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TITLE: Improved calibration of modeled discharge and storage change in the Atchafalaya Floodplain using SAR interferometry

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ABSTRACT BODY: This study focuses on the feasibility of using SAR interferometry to support 2D hydrodynamic model calibration and provide water storage change in the floodplain. Two-dimensional (2D) flood inundation modeling has been widely studied using storage cell approaches with the availability of high resolution, remotely sensed floodplain topography. The development of coupled 1D/2D flood modeling has shown improved calculation of 2D floodplain inundation as well as channel water elevation. Most floodplain model results have been validated using remote sensing methods for inundation extent. However, few studies show the quantitative validation of spatial variations in floodplain water elevations in the 2D modeling since most of the gauges are located along main river channels and traditional single track satellite altimetry over the floodplain are limited.. Synthetic Aperture Radar (SAR) interferometry recently has been proven to be useful for measuring centimeter-scale water elevation changes over the floodplain. In the current study, we apply the LISFLOOD hydrodynamic model to the central Atchafalaya River Basin, Louisiana, during a 62 day period from 1 April to 1 June 2008 using two different calibration schemes for Manning's n. First, the model is calibrated in terms of water elevations from a single in situ gauge that represents a more traditional approach. Due to the gauge location in the channel, the calibration shows more sensitivity to channel roughness relative to floodplain roughness. Second, the model is calibrated in terms of water elevation changes calculated from ALOS PALSAR interferometry during 46 days of the image acquisition interval from 16 April 2008 to 1 June 2009. Since SAR interferometry receives strongly scatters in floodplain due to double bounce effect as compared to specular scattering of open water, the calibration shows more dependency to floodplain roughness. An iterative approach is used to determine the best-fit Manning's n for the two different calibration approaches. Results suggest similar floodplain roughness but slightly different channel roughness. However, 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 storage change over the 46-day 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.

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