

# ArcticScope User Manual

## A Sea Ice SAR Image Visualizer & Annotation Tool

## 1. Introduction

ArcticScope is a Windows desktop application designed to help users review and correct model predictions on Synthetic Aperture Radar (SAR) imagery of sea ice.

The application allows you to:

- View SAR images in **HH** and **HV** polarization bands, with options for colour composite views (**HH, HH, HV**) and (**HH, HV, HV**)
- Adjust image **brightness**, **contrast**, and **prediction overlay opacity**
- Run a **prediction model** on the image
- Draw **polygon annotations** to highlight regions where the model prediction is incorrect
- Can handle both **Earth** and **sensor geometry**
- **Note: The current model should be used with amplitude images, not dB images**

This tool is intended for analysts, researchers, and annotators working with sea ice SAR data.

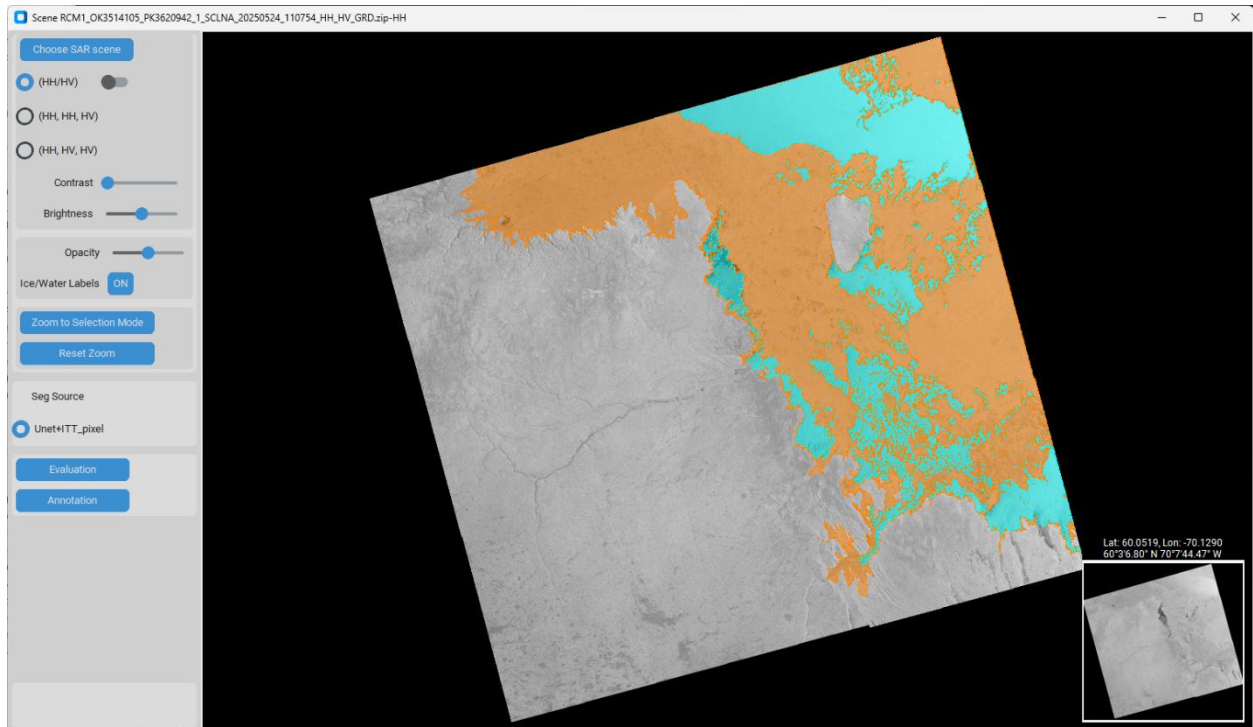


Figure 1. Overview of app with sample scene

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## 2. System Requirements

- Operating System: **Windows 10 or Windows 11**
  - No Python installation required (application runs as a standalone executable)
  - Recommended screen resolution: **1920 × 1080 or higher**
  - Recommended memory: **32 GB or higher**
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## 3. Launching the Application

1. Locate the application executable (.exe) file.
2. Double-click the file to launch the application.
3. The main viewer window will open after a brief loading period.

If the application does not start:

- Ensure the .exe file is fully extracted (not inside a compressed folder).
- Make sure required files are present in the application directory (\_internal folder).

