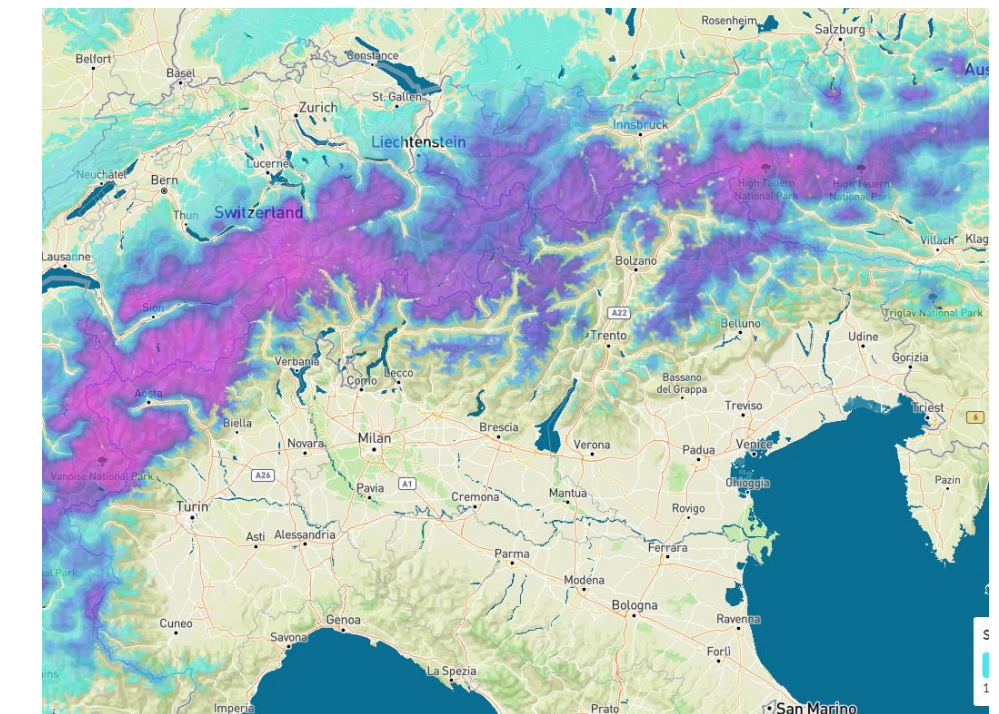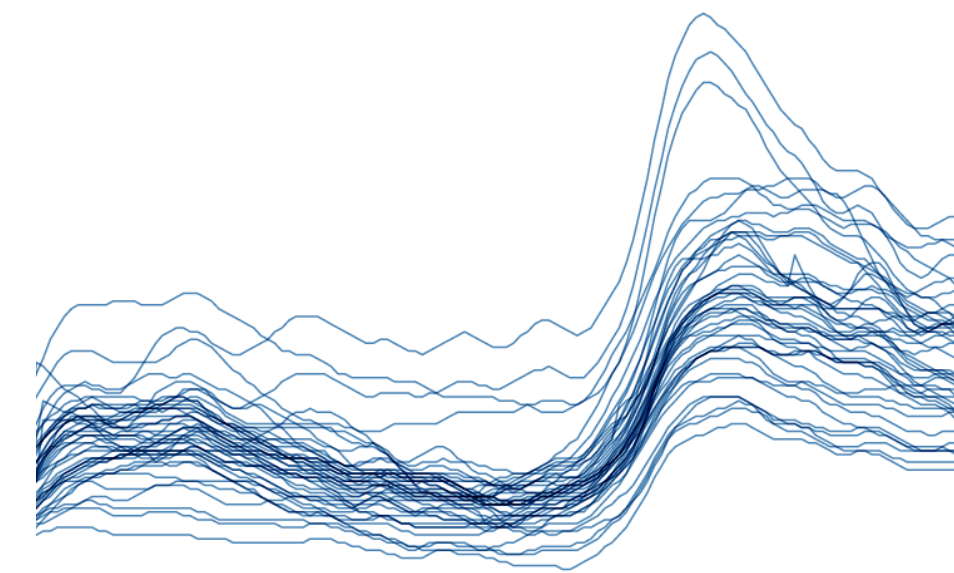
7+ ESA/NASA satellites

We download raw, real-time data from **multiple satellite sensors** and pre-process them in-house as fast as technology allows.

RADAR & Optical sensors

We combine **RADAR** and **optical** satellite sensors with **ground, meteorological and ancillary data** (solar radiance, temperature, etc.).

Deep Learning & Models

We fuse the resulting historical satellite base data with Deep Learning and Environmental models to **forecast the evolution of environmental variables.**

Snow & Water

As a result, we can provide accurate snow and water historical and near real time data. Helping our customers improve short term **water forecasting and long-term energy trading.**

CURRENT SNOW AND WATER DATASETS
DELIVERED IN SPATIAL OR STATISTICAL FORMAT

SCE

WET & DRY

SD

SWE

Snow Cover Extent

Daily SCE from 7 satellites, meteorological models and in-situ data in near real-time.

Wet & Dry Snow

Information on wet and dry snow extent every 3-4 days.

Snow Depth

Low-resolution SD from meteorological data daily / high-resolution SD weekly from SAR.

Snow Water Equivalent

SWE based on DeFROST data, currently produced through run-off models. Future developments (Q3 2021) to achieve it through satellite data.

SNOW COVER AND SNOWLINE (in m)

Snow Cover Extent layer

- Binary snow no-snow confidence layer based on 5 satellite observations.

- Available daily at up to 20m resolution.

- Validated through SLF validation system at average 93% accuracy.
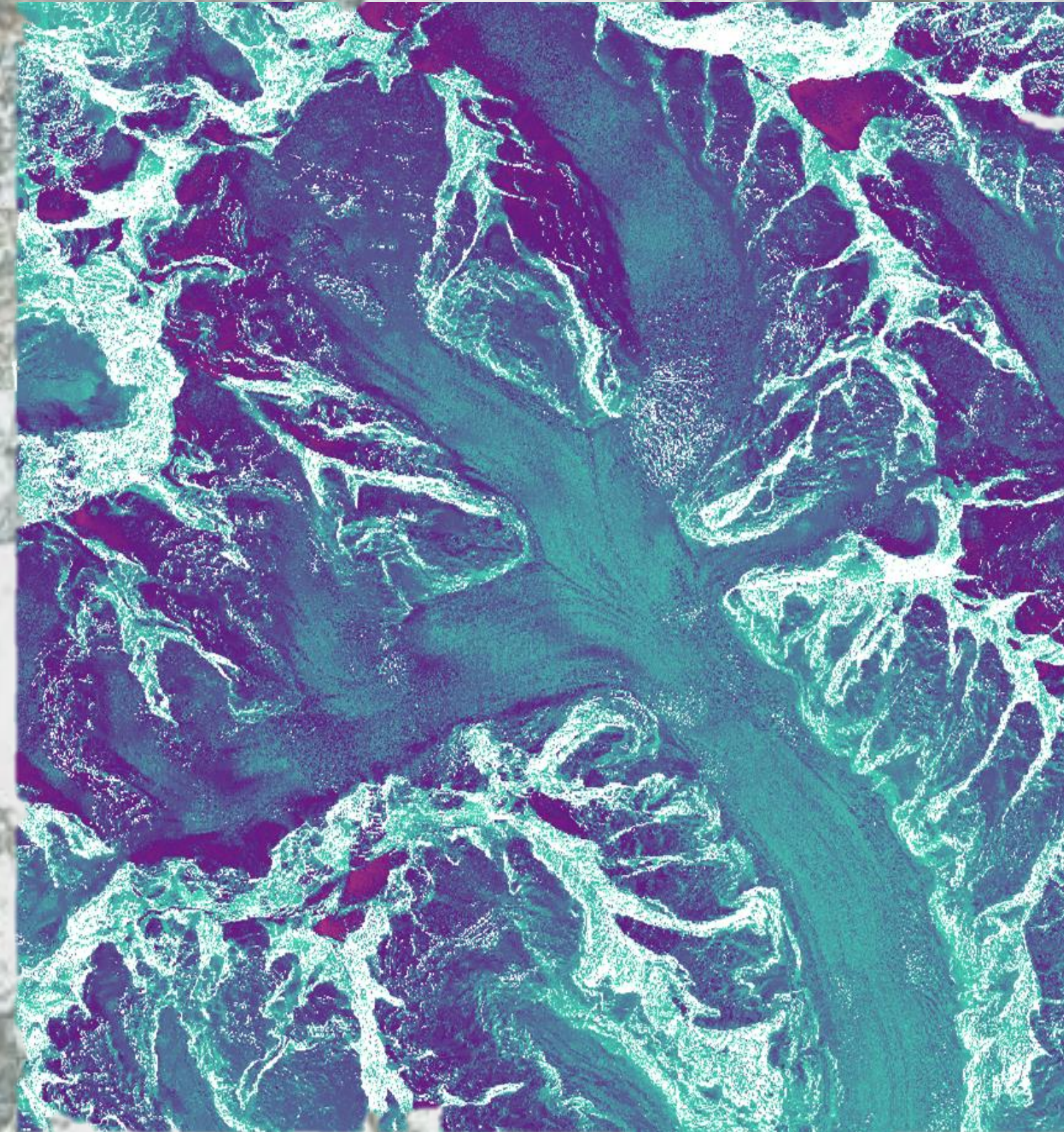
WET SNOW COVER

Snow & Wet Snow layer

- Track easily if snow is wet or dry for melt-onset prediction at up to 20m resolution.

- RADAR allows to distinguish between dry and wet snow areas every 3-4 days.

- Technology applicable independent of night or cloud coverage.

SNOW DEPTH

Snow Depth Layer

- Infer snow depth over areas and track snow melt and accumulation through time series change detection.

- Augmented with deep learning and terrain modelling techniques trained on in situ snow depth data.

