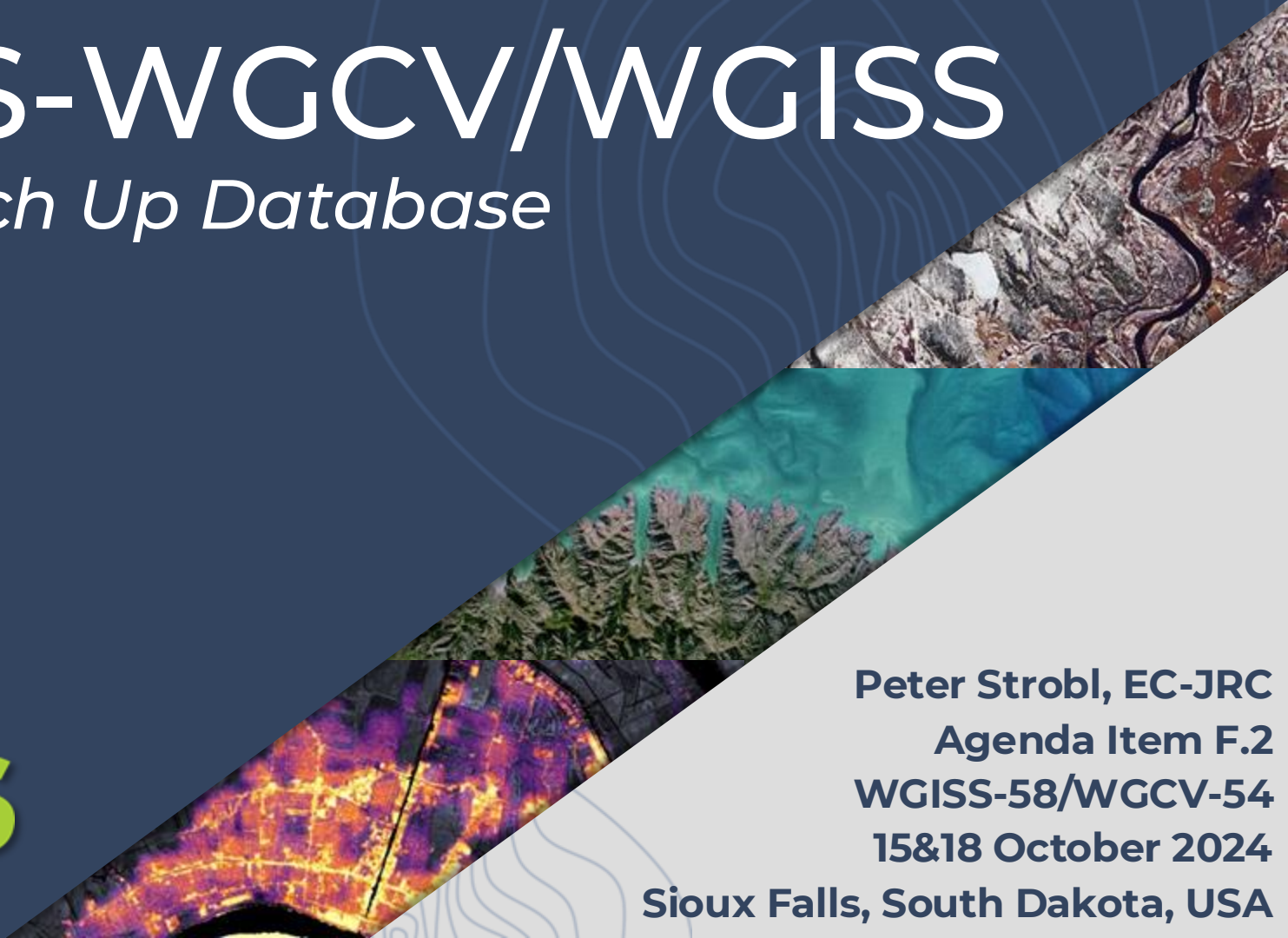
CEOS-WGCV/WGISS

GCP Match Up Database



Peter Strobl, EC-JRC

Agenda Item F.2

WGISS-58/WGCV-54

15&18 October 2024

Sioux Falls, South Dakota, USA

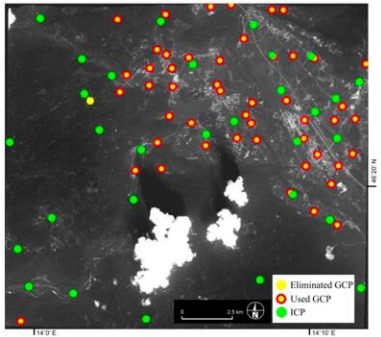
Committee on
Earth Observation Satellites

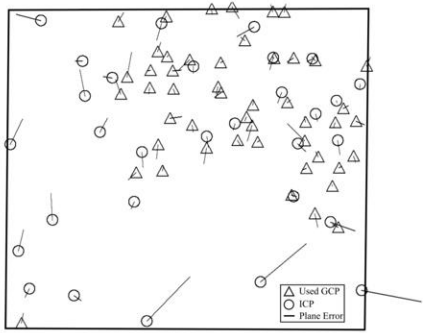
Background

- **CEOS** Strategic Implementation Team (SIT)
  - **New Space Task Team**
  - **Cooperation and collaboration** opportunities to **facilitate interoperability** between private and public sector data
  - **Identify and support** potential **complementary capabilities** enabled by New Space actors
  - **P. Goryl** et al. Presentation at VH-RODA DAY 23
    - **CEOS Recommendation**: Establishing a reference for geometry and image quality Cal/Val via a **GCP Database**
  - **TMSG** proposed to host a respective activity

Why GCPs?

