MSI L1 Geolocation Accuracy

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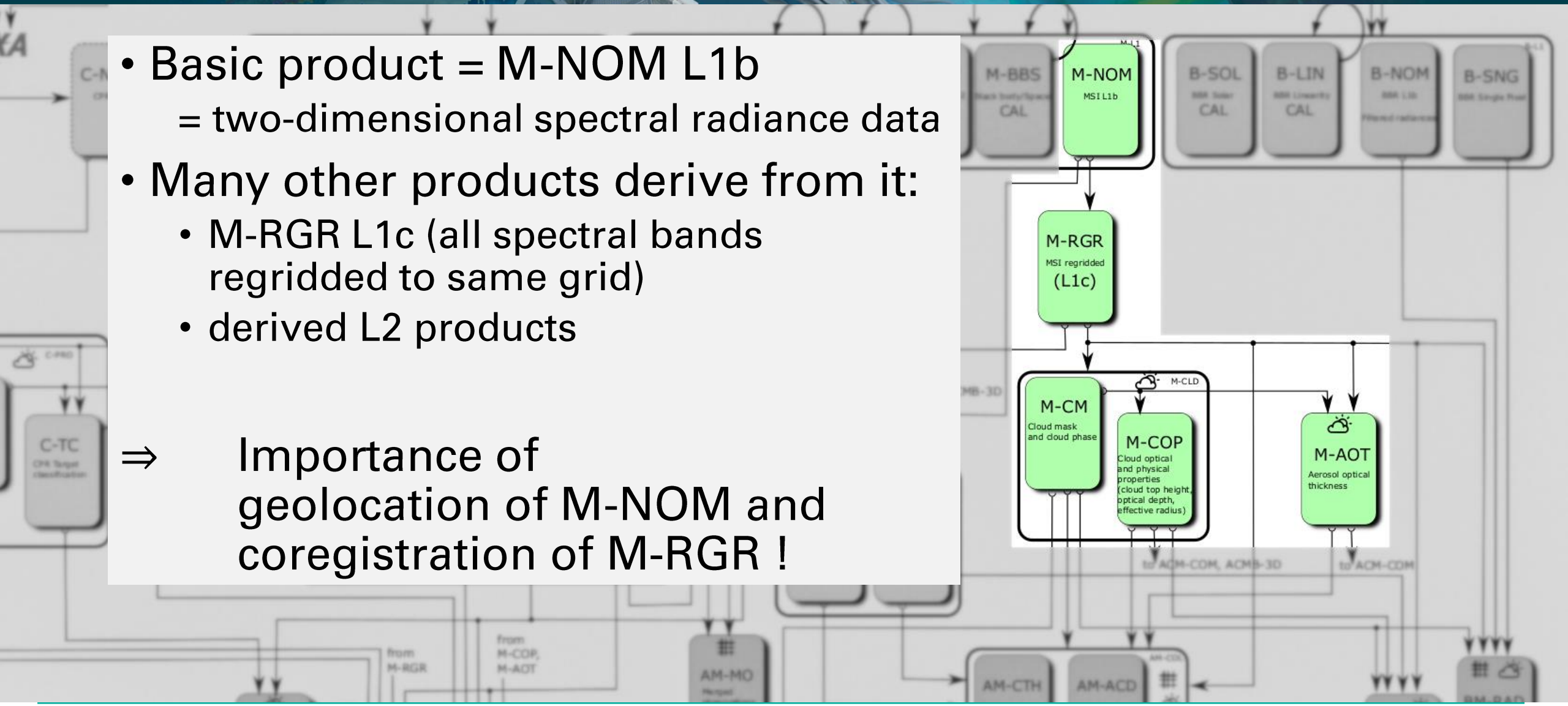
MSI L1 geolocation: introduction

