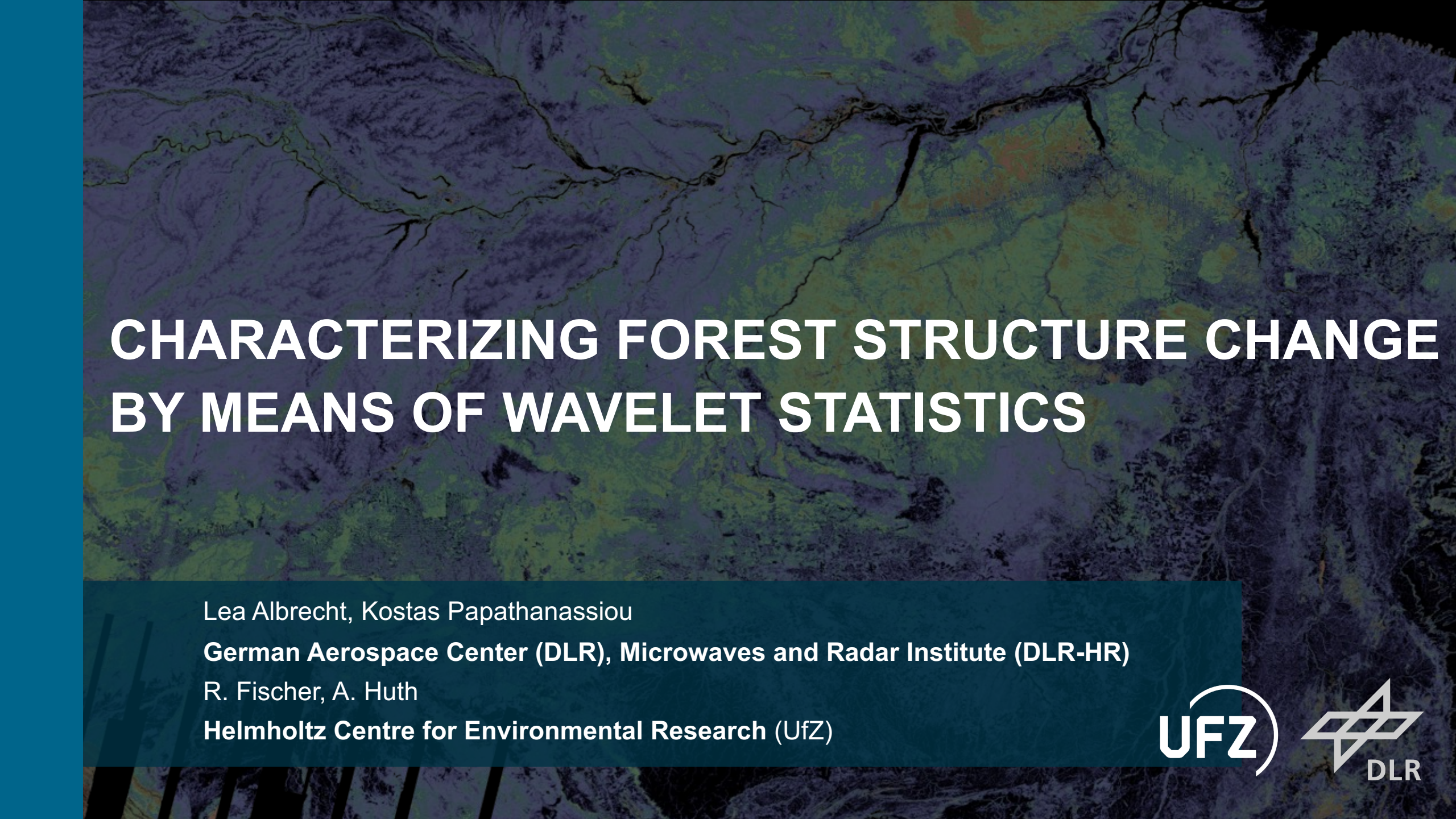


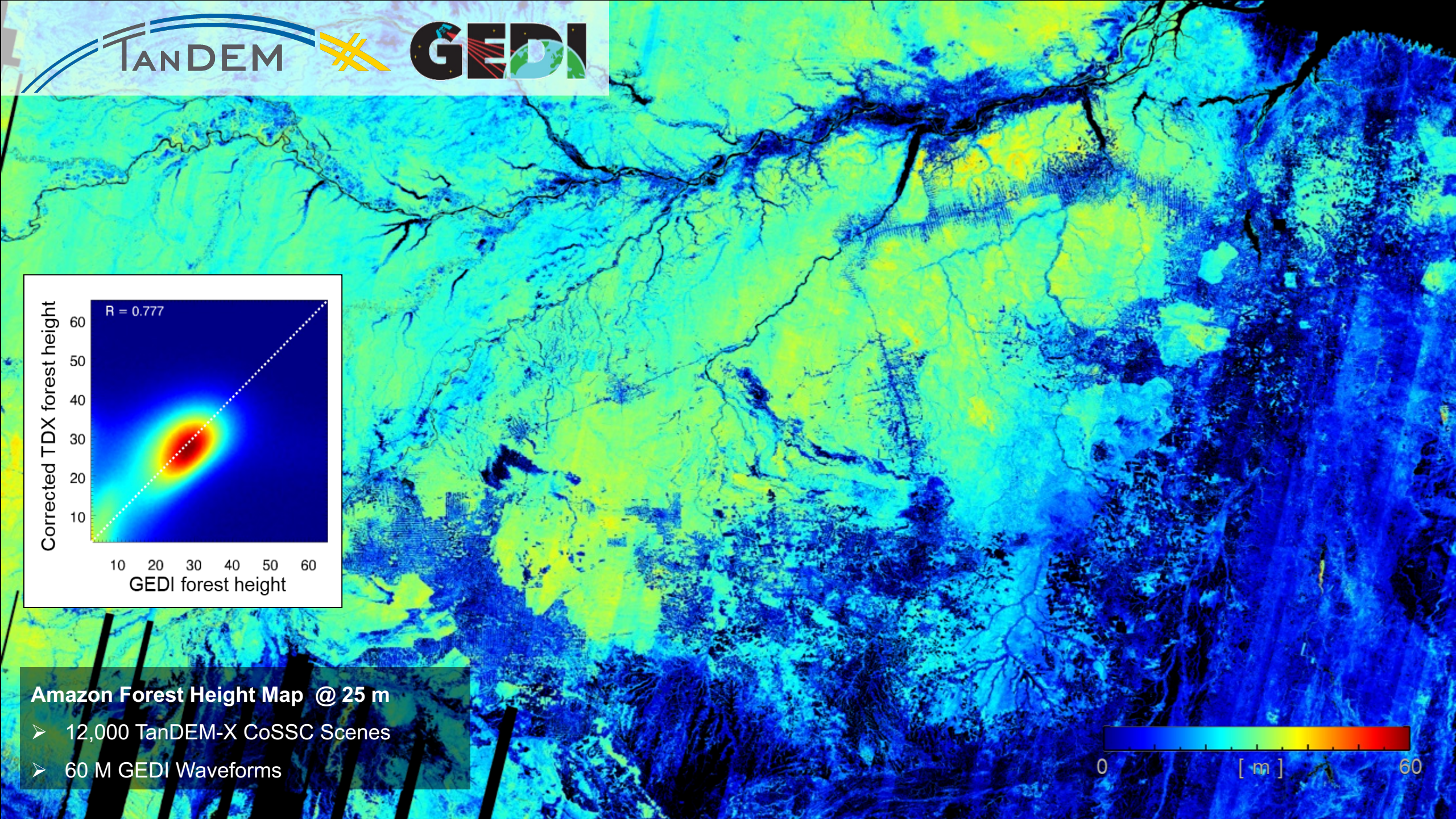
CHARACTERIZING FOREST STRUCTURE CHANGE BY MEANS OF WAVELET STATISTICS

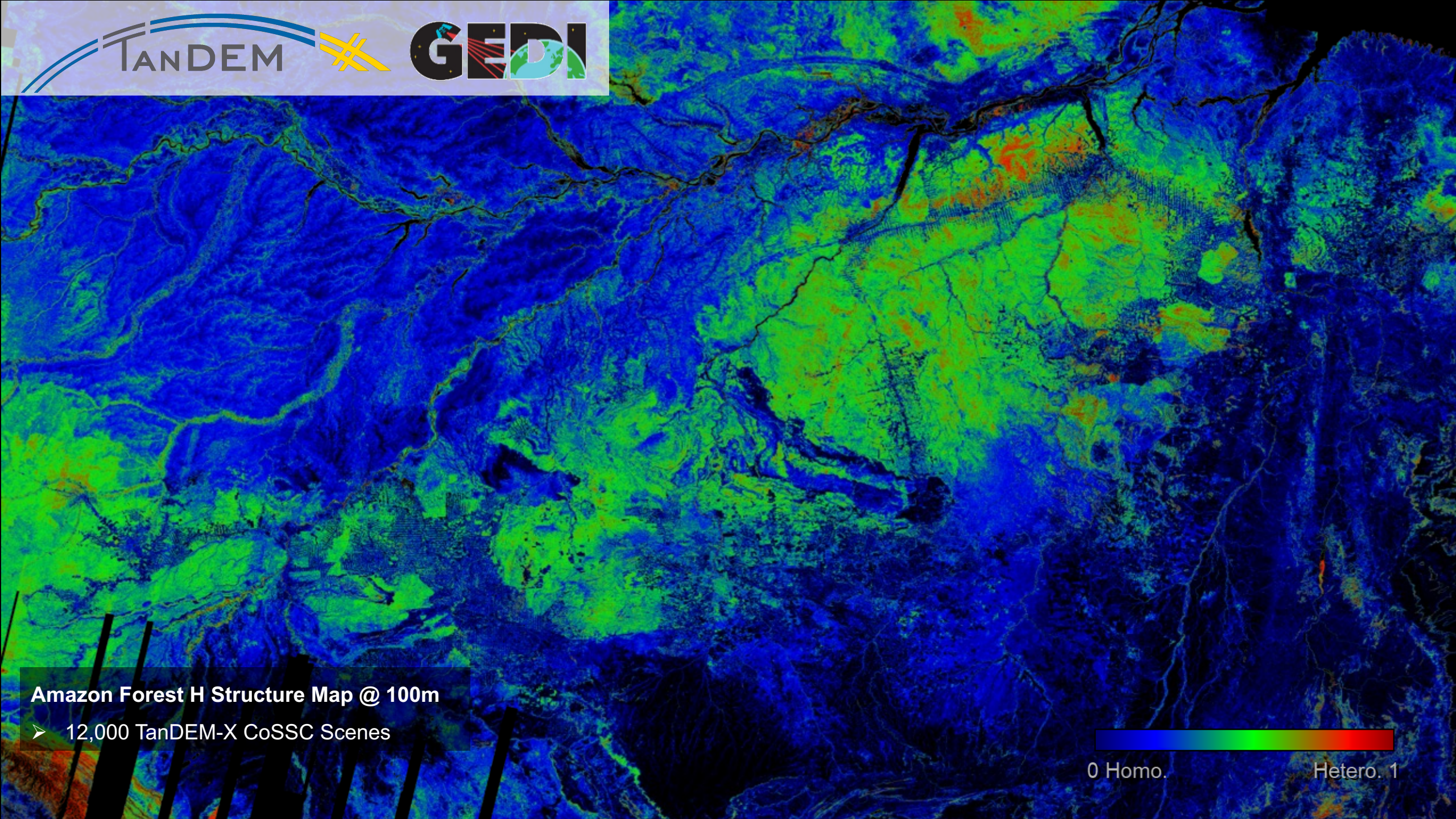
Lea Albrecht, Kostas Papathanassiou

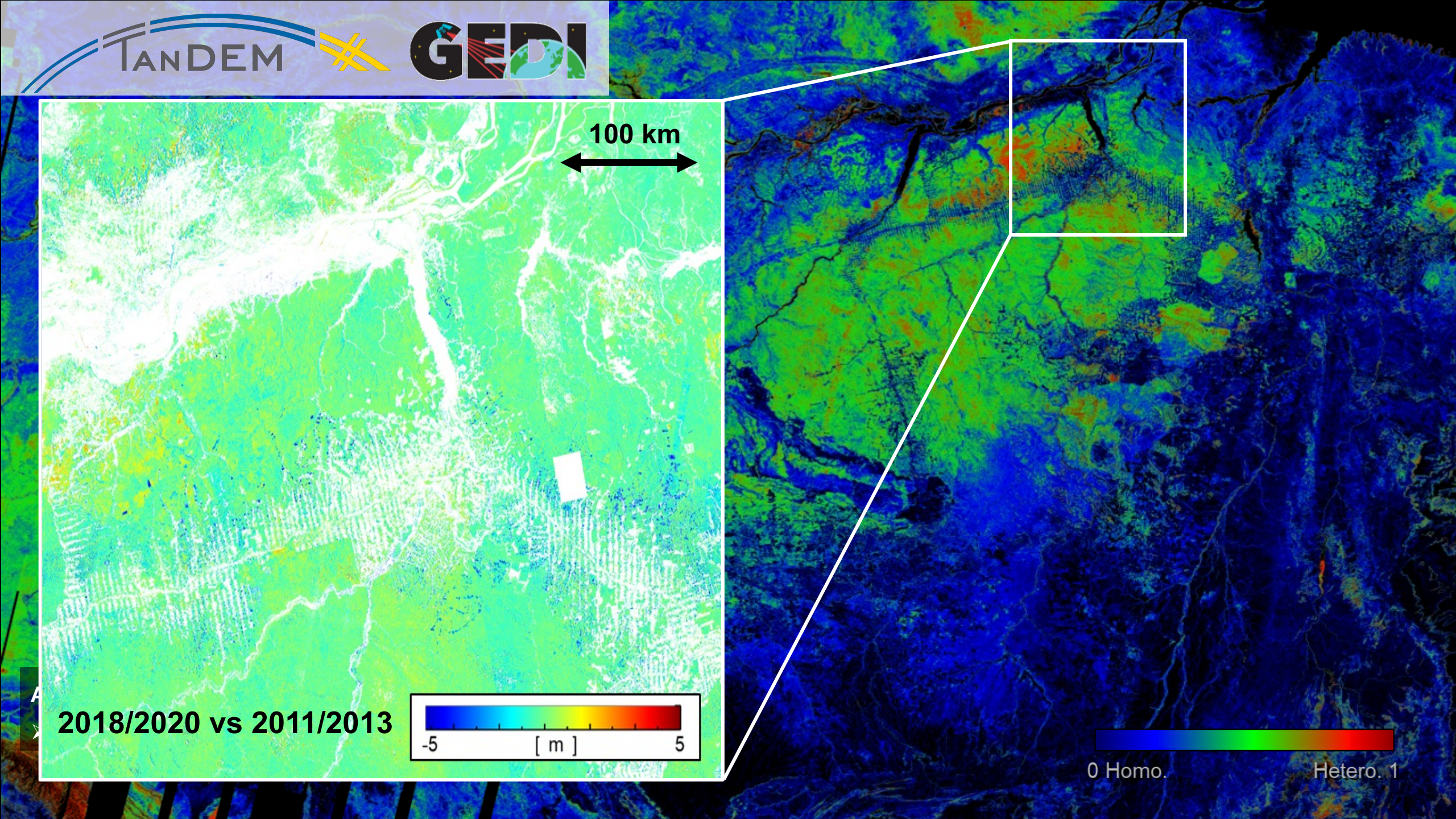
German Aerospace Center (DLR), Microwaves and Radar Institute (DLR-HR)

R. Fischer, A. Huth

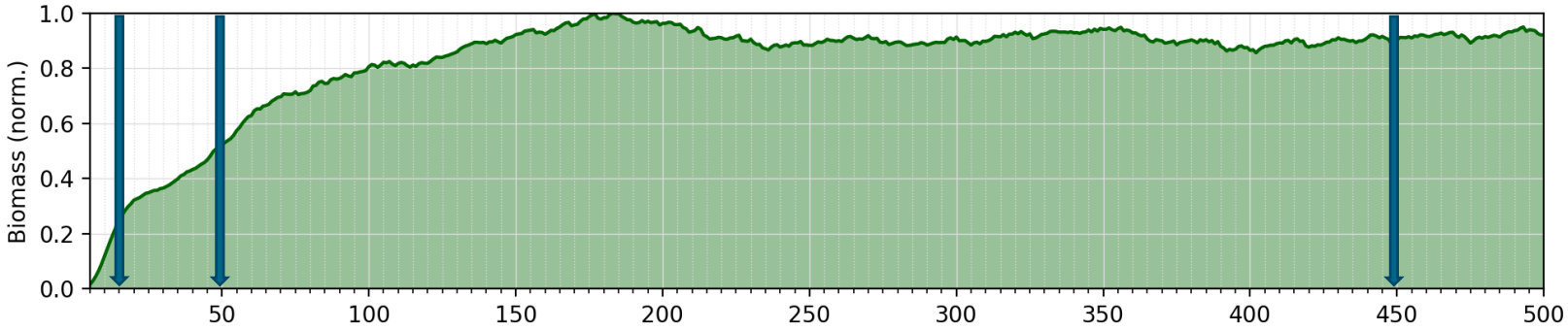