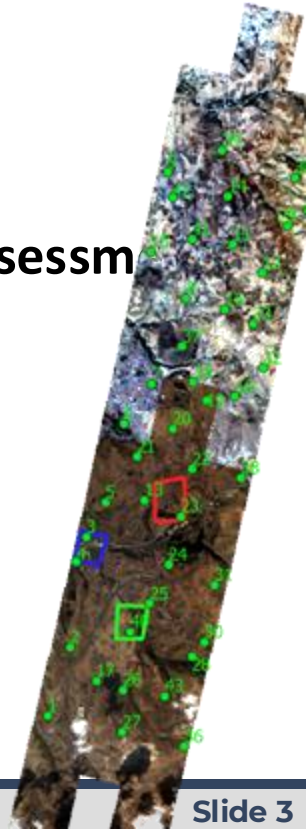
- Spatial data **interoperability**, seamless **integration/analysis** of **multi-source** and **multi-temporal** data
  - **Geolocation accuracy** is crucial
  - **Geometric distorsions** corrections are vital
- **GCPs** are essential for **georeferencing** and **Geometric quality assessm**





Credits: Pehani et al. Remote Sens. 2016, 8(4), 343; https://doi.org/10.3390/rs8040343

Credits: Kocaman, Saunier, Albinet, Cal/Val Activities over Ankara Test Site within ESA EDAP Framework, VH-RODA 2023

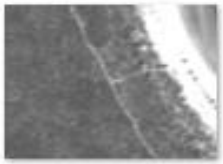


How?

- ***CEOS** is now **proposing** the development of a **harmonised global CEOS Ground Control Points (GCP) Database** and its extension **to cover also VHR Optical Data** [2.5-10m GSD, and **potentially** <2.5m GSD]*
- *CEOS agencies are pooling activities and resources towards a unified and **harmonized CEOS GCP Database** for HR&VHR Optical Data hosted in the TMSG and IVOS sub-groups of WGVC, coinded Ground Control Point Intercomparison eXercise*

  - ***GCPIX!***

- *Precursor works:*
  - *A. Lewis, L.-W. Wang, R. Coghlan, **AGRI: The Australian Geographic Reference Image**, https://cmi.ga.gov.au/sites/default/files/2020-08/agri_report.pdf*
  - *S. Saunier, S. Kocaman, C. Albinet, P. Goryl, "**Development of a GCP Database Approach for Geometric Cal/Val of VHR Optical Imagery**"*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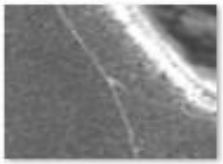
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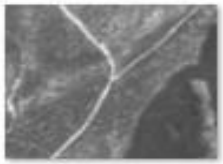
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91412002_E_photo.jpg


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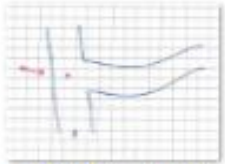
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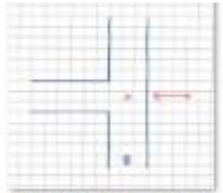
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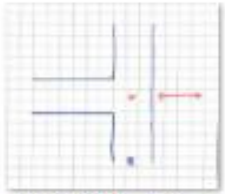
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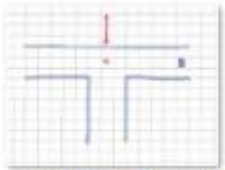

91412079_sketch.jpg


91412503_sketch.jpg

S. Saunier, S. Kou *ment of a GCP*
Database Approa *cal Imagery”*

3 Sites: Ankara (Tu
Check out S. Sauni

ISTRES_12			
Id : 12	Latitude: 43.46363° / 0.75858345 radians	Longitude: 5.14762° / 0.08984293 radians	Altitude (ellipsoid) : 65.47262013 m

