Sea Ice Extent Classification using Active/Passive Microwave Measurements from QuikSCAT

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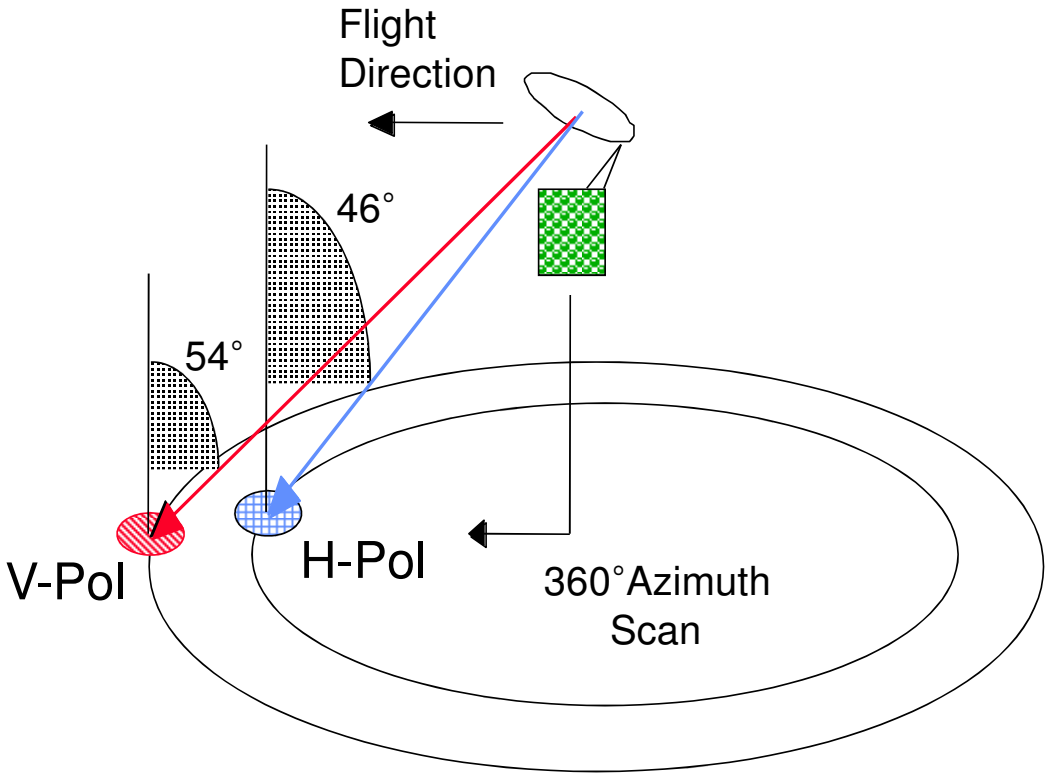
Objective