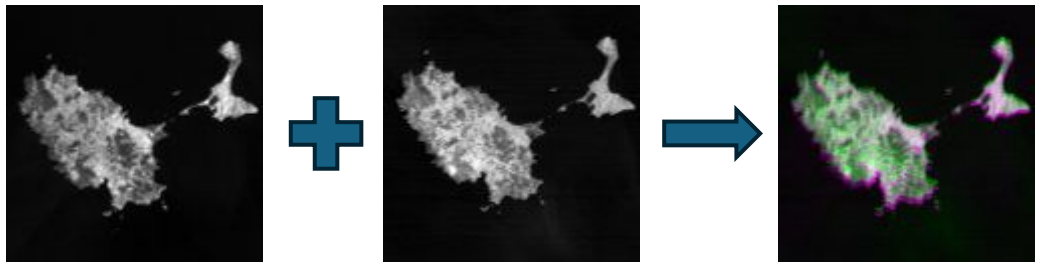
- Basic product = M-NOM L1b
  = two-dimensional spectral radiance data
- Many other products derive from it:
  - M-RGR L1c (all spectral bands regridded to same grid)
  - derived L2 products

⇒ Importance of geolocation of M-NOM and coregistration of M-RGR !



Registration method

- Evaluate registration between two images = intensity-based image registration
- Input = reference + ‘observation’
- Optimization algorithm that maximizes Mutual Information (MI) metric (≈ similarity between images that are not necessarily linearly correlated)
- The output of the optimization = translation of observation to match reference image

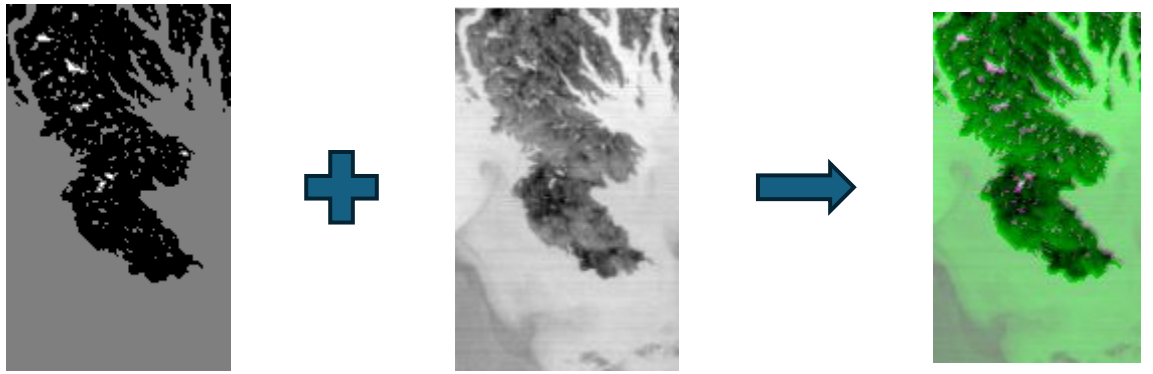


reference channel channel

coregistration assessment

Registration method: adaptation

- Registration tool can be used to evaluate registration of M-NOM data with a high-resolution water-body mask data source, with high spatial accuracy
- Used here: Copernicus GLO-30 water body mask data at 1″ resolution (~30m spatial resolution, accuracy <10m)

