RC2: 'Comment on essd-2022-10', Anonymous Referee #2

General comments

This manuscript shows the dataset of microbial abundance and geochemistry of ice cores, snow pit, surface ice/snow, and glacial runoff collected from 40 mountain glaciers in Tibetan Plateau. The data set contains valuable information on microbes and chemistry to study glacier ecosystems of the region. Since the distinct microbial communities from polar regions have been reported on Asian glaciers, it is important to publish such data set. Although some additional information is necessary in the data set as shown below, I would support to publish them after revision.

Reply: We appreciate the reviewer's time and positive comments on our manuscript.

L75 Does "the multiyear average temperature" mean air temperature or snow temperature? Please specify. If snow/ice temperature is available for all glaciers, please add them in "Glacier info.xlsx".

Reply: Thanks for the nice suggestion! We have rephrased "the multiyear average temperature" to "the multiyear average air temperature" to make it clear (L21, L76, and L102), and we do not have snow/ice temperature for all glaciers.

L80 There is a lack of elevation of the sites of sample collections as microbes and snow/ice chemistry vary with elevation. Please indicate the locations of the sites of the ice cores and snow pits.

Reply: The longitude, latitude, elevation, and sampling time of ice cores and snow pits have been added in the "Icecore-info.xlsx" and "Snowpit-info.xlsx" files. The "IcecoreID" or "SnowpitID" field can be used to link these information to the records in "Microbial abundance-ice core.xlsx", "Microbial abundance-snow pit.xlsx", "DOC-TN-ice core.xlsx", and "DOC-TN-sonw pit.xlsx". These files have been updated in https://doi.org/10.11888/Cryos.tpdc.271841.

L121-123 There is a lack of measurement procedures for conductivity and pH shown in Figure 9.

Reply: The conductivity and pH of proglacial runoff were measured with the YSI EXO2 Water Quality Sonde. This has been added in Section 3.3 (L129-130).

L140-141 I wonder the bacteria analyzed in this study were those grew in situ in snow or were cells deposited from atmosphere. Please explain the possible sources of bacteria in each ice core.

Reply: The possible sources of bacteria in ice cores have been added in L148-151.

"Bacteria in glacier are originated from atmospheric deposition, and it has been reported that microorganisms originating from the Saharan Desert have been found thousands of kilometers away in the Caribbean and European Alps (Kellogg et al., 2006). The deposited microorganisms are subjected to a range of post-depositional environmental selection processes (Chen et al., 2021), until they are buried by snow and eventually frozen in the ice core."

L146 Is there any geographical trend of the bacterial abundance? Also, is there any relationship between the altitude of drilling site and the bacterial abundance?

Reply: At the regional scale, the bacterial abundance of both ice cores and snow pits in the north of Tibetan Plateau was generally higher than that in the south of Tibetan Plateau. This has been described in 139-141 to L157-159.

As there were no altitude gradients in the ice-core or snow-pit samples in each glacier, the relationship between the altitude of drilling site and the bacterial abundance was not analyzed.

L155 It would be worth to add some explanation of possible sources of DOC and TN in the ice cores.

Reply: The possible sources of DOC and TN in the ice cores have been added in L168-175.

"Organic carbon and nitrogen in ice cores can be both from both allochthonous or autochthonous sources. It has been reported that the wet DOC deposition ranged from 47 to 330 mg C m^{-2} y^{-1} (Yan et al., 2020) and the wet N deposition ranged from 44 to 155 mg N m^{-2} y^{-1} on the TP (Liu et al., 2015). In addition, microbial carbon fixation has also been reported in glacier surface microbiome, and the average fixation rate in cryoconite holes of four glaciers on the TP was 1.77 μmol C m^{-2} d^{-1} (the yearly rate was approximately 3.3 mg C m^{-2} y^{-1} assuming a growing season from May to September) (Zhang et al., 2021), which is substantially lower than the atmospheric deposition rate. The microbial nitrogen fixation rate has not been quantified, but a research at the Arctic region has been reported as 0.04 mg N m^{-2} y^{-1} (Telling et al., 2011), which is again orders of

magnitude lower than the atmospheric deposition. ”

References:

Liu, Y. W., Xu-Ri, Wang, Y. S., Pan, Y. P., and Piao, S. L.: Wet deposition of atmospheric inorganic nitrogen at five remote sites in the Tibetan Plateau, Atmos. Chem. Phys., 15, 11683-11700, https://doi.org/10.5194/acp-15-11683-2015, 2015.

Telling, J., Anesio, A. M., Tranter, M., Irvine-Fynn, T., Hodson, A., Butler, C., and Wadham, J.: Nitrogen fixation on Arctic glaciers, Svalbard, J. Geophys. Res. Biogeosciences, 116, https://doi.org/https://doi.org/10.1029/2010JG001632, 2011.

Yan, F., Wang, P., Kang, S., Chen, P., Hu, Z., Han, X., Sillanpää, M., and Li, C.: High particulate carbon deposition in Lhasa—a typical city in the Himalayan–Tibetan Plateau due to local contributions, Chemosphere, 247, 125843, https://doi.org/https://doi.org/10.1016/j.chemosphere.2020.125843, 2020.

Zhang, Y., Kang, S., Wei, D., Luo, X., Wang, Z., and Gao, T.: Sink or source? Methane and carbon dioxide emissions from cryoconite holes, subglacial sediments, and proglacial river runoff during intensive glacier melting on the Tibetan Plateau, Fundam. Res., 1, 232–239, https://doi.org/https://doi.org/10.1016/j.fmre.2021.04.005, 2021.

More information on the glaciers would be worth in “Glacier info.xlsx”. For example, mountain range of the location, type of glaciers (valley or ice cap), elevation range, equilibrium line altitude (ELA).

Reply: More information has been added to “Glacier info.xlsx” as suggested, including the mountain range (the “MountainName” field), the glacier types by geomorphology (the “GlacierTypeGeomorph” field) and by climate (the “GlacierTypeClim” field), elevation range (the “ElevMin(m)” and “ElevMax(m)” fields), and equilibrium line altitude (the “ELA” field). The file has been updated in https://doi.org/10.11888/Cryos.tpdc.271841.

Date of sampling, coordinates, and elevation are necessary for each sample in “DOC-TN surface snow ice.xlsx” as geochemistry of the surface snow and ice varies temporally and spatially.

Reply: The information of sampling date (the “SamplingTime” field), coordinates (the “Longitude” and “Latitude” field) , and elevation (the “Elevation(m)” field) has been added to the “DOC-TN

surface snow ice.xlsx" when available. In addition, the elevation extracted from DEM (Digital Elevation Model) was also added (the "Elevation_fromDEM(m)" field) considering the in-situ elevation of some sites was not measured. The file has been updated in https://doi.org/10.11888/Cryos.tpdc.271841.

As water characteristics of glacier runoff have a diurnal variation, it is necessary to show the time of sample correction for the runoff data ("DOC-TN-runoff.xlsx"). The time seems to be partially included in the column of "SampleID", but they would be better to be shown in an independent column. Time zone (probably Beijing standard time?) should also be shown.

Reply: The information of sampling time and time zone (i.e. the "SamplingTime" and "TimeZone" fields) has been added to the runoff data. The file has been updated in https://doi.org/10.11888/Cryos.tpdc.271841.