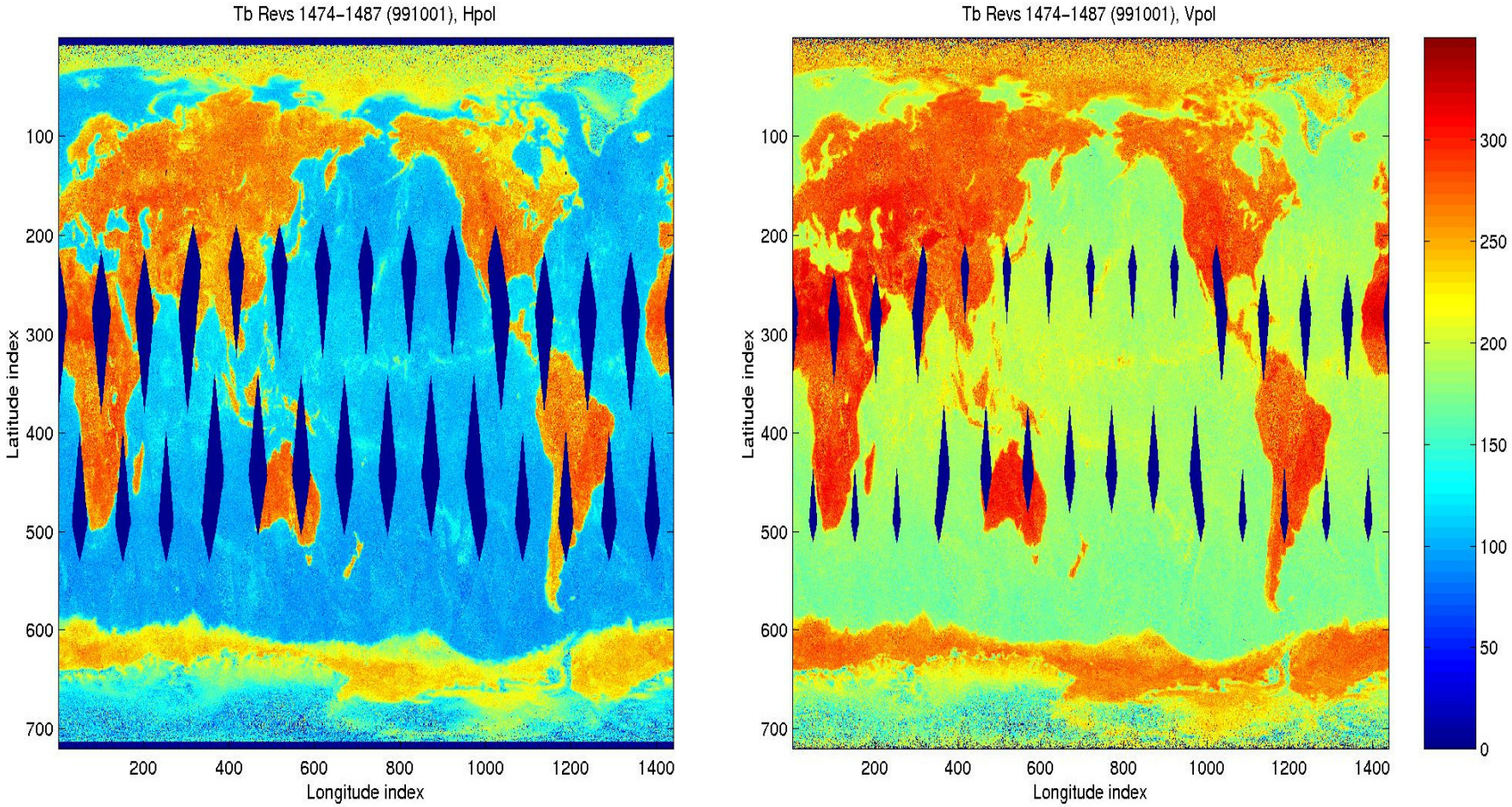
- Measure the sea-ice extent using radar backscatter and radiometric brightness temperatures from QuikSCAT.
  - Develop sea-ice classification algorithm using neural network.
- Evaluate performance by comparison with surface truth from National Snow and Ice Data Center (NSIDC).