Helmholtz Centre for Environmental Research (UfZ)

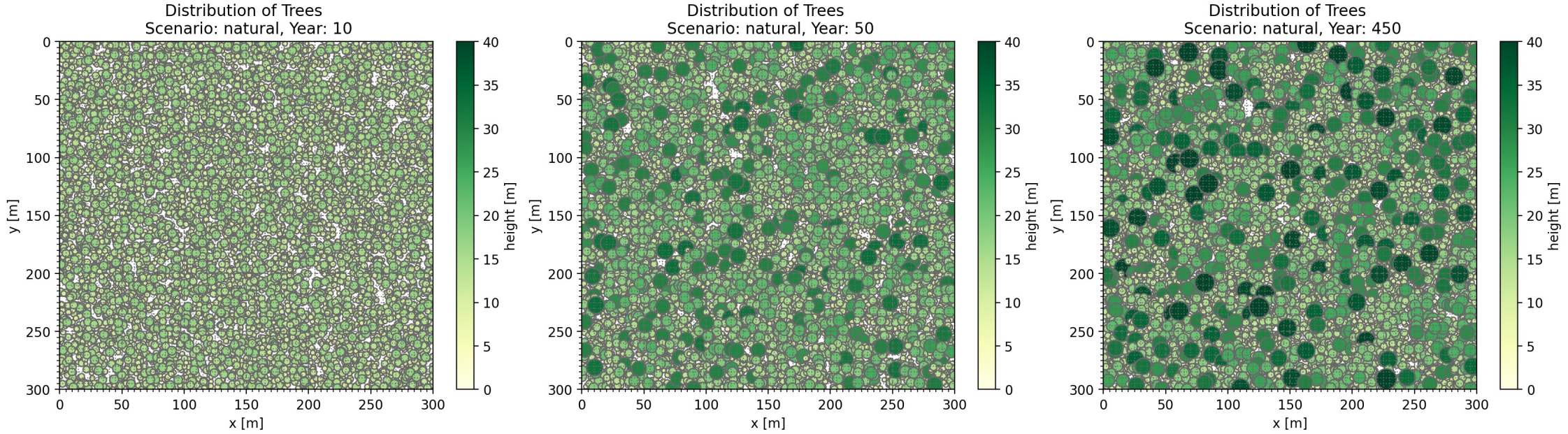

TanDEM
GEDI
R = 0.777
Corrected TDX forest height
GEDI forest height
10
20
30
40
50
60
Amazon Forest Height Map @ 25 m
12,000 TanDEM-X CoSSC Scenes
60 M GEDI Waveforms
0
[m]
60


TanDEM
GEDI
Amazon Forest H Structure Map @ 100m
12,000 TanDEM-X CoSSC Scenes
0 Homo.
Hetero. 1


