

Interactive comment on “Observation-based modelling of permafrost carbon fluxes with accounting for deep carbon deposits and thermokarst activity” by T. Schneider von Deimling et al.

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We thank the referee for the helpful comments. We will respond to each issue in detail after all referee comments are posted. However, we here want to provide a quick comment on the referee’s point that there might be serious issues with our model physics related to thermokarst lake parametrization and our results shown in Fig.2 (lower panels). After the referee’s comment we now believe that the figure could be misinterpreted without providing further model details. What we show here in Figure 2 is a two-stage process: 1) a slow deepening of the active layer in sediments overlain

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by non-thermokarst ponds (until the year 2000), and 2) a strong increase in thawing rates after thermokarst starts to deepen the pond enough to prevent winter re-freeze, effectively initiating a thermokarst lake (after the year 2000). It was our intention to describe thawing of sediments under newly formed thermokarst lakes in an idealized model scheme (we define “newly” by referring to the year 2000).

A strong talik deepening in continuous permafrost in stage 2 (Fig.2, lower panel, blue curve) below the initial active layer depth of southerly permafrost in stage 1 (Fig.2, lower panel, red curve) is not an expression of biased model physics. It rather describes the potential of abrupt thaw after thermokarst lakes have formed which provide physical conditions favorable for strong thaw.

In the supplement (bottom of page 6) we have discussed the two-stage description (see below). We will make sure to clarify this issue prominently in the main text of the revised manuscript (and also mention the setting in the figure legend).

Page 6, supplement: “As we do not model lake depth expansion we assume that formation of new thermokarst lakes is initiated for any warming above our reference climate (i.e. pre-industrial climate), while we also assume that extensive talik formation under thermokarst lakes is only realized after newly formed lakes have deepened enough to reach the critical depth which prevents winter refreeze (we define this time to be the year 2000).”

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