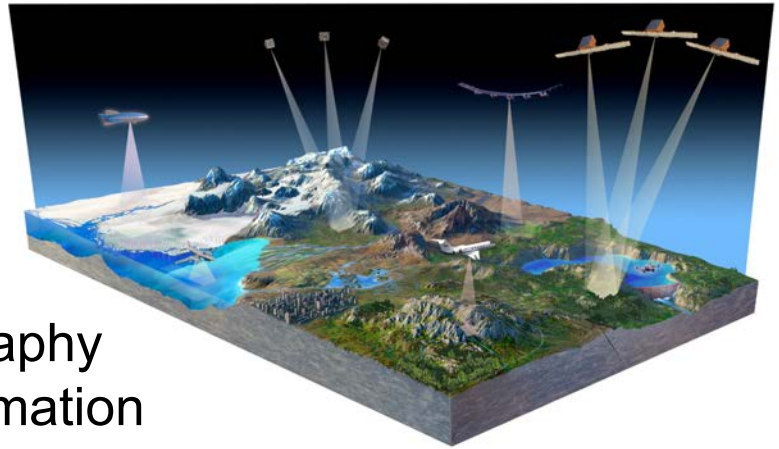
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California



Multi-Sensor Multi-platform Surface Topography and Vegetation Structure Data Fusion Information System (STV-FIS)

PI: Sassan Saatchi (JPL, 329)

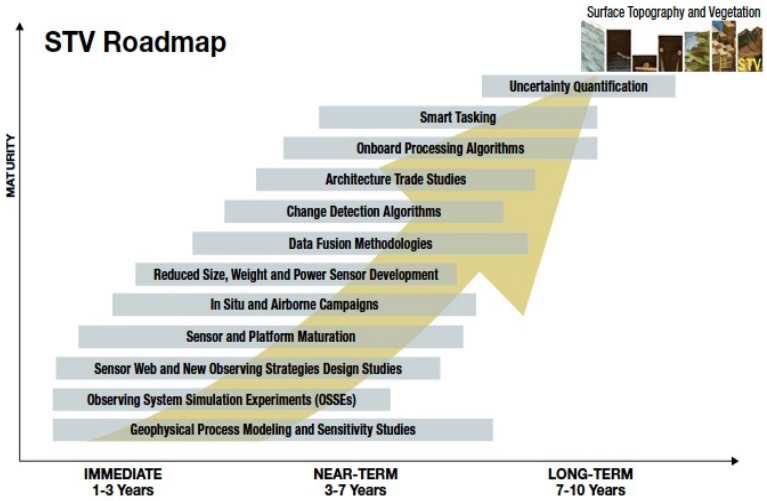
Co-I: Yunling Lou (JPL, 334), Michael Denbina (JPL, 334), Richard Chen (JPL, 334), Jessie Duan (JPL, 334), Sermsak Jaruwatanadilok (JPL, 334), Bryan Stiles (JPL, 334), Thomas Huang (JPL, 398), George Chang (JPL, 398), Marjorie Lucas (JPL, 398), Nga Chung (JPL, 398),+ Postdoc

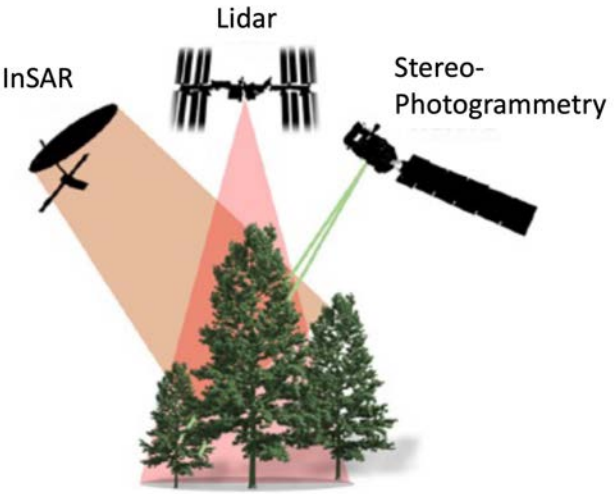
External Co-I: Wenge Ni_Meister (City University of NY)+Student

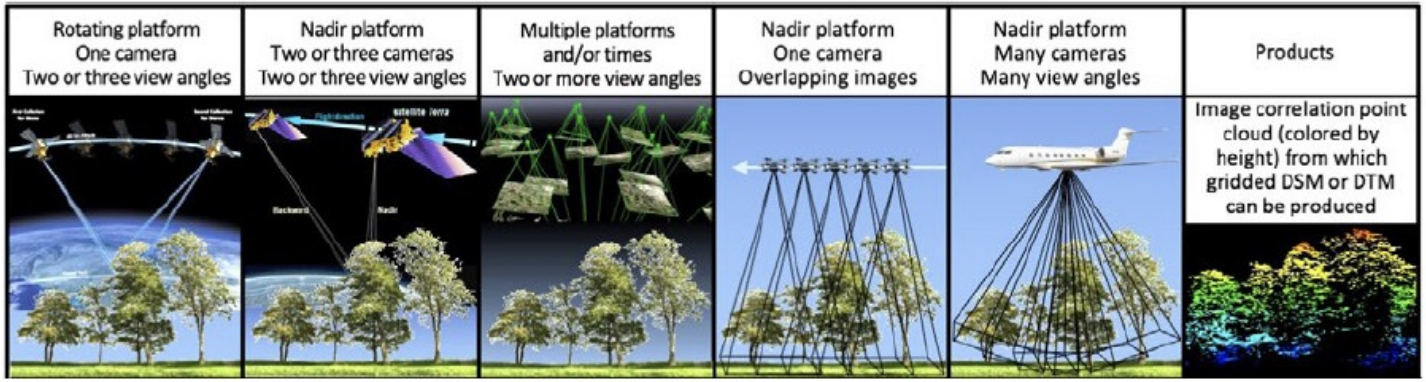
Type of Observing Platform
Radar and Lidar
Science Topic Focus
Vegetation Structure and Topograpgy

