Introduction to the Radarsat Geophysical Processor System (RGPS)

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ASF

Outline

- Background
- Relevant terms
- Data sets
- Products
- Current status
- Future plans

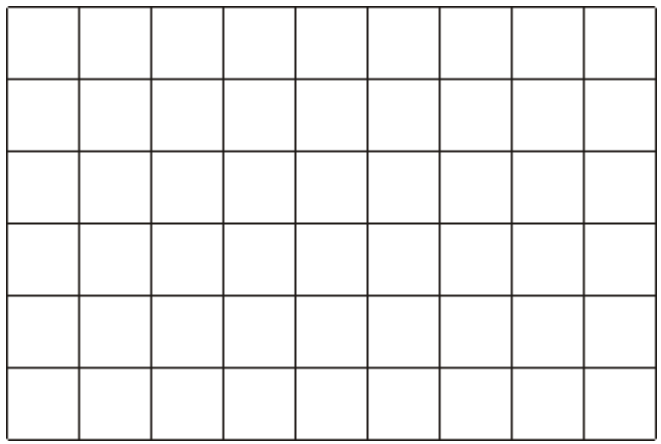
Background

- RGPS produces observations of *sea-ice motion*, *ice deformation* and *estimates of ice thickness* from sequential SAR imagery of the Arctic Ocean
- developed by Ron Kwok at the Jet Propulsion Laboratory (JPL)
- successor of the Geophysical Processor System (developed for ERS imagery)

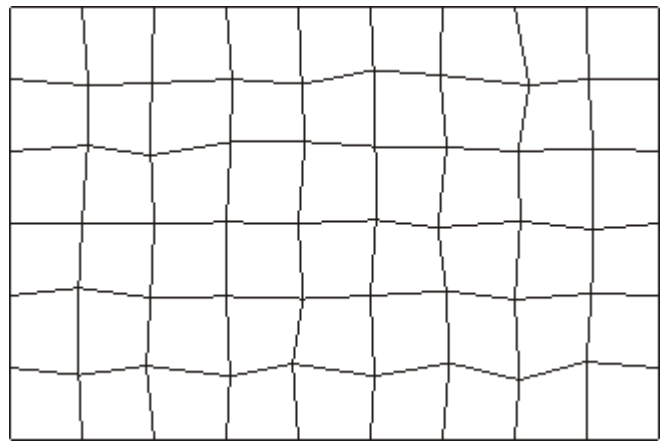
Background

- ASF RGPS team
  - Nettie LaBelle-Hamer: RGPS scientist (until recently)
  - Cliff Moore: Operator
  - Ed Barker: Operator
  - Rudi Gens: RGPS scientist

