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Supplement of

Spatial characterization of near-surface structure and meltwater runoff conditions across the Devon Ice Cap from dual-frequency radar reflectivity

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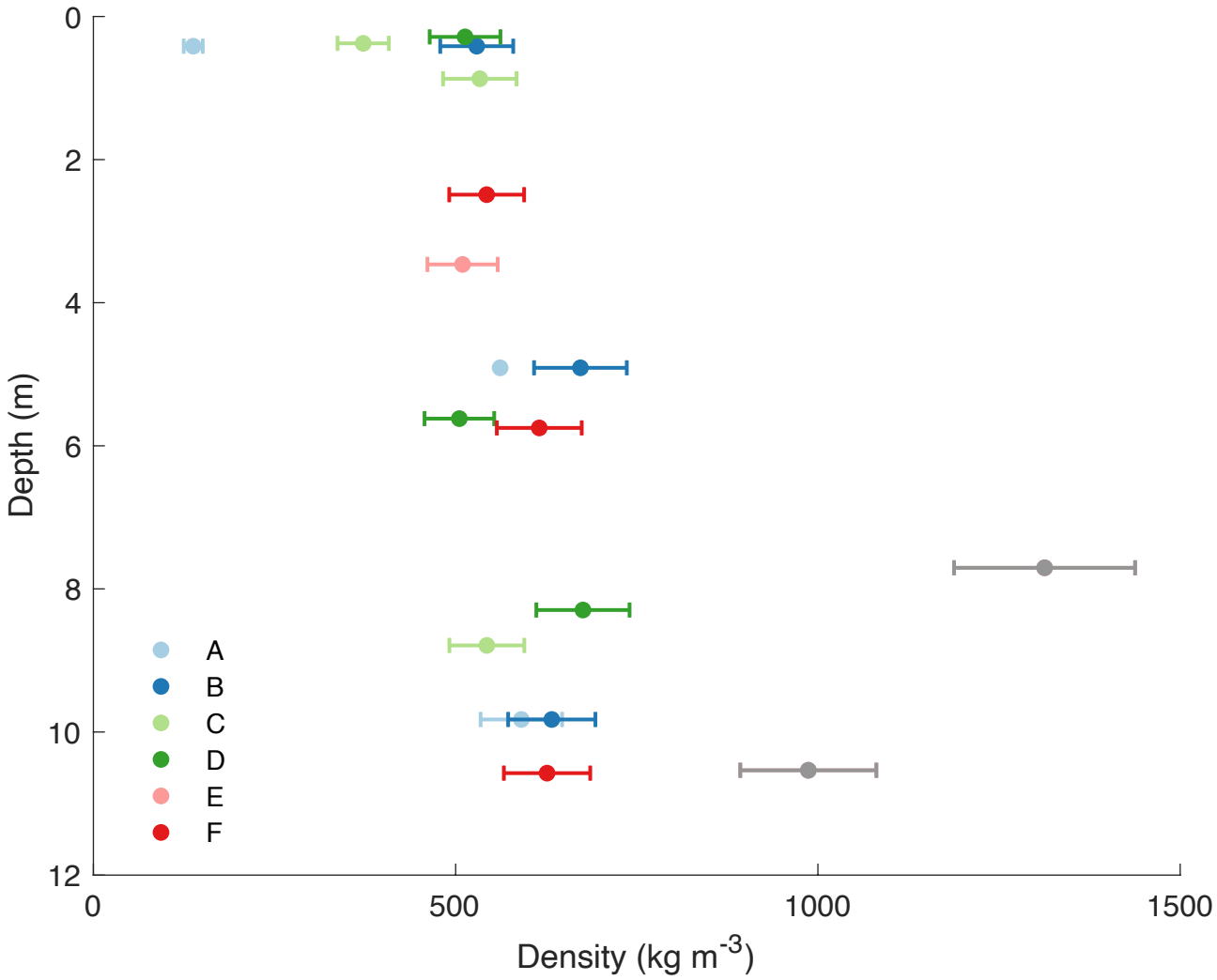
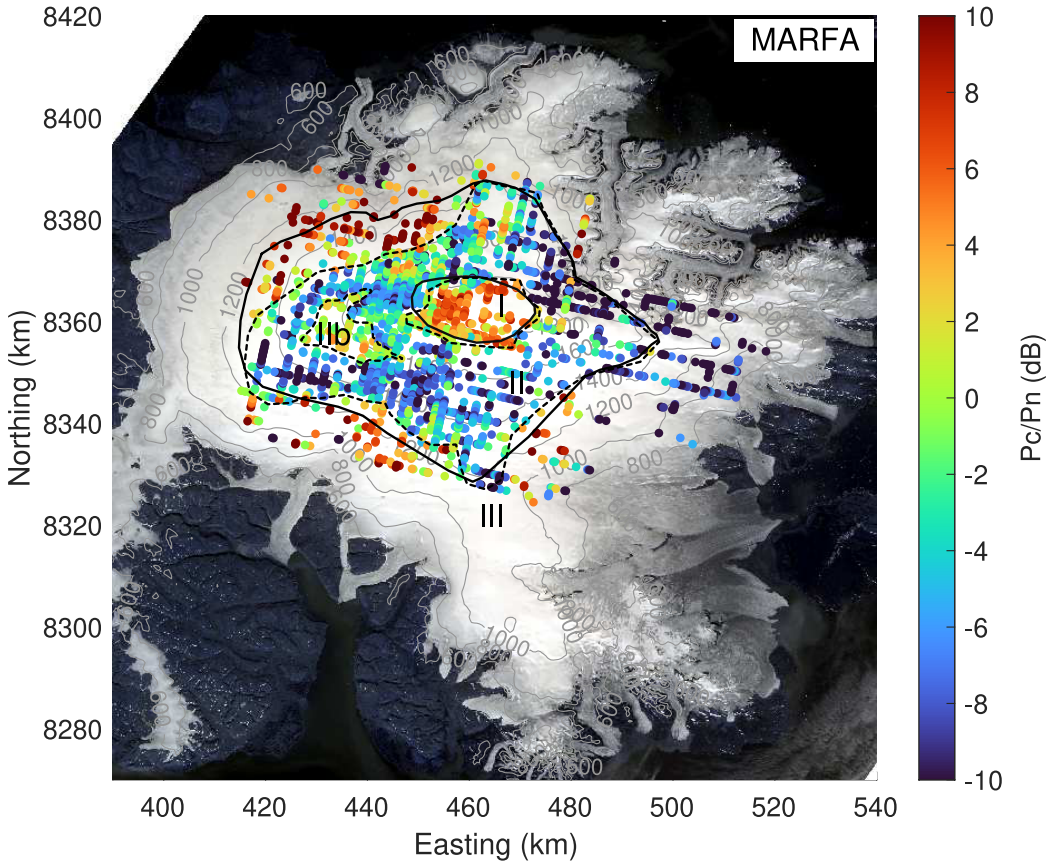


