



Iceberg and floating sea ice characterisation in the Yung Sund fjord, Greenland, by means of optical and radar data observation

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► To cite this version:

Stephane Guillaso, Michel Gay, Cedric Gervaise, Carole Nahum. Iceberg and floating sea ice characterisation in the Yung Sund fjord, Greenland, by means of optical and radar data observation. EGU 2017 - European Geosciences Union General Assembly, Apr 2017, Vienne, Austria. hal-01535487

HAL Id: hal-01535487

<https://hal.science/hal-01535487>

Submitted on 20 Jun 2017

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MOTIVATIONS

This study concerns the observation, detection, ranging and tracking of icebergs and floating sea ice. Indeed, they represent a risk for maritime transport and need to be monitored. We focus our study on the Yung Sund fjord, Greenland where lot of icebergs and sea ice are generated during the break off. In beginning of July, sea ice is breaking first followed by iceberg created by the different glaciers having their base on the ocean, that are drifting very fast.

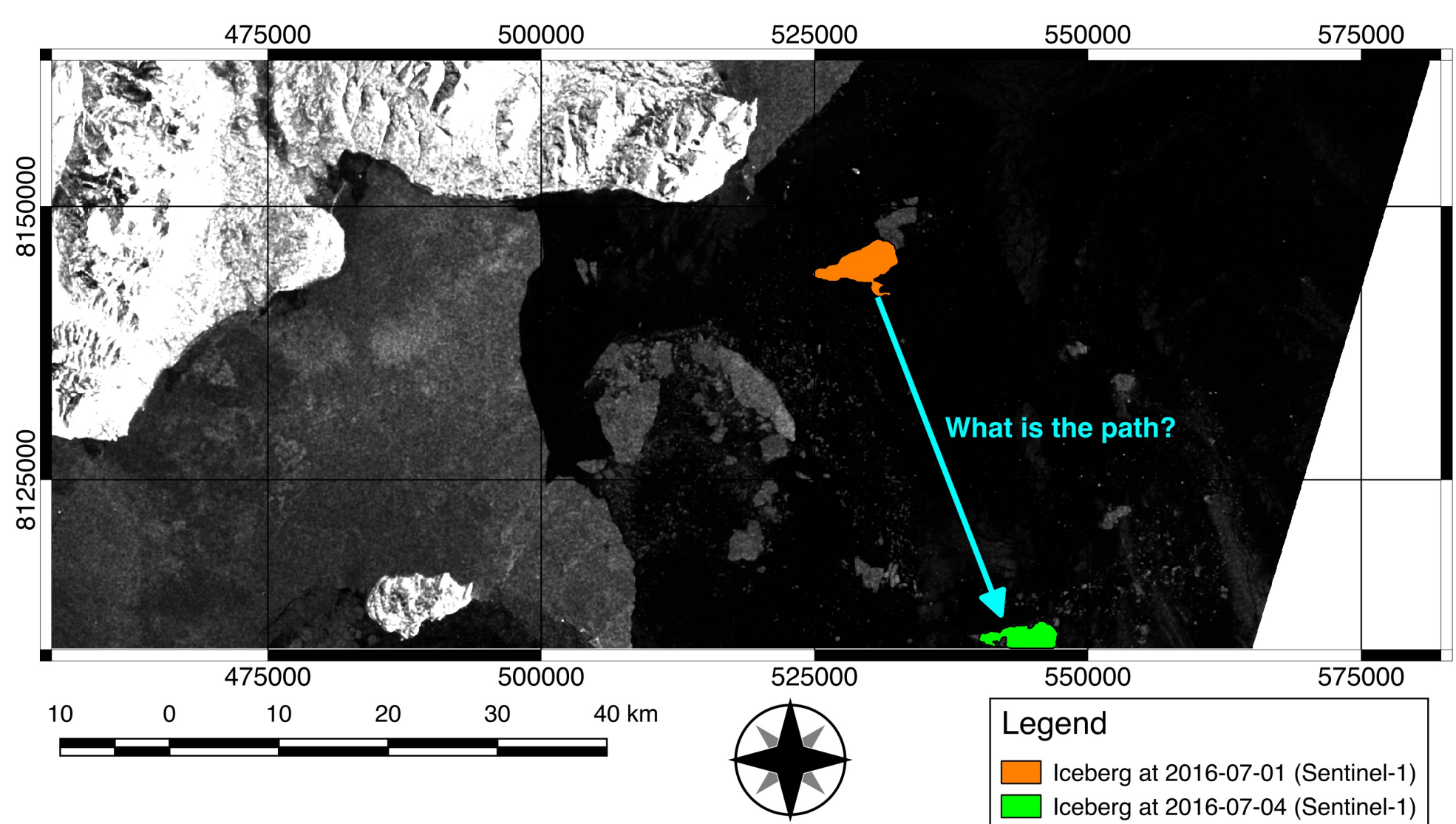


Figure 1: Displacement between 4 days.

