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Impacts of terrigenous Dissolved Organic Carbon on the carbon sink of shelf seas

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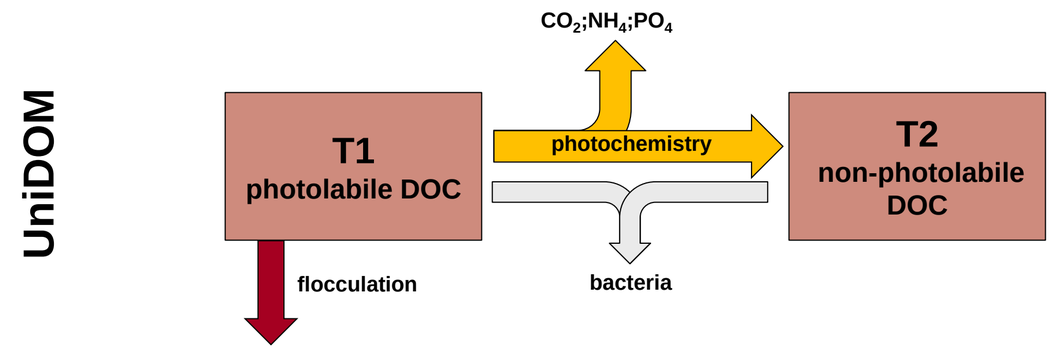
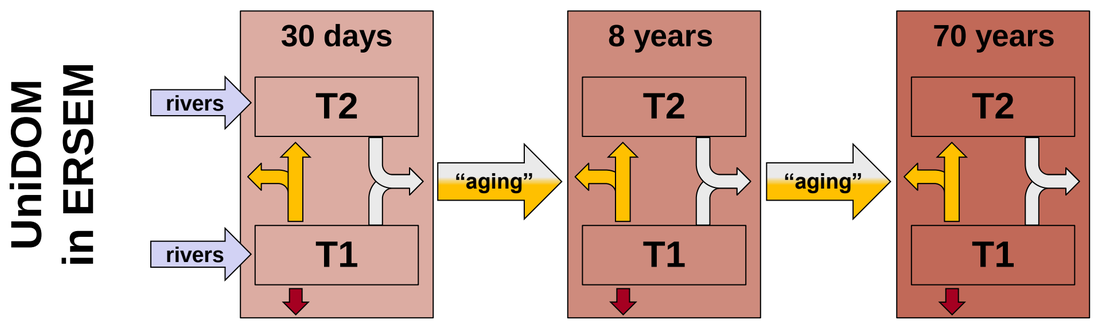
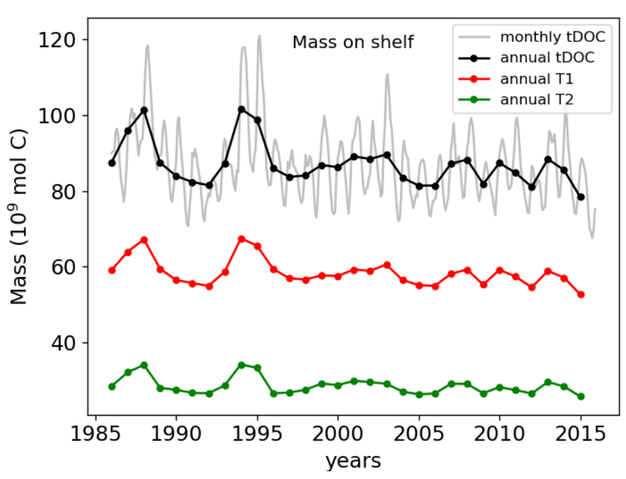
The amount of terrigenous Dissolved Organic Carbon (tDOC) discharged by rivers into the coastal ocean are increasingly recognised as an important part of the global carbon cycle and its fate is largely uncertain [1].

