Environment Canada Environnement Canada

# Annual Arctic Ice Atlas

## Winter 2010

By


Canadian Ice Service
Le service canadien des glaces

Canada

## Foreword

The 2010 Annual Arctic Ice Atlas is part of a continuing series, prepared each year since 1990. These atlases, along with earlier programs, document Arctic winter ice conditions with synthetic aperture radar (SAR) imagery back to 1986/87. The main objective in compiling these atlases is to maintain a climatological archive of winter ice conditions, to provide a clearer understanding of variations in Arctic ice regimes both geographically and seasonally.

SAR data from the RADARSAT-2 satellite has been used exclusively in the compilation of the image mosaics in this Atlas. The data were captured by the Prince Albert (Saskatchewan) and Gatineau (Quebec) receiving stations, between January 29 and February 7, 2010.

In this atlas the Arctic is divided up into four main regions and four larger-scale snapshot regions. Three of the main regions (the Eastern Arctic, the Western Arctic, and Hudson Bay) include an analysis of the data as well as a SAR image mosaic. The ice analyses were created by Environment Canada's Canadian Ice Service personnel, who used additional supporting information (including meteorological summaries, ice thickness reports and NOAA AVHRR imagery) in their preparation. An explanation of the nomenclature on the analysis charts can be found on the Key Ice Symbols page. A more detailed explanation of the terminologies is available in MANICE (Manual of Standard Procedures for Observing and Reporting Ice Conditions), prepared by Environment Canada's Meteorological Service.

For most regions, the SAR image mosaic represents a composite of orbits from several days. The period over which the data were acquired is noted on each page. Basic geographic annotation is provided on the mosaics as a reference. During the image production, the raw data were radiometrically adjusted and enhanced. The overlapping orbits were then digitally seamed together to give a balanced and finished picture. Although the data were captured at 50 metre/pixel spacing, the SAR data were analyzed at approximately 100 metre/pixel resolution, and the published image mosaics have been resampled to approximately 200-400 metre/pixel size.

Sensing (CCRS). This atlas has been published with the permission of MDA.

The successful completion of this project was made possible with the able assistance of many people. The following contributions should be noted:

- Project Manager: Dan Fequet, Canadian Ice Service (CIS)
- RADARSAT SAR data acquisition: MDA, Céline Fabi and Kathy Clevers (CIS)
- Mosaic production: Claire Elliott (CIS-COOP)
- Image analysis: Raymond Pelletier, Laurie Weir, Nicolas Nguyen (CIS)
- Climate summary: Trudy Wohlleben, Laurie Weir, Luc Desjardins (CIS)

Funding for this project was provided by the Canadian Coast Guard (Fisheries and Oceans Canada) and the Canadian Ice Service (Environment Canada).

# Table of Content

## Freeze-up

### Hudson Bay and Approaches

In spite of a 2-week earlier-than-normal freeze-up along the western shores of Hudson Bay in the second half of October, freeze-up was delayed almost everywhere else by 3-4 weeks as a result of the above normal November and December air temperatures. Air temperatures during the first half of November were near normal everywhere. In the second half of November, air temperatures were 4-6°C above normal for most of Hudson Bay and Hudson Strait except 7-10°C above normal for northwestern Hudson Bay. They were 1-3°C above normal for Frobisher Bay but 1-3°C below normal over the Cumberland Peninsula. In December, air temperatures averaged 10°C and greater above normal in northeast Hudson Bay, Hudson Strait and southern Baffin Island. Air temperatures were 4-8°C above normal over the rest of Hudson Bay except only 1-4°C above normal along the southwest shore of Hudson Bay and James Bay. By the first week of January, measured ice thickness values lagged normal ice thicknesses by 12cm. At the end of January, measured ice thicknesses lagged normal thicknesses by 17cm.

October/November: Ice growth was slower-than-normal for almost all parts of Hudson Bay and its approaches, with the following exceptions: 1) in the second half of October, near-shore ice formed 2-3 weeks earlier than normal along the southwest coast of Southampton Island and along the western shore of Hudson Bay; and 2) in late October - early November, near-shore ice formed 2-3 weeks earlier than normal along the northeast coast of Hudson Bay, the west coast of Ungava Bay and at the head of Frobisher Bay. New ice started to form along the shore near Churchill, Manitoba, in the second week of October. New ice started to form along the shores of Southampton Island, along the western shore of Hudson Bay and at the head of Frobisher Bay during the third week of October. By mid-November, grey and grey-white ice surrounded Southampton Island, filled Roes Welcome Sound and extended along the west coast of Hudson Bay. Grey and new ice had spread along the southwest shore and parts of the northeast shore of Hudson Bay and also along the southwest coast of Ungava Bay. New ice had developed along the coast in James Bay. New and grey ice had developed along the east coast of Baffin Island and now extended around Cape Dyer to the mouth of Cumberland Sound. New ice had developed along most of the south coast of Baffin Island, including the north shore of Hudson Strait and in Frobisher Bay and Cumberland

Sound. By the end of November, conditions in Hudson Bay had changed very little. In the approaches, however, new ice now covered much of the western half of Hudson Strait and filled Frobisher Bay. Thin first-year ice descended along the east coast of Baffin Island to Cape Dyer and grey-white ice extended towards the mouth of Cumberland Sound. Cumberland Sound was predominantly covered in grey ice.

December: Ice growth was slower-than-normal throughout December. By mid-December, areas of open water still remained in eastern Hudson Bay and James Bay while central Ungava Bay was still primarily bergy water. Grey-white ice extended from the first-year pack to the mouth of Frobisher Bay and around Resolution Island. New ice filled central Hudson Bay and grey ice now covered Hudson Strait west of Ungava Bay. Frobisher Bay and Cumberland Sound were covered in grey and grey-white ice and patches of new ice were developing along the Labrador Coast. By the end of December, ice concentrations had recovered to near-normal values everywhere except at the eastern entrance to Hudson Strait, along the leading edge of the ice pack in Davis Strait and along the Labrador Coast. Furthermore, ice thicknesses lagged normal values almost everywhere in Hudson Bay, Hudson Strait and along the Labrador Coast. While a tongue of thin first-year ice extended from the southwest Southampton Island into central Hudson Bay, the remainder of Hudson Bay, including James Bay, remained covered in grey-white ice which thinned to grey ice along many parts of its shores. Hudson Strait and Ungava Bay were primarily covered in grey-white ice except for eastern sections, which remained covered in grey ice. First-year ice rounded Cape Dyer and filled Cumberland Sound and Frobisher Bay, areas of coastal fast ice had yet to develop in Frobisher Bay. New ice predominated in a thin band along the Labrador Coast.

January: By the end of January, medium first-year ice covered most of central and northeastern Hudson Bay, western Hudson Strait, and extended around Cape Dyer across the mouth of Cumberland Sound to the entrance of Frobisher Bay. Medium first-year ice also filled Roes Welcome Sound and the heads of Frobisher Bay and Cumberland Sound. Thin first-year ice prevailed to the east of the Belcher Islands in Hudson Bay, in James Bay and in the western parts of Hudson Bay (except for a band of grey-white ice along the northwestern shore). The area to the east of the Belcher Islands, which is normally consolidated by this time remained mobile. Thin first-year ice also filled the eastern sections of Hudson Strait, Ungava Bay and the bulk of Frobisher Bay and Cumberland Sound although areas of grey and

grey-white ice could be found along the southern coasts of Ellesmere Island and the western shores of Ungava Bay. Grey-white ice, extending from the outer edge of the first-year pack ice in Davis and Hudson Straits, extended southwards along the Labrador Coast, where normally first-year ice would prevail at this time of year. South of ~57°N, a lead containing primarily new ice prevailed between this grey-white ice pack and the coastal fast ice (mostly thin first-year ice). An area of 2 tenths old ice was just rounding Caper Dyer and a trace of old ice extended down from this area to 59°N.

## Eastern Arctic

Overall, air temperatures in the eastern Canadian Arctic averaged above normal during the freeze-up period. The most consistent warming was observed along the north coast of Ellesmere Island where temperatures reached greater than 3-6°C above normal from mid-September to December. Over Nansen and Eureka Sounds, Norwegian Bay, Jones Sound and Lancaster Sound, air temperatures averaged 1-3°C above normal in the last half of September and in October, and reached up to greater than 5°C above normal in November and December. While during the early part of the freeze-up period air temperatures were near normal in Nares Strait, Baffin Bay and in the eastern half of Foxe Basin, they increased dramatically in these areas in December, particularly in western sections of Baffin Bay and Davis Strait where temperatures reached greater than 10°C above normal. North of ~75°N (except for Jones Sound), freeze-up was delayed by 1-2 weeks, especially in areas where end-of-melt season ice concentrations were already below normal (e.g. Nares Strait, Nansen Sound, Eureka Sound, Norwegian Bay, Penny Strait, and Wellington Channel). Between 70°N and 75°N and also in Jones Sound, freeze-up was 3-4 weeks late (i.e. in Barrow Strait, Prince Regent Inlet, Lancaster Sound, Admiralty Inlet, and in Navy Board Inlet and Eclipse Sound). Freeze-up was 2-3 weeks late in the Gulf of Boothia, Pelly Bay and Committee Bay. In Baffin Bay, except for a brief 1-week earlier than normal freeze-up along the leading edge of the ice pack in the far northwest in early October, the general progression / advance of the ice from north to south was ~2 weeks later than normal. Similarly in Foxe Basin, in spite of an ~2 week early start in the ice formation around the islands in the northeast part of the basin, subsequent formation of the ice from north to south was generally delayed by ~2 weeks. By the end of January, measured ice thicknesses at Eureka were ~9 cm thinner than normal. At Resolute Bay, measured ice thicknesses were very close-to-normal until a

strong and persistent northwesterly wind event caused an anomalous break-up of the local fast ice in the 3rd and 4th weeks of January. Subsequently, measured ice thicknesses in the last week of January were ~15 cm thinner than normal. Although no ice thickness measurements are available for Baffin Island, anomalous local fast ice breakages were also reported at the communities of Qikiqtarjuaq and Clyde River at the end of December and beginning of January. In Hall Beach, November to mid-December measured ice thicknesses were 2-5 cm thicker than normal.

At the end of the summer of 2009, the old ice distribution was slightly greater than normal in southern Kane Basin and in the extreme northwest part of Baffin Bay. There was considerably more old ice than normal in Belcher and Queens Channels and in the Hell Gate polynya region. Although less than normal, ice remained in the Gulf of Boothia or Committee Bay at the end of the summer for the first time in three years (after completely melting away by the end-of-summer in 2007 and 2008), leading to renewed areas of second year ice. Elsewhere in the Eastern Arctic, concentrations of old ice were generally less than normal.

September: By mid-September, new ice had begun forming north of 77°N, in Nares Strait, Norwegian Bay, in the mouth of Nansen Sound and in the fiords along the north coast of Ellesmere Island. By the end of September, predominantly grey ice filled Nansen and Eureka Sounds, eastern Kane Basin, and the fiords and inlets of Ellesmere and Axel Heiberg Islands. New ice formation had not developed much further, with the exception of patches of new ice between floes of old ice in western Barrow Strait, in northern Pelly Bay and in Fury and Hecla Strait.

October: By mid-October, the ice in the northern Ellesmere Island fiords, Greely Fiord, the Axel Heiberg Island inlets and western Norwegian Bay had thickened to grey-white ice. Grey ice continued to predominate in eastern Kane Basin, Nansen and Eureka Sounds and in eastern Norwegian Bay. Grey ice had developed in parts of Jones Sound, Penny Strait, Barrow Strait, Prince Regent Inlet and along the east coast of Devon Island, while new ice prevailed elsewhere in these areas. New ice now also covered most of the Gulf of Boothia, and patches had formed in southern Admiralty Inlet, in Eclipse Sound, along the north coast of Bylot Island and around the islands in northeastern Foxe Basin. By the end of October, thin first-year ice prevailed north of 77°N in areas not occupied by second-year or old

ice, except in eastern Kane Basin and in the bays on its southwestern side, where grey-white ice prevailed. Nansen and Eureka Sounds had finally consolidated, 2-3 weeks later than normal. Grey-white ice covered most of Penny Strait, the western part of Jones Sound, Barrow Strait and the Gulf of Boothia. An anomalous patch of old ice had been detected in the eastern part of Lancaster Sound, at the leading edge of the grey-white ice area. A mixture of grey and grey-white ice had developed along the coasts and between the islands of northern Foxe Basin, while grey ice covered the eastern part of Jones Sound and the mouth of Lancaster Sound. Extensive new ice patches had developed in northern Baffin Bay, north of 72°N. Second year ice drifted through Fury and Hecla Strait into northwestern Foxe Basin.

