

Acquisition Status and DEM Performance

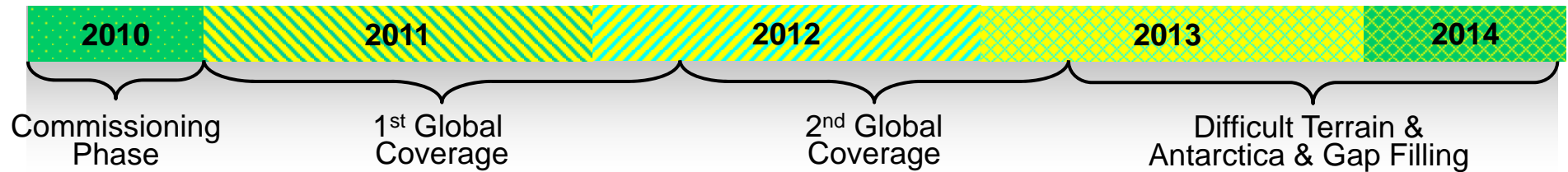
**M. Bachmann, D. Borla-Tridon, J. Böer, B. Bräutigam, T. Kraus,
G. Krieger, M. Martone, C. Ortega Miguez, P. Rizzoli, U. Stein-
brecher, D. Schulze, J. Walter Anthony, F. De Zan, M. Zink
+ GS Team**



Outline

- Overview about the Acquisition Plan
- Global DEM Performance
 - Quicklook Mosaicks
 - Global Statistics
- Coming Acquisition of Difficult Terrain
 - Geometry for Shadow/Layover Areas and Implications on the Satellite Formation
 - Deserts
- Interferometric Calibration
- Conclusions

TanDEM-X Global DEM Acquisition Plan



1st Global Coverage

- Small baseline (~200 m)
- HoA* ~ 45 m



2nd Global Coverage

- Increased baseline (~300 m)
- HoA* ~ 30 m

Combination:

- Dual Baseline Phase Unwrapping
- Improved Height Accuracy

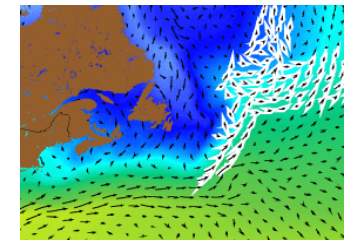
3rd Year Acquisitions

- Antarctica
- Difficult terrain to account for shadow & layover => Different viewing geometry



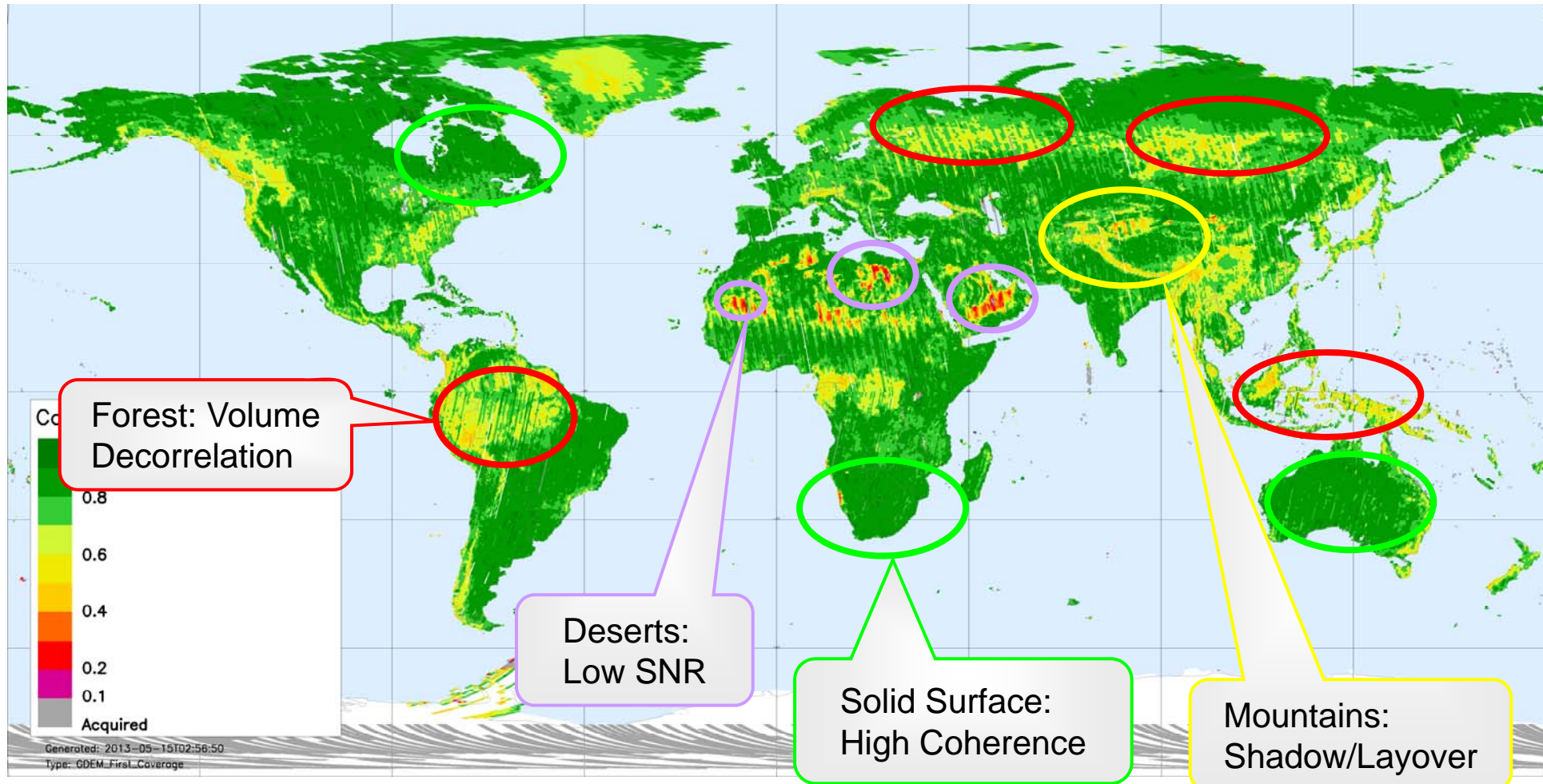
Secondary Mission Goals

- Science acquisitions with special formations
- Higher resolution DEMs with local extend



