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Interactive comment

Interactive comment on "Correlation between tectonic stress regimes and methane seepage on the west-Svalbard margin" *by* Andreia Plaza-Faverola and Marie Keiding

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First, thank you for constructive and kindly exposed comments. These comments will be very helpful to improve the study. We would like to add a note on how we would proceed based on each specific comment:

Comment 1: We agree in how crucial the structural setting at Vestnesa Ridge is to understand seepage activity. The reason why we initially decided not to dedicate a more substantial section to this here, is that the tectonic setting and the description of faults along the ridge is presented in a previous paper (Plaza-Faverola et al., 2015). This 2015 paper actually provides the basis for the modeling study reported here. In that

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paper we discuss the correlation of faults with seepage distribution and we postulate for the first time that the morphology of the Vetsnesa Ridge and seepage activity may be controlled by spatial changes in the stress field. The change from the NW-trending western sector to the NNW-trending eastern sector and a possible explanation for this are also presented in the 2015 paper. We see now the need for presenting a more complete description of the tectonic settings and summary of the observations from previous studies.

The location of the seismic section in figure 2 is shown by a black line in figure 1, however, this should have been clearly written out in the caption. Thanks for pointing this out. We will expand panel b of figure 1, as suggested, to support a more detailed description of the structural setting of the Vestnesa ridge.

Comment 2: The Vetsnesa ridge is a contourite drift and its development as an anticline feature is strongly controlled by bottom currents (i.e., it has a sedimentological origin). However, the observation by the reviewer regarding the focusing of gas is of course important to keep in mind for our discussion here. Bünz et al., 2012 discuss how there is a structural control on near-surface gas migration. The gas migrates to the crest of the ridge and gets trapped beneath gas hydrate bearing sediments. Plaza-Faverola et al., 2017 shows that there is a continuous bottom simulating reflector and free gas trapped along the entire ridge extent. The interesting point is that despite the presence of gas all along (e.g., fig 3 in Plaza-Faverola et al., 2017), seepage is only sustained along the easternmost segment. As the reviewer recalls, most likely being related to the capacity of faults to work as fluid pathways. We will make sure that this part of the discussion comes out more substantially in the paper.

Comment 3. The reviewer raises an important question about the geometric relationship between stress field and pre-existing faults. We agree that a discussion about this has to be included in the manuscript. We plan to show the directions of maximum horizontal stress in a figure and discuss how it will affect pre-existing faults. We will clearly describe any known variation in fault orientation along the Vestnesa ridge with respect to the predicted stress directions. Regarding the type of faults, we agree entirely with the reviewer that seepage is not limited to normal faults. Indeed, we envision that the steep NW-SE oriented faults mapped along the Vestnesa Ridge may have formed in a strike-slip regime, but become permeable during periods of tensile stress. We will revise the manuscript to make sure this important point is clearly communicated.

Comment 4. Thank you for pointing this out. We see that the sentence can be miss-interpreted. With this sentence we intended to emphasize the global relevance of investigating the interplay between regional stress variations in time and fluid discharge. We evoked earthquakes as one example of an external mechanism interacting with the near-surface fluid flow system. We will reformulate.

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