November: Jones Sound briefly consolidated near the beginning of November (a month earlier than normal), but the eastern half almost immediately re-fractured. Norwegian Bay consolidated in the first week of November, 1-2 weeks later than normal. By mid-November, medium first-year ice had developed in Nansen Sound and thin firstyear ice prevailed elsewhere further south to 70°N. A few patches of thin new ice prevailed within the areas of thin first-year ice. New ice formed in leads along the north coast of Somerset Island, along the eastern shores of Prince Regent Inlet and Committee Bay, along the northeastern Baffin Island coast and in parts of northern Foxe Basin. The north central part of Baffin Bay contained primarily grey-white ice while the northeastern part was covered in a mix of grey and new ice. Grey-white ice extended southwards along the eastern Baffin Island coast from 70°N down to 65°N, and new and grey ice extended eastward from this to ~60°W. Grey-white ice prevailed east and south of Prince Charles Island in Foxe Basin and around the north coast of Southampton Island, with a mix of new and grey ice in between. Open water still prevailed in the very southern part of Foxe Basin. By the end of November, the ice in Eureka Sound and Norwegian Bay had thickened to medium first-year ice. The consolidated ice in the western part of Jones Sound had refractured and was now once again mobile. Thin first-year ice now covered the central part of Baffin Bay with a tongue reaching southwards from 70°N to 67°N. Patches of old ice continued to exit the Lincoln Sea drifting southwards into northwestern Baffin Bay. The thin first-year ice covering the northern half of Foxe Basin now also covered its southeastern part. Grey ice extended from the mouth of Smith Sound southwards along the coast of Greenland to ~70°N, and the grey-white ice found between the coastal Greenland grey ice and the central Baffin thin first-year ice now extended south beyond these areas and around Cape Dyer to 65°N. Grey-white ice

also covered most of the south-central and southwestern parts of Foxe Basin.

December: The eastern part of Kane Basin consolidated in mid-December, 2 months later than normal. By the end of December, Jones Sound and Wellington Channel had yet to finally consolidate (both were now ~5 weeks late). Medium first-year ice prevailed in Nares Strait, Jones Sound, Lancaster Sound, the Gulf of Boothia, northern Foxe Basin and in western Baffin Bay. Thin first-year ice covered southern Foxe Basin and eastern Baffin Bay between the medium first-year ice and 58°W. Patches of 5 to 7 tenths of old ice existed in parts of Nares Strait, while areas of 1 to 3 tenths of old ice could be found among the medium first-year ice in western Baffin Bay. Traces of second year ice were in northwestern Foxe Basin. The bergy water lead along the west Greenland Coast extended north to ~75°N, containing new ice in its very northern extremity. On the last day of December, areas of the coastal fast ice along the east coast of Baffin Island broke away in very warm temperatures and strong southeasterly winds, affecting the communities of Qikiqtarjuaq and Clyde River, and creating many small areas of open water in some of the coastal inlets.

January: Wellington Channel consolidated by mid-January, 7-8 weeks later than normal. By the end of January, the western half of Jones Sound had finally re-consolidated, 11-12 weeks later than normal. Western Barrow Strait had not yet consolidated and Nares Strait (except for eastern Kane Basin) showed no signs of consolidation. Medium first year ice prevailed in almost all areas except along the leading edge of the ice pack in Baffin Bay, between 57°W and 60°W, and to the south of Smith Sound in the North Open Water polynya. Also, thick first year ice had developed in Norwegian Bay, Eureka sound and Nansen Sound. The bergy water lead along the west Greenland Coast had closed down to 71°N, now filled with greywhite ice in its northern parts. Overall concentrations of old ice averaged ~2 tenths along the length of Nares Strait and in western Baffin Bay. In southern Committee Bay there were patches of 1 to 4 tenths of old ice, after a two year absence. In Foxe Basin trace amounts of old ice extended to 66 °N.

## Western Arctic

The September-December freeze-up period, averaged from 1-5°C warmer over the Central Arctic to greater than 8°C warmer over the

western Beaufort Sea. Although a period of 1-4°C colder than normal air temperatures affected the region encompassing Larsen Sound and Queen Maud Gulf to Amundsen Gulf in late October to early November, this was more than balanced by a period of >5°C warmer than normal temperatures over the same region in late November. Temperatures in Viscount Melville Sound and northwards reached greater than 10°C warmer than normal during this same late November period. As a result, freeze-up and consolidation were delayed everywhere. New ice formation in Coronation and Amundsen Gulfs and between the Beaufort Sea pack ice and the Canadian mainland coast began 1-2 weeks later than normal and ice thicknesses in these areas did not reach the thin first-year ice stage until mid December, 1 month later than normal. The inter-island ice north of M'Clure Strait, in Byam Martin Channel and Penny Strait normally consolidates by mid-October. This winter season, although 2 weeks later than normal, the ice over most of this area had consolidated but then, as a result of the extremely warm temperatures in the last part of November which were accompanied by very strong winds, the bulk of the inter-island fast ice broke up and did not re-consolidate until the last week of December (10 weeks later than normal). M'Clure Strait and Viscount Melville Sound, which normally begin to consolidate during the last week of November to the first week of December, only began to partially re-consolidate once again in mid to late February. Further south, M'Clintock Channel and the corridor running from Peel Sound to Coronation Gulf did not begin to consolidate until the week of December 21 (5 weeks later than normal). Larsen Sound and M'Clintock Channel only finally completely consolidated towards the end of January (8 weeks later than normal), but the northern part of M'Clintock then fractured again at the end of February. By the end of January, measured ice thicknesses were 17cm thinner than normal at Cambridge Bay. Measured ice thicknesses were 18cm thinner than normal at Inuvik at the end of December.

At the end of September 2009, old ice concentrations were considerably less than normal in central and northern parts of the Beaufort Sea, especially north of 73°N and west of 135°W. The southern extent of the old ice pack, however, although less than normal north of the Alaskan coast, was greater than normal in places north of the Yukon coast and north of Mackenzie Bay. Pockets of greater than normal concentrations of old ice could be found in Belcher Channel, Penny Strait and Queens Channel, Byam Martin Channel, Barrow Strait, Peel Sound and M'Clintock Channel. However, less than normal concentrations of old ice prevailed in M'Clure Strait and

Viscount Melville Sound, in Victoria Strait, along the north coast of Melville Island and in the Peary and Sverdrup Channels. No persistent leads developed between the Arctic Ocean pack ice and the northeast coast of Ellesmere Island in the summer of 2009. There were no ice shelf breakups; no new ice islands resulted. A fragment of the original Ayles Ice Island could still be found in the Belcher Channel, while a number of ice islands derived from the 2008 break-up of the Serson, Ward Hunt and Markham Ice Shelves could be found between and to the northwest of Meighen Island and Ellef Ringnes Island. To the south, ice-free water extended from Rae Strait, through Queen Maud Gulf, Coronation Gulf, southern portion of Amundsen Gulf, and along the MacKenzie Delta and in the large rectangle extending from the coast of Alaska north of 75 ° N between 145 and 155 ° W. Ice-free water also prevailed north of Point Barrow. Pockets of open water and very open drift ice could be found in Victoria Strait, Larsen Sound, and from M'Clure Strait east to Barrow Strait. In 2009, the southern route of the Northwest Passage became navigable. However, the northern route, through M'Clure Strait and Viscount Melville Sound, did not become navigable in 2009.

September: New and grey ice growth began in Norwegian Bay and along the coasts of Axel Heiberg, Amund Ringnes and Ellef Ringnes Islands in mid-September. By the third week of September, new ice had formed in M'Clure Strait and Viscount Melville Sound and had formed along the western side of the Beaufort Sea multi-year ice pack. The ice in Norwegian Bay had thickened to grey ice. By the end of September, a mix of new and grey ice prevailed among the Arctic islands, in between the areas of multi-year ice, north of 75°N and also in M'Clure Strait and Viscount Melville Sound. New ice had also formed in parts of western Barrow Strait, Peel Sound, M'Clintock Channel and in the western part of Larsen Sound. New ice also extended westward in a strip from the southwest extremity of the Beaufort Sea multi-year ice pack. Anomalous areas of ice-free water still prevailed north of Point Barrow and in a large swath along the MacKenzie Delta to Amundsen Gulf and eastwards to Rae Strait.

October: By mid-October, old-ice from the Beaufort Sea ice pack, compressed against the Canadian Arctic Archipelago east of 135°W, now trailed westwards in a narrow band between 72-73°N to just north of Point Barrow. North of this trail of old ice and west of the main pack, an area of grey-white ice prevailed, which thickened to thin first-year east of 140°W and thinned to new and grey ice west of 150°W. A mix of grey-white and thin first-year ice prevailed in

Norwegian Bay and in M'clure Strait and Viscount Melville Sound. A mix of grey and grey-white ice prevailed in Penny Strait and Wellington Channel, in Barrow Strait, in Peel and Larsen Sounds, and in and around the old ice in M'Clintock Channel. An area of old ice had descended into Wellington Channel from Queens Channel. New ice was forming in Rae Strait, in Victoria Strait and in MacKenzie and Liverpool Bays and westward along the coast towards Point Barrow. New and grey ice filled Prince of Wales Strait and had developed in the large lead between the Beaufort Sea old ice pack and the west coast of Banks Island. A large anomalous swath of open water still extended from between the Beaufort Pack and the Alaskan coast all the way eastward to Queen Maud Gulf. By the end of October, the inter-island ice north of 75°N had mostly consolidated (2 weeks later than normal), except for an area between Borden and Ellef Ringnes Islands. Thin first year ice now prevailed to the west and north of the arced Beaufort Sea multi-year ice pack and in most inter-island areas north of 75°N, between the areas of multi-year ice. The southern halves of M'Clure Strait, Viscount Melville Sound and western Barrow Strait were also covered in thin first-year ice, but their northern halves remained covered in grey-white ice, with even thinner areas of new and grey ice to be found in western Barrow Strait. Thin first-year ice could also be found in northern M'Clintock Channel and in Peel Sound. Larsen Sound and Rae Strait were primarily covered in grey-white ice, while Victoria Strait and Queen Maud Gulf were covered in grey ice. Grey ice was also forming in Amundsen Gulf and now prevailed in the large lead to the west of Banks Island, while new ice was now forming in Coronation Gulf and between the Beaufort Sea ice pack and the mainland coast. Some open water remained west of Point Barrow, however. Areas of coastal fast ice had formed around Point Barrow and eastward along the coast to Mackenzie Bay and along the Tuktoyaktuk peninsula.

November: By mid-November, a large portion of the inter-island fast ice extending from Prince Gustaf Adolf Sea down to the head of Byam Martin Channel had re-fractured and was now mobile. The ice in Peel sound, Rae Strait and Prince of Wales Strait had consolidated, but the ice in Victoria Strait, Queen Maud Gulf and Coronation Sound remained mobile. A large open water lead had opened between the Borden and Prince Patrick Island coastal fast ice and the offshore pack ice, although this quickly became partly covered with a layer of new ice. Thin first-year ice prevailed almost everywhere except: 1) north of 77°N where ice had thickened to medium first-year ice; and 2)

between the Beaufort Sea multi-year pack ice and the mainland coast where grey-white ice prevailed, extending into Amundsen Gulf and also filling a wide swath immediately west of Banks Island. Coronation Gulf remained covered in grey ice and large leads containing new ice could be found in Queen Maud Gulf and Larsen Sound. Large leads containing new ice could also be found in southeastern Viscount Melville Sound and in southern Barrow Strait. By the end of November, large portions of the inter-island ice north of 75°N remained fractured and mobile, showing no signs of consolidation. M'Clure Strait, western Viscount Melville Sound, M'Clintock Channel, Larsen Sound and Queen Maud Gulf to western Amundsen Gulf also remained abnormally unconsolidated. Discontinuous but growing areas of fast ice (thin first-year) now extended from Point Barrow eastwards to Mackenzie Bay and into Franklin Bay and Darnley Bay. The ice west of Banks Island had thickened to thin first-year ice, although a thin open water lead remained between the coastal fast ice and the predominantly multiyear pack ice. Elsewhere most of the open water leads created earlier in the month now contained grey and grey-white ice, although the one in Larsen Sound still primarily contained new ice.

