**RADARSAT Constellation Mission / Sentinel-1 Sea Ice Motion (RCMS1SIM)**

This gridded sea ice motion (SIM) dataset is produced from the ice feature tracking algorithm (Komarov and Barber, 2013) as applied in the Environment and Climate Change Canada Automated Sea Ice Tracking System (ECCC-ASITS; Howell et al., 2022). ECCC-ASITS detects ice displacement features between two overlapping synthetic aperture radar (SAR) images for a large collection of SAR imagery across the pan-Arctic domain. Spatiotemporal windows are used to collect and convert individual ice-displacement features into grids of SIM with associated statistics and uncertainty estimates.

Product Generation and Quality Control

The following processing steps and quality controls were performed during SIM product generation:

1. The spatial window for collecting ice displacement samples was 3-times the product grid resolution (e.g. 75km window for 25km SIM product)
2. New SIM products are generated daily with 2-day lag at 1000h UTC
3. Uncertainty calculations are outlined in the associated publication (Howell et al., 2022)
4. Overlapping pairs of imagery with a time displacement of less than 12 hours were not included for product generation
5. Any detected ice displacement with a speed of 75km/day or greater was removed
6. Any grid cell with fewer than 5 sampled ice displacements was removed
7. Any grid cell with a displacement speed of 0 was removed
8. Any grid cell with a null displacement speed was removed (except for the raster product, where null grid cells are masked using fill-values)

File Name and Versioning

Each SIM product follows a similar filename template:

RCMS1SIM\_YYYYMMDD\_YYYYMMDD\_GGGG\_VVV

Where the left-most YYYYMMDD is the start-time of the product’s temporal window beginning at 0000h UTC (e.g. 20220316 or March 16 2022), the right-most YYYYMMDD is the end-time of the product’s temporal window ending at 2359h UTC (e.g. 20220322 or March 22 2022), GGGG refers to the grid specification (e.g. EASE1 for Equal-Area Scalable Earth version 1), and VVV refers to the product version (e.g. v1.0).

File Format

SIM products are generated in vector (Esri Shapefile) and raster (Network Common Data Form; NetCDF) formats. The vector dataset can be loaded in conventional GIS GUI applications such as QGIS and Esri ArcGIS Pro/ArcMap. The raster dataset can also be loaded by the same GIS applications as well as other NetCDF tools including ncview and the Panoply data viewer provided by NASA: <https://www.giss.nasa.gov/tools/panoply/>. Both the vector and raster datasets contain a series of attributes that contain information on ice-motion-related variables (see Table 1).

Table 1. Description of variables contained within each RCMS1SIM product

|  |  |
| --- | --- |
| **Variable Name** | **Description** |
| Lat | Latitude coordinate of grid cell centroid in decimal degrees |
| Lon | Longitude coordinate of grid cell centroid in decimal degrees |
| U | Sea ice motion in X-direction relative to grid in kilometers per day |
| V | Sea ice motion in Y-direction relative to grid in kilometers per day |
| Samples | Number of tracked ice features used to estimate sea ice motion in grid cell |
| Ccorr | Average cross-correlation coefficient for samples in grid cell |
| Wet\_uncertainty | Sea ice motion uncertainty estimate assuming grid cell consists entirely of ice with near-total liquid-water content |
| Dry\_uncertainty | Sea ice motion uncertainty estimate assuming grid cell consists entirely of ice with minimal liquid-water content |

References

Komarov, A. S., & Barber, D. G. (2013). Sea ice motion tracking from sequential dual-polarization RADARSAT-2 images. IEEE Transactions on Geoscience and Remote Sensing, 52(1), 121-136. <https://doi.org/10.1109/TGRS.2012.2236845>

Howell, S. E. L, Brady, M., & Komarov, A. S. (2022). Generating large-scale sea ice motion from Sentinel-1 and the RADARSAT Constellation Mission using the Environment and Climate Change Canada automated sea ice tracking system. The Cryosphere, 16(3), 1125-1139. <https://doi.org/10.5194/tc-16-1125-2022>