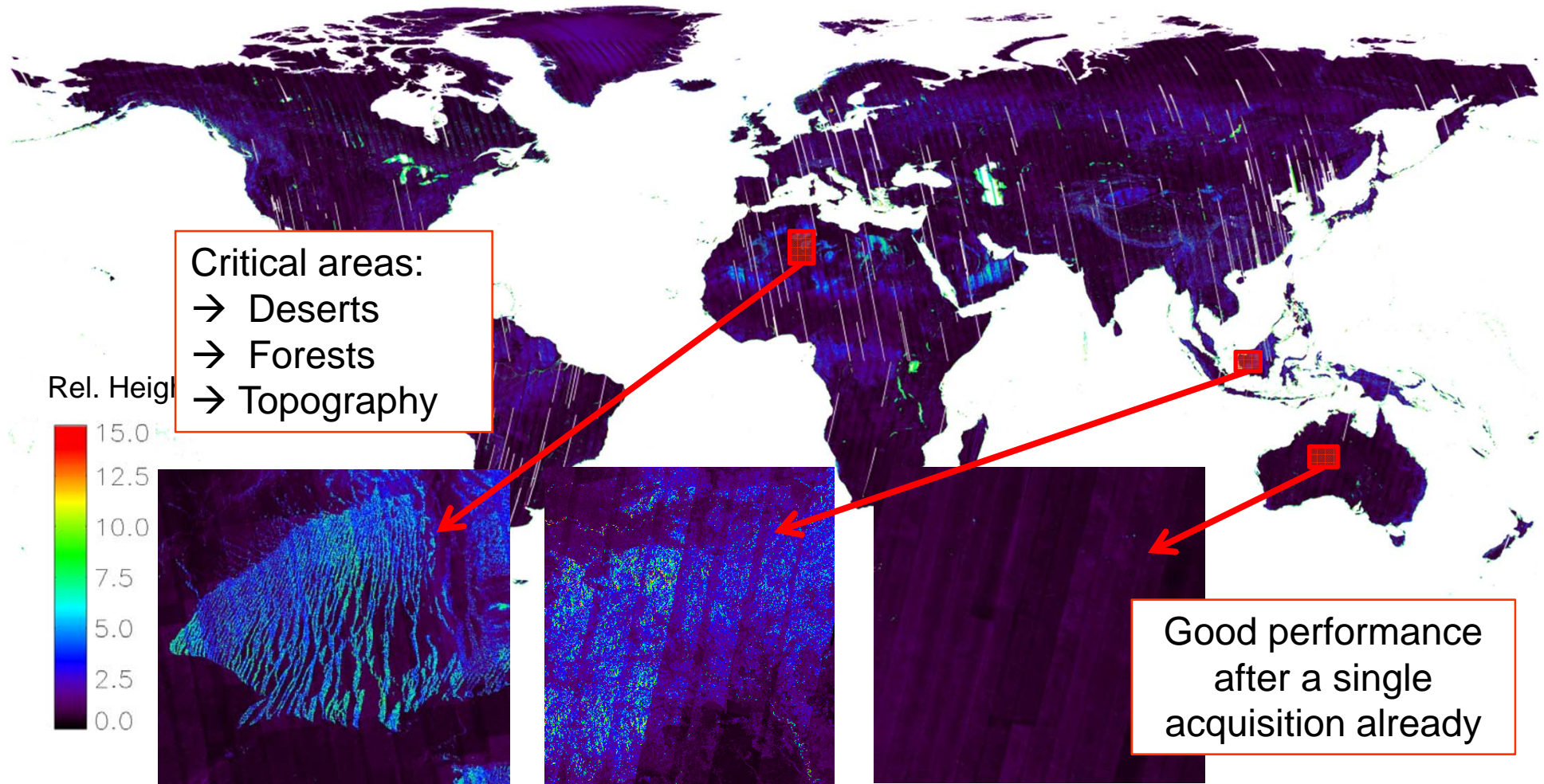


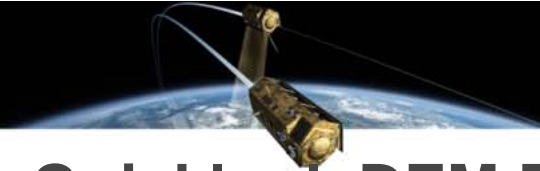
Wrap up - Global DEM Performance





Relative Height Error from Interferometric Coherence





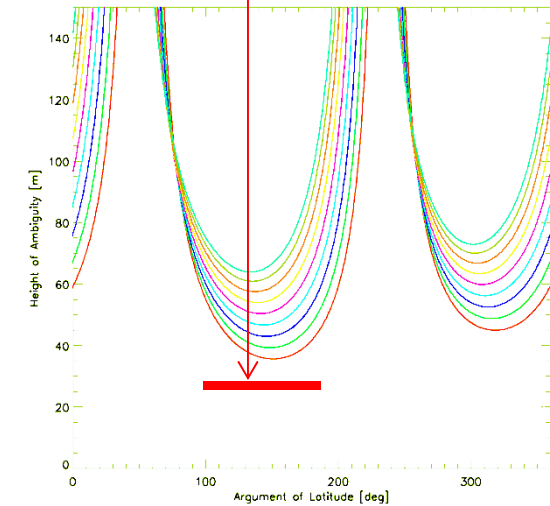
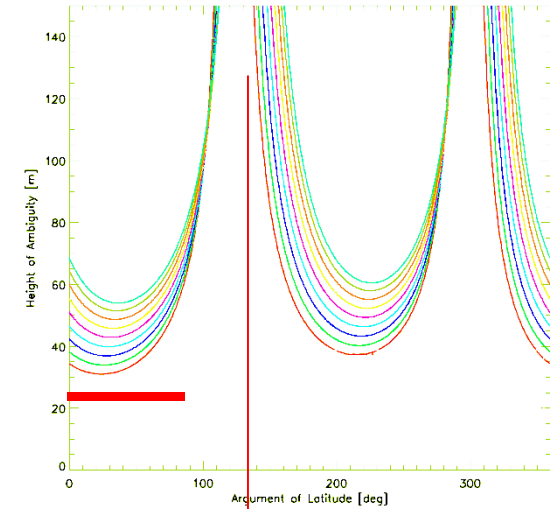
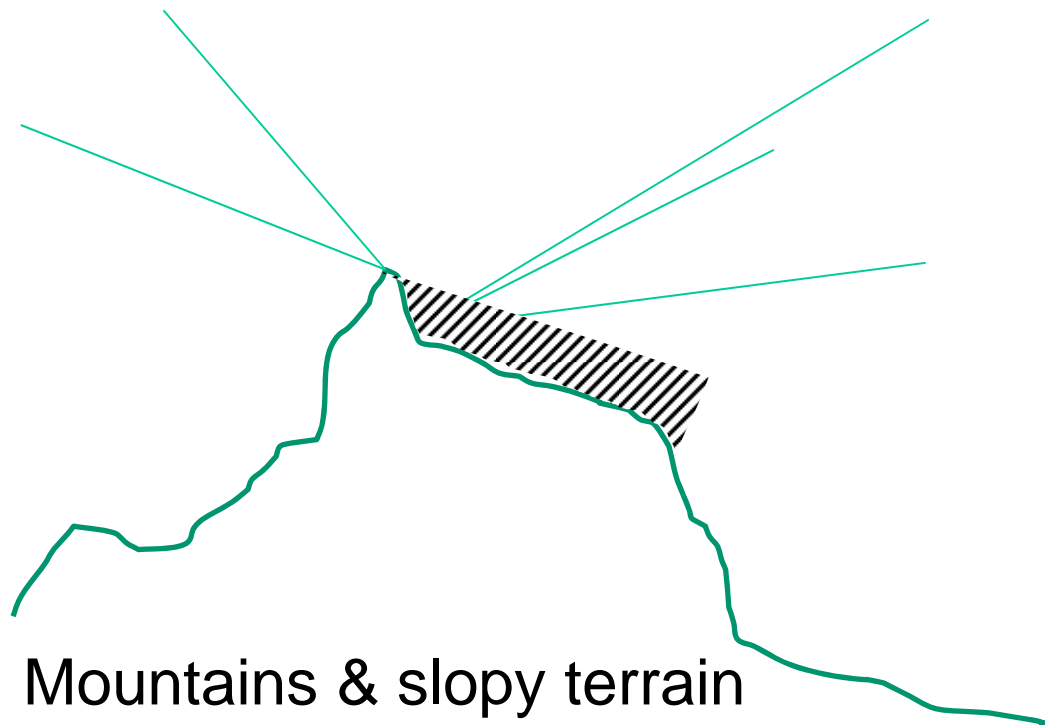
Global Relative Height Error on Quicklook DEM Basis

Coverage	p-to-p RHE 90% < 2 m (slope < 20%)	p-to-p RHE 90% < 4 m (slope > 20%)
1 st Global DEM	66.40%	79.40%
2 nd Global DEM*	75.42%	84.91%
Combination of 1 st and 2 nd Global DEM*	90.30%	95.64%

- IDEMs: Similar Performance than 1st Global Coverage
- 3rd & 4th Coverage for Difficult Terrain