TanDEM
GEDI
100 km
2018/2020 vs 2011/2013
-5
[m]
5
0 Homo.
Hetero. 1

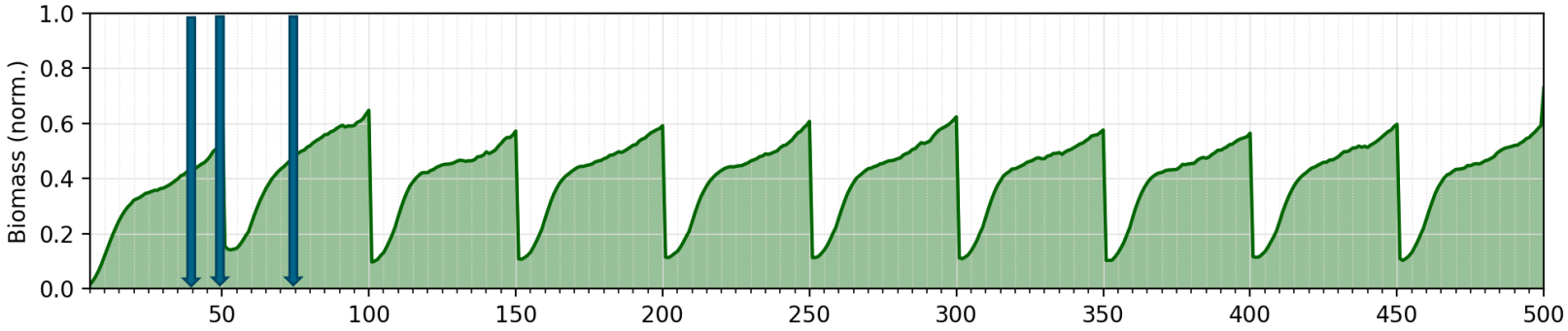
Forest structure from FORMIND

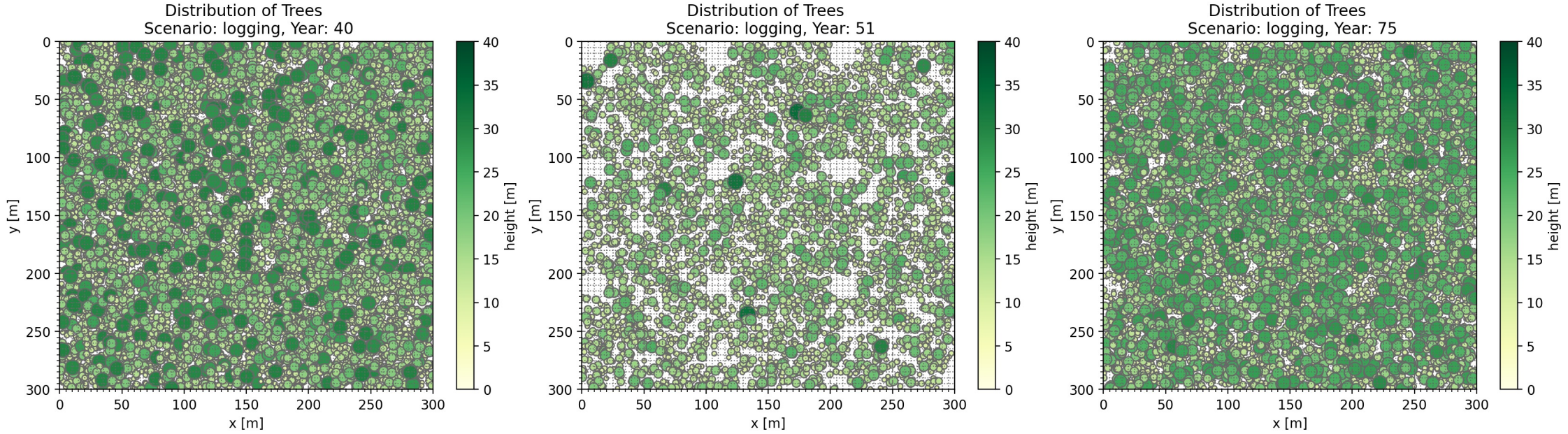




Undisturbed Forest

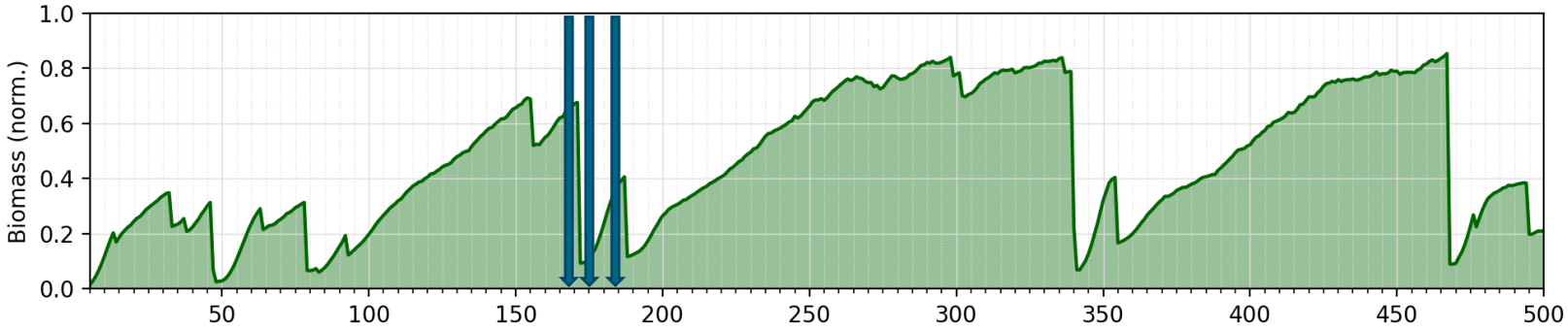
Forest structure from FORMIND

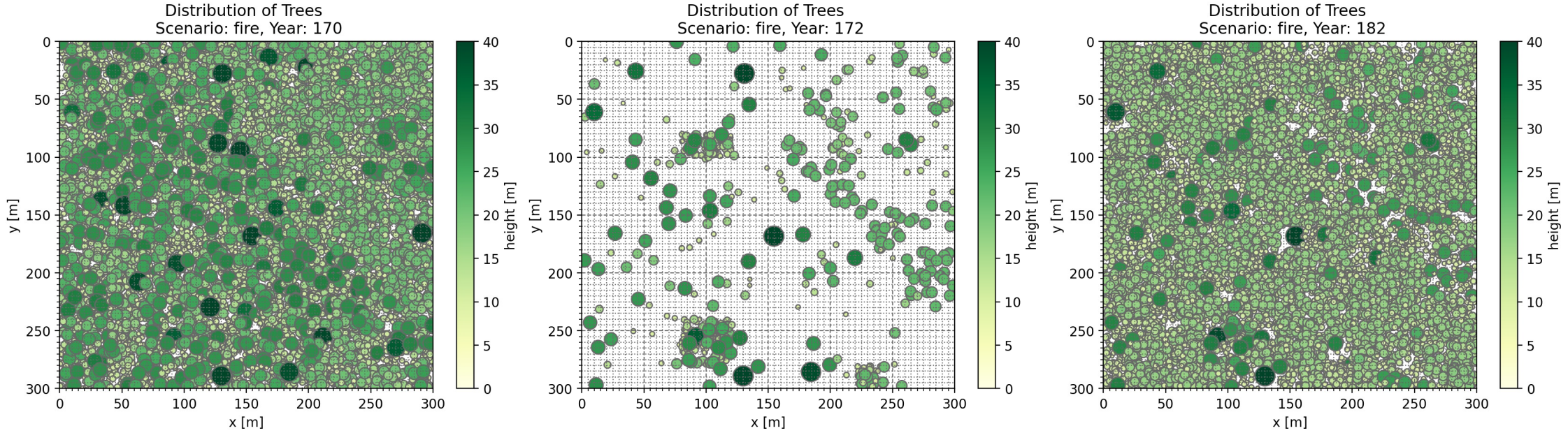




Logging Scenario

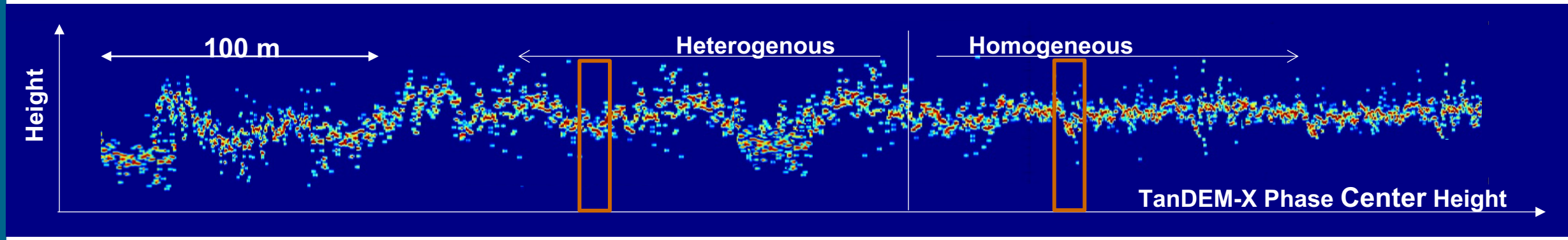
Forest structure from FORMIND





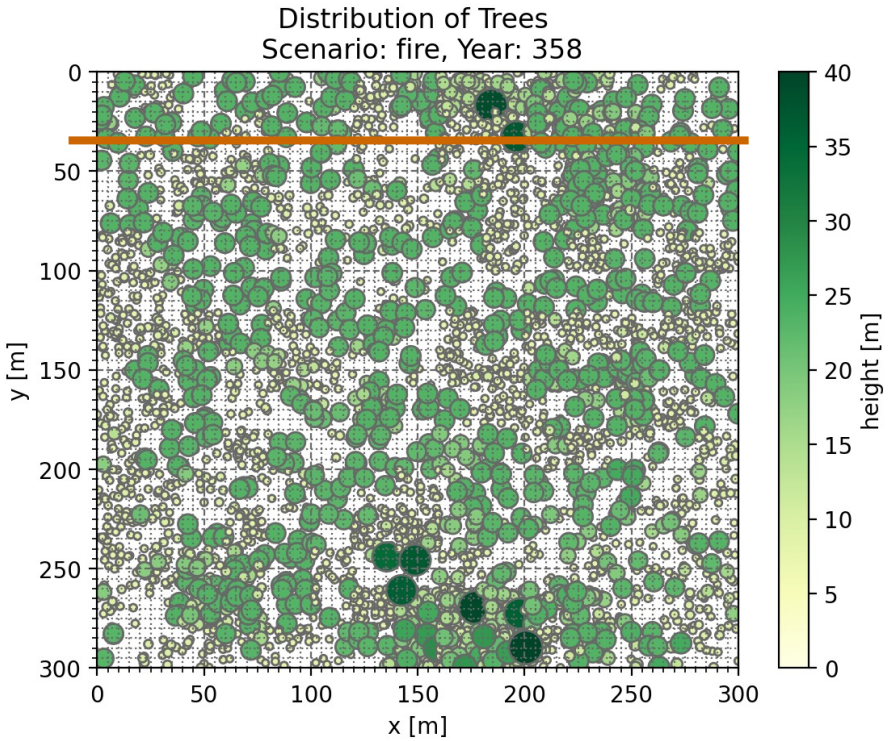
Fire Scenario

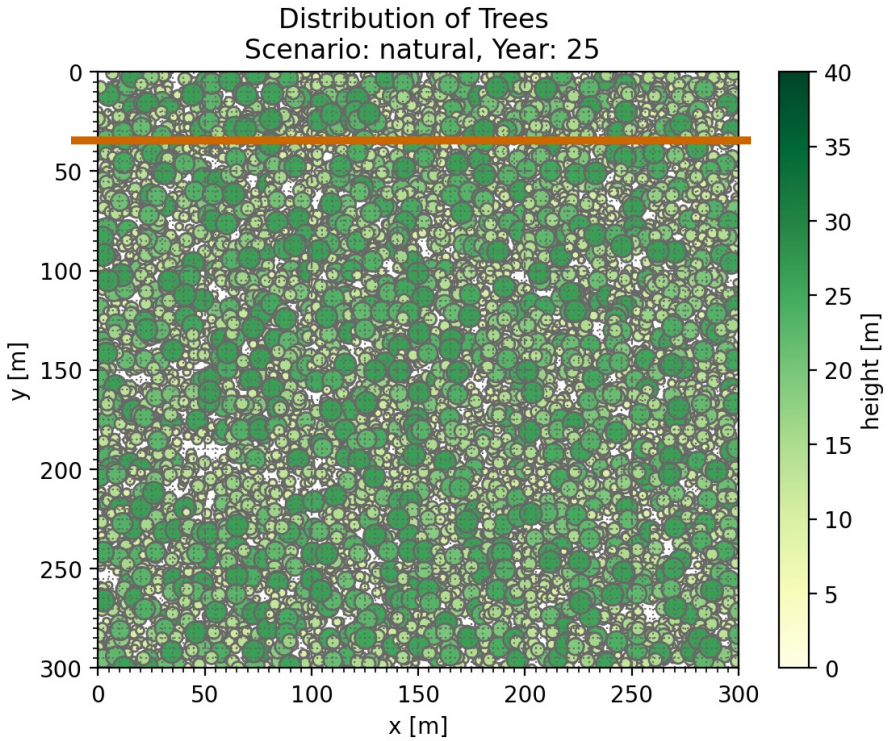
Scale dependency of forest structure



