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Simulating the spatio-temporal variability in terrestrial - aquatic DOC transfers across Europe

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Inland waters receive important amounts of dissolved organic carbon (DOC) from surrounding soils, which drives an important net-heterotrophy and subsequent CO_2 emission from these systems. At the same time, this DOC transfer decreases the soil carbon sequestration capacity, which may limit the efficiency of the land carbon sink. The variation of DOC stocks and fluxes in time and space is modeled using the ORCHILEAK model that couples terrestrial ecosystem processes, carbon emissions from soils to headwater streams by runoff and drainage, as well as carbon decomposition and transport in rivers until export to the coastal ocean. The runs were performed at the resolution of 0.5°, taking advantage of the relatively dense observations of soil and river DOC available for European catchments. The model was first evaluated for the hydrology by comparing the discharge at different stations along several large European rivers. The DOC measurements were used to calibrate the different parameters of the ORCHILEAK model and to evaluate the model results. ORCHILEAK was then used to generate the first European map of DOC stocks and leaching for the four seasons. We estimate a soil DOC stock at 71 TgC and a DOC leaching flux of 7,8 TgC/yr, largely dominated by runoff exports during the winter season. Our model results also allow to identify the underlying processes controlling the fraction of terrestrial NPP exported to the European inland water network. The next step will be to use the model to hindcast historical DOC fluxes and predict their evolution over the 21st century using climate change and land use projections from the SSP-RCP scenarios developed for the IPCC assessment report.