OPT-MPC

Copernicus Sentinel

Optical Mission Performance Cluster

Sentinel-3 L1 product geometric validation using reprojected images

S. Clerc

S3VT, March 2026

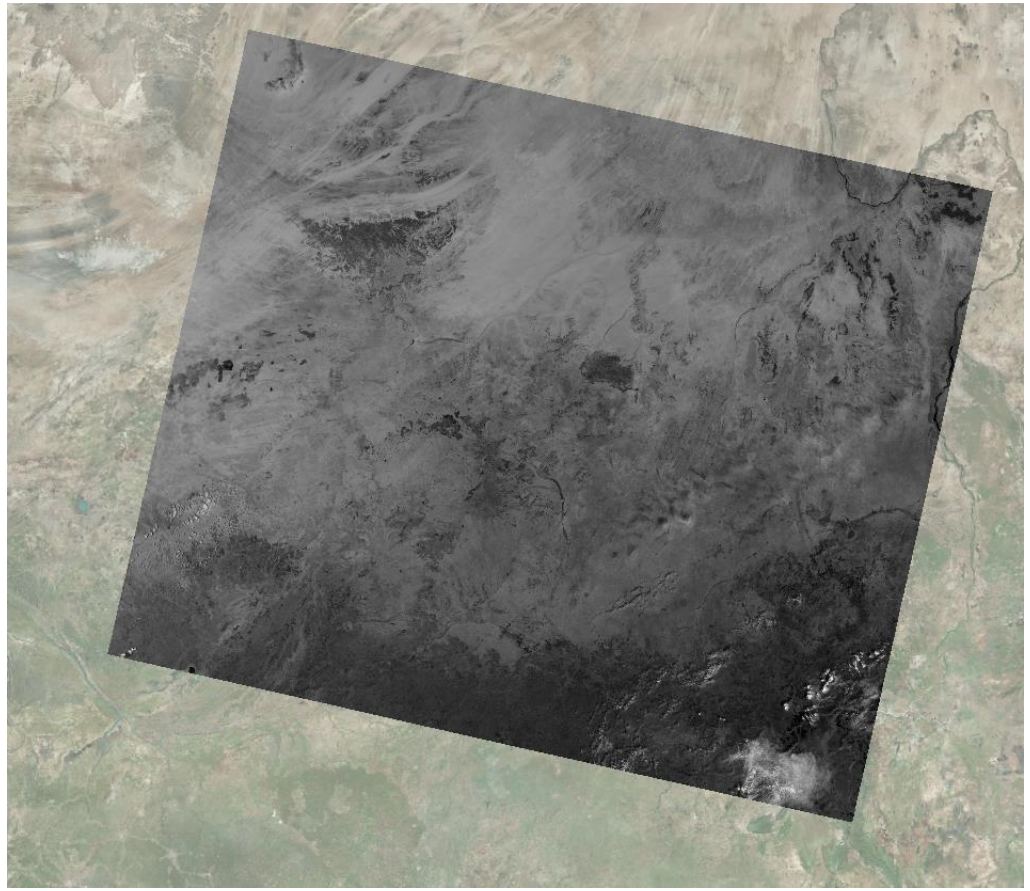
Funded by the EU and ESA

European Union

Method and data

- **Approach: reproject OLCI and SLSTR images to a common cartographic grid**
- **Target grid**
  - Best UTM coordinate reference system
  - Bounding box fitted on SLSTR in channel
  - 300 m grid step for OLCI bands
  - 500 m grid for SLSTR VIS and SWIR channels
  - 1000 m for SLSTR TIR channels
- **Reprojection**
  - Based on triangulation + interpolation (here linear)

SLSTR S3 radiance
overlayed on reference layer



Method and data

Test images

- Cloud-free granules over land
- Ideally not too hot to avoid SLSTR S7 saturation

