Response to Reviewers

Reviewer #1

I'm not sure I understand the reference to the sq.km scale of the frazil growth phenomena but the Reviewer's only explicit difficulties appear to be in not clearly understanding how we identify returns from the 2 different ice species. Let me be clear: although we include long term and shorter term plots showing water levels systematically responding to frazil and postulated anchor ice growth we do not do significant interpretations of these changes because, as indicated in the text, such interpretations depend upon a number of local factors on which we have no data. Instead, we rely on the strength and character of the acoustic returns which are represented by the colour and the numbers of coloured pixels in the first and third (Figs 4 and 8) Echograms to tell us how much and what kind of ice is in the water. In most cases these returns represent scatter by several individual particles of frazil in a particular range cell. Beginning near line 25 of Page 7, I have inserted words in the text to clarify what you are looking at in Fig.4. The added text in the marked up version is given in red. In Figure 8, there are much smaller numbers of high intensity green to red orange returns appearing in the water column which are indicative of returns so strong as to only be associated with large chunks of anchor ice released from the anchor ice layer. Here, additional clarifying text has been added in the Figure caption and, again, presented red in the mark up. The only other place anchor is detectable is, as you suggested, is as it collects on or above transceiver face well after the start of the frazil interval. I assume this is clear.

Reviewer #2

I agree that I was pretty emphatic about the dominance of the in situ processes and that I did run on at greater length than I originally intended in making connections with the Ghobrial and Loewen work.

In the first case, I did make it clear that very reputable people saw evidence of a veritable stew of in situ, frazil capture and, I guess, other ways of mixing ice types…but primarily in small streams, creeks etc. Our results are representative of sizable Canadian rivers with widths measured in tens and hundreds of metres and depths running up to 10 m and more. The consistency of the results we've seen in BC Hydro's annual programs and in the University of Alberta studies of several Alberta rivers makes me pretty confident that what we saw in our data was the dominant mode of anchor ice production. I don't doubt that there might be other features of a river that could contribute similar ice and we specifically note possibilities for dependences on water depth, bottom type and other factors about which have no data. Clearly detailed measurements at a single site in one river leave lots of room for new details and even possibilities of contradiction although I don't think it will be easy to explain frazil growth intervals similar to those we report within a dominant frazil capture picture.

Our original intention was to include comments on the Ghobrial and Loewen manuscript as a sort of proof of concept whereby their observations of long period of steady anchor ice growth coincided nicely with our claim that, unless in situ anchor ice releases and moves to the river surface, frazil concentrations tend to remain at low, equilibrium levels coincident with anchor ice thickening at a relatively steady rate. In trying to make this point and relate it to the Ghobrial and Loewen results, it was impossible to ignore that their lack of access to relevant ancillary data and preference for laboratory results precluded either proving their point or coming up with a more defensible interpretation. Unfortunately, their situation was not an uncommon one in this field and we believed it to useful to make suggestions for a more comprehensive research approach.