- Snow Depth is extracted using Sentinel-1 RADAR information from the ESA over basins or at 200m resolution.

MAXIMUM INTEGRABILITY

integrable on any application or system of your choice via mapping and API services

HISTORICAL DATA

We store each daily snapshot on the global snow and can provide data for the last 20 years
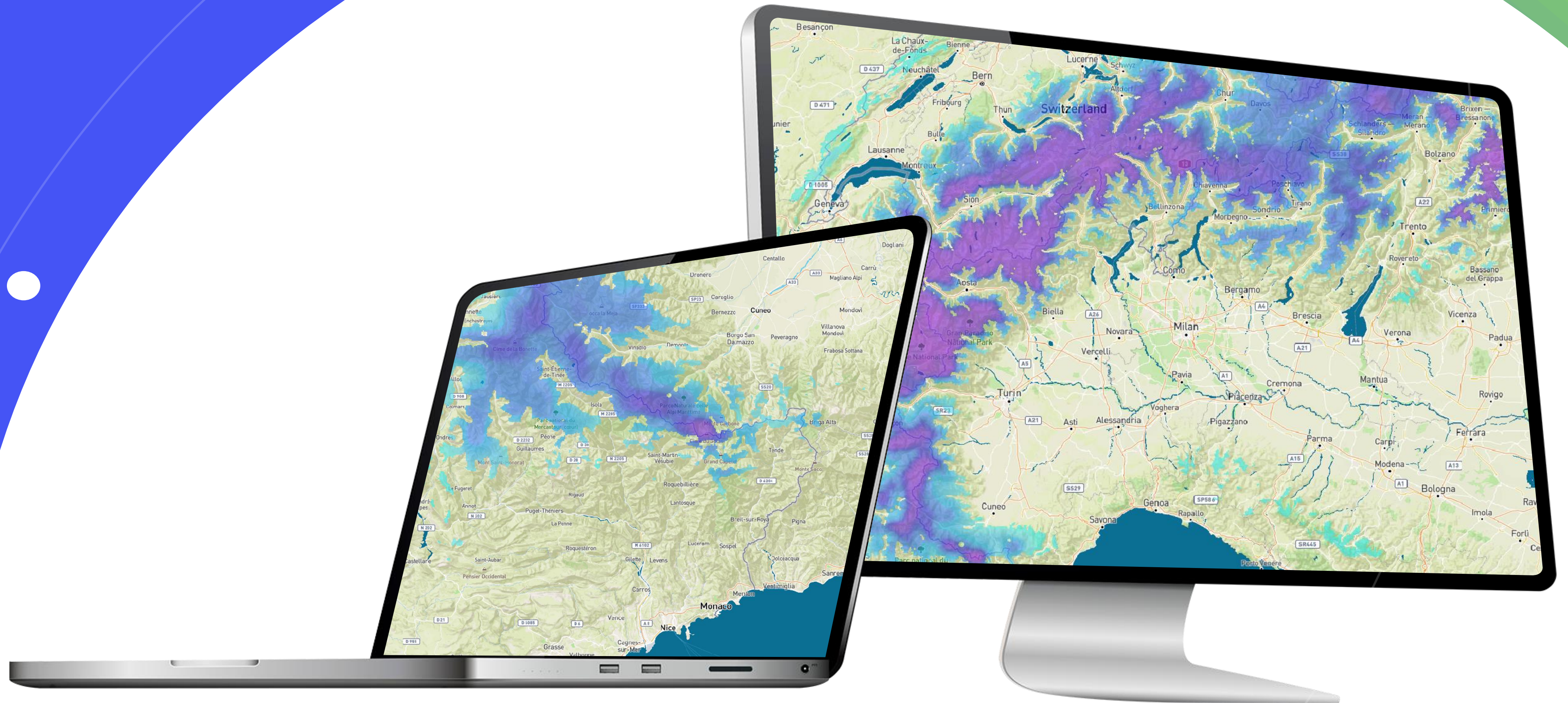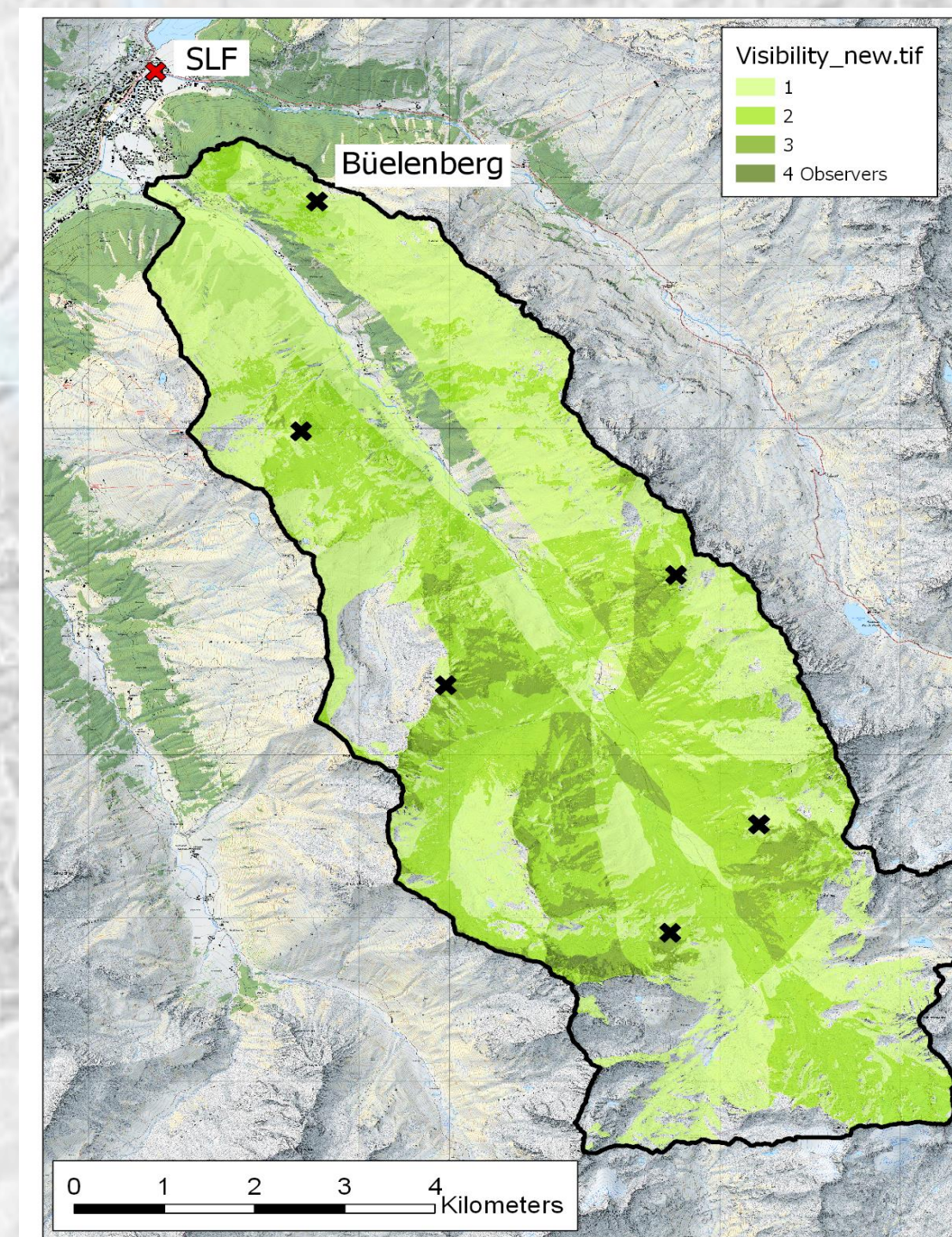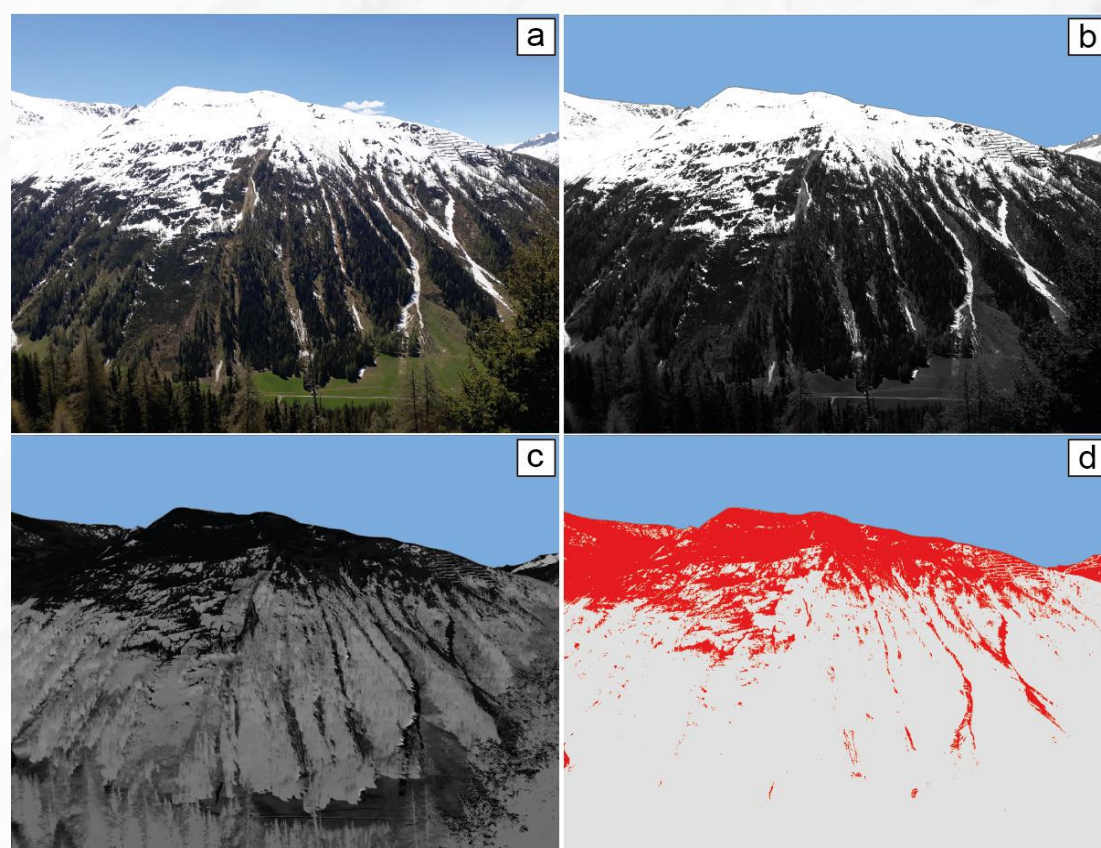
SNOW SCE VALIDATION SYSTEM

SLF Webcam Validation System in Dischma Valley

(1500m - 3200m a.s.l.)