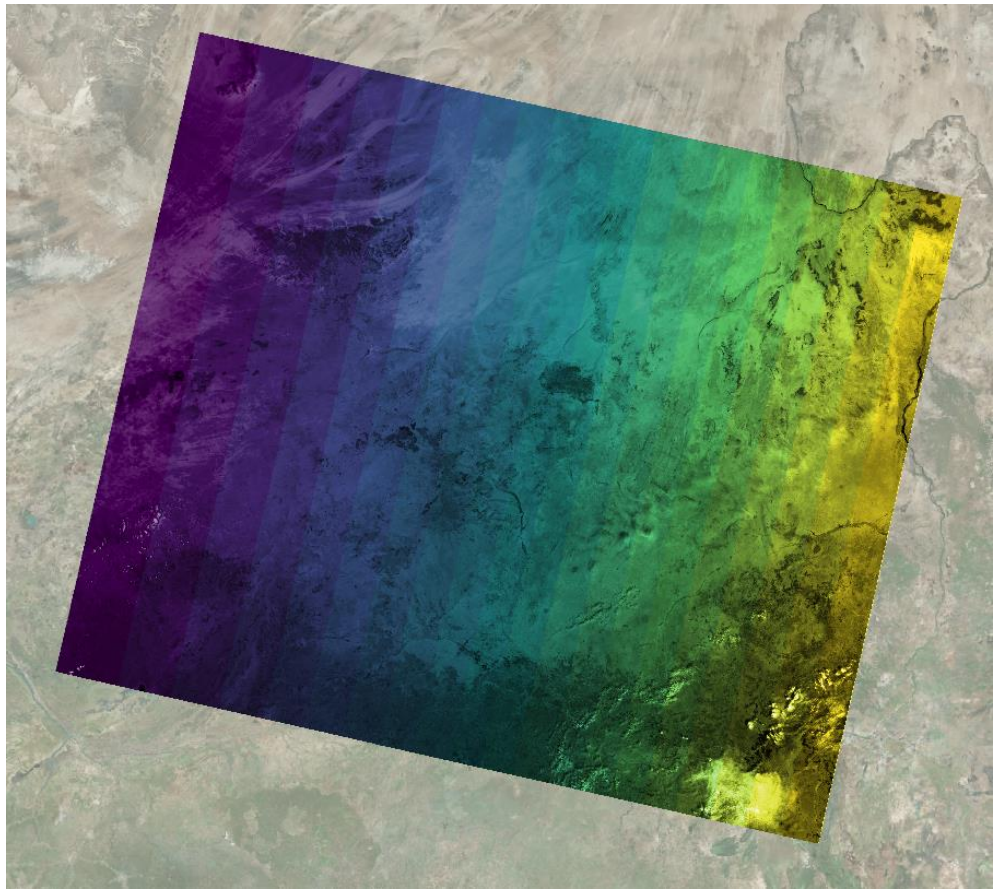
Reference images

- Sentinel-2 mosaics of NIR and SWIR 2 bands (cloud-free images with a close acquisition date)
- OLCI image can also be used as reference for SLSTR NIR band => SYN inter-instrument performance

Co-registration measured using Geocheck tool

- Generation of dense co-registration maps in ALT/ACT coordinates
- Using local contrast inversion to maximize correlation with TIR bands
- Use of pixel index bins to compute ACT mean profiles

