

# SEA-ICE EDGE MONITORING FOR POLAR NAVIGATION (CANADA)

## SUMMARY

### Title

Sea-ice edge monitoring for polar navigation (Arctic Canada)

### Service

Assessment of sea-ice conditions in support of Inuit communities' access to safe travel routes and hunting areas

### End users

Inuit communities

### Intermediate users

- Noetix Research Inc.
- Environment Canada

### Application(s)

- Navigation planning
- Fishing and wildlife harvest support
- Climate monitoring, climate change adaptation

### Models used

N/A

### Climate data records used

30-year average of historical sea-ice edge locations

### Satellite observations used

RADARSAT-1/-2, ASAR/Sentinel-1

### Agencies that produce records

CSA, ESA, MDA Canadian Data Processing Facility (for pre-processing)

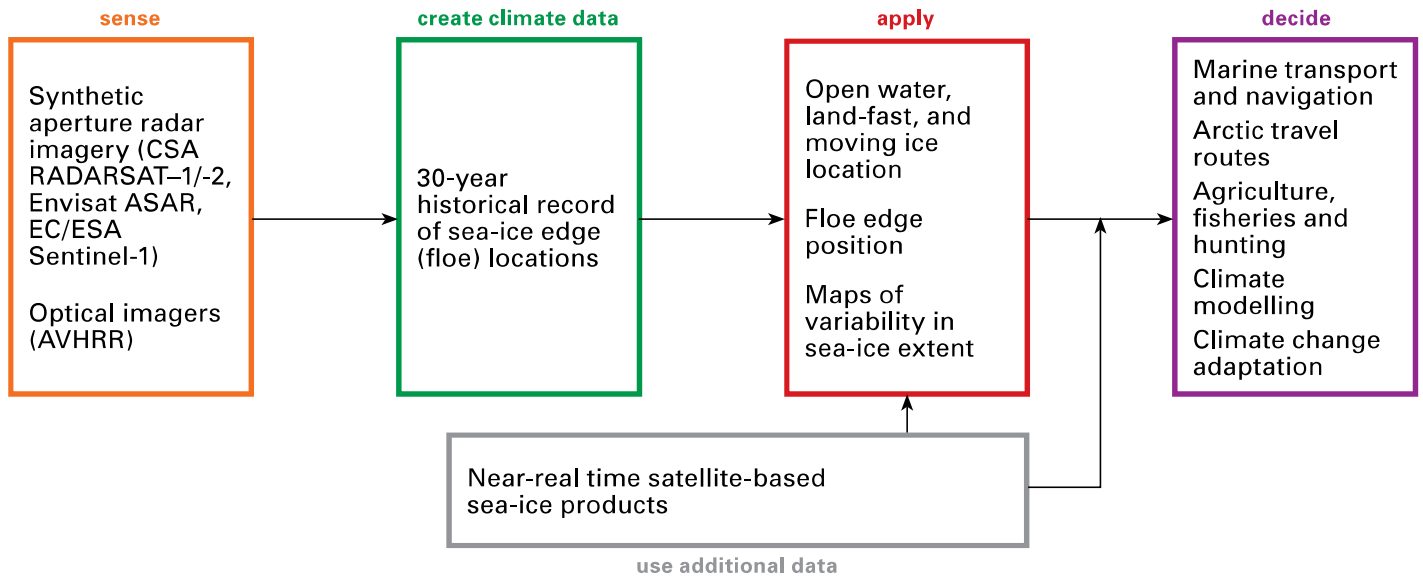
### Sustainability of service (demonstration or ongoing)

Ongoing service (initiated during International Polar Year 2007–2008)



*Polar bear, Spitsbergen,  
Norway*

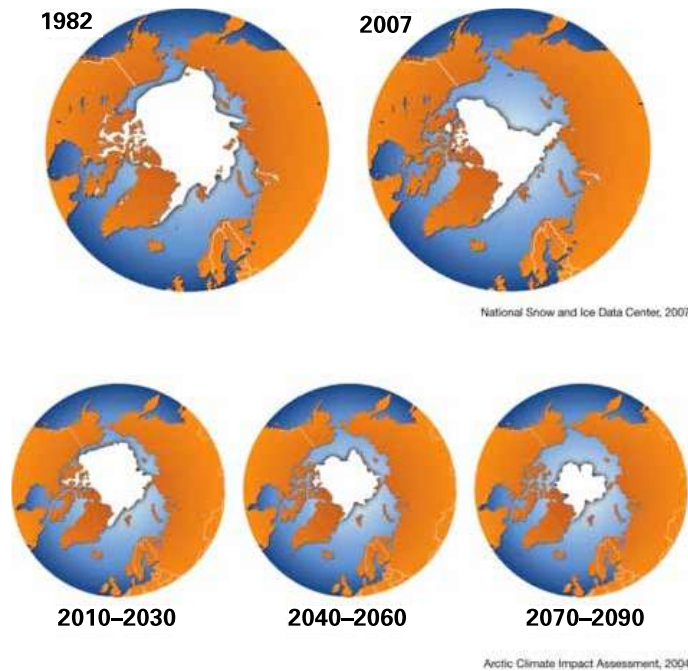
## INFORMATION FLOW



## DESCRIPTION

Long-term satellite observations of the Arctic Ocean show trends in reduced sea-ice extent and thickness (Figure 1). However, these trends are not easily transformed into local consequences for sea-ice conditions, which are dependent on geographical contexts. The unpredictability of local sea-ice conditions has raised concerns among Canada's

Inuit and other indigenous Arctic communities. Sea ice is critical to the ways in which they travel and hunt. It determines wildlife harvest destinations, travel routes, modes of transport, amounts of fuel needed and travel safety. In Canada, Inuit communities have started to use satellite products to evaluate safe on-ice travel routes.



