This manuscript reports on levoglucosan and the calculated fine (i.e., non sea-salt and non dust) potassium fraction measured on sub-samples from a Talos Dome (Antarctica) ice core spanning the second part of the Holocene. The aim of the work is to reconstruct past fire activity in the southern hemisphere.

The data presented in the manuscript possibly contain information in view to better understand past variability of fire activity. This topic is clearly relevant for Climate of the Past journal. As it stands the manuscript, however, requires major revisions on several key aspects and a re-evaluation prior to publication.

First, the wording "We reconstructed the high latitude Southern Hemisphere fire history by using the specific biomarker levoglucosan and potassium in ice cores from the TALDICE during the Mid-Late Holocene (750-6000 yr BP) » is clearly an overstatement since your data are discontinuous (only 15% of the ice core was measured). Please, make this point more clear in the manuscript and change the wording in your discussion.

Second, I would like to see in the manuscript the raw data (concentrations and not only calculated deposition flux) for levoglucosan and potassium. If my estimate is correct, you calculated fine potassium concentrations in the order of 0.2 ppb. I strongly recommend to the authors to show concentrations of potassium, sodium, and iron and error propagation estimates. Only with that the reviewers (and the readers) can evaluate to robustness of the potassium approach. Also concerning the discrepancies between levoglucosan and potassium: line 8 page 7: what other sources for potassium in the pre-industrial atmosphere (apart from sea-salt and dust) you have in mind here ????

Third, you have ignored the study of black carbon from Antarctic ice covering the Holocene from Arienzo et al. (2017) published in the JGR in 2017. Even though the ice core discussed in this recent paper is from another Antarctic site, it is needed to refer to this previous work and discuss similarity and difference with your work. Note that this JGR paper is based on a continuous back carbon record. I attached below the abstract, showing how deep was the discussion of this record in terms of climatic condition changes in the south hemisphere and particularly in South America.

"Black carbon (BC) and other biomass-burning (BB) aerosols are critical components of climate forcing, but quantification, predictive climate modeling, and policy decisions have been hampered by limited understanding of the climate drivers of BB and by the lack of long-term records. Prior modeling studies suggested that increased Northern Hemisphere anthropogenic BC emissions increased recent temperatures and regional precipitation, including a northward shift in the Intertropical Convergence Zone (ITCZ). Two Antarctic

ice cores were analyzed for BC, and the longest record shows that the highest BC deposition during the Holocene occurred ~8–6 k years before present in a period of relatively high austral burning season and low growing season insolation. Atmospheric transport modeling suggests South America (SA) as the dominant source of modern Antarctic BC and, consistent with the ice core record, climate model experiments using mid-Holocene and preindustrial insolation simulate comparable increases in carbon loss due to fires in SA during the mid-Holocene. SA climate proxies document a northward shifted ITCZ and weakened SA Summer Monsoon (SASM) during this period, with associated impacts on hydroclimate and burning. A second Antarctic ice core spanning the last 2.5 k years documents similar linkages between hydroclimate and BC, with the lowest deposition during the Little Ice Age characterized by a southerly shifted ITCZ and strengthened SASM. These new results indicate that insolation-driven changes in SA hydroclimate and BB, likely linked to the position of the ITCZ, modulated Antarctic BC deposition during most of the Holocene and suggests connections and feedbacks between future BC emissions and hydroclimate."

In conclusion, I would like to review a more adequate version of this manuscript in which authors report concentrations, provide error propagation estimates for fine potassium, and discuss in depth their finding with the continuous black carbon record from Arienzo et al. 2017.

Arienzo, M. M., J. R. McConnell, L. N. Murphy, N. Chellman, S. Das, S. Kipfstuhl, and R. Mulvaney (2017), Holocene black carbon in Antarctica paralleled Southern Hemisphere climate, J. Geophys. Res. Atmos., 122, 6713–6728, doi:10.1002/2017JD026599.

End of the review