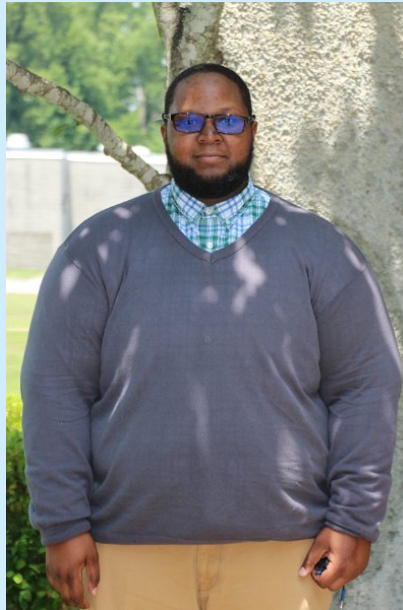


# Validation of the Antarctic Snow Accumulation and Ice Discharge Basal Stress Boundary of the Southeastern Region of the Ross Ice Shelf, Antarctica

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# OVERVIEW

- Abstract
  - Introduction
  - Methodology
  - Conclusion
  - Future Work
  - Acknowledgements
  - Questions
- 

# ABSTRACT

The largest ice shelf in Antarctic, Ross Ice Shelf, was investigated over the years of (1970-2015). Near the basal stress boundary between the ice shelf and the West Antarctic ice sheet, ice velocity ranges from a few meters per year to several hundred meters per year in ice streams. Ice velocity increases as the ice moves seaward, reaching more than 1 km yr<sup>-1</sup> in the central portions of the ice front. Most of the drainage from West Antarctica into the Ross Ice Shelf flows down two major ice streams, each of which discharges more than 20 km<sup>3</sup> of ice each year.

Along with velocity changes, the warmest water below parts of the Ross Ice Shelf resides in the lowest portion of the water column because of its high salinity. Vertical mixing caused by tidal stirring can thus induce ablation by lifting the warm water into contact with the ice shelf. This process can cause melting over a period of time and eventually cause breakup of ice shelf.

With changes occurring over many years a validation is needed for the Antarctic Snow Accumulation and Ice Discharge (ASAID) basal stress boundary created in 2003. After the 2002 Larsen B Ice Shelf disintegration, nearby glaciers in the Antarctic Peninsula accelerated up to eight times their original speed over the next 18 months.

# ABSTRACT

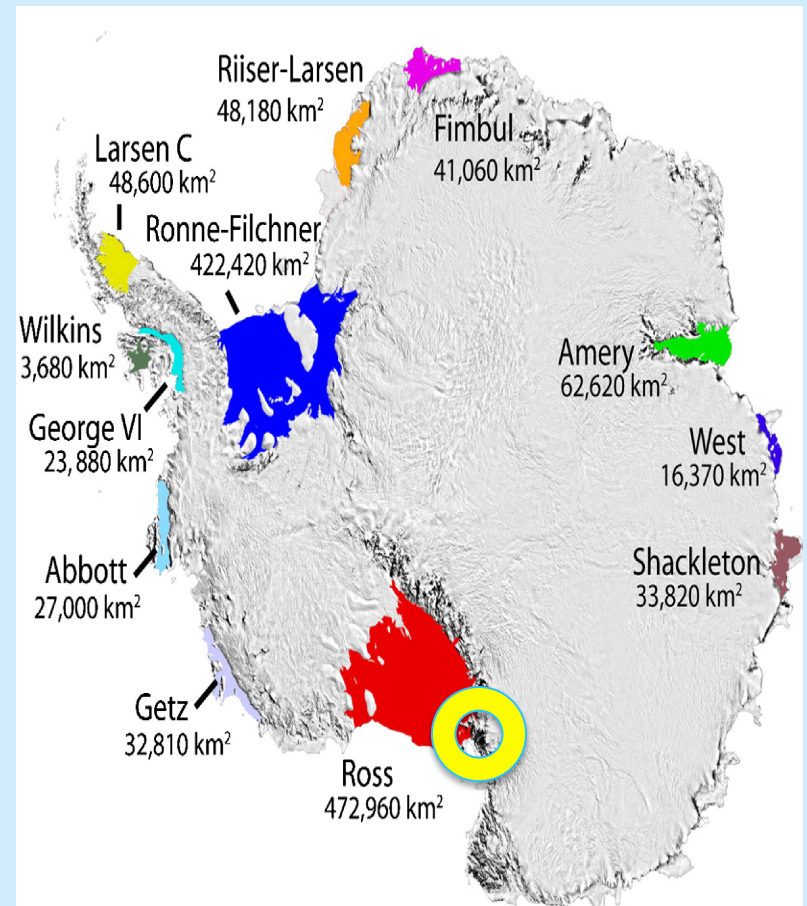
Similar losses of ice tongues in Greenland have caused speed-ups of two to three times the flow rates in just one year. Rapid changes occurring in regions surrounding Antarctica are causing concern in the polar science community to research changes occurring in coastal zones over time. During the research, the team completed study on the Ross Ice Shelf located on the south western coast of the Antarctic. The study included a validation of the ABSB vs. the natural basal stress boundary (NBSB) along the Ross Ice Shelf. The ASB BSB was created in 2003 by a team of researchers headed by National Aeronautics and Space Administration Goddard Space Flight Center (NASA GSFC), with an aim of studying coastal deviations as it pertains to the mass balance of the entire continent. The point data file was aimed at creating a replica of the natural BSB. Select cloud free Landsat satellite imagery from satellites 1 through 7 was used to detect changes occurring over the span of 19 years. The last major interest in the study included documenting the deviations or incorrect placements of the ABSB vs. NBSB. ENVI 4.7 as well as ENVI 5.0 image manipulation software was used in the geo-rectifying and the geo-referencing process. Changes that occurred were documented in the form of a data table with the change that occurred along with the latitude and longitude geographic coordinates.