**Figure 1. Decrease in minimum sea-ice extent (observed: upper two figures) and climate projections (modelled: bottom three figures)**

Source: Hugo Ahlenius, UNEP/GRID-Arendal

Traditionally, weather conditions and geographic reference points were used to determine travel routes. In the past, the latter were used to evaluate sea-ice conditions. That assessment was based on an interpretation of how terrestrial characteristics influence sea-ice formation, stability and decay. However, the nature of the changes in sea-ice conditions is becoming increasingly unpredictable.

The initiative of Canada Ice Services focuses on supplementing traditional Inuit knowledge with Synthetic Aperture Radar data on sea-ice conditions. The final product is accessible to non-technical end users.

Synthetic Aperture Radar is an active microwave satellite sensor that can operate day and night, and is not obstructed by clouds. The underlying physical principles of the sea-ice edge (Floe-Edge) product rely on differences in surface and volume scattering of the radar beam. The contrasts between water, wet first-year ice and multi-year ice are enhanced by the use of both horizontal and vertical polarisation with varying incidence angles.

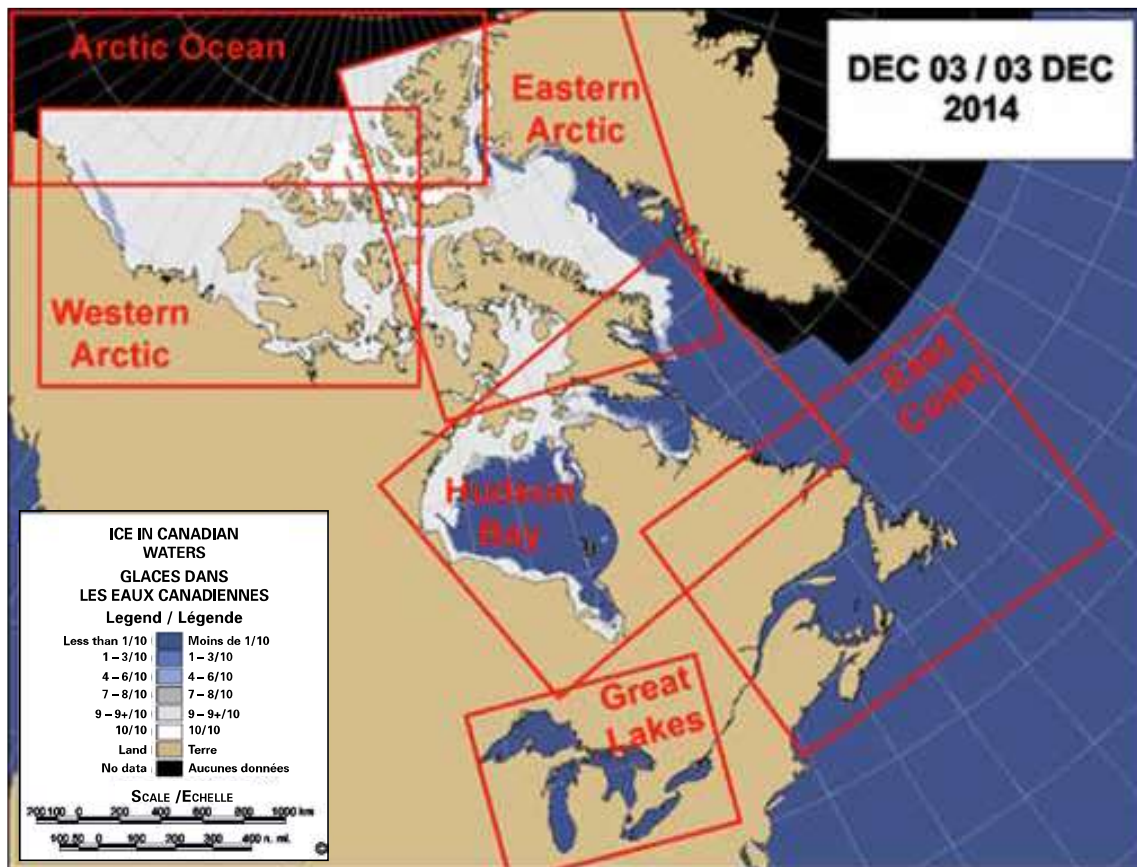
Data post-processing is undertaken by Noetix Research Inc, which provides the Web-based Floe-Edge service

under the auspices of Canadian Ice Service/Environment Canada, a division of the Meteorological Service of Canada.

