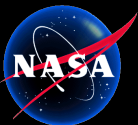


Estimation of Canopy Height using UAVSAR Data in the Reserve Faunique des Laurentides and Penobscott Forests.

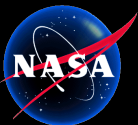
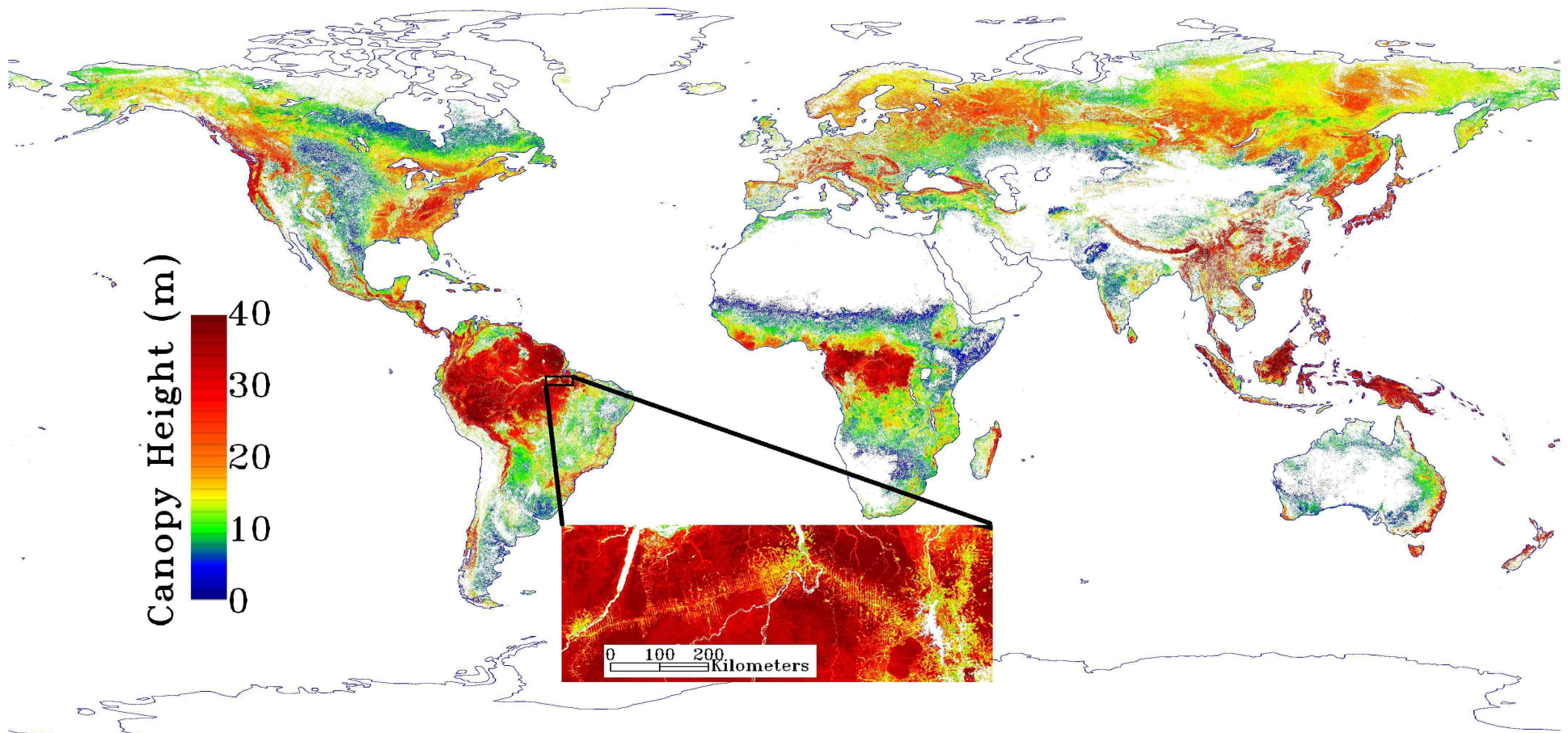
Marc Simard

Jet Propulsion Laboratory, California Institute of Technology

Marco Lavallo, Naiara Pinto, Scott Hensley,
Maxim Neumman, Thierry Michel, Ralph
Dubayah

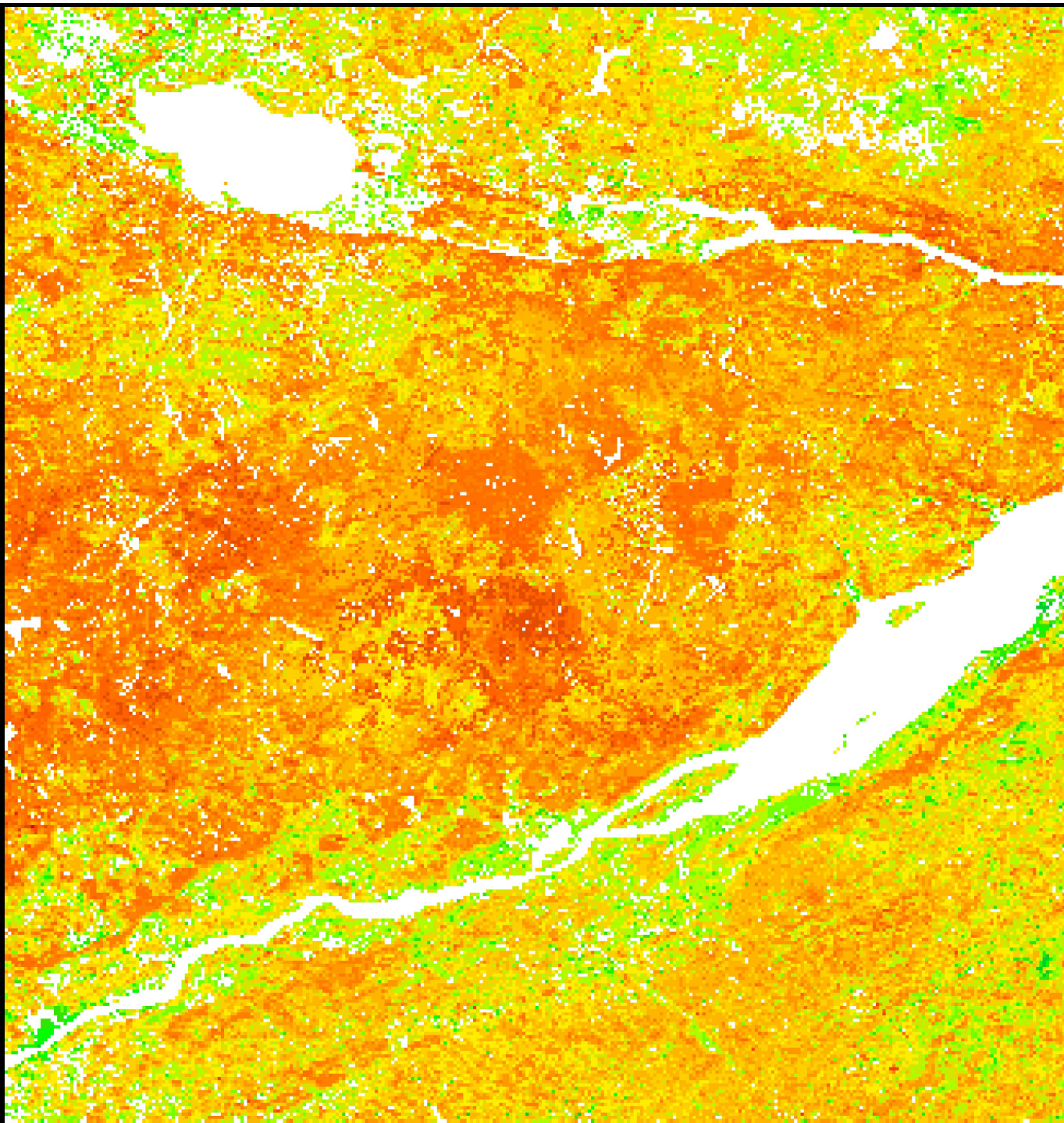


Global Map of Forest Canopy Height (1km resolution)

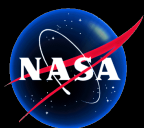
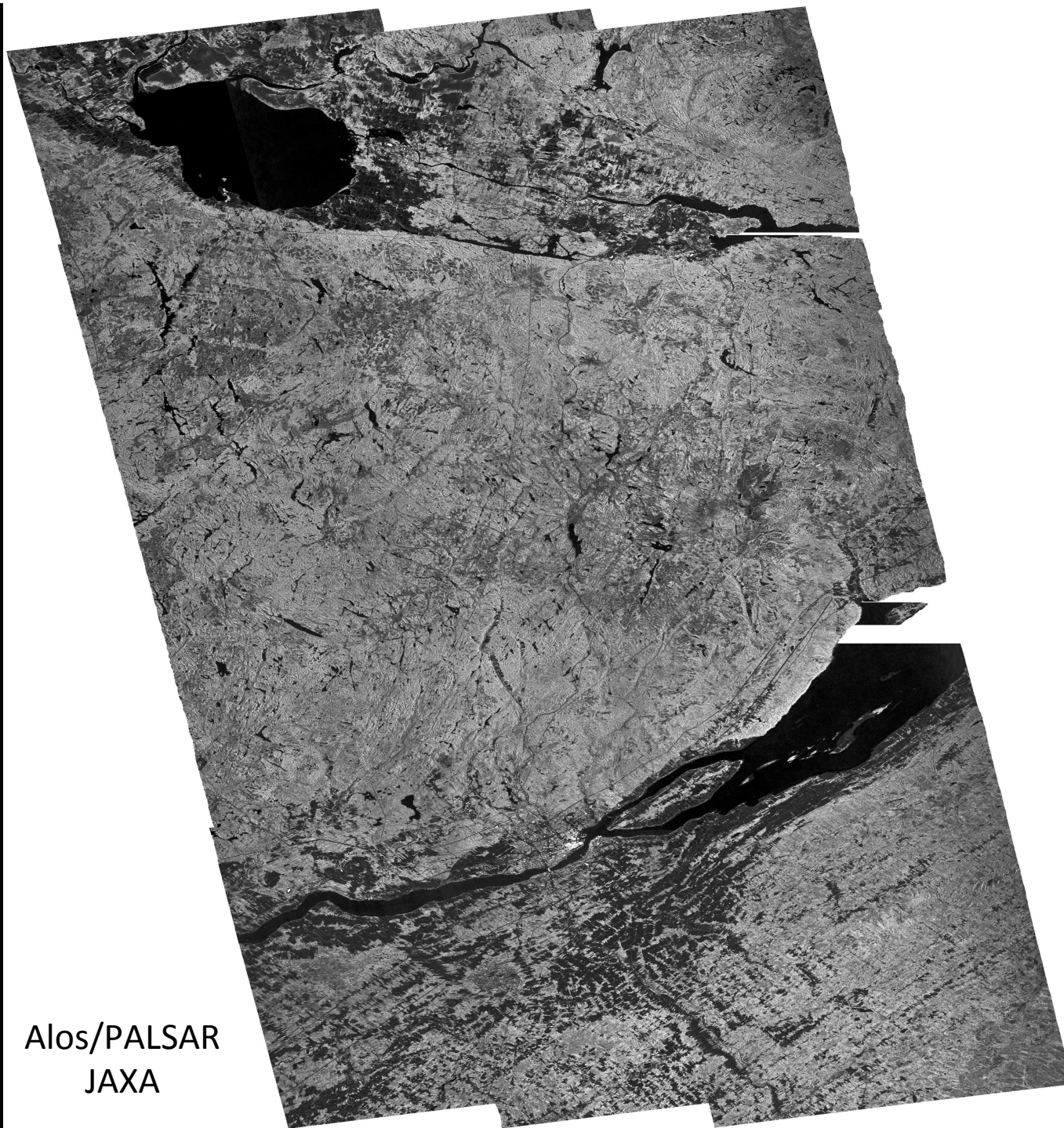