DeFROST is validated against a daily, cloud free snow cover composite of ~150 images taken by 6 webcams

Snow cover is identified by SLF **using Principal Component Analysis**
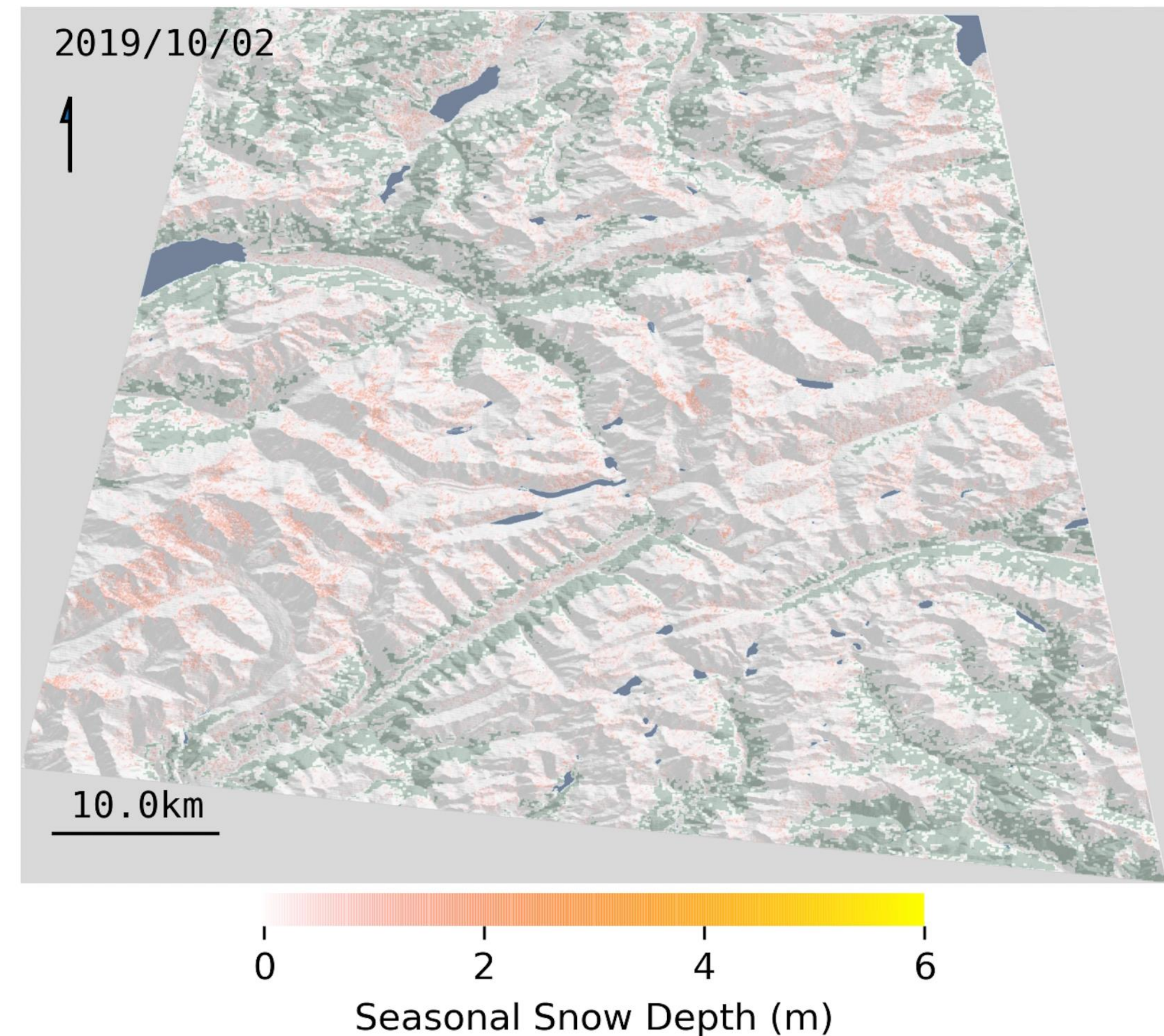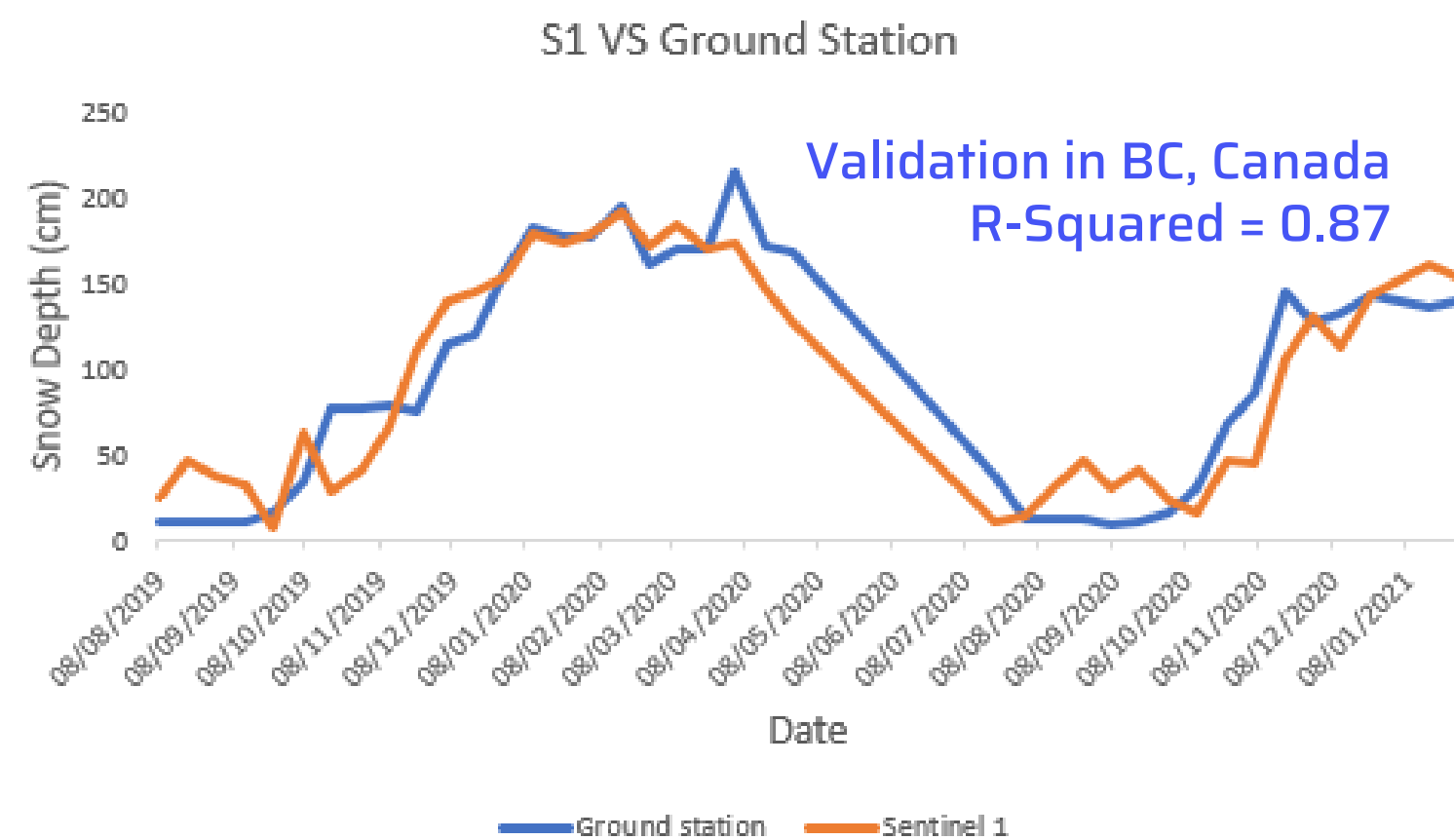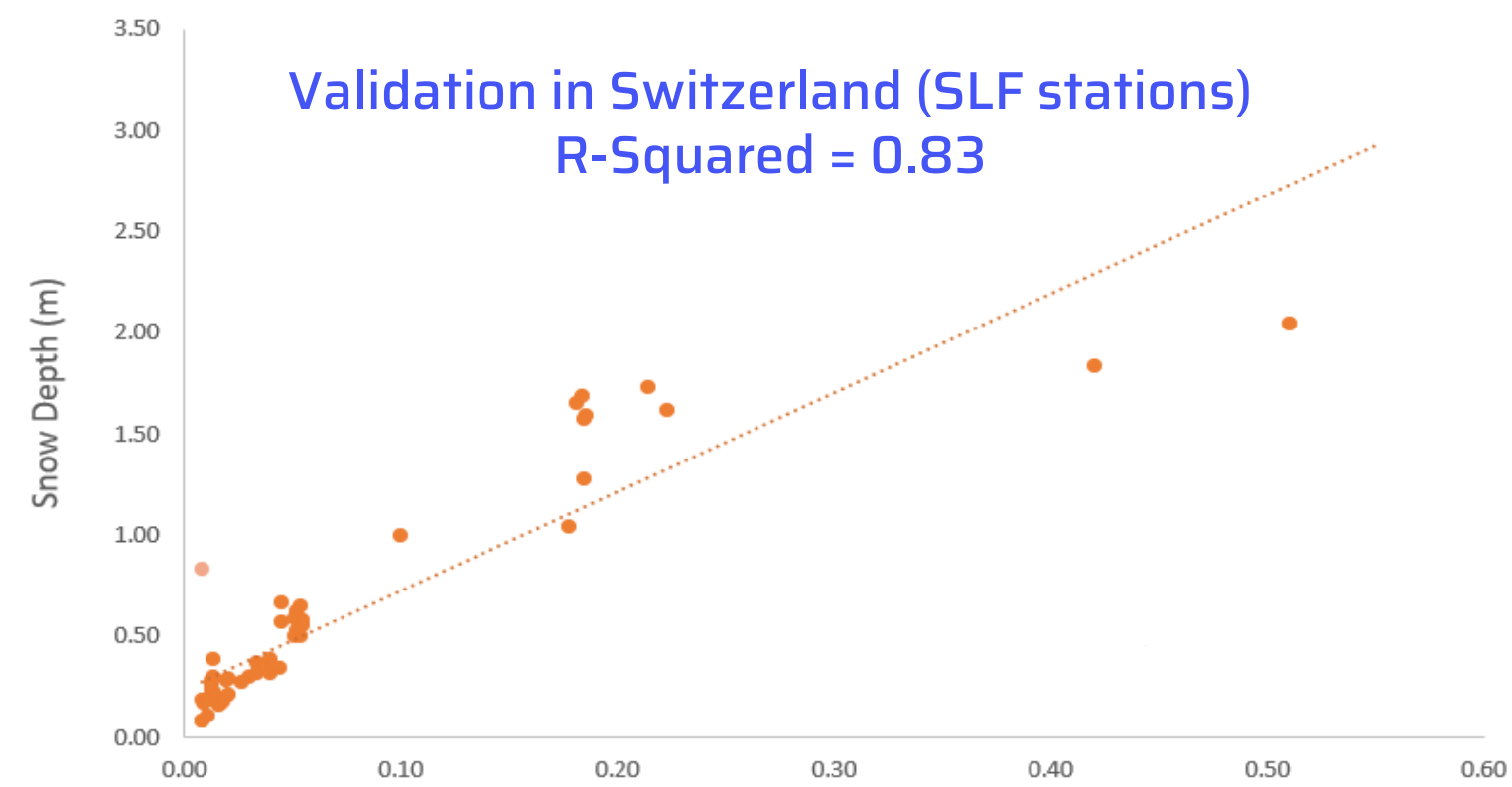
Average accuracy reached in winter season 2019/2020: **93%**