December: By mid-December, the inter-island ice between Bathurst and Ellef Ringnes Island (north of 75°N) had begun to reconsolidate, although large swaths remained anomalously mobile in this area. The ice in M'Clure Strait, Melville Sound, M'Clintock Channel, Larsen Sound and Queen Maud Gulf to western Amundsen Gulf remained mobile. Medium first-year ice prevailed north of 73°N between existing areas of multi-year ice, and extended into Larsen Sound, Rae Strait, Victoria Strait and Bathurst Inlet. Elsewhere, thin first-year ice prevailed except in areas that had experienced recent fracturing due to the mobility of the ice. These leads contained primarily grey-white ice, including a narrow band of grey-white ice north of the fast ice in Mackenzie Bay and along the Tuktoyaktuk Peninsula. By the end of December, the predominantly multi-year ice in the Beaufort pack was just off-shore of the Alaskan coast, arcing to the northwestern shores of Banks Island. The ice west of Banks Island was predominantly medium first-year. The inter-island ice north of 75°N (except in Penny Strait and Wellington Channel) had finally consolidated by December's end (10 weeks later than normal). The western part of Viscount Melville Sound had consolidated, although the eastern half remained mobile. Larsen Sound, Queen Maud Gulf and westward to the western edge of Amundsen Gulf had also finally consolidated (6 weeks later than normal), although the ice in M'Clintock Channel remained mobile. Medium first-year ice prevailed everywhere except west of 120°W,

where thin first-year ice still prevailed in a narrow band south of 72.5°N and north of the mainland coastal fast ice. Large areas of grey-white ice had also developed in wide leads in western Amundsen Gulf, to the west of Banks Island, in northern M'Clure Strait and to the west of Prince Patrick Island.

January: At the beginning of January, a large anomalous open water lead (wider than 15km in places) developed between the coastal fast ice of the Queen Elizabeth Islands and the Beaufort Sea pack ice. To the east, the ice finally consolidated in Penny Strait but the fast ice in Larsen Sound had re-fractured. By mid-January, the fast ice in western Viscount Melville Sound had also re-fractured, while the ice in Wellington Channel had now finally consolidated (6-7 weeks later than normal). The ice in M'Clintock Channel remained unconsolidated. Medium first-year ice prevailed everywhere in the western Arctic not covered in multi-year ice, except where leads had previously opened – these areas mostly contained thin first-year ice. By the end of January, the ice in M'Clintock Channel and Larsen Sound had reconsolidated but the ice in M'Clure Strait, Melville Sound and western Barrow Strait remained mobile. Open water leads had also re-developed to the north of the coastal fast ice in Mackenzie Bay and along the Tuktoyaktuk Peninsula and to the west of Banks Island.

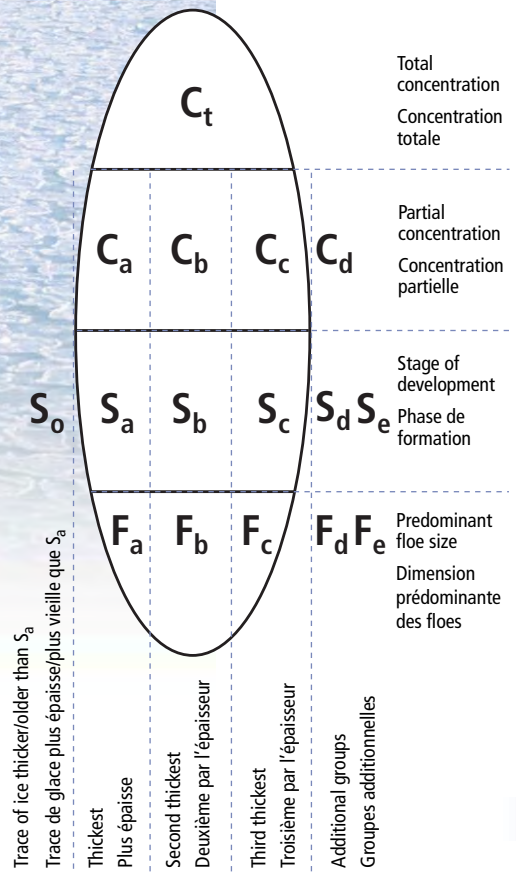
Additional: Beyond the end of January, winter 2010 in the western Arctic continued to be unusual. Areas of ice which should normally be consolidated remained prone to periodic fractures or remained mobile. In mid-February, M'Clure Strait remained unconsolidated and the coastal lead had re-widened, not only west of Banks Island where this often occurs, but also west of Prince Patrick Island and all the way northwards to the northeast coast of Ellesmere Island. An open water lead had also developed between the coastal fast ice and the pack ice west of Point Barrow. The ice in western Viscount Melville Sound again reconsolidated. At the end of February, ice in the northern portion of M'Clintock Channel re-fractured once again. The ice in eastern Viscount Melville Sound and western Barrow Strait remained mobile. Anomalous fracturing of the ice and the widening of the coastal lead between the coastal fast ice and Beaufort Sea pack ice continued north of Banks Island. M'Clure Strait had still not consolidated (now 3 months late).

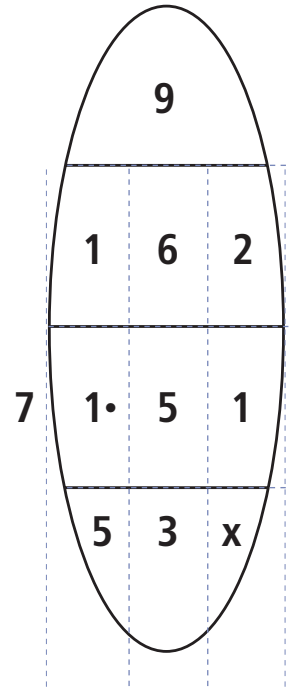
Environment Canada | Environnement Canada

FACT SHEET / FICHE D'INFORMATION

# SEA ICE SYMBOLS
# SYMBOLES DE LA GLACE DE MER

2009




**Total concentration:** the ice coverage of an area determined by its concentration and expressed in tenths (in this example, 9/10).
**Concentration totale :** l'étendue de la couverture de glace, exprimée en dixièmes de la superficie du secteur (dans cet exemple, 9/10).

**Partial concentration:** the break-down of the total ice coverage expressed in tenths and graded by thickness. The thickest starting from the left and in this example, 1/10 is the thickest.
**Concentration partielle :** les concentrations respectives, exprimées en dixièmes, des glaces de différente épaisseur, par ordre décroissant. La plus épaisse commence à la gauche du diagramme, c'est-à-dire, 1/10 est le plus épais.

**Stage of development:** the type of ice in each of the grades, determined by its age, that is 1/10 is medium first-year ice (1•), 6/10 is grey-white ice (5) and 2/10 is new ice (1). Trace of old ice is represented on the lefthand side (outside the egg) by the number 7.
**Stade de développement :** le type de glace de chacune des catégories déterminé par son âge, c'est-à-dire, 1/10 est de la glace moyenne de première année (1•), 6/10 est de la glace blanchâtre (5), et 2/10 est de la nouvelle glace (1). Une trace de vielle glace est représentée à gauche (à l'extérieur de l'oeuf) par le chiffre 7.

**Floe size:** the form of the ice determined by its floe size for each section. In this example, big floes (5) for medium first-year ice (1•); small floes (3) for grey-white ice (5); and undetermined, unknown or no form floes (x) for new ice (1).
**Taille des floes :** la forme de la glace, déterminée par la taille des floes dominants de chaque section. Dans cette exemple, grands floes (5) pour la glace moyenne de première année (1•); petits floes (3) pour glace blanchâtre (5)et floes indéterminée, inconnue ou sans forme (x) pour la nouvelle glace (1).

**Note:** When an ice type has a dot (•) every other value to the left of it is also considered to have a dot.

**Remarque:** Lorsqu'un nombre est suivi d'un point (•), toute autre valeur apparaissant à sa gauche est également pointée.

## SEA ICE SYMBOLS/SYMBOLES DE LA GLACE DE MER


## Stage of Development/Stade de développement ($S_oS_aS_bS_cS_dS_e$)

| Description/Élément | Thickness/Épaisseur | Code |
|---|---|---|
| New ice/Nouvelle glace | <10 cm | 1 |
| Nilas; ice rind/Nilas glace, vitrée | <10 cm | 2 |
| Young ice/Jeune glace | 10-30 cm | 3 |
| Grey ice/Glace grise | 10-15 cm | 4 |
| Grey-white ice/Glace blanchâtre | 15-30 cm | 5 |
| First-year ice/Glace de première année | 30 cm | 6 |
| Thin first-year ice/Glace mince de première année | 30-70 cm | 7 |
| Medium first-year/ Glace moyenne de première année | 70-120 cm | 1• |
| Thick first-year ice/Glace épaisse de première année | >120 cm | 4• |
| Old ice/Vieille glace | | 7• |
| Second-year/Glace de deuxième année | | 8• |
| Multi-year/Glace de plusieurs années | | 9• |
| Ice of land origin/Glace d'origine terrestre | | ▲• |
| Undetermined, unknown or no form/ Indéterminée, inconnue ou sans forme | | X |

## Floe Size/Grandeur des floes ($F_aF_bF_c$)

| Description/Élément | Width/Extension | Code |
|---|---|---|
| Pancake ice/Glace en crêpes | | 0 |
| Small ice cake, brash ice/Petit glaçons, sarrasins | <2 m | 1 |
| Ice cake/Glaçons | 2-20 m | 2 |
| Small floe/Petits floes | 20-100 m | 3 |
| Medium floe/Floes moyens | 100-500 m | 4 |
| Big floe/Grands floes | 500-2000 m | 5 |
| Vast floe/Floes immenses | 2-10 km | 6 |
| Giant floe/Floes géants | >10 km | 7 |
| Fast ice/Banquise côtière | | 8 |
| Icebergs | | 9 |
| Undetermined, unknown or no form/ Indéterminée, inconnue ou sans forme | | X |
| Strips (concentration = C)/ Glace en cordons (concentration = C) | | ᔕC |

Table of Contents / Table des matières


## Canadian Ice Service/Service canadien des glaces (CIS/SCG)

**Client Services/Service à la clientèle**
**373 promenade Sussex Drive, E-3**
**Ottawa, Ontario**
**K1A 0H3**

Tel./Tél.: 1-800-767-2885 (Canada) and/et 613-996-1550
Fax: 613-947-9160
Email/Courriel: cis-scg.client@ec.gc.ca
Web site/Site web: http://ice-glaces.ec.gc.ca


Canada

Environment Canada Environnement Canada

# SEA ICE SYMBOLS
# SYMBOLES DE LA GLACE DE MER

## WMO Concentration Colour Code – Sea Ice
## Code de couleurs de l'OMM – Concentration – Glace de mer

- Ice Free / Libre de glace
- < 1/10
- 1-3/10
- 4-6/10
- 7-8/10
- 9-10/10
- Fast Ice / Banquise côtière
- ??? Undefined / Non-définie

Optional/Facultatif

- 7/10 New Ice / Nouvelle glace
- 9+-10/10 Nilas, Grey Ice / Glace grise**

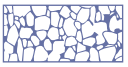
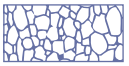
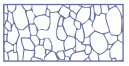
Colour is based on total ice concentration.

La couleur utilisée est établie en fonction de la concentration totale de la glace.

** The optional colour indicating 9/10+-10/10 of nilas or grey ice indicates level ice, mainly on leads; it is not used for ice broken into brash or ice cakes or for concentrations less than 9/10+.

La couleur optionnelle désignant 9/10+-10/10 de nilas ou de glace grise indique de la glace uniforme se retrouvant surtout dans les chenaux; elle n'est pas utilisée pour désigner des sarrasins, des glaçons ou des concentrations de glace inférieures à 9/10+.

## Concentration of Ice
## Concentrations de glace

| | | |
|---|---|---|
|  | <1/10 | Open water/ Eau libre |
|  | 1–3/10 | Very open drift/ Banquise très lâche |
|  | 4–6/10 | Open drift/ Banquise lâche |
|  | 7–8/10 | Close pack/Drift Banquise serrée |
|  | 9/10 | Very close pack/ Banquise très serrée |
|  | 9+/10 | Very close pack/ Banquise très serrée |
|  | 10/10 | Compact/Consolidated ice Banquise compact/consolidée |

## WMO Stage of Development Colour Code – Sea Ice
## Code de couleurs de l'OMM – Stade de développement – Glace de mer

- Ice Free / Libre de glace
- Open Water / Eau libre
- New Ice / Nouvelle glace — *< 10 cm*
- Grey Ice / Glace grise — *10-15 cm*
- Grey-White Ice / Glace blanchâtre — *15-30 cm*
- First-Year Ice / Glace de première année — *>= 30 cm*
- Thin First-Year Ice / Glace mince de première année — *30-70 cm*
- Medium First-Year Ice / Glace moyenne de première année — *70-120 cm*
- Thick First-Year Ice / Glace épaisse de première année — *120 cm >*
- Old Ice / Vieille glace
- Second-Year Ice / Glace de deuxième année
- Multi-Year Ice / Glace de plusieurs années
- Fast Ice / Banquise côtière
- ??? Undefined Ice / Glace non-définie
- Icebergs

Colour is based on stage of development of predominant ice.