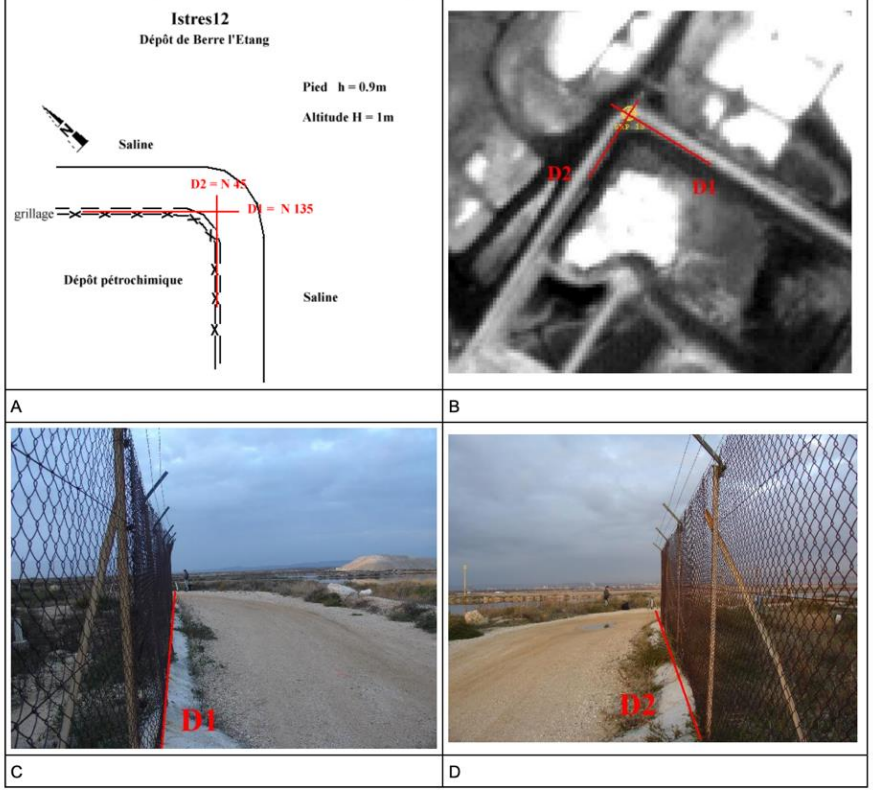
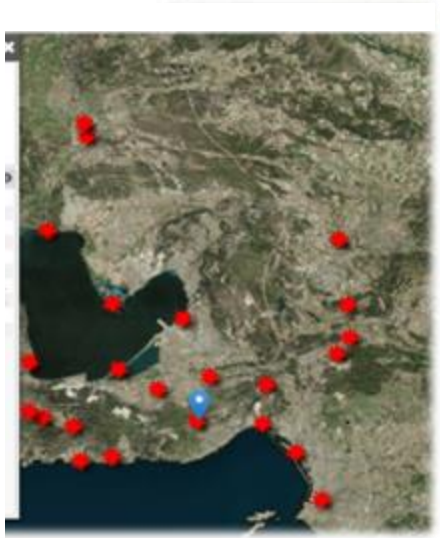
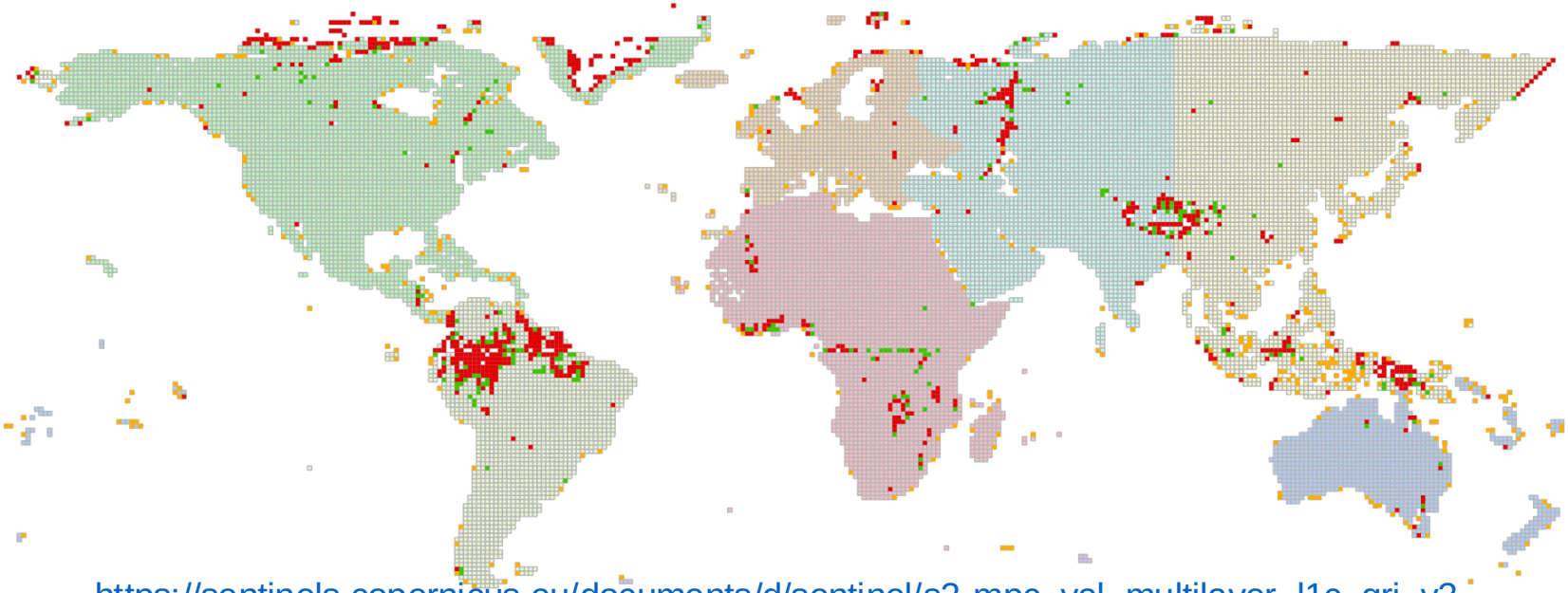


Table 1 - GCP 12 Description.