 _internal	2026-02-11 1:14 PM	File folder
 ArcticScope	2026-02-11 1:14 PM	Application

*Figure 2. Application directory file and folder*

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## 4. Main Interface Overview

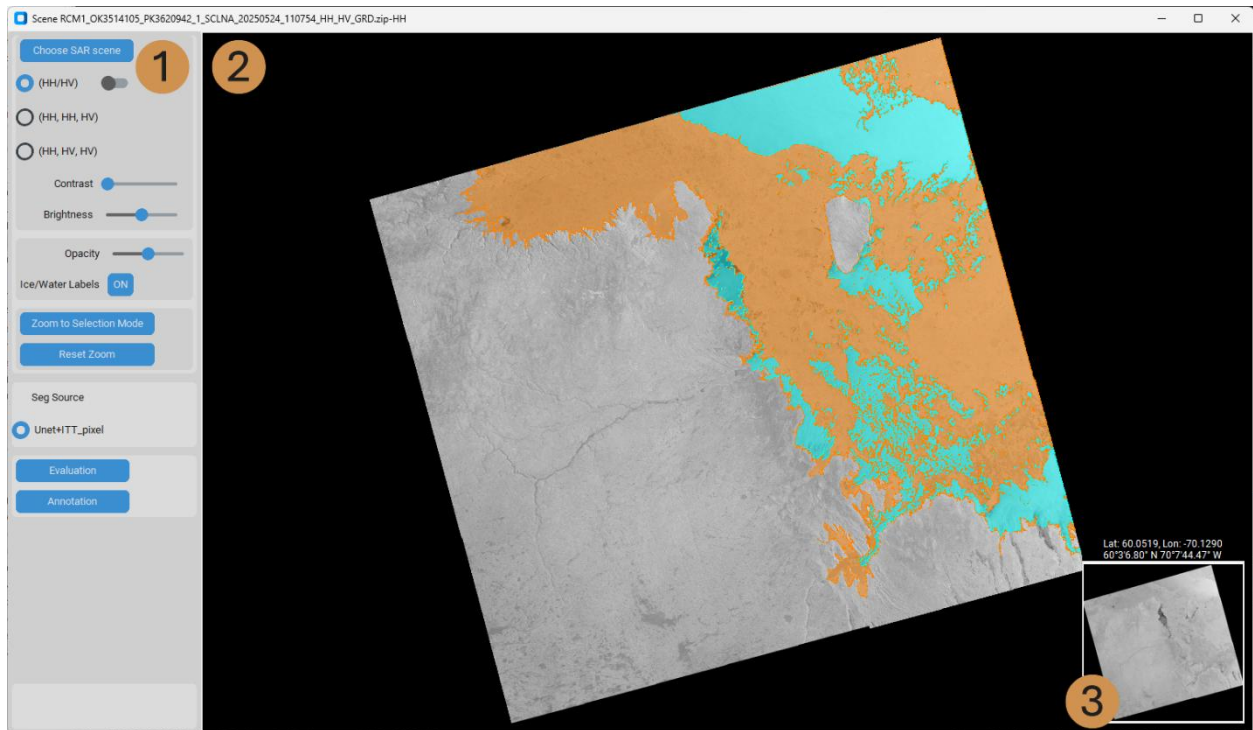


Figure 3. Labeled sections of app

The application interface consists of the following main areas:

### 4.1 Control Panel

Contains following controls:

- Choose SAR scene button (choose a folder path containing a SAR scene)
- Image band / colour composite selection
  - (HH/HV) switching enabled by slider on the right of the button (slider on left displays HH, slider on right displays HV)
  - (HH, HH, HV)
  - (HH, HV, HV)
- Contrast slider
- Brightness slider
- Opacity slider
- Ice/Water Labels toggle button (ON to show overlay, OFF to hide overlay)

- Zoom Buttons
  - Zoom to Selection Mode button (select to enter zoom selection mode)
  - Reset Zoom button (select to reset zoom to fit window)
- Seg Source selection (list of predictions, custom annotation)
- Evaluation button (opens evaluation panel)
- Annotation button (opens annotation panel)
- Progress bar (bottom left, shows up when performing long computations such as running models)

## 4.2 Image Display Area

- Displays the SAR image
- Shows the prediction overlay on top of the image
- Supports zooming and panning
- When annotation panel is opened, supports polygon drawing, labeling and unsupervised local segmentation for annotation purposes

## 4.3 Minimap

Displays:

- Current view area on the full image
- Latitude and longitude in decimal and DMS notation based on mouse hover location on image
- Areas that have been annotated (shown as white on minimap)

