

4-D Waldstruktur mit Radarfernerkundung

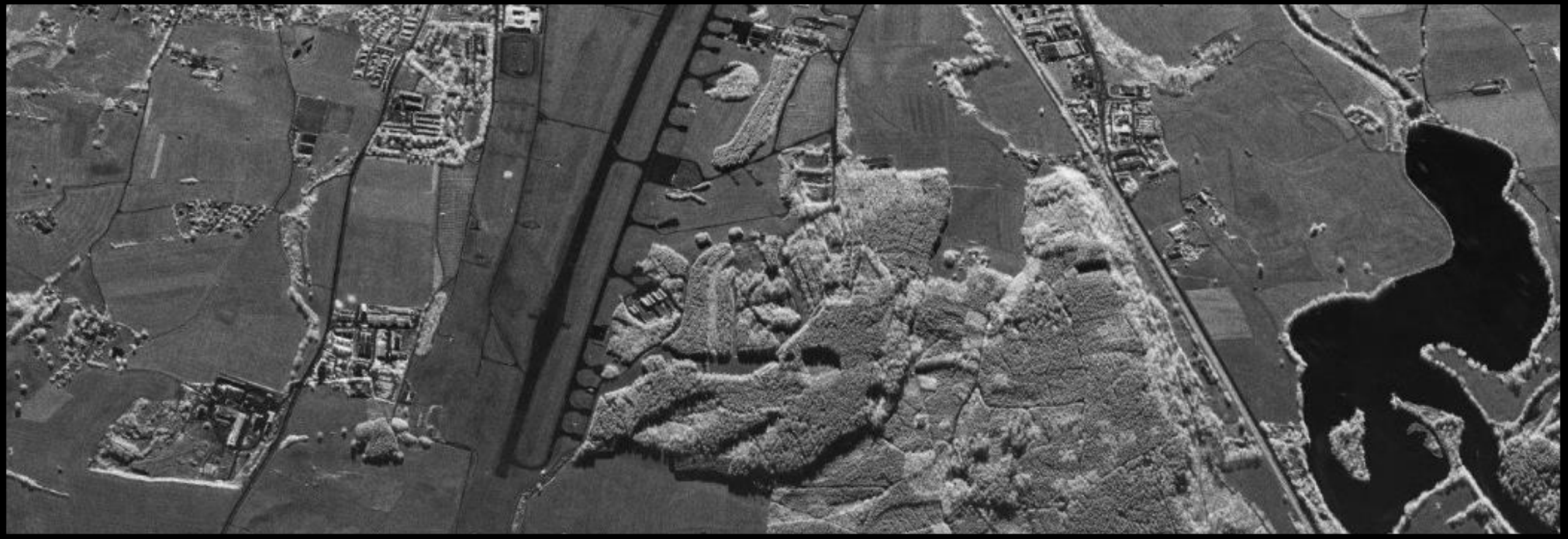
R. Guliaev, C. Choi, I. Mansour, L. Albrecht, N. Romero-Puig,
A. Alonso-Gonzalez, J-S. Kim, M. Pardini, [K. Papathanassiou](#)

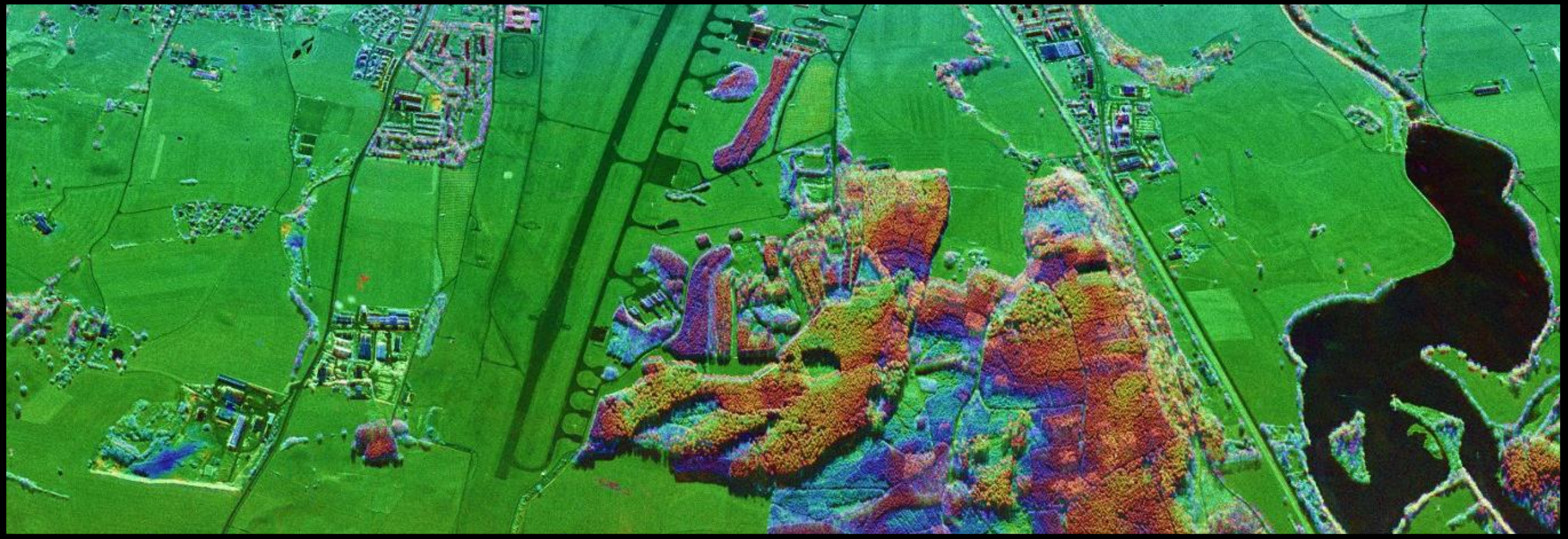
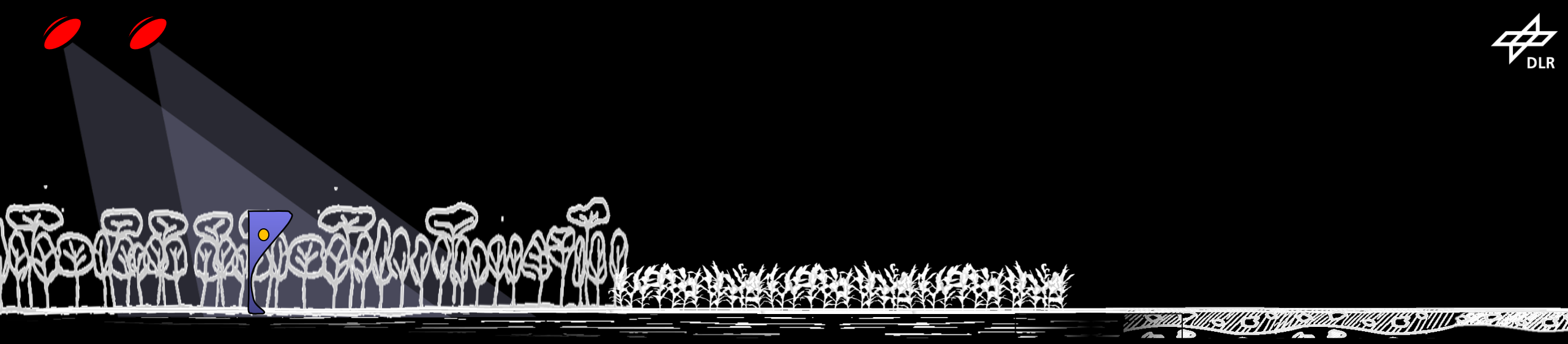
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DLR Oberpfaffenhofen