SNOW DEPTH POINT VALIDATION

Validated at points to SLF data (Switzerland) at altitudes at depths of less than 3m and British Columbia (Canada) data for more than 3m

Validation results: 83-92% accuracy (depending on altitude)

SNOW DEPTH BASIN ACCURACY

Area validation in the Western United States based on NSIDC DAAC Airborne Snow Observatory (ASO) data
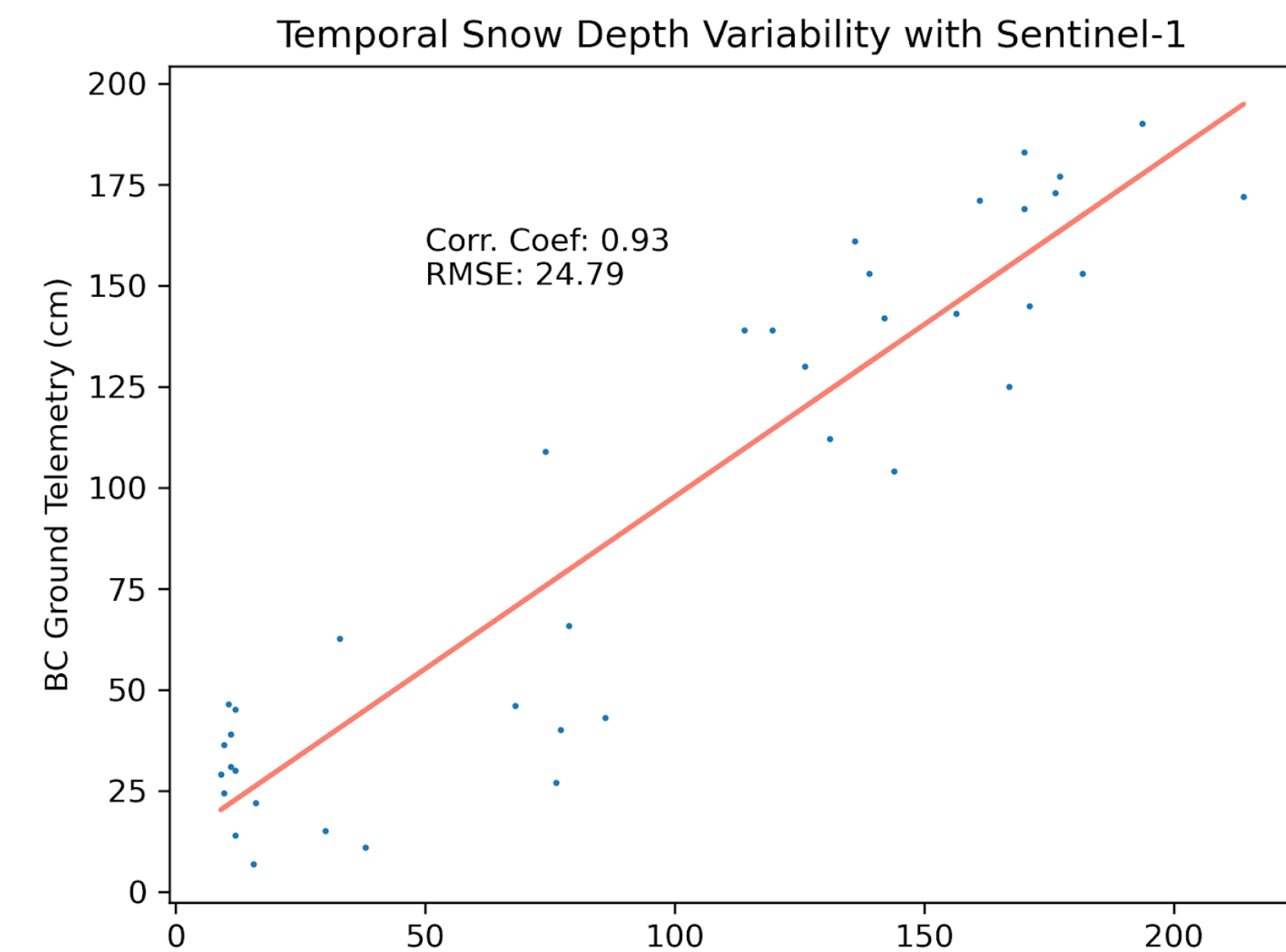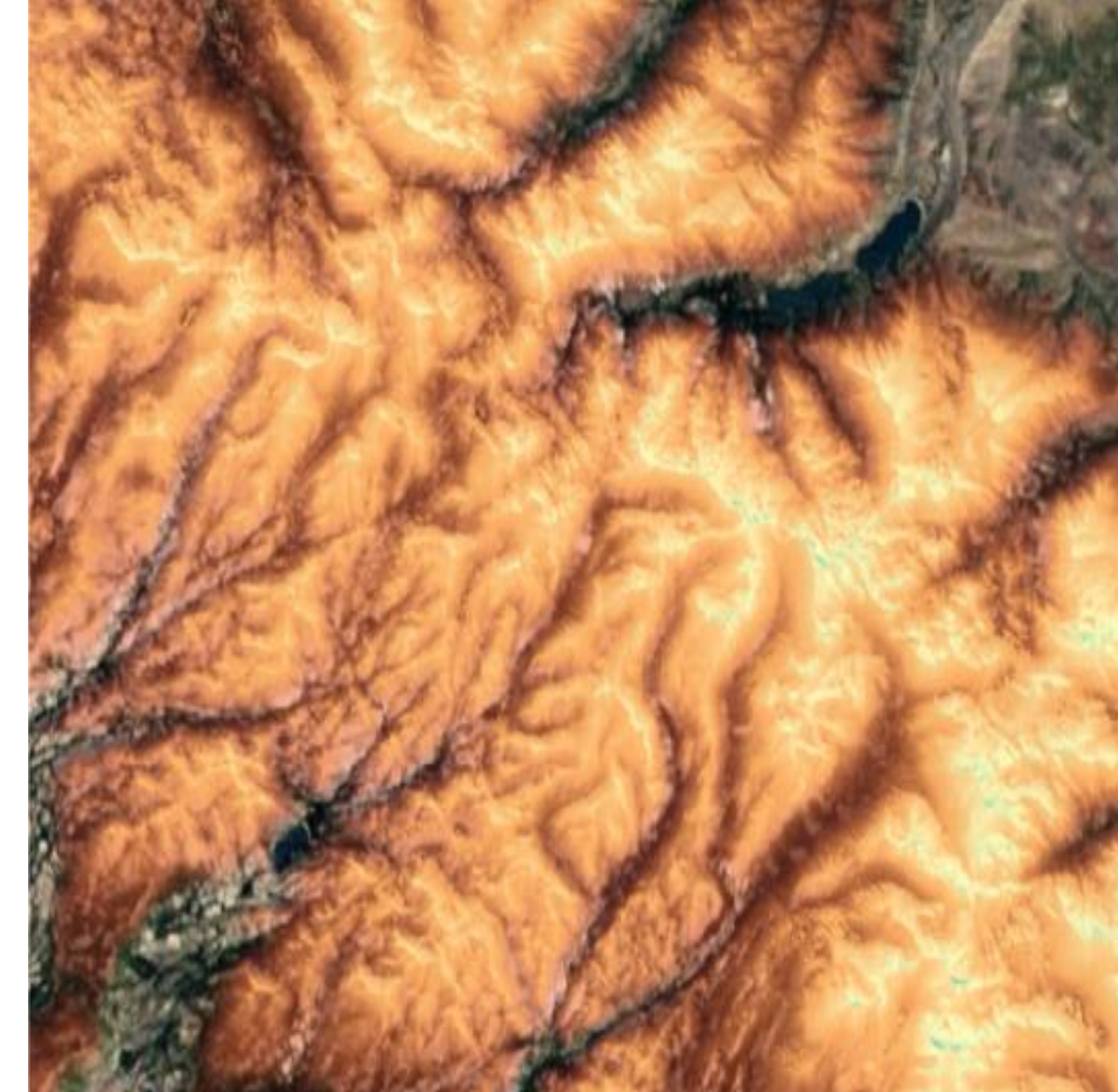

