ARCTIC GRAVITY GRID
March 29, 2018

Objective: Construct the best possible free-air gravity grid of the Arctic using non-proprietary data.

Data Sources: Free-air anomalies from the Arctic Gravity Project for areas above 85° N (http://earth-info.nima.mil/GandG/wgs84/agp/readme.html).
Retracked satellite radar altimeter profiles from ERS-1, Geosat/GM, Envisat, CryoSat, and Altika.

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Construction of Merged Gravity Grid

Three data sources were combined to make the final 1-minute Arctic gravity grid (Figure 1). For latitudes between 50° and 85°N the marine gravity is based on retracked satellite altimeter profiles as described in *Sandwell et al*., [2014]. This version has been updated using 3 more years of CryoSat-2 altimetry and 13 months of Altika altimetry. The land gravity is primarily based on EGM2008 [*Pavlis et al*., 2012]. Marine gravity in areas north of 85°N is based on the ArcGP gravity project [*Kenyon et al*., 2008] (Figure 2) to form a complete base gravity grid. The retracked satellite altimeter profiles used in this analysis are shown in Figures 3a-e.

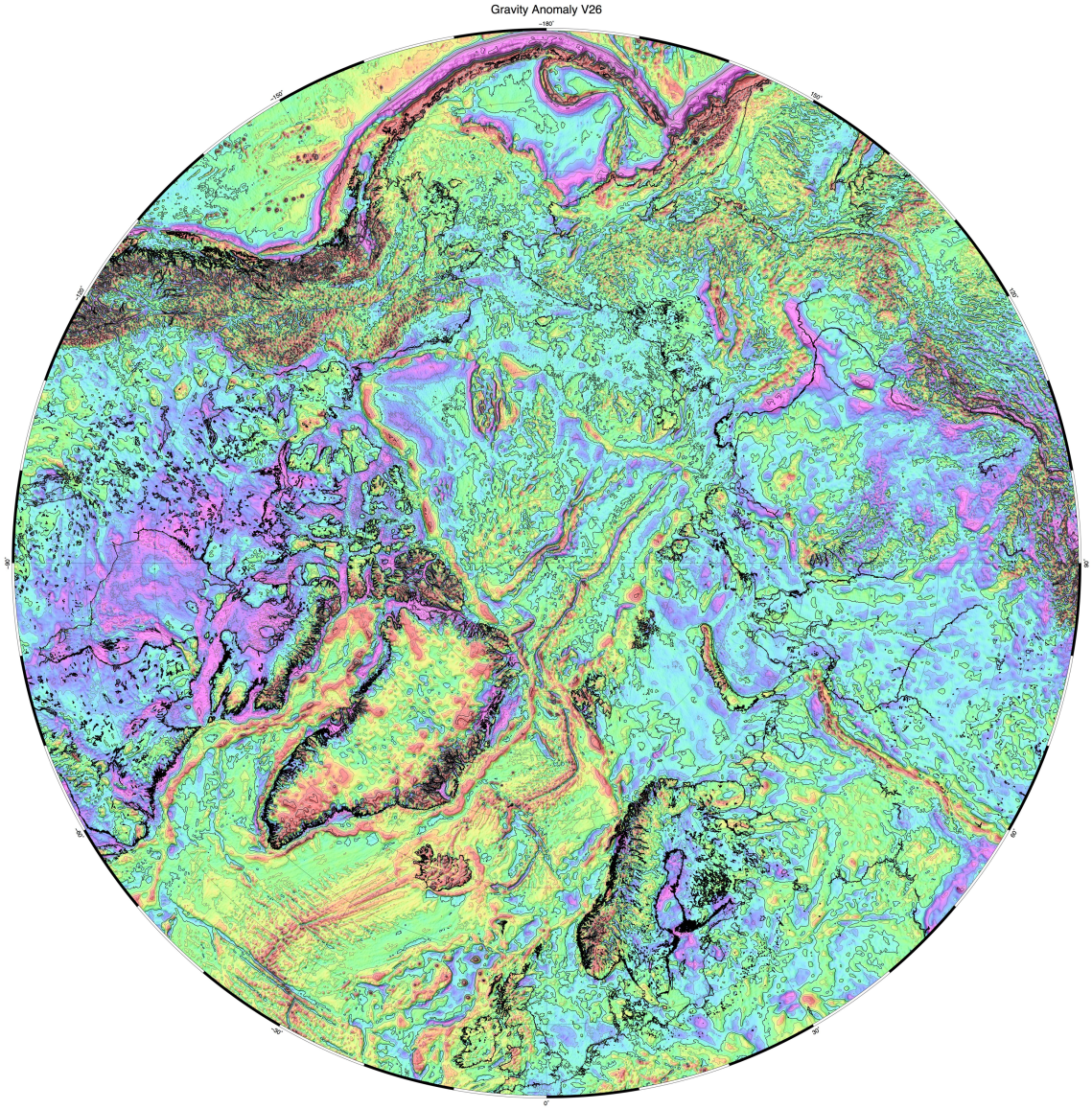

Figure 1. Final merged free-air gravity anomaly grid. Altimeter-derived gravity latitude < 85°N and ArcGP gravity latitude > 85°N (Version 26). Although this grid contains much of the same data used in the ArcGP grid, it has higher resolution due to the smaller grid size (1 minutes versus 5 minutes). In addition, it is based on the latest satellite altimeter data from CryoSat-2 and Altika.

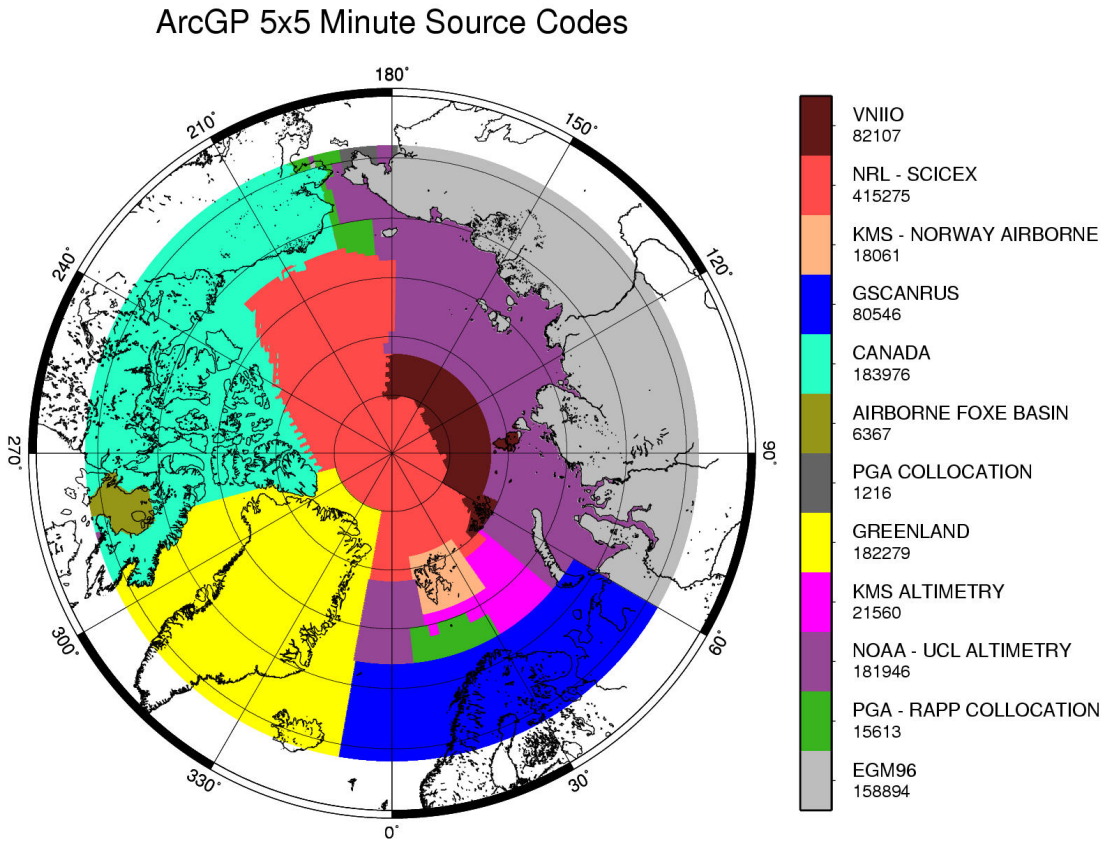

Figure 2. Sources of gravity information for the ArcGP 5 minute by 5 minute gravity grid [*Kenyon et al*., 2008]. We used ArcGP data north of 85° only. These polar data were primarily derived from US Navy submarine gravity profiles.

