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Regulators of Atmospheric CO_2

$\delta^{13}C$ tracing of dissolved inorganic carbon sources in major world rivers

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The significance of rock weathering and river transport in the global carbon cycle has already been discussed by many authors. Rivers discharge into the oceans on average 1 GtC.y-1 of which 40% as Dissolved Inorganic Carbon (DIC). DIC originates mainly from atmospheric CO_2, soil organic matter oxidation and carbonate dissolution. Only geochemical modeling and geochemical tracers have been used until now to distinguish DIC sources. Nevertheless each DIC sources have different $\delta_{13}C$ isotopic signatures (-26‰ to -9‰ for soil organic matter according to C3 or C4 plants, -8‰ to -6‰ for the atmospheric CO_2 and around 0‰ for carbonate rocks) but few studies have been devoted to the use of carbon isotopes to trace the different DIC sources and their behaviour in the river water. This study presents the results obtained for some large rivers in South America, in India, in Africa and in Europe. $\delta_{13}C_{DIC}$ values are greatly variable from one river to another, going from very negative values as for the Amazon river (until -27‰) to less negative values as for the Patagonian rivers (until -2‰ for the Chico). All these results are also compared with literature values which are not yet very abundant. These variations show that the average isotopic signature of the DIC fluxes discharged into the world ocean (-10‰ to -12‰) which is used in the oceanic carbon cycle modeling needs to be revised, at least regionally. The major result of this study concerns the negative relationship between $\delta_{13}C_{DIC}$ and the dissolved organic carbon (DOC) content, showing that the organic carbon oxidation greatly contributes to decrease the riverine $\delta_{13}C_{DIC}$.