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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.

kaspari@Geology.cwu.EDU

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We thank the Referee #1 for their review, and here respond to their comment that the manuscript has contradictory conclusions. Referee #1 states that: “1) Post-1940 BC concentrations are elevated relative to the previous record, suggesting greater emissions and/or enrichment of BC from melt at the upper levels; 2) The uppermost layers are not substantially higher relative deeper in the ice core, which the authors suggest indicates that BC has been removed vial melt. How can these contrary conclusions can be resolved?”

There may be a misunderstanding in what we are stating, as these two conclusions

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are not contrary. We refer the referee to Section 3.5 of the manuscript and the second paragraph of the conclusions section, and clarify further here:

Conclusion 1) For the period of the record preserved by the ice core (up to 1982 AD) there is annual mass accumulation, and as stated in the manuscript post 1940 BC concentrations increase due to higher BC deposition and/or melt enrichment.

Conclusion 2 is based on the fact that the core was drilled in 2005, but the top layer of the core representing the glacier surface is from 1983. No net snow accumulation from these 22 years is preserved, but BC was presumably still deposited on the glacier via wet and dry deposition during this time. If all of the BC deposited on the glacier since the early 1980s was still present (or even some of it), one could anticipate that the upper layer of the ice core (i.e. the glacier surface) would have much higher BC concentrations than any other period of the record. This isn't the case, suggesting that BC deposited since the early 1980s isn't being preserved at the surface of the glacier, but rather is being removed.

The referee may have misunderstood that we are addressing the glacier surface in conclusion 2, as opposed to the entire record in conclusion 1.

Conclusion 2 is an important finding, because with rising equilibrium line altitudes (ELAs), it is suggested that dirty layers (partially due to melt enrichment) preserved in Tibetan Plateau glaciers will be exposed (Xu et al. 2012). Our study site is an example of a glacier where the ELA has increased (site used to be in accumulation zone and is now in the ablation zone). The BC deposited post 1980s doesn't appear to be preserved at the glacier surface at our site. This is important because it suggests that as ELAs rise and dirty layers are exposed, these dirty layers are likely not preserved at the glacier surface. Rather the BC appears to be removed, and as we state "we suggest that some of the BC has been transported off the surface of the glacier, potentially via supraglacial or englacial flow."

Conclusion 1 is thus referring to a situation where some melt may occur, but ice mass

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and impurities are preserved in the glacier, as opposed to conclusion 2 where no mass is being accumulated and BC doesn't appear to be preserved at the glacier surface.

We will pay close attention to revisions on the manuscript to make sure these points are clearly expressed.

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

TCD

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