Januar 17, 2023

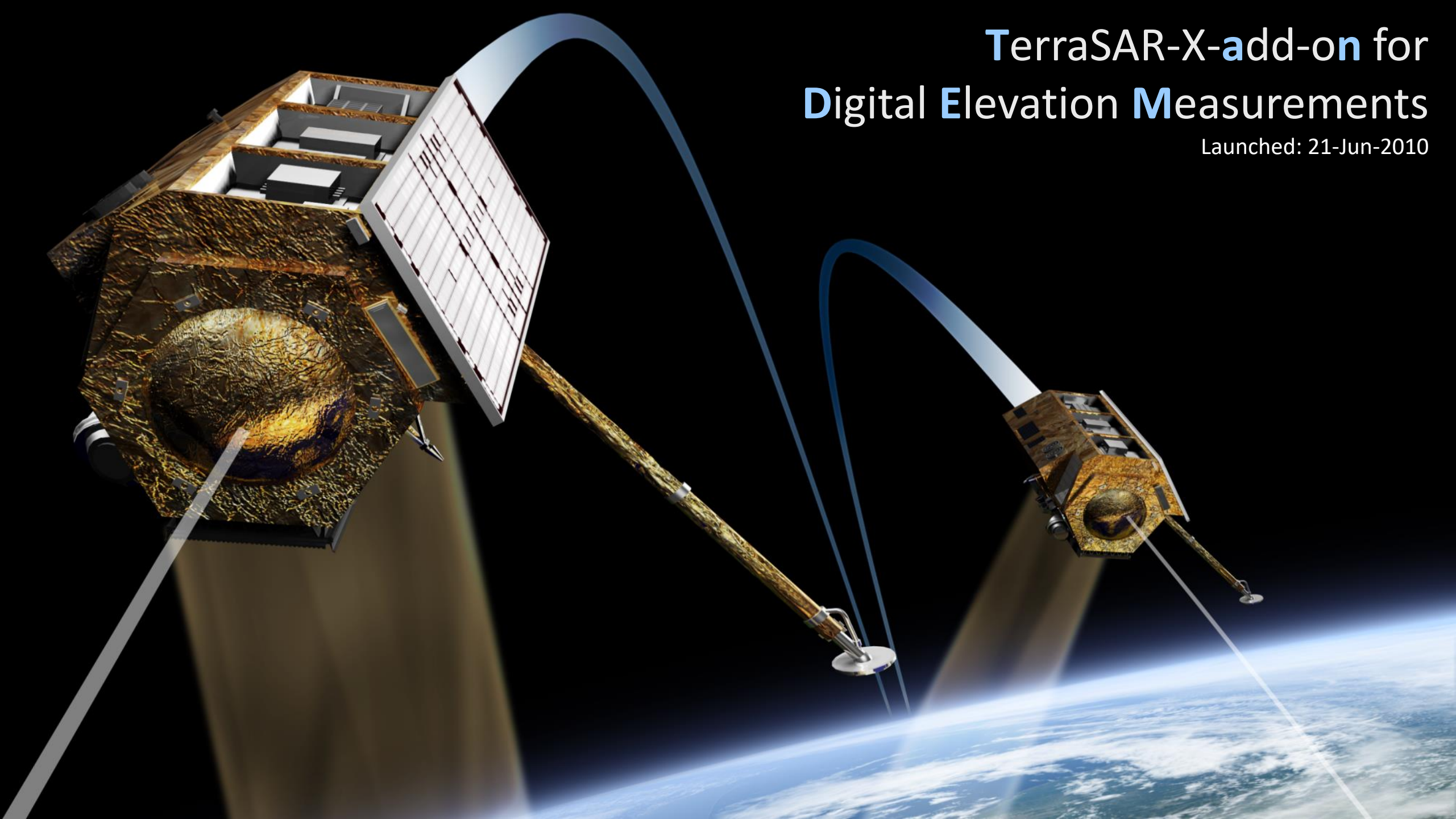






TerraSAR-X-add-on for Digital Elevation Measurements

Launched: 21-Jun-2010





0 Interferometric Coherence 1

By DLR-HR-STL 500x500 m² resolution

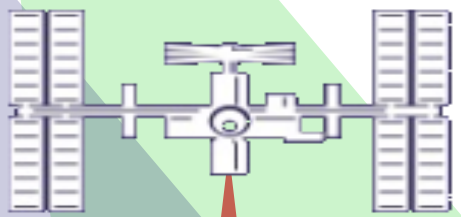




TDX Interferometric Coherence
(after calibration for system effects)

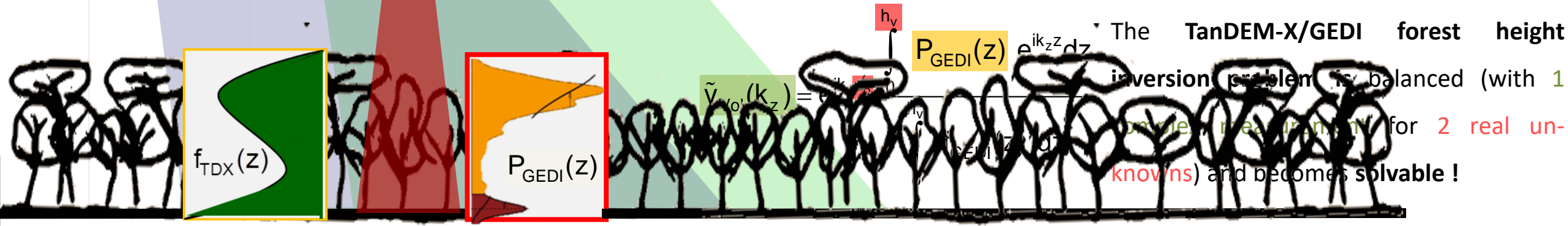
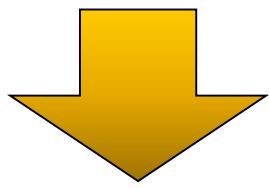
$$\tilde{Y}_{Vol}(k_z) = \frac{e^{ik_z z_0} \int_0^{h_v} f_{TDX}(z) e^{ik_z z} dz}{\int_0^{h_v} f_{TDX}(z) dz}$$

The **TanDEM-X forest height inversion problem** is underdetermined (1 complex measurement for at least 3 real unknowns) and thus **not solvable!**

