As a contribution to this discussion, I would like to submit some observations from remote sensing that may aid in interpretation of annual surface melting from modeling in Brun et al. (2002). In Scher et al. (2021) created a record of surface melting over glaciers in the Himalayas from a time series Sentinel-1 synthetic aperture radar (S1-SAR). Melt is detected where annual backscatter is reduced as liquid surface water obscures the radar scattering from the glacier interior, resulting in a marked reduction in backscatter. For the South Col glacier, we observe radar signatures that indicate surface melting is occurring in 2019 over areas of exposed ice in the southern extent of the glacier (Figure 1, attached). From time series S1-SAR, we observe continuous indications of surface melting from June 26, 2019, until October 6, 2019, with an approximately biweekly repeat observations during this period. Since seasonal snow over areas that are exposed on an interannual basis are not deep enough to contribute substantially to radar scattering, we infer that the melting signal originates from structural features (e.g., laying) in the glacier interior that result in enhanced backscatter during colder winter months. It is important to note that at C band frequencies backscatter is extremely sensitive to liquid water and it is difficult to differentiate very small amounts of surface melting from more extensive melting, and therefore our methodologies are not well suited to evaluate the amount of melting that may be occurring. For more details on our methodologies, please refer to Scher et al., (2021).

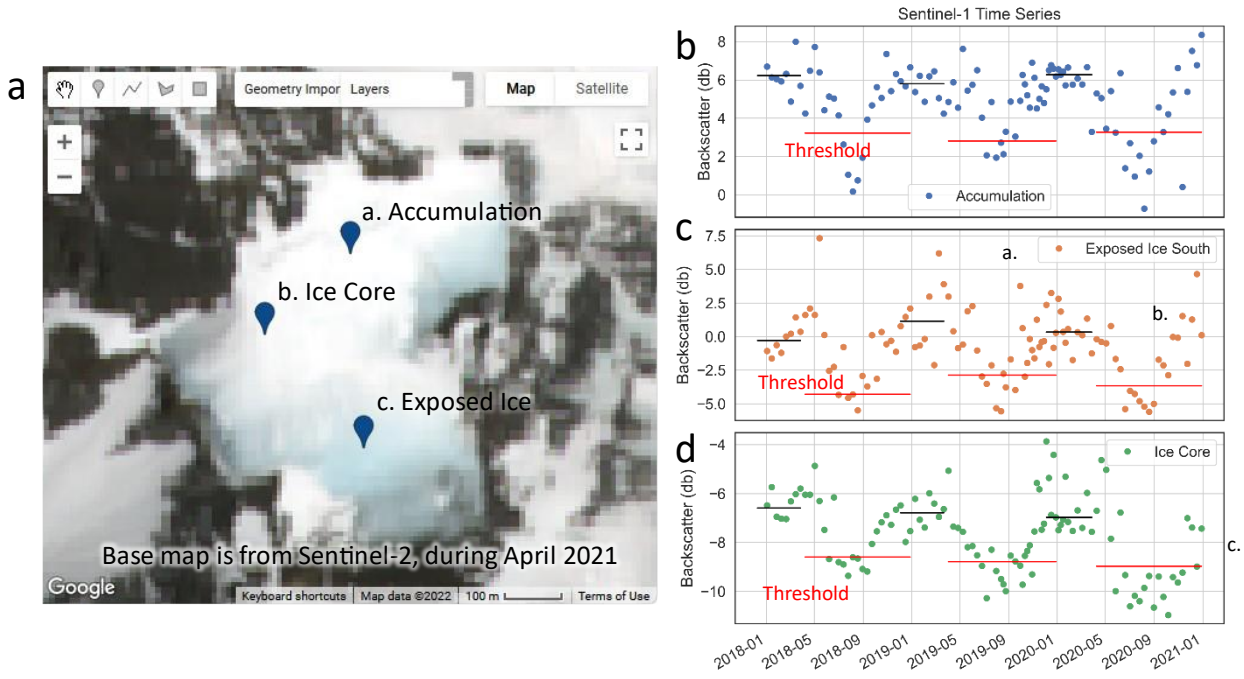

Figure 1 (a) A true-color map from Sentinel-2 during April 2021 of the South Col Glacier indicates areas of blue ice. Sentinel-1 time series synthetic aperture radar (SAR) from locations in (a) the accumulation zone, as designated by Brun et al., (2022) in Figure A6 indicate melting where observed backscatter is found to be ~3 db below (red lines) the winter mean (black-lines). For both the (c) exposed ice and the location of the (d) ice core site from Potocki et al. (2022) we find similar radar signatures that indicate surface melting.