***Title****:* Land and River Two-way Coupling Development in E3SM

***Author:*** Donghui Xu, Gautam Bisht, Tian Zhou, Chang Liao, Hong-Yi Li, Zeli Tan

***Abstract***

Coastal zones, which are characterized by coupled land-river-ocean hydrologic and biogeochemical processes, are experiencing wide range of hazards and extreme weather events. Current generation Earth System Models, including DOE’s Energy Exascale Earth System Model (E3SM) are unable to resolve the dynamic land-ocean interface boundary in coastal zones as land, river, and ocean models are one-way coupled in which runoff from the land is transported by the river to the ocean. We developed a two-way hydrologic coupling between E3SM’s land model, ELM, and river model, MOSART, to study the impacts of floodplain inundation on land processes during flooding events. In the two-way coupled model, inundated water from MOSART infiltrates into ELM’s soil column based on fractional area of grid cell inundated in ELM while the river stage in MOSART is decreased based on the amount of water that infiltrates the soil column. Global simulations at $0.5°×0.5°$ resolution was performed with and without two-way coupling to quantify the effects of two-way coupling scheme. Preliminary results show that during rainfall event, soil moisture is wetter with the two-way coupling for most of areas globally compared to one-way coupling (e.g., the floodplain inundation does not influence land processes), consequently, resulting in higher surface and subsurface runoff. The increase in surface runoff is especially prominent when comparing at hourly scale, implying that flash flooding intensity can be stronger with the two-way coupling.