Metamorphism of layered firn at Dome Fuji, Antarctica: Evolution of relations between Near-infrared reflectivity and the other textural/chemical properties

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Evolution of polar firn was investigated at sites at Dome Fuji, to better understand signals of deep ice cores. Using samples from a 4-m-deep pit and a 122-m-deep core, relations between major textural and chemical properties, such as Near-infrared light reflectivity R, density ρ, microwave dielectric anisotropy Δε, and concentration of major ions, were investigated at a depth range of 0 –122 m, with high spatial resolutions. At the near-surface depths, we found: (i) Fluctuations of R , ρ, and Δεare positively correlated; (ii) Δεranges 0.03 –0.07 at depths immediately below the snow surface at ~0.1 m; (iii) These properties of R, ρ, and Δεare not correlated to major ions. With increasing depths during reported phenomena of density crossover, the positive corrlation of R to Δεpersistently remains with a slight decrease. Besides, R becomes weakly negatively correlated to concentration of Na^+ which is the sea salt marker. These facts suggest that textural features of the near-surface depths are preserved in both R and Δεat a depth range immediately below bubble-close-off, being weakly affected by reported softening of ice by Cl- ions. We therefore suggest that optically layerd features in ice cores are directly linked to the metamorphism.

Keywords: Antarctica, snow, firn, metamorphism, ice sheet

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