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Coupling between the carbon cycle and the lateral hydrology: First implementation of riverine organic carbon transport within MPI-ESM

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Permafrost and peat carbon storage is much larger than the global atmospheric carbon storage. The thawing of permafrost leads to a substantial addition of riverine organic carbon along with the emission of greenhouse gases. The current state of the art Earth System Models (ESMs) do not consider the lateral transport of carbon from land to ocean via rivers/streams and account only on vertical gas exchange processes between land or ocean carbon reservoirs in the evaluation of the global carbon budget. Moreover, the vertical gas exchange processes are active during the lateral transport but are not considered in the impact of thawing permafrost on global climate.

In this research, we propose a framework of combining the soil carbon transport via rivers using the hydrological discharge scheme of MPI-ESM (HD model). The soil carbon classification is based on the water solubility (YASSO carbon pools) and their subsequent attribution to the dissolved organic carbon (DOC) via runoff and baseflow. The HD model will be extended by the inclusion of the DOC as a tracer and evaluated over selected test areas. Evaluation of DOC transport scheme is intended at reservoir level via available site measurements. Decomposition of DOC en-route land to ocean via vertical gas exchange processes will be included.