

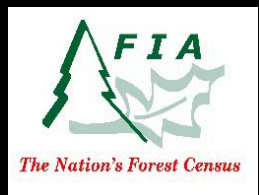


OBI-WAN
Forest Carbon Reporting

OBI-WAN

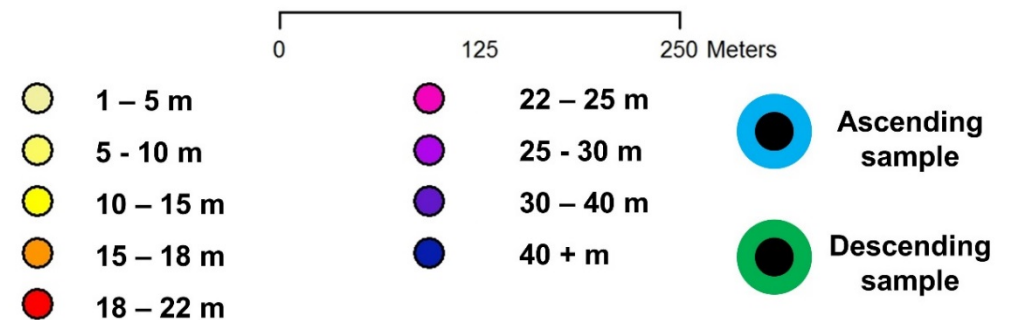
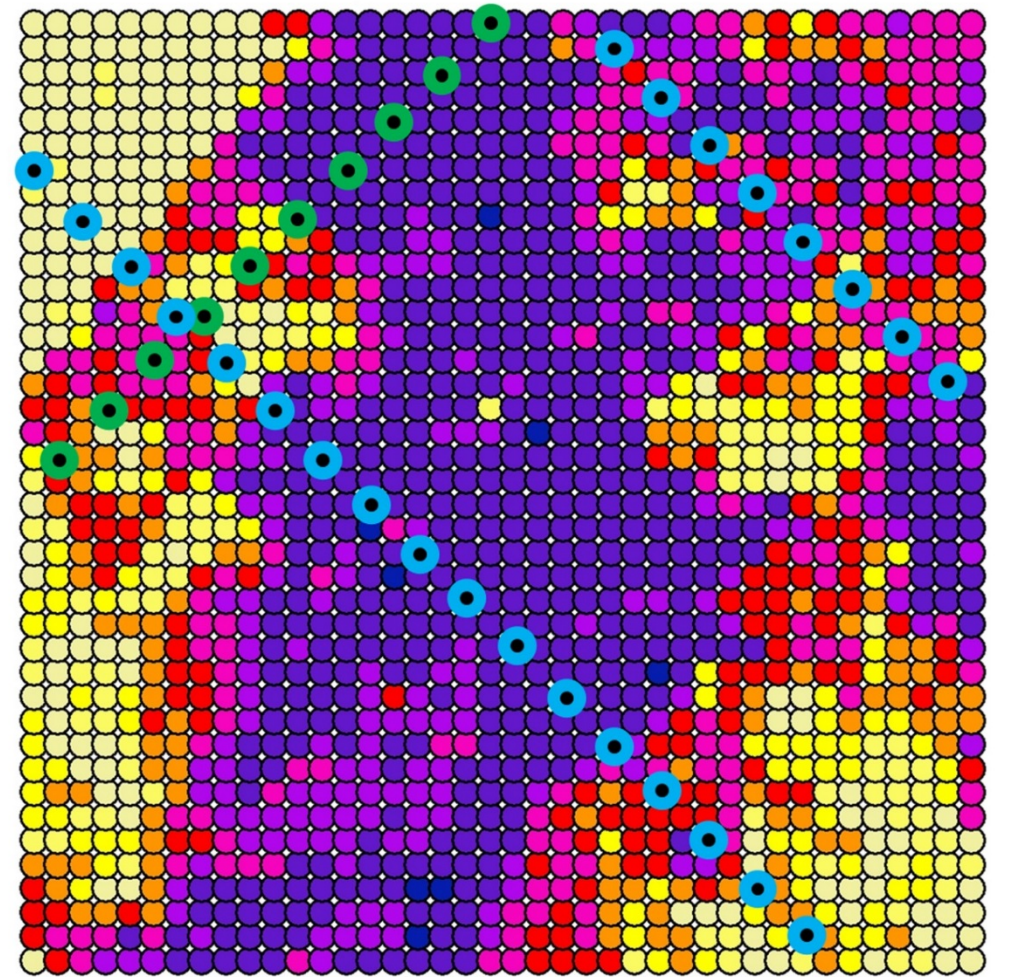
Online Biomass Inference using
Waveforms And iNventory