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

STV Measurements



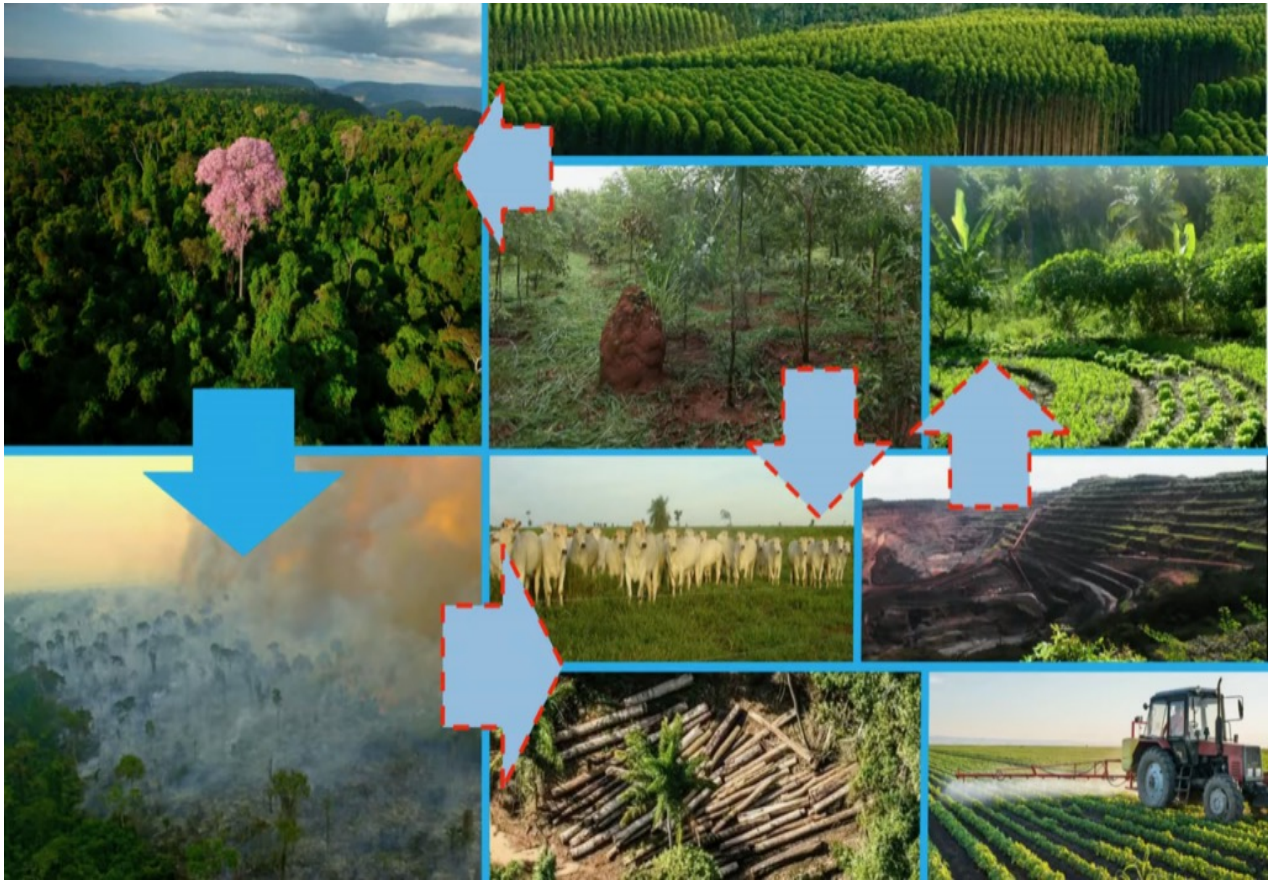


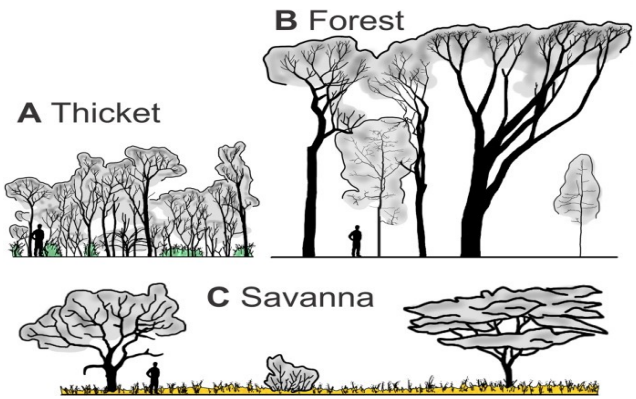


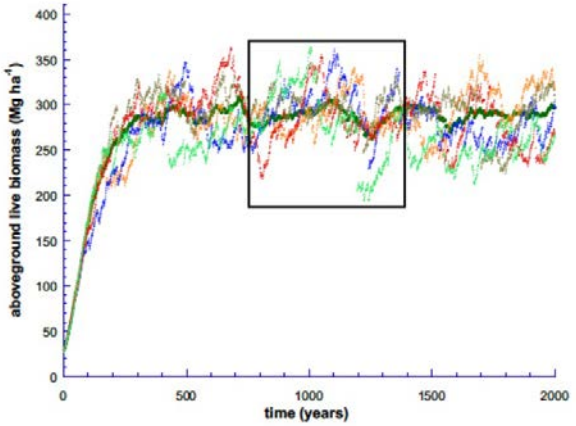
National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Science of Vegetation

