Geophysical Research Abstracts, Vol. 7, 06402, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06402
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The combined effect of continental iron supply and mesoscale variability on the phytoplankton of the eastern equatorial Pacific

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The response of phytoplankton to the effects of tropical instability waves (TIWs) and iron supply in the eastern equatorial Pacific has been investigated with a coupled physical-biological model. The outcomes of this process study indicate that, given the presence of sufficient iron concentration in the EUC, the TIWs can efficiently enhance the iron supply to the upper layers of the equatorial Pacific, favoring phytoplankton production and net biomass increase. The model is a coupling between the OGCM OPA and the Marine Modular Ecosystem Model, a global implementation of the ERSEM model. It simulates the global ocean circulation and plankton dynamics from bacteria to mesozooplankton over the period 1990-2001, as forced by the ERA40 surface fluxes and climatological atmospheric iron dust deposition. The model analysis has been focused on the equatorial Pacific dynamics and particularly on the representation of the Equatorial Under-Current (EUC) and TIWs, which have been found to be in good agreement with the observed features. The biological effects of an additional iron supply to the eastern Pacific have been studied. The source is a stationary continental iron supply, derived from observations, imposed on the New Guinean shelf, and advected in the model by the EUC. Results are compared with a control simulation where only the atmospheric iron deposition has been used. The results show an intensification of phytoplankton production during periods of TIWs activity, as revealed by a wavelet analysis of the total autotrophic carbon in the simulation with the continental iron source. The effect of the waves is to enhance iron availability in the euphotic zone, thus leading to a net increase of phytoplankton biomass. In the control

run, the phytoplankton variability is still affected by the waves, but the absence of the EUC-advected iron source does not lead to any net increase of carbon biomass.