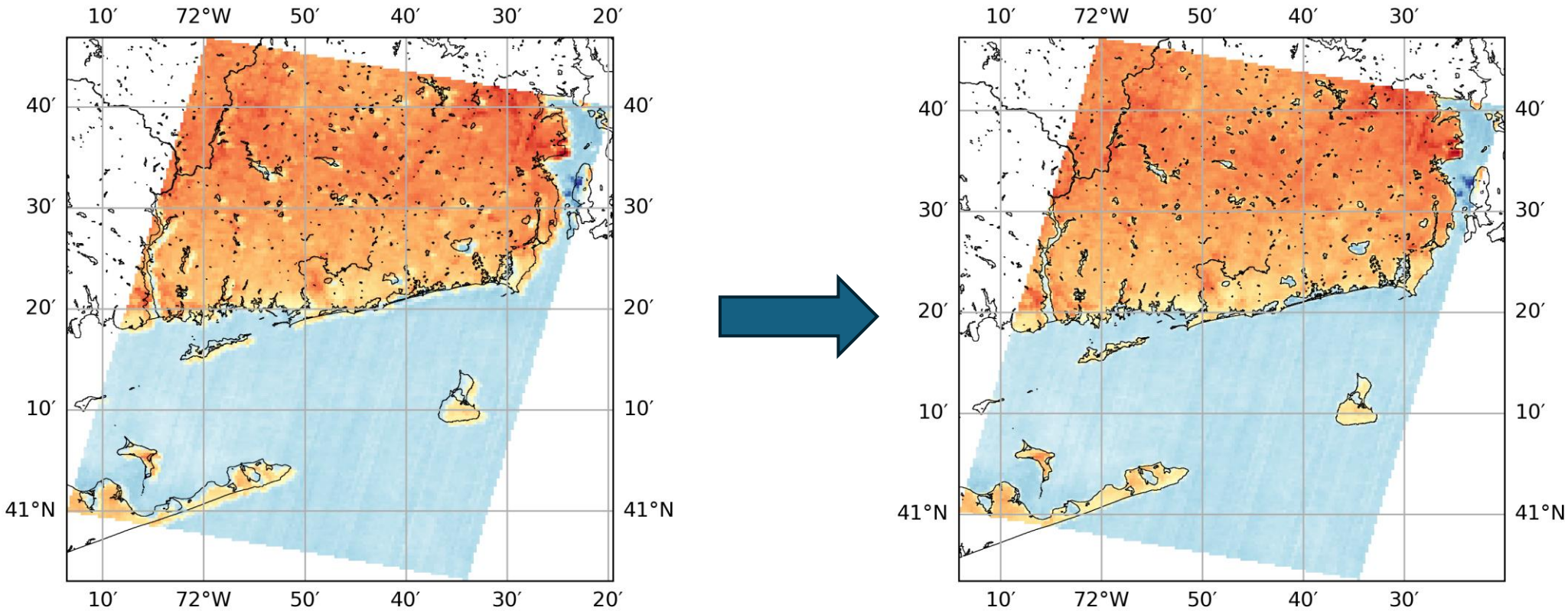


Copernicus 30m Water Body Mask

radiances

geolocation assessment

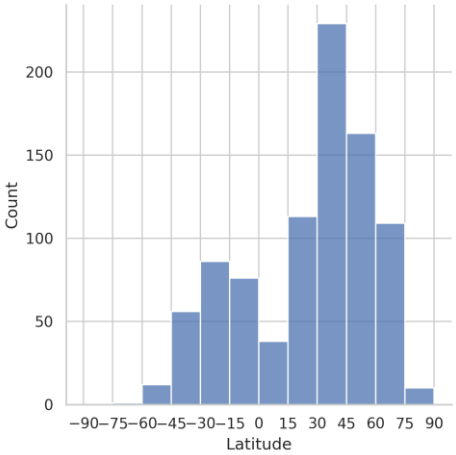
Example of method application

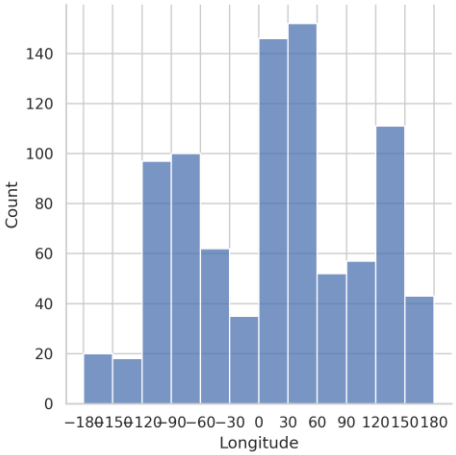


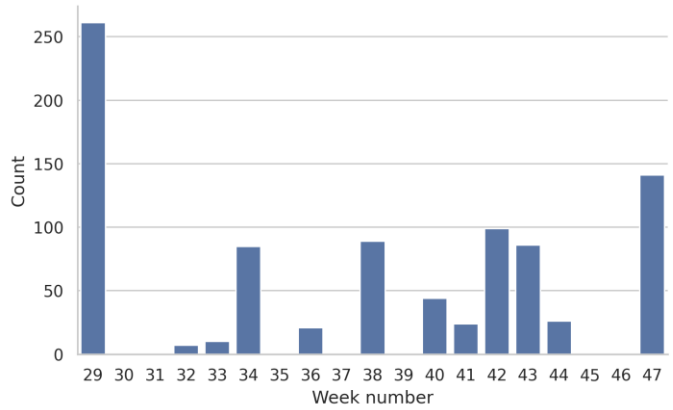
contours = reference = Copernicus GLO-30 Water Body Mask (~30m spatial resolution)

