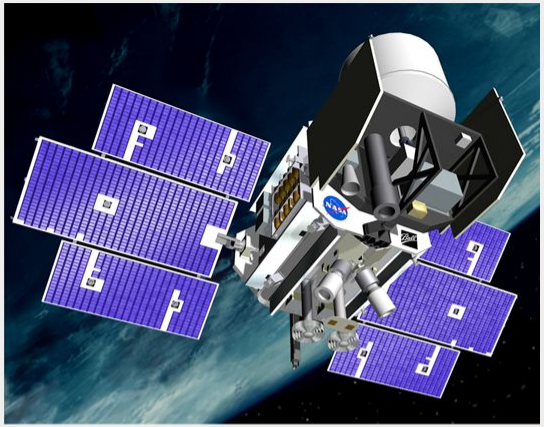
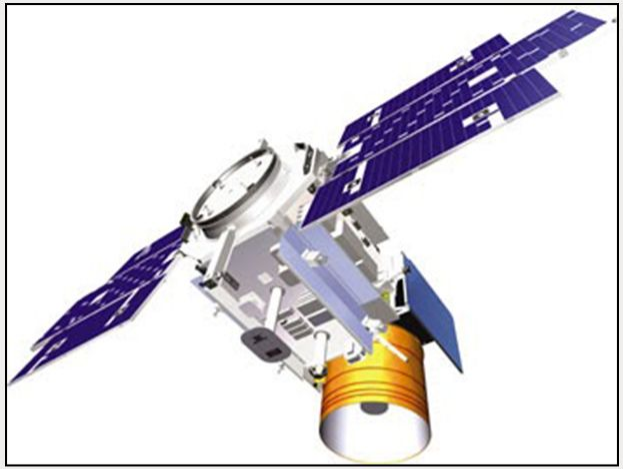
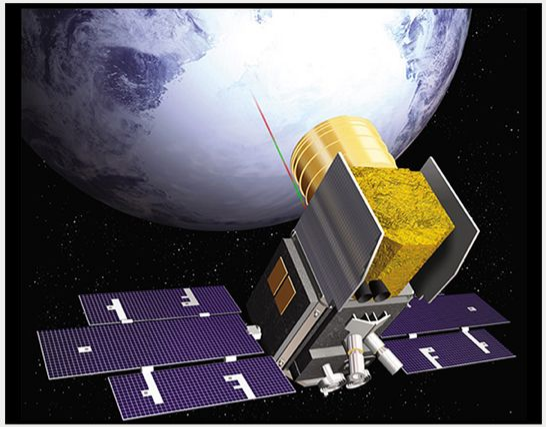






ICESat Presentation

By Karan Bhasin, Erik Dallman, Jason Ren, Cody Garcia,
Dallas Balentine, Nikita Bharati, and Paul Sangiorgio

Introductions

Team Members:

- Dallas Balentine (11th grade, Minnesota)
- Nikita Bharati (12th grade, Arizona)
- Karan Bhasin (12th grade, California)
- Erik Dallman (12th grade, Kansas)
- Cody Garcia (11th grade, California)
- Paul Sangiorgio (11th grade, New York)
- Jason Ren (11th grade, Texas)
- Dr. Tim Urban (Mentor)

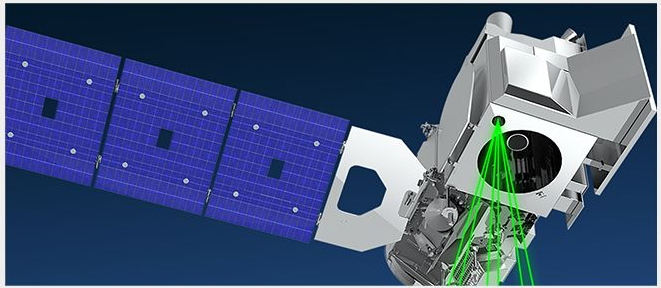
ICESat Mission Background

- **ICESat** (**I**ce **C**loud and Land **E**levation **S**atellite)

