National Aeronautics and Space Administration

Postdoc Research

Studying water channel connectivity and overbank flow in wetlands using UAVSAR

Bhuvan K. Varugu(334G) - JPL Postdoctoral Fellow,
Cathleen E. Jones(334G), Talib Oliver-Cabrera (334D), Marc Simard (334F).

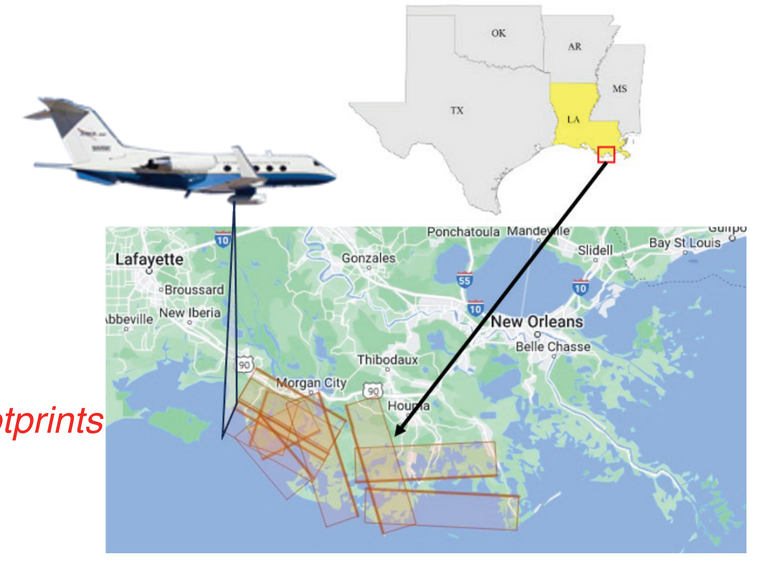
Motivation:

Rising sea level and subsiding land on the Gulf Coast of the United States is leading to coastal erosion and loss of wetlands, which protects against floods. Gain and loss of land in different parts of the coast have stimulated interest in studying the factors affecting sediment delivery and deposition in the coastal wetlands. The Delta-X project aims to study this phenomenon with multiple remote sensing (UAVSAR, AirSWOT, AVIRIS-NG) and field measurements.

Objective:

Our goal is to use UAVSAR to study the movement of water within the wetlands through a tumultuous network of channels and identify locations where,

1. Water can transport sediment and nutrients into the interior of the wetlands.
2. Water is eroding sediments around the channel edges or slowing down to deposit sediments.

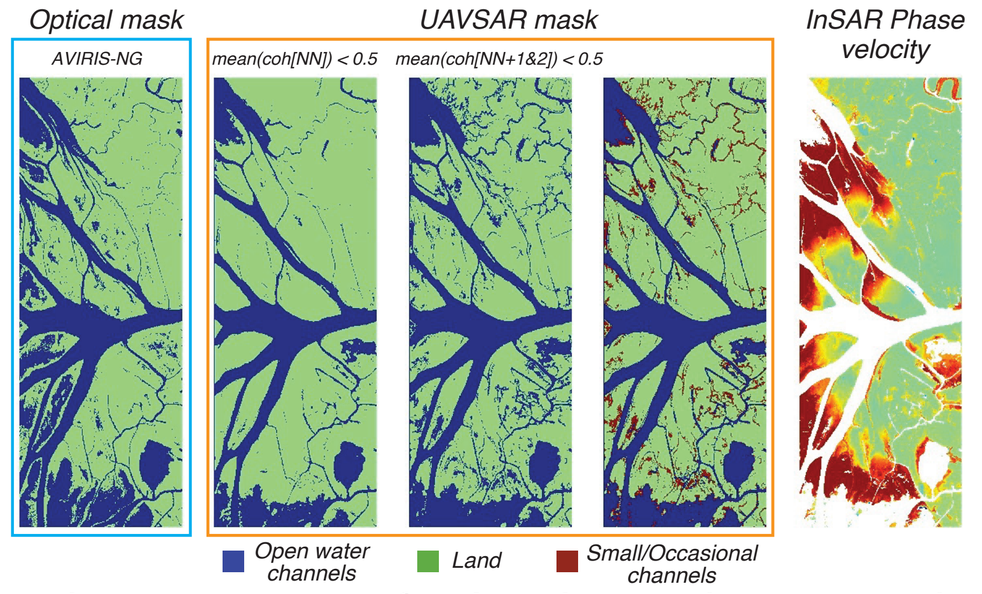


Study area showing the UAVSAR image footprints

- *Pre-DeltaX campaign in Oct. 2016 has taken acquisitions over Atchafalaya basin.*
- *DeltaX campaign has taken acquisitions in Mar. and Sep. 2021 over the Atchafalaya and Terrebonne basins.*

