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The Cryosphere Discussions

Interactive comment on "Changes of Wilkins Ice Shelf over the past 15 years and inferences on its stability" *by* M. Braun et al.

Anonymous Referee #3

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Braun and others, (2008) provide a thorough review of Wilkins Ice Shelf (WIS) historic behavior. They further provide an important analysis of the changing physical characteristics of the ice shelf. We are early in the process of examining ice shelf collapse mechanisms and an analysis such as this paper and Glasser and Scambos (2008), are of critical importance in extending our understanding. This paper using multiple remote sensing products provides an important baseline for continued observation and understanding of the ongoing collapse of Wilkins Ice Shelf. I also congratulate the authors on their proofreading, which has left very few minor errors. I recommend the paper be published, after the following points are addressed that will strengthen the paper.

The most compelling evidence offered by the authors is the nature of the expansion and extension of rifts and the rifted zone of the ice shelf leading to mechanical failure

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Interactive Discussion
Discussion Paper

of sections of the ice shelf. This line evidence should be emphasized even more. The difference between tensile stress related and buoyancy stress related rift development needs to be emphasized throughout, to better illustrate that buoyancy stress is the key.

In addition the paper relies on ice surface elevation data determined largely from ICESat data. The general ice shelf thicknesses and surface elevation noted in Figure 3 seem well corroborated by the radio echo sounding data; however, the correlation between the two data sets needs to be specifically stated. The derivation of ICESat GLAS data for Figure 6 and Figure 7 needs to be better explained in section 3.5.3 before the reader can have confidence in the observations. As has been noted by H. Fricker it is not clear exactly how this data was processed to deal with either the cloud or tide effects. On page 356 a number of points are made regarding relatively modest changes in ice surface elevation, less than 1 meter, which raises the question of the accuracy of elevations from the repeat profile comparison of ICESat. This accuracy is possible given the instrument accuracy of approximately 0.1 m, if it is properly adjusted. Without proper reporting of how this data was processed and the resulting error bars, section 3.5.3, Figure 6 and 7 are not yet ready for inclusion in this paper.

A map based figure more fully illustrating the structural characteristics of the ice shelf similar to those used by Glasser and Scambos (2008) would be quite useful at least in the Charcot and Latady Island area. In the conclusion more of a contrast-comparison with Larsen B conclusions from Glasser and Scambos (2008) should be made.

This paper comments on the weak connection between Lataday and Charcot Island, and discuss its likely demise in the conclusion. Given the ensuing developments in May-July on the Wilkins Ice Shelf the authors should make a brief comment on the further collapse as it relates to the observed rift developments noted in this paper and add the appropriate ENVISAT image to Figure 4. I look forward to continued work by the authors on this ice shelf. Specific Comments:

345-12. ...This coincides with... What is this referring to? A jump in ice shelf elevation

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is also noted in this sentence. Is there any corroborating evidence for this statement? Jumps in elevation of the surface of an ice shelf other than around an ice rise or island pinning point are not typical. Does the surface elevation change commensurate with shelf thickening coincide with a line from Dorsey Island to Petrie Ice Rise to Burgess Ice Rise?

345-22. Explain connection of pore closure to brine infiltration.

346-20. Where was this breakup?

353-22. After defining crack types, it is important to consistently identify rifts as either tensile or shear stress induced based on orientation. This will aid the reader in developing a sense of the relative importance of each crack type, for example when fractures are discussed on 354-14-25.

355-5. ...Crack propagation toward the ice front s...,is this in general or in reference to a specific crack? Are the associate cracks in this paragraph tensile or shear in origin?

358-17. It is noted that ice rises have been viewed as key pinning points in the past, and not key zones of weakness development. There is a fine line separating these two differing roles. Whether this is correct or incorrect this logical reasoning sequence for ice rises becoming a locus of failure needs to be completed. The authors may in fact be saying this in the sentence, ...Hence, ice rises are, in the absence of a compressive stress zone that hinders rift propagation, a destabilising factor...

359-9. ...drastic rift extension in coherence with break-up events...,Can this observation be quantified in some fashion?

361-9. The conclusion that bending stresses and changing buoyancy forces are a cause for break-up needs to better explained.

365-7. The buoyant stress is indicated as the min cause for breakup, what would a tensile stress related breakup look like, needs to be stated here or on 361-9.

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Interactive Comment

Figure 3. What is the correlation coefficient between the ICEsat GLAS data and the radio echo sounding data? It looks to be good.

Figure 4. Indicate extent of rifted zone on ice shelf with line similar to ice front position.

Figure 5. In panel 5d indicate extent of melt features on WIS as a whole.

Figure 6. Without further data explanation 3.5.3 this figure should be removed.

Figure 7. Without further data explanation 3.5.3 this figure should be removed.

Figure 9. Identify type of crack formation of rifts.

Interactive comment on The Cryosphere Discuss., 2, 341, 2008.