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Climate of the Past
Discussions

Interactive comment on "Physically based summer temperature reconstruction from ice layers in ice cores" *by* Koji Fujita et al.

Anonymous Referee #1

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The manuscript entitled "Physically based summer temperature reconstruction from ice layers in ice cores" by Fujita et al. presents further understanding on the method to reconstruct summer temperature from ice layer thickness using an energy balance model. Given the complex interpretations of ice core stable isotopic record as a temperature indicator, a Physically based temperature paramater holds its merits for publication. However, I concerned much about the feasibility of the method presented here. As indicated by the authors, applicable range of this method is likely from –6 °C to +1 °C, while uncertainty in the reconstructed SMT is comparatively high. Errors derived from the density assumption and from the seasonal pattern range from 0.04 to 0.15 °C, and from 0.78 to 1.57 °C, respectively (Table S2). The situation might worsen when considering uncertainty with the density assumption and the seasonal pattern.

Especially the firn densification model requires prior parameters on temperature and accumulation.

Ideal assumptions bear upon the energy balance model. How much uncertainty can these assumptions can bring about? Some assumptions require further confirmation, for instance, the authors assume that each snow layer can retain water with a volume content, and the exceeded water percolates into the next lower layer. The volume content might be partly dependent on the snow temperature distribution and ice layers.

minor comments: (1) Possibly better to make use of cumulative temperature in summer than SMT? (2) What if the method were performed on the ice cores that are recovered at different elevations of the accumulation zone of the same glacier? (3) Line 234: why Tibetan glaciers? (4) Line 317: Is there independent evidence to support the correlation between SMT and accumulation? (5) Line 351: Is this reasonable given the more complicate albedo scheme?

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