# METHODOLOGY

- Identifying the Ross Ice Shelf
- Locating Landsat images
- Shrinking the text file
- Converting text file to a vector file
- Validation of the Basal Stress Boundary
- Geo-referencing the Image
- Image Warping
- Linking Images
- “Tracking Deviations”

# ROSS ICE SHELF

- Located in the Southeastern region of Antarctica
- Path/Row: 32/115, 32/116, 30/116





# LOCATING LANDSAT IMAGES

Search Criteria | Data Sets | Additional Criteria | Results

## 1. Enter Search Criteria

To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the [help documentation](#)), and/or choose a date range.

Address/Place | **Path/Row** | Feature | Circle

Point | Polygon

Type: WRS2 Path: Row:

Show Clear

Coordinates | Predefined Area | Shapefile | KML

Degree/Minute/Second | Decimal

No coordinates selected.

Use Map Add Coordinate Clear Coordinates

Date Range | Result Options

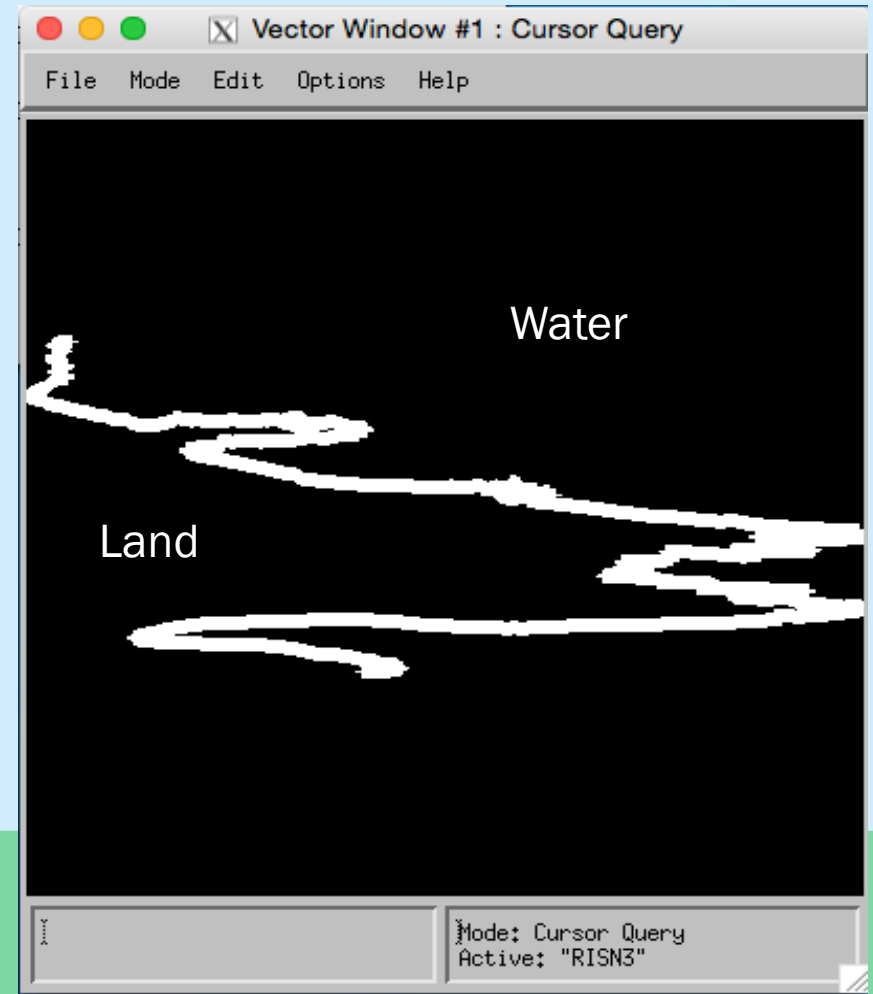
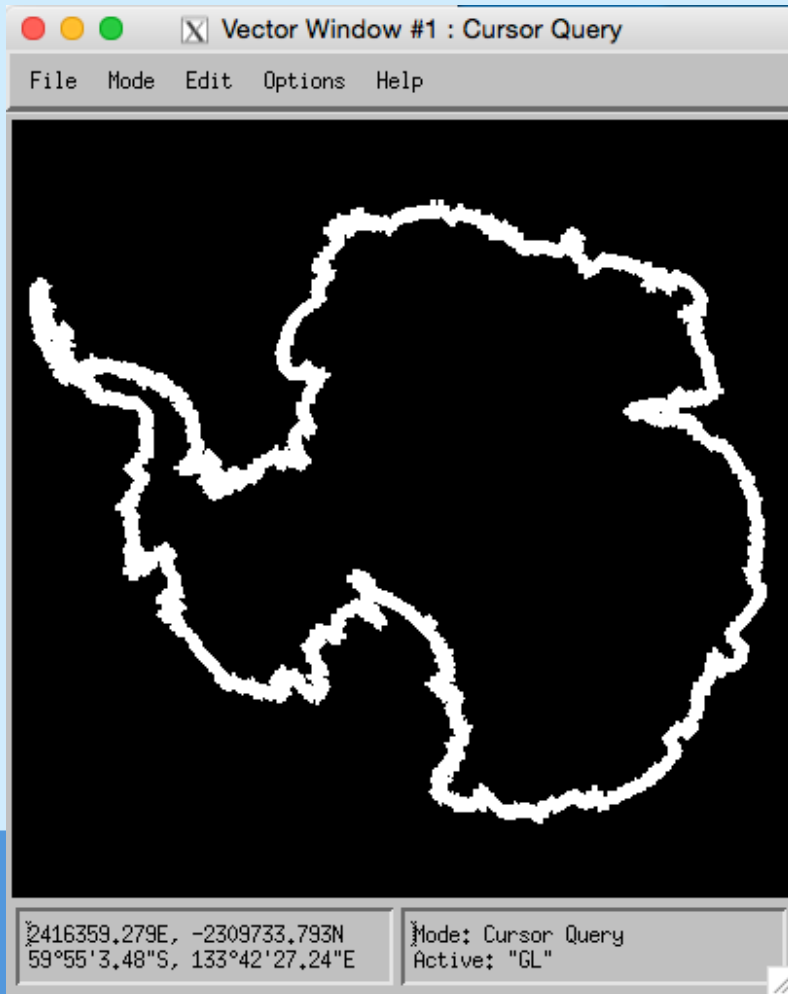
Search from: to: mm/dd/yyyy