M-NOM frame 22269D (baseline AD), TIR3 (descending orbit)
rectified grid, 500 m, Hotine Oblique Mercator, grid azimuth 12.79°
along-track correction: 393 m (backwards w.r.t. direction of flight)
across-track correction: 913 m

Scene distribution

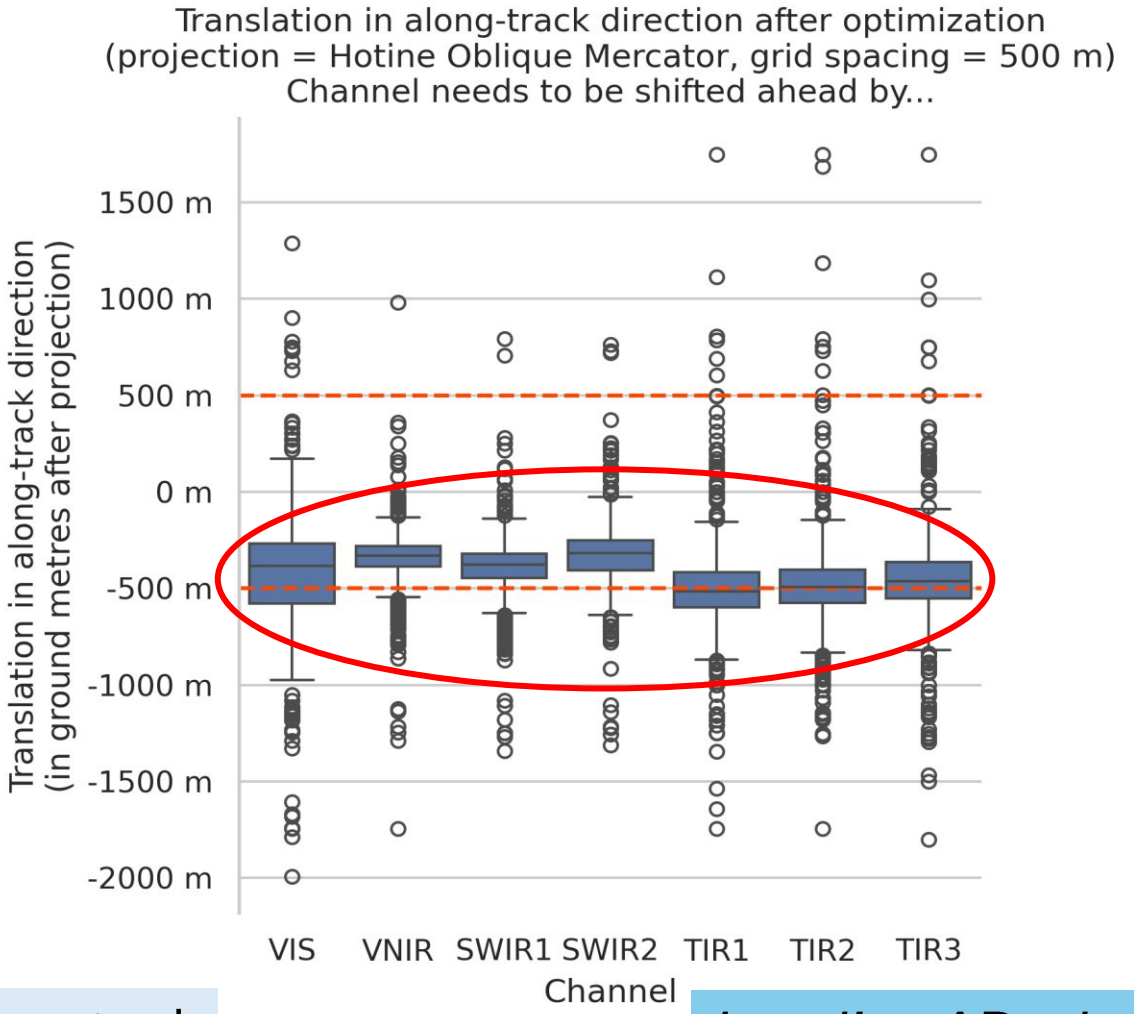


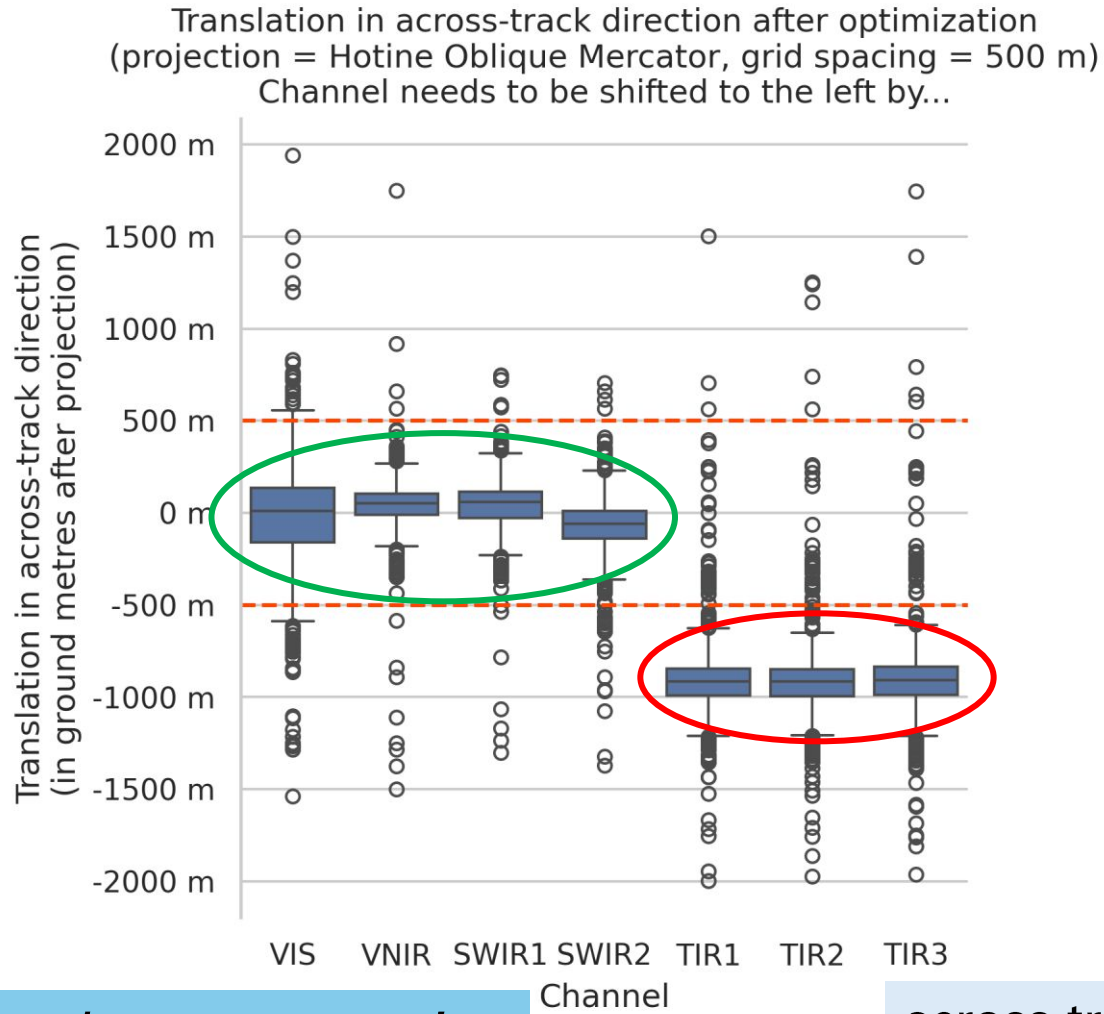




893 scenes, 336 frames, 144 orbits,
18 July – 24 November

M-NOM geolocation accuracy





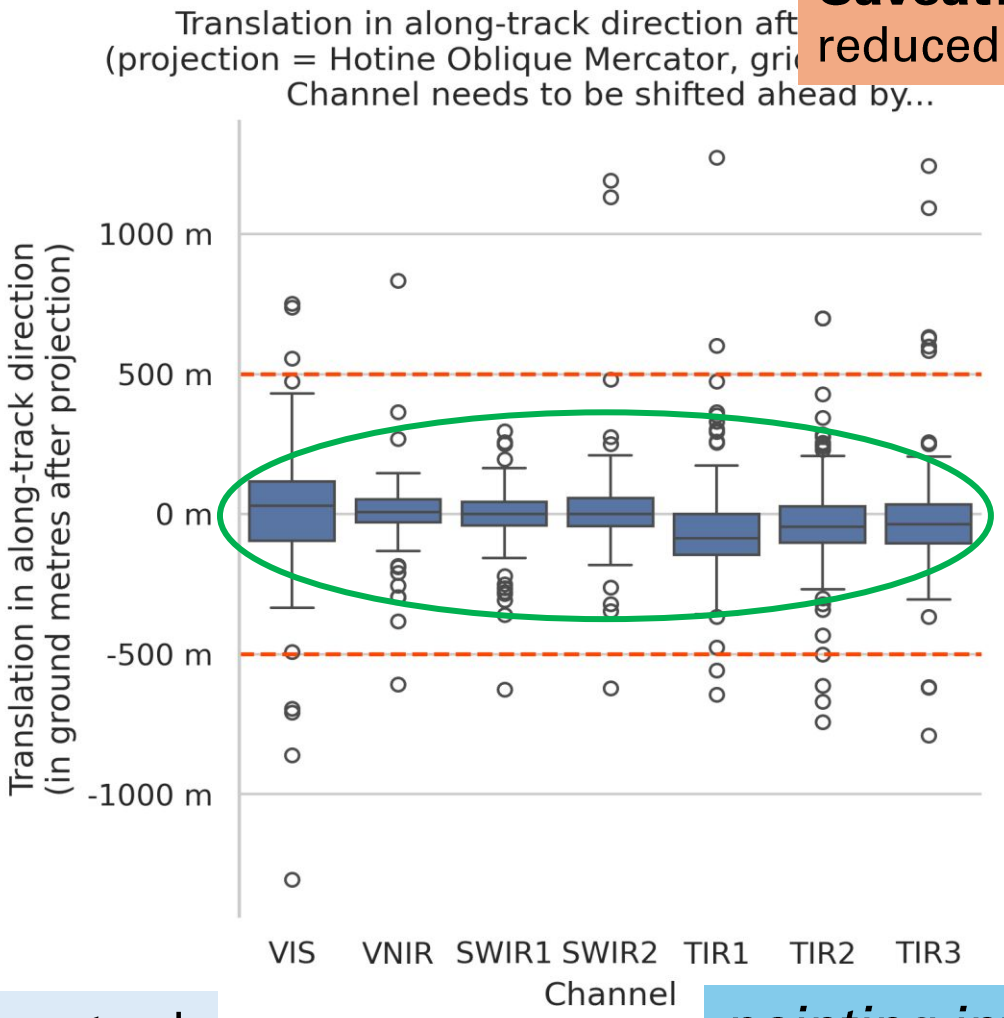
along-track

baseline AD = last complete reprocessing