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Göran Ståhl, Svetlana Saarela,
Zhiqiang Yang, Sören Holm,
Ralph Dubayah, GEDI Science
Definition Team

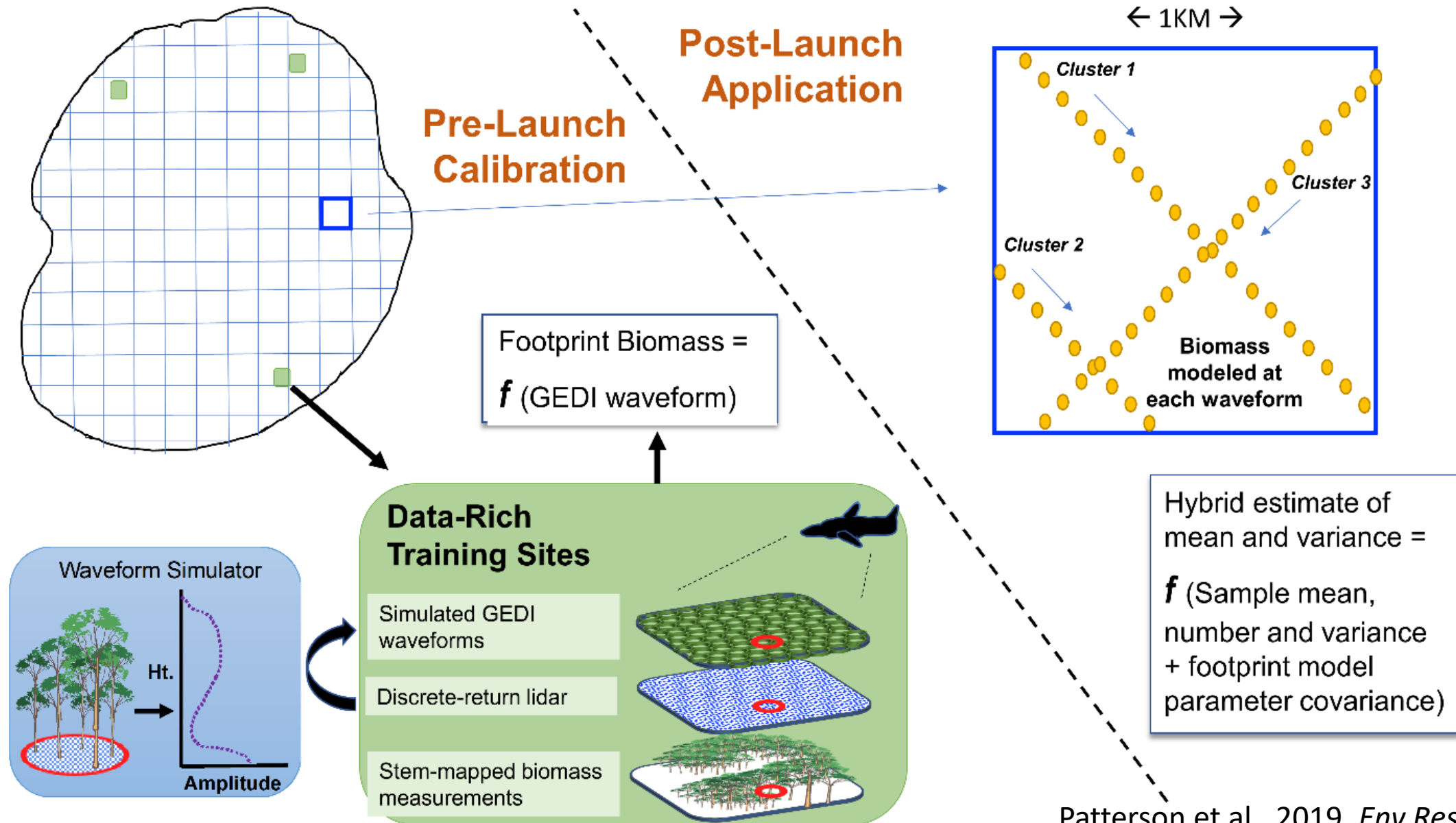




Whether we care about a 1-km grid cell or a national forest, we need a strategy for turning spatially discontinuous height measurements into [population estimates](#) of mean aboveground biomass