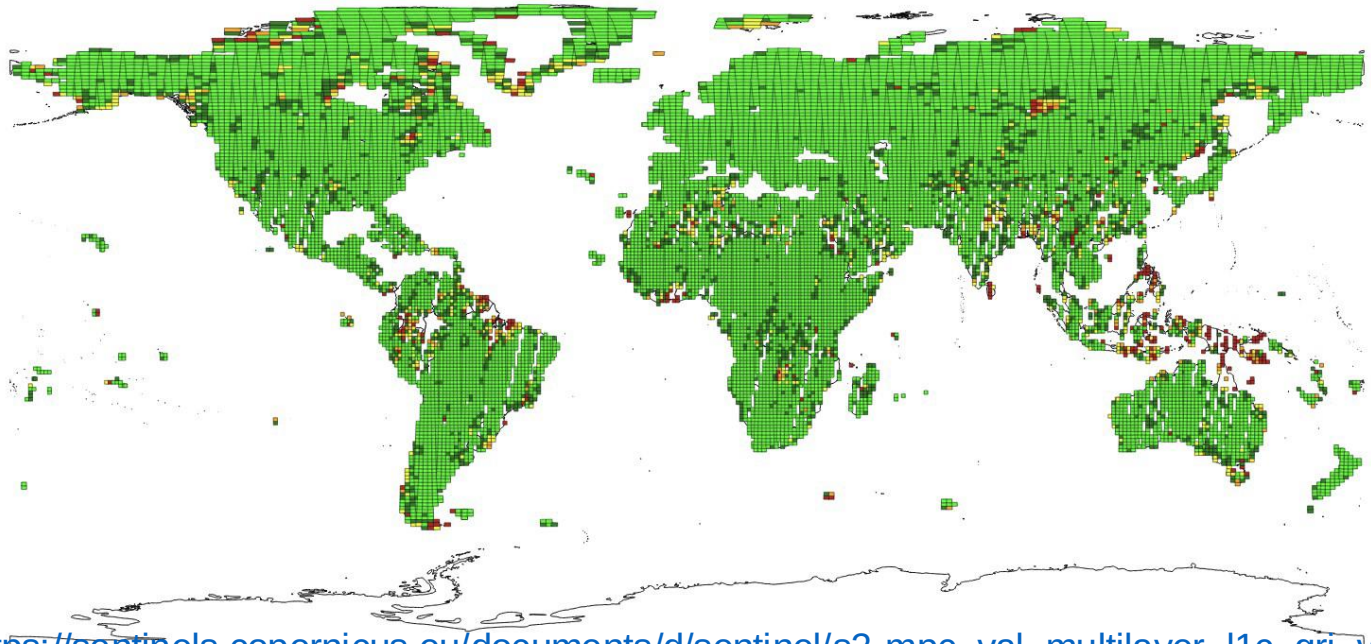
Sentinel-2 GRI - GCP Database

Conversion of >1000 GRI images to L1C using Collection 1 processing baseline and Copernicus-DEM, **>2 Million GCPs**



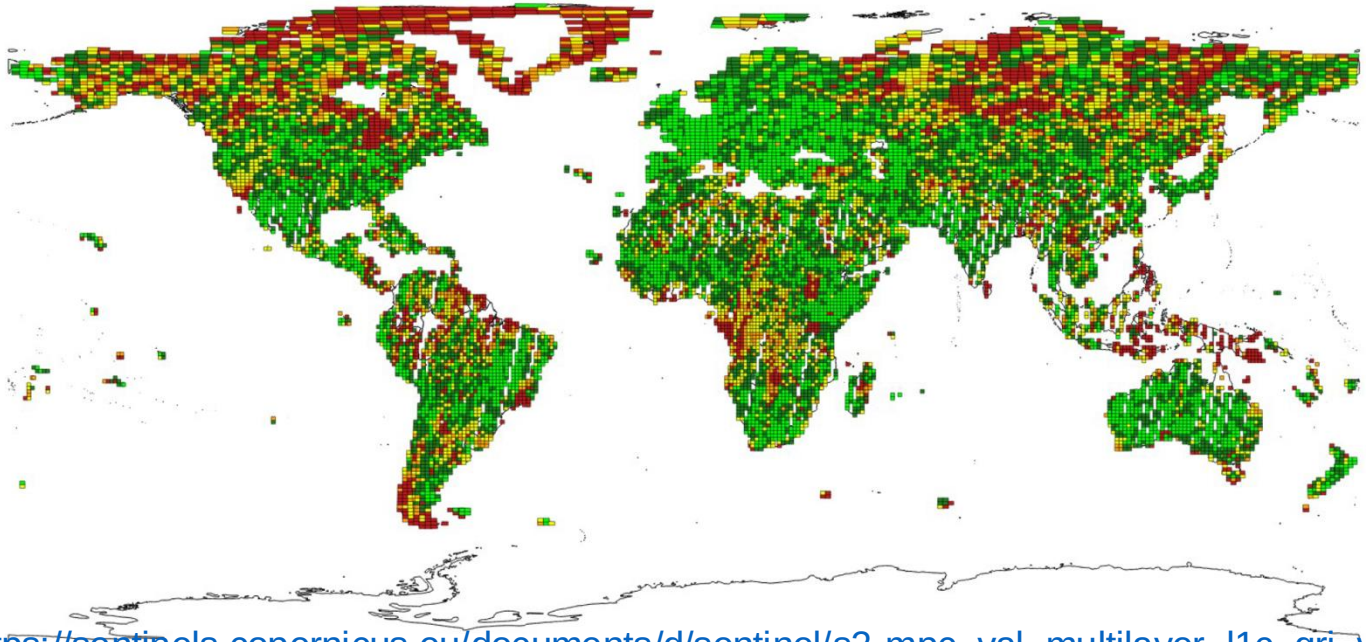
https://sentinels.copernicus.eu/documents/d/sentinel/s2-mpc_val_multilayer_l1c_gri_v3

