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## Processes controlling the efficiency of the biological pump

J. Sarmiento (1) and J. Dunne (2)

(1) Atmospheric and Oceanic Sciences Program, Princeton University, Princeton, New Jersey, USA, (2)NOAA/Geophysical Fluid Dynamics Laboratory, Princeton, New Jersey, USA (jls@princeton.edu)

A new paradigm of ecological systems in the surface ocean has emerged during the last several years focused on the relative roles of the microbial regeneration system versus the diatom based food chain and the importance of an adequate iron supply in determining whether the diatom based food chain is present or not. The microbial regeneration system retains nutrients in the surface ocean (low *ef*-ratio) whereas the diatom based food chain tends to be very efficient at exporting nutrients (high *ef*-ratio). We examine whether this improved knowledge of what controls the *ef*-ratio can help us to determine what controls the efficiency of the biological pump in maintaining low surface nutrient concentrations. We find that the efficiency of the biological pump efficiency is generally associated with a low *ef*-ratio). We suggest that the critical process determining the efficiency of the biological pump is the supply of iron relative to other nutrients through Liebig's Law of the Minimum with the possible addition of light limitation in the Southern Ocean. The structure of the ecosystem reflects primarily the nutrient and iron environment rather than determining that environment.