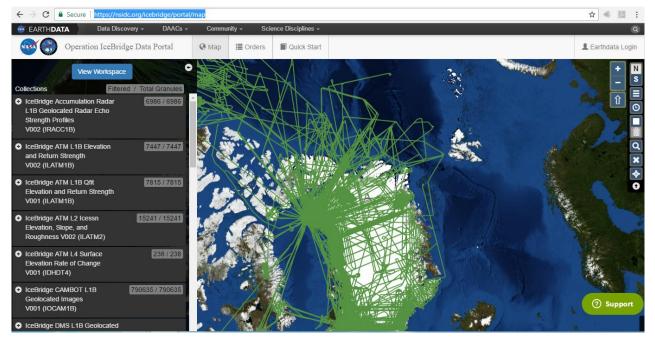
NASA Operation IceBridge Flight Segment Data Lab - Student Guide

Introduction: NASA's Operation IceBridge (OIB) uses remote sensing techniques from an airborne laboratory to take measurements on changing polar ice in the Arctic and Antarctica each year. The amount of data collected is immense, but in this study you will learn how to extract localized data from a segment of a particular science flight and explain how the data from an airborne mission fits into the 'big picture' of understanding how Earth's ice sheets are changing. Work through each part in this series of exercises carefully to learn how to use OIB data in Excel and how to attach a segment of data points to a map in Google's MyMaps application. You will need access to a computer and internet for this assignment.

Part 1: Accessing Data from National Snow and Ice Data Center (NSIDC)

 Open the NASA Operation IceBridge data portal in your internet browser using the following URL: <u>https://nsidc.org/icebridge/portal/map</u>. You will see a map of the Greenland Ice Sheet covered with hundreds of green flight lines. These lines represent every science flight Operation IceBridge has completed since it began its mission in 2009.

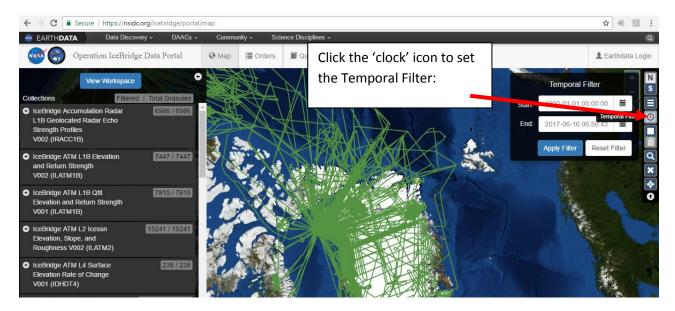


The National Snow and Ice Data Center (NSIDC) contains collections from each year of NASA Operation IceBridge science flights in the Arctic and Antarctica and includes data from snow and ice penetrating radar, a LiDAR-based instrument known as the Airborne Topographic Mapper (ATM), and high resolution digital imagery. Each collection is listed in the Collections Menu on the left side of the screen. **FOCUS:** We will be working with data collected using the Airborne Topographic Mapper which uses Light Detection and Ranging (LiDAR) to measure the topography of the ice surface above ground level. By the end of Parts 1-3 you should be able to plot position and height coordinates from OIB ATM data on a map in the Google MyMaps application.

BACKGROUND: Each year a panel of scientists determines critical flight paths needed to collect important information on Earth's polar ice and to maintain a continuous record of data. One of those flights each year is known as Zachariae- 79N named for two outlet glaciers in Northeast Greenland. The base of these glaciers is below sea level and data from these glaciers is critical for scientists studying how they lose ice and interact with ocean water. In this assignment, we are going to examine data from the 2016 mission over those glaciers (each year the same flight path is flown to keep a record of changes over time).

EXTRACTING OUR DATA: Let's filter the map in our browser window to reveal only the Zachariae- 79N 2016 flight path. Follow these steps:

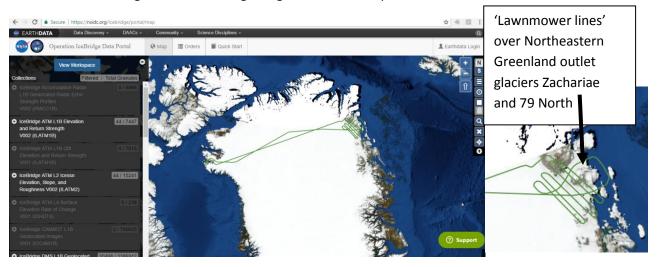
2. On the right side of the map in your browser, select the icon that looks like a clock (see below). This provides a temporal filter (or allows us to filter by time). You should see a window pop up with spaces to input a **start** and **end** time:



3. In 2016, the Zachariae- 79N 2016 mission was completed on May 9. Use this information to set your start and end boundaries as shown below, from midnight on May 9th to midnight on May 10th (entered in military time as 2016-05-09 00:00:00 to 2016-05-10 00:00:00):



4. All of the flight lines will disappear except for the May 9, 2016 flight which collected data from West to East across the interior of Greenland and then across the outlet glaciers in the Northeast along 'lawn mower' flight segments. Your map should look like this:



 We are going to work with data from a segment of that flight as the aircraft passed over the interior of the Greenland Ice Sheet. Below, you see some images from the aircraft (a NOAA WP-3D) taken by ATM Scientist Jim Yungel during this flight:



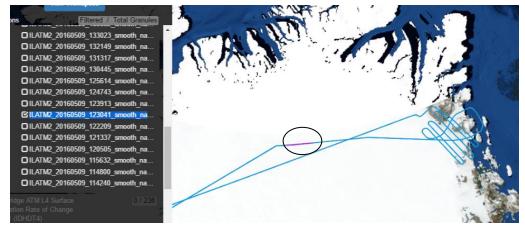
- To access the data collected along the flight line chosen, take a look at the Collections Menu on the left of the browser window. Find the file set titled: IceBridge ATM L2 Icessn Elevation, Slope, and Roughness V002 (ILATM2)
- Click the (+) sign next to that title to reveal the year of data available (2016). Click the (+) sign next to 2016 to reveal the dates of data available. Finally, click the (+) sign next to May 9 to reveal all of the data sets from the May 9th 2016 science flight as shown.



With the cursor, hover over each of the data files listed and pay attention to the flight path on your map. What do you notice about the flight line as you move your mouse over each file? We are going to select a segment from the interior of the Greenland Ice Sheet and you will see that section of the flight line change color. Follow the instructions below:

8. Find the data file on the left menu with the name

ILATM2_20160509_123041_smooth_nadir3seg_50pt.csv Click the checkbox next to the file name. You should see a segment in the middle of the flight line change to purple once that box is checked:



- 9. Now all of the data from that segment of the flight is available in your 'Workspace.' To access and download the data you will need to Create a Log-in for the NSIDC Operation IceBridge Portal. If your teacher has provided a log in or a link to the file, you may use that instead.
- 10. Click the 'View Workspace' button above the data collections menu on the left side of your screen. You will see a pop-up window like the one shown below:

Secure https://nsidc.org/	/icebridge/portal	/map		
A Data Discovery +	DAACs + C	ornmunity + Science Disciplines +		
Operation IceBridge Data I	My Workspace			×
View Workspace Filtered / Tota	1 granules, 2 file Data in my work			
ATM2_20160509_133023_smoc ATM2_20160509_132149_smoc	+ IceBrid V002 (I	ge ATM L2 Icessn Elevation, Slope, and Roughness ATM2)	Documentation 🕑 710 KB	6
ATM2_20160509_131317_smot ATM2_20160509_130445_smot	Login for O	der Options		
ATM2_20160509_125614_smoc ATM2_20160509_124743_smoc ATM2_20160509_123913_smoc			Clos	e
ATM2_20160509_123041_smoo ATM2_20160509_122209_smoo ATM2_20160509_121337_smoo	th_na	_	A A A A	sida.
ATM2_20160509_120505_smoo ATM2_20160509_115632_smoo	th_na th_na		No.	
ATM2_20160509_114800_smool ATM2_20160509_114240_smool			14 Martin	

If there is more than one file listed in your workspace, you may have accidentally checked another file's box. You can hover over the right side of the file name IN THE POP-UP window to click an 'x' and delete the additional files.

- 11. Log in to download the file or follow the prompts to create an account by clicking the green login button.
- 12. Once you have created an account or logged into the portal, you can download the data set either to your computer or send it to Google Drive. With the file available as an xml worksheet, it is time to dig in to the raw data and clean it up to create a visual. You are now ready to move into Part 2: Working with OIB ATM data in Excel!

PART 2: WORKING WITH OIB ATM DATA IN EXCEL

In this section, you will learn how to extract a data from a segment of a NASA OIB science flight using Microsoft Excel.

File Preparation

- 1. Begin by launching Microsoft Excel on your desktop. Open the xml file you saved in Part 1 (if you sent the file to Google Drive, you will have to download the file to your computer first.
- 2. You should see a table that looks like this:

		• (° ·) •					ILATI	M2_2016050	9_123041_sr	nooth_nadir	seg_50pt -		ETAD. FORM					DATA	SET	
Pas	Home	nat Painter	Page Lay	• 11 • A ▲ I • = • ◇ • <u>A</u>		<mark>=</mark> ≫- ≡ ∉ ¢	ew Wrap Merg mment	je & Center	Genera S				rmat Cell able ← Styles →	Insert	Delete Form Cells	🗄 🗔 Fil	S	ort & Find & Iter Y Select Y		
	-	В	С	D	E	F	G	H	-	J	K	L	M	N	0	Р	Q	R	S	1
1 1	# Filename		20160509	123041 smooth na	dir3seg 50	ot.csv	<hr/>	/												
_		_		60509_123125.atm5				/												
	#Number			-				<hr/>												
_	# Nadir blo							\mathbf{N}												
5 #	#Output in	nterval: 0.2	25sec			-														
6 #	# Smoothir	ng interval	: 0.5sec																	
7 ‡	# Trajector	y file used	: 160509_w	vp3d_l12_cfm_itrf08	3_03jun16_	b897														
				rence Frame: ITRF08																
9 #	#																			
				WGS84_Ellipsoid_H	South-to-	West-to-	RMS_Fit(Number_	Number	Distance	Track_Id	entifier								
	45026.75			2226.6749	-0.00455	0.002038	6	582	2			L								
12	45026.75	79.71247	315.9564	2226.5428	-0.0019	0.001395	5.54	312	1	-22										
_	45026.75			2226.4467		0.000641	5.75	550				-								
L4	45026.75			2226.5851		0.001403	5.54	522				-								
15	45027		315.9582	2226.7238		0.000624	6.21	579												
16		79.71248		2226.5935		0.001614	5.66	321				2								
17		79.71296	315.958	2226.486		0.001499	6.05	556				-								
18		79.71229		2226.6392		0.001761	5.17	530												
	45027.25		315.96	2226.7717		0.001628	5.43	586												
	45027.25			2226.6367		0.000758	5.81	327			:									
_	45027.25			2226.5389		0.001647	6.15	564				-								
	45027.25		315.9599	2226.6931			5.64	539												
23		79.71202		2226.8248		0.001572	5.23	588				L								
24	45027.5		315.9616	2226.684		0.002037	6.4	332				2								
25		79.71298		2226.5855		0.001474	6.19	558	1	-74	3									
••		IM2_2016	50509 <u>12</u> 3	3041_smooth_n 🦯								I 4 🔚								

Rows 1-8 in this table provide our **metadata**, a data set that provides information about other data. Row 10 identifies the information listed in each column.

3. First, we want to determine the data we are interested in plotting. In our case, we are going to plot position (latitude and longitude) and height. In this data set, select and highlight the columns titled Latitude, Longitude, and Ellipsoid Height. You can use the double arrow with your mouse to stretch each column in order to see full titles and units. (*Note: the combination 'Shift+Ctrl+↓' allows you to highlight the full column instantly). See the example on page 7.

9	#											
10	# UTC_Sec	Latitude(deg)	Longitude(deg)	WGS84_Ellipsoid_Height(m)	South-to-	West-to-I	RMS_Fit(Number_	Number_	Distance_	Track_Identi	fier
11	45026.75	79.71199	315.956521	2226.6749	-0.00455	0.002038	6	582	2	31	1	
12	45026.75	79.71247	315.956379	2226.5428	-0.0019	0.001395	5.54	312	1	-22	2	
13	45026.75	79.712949	315.956237	2226.4467	-0.00258	0.000641	5.75	550	4	-76	3	
14	45026.75	79.71227	315.956438	2226.5851	-0.00215	0.001403	5.54	522	2	0	0	
15	45027	79.712002	315.958242	2226.7238	-0.00381	0.000624	6.21	579	3	32	1	
16	45027	79.712481	315.958103	2226.5935	-0.00256	0.001614	5.66	321	1	-22	2	
17	45027	79.712961	315.957964	2226.486	-0.00264	0.001499	6.05	556	1	-75	3	
18	45027	79.712286	315.95816	2226.6392	-0.00203	0.001761	5.17	530	4	0	0	
19	45027.25	79.712012	315.959965	2226.7717	-0.0024	0.001628	5.43	586	3	32	1	
20	45027.25	79.712492	315.959829	2226.6367	-0.00268	0.000758	5.81	327	0	-21	2	
21	45027.25	79.712972	315.959692	2226.5389	-0.00212	0.001647	6.15	564	2	-75	3	
22	45027.25	79.712302	315.959883	2226.6931	-0.00259	0.00158	5.64	539	1	0	0	
23	45027.5	79.712022	315.961687	2226.8248	-0.00224	0.001572	5.23	588	2	33	1	
24	45027.5	79.712502	315.961553	2226.684	-0.00249	0.002037	6.4	332	1	-21	2	
25	45027.5	79.712982	315.961419	2226.5855	-0.0011	0.001474	6.19	558	1	-74	3	
н	ILA	TM2_2016050	9_123041_smoo	th_n 🔁					Ī	4		

4. Copy and paste the three selected columns into a new sheet. Once everything is highlighted, CTRL + C will work to copy everything the selected columns. Click the tab at the bottom of the Excel workbook to add a new sheet. Click Cell A1 and use the combination Ctrl + V to paste your copied data columns. Your new sheet should look like the one below (be sure to include the titles for those columns):