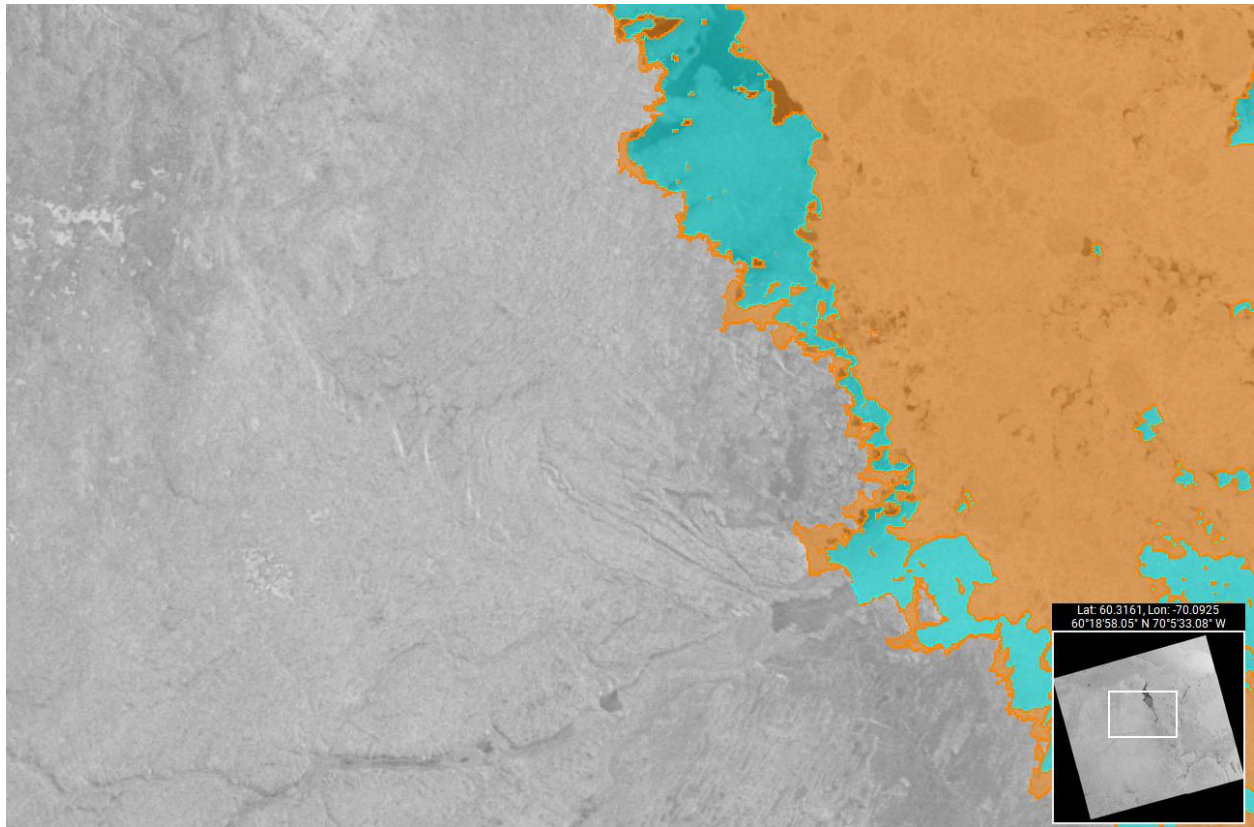


Figure 4. Image zoomed in, zoomed in area shown in minimap

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## 5. Loading a SAR Image

1. Open the application or locate the **Choose SAR Scene** button and select it.
2. Select the folder with SAR image information. **Note: The current model should be used with amplitude images and not dB images**
3. The image will be displayed in the main view.
4. The model prediction will be generated automatically.
5. If there are existing annotations for the scene, the previous annotations and notes will be loaded as well

Required files in image folder:

- .img/.tif
- .xml

- Example shown below:






 license	2026-01-30 3:45 PM	Microsoft Edge PDF Document
 product	2026-01-30 3:45 PM	Microsoft Edge HTML Document
 RCM2	.. 2026-01-30 3:45 PM	Text Document
 sigma_s1r_dB_none_none_reproj	2026-01-30 3:45 PM	Disc Image File
 sigma_s1r_dB_none_none_reproj_preview	2026-01-30 3:45 PM	JPG File

Figure 5. Example of contents in a valid scene folder

## 6. Switching Between Bands/Colour Composites

1. Locate the **radio buttons** below Choose SAR Scene.
2. Choose either:
  - (HH/HV)
    - If toggle is to the left: **HH shown** (horizontal transmit / horizontal receive)
    - If toggle is to the right: **HV shown** (horizontal transmit / vertical receive)
  - (HH, HH, HV)
  - (HH, HV, HV)
3. The image updates immediately to reflect the selected band/colour composite.

Note: The prediction overlay remains unchanged. The minimap will update to reflect the image.