- Minimal inner consistency of the ML L1C GRI versus L1C GCP GRI (green<1m to red >4m)



https://sentinels.copernicus.eu/documents/d/sentinel/s2-mpc_val_multilayer_l1c_gri_v3

- Maximal inner consistency of the ML L1C GRI versus L1C GCP GRI (green<1m to red >4m)

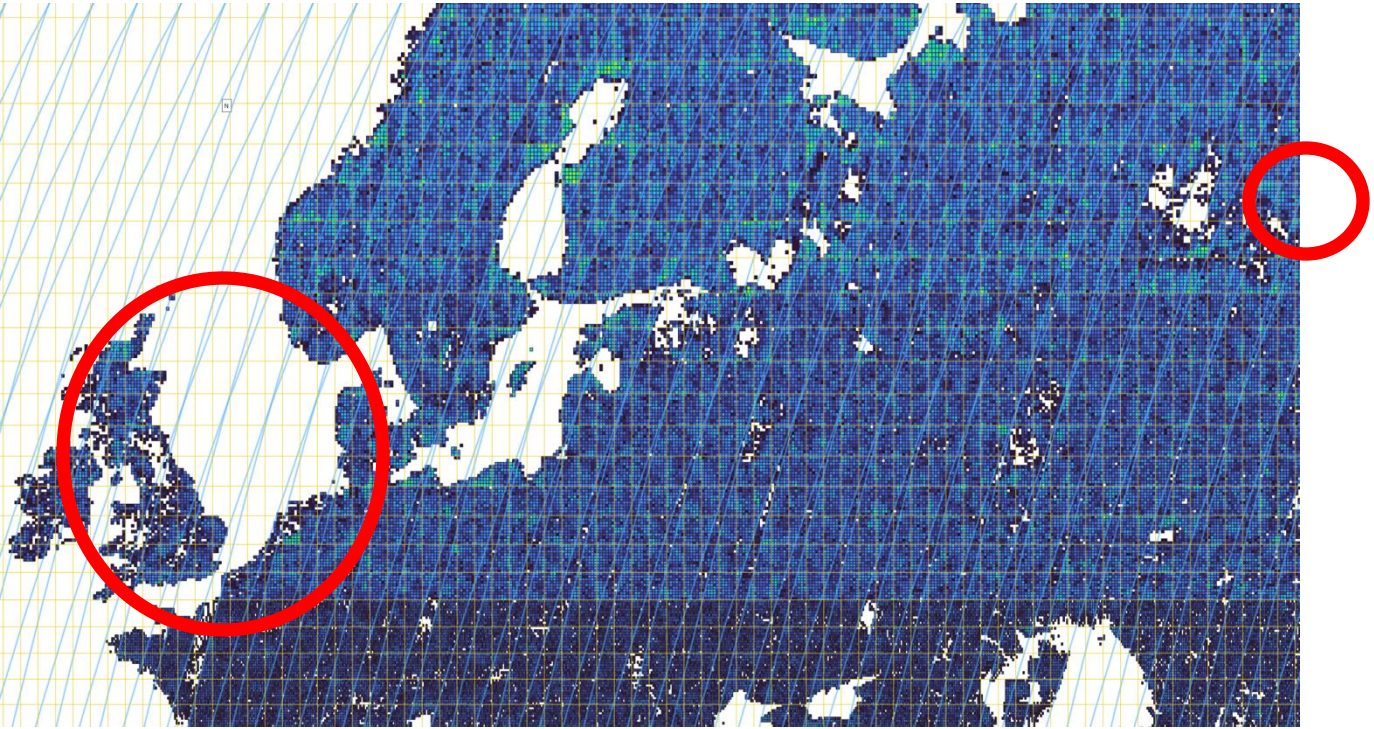


https://sentinels.copernicus.eu/documents/d/sentinel/s2-mpc_val_multilayer_l1c_gri_v3

