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Interactive comment on “Black carbon concentrations from a Tibetan Plateau ice core spanning 1843–1982: recent increases due to emissions and glacier melt” by M. Jenkins et al.

M. Jenkins et al.

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Referee #2 commented that our suggestion that melt induced enrichment may be (at least partially) responsible for the recent increase in black carbon concentrations was not convincing, and pointed out that the annual-mean BC concentration in the ice should reflect the total annual BC deposition. The exceptions to this the referee noted would be if 1) there was a decrease in the H₂O mass of the water column, or 2) if the BC migrated below the annual layer of the ice.

We thank the referee for their constructive review, and here partially address their comments.

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Our suggestion that the increase could partially be due to melt was based on that with melt the BC becomes more concentrated in a thinner horizon of the ice (which has albedo implications), which would result in more frequent occurrences of high BC layers. Because the record needed to be resampled to the lowest sampling resolution (3 samples/yr) due to layer thinning with depth in the glacier, the sampling resolution makes it difficult to determine if there was an increase in these more concentrated layers. The referee is correct that the total amount of BC in the annual layer should not be affected unless one or both of the two exceptions that were noted occurred, and we had not approached our interpretation from the perspective of total amount of BC in the annual layer.

We've examined the annual BC (based on the average of the 3 sample/year) and annual accumulation rate records, and calculated the BC annual flux (concentration \times accumulation). While it is difficult to determine if changes in accumulation are due to changes in snow deposition or potential melt, these annually resolved records suggest that changes in accumulation are partially responsible for the higher BC concentrations since 1940, with some of the increase due to greater BC deposition (Fig. 1). We will modify the manuscript accordingly, and conduct further analyses on the contribution of accumulation vs. deposition to changes in BC concentrations.

The possibility that BC migrated outside of the annual layer of ice is less likely, as annual layers are preserved (Kang et al., submitted).

We will address the referee's other comments when revising the manuscript.

Interactive comment on The Cryosphere Discuss., 7, 4855, 2013.

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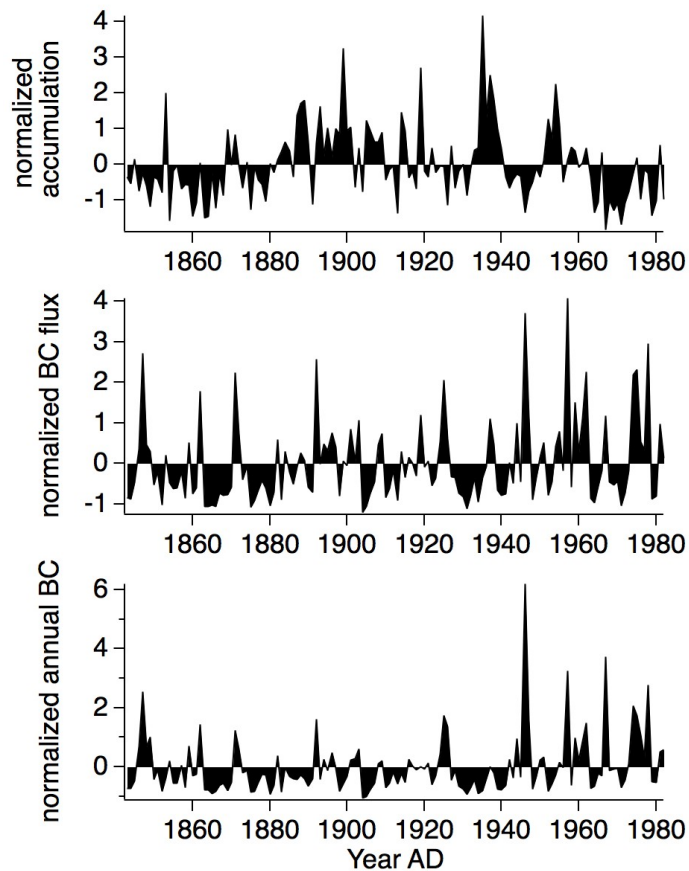


Fig. 1. Geladaindong normalized accumulation, black carbon flux, and annual black carbon. Records were normalized by taking the difference from the mean divided by the standard deviation. Black carbon flux=

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