Simard et al. (Journal of Geophysical Research, 2011)

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Alos/PALSAR
JAXA

ard@jpl.nasa.gov

IS THE NEW
LeisureArts

The project documents every instance of the phrase "is the new" encountered from various sources in 2005. It is intended to map the iterations of a peculiarly common marketing and literary device.

http://thediagram.com/6_3/leisurearts.html

IS THE NEW
LeisureArts

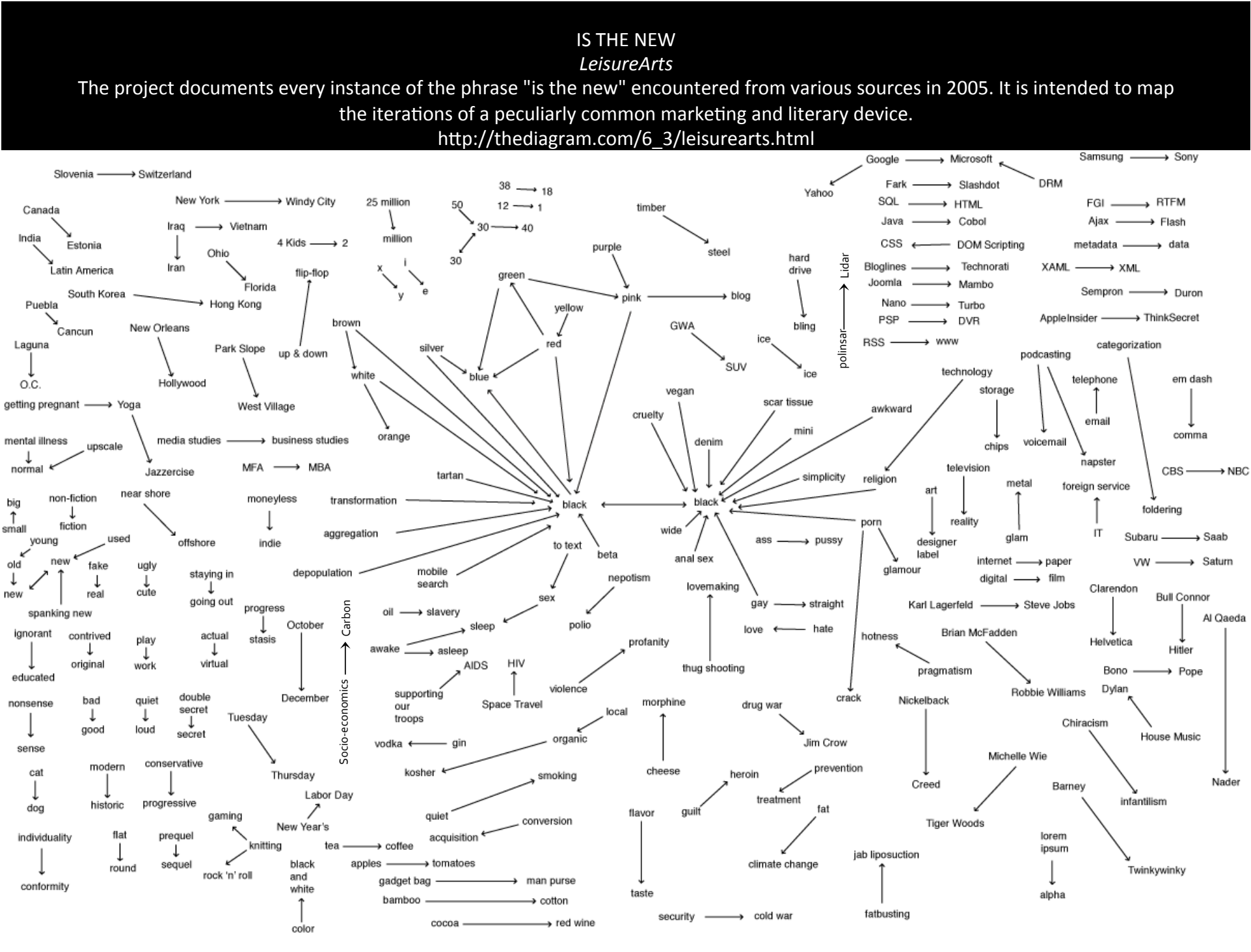
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http://thediagram.com/6_3/leisurearts.html

IS THE NEW
LeisureArts

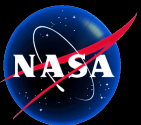
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http://thediagram.com/6_3/leisurearts.html



UAVSAR Campaign 2009-2010

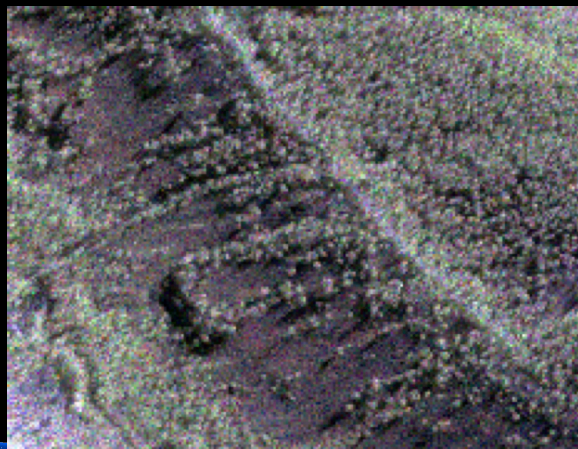
- PI: Marc Simard,
 - Co-I's Ralph Dubayah, Scott Hensley
- Objective:
 - To assess, quantify and mitigate the impact of temporal decorrelation on the retrieval of canopy height from polinSAR



Airborne and Field Data Collection

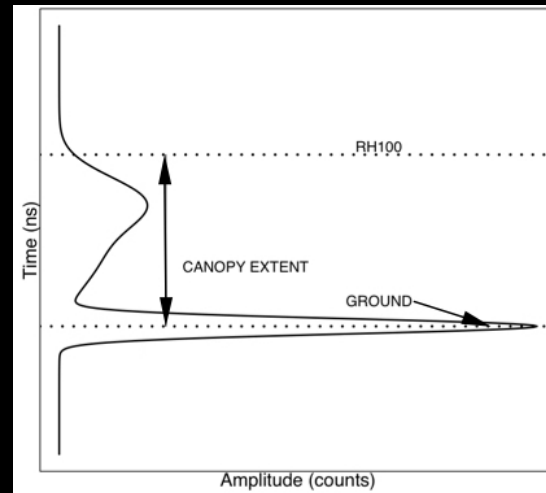
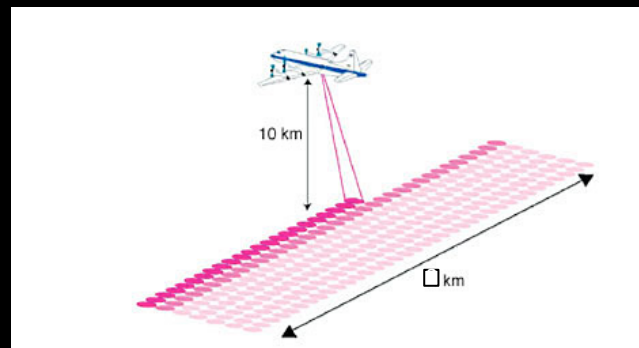
UAVSAR

L-band polarimetric radar capable
of repeat pass interferometry



LVIS

Laser Vegetation Imaging System
Full waveform lidar (25m footprint)



- Spatial resolution

- UAVSAR: ~6m
- LVIS ~25m

Swaths

- UAVSAR ~20km
- LVIS 2km (based on max of 5° look for vegetation)

Field data (88 forest plots)

- Tree height;
- Trunk diameter DBH
- Tree species
- Crown size
- Terrain Slopes
- Plot height and biomass

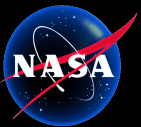




Marc.simard@jpl.nasa.gov

Sites

- Laurentides, Québec
- Penobscott/Howland, Maine
- Bartlett/Hubbard Brook, New Hampshire
- Sierra Nevada, California
- La Selva, Costa Rica