Periodic satellite data are necessary in order to provide a useful service to the Inuit communities. Product updates may be as frequent as 3–5 times per week across the Northwest Territories, Nunavut and Nunavik (Figure 2; Figure 3 with details of a product).

Jimmie Qaapik from the Inuit community says that climate change is affecting the daily lives of Inuit communities in the high latitudes of Canada, but that they are adapting to these changes with the help of new technology:

“During the dark season and after storms, radar images are a necessity: they allow us to safely navigate through smooth and rough ice and tell us where the floe edge is. We now know better and faster what happened to the ice. This is important also for fishing, hunting and getting drinking water. This technology keeps us safe.” (<http://www.bio-medicine.org/biology-news-1/Climate---the-hot-topic-in-Doha-27767-2/>)



**Figure 2. Regions for which Canada Ice Service provides the latest known ice cover information in Canadian waters; Noetix Research Inc analyses data across the Northwest Territories (Western Arctic), Nunavut (Eastern Arctic) and Nunavik, Quebec (Hudson Bay)**

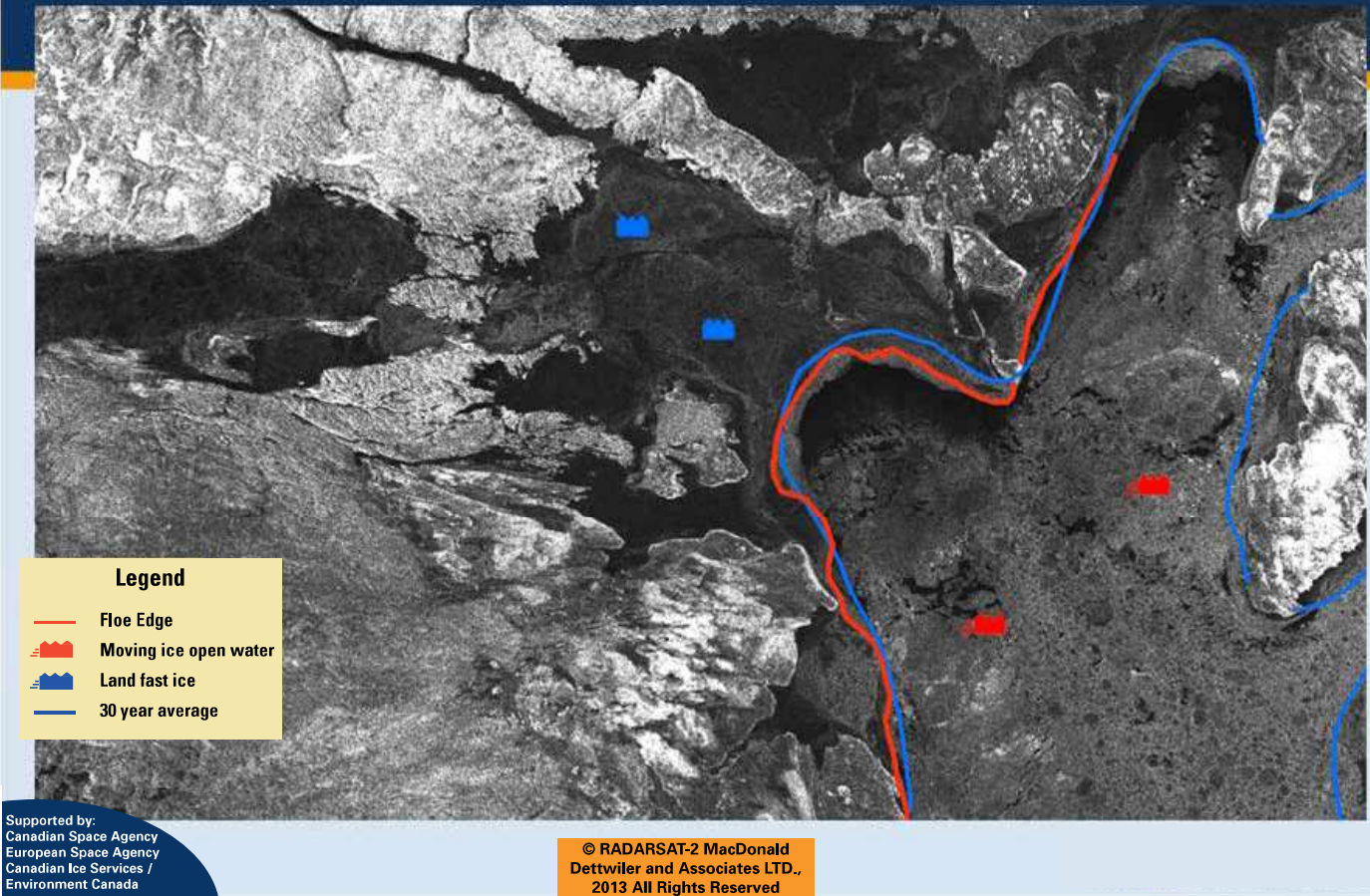


Figure 3. Example of Floe-Edge Service product