Improved Floodplain Inundation Model Calibration Using 2D InSAR Altimetry

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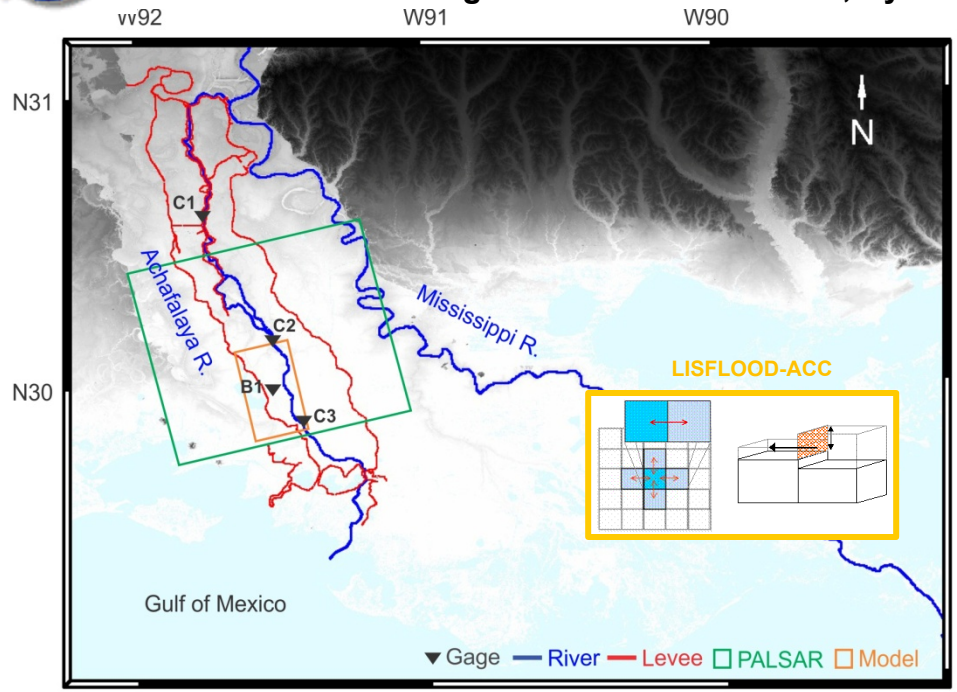

Figure 1 LiDAR map over the study area.

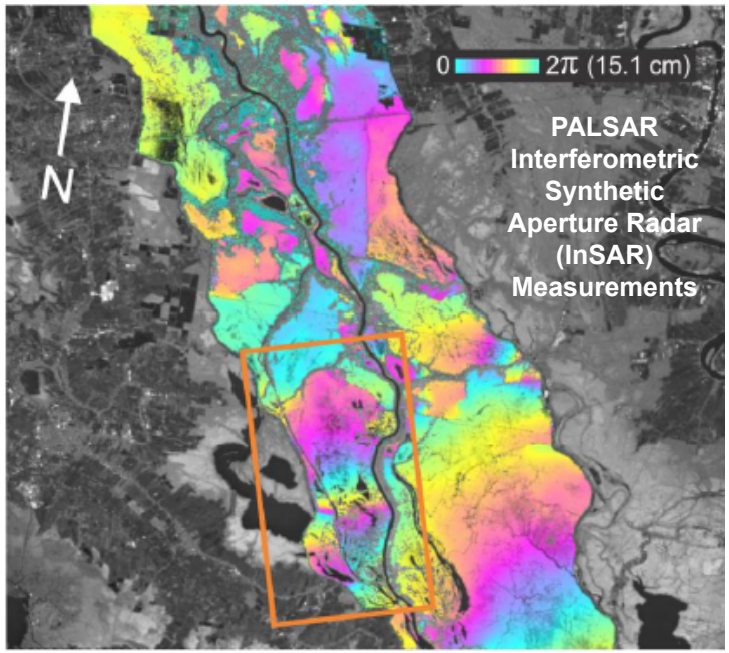

Figure 2: Differential wrapped interferogram of L-band PALSAR superimposed on the image reflectivity map.

