

Interactive comment on “The “tipping” temperature within Subglacial Lake Ellsworth, West Antarctica and its implications for lake access” by M. Thoma et al.

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> The paper considers only present day lake conditions. It would be useful to
> develop an analysis of the lake conditions over the history of the lake as
> the ice sheet above evolved. The accumulation and preservation of sediments
> is time dependent and it is not clear that present conditions prevailed in
> the past; in fact it is unlikely that they have. Combining knowledge of the
> evolution of the ice sheet above Lake Ellsworth with the model predictions
> of lake regimes would provide an integrated view of how the current state of
> the lake developed which may be as important for access site location as

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> current conditions.

* The reviewer is correct, an analysis of the impact of past ice sheet thickness, surface temperatures, and accumulation would provide a view how the current state of the lake developed. However, as these information are not known to an adequate precision, the results would be mere speculative, and hence would not have any impact on the access site location.

However, currently we develop a fully coupled ice-sheet–lake model, which allows to investigate these matters further.

> The challenge is to optimally access and sample a feature of several tens of

> square kilometers. One obvious solution is multiple points of access placed
> across the lake. If optimal spatial coverage is the objective, locations
> can be selected on a fixed point basis (sampling lake regions characterized
> by some set of variables) or randomly selected sites based on some desired
> spatial density.

* The 'obvious solution', described by the reviewer would require many boreholes. Unfortunately, logistics and financial support limits the number of holes (up to three at the most). Hence, a careful pre-survey and selection of the drilling site is required and consequently discussed in this manuscript.

> The issue of influxes of water from sources external to the lake seems to
> be quickly dismissed. Evidence elsewhere is that these flows can be
> substantial (in relation to lake volume), sporadic, and quite high energy.
> One or more of these events over time would disrupt lake regimes predicted

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- > from the Equation of State. Lake regimes that take years to develop based
- > on physical/chemical gradients could be almost instantaneously disrupted
- > requiring a very long time period to recover to some type of steady state
- > condition.

* In section 4.1, we address this issue. We discuss how 'substantial' these flows can be with respect to our result (up to 8 would be worthwhile modelling the 'disruption of a lake regime', however, no model exist to test this.

- > Direct mapping of sediment accumulations within the lake basin
- > by remote sensing methods would be the most direct way to establish where
- > sediments are preserved and most likely to be recovered.

* Correct, the drilling campaign will collect sediment from the drill location, which help to answer this question.

Interactive comment on The Cryosphere Discuss., 5, 1003, 2011.

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