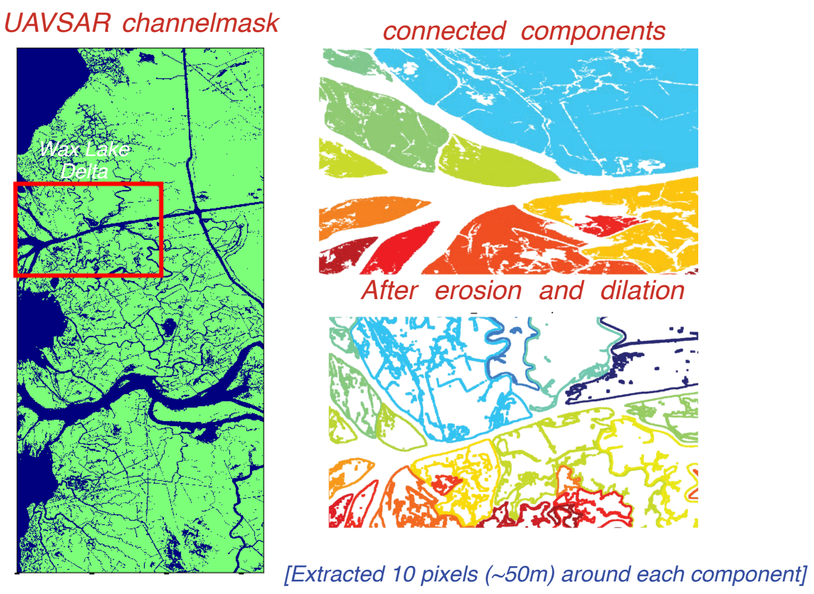
Methods:

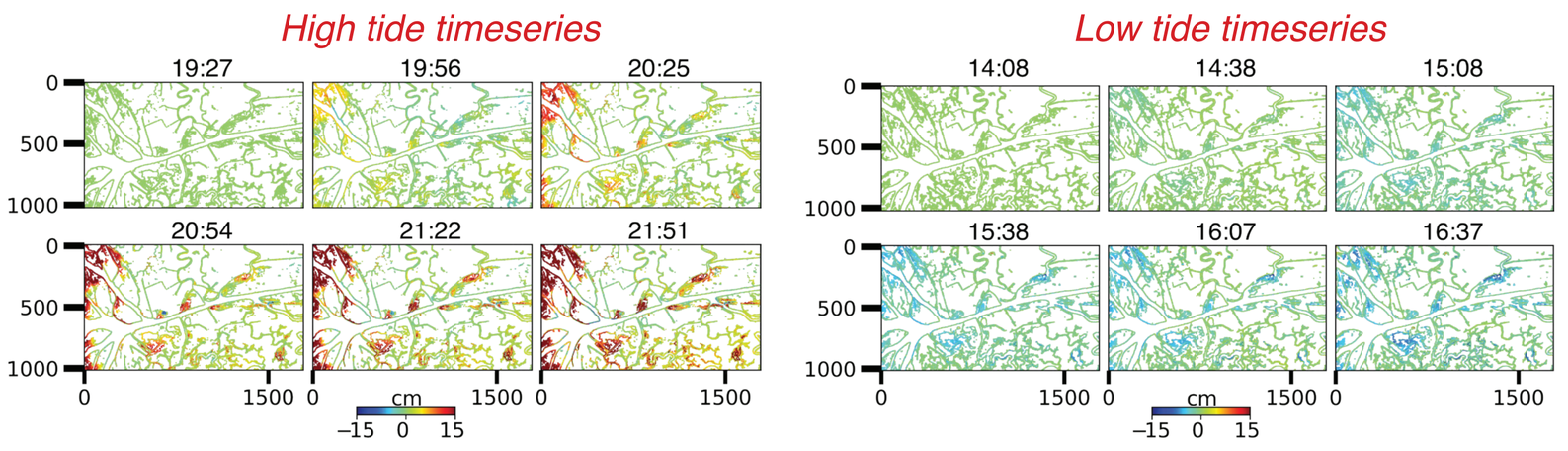
- We generate interferometric products for nearest-neighbor (NN), NN+1, and NN+2 images with ~ 30,60,90 min time separation.
- Wider open channels (identified as water all the time) can be identified by thresholding interferometric coherence on the NN pairs.
- Small Occasional channels (sometimes stagnant) can be identified by their slower loss of coherence in NN+1 and NN+2 pairs.
- Interferometric phase has shown strong potential in identifying overbank flow from the channels onto the land along the channel edges.



Results:

To identify phase changes along channel edges, we grow connected components for land area between the channels and extract the boundaries. We then take the pixels with greater phase on the boundary than the interior of the connected component to separate water level change from atmospheric noise.





- *Water level rise and fall observed during high tide and low tide in similar areas.*
- *Indicates parts of the delta receiving overbank flow and thus sediment.*

Expectations for NISAR:

- Wetland surfaces are highly dynamic and typically lose coherence in X-band and C-band SAR imagery. L-band NISAR is expected to produce more coherent measurements over the wetlands, paving way for interferometric measurements of water level changes.
- The interferometric phase has shown strong potential in identifying overbank flow from the channels onto the land along the channel edges, which can be used to monitor which parts of the cwetlands are receiving sediments and nutrients.

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California
www.nasa.gov

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Authors contact information: *bhuvan.k.varugu@jpl.nasa.gov*