La couleur utilisée est établie en fonction du stade de développement de la glace prédominante.

Table of Contents / Table des matières

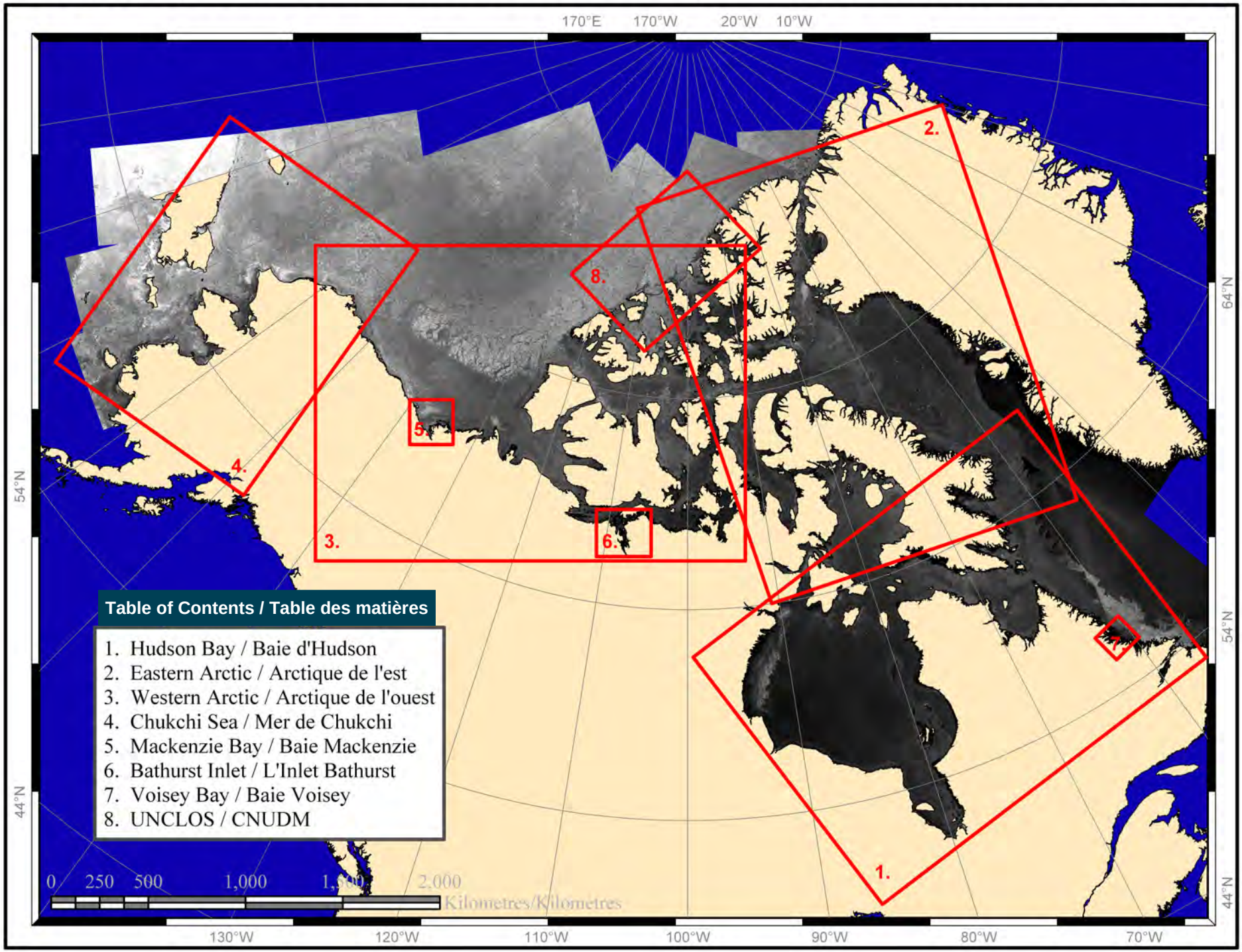

## Canadian Ice Service/Service canadien des glaces (CIS/SCG)

**Client Services/Service à la clientèle**
**373 promenade Sussex Drive, E-3**
**Ottawa, Ontario**
**K1A 0H3**

Tel./Tél.: 1-800-767-2885 (Canada) and/et 613-996-1550
Fax: 613-947-9160
Email/Courriel: cis-scg.client@ec.gc.ca
Web site/Site web: http://ice-glaces.ec.gc.ca


