Comparison of Forest Canopy Height estimation from Lidar, InSAR and Very High Resolution Stereo Imagery highlights the advantages and alternatives for forest structure and biomass estimation in remote areas

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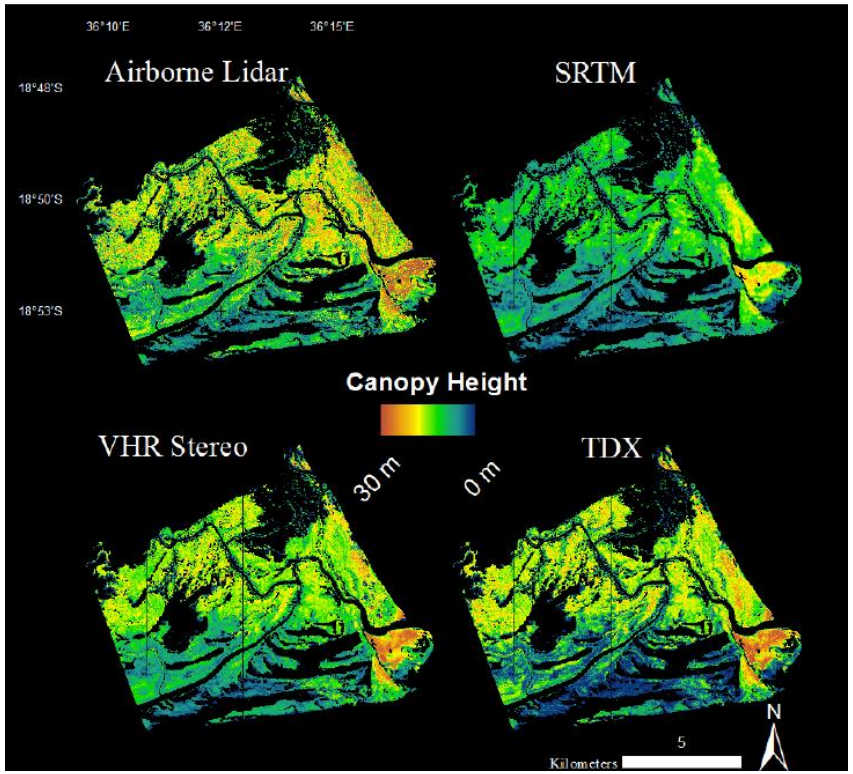

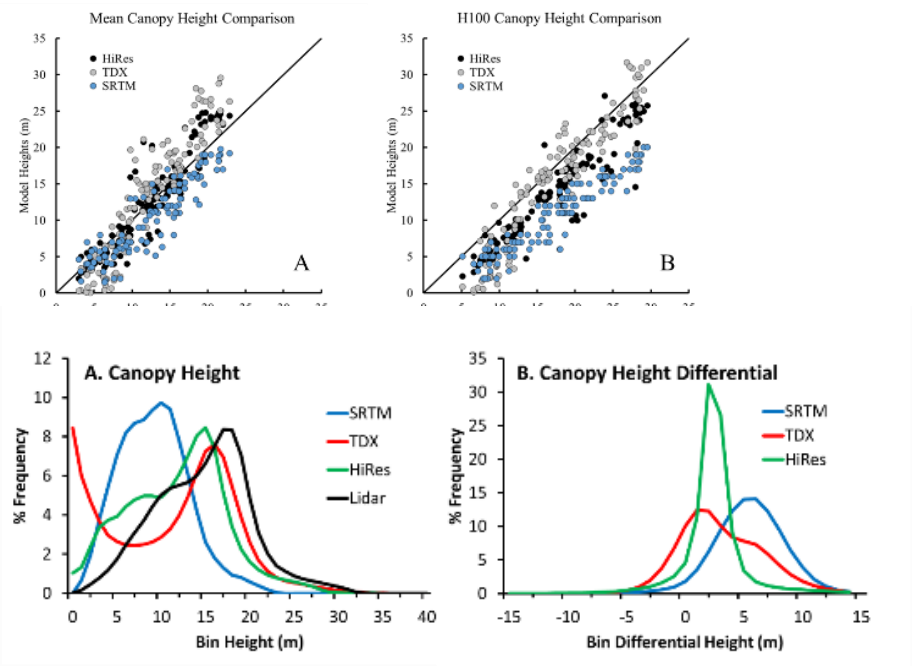

Height distributions for each of the remote sensing models. Close match between VHR, TanDEM-X (TDX), and airborne lida

Our results show the applicability and accuracy of Very High Resolution Stereo Imagery (VHR Stereo) InSAR data (from TanDEM-X and SRTM) to measure canopy height, canopy height changes, and estimate aboveground biomass and carbon stocks in forest ecosystems, such as mangroves.

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Possible other logo(s)

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Data Sources: SRTM (Shuttle Radar Topography Mission) 30 m DEM, WorldView 1 Stereo data acquired through the NASA/NGA commercial data archive, TanDEM-X data, commercial airborne Lidar; **Acknowledgements:** "Digital Globe data were provided by NASA's NGA Commercial Archive Data (cad4nasa.gsfc.nasa.gov) under the National Geospatial-Intelligence Agency's NextView license agreement. TanDEM-X data was provided through the TanDEM-X science team membership, airborne Lidar was acquired through the USFS/CIFOR SWAMP program; Funding for this research was provided through the NASA Carbon Monitoring System project **"**Total Carbon Estimation in African Mangroves and Coastal Wetlands in Preparation for REDD and Blue Carbon Credits";

Technical Description of Figures:

Graphic 1: This figure shows four canopy height models of mangrove forests generated from Airborne Lidar, SRTM Interferometric SAR (InSAR) data, Very High Resolution (VHR) Stereo and TanDEM-X (TDX) Polarimetric InSAR data. The aim of this study was to evaluate the accuracy and sensitivity of Interferometric SAR and Stereo photogrammetric datasets to canopy height with the aim of upscaling local estimates of canopy height and biomass from Lidar to much larger, National and potentially Global scales. The canopy height models (CHM) of the four datasets correspond well, although as shown in ***Graphic 2*** : TDX canopy heights CHMs exhibited a negative and positive bias respectively. The canopy height histogram distributions computed for all four CHMs (e.g., SRTM, TDX, VHR, and Lidar) exhibit two distinct patterns: negatively skewed distributions with peak frequencies clustered around each other, and a positively skewed distribution with a lower magnitude frequency. Lidar, TDX, and VHR CHMs all show similar maximum height frequencies between 15 and 18 meters that accounted for nearly 8% of canopy in the study area.

Scientific significance, societal relevance, and relationships to future missions: Mangroves and tidal wetlands have the highest carbon density among terrestrial ecosystems**.** Although they only represent 3 % of the total forest area (or 0.01 % of land area), C emissions from mangrove destruction alone at current rates could be equivalent to 10 % of carbon emissions from deforestation. The high C sequestration coupled with the high risk of destruction makes mangroves a prime candidate for carbon mitigation initiatives such as REDD and an important contributor to the Global Carbon Cycle. One of the main challenges in forests is measuring carbon, efficiently, effectively, and safely. Our goals are to develop the methodologies for, and produce the initial remote sensing products necessary to measure carbon stocks in Forests and Blue Carbon ecosystems. This research is also directly relevant to the upcoming NASA GEDI-Lidar Mission as one of the GEDI L4 products is to be a GEDI-TanDEM-X fusion dataset.