Development status of compact, software-defined-radio-based radio echo sounder for helicopter-borne radar measurement in glaciers around Syowa Station

Taishi Hashimoto[1], Masahiro Minowa[2], Kazuhiko Mushiake[3], Shuntaro Hata[2], and Ken Kondo[2]
[1]*National Institute of Polar Research*
[2]*Institute of Low Temperature Science, Hokkaido University*
[3]*Ilohas Project Co., Ltd.*

The Antarctic ice sheet has been losing mass due to the dynamic response of outlet glaciers to ocean melting of ice shelves [1]. Therefore, measuring the thickness, bedrock topography, internal ice layers and subglacial substances in the marginal part of the ice sheet is important to quantify the loss of ice mass, understand its mechanisms, and project the ice sheet fluctuation.

Among the numerous techniques, airborne ice radar is the most reliable and efficient means of measuring for example ice thickness and bedrock topography in a wide area [2]. A number of airborne surveys have been conducted in vast areas of Antarctica so far. However, the published dataset is still sparse, especially in East Antarctica. The bedrock topography under the ice is poorly measured in these areas, and the estimated ice discharge from the outlet glaciers could be inaccurate resulting in a large uncertainty in ice change and its contribution to the sea level rise [3, 4].

This motivated us to develop a compact radio echo sounder (RES) for helicopter-borne operation in the glaciers around Syowa Station in East Antarctica. Our radar system is based on a software-defined-radio (SDR) platform called Red Pitaya [5]. Currently, we aim for the helicopter-borne observation in the 68th Japanese Antarctic Research Expedition (JARE 68). Until then, several challenges need to be addressed, including reducing the weight and dimension of antennas, extending the observable range, and suppressing the reflection from the side of valleys to obtain the distance directly below the ice surface. These features will first be tested in JARE 65 at Langhovde Glacier, Telen Glacier, and the marginal part of the ice sheet in Skarvsnes.

This presentation will explain the current status of the development of our compact SDR-based RES system and the plans for successive radar experiments.

References

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