



CRREL Flume

Refrigerated, Physical Modeling of River Beds and Processes

The Flume in the Ice Engineering Facility at ERDC-CRREL is refrigerated, tilting bed structure capable of constant water re-circulation. The structure can be used to model a wide range of riverine scenarios, even those involving fresh water ice. Previous research activities supported by the Flume include:

- Investigating the fundamental properties of frazil ice formation, evolution, and accumulation
- Investigating frazil ice blockage of water intake trash racks
- Determining the effects of ice cover on sediment transport and scour
- Investigating the effects of frazil ice on fish respiratory systems
- Quantifying the relationship between waves and ice formation processes
- Determining heat transfer between ice cover and moving water
- Modeling snowdrift in an urban environment
- Determining the effects of oil spills in river environments using sand, gravel and cobble beds



New York University researchers and CRREL set up instrumentation in the Ice Engineering Facility Flume

Supported Research

There has been recent National interest in diluted bitumen products produced from Canadian tar sand deposits and the potential for environmental impacts. A major point of discussion is the anticipated behavior of these oil products, both within the distribution pipeline and if spilled in a fresh water environment. Using the flume, ERDC-CRREL researchers successfully measured the behavior of diluted bitumen and crude oil products in a variety of simulated riverine environments.

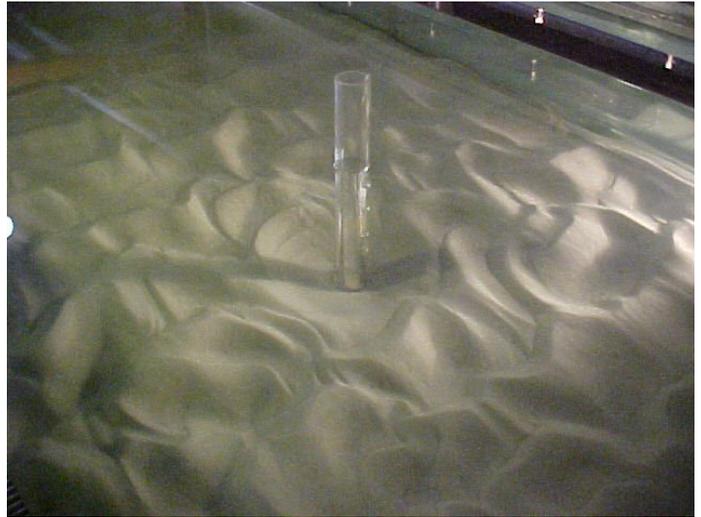
Results from the study provided insight into the behavior, fate and subsequent movement of diluted bitumen products, specifically as they compared with conventional heavy crude oils. The Flume provided an ideal cost-efficient platform for quantifying the environmental impacts of bitumen products on riverine environments. An understanding of material properties and complex interactions that occurred as the product weathered could be used to inform stakeholders of potential second order impacts that could result from spills.



Longitudinal view of the Ice Engineering Facility's Flume

Features

- The flume is 120 ft long by 4 ft wide and has a tilting bed that can create a $+1^\circ$ to -2° slope
- A paddle-type wave maker can be used to create regular waves
- An ammonia refrigeration system can cool the entire flume room to -15°F (-26°C)
- An ice builder coil can maintain the water temperature at the freezing point independent of the ambient air temperature
- The flume bed can be heated, refrigerated, or frozen
- Air bubblers can be used to agitate the water and keep sediment suspended during recirculation and to ensure that the water is isothermal
- A sand filtration system is used to maintain water quality; if required, additional filtration can be accomplished with cartridge filters
- Wind currents can be generated by use of two moveable independent fans that rest on rails paralleling the flume structure



CRREL researchers study sediment transport under ice

Instrumentation

- Thermistors for temperature measurement
- Laser for bed profiling
- Pressure sensors for monitoring water levels and waves
- Sontek acoustic Doppler velocimeter capable of measuring both mean flow and turbulence in three directions

The research at CRREL is a unique facility capable of supporting a wide range of science and engineering research application. The flume is ideally suited for investigations into oil spill detection, containment and mitigation under non-static conditions, specifically those encountered in the polar regions.

ERDC Point of Contact

Questions about the CRREL Flume?

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