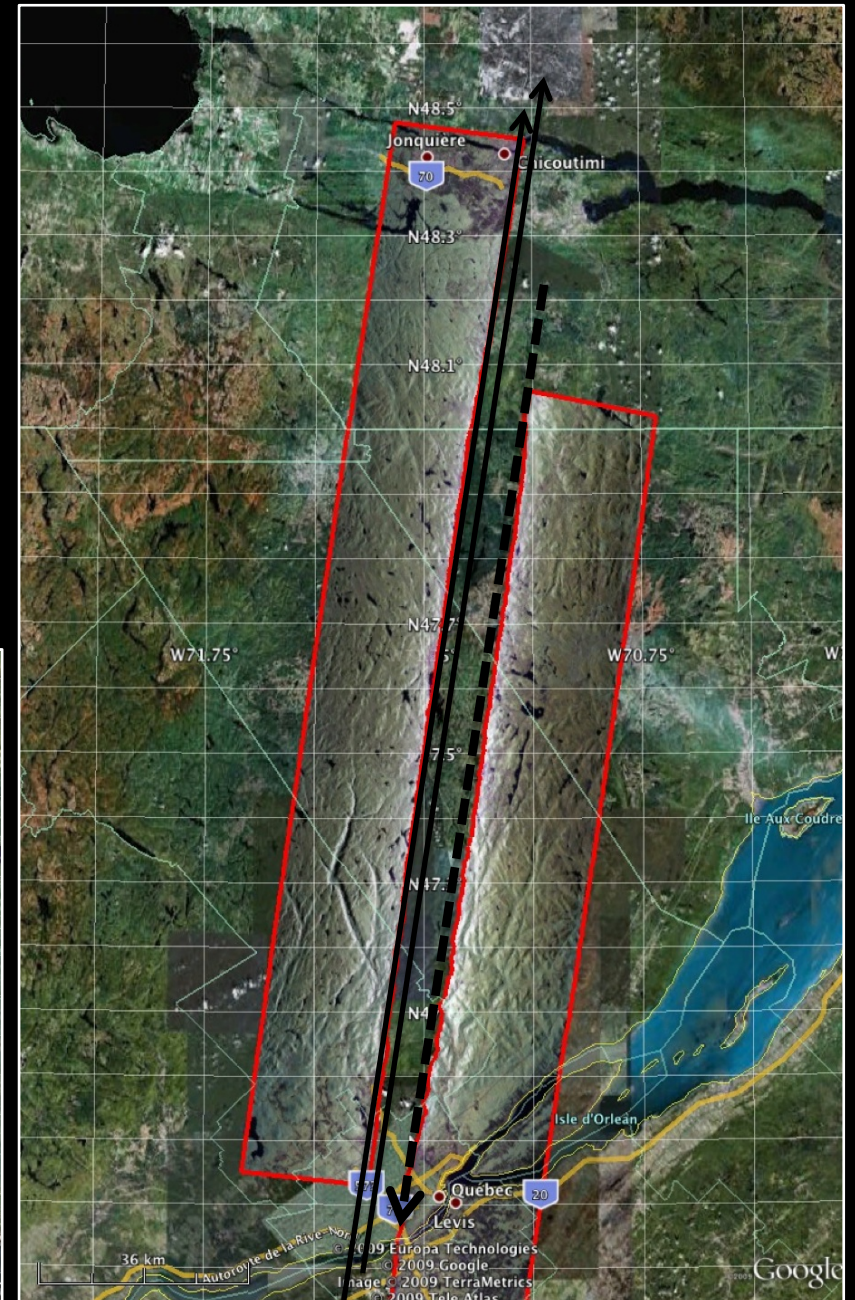
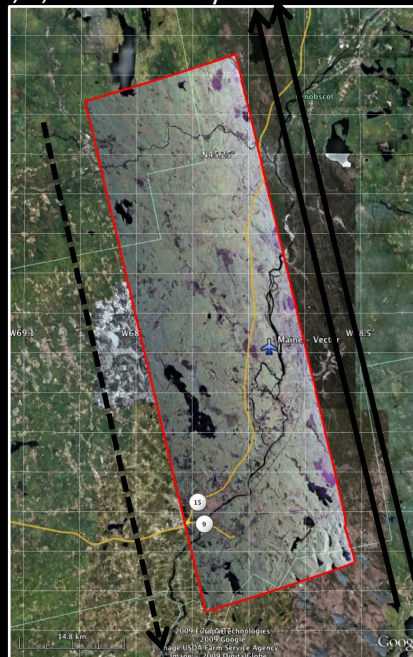
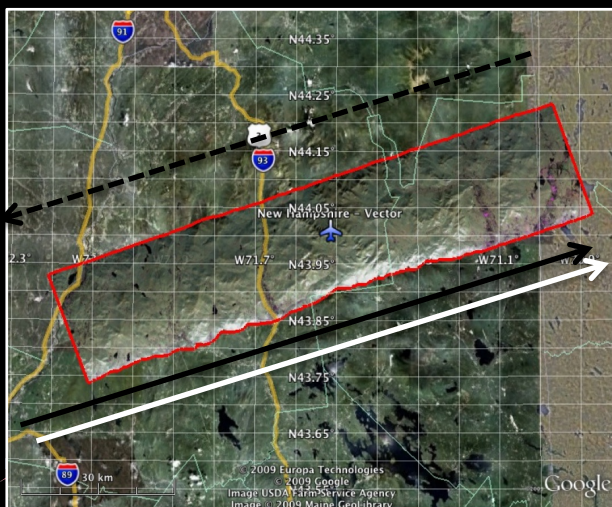
UAVSAR Campaign 2009-2010

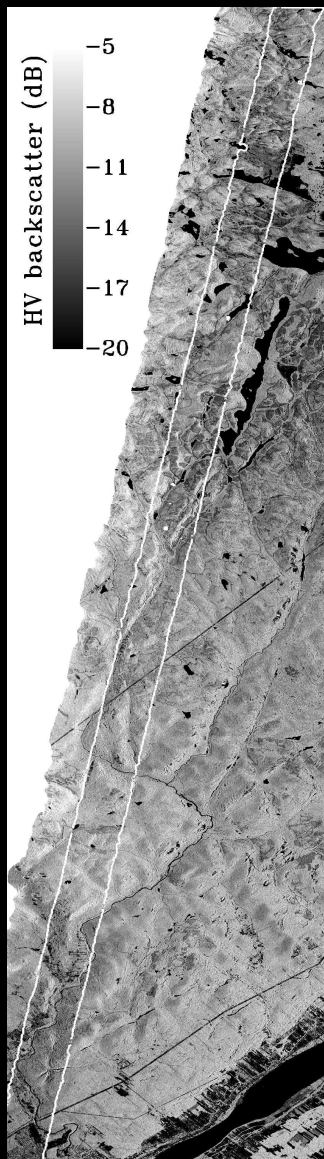
- Test Sites cover a wide range of forest types and terrain
 - New Hampshire (Temperate)
 - Maine (Temperate)
 - Québec (Temperate and boreal)
 - Sierra (Temperate with strong elevational gradient)
 - La Selva (Tropical)



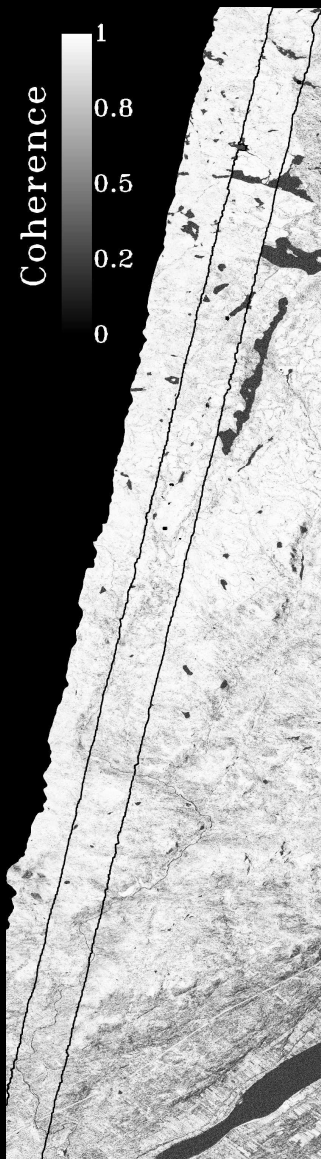
Data collection strategy

- UAVSAR images covered transects of ~100km with ~20km swath (Laurentides is 185km long)
- Covered boreal, temperate and tropical forests
- Large diversity of management practices:
 - sites are characterized by experimental forests, national parks and managed forests (e.g. lumber)
- UAVSAR flew 3 days (5 in tropics) over a period of about 2 weeks.
 - Each day, UAVSAR flew 4 times over each site.
 - Collected both zero and 65m baselines.
- Example:
 - North East sites flown on 5th, 7th and 14th of August 2009.
 - Providing 4 temporal baselines of 45', 2, 7 and 9 days
 - Costa Rica: January 29th, 31st, February 4th, 6th, 10th 2010
 - Temporal baselines: 30' and 2, 4, 6, 9, 10 and 12 days

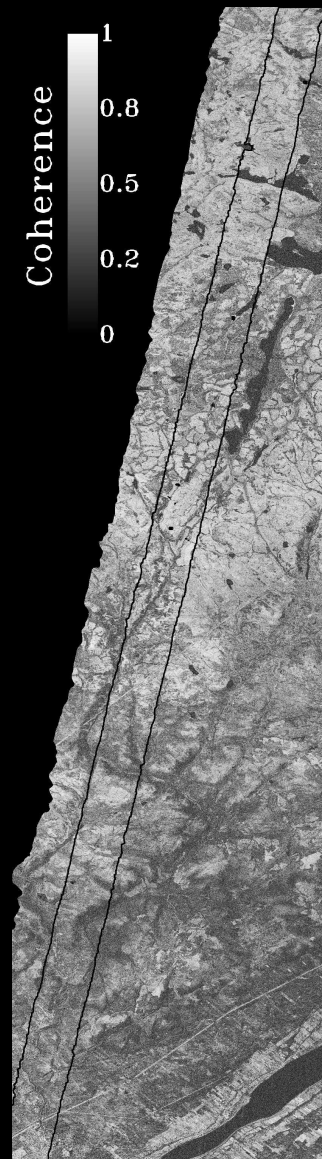




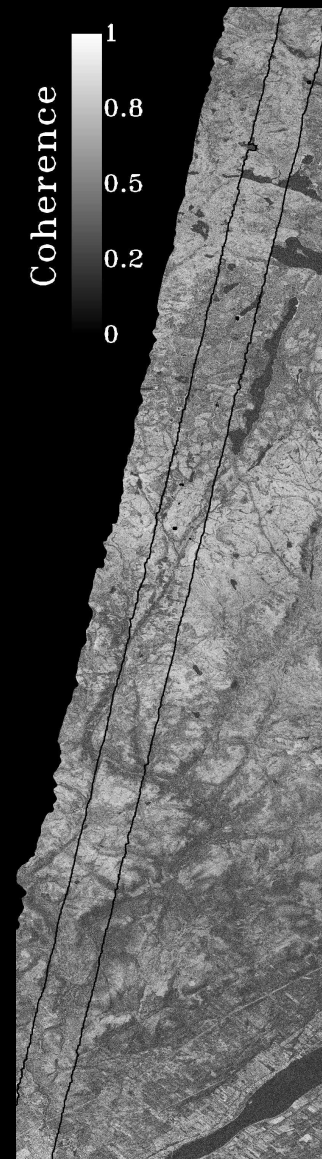
σ_{HV}



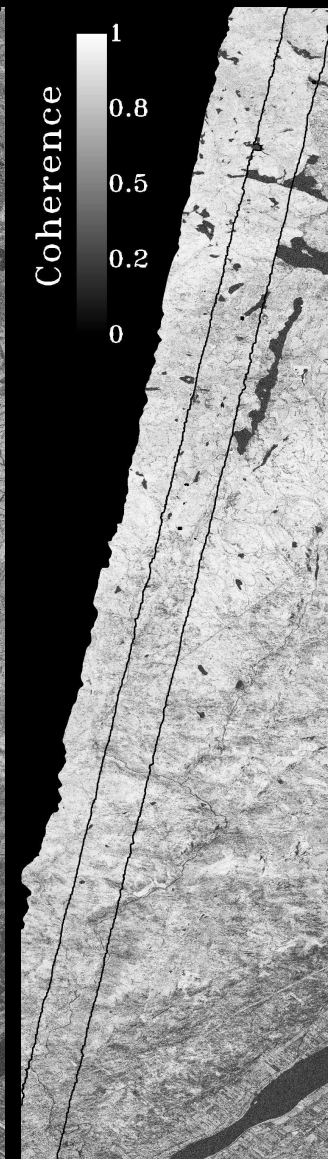
45'



