Seasonal algae plays critical role in North Pacific carbon uptake

June 18 2012

The role of the North Pacific Ocean as a net carbon sink may prove to be more precarious than previously thought as researchers work to isolate the contributions of biological and physical processes to air-sea gas exchange. Scientists have long known that physical processes, such as the seasonally changing solubility of carbon dioxide in seawater, combine with a biological pump driven by seasonal shifts in phytoplankton growth to control the carbon dioxide flux in the region.

A dearth of on-site evidence regarding biological pump function, however, has prevented researchers from assessing the relative importance of either mechanism to known carbon uptake rates. From data collected during four cruises from 2003 to 2008, Juranek et al. determined the strength of the biological pump, finding that for the northern Pacific Ocean it was strong enough to counteract solubility induced outgassing in summer, turning a net source region into a carbon sink.

The North Pacific is split into three sections: an anticyclonic subtropical gyre, a cyclonic subarctic gyre, and a transition zone sandwiched between. Superimposed on these largely stationary features, the transition zone chlorophyll front (TZCF) travels from 30 degrees North in winter to 40 degrees North in summer. Using dissolved gas concentration and isotope ratio detections, satellite measurements of chlorophyll concentrations, and other data sources, the authors map the oxygen and carbon dioxide budgets of the different North Pacific regions. They find that in the TZCF, biological productivity was 2-4

times higher than in adjacent regions. This spike was driven by the confluence of enhanced ocean mixing, increased nutrient availability, and a change in the TZCF's algal ecosystem composition.

Owing to the newly realized power of the biological pump, the authors suggest that understanding how North Pacific algal populations could be affected by changing climate or hydrological conditions is a pressing concern.

More information: Biological production in the NE Pacific and its influence on air-sea CO2 flux: Evidence from dissolved oxygen isotopes and O2/Ar, *Journal of Geophysical Research-Oceans*, doi:10.1029/2011JC007450 , 2012.

Provided by American Geophysical Union