Canada

# REGIONAL ICE CHART AND SAR IMAGE REGIONS
# LES REGIONS POUR LES CARTES DES GLACES RÉGIONALES ET LES IMAGES ROS



To: Stage of Development / à: Stade de formation

To: Regional Mosaic / à: mosaïque régionale

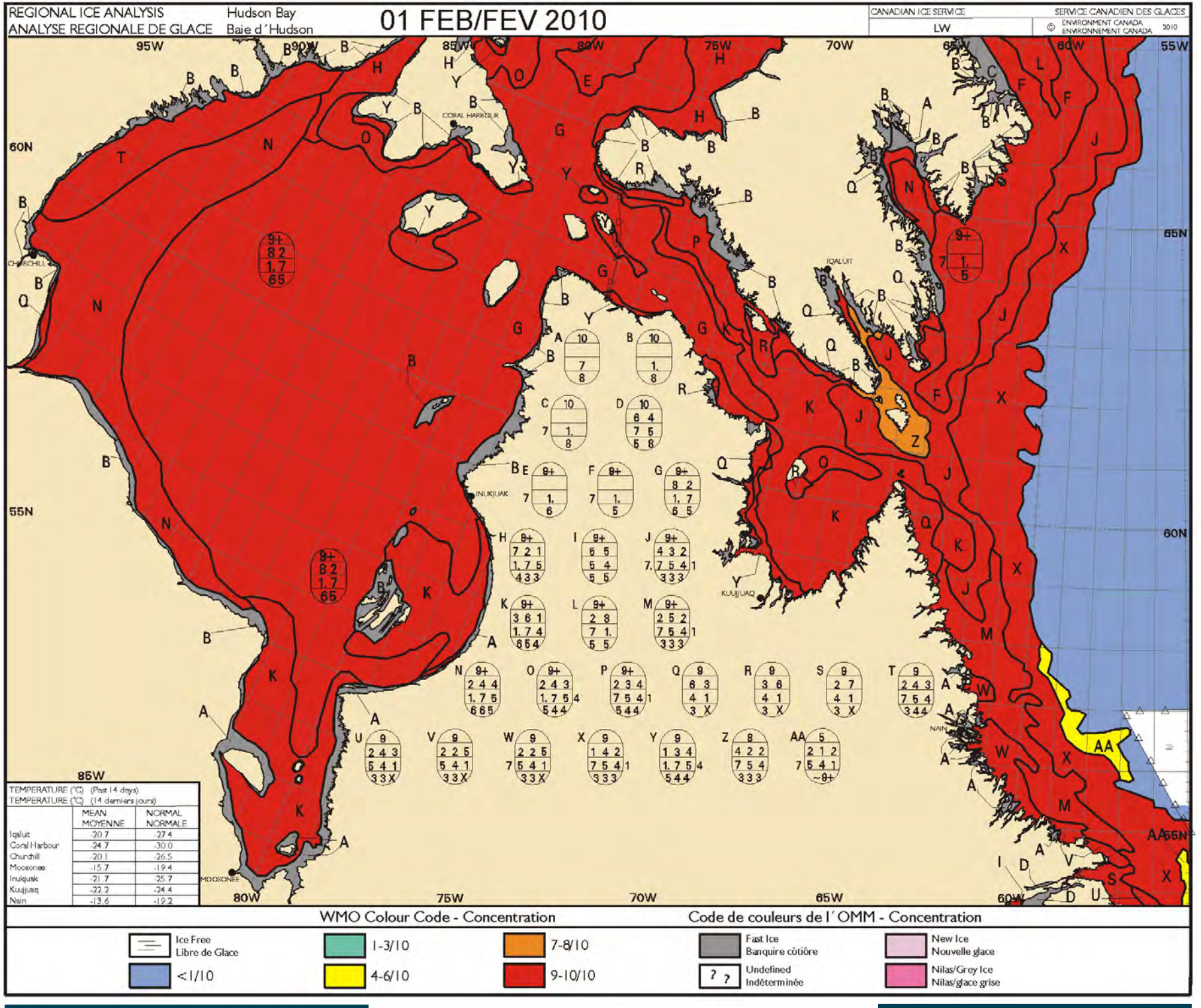



Table of Contents / Table des matières

Overview Map / Vue d'ensemble

To: Concentration / à: Concentrations

To: Regional Mosaic / à: mosaïque régionale

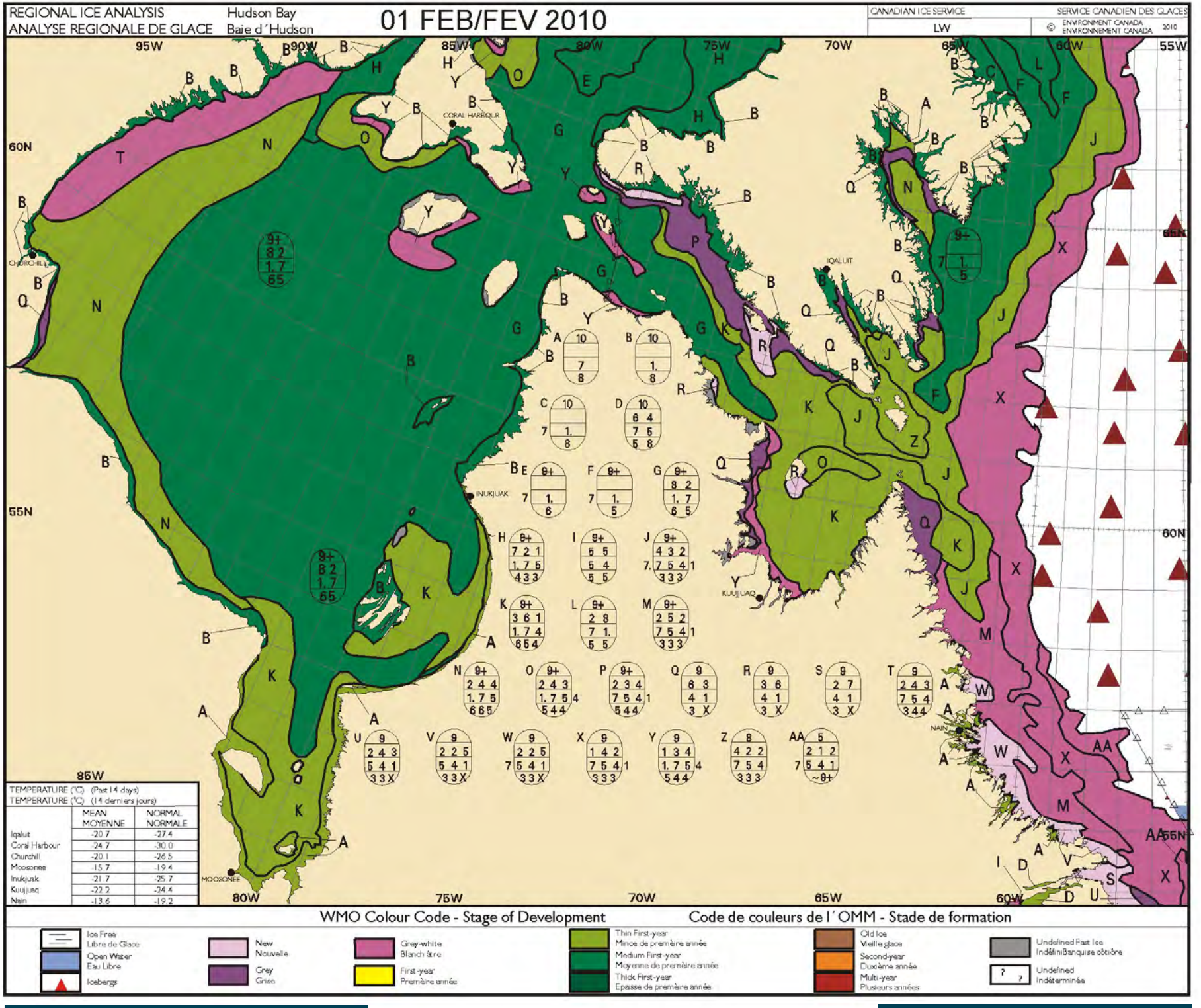
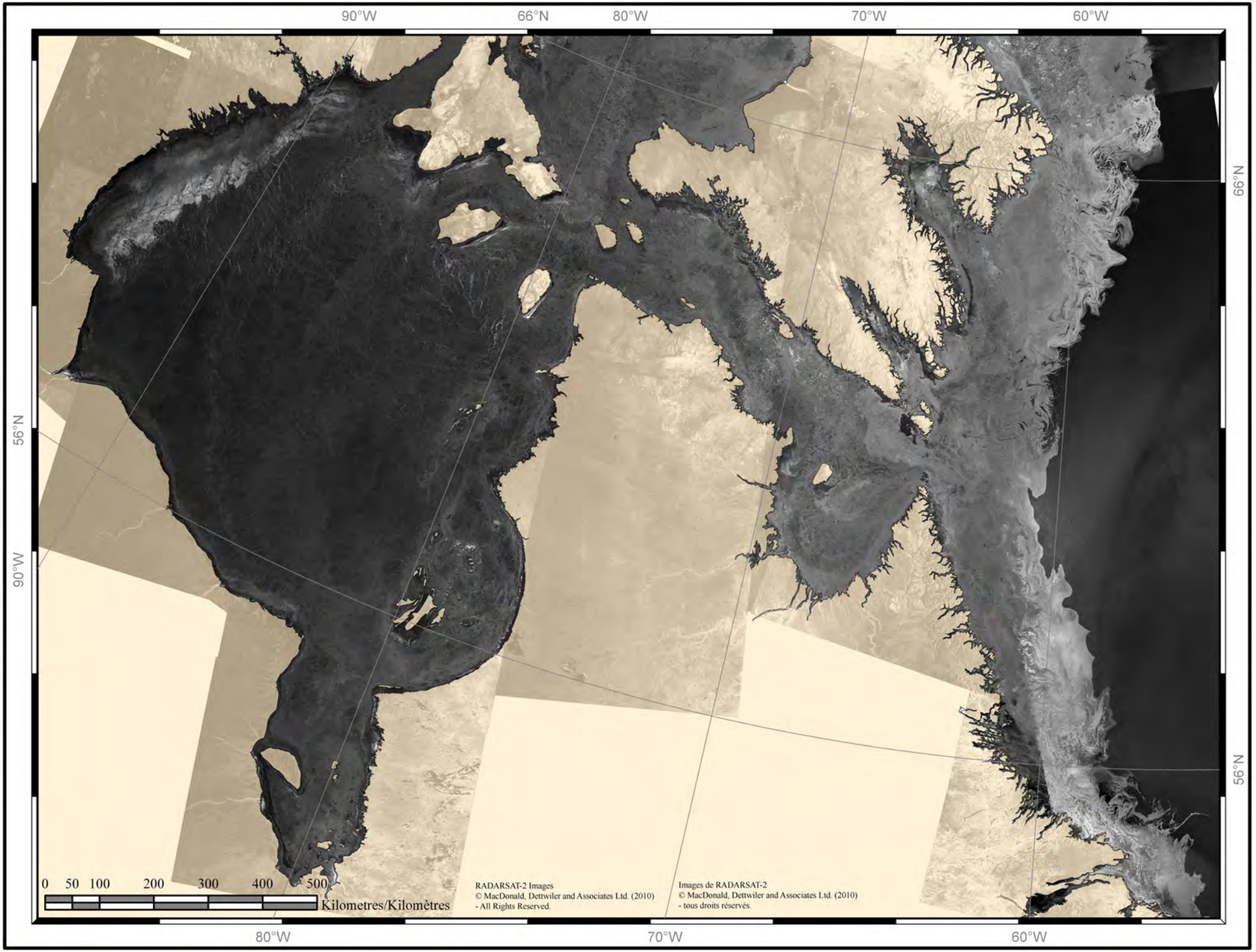



Table of Contents / Table des matières

Overview Map / Vue d'ensemble




# Hudson Bay / Baie d'Hudson

01/29/2010 - 02/01/2010

**Overview Map / Vue d'ensemble**

To: Stage of Development / à: Stade de formation

To: Regional Mosaic / à: mosaïque régionale

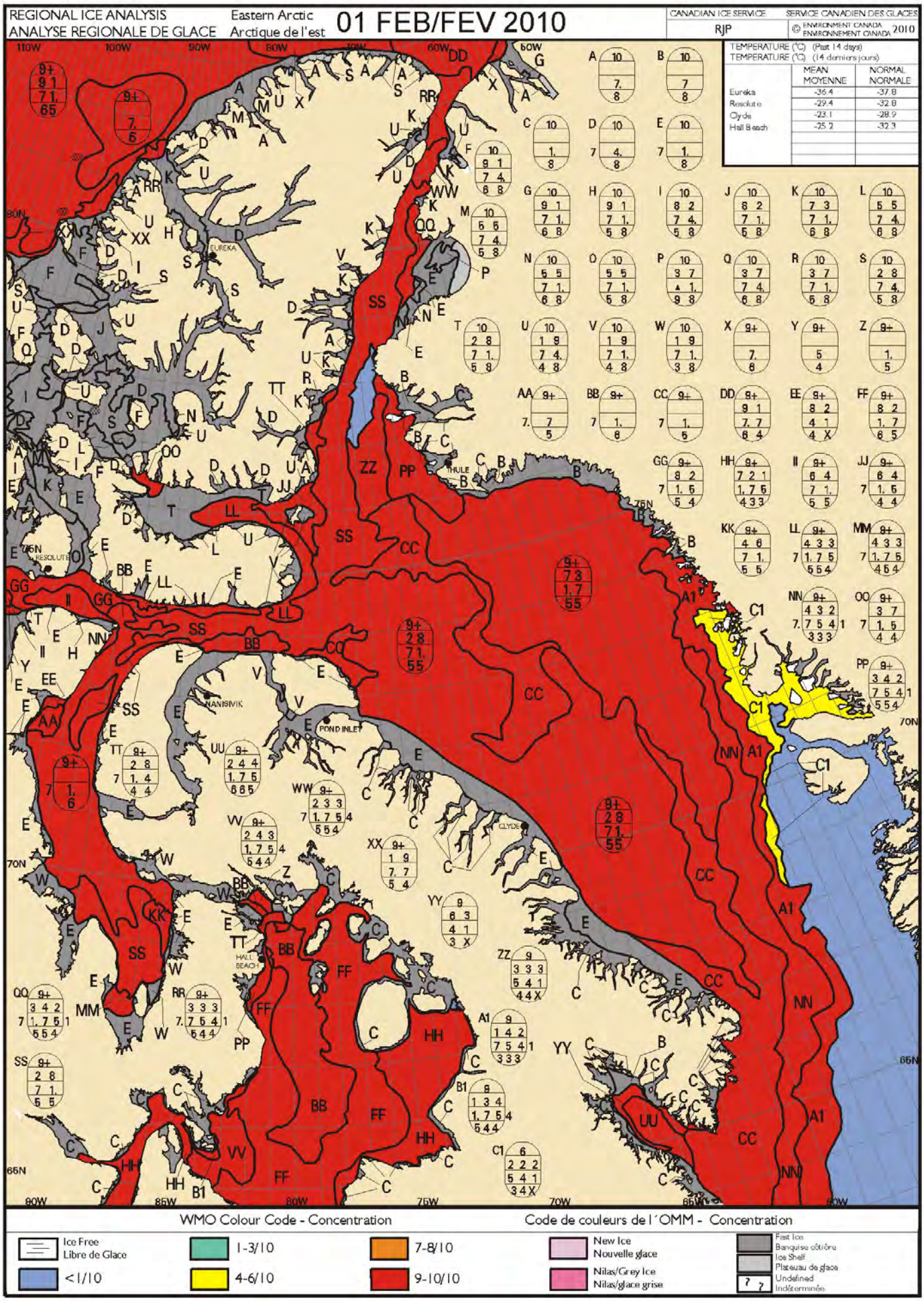



Table of Contents / Table des matières

Overview Map / Vue d'ensemble

To: Concentration / à: Concentrations

To: Regional Mosaic / à: mosaïque régionale

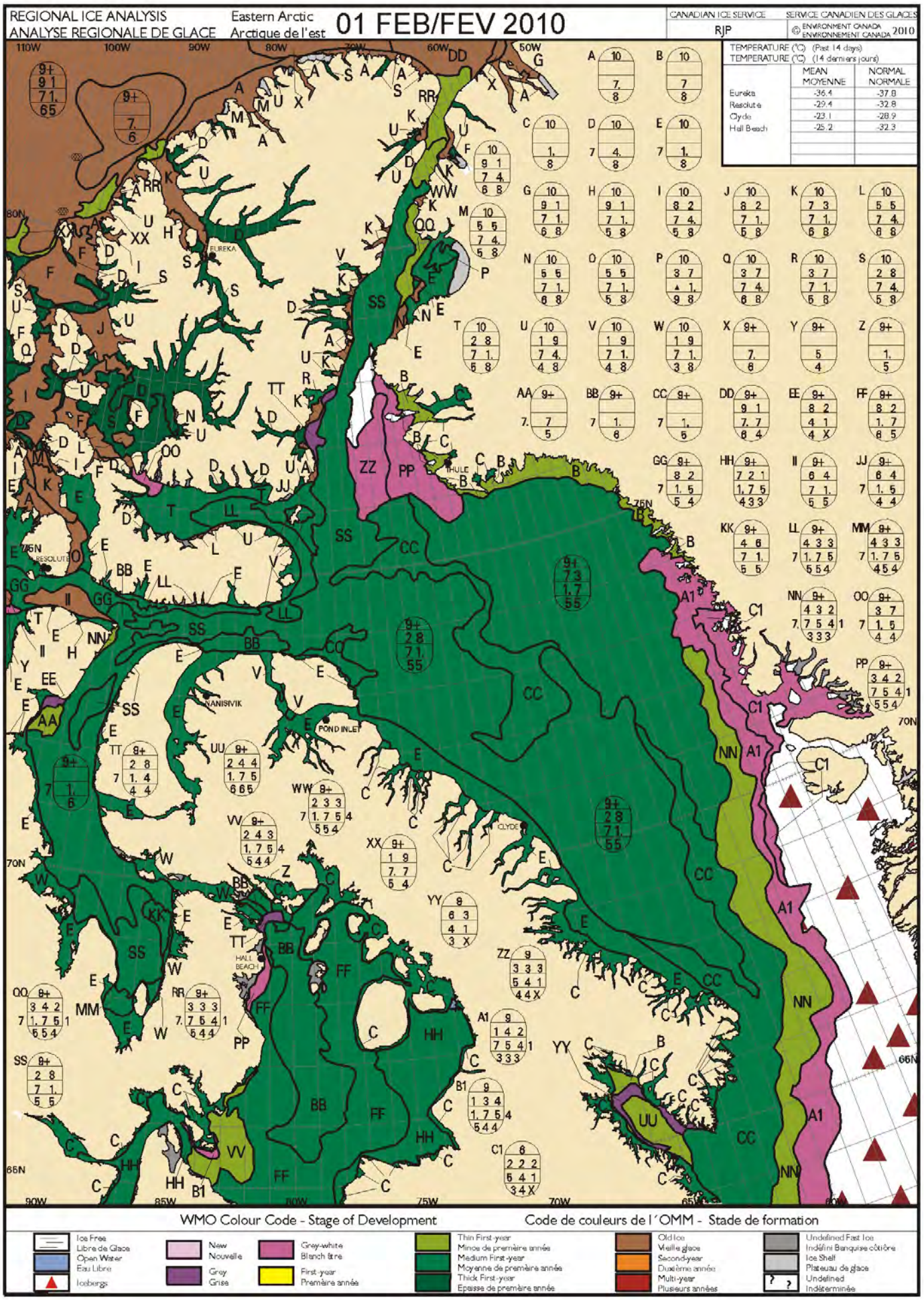
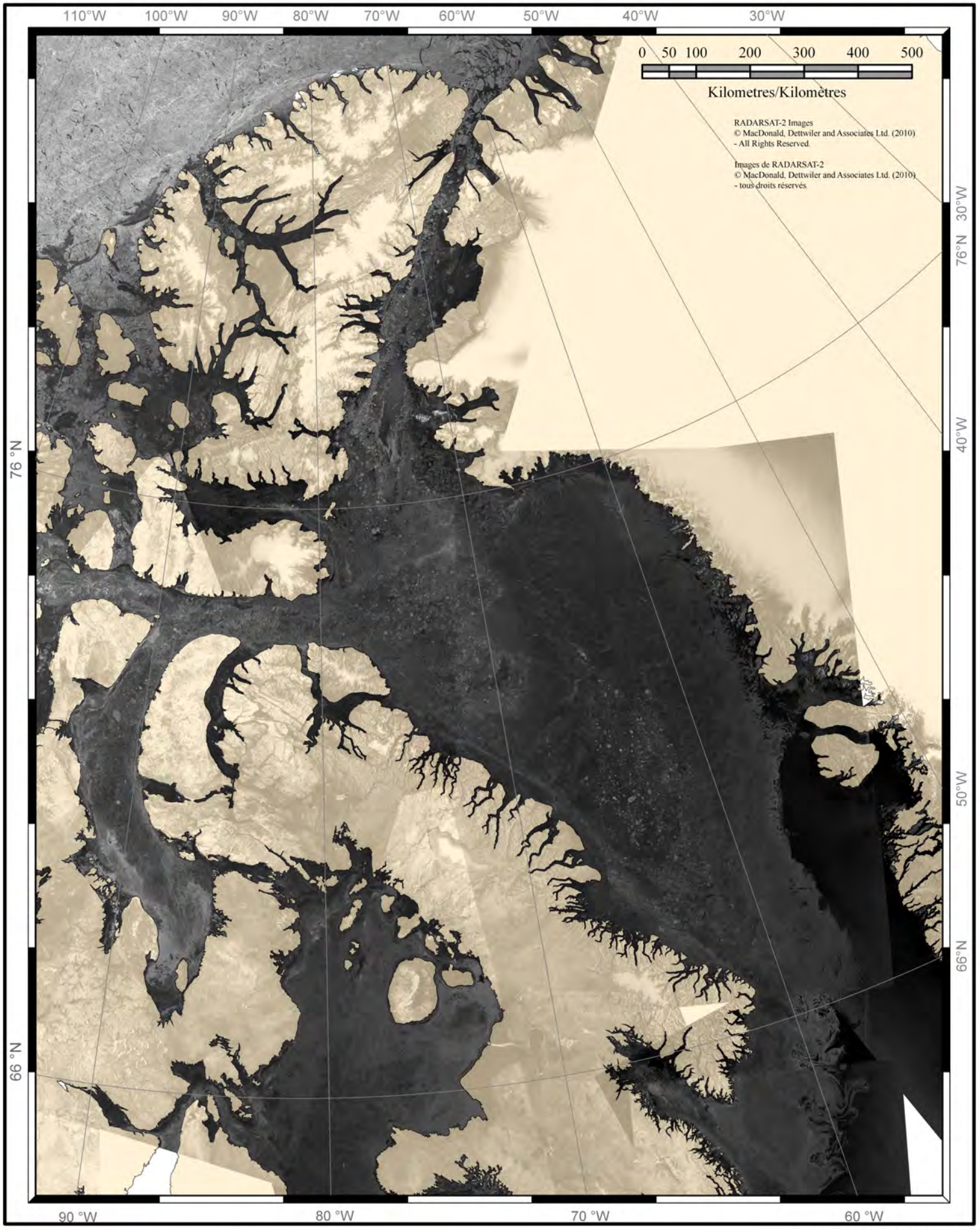



