SUPPLEMENTARY

Integrated Earthquake Catalog III: Gakkel Ridge, Knipovich Ridge and Svalbard Archipelago

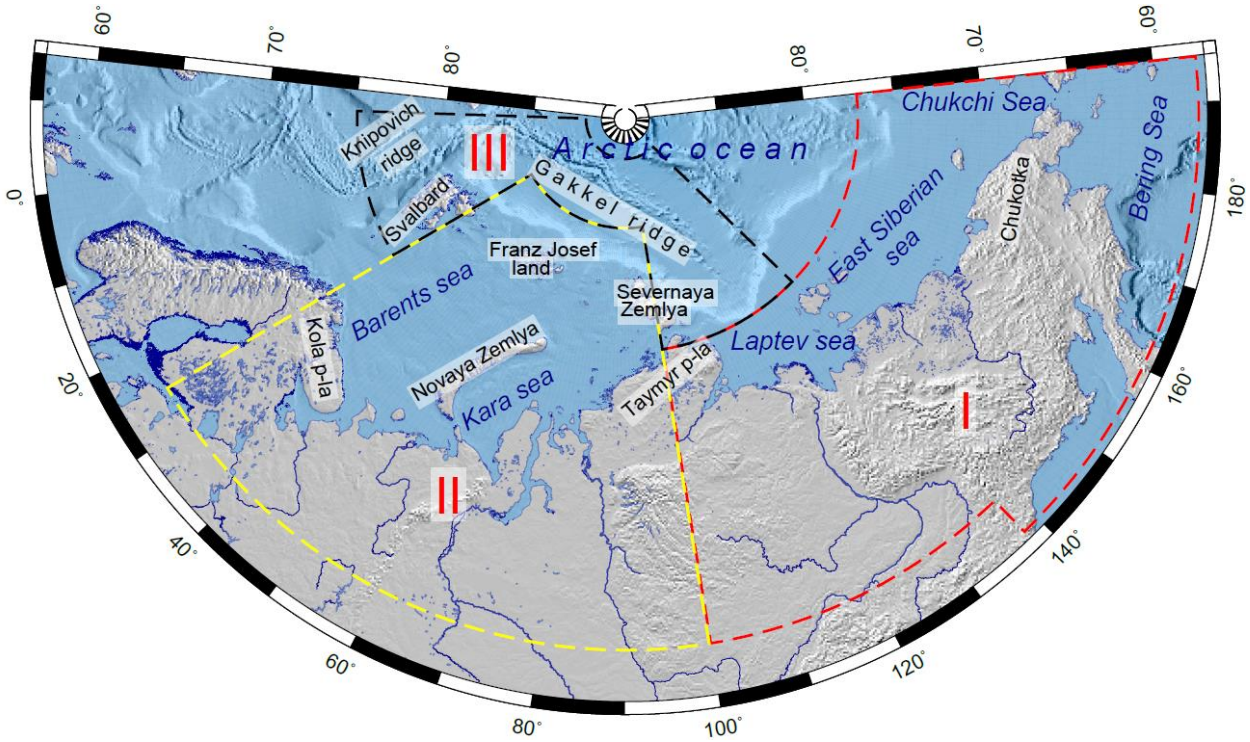

Figure S1. Schematic coverage map for catalogs **I** (Eastern Sector), **II** (Western Sector) and **III** (75°N, 10°W; 88°N, 10°W; 88°N, 140°E; 77°N, 140°E; 77°N, 100°E; 84°N, 100°E; 84°N, 25°E; 75°N, 25°E). It includes the Svalbard Archipelago and adjacent areas (75°N–84°N, 10°E–25°E), the Knipovich Ridge, Molloy and Spitsbergen fracture zones (75°N–83°N, 10°W–10°E), and the Gakkel Ridge (the rest of the studied area)

Table S1. Statistics of the ISC catalog.