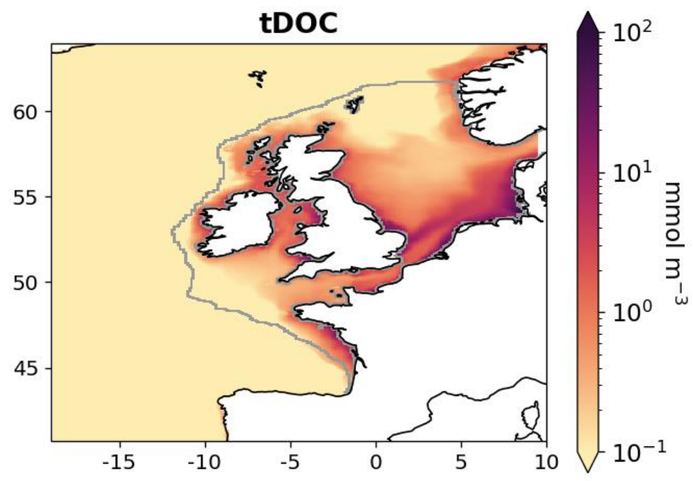
To study the transformation of tDOC along the Land-Ocean Aquatic Continuum (LOAC), a new model called UniDOM was recently created [2]: tDOC is split in a photolabile pool (T1) and a non photolabile (T2) and their degradation is a function of the age (i.e. time from release in LOAC).

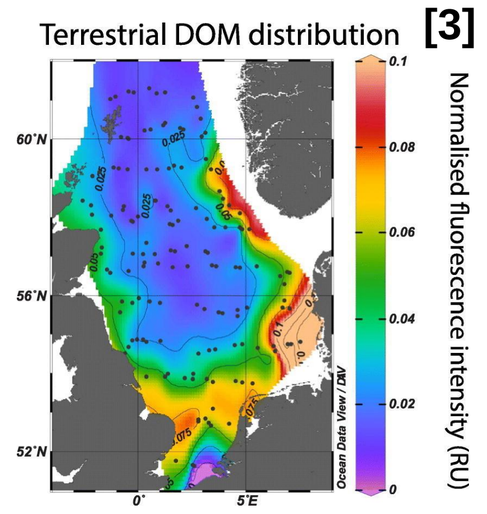
To study the fate of the tDOC discharged by European rivers in the North Western European Shelf, we implemented UniDOM in the NEMO-ERSEM framework by considering three fixed-age classes and assuming aging as a function of the degradation process.

