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Floodplains representation in Land Surface Model : toward higher resolution

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Floodplains are flat regions close to rivers which are temporarily or permanently flooded. When they are next to large streamflow, their flooding is mainly related to the river overflow and, thus, to the precipitation occurring in the upstream regions. Large floodplains are important for the regional water cycle, the hydrological resources, the ecological services they provide and, when they are located in tropical regions, for their interaction with the atmosphere. Large tropical floodplains exist in the Amazon, the Mississippi, the Congo, the Paraguay and the Nile basins.

On the one hand, floodplains are regions with scarce ground observations which lead to difficulties to assess the accuracy of the satellite products that limits their calibration. One the other hand, the dynamic of the floodplains is usually not integrated in Land Surface Models and even less in Earth System Models although they may be important for land-atmosphere interactions. There is a need to develop numerical schemes in order to be able to represent the impact of the floodplains on the water cycle. These schemes will also allow us to better understand the hydrological dynamics in these regions.

The Land Surface component of the IPSL Earth System Model, ORCHIDEE (CMIP6 version) includes a river routing scheme with a floodplains scheme at a resolution of 0.5°. This scheme allows the water from the precipitation over the upstream region to flood and evaporate over the floodplains. Recent developments in ORCHIDEE driven by the need for a higher resolution routing scheme, based on sub-grid hydrological units, allowed us to implement a floodplain scheme which improves the representation of the overbank flow and the spatial distribution of ponded water with respect to the CMIP6 version of ORCHIDEE.

This study focuses on the Pantanal region which is the world's largest tropical floodplains and is located in the La Plata Basin, in the Upper Paraguay River (South America). ORCHIDEE's sensitivity to the activation of floodplain schemes has been assessed through simulations performed at various resolutions. These simulations have shown the importance of representing floodplains to simulate the water cycle in the area. Combining these simulations and observations, we estimated the evapotranspiration loss by models when the floodplains scheme is deactivated to 90 mm/year

over the Pantanal. The higher resolution scheme shows realistic simulations of the river discharge over the floodplains and is expected to improve the spatial distribution of the flooded area and, thus, the representation of evapotranspiration.