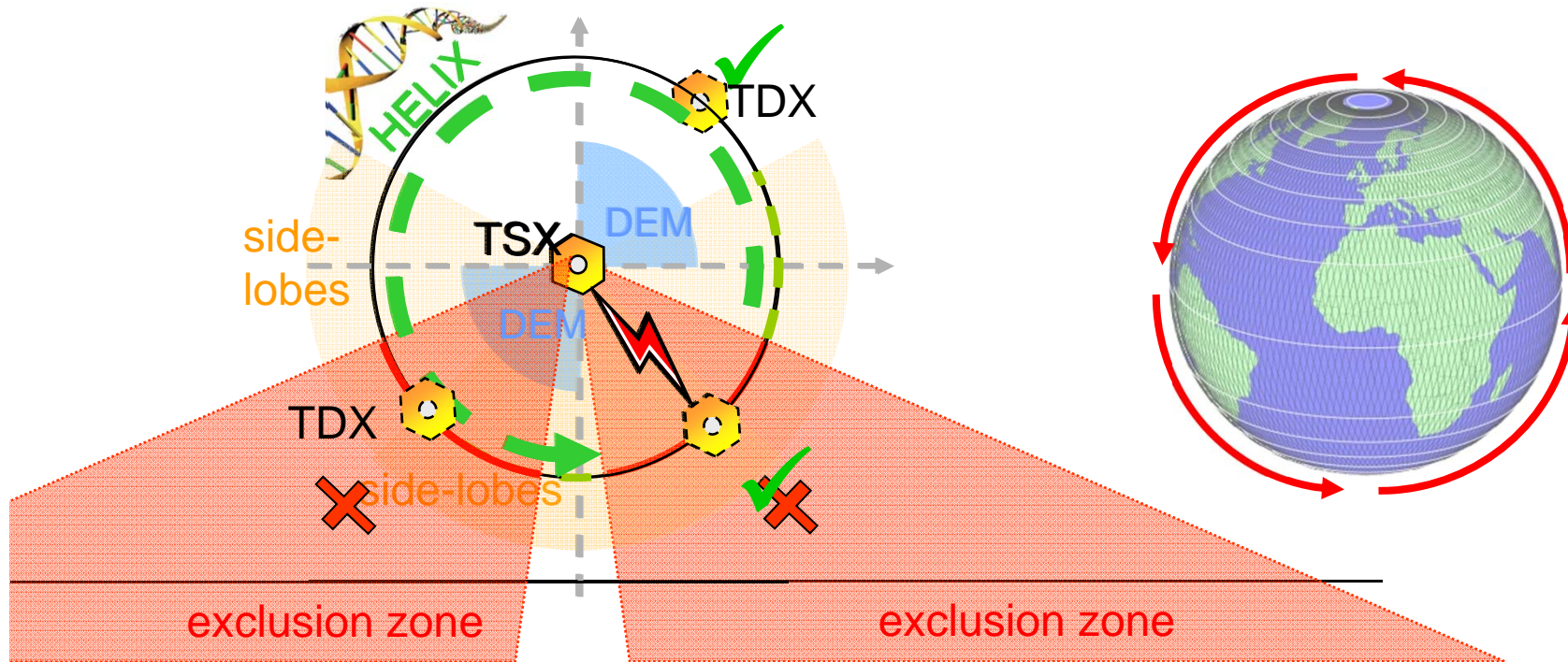


Difficult Terrains: Shadow/Layover Acquisitions





Exclusion Zone Change



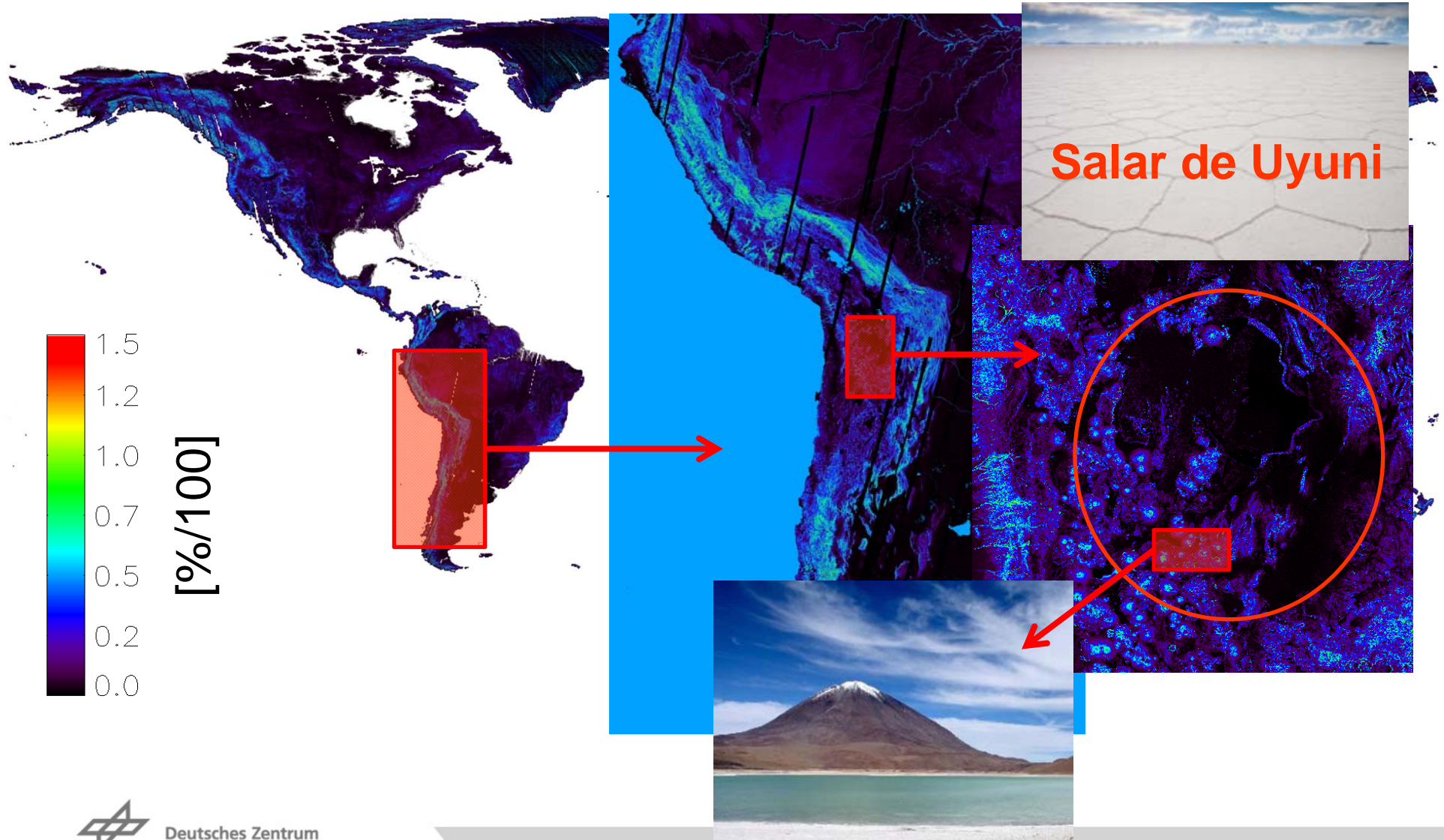
Implications for science acquisitions:

- Baselines will change significantly
- Alternating bi-static possibilities also changed