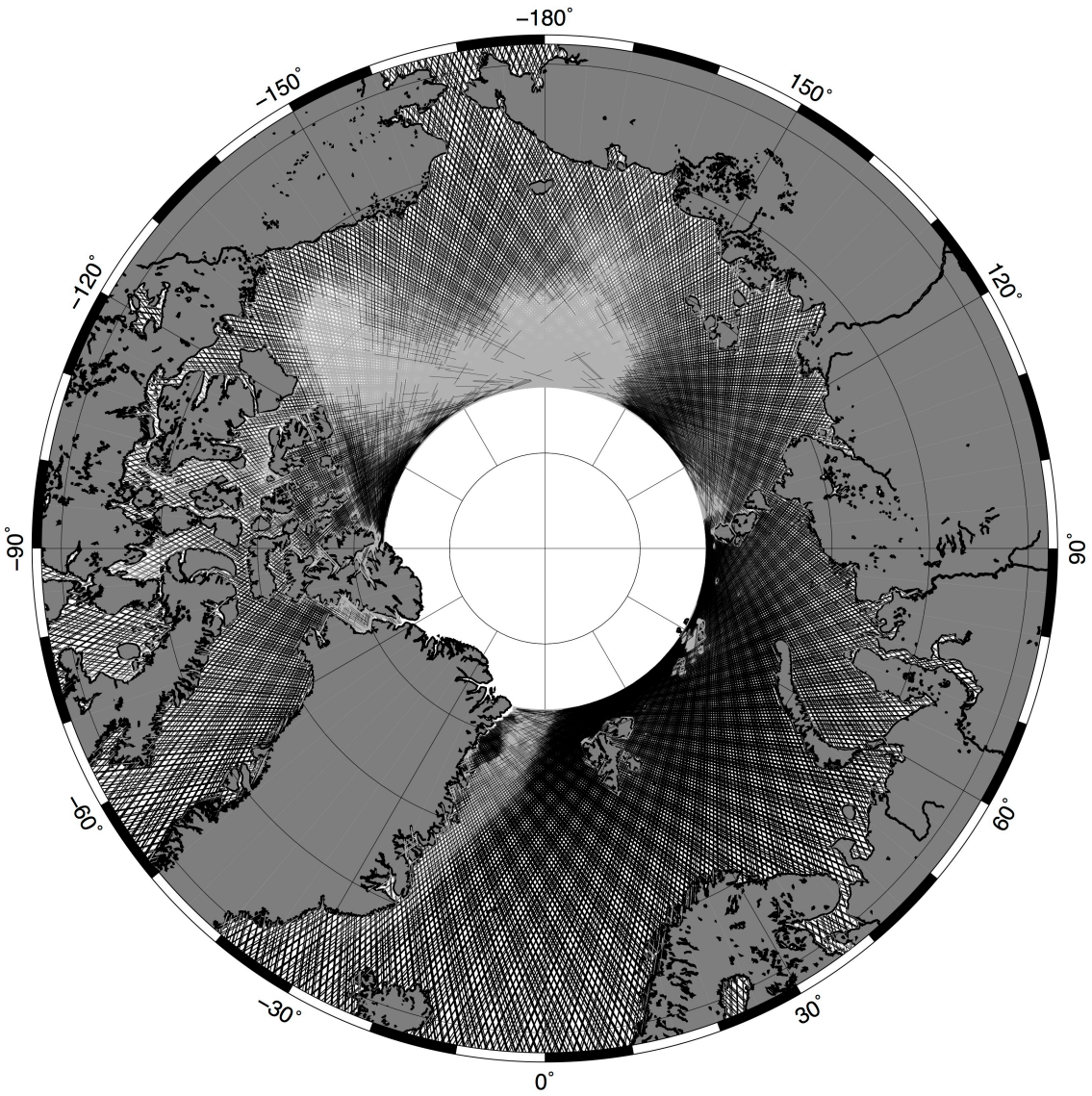

Figure 3a. Tracklines of ERS-1 and Envisat altimetry data from both the geodetic phase (168-day repeat) and repeat phase (35-day repeat) in the Arctic area. A simple threshold retracking algorithm was used to recover gravity information over areas of permanent ice cover (light grey). This retracker has about a factor of 3 worse precision than the open ocean retracker.

