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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reevaluating the black carbon in the Himalayan and Tibetan Plateau: concentration and deposition" *by* Chaoliu Li et al.

Anonymous Referee #1

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Comments on Âń Reevaluating the black carbon in the Himalayan and Tibetan Plateau : concentration and deposition Âż by Chaoliu Li et al :

This paper describes a reevaluation of the black carbon content mostly at two sites in the Himalayan and the Tibetan plateau, the Everest and Namco stations. The authors consider that the BC concentrations were overestimated due to an underestimation of the carbonates from mineral dust. They also compare various BC measurement methods (in snow and glacier, in lakes and in the atmosphere) to test the coherence of deduced BC concentrations. They found that the BC concentrations measured in lake cores are mainly driven by river sediments and not atmospheric deposition. The adjusted BC concentration is then estimated as ranging from 10-25 mg m-2 a-1.

Main comments: - The introduction is very long and could be better structured to obtain

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a clear view of the already published results, the problems related to the estimation of BC concentration and the analysis presented in this study. - Several species containing carbon are described (IC, CA, BC, OC, EC, TCA. . .) and one subject of this study concerns the wrong estimate of BC. BC is however not the only carboneous compound that absorbs -and therefore contributes to atmospheric warming- and that modify the surface albedo – and therefore modifies the glacier persistence. Can you please describe the effect of these various carboneous compounds on the climate ? - For example, you mention (§3.1.2) that the presence of carbonate led to an overestimation of the HTP TC levels. TC= total carbon. Is IC not comprised into "total carbon" ? is the effect of IC (once it is converted in equivalent BC) is air different than BC regarding the light absorption and warming of the air? Is the effect of IC different than the BC one regarding the surface albedo of glacier with deposited dust ? It is really important to have a clear discussion of these various effects to demonstrate that your main results (the BC concentration is partially due to the presence of carbonates) is important for climate analyses. - It seems (§3.2.1) that the fact that BC in lake core is largely influenced by catchment inputs was already demonstrated in several publications. Please specify clearly what is the new input of your research ! - Does the IC content depend on the mineralogical composition of MD? If yes, what are the difference between various mineral ? Does it change between the various deserts around the world ? - Lines300-305: at this place you mention for the first time that the acid-treated samples transfer OC to BC components. Depending of the rate of this process (that perhaps also depends on temperature), the discussion of figure 2 and §3.1.1 has to be changed. Moreover, this information is really necessary to be explained under §3.1.1 - English should really be improved! Minor comments: - Line 45: please check the language - Lines 71-73: please rephrase + are you sure that all these studies have methodological limitations bounded to the mineral dust underestimation and the impact of catchment inputs? - Line98-99: there is probably other species which concentration depends on particle size. Please mention them (see also further comment on BC content as a function of size distribution). - Lines 118-121: It is obvious that the MD content during dust storm

is high !+ Please add the reference for this results - -line 142: . . . than the values measured in lake cores at Namco and Quinghai lakes. . . - Line 143-144: Do you mean that the HTP BC content is “measured” outside the plateau or that BC content comes from other regions that the HPT plateau ? - Line 156: which kind of values? Other measurements ? other kind of data? Other analysis and methodologies ? - Line 159-160: which quantity is then measured if they did not report BC deposition directly ? What do you mean by “deposition pattern” ? - 172: please delete (Namco station) - 204: I suppose the blank concentrations were subtracted from the measured concentrations ? - 213: “previously reported BC deposition data were adopted”: what is the meaning of this sentence ? - 225-226: CBC-TSP is then the equivalent BC (usually reported as eBC) concentration in the atmosphere ?, From where do you take the dry deposition velocity and the particle washout? - 231: the values used in the BC deposition calculations for these two areas are shown. . . - 236: this is probably your main results. You have first to present the measurements and then to give the main conclusion. At this place, I can only say that up to now you have not given any proof for this statement. - 239-246: I do not really agree with your statement “BC concentrations are more heavily influenced than OC and TC”: the ratio BCa/BCois lower than for the one of OC or TC, but the uncertainties are really high (0.37 and 0.26) leading to a much more nuanced conclusion! Is it possible that the uncertainty differences between NamCo and Everest is bounded to another kind of carbonate dissociated at various temperatures ? - Figure 2: since the acid treatment is supposed to remove the IC, how is it possible to obtain values greater than 1 ? It should be really informative to add error bars for both TC and BC ratios. - 254: I suppose that you consider only MD and TCA as components of your sample, leading to MD+TCA=100%. The mention of percentage in the text (and not only in the figure) will clarify this point. Could you also give the uncertainty on dust and TCA percentages in order to estimate if the difference between non-monsoon and monsoon seasons are significant or not ? - 258: it seems to me that the NCO-P station was not mentioned before, is not in Figure 1 or in Table 2 ? - 262: does it mean that the NCO-P station measures PM10 and not TSP ? Was the method applied at NCO-P