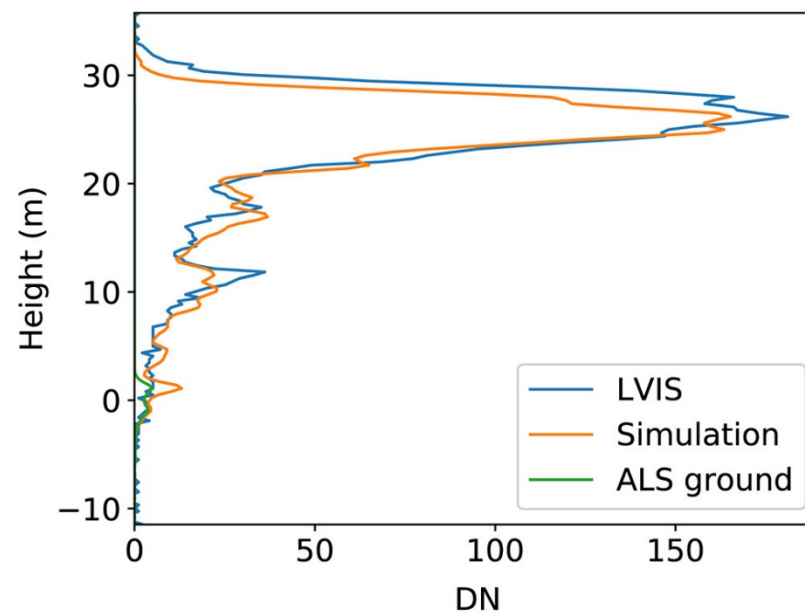


Hybrid inference: when we have at least 2 GEDI ground track in a 1km cell

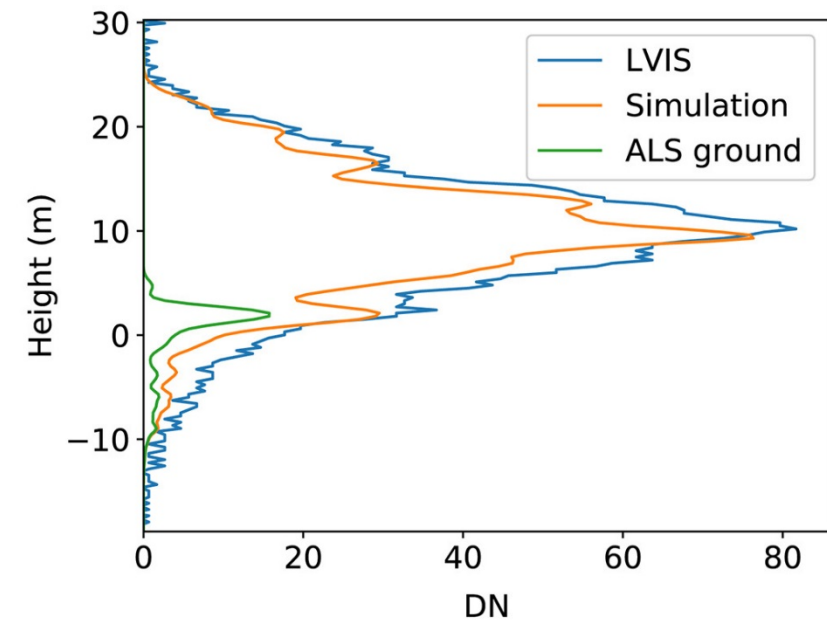


The GEDI Waveform Simulator has been published

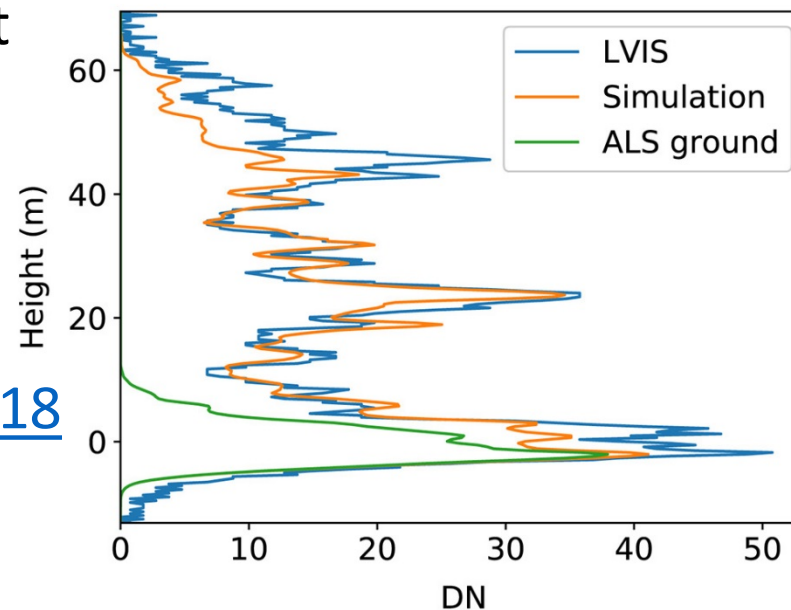
Hancock, S., Armston, J., Hofton, M., Sun, X., Tang, H., Duncanson, L., et al. (2019). The GEDI simulator: A large-footprint waveform lidar simulator for calibration and validation of spaceborne missions. *Earth and Space Science*, 6, 294–310. <https://doi.org/10.1029/2018EA000506>



