We would like to thank the two referees for providing constructive reviews on our paper on cryogenic cave carbonates.

As requested by the Journal we reply to their comments as follows.

Review by Referee #2

Formation of CCCcoarse in MSK cave:
The reviewer commented that the Richter et al. (2010) model, which we use in our paper, may only partly be applicable to MSK Cave, because the propagation of the 0 °C isotherm and the mechanism of CaCO3 dissolution in the host rock in unknown. Starting with the second point: the role of vegetation and soil is not a key aspect of the Richter model (at least it is not well laid out in the 2010 publication). We do not think that the mechanism of carbonate dissolution is a crucial term of the equation. The gray marble at MSK Cave and under/overlying schist and gneiss contain disseminated pyrite. Oxidation of this sulphide has been shown to be the key process in dissolution and concomitant calcite precipitation even during glacial times in the nearby Spannagel Cave.
The question about the propagation of the 0 °C isotherm is more difficult to address. Clearly, the Richter model is simplified and we mention its underlying assumptions in our manuscript. We can only hypothesize about the geometry of the 0 °C isotherm in MSK Cave at the time of CCC formation as these deposits only occur in two isolated chambers. Despite its limitations the Richter model is still a very useful concept and we feel that the current database of recently formed CCC in high-alpine caves is too small to establish a new model.

Is it possible that calcite precipitation was also partly caused by microbial communities?
Our answer is yes, but we do not want to go any further as we do not have data to address this interesting question.

Interpretation of d13C and d18O values and 230Th dating.
How much CCCcoarse samples from MSK cave were measured for their isotope signature and what fraction (approximately) was is compared to the overall amount of CCCcoarse samples of each heap?
We collected a few grams per each occurrence of CCC in MSK Cave and hand-picked a few aliquots (each totaling 0.05-0.2 mg) from each sample. These are the data points shown in Fig. 10. We modified a sentence in the Methods:
CCC crystals were hand-picked using a binocular microscope and several aliquots (0.05-0.2 mg) were analyzed for their stable isotope composition.

Is it possible that the isotope offset between the white and brown crystals is caused by a sampling hiatus?
No, because we hand-picked (as explained in the Methods) crystals of the two fractions and analyzed several aliquots of each. The values of these aliquots cluster tightly (Fig. 10A).

Is it possible that the former pool (area) in which sample MSK6B grew underwent several melting and freezing periods and that sample MSK6B record, therefore, different periods of time?
We agree that this particular sample is an outlier. We see no reason to distrust its U/Th age, nor is there compelling evidence of diagenesis (as questioned by the referee). We

tend to concur with the referee that several freezing cycles might be one way of explaining this anomalous sample.
In addition, we see no reason to question the overall quality of the dating. We would expect to see a wider spread of apparent ages had there been alteration. The tight clustering of the ages (Fig. 11) strongly argues against it.

Fig. 10 must be enlarged in the final manuscript.
This is an issue of layout and we realize that this Figure was way too small reproduced in the Discussion version. We prefer not to combine 2B and 2C as this would reduce the readability of the overall diagram. We did change the original labeling 1 to 3 to A, B and C.

All technical points are corrected in the revised version.