-	Home	Insert	Page Lay	out Fo	rmulas	Data	Review	View
ſ	🗎 🔏 Cut		Calibri	* 11	• A A		- 🕳 🗞	-
Pa	ste Cop		BI		Δ. Δ.			5
	🗸 🝼 Forr	nat Painter	D 1 9				-	
	Clipboard	4 6		Font		2		Alignm
	A1	-	()	<i>f</i> _≭ Latit	ude(deg)			
	А	В	С	D	E	F	G	
1	Latitude(Longitude	WGS84_E	lipsoid_H	eight(m)			
2	79.71199	315.9565	2226.675					
3	79.71247	315.9564	2226.543					
4	79.71295	315.9562	2226.447					
5	79.71227	315.9564	2226.585					
6	79.712	315.9582	2226.724					
7	79.71248	315.9581	2226.594					
8	79.71296	315.958	2226.486					
9	79.71229	315.9582	2226.639					
10	79.71201	315.96	2226.772					
11	79.71249	315.9598	2226.637					
12	79.71297	315.9597	2226.539					
13	79.7123	315.9599	2226.693					
14	79.71202	315.9617	2226.825					
15	79.7125	315.9616	2226.684					
16		315.9614						
17		315.9616	2226.744					
18		315.9634	2226.878					
19	79.71251	315.9633	2226.738					
20	79.71299	315.9631	2226.619					
21	79.71233	315.9633	2226.796					
22	79.71204	315.9651	2226.904					
23	79.71252	315.965	2226.777					
24	79.713	315.9649	2226.671					
25	79.71235	315.965	2226.826					

Google MyMaps has some restrictions and we will need to make some adjustments to our data in order to meet the criteria. The first restriction involves position coordinates: Latitude and longitude values range from 0° to $\pm 90^{\circ}$. Notice the longitude coordinates in Column B do not meet that restriction so we will need to reformat that information.

5. Select and cut (**CTRL+X+**[↓]) the numerical data in Column B (beginning with B2) in Sheet 1 and paste it into Column E as shown below:

0) 🖬 🤊	• (* •) =						
U	Home	Insert	Page La	yout	For	nulas	Data	Re
	Cut	у	Calibri		- 11	· A A		=
Pa	For	mat Painter	BI			◇ - A		=
	Clipboar	d G		For	nt		5	
	E2	•	()	f _x	315.95	56521		
	А	В	С	C)	E	F	
1	Latitude(Longitude	WGS84_E	llipso	id_He	ight(m)		
2	79.71199		2226.675			315.9565	i	
3	79.71247		2226.543			315.9564	ļ.	
4	79.71295		2226.447			315.9562	2	
5	79.71227		2226.585			315.9564	ļ.	
6	79.712		2226.724			315.9582	2	
7	79.71248		2226.594			315.9581		
8	79.71296		2226.486			315.958	1	
9	79.71229		2226.639			315.9582	2	
10	79.71201		2226.772			315.96	i	
11	79.71249		2226.637			315.9598	8	
12	79.71297		2226.539			315.9597	1	
13	79.7123		2226.693			315.9599)	
14	79.71202		2226.825			315.9617	'	
15	79.7125		2226.684			315.9616	6	
16	79.71298		2226.586			315.9614	ļ.	
17	79.71232		2226.744			315.9616	5	

6. To reformat the longitude, we need to subtract 360 degrees from each longitude value to obtain its reference angle and sign. This is a fast process using Excel formulas. Begin by highlighting cell B2:

C) 🖬 🤊	• (* •) •						IL
0	Home	Insert	Page Lay	out Fo	rmulas l	Data Re	view V	iew
1	🗎 🔏 Cut		Calibri	- 11	· A A	= =	≡ ≫	a v
Pa	ste	У	BI	, ,	A - A -			
	🗧 🝼 Fori	mat Painter	D <u>1</u>		<u> </u>		-=	
	Clipboar	d D		Font	5		Aligi	nment
	B2	•	()	f_{x}				
	А	В	С	D	E	F	G	Н
1	Latitude(Longitude	WGS84_E	lipsoid_H	eight(m)			
2	79.71199		2226.675		315.9565			
3	79.71247		2226.543		315.9564			
4	79.71295		2226.447		315.9562			
5	79.71227		2226.585		315.9564			
6	79.712		2226.724		315.9582			
7	79.71248		2226.594		315.9581			
8	79.71296		2226.486		315.958			
9	79.71229		2226.639		315.9582			
10	79.71201		2226.772		315.96			
11	79.71249		2226.637		315.9598			
12	79.71297		2226.539		315.9597			
13	79.7123		2226.693		315.9599			
14	79.71202		2226.825		315.9617			
15	79.7125		2226.684		315.9616			
16	79.71298		2226.586		315.9614			
17	79.71232		2226.744		315.9616			
18	79.71203		2226.878		315.9634			
19	79.71251		2226.738		315.9633			
20	79.71299		2226.619		315.9631			
21	79.71233		2226.796		315.9633			
22	79.71204		2226.904		315.9651			
23	79.71252		2226.777		315.965			
24	79.713		2226.671		315.9649			
25	79.71235		2226.826		315.965			
H -		LATM2_201	60509_123	041_smoot	th_n St	neet1 🦯	i/	

Page Layout

B I U - 🖸 - 🖄 -

f_x

C D

Font

Calibri

Latitude(Longitude WGS84_Ellipsoid_Height(m)