Basin accuracy

Over static surfaces (Rock and Glacier)
Corr Coef. > 90% ¦ RMSE: 24cm

Over areas of multiple land features (Expected within a full basin) (Rock/Glacier/Urban and Vegetation)
Corr Coef. > 70% ¦ RMSE: 50cm

Temporal Snow Depth Variability with Sentinel-1

Corr. Coef: 0.93
RMSE: 24.79

BC Ground Telemetry (cm)

HYDRO SERVICES

Short term discharge detection

Using Wegaw SCE and snow wetness monitoring, we can help hydropower companies improve **time to snow melt-based discharge detection up to 4 days** before, depending on catchment area, dam location and basin slopes.
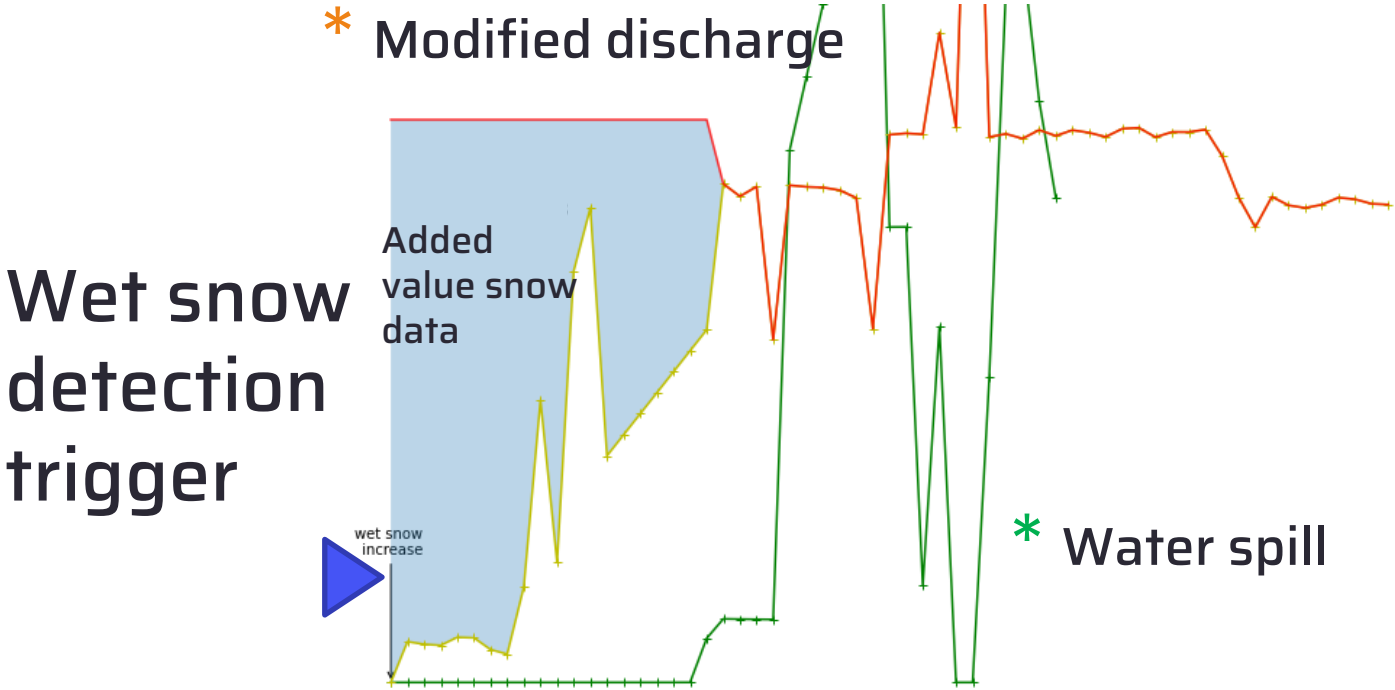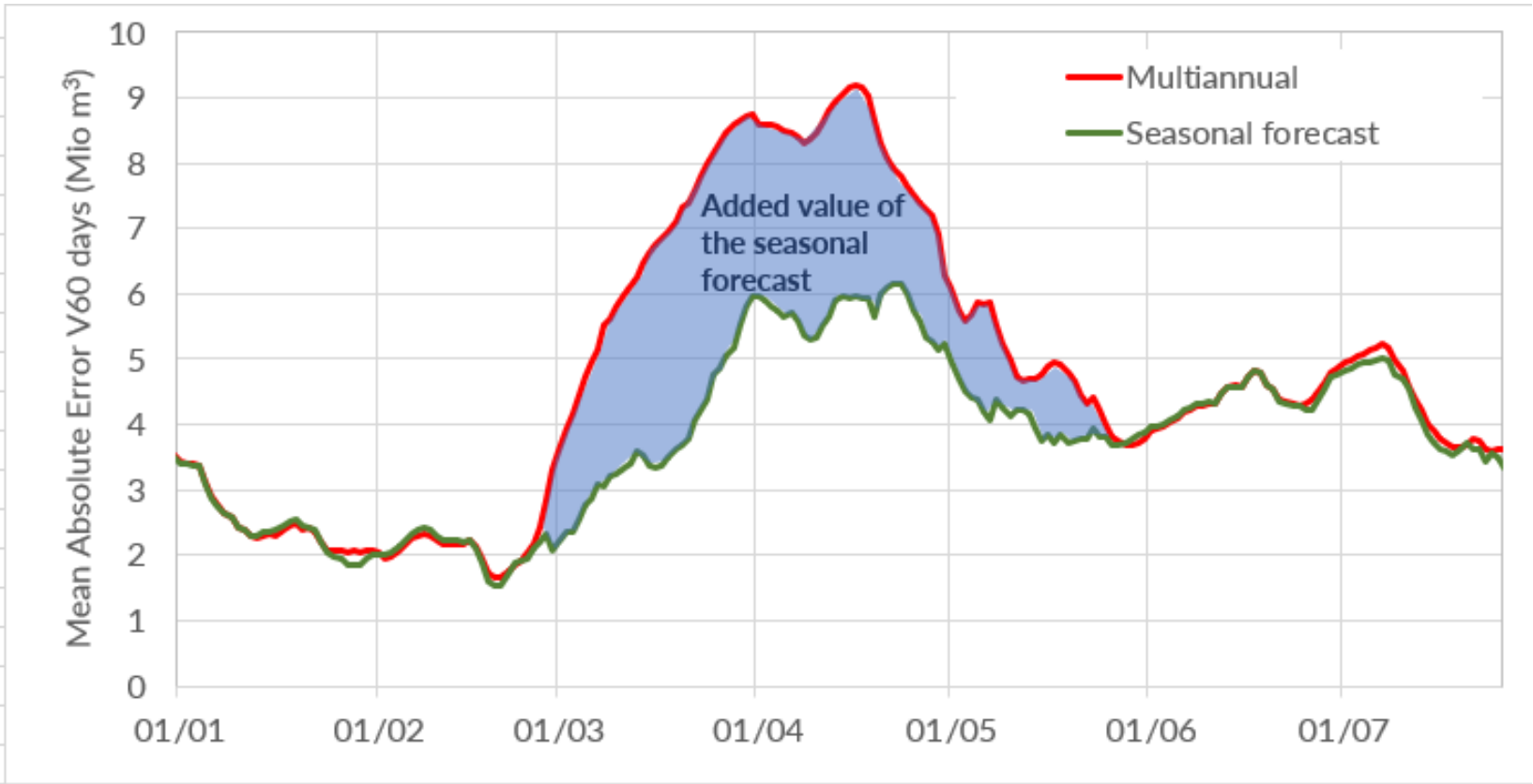

10% Energy increase

30% Water Spill reduction

With this early snow detection technique based on wet snow monitoring we help improve 10% energy production per season.

Seasonal Forecast error reduction

Snow Water Equivalent measurement improvement through Wegaw Snow Depth product. Reducing the error by 20% - 40% compared to multiannual average water discharge.