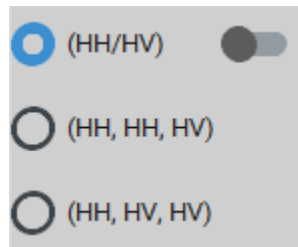


Figure 6. Band / colour composite selections

## 7. Adjusting Image Appearance

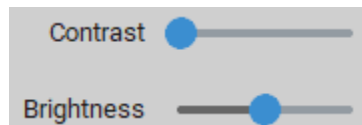
### 7.1 Contrast

- Use the **Contrast** slider to stretch or compress pixel intensity distribution.
- Right clicking the slider will reset the contrast to the original image.

### 7.2 Brightness

- Use the **Brightness** slider to make the image lighter or darker.
- Right clicking the slider will reset the brightness to the original image.

Adjustments apply to the SAR image and do **not** modify the prediction map.



*Figure 7. Contrast and brightness sliders at default positions*

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## 8. Prediction Overlay Controls

### 8.1 Overlay Visibility

- The prediction overlay is drawn on top of the SAR image.
- The overlay highlights areas identified by the model.
  - Orange: Ice
  - Blue: Water
  - Unlabeled area: land/nan
- Completely hide overlay, turn Ice/Water Labels OFF, to show overlay, turn ON

### 8.2 Overlay Opacity

1. Locate the **Opacity** slider.
2. Move the slider to:
  - Increase opacity → overlay becomes more visible
  - Decrease opacity → underlying SAR image becomes clearer

- **Note: Prediction boundaries not affected by moving opacity slider**

Adjust opacity to compare model output with the original image.



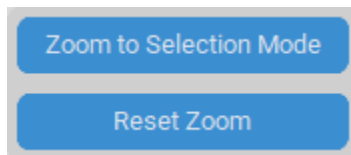
*Figure 8. Overlay controls*

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## 9. Zooming and Panning

### 9.1 Zoom

- Use the mouse wheel or zoom controls to zoom in and out.
- Zooming allows precise inspection of small features.
- Zoom controls include:
  - Zooming to a selected area using the Zoom to Selection Mode button.
    - Once selected, draw a rectangle on the image to the area you wish to zoom to.
  - Resetting the zoom to fit the view window using the Reset Zoom button.



*Figure 9. Zoom controls*

### 9.2 Pan

- Click and drag the image to move across the scene.
- Panning works at any zoom level.

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## 10. Choose Segmentation Source

- Select which prediction overlay to view.



- Custom annotation appears under this section when created.