- Cost: ICESat-1: 282 Million USD, ICESat-2: 96.6 Million USD

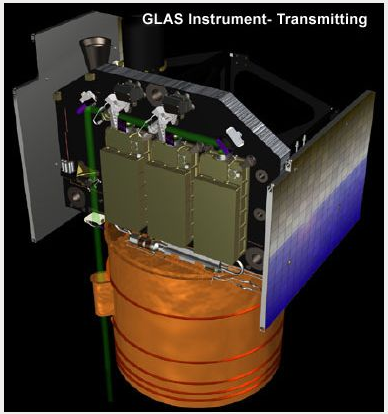
- Mission Objectives: Measuring ice sheet mass balance and elevation, sea ice, land topography, vegetation characteristics, and cloud/aerosol heights

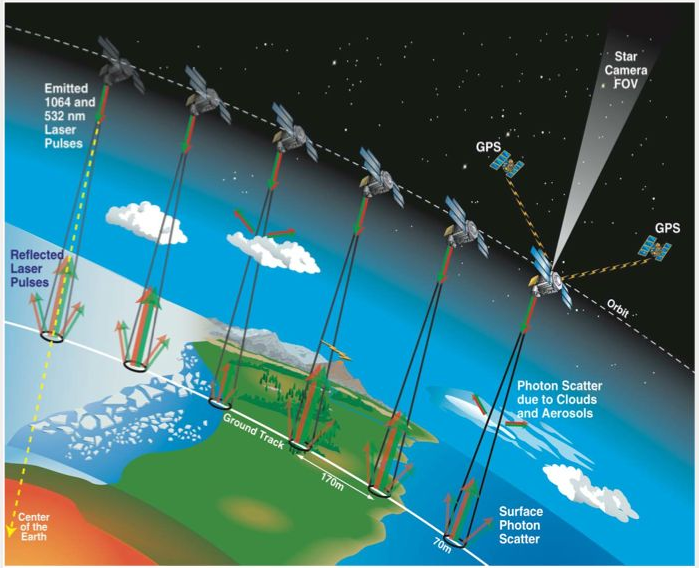
- Launch Dates: ICESat-1: January 12, 2003, ICESat-2: September 15, 2018
- Launch Vehicle: Delta II

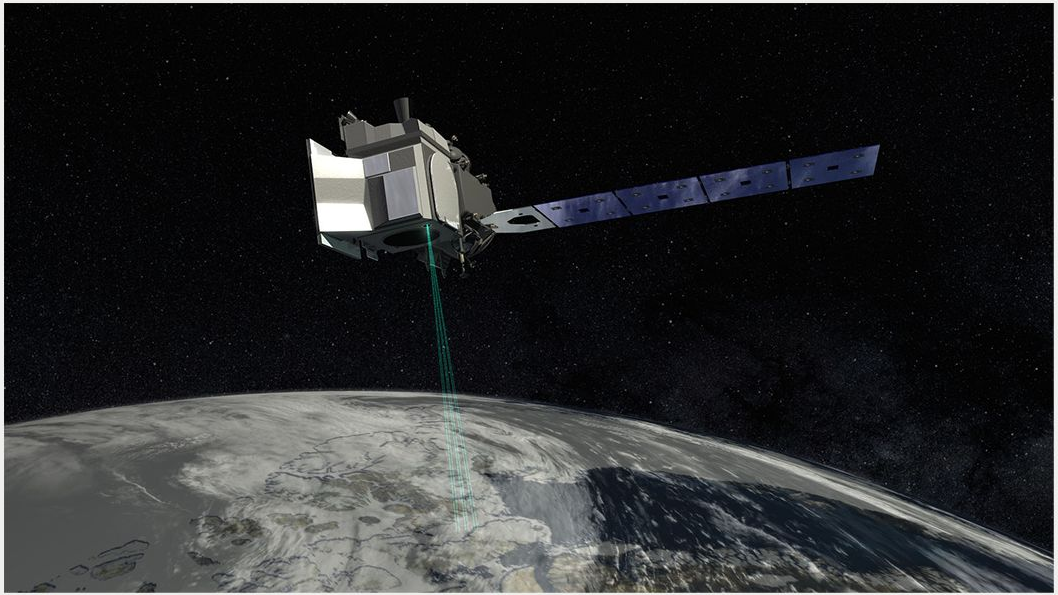


GLAS/ATLAS

- GLAS: (**G**eoscience **L**aser **A**ltimeter **S**ystem)
- ATLAS: (**A**dvanced **T**opographic **L**aser **A**ltimeter **S**ystem)