Europe aggregated in DEMIX tiles

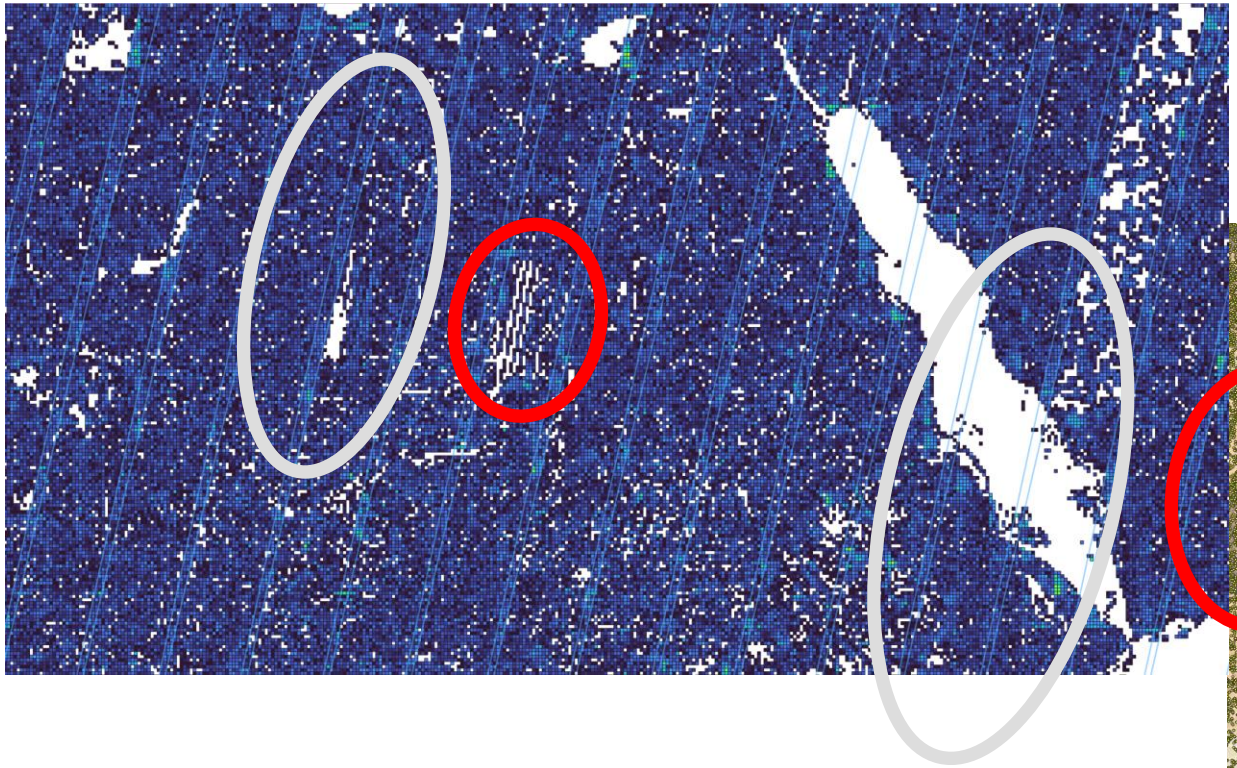
- Increasing de-facto density with latitude
- Gaps become visible