Search months: (all)

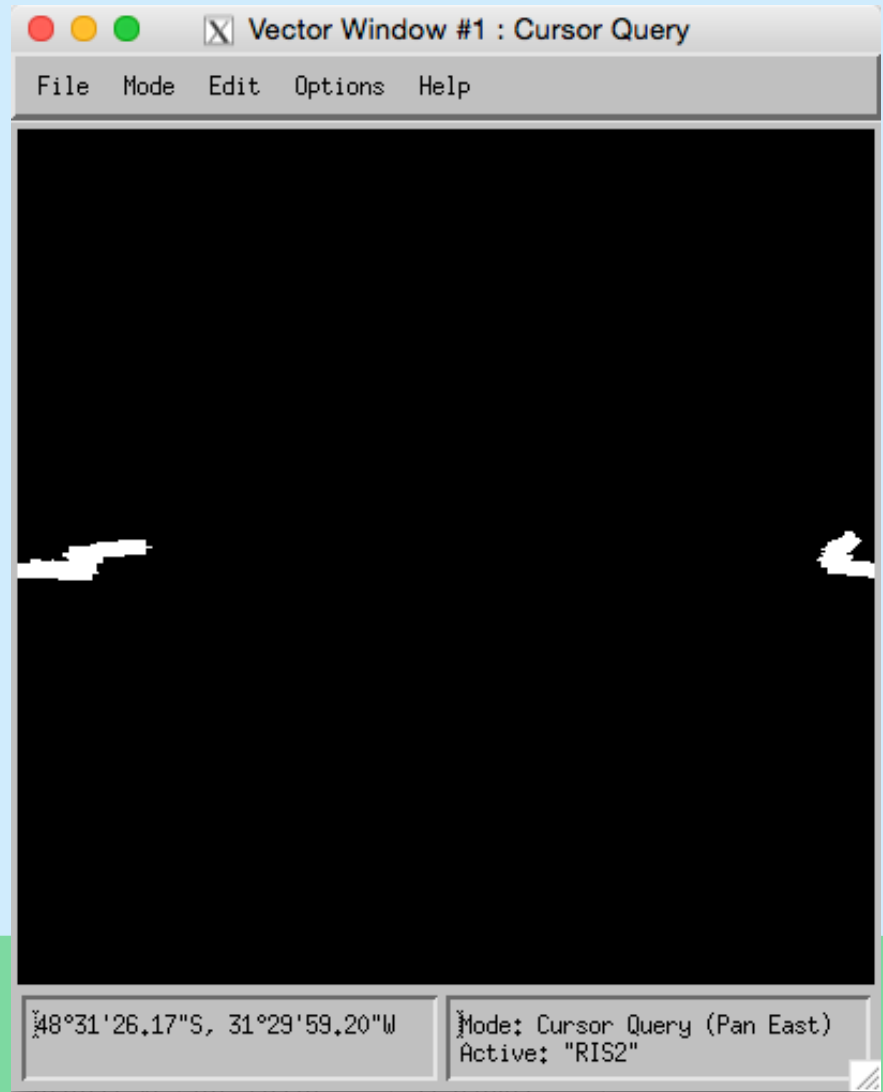
Data Sets » Additional Criteria » Results »