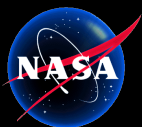
2 days



7 days

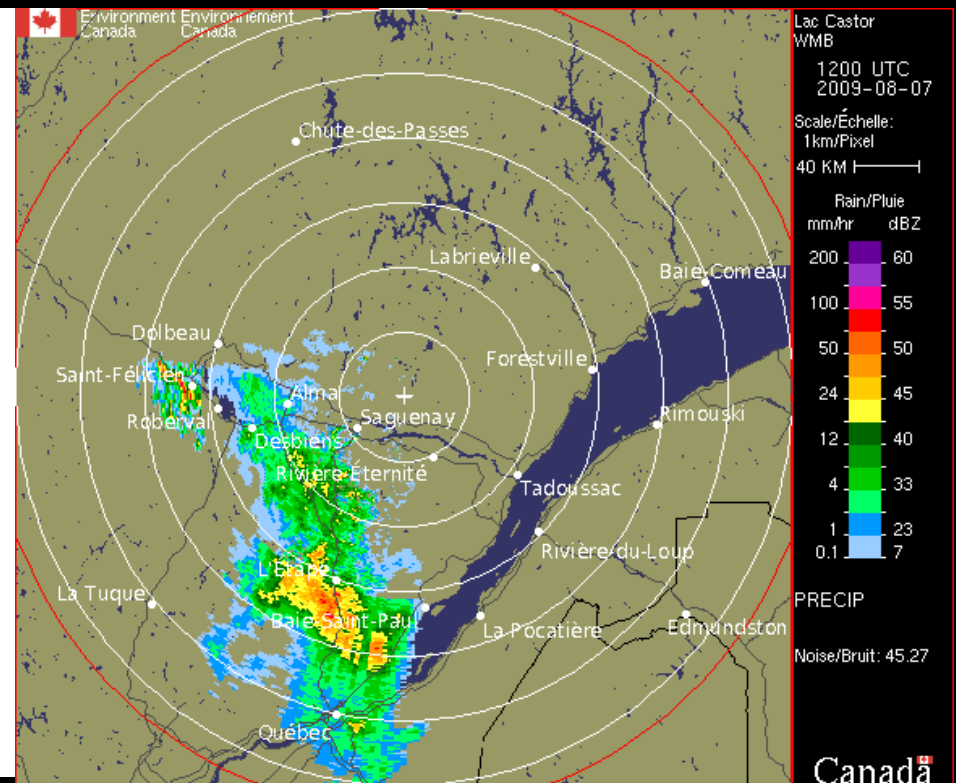
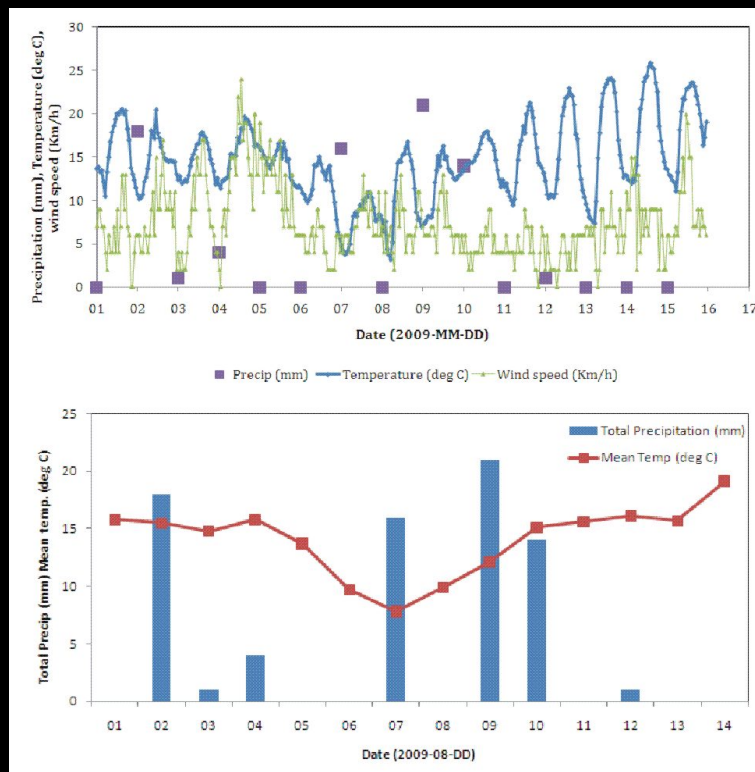


9 days



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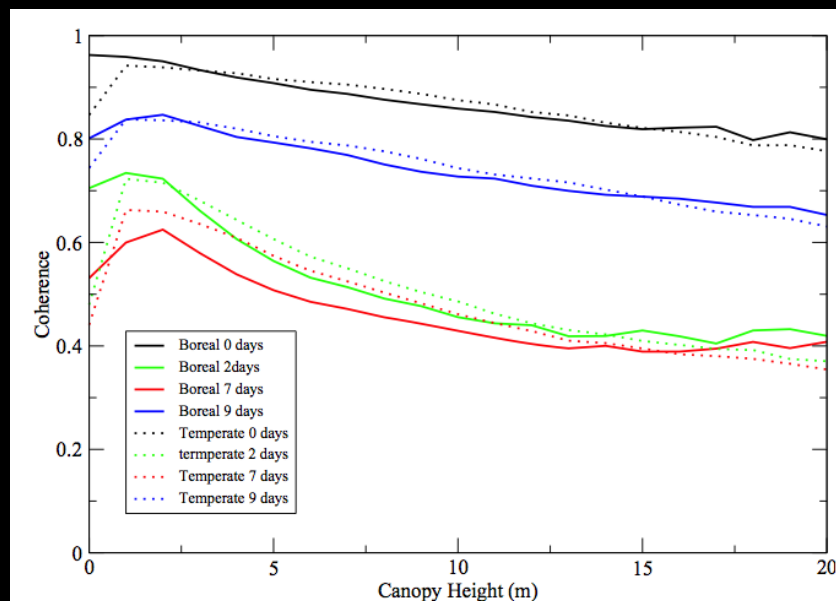
It is precipitation and change in moisture rather than “time” that most impacts temporal decorrelation on temporal scales of days.



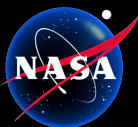
- A large rain storm on the acquisition date of the 7th causes a decrease of the inSAR correlation with pairs including other days.
- Wind is nearly stable between 5 and 10km/h.



Temporal Decorrelation Experiment Summary and Conclusion



- Simard, M.; Hensley, S.; Laval, M.; Dubayah, R.; Pinto, N.; Hofton, M. An Empirical Assessment of Temporal Decorrelation Using the Uninhabited Aerial Vehicle Synthetic Aperture Radar over Forested Landscapes. *Remote Sens.* **2012**, *4*, 975-986.
- M. Laval, M. Simard, and S. Hensley, "A temporal decorrelation model for polarimetric radar interferometers," *IEEE Transactions on Geoscience and Remote Sensing*, 2011 (online), DOI: 10.1109/TGRS.2011.2174367.
- Pinto, N.; Simard, M.; Dubayah, R. Using InSAR Coherence to Map Stand Age in a Boreal Forest. *Remote Sens.* **2013**, *5*, 42-56.

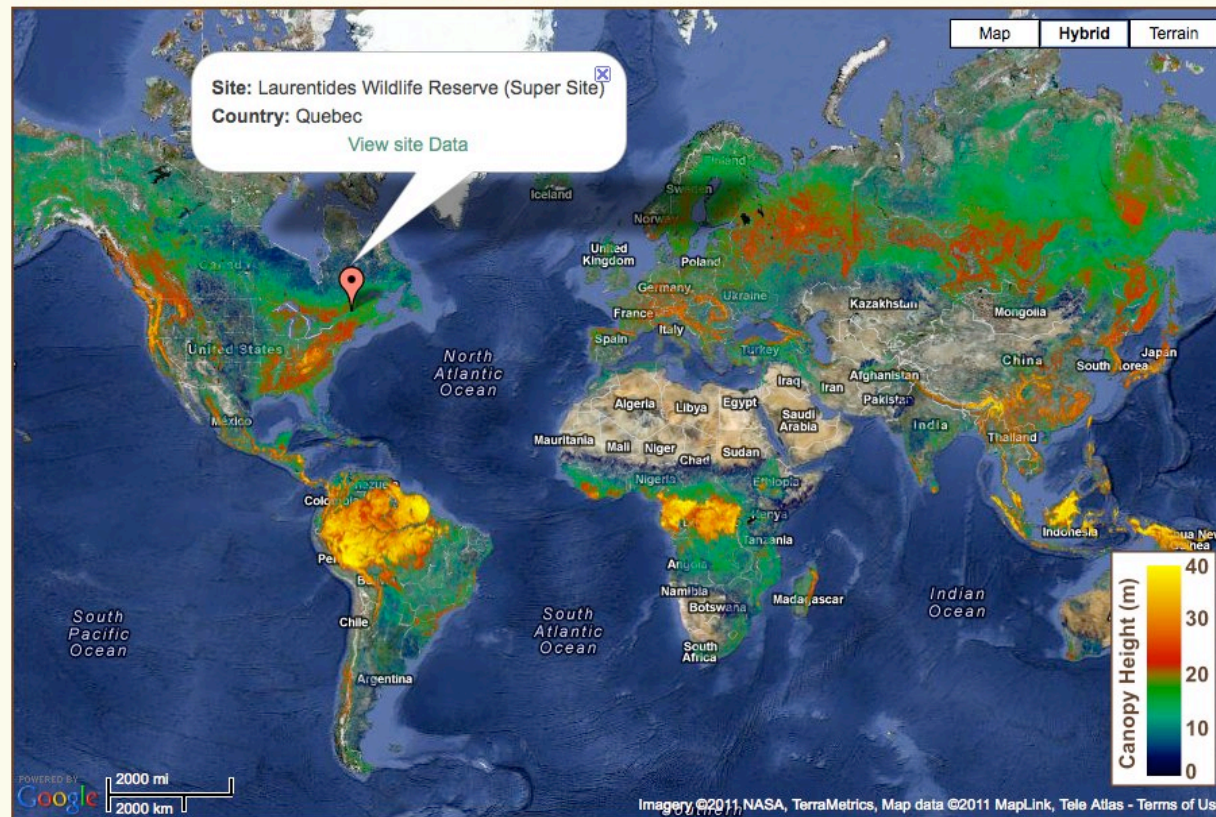




3D Land Mapping

Combining Lidar and Radar for Remote Sensing of Land Surfaces

Click on a marker to find out more information about your favorite site.