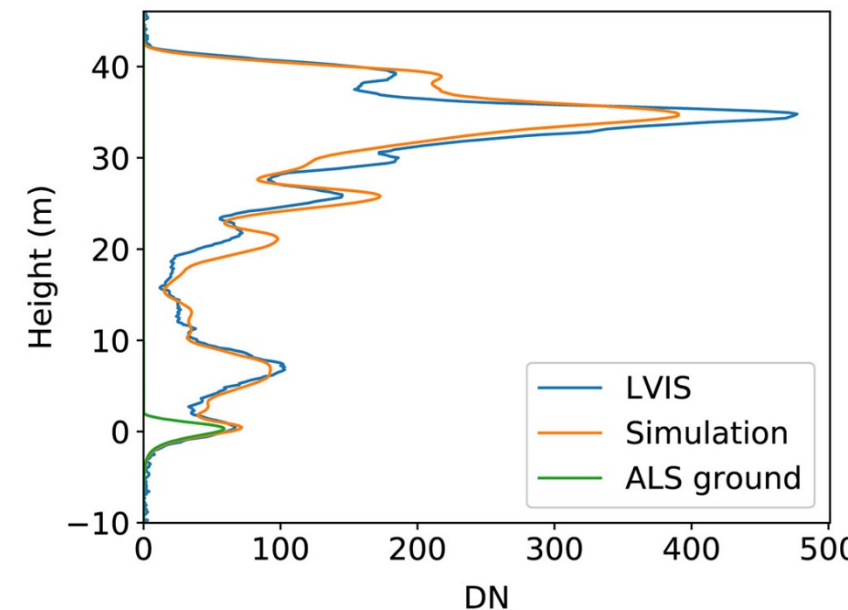
(a) La Selva



(b) Hubbard Brook

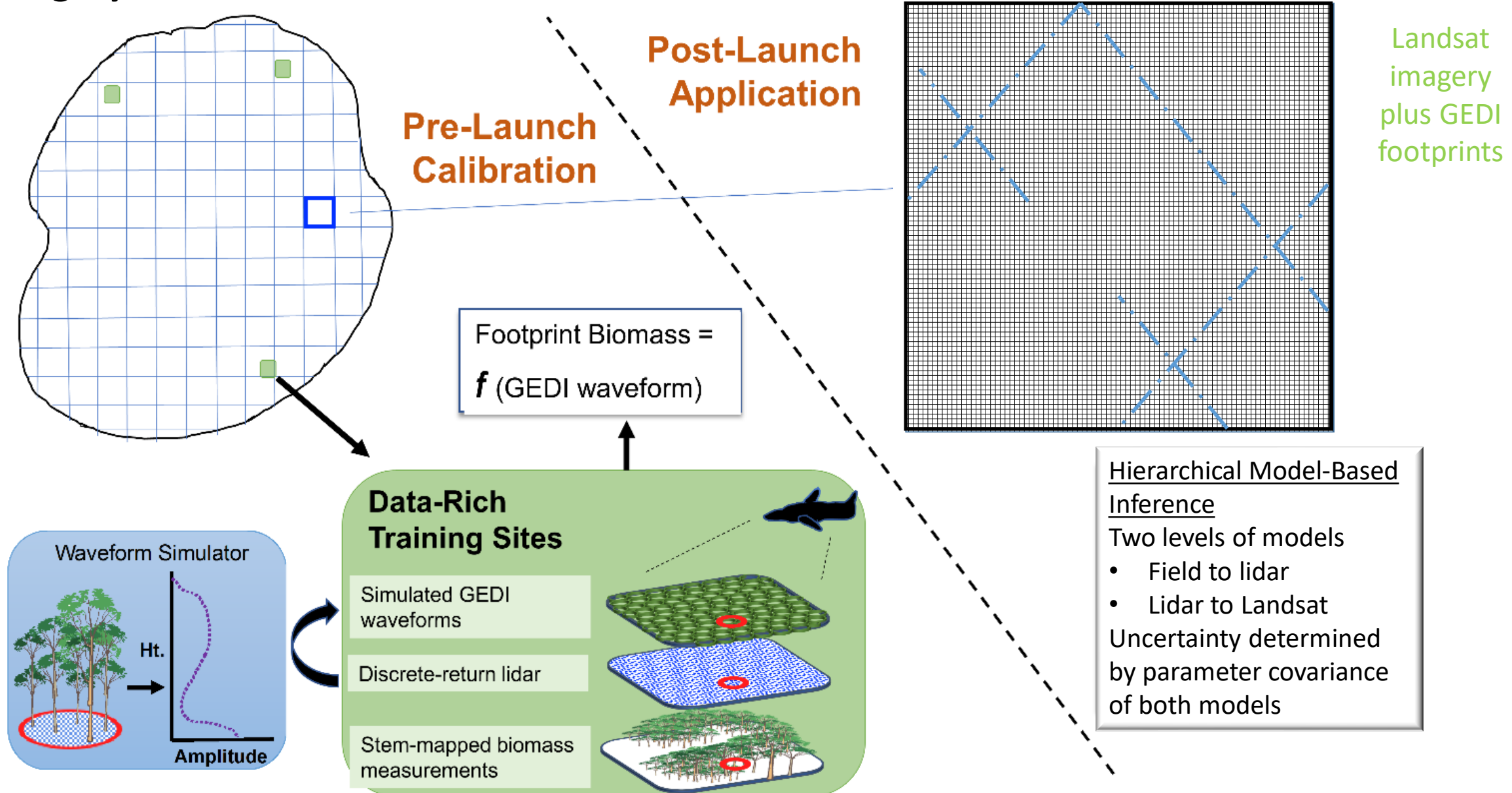


(c) Sierra Nevada



(d) Lope

Generalized Hierarchical Model-Based Inference: uses ancillary data from wall-to-wall imagery



