

## ***Interactive comment on “Geographic and seasonal variation of dissolved methane and aerobic methane oxidation in Alaskan lakes” by K. Martinez-Cruz et al.***

**Anonymous Referee #1**

Received and published: 8 April 2015

Martinez-Cruz and co-authors performed surveys along a transect through Alaska, incorporating 30 lakes during a summer and a winter season. By doing this, they accumulated a huge data-set on methane - and oxygen concentrations in these lakes. Additionally they analysed aerobic methane oxidation (MO) rates. This became possible due to a laser spectroscopy method for the field, newly developed by this group. The authors are well known specialists for studies on greenhouse gases (GHG), mainly on methane in arctic environments. Global changes in climate lead to thawing of permafrost in the arctic regions, with related increase in organic carbon supply to aquatic systems. The study is highly important because of the amount of data from arctic lakes, as well as because of the differences in the lakes, chosen. Methane oxidation within

C1087

the environment of production is one of the most important pathways to mitigate GHG emission to the atmosphere. It is a merit of this study to summarize such a data-set from the arctic. The ms is well written.

The authors have chosen a fixed pattern of sampling depths (same depths in all lakes, except very shallow or very deep ones). To overcome the problem of sampling outside the oxycline, the place of maximum MO, they used a double monod model. A sensitivity analysis was conducted to calculate the MO rate when affinities ( $K_s\text{-CH}_4$  and  $K_s\text{-O}_2$ ) would change.

It is an important paper addressing relevant scientific (and social) question on the basis of a well developed sampling design.

Specific comments: 1. A clear description of yedoma and non-yedoma types is needed on a prominent position.

- a. In both tables I recommend to underlay the yedoma lakes rows by a light grey bar
2. page2/line 4: dependance of MO on  $\text{CH}_4$  and  $\text{O}_2$  concentrations is to general; I would prefer to read about ‘relation at the interface’
  - a. page2/line 4: MO depends only indirectly on OC supply –via methanogenesis and see 2. on relation at interface
3. page2/line 13:  $\text{CH}_4$  concentration may be lower at a given depth in summer due to the better oxygen supply compared to winter; it should not be called ‘deficit’
4. page2/line 17: the meaning of ‘landscape processes’ could be more clearly described as ‘coupling of terrestrial and aquatic habitats’
  - a. page2/line 17/Fig 1 etc: the thawing permafrost needs to be more clearly described: when thawing impacts terrestrial plants in the catchment of the lakes (p12/13), a direct surface input/inflow of thawed material into the lake seems to be likely; perhaps this can be shown in Fig 1 also

C1088

5. page2/line 22: references should be clear (in text, in list) if Walter, Walter Anthony or Anthony, KMW (p21/130) are different persons
6. page5/line 13: please delete 'offshore and'
7. page6/line 13: please, give full name of HE-TDLAS –I guess it is an abbreviation
8. page10/line 25: see 7., here TK
9. page12/line 13: nutrient supply (P, N) can force bacterial and algal growth also, with similar effect on sedimentation etc.
10. page12/line 20: see 4a: please, describe clearly, where thawed C reaches the lake; deep under beneath the sediment or from the catchment or in medium depth directly from thawed surface sediments (as in Fig. 1)
11. page13/line 13: "CH<sub>4</sub> production was higher due to warmer sediments" as there is no measurement for this statement, it should be rewritten
12. page13/line 15ff: The title of ms "Geographic and seasonal variation. . ." has to be followed by a clear statement about geographical variation;
  - a. please replace 'concentration..of lakes' by 'number of lakes' or 'portion of ..'

The references are on the state of the art. All figures are necessary and well prepared.

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