- ☒ Show low resolution (10km) 3D Global Vegetation Map derived from ICESat/GLAS and environmental modeling
Download the full resolution (1km) map [here](#) [TIF] and map legend [here](#). An error map can be downloaded [here](#).

Project Description

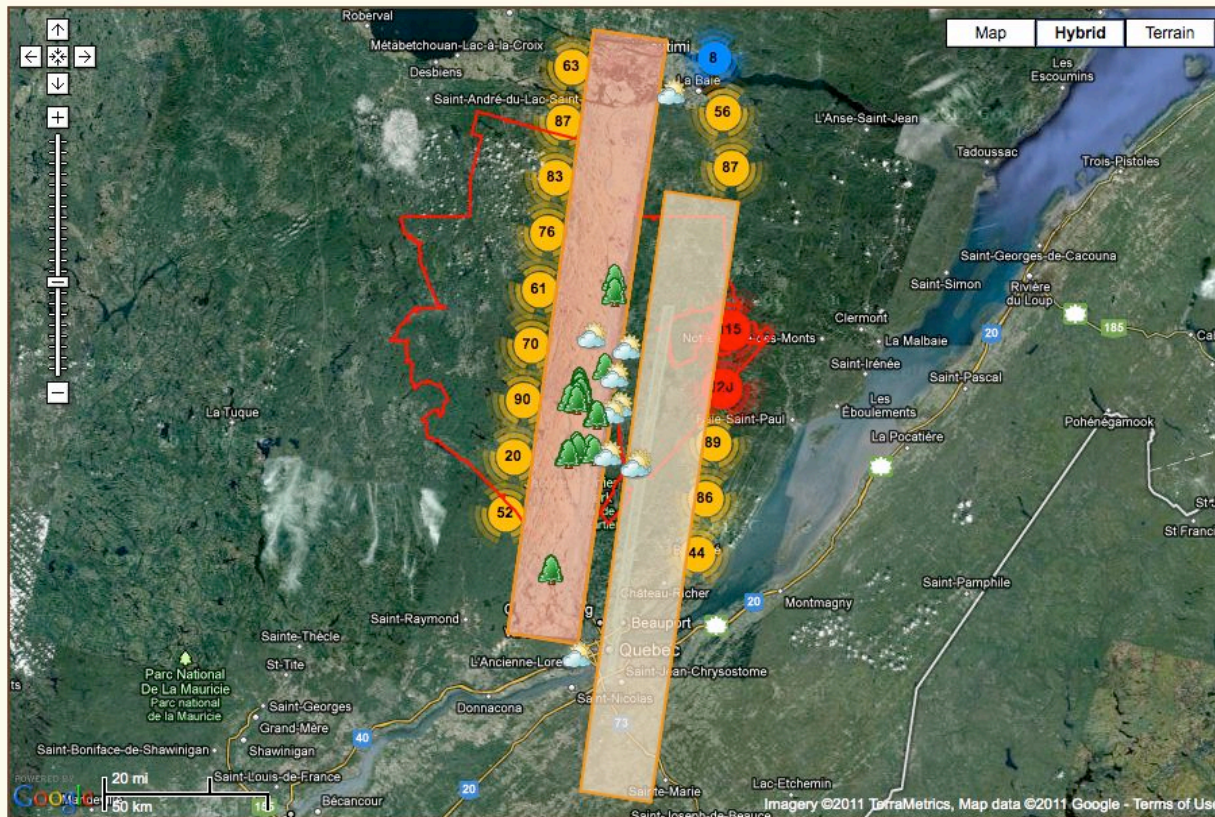
This website presents the research projects of [Dr. Marc Simard](#), Senior Scientist at the [Jet Propulsion Laboratory](#). The overall objective is to combine radar and lidar remote sensing to characterize the forested landscapes in 3D. The science products generated by Simard and



[<< Back to all sites](#)

Super Site: Laurentides Wildlife Reserve, Quebec

Click a checkbox to show a specific dataset in the map. Then click the objects (markers, swaths, etc) in the map for more information.

☒ Super Site [\[KML\]](#)☒ UAVSAR☒ LVIS☒ ICESat [TXT]☐ SRTM [KMZ]☒ Field Data [CSV]☒ Weather Data [\[KML\]](#)

Lat:

Lng:

UAVSAR Swath Details: Laurnt_00802

Radiometrically Calibrated Backscatter (View a high-resolution map here)

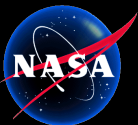
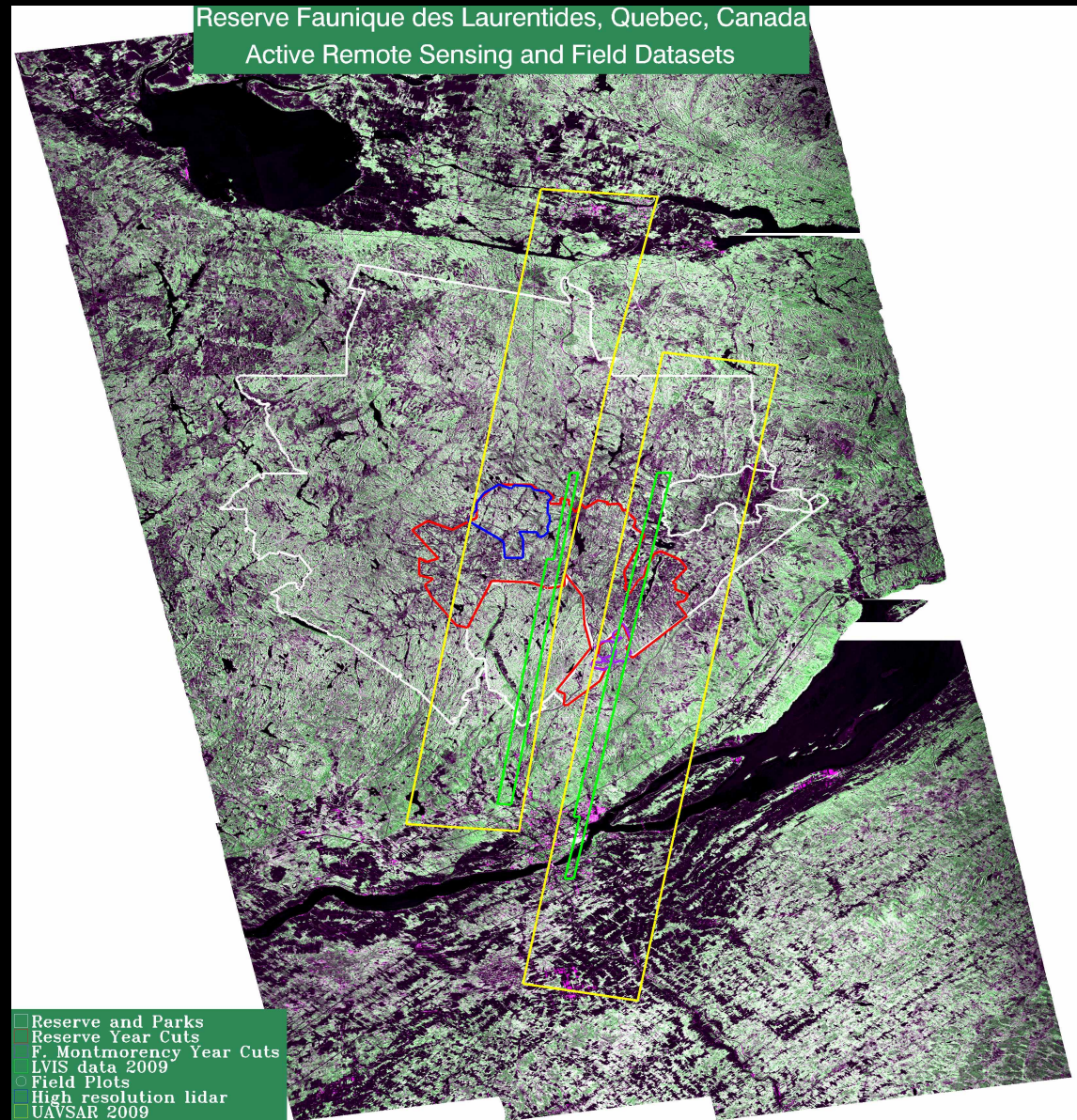
⦿ Low-resolution: [KML], GeoTIFF files by polarization: [HH] [HV] [VV]