30% Error Reduction

5% price improvement

By using SD information for SWE-based discharge adjustment, we help reduce the relative forecasting error by up to 40%.
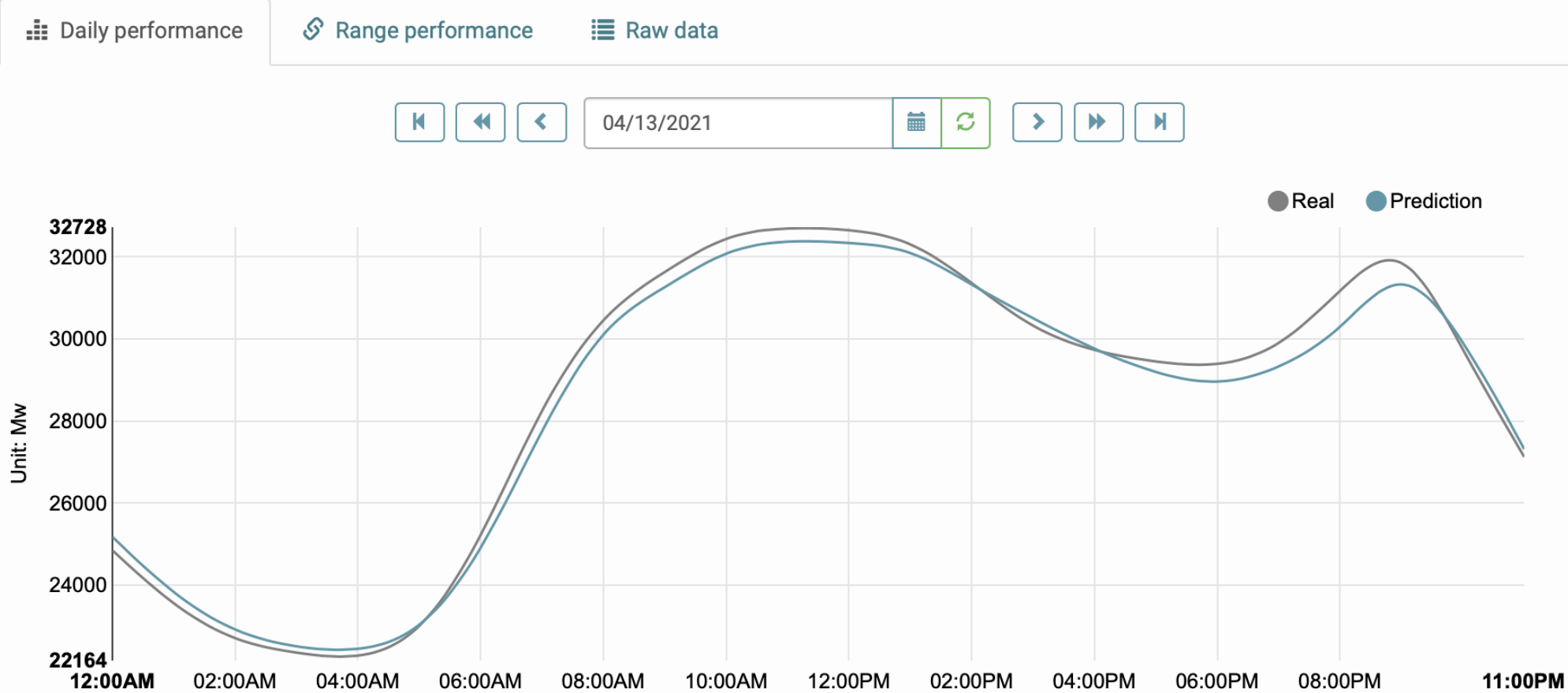
TRADING SERVICES

Energy load forecasting

Using Wegaw geospatial dataset with our partner energy datasets we can help energy grid operators and utility companies to forecast energy load.
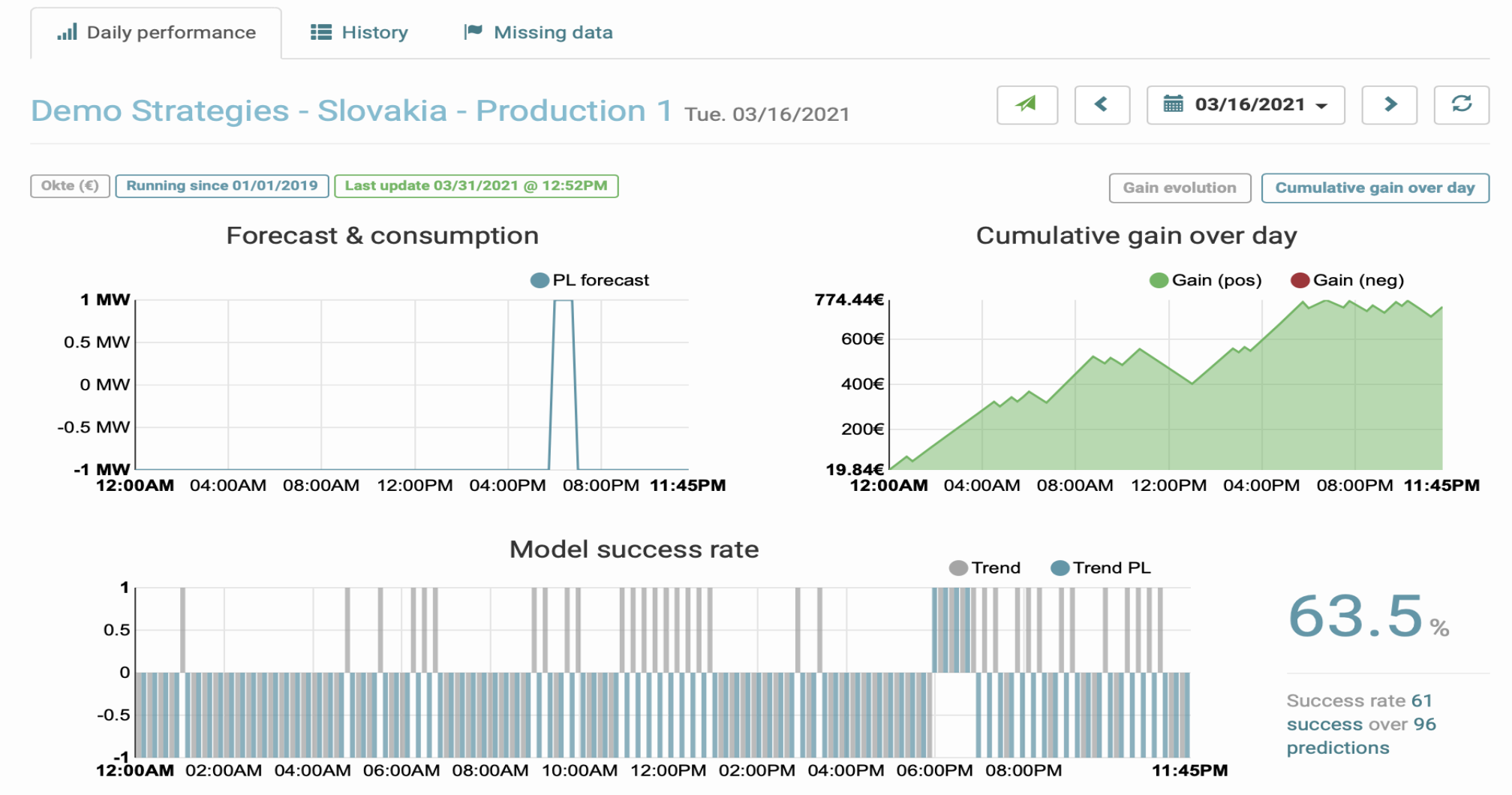