the same as at Namco and Everest station ? - 265: do you have a reference estimating the contribution of local surface soil to total MD contribution ? How is it possible to distinguish between local and desert contribution to MC ? by the carbonate types ? - 267-268: please rephrase - 269-272: you compare precipitations at Namco and Everest during one year (January 2014-January 2015), that do not correspond to the unique monsoon period. I suppose that most of the precipitation occurs during monsoon, but this should be specified. - 275: you mentioned under §2 that you measured soil samples. The PH is however taken from a reference. Were the same samples used for both studies ? - 279-282 + Figure 4 : The slope of Ca versus IC is smaller (about 0.25) for Namco than for Everest station (0.30). Does it mean that there is different carbonates types at both stations ? - 289-292: here again, it is not possible to ignore the very high uncertainties in the conclusion of the impact of IC on BC concentration. - 294-292: was the BC concentrations measured by Ming and Cong estimated with a similar method that your method described in this paper ? - 294-292: please report the uncertainties of BCa/BCo to the estimated concentration in ng/m3. - 296: does the decomposition temperature of carbonate depends on the size of the particle ? If yes, you have to put a reference. - 296-300: you mixed several notion if this sentence: please clarify if you want to link the particle size distribution with the decomposition temperature, the BC and OC overestimation with the size distribution or the BC and OC overestimation with the temperature! - 308-310: it seems obvious that carbonate contribute to TC since it was stated before that it contributes to BC. - 312: where: not grammatically correct - 311 -315: could you please mention where are the station of Zhao and Karamasiou so that the reader can estimate why the dust storms are more severe at the studied stations. Please provide the same information for used stations in Cao and Ho - 319: you have to explain why you estimate the overestimation of “at least 45%” - 320-321: please see the main comment concerning the effect of carbonate or BC on climate analyses. - 318-330: if you mention the name of the stations, the reader will take much less time to understand your comparison and to find them in Table 2. - 331-336: the conclusion is too simple since you have no real correlation between measured BC in

the atmosphere and in the lake core and no proof of the polluted east asia and less polluted area in Europe! Moreover §3.2.1 shows that lake core are influence by catchment area and rivers so that you cannot here make some conclusion about Sweden lake core or about deep ocean sediment samples without taking the other results of your paper into account. - 340: re much ? - 338-344: a usual structure for a paper is not to propose an interpretation at the beginning, but to describe the results and then to draw conclusion! Do you think that you have to take into account some other parameters such as the evaporation of the lake that depends on temperature, surface and depth ? - 343: what is NMC09 ? - 347: why the BC concentration in PM2.5 should be lower than in TSP? is this statement is clear for MD due to their large size, it is not directly applicable to BC, soot being usually quite small particles. The following conclusion has therefore to be more seriously validated. - 352-355: how can you conclude that the atmosphere and the lake core should have a similar concentration of BC ? This is based on 2 not proved inputs. Moreover 65% «< 100%! - Figure 5: the axes are not readable. - 407: you probably want to compare BC in ice with BC in atmosphere ? please change the sentence. - 418: the values of BC in remote areas depend on the sources and long range transport processes and cannot be compared without caution. - 423: it is perhaps better to give the discrepancy in % instead of in mass concentration - 466: if the lake are smaller, the catchment inputs are probably also smaller of the flow through the lake is larger involving a smaller deposition into the lake core. It is therefore not obvious that smaller lake with have a higher BC concentration due to catchment inputs.

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