To achieve our goal, we combine optical and radar remote sensed data in a common framework which consists in segmenting input data using a watershed transformation.

(PRE)PROCESSING

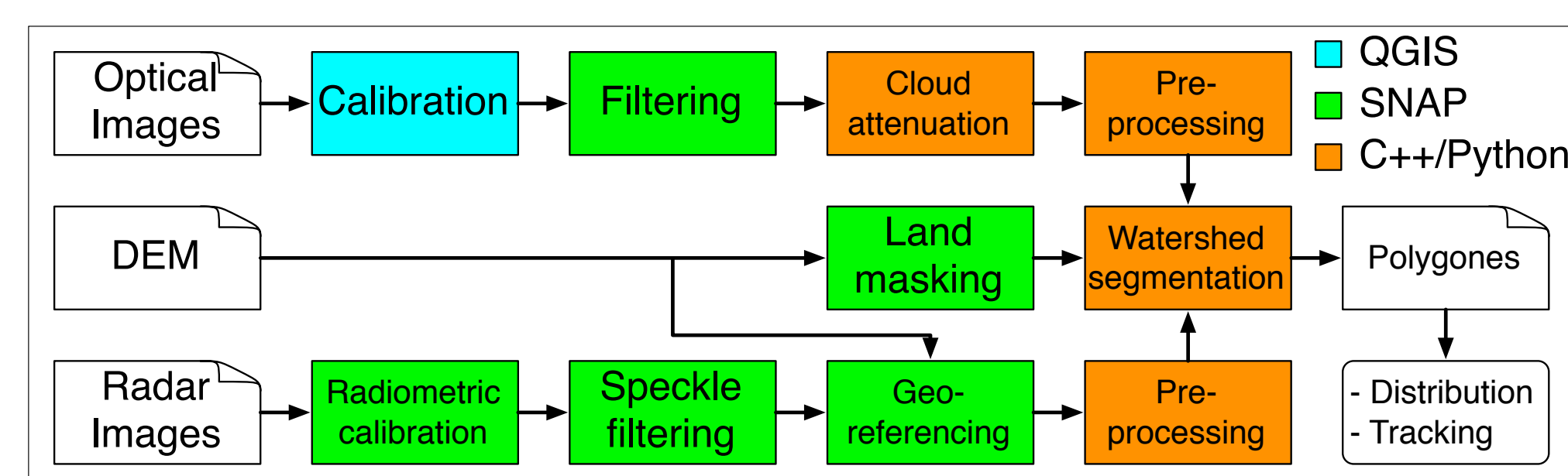


Figure 2: Processing chain.

Optical images:

- **Calibration:** Get the reflectance
- **Filtering:** Remove image noise
- **Cloud attenuation:** Increase ice radiometry level

Radar images:

- **Calibration:** Apply radiometric calibration
- **Filtering:** Remove speckle effect
- **Geocoding:** Resample image in a geographic coordinate system