Relevant terms



- Eulerian data



- Lagrangian data

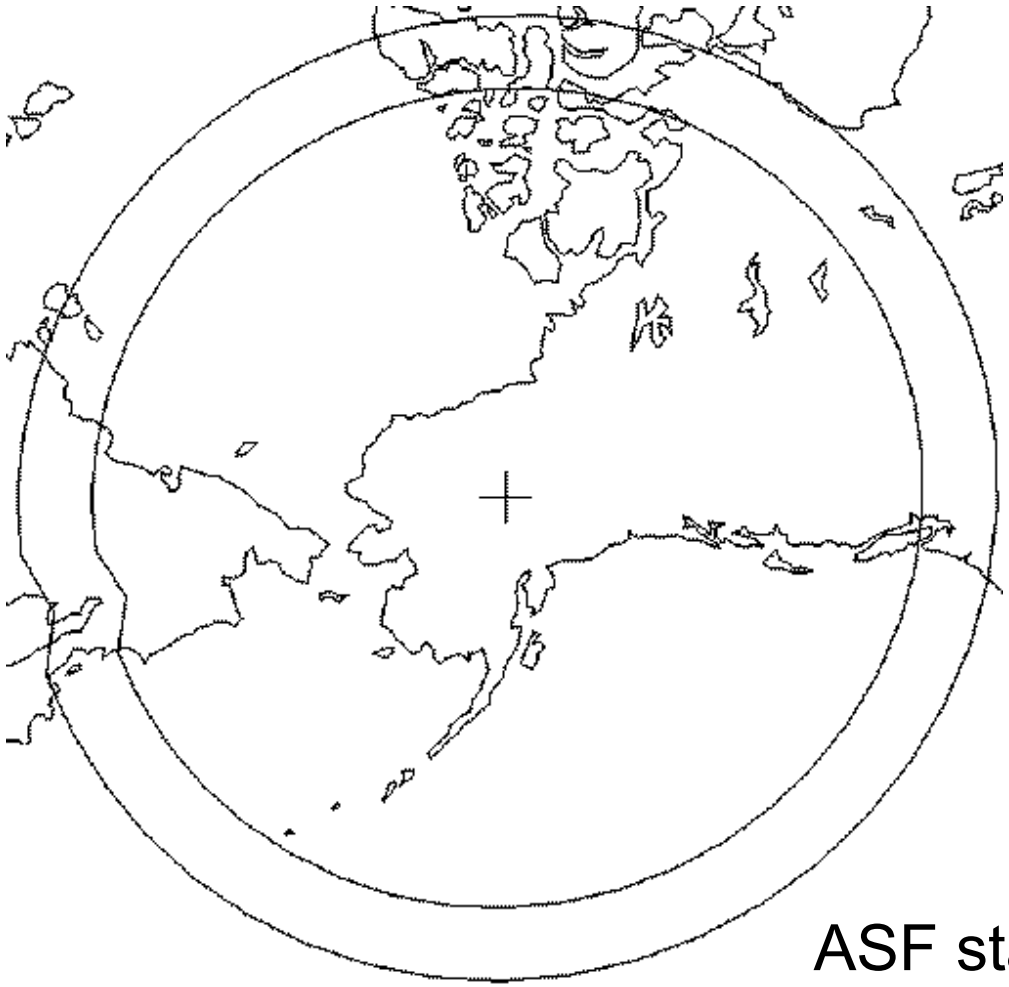
Relevant terms

- *snapshot* is the number of days it takes to cover a selected region using a collection of datatakes
- *stream* contains the trajectories of all grid points and time-varying cell attribute information defined on the image frames of an initial datatake
- *trajectory* is the path followed by a point

Data sets

- Radarsat ScanSAR Wide B
  - 100 meters resolution
  - acquired usually in 3-day cycles within ASF mask, 6-day cycles within Tromso mask
  - images in polar stereographic coordinates following the Special Sensor Microwave/Imager (SSM/I) standard (ordinate and abscissa of the grid defined by the 135°E and 45°E with a scale of 0.97 at the pole)

Data sets



ASF station mask

Products

- Lagrangian ice motion
- Ice deformation
- Backscatter histogram
- Age histogram
- Thickness histogram

Products

- divided in streams (processed independently)
- each stream is a set of trajectories (or cells) that are initialized with images from a single swath
- streams are largely non-overlapping
- small overlapping border region with usually four trajectories initialized at the same geographic locations

Products

- number of trajectories in each stream is highly variable
- initial spacing of points: 10 km
- initial spacing of coast line points: 25 km
- tracking error: 100 – 300 m

