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Biogeosciences Discussions

Interactive comment on "Structure of mass and momentum fields over a model aggregation of benthic filter feeders" *by* J. P. Crimaldi et al.

Anonymous Referee #1

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General assessment:
This is a very interesting paper and extremely suitable for the scope of Biogeosciences. As well as removing particles from the water column the exhalent jets from bivalves interact with the overlying flow. These jets add kinetic energy to the flow, powered by the pump action of many individual shellfish. However, because the jets interact with the overlying flow and act as roughness elements, they also remove momentum from the flow. The strength of this paper lies in the combination of techniques. The LDV technique allows detailed analysis of the effects on hydrodynamics. The LIF technique allows simultaneous analysis of the spatial and temporal fluctuations in concentration. Due to the novelty of this technique and the elaborate set-up required to mimic the exhalent jets in a flume tank, the paper is rather lengthy and contains a large amount

of graphs. To a certain extent this cannot be helped. Perhaps some savings of page space can be achieved by removing certain non-essential calibration figures, such as figure 8. However, these savings are rather minimal. I have very few fundamental problems with this paper only a few points I'd like to see discussed further and a couple of minor quibbles.

Specific comments:

Pages 509/510: A major difference between the experiments by Van Duren et al (2006) and these experiments is the difference density and configuration of jets interacting with the flow. The live blue mussels have an average filtration rate of several litres per individual per hour. In the mussel experiments the density was about 1800 individuals per square metre. In the current manuscript the filtration rate per individual is much lower (0.108 - 0.216 l/hr), but the number of individuals per m^2 is much higher (441/0.04 = 11025 individuals/m^2). This different configuration will almost certainly lead to a different interaction and some interesting questions, such as: under what circumstances (external flow, number of jets per m^2, jet diameter) do jets really act as roughness elements? The same issue goes for the study of Jonsson et al (2005), which involved a bed with about 540 cockles per m^2. Jonsson et al explained the fact that they found an increase in depletion with increasing shear velocity with the probability that at higher flow rates refiltration of water from upstream animals was less and therefore much more efficient. It is possible that with the extremely high density of filtering "animals" per m^2 in the current manuscript there is little relation between the proportion of water that is refiltered and the shear velocity?

Page 518, figure 4: Is there any chance that the regular spacing of the mimic siphons has an effect on the turbulence parameters at the bed? E.g. a kind of channelling effect?

Technical comments:

Subscript figure 518: c*c* should be wc*

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