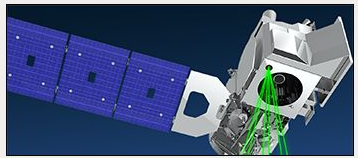


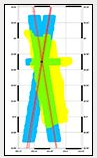




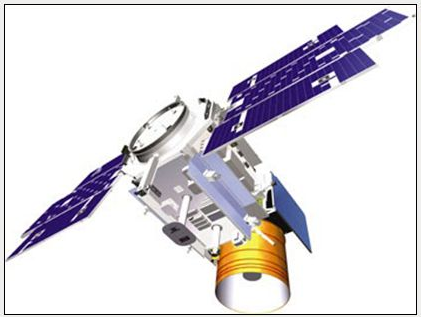
Our Project Task

• Using the training interns received in coding with Python, analyze ICESat mission data from White Sands, New Mexico by plotting land topography, roughness, and slope on graphs to present the data in a video less than 20 minutes in length.





python™

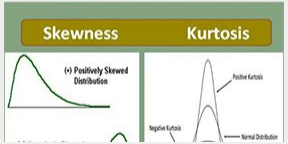


We chose White Sands, New Mexico because it is a primary calibration site for ICESat-1. This site was chosen for its geophysical qualities, including its flatness and reflectivity. It was also chosen for logistical reasons, as it is a domestic and secure site.

Details and Approach

- Python code was used to plot data from sources such as a DEM (digital elevation model from the 2003 and 2007 aircraft missions), ICESat-1, and ICESat-2

- DEM data included latitude, longitude, and elevation values
  - 2D and 3D plots with colorbars were created using given data values
  - Maps were divided into grids and slope and roughness was calculated for each
  - Values such as standard deviation, least-square fits, etc. were calculated for determining slope and roughness



• ICESat-1 data consisted of 20 campaigns collected from 2003 to 2009 with similar parameters from DEM data sets, as well as skewness and kurtosis
  ○ All parameters in ICESat-1 were graphed in different plots to show relationship between features

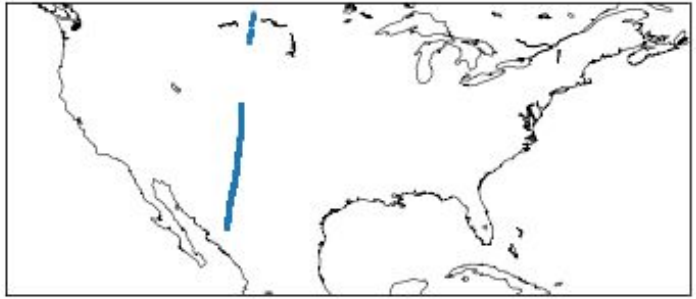
Details and Approach (Continued)

- ICESat-2 data was collected from the NSIDC (**N**ational **S**now and **I**ce **D**ata **C**enter) and included data from only 2020
  - ICESat-2 differs from both ICESat-1 and DEM, because it has 6 lasers which create 6 distinct tracts of data

- Data had to be filtered to only include White Sands
  - 2D and 3D Plots were created from data

