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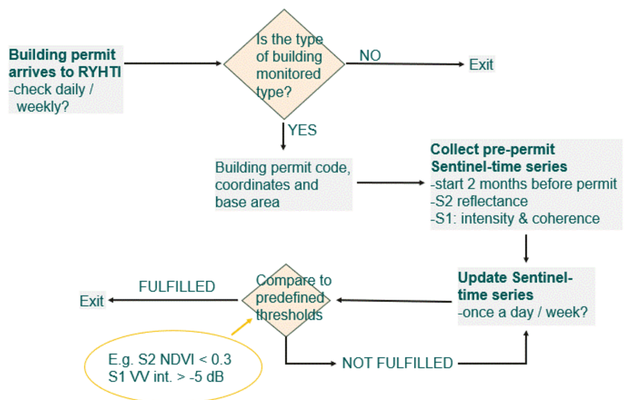
Enhancing the Finnish construction project start statistics utilizing EO data

One of the aims of GSFIBU-project is to investigate the utilization of EO data for the identification of building construction project start and to accelerate the accumulation of project start information in statistics compared to the information obtained through the register. EO data can be used to improve the up-to-datedness of the statistics and supplement start up data, especially for large office or industrial projects, which can have a significant impact on the figures in the statistics. The preliminary experiences are presented in this poster.

1. Aim

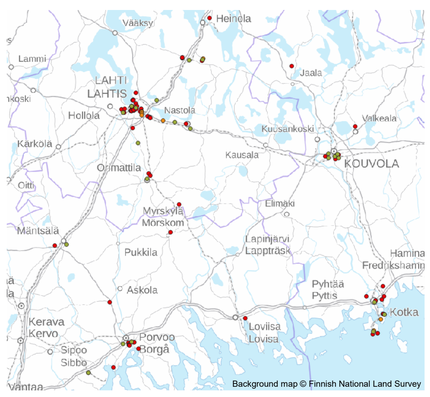
To estimate the start of building construction date, preferably within one week accuracy, as soon as possible.



The proposed process for detecting the start of building construction.

2. Data

RYHTI is Finnish national information system on the built environment, bringing together in one place the land use and construction data from the information systems of municipalities and central government authorities.



The new construction sites of test area between 2020-2024.

- larger constructions, no single-family houses
- 84 sites, 4 sites 2023 and 2 sites 2024

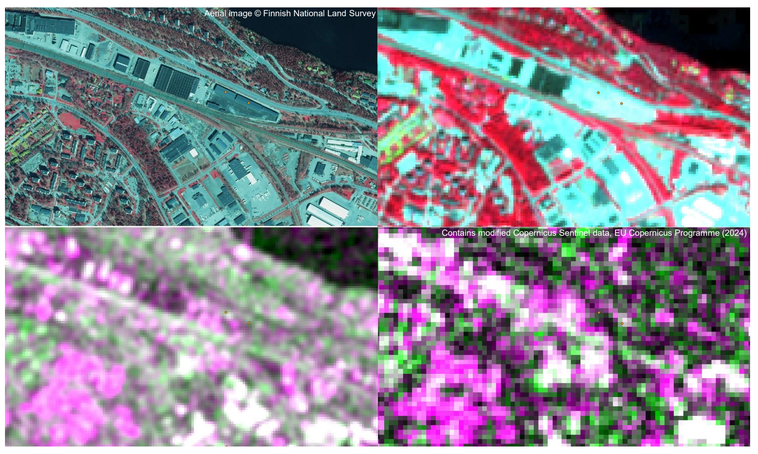
Different kind of Sentinel satellite data has been used and tested from years 2023 and 2024.

Sentinel-1

- Daily images: Radiometrically Terrain Corrected IW backscatter from Planetary Computer, 20 m
- Monthly backscatter mosaics: Copernicus IW, 20m
- Coherence time series: processed using Copernicus Workspace, 20 m

Sentinel-2

- Daily timeseries: Sentinel-2 Global Mosaic service, 20 m
- SYKE monthly image index mosaics, 13 per growing season 1.4.-31.10., 10 m



Top left: aerial image
Top right: Sentinel-2 reflectance summer 2024 mosaic
Lower left: Sentinel-1 backscatter 7.7.2024
Lower right: Sentinel-1 coherence 7.7.-19.7.2024.

