**Introduction**

Rivers deliver freshwater, nutrients, carbon, and pollutants to coastal regions, with consequences for marine habitats, primary production, eutrophication, hypoxia, and the global carbon cycle. Here, and in the companion presentation PL24A-2647, we describe the first steps towards improving the representation of river runoff in Estimating the Circulation and Climate of the Ocean (ECCO) global-ocean state estimates.

**Methods and Results**

**Model and Representation of River Runoff**

We use the Massachusetts Institute of Technology general circulation model (MITgcm) in several global configurations that have been previously developed and used by ECCO. We compared the impact of daily, localized JRA55-do runoff (Tsujino et al. 2018) to diffuse, climatological runoff that has been previously used by ECCO (Stamler et al. 2004; Forget et al. 2015).

**Climatological runoff**

**Daily JRA55-do runoff**

**Regional Analysis**

We focus on 10 large rivers (flowing into 8 coastal regions): 1) Amazon and Orinoco, South America, 2) Congo, Africa, 3) Changjiang, Asia, 4) Ganges and Brahmaputra, Asia, 5) Mississippi, North America, 6) Parana, South America, 7) Mekong, Asia, 8) Columbia, North America. Red circles are scaled by net river discharge.

**Models vs. Observations**

**Conclusions**

We explored the sensitivity of modeled river plumes to: 1) realistic runoff, 2) model grid spacing, and 3) model grid type. For all sensitivity experiments, the impacts are primarily local. When compared with the Soil Moisture Active Passive (SMAP) satellite observations from Apr. 2015 to Dec. 2017, we found that:

- SSS near the mouth of large rivers improved greatly when using realistic river forcing.
- SSS improved greatly when decreasing nominal grid spacing from 1° to 1/3°, but there was minimal improvement when further decreasing grid spacing to 1/6°.
- Model grid type had a negligible impact on SSS for coastal rivers in tropical and temperate zones.

These results are an important first step towards predicting land-ocean-atmosphere feedbacks seamlessly in next-generation earth system models.

**References**