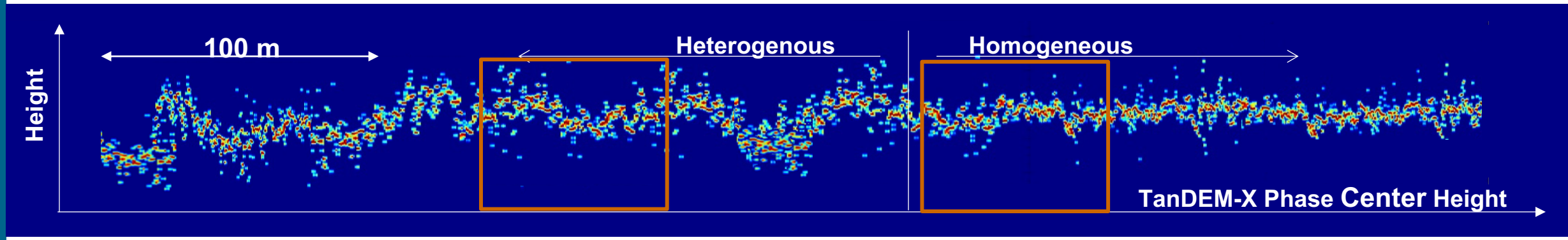
Forest structure parameters depend on the estimation **scale:**

If the estimation window is too small, the local heterogeneity dominates



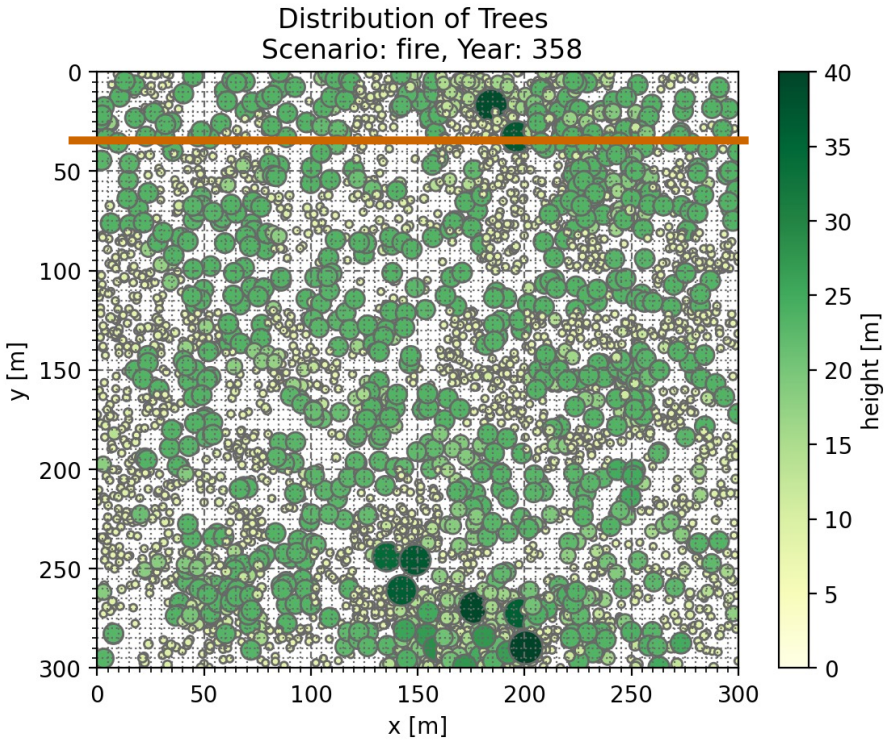


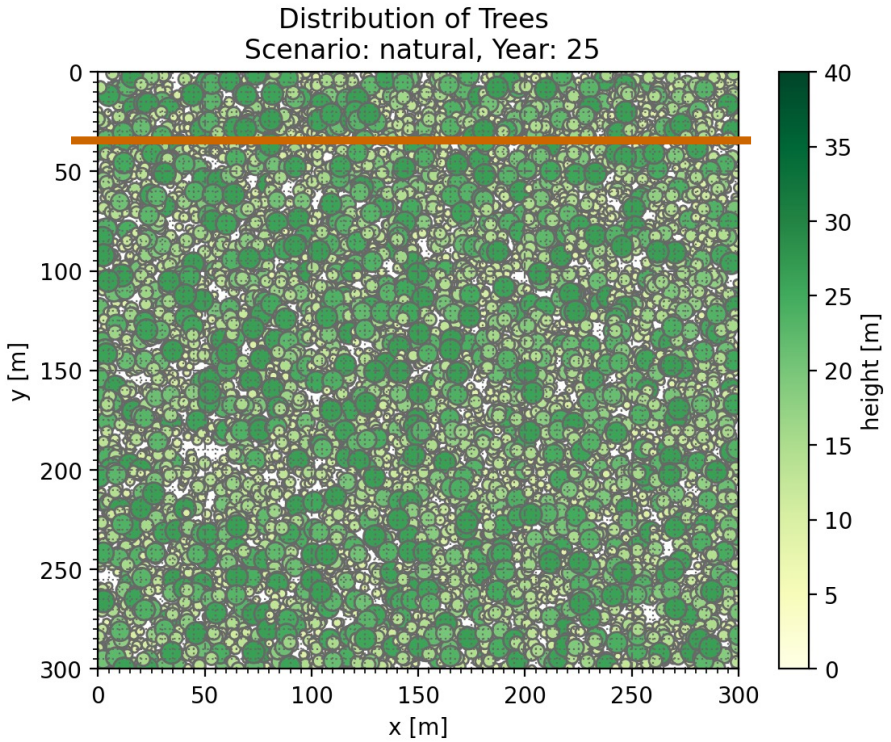
Scale dependency of forest structure



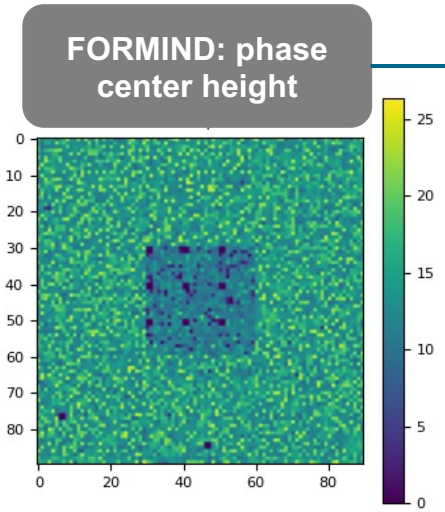
Forest structure parameters depend on the estimation **scale:**

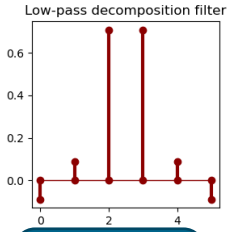
If the estimation window is too large, it loses its sensitivity to structure variability