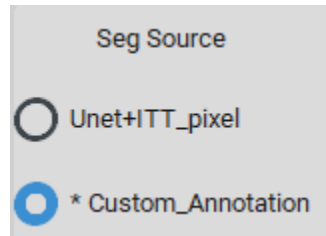


Figure 10. Prediction overlay choices

## 11. Annotating Panel

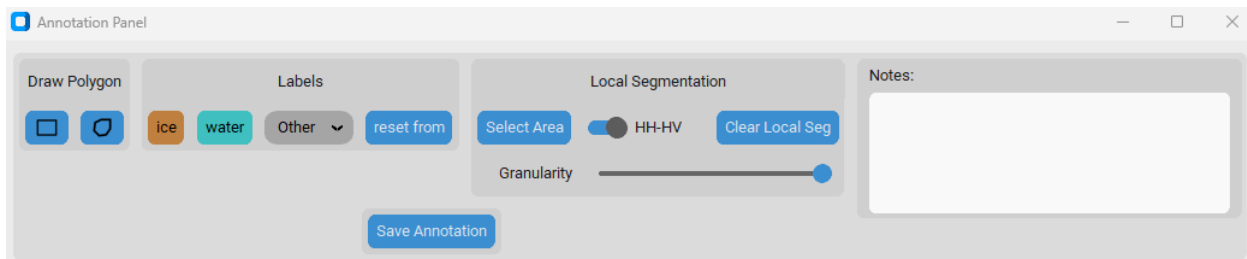


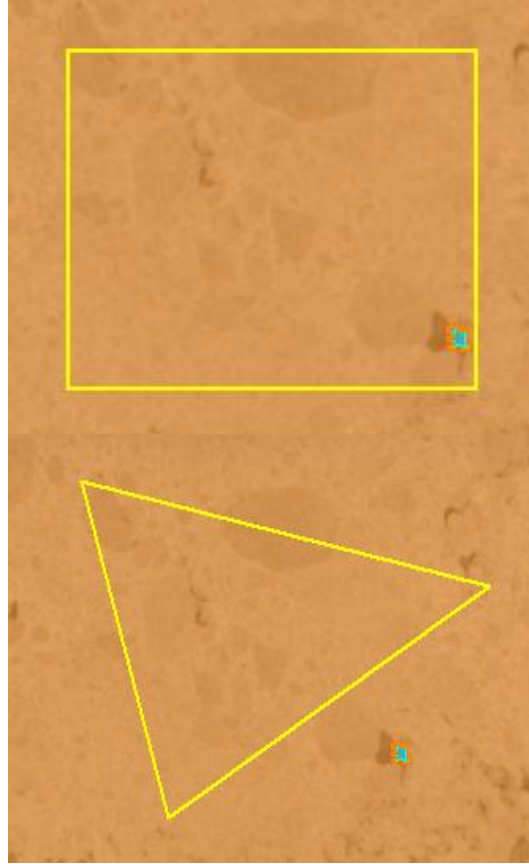
Figure 11. Annotation panel

### 11.1 Enter Annotation Mode

1. Select the **Annotation** button.
2. The annotation panel will appear.

### 11.2 Drawing a Polygon

1. Locate the **Draw Polygon** section at the left of the panel.
2. Two options for drawing.
  - **Rectangle selection:** Once selected, left click and hold to set the first corner. Drag to enlarge the rectangle.
  - **Polygon selection:** Once selected, left click to create a point.
3. Close the polygon by:
  - **Rectangle selection:** Releasing left click
  - **Polygon selection:** After 3 points are created, the polygon will automatically close. More points can be added but 3 points is the minimum needed to close the polygon. Right click to exit drawing mode.

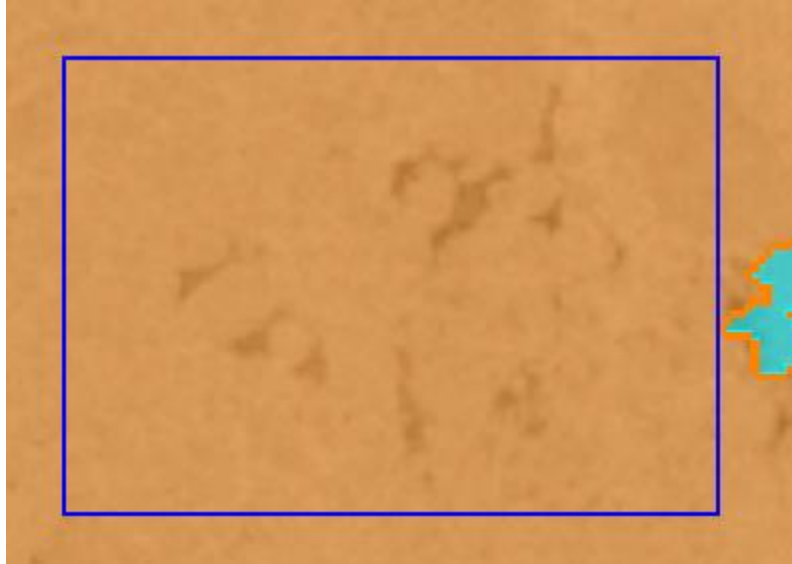


*Figure 12. Drawn polygon using rectangle selection (top), draw polygon with 3 points using polygon selection (bottom)*

### 11.3 Unsupervised Local Segmentation

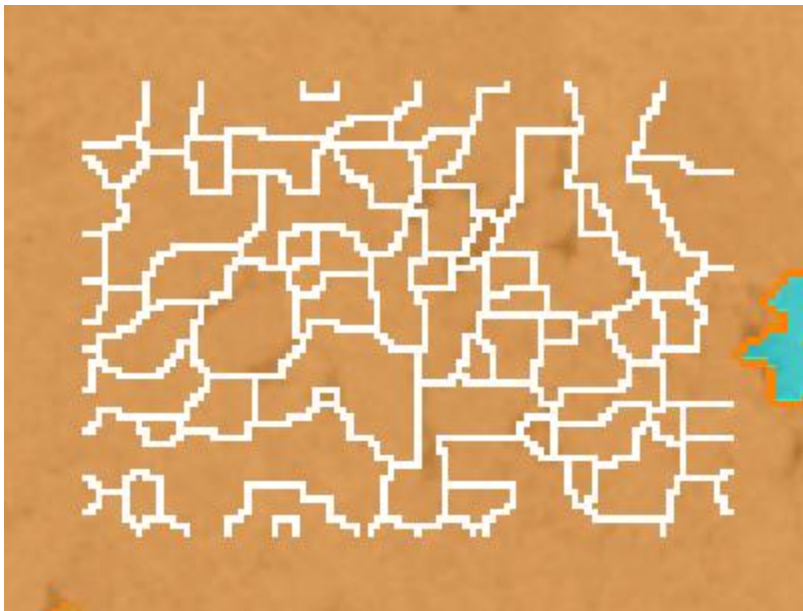
An unsupervised local segmentation model (IRGS) is included in this app. To run it follow the below steps:

1. Locate the **Local Segmentation section** in the annotation panel.
2. Select which band to run local segmentation on using the slider, default is HV (left = HH, right = HV).
3. To run the model, click the **Select Area** button, then on the image draw a rectangle over the area you wish to run the model on similar to drawing a polygon with the rectangle selection. **The model will run on release of left click.**



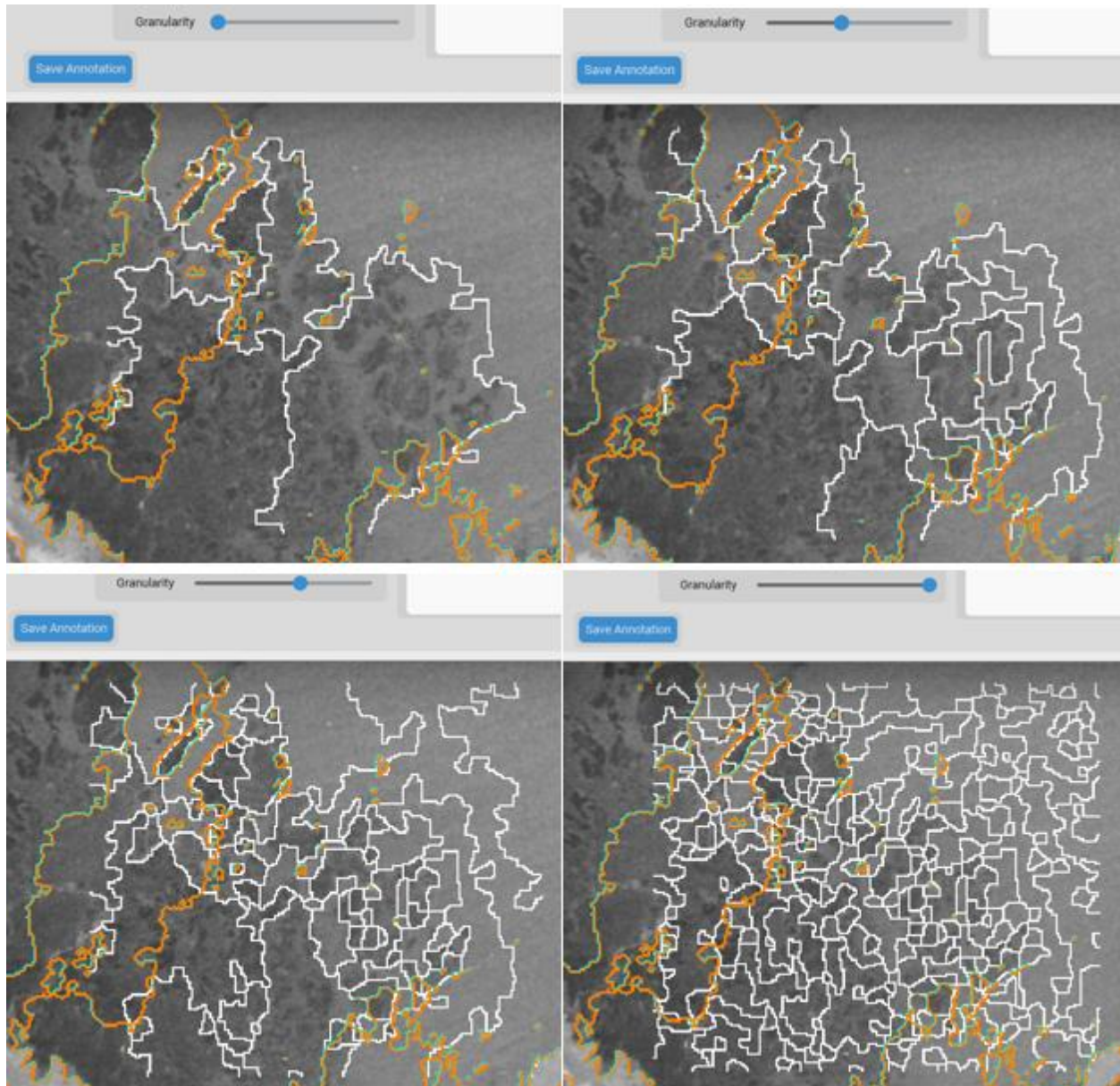
*Figure 13. Selecting area to run unsupervised local segmentation*

4. After a moment, the segmented areas will appear separated as white lines on the overlay in the area selected.



*Figure 14. Aftermath of running unsupervised local segmentation*

5. To clear the local segmentation boundaries, just select **Clear Local Seg**
6. To change the granularity of the segmentation, move the **Granularity slider**.