Agency abbreviation	Agency	With magnitude
BCIS	Bureau Central International de Sismologie, France	7
BER	University of Bergen, Norway	10,075
CSEM	Centre Sismologique Euro-Méditerranéen (CSEM/EMSC), France	548
DNK	Geological Survey of Denmark and Greenland, Denmark	888
EIDC	Experimental (GSETT3) International Data Center, U.S.A.	47
FCIAR	Federal Center for Integrated Arctic Research, Russia	110
GFZ	Helmholtz Centre Potsdam GFZ German Research Centre For Geosciences, Germany	1
HEL	Institute of Seismology, University of Helsinki, Finland	14
HFS	Hagfors Observatory, Sweden	1
IDC	International Data Centre, CTBTO, Austria	217
IEPN	Institute of Environmental Problems of the North, Russian Academy of Sciences, Russia	307
INMG	Instituto Português do Mar e da Atmosfera, I.P., Portugal	1
ISC	International Seismological Centre, United Kingdom	3,419
ISS	International Seismological Summary, United Kingdom	5
MOS	Geophysical Survey of Russian Academy of Sciences (GS RAS), Russia	3
KOLA	Kola Regional Seismic Centre, GS RAS, Russia	156
MSUGS	Michigan State University, Department of Geological Sciences, USA	1
NAO	Stiftelsen NORSAR, Norway	1,035
NEIC	National Earthquake Information Center, USA	85
OTT	Canadian Hazards Information Service, Natural Resources Canada	8
SYKES	Sykes Catalogue of earthquakes 1950 onwards	2
WAR	Institute of Geophysics, Polish Academy of Sciences, Poland	5
ZEMSU	USSR	2
	TOTAL:	**16,937**

We check the hypothesis that small events recorded in Svalbard are ice-quakes, as proposed in [18,19]. We suppose ice-quakes must have focal depth smaller than 1km. The distribution of focal depth for earthquakes with magnitude $M \leq 2.2$ (Figure S2) shows that more than 90% events are too deep to be ice-quakes.

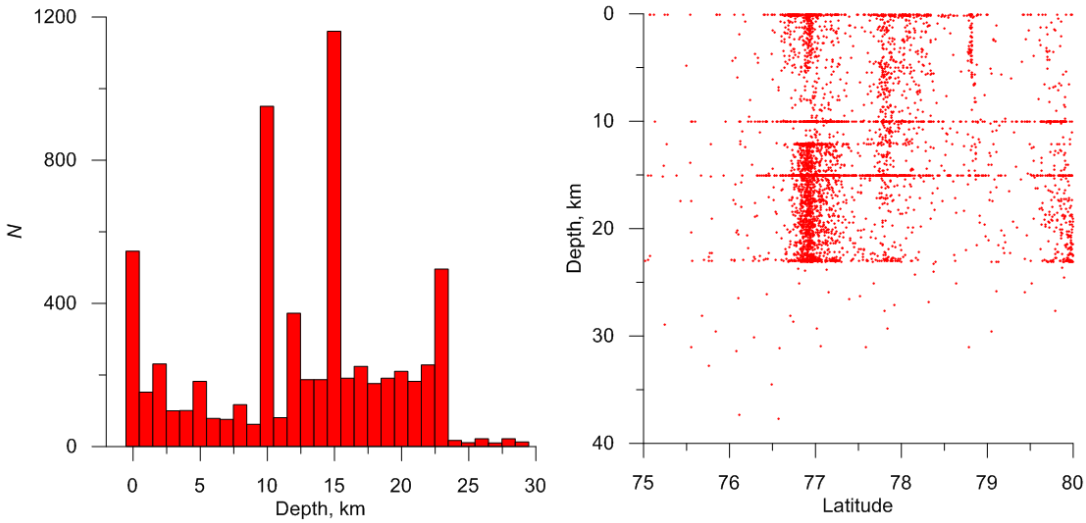

Figure S2. Distribution of focal depth for events with $M \leq 2.2$ in Svalbard.

Before the merging process, each of the source catalogs (Table 1) was checked for internal duplicates. Statistical analysis did not reveal any anomalous groups of close events (Figure S3). It should be noted that duplicates typically have a metric value (1) $Ro < 10$ [26,27]. The number of such close events within each catalog is small, and there are no statistical reasons to consider such events as duplicates. Analysis (Figure S5) was performed with metric parameters $\sigma_T = 0.05\ min$, $\sigma_X = \sigma_Y = 15\ km$.