ID: LE70321162009051EDC00  
CC: 0% Date: 2009/2/20  
Qty: 9 Product: ETM+ L1GT

# BASAL STRESS BOUNDARY TEXT FILE



# ERROR IN FILE SHRINKING



# CONVERTING TO A VECTOR FILE

ENVI Point Collection

File Options

	Image X	Image Y	Longitude	Latitude	Attribute Description
3575496	1996636,40	-1688115,30	130,213840	-66,267372	
3575497	1996645,90	-1688103,60	130,213520	-66,267372	
3575498	1996651,00	-1688089,50	130,213200	-66,267418	
3575499	1996656,40	-1688075,50	130,212890	-66,267464	
3575500	1996663,00	-1688062,00	130,212570	-66,267494	
3575501	1996672,30	-1688050,30	130,212230	-66,267502	
3575502	1996677,30	-1688028,90	130,211810	-66,267525	
3575503	1996694,80	-1688016,90	130,211360	-66,267586	

Info Export Delete Delete All

Input ASCII File

Input File: /Users/censeradmin/Desktop/B  
Columns: 4, Rows: 3575503

1996695,0	-1687980,0	-6
1996701,4	-1687966,4	-6
1996707,8	-1687952,9	-6
1996714,3	-1687939,3	-6
1996720,6	-1687925,8	-6

Image X Column: 1 Image Y Column: 2  
Longitude Column: 4 Latitude Column: 3  
Map X Column: Map Y Column:  
Elevation Column:

Select Map Projection: New...

Arbitrary  
Geographic Lat/Lon  
UTM  
State Plane (NAD 27)  
State Plane (NAD 83)  
Argentina - Zone 1  
Argentina - Zone 2  
Argentina - Zone 3

Datum...: WGS-84  
Units...: Degrees

OK Cancel

# VALIDATION OF THE BASAL STRESS BOUNDARY

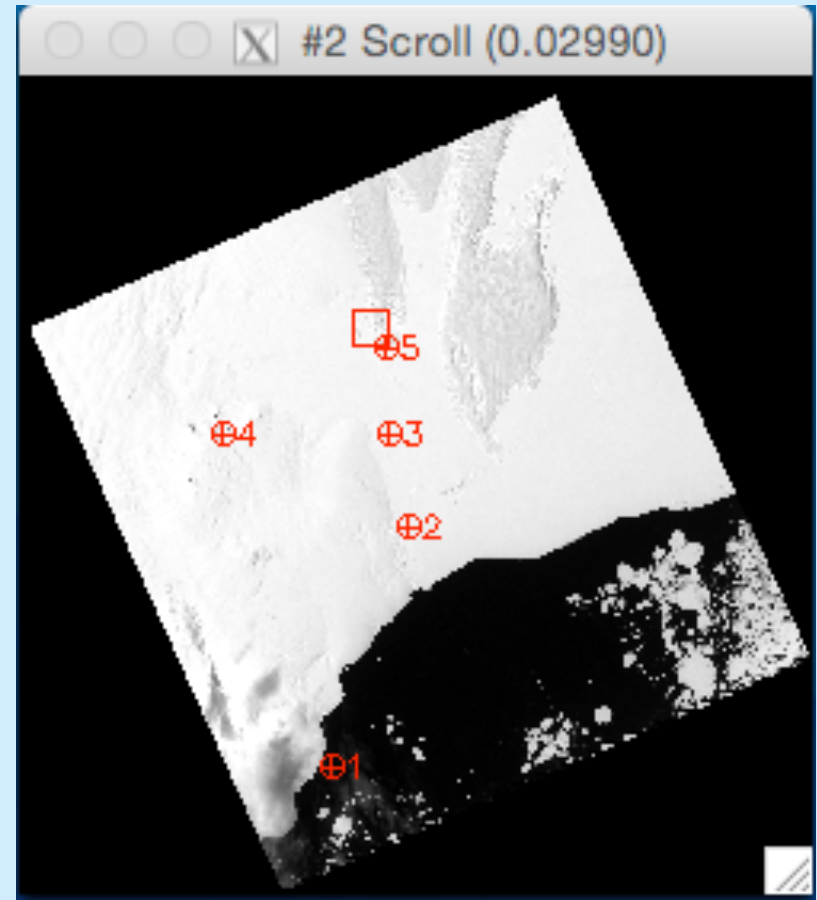
- Image accuracy and resolution has improved over time
- Older images needed additional processing
- Image warping