Table of Contents / Table des matières

Overview Map / Vue d'ensemble




# Eastern Arctic / Arctique de l'Est

01/30/2010 - 01/31/2010

Overview Map / Vue d'ensemble

To: Stage of Development / à: Stade de formation

To: Regional Mosaic / à: mosaïque régionale

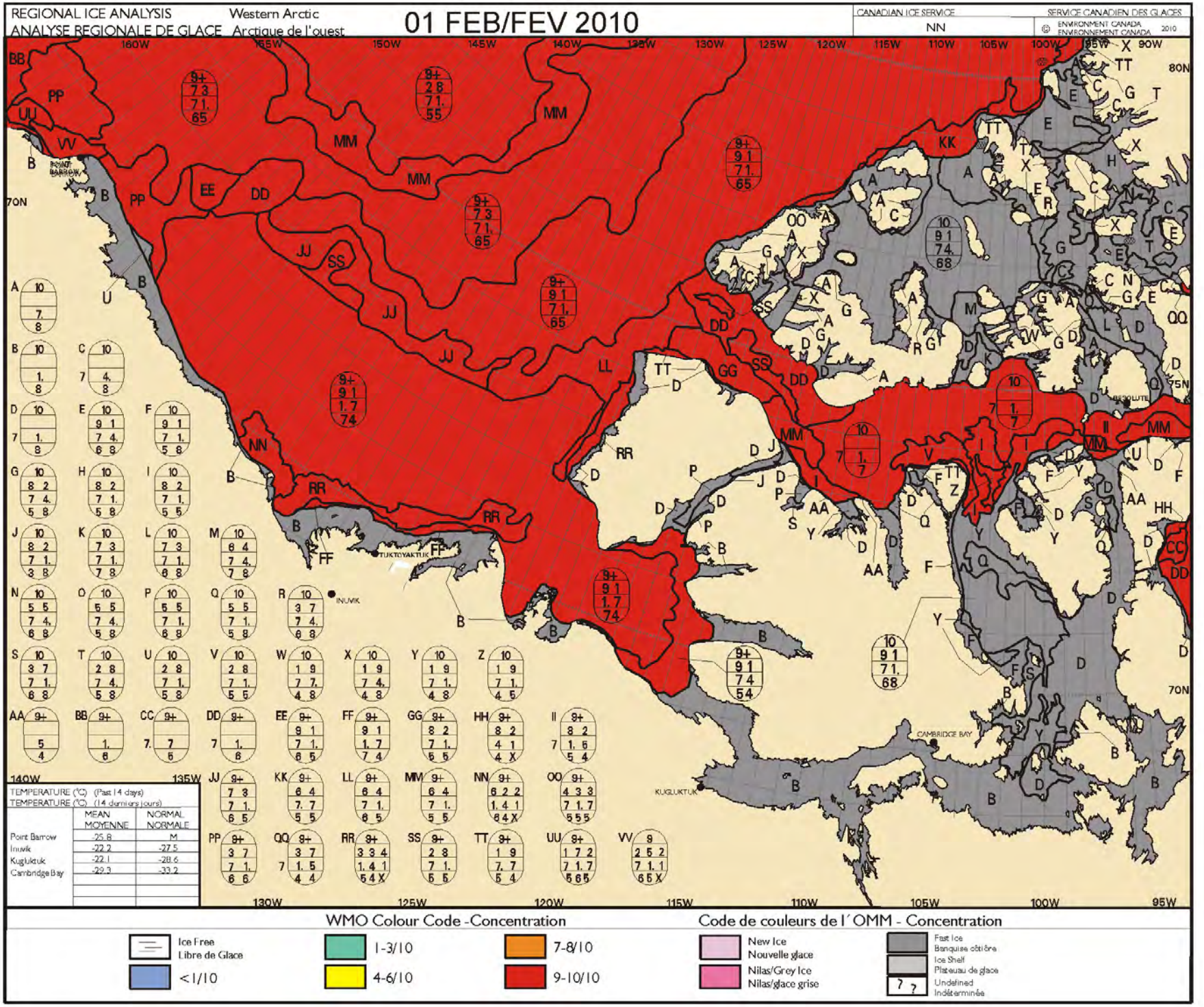
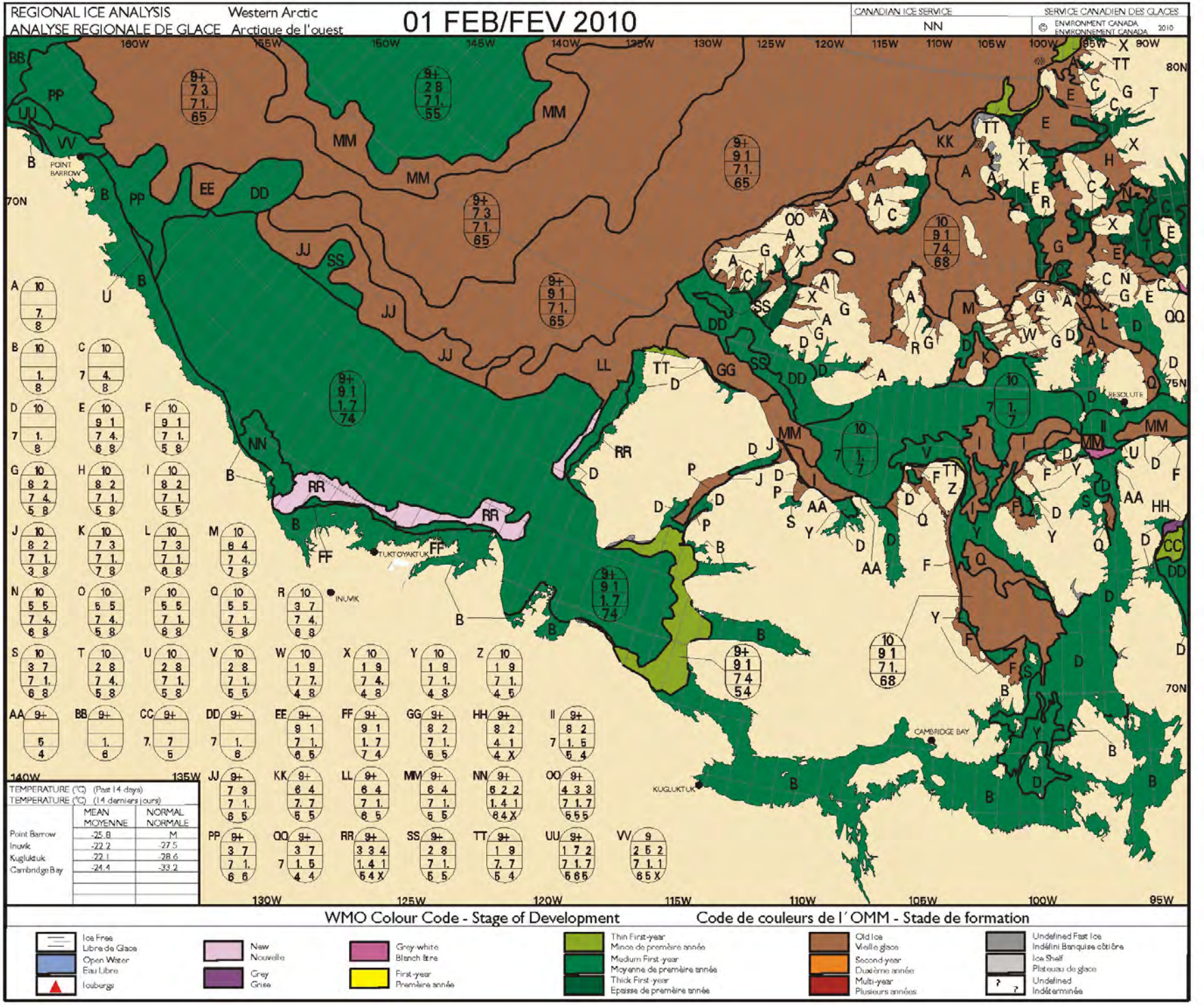
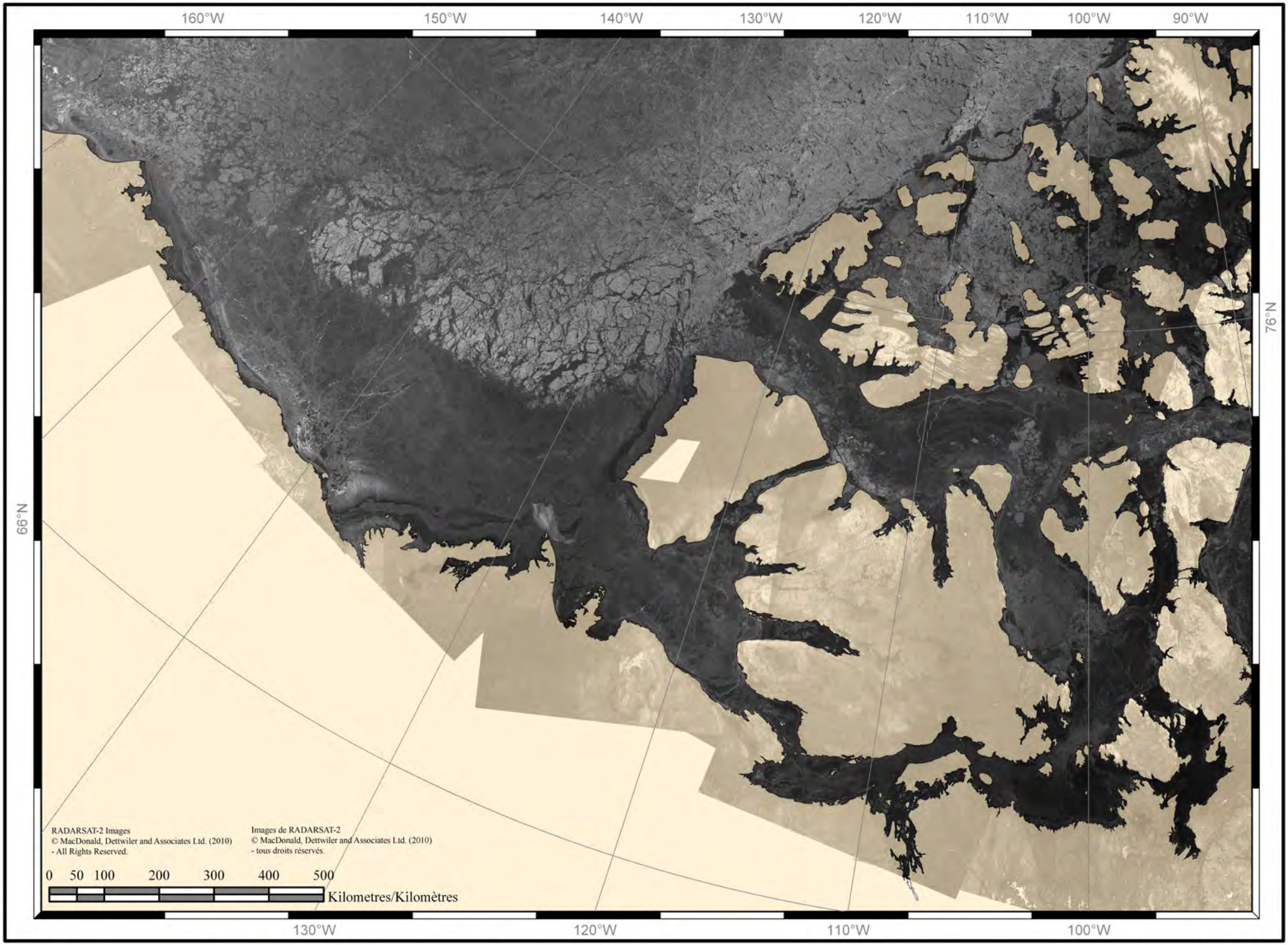