2226.675

2226.543

2226.447

2226.585

2226.724

2226.594

2226.486

2226.639

2226.772

2226.637

2226.539

2226,693

2226.825

2226.684

2226.586

2226.744

2226.878

2226.738

Formulas

• 11 • A A

A

Е

315.9565

315.9564

315.9562

315.9564

315.9582

315.9581

315.958

315.9582

315.9598

315.9597

315,9599

315.9617

315.9616

315.9614

315.9616

315.9634

315.9633

315.96

5

Data

=

E 三

F

=

🚽 🍤 = (°) =

💞 Format Painter

🕒 Сору

Clipboard **B**3

) =

5

В

-44.0435

- ()

Insert

7. With B2 highlighted, and the original Longitude values listed beginning in cell E2, type the following formula exactly as shown: = E2 - 360. You will see it appear in the function cell in the menu bar. Hitting enter will reveal the calculated value (315.9565-360).

							_	_	
0) 🖬 🤊	- (° -) -						G	
Ci	Home	Insert	Page Lay	out F	ormulas	Data	Revie	_	Н
Pa	Ste	y nat Painter	B I I	• 11 <u>J</u> • .	• A /			Pa	ste Clipi
	Clipboard	d G		Font		G.			I
	SUM	•	() X 🗸	<i>f</i> _∞ =E2-	-360				А
4	А	В	С	D	E	F		1	Latitu
1		-	WGS84_E	_	-			2	79.71
-				inpsold_F		· -		3	79.71
2	79.71199	=E2-360	2226.675		315.956	-		4	79.71
3	79.71247		2226.543		315.956			5	79.71
4	79.71295		2226.447		315.956	52		6	79.
5	79.71227		2226.585		315.956	54		7	79.71 79.71
6	79.712		2226.724		315.958	32		8 9	79.71
7	79.71248		2226.594		315.958	31		10	79.71
8	79.71296		2226.486		315.95	8		11	79.71
9	79.71229		2226.639		315.958	32		12	79.71
10	79.71201		2226.772		315.9	96		13	79.7
11	79.71249		2226.637		315.959	8		14	79.71
12	79.71297		2226.539		315.959	-		15	79.7
13	79.7123		2226.693		315.959	-		16	79.71
						-		17	79.71
14	79.71202		2226.825		315.961			18	79.71
15 16	79.7125		2226.684		315.961			19	79.71

8. Highlight B2 and use the combination **Ctrl + Shift +** \downarrow on your keyboard to highlight all of the cells in column B. From the menu bar, select 'Fill' and 'down' in order to apply the formula in B2 to the rest of the column. Delete any cells in column B that do not have a corresponding latitude and height coordinate.

	Home	<u>• (≌ •</u>) = Insert		Formulas D	ata R	eview Vi	-					itosaved] - Mic							0	
	Cut		Calibri 🔹	11 × A a	= =	= »··	📑 Wrap	o Text	General			s 🥠			*	Fill Y		A		
as	ste	mat Painter	B I U -	- 👌 - 🗛 -		≡ 律律	Merg	je & Center 👻	\$ - %	· · · · · · · · · · · · · · ·	Cond	itional Format tting = as Table		Ins	Down	-		& Find &		
	Clipboar		Font	6		Align	ment	6	Nu	mber 6		Styles	Style		Bight		Editing	· Select ·		
-	B2		(<i>f_x</i> =E	2-360	A	-			~		<u> </u>			•	Up					_
1	A	В	C D	E	F	G	н			К	L	М	N		Left		R	S	Т	
ł			WGS84_Ellipsoid		F	0	п			ĸ	L.	IVI	IN		Across Workshee	+-	n	3		
t	79,71199		2226.675	315,9565										_	Series					
t	79.71247		2226.543	315,9564											Justify					
	79.71295		2226.447	315.9562											Zustity					
	79.71227	-44.0436	2226.585	315.9564																
	79.712		2226.724	315.9582																
	79.71248	-44.0419	2226.594	315.9581																
	79.71296	-44.042	2226.486	315.958																
	79.71229	-44.0418	2226.639	315.9582																
	79.71201	-44.04	2226.772	315.96																
	79.71249	-44.0402	2226.637	315.9598																
	79.71297	-44.0403	2226.539	315.9597																
	79.7123	-44.0401	2226.693	315.9599																
	79.71202	-44.0383	2226.825	315.9617																
	79.7125	-44.0384	2226.684	315.9616																
	79.71298	-44.0386	2226.586	315.9614																
	79.71232	-44.0384		315.9616																
	79.71203		2226.878	315.9634																
	79.71251			315.9633																
	79.71299	-44.0369		315.9631																
	79.71233	-44.0367		315.9633																
	79.71204			315.9651																
	79.71252		2226.777	315.965																
	79.713		2226.671	315.9649																
	79.71235	-44.035	2226.826	315.965																

9. Highlight columns A, B ,and C. Then, use the combination **Ctrl+C** to copy your reformatted position and elevation values. Open another new sheet (Sheet 2).

