**Assessing the performance of a coastal carbon model in the Chesapeake Bay**

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**Introduction/methods**

As a connecting point between land and oceans, estuaries are where inorganic and organic carbon undergoes important biogeochemical processes and transformations, such as photosynthesis, respiration, regeneration, flocculation, and sedimentation, but the net role estuaries play in the coastal carbon cycle is still not well understood. We applied a high resolution, 3-D, coupled biogeochemical model (Fig. 1) to the Chesapeake Bay to study the role of estuaries in coastal carbon cycling. The model is forced by riverine inorganic nutrients, inorganic carbon and organic carbon from USGS. We ran the model for 2004 and compared the model simulated state variables with available observations from the Chesapeake Bay Program (CBP; Fig. 2) using Target Diagrams (Fig. 3).

**Results**

Using the high resolution, 3-D, coupled biogeochemical model, we calculated the magnitudes of the emissions and sinks of carbon and chlorophyll (Fig. 4-10). The magnitudes of the emissions and sinks of carbon and chlorophyll (Fig. 4). The model has significant skill in terms of reproducing the hydrodynamics of the estuary. Model-data comparisons of biogeochemical variables (e.g. ammonium, nitrate, chlorophyll, dissolved and particulate organic nitrogen (DON & PON)) demonstrate that the model has more difficulty reproducing the biogeochemical fields. Specifically, the model significantly overestimates the nitrate field, particularly in the lower Bay. The model also slightly underestimates chlorophyll, POC, DOC and PON, implying that the model may need to be adjusted such that inorganic nitrogen and carbon are converted more efficiently to organic forms. In general, the biogeochemical model reproduces the magnitude of the observed carbon and chlorophyll distributions better than the seasonal variability.

**Conclusions**

Model-data comparisons of physical variables (e.g. salinity and temperature; Fig. 4-6) demonstrate that the model has significant skill in terms of reproducing the hydrodynamics of the estuary. Model-data comparisons of biogeochemical variables (e.g. ammonium, nitrate, chlorophyll, dissolved and particulate organic nitrogen (DON & PON)) demonstrate that the model has more difficulty reproducing the biogeochemical fields. Specifically, the model significantly overestimates the nitrate field, particularly in the lower Bay. The model also slightly underestimates chlorophyll, POC, DOC and PON, implying that the model may need to be adjusted such that inorganic nitrogen and carbon are converted more efficiently to organic forms. In general, the biogeochemical model reproduces the magnitude of the observed carbon and chlorophyll distributions better than the seasonal variability.

**Future Work**

Kemp et al. (1997) estimated carbon fluxes in the mainstream of Chesapeake Bay, including physical input and output fluxes as well as biotic metabolism associated with primary production and respiration (Fig. 11). We will use our model to similarly estimate these carbon fluxes and transformations, in order to better understand the role estuaries play in the coastal carbon cycle.

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**Reference**

Drearn et al. (2010), Modeling the dynamics and export of dissolved organic matter in the northeastern U.S. continental shelf, Estuar. Coastal Shelf S., 86(4), 488 – 507
