

Referee #1 (RC C6570)

General comments: “This paper presented the microbial concentrations of two Tibetan ice cores to deduce its connection with dust and temperature. Though this topic is quite interesting, and much progress has been achieved during the passing more than 10 years, it seems that the current version of this paper is just echoing the previous sayings. For instance, the main content in the sections of Results and Discussion is redundant of what was said in the section of Introduction. And the conclusion is not convincing, mainly due to the low resolution of sampling in intervals of 15–30 cm, which may cover multi-year deposition because of the low accumulation rates at the Muztag Ata glacier and the Dunde ice cap. Thus it’s probably impossible to identity its seasonality, saying nothing of comparison with "the cooling autumn and warming spring-summer seasons".

REPLY FOR THE NEW DATA QUESTION: Despite advances achieved in the past 20 years, it is still not clear about the concerns of how the climatic changes influence the distribution of microorganisms in the glacier ice and its further reflections of the aeolian activities in the geographically different regions (see the introduction section: lines 54-57 in the new MS version).

In this study, we forwarded our previous concerns about possible influences of aeolian activities on the microbial distribution in the glacier ice, presented the new information, the consecutive microbial data of two ice cores recovered from the geographically different regions on the Tibetan Plateau. Field observations and previous data showed a good preservation of the seasonal temperature changes along the ice core depth profile from the Muztagata Glacier (Tian et al., 2006). This made it possible for us to explore the seasonal profile of microbial cell density and relate it to the temperature changes over the glacier (see the introduction section in the new MS version: lines 58-64).

The community structure geography has been discussed (Xiang et al., 2010). Here, we will discuss the biogeography of microbial cell density across the mountain glaciers in western China. (lines 181-182 in the discussion section in the new MS version).

REPLY FOR THE QUESTON ABOUT THE LOW RESOLUTION OF SAMPLING:

For microbial analysis, the Muzt ice core sections were cut into 156 samples, while the Dunde ice sections were cut into 37 in intervals of 15-30 cm using a band saw within walk-in freezers (-18 to -24 °C). The ice samples were cut between the visible dust layers, and ice layers were collected separately (Lines 84-86 in the method section in the new MS version).

See lines 325-328 in the new version of MS: The annual ice layers ranged from 50 to 136 cm, and the years were indicated by the dash lines in the Figs. 2a, 2b, and 2c. The data presented here were only for the ice core section in a depth range from 0 to 36.85 m since the annual layers become thinner below 35 m and the ice layer being near the bottom of the glacier (the depth of the glacier is 52.6 m, Tian et al., 2006).

Seasonal changes in live cell density were summarised in the result section (lines 107-109 in the new version of MS). High microbial cell density in warming seasons is possibly attributed to the high microbial load by wind and microbial growth in the processes of post-deposition, which suggests the interactive regulation of both aeolian- and post-deposition mechanisms on the distribution of microorganisms in a glacier (Xiang et al., 2009c; lines 163-165 in the new MS version). The cell density peaks appeared in the cold

winter-spring is most likely due to the directly microbial load by wind (lines 170-171 in the new MS version)..... This is the first report about the seasonal changes of live cell density in the ice. More information on the seasonal characters of microorganisms in the ice is necessary before a definite conclusion is drawn (lines 173-175 in the discussion section of the new MS version).

SPECIFIC COMMENTS,

In Discussion 4.1, the microbial depth profiles might be modified by post-deposition processes, especially for the Dunde ice core, because melting happens in summer at the glacier snow surface.

RE: The effect of post-deposition processes was discussed. High microbial cell density in warming seasons is possibly attributed to the high microbial load by wind and microbial growth in the processes of post-deposition, which suggests the interactive regulation of both aeolian- and post-deposition mechanisms on the distribution of microorganisms in a glacier (Xiang et al., 2009c; lines 163-166 in the new MS version).

QUESTION: In Discussion 4.3, broad ranges of microbial density are evident for each studied sites, so it's improper to only give a fixed number (average concentration?) without indicating its corresponding range.

RE: Fig. 5. Map showing the geographic orientation of climate zones and glaciers with associated maximum cell density (cells/ml) (lines 338-339 in the new MS version).

The relatively high values of maximum cell density in the mountainous glacier are frequently associated with dust events dust origination centers (lines 212-213 in the new MS version).

QUESTION: Page 14532, Line 25: "that causes climatic changes Basin (Wake et al., 1993; Davis et al., 2005)", I can not understand this sentence.

RE: The sentence was corrected to "it is uncertain how aeolian processes, that drive the air mass and climatic changes (Wake et al., 1993; Davis et al., 2005), control the distribution of microorganisms in the glacier ice" (lines 30-32 in the new version of MS).

QUESTION: Page 14536, Line 17: "B1 to B7" should be "A1 to A7".

RE: It was already corrected, and "A1 to A8" was in the new version of MS (line 114).

QUESTION:Page 14540, Line 5: The lowest microbial cell density occurred in the Rongbuk Glacier which contained 9×10^4 cells/ml (Fig. 5). But in Fig. 5, the number is 9.4×10^4 cells/ml

RE: The sentence was corrected to "The lowest microbial cell density occurred in the Rongbuk Glacier which contained 9.4×10^4 cells/ml" (lines 200-201 in the new version of MS)

QUESTION:Page 14540, Line 18-25: "in the Arctic glacier, Kongsvegen, with 2×10^5 cells/ml (Amato et al., 2007).....By contrast, the relatively low cell density in the polar glaciers may be indicative of a decrease in the microbial input due to the longer transport distance from non-polar environments" cell density is 3.7×10^5 cells/ml in Palong Glacier, 2.2

$\times 10^5$ cells/ml in Muztagata (Fig. 5), which does not support the argument of “the relatively low cell density in the polar glaciers”.

RE: The sentences were corrected to “The microbial cell density in the mountainous glaciers of western China ranges from 10^4 to 10^6 cells/ml in maximum values (Fig. 6). This is higher than the Antarctic glaciers which contain cell density ranging from 5×10^3 cells/ml at the South Pole (Carpenter et al. 2000) to 8×10^3 cells/ml at the Vostok station (Abyzov et al., 1998).” (lines 208-211 in the new MS version).

And the sentence was corrected to “By contrast, the relatively low cell density in the Antarctic glaciers may be indicative of a decrease in the microbial input due to the longer transport distance from non-polar environments” (lines 216-217 in the new MS version).

QUESTION: In Conclusions, "Physical–chemical and microbiological data from three ice cores presented here", where is the third core?

RE: The sentence was corrected to “Physical-chemical and microbiological data from two ice cores presented here” (line 219 in the new MS version)

QUESTION: Figure 1 and Figure 5 can be merged.

RE: Figure 1 focused on the geographical location of the glaciers discussed in this study while Figure 5 focused on the climatic and environmental (deserts) zones and the relation to the microbial cell density in the glacier ice across the western China