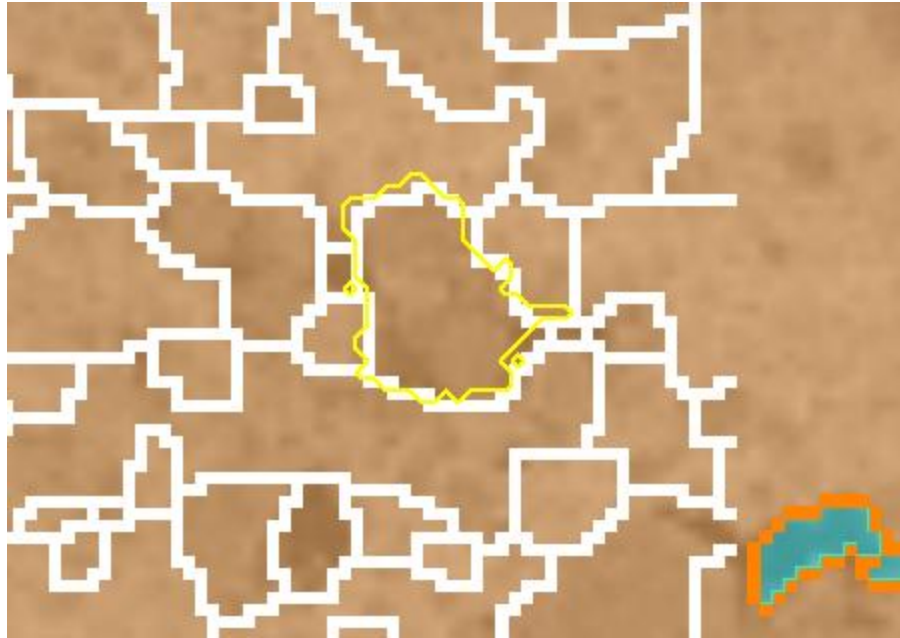


*Figure 15. Effect of changing granularity on segmentation*

Note: Ensure the Ice/Water Labels button is turned ON.

## 11.4 Selecting a Polygon

Along with creating your own polygon, you can select a polygon from the existing overlay or from the local segmentation by **double clicking on the polygon**. If you create a polygon, it will be automatically selected. The selected polygon will be highlighted with a yellow outline.



*Figure 16. Selecting a polygon created from unsupervised local segmentation*

## 11.5 Labeling Polygon

1. Ensure you have a polygon selected.
2. Locate the **Labels** section in the annotation panel.
3. Select the label corresponding to the area, options include:
  - Ice (orange)
  - Water (blue)
  - Other
    - Shoal (green)
    - Ship (yellow)
    - Iceberg (pink)
    - Unknown (grey)

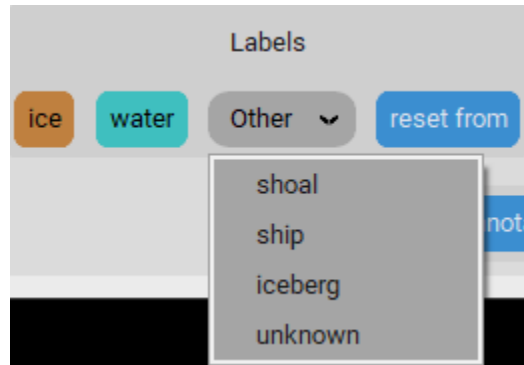


Figure 17. Label options

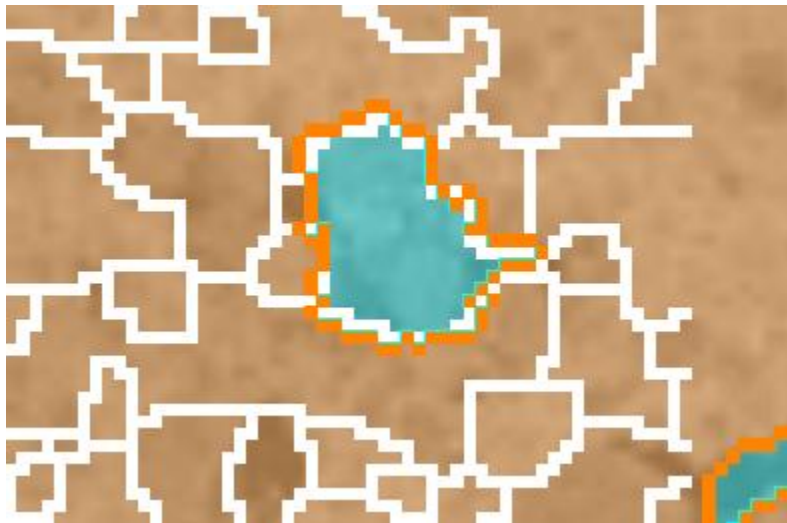


Figure 18. Selected area labeled as water

## 11.6 Resetting Annotations

If you wish to reset the annotation to a model prediction you can do so:

1. Ensure you have a polygon selected.
2. Locate the **Labels** section in the annotation panel.
3. Select the **reset from** button, a new window will pop up showing a preview of the selected area with options at the bottom for which model prediction to reset from. Selecting a different model prediction will update the preview.



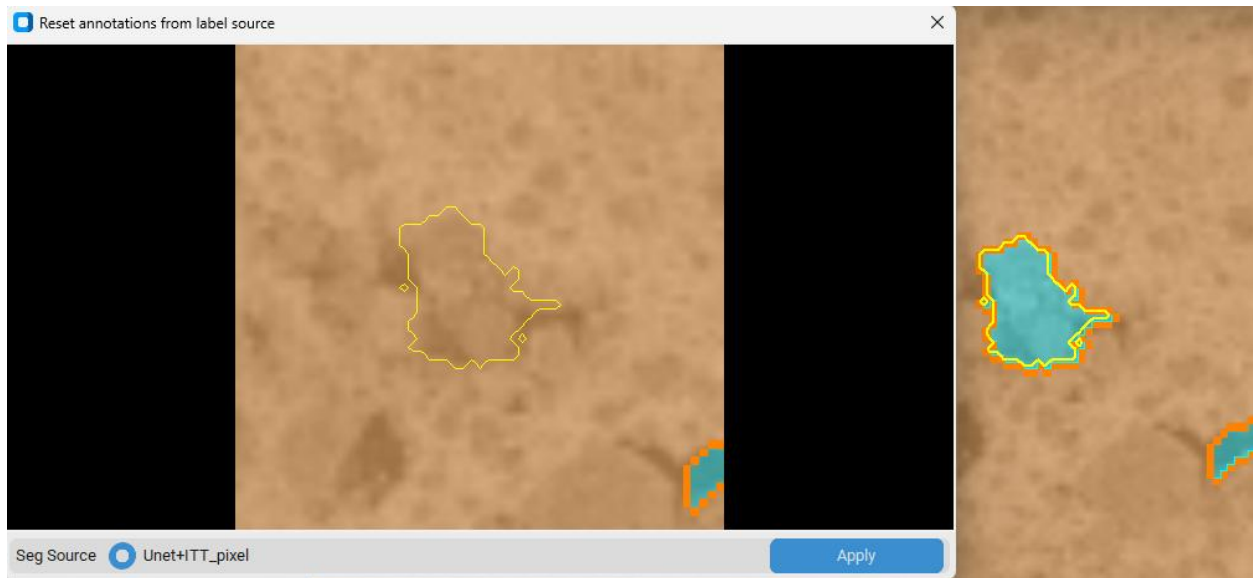


Figure 19. Reset pop-up showing preview

4. Once confirmed, select **Apply** and the area in the overlay will be reset to the chosen prediction



Figure 20. Area selected reset to prediction label

## 11.7 Saving Annotations

1. After completing annotations, select **Save Annotation**.
2. An annotation file will be written to the output directory folder **Custom\_Annotation** along with any notes and the areas that have been annotated.
3. Saved data includes:
  - Custom Annotation overlay .png file
  - JSON file with notes

- .npz file containing pixel locations of annotated areas (for minimap use)
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## 12. Handling No-Data / Black Areas

Some regions of the SAR image may appear black or empty due to missing or invalid data.

- Annotations should generally **not** be drawn in these areas.
  - Coordinates or information may be unavailable in no-data regions.
  - The application may display “N/A” when hovering over these pixels.
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## 13. Troubleshooting

### Image Does Not Load

- Verify the file format is supported.
- Ensure all required files are present.

### Overlay Not Visible

- Increase overlay opacity.
- Check if Ice/Water Labels is ON
- Confirm the model prediction completed successfully.

### Application Feels Slow

- Zoom in on a smaller area
  - Close other applications if system memory is limited.
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## 14. Closing the Application

- Save annotations before closing, if there are unsaved changes a warning will pop up.
  - Exit using window controls.
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## 15. Contact / Support

For issues, questions, or feature requests, contact:

- **Project Maintainers:**

- *Javier Noa Turnes* / [jnoaturnes@uwaterloo.ca](mailto:jnoaturnes@uwaterloo.ca)
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