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Interactive comment on "Methane at Svalbard and over the European Arctic Ocean" *by* Stephen M. Platt et al.

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This paper looks as a comprehensive study that pretends to cover all aspects of the methane cycle over Barents sea and mostly around Svalbard. Nevertheless, several specific questions arise that need to be clarified.

1. Zeppelin data. Continuous precise measurements of trace gases are necessary for identification of their sources and analysis of short-term variations is important. The authors are correct considering the site itself as a really remote one and hardly affected by terrestrial sources. This is an advantage. A disadvantage is its height above sea level: 476 m. This means that a part of time it is inside Boundary Layer (BL) and a part of time it is outside it. In this concern a difference in day-by-day variability be-

tween summer and winter should be analyzed and explained: practically no variations in summer and 30-50 ppb variations in winter. There may be at least two explanations of this: a) strong emission from the sea in winter and negligible flux in summer; b) different heights of BL in summer and winter. The authors have all available information to check up the second opportunity. The first option is explored in our paper, submitted to Rem. Sens. of Environment, and treated as a result of blocking turbulent transfer from the seabed by the thermocline in summer. 2. Also about Zeppelin data. The winter-time excursions surprisingly vanished in winters 2010/11 and 2011/12. No explanations have been given. Another effect is overlooked: a change in methane trend around 2014, that is observed by IASI satellite instrument, as well as on the global NOAA/ESRL network (Yurganov, Leifer, Vadakkepuliyambatta, 2017). 3. Sea/air flux. A very important point is relative roles of bubbles and turbulent transport in the seawater column for the total methane flux. A blocking effect of the thermocline seems to be decisive for the turbulent transfer (excluding cases of mixing by storms, that may disturb the stable surface layer). On the contrary, methane bubbles are expected to go through this barrier easily. In this case short term (on hourly basis) methane spikes must be similarly observable in summer and in winter, but longer term positive (of a few days and weeks) anomalies are expected only if the water column is well-mixed, i.e., in winter. I have not found a discussion of this in the paper. 4. Finally, the above-mentioned drawbacks do not downplay its significance as a compilation of valuable experimental data, that would help to elucidate a role of the Arctic Ocean in the methane fate in the atmosphere now and in the future.

References Yurganov L.N., Leifer I., & Vadakkepuliyambatta, S., 2017. Priznaki uskorenija vozrastanija koncentracii metana v atmosfere posle 2014 g.: sputnikovye dannye dlja Arktiki (Evidences of accelerating the increase in the concentration of methane in the atmosphere after 2014: satellite data for the Arctic). Sovremennye problemy distantsionnogo zondirovaniya zemli iz kosmosa 14(5), 248-258. (see attached English translation)

Yurganov L.N., Karger-Muller F., Leifer I., 2018. Methane Variation Over Terrestrial and Marine Arctic Areas (2010 – 2017): IASI Satellite Data, submitted to Rem. Sens. of Environment.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2018-597/acp-2018-597-SC1-supplement.pdf

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