

Spatial variation of surface mass balance over the last few millennia in the Dome Fuji area from the analyses of shallow ice cores

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One of the main targets in the current Japanese Antarctic program is to identify the drilling site for the oldest ice around Dome Fuji. The site selection activities (during JARE 59 and 60 summer seasons) include national and international ice-penetrating radar surveys, four shallow ice corings, and firn air sampling at one site. In this presentation, we report the shallow drillings and their analytical results for DEP (dielectric profiling) for deducing spatial differences of accumulation rate among the shallow drill sites.

During the JARE 59 surveys (2017-2018), the first core was drilled at 55 km south of Dome Fuji (New Dome Fuji; NDF) to the depth of 151.9 m, second one was drilled at 40 km southeast of Dome Fuji (DFSE) to 41 m, and third one was drilled at 30 km northwest of Dome Fuji (DFNW) to 41 m. The DEP of these cores were analyzed in summer 2018 at the NIPR cold laboratory, and major volcanic signals were identified back to 13th century for all three cores. During the JARE 60 surveys (2018-2019), we set up one base camp 5 km north of NDF (~50 km south of Dome Fuji) (NDFN) and drilled a shallow core to 142 m. The DEP analyses will be conducted for detecting volcanic signals along the core.

We also found a visible 20-mm-thick volcanic ash layer at 118.9 m in the NDF core, and a 10-mm-thick layer at 122.18 m in the NDFN core. Visible ash layers from probably the same origin have also been found in the Dome C (< 1-mm-thick layer at 132.6 m) and Vostok (~30-mm-thick layer at 103.04 m) ice cores. These ash layers were dated at 3500–3600 years before present (Basile et al., 2001; Kohno et al., 2004). On the other hand, volcanic ash layer was not found in the first Dome Fuji deep ice core (Narcisi et al., 2005) but in the second Dome Fuji deep ice core at 133.6 m.

The DEP and in-situ density data are used to date the horizons by comparing the DEP peaks to published volcanic data sets from several ice cores including the WAIS Divide core (Sigl et al., 2014), and to deduce surface mass balance between the volcanic signals for the three cores from JARE 59.

We identified 6 volcanic signals to 40-m depth and 12 signals to ~150-m depth (from the DF and NDF cores). We also use the data from the previously drilled cores (e.g. one from 6-km south of DF drilled in JARE 52, and one from 195-km south of DF in JARE 54) to discuss spatial patterns of accumulation rate from the corings. In the near future, the data will be combined with shallow ice-radar data from the JARE

60 international surveys to expand the spatial estimate of accumulation rate over the Dome Fuji area.

Keywords: Ice core, Volcanic ash, Antarctica, Dome Fuji