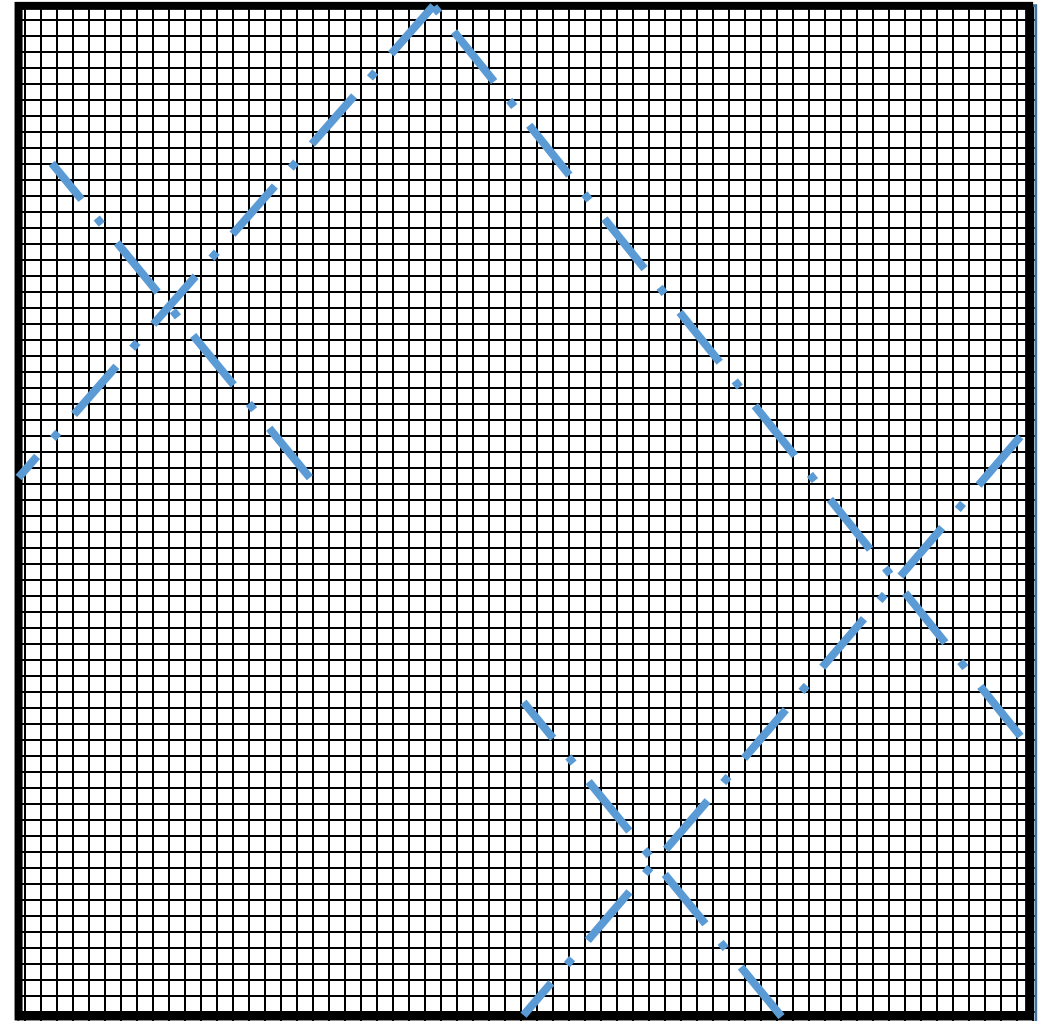
Supplementing GEDI with wall-to-wall imagery will allow us to make estimates for areas obscured by clouds and may reduce our standard errors

