The authors presented a thermodynamic-hydraulic-geomechanical modeling work to study the impact of the anaerobic oxidation of methane (AOM) on the warming-driven methane release at seafloor. This work is built upon the previous studies (Stranne et al., 2016, 2017) by explicitly accounting for the process of anaerobic methane oxidation near the seafloor. This study did an extensive model sensitivity study to bracket a large uncertainty in sediment permeability and AOM rate to illustrate the different roles of AOM in different flow regimes (fracture vs. matrix flow). This study clearly shows that a fair amount of methane can bypass the anaerobic methane oxidation zone in the fracture-dominated flow domains.

1) As the authors have pointed out, the thickness and rate of AOM zone is one of the biggest assumptions in this model, which may depend upon many factors, e.g., biodiversity, nutrient supply, sulfate concentration, etc. Some previous studies (Borowski et al., 1996; Bhatnagar et al., 2011) tried to relate the sulfate reduction depth to the underling methane flux. Thus, the thickness of AOM zone is variable with the underlying methane gas. This makes me wonder if the authors have thought of trying different boundary conditions for the model (i.e., the sulfate concentration is fixed at the seafloor)?

2) The current modeling results make a lot of senses to me, given the above assumption. Only in the fracture-dominated flow with base-case AOM rate, the dissociated methane can bypass the AOM zone to escape to the seawater column.

3) This study has some other assumptions and its conclusions are only applicable to the shallow gas hydrate within the featheredge on the slope, where 1) gas hydrate is most susceptible to seafloor warming and 2) pressure buildup due to hydrate dissociation in such shallow sediment can easily generate and propagate fractures to the seafloor. Hugh Daigle presented a talk at AGU 2018 entitled “can gas associated with hydrate fracture shallow marine sediment?” - his study suggested that gas-driving fracturing is only likely in the shallowest 10 meter and porous flow of gas is the preferred flow model below this depth. This is somehow different from your work.

4) Figure 4 is a bit difficult to understand, if the readers are not familiar with Stranne et al., (2016, 2017). I would recommend to show a few 1D models coupled with AOM before showing Fig. 4

5) After I zoom in the Figure 4g (AOM rate=0), there is a small component of “cumulative dissolved gas (orange color). This is slightly different from Figures 4a and 4d. Please elaborate on what drives this small difference between fracture vs. matrix flow regimes with AOM rate=0.

6) Technical corrections:

Page 1 Line 34-35: awkward sentence “the temperature-sensitive part of the marine hydrate reservoir”
Page 2 Line 8 – what’s IPCC AR5?
Page 2 Line 9: double parentheses
Page 5 Line 5 – (Boswell and Collett. 2011)
Page 5 Line 6: “As pointed out”
Page 6 Line 7: Rodrigues et al. (2017) measured
Page 11 Line 16: awkward sentence “the efficiency of microbial filter becomes a questions of permeability”
Page 15 Line 31: double parentheses
Page 15 Line 27: AOMmax<1e-8 mol cm-3 day-1)

The current manuscript has some grammar errors/ typos and some awkward sentences. I think, the authors need to improve its writing in the revision and to make the manuscript as concise as possible for publication. With that, I would recommend, this is a scientifically sound paper and it can be accepted for publication after the authors make the appropriate revisions.