

# Linking In Situ Data with Earth Observations

## CCI-Biomass

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# In situ activities

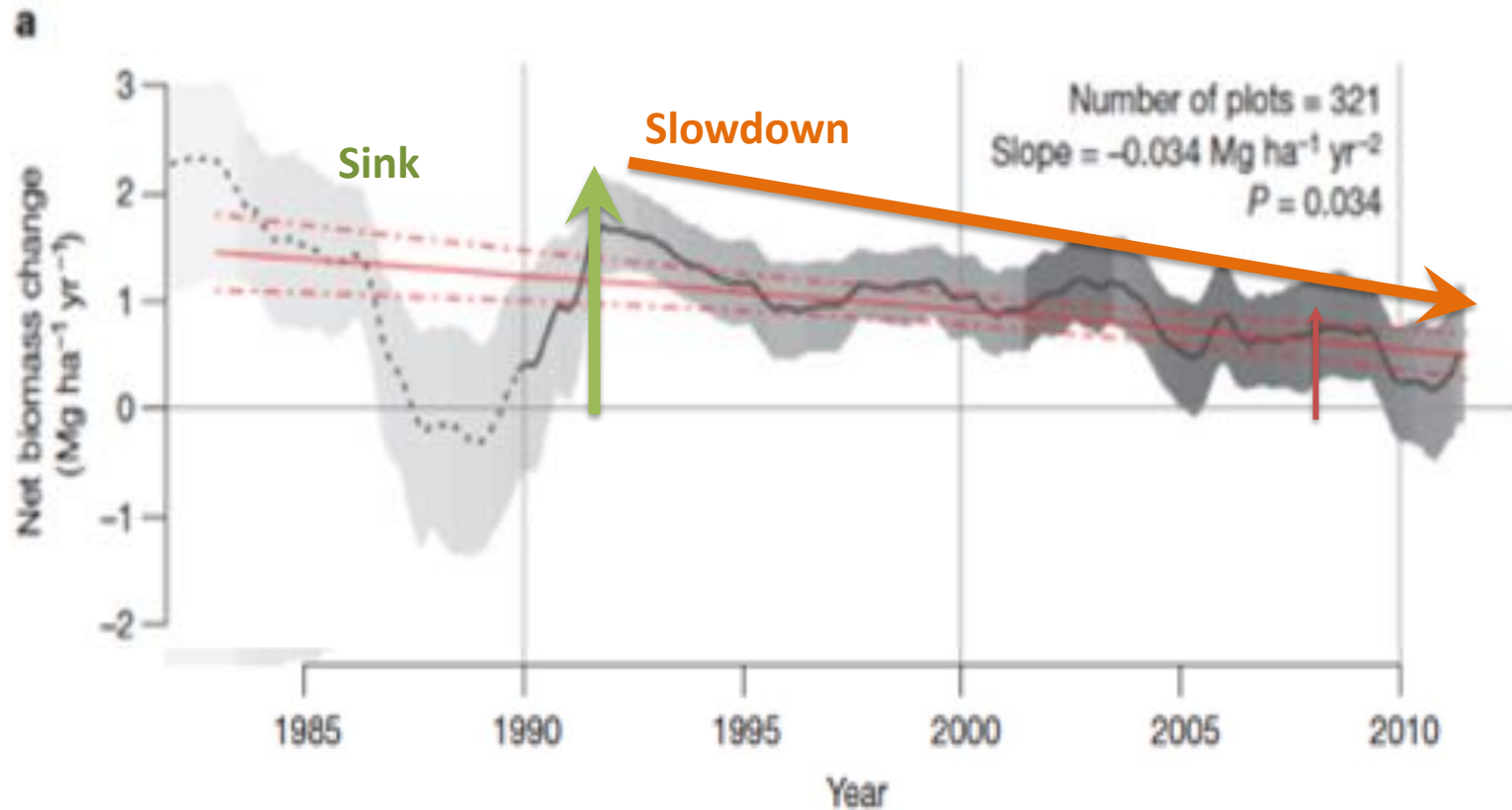
In situ data: understanding of the physical basis, algorithm training, validation data