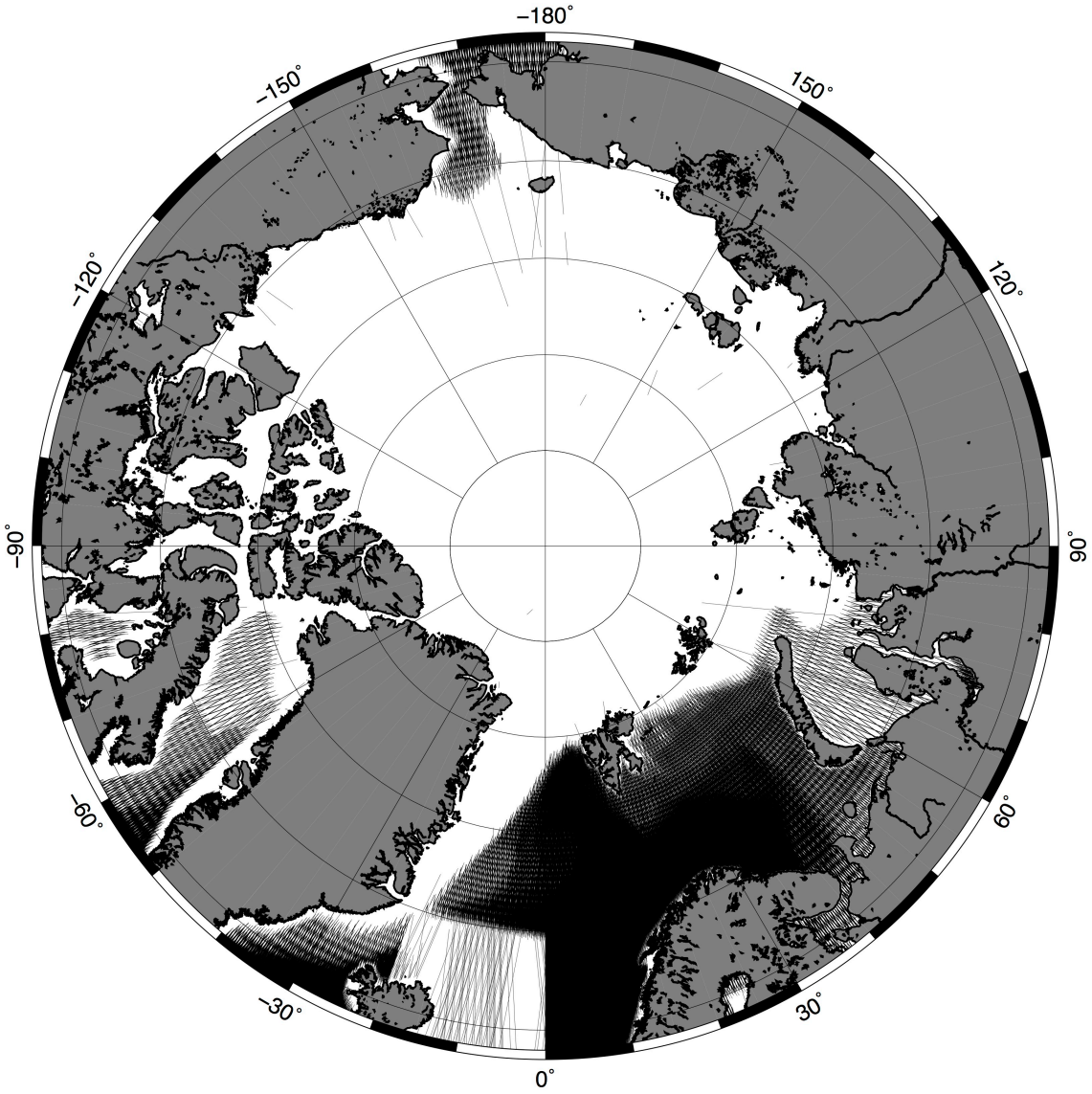

Figure 3b. Tracklines of CryoSat/LRM. This mode is mainly used in ice-free ocean areas.