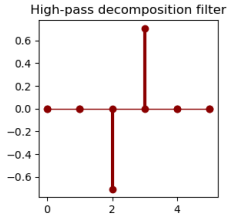




Wavelet Transformation Scheme







Level 0

Level 1

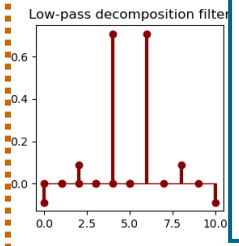
…

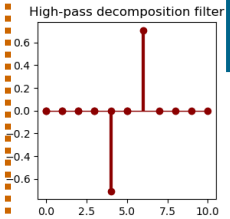
Lo

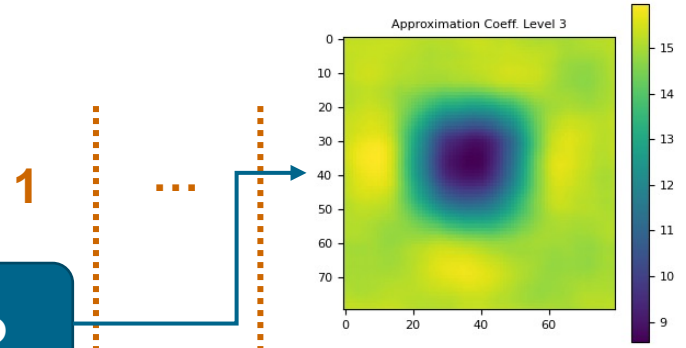
Hi

rows

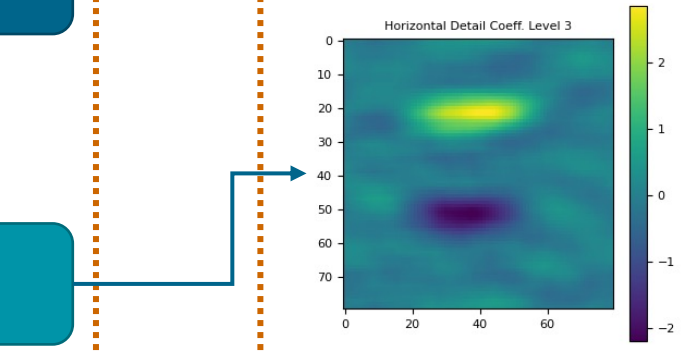
columns



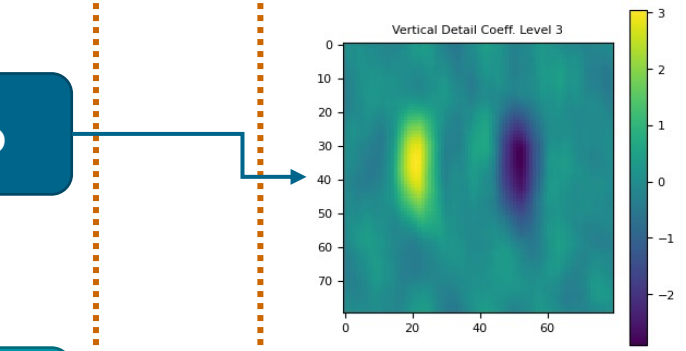




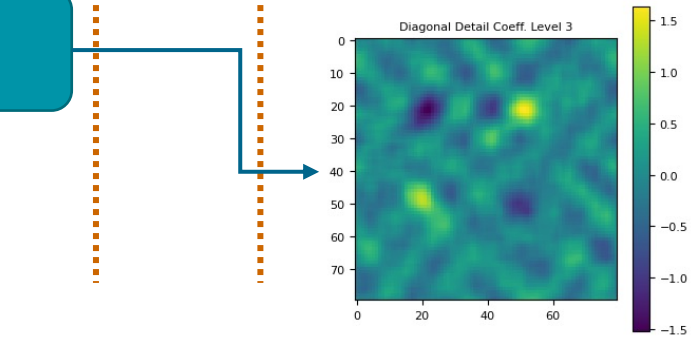
c_A



$c_{D_{hori}}$

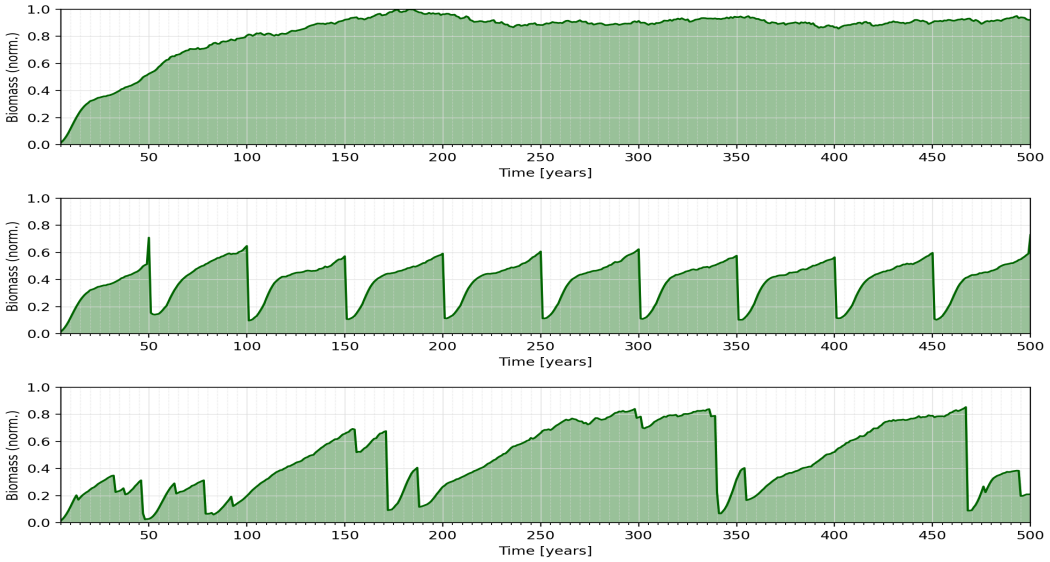


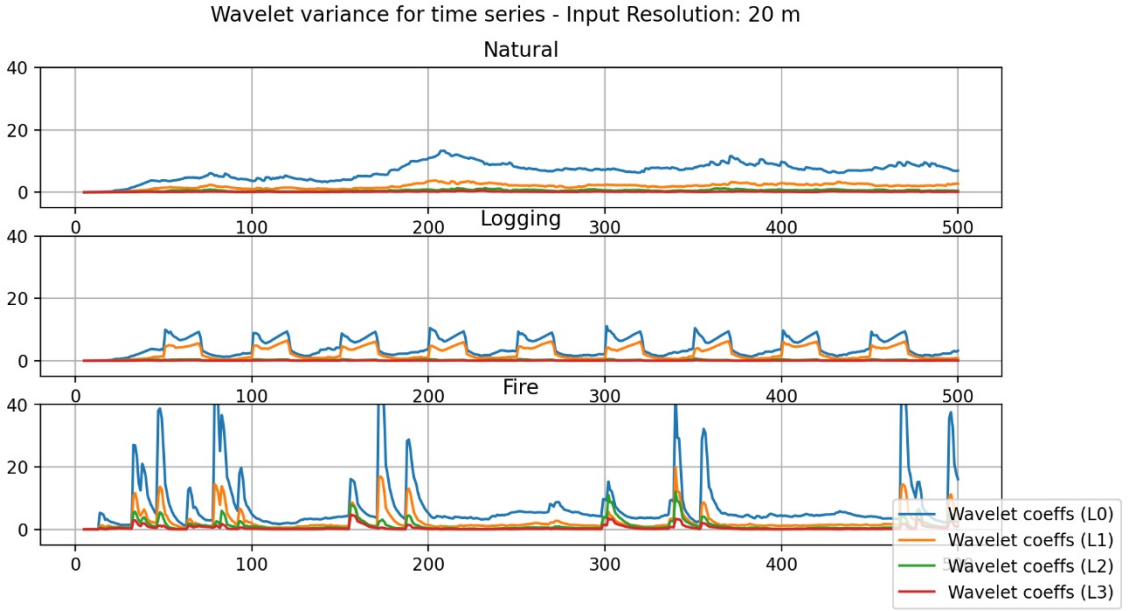
$c_{D_{vert}}$

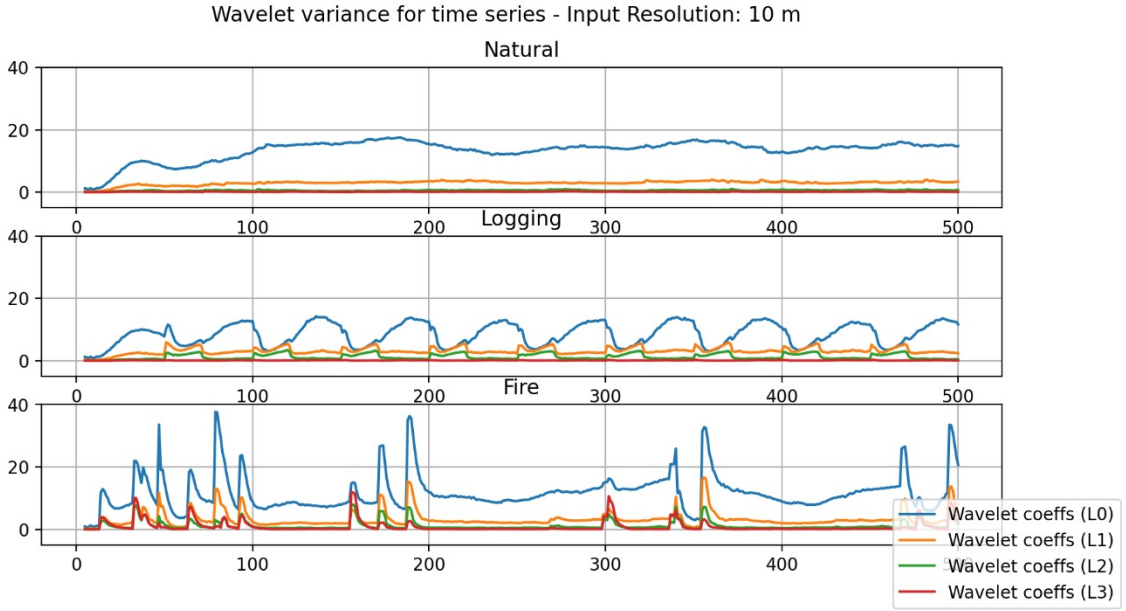


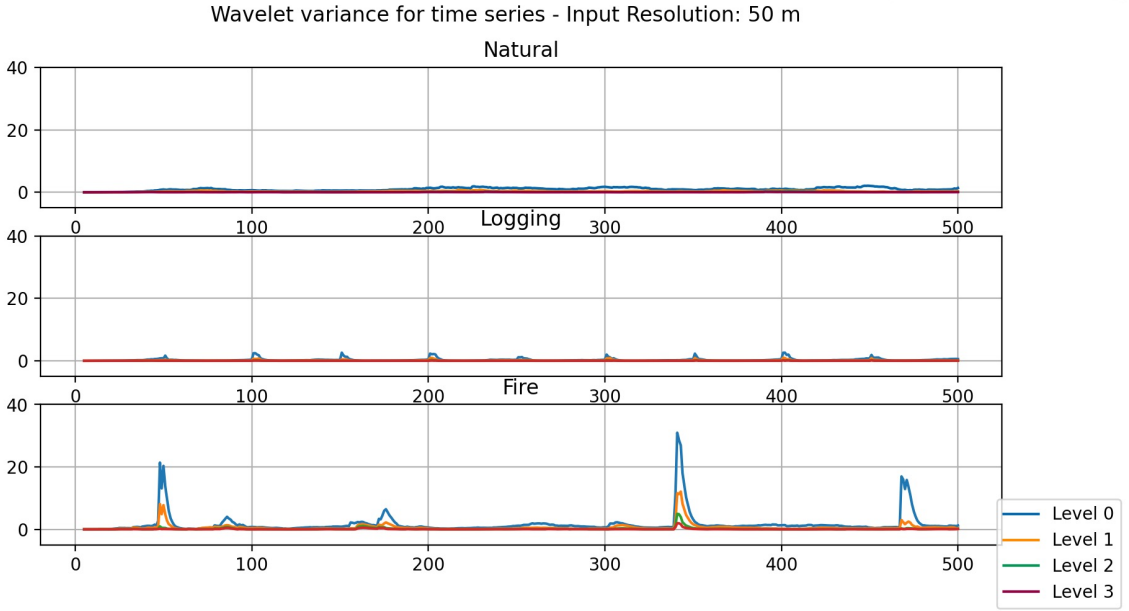
