

Interactive comment on “Variations in mineralogy of dust in an ice core obtained from northwestern Greenland over the past 100 years” by Naoko Nagatsuka et al.

Naoko Nagatsuka et al use the upper 38.6 m dust mineral record (1915-2013 CE) of an ice-core of a total 222.72 m (1660-2013 CE) to study the variation in the mineralogy of dust from northwestern Greenland. The authors used 5 year averaged dust mineralogy record (1915-2013 CE) analysed in SEM-EDS instrument from the different sections (5-year resolution) of the firn part of the ice core. The variation in dust mineralogy record was interpreted in terms of their different geological origin with the help of air parcel trajectories during the period 1915-2013 CE. The authors suggested the possibility of dust sources from local ice-free areas during warmer periods and from northern America during colder periods using air trajectories and abundance of kaolinite mineral respectively.

General comments

The reporting of new dust mineral record observations in Greenland as well as attempts to identify the sources of dust during warmer/colder periods during 1915-2013 is worthy of publication. However, the report is not suitable for publication as it is. The strength of this work resides only in reporting a mineralogy record of a century time scale from Greenland; there have been no attempts to offer climatic reasons for recent changes in dust mineralogy/sources/production in source/deposition regions. Conversely, perhaps in the attempt to cover so much, the paper fails to go in-depth in a number of aspects of these important subjects and offer no insightful reasons for the possible causes in variation in dust mineralogy and sources changes during the recent colder/warmer periods of last century. In particular, the authors omitted the potential methods (stable isotope ratio of Sr and Nd) to identify the sources of dust in different time scales as well as failing to consider high-resolution fractional dust estimates using water-insoluble particle counting (Coulter counter and laser-sensing particle detector) along with the estimated mineralogy data for dust sourcing/variation of dust mineralogy for strengthening the present argument. Further, lack of trajectories observed from well-known dust sources reported in Greenland (eg:-North Africa/Middle East, and Eastern Asia eg;- Simonsen et al., 2019 and publication by Svensson & group), thereby doubting the uncertainties in using reanalysis data prior to 1979 CE. Additionally, I strongly encourage the authors to consider the full ice core mineralogy/dust records of 223 m or/at least 113 m (1660-2013 CE) for a better understating of variation in mineralogy records in Greenland during a longer period instead of considering the present firn part of the ice core (38 m) where most of the uncertainties are present.

I believe that the above-mentioned issues can be addressed with reasonable additions and extra analysis. I leave it to the Editor to decide whether to recommend, to modify/drop one of the subject study (mineralogy variation in Greenland during the last century) or leave them all.

Specific comments

Line No. 23 - This indicates that the multi-decadal variation of the relative abundance of the minerals can be attributed to the local temperature changes in Greenland. The statement is quite arbitrary so may be re-written or removed.

Maybe a statement on the overall implication of your study or future perspectives will be useful at the end of the abstract.

The first paragraph of the introduction may be rewritten or adding a new paragraph by including recent studies (eg:- Zhang et al., 2020; Bory et al., 2002 & 2003) on dust sources dust in Green land/mineralogy of dust in Greenland/implications in terms of climate changes may be included.

Line No. 103- How reliable the SEM analysis is to estimate the particle size and the number of particle counting from ice core used in the present study? May be compared/clarified here using the different particle count estimate from other instruments.

Line No. 180- Since there are no other non-sea salt sulphate spikes of volcanic origin in the present time scale (1915-2013), Fig. A1 may be included with tritium spike data of chronology as a reference point

Line 245- Is the abundance of silicate minerals due to volcanic ash? There are several volcanic dusts reported in Greenland ice cores during the period between 1915-2013. Please include a discussion on it.

Line No.310:-The choice of 07 days is not explained either and why the author considered only wet deposition?. At least this should be discussed. Trajectories also can never be discussed without cross-checking the results with the general synoptic situation(s) during the transport. Trajectories with links, as shown in Fig. 2, are very unlikely to represent the real path of the air/dust particle. What does it mean by a little contribution from Asia? please quantify it.

References

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