Pixel index bins

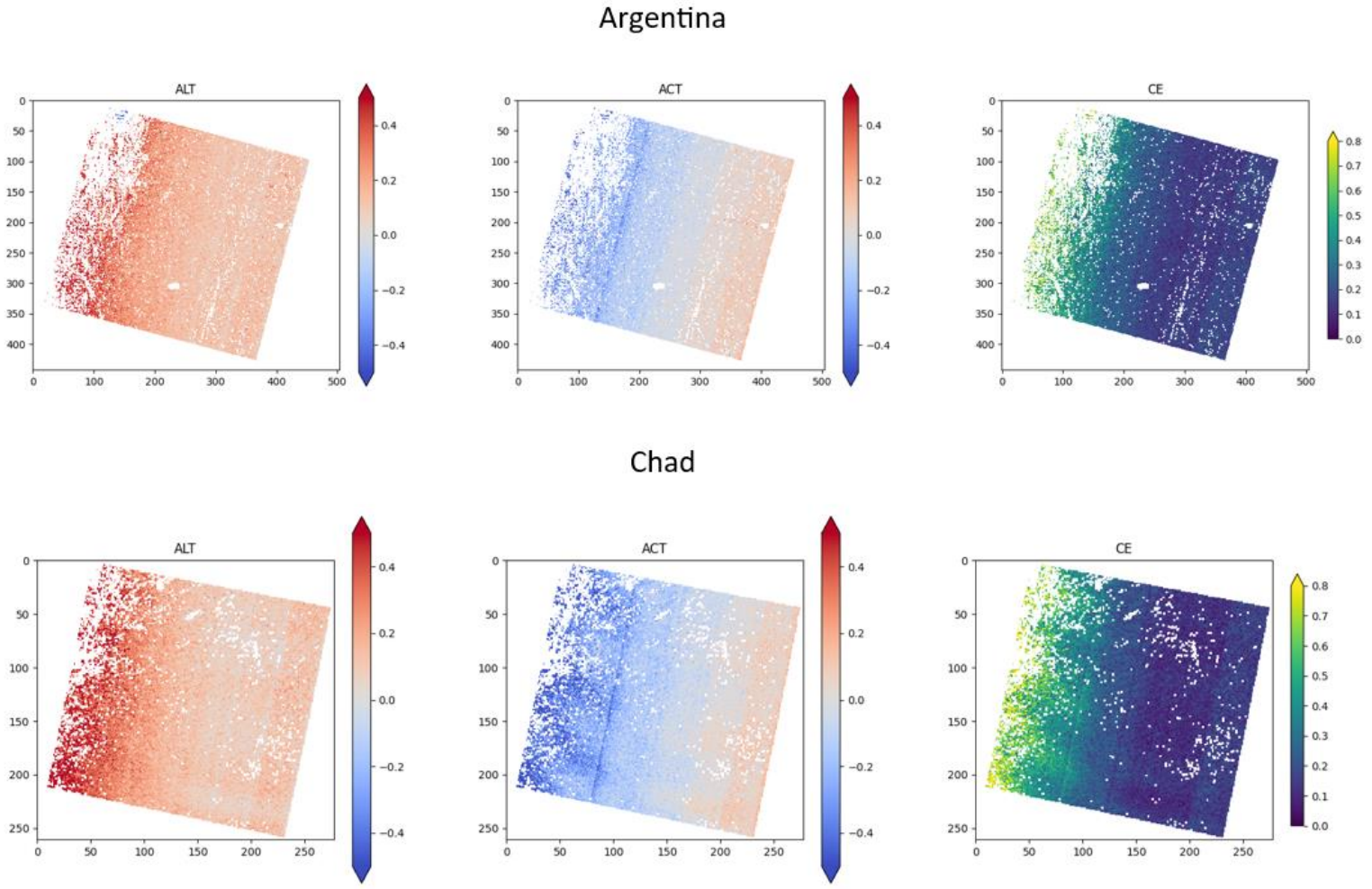


SYNERGY CO-REGISTRATION (OA17/S3)

Sentinel-3A SLSTR band S3 / OLCI Oa17

Co-registration error maps on 500 m pixel grid

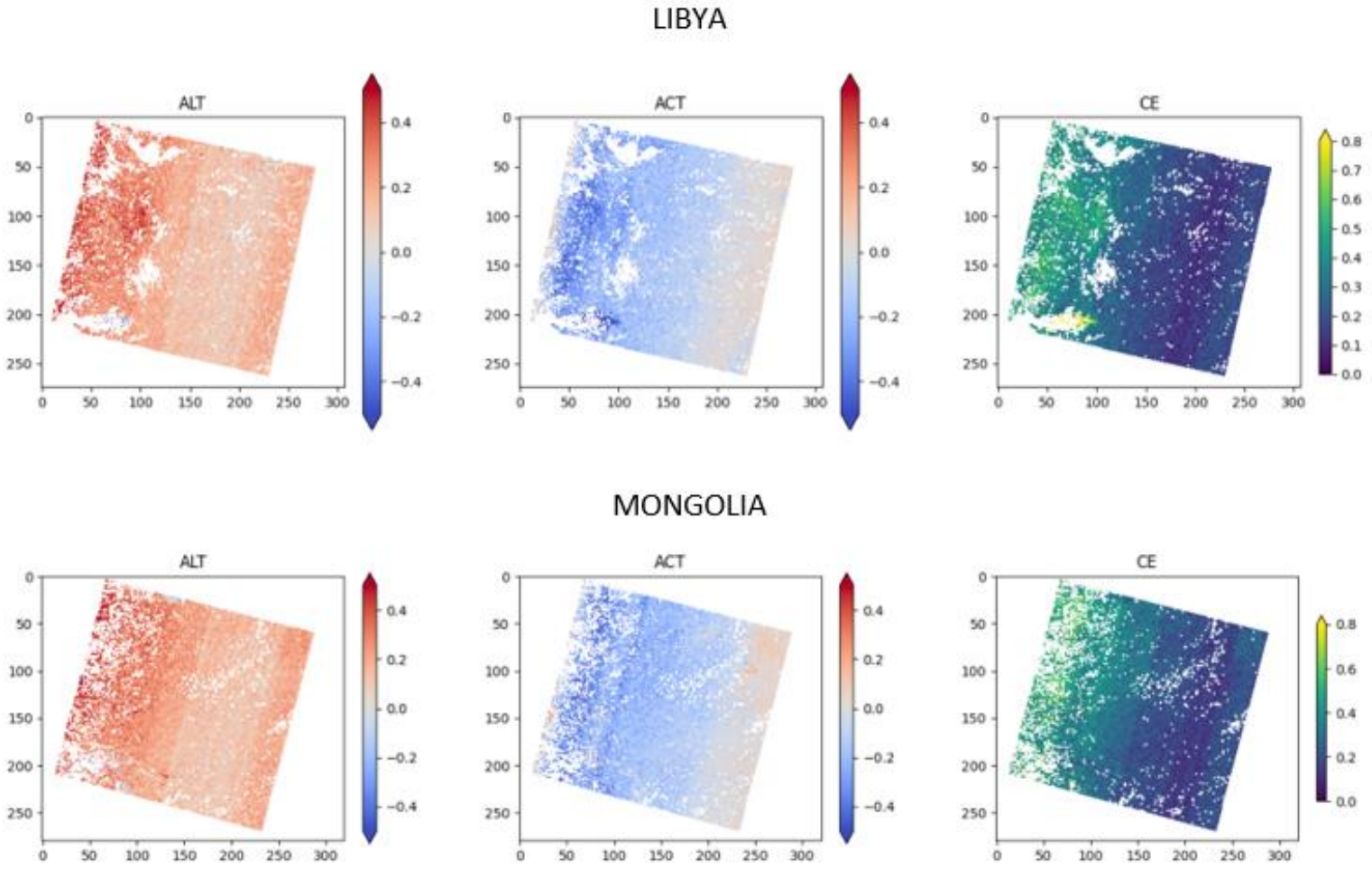
- OLCI camera interfaces visible
- Error is essentially constant along-track - very small oscillations visible on the Chad product
- No significant different between the two products
- Positive ALT error (SLSTR shifted southward)
- Variation of ACT error: SLSTR swath too narrow