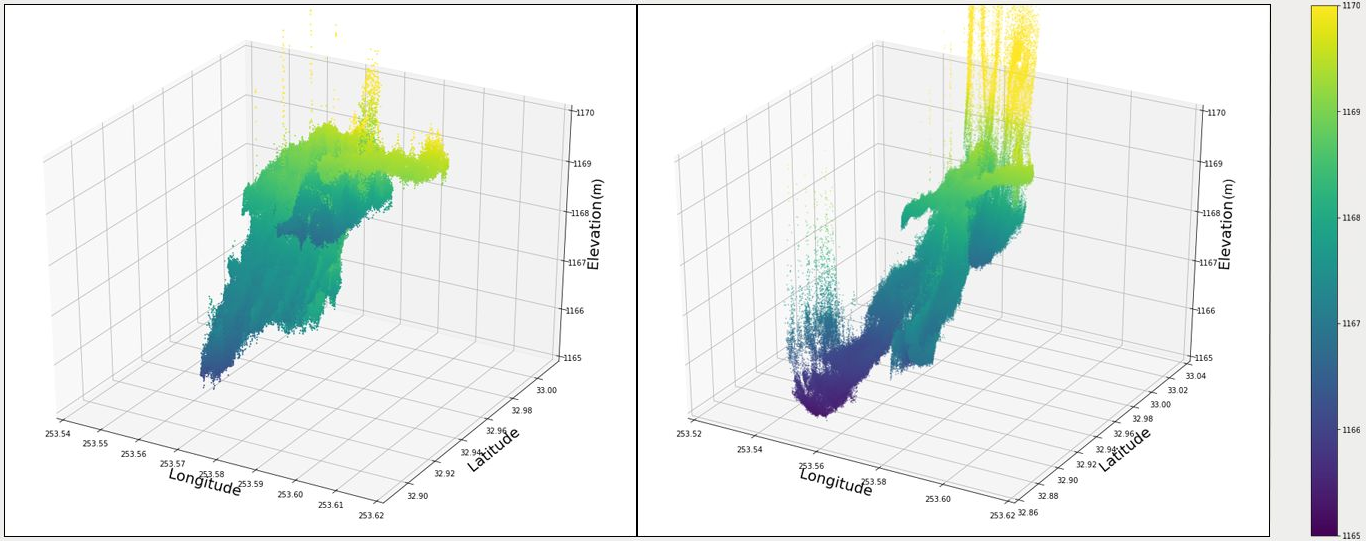
- Every data point was 100 meters apart
  - 10 data points for a kilometer

- Slope in degrees calculated by taking arctangent of slope in meters
- Roughness calculated by taking standard deviation of data

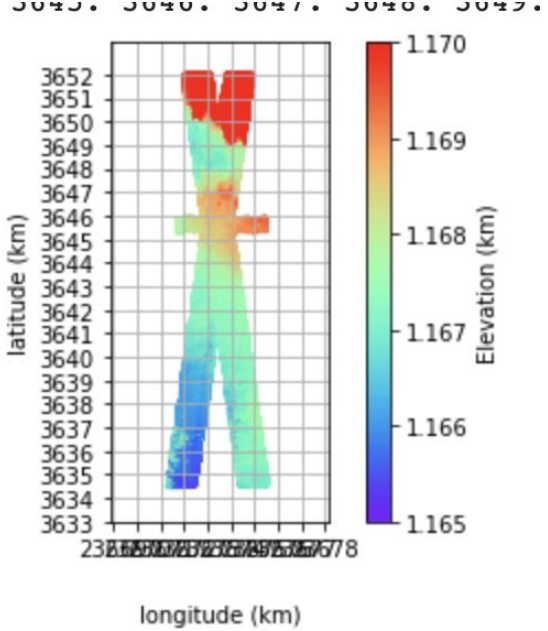


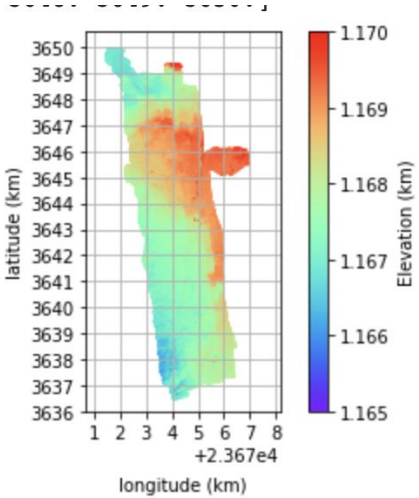
Map of full ICESat-2 data track

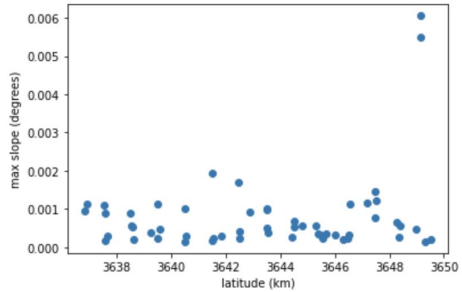
3D Elevation Maps
from two aircraft LiDAR Misisons
(DEM Data)
White Sands, NM