Table of Contents / Table des matières

Overview Map / Vue d'ensemble


REGIONAL ICE ANALYSIS
ANALYSE REGIONALE DE GLACE
Western Arctic
Arctique de l'ouest
01 FEB/FEV 2010
CANADIAN ICE SERVICE
SERVICE CANADIEN DES GLACES
NN
ENVIRONMENT CANADA
ENVIRONNEMENT CANADA
2010
POINT BARROW
TUKTOYAKTUK
INUVIK
RESOLUTE
CAMBRIDGE BAY
KUGLUKTUK
TEMPERATURE (°C) (Past 14 days)
TEMPERATURE (°C) (14 derniers jours)
MEAN MOYENNE
NORMAL NORMALE
Point Barrow -25.8 M
Inuvik -22.2 -27.5
Kugluktuk -22.1 -28.6
Cambridge Bay -24.4 -33.2
WMO Colour Code - Stage of Development
Code de couleurs de l'OMM - Stade de formation
Ice Free
Libre de Glace
Open Water
Eau Libre
Icebergs
New
Nouvelle
Grey
Grise
Grey-white
Blanch âtre
First-year
Première année
Thin First-year
Mince de première année
Medium First-year
Moyenne de première année
Thick First-year
Epaisse de première année
Old Ice
Vieille glace
Second-year
Deuxième année
Multi-year
Plusieurs années
Undefined Fast Ice
Indéfini Banquise côtière
Ice Shelf
Plateau de glace
Undefined
Indéterminée