$c_{D_{diag}}$

Wavelet statistics in FORMIND

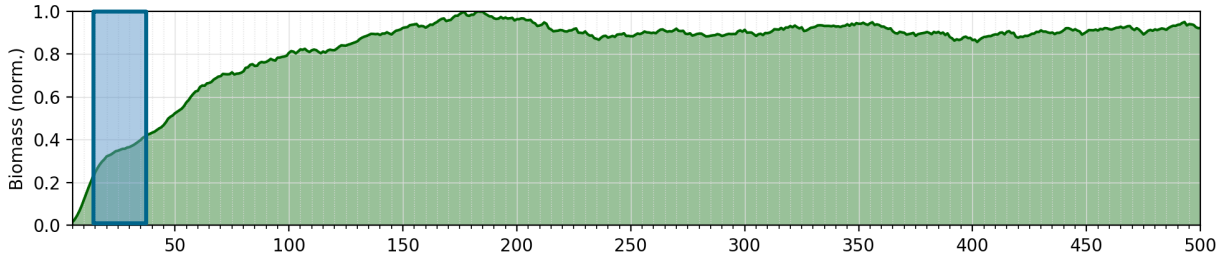


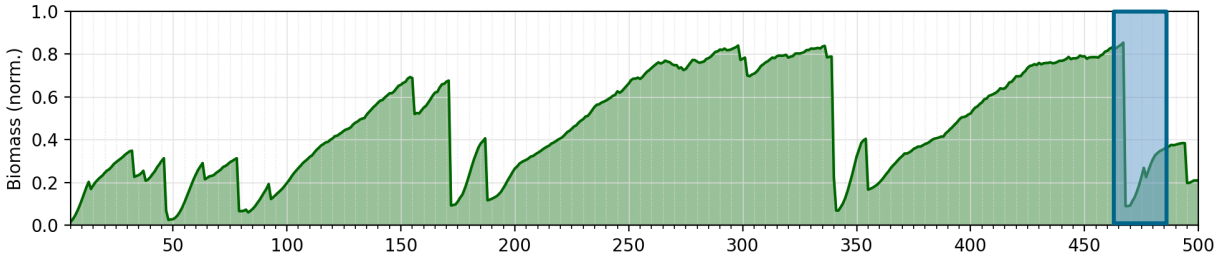


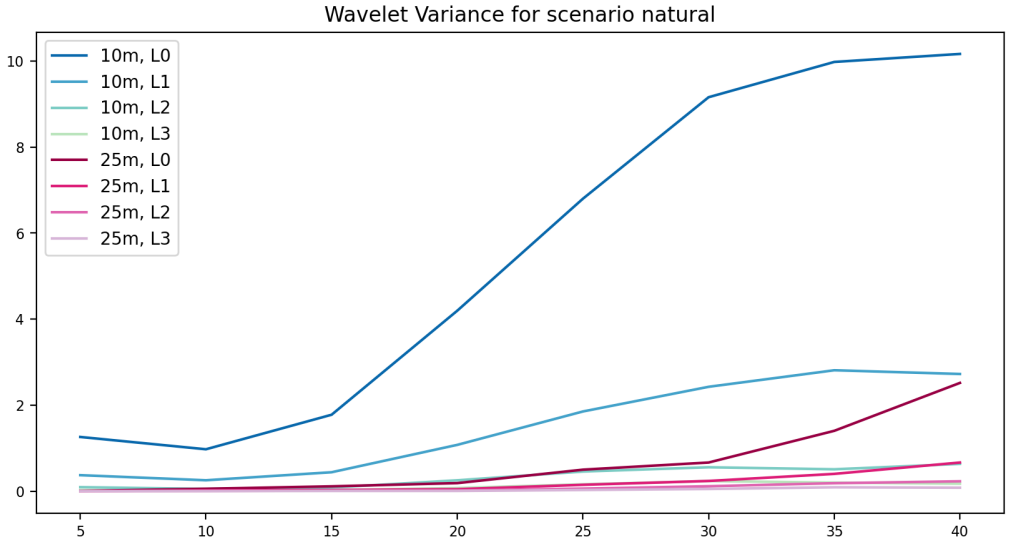


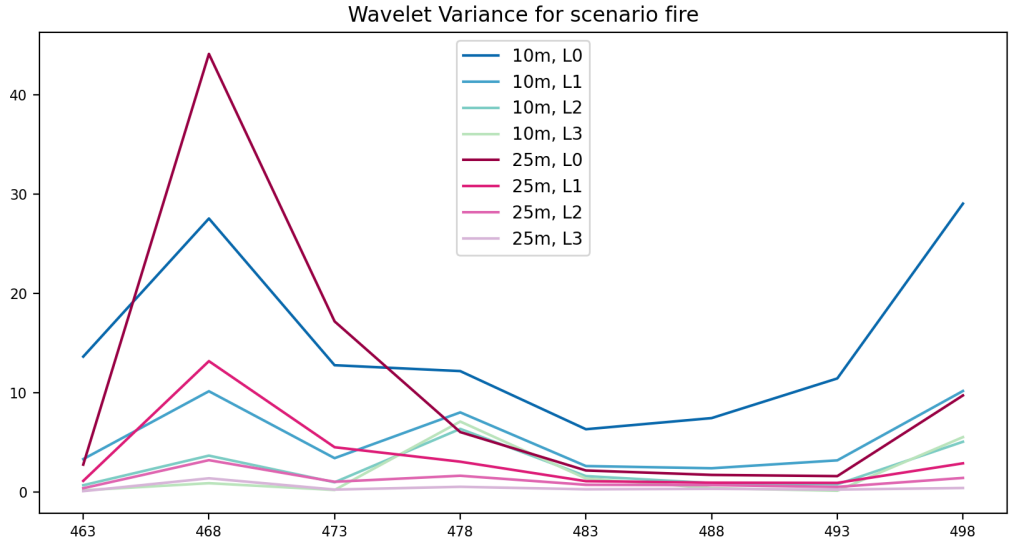


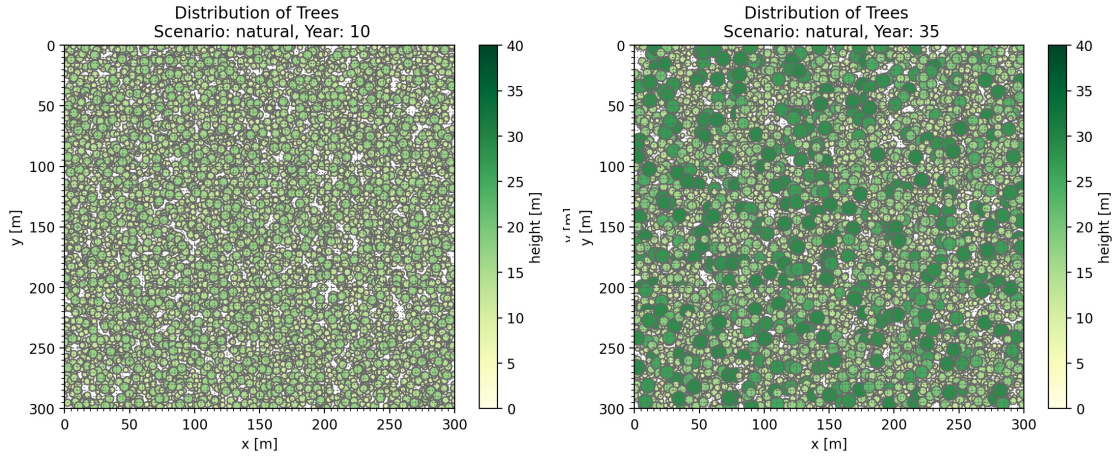
Wavelet statistics in FORMIND

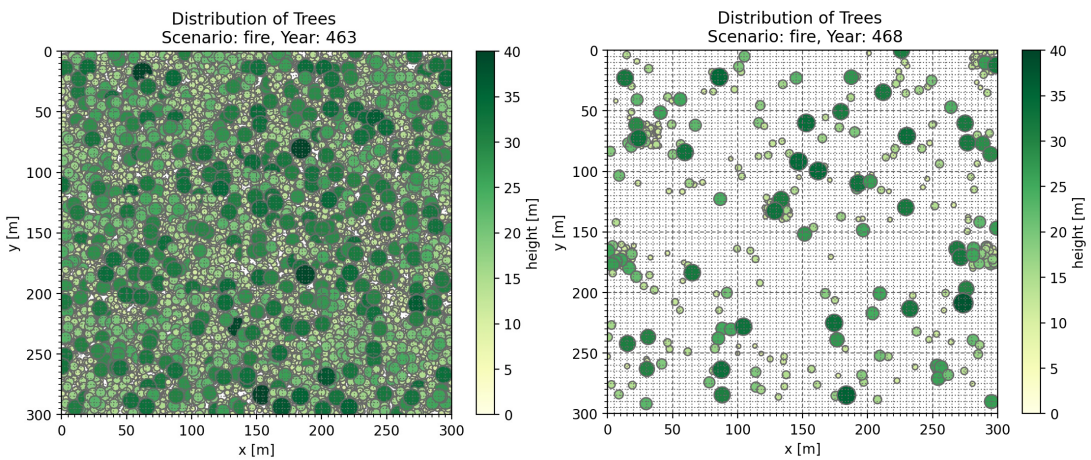




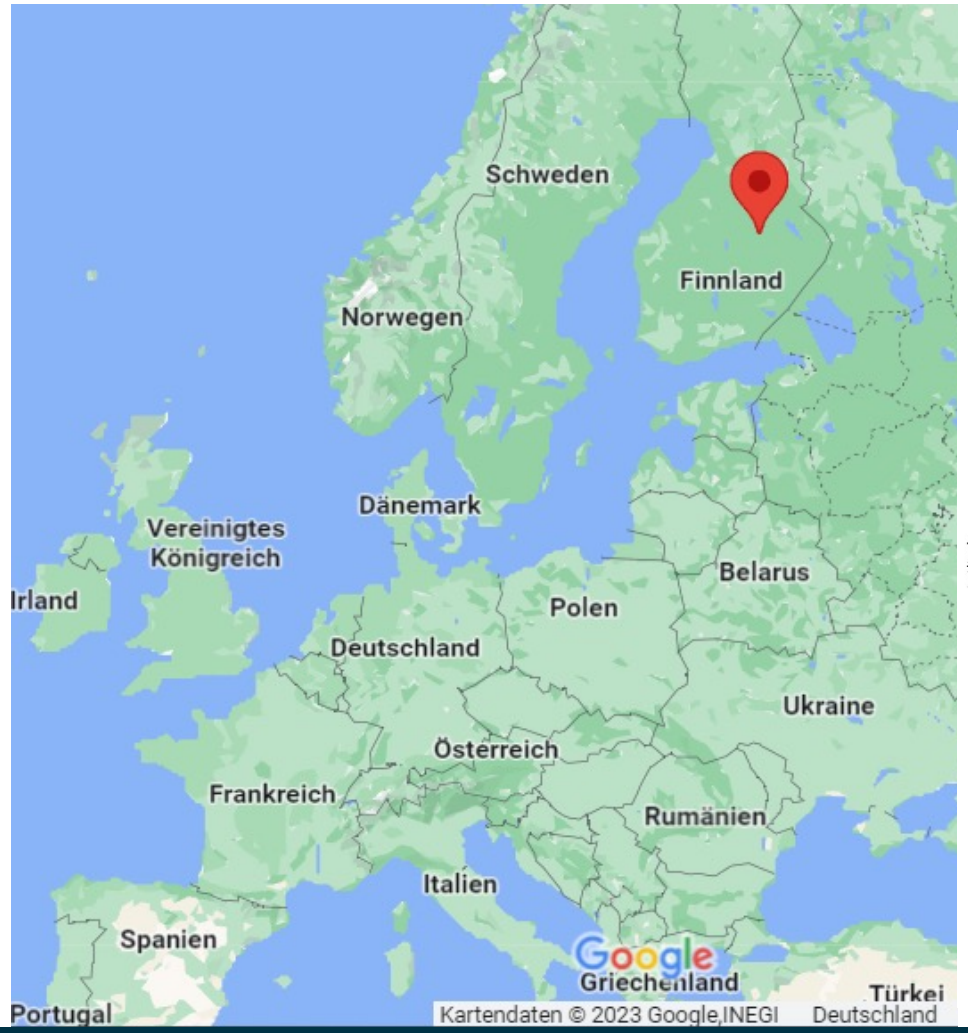


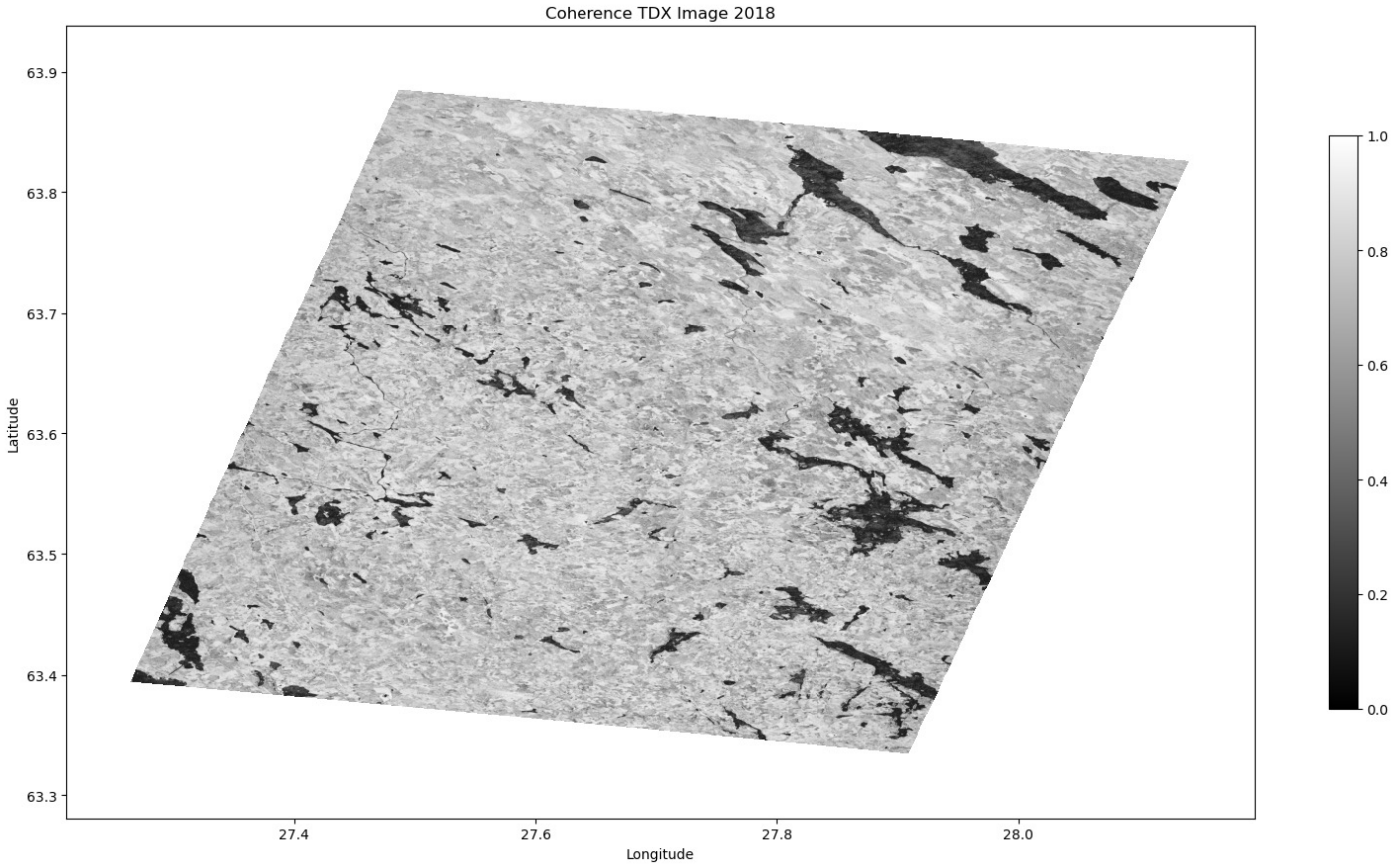






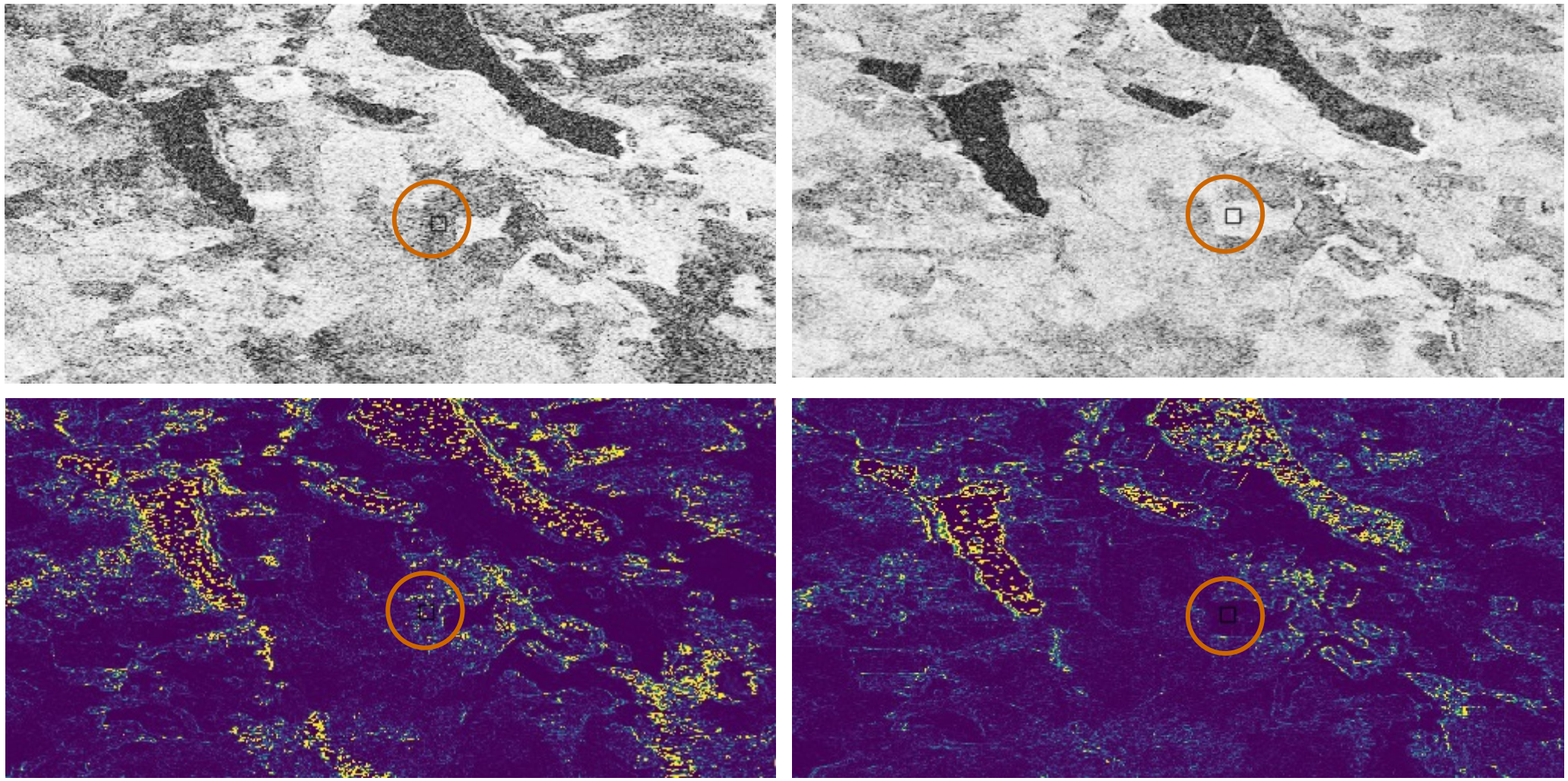
Wavelet statistics in TanDEM-X





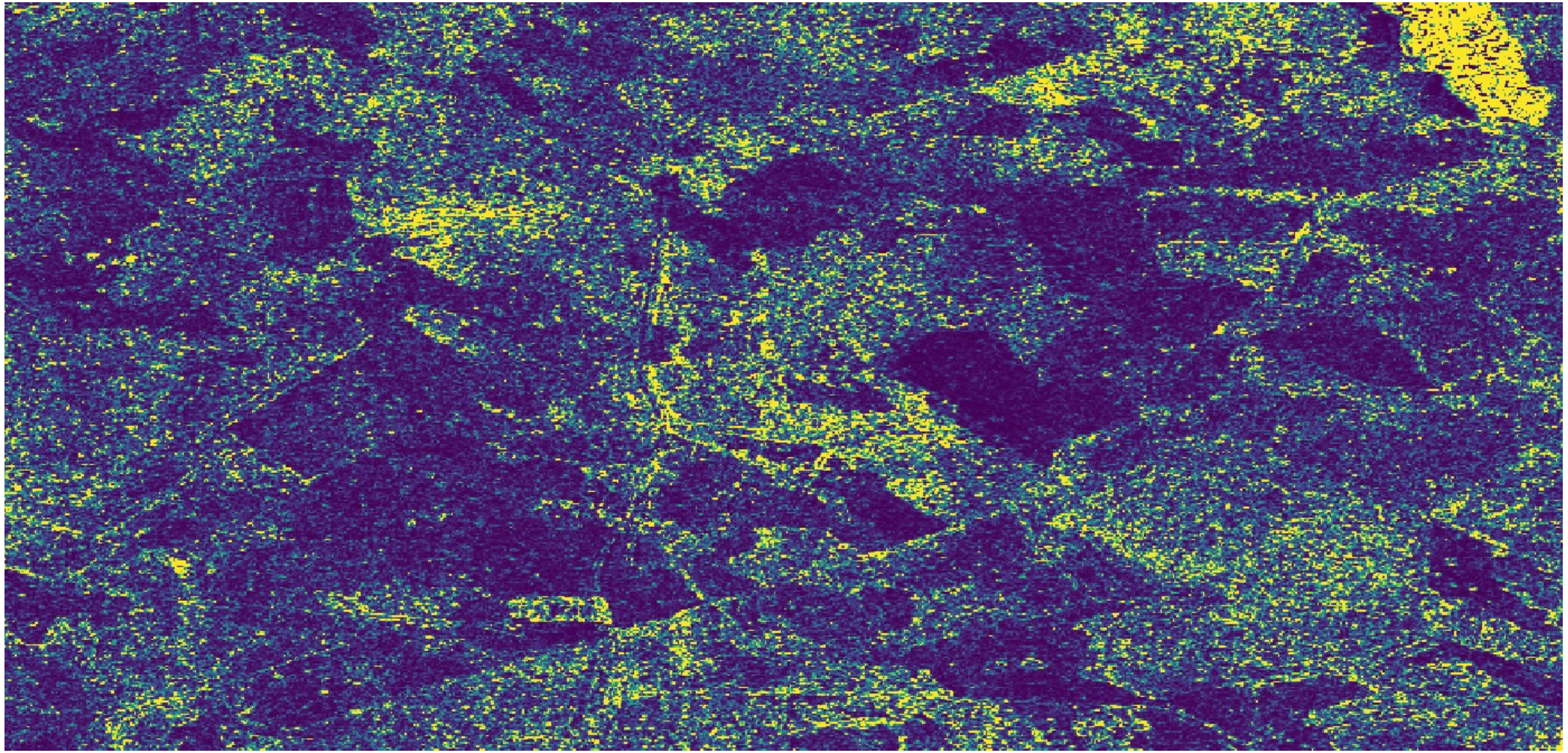
Test Site: Kuopio - Finland

Wavelet statistics in TanDEM-X