Figure S1: Depth-density firn measurements taken at corresponding firn core locations of Fig. 1. Outlier density measurements (gray) were obtained from firn core E. Density measurement at about 5 m depth from firn core A (light blue) was obtained without a segment length; thus, no firn density uncertainty was assigned to it.



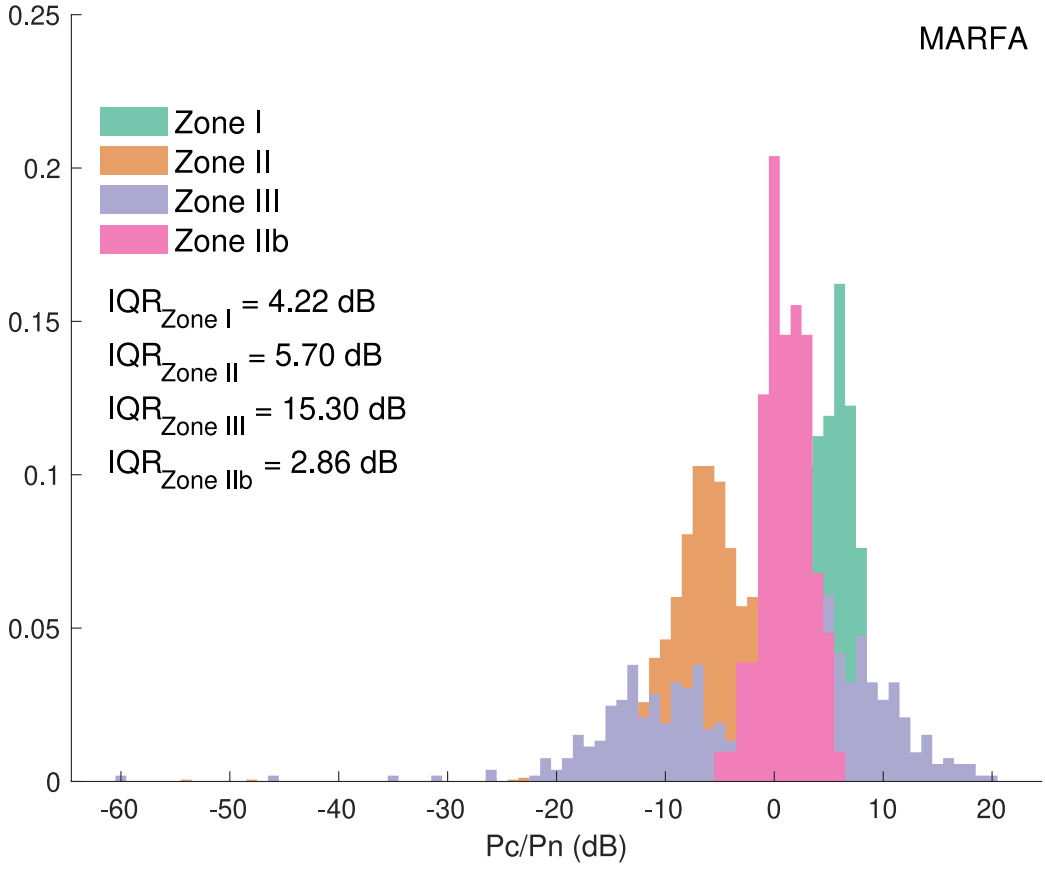


Figure S2: (Top) Map of the P_c/P_n ratio from MARFA over the Devon Ice Cap. Solid black lines denote old firn zone boundaries of Rutishauser et al. (2016). Dashed black lines denote new firn zone boundaries from this work. Thin gray lines are elevation contours displayed from 600 m to 2000 m every 200 m. P_c is the surface coherent/specular power, and P_n is the incoherent/scattered power. (Bottom) Normalized histogram distributions of the P_c/P_n ratio for each zone. IQR is the interquartile range.