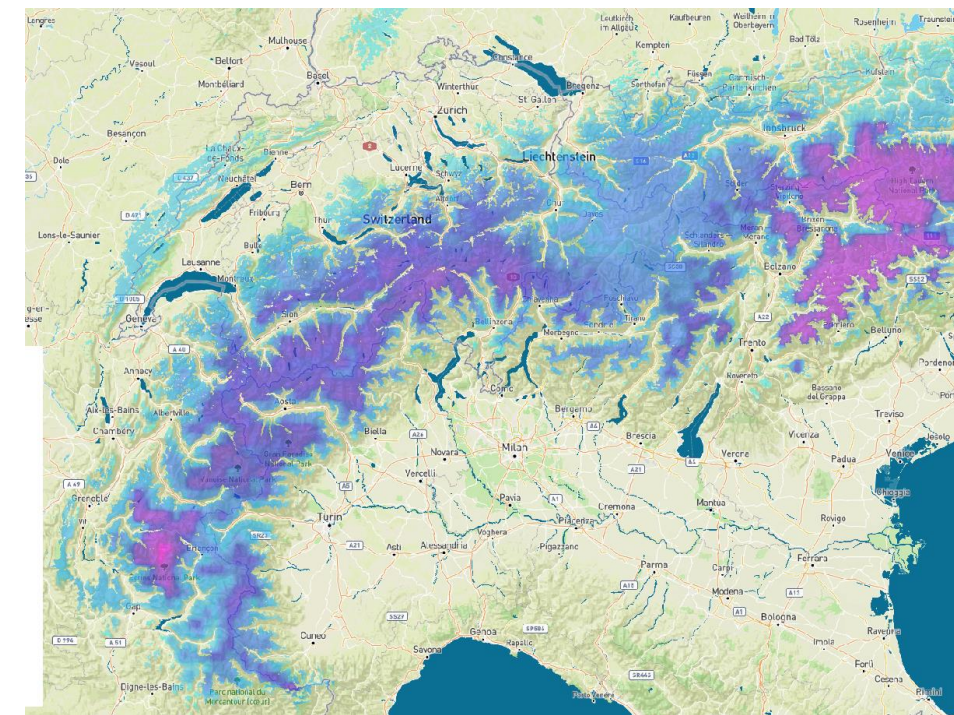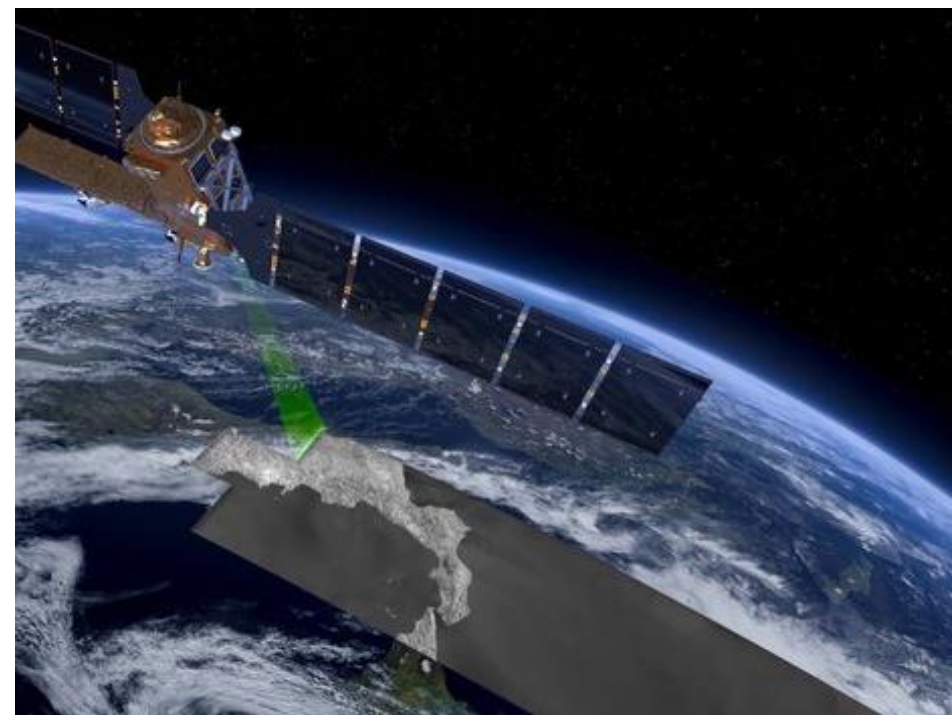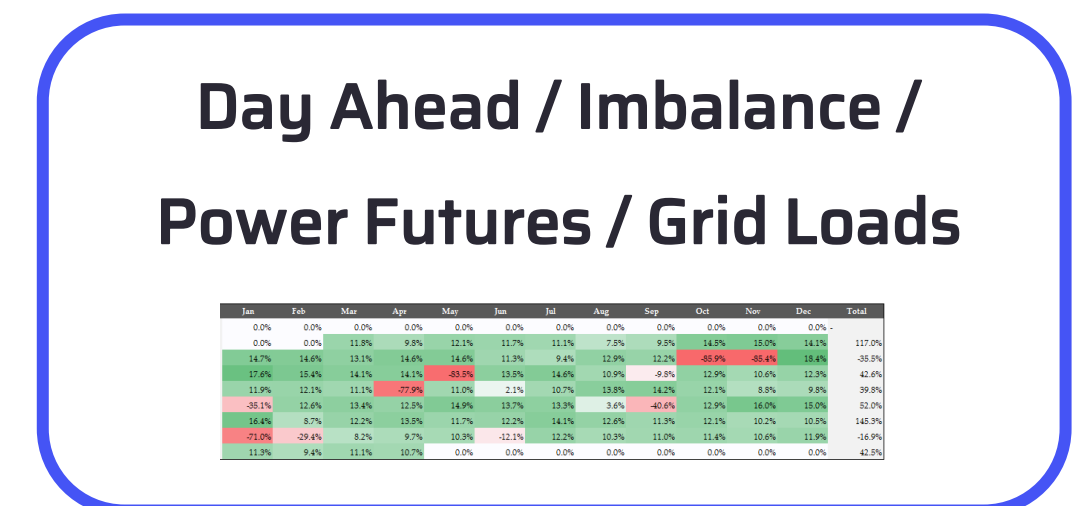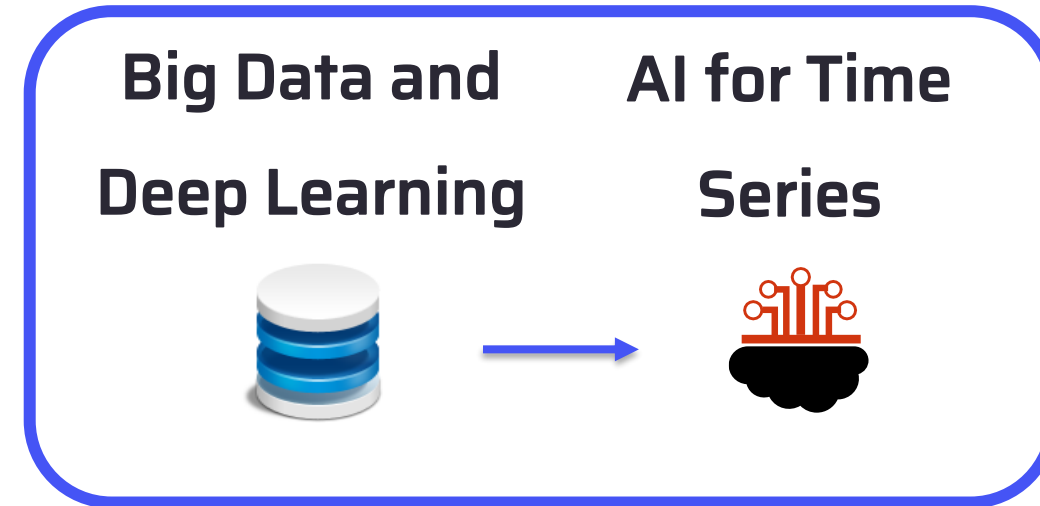## Day-Ahead price forecasting

Using Wegaw geospatial datasets we can train a day-ahead price forecasting model to speculate on energy prices. Helping increase trading gain and reduce volatility. **2-10% gain per trade**

In partnership with: predictive layer
Shape Your Future

ENERGY TRADING USE CASE

Big Data and Deep Learning → AI for Time Series

Supervised & controlled

Day Ahead / Imbalance / Power Futures / Grid Loads
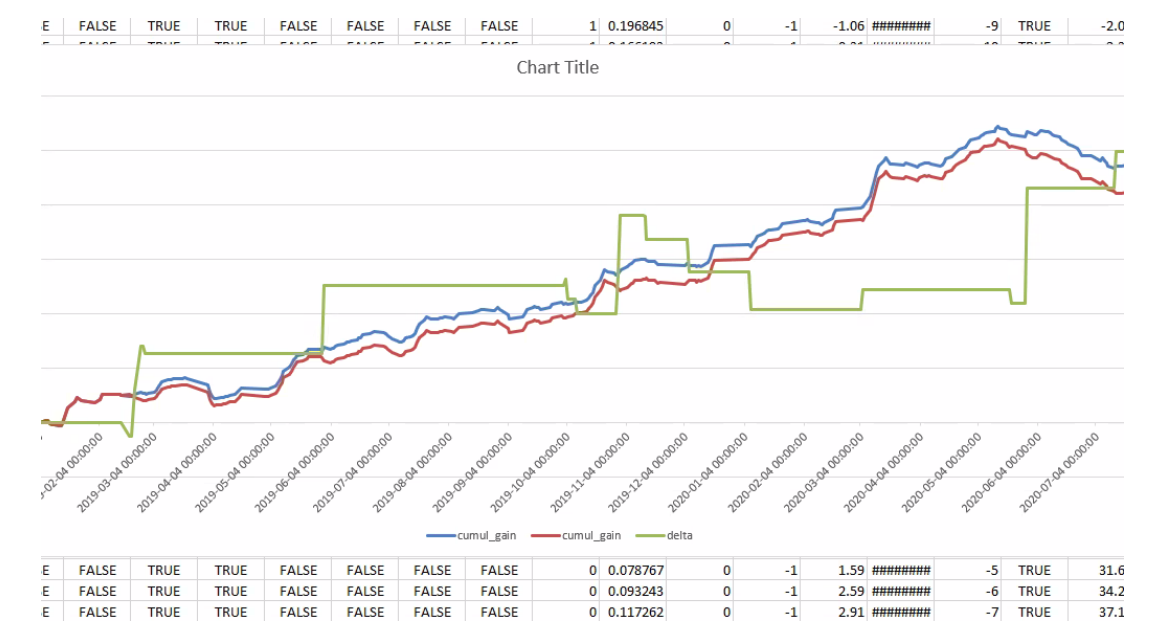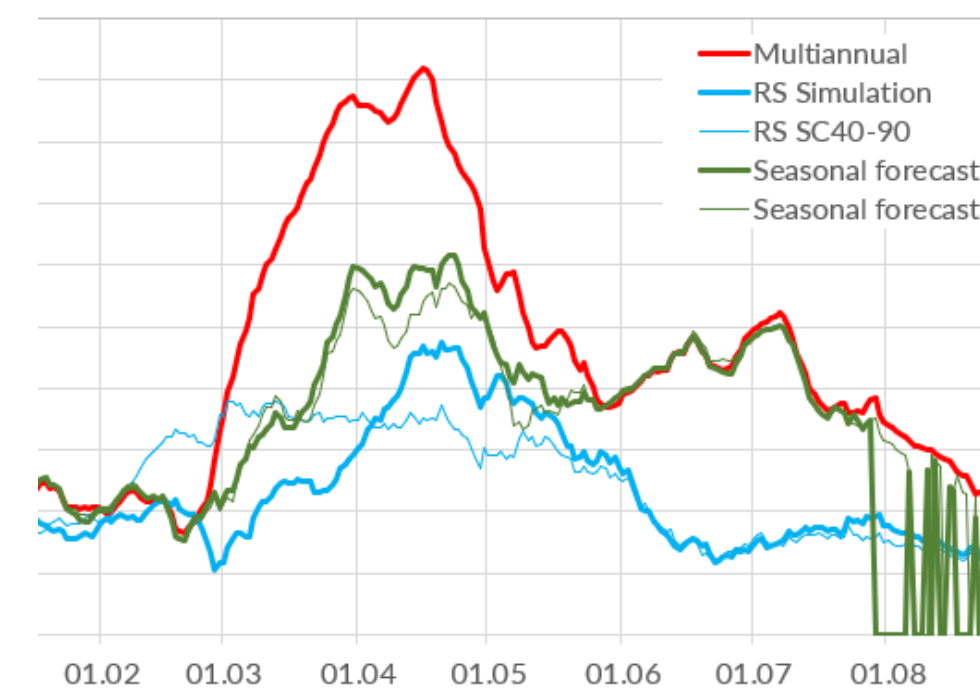
Data Crawling, Cleaning and monitoring
We combine geospatial datasets with 100+ energy related data sources.

AI Modelling
We combine Deep learning models and big data techniques with Artificial Intelligence time series.