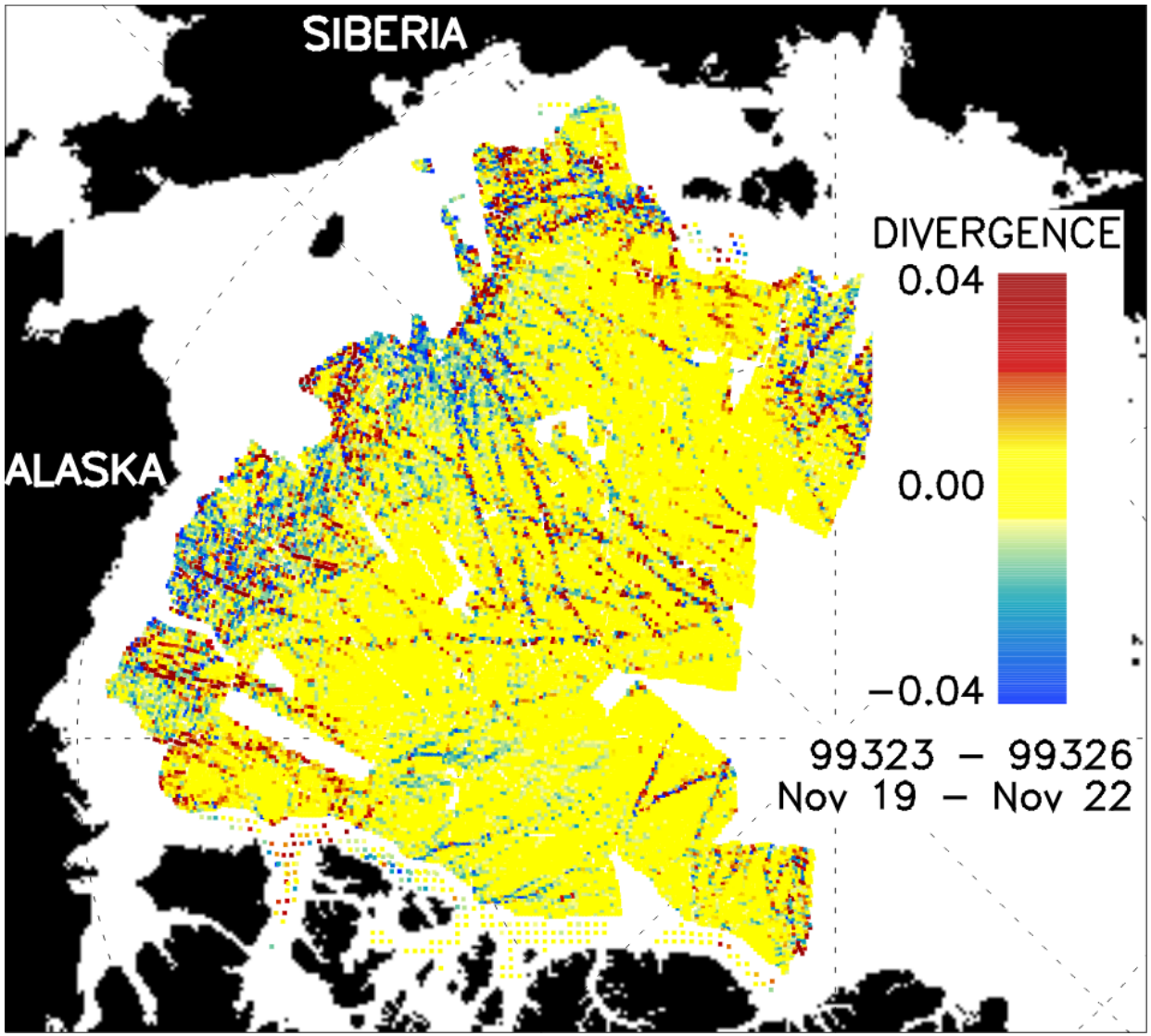
Stream definition

Lagrangian ice motion

- most fundamental product from which all other products are derived
- trajectories in each cycle are cumulative over the season
  - all trajectory information from previous cycles is retained in the product for the most recent cycle
- any trajectory that fails to obtain an observation for 21 days is no longer tracked

Ice deformation

- each cell contains multiple observations of area change and ice motion spatial derivatives
- divergence, shear and vorticity of displacement vector can be used to describe deformation more precisely