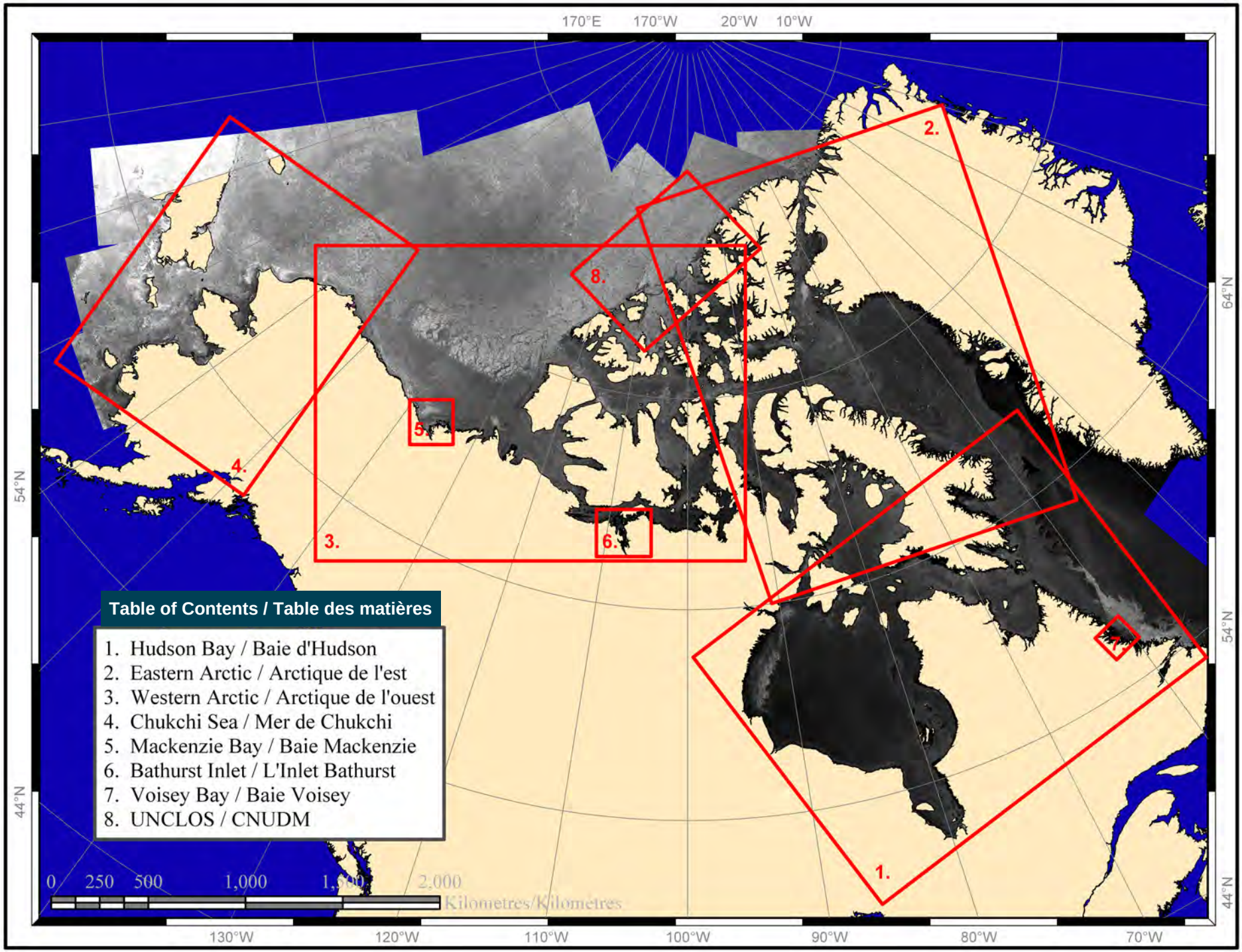


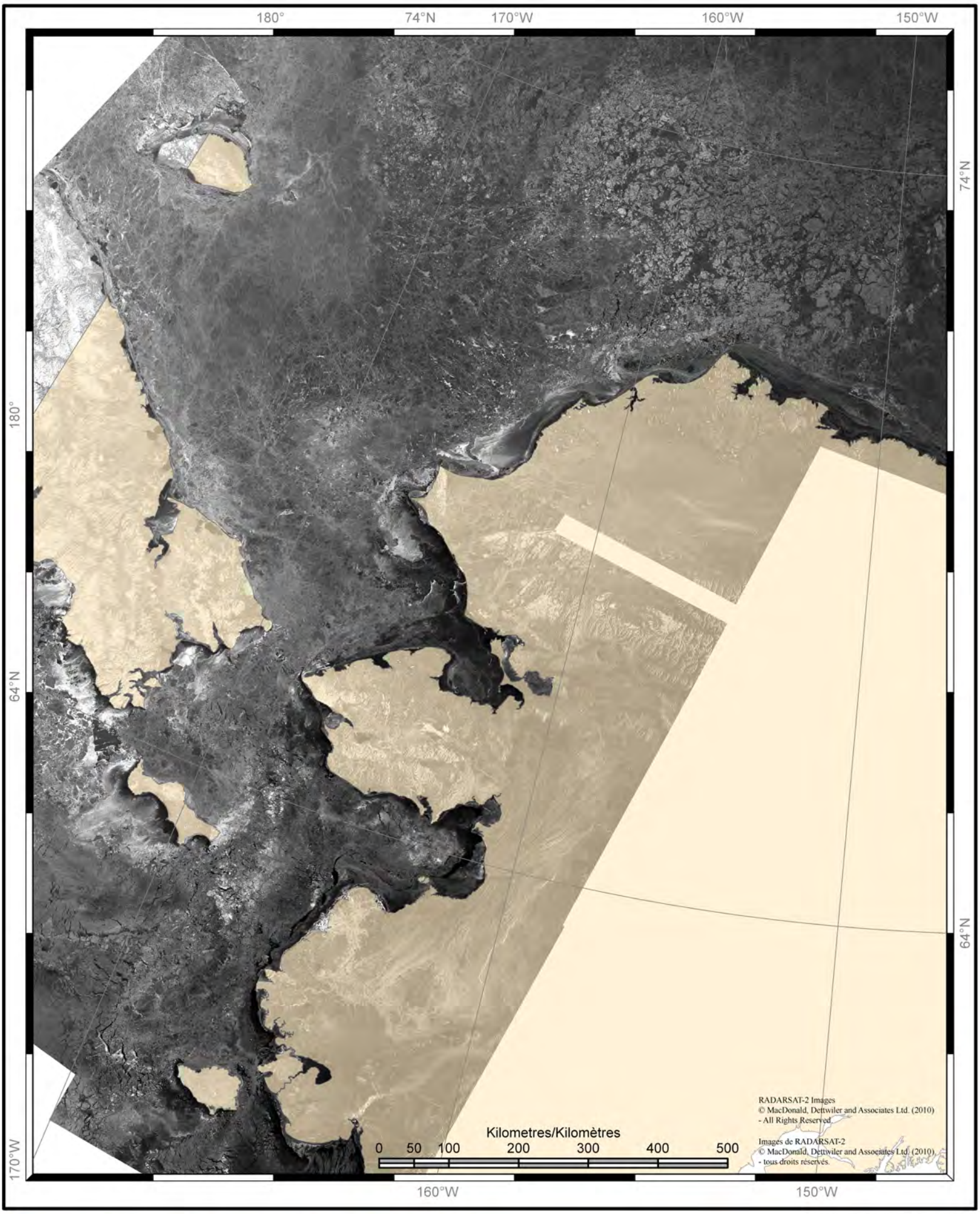

# Western Arctic / Arctique de l'Ouest

01/30/2010 - 02/01/2010

Overview Map / Vue d'ensemble

# CANADIAN ARCTIC MOSAIC / MOSAÏQUE DE L'ARCTIQUE CANADIEN

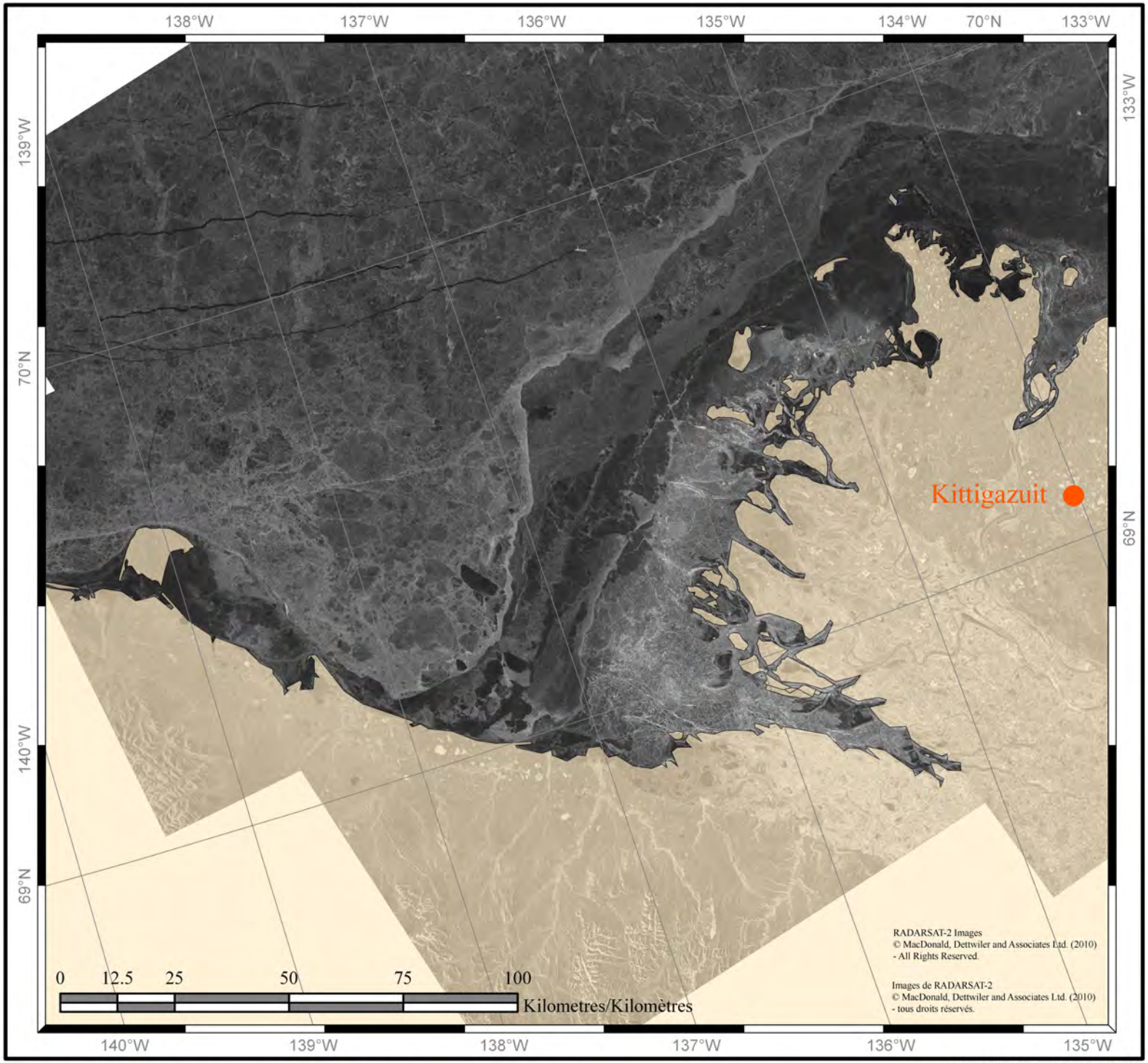





# Chukchi Sea / Mer de Chukchi

01/30/2010 - 02/01/2010

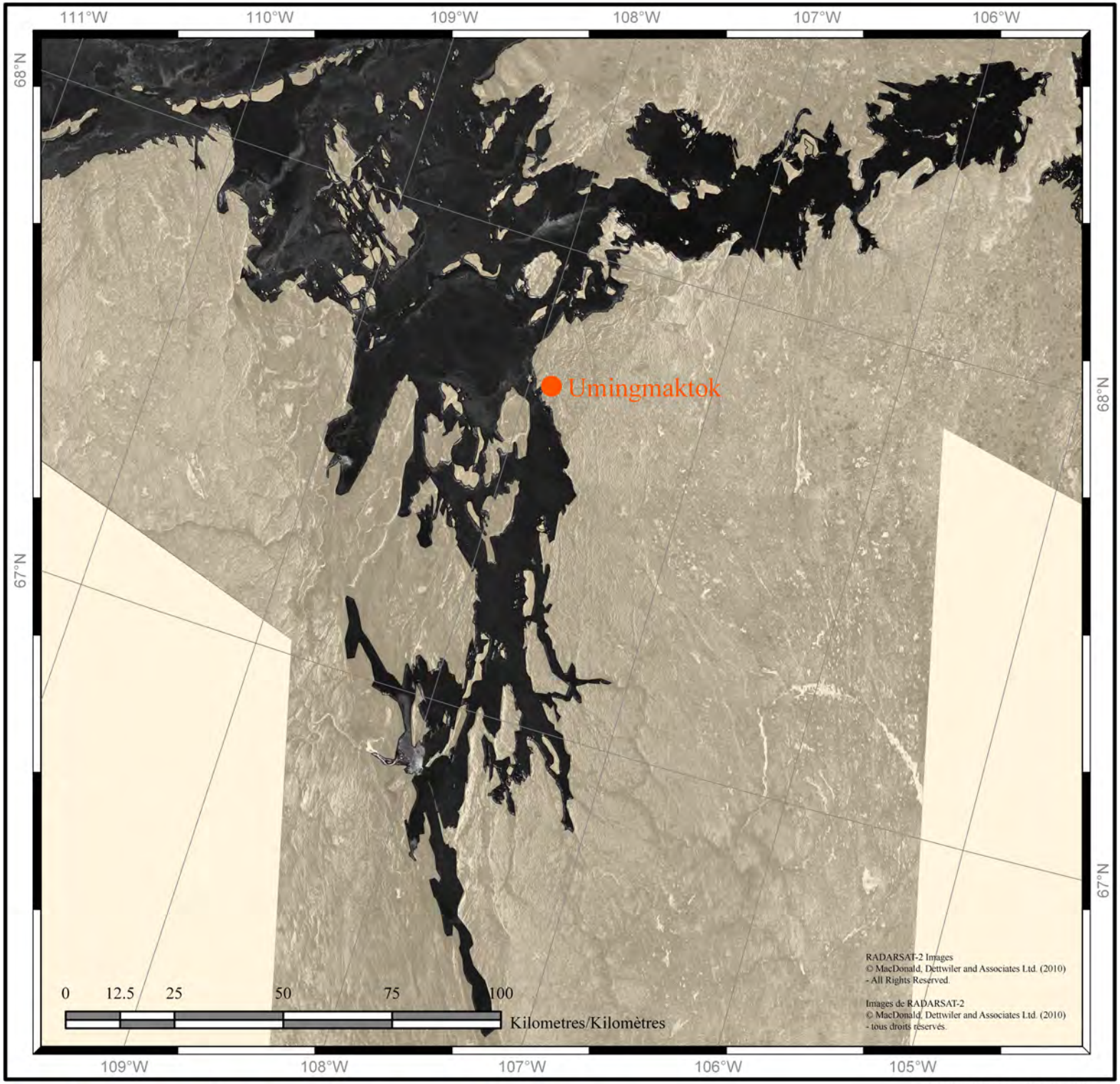
**Overview Map / Vue d'ensemble**




02/03/2010 - 02/06/2010

# Mackenzie Bay / Baie Mackenzie

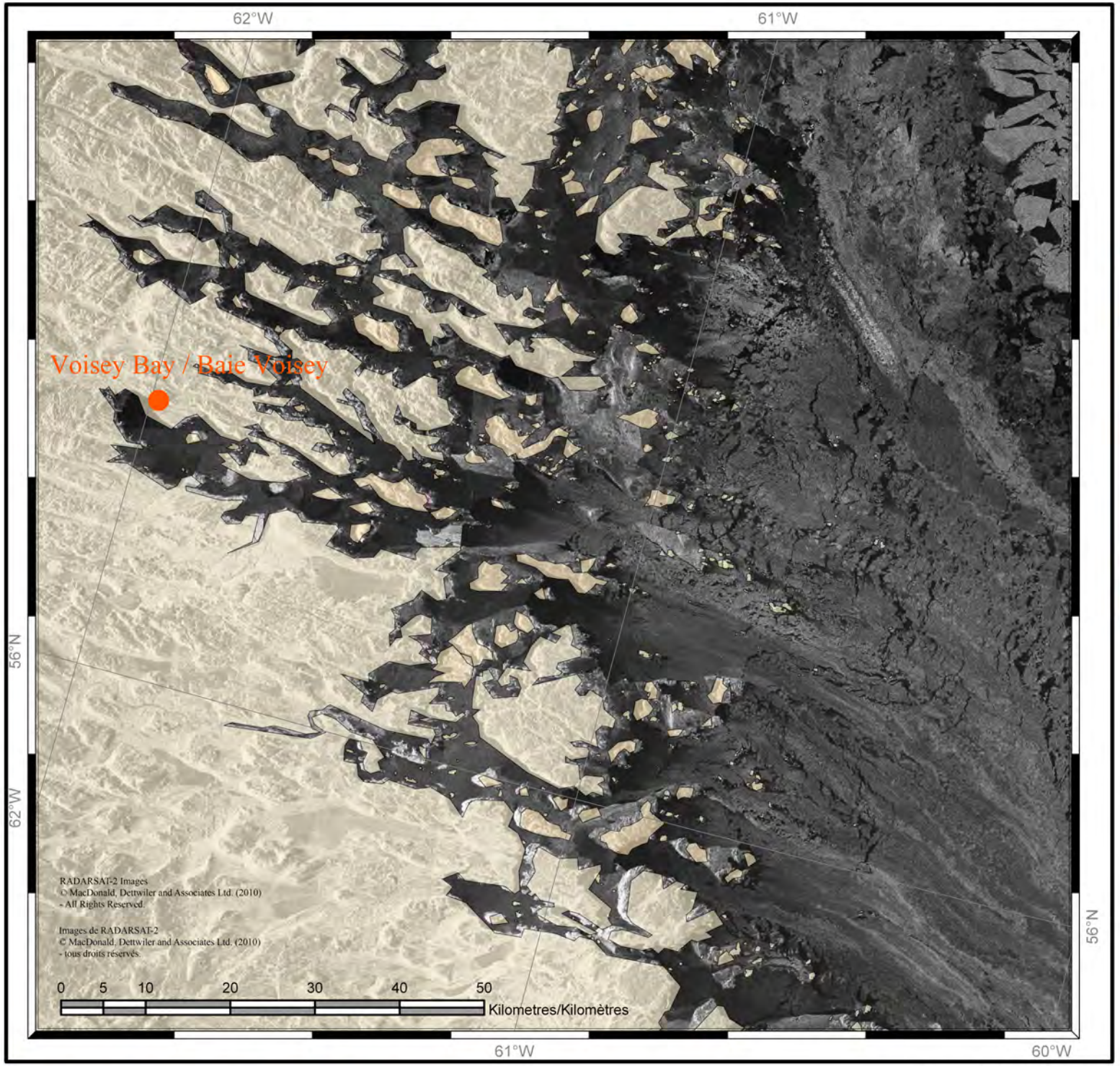
Overview Map / Vue d'ensemble




# Bathurst Inlet / L'anse de Bathurst

02/03/2010 - 02/04/2010

**Overview Map / Vue d'ensemble**




# Voisey Bay / Baie Voisey

02/01/2010 - 02/04/2010

**Overview Map / Vue d'ensemble**


# UNCLOS / CNUDM

02/01/2010 - 02/03/2010

**Overview Map / Vue d'ensemble**

## Contact Us

Environment Canada
Canadian Ice Services
373 Sussex Drive, E-3
Ottawa, Ontario Canada, K1A 0H3
Attention: Client Services

Telephone: 1-877-789-7733
E-mail: Weather.Info.Meteo@ec.gc.ca
Fax: 613 947-9160
Web site: http://ice-glaces.ec.gc.ca

## Contactez-nous

Environnement Canada
Service canadien des glaces
373, promenade Sussex, E-3
Ottawa (Ontario) Canada, K1A 0H3
À l'attention du: Service à la clientèle

Téléphone: 1-877-789-7733
Courriel: Weather.Info.Meteo@ec.gc.ca
Télécourriel: 613 947-9160
Site web: http://glaces-ice.ec.gc.ca

---

Table of Contents / Table des matières