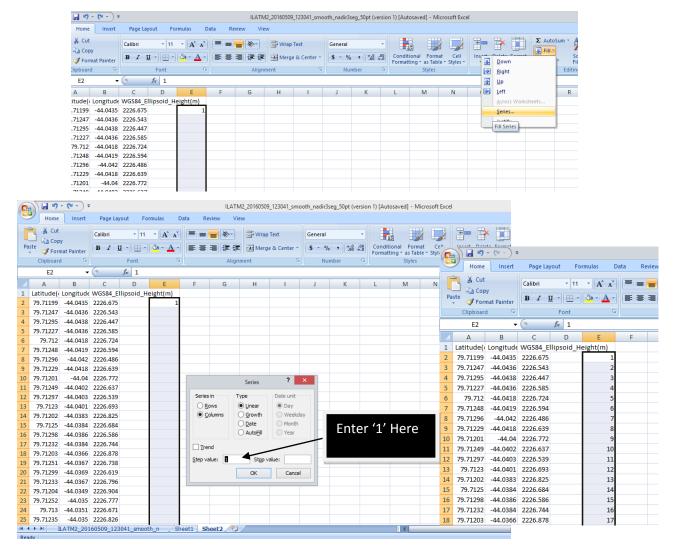
	Home Insert Page Layout Formulas Data Review View													
C	Home	Insert	Page La	yout Fo	rmulas [Data Re	view Vi	ew						
Pa	K Cut		Calibri	• 11 <u>•</u> • = •	• A • •		<mark>_</mark> ≫- ∃ :: :	Т Т П П П М						
	 Clipboard 	mat Painter		Font			Alian	ment						
		u	G				Aligi	iment						
	A1	-	(ude(deg)									
	А	В	С	D	E	F	G	Н						
1		Longitude	_	lipsoid_H										
2	79.71199	-44.0435	2226.675		315.9565									
3	79.71247	-44.0436	2226.543		315.9564									
4	79.71295	-44.0438	2226.447		315.9562									
5	79.71227	-44.0436	2226.585		315.9564									
6	79.712	-44.0418	2226.724		315.9582									
7	79.71248	-44.0419	2226.594		315.9581									
8	79.71296	-44.042	2226.486		315.958									
9	79.71229		2226.639		315.9582									
10	79.71201	-44.04	2226.772		315.96									
11	79.71249		2226.637		315.9598									
12	79.71297		2226.539		315.9597									
13	79.7123	-44.0401	2226.693		315.9599									
14	79.71202		2226.825		315.9617									
15	79.7125	-44.0384	2226.684		315.9616									
16	79.71298	-44.0386	2226.586		315.9614									
17	79.71232	-44.0384	2226.744		315.9616									
18	79.71203	-44.0366	2226.878		315.9634									
19	79.71251	-44.0367	2226.738		315.9633									
20 21	79.71299 79.71233	-44.0369	2226.619		315.9631									
_		-44.0367	2226.796		315.9633									
22	79.71204	-44.0349	2226.904		315.9651									
23	79.71252	-44.035	2226.777		315.965									
24	79.713	-44.0351	2226.671		315.9649									
25	79.71235	-44.035	2226.826	041	315.965									
	dv	LATM2_201	00509_123	5041_SM001	un_n jsr	eet1 / Sh	ieet2 🖉							

10. From the Paste drop-down on the menu in Sheet 2, select '**Paste Values**.' If you miss that option, you will see an error resulting from the formula used in Column B on Sheet 1.

0) 🖬 🤊	- (~ -) -					П	LATM2_20160509_
	Home	Insert	Page Lay	out Fo	rmulas	Data	Review	View
	📜 🔏 Cut		Calibri	- 11	• A 4		_	📑 Wrap T
Pa	ste Cop	·	BIL	, -) []] -)	8 - A			Merge
		nat Painter		Font				
*	<u>P</u> aste							Alignment
	<u>Formulas</u>				ude(deg)			
_	Paste <u>V</u> alue		с	D	E	F	G	Н
	No <u>B</u> orders	•	WGS84_EI	lipsoid_H	eight(m)			
	Transpose		2226.675					
	Paste Li <u>n</u> k		2226.543					
B	Paste <u>S</u> peci	al	2226.447					
8	Paste as <u>H</u> y	perlink	2226.585					
	As Picture	•	2226.724 2226.594					
8	79.71296	-44.042	2226.394					
9	79,71229	-44.0418	2226.639					
10	79.71201	-44.04	2226.772					
11	79.71249	-44.0402	2226.637					
12	79.71297	-44.0403	2226.539					
13	79.7123	-44.0401	2226.693					
14	79.71202	-44.0383	2226.825					
15	79.7125	-44.0384	2226.684					
16	79.71298	-44.0386	2226.586					
17	79.71232	-44.0384	2226.744					
18	79.71203	-44.0366	2226.878					
19	79.71251	-44.0367	2226.738					
20	79.71299	-44.0369	2226.619					
21	79.71233	-44.0367	2226.796					
22	79.71204	-44.0349						
23	79.71252	-44.035						
24	79.713	-44.0351	2226.671					
25	79.71235	-44.035						
14 4		LATM2_201	60509_123	041_smoot	th_n 🖉	Sheet1	Sheet2	2
Rea	ay							

Make sure to choose this option to avoid any errors from the formula used in Step 9 (which requires the values from column E2)! Now that we have correctly formatted position coordinates, the next step is reducing the amount of data points in order to successfully create a visual in My Maps. To do this, we will extract every 3rd data point from our data set in Sheet 2. This will reduce our set by about 6000 points but still provide enough information to plot on Google MyMaps.