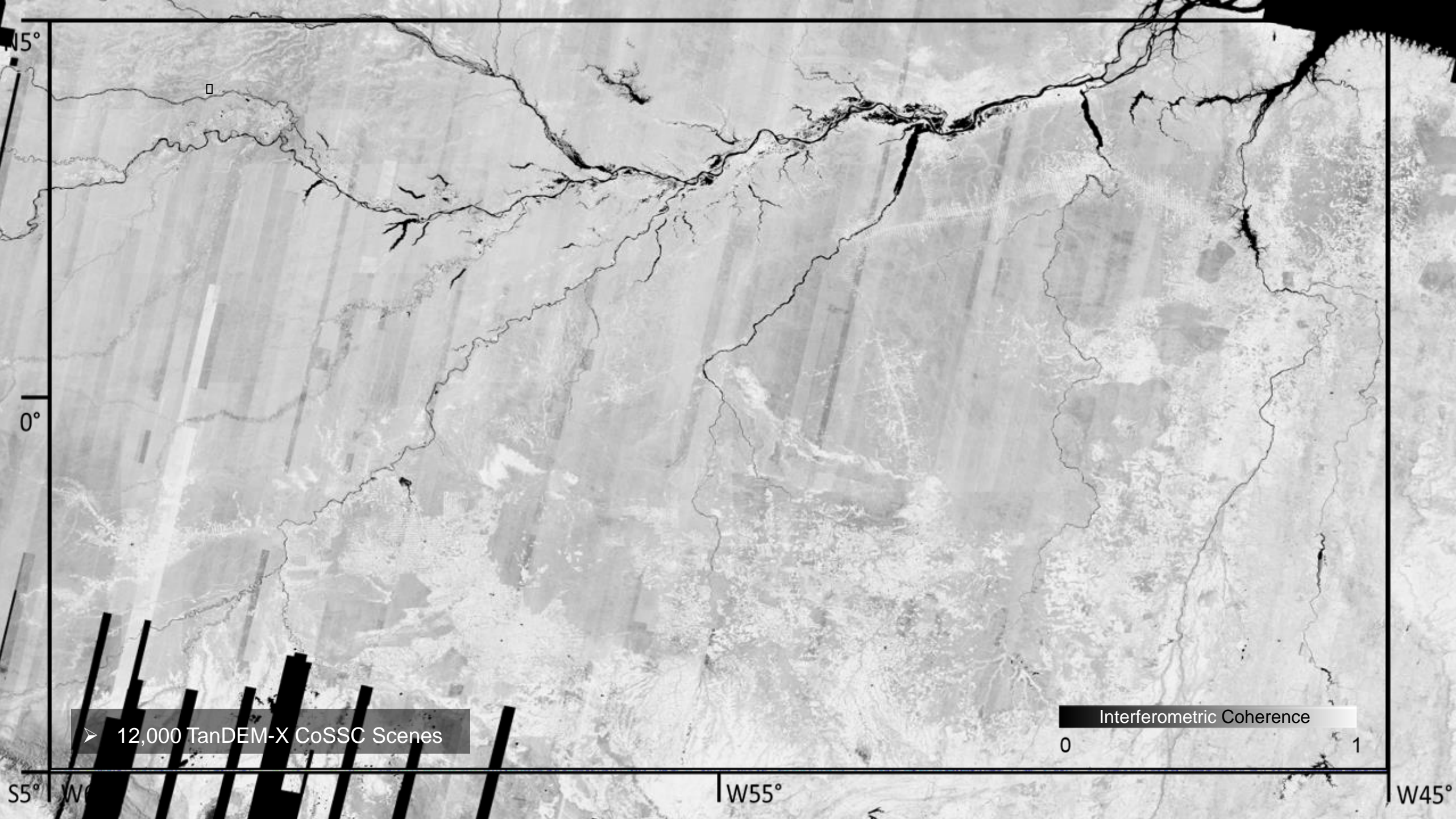


GEDi waveforms can be used to approximate the X-band (vertical) reflectivity profiles

$$f_{TDX}(z) \approx F(P_{GEDi}(z))$$



The **TanDEM-X/GEDI forest height inversion problem** is balanced (with 1 complex measurement for 2 real unknowns) and becomes **solvable!**



