Re-evaluation of carbon cycle in biosphere through advanced model

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New Development of Eco-hydrologic and Biogeochemical Coupling Model

Inland waters including rivers, lakes, and groundwater are increasing to draw attention in biogeochemical cycling [1]. The authors have so far developed process-based National Integrated Catchment-based Eco-hydrology (NICE) model [2, 3], which includes feedback between hydrologic-geomorphic-ecological processes in various scales. In this study, NICE was further developed to couple with some biogeochemical cycle models (LPJ, SWAT, QUAL2K, CO2SYS, RokGeM, etc.) in global scale. This NICE-biogeochemical coupling model incorporates connectivity of the biogeochemical cycle accompanied by hydrologic cycle between surface water and groundwater, hillslopes and river networks, and other intermediate regions. The model also includes reaction between inorganic and organic carbons, and its relation to nitrogen and phosphorus in terrestrial-aquatic continuum.

Discussion of Results

The model simulated CO2 evasion from inland water in global scale, and agreed reasonably with empirical relation [4]. The model also showed carbon storage, and DOC, POC, and DIC export to ocean in relation to hydrologic change, which are strictly conserved as carbon budget in the model. Further, the authors tried to clarify how carbon cycle might change as inland waters become polluted with nutrients from agriculture and urban areas. This advanced mechanistic model would help to re-evaluate greenhouse gas budget and to bridge gap between top-down and bottom-up approaches [1].

[1] Battin *et al* (2009) *Nat. Geosci.* **2**, 598-600. [2] Nakayama (2014) *Handbook of Engineering Hydrology*, Taylor and Francis, 329-344. [3] Nakayama (2015) *Geophysical Monograph 206*, AGU, 521-535. [4] Aufdenkampe *et al* (2011) *Front. Ecol. Environ.* **9**, 53-60.