Formation changed for 8 month

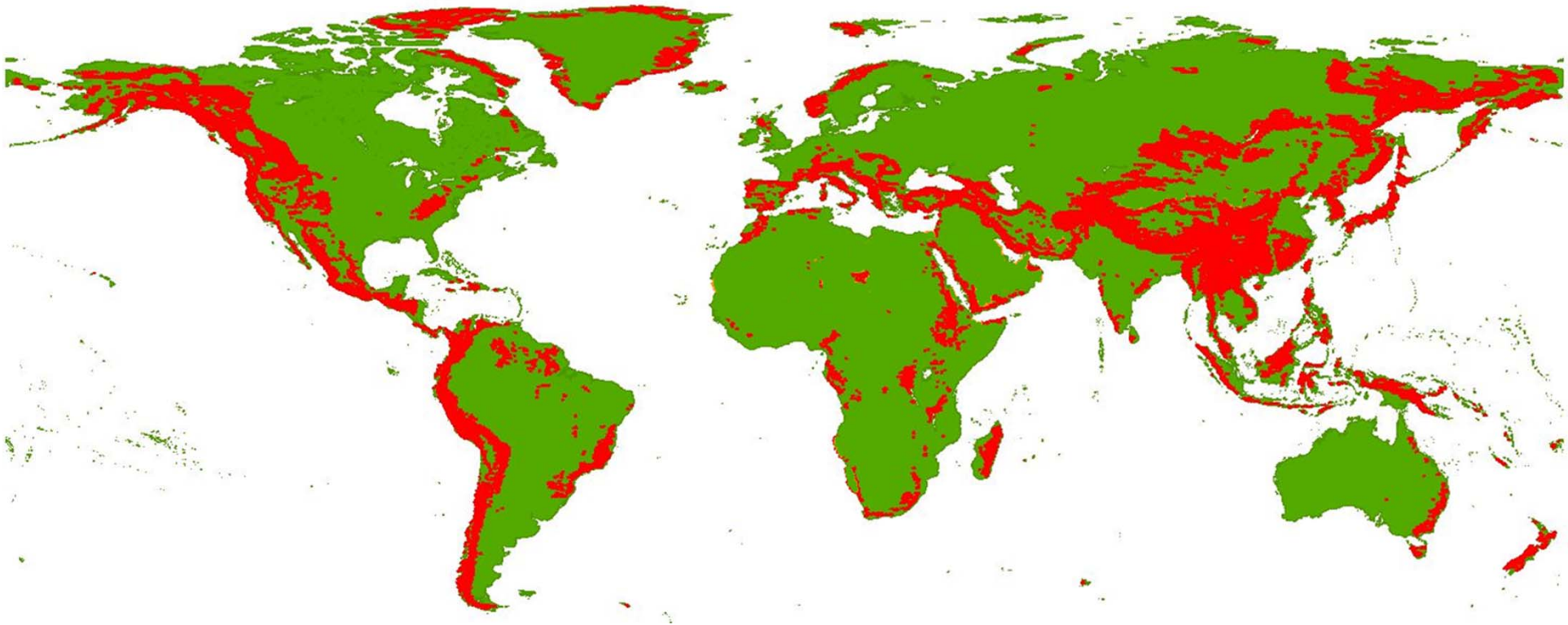


Identification of Difficult Terrain Areas via Slope Map

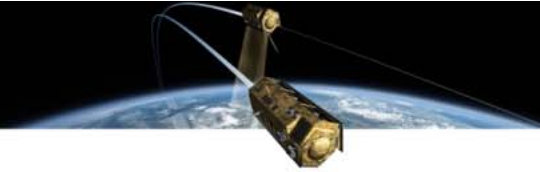




Coverage of 3rd & 4th Acquisition

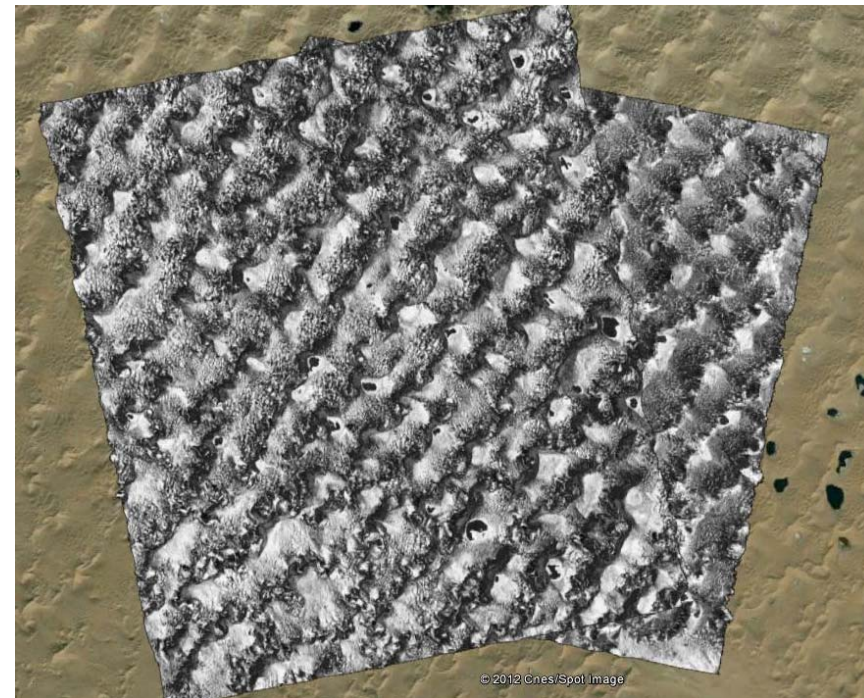


- Shadow and Layover



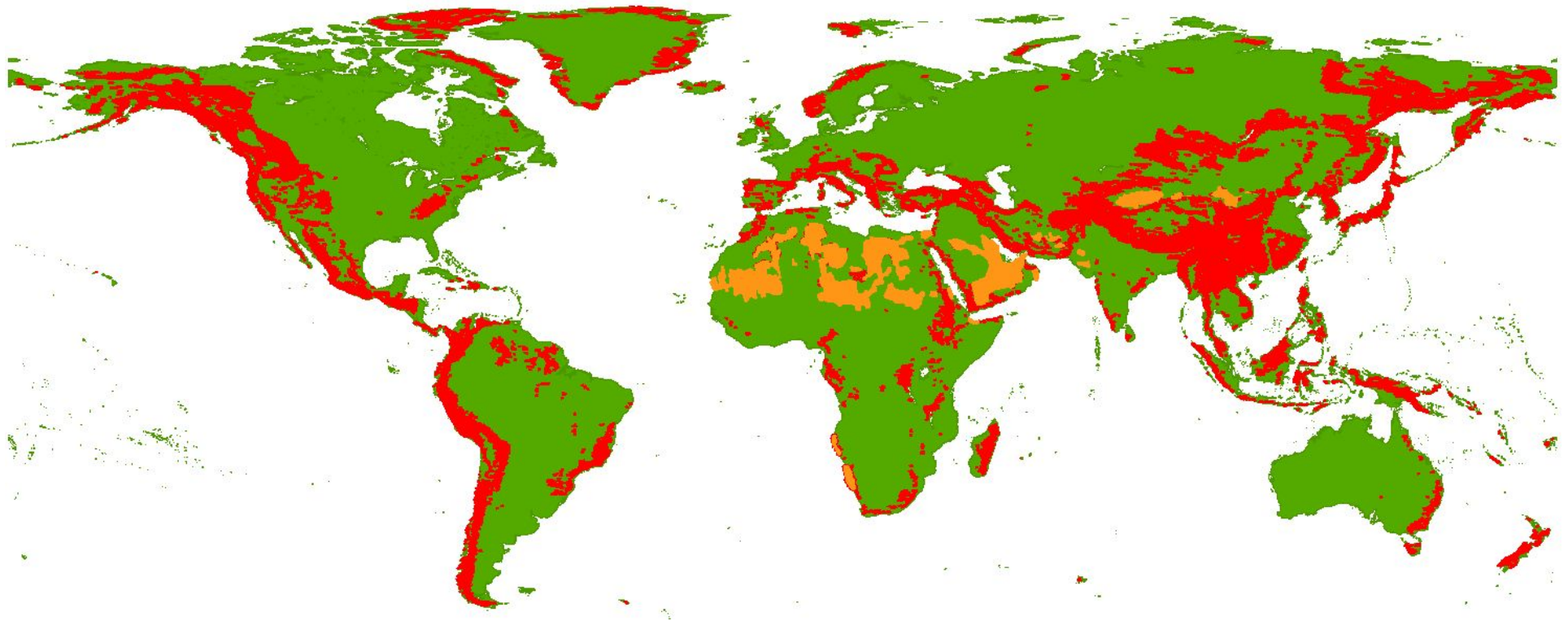
Re-Acquisition of Deserts

- Deserts: low SNR => low coherence => high relative height error
=> Sandy deserts require small incidence angle: 14° and 28° (nominal $28^\circ - 48^\circ$)
- Rocky deserts present difficult topography
=> acquisition with different viewing geometry as for mountainous regions





Coverage of 3rd & 4th Acquisition



- Shadow and Layover
- Desert



Preliminary Acquisition Plan Schedule

