

*Review of the article titled “Characterizing black carbon in rain and ice cores using coupled tangential flow filtration and transmission electron microscopy” by A. Ellis et al. for publication in Atmospheric Measurement Techniques.*

This work aimed to improve the capability of measuring and characterizing black carbon (BC) particles and aggregates in remote regions by combining a tangential flow filtration (TFF) to isolate and concentrate BC with transmission electron microscopy (TEM) to characterize the particles. There is much need for a BC characterization method in ice core samples to give insights on paleo-changes to BC form, deposition and transport. This work provides promising qualitative results which could be implemented in a more rigorous field study (rain or ice core) to enhance our understanding of modern and pre-industrial BC.

The paper demonstrated the care, trial and error, and rigorous quality control applied by the authors, which ultimately resulted in a reduced sample volume compared to a previous, drop-wise, approach. I found the paper overall easy to read and follow and was convinced by the careful method development. However, in the introduction, the author’s state the need for a “reasonably quick” method to characterize insoluble BC in precipitation. I wonder how long a sample process, handling, and analysis would be compared to the drop-wise method. While this method does seem effective in its characterizing capabilities, it does seem rigorous (yet optimized for their purpose).

### **General Comments**

GC-1: With both an approximated black carbon concentration and ice core age, can a general deposition of BC onto the ice be estimated? This may not be in the scope of this work, and the authors did stress that this study was a qualitative first application of the method, but a deposition could provide some useful insight.

GC-2: What affect would BC aging and compaction from the weight of overlying ice have on the size of the BC aggregates characterized? I wonder if the smaller size of the BC aggregates in the ice compared to rain is due to transport and deposition processes, or if it is the results of post-deposition processes within the ice core.

### **Specific Comments**

Page 2061, line 18-19: how does the selected filter pore size affect (or not affect) the retention of salts and minerals?

Page 6022, line 24: Which stable isotopes were measured to date this ice core?

Page 6024, line 29: What temperature were the drops left to evaporate at?

### **Technical Comments**

Page 6020, line 25: I suggest making the clean water set-up a separate paragraph to make the flow of this section easier to read.

Page 2061, line 13: Define/spell out PSL in the header of this section. The acronym is spelled out in the following sentence, which seems out of order.

Page 6022, line 3: When beginning a sentence, spell out acronyms. In this sentence, SEM begins the sentence, but elsewhere acronyms are spelled out if they are at the front of a sentence. This is just for consistency and ease of reading. This is repeated again with BC on page 6027, line 21.

Page 6023, line 4-5: This sentence seems to be repeated from above.

Page 2023, line 24: “Difference” should be “different”

Page 2042, line 16: misspelled “elevate”