There is more than DATA about in situ activities: **capacity building, user engagement**

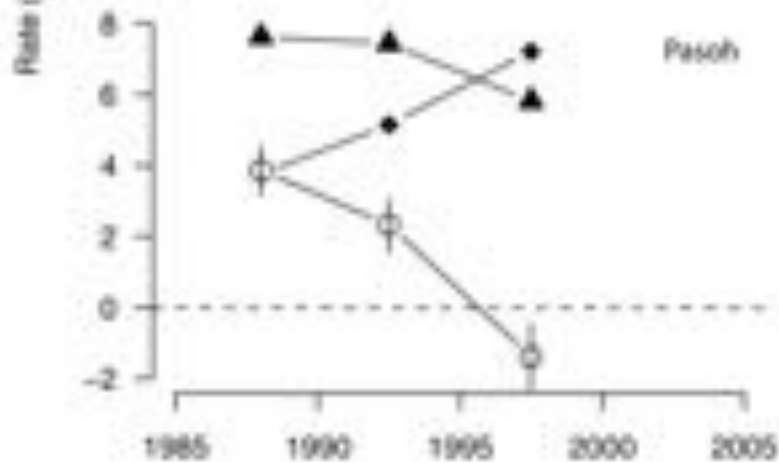
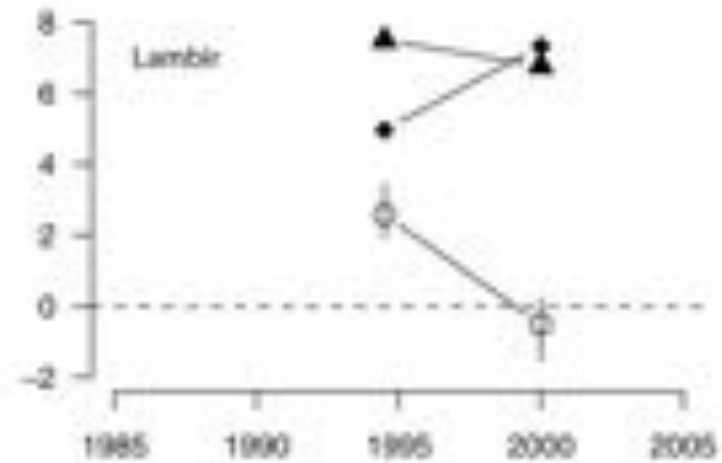
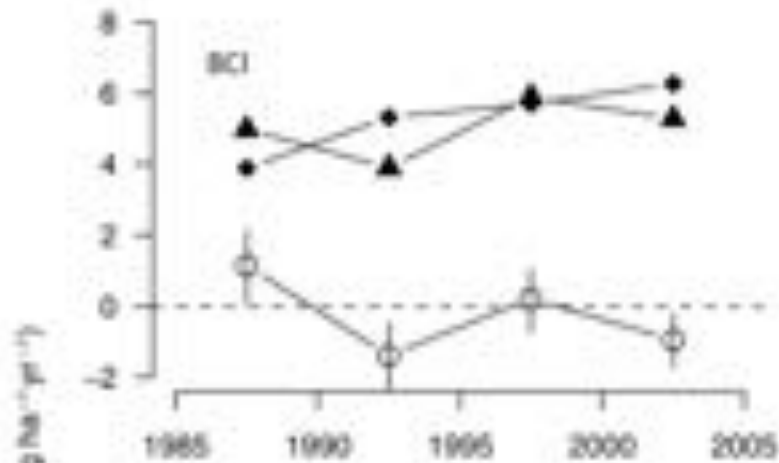
# Types of in-situ data

- Forest inventories (small non-permanent plots, large permanent plots, ...)
- Forest structure mapping (airborne lidar, TLS, DLS)
- Plant traits (reflectance, photosynthesis)
- Site covariates (soil moisture, wood dielectric constant, climate, land use history)