5°N

0°

5°S

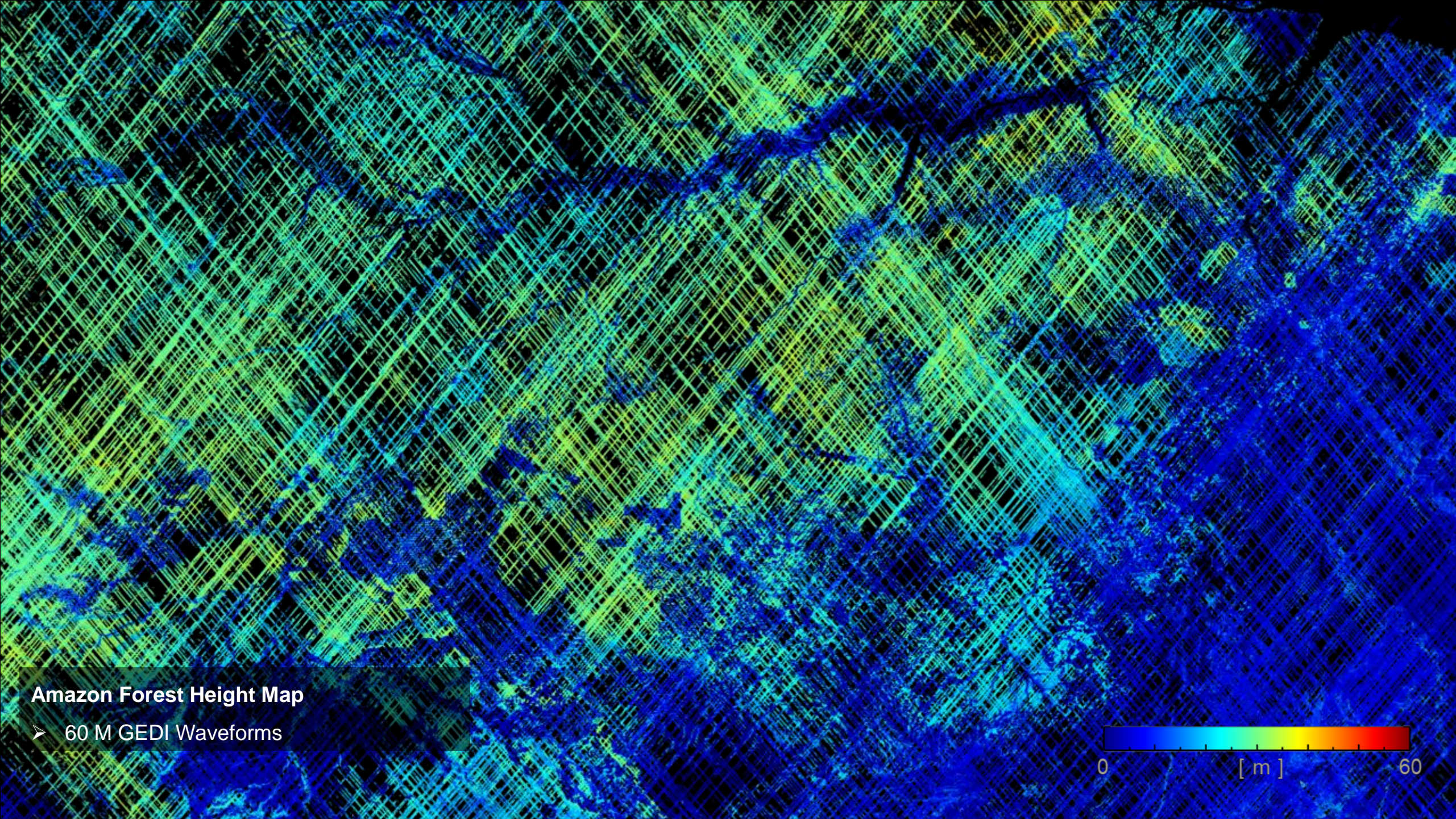
W60°

W55°

W45°

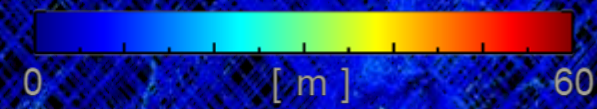
➤ 12,000 TanDEM-X CoSSC Scenes

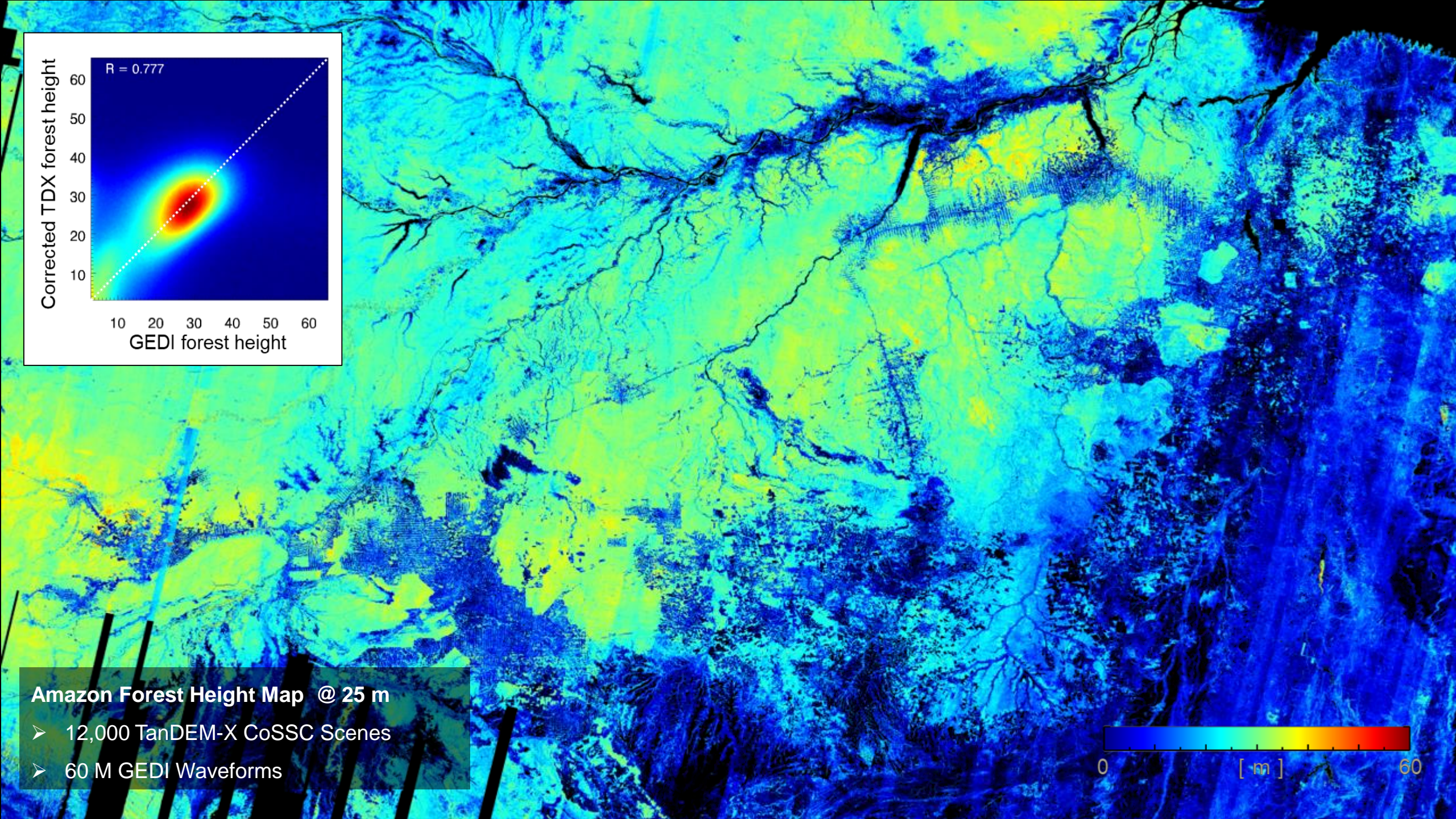
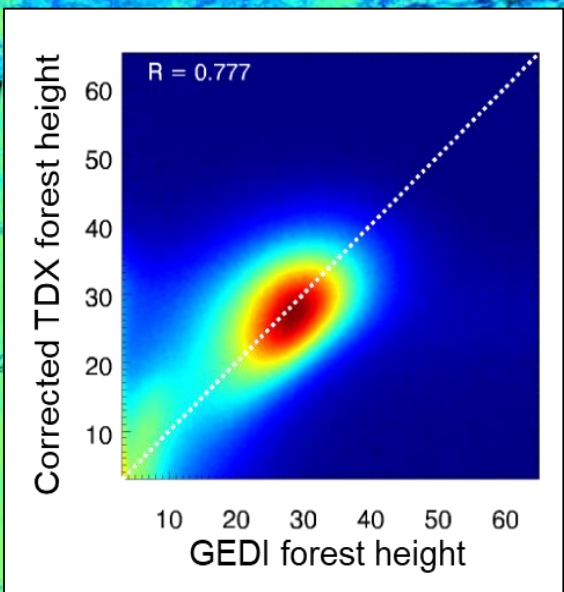
Interferometric Coherence
0 1