If there is a noticeable number of internal duplicates in the catalog, the distribution of the proximity function (*Ro* metric) between the nearest events has a characteristic bimodal shape with a minimum in the region of $Ro = 10$. For all source catalogues, there is no mode of metric distribution in small values. The number of close events with a metric value $Ro < 10$ is very small, less than 0.5%. We do not consider these events to be duplicates because, due to natural clustering, earthquakes can occur very close in space and time.

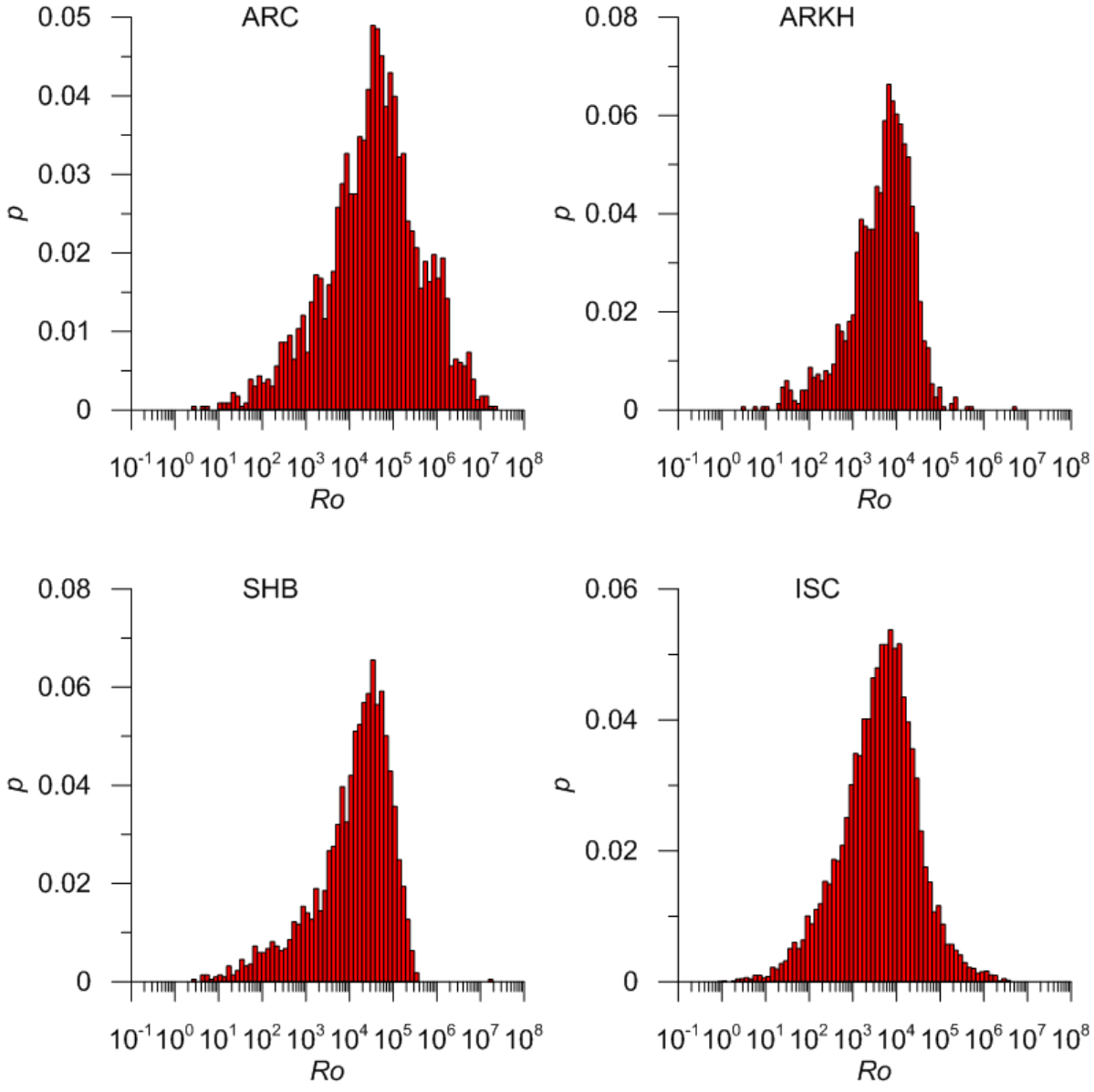

Figure S3. Distribution of the metric for events within the source earthquake catalogs (Table 1). The catalog name is indicated on the histogram.