# Value of long-term data



# Value of long-term data



- ▲ Biomass gain
- ◆ Biomass loss
- Balance



# In situ remote sensing: TropiSCAT experiment



*TropiSCAT*

*Continuous  
B-band  
sensing of  
the forest  
from a tower*

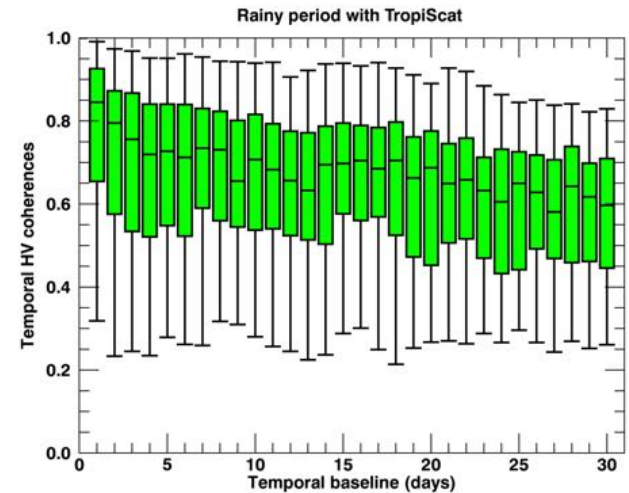
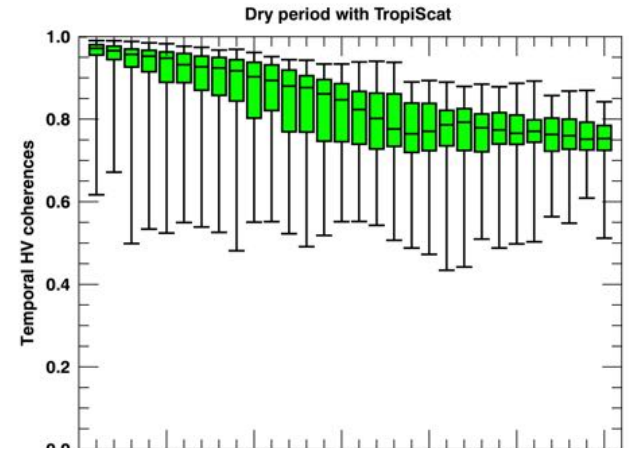


*(Paracou,  
French  
Guiana)*

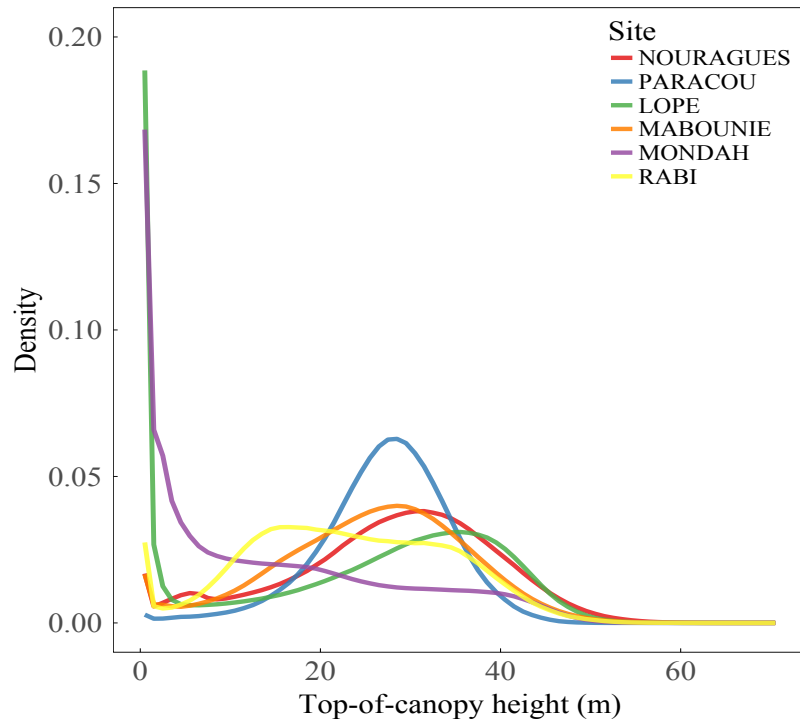
Koleck et al.