# GEO-REFERENCING THE IMAGE

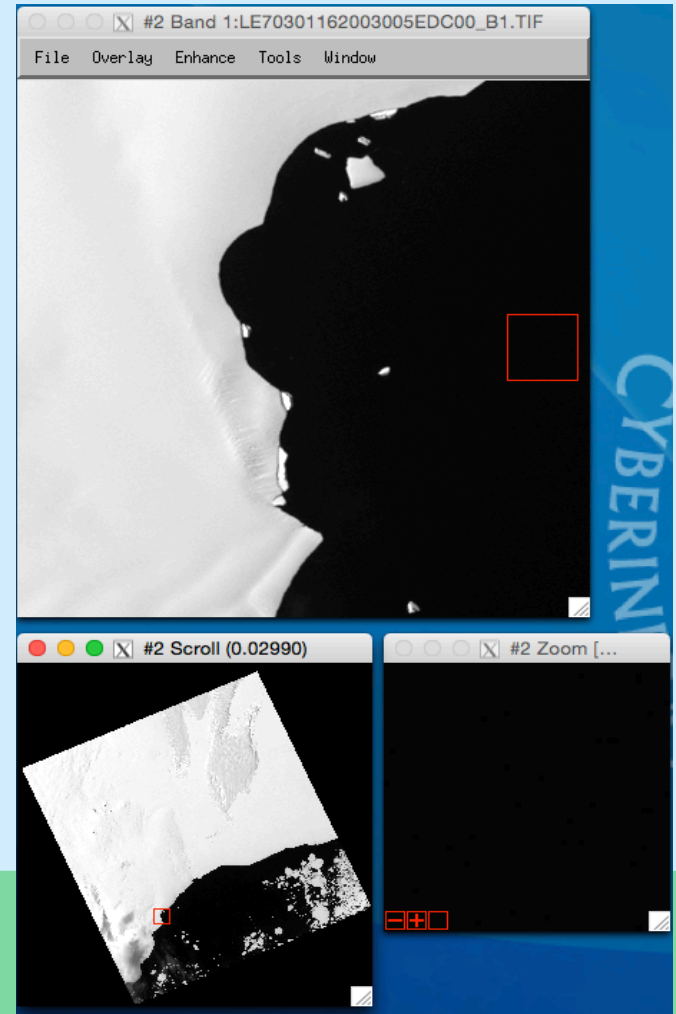
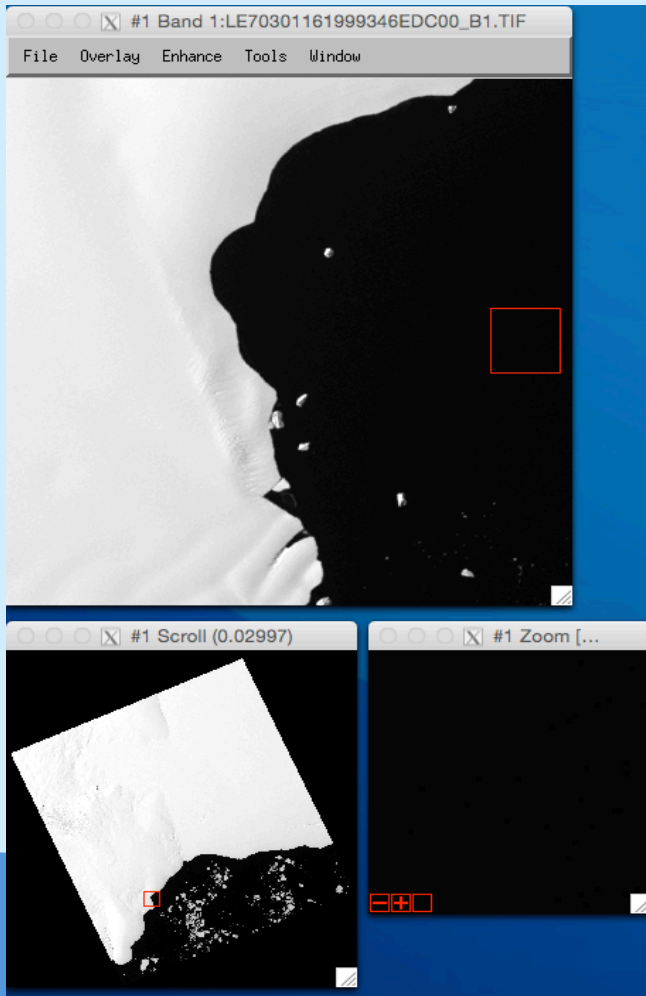
- ENVI Classic and ENVI 5.0
- Base image: recent image
- Warp image: older image