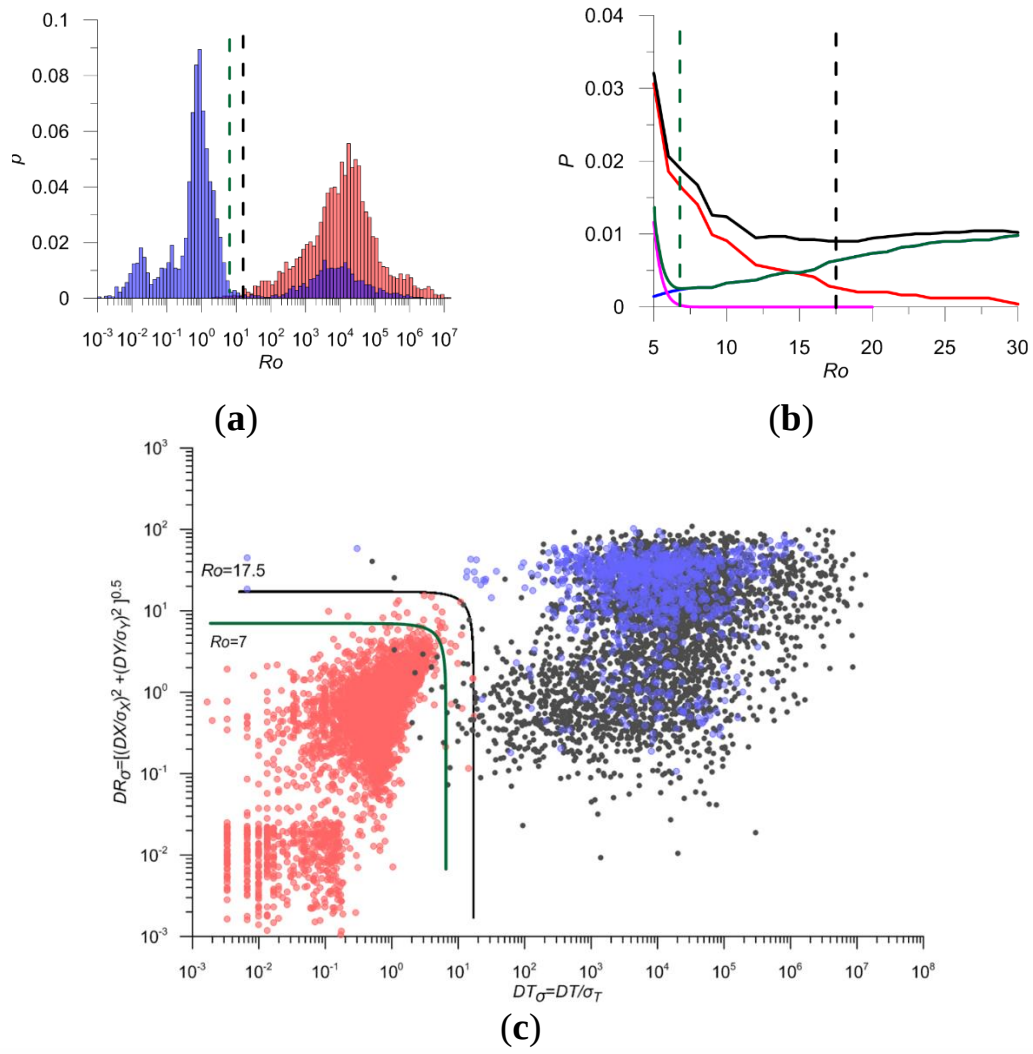

Figure S4. Modified Figure 9. Magenta line in (b) shows the probability of missing a duplicate in the model of multivariate normal distribution, green line shows the total probability of the first and the second kind errors. Dashed green line in (a) and (b) shows threshold value of Ro=7, minimizing total error. (c) Green contour line of the metric (1) $Ro = 7$ shows obvious missing of duplicates.