3. Test sites

The time series of Sentinel-1 and -2 observations have been produced for 23 sites. Some Sentinel-1/2 time series of building construction sites are illustrated in the right part of poster:

- ID 2719645: Apartment building, building permit: 6/2023, start: 15.6.2023, end: 18.7.2024
- ID 2705321: Parking garage, building permit: 10/2022, start: 6.3.2023, end: 13.11.2023
- ID 2731224: Industrial warehouse (cold), building permit: 1/2024, start: 19.8.2024, end: 29.10.2024

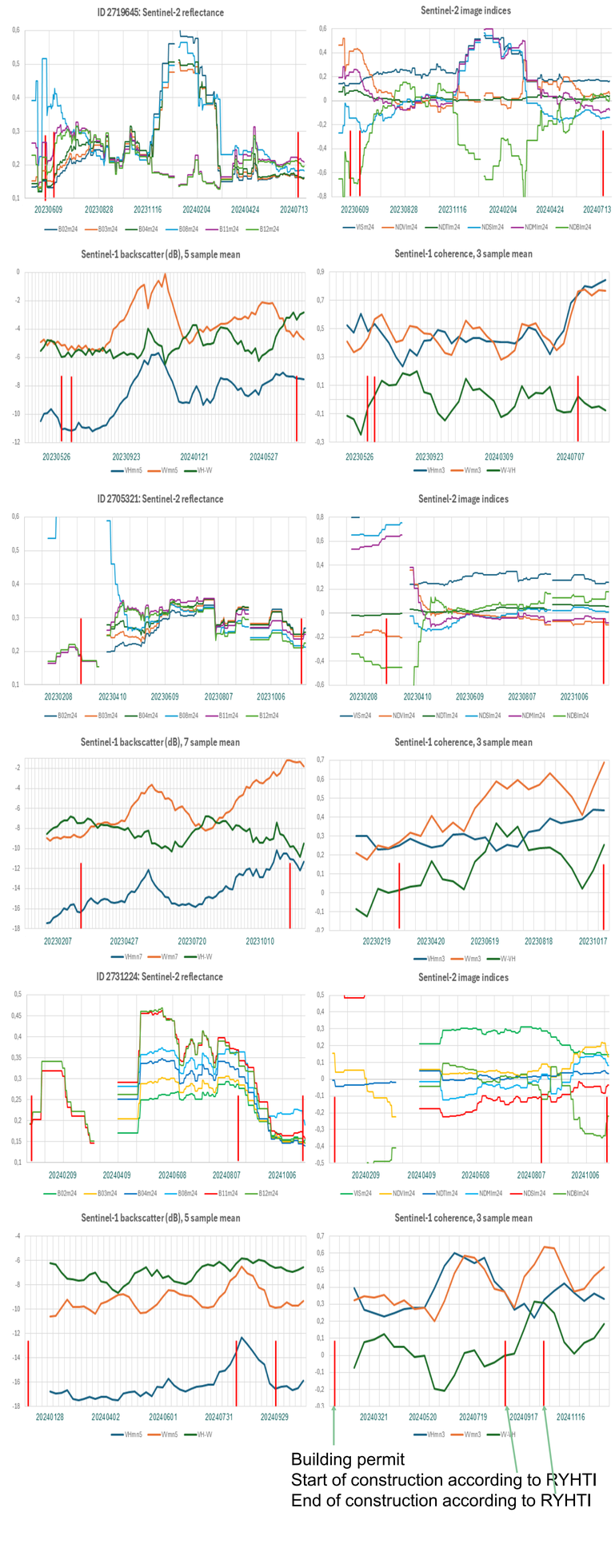
4. Experiences and observations

RYHTI: The location of building coordinate point is within the outline of the building, but not necessarily in the center. In the case of building expansion, the given point can be within the old, already constructed part of building. In some cases, the given building start date looks suspicious.

Geometric correction of EO data: Different data should be geometrially orthocorrected very well and uncertainty should be less than 10 m. There are doubts concerning used Sentinel-1 RTC, especially ascending orbit. Sentinel-2 is reasonably good in this sense.

Sentinel-2: Different indices are useful but gaps due to clouds and their shadows, as well as winter can be long, even more than month with 3 satellites. NDVI (>0.4) and NDSI (>0.4) can be used to detect vegetated and snowy areas.

Sentinel-1: Useful due to independence from Sunlight, but noisy and difficult to interpret. Soil freezing and snow melt have large effect to backscatter. If VV-backscatter increases 10% from mean backscatter before building permit, that construction has been most likely started.



5. Conclusions and future directions

- Very important that geometric correction is very good
- Clouds and seasons make the use of optical Sentinel-2 difficult, Sentinel-1 is better because of independence of Sunlight
  - More dense time series of Sentinel-1 backscatter and coherence for 2025
- In some cases, the mean value of real estate could be used instead of point given in building permit. The availability of building polygon would be the best case.

Links:
Ryhti: https://ryhti.syke.fi/en/
Copernicus CDSE: https://dataspace.copernicus.eu/
Sentinel-1 Planetary computer: https://planetarycomputer.microsoft.com/dataset/sentinel-1-rtc
Sentinel-2 Global mosaics: https://s2gm.land.copernicus.eu/mosaic-hub
Sentinel-2 image index mosaics: https://ckan.ymparisto.fi/dataset/sentinel-2-image-index-mosaics-s2ind-sentinel-2-kuvamosaiikit-s2ind

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