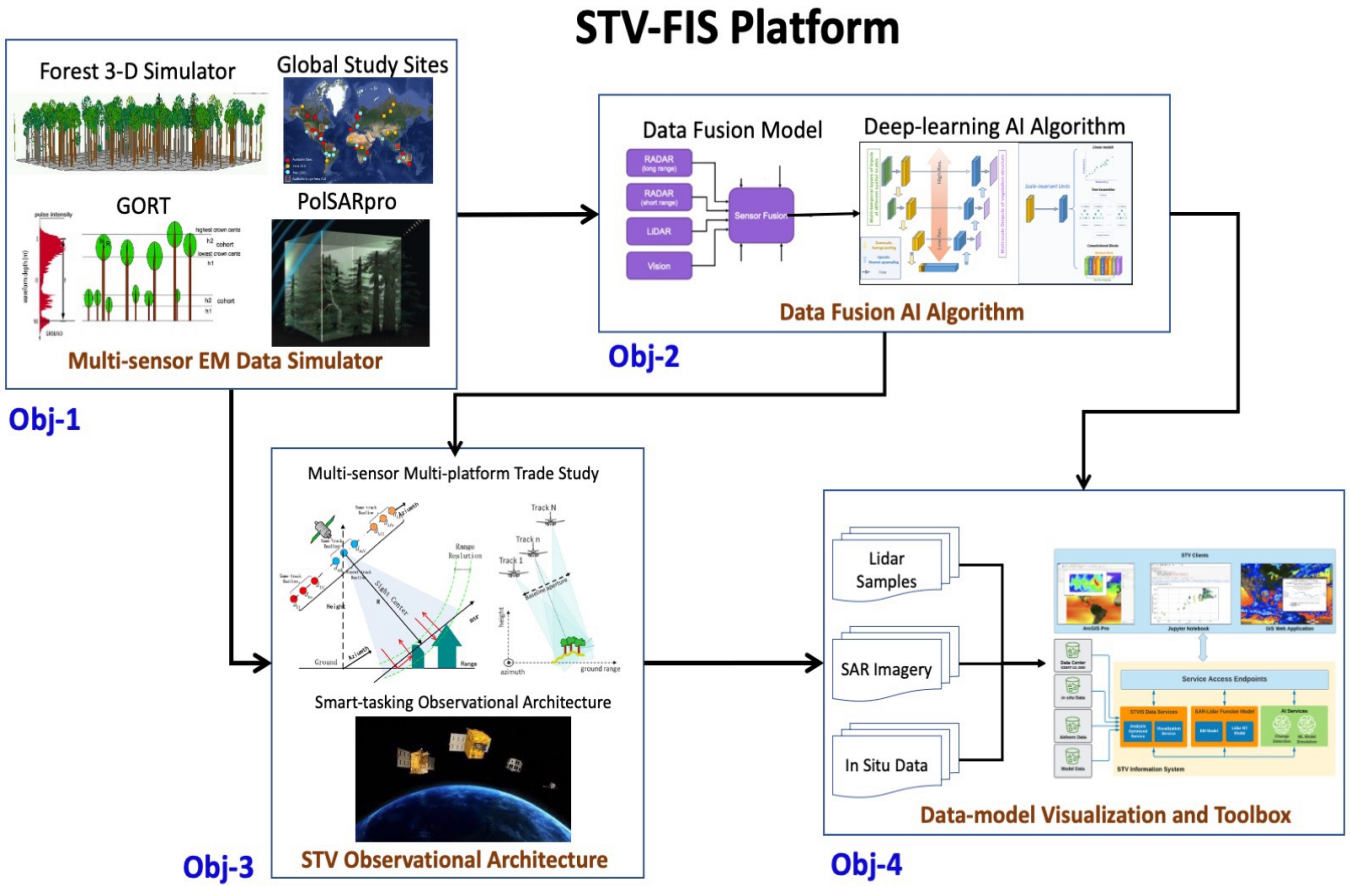






National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Graphical Project Summary



- *Obj-1. Develop a multi-sensor (Radar and Lidar) data fusion platform based on 3D EM simulations*
- *Obj-2. Develop Artificial Intelligence (AI) model-data analytics change detection, and uncertainty assessment.*
- *Obj-3. Simulate a dedicated data fusion observing system for multi-sensor and multi-platform*
- *Obj-4. Integrate model and data fusion within a visualization system and on-line analytical toolbox*