Forecast and control
Supervised by Predictive Layer and Wegaw experts, forecast based on custom built models.

P&L driven Results
Energy experts validated and measurable results.

2-10% gain per trade.

KEY ADVANTAGES...

**1.** **GLOBALLY SCALABE – INDEPENDENT OF FIELD DATA**

Wegaw technology leverages Remote Sensing satellite data, and therefore does not need field hardware or teams to deliver snow & water datasets. This approach allows for flexible deployment anywhere in the world.

2. **OBSERVATIONAL DATA**

Wegaw datasets are based on observational data instead of the currently industry-dominating interpolated models or physical models. Thus, this dataset to has a tangible accuracy and reduces uncertainty when included in hydrology or trading models.

3. **TRADING EDGE FOR MWH PURCHASE**

Snow/water evolution has a heavy correlation with the energy price. Hydropower influenced countries tend to have up to 0.65 correlation on snow evolution and energy price. Thanks to the ability to monitor their snow & water resources with Wegaw data, energy purchase can be better estimated based on energy yield of other company hydropower assets.
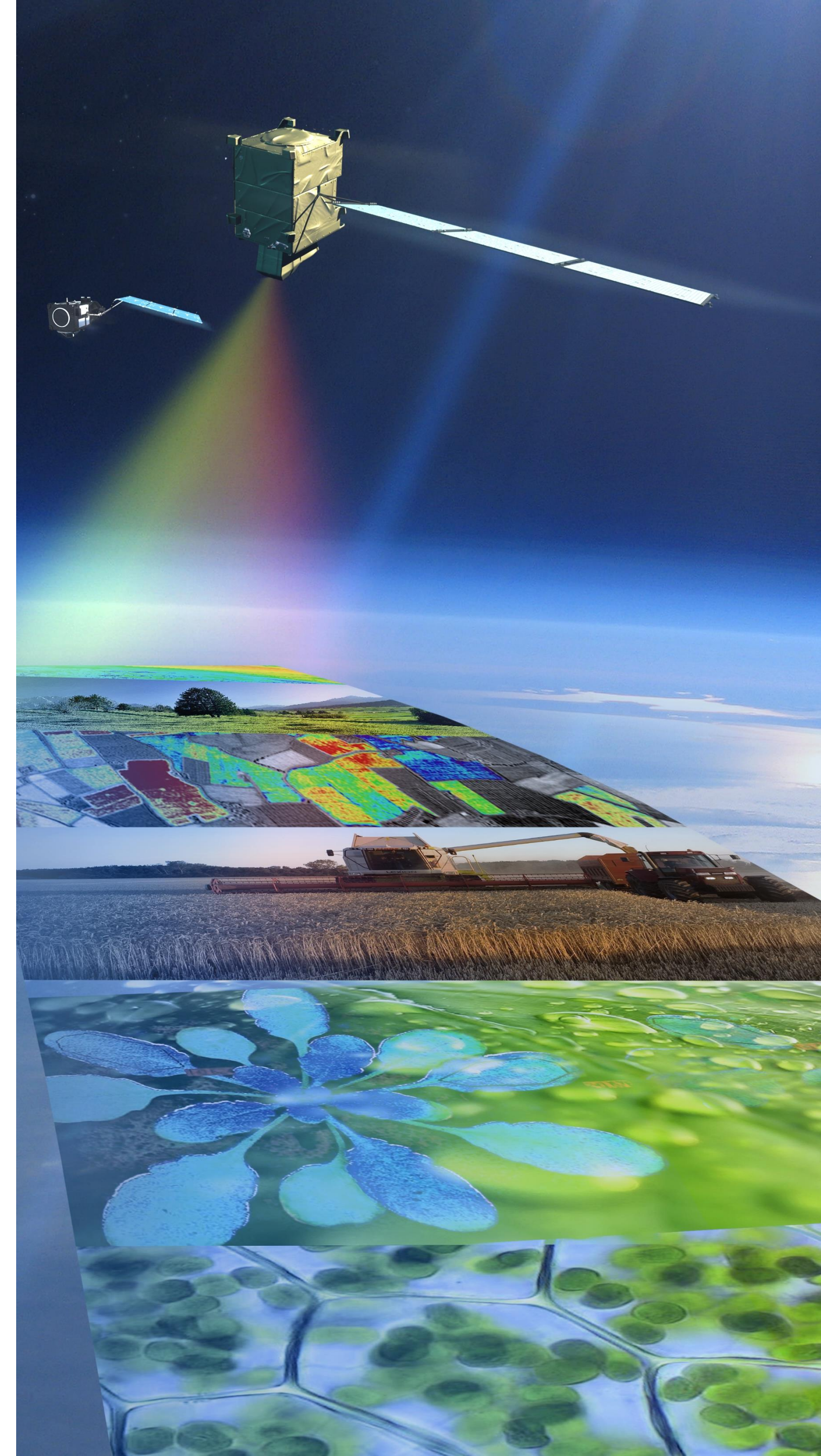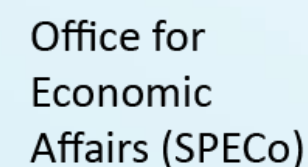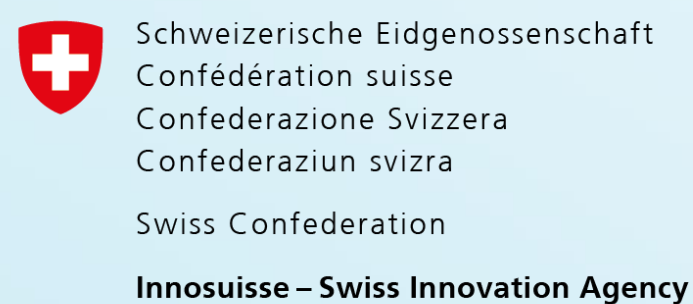
REFERENCES

A OFFICIAL PARTNERSHIPS
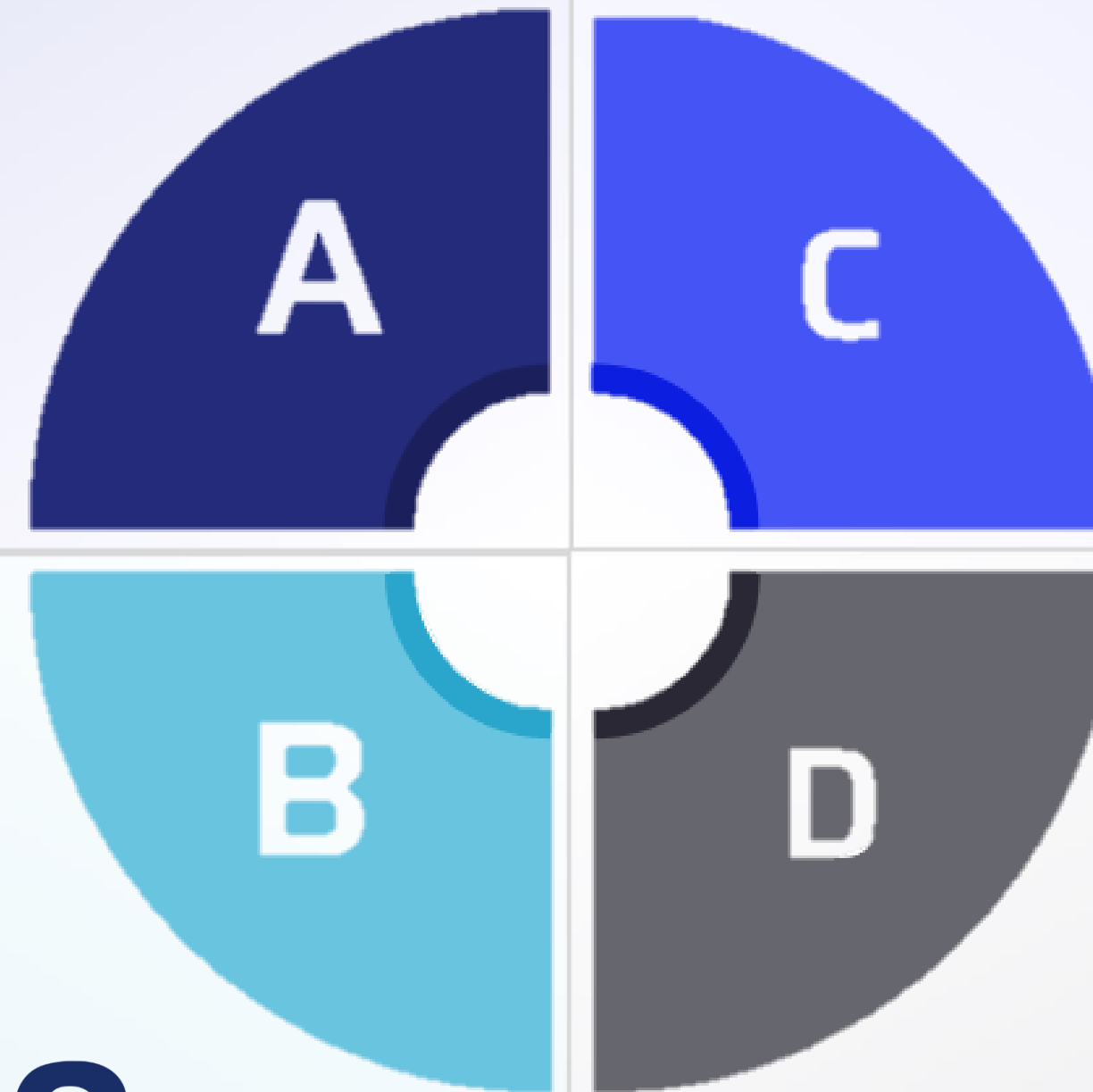
C RESEARCH ECOSYSTEM

B INSTITUTIONAL SUPPORT BY

D PROJECTS WITH

SIGNED PROPOSALS WITH

THANK YOU FOR YOUR ATTENTION

Any question:
info@wegaw.com

WEGAW