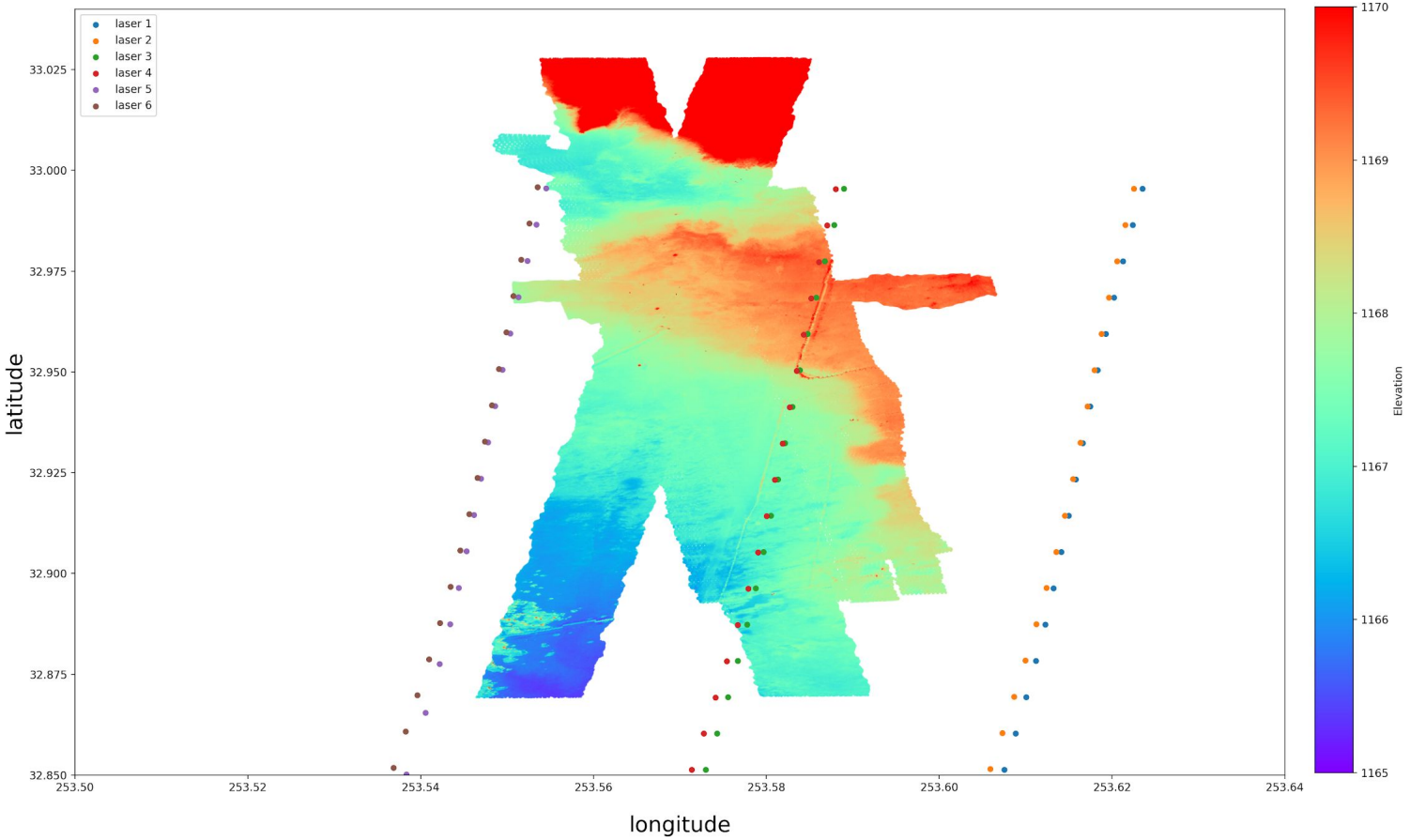


DEM Data Continued








laser 1
laser 2
laser 3
laser 4
laser 5
laser 6
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33.000
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32.950
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32.850
latitude
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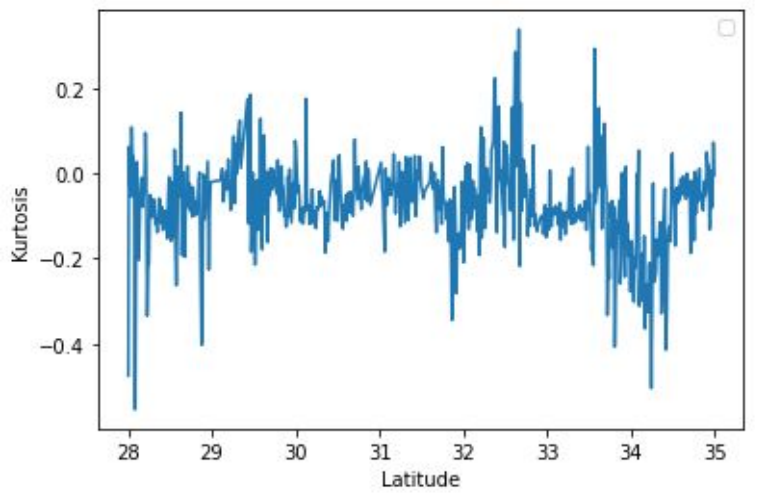
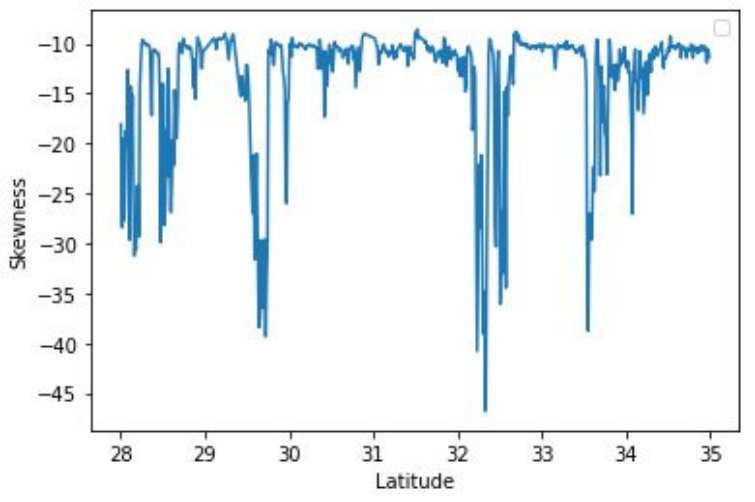
253.54
253.56
253.58
253.60
253.62
253.64
longitude
1170
1169
1168
1167
1166
1165
Elevation