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

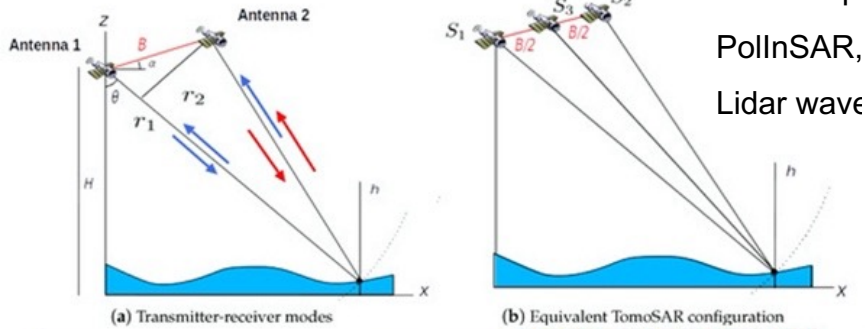
Methods

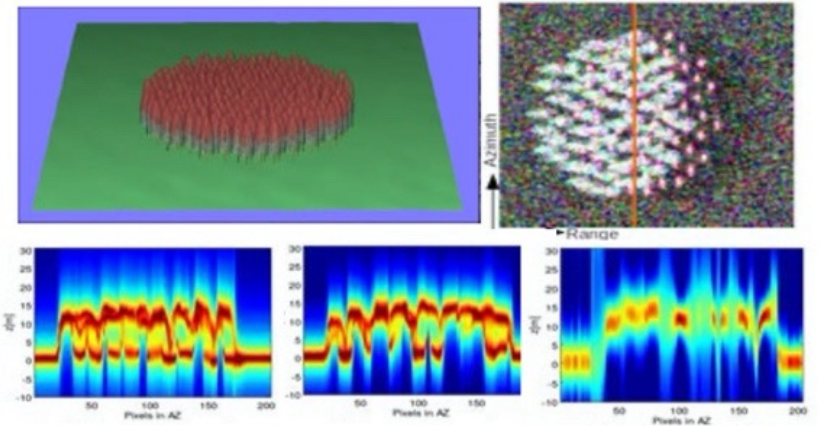
Forest Canopy Simulator

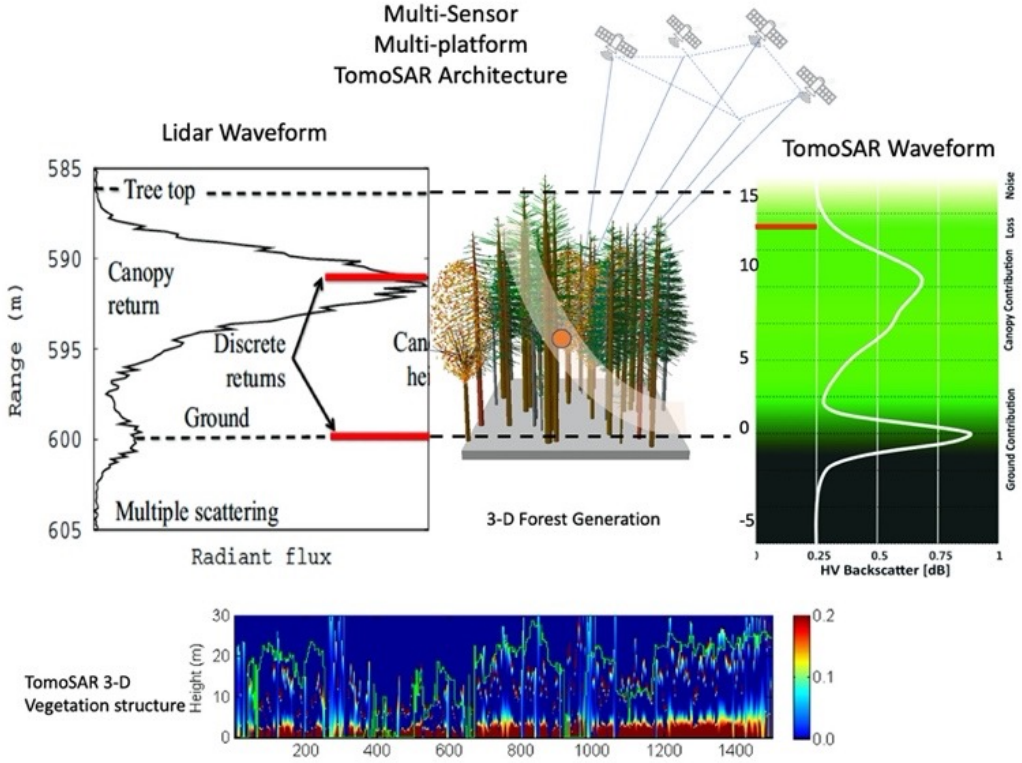
Multi-frequency SAR (P-, L-, C-band)