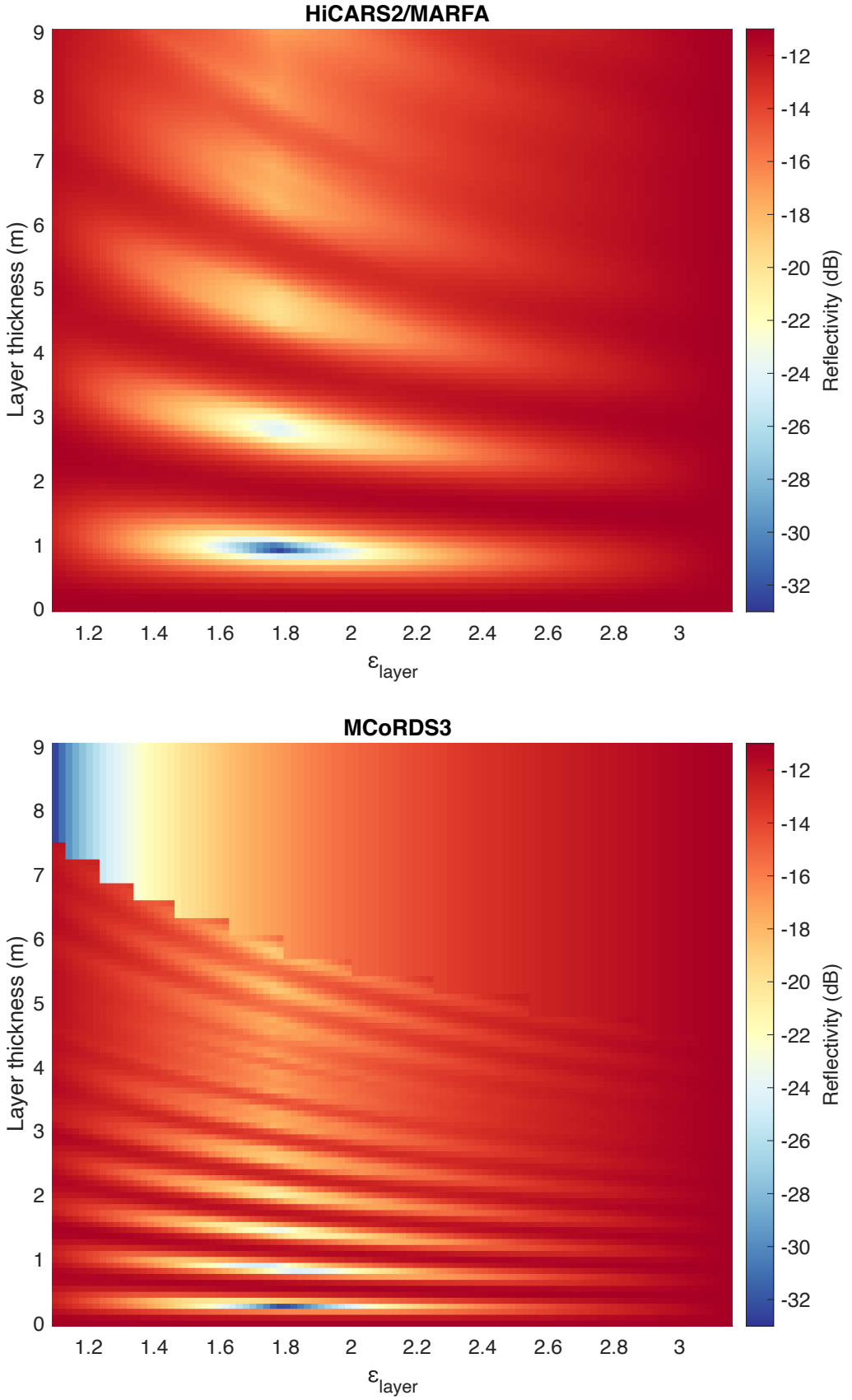


Figure S3: Reflectivity from a layer, as a function of layer thickness and permittivity, for HiCARS2/MARFA (top) with 60 MHz center frequency and MCoRDS3 (bottom) with 195 MHz center frequency. The thin layer is bounded by semi-infinite half spaces of air ($\varepsilon = 1$) above and ice ($\varepsilon = 3.15$) below. For a given layer thickness and permittivity, the radar range resolution is compared with the layer thickness to determine whether a 2-layer or 3-layer stack configuration is appropriate to calculate reflectivity (i.e., when the effects of thin film interference are no longer relevant).

