

Basal topography in the Dome Fuji region derived from the ground-based radar survey

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Long climatic histories from about 800 ka ago up to present have been studied using very deep ice cores from East Antarctic inland (Dome Fuji, Dome C and Vostok). Knowledge gained from the ice cores studies are crucial to understand the past and present climate and also to project the impacts of future anthropogenic forcings. International Partnership for Ice Core Sciences (IPICS) identified that multiple ice cores covering the mid-Pleistocene Transition (about 1.3 to 0.7 Ma ago) are necessary to better understand the climate dynamics for the transition. Dome Fuji area in East Antarctica is one of the candidate areas where we may be able to find such old ice near the bottom of the ice sheet. The bed topography beneath the ice sheet is one of the most important information for locating the most promising site for the next deep drilling. It provides the basic information such as ice thickness, bed slopes, roughness and bottom environment (frozen or melting), which are also crucial for ice sheet model experiments to deduce the past ice sheet deformation and flow fields.

Japanese Antarctic Research Expedition (JARE) have accumulated radar sounding data in this area since the JARE26. In the season of 2017/2018, ground-based radar surveys were conducted over wide areas (20000 km² in total) with a line spacings of 5 km or less (total length travelled is 2950 km). Based on the results of these previous surveys, we conducted a more detailed radar survey in the south side of Dome Fuji in the 2018/2019 season as a collaborative research projected by the University of Alabama, the University of Kansas, National Institute of Polar Research and Norwegian Polar Institute (with support by the Beyond EPICA project).

In this presentation, we present the data collected by a conventional pulse-modulated VHF radar (JARE radar) with high gain antennas. Using a traverse team of JARE and its snow vehicles, we investigated along 2700 km in an area of about 1000 km². Final spacing between the survey lines varied between 0.5 km and 0.25 km. The dense-spacing surveys greatly improved the spatial distribution of ice thickness distributions in the Dome Fuji area. The combined JARE59 and JARE60 radar survey data clearly identifies the ridges, valleys and other topographic irregularities under the ice sheet in the southern part of the Dome region. On the subglacial ridges, the ice sheet thickness is about 2000–2400 m. On the other hand, the ice thickness is more than 3000 m along the subglacial valleys in the areas west of the Dome Fuji Station. Based on the detailed ice thickness distribution and bed topography data, we will discuss the potential candidate areas for next deep ice core drilling.

References

Rodriguez-Morales, F. et al., A Mobile, Multi-Channel, UWB Radar for Potential Ice Core Drill Site Identification in East Antarctica: Development and First Results, IEEE JSTARS, 13, 4836–4847, 2020