EcoSAR: A P-Band Digital Beamforming Polarimetric Interferometric SAR Instrument to Measure Ecosystem Structure, Biomass, and Surface Water

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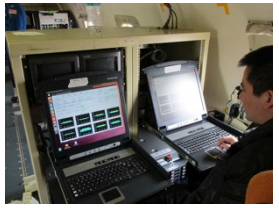
Objective

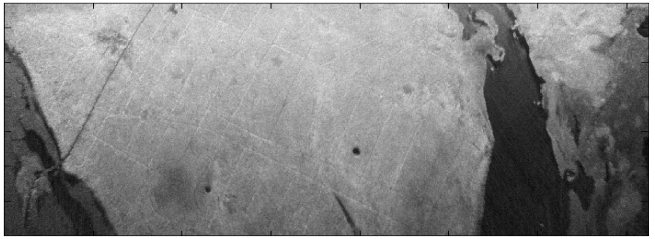
- Develop EcoSAR, an airborne polarimetric and "single pass" interferometric P-band Synthetic Aperture Radar (SAR), instrument to enable two- and three-dimensional measurements of terrestrial ecosystem structure and biomass.
- Integrate and flight test EcoSAR on the P3 aircraft, and conduct flight and ground campaigns to measure high density biomass and carbon storage ecosystems.
- Perform data analysis and modeling, and develop algorithms for the generation of Level 1 products and validate using existing biomass retrieval algorithms.

EcoSAR antenna (1 out of 2 shown) integrated to NOAA P3 aircraft

Radar Transceiver and Processor Rack (2 out of 4 shown)



Radar Graphical Interface for radar configuration and monitoring



Digitally beamformed image (3 m resolution) acquired during EcoSAR's flight campaign over Andros Island, Bahamas

Flight Tracks over Andros Island

Accomplishments

- Designed, simulated, fabricated and successfully tested the full EcoSAR system, including:
  - Up to 200 MHz fully polarimetric P-band antennas (2.9 m x 1.3 m) for operation under wings of the P3 aircraft
  - 32 channel radar electronics unit and 32 channel digital unit and processor system
- Calibrated the full system in low frequency anechoic chamber
- Integrated and flight-certified the full system on NOAA P3 aircraft
- Tested the system for ~19 hours during engineering and science flights over Andros Island and Costa Rica
  - Demonstrated multiple modes of EcoSAR operation including 1 m (200 MHz) and 3 m (50 MHz) resolution, "sniffing" (RFI sensing), wide beam, calibration and full-polarimetric (VV, HH, HV, VH) PingPong (cross-track interferometer) modes
  - Collected over 6 Terabytes of raw data
- Generated Level 1 products and produced first SAR images with frame sizes of 12 km by 4 km at 3 m resolution
- Developed image processing and RFI removal algorithms

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TRL_{in} = 3 **TRL_{out} = 6**