Time Frame	Acquisitions
Dez 10 – Mar 12	1 st Global Coverage
Apr 12 – Apr 13	2 nd Global Coverage
May / June 13	Antarctica 1 st Coverage
Aug 13 – Mar 14	3 rd /4 th Coverage: Difficult Terrain – Other Viewing Geometry
May / June 14	Antarctica 2 nd Coverage
July – Sep 14	Science Commissioning Phase
From Oct 14	Special Science Formations, High Resolution DEMs

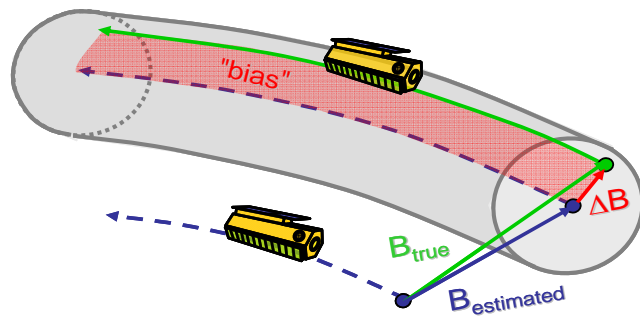


Interferometric Calibration



Interferometric Calibration

➤ Baseline Calibration

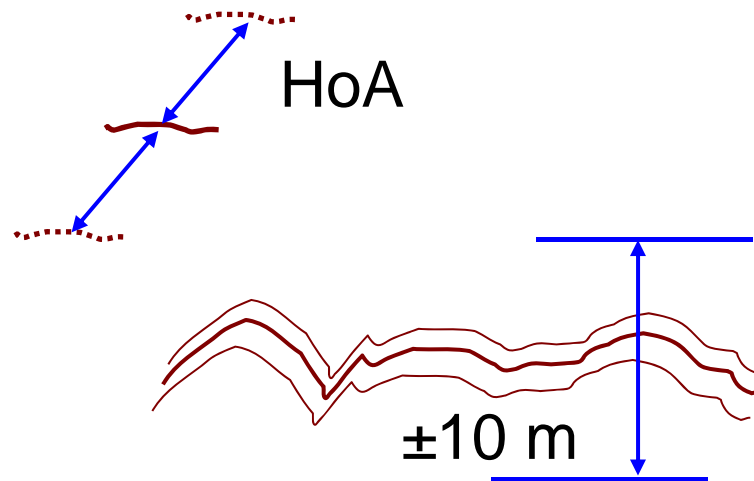


Purpose:

- Calibrate the system to bring the RawDEMs down to their real height location in order
 - to allow accurate geocoding
 - minimize amount of reprocessing
 - to minimize effort for DEM Calibration & Mosaicking