Amazon Forest Height Map

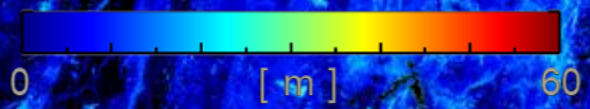
➤ 60 M GEDI Waveforms

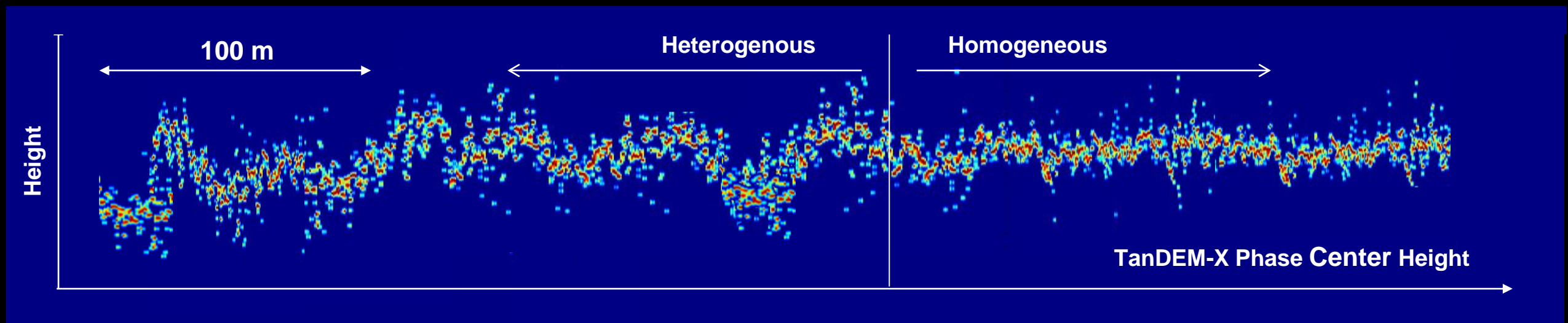


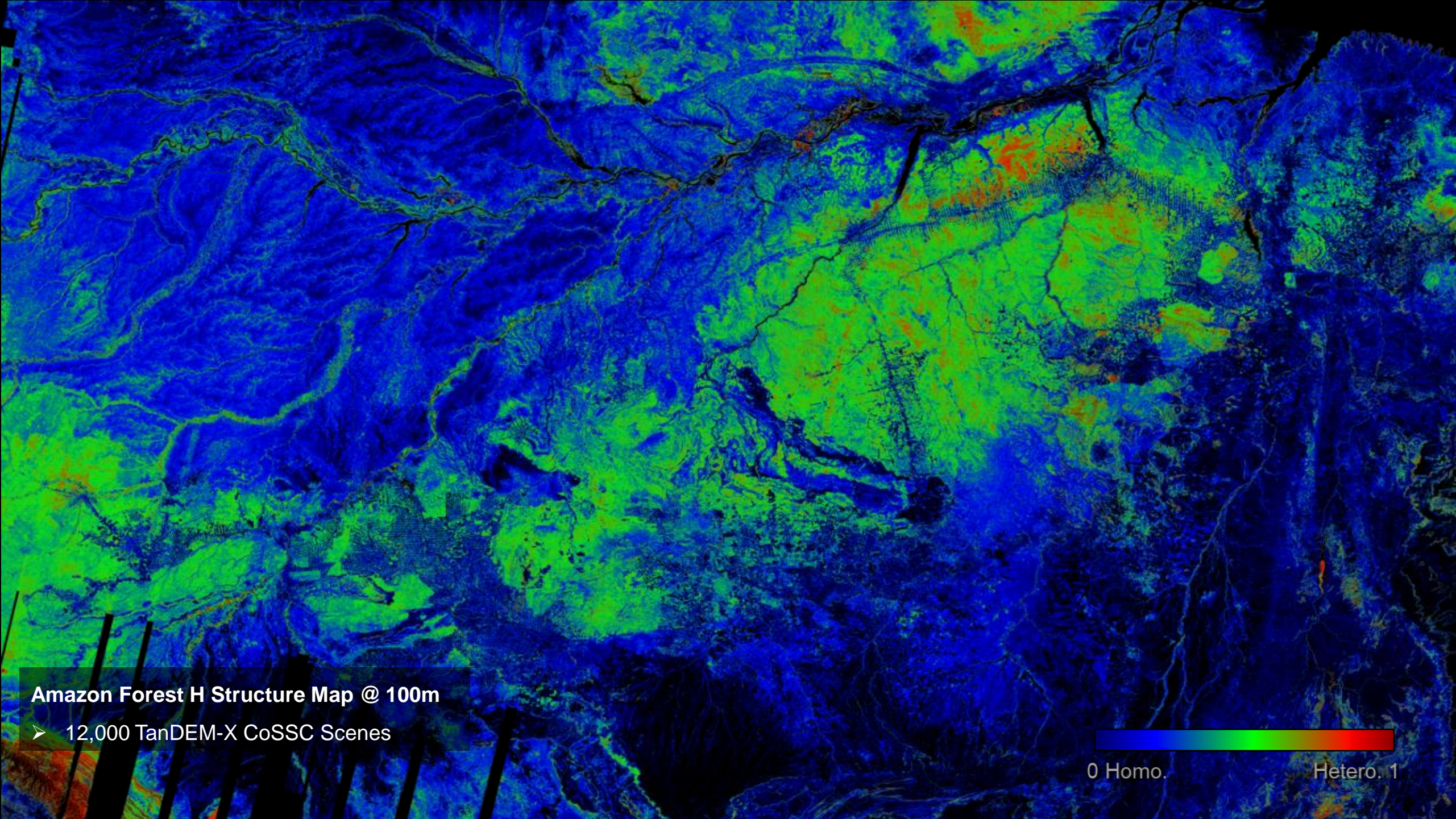


Amazon Forest Height Map @ 25 m

- 12,000 TanDEM-X CoSSC Scenes
- 60 M GEDI Waveforms

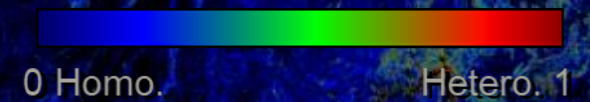


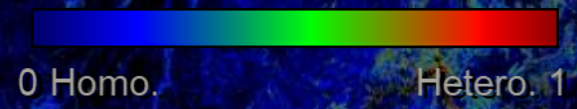
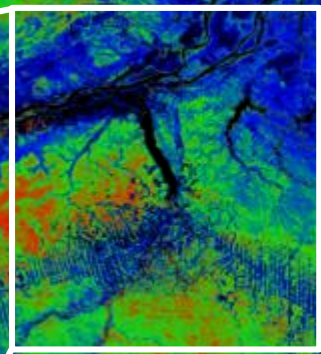
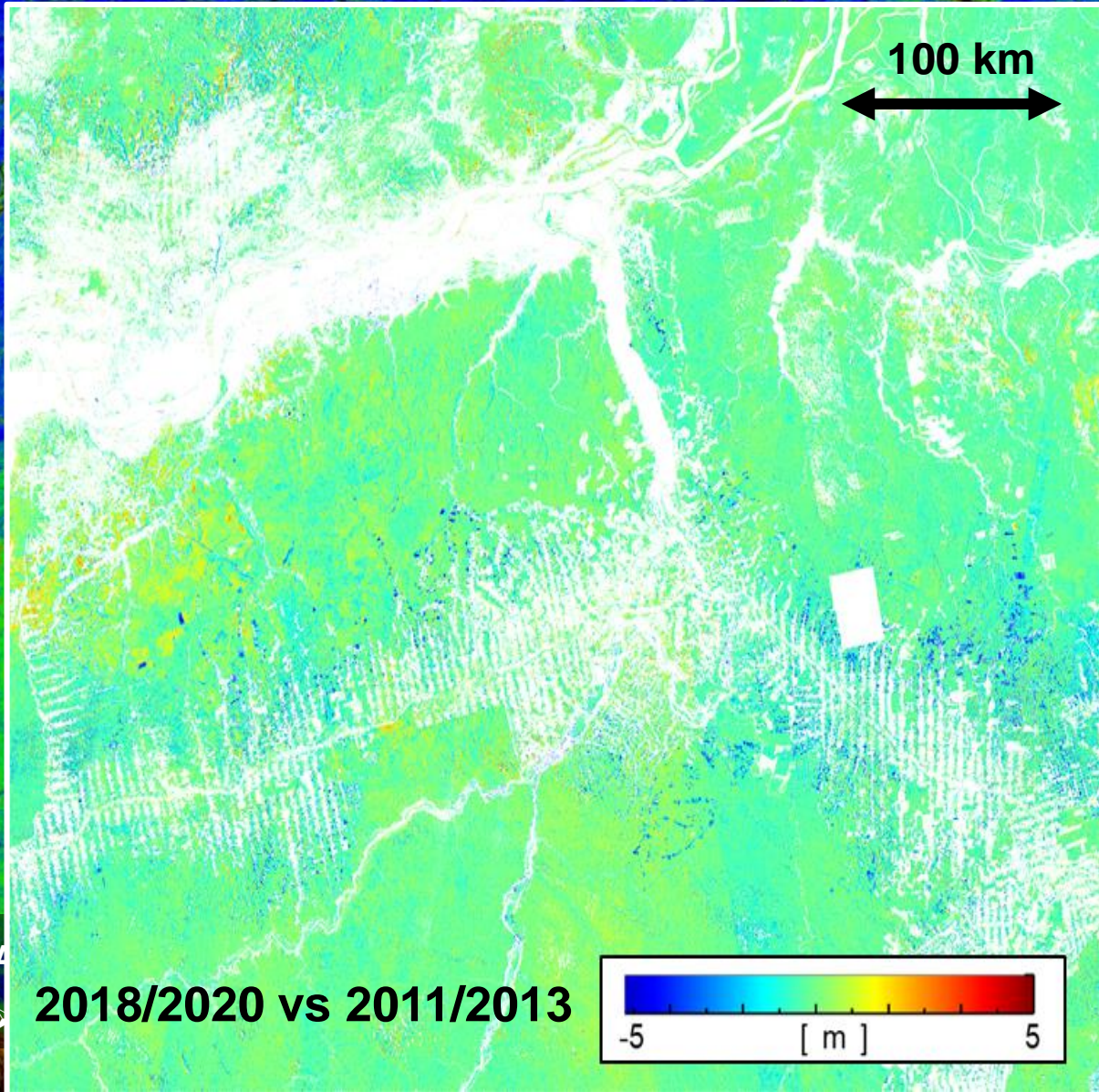


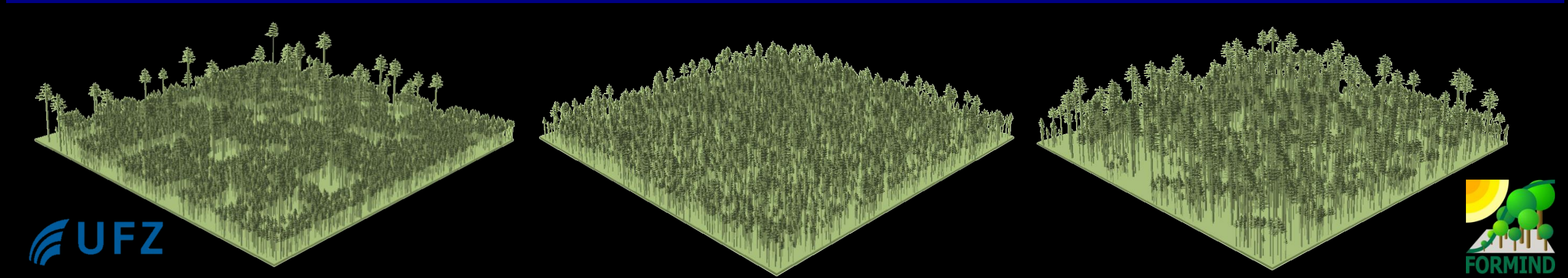
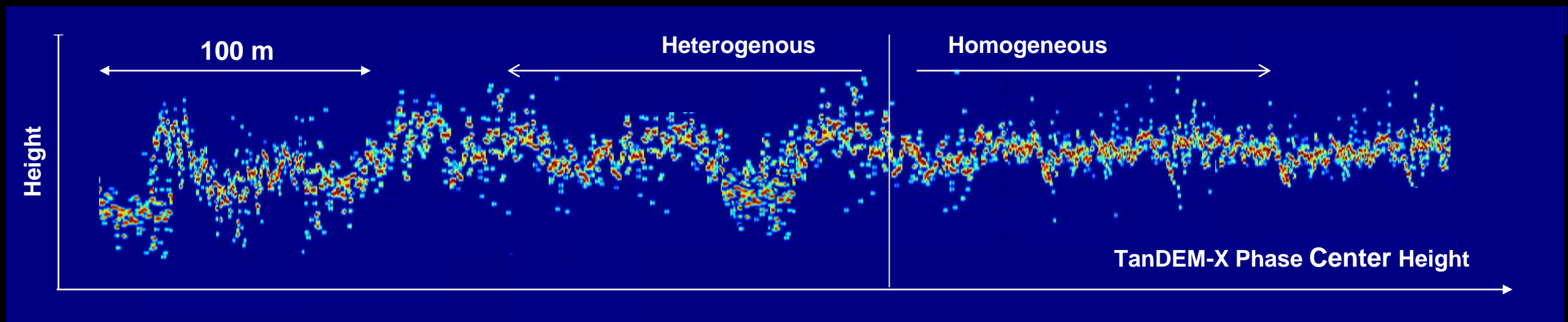