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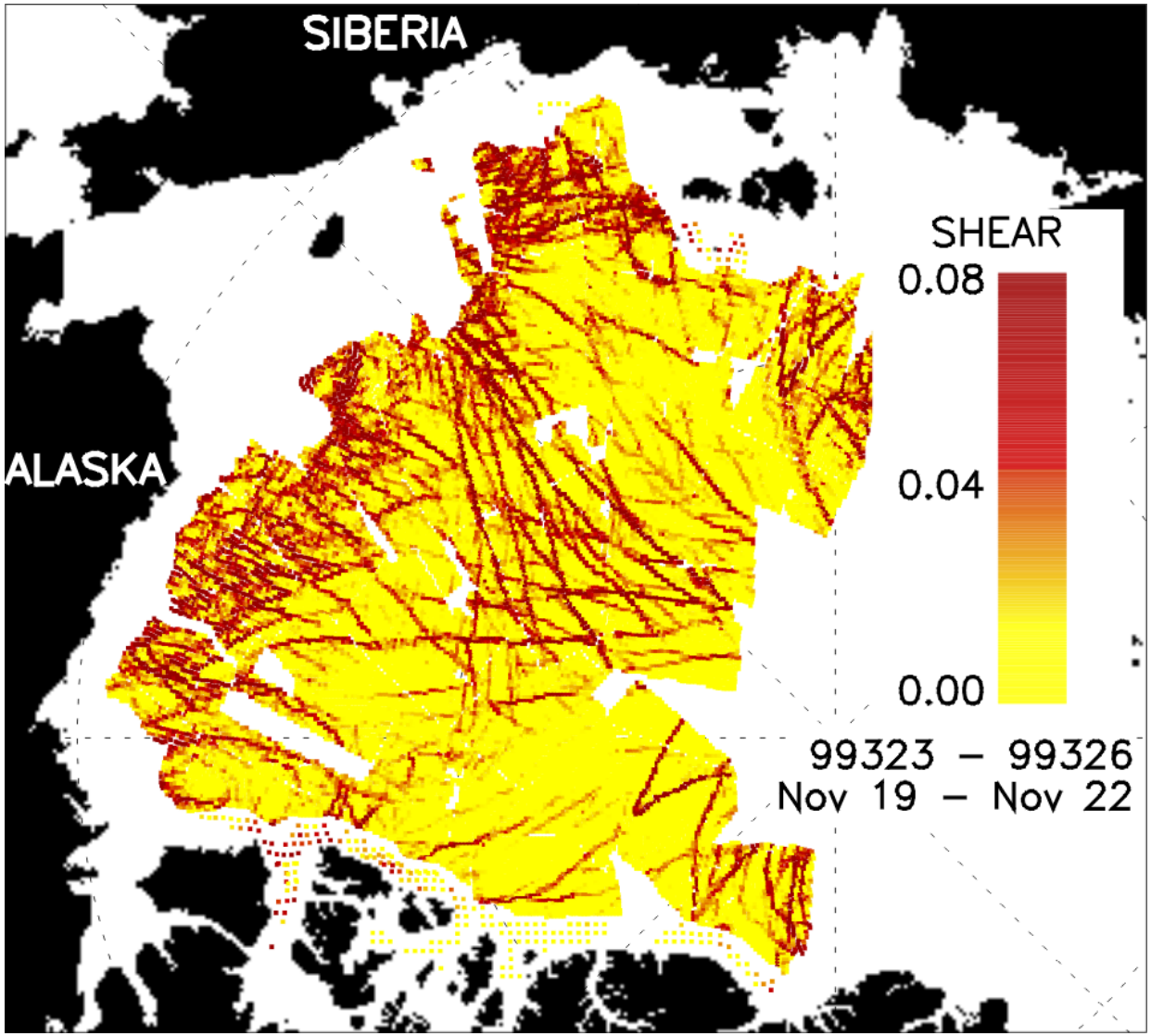
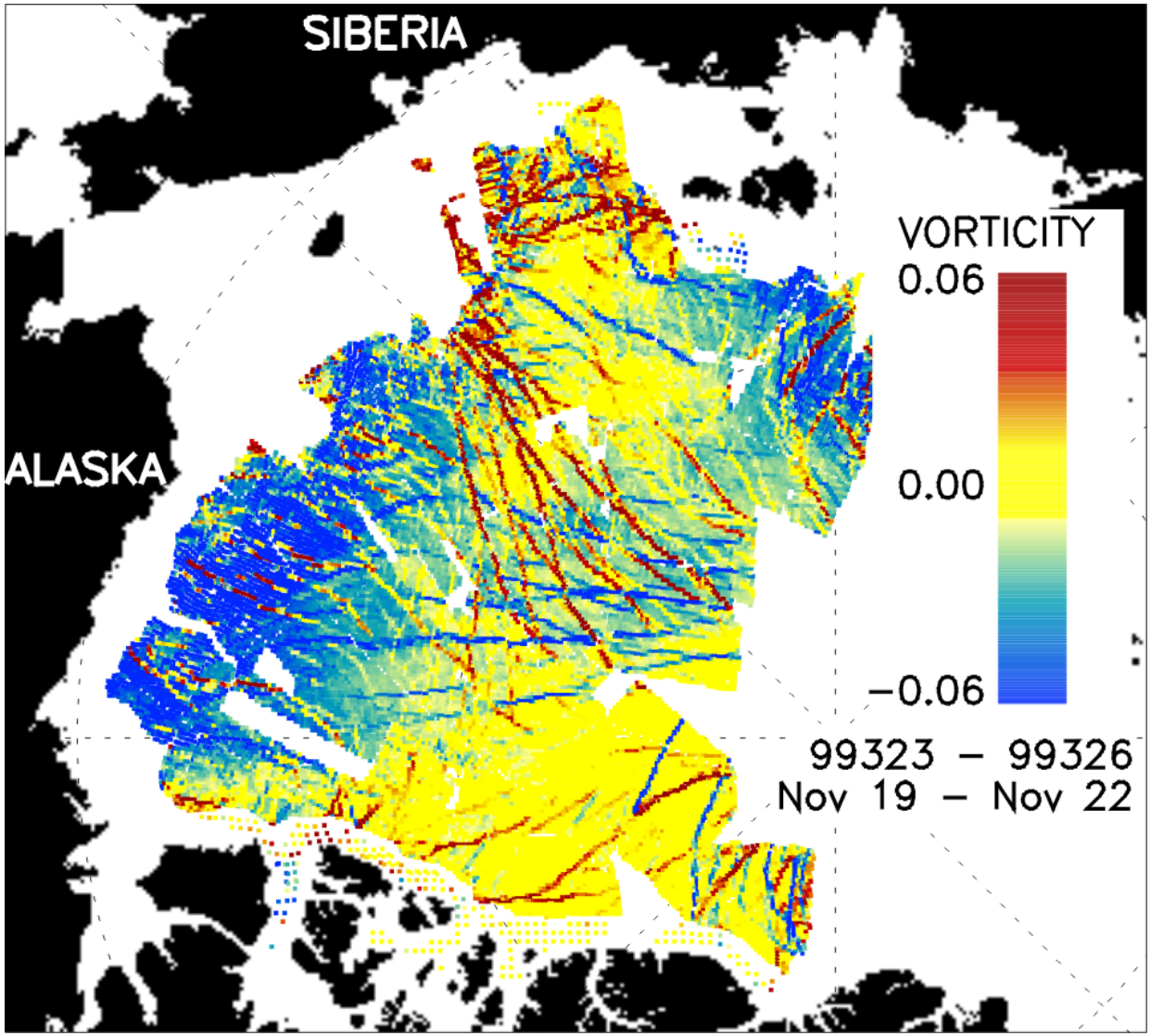