# IMAGE WARPING

- Minimum of 5 points
- Images are linked
- Similarities are highlighted

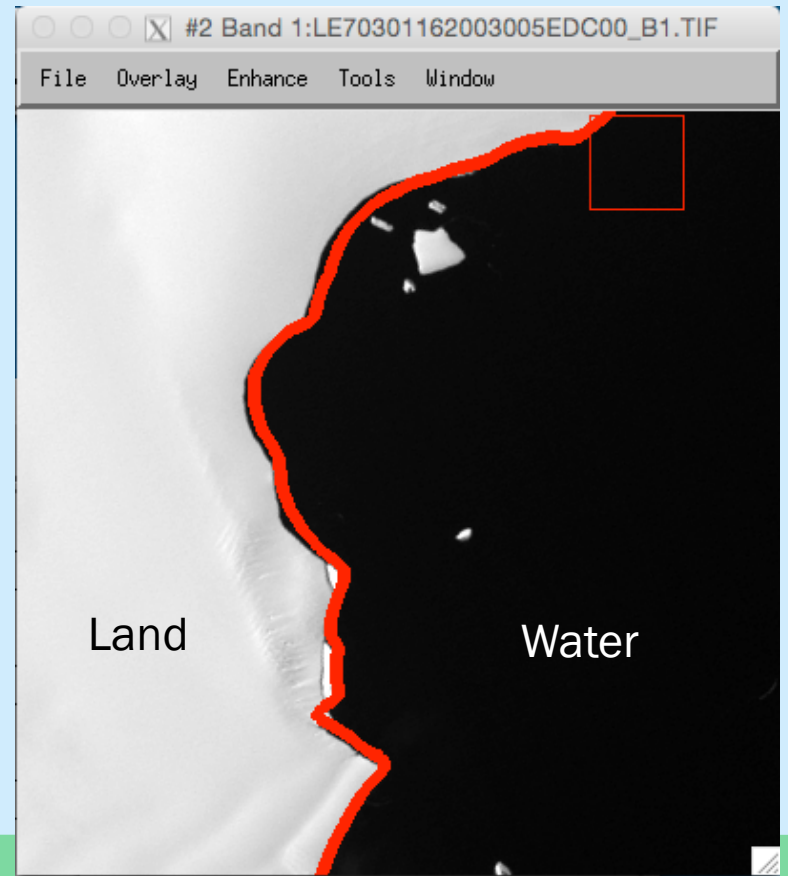
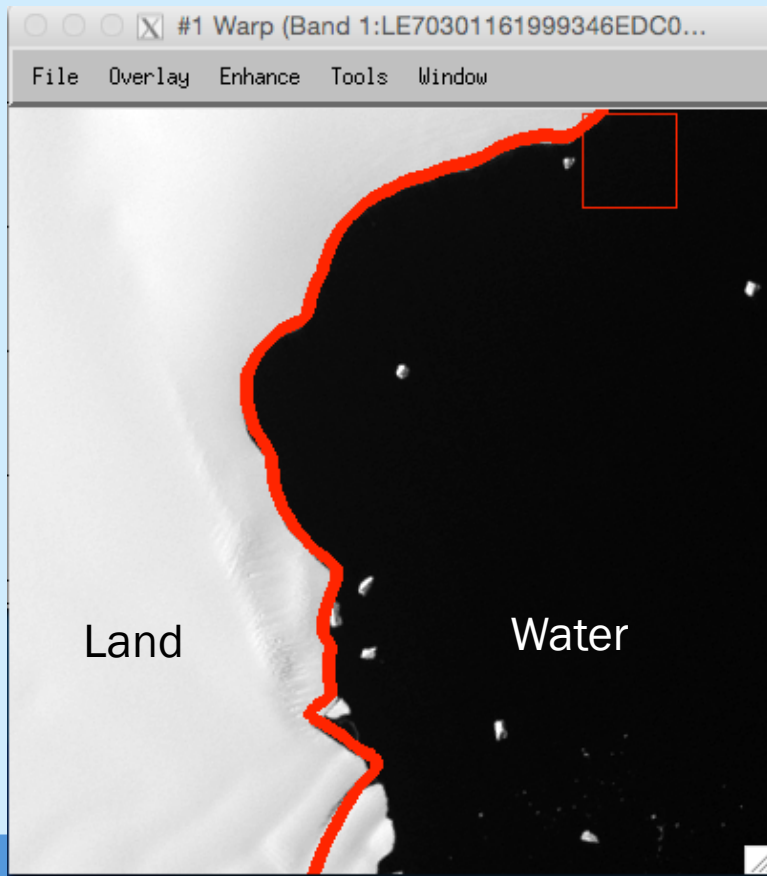