Sentinel-3B SLSTR band S3 / OLCI Oa17

Co-registration error maps on 500 m pixel grid

- S3B map is similar, but errors are lower
- OLCI-B ACT error spike near Western edge



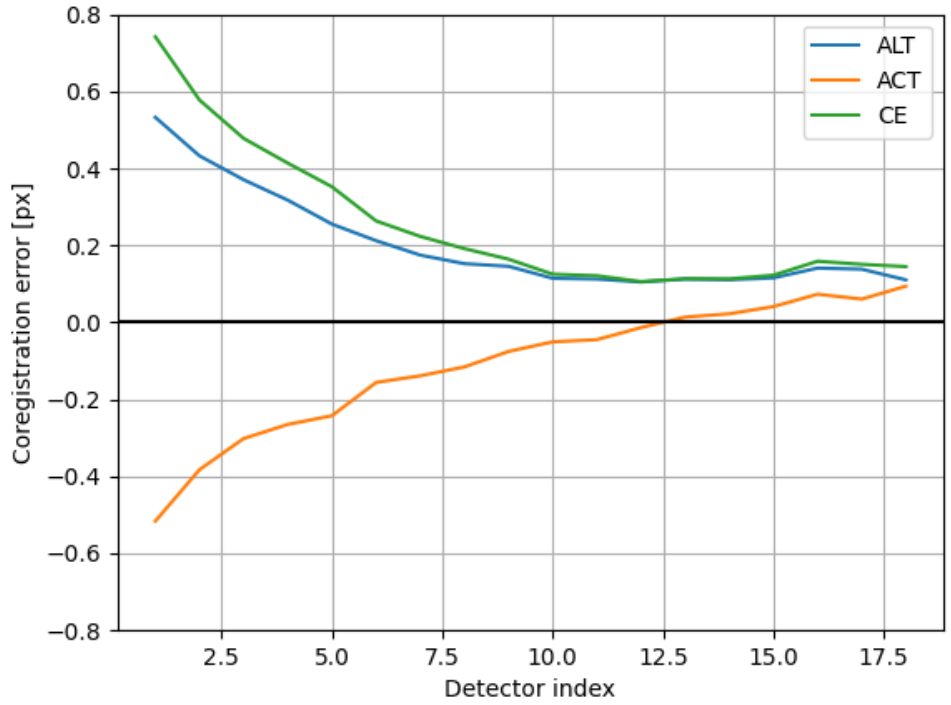
SYN co-registration (Oa17/S3)

