

# COMPARISON OF CFAR ALGORITHMS FOR DETECTION OF ICEBERGS IN SAR IMAGERY



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## Introduction

- C-band SAR is widely used for iceberg detection
- Studies indicate that L-band may be better suited under certain conditions.
- A comparison of performance of iceberg detection is important for operational monitoring.

## Objectives

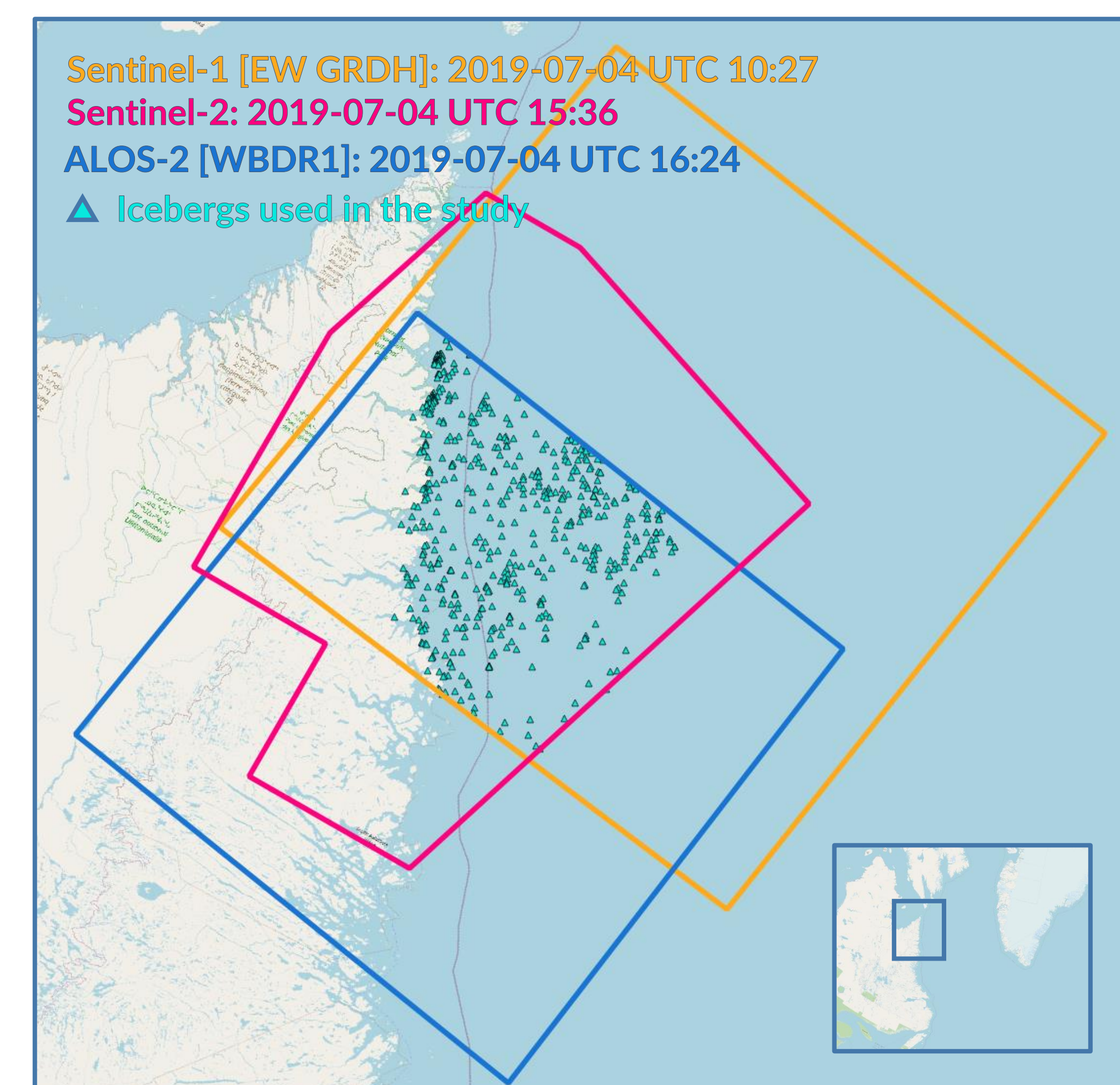
- Compare various detection algorithms on both L- and C-band data
- Calculate the detection accuracy
- Investigate the sensitivity of tuning the algorithms to a desired false alarm rate (PFA)
- Compare the execution times