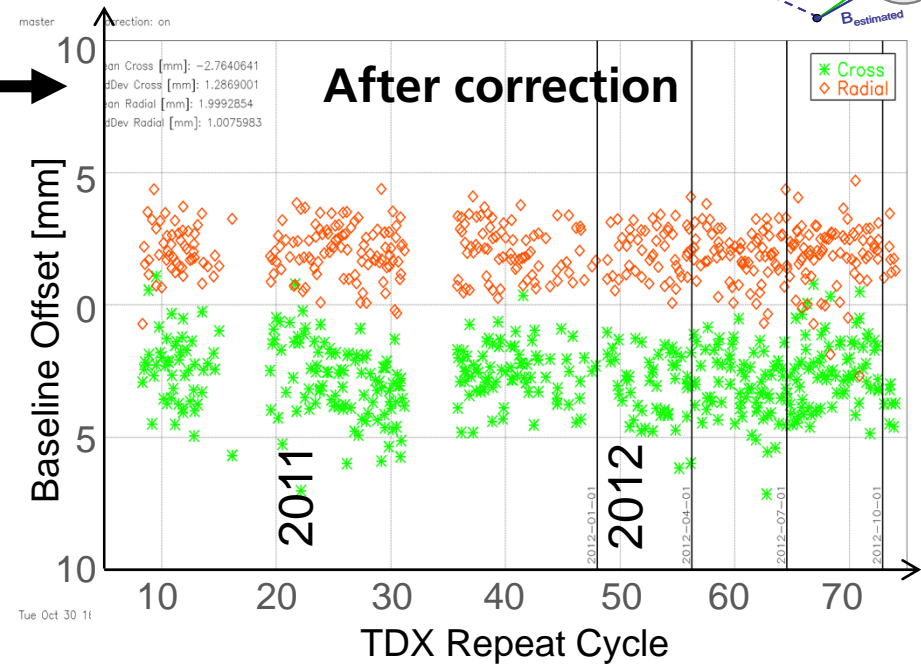
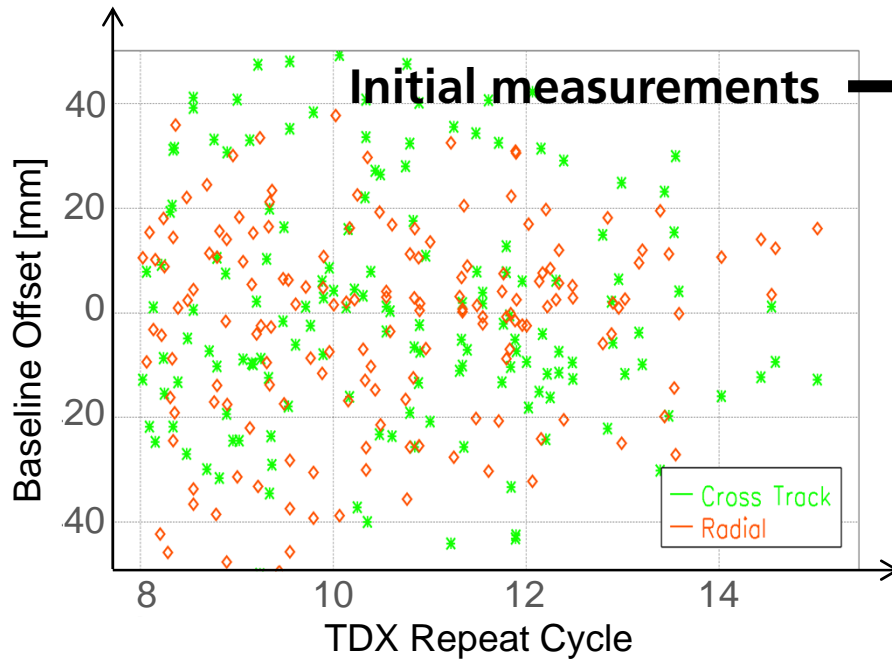
➤ Instrument Delay Calibration for Radargrammetry

➤ Absolute Height Error - Before DEM Calibration





Interferometric Calibration – Baseline Offsets



- Baseline Calibration Results:**
- Baseline determination even from SAR acquisition very accurate
 - Baseline very stable
 - Baseline offsets determined

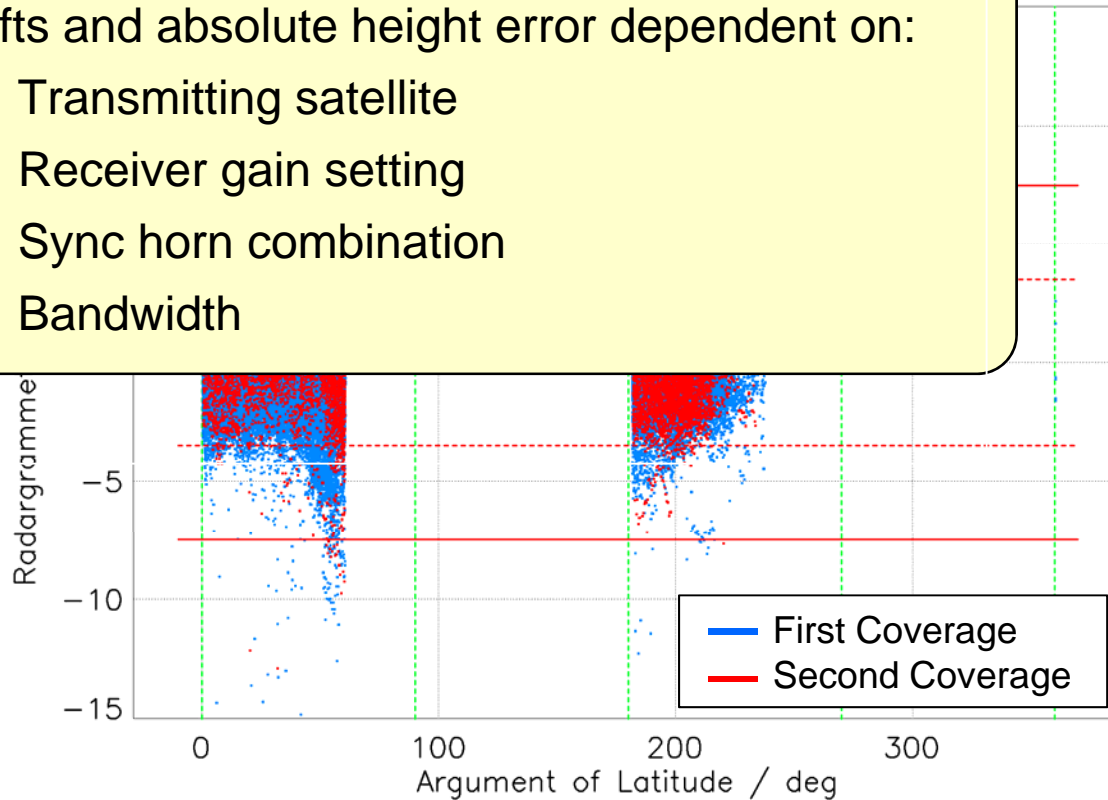
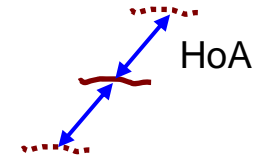
Radial: mean = 1.99 mm, σ = 1.01 mm
Cross Track: mean = -2.76 mm, σ = 1.29 mm