SIBERIA
ALASKA
SHEAR
0.08
0.04
0.00
99323 – 99326
Nov 19 – Nov 22



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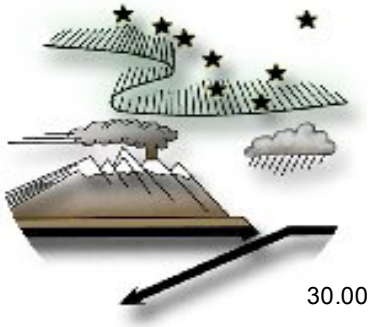
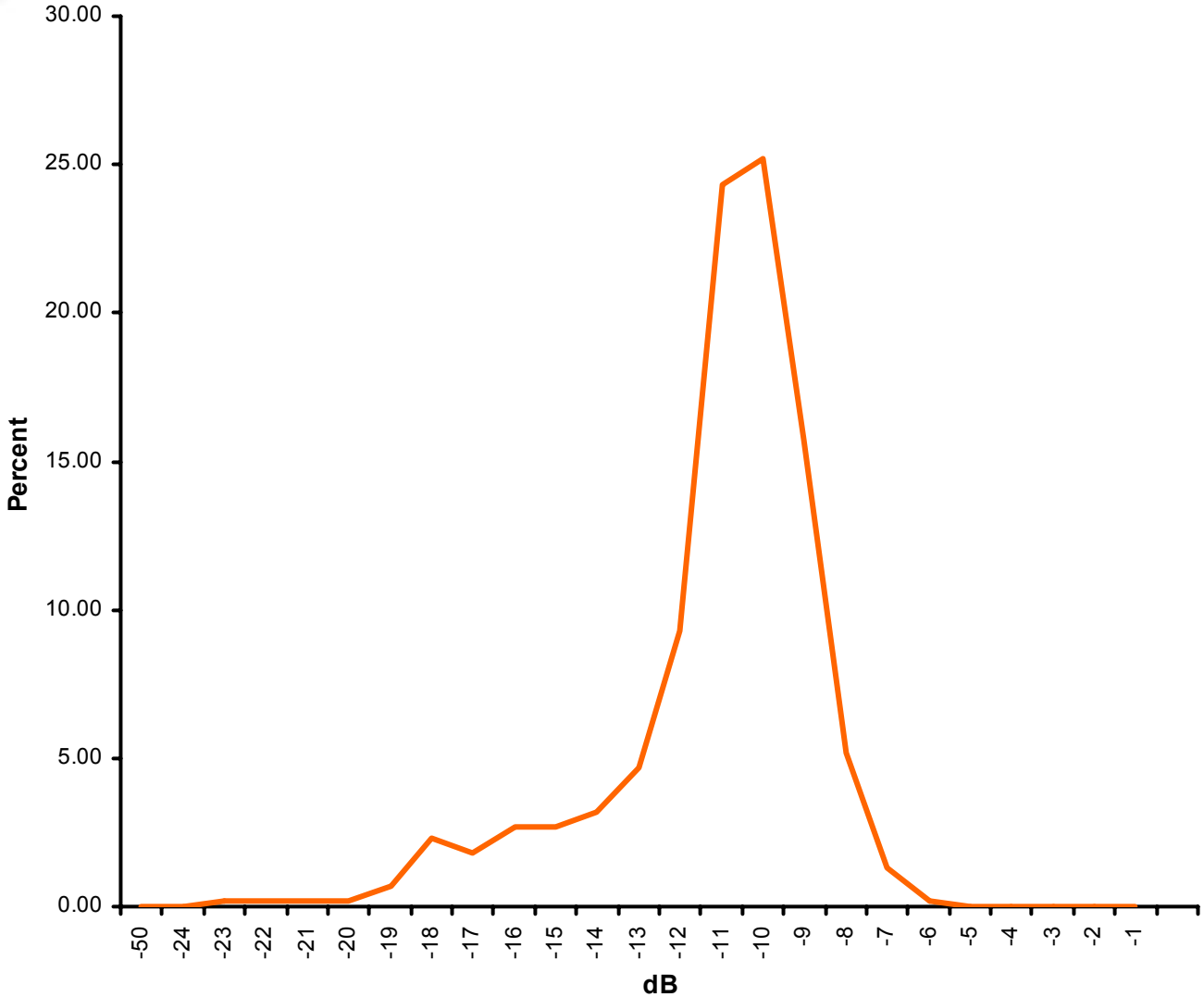
Backscatter histogram

- product contains the monthly observations of a backscatter histogram for a grid cell
- histogram consists of values for 25 backscatter ranges, each 1 dB wide
- backscatter is the basis for determining the open water, multiyear ice fractions and age products



Backscatter histogram



Ice age histogram

- product uses changes in the area of each cell to estimate the age of thin ice
- opening events create thin ice
- closing events remove thin ice and ridged ice is formed

Ice thickness histogram

- product reports the thickness of thin ice categories in 10 cm bins (number of bins depends on the thickest thin ice present)
- also reports the area fractions of first-year ice and multiyear ice

Ice thickness distribution

- derived using surface air temperatures
- two calculation methods
  - simple empirical relation between accumulated freezing-degree days and ice thickness
  - more complicated thermodynamic model (requires routine observation of atmospheric and oceanic parameters such as snow depth, snow surface temperature etc.)

Current status

- data processed
  - winter 97/98 (multiyear ice + seasonal ice zone)
  - winter 98/99 (multiyear ice + seasonal ice zone)
  - winter 99/00 (cycles 60-5 to 63-1)
- data acquired
  - about 2.5 years worth of data to be processed
  - acquisitions as long as Radarsat satellite is around
- increased interest in data set
  - 7 publications in Journal of Geophysical Research in the last couple of months

Future plans

- visualization and analysis tool
  - handle binary product files
  - display imagery with attribute overlays
  - animation of time series
  - data subset definition
  - export of RGPS products into user friendly formats
- processing enhancements

Questions

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