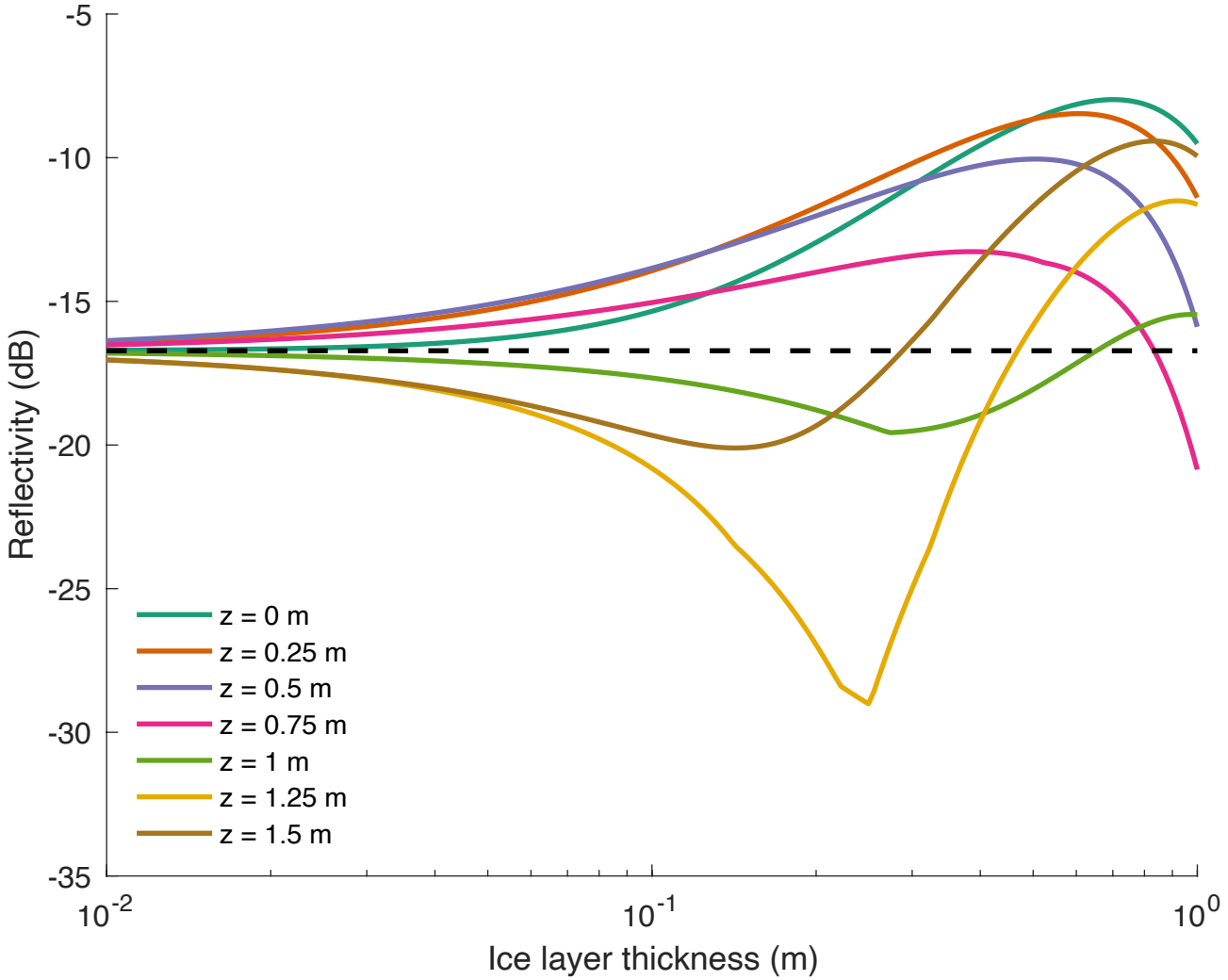


Figure S4: Reflectivity from an ice layer embedded in firn for HiCARS2/MARFA (60 MHz), as a function of ice layer thickness. Ice layers are located at various depths (z) from the surface. The firn column is homogeneous, with a permittivity of $\varepsilon = 1.8$. The black-dashed line is the surface reflectivity of this firn column without the influence of any ice layers.