TEST SITE

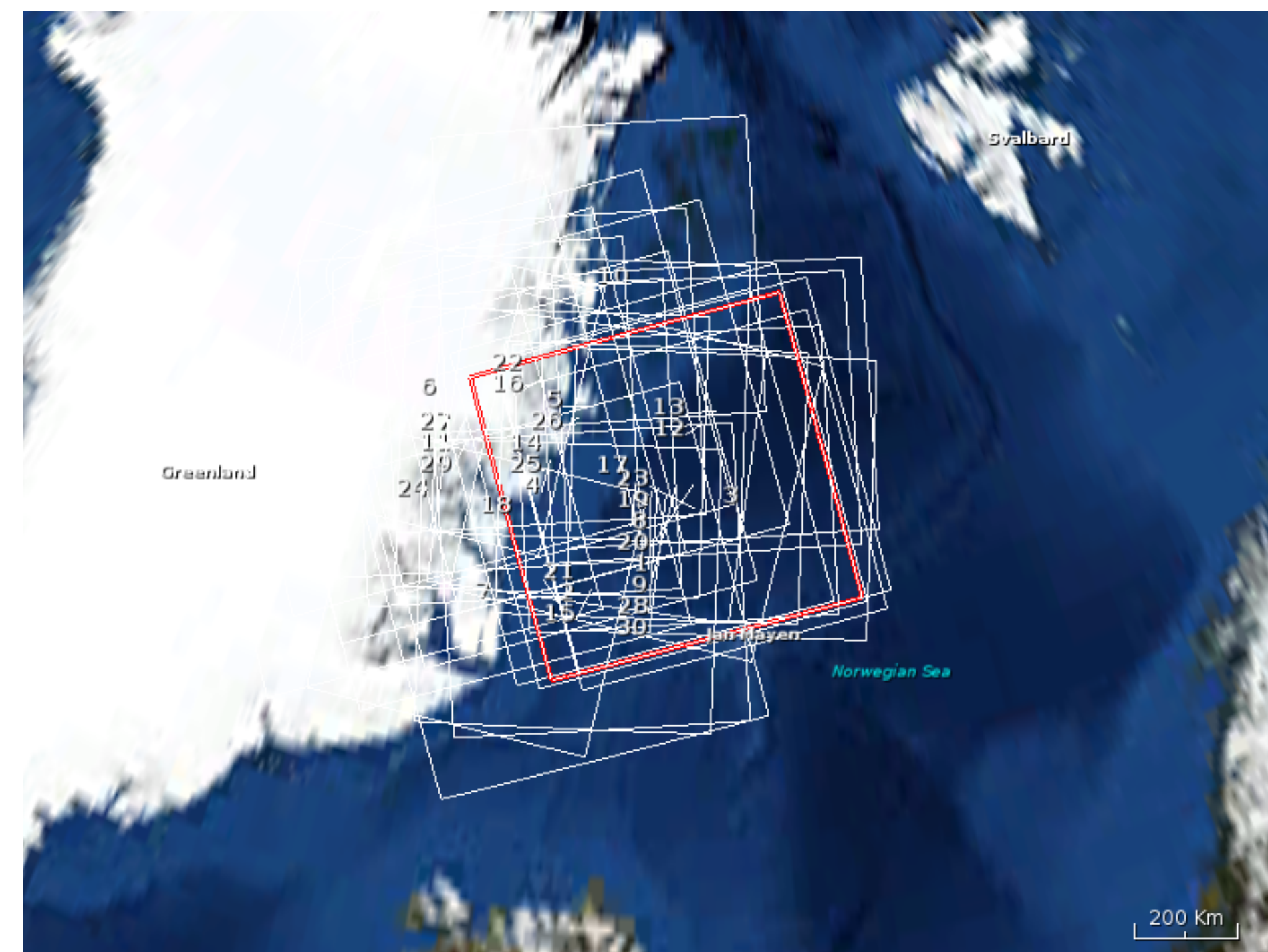


Figure 3: Zackenberg Test Site

The Yung Sund fjord (74°18N, 10°15W) is located in a natural park of the North-East of the Greenland. This fjord is covered by ice between 9 to 10 mth/yr and we can observe open water from 15th July until 15th September. Biological and physical knowledges for this site offer an unique opportunity to study climate change impact on Actic ecosystems.

For the proposed study, we used a combination of 10 Sentinel-1, 4 Sentinel-2 and 2 Landsat-8 images, acquired between 30th June 2016 and 19th July 2016.