## Data

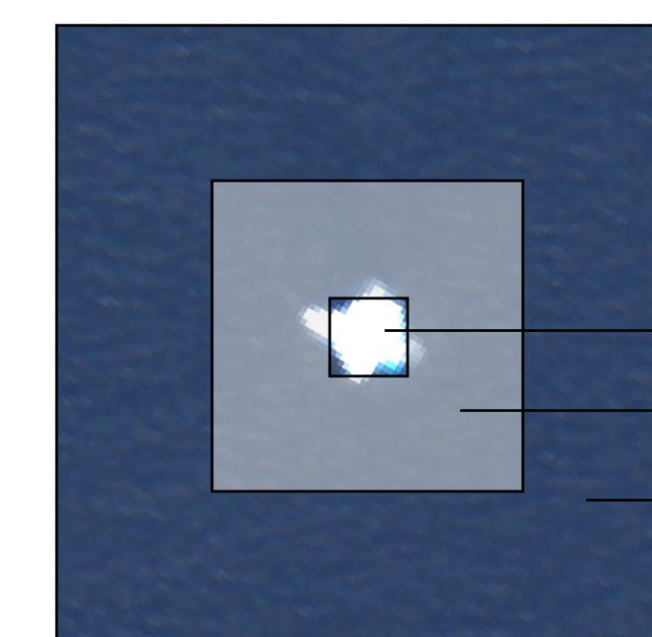
- 2 dual-pol SAR images (HH/HV)
  - Sentinel-1 [EW GRDH] C-band
  - ALOS [WBDR1] L-band
- 1 optical Sentinel-2 image
- 230 manually verified icebergs

## Methods

- Use optical data to get validated iceberg locations
- Manually account for the drift between acquisitions
- Apply different CFAR detection algorithms
- Calculate the precision, recall, and F-score as a function of false alarm rate
- Measure execution times



Study Area. 230 icebergs were identified in overlapping satellite images outside the coast of Labrador, Canada.