Amazon Forest H Structure Map @ 100m

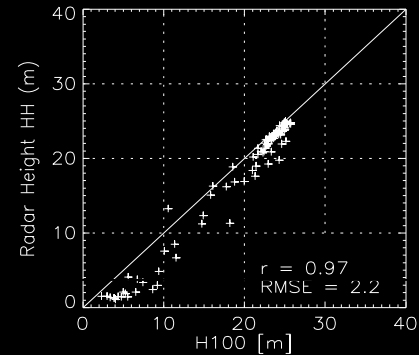
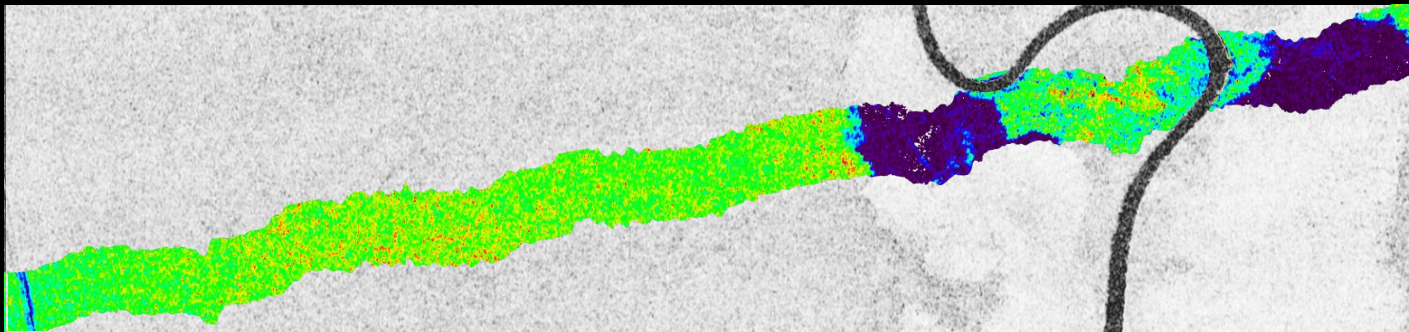
➤ 12,000 TanDEM-X CoSSC Scenes



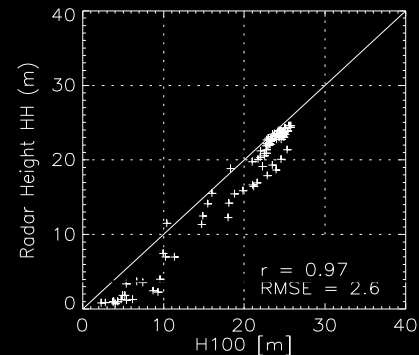
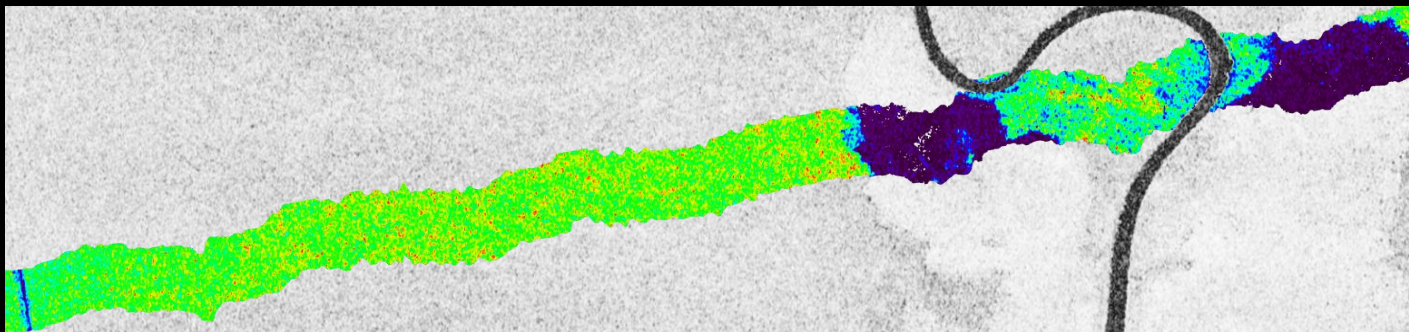




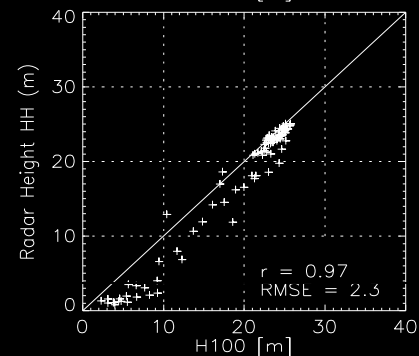
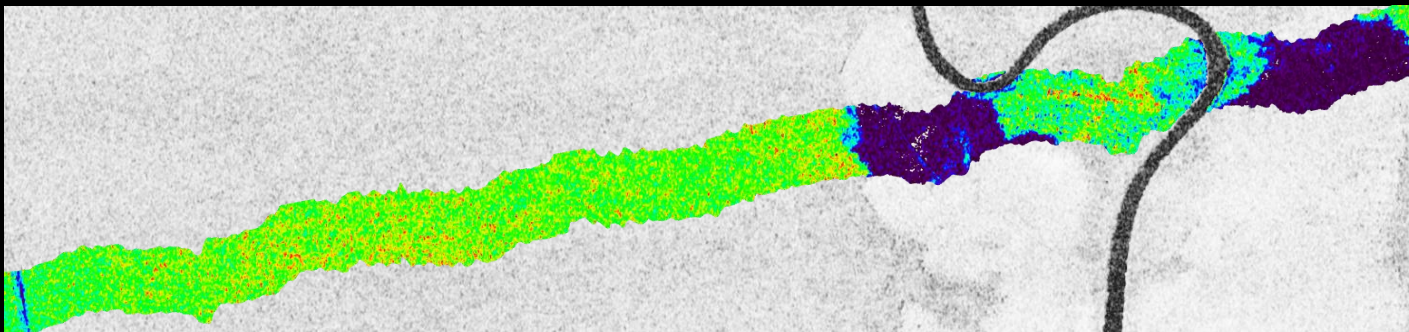
04.01.2011