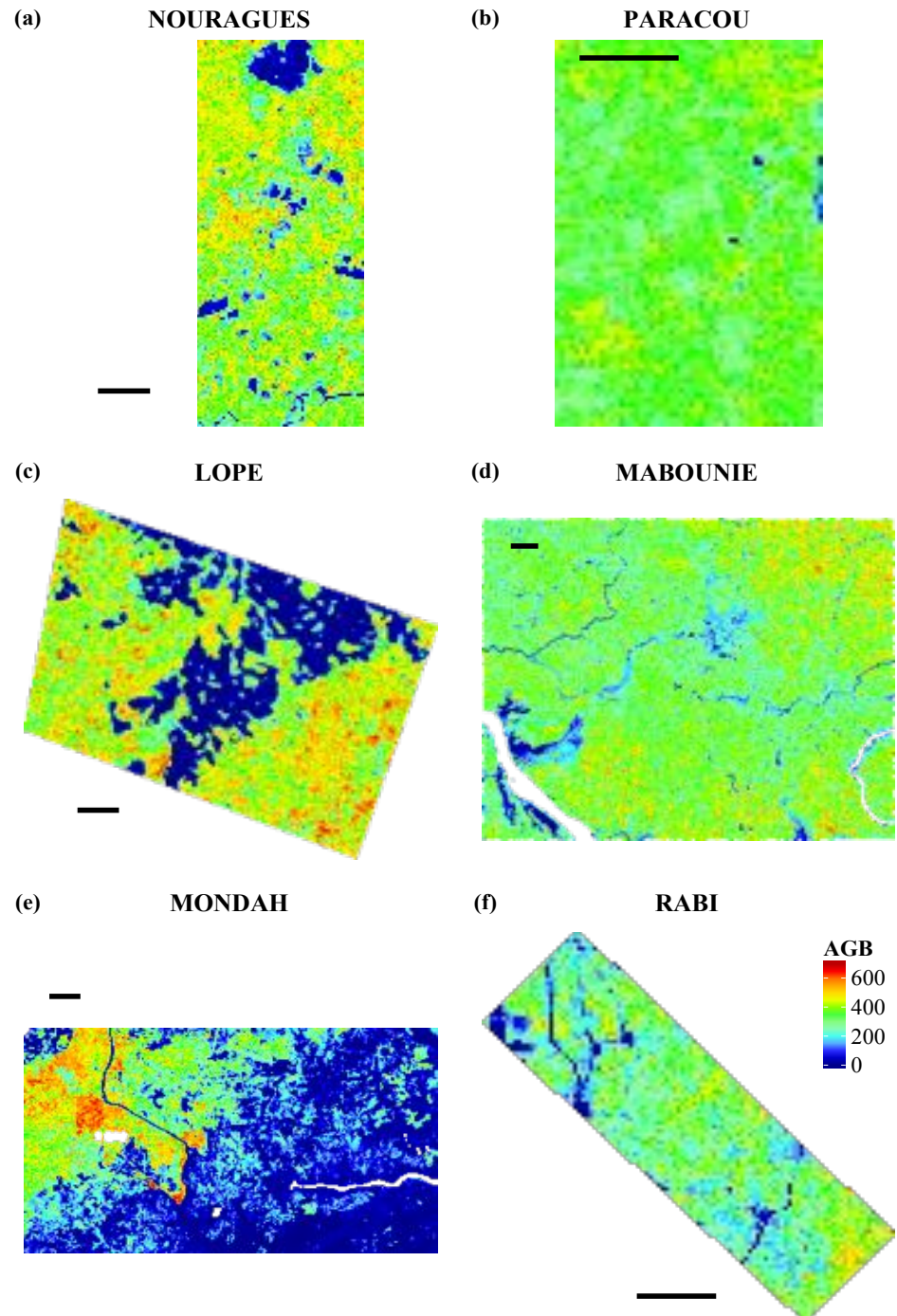
*Temporal decorrelation*