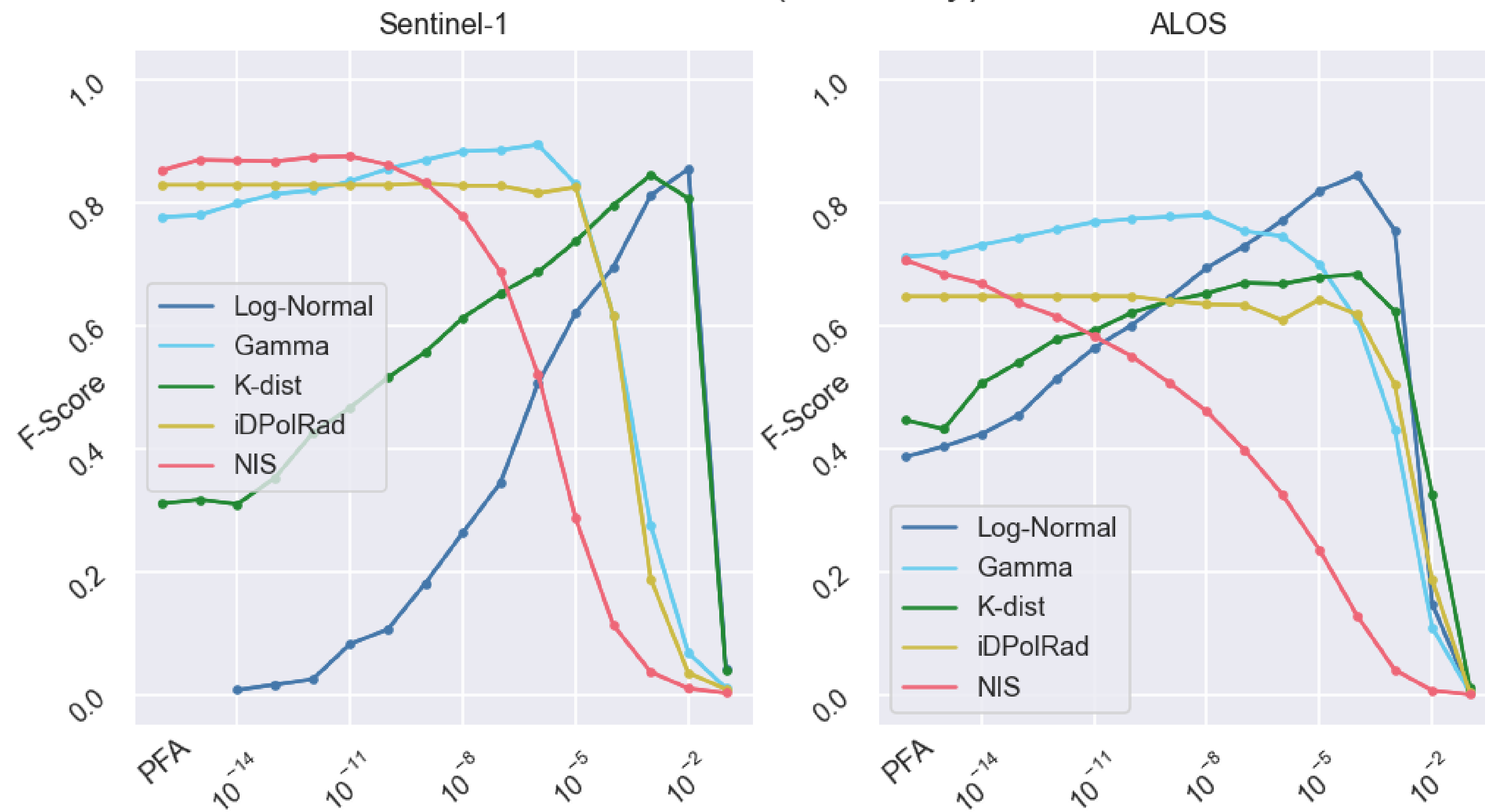
CFAR window design. The iceberg mask is 360x360 meters, and the background mask 520x520 meters

Execution times of the different algorithms.

Algorithm	Run time (1000x1000 px)	Run time (entire S1EW scene)
LogNormal	222 [ms]	39.8 [s]
Gamma	177 [ms]	15.9 [s]
K-Distribution	4241 [ms]	25.6 [minutes]
iDPolRad	4372 [ms]	8.5 [minutes]
NIS	229 [ms]	28.6 [s]