Interferometric Calibration – Delay Calibration

Corrections implemented for radargrammetric shifts and absolute height error dependent on:

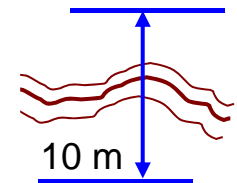
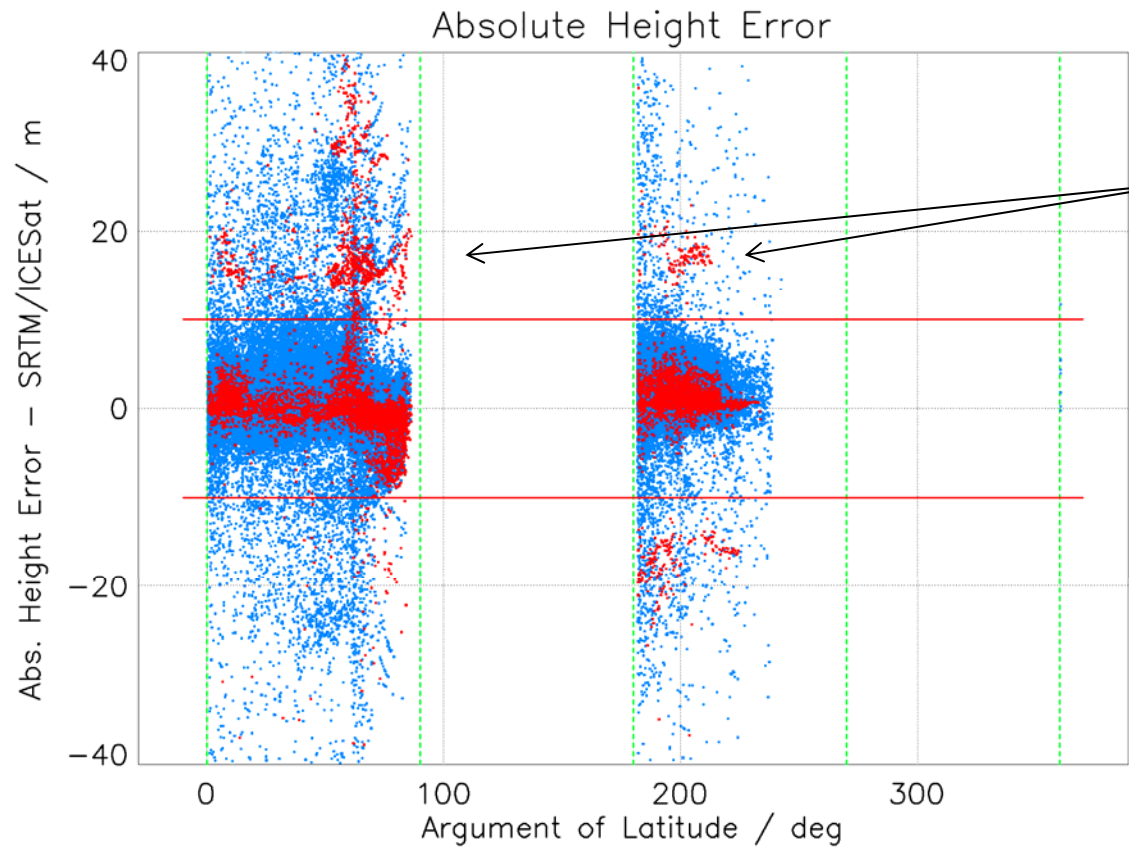
- Transmitting satellite
- Receiver gain setting
- Sync horn combination
- Bandwidth



1st Coverage: 99.4%
2nd Coverage: 98.6%

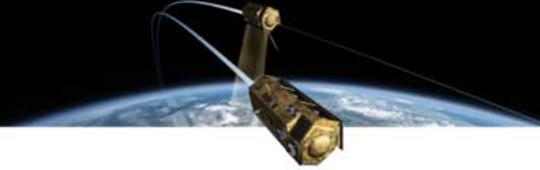


Interferometric Calibration – Absolute Heights



Sync-Link Pi-Ambiguities to be reprocessed

About 90% within +/-10 m already before DEM Cal.



Conclusion

- Global DEM performance statistics
 - Relative height error even for IDEM often < 2 m
 - Absolute height error $< +/-10$ m

- Implications for future acquisition plan
 - Difficult terrain => other viewing geometry necessary
 - Deserts

- Interferometric calibration
 - System calibrated and stable

Thank you for your attention!





Backup



Wrap up - Global Height Error Performance