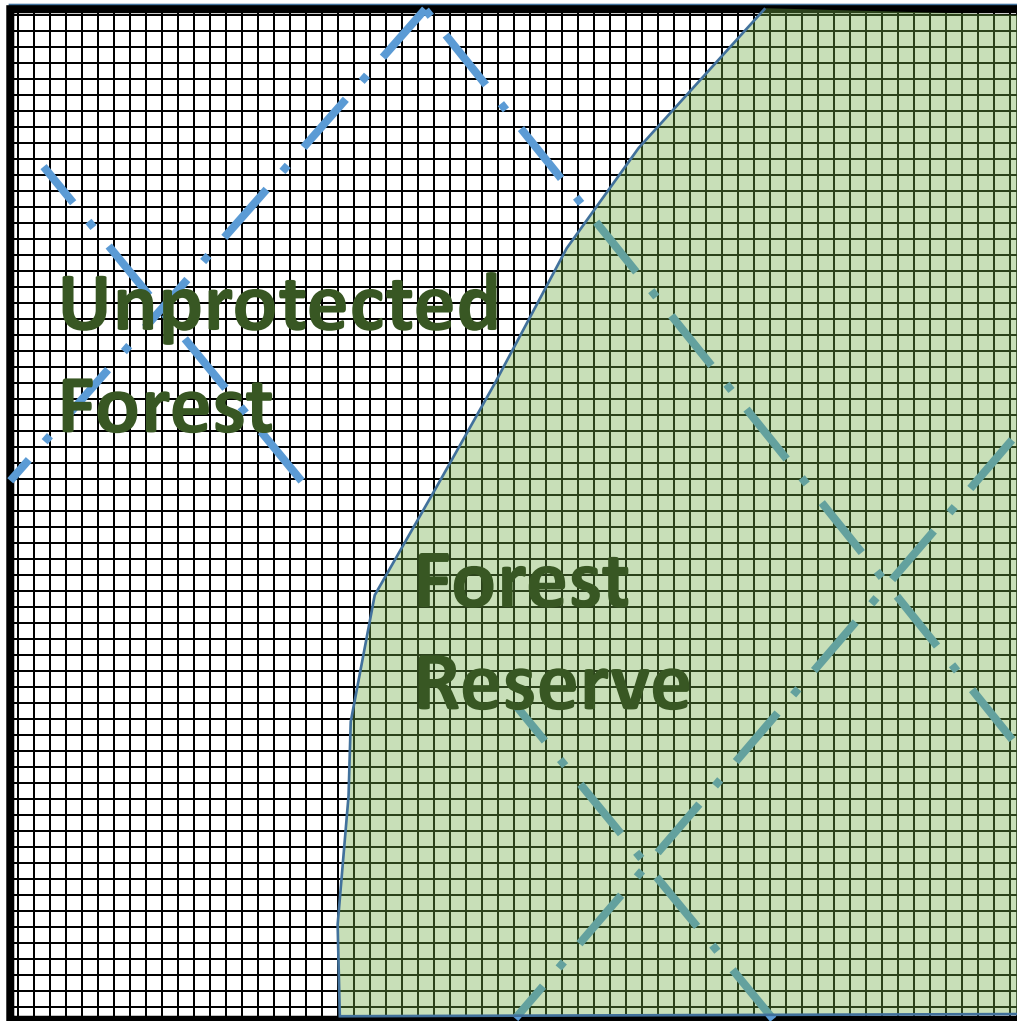
Hierarchical Model-Based Inference

- **Model biomass: ground → GEDI
→ Local Landsat (or NISAR,
Sentinel or other sensors)**
- **Account for multiple levels of
model uncertainty**
- **Add up the Landsat-scale
predictions**

