

## 2023 Breakup of the land-fast ice in Lützow-Holm bay, Antarctica

\*T. Waseda<sup>1</sup>, K. Tateyama<sup>2</sup>, R. Uchiyama<sup>1</sup>, T. Nose<sup>1</sup>, T. Kodaira<sup>1</sup>, T. Katsuno<sup>1</sup>,  
T. Tamura<sup>3</sup>, T. Toyota<sup>4</sup>, J. Rebault<sup>5</sup>, M. Hoppmann<sup>6</sup>, D. Shimizu<sup>3</sup>

1. The University of Tokyo, 2. Kitami Institute of Technology, 3. National Institute of Polar Research,  
4. Hokkaido University, 5. Met. Norway, 6. Alfred-Wegener-Institute

During the 64th Japanese Antarctic Research Expedition (JARE), over 30 wave buoys were deployed in the Lützow-Holm bay, Antarctica. The aim of our observational campaign during JARE64 is to monitor the incoming waves through the MIZ, packed ice zone (PIZ), and the land-fast ice zone, and to monitor the horizontal movement of the sea ice. It is the first observation in the six-year observational program sponsored by the National Institute of Polar Research (AP1001). During JARE64, 15 wave buoys were deployed on the land-fast ice, 8 wave buoys on the drifting ice floes, and 10 wave buoys in the water covered by bluish ice between ice floes. The same observation will be made during the JARE65. The deployment was conducted by a helicopter and by a ship operation. A wide areal coverage of the buoys was possible only with the use of a helicopter. We have also landed on the land-fast ice of the 13 buoy locations and measured the ice thickness. In this presentation, the logistics of these observations will be discussed as well, in view of conducting a similar observation in the Arctic Ocean when the new Japanese ice-breaker becomes operational in a few years.

The eventual goal of this research is to support Shirase operation in JARE. Syowa Station is the central hub of the Japanese Antarctica observation, and its maintenance relies on the successful and timely berthing of the Ice breaker Shirase on the Syowa land-fast ice docking station. Syowa Station is located in the East Ongul Island, east of the Lützow-Holm bay. Shirase visits Syowa Station every year, bringing cargos over 1000 tons and around 70 members of JARE. But, every once in a while, it fails to deliver the cargos when the fast-ice becomes thick and prevents Shirase to approach the Syowa station.

The fast ice in the Lützow-Holm bay is protected from the incoming swells of the screaming 60s by a vast land-fast ice, packed ice zone in the north, and the Marginal Ice Zone (MIZ). Waves that propagate under sea ice are considered to be one of the causes of a large breakup of the land-fast ice. The sea ice in the Lützow-Holm bay grows not only because of the freezing of the sea water, but because of the icing of the snow at the surface as the sea water intrudes into the snow. The material strength of such sea ice is considered to be weak and subject to breakup as it oscillates due to the incoming waves. The cycle of sea-ice breakup and growth has been around 10 years and interestingly enough, the number of ramming maneuver of the ship synchronously changes. The knowledge of the long-term cycle of sea-ice breakup is critical for the long-term planning of Shirase operation.

We present the breakup event that occurred from the end of March to the beginning of May as observed by the buoys deployed on the sea ice. The buoy motion and the sea ice are shown in Figure 1. The breakup did not occur at once, but a number of breakups gradually eroded the fast ice, and eventually, most of the fast ice had drifted away from the Lützow-Holm bay. A number of events were associated with a propagation of waves into the bay as observed by the buoys. In this presentation, we highlight those events and discuss the origin of the waves and how that may have triggered the breakup. Wind is another and perhaps the most important factor in determining the sea ice drift. Therefore, both the wave field and the wind field will be discussed.

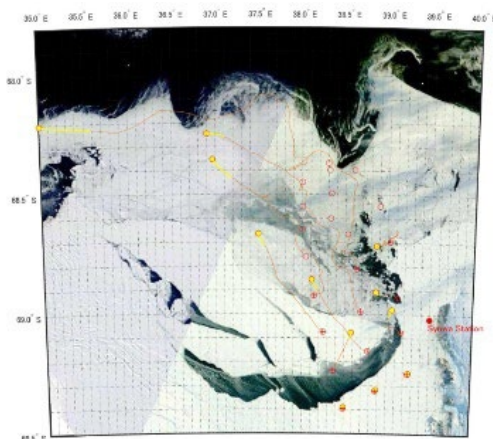


Figure 1. Wave buoys tracking the movement of sea ice as it breakups and drifts out of Lutzow-Holm Bay.