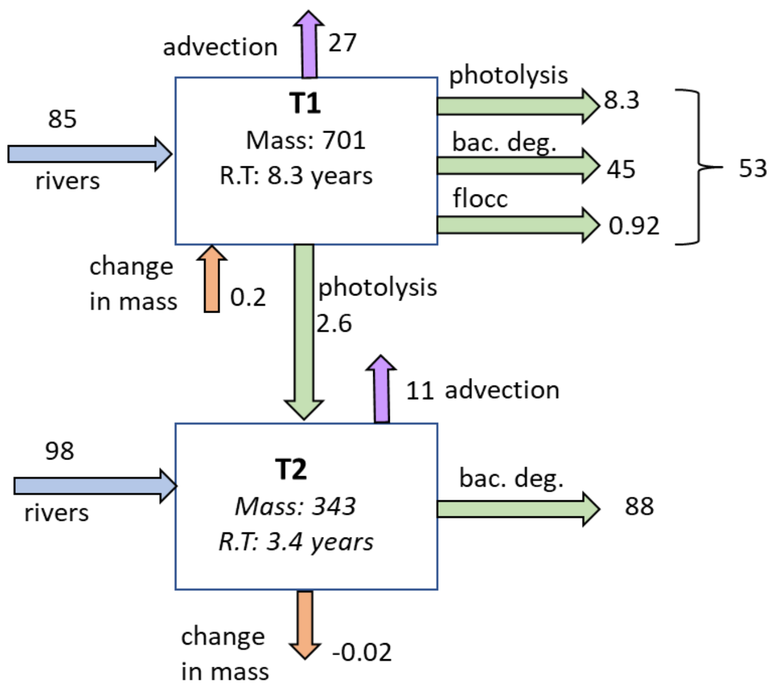


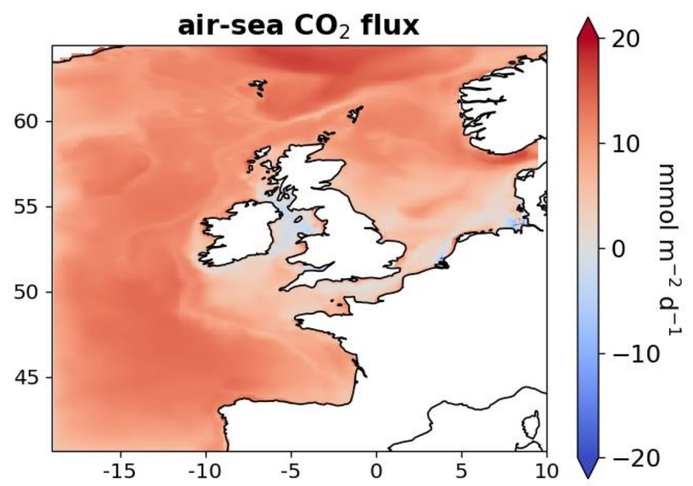


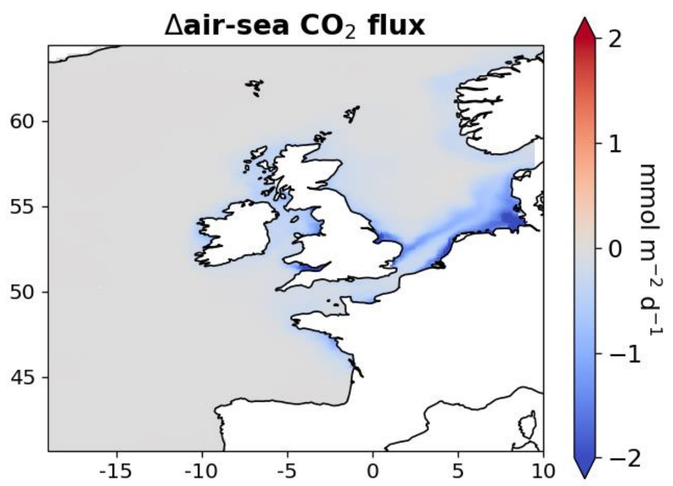






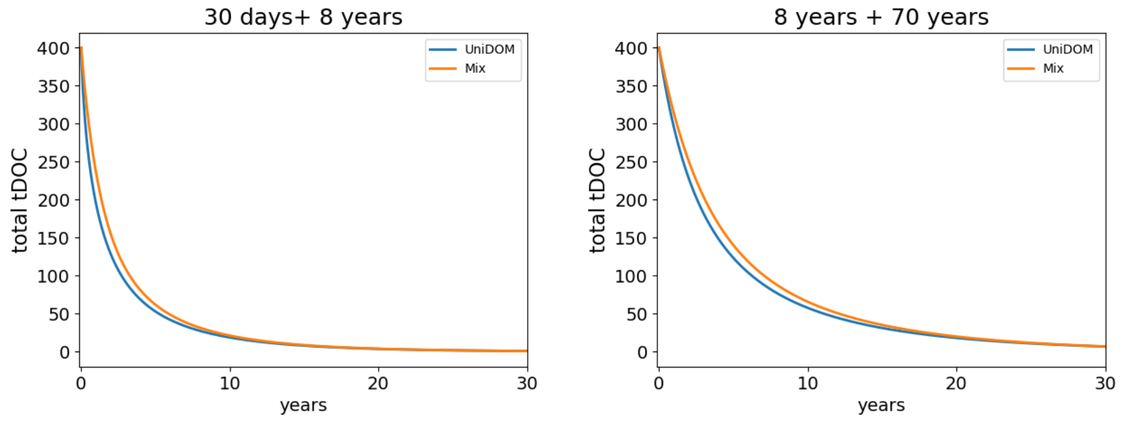






38 GmolC yr^{-1} of tDOC are advected into the wider Atlantic Ocean (21% of the input from rivers), with the rest (141 GmolC yr-1) being internally processed. As a consequence, the carbon sink of the shelf is reduced of 112 GmolC yr^{-1} (4%)

To reduce the amount of tracers to add in Earth System Models, the original concept of UniDOM of continuously varying age could be applied, using the approach of Deleersnijder et al [4]. However, mixing tDOC of different ages would result in an intermediate degradation rate that are not representative of the dynamics of any of the age in the mix. Preliminary 0D studies suggest that such a model might overestimate the tDOC, but potentially within an acceptable range



References: [1] Ciais et al., IPCC AR5 Chapter 6; [2] Anderson et al., Biogeochemistry, 2019; [3] Painter et al., Sci Tot Env, 2018; [4] Deleersnijder et al. J of Mar Sys, 2001

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