PolInSAR,

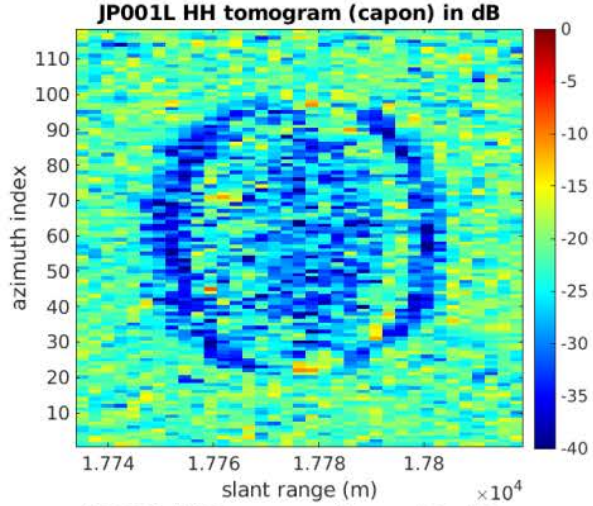
Lidar wave

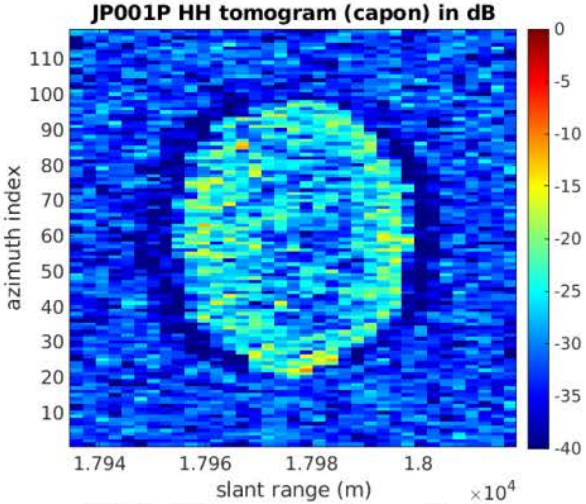


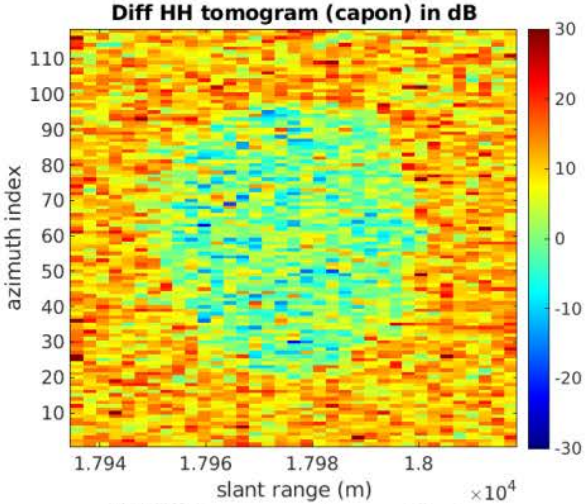


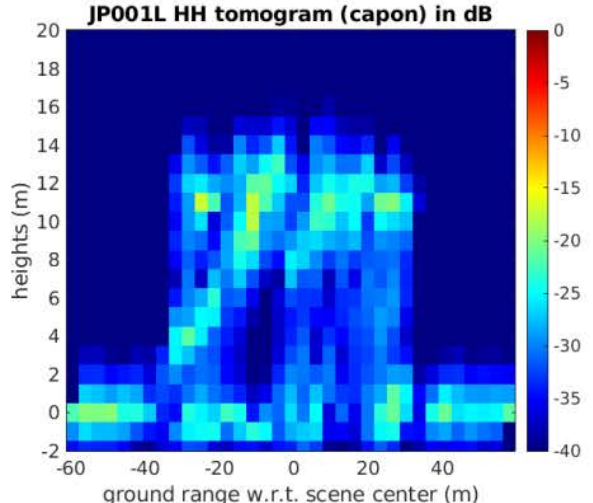


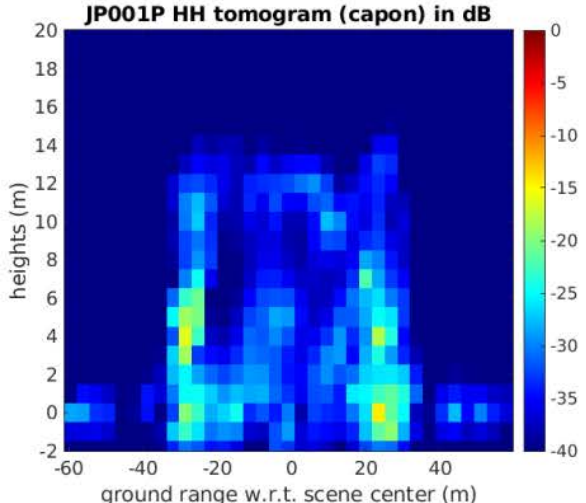
Compare same Jack Pine forest at two different frequencies