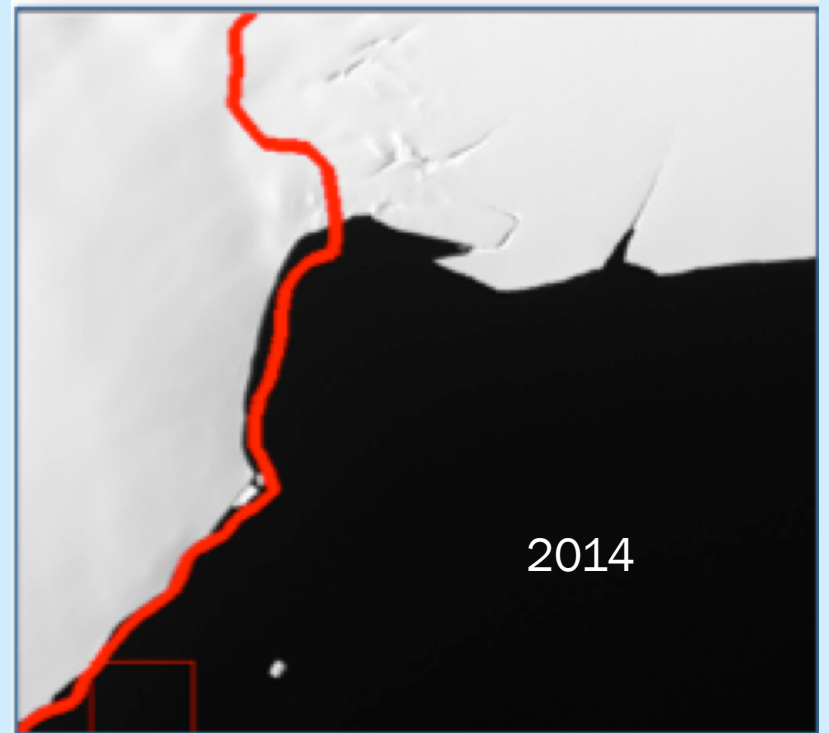
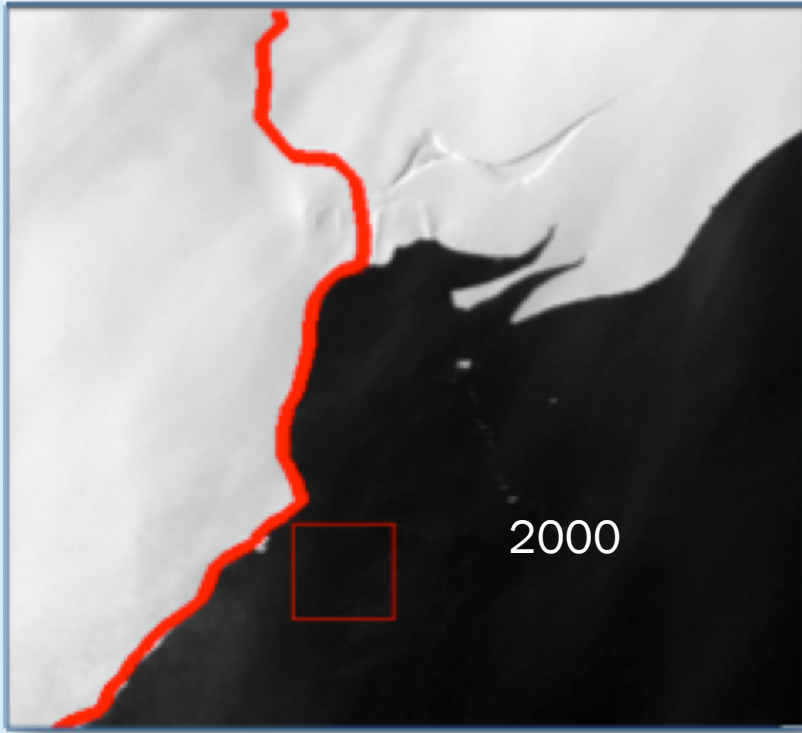
# LINKING IMAGES

