CRREL Geophysical Research Facility

Providing a temperature controlled indoor/outdoor facility for fresh water and sea ice research

The Geophysical Research Facility (GRF) is a 60 ft long x 22ft wide x 7 ft deep concrete basin at ERDC-CRREL for support of fresh and saltwater investigations. The facility can be temperature controlled or allowed to remain at ambient conditions, enabled by a retractable roof and dedicated refrigeration system. Due to its size, year-round refrigeration, and indoor/outdoor capabilities, the GRF bridges the gap between laboratory and field-scale investigations of fresh water and sea ice environments. Previous research activities performed in the facility include:

CRREL collaborates with Boise State University and DF Dickens Associates to conduct remote sensing investigations above 1.5 foot thick sea ice

- Remote detection of petroleum signatures, including oil in and under ice
- Mitigation of petroleum spills, including chemical and mechanical herding of oil in ice
- Understanding the relationship between the physical and electromagnetic properties of sea ice
- Studying waves and sea ice interactions
- Studying sea ice mechanics

Features

The GRF contains a concrete basin, 18.25 m long x 6.7 m wide x 2 m deep (60 x 22 x 7 ft), with a removable refrigerated roof that maintains an ice cover and protects the underlying ice surface from snow (if desired). The self-contained refrigeration system allows early season ice sheet growth as well as maintains a consistent character and thickness of established ice sheets, up to ~0.5 m (1.5 ft) thick. The facility is equipped with an instrument gantry mounted on rails that extend the full length of the basin. Activation of a wave-maker allows the production of ice under agitated conditions. A separate basin at one end, equipped with hydraulic loading pistons, allows for mechanical testing of large ice blocks.

Research Support

A number of agencies, academia and corporate entities have used the GRF to support their research needs. For example, studies conducted for the Office of Naval Research have enhanced our understanding of the fundamental relationship that exists between the physical and electromagnetic properties of sea ice, which has led to improved application of remote sensing assets.

CRREL collaborates with Woods Hole Oceanographic Institution and Scott Polar Research Institute to detect oil under sea ice

Researchers from Dartmouth College conducted intermediate-scale (approx. 1 m) biaxial compression tests on sea ice samples to investigate the impact of scale on the mechanical behavior of sea ice. Their investigation indicated that the results of the large scale laboratory tests performed in the GRF could be applied to estimate field conditions.

Lastly, a wave-making device, installed to support collaborative research with Clarkson University, has enabled research on the formation and rafting of pancake ice, which is characteristic of ice in the seas of Antarctica and the marginal ice zones of the Arctic.

Benefits

The Geophysical Research Facility provides geophysicists with controlled ice growth conditions and a technical and economical bridge between laboratory and field-scale studies. It is supported by a staff of internationally recognized experts in sea-ice research, and it is particularly well-suited for studies of young sea ice, which can be difficult to access safely in the field.

ERDC Point of Contact

Questions about the Geophysical Research Facility?

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CRREL collaborates with Scott Polar Research Institute to detect oil under sea ice using submerged sensors

CRREL conducts cold regions oil spill training and mitigation exercises with Alaska Clean Seas