Seawinds on QuikScat



Seawinds Geometry

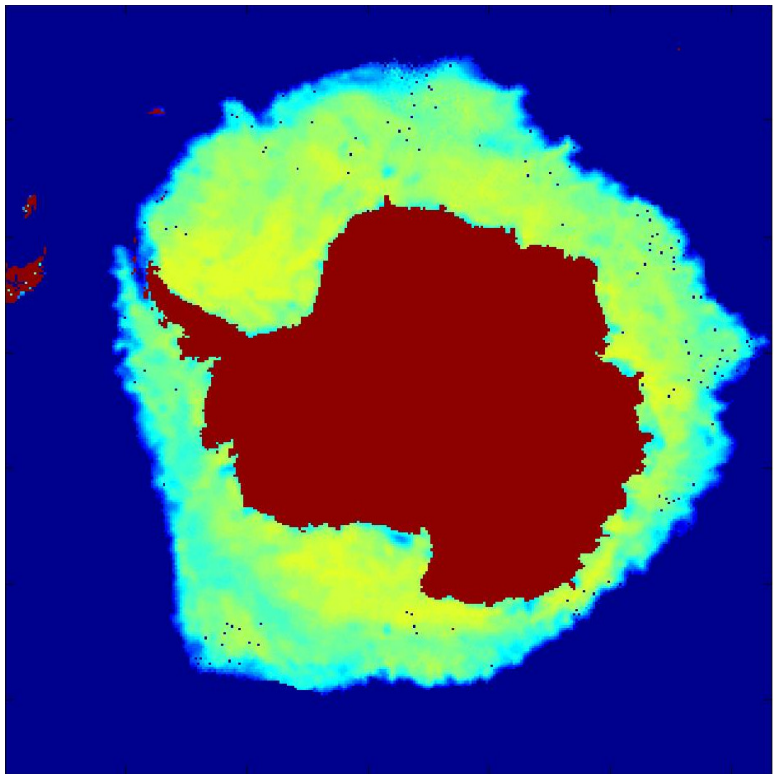
QRad T_b


Tb Revs 1474–1487 (991001), Hpol
Tb Revs 1474–1487 (991001), Vpol
Latitude index
Longitude index
100
200
300
400
500
600
700
200
400
600
800
1000
1200
1400
300
250
200
150
100
50
0

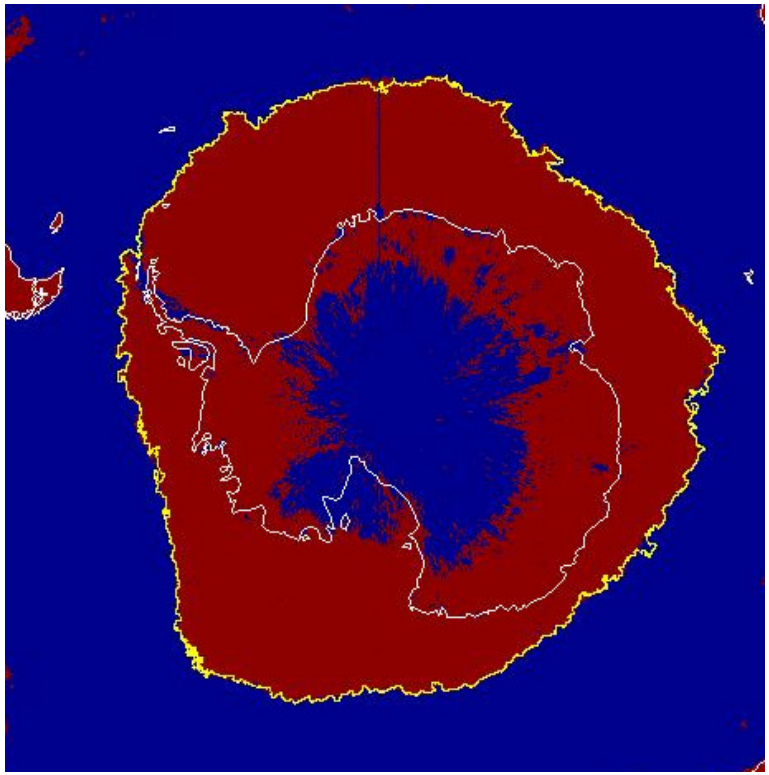
Antarctic Region Surface Truth

- NSIDC Sea-Ice Concentration is compared with high resolution (5 - 8 km) sigma-0 imagery produced by Scatterometer Image Reconstruction with Filtering (SIRF) algorithm (Long, BYU).
- SIRF Sea-Ice edge corresponds to approximately 20% concentration.