11. We are going to use Columns E and F in Sheet 2 for this step. Number the rows in column E (beginning with E2) in sequential order beginning with the number 1. To do this type '1' in cell E2. Then select 'Fill', 'series', and 'linear.' Make sure the step value under linear is set to '1.' (See inset below):



12. Now, in column F, beginning with cell F2, enter the following formula:

=MOD(E2,3)

Use the combination **Ctrl+Shift+** \downarrow to highlight the entire column; select 'Fill' and 'down' to apply the formula to all of column F. Your table should like this:

	Image: Control of the second												
E	Home	Insert	Page Lay	out Fo	rmulas D	ata Revi	ew Viev	v					
	🗎 🔏 Cut		Calibri	- 11	× A A	=		📑 Wrap	Test				
ų	🗐 🔓 Cop	у	Calibri	• •		- = =	3 3 7 1	Ele Miab	Text				
Pa	ste 🛷 Forr	nat Painter	BII	I - 🖽 -	🏷 - <u>A</u> -			📑 Merg	e & Center *				
	Clipboard	d 6		Font	G		Alignm	ient	6				
	F2	-	(•	<i>f</i> _∞ =MO	D(E2,3)								
	Α	В	С	D	E	F	G	н	1				
1	Latitude(Longitude	WGS84_EI	lipsoid_H	eight(m)								
2	79.71199	-44.0435	2226.675		1	1							
3	79.71247	-44.0436	2226.543		2	2							
4	79.71295	-44.0438	2226.447		3	0							
5	79.71227	-44.0436	2226.585		4	1							
6	79.712	-44.0418	2226.724		5	2							
7	79.71248	-44.0419	2226.594		6	0							
8	79.71296	-44.042	2226.486		7	1							
9	79.71229	-44.0418	2226.639		8	2							
10	79.71201	-44.04	2226.772		9	0							
11	79.71249	-44.0402	2226.637		10	1							
12	79.71297	-44.0403	2226.539		11	2							
13	79.7123	-44.0401	2226.693		12	0							
14	79.71202	-44.0383	2226.825		13	1							
15	79.7125	-44.0384	2226.684		14	2							
16	79.71298	-44.0386	2226.586		15	0							
17	79.71232	-44.0384	2226.744		16	1							
18	79.71203	-44.0366	2226.878		17	2							
19	79.71251	-44.0367	2226.738		18	0							
20	79.71299	-44.0369	2226.619		19	1							
21	79.71233	-44.0367	2226.796		20	2							
22	79.71204	-44.0349	2226.904		21	0							
23	79.71252	-44.035	2226.777		22	1							
24	79.713	-44.0351	2226.671		23	2							
25	79.71235	-44.035	2226.826		24	0							
	I F FI I	LATM2_201	60509_123	041_smoot	h_n / Sh	eet1 She	et2 🖉						

13. Now we'll implement a filter to delete every third row in the sheet

-Select all of column F using the Ctrl+Shift+↓ combination.

-Choose 'filter' from the data menu.

-Select Autofilter and using the drop-down menu, choose '0':

	🚽 🍤	- 01 -) =							ATE43 201	60500 1000	41 smooth_*	DATA MENU	oft Excel	
		- ()•							LATIVIZ_201	00009_1230	41_smooth_r	DATA MENU	ott Excel	
	Home	Inse	ert Pag	ge Layout	For	mulas	Data	Review	Vie	w					
From Access	From Web	Text	From Other Sources *	r Exist Conne	ing	Refresh All *	Conn Prope Se Edit L	rties inks	Ž↓ Ž Z↓ So		🦉 Adva	ply Text		solidate What-If Analysis ~	Group Ungroup Subt
	C8107		- 6	fr											
						ILATN	12_20160509_	123041_smo	th_nadir3	seg_50pt (Auto	osaved) - Mic	rosoft Excel			
			nulas	Data	Review	View									
				Connecti	ons A I			lear			~ –	i i i i i i i i i i i i i i i i i i i			
				Propertie	z+			leapply	-		š	.			
				🖘 Edit Links		Sort				Remove E uplicates Valio		olidate What-II Analysis			
				nnections		S	ort & Filter		.orunnis D		ta Tools	enuity in			
			4_Ellips	oid_Heigh	it(m)										
			A	В	с	D	E	F	G	н	1	J			
			titude(Longitude	WGS84	Elipsoid	l_Height(m)							
			€,71199			5		1	N						
).71295	-44.0438		Sort Sma	llest to Larges	t							
				-44.0419		Sort Larg	est to Smalles	t							
			€.71201	-44.04		Sort by C	olor		·						
			79.7123	-44.0401	22: 隊	<u>C</u> lear Filt	er From "1"								
			9.71298	-44.0386		Filter by	Color								
				-44.0367		Number	Eilters		·						
			9.71204				elect All)								
			9.71235	-44.035			elect Ally								
).71301).71253			🗆 1									
).71205			2 (B	lanke)								
			3.71239				idi iks/								
			9.71303												
			9.71256												
			∂.71208												
).71243	-44.0246	22:										
).71305	-44.023	2:		OK	Cancel							
			€,71258	-44.0212	222				.:						
			9.71211	-44.0194	2227.28	15		57	0						
			9.71247	-44.0195	2227.20)6		60	0						
				-44.0179				63	0						
			9.71261		2227.26			66	0						
				-44.0142				69	0						
			H ILA	TM2_2010	60509_1	23041_9	mooth_n	2							