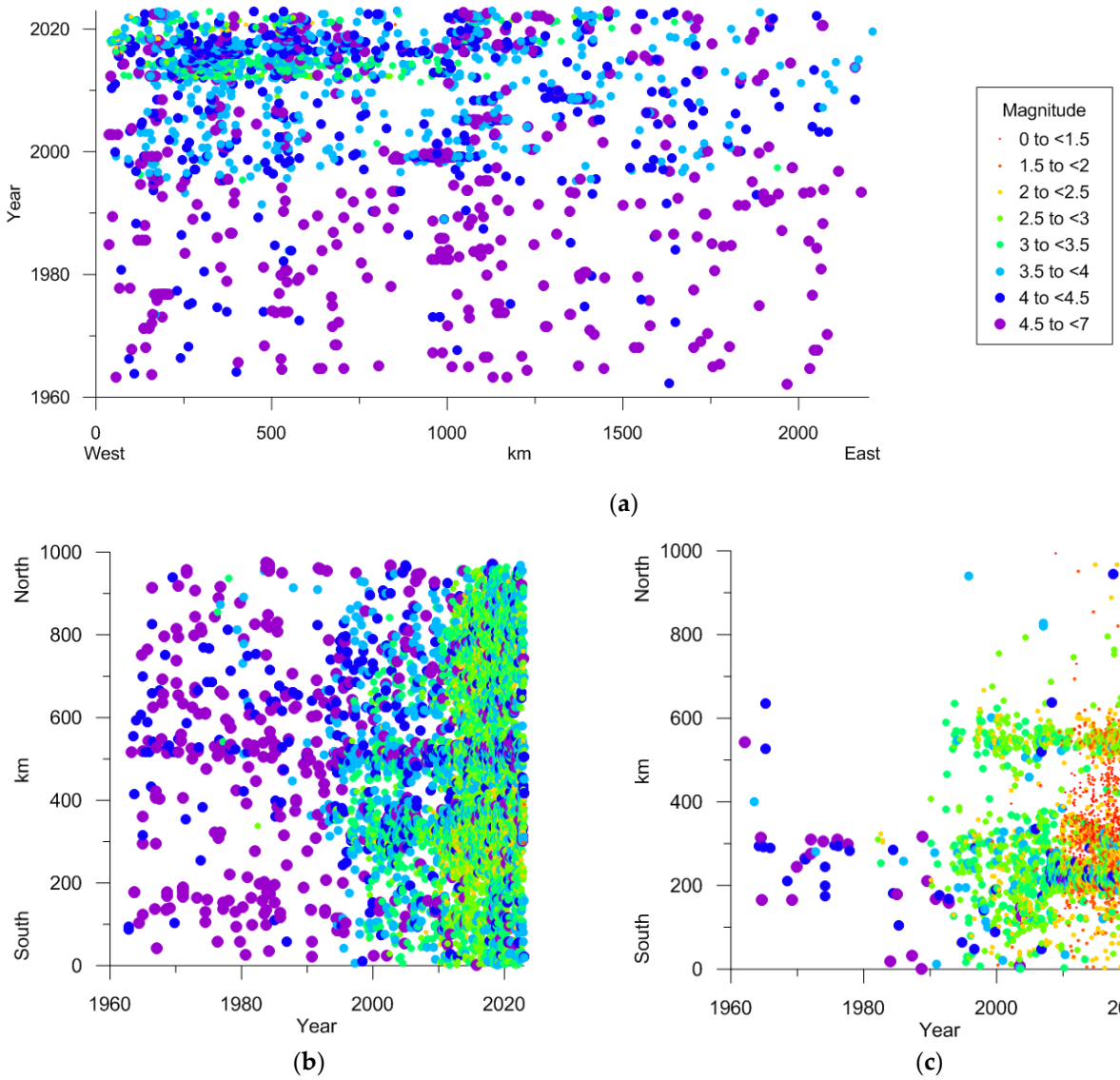

Figure S5. Distribution of earthquakes in space and time. **(a)** Gakkel ridge; **(b)** Knipovich ridge; **(c)** Svalbard.