Antarctic Region on Oct. 01, 1999



NSIDC Sea-Ice Concentration

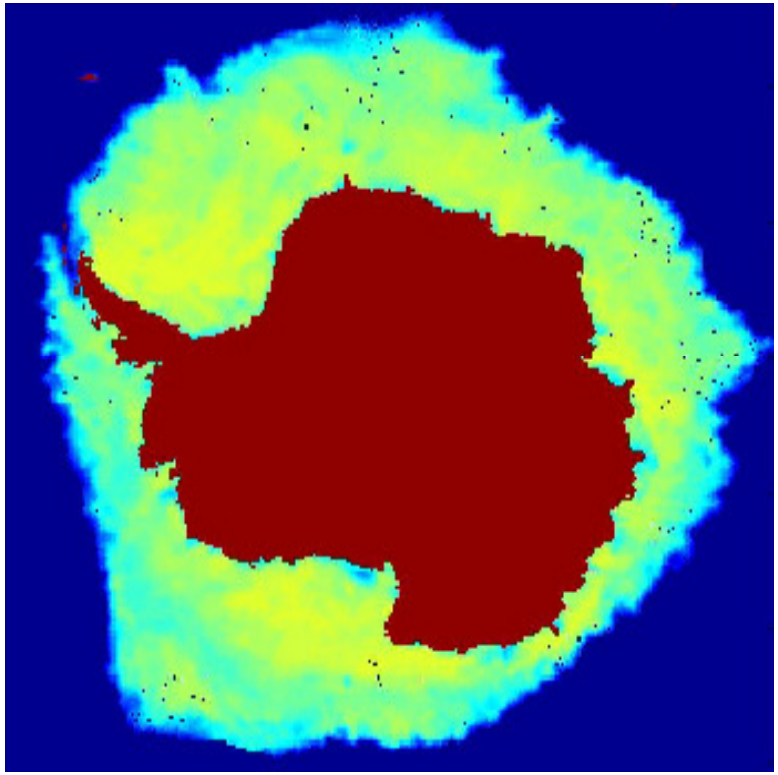


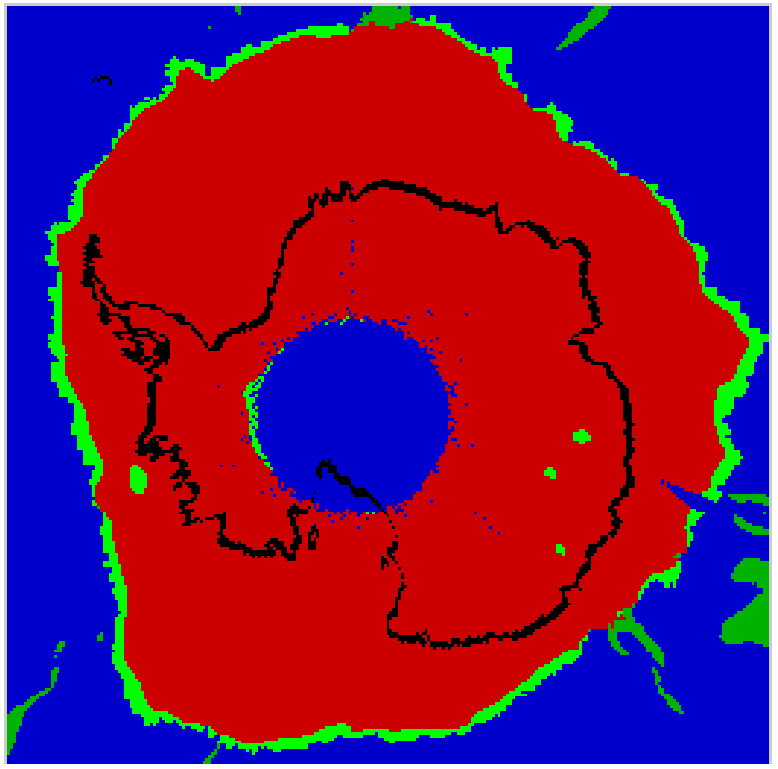
QuikScat SIRF
(5-8 km resolution)

Neural Network

- A multilayer perceptron neural network is trained to classify sea-ice and ocean.
  - Case-1: multi-look (forward & aft) and co-polarization (V & H-pol) sigma-0's.
  - Case-2: multi-look and co-polarization sigma-0's and dual-pol T_b's.

