Cross-boundary Exchanges of Carbon and Nitrogen in the Marginal Seas

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Continental marginal zones are characterized as those areas where rivers, lands, oceans, the atmosphere and sediments meet and interact. Despite their moderately-sized surface areas, marginal zones play a significant role in the biogeochemical cycles of both carbon and nitrogen in that they receive huge upwelled and riverine inputs of both. Although the riverine flux of nutrients has been on the rise in the past few decades, this study confirms the results of a recent synthesis (Chen et al., 2002) according to which eutrophication-derived carbon deposits in the continental margins do not yet account for all the reportedly missing anthropogenic CO_2. Nevertheless, marginal zones absorb $30 \cdot 10^{12}$ molC y^{-1} (0.36 GtC y^{-1}) from the atmosphere, therefore representing important, albeit often neglected, links in the global carbon cycle. On the other hand, most shelves and estuaries do show that the production of other such greenhouse or reactive gases as CH_4, dimethyl sulfide (DMS) and N_2O are an on-going feature, making up a net total flux of $0.1 \cdot 10^{12}$ mol y^{-1} CH_4, $0.07 \cdot 10^{12}$ mol y^{-1} DMS and $2.5 \cdot 10^{12}$ molN y^{-1} N_2O to the atmosphere. The shelves also transport $50 \cdot 10^{12}$ mol y^{-1} DOC, $45 \cdot 10^{12}$ mol y^{-1} POC, $21 \cdot 10^{12}$ mol y^{-1} PIC, $5 \cdot 10^{12}$ mol y^{-1} DON and $5 \cdot 10^{12}$ mol y^{-1} PON to the open oceans.