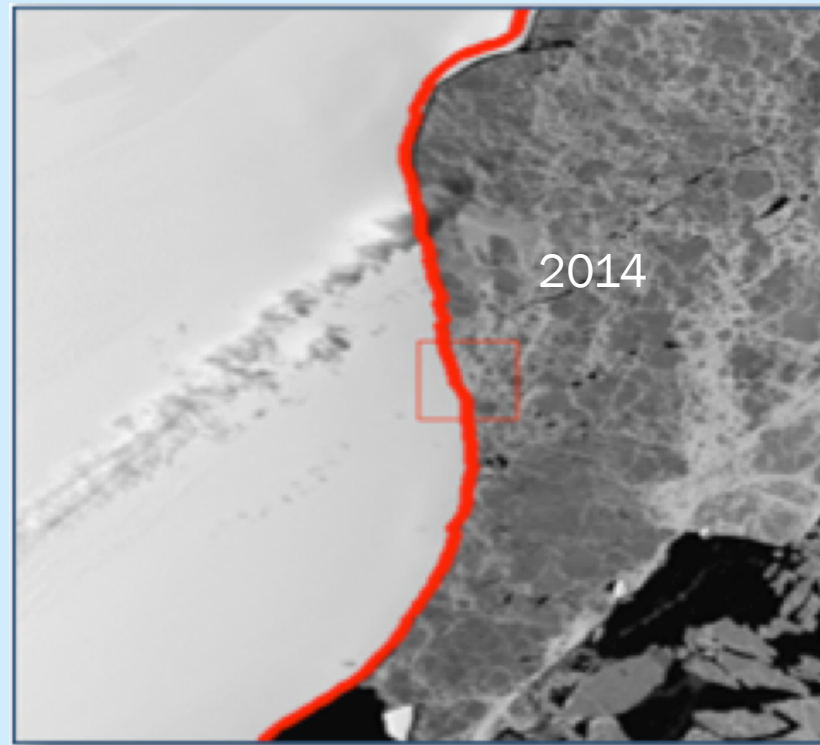
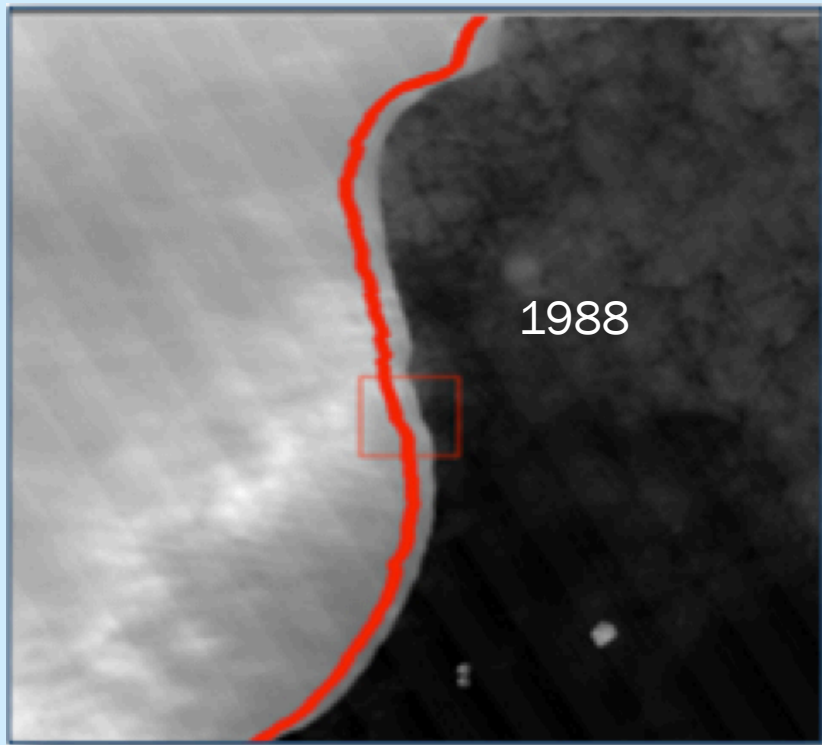




# “TRACKING DEVIATIONS”







# CONCLUSION

- Observation spanned a total of 25 years
- Features images before and after the NBSB was discovered
- Utilized the standard zoom of ~x4 of the ENVI Classic zoom window feature
- There had been a misplacement of the NBSB along the ice shelf

<i>Base Image</i>	<i>Comparison Image</i>	<i>Warped Image</i>	<i>Years Observed</i>	<i>Deviation Observed</i>
LE703211620 00011EDC00	LC80321162014 361LGN00	N/A	14	Yes
LE703011619 99346EDC00	LE70301162003 005EDC00	301161999_301 162003_warp	4	Yes
LT403211519 88010XXX04	LC80321152014 313LGN00	321151988_321 152014_warp	26	Yes

# FUTURE WORK

- Add the text file and vector file into one folder
- Finish validation of the Ross Ice Shelf in the Southwestern region

# ACKNOWLEDGEMENTS

- Michael Jefferson Jr., Mentor
- Dr. Linda B. Hayden, Principle Investigator
- CReSIS

**QUESTIONS?**  
QUESTIONS?