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Hydrodynamic Modeling of the Congo Wetlands Using LISFLOOD and Satellite Based Measurements

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The Congo River, with the second-largest discharge and basin area of any river, has not had the same degree of research compared to the Amazon. Access to Congo wetlands is difficult resulting in a paucity of published research on the surface water hydraulics. Most of the primary research on the Congo swamps and wetlands is from the colonial era with a limited number of surface water hydrology publications since then. Hydrodynamic or hydrological modeling efforts instead rely on remotely sensed observations that either directly record water surface elevations using satellite radar altimetry or infer stage and discharge from relationships between main channel gauge data and remotely sensed data. Here we quantify the spatial and temporal distribution of water level and storage changes in the central Congo wetland using spaceborne data and the LISFLOOD-FP hydrodynamic model. This model provides 1-D kinematic and diffusive channel flow and 2-D dynamic floodplain flow. We derive model parameters such as local topography, channel width, and water depth from the Shuttle Radar Topography Mission (SRTM), from the Hydrological data and maps based on Shuttle Elevation Derivatives at multiple Scales (HydroSHEDS), and from L-band JERS-1 SAR data from the Global Rain Forest Mapping project (GRFM). We use water elevation from altimetric measurements as downstream boundary conditions and water flow derived from empirical equations or other hydrological models as initial conditions. Preliminary results show centimeter scale water level changes on the main stem Congo River and in its tributaries (e.g. Ubangi, Sangha, Likouala-aux-Herbes, Likouala Rivers) at 270-meters/pixel spatial resolution. We aim to calibrate the model with water level change and inundated area from ALOS PALSAR repeat pass interferometric measurement.