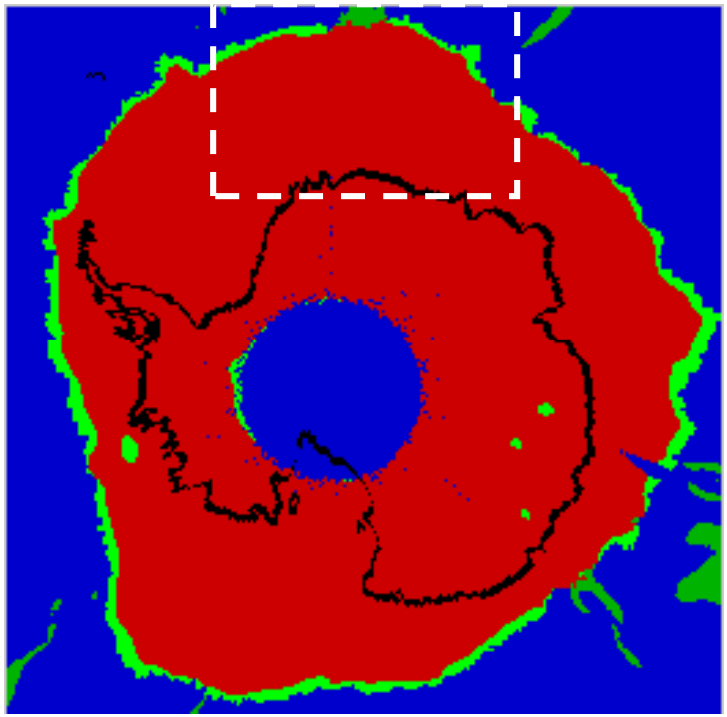
Antarctic Sea-Ice Extent on Oct. 1, 1999