Europe (north) aggregated

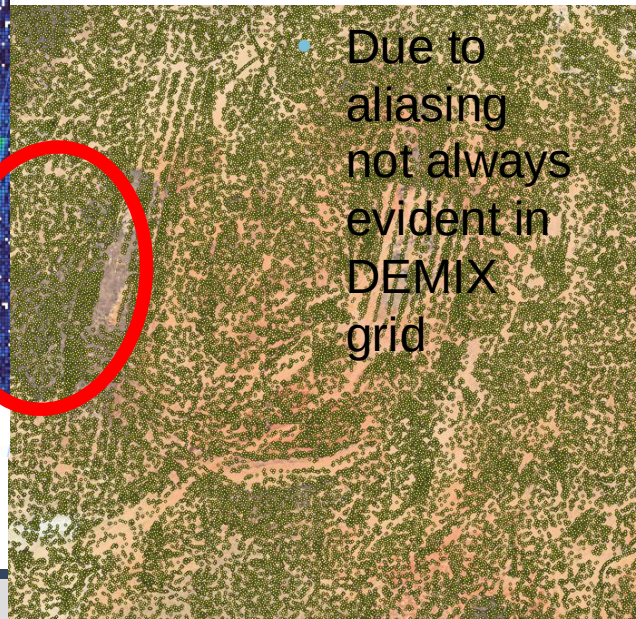


- Gaps particularly in British Islands (clouds)
- and one in Russia

Northern Africa: Egypt and Sudan

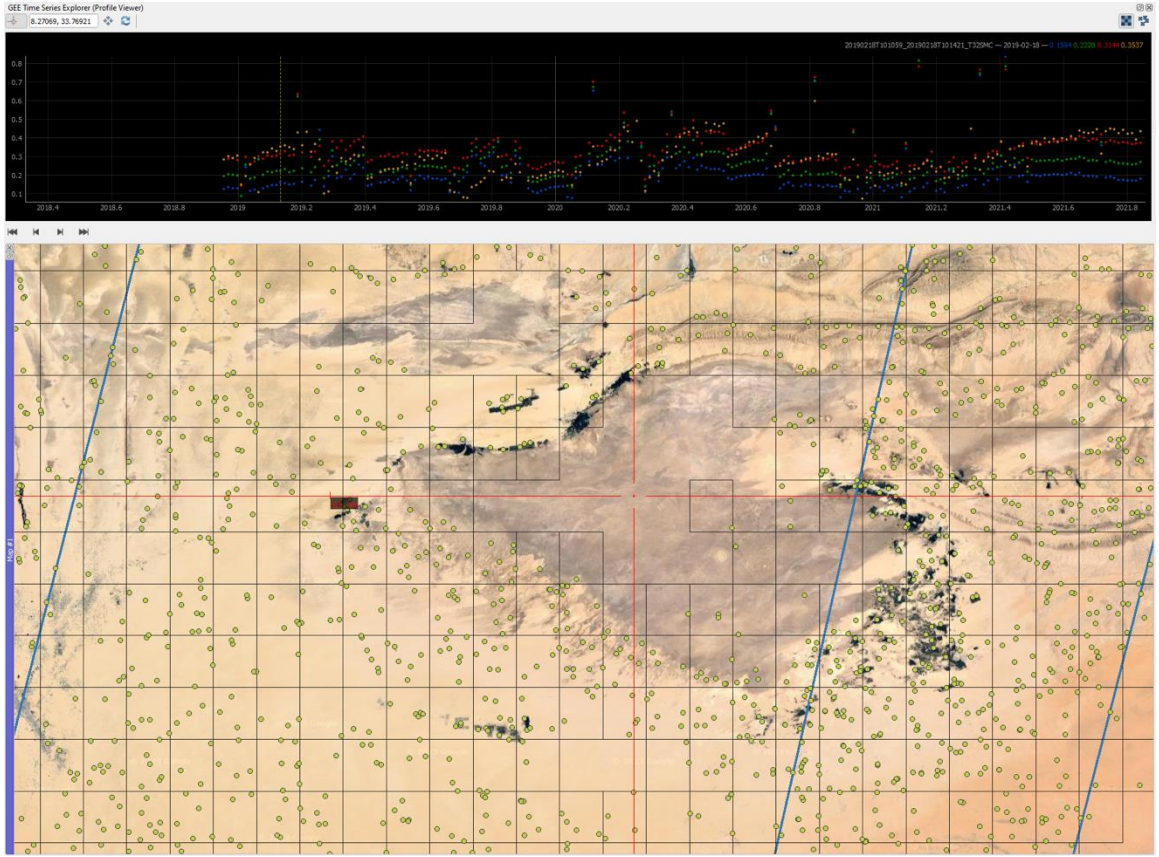


- ‘Striping’ patterns, following detector footprints?