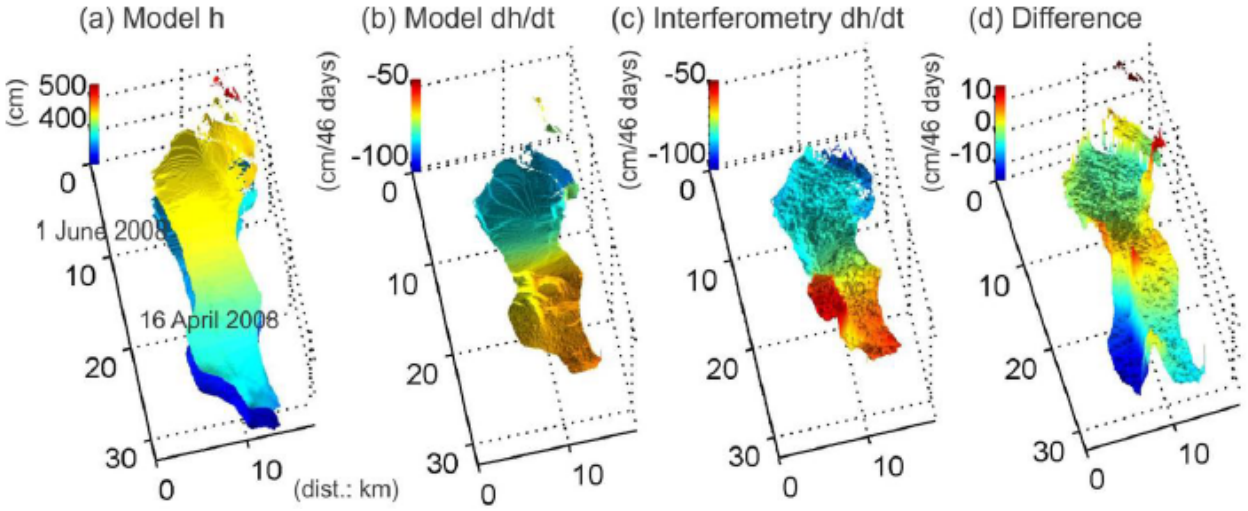

Figure 3: (a) Water elevation maps on 16 April 2008 (upper) and 1 June 2008 (lower). (b) Water elevation change map calculated from the calibrated LISFLOOD-ACC model. (c) Water elevation change map from SAR interferometry. (d) Difference between LISFLOOD-ACC and SAR interferometry water elevation change maps.

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Abstract:
Research has demonstrated the feasibility of using SAR interferometry to improve 2D hydrodynamic river model calibration through greatly enhanced knowledge of temporal changes in floodplain water surface elevation and slope. Most in situ gages are located in the river channel, which makes calibration of overbank floodplain flows difficult. The availability of high resolution altimetric imagery, such as the ALOS PALSAR Interferometric Synthetic Aperture Radar (InSAR), has offered an unprecedented opportunity for quantitative knowledge of surface water heights and slopes.

References:

- Jung, H. C., M. Jasinski, J. W. Kim, C. K. Shum, P. Bates, J. Neal, H. Lee, and D. Alsdorf, Calibration of two-dimensional floodplain modeling in the central Atchafalaya Basin Floodway System using SAR interferometry, *Water Resources Research*, 48, W07511, doi:10.1029/2012WR011951, 2012.
- Jung, H. C., M. Jasinski, J.W. Kim, C.K. Shum, P. Bates, J. Neal, H. Lee, and D. Alsdorf, Improved calibration of modeled discharge and storage changes in the Atchafalaya Floodplain using SAR interferometry, AGU Chapman Conference on Remote Sensing of the Terrestrial Water Cycle, Kona, HI, USA, 2012.

Data Sources: LiDAR data were undertaken and provided by U. S. G. S. National Geospatial Program and U. S. G. S. Coastal and Marine Geology Program. ALOS PALSAR data were provided by AK Satellite Facility (ASF).

Technical Description of Figures:

Figure 1: LiDAR map over the study area. The Atchafalaya Basin Floodway System (ABFS) is bounded on the east and west sides by levees in southern Louisiana. The upstream main channel in the basin diverts the Lower Mississippi River and flows out to the Gulf of Mexico. The orange rectangular box represents the model study area and the green diagonal box indicates the ALOS PALSAR swath. The Atchafalaya River and Mississippi River are represented by blue lines. Levees and gauges are marked with red lines and inverted black triangles. Gage stations are located at (C1) Krotz Springs and (C3) Myette Point along the main channel and at (B1) Buffalo Cove in the bayou, whereas C2 is a virtual station.

Figure 2: Differential wrapped interferogram of L-band PALSAR superimposed on the image reflectivity map in the model area. The orange rectangular box shows the location of the LISFLOOD model area. The color scale represents one cycle of interferometric phase that can be interpreted as 15.1 cm in vertical displacement. These fringes represent water elevation changes between 16 April 2008 and 1 June 2008.

Figure 3: (a) Water elevation maps on 16 April 2008 (upper) and 1 June 2008 (lower). (b) Water elevation change map calculated from the calibrated LISFLOOD-ACC model. (c) Water elevation change map from SAR interferometry. (d) Difference between LISFLOOD-ACC and SAR interferometry water elevation change maps.

Scientific significance:
The application of SAR interferometry provides a unique view of the floodplain flow gradients, not possible with a single gauge calibration. These gradients allow improved computation of water elevation and storage change over the simulation period. Overall, the results suggest that the use of 2D SAR water elevation changes in the Atchafalaya basin offers improved understanding and modeling of floodplain hydrodynamics.

Relevance for future science and relationship to Decadal Survey:
The results indicate the feasibility of using altimetry from SAR interferometry for enhanced prediction and assessment capabilities for future flood events in the floodplain. Thus, this study can offer valuable insight and preliminary results on floodplains and wetlands applications in the SWOT and DESDynI communities.