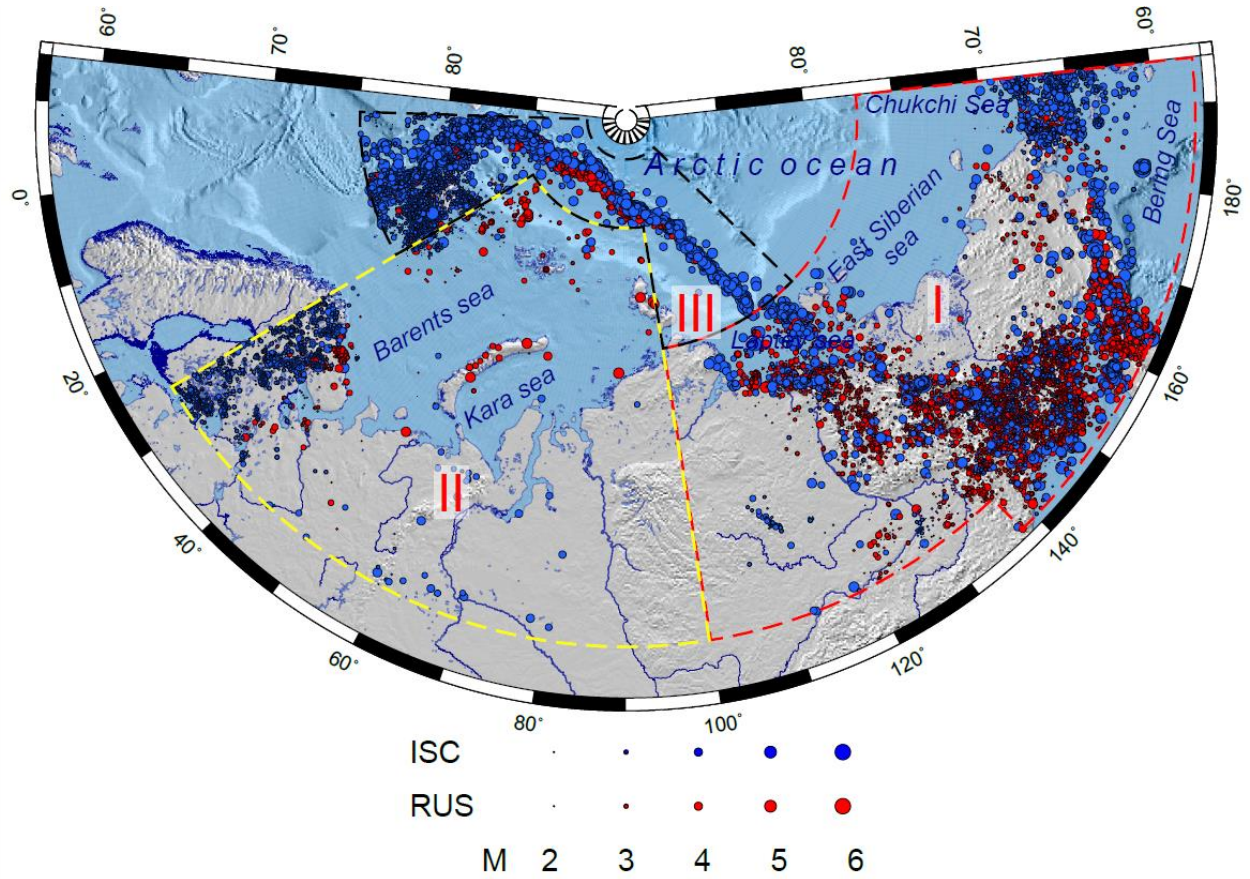

Figure S6. Map of earthquake epicenters of three created integrated catalogs: **I** (Eastern Sector), **II** (Western Sector) and **III** (Gakkel Ridge, Knipovich Ridge and Svalbard Archipelago).