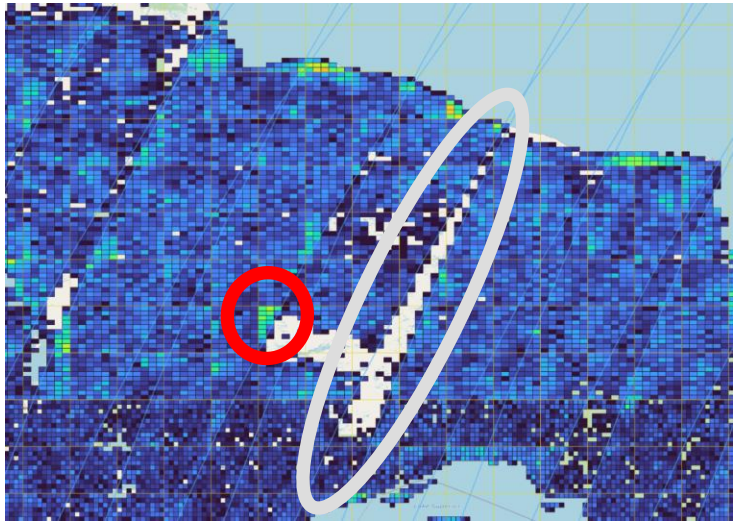


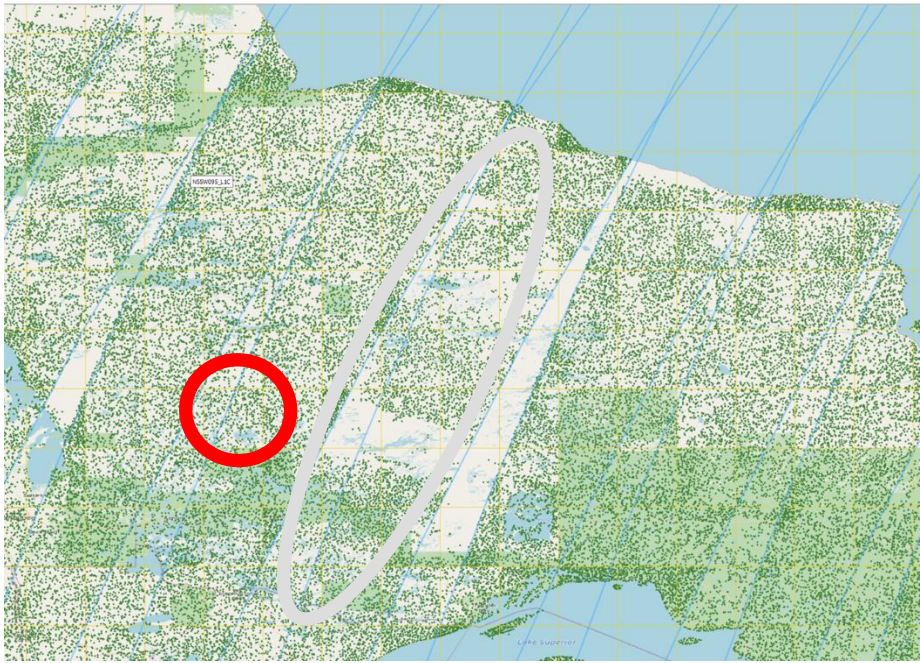
- Due to aliasing not always evident in DEMIX grid

Sahara / Tunesia



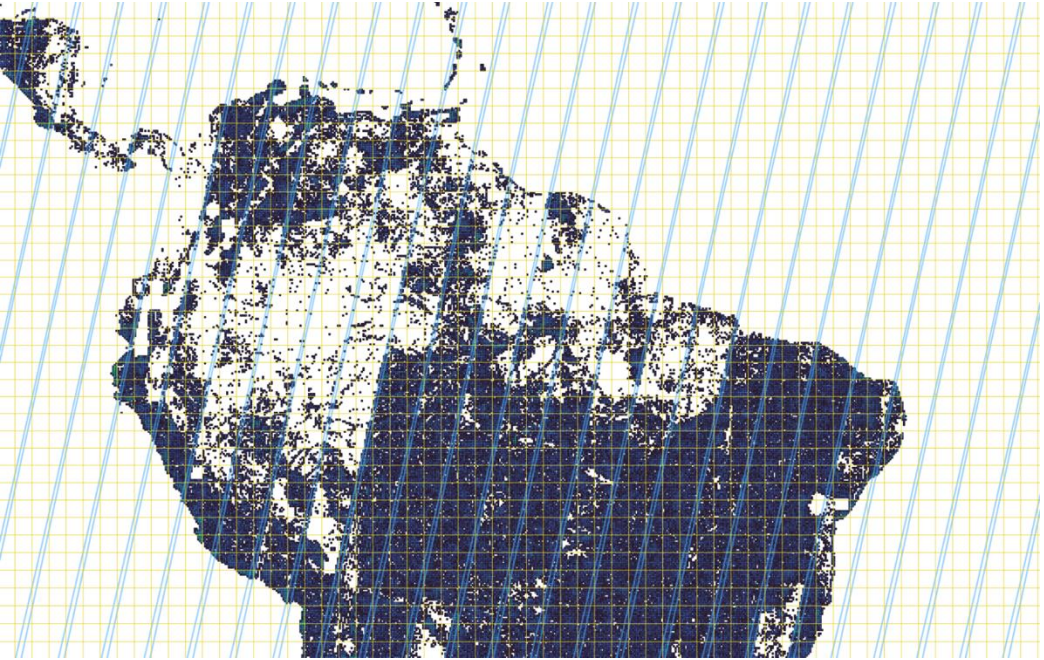
- Generally, plenty of points
- Many are dunes: are they stable enough over time?
- Almost no points in Chott el-Jerid, why?





- Missing orbits
- Over-densification to compensate for gaps

Amazonia / tropical forests



- More orbits needed!

Lessons learned

- GCPs should be orthorectified
- Do not base statistics on 1x1 graticules as too coarse and too much distorted
- Add additional orbits to the database to fill larger gaps
- Densify but don’t force where parts of a tile are ‘no-data’ (water, cloud, etc.)
- Scrutinise GCPs for temporal stability 10+yrs (sand, ice, shores, …)

GCPIX – first outline

❖ *Key elements to be further developed during GCPIX*

- define **criteria** for the **suitability** of GCPs (by resolution, season, wavelength, …) and respective uncertainties, spatial density and distribution requirements
- establish **protocols and formats for documenting and sharing** GCPs and respective libraries
- **harmonization** of existing **sources** from the different CEOS agencies **towards a unified DB**
- identification of **gaps/weaknesses** in coverage, consistency, quality, availability, ...
- design and set-up of a (**cloud-based) platform** for sharing and managing the database
- **improvement, densification**, and allocation of **additional source data (VHR)**
- potential inclusion of **DEM data/reference chips** from suitable and agreed reference data

Thank you!

CEOS
Committee on
Earth Observation Satellites

any questions?

Peter.Strobl@ec.europa.eu