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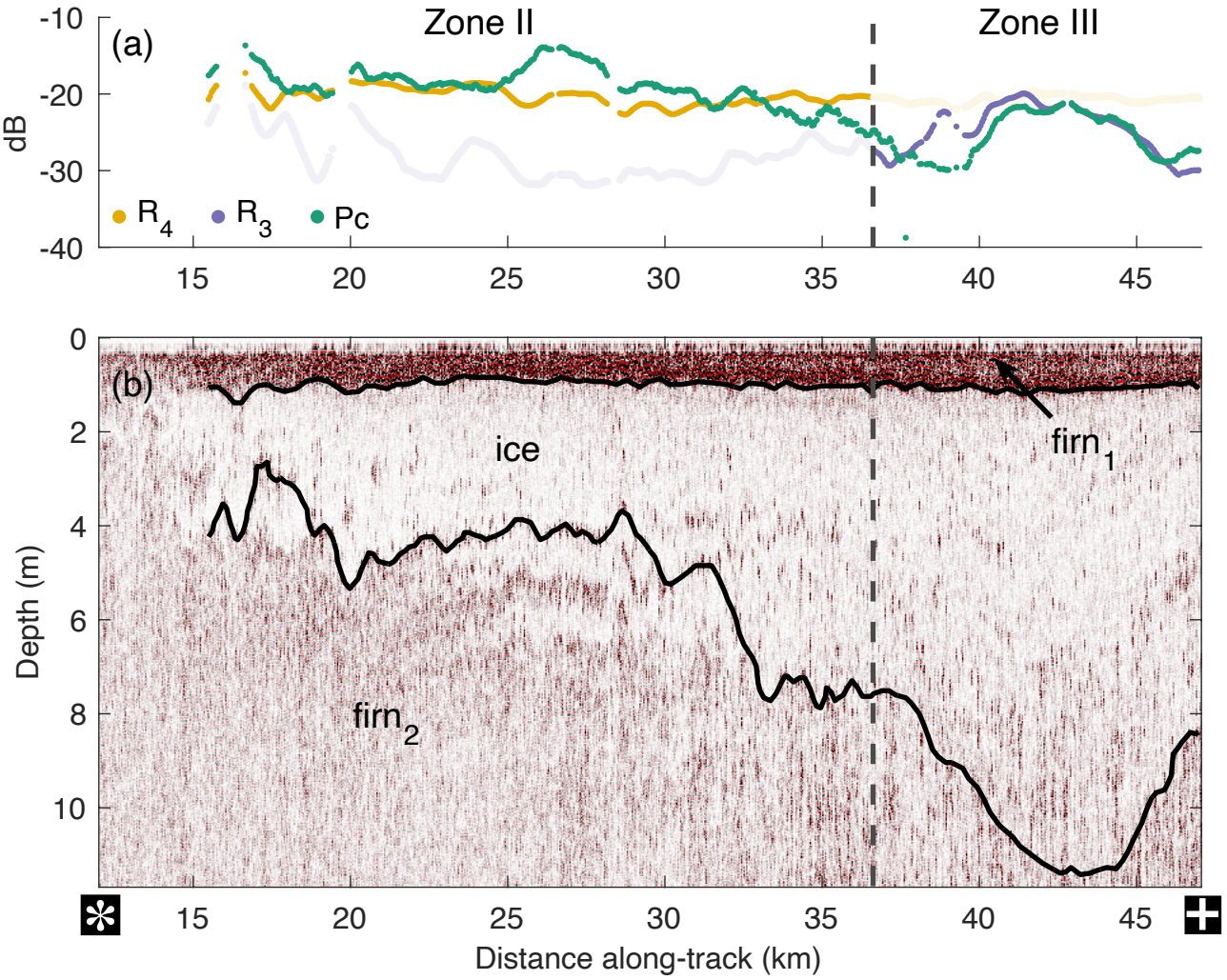

Figure S5: Same as Fig. 4a and 4b, except picking the bottom of the ice slab to exclude more interstitial firn from the ice slab in Zone II. Consequently, the firn$_2$ layer contains more fully densified ice, particularly near this interface.