ACT

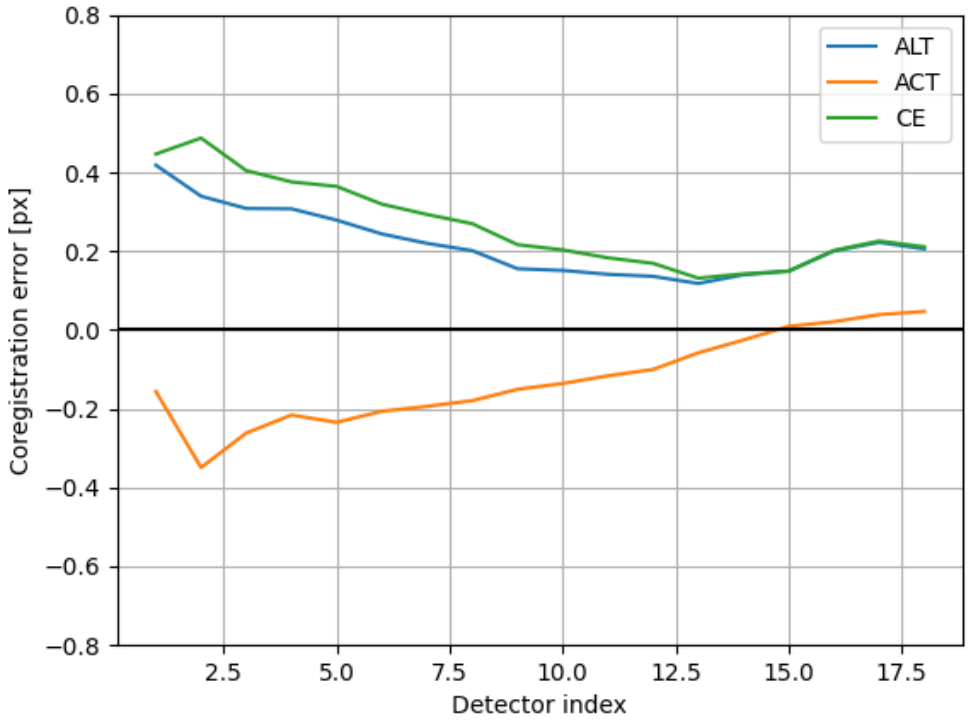
ALT

❖ Average ACT profiles on 500 m grid

S3A
ALT = 85 m
ACT = −50 m
Max CE = 370 m



S3B
ALT = 95 m
ACT = −55 m
Max CE = 245 m



OLCI ABSOLUTE GEOLOCATION

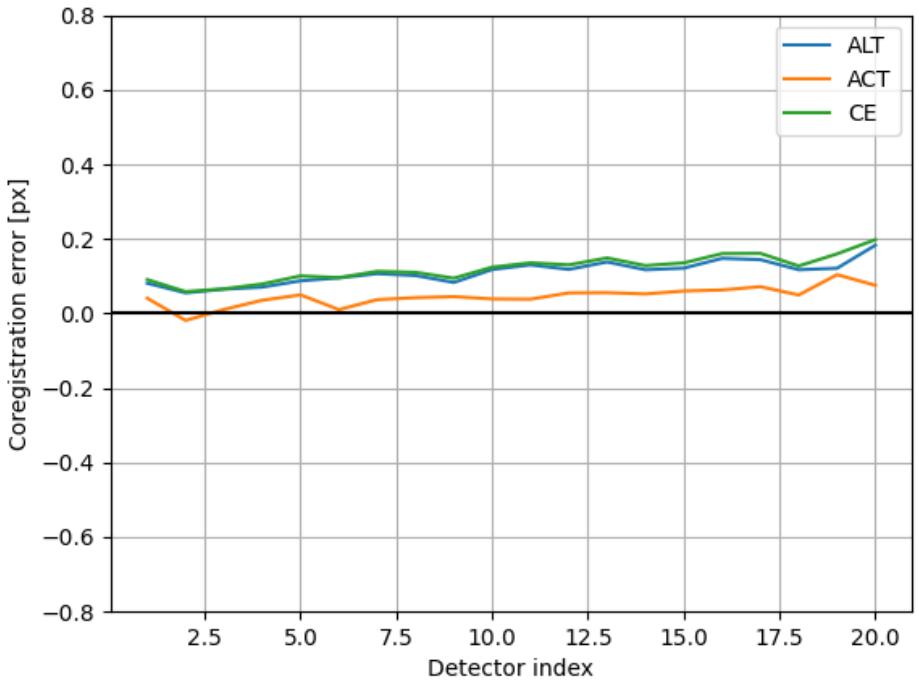
OLCI Oa17

ACT

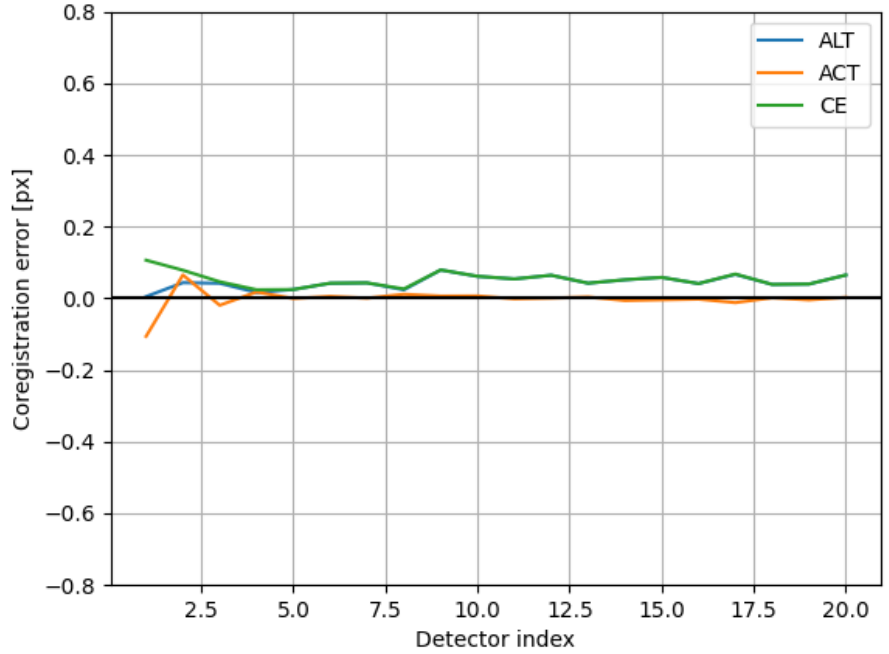
ALT