WATERSHED PROCESSING

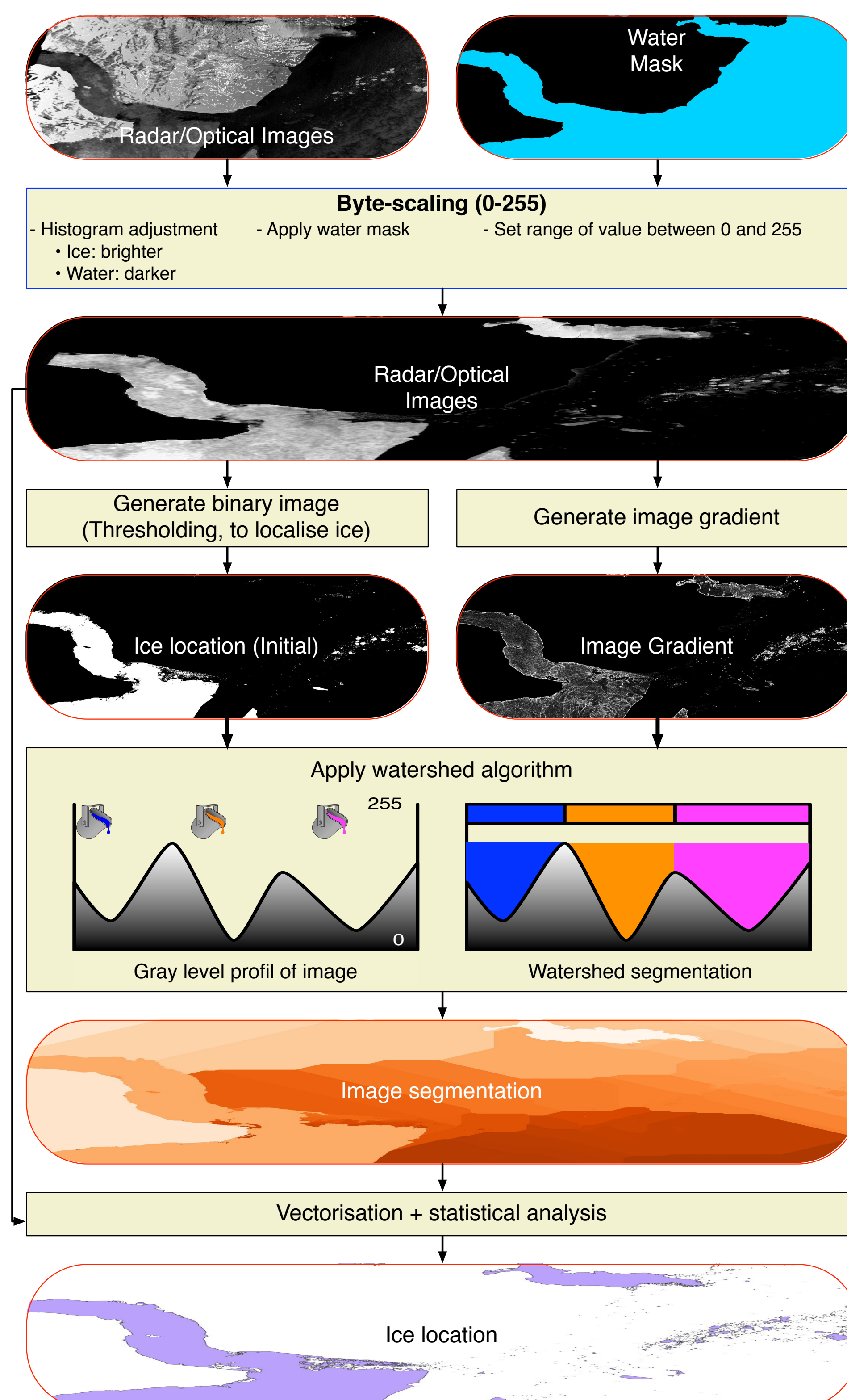


Figure 5: Watershed approach

PRELIMINARY RESULTS

Detection

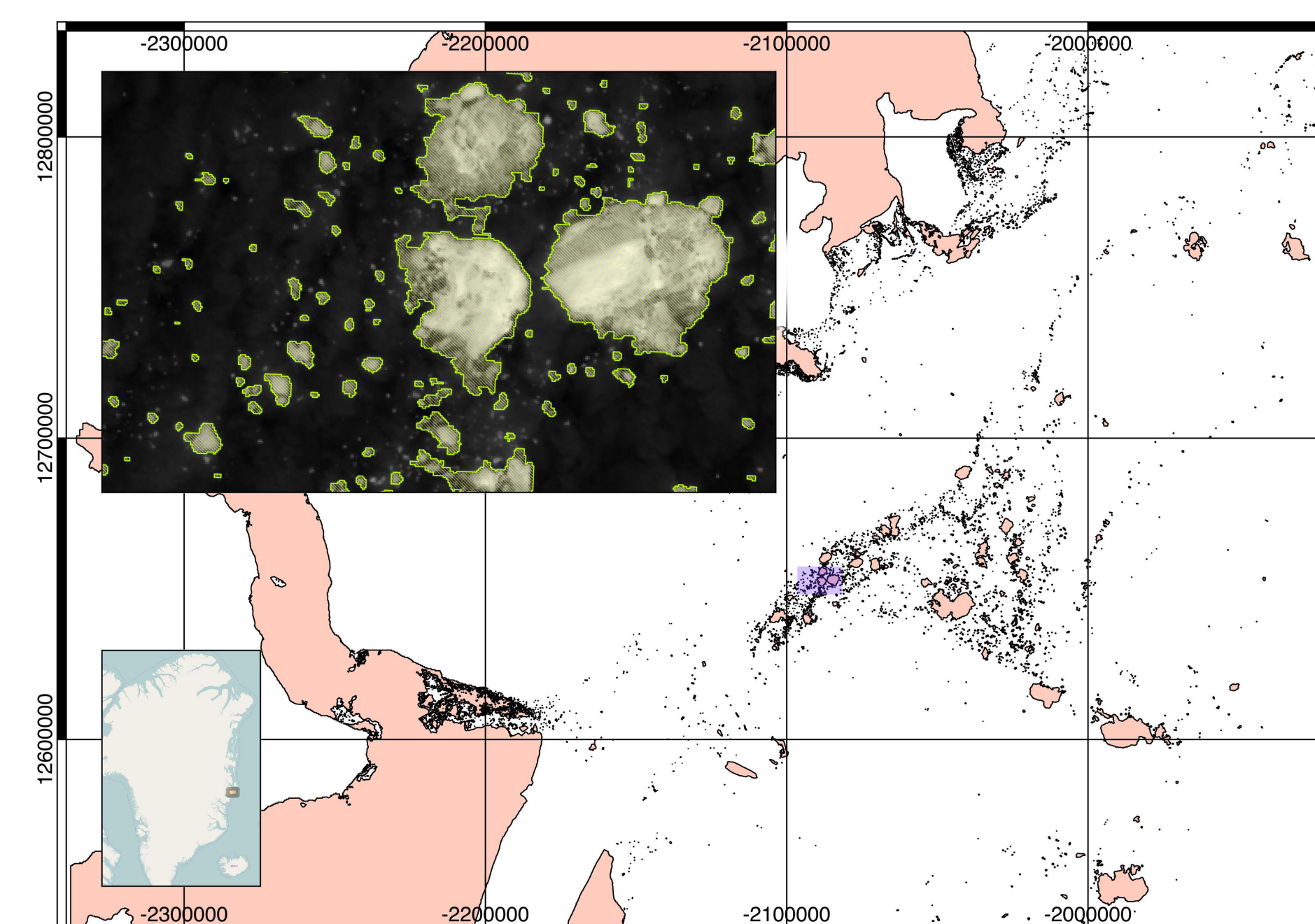


Figure 6: Iceberg/Floating ice detection

Tracking

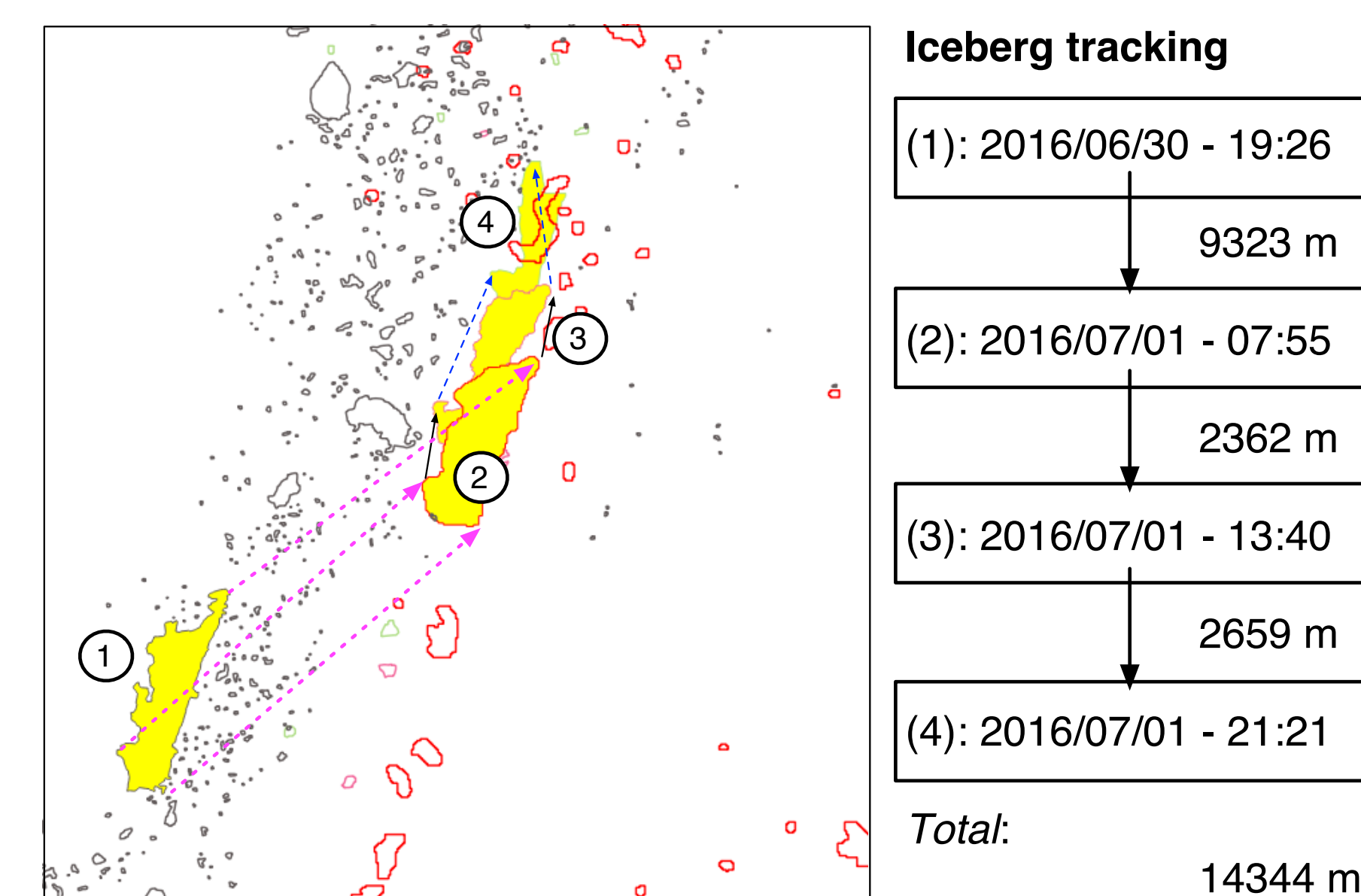


Figure 7: Manual iceberg tracking

CLOUD ATTENUATION

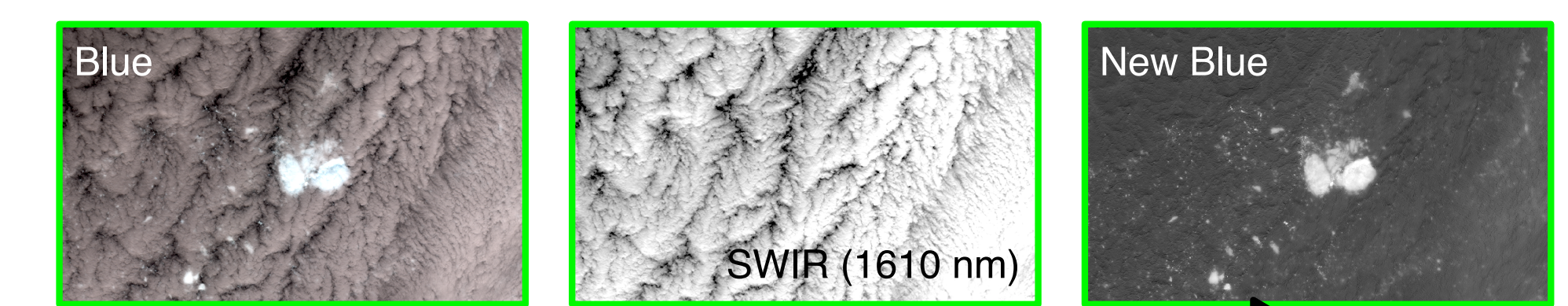


Figure 4: Cloud attenuation

- Band SWIR is insensible to ice reflection
- Is used to estimate the cloud part in visible band (here blue)
- The following formula is applied (at first approximation):

$$\hat{RT}_{vis} = \frac{RT_{vis} - RT_{swir}}{1 - RT_{swir}}$$

CONCLUSION / Future work

- Iceberg and floating ice detection and tracking using optical and radar imagery;
- Watershed segmentation;
- Cloud influence reduction on optical imagery;
- Independent of the image resolution;
- *Improve the input labeling (watershed)*
- *Automatize the iceberg/floating ice tracking*

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ACKNOWLEDGEMENT

The authors acknowledges the support of the French Agence Nationale de la Recherche (ANR), under grant ANR-15-ASTR-0025 (project GAAP), financed by DGA.

The authors would like to thank ESA and United States Geological Survey (USGS) for providing Sentinel 1/2 and Landsat-8 images respectively at free of cost.