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Biogeosciences Discussions

# *Interactive comment on* "Carbon dynamics and $CO_2$ air-sea exchanges in the eutrophied coastal waters of the southern bight of the North Sea: a modelling study" *by* N. Gypens et al.

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In the introduction, the authors reviewed results from other shelves and suggested a latitudinal change of CO2 uptake in high latitudes and release in lower latitudes. The anonymous referee #1 suggests that the authors not to "confuse the introduction with low latitude or other unrelated studies." I agree with this referee that the authors should focus on reviewing information from similar systems in the introduction since this paper does not deal with the latitudinal variability. Because of this reason, a casual mention of latitudinal pattern here (though with refs cited) is somewhat "speculative". Therefore, I also recommend that this part be removed from the ms.

However, I actually agree with the authors on their view on the latitudinal variation of shelf CO2 flux (Cai and Dai 2004). It is indeed time to summary available information of CO2 fluxes from coastal oceans to derive a more reliable global flux. Past global

shelf CO2 fluxes (0.4-1.0 PgC/yr) were derived from single case studies such as those in the North Sea and the East China Sea.

Finally, a minor clarification. Cai et al. (2003) reported that the US South Atlantic (SAB) was a source of CO2 to the atmosphere. It was also reported that river estuaries and marsh waters nearby were sources of CO2 to the atmosphere (Cai et al. 1999; Wang and Cai 2004). In finding the reason for apparent net heterotrophic in these systems, I have argued that it is the large CO2 fixation of marsh plants (and thus the subsequent DOC export and degradation) that sustains or drives such CO2 release in coastal waters there. The large CO2 fixation flux into marsh plants given in Cai et al. (2003) was, however, from marsh ecological studies not from direct CO2 flux measurements. Such heterotrophic coastal aquatic system subsidized/driven by external OC input should not be uniquely limited to the SAB since salt marshes (and mangroves) are abundant in mid to low latitude coastal areas.

Refs: Cai, W.-J. and Dai, M. 2004. A Technical Comment on “Enhanced open ocean storage of CO2 from shelf area pumping” by Thomas et al. (Science 304). Science (in press).

Cai, W-J., Z. Wang and Y. Wang. 2003. The role of marsh-dominated heterotrophic continental margins in transport of CO2 between the atmosphere, the land-sea interface and the ocean. Geophys. Res. Lett. 30(16), 1849.

Cai, W.-J., L. R. Pomeroy, M. A. Moran and Y. Wang. 1999. An oxygen and carbon dioxide mass balance model of the estuarine/intertidal marsh complex of five rivers in the Southeastern U.S. Limnol & Oceanogr. 44:639-649.

Wang, Z. and Cai, W-J. 2004. Carbon dioxide degassing and inorganic carbon export from a marsh dominated estuary (the Duplin River): A marsh CO2 pump. Limnol. & Oceanogr. 49(2):341-352.

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