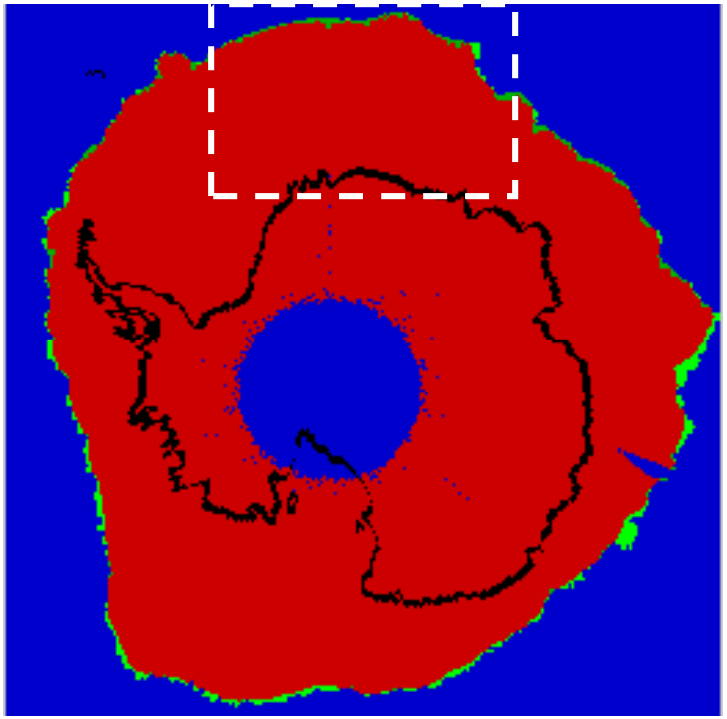


Case-1 : Sigma-0 alone

Neural Net Classification



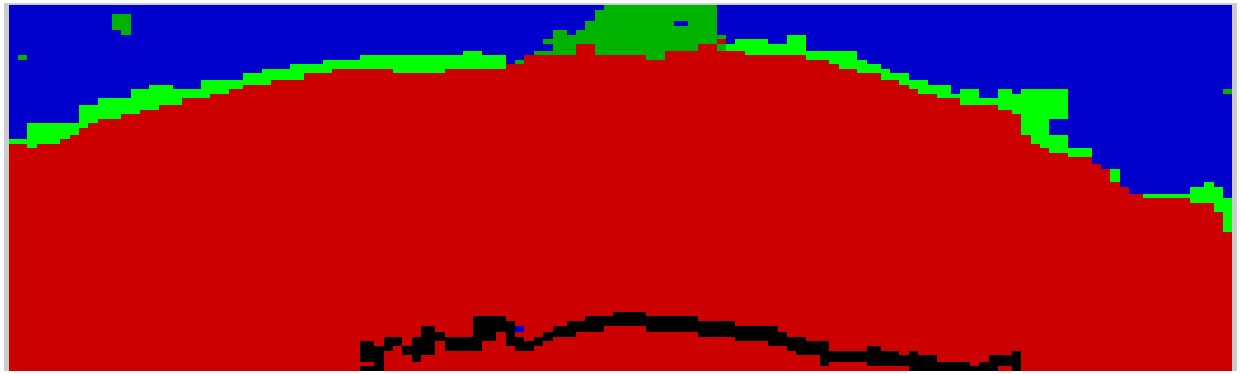
Case-1 : Passive only



Case-2 : Passive/Active

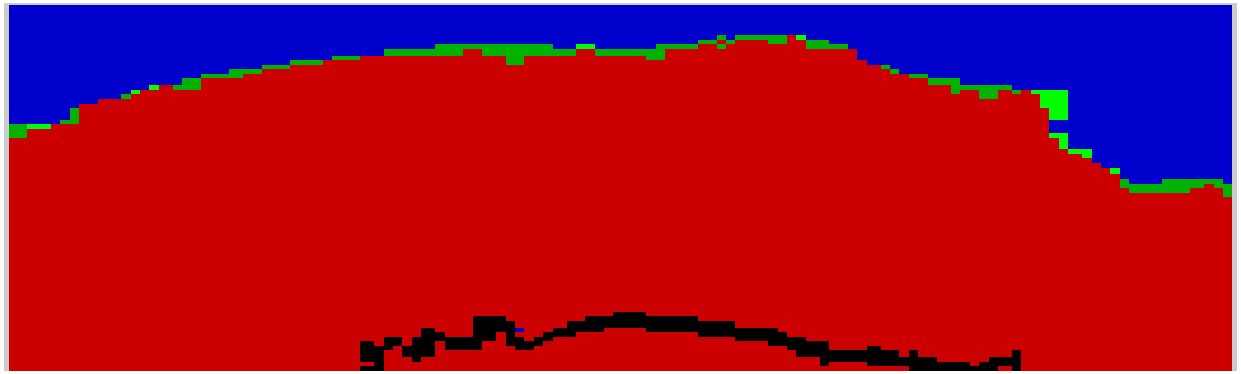
- Correct ice classification
- Missed ice classification
- False ice classification
- Correct ocean or no data

Zoomed Image



Case-1:

Passive Only



Case-2:

Passive/Active

- Correct ice classification
- False ice classification
- Missed ice classification
- Correct ocean or no data

NN performance

- The resulting sea-ice classification and their resulting classifications accuracy (%) are tabulated below.

NN/Surface truth	Ice	Ocean
Ice	59.8%	3.3%
Ocean	3.0%	33.9%

Case-1: Passive Only

NN/Surface truth	Ice	Ocean
Ice	64.9%	1.2%
Ocean	0.5%	33.4%

Case-2: Passive/Active

Conclusion

- Sea ice extent can be inferred using a Neural Network Classifier.
  - Best performance when both sigma-0 and T_b are used.
  - Improved approach for sea-ice flagging.
    - based solely on QuikSCAT data.
    - better collocation than NSIDC weekly ice product.