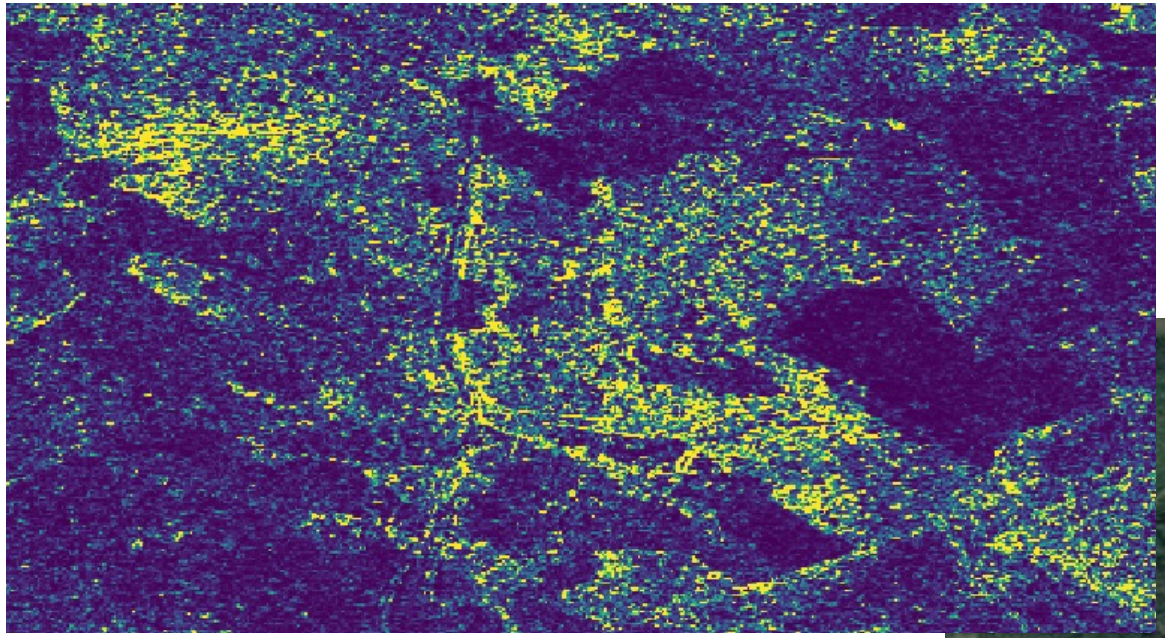
TanDEM-X Coherence and Wavelet Spectrum (L0) - 2012 and 2018 – Resolution: 20 m

Wavelet statistics in TanDEM-X



Wavelet Variance 2018, Resolution: 10 m

Wavelet statistics in TanDEM-X



Wavelet Variance 2018, Input Resolution: 10 m

Summary

- Forest (horizontal) structure changes at different spatial and temporal scales making its characterization a **multi-scale problem**.
- Significant forest structure change occurs already at small spatial scales and requires a high spatial resolution at “starting level”.
- TanDEM-X provides such forest structure sensitive data at high spatial resolutions.
- Wavelet analysis of TanDEM-X derived canopy height profiles allows the characterization and interpretation of the structural heterogeneity at different scales.
- The physical interpretation and the resolving of potential ambiguities is ongoing, supported by forest simulations.

CHARACTERIZING FOREST STRUCTURE CHANGE BY MEANS OF WAVELET STATISTICS

Lea Albrecht, Kostas Papathanassiou
German Aerospace Center (DLR), Microwaves and Radar Institute (DLR-HR)
R. Fischer, A. Huth
Helmholtz Centre for Environmental Research (UfZ)