ICESat-1 Results

Kurtosis vs. Latitude



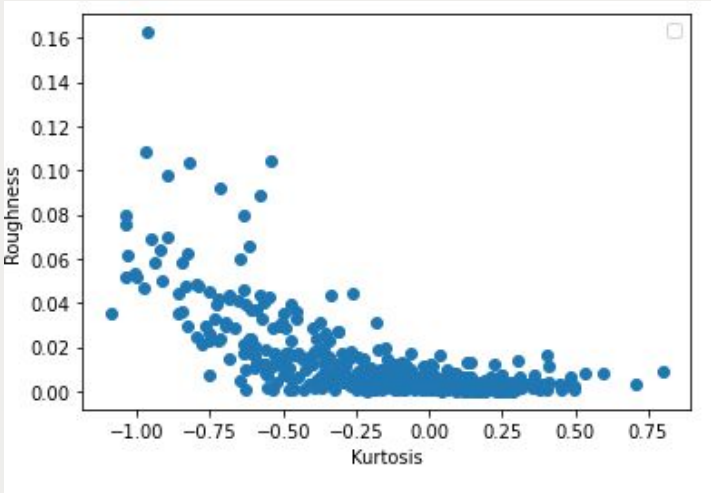
Skewness vs. Latitude



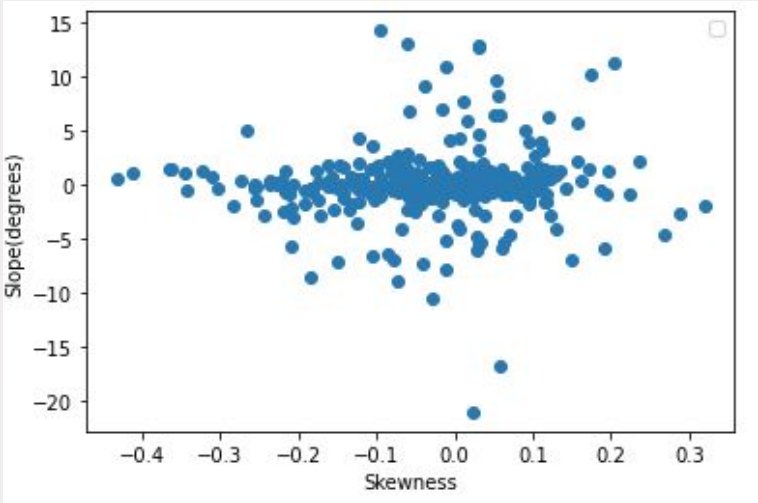
Both of these graphs are taken from the ICESat-1 track, L3j1307.

ICESat-1 Results (Continued)