Incidence Analysis

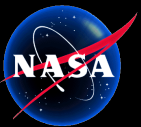
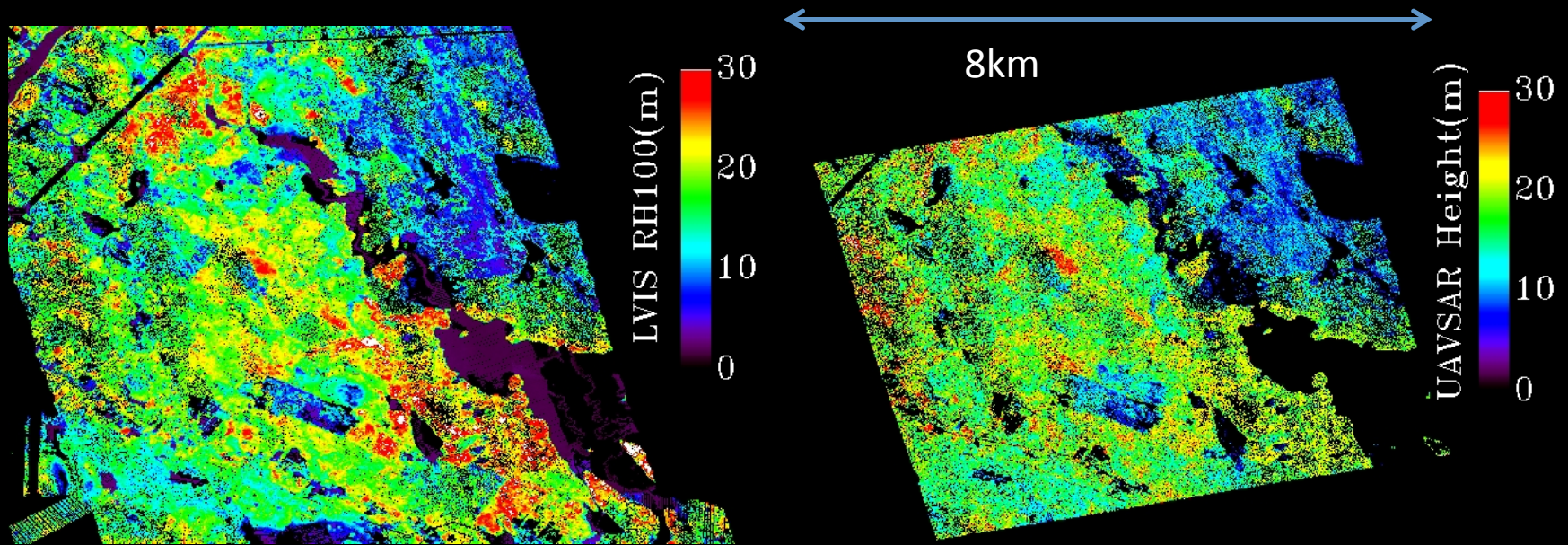
A Cal/Val Super Site for Active Remote Sensing Platforms

Réserve Faunique des Laurentides (Québec, Canada) proposed at CEOS 2010

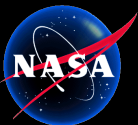
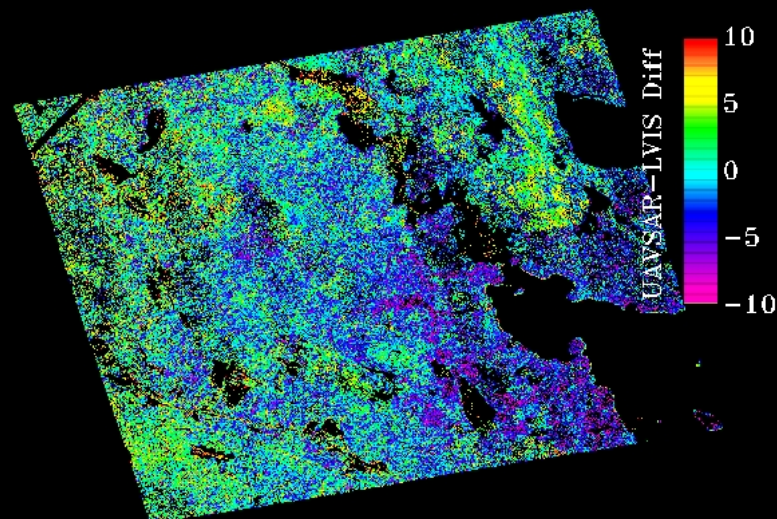
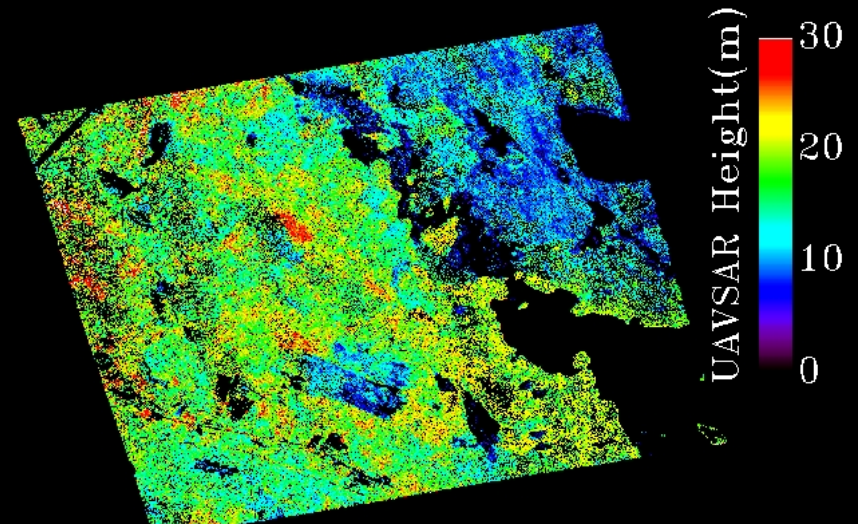
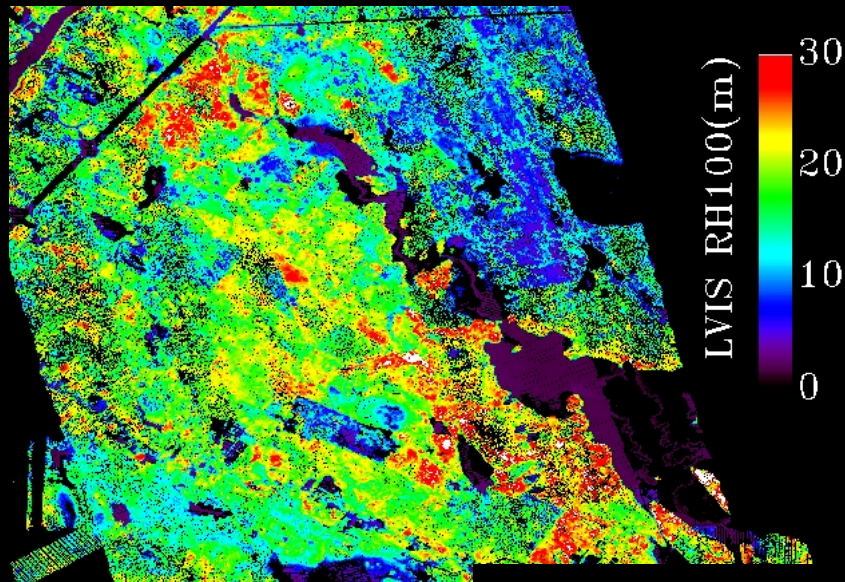
- Laurentides
 - 1000m elevation range
 - Temperate and boreal forests
 - National Parks
 - Experimental forests
 - Large scale (Governmental) lumber management
 - Public access to all sites
- Data
 - UAVSAR, ALOS/PALSAR
 - repeat-pass UAVSAR (Multi-temporal)
 - MODIS, LANDSAT
 - Lidars : LVIS, ICESat/GLAS, high res.
 - **TanDEM-X**
 - Field
 - Canopy structure
 - Weather data
 - Government/industry participation
 - Stand age
 - Real Time Weather data
- Missing
 - Radarsat (requested)
 - ENVISAT
 - TerraSAR-X



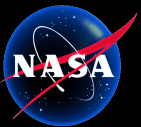
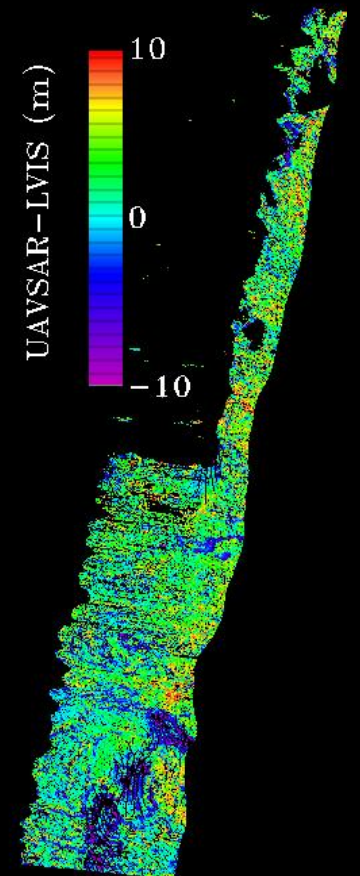
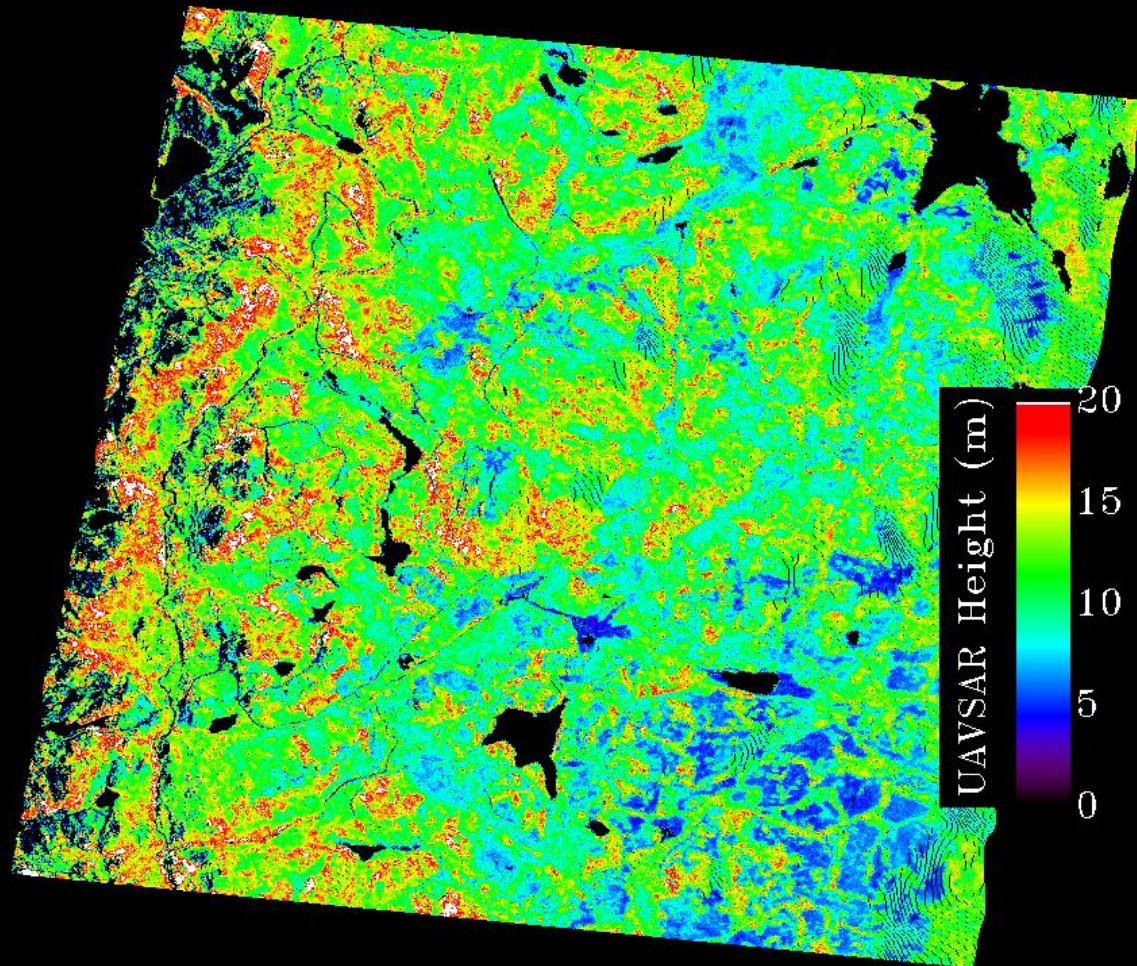
Penobscott, Maine



