Comment on essd-2021-135
Keith Jackson (Referee)

Referee comment on "Inter-annual variation of lake ice composition in European Arctic: observations based on high-resolution thermistor strings" by Bin Cheng et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-135-RC1, 2021

The paper as submitted represents a significant effort to measure and analyse long-term trends in Boreal lake ice behaviours and the results are very relevant to ongoing monitoring of climate changes. The paper also details useful developments in the instrumentation used and the methods of analysis of the data the instruments produce.

This reviewer is an Engineer involved in the initial development of the instrumentation used and cannot comment on the metrological and climatological issues raise and analysed. Comments are limited to instrumentation matters only.

The work details a considerable programme of over a decade duration over which the SIMBA instrument has developed. The authors present advances made in the instrument itself and improved methods of deployment but more significantly is the presentation of results from a newly developed algorithm to process the SIMBA data. This is a major advancement in the use of the SIMBA device as to date the interpretation of results has been largely subjective human activity. The use of this algorithm now allows for a repeatable and consistent analysis of the considerable data set collected.

Specific comments on the text are as follows.

- The SIMBA sensors are calibrated at a single point to remove large offsets in a very accurately controlled bath. The sensors have been shown to be very linear and so the largest source of error becomes the resolution of the sensors. The absolute accuracy is therefore in the region of the resolution plus the error in the water bath accuracy which is very small. The quoted +-0.01C is not possible and the accuracy more like +-0.0625C. The sensor drift over time is small and can largely be ignored.
- Diffusivity is a transient measure of how heat is conducted away when a temperature change occurs (i.e. how cold to the touch something is). The SIMBA heating cycle is usually long enough for the temperature rise at the sensor to reach a steady state so is it not the thermal conductivity which dominates?
- Really impressive plots!
Overall this is a paper worthy of publication and represents an impressive and well executed effort at studying important phenomena.