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Impurity Location in the Firn Matrix

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Physically-based firn densification models are difficult to create and tend to be very site specific, therefore the empirical firn densification model developed by Herron and Langway (1980) is still widely used. Having an easily measurable parameter to describe densification rates in firn layers would be an ideal addition to an empirical model, especially if applicable to a wide range of shallow core sites. Recently, the correlation between firn density and Ca++ has been described by Horhold et al. (2012), which could give a measurable variable to input into densification models from all coring sites. In this study, we examine the location of the calcium in the firn matrix from the NEEM 2009 S2 firn core, using energy dispersive spectroscopy (EDS) with a scanning electron microscope (SEM), and Raman spectroscopy with a cold stage-equipped confocal microscope. The concentrations of impurities are compared to the density of the sampled layers and compared to the Horhold results. The location of the impurities is analyzed to determine what role the impurities, including calcium, may or may not have on the firn densification process, shedding light on the interesting correlation between density and calcium in firn layers.