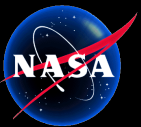
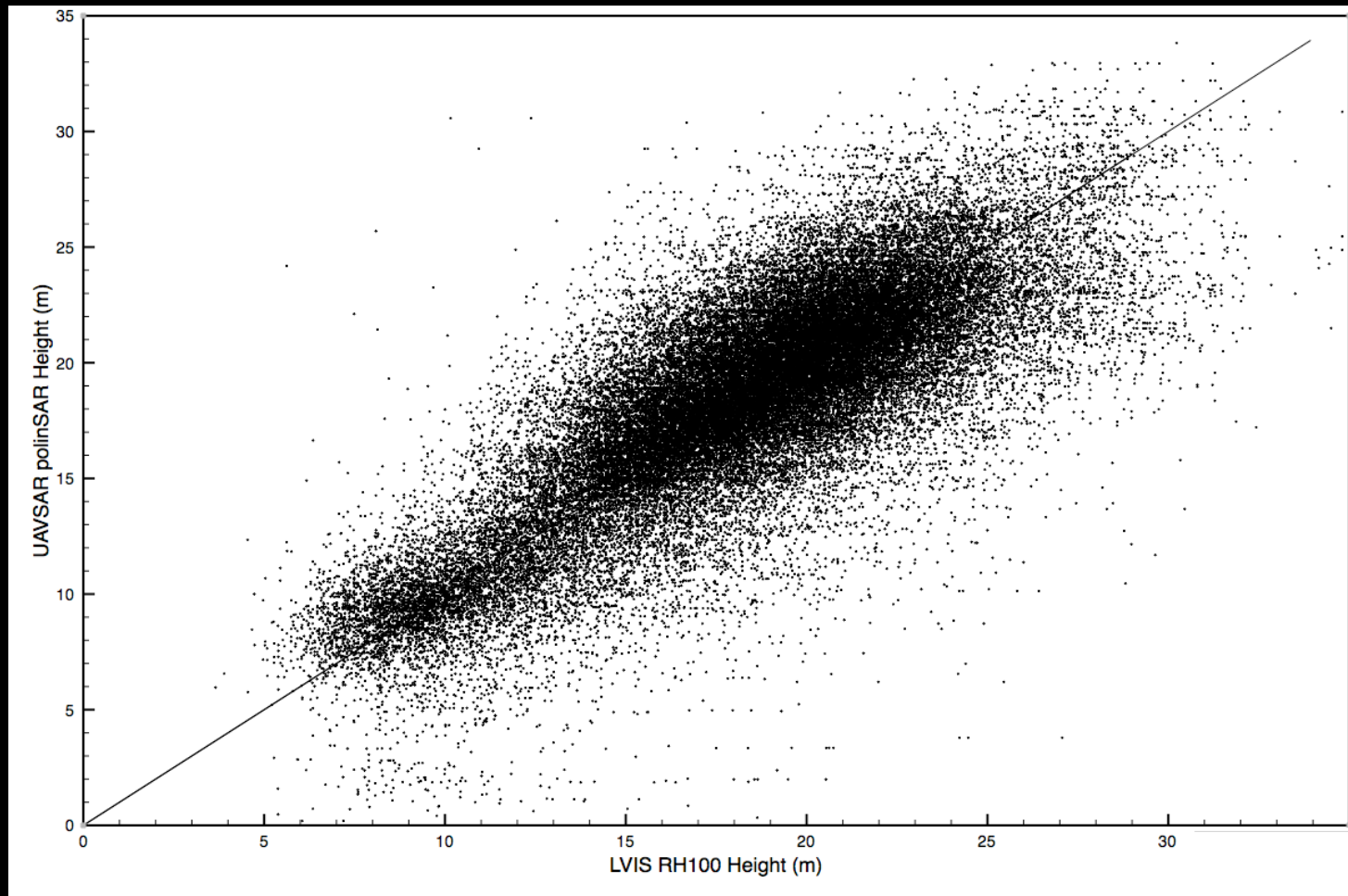
Penobscott, Maine



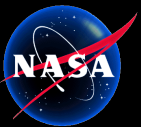
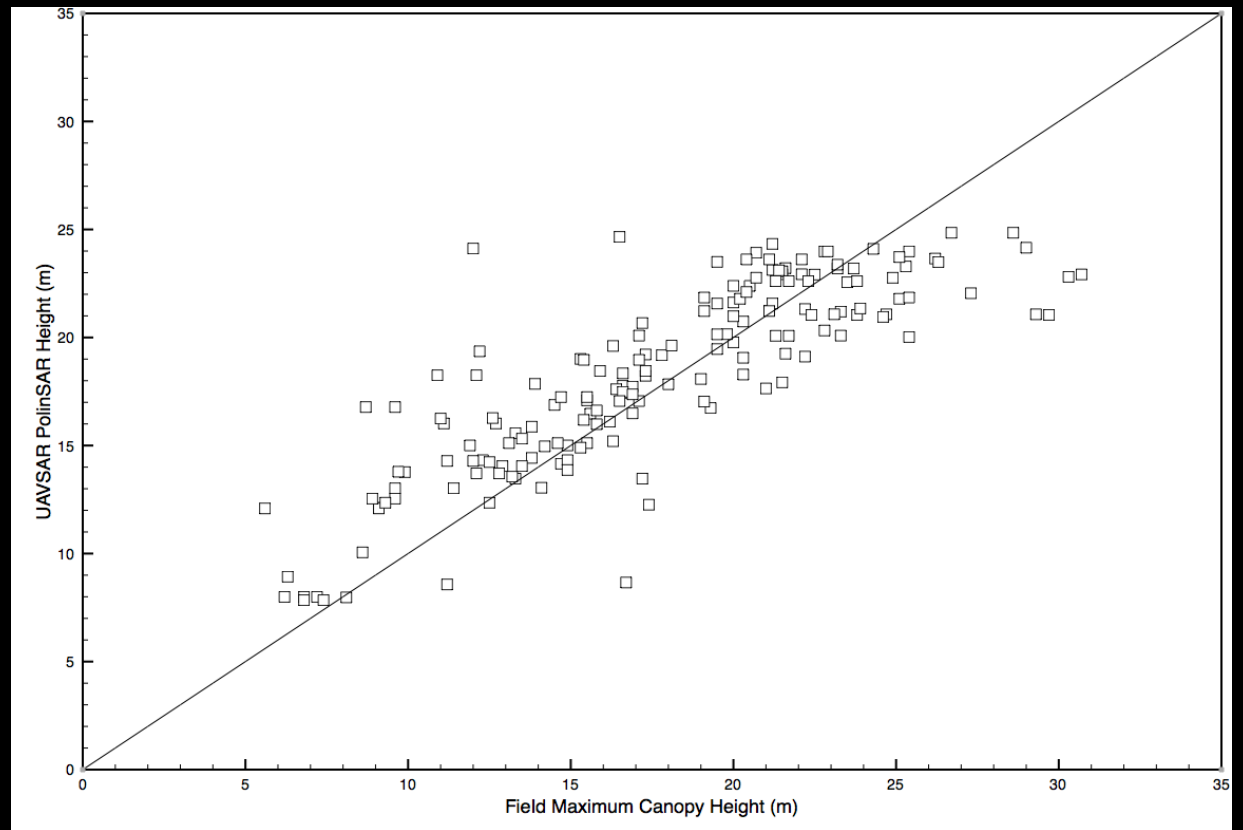
Laurentides, Québec