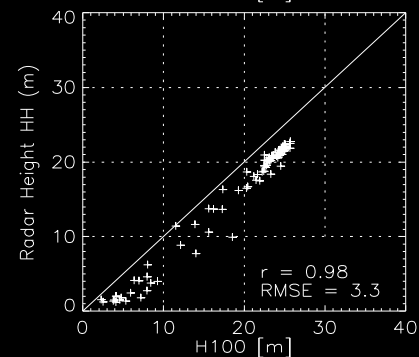
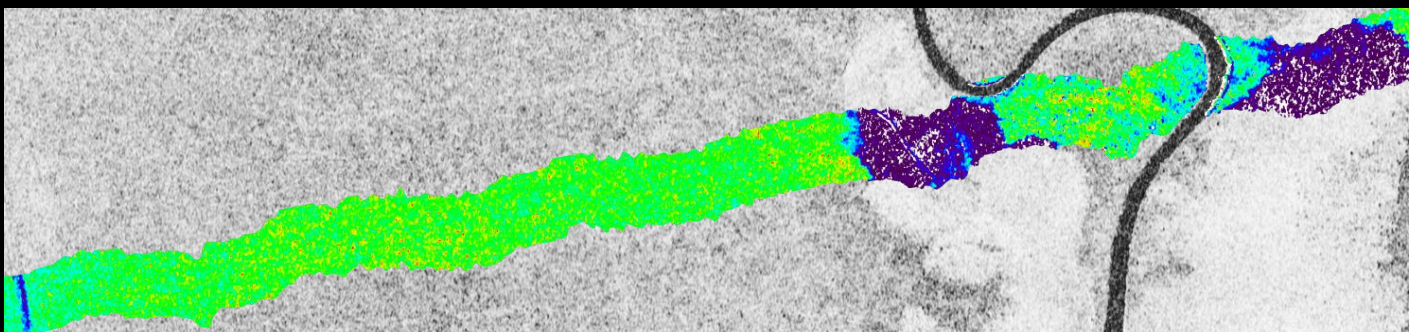
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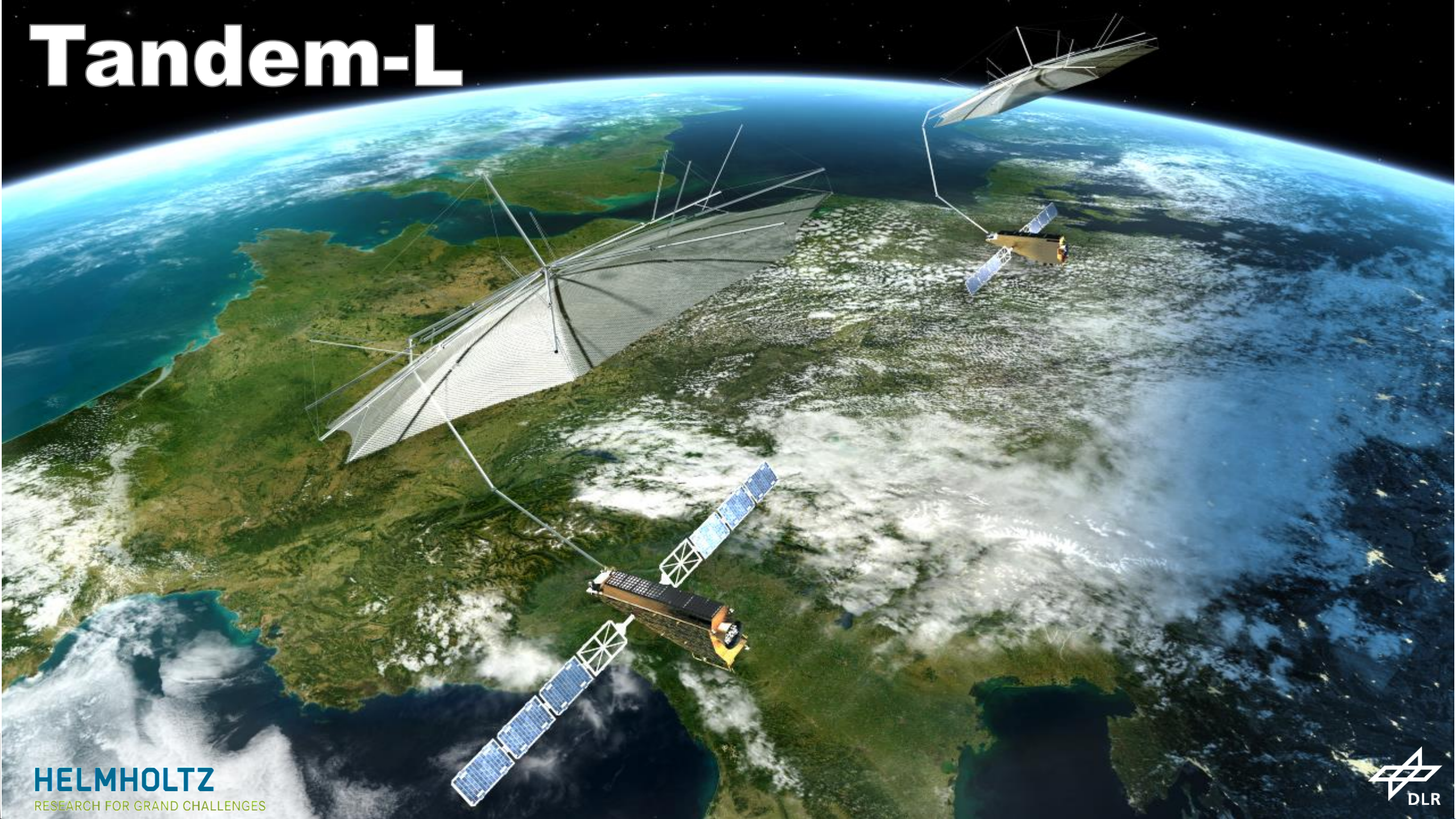
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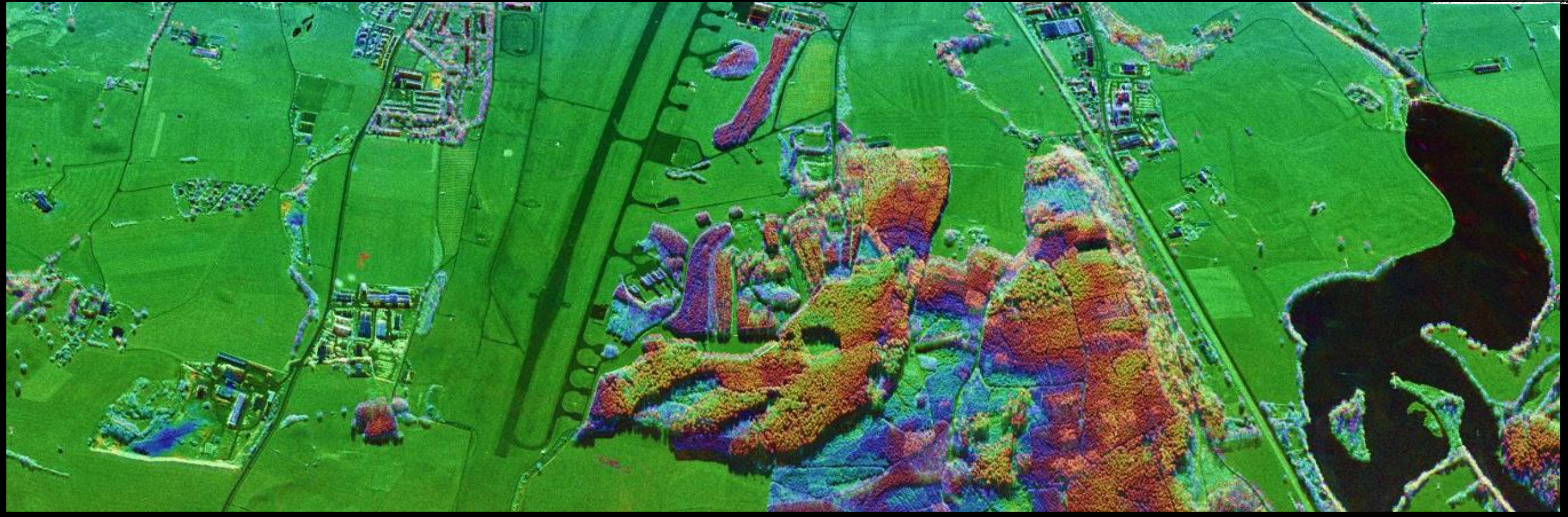
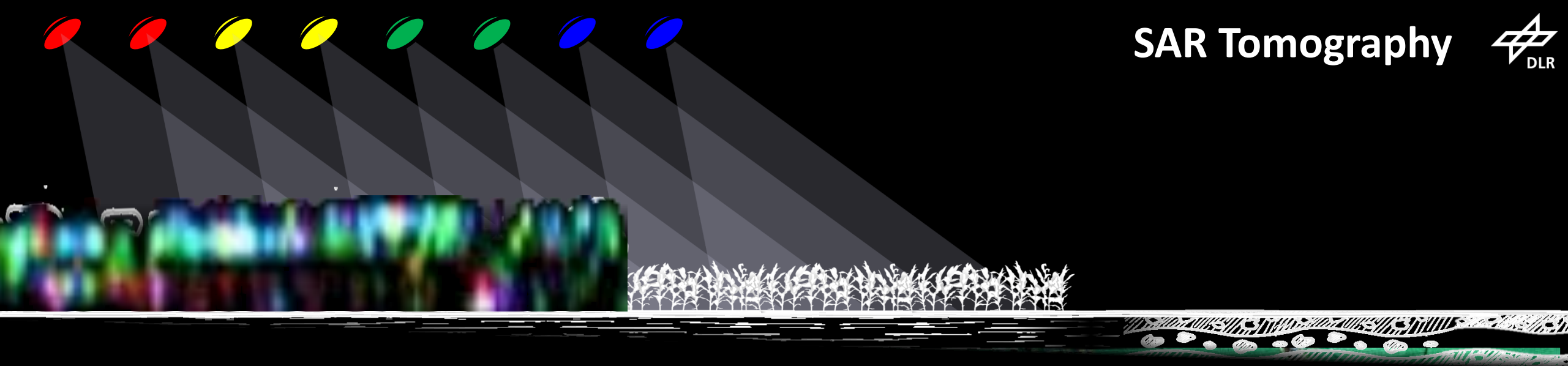