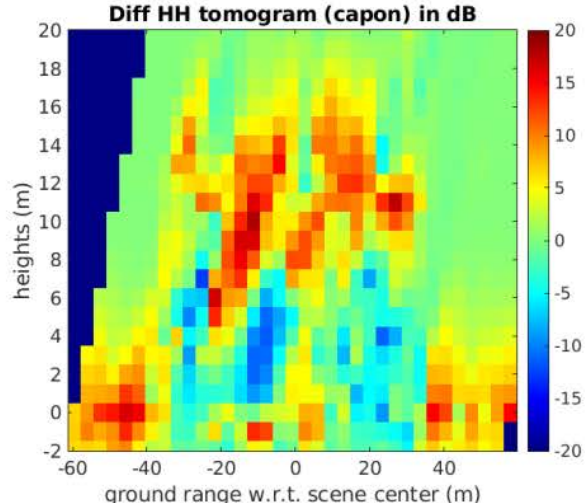




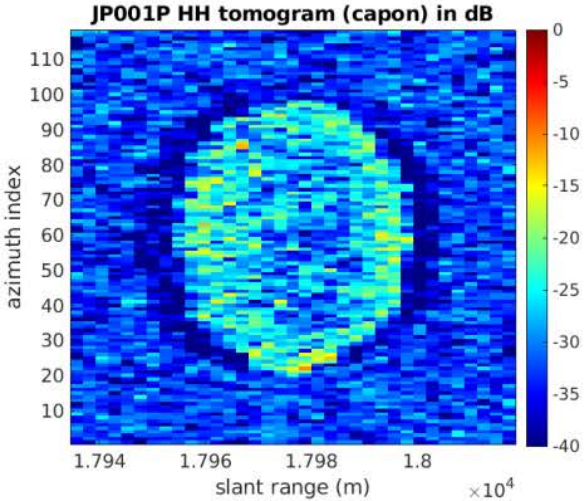


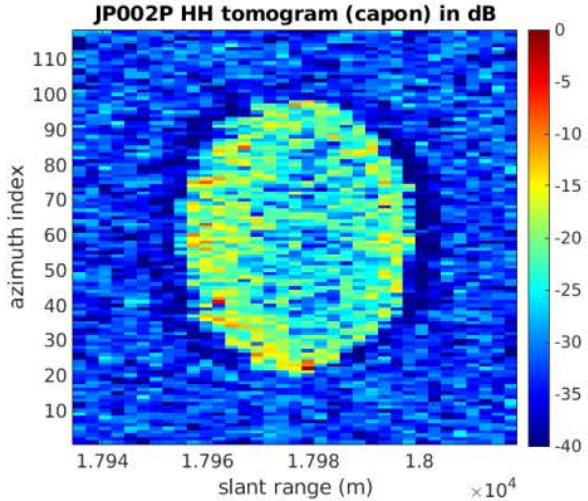


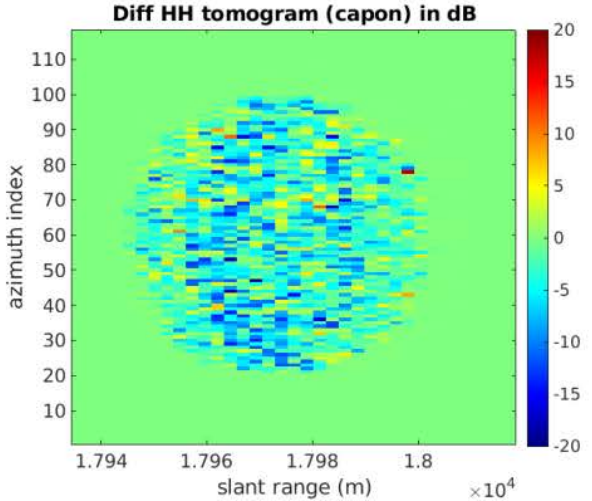


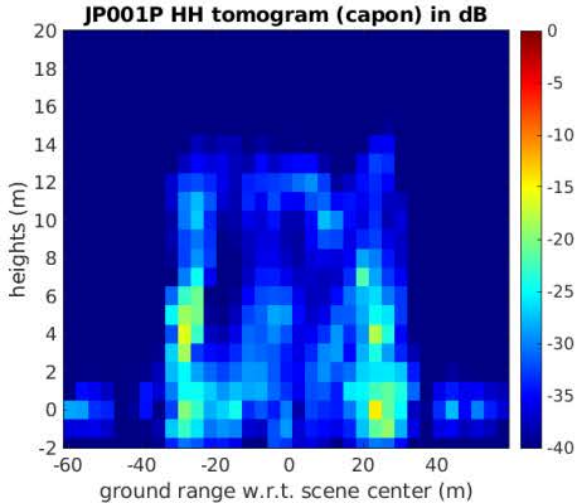


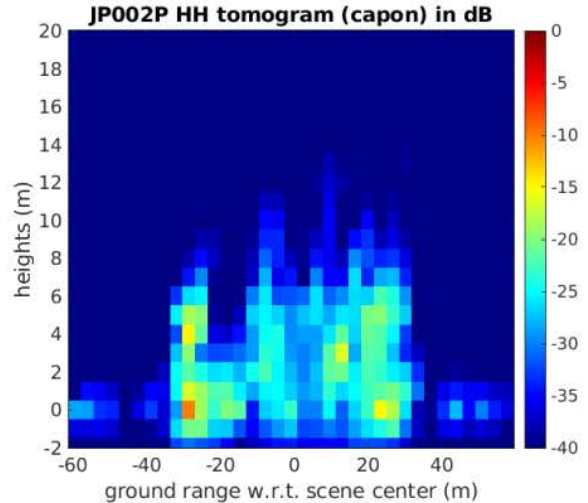
Compare Jack Pine forest where number of primary and secondary branches are 20% for P band