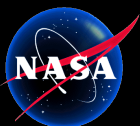
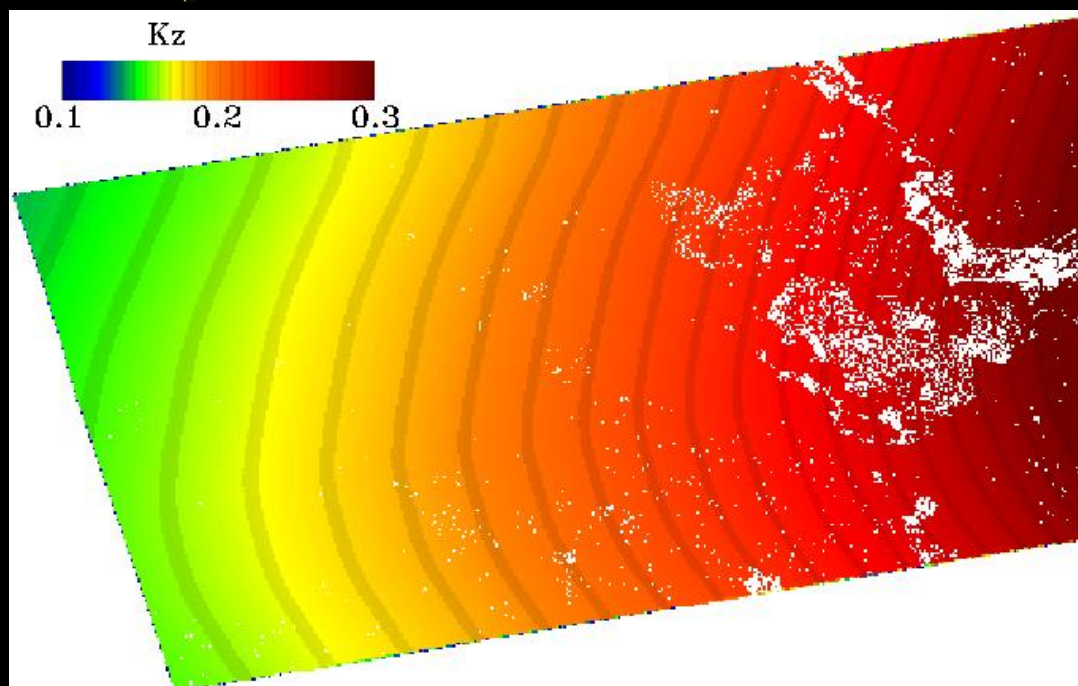
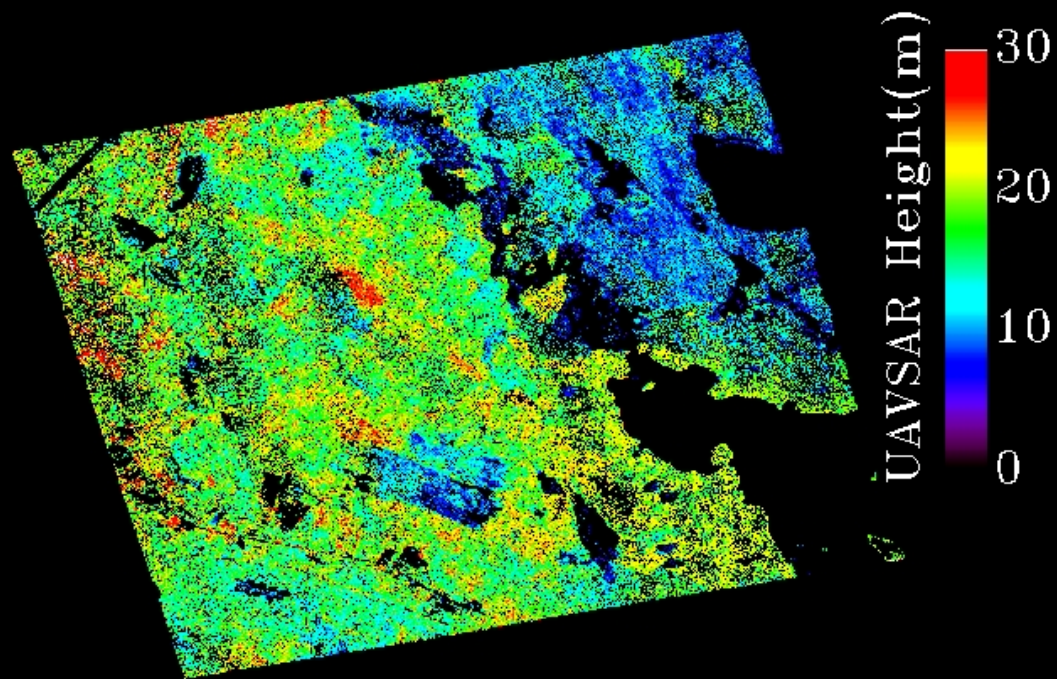


PolinSAR inversion of canopy Height



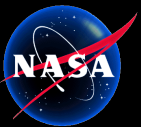
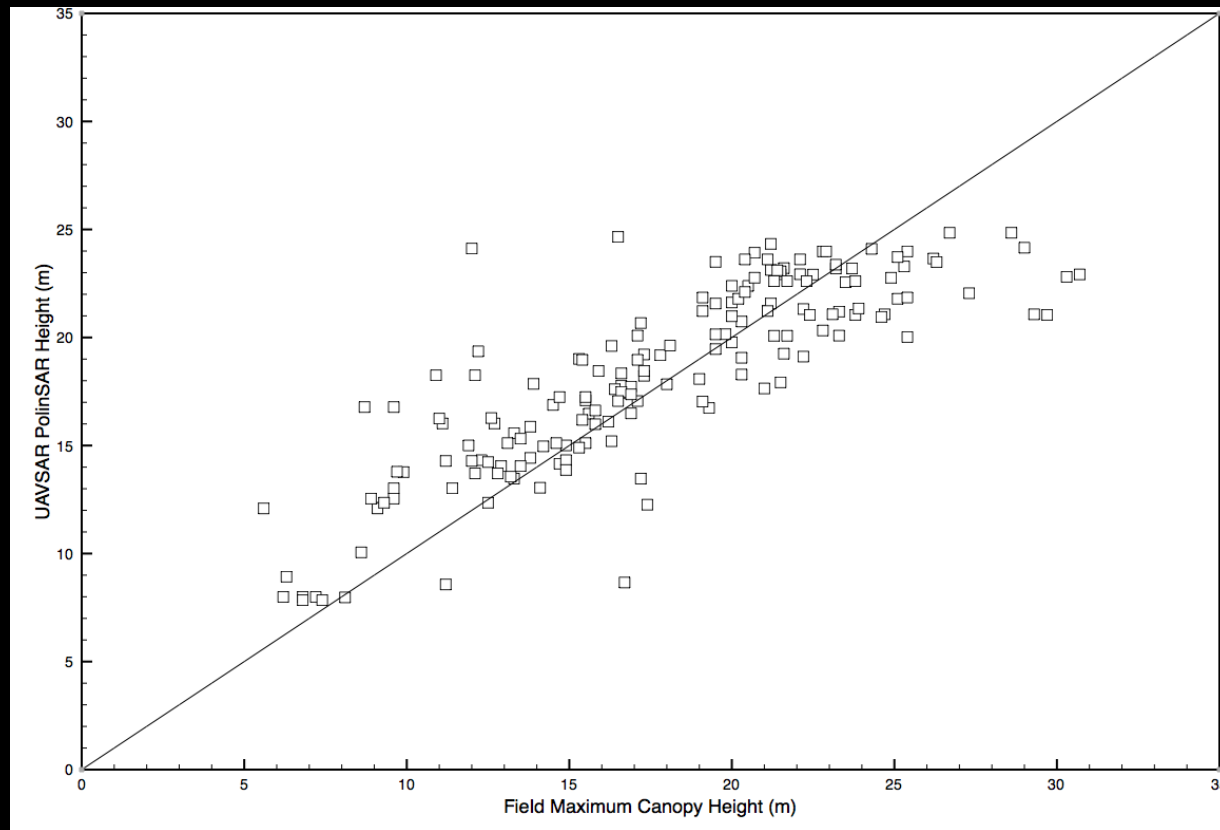
UAVSAR polinSAR vs Field Height





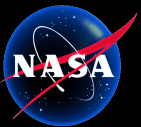
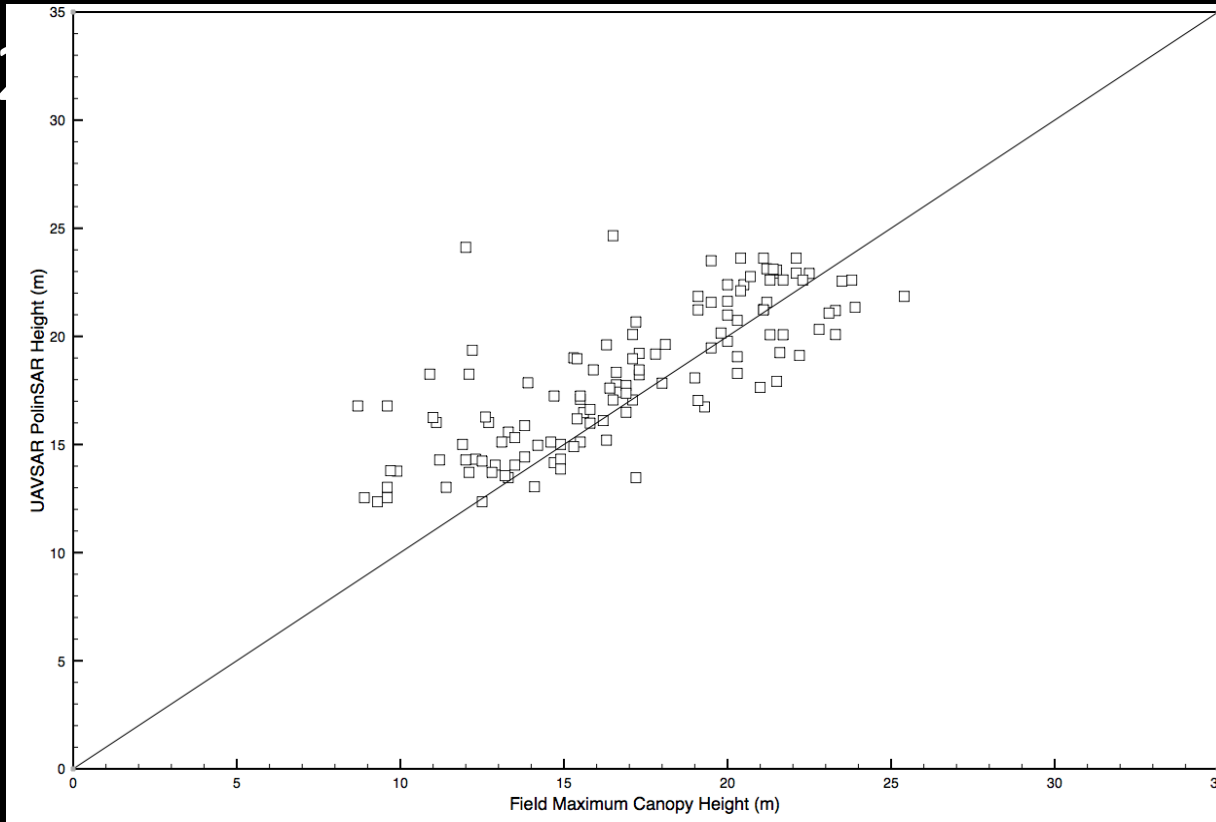
Marc.simard@jpl.nasa.gov

UAVSAR polinSAR vs Field Height



UAVSAR polinSAR vs Field Height

- $K_z < 0.2$



Conclusion

- We empirically estimated the impact of temporal decorrelation on interferometric coherence and identified a few causes
- We successfully performed polinSAR inversion of canopy height using repeat-pass UAVSAR data
- Future: Continue analysis of the impact of K_z , extinction, temporal decorrelation and spatial resolution
- Process other sites