❖ Average ACT profiles 500 m grid

S3A
ALT = 50 m
ACT = 20 m
Max CE = 100 m



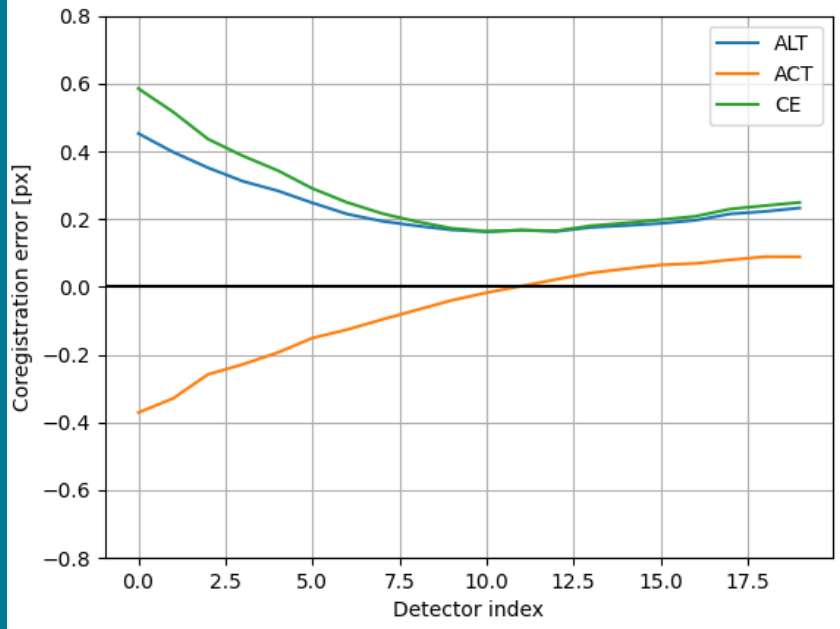
S3B
ALT = 20 m
ACT = 0 m
Max CE = 60 m



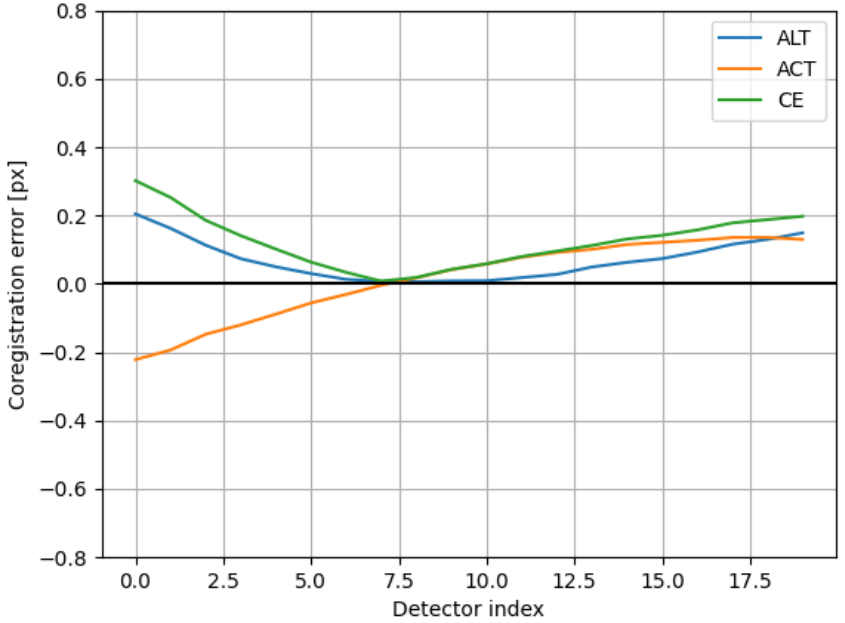
SLSTR ABSOLUTE GEOLOCATION

❖ Profiles

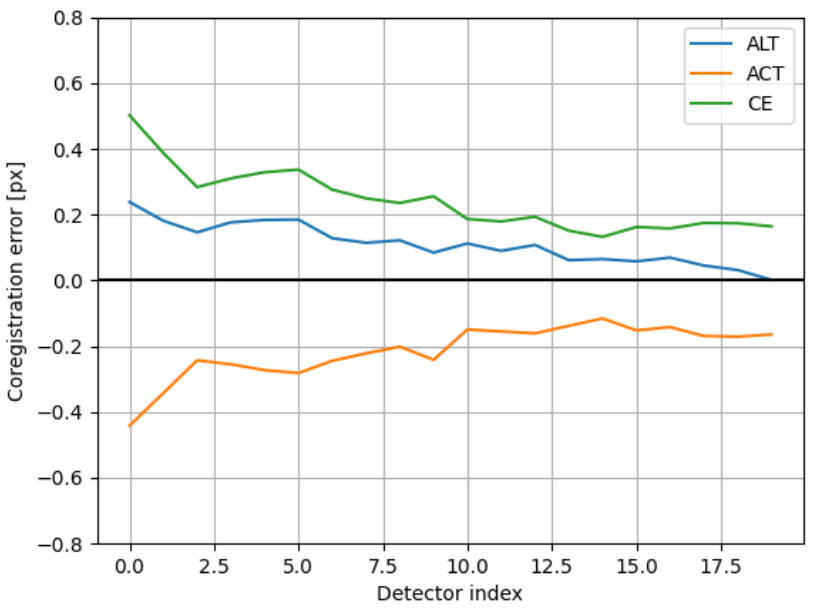
S3 (500 m pixel)
ALT = 110 m
ACT = -35 m