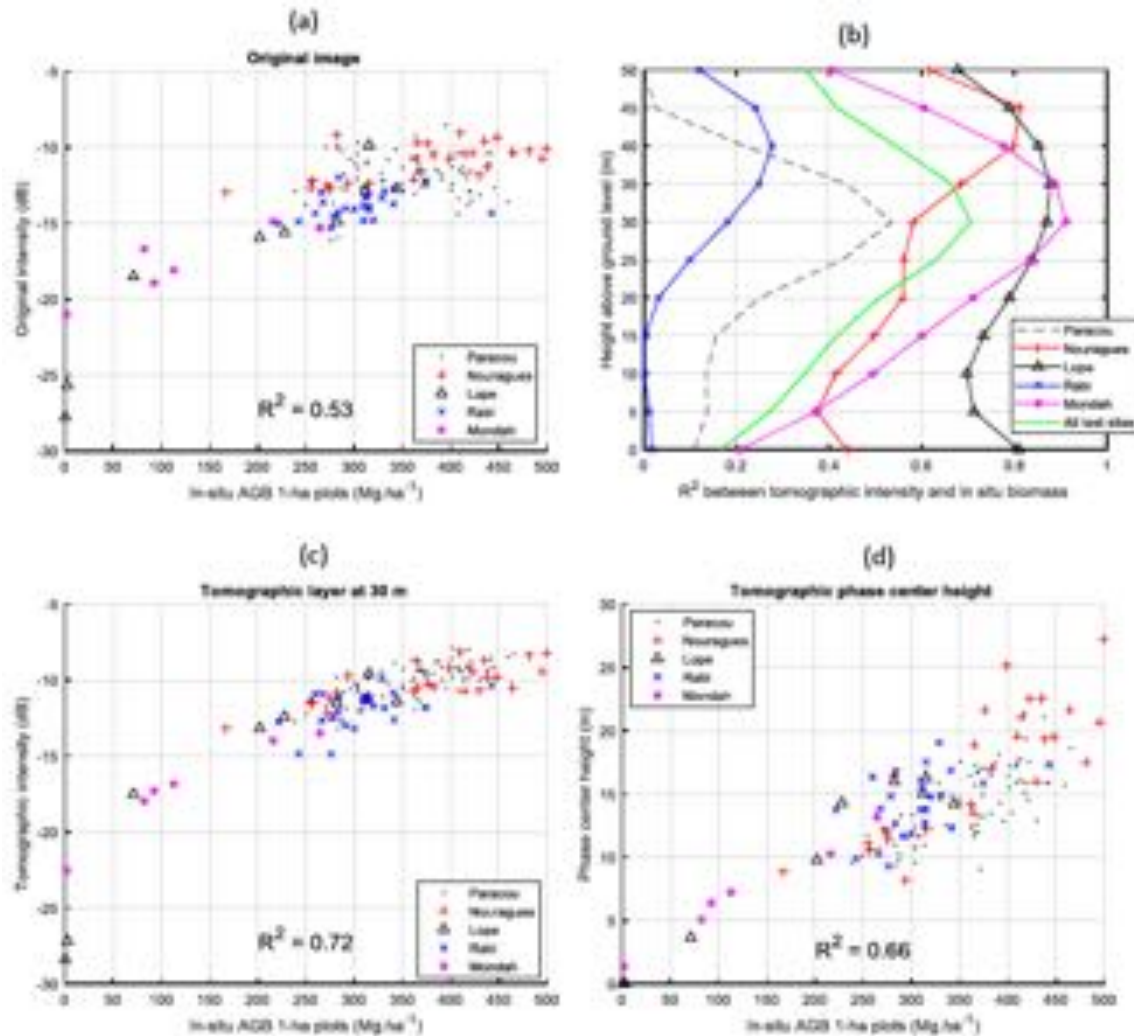
# AfriSAR and TropiSAR in situ biomass maps