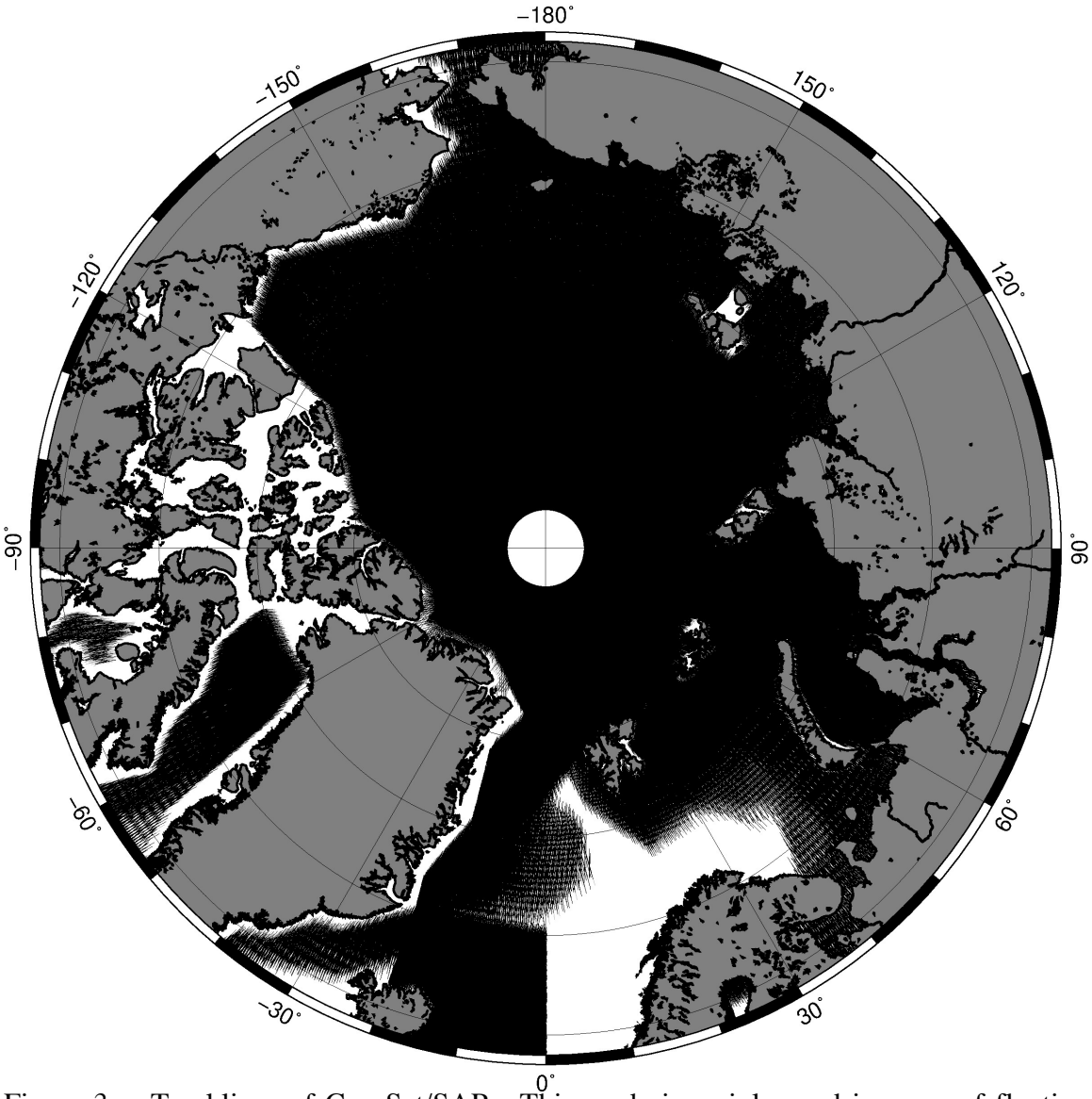

Figure 3c. Tracklines of CryoSat/SAR. This mode is mainly used in areas of floating sea ice.