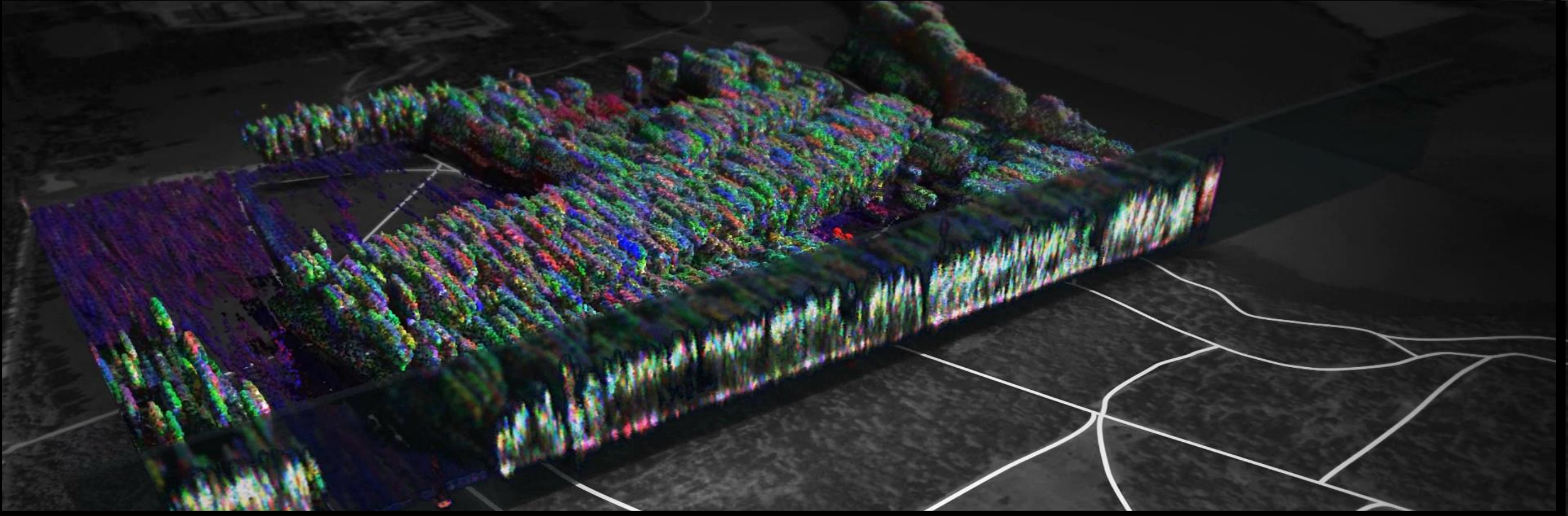
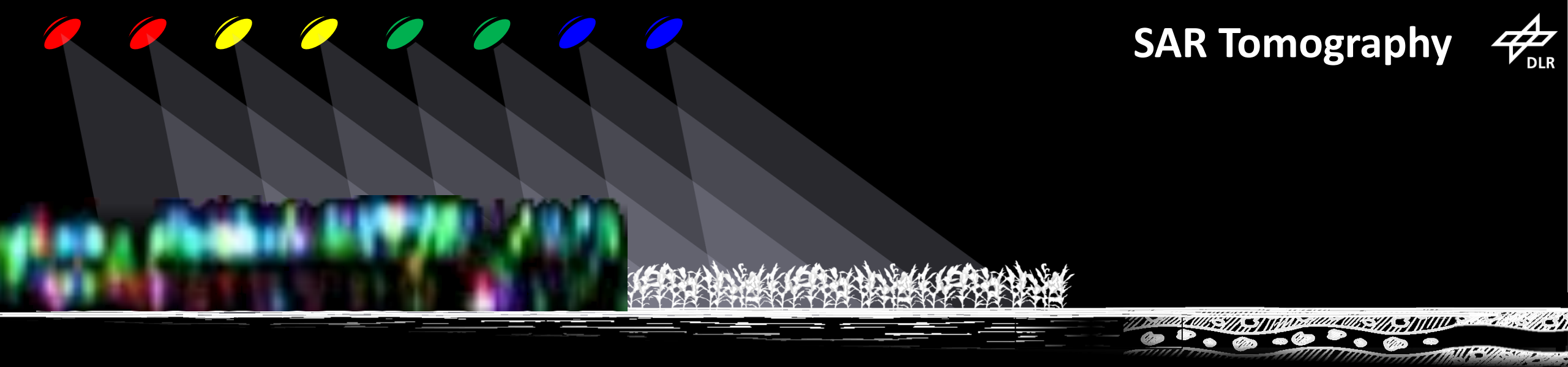
25.08.2012



Tandem-L







	APPLICATIONS/PRODUCTS	COVERAGE	RESOLUTION	ACCURACY	REPETITION RATE
BIOSPHERE	Forest Height	all forest areas	50 m (global) 20 m (regional) 10 m (local)	~ 10 %	every 16 days up to seasonal acquisitions and seasonal to annual product delivery
	Above Ground Biomass		100 m (global) 50 m (regional)	~ 20 % (or 20 t/ha)	
	Vertical Forest Structure		50 m (global) 30 m (regional)	3 layers	
GEO-/ LITHOSPHERE	Tectonics (3D Deformation Rate map)	high strain areas	50 m (global)	1 mm/year (after 10 years)	weekly acquisition and products seasonal to annual
	Volcanoes (Displacement map)	>1500 land volcanos 50x50 km	50 m	10 mm	
	Landslides (PSI)	risk areas	7 m	1 mm/year (after 10 years)	
	Subsidence (PSI)	urban areas	7 m	1 mm/year (after 10 years)	
CRYOSPHERE	Glacier Flow	worldwide	50 – 500 m	cm – m/year	seasonal
	Ice Structure Change	Greenland	100 m	> 1 layer	annual
	Ice Sheet Elevation	worldwide	50 m	0.5 – 1 m	half a yearly
	Sea Ice	Arctic/Antarctic	5 – 50 km	Thickness <0.5-1m Type 5-20%	every 16 days up to monthly
HYDROSPHERE	Soil Moisture	selected areas	50 – 100 m	5 – 10 %	weekly
	Ocean Currents	selected areas	4 – 20 km	5 cm/s	weekly
	Wind Speed Velocity	selected areas	4 – 20 km	2 m/s	weekly
	Ocean Surface Waves	selected areas	5 km	0.1 – 0.25 m / 10°	weekly
GLOBAL	Digital Terrain & Surface Models	global/local	12 m	2 m (bare) 4 m (vegetation)	global:annual local: on demand
EMERGENCY	Risk areas	local	1 m	- t.b.d.	and



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