Roughness vs. Kurtosis



Slope vs. Skewness



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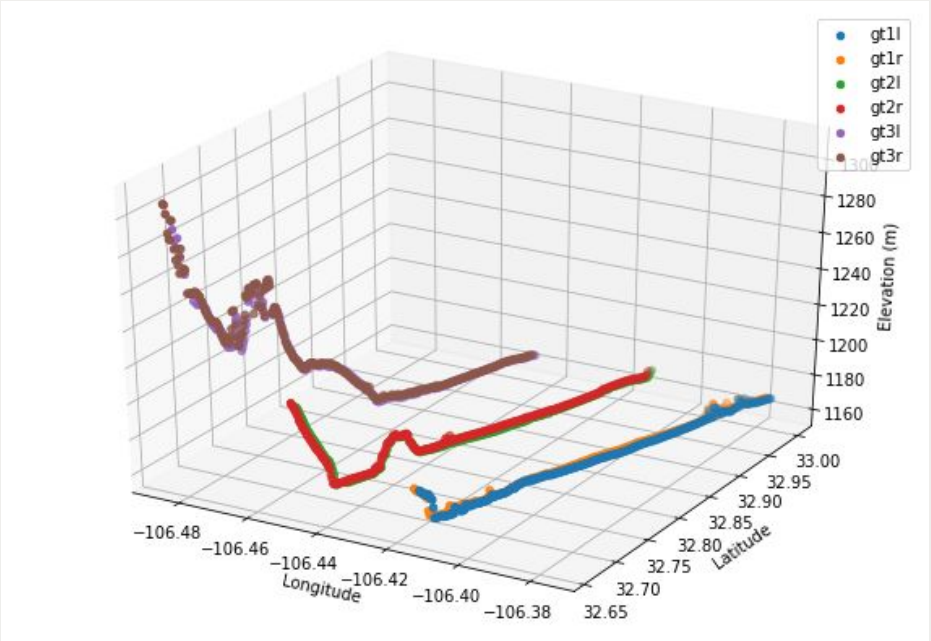
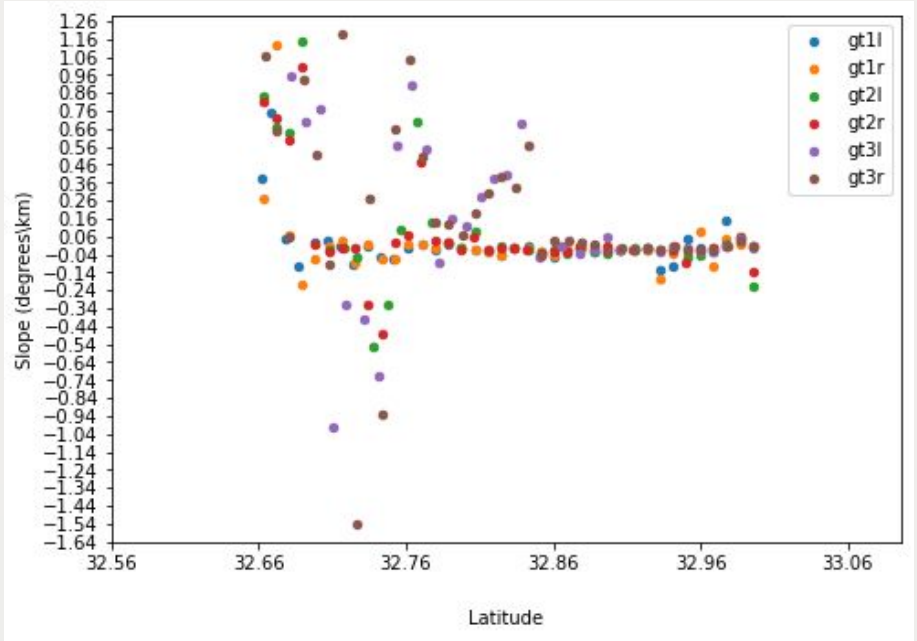
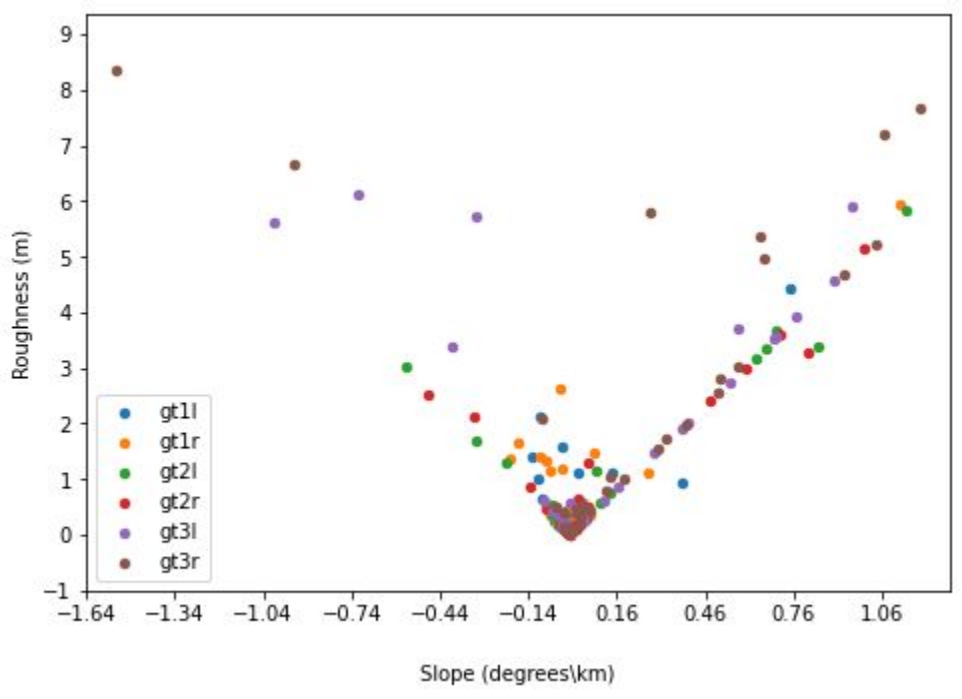
ICESat-2 Results





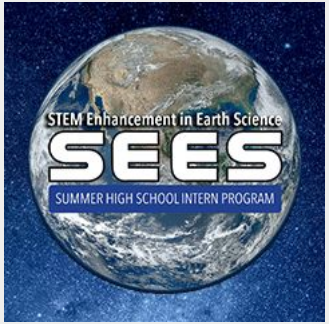
ICESat-2 Results (Continued)



The greater the absolute value of the slope, the greater the roughness. As slope approaches 0, so does roughness

Our Impression of the Virtual SEES Internship

- Highlights
  - Detailed training in earth and space science as well as Python coding which will be useful in the future
  - Heard from interesting and experienced speakers, scientists, and researchers
  - Opportunity to conduct real-world NASA research using satellite data
- Challenges
  - Efficiently and effectively making the best use of all of our skills
  - Communication without meeting in person



How SEES has Contributed to Our Future Education and Career Plans

Thank You to all mentors and the SEES program for this amazing opportunity!