Biogeosciences Discuss., 9, C1668–C1670, 2012
www.biogeosciences-discuss.net/9/C1668/2012/

Biogeosciences Discussions

Interactive comment on "Estimation of the global inventory of methane hydrates in marine sediments using transfer functions" *by* E. Piñero et al.

E. Piñero et al.

epinero@geomar.de

Received and published: 5 June 2012

We address the major points raised by B. Buffett ordered according to his review.

To obtain a good and realistic data base for determining our transfer function, we ran many realizations with our standard transport-reaction model covering the whole range of parameters found in nature. Analyzing all of these results, we have identified the most critical control variables and established an empirical relationship of those variables with respect to the gas hydrate content below the seafloor. In this regard, and as suggested by the reviewer, we will rephrase Line 25-29, Page 601.

The reviewer pointed out that the global budget presented here does not differ signif-

icantly from some previous estimates and he cannot follow the argumentation that it implies some clear improvements to those. Referring to his specific comments we will detail our systematic approach on determining the control parameters and specify the advantages of our kinetic model in a revised version of the manuscript (see also replies to comments of the other 2 reviewers).

As shown in Figure 7 and 8, fluid flow has a major impact on GH formation. However, it is possibly the most difficult parameter to constrain on the global scale, because of high spatial variability and lacking global information and constraints. The use of site-specific data on fluid flow (e.g. geochemical tracers) is very difficult to implement on a global scale, since we are not aware of any good method of extrapolation. In order to overcome this problem, we used a mass balance approach that considers the global formation of pore water that may drive fluid flow. We agree with the reviewer that there is no guarantee that all of the buried fluid returns to surface through marine sediments, and therefore in our manuscript we describe different scenarios (see Table 3) and discuss the sensibility to the different distribution of the fluid in passive and active margins (Page 601, Line 13-20). However, the mass balance approximation for the global fluid flow presented in our manuscript allows us at least to calculate realistic average values of fluid flow for each grid cell. Fluid flow is not homogeneous, but preferentially follows geological pathways, such as faults and other high-permeability conduits, leading to seepage at the seafloor and generating local sub-seafloor gas hydrate enrichments. As result of our averaged fluid flow, our distribution map of gas hydrate accumulations (Figure 10) shows a smooth distribution along the continental margins. We are aware about the fact that the "real" gas hydrate distribution may have a more patchy appearance, with large areas with only minor concentrations of disperse gas hydrate and patches with rich accumulations. However, most of the control parameter influencing these local accumulations cannot be resolved in a 1x1-degree resolution. We will further address this resolution problem in the new version of our manuscript.

Specific comments:

i) New model runs and transfer functions based on a separation of the control parameters POC content and sedimentation rate will be presented in a new version of the MS. Thus, section 2.1 (Page 586 L 10 to Page 589 L.15) will be rewritten accordingly.

ii) The unit mistake will be corrected in the revised version.

Elena Piñero,

in behalf of all co-authors

Interactive comment on Biogeosciences Discuss., 9, 581, 2012.