Supplementary Information of “Diagnosing the sensitivity of grounding line flux to changes in sub-ice shelf melting”

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Figure S1. $N_b$ values rotated counterclockwise by $\Delta \phi$ degrees relative to the direction corresponding to $\sigma_{p1}(n_{p1})$. 
Figure S2. Histograms showing the angular difference between $n_p$ and $n_f$. Points analyzed are those from Fig. 4.
Figure S3. An example of the local change (ratio, in %) in (a) the ice thickness gradient in x, (b) ice thickness gradient in y, (c) ice speed, (d) ice velocity (relative), (e, f) principal strain rates, and (g, h) buttressing number following a local perturbation to the ice shelf thickness. In (e) and (g), changes (colors) are associated with the $n_{p1}$ direction and for (f) and (h) changes are associated with the $n_{p2}$ direction. The white- and black-dashed lines show the direction of $n_{p1}$ and $n_{p2}$ at the perturbation location, respectively.
Figure S4. An example of the local change (ratio, in %) in (a) the ice thickness gradient in $x$, (b) ice thickness gradient in $y$, (c) ice speed, (d) ice velocity (relative), (e, f) principal strain rates, and (g, h) buttressing number following a local perturbation to the ice shelf thickness. In (e) and (g), changes (colors) are associated with the $n_{p1}$ direction and for (f) and (h) changes are associated with the $n_{p2}$ direction. The white- and black-dashed lines show the direction of $n_{p1}$ and $n_{p2}$ at the perturbation location, respectively.

Figure S5. Histograms for the maximum (red) and minimum (blue) percent speed increases in grid cells adjacent to a thickness perturbation on the Larsen C ice shelf, plotted as a function of angular distance with respect to (a) $n_{p1}$ and (b) $n_f$. 
Figure S6. An example of the local change (ratio, in %) in (a) the ice thickness gradient in $x$, (b) ice thickness gradient in $y$, (c) ice speed, (d) ice velocity (relative), (e, f) principal strain rates, and (g, h) buttressing number following a local perturbation to the ice shelf thickness. In (e) and (g), changes (colors) are associated with the $\mathbf{n}_{p1}$ direction and for (f) and (h) changes are associated with the $\mathbf{n}_{p2}$ direction. The white- and black-dashed lines show the direction of $\mathbf{n}_{p1}$ and $\mathbf{n}_{p2}$ at the perturbation location, respectively.
**Figure S7.** The change in buttressing number $\Delta N_b$ at the neighboring cells with maximum ice speed increase for each perturbation point in the inset of Fig. 14 that are > 50 km away from the grounding line and the calving front of the Larsen C shelf. Changes in buttressing are calculated along the direction $\Delta \phi$, rotated counterclockwise relative to the $n_{p1}$ direction.
Figure S8. Correlation between the change in normal stress and the change in ice surface speed along grounding line (i.e., $Y_{gl}$ from Eq. 12) for Larsen C experiments. The horizontal axis shows how $Y_{gl}$ varies as a function of the direction $\mathbf{n}$ used to define the normal stress, rotated counterclockwise from $\mathbf{n}_{p1}$. The blue shaded area is the range for all perturbation experiments (same as in Fig. 5a) and the thick black curve is their mean value.