A Recipe for Ocean Productivity, and Variations

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I discuss a formula for calculating ocean productivity based on the ingredients chlorophyll, irradiance, phytoplankton absorption, and quantum yield for photosynthesis. From satellite sensors, chlorophyll and irradiance can be estimated with known reliability. The geographic and temporal variability of phytoplankton absorption and quantum yield, however, are not well understood. The key for phytoplankton absorption is the variability in the pigment composition. Thus, understanding how communities change and adapt along environmental gradients will help in refining the formula. Progress has been made, too, in understanding the determinants for the quantum yield. I will consider sources of variation in quantum yields, exemplified by results from the U.S. JGOFS programs in the Southern Ocean and Arabian Sea. Finally, I consider the variations that can occur with mesoscale variability, using examples from eddies west of the island of Hawaii and in the Leeuwin Current off western Australia.