High-Resolution Ocean-Biogeochemistry Modeling for the East and Gulf Coasts of the U.S. in Support of the Coastal Monitoring and Research Objectives of the NOAA OA Program

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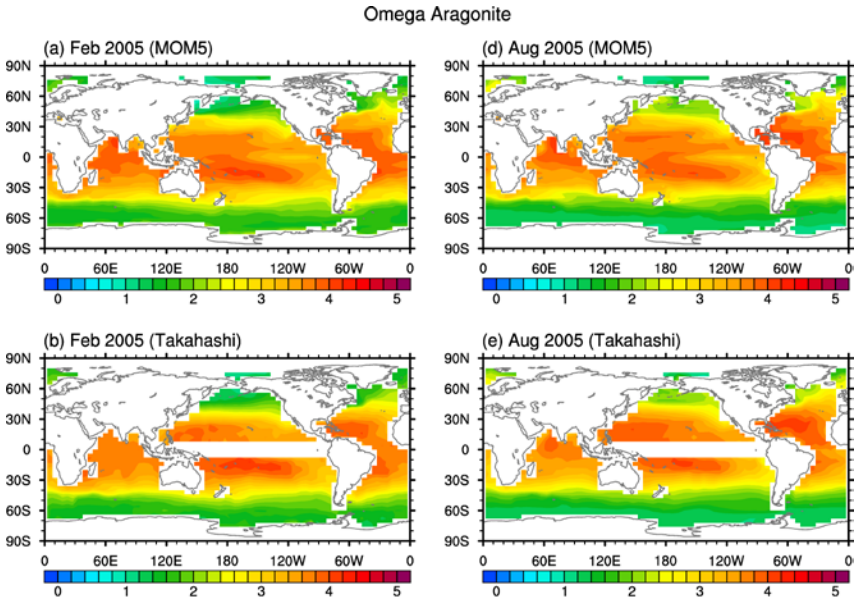
Analysis of the data collected during the first (2007) and the second (2012) Gulf of Mexico and East Coast Carbon (GOMECC) cruises showed measurable temporal pH and aragonite saturation state (Ω_{Ar}) changes along the eight major transects. However, it is challenging to determine how much of this temporal change between the two cruises is due to global ocean acidification and how much is due to variability on seasonal to interannual scales. Indeed, the expected 2% average decrease in Ω_{Ar} due to increasing atmospheric CO_2 levels over the 5-year period was largely overshadowed by local and regional variability from changes in ocean circulation, remineralization/respiration and riverine inputs. Therefore, in order to provide useful products for the ocean acidification (OA) research community and resource managers, it is important to filter out seasonal cycles and other variability from the multi-annual trend. Here, we propose to use a high-resolution regional ocean-biogeochemistry model simulation for the period of 1979 - present day (real-time run) to fill the temporal gap between the 1st and 2nd GOMECC cruise data. In addition we will fine-tune and validate the model by using extensive surface water pCO_2 observations from the ships of opportunity in the coastal region (SOOP-OA), and using the carbon observations from the East Coast Ocean Acidification Cruises (ECOA-1) and OAP mooring stations and from remotely sensed data. Then, we will use the real-time model run to estimate the 5-year trends (2012 – 2007) of OA and the carbon and biogeochemical variables along the East and Gulf coasts of the U.S. We will also examine the future OA variability in the East and Gulf coasts of the U.S. by downscaling the future climate projections under different emission scenarios developed for the IPCC-AR5. Based on the results obtained from the proposed model simulations, we will contribute to an observational strategy suitable for elucidating multi-annual trend of carbon and biogeochemical variables along the East and Gulf coasts of the U.S.



Surface aragonite saturation state in February and August of 2005 derived from

(Upper panels) the global MOM-TOPAZ simulation and (Lower panels) observation based estimates by Takahashi et al. (2014).