14. Now your table will only be showing every 3rd data point from the original data set. This reduces the size of the file by several thousand points.

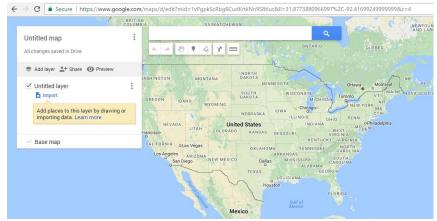
SAVING DATA INTO A CSV FILE (For Import into MyMaps):

- Highlight and copy columns A, B, and C now that you have formatted and reduced the data set.
 Use Ctrl + C to copy those columns.
- 16. Select 'File', 'New,' and 'Blank Workbook'.
- 17. Paste your newly reformatted and reduced columns A, B, and C into the new workbook. Now you will save the workbook into a file format that can be important into MyMaps in Google.
- 18. Go to 'File,' and 'Save As': ATM_MAPFILE_NAMEDATE. In File Type, select the option for CSV file. There may be pop-up warnings explaining formatting changes in csv versus xml. Click 'OK' on each of these warnings.

Now you have a file ready to be imported as a map layer- move on to Part 3!

Part 3: Creating a Layer in Google MyMaps with OIB Data

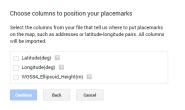
- 1. Open your internet browser (this instruction set was created using Google Chrome).
- 2. In the browser window, type mymaps.google.com
- 3. You will be prompted to log into your Google account (if you do not have one, follow the prompts to Create a New Account before moving on).
- 4. Select the +CREATE A NEW MAP button to (you guessed it ⁽²⁾) create a new map. You'll see the following screen:



- 5. Click the words 'Untitled map' and change the name to 'FlightSegment1'. Click the words 'Untitled Layer' and change the name to SegmentYourName (using your actual name)
- 6. Under 'SegmentYourName,' click Import.
- 7. Choose the file you saved from Part 2 to import into your map

Add places to this layer by importing data. Learn more	SegmentName	pload Google Drive Photo albums
Adoplaces to this layer by importing data. Laam mor Base map Drag a CSV, XLSX, KML or GPX file here or, if you prefer	Add places to this layer by	
Or, if you prefer		
·	Base map	Or, if you prefer
	1	

8. A pop-up window will appear to determine which columns in your csv file to use for position. If this does not appear, double check your saved file and make sure you have titles in each of your columns (Latitude, Longitude, Ellipsoid Height).



9. Click Latitude, and then select *latitude* in Google's options:



10. Repeat that process for Longitude (then click 'continue'):



11. The next pop-up asks you to title your data markers that will appear on the map. Select the 3rd option (Ellipsoid height) and click 'Finish':

Pick a colum of the locatio		title for the placemarks, such as the	nam
	(deg)		
	de(deg) 🔝 Ellipsoid_Heig	ht(m) ?	
Finish	Back	Cancel	

12. Your screen should look something like this:

10	ui sereen should	
	FlightSegment1 1 view All changes saved in Drive	
	s Add layer 🛓 Share 💿 Preview	
	 SegmentName Cuitorm style All items (2000) 	
	🔄 Base map	
		+

13. Click 'Uniform Style' and select the option to style data by column 'ellipsoid height':

FlightSegr 1 view All changes s		:	8 • 4 ¥ 📼		٩			0	
	r 🛓 Share 💿 Preview								
Segr Base	irrun aleces hv Uniform style Sequence of numbers Individual styles Style by data column: Latitude(deg) Longitude(deg) WGS84_Ellipsoid_Height(×							\$
				Google My Ma	ips			?	+

14. Select 'Range' and change the range value to 10



15. Describe based on the segment of data points on your map, how thickness or height level varies from West to East. Do you think this information is representative of the entire mission flown when this data was collected? What differences might you see if we extracted a flight segment closer to the East Coast of Greenland?

16. Change the 'Base Map' to satellite view. Zoom out until you can see the outline of the Greenland Ice Sheet. How does the flight segment you worked with today