Biogeosciences Discuss., 3, S891–S893, 2006
www.biogeosciences-discuss.net/3/S891/2006/

Biogeosciences Discussions

BGD

3, S891–S893, 2006

Interactive Comment

Interactive comment on “Small-scale spatial structure in plankton distributions” *by* A. Tzella and P. H. Haynes

Anonymous Referee #1

Received and published: 13 December 2006

>>> General Comments <<<

The authors show that phytoplankton and zooplankton are coupled on small scales i.e. both densities share a filamentary structure. At large scales the two distributions are decoupled: the zooplankton are filamentary and phytoplankton is smooth. This small-scale result is consistent with theoretical arguments of Hernandeez Garcia, Lopez and Neufeld, and contradictory to simulations of Abraham (1998). The authors convincingly explain that their numerical method does a better job of resolving small scale structure than the method of Abraham.

>>>>Specific Comments <<<<

Section 1793 line 2: To consider the plankton concentration in a fluid parcel as depen-

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

EGU

dent only on the parcel's history requires not only ignoring diffusion, but also locomotion and buoyancy regulation in the presence of vertical sheared velocities. For many planktonic species the latter is particularly implausible.

Section 1793: the model in eqns(2) is not an NPZ model. The defining characteristic of an NPZ is a conservation law for the conserved "currency", N+P+Z, which might be nitrogen or some other limiting element.

More seriously, I don't see how to motivate making the carrying capacity C a function of position, while maintaining a spatially homogeneous growth rate for P (equal to one in equation (2b)). The authors talk about localised upwelling of nutrients or latitudinal variation of sunlight. But these factors are as likely to alter growth rate as carrying capacity. Part of this complaint is that C is not really a nutrient concentration so C_0(x) cannot be interpreted as a spatially varying nutrient source.

Figure 2: The data looks like it might be curved, rather than two intersecting straight lines. In fact, why is there no data in the important interval around the suggested intersection at alpha/lambda = 1?

How is the "characteristic length scale" of the regime transition defined and can this length be objectively measured in the simualtions? (I have in mind some algorithmic procedure such as the one used to obtain the Holder exponent.) I guess this is one of the future research issues in the conclusion.

$>>>>$ Technical Corrections $<<<<$

Section 1795, line 6: Each parcel also carries C with it.

Section 1795 para 5: "in the absence of advection , C_0(x) is constant" This doesn't make sense. I think the auhors mean that in the absence of advection C=C_0(x). In fact they say as much in the next sentence.

Section 1796, line 27: The units of the dimensional time step should be days not daysˆ-1.

-Section 1797, line 3: By equilibrium you mean the fixed point C^*(x), P^*(x), Z^*(x)? Perhaps this should be called local equilibrium.

Section 1797, line 12: The epsilons should be betas.

Section 1799, line 8: 10^-2 L = .5 km, not 5 km.

Section 1797 para 5, just before eqn (3), delete "the square root of the variance".

First and second sentences in section 2: incompressibility and two-dimensionality is not "usually enough" to ensure chaotic advection. The flow must be unsteady as well.

The writing needs to be thoroughly edited. I noticed several sentences that are copied verbatim from other papers. Examples: Section 1795, liness 13-14: The words "defined as the maximum phytoplankton content that the parcel can support in the absence of grazing" were taken without citation from H-G, L & N 2002. Section 1796, lines 3-9 are a slightly modified paragraph from Abraham (1998). Section 1796, lines 18-19: The words "distributions are obtained from a Dalauny triangulation of the parcel positions onto a regular grid" are taken directly from Abraham (1998). It is probably OK to quote directly when describing technical details, but please cite the originating source in the context of the quotation.

Interactive comment on Biogeosciences Discuss., 3, 1791, 2006.