Labrière et al. IEEE (2018)



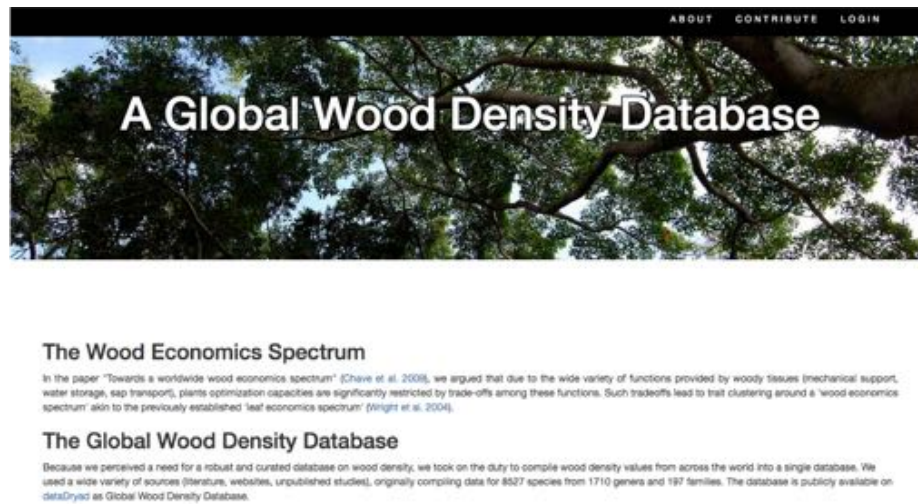
# Application for tomoSAR training





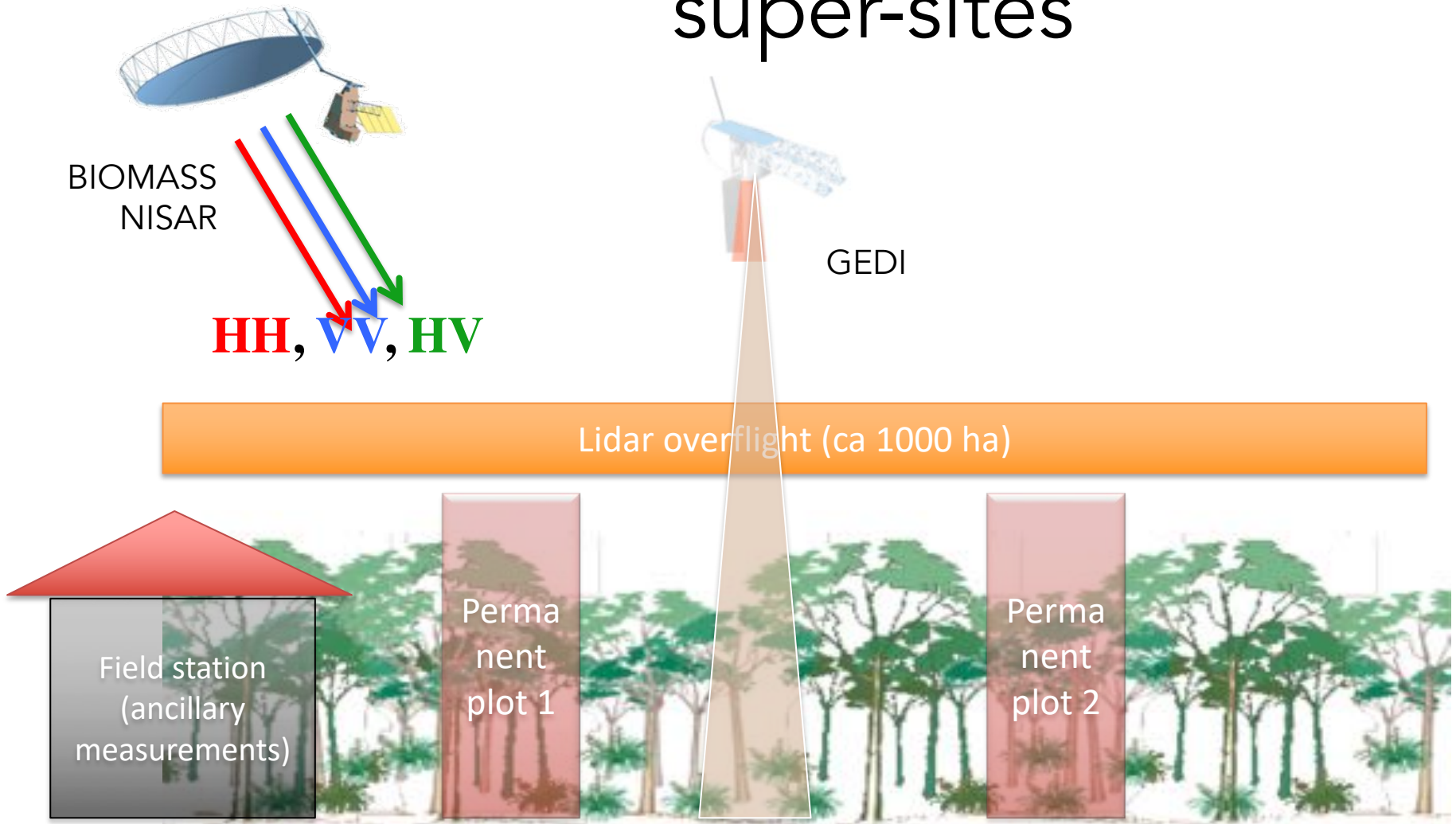
# Improving existing maps

- Improving biomass expansion factors (BEF)
- ... or better: inference based on total volume rather than GSV x BEF
- Global wood density maps



<http://wooddensity.univ-tlse3.fr/>

# Learning from experience: super-sites



# Super-site specifications

Long-term (repeated) monitoring of:

1. at least 10 1-ha already established **permanent** sampling plots. Plots should be established and monitored according the best tropical forestry standards (Rainfor or ForestGEO protocols)
2. Aerial LiDAR scanning (ALS) over at least 1000 ha, with minimal quality requirements
3. terrestrial LiDAR scanning (TLS) at (at least) two of the permanent plots, and if possible all 10 plots
4. weather/soil moisture measurements

These sites need to operate continuously (plot recensus, ALS resurvey) from 2020 to 2030

# Forest Observation System



FORESTOBSERVATIONSYSTEM



Dmitry Schepaschenko, Jerome Chave,  
Christoph Perger, Oliver L. Phillips, Simon L.  
Lewis, Stuart J Davies, Maxime Réjou-  
Méchain, Plinio Sist, Keryn Paul, Sassan  
Saatchi, Klaus Scipal



# Platform for tropical biomass estimation from plots



FORESTOBSERVATIONSYSTEM

Bayesian inference for error propagation  
R package (free, fast, verifiable)



## Methods in Ecology and Evolution



Methods in Ecology and Evolution 2017, 8, 1163–1167

doi: 10.1111/2041-210X.12753

### APPLICATION

## BIOMASS: an R package for estimating above-ground biomass and its uncertainty in tropical forests

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# Data : intellectual property



1. In situ data are expensive: maintaining the network would cost about **25 M€** to fully fund 50 supersites for 2020-2030
2. Free access to in situ data will be only possible if long-term support is granted
3. Inviting plot Pis to coauthor papers is **necessary but not sufficient: they should be empowered as collaborators**
4. In situ activities are an integral component of country capacity building

# Thank you



CENTRE NATIONAL D'ÉTUDES SPATIALES



European Space Agency  
Agence spatiale européenne

