Ice Property Variability of the Pack Ice off the Labrador Coast, Canada

Prinsenberg¹, S.J., I.K. Peterson¹, J.S. Holladay² and L. Lalumiere³

¹ Fisheries and Oceans Canada, Bedford Institute of Oceanography, Dartmouth, N.S.
² Geosensors Inc. Toronto, Ontario
³ Sensors by Design Ltd. Newmarket, Ontario

ABSTRACT

During March 2009 and 2011, ice property data were collected from the mobile pack ice off the mid-Labrador coast with helicopter-borne sensors. The surveys collected ice thickness and roughness data with Electromagnetic-Laser (EM) system and overlapping-pictures with a Video-Laser system. The surveys in 2009 and 2011 covered the same offshore region and thus provide information on the inter-annual variability of the First Year pack ice properties.

There are several overall pack ice differences between the near-normal winter of 2009 versus the warmer winter of 2011. From satellite imagery it can be seen that the ice extent was much less in the warmer winter of 2011 than in 2009. In addition, the helicopter-borne sensors data showed that mean and modal ice thicknesses of 2011 were much less than those of 2009, having a mean offshore ice thickness of 0.71 m relative to 1.68 m for 2009. The moda 1 (most frequent occurring) ice thickness similarly decreased from 1.0-1.1 m in 2009 to 0.6-0.7 m in 2011. Thus ignoring ice extent, the ice volume off the mid-Labrador Shelf in 2011 due to ice thicknesses alone would be half of that present in 2009.

The thinner ice and lower ice extent ice in 2011 can be explained by the fact that the 2011 winter was much warmer reducing regional ice growth as well as providing more heat to the offshore ocean which in turn also retards ice growth. In addition, westerly winds bringing the cold air to the region occurred less frequent during the winter of 2011, reducing the ice transport from the northern latitudes.

KEY WORDS: Sea ice observations, Labrador Sea shelf, Electromagnetic-Laser sensor, Video-laser sensor and Eastern Canada

INTRODUCTION

It is now generally accepted that due to climate change, the Arctic polar ice cap is melting (IPCC, 2007) with the ice extent decreasing (Serreze et al., 2007) and the remaining ice thinning (Kwok and Rothrock, 2009). Large inter-annual variations in ice properties have been observed along the Canadian east coast (Fig. 1, http://ice-glaces.ec.gc.ca/IceGraph103/) and in the Canadian Arctic (Tivy et al., 2009). First Year ice predominantly occurs along the southern Labrador coast and its extent shows a decadal (10Yr) variability in the early part of the 40 yr time series shown in Fig. 1. This interval has been followed by a steady decline in ice extent since the early 1990s. Although the pack ice serves as a marine habitat for species such as seals and polar bears, it also represents a hazard to navigation and an impediment to offshore oil and gas development.

Fig. 1 Forty year time series of ice extent along the southern Labrador Sea coast indicates ice extent decline over recent years after a period of a stable decadal pattern (red line); yellow line is the linear trend.