

Interactive comment on “Modeling of stability of gas hydrates under permafrost in an environment of surface climatic change – terrestrial case, Beaufort-Mackenzie basin, Canada” by J. Majorowicz et al.

Anonymous Referee #3

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The scientific problems discussed in this paper are very relevant to the scope of this journal. Recent climate warming has a profound effect on permafrost in most areas of the Northern Hemisphere. Recently, there is much attention in the scientific community devoted to the role that degrading permafrost may play in the changing global carbon cycle. It was long recognized that formation and decay of gas hydrates in or without relation to changes in permafrost may also be an important process in the climate-terrestrial or climate-ocean interactions and should be considered as one of possible forms of feedback to climate change. In this paper the authors investigate the

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long-term history of permafrost and gas hydrate formation and degradation for a specific region in the Canadian North-West using a numerical modeling approach. With all the uncertainties related to the adopted paleo-climate scenarios and physical properties of the investigated domain, the results of these modeling exercises look very reasonable and may be used in advancing our general understanding of the long-term history of permafrost and gas hydrates dynamics in the investigated region. The use of temperature-dependent thermal properties and unfrozen water content to calculate the latent heat effects related to phase change of water and gas hydrates makes this model more realistic. Also, the availability of information on the physical properties of sediments and on the present-day distribution of permafrost and gas hydrates in the region increases reliability of the obtained results. It would be beneficial for readers if the authors would provide more explanation how the salinity of the pore water (9 g/L) was chosen. The paper in review could be published in the “Climate of the Past Discussions” after minor revision. My only serious request to the authors is to recognize and adequately discuss in the paper the limitations of the used one-dimensional modeling approach with a very restricted range of used physical properties and implied simplifications in boundary conditions (including the lower boundary conditions). I also strongly suggest to restrict their conclusions about the possible impact of changes in sub-permafrost gas hydrates on climate to the area where research was conducted and not to try to generalize these conclusions to the entire Arctic domain where variety of paleo-environmental conditions and geological settings may easily prove these conclusions wrong.

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