ELS2014 –The Earth Living Skin: Soil, Life and Climate Changes
EGU – SSS Conference
Bari | Italy | 22 – 25 September 2014
ELS2014-91-1

Anthropogenic perturbation in the land to ocean aquatic continuum: implications for the global carbon budget

Pierre Regnier (1), Pierre Friedlingstein (2), Philippe Ciais (3), Fred Mackenzie (4), Nicolas Gruber (5), Ronny Lauerwald (1), and Goulven Laruelle (1)

(1) Université Libre de Bruxelles (ULB), Dept. of Earth & Environmental Sciences, CP160/02, Bruxelles, Belgium (pregnier@ulb.ac.be), (2) University of Exeter, Exeter, UK, (3) Institut Pierre Simon Laplace, Gif-sur-Yvette, France, (4) University of Hawaii, Hawaii, USA, (5) ETH Zurich, Zurich, Switzerland

A substantial amount of atmospheric carbon taken up on land through photosynthesis and chemical weathering is transported laterally along the aquatic continuum from upland terrestrial ecosystems into the ocean. So far, global carbon budget estimates implicitly assumed that the lateral transport and the myriad of transformation processes along this aquatic continuum have remained unchanged since pre-industrial times. We show here that the anthropogenic perturbations to the land-ocean aquatic continuum may have increased the flux of carbon to inland waters by as much as 1 Pg C yr-1 since preindustrial times, mainly by enhanced carbon exports from soils. Most of this input to upstream rivers is either lost back to the atmosphere by CO_2 outgassing ($\sim$0.4 PgC yr-1) or sequestered in sediments ($\sim$0.5 PgC yr-1) along the freshwater-estuarine-coastal waters continuum, leaving only a perturbation carbon input of $\sim$0.1 PgC yr-1 to the open ocean. According to our analysis, terrestrial ecosystems store $\sim$0.9 Pg C yr-1 at present, which is in agreement with results from forest inventories but significantly differs from the figure of 1.5 Pg C yr-1 previously estimated when ignoring changes in lateral carbon fluxes. This suggests that the anthropogenic perturbation of the carbon fluxes from land to ocean need to be included in global CO_2 budget analyses.