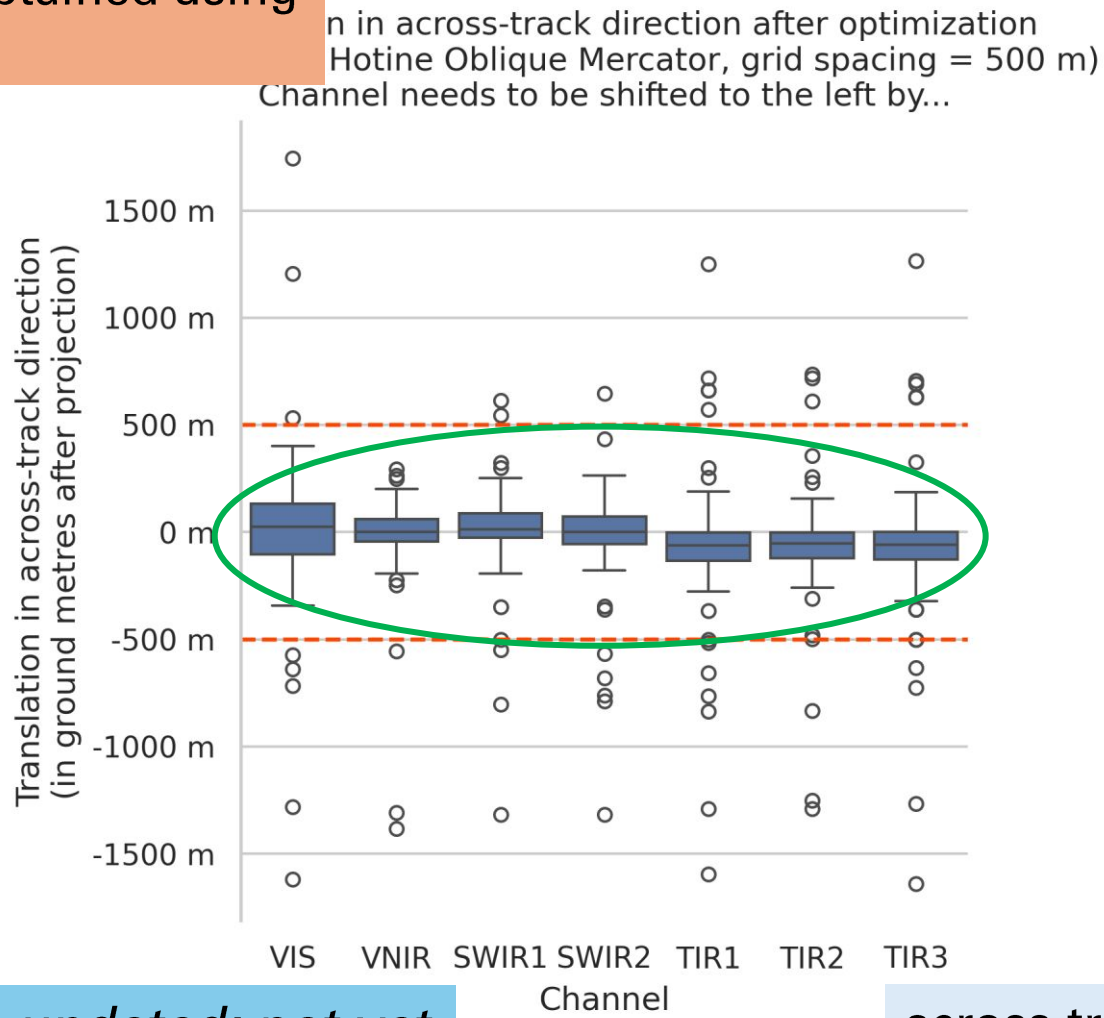
across-track

M-NOM geolocation accuracy: update

Caveat! Results obtained using reduced data set



along-track



across-track

pointing information updated; not yet available as new baseline

M-RGR coregistration accuracy

- Coregistration after compensation for geolocation error
- Units are (fractional) native MSI L1c pixel sizes

along-track

	VIS	VNIR	SWIR1	SWIR2	TIR1	TIR2	TIR3
VIS		-0,058	-0,061	-0,017	0,064	0,102	0,128
VNIR	0,041		-0,026	0,028	0,109	0,111	0,158