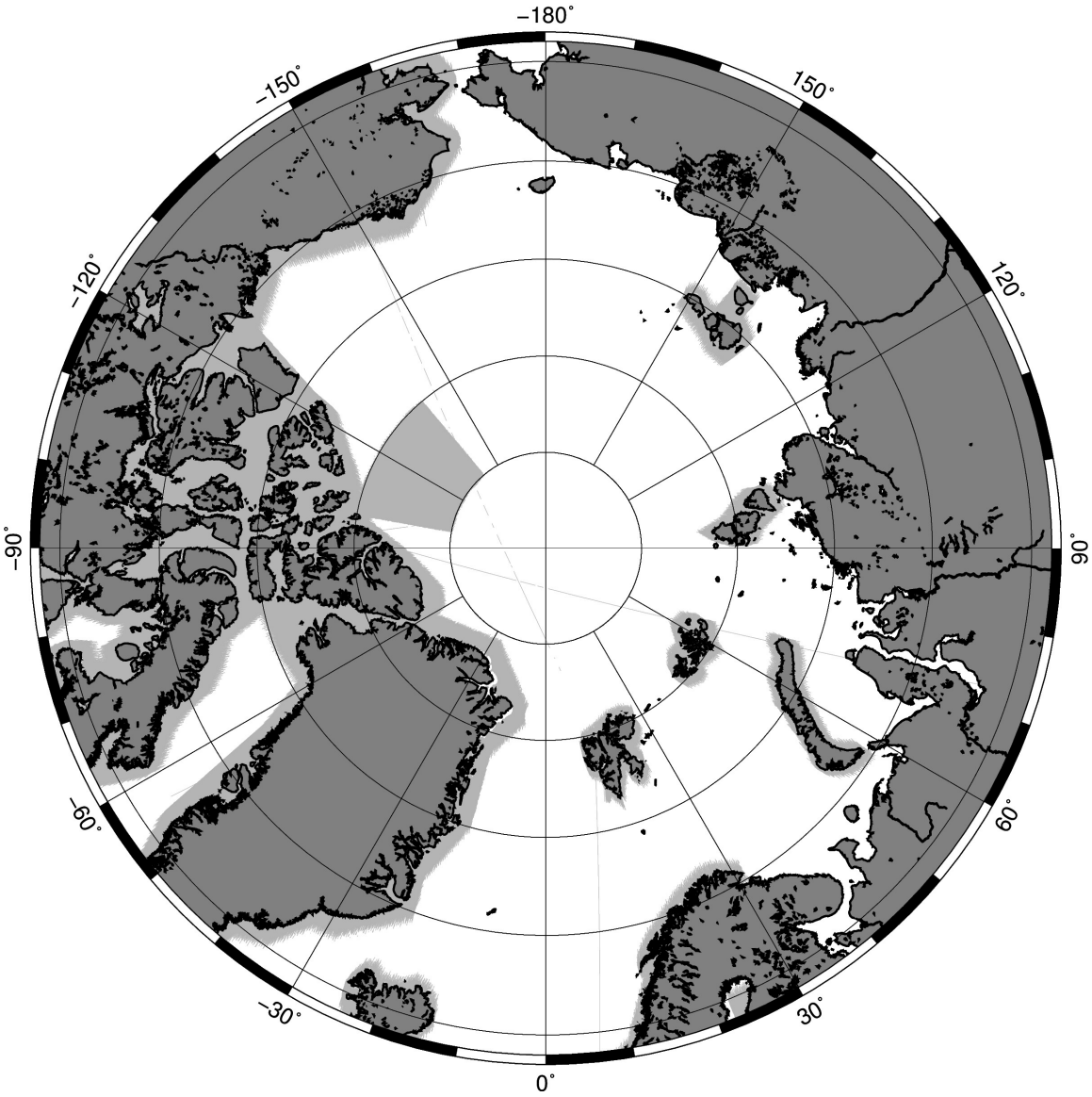

Figure 3d. Tracklines of CryoSat/SIN. This mode is mainly used in areas of grounded or multiyear ice and is about 3 times less accurate than the LRM and SAR modes.

