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Effects of freshwater inflow to the ocean on climate simulation using the coupled climate model

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Freshwater flux has a direct effect on salinity in the ocean, which affects climate and water cycles. It modifies the density of water, mixed layer depth, and mixing and entrainment, all of which can affect sea surface temperature. Moreover, freshwater flux is an important component forcing source driving thermohaline circulation. Recently, the climate modeling community has found the importance of freshwater forcing from precipitation of river to track the flow of water to the ocean on a global scale. However, there are only a few modeling studies considering freshwater forcing and its salinity-related effects on climate variability.

In this study the effects of river discharge are investigated on simulated climatology using the coupled model. Two experiments are designed with and without the TRIP, that is, a river routing algorithm. In the run with the TRIP, the salinity is largely decreased, in particular, over the eastern and western Pacific coastal regions. The increase in SST is distinct over the eastern equatorial Pacific region. As a result, the surface fluxes are increased over the eastern Pacific, which enhances precipitation activity. The increase of precipitation over the eastern Pacific and a reduction of it over the north of the equator in the central Pacific, and the southern displacement of tropical rain over the Atlantic oceans improve the precipitation climatology. An overall increase of precipitation activity over the tropics reduces the biases in the large-scale features by warming and moistening the troposphere when the river flow routing is executed.

Our results suggest that the inclusion of freshwater routing from the continents to oceans should not be ignored in climate simulation since it alters the SST, which is the external boundary condition for the atmospheric model. This study will be extended to investigate the effects of snow-melting into the coupled model with TRIP.