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1997 Pack Ice Properties in Northumberland Strait

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ABSTRACT

As part of the joint effort by the Canadian Coast Guard (CCG), Fisheries and Oceans Canada (DFO) and Canadian Ice Service (CIS) to improve ice information available to mariners in the Southern Gulf of St. Lawrence, data from ice beacons, helicopter-borne sensors and satellite imagery are available for the Northumberland Strait to study the effect of the Confederation Bridge on the local ice properties. GPS-ARGOS ice beacons deployed on ice floes provided hourly ice velocities as they drifted past the Bridge site while helicopter-borne sensors provided ice thickness, concentration and floe size distributions in the strait. This provided site-specific ground validation data for ice signatures seen in the available RADARSAT SAR imagery covering the total Northumberland Strait and the Southern Gulf.

The beacon data showed that ice drift in Northumberland Strait responds to tidal currents and wind forcing. The drift of thinner, softer and less concentrated pack ice was not affected by the Bridge, and large floes passing eastwards under the Bridge area were fractured by the bridge piers. However in some NOAA infrared images, it appeared that ice drift was being impeded by the bridge. As part of the continuing effort by CCG, DFO and CIS to monitor ice conditions for winter navigation near the Bridge, more data will become available to determine the effect of the Bridge on the local pack ice conditions.

KEYWORDS: Northumberland Strait, Confederation Bridge, RADARSAT, GPS ice beacons, airborne electromagnetic system, ice drift, ice thickness

INTRODUCTION

In February-March 1997, a field program was conducted out of Charlottetown, Prince Edward Island (P.E.I.) to study ice drift and thickness in the southern Gulf of St. Lawrence. Some of the field work was done south of P.E.I. in Northumberland Strait, where the Confederation Bridge which is 13 km long has recently been completed (Fig. 1). During the experiment, ice drift was monitored using GPS-ARGOS ice beacons deployed on the pack ice by helicopter. A GPS/Video system was used to frame-grab video imagery in real-time to determine floe size distributions and to validate RADARSAT imagery. Ice thickness profiles were collected using the CCG Ice Probe, which uses electromagnetic induction to measure sea ice thickness. This paper describes ice drift in Northumberland Strait measured by the ice beacons and its response to wind, and presents evidence of the effect of the bridge on ice seen in NOAA imagery. In addition, video images and EM-measured ice thicknesses are compared with RADARSAT imagery.

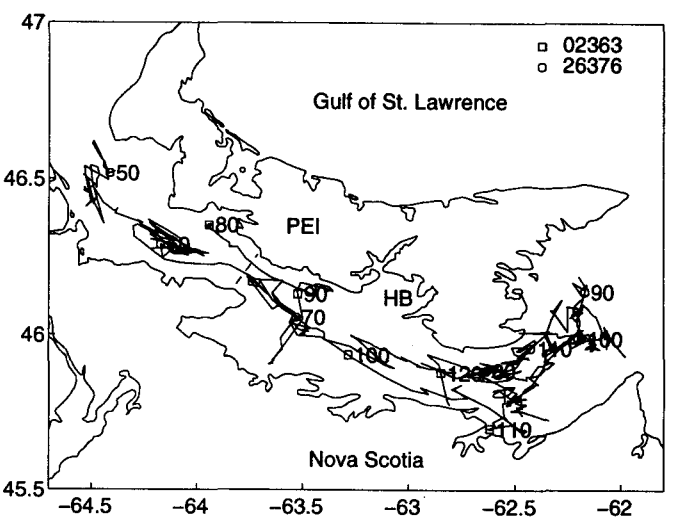

Fig. 1. Trajectories of two satellite-tracked ice beacons deployed off PEI in Northumberland Strait in February-March 1997. The dashed line indicates the position of Confederation Bridge and HB=Hillsborough Bay.

SATELLITE-TRACKED ICE BEACONS

Two Argos satellite-tracked ice beacons manufactured by Metocean Data Systems Ltd., were deployed on ice floes in western Northumberland Strait by helicopter on February 18 (Jday 49) and March 18 (Jday 77) to monitor ice drift. They were placed on floes which were relatively large and thick for the time of deployment. The floe diameter was at least 500 m for both beacons, and floe thicknesses