Saarela et al. (2016) *Annals of Forest Science*

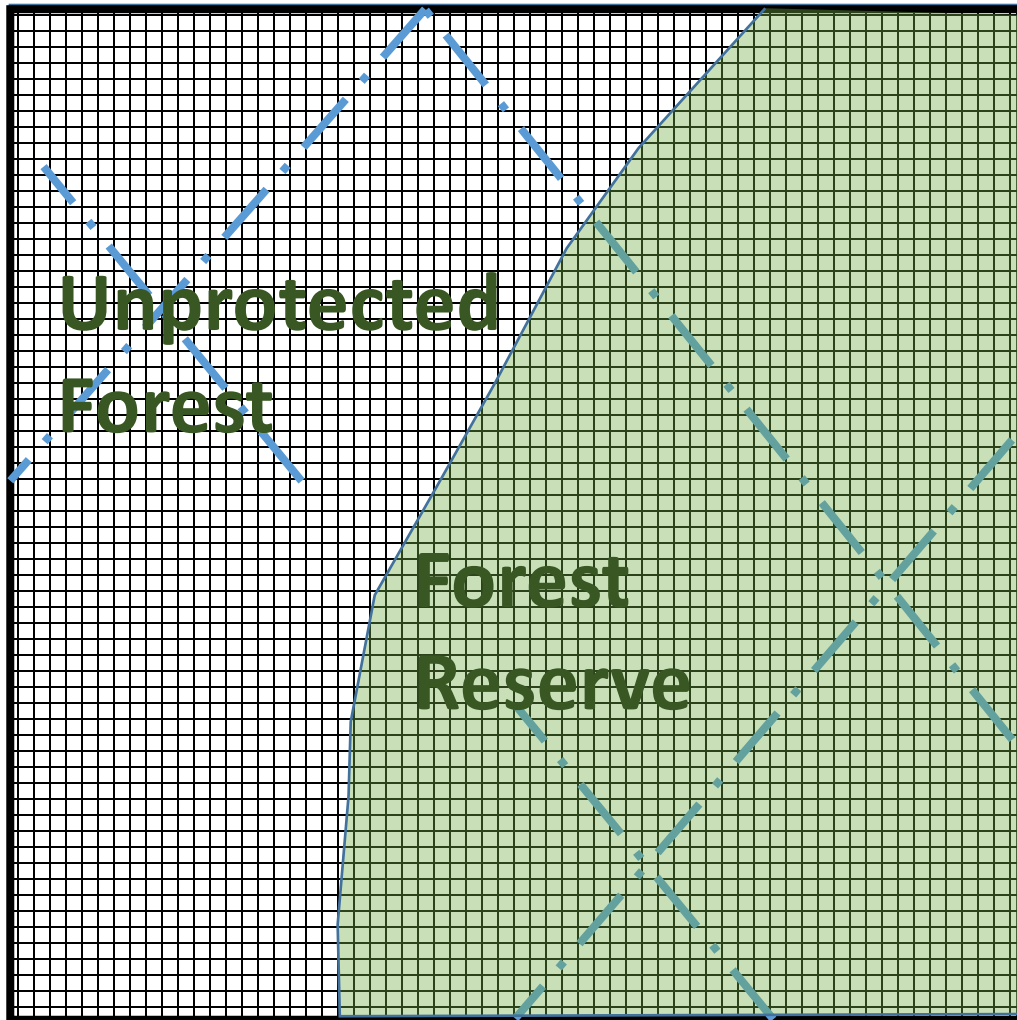
Saarela et al. (2018) *Remote Sensing*



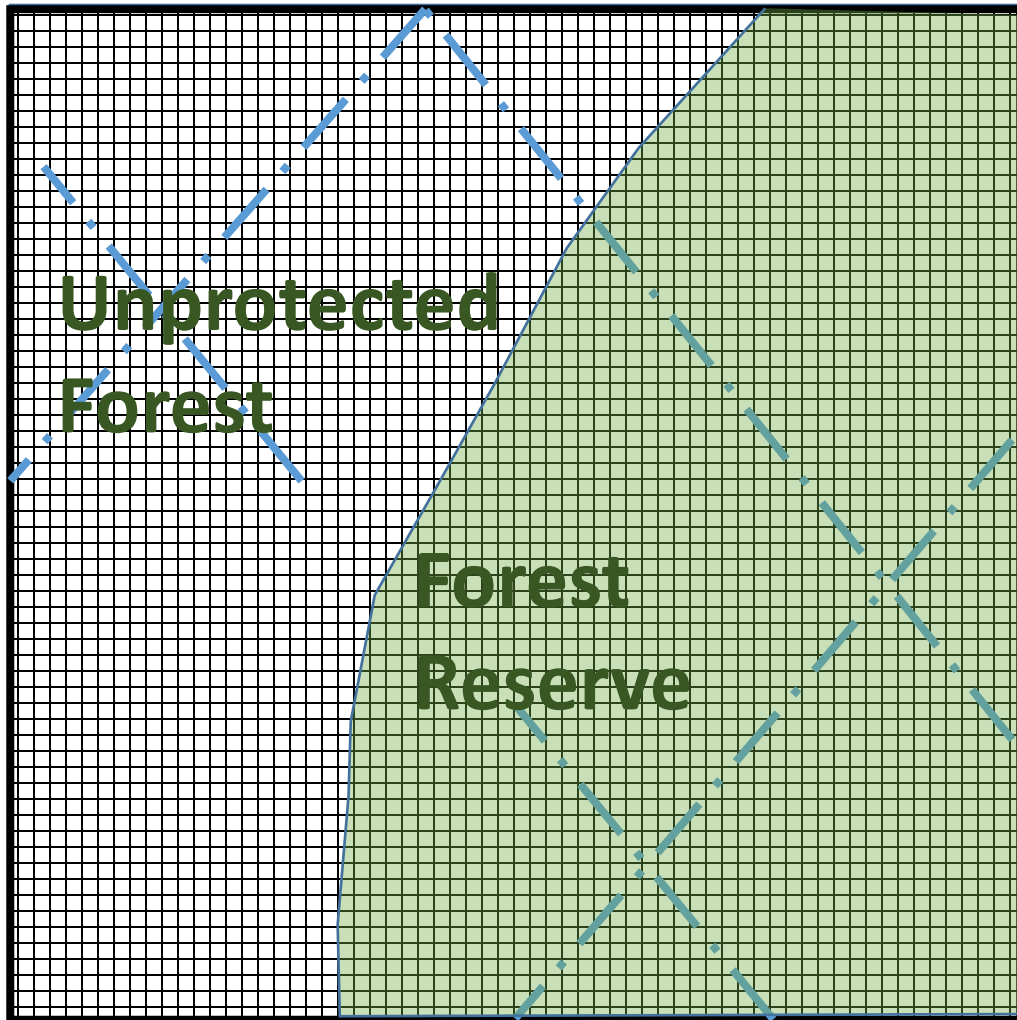


There is no reason hierarchical model-based inference should be limited to grid cells

OBI-WAN



1. User inputs shapefile to a Google Earth Engine app (200-hectare minimum)
2. OBI-WAN accesses GEDI's plot/model/lidar database, supplemented with Landsat archive stored on Google Earth Engine
3. Uncertainty is tracked through hierarchical model-based inference
4. Customized forest biomass report is generated, including estimates of mean biomass, standard error of the mean, and thorough documentation



Potential applications of OBI-WAN include reporting carbon stocks for:

- Forest reserves
- Individual companies
- Municipalities from villages to countries

For the Forest Service, OBI-WAN might fill a need for carbon density information not met by FIA at the watershed level (via the Watershed Condition Classification effort) or district scale (for Planning Rule assessments)

Estimates of forest carbon will be available through OBI-WAN starting in mid-2020

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*OBI-WAN is a NASA CMS project, and is
also supported by the GEDI Science
Definition Team*