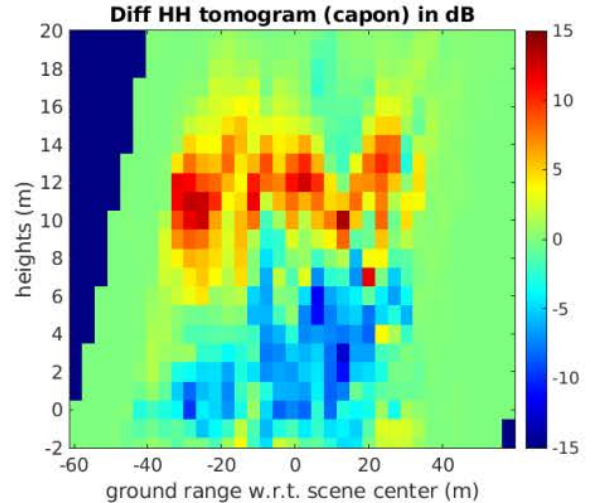






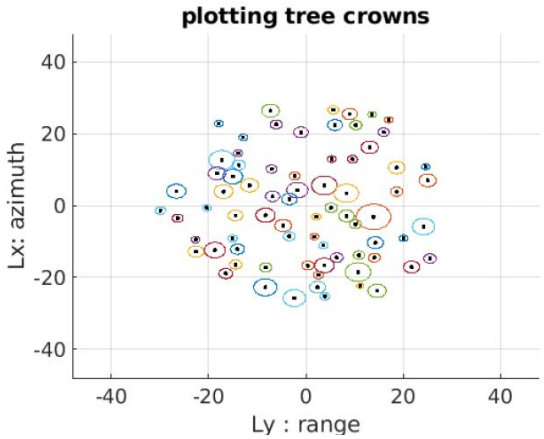


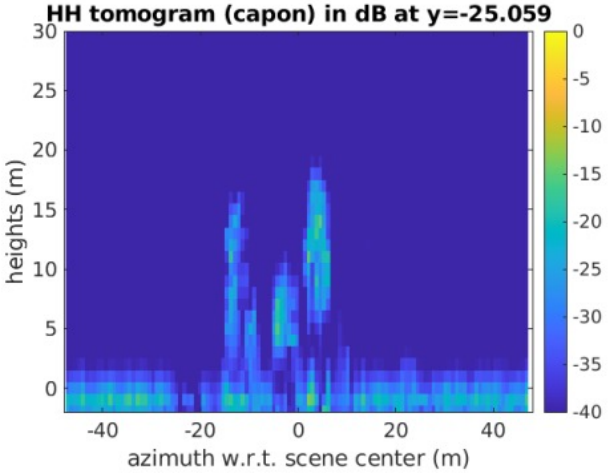


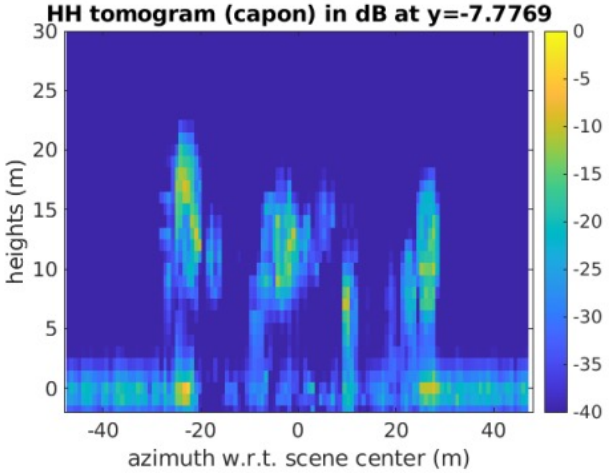


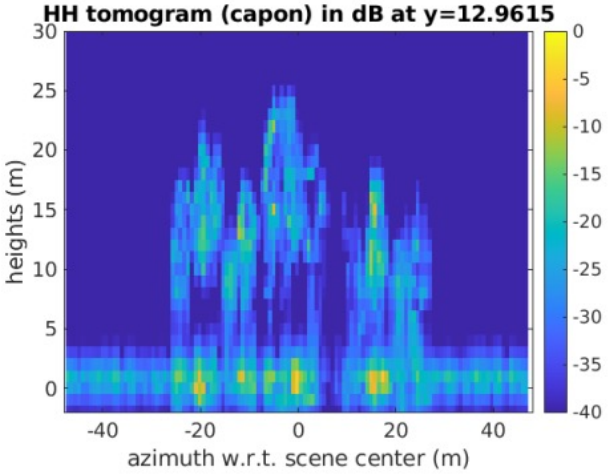
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

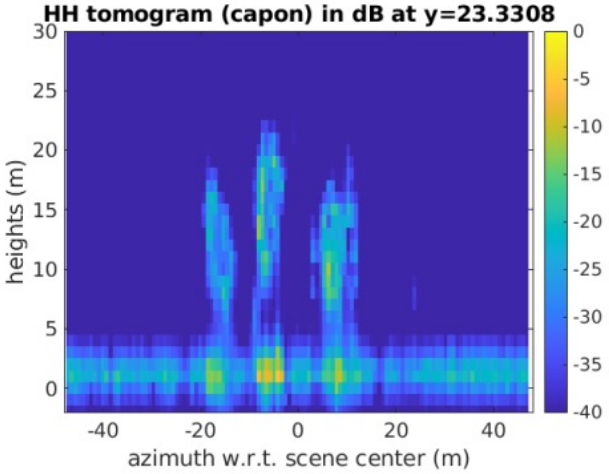
custom7_JP023_GSLP5L







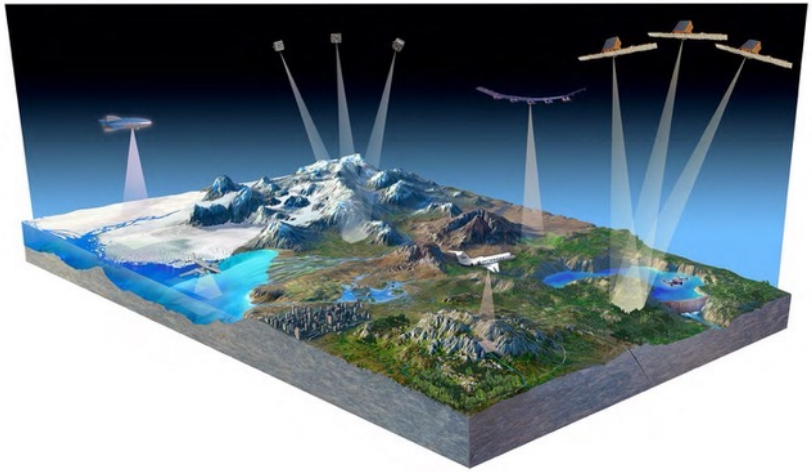


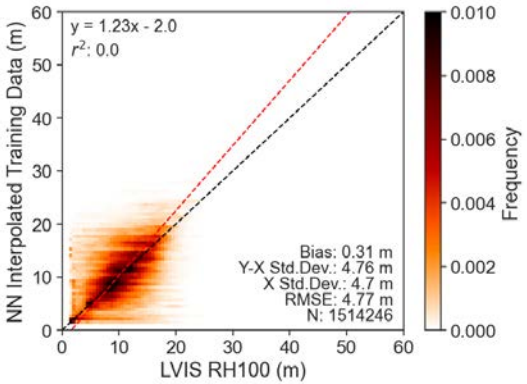


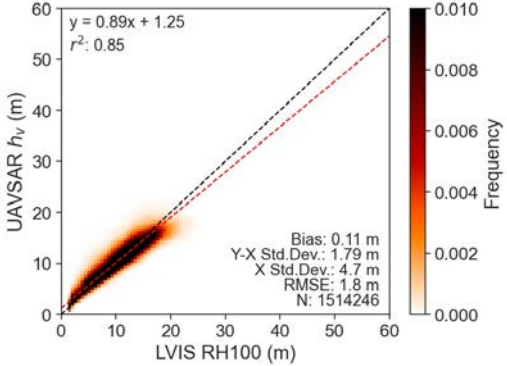
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