SWIR1	0,070	0,028		0,045	0,034	0,051	0,106
SWIR2	0,004	-0,027	-0,025		0,022	0,055	0,090
TIR1	-0,081	-0,114	-0,066	-0,048		0,034	0,056
TIR2	-0,153	-0,170	-0,112	-0,097	-0,018		-0,008
TIR3	-0,151	-0,181	-0,132	-0,114	-0,037	-0,008	

across-track

	VIS	VNIR	SWIR1	SWIR2	TIR1	TIR2	TIR3
VIS		-0,169	-0,964	0,025	-0,028	-0,008	-0,034
VNIR	0,194		-0,831	0,072	-0,031	0,007	-0,043
SWIR1	1,008	0,841		1,314	0,979	1,003	0,954
SWIR2	0,002	-0,043	-1,269		-0,054	-0,010	-0,075
TIR1	0,120	0,072	-0,941	0,110		0,049	0,019
TIR2	0,075	0,025	-0,969	0,065	-0,045		-0,042
TIR3	0,074	0,055	-0,941	0,116	-0,012	0,040	

baseline AD = last complete reprocessing

Conclusion

- Geolocation accuracy:
  - along-track: marginally within specification
  - across-track geolocation accuracy: VNS is excellent, TIR is out-of-spec
- Coregistration accuracy:
  - generally good, known problem with SWIR1

- All the above are expected to be **fixed with new baseline update!**
- Until then: interpret product geolocation with care