Response from authors for RC1 for manuscript “Evidence of radionuclide fractionation due to meltwater percolation in a temperate glacier”

Regarding the discussion about why we find a dust-rich layer approximately 1 meter below the misaligned 137Cs peak, our interpretation is that the notable dust peak below the 137Cs rich layer is indipendent and has not been influenced by 137Cs percolation. It is difficult to provide hypothesis circa the conservation signal of the dust peak and its origin without having the complete dust profile of the ice core. In regards to why the 137Cs was not at least partly accumulated in the dust-rich layer this is a problem we cannot solve definitely with current data. Nonetheless we think that the key information contained in our data series is that in glaciers were heavy amount of melting is expected under current climate conditions, the 137Cs data is not to be considered as reliable as it always has been up to now in the ice core dating community. We will add some text to the article to further clarify this point:

“Dislocation of cesium particles inside the ice cores has undoubtedly happened, and the fact that a dust-rich layer with no cesium was found just below the cesium peak may be an indication that even a small amount of particulate (small enough to not be identified as a dust layer in the stratigraphy) can lead to a high cesium peak. On the other hand, a signal such as the tritium one which is a matrix signal, is more likely to either be conserved or be lost to melting, but we do not expect to observe relocation of the peak, and therefore we wish to recommend tritium analysis rather than cesium when a strong tie point is needed for datation.”

In regards to misalignment between the two tritium peaks (high and low resolution), we consider the high-resolution series to be more reliable since the low-resolution series provides a mean value over a thicker portion of ice (as the samples are usually 50-60cm instead of 5-10 of the high-resolution series) and the high-resolution series has shown notable variations over limited ice thickness. Nonetheless the discrepancy between the activity values is inside the error bars as shown in Figure 4 and both series are not compatible with the depth of the 137Cs signal. It cannot be possible to have a relocation of the tritium signal following the same mechanism proposed for cesium because of the very nature of this signal, which is tied to the water molecule itself and not to particulate matter. No traces of refreezing at this depth in the ice core samples were found, thus if meltwater was present, it percolated down to lower levels leading eventually to signal loss of tritium but not to mislocation of the peak.