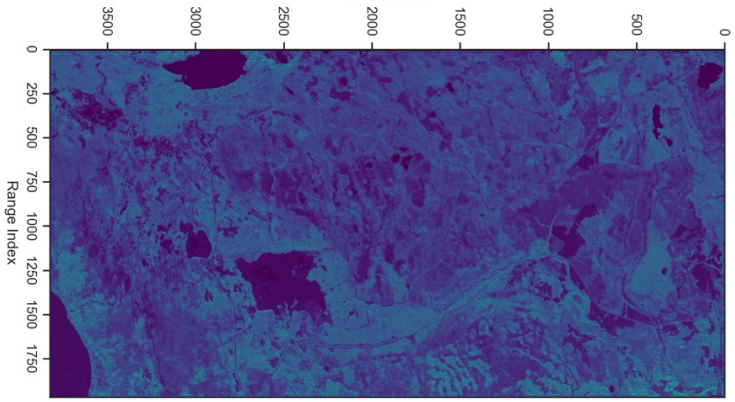
Data Fusion Performance Model

- ML Data fusion work has started using UAVSAR and Lidar data during the the AfriSAR field campaign and extended to the recent data collected in California
- Deep-learning networks were trained using different UAVSAR scenes and different interferometric baselines within each scene.
- The work was build on previous work and the SR&TD results without any model inversions.
- The trained networks estimate canopy height directly from the input features.









National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Improving UAVSAR PolInSAR and TomoSAR Processing and Analysis at L- and P-Band to Address STV Observables

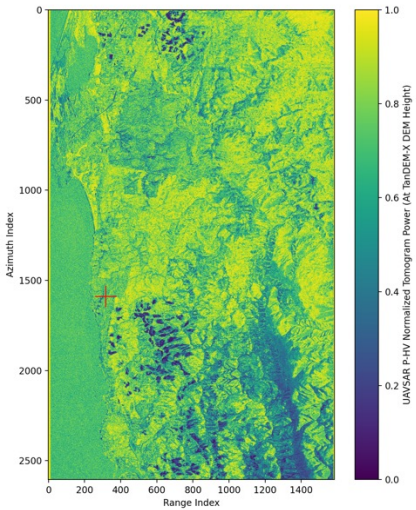
Milestone #1 Status

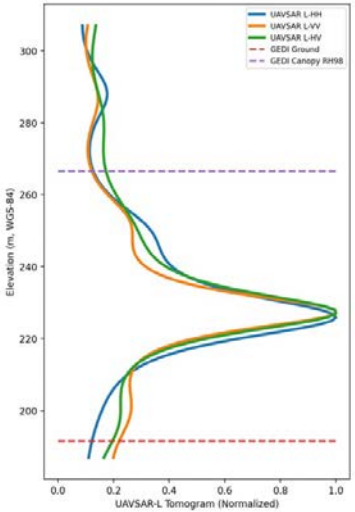
Milestone: Update UAVSAR phase calibration software and other processing tools in order to produce better calibrated UAVSAR SLC stacks for available L- and P-band data. Add support for P-band UAVSAR data to Kapok software. (Proposed Completion: January 31, 2023)

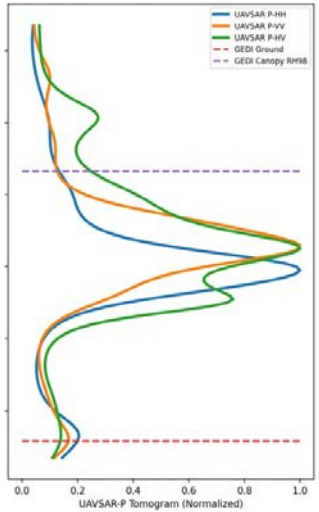
Status: Complete

Sub-Tasks:

1. Update UAVSAR phase calibration software to support longer, multi-segment L- and P-band data (Complete)
2. Add support for P-band UAVSAR data to Kapok PolInSAR/TomoSAR post-processing software (Complete)



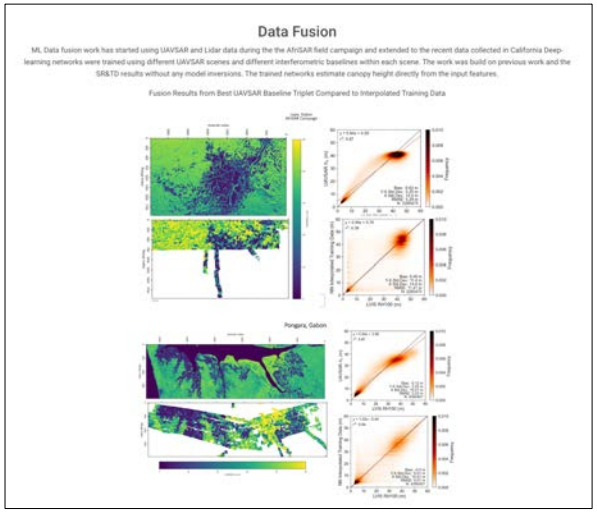




Comparing UAVSAR tomogram power profiles to GEDI data shows complex (multiple peak) structure of tall redwood forests. Example profile has GEDI canopy height of 75 m. Ground peak can be observed at P-band but not L-band

Public-facing Website

- One-stop web presence about our project
- Background information
- Latest research
- Latest tools and visualizations
- Access to public repo to the project's jupyter notebook



https://ideas-digitaltwin.jpl.nasa.gov/stvfis/