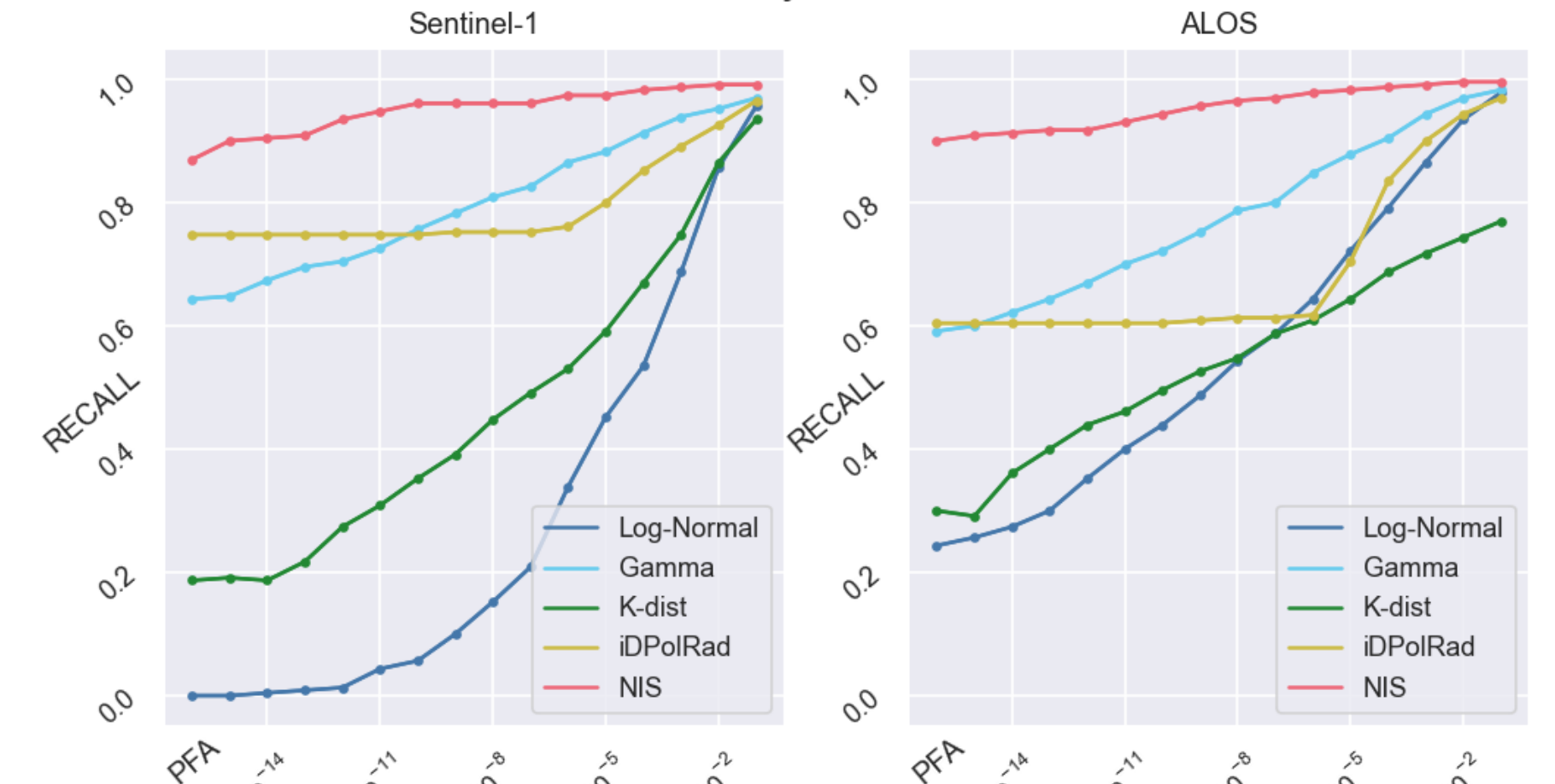
## Results

### F Score (Accuracy)



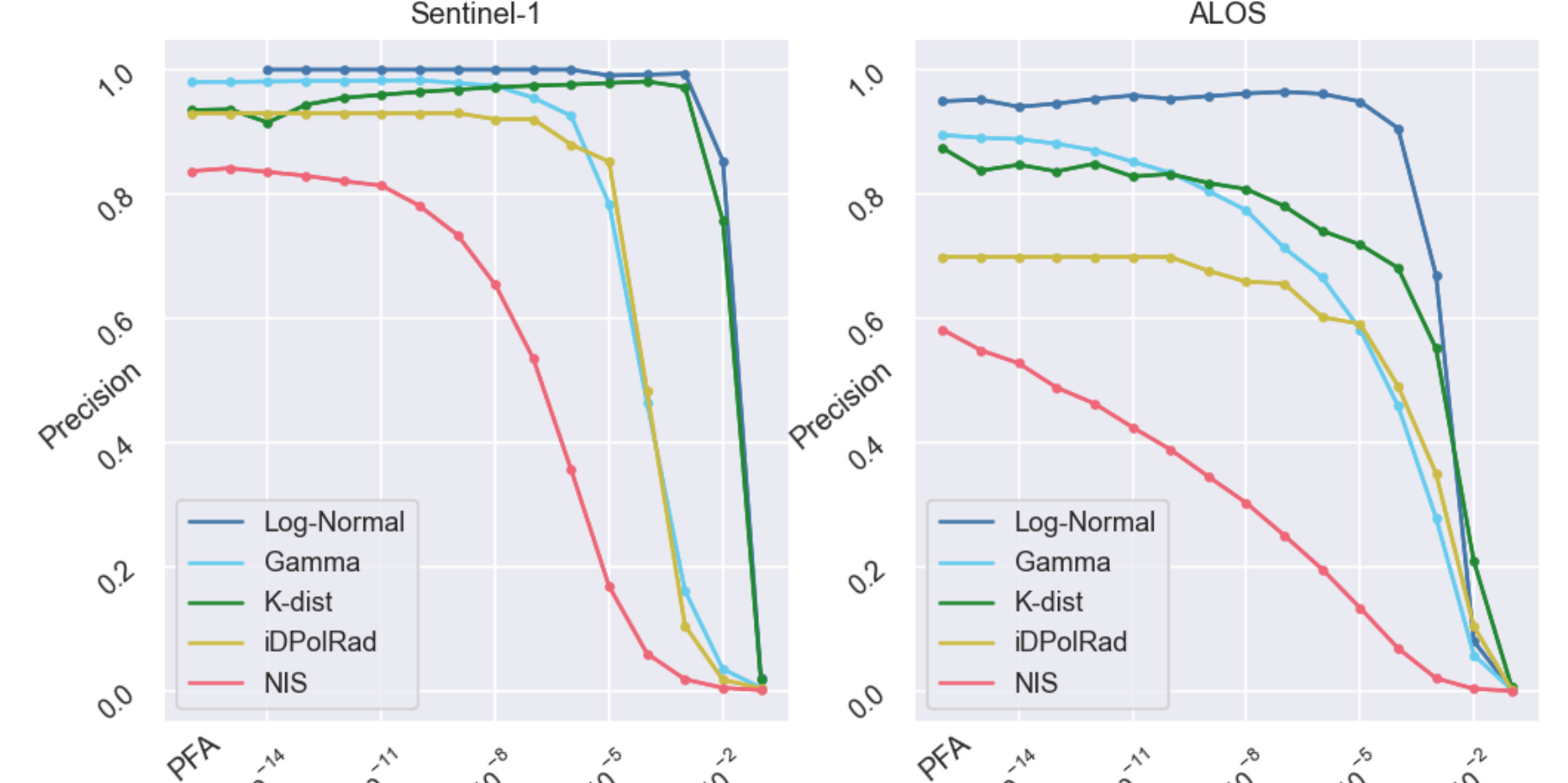
F-Score as a function of different PFA-levels for the different filters

### Probability of Detection



Recall as a function of different PFA-levels for the different filters

### Probability of detection being true



Precision as a function of different PFA-levels for the different filters

## Conclusion

- L-band gives overall slightly lower accuracy
  - But other results suggests that L-band is less sensitive to high wind
- At C-band, the gamma detector gives the highest accuracy
- At L-band, the Log-Normal detector gives the highest accuracy
- This indicates that sea clutter distributions differ between C- and L-band
- K-distribution CFAR is significantly slower than the alternatives