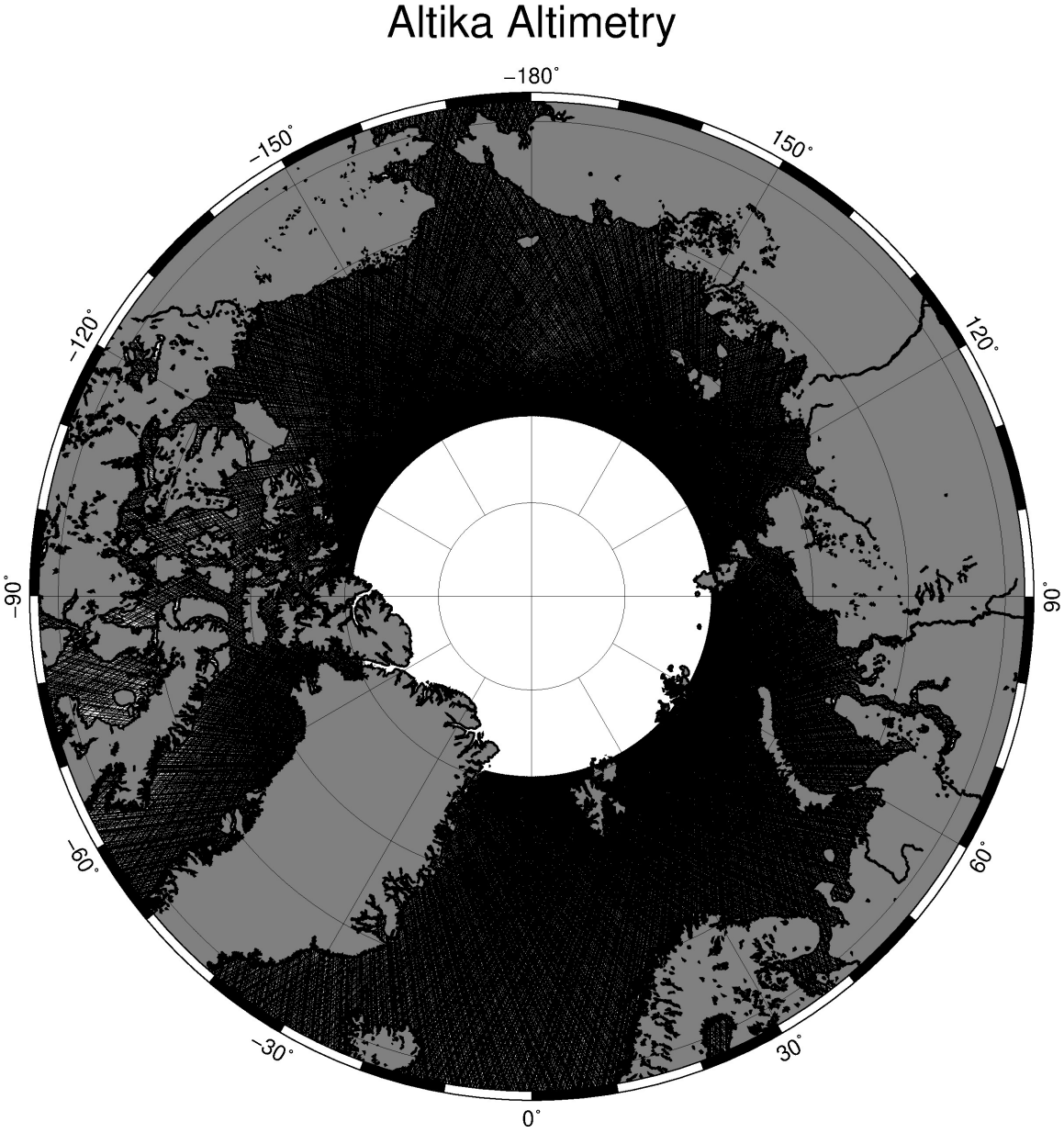

Figure 3e. Tracklines of Altika. In the ice-free ocean areas, the Altika altimeter profiles are about two times more previous than all previous radar altimeter data.

References

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