The Cryosphere Discuss.,
doi:10.5194/tc-2016-52-SC1, 2016

Interactive comment on "Basal sliding of temperate basal ice on a rough, hard bed: pressure melting, creep mechanisms and implications for ice streaming" *by* M. Krabbendam

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Received and published: 6 April 2016

This is an interesting paper that draws attention to a possibly highly significant process. I shall not comment on the analysis, but would like to highlight evidence for grain boundary pressure melting beneath Svalbard surging glaciers. Ice formed during surges is well exposed at calving cliffs and in 'ice caves' (englacial and subglacial conduits), and has been the subject of recent detailed studies (see Lovell et al. 2015. Debris entrainment and landform genesis during tidewater glacier surges. Journal of Geophysical Research DOI: 10.1002/2015JF003509). A distinctive ice facies is commonly present at or close to the glacier beds, consisting of glassy, bubble-free ice, sometimes containing dispersed clots of silt. In some cases, filaments and ribbons of

bubbles are present, delineating crystal boundaries and apparently recording migration of gas between crystals. We interpret the facies as formerly wet, highly strained basal ice, in which pervasive grain boundary melting has occurred as a consequence of strain heating - the same process discussed by Krabbendam.

In Svalbard, this facies is typically < 1 m thick, occurring either as a single basal ice layer, or multiple thinner lenses between layers of sheared, debris-rich ice. The thickest basal layer of glassy ice we have observed was at Rabotsbreen, where it attains 10 m in places.

Bubble-free ice also occurs at the base of temperate glaciers, where it too appears to record the expulsion of gases along interconnected grain boundaries. At some locations (including Icelandic glaciers and at the base of Engabreen, Norway) one finds curious ellipsoidal water-filled lenses aligned parallel to flow, which may relect the concentration of excess water.

Ice in which net melting occurs contrasts with the classic conception of 'temperate ice' in which net meltwater production is zero or very small. In essence, excess grain boundary melting reflects an increase in enthalpy, mirroring the loss of potential energy during ice flow. For ice at the pressure-melting point, the key issue is whether this enthalpy can be evacuated from the system at a rate commensurate with its production.

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-52, 2016.