S6 (500 m pixel)
ALT = 35 m
ACT = 50 m

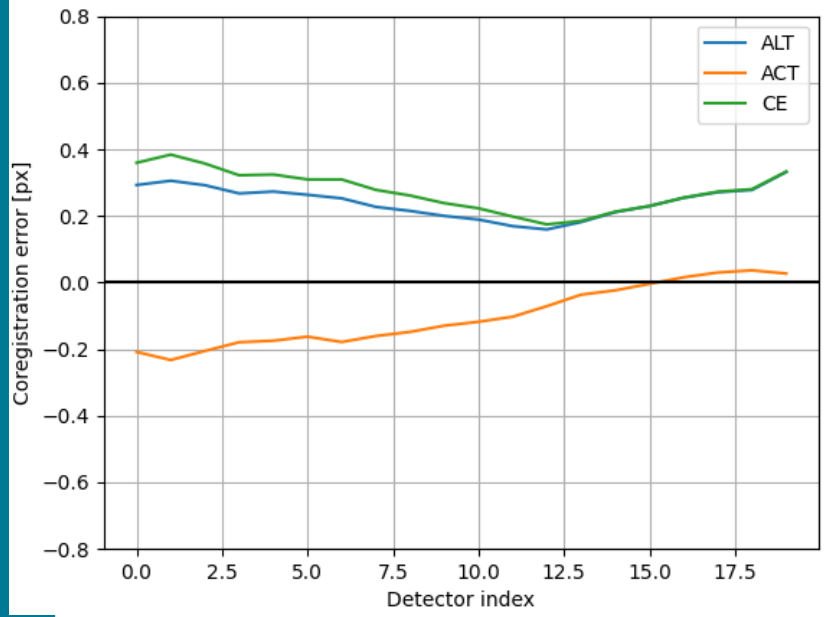


S8 (1000 m pixel)
ALT = 100 m
ACT = -200 m

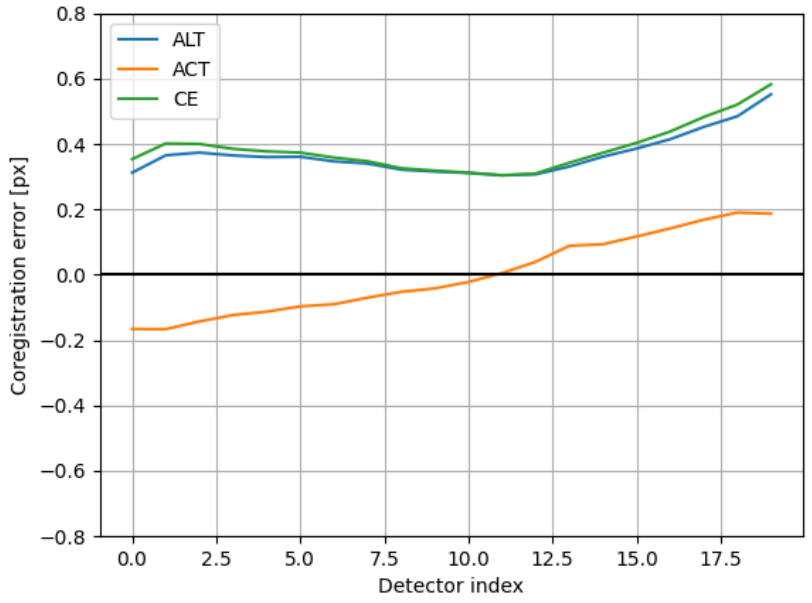


❖ Profiles

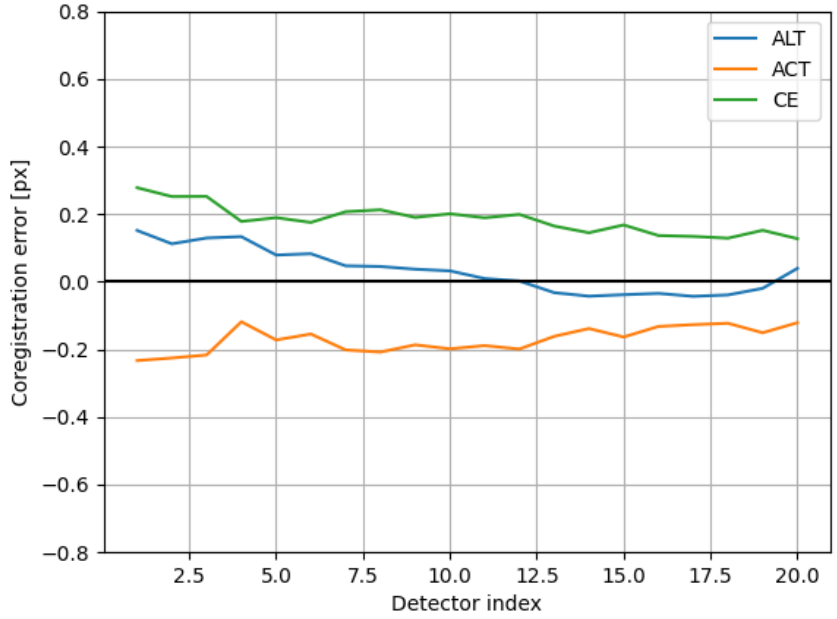
S3 (500 m pixel)
ALT = 115 m
ACT = -50 m



S6 (500 m pixel)
ALT = 175 m
ACT = 0 m



S8 (1000 m pixel)
ALT = 30 m
ACT = -160 m



Conclusions

Conclusions

❖ OLCI A&B have quite good absolute geolocation

- But both have a measurable ALT bias
- Maximum error for OLCI B is ~1/3rd of a pixel

❖ SLSTR absolute geolocation errors are a bit large

- Mean errors are compliant with specifications
- But strong dependence on the scan angle
- Worst case error can be up to 0.6 pixel

❖ Synergy co-registration is dominated by SLSTR biases

- No evidence of significant dynamic errors (short-term, orbital or seasonal) for OLCI, SLSTR or SYN
- Dynamic mis-registration files are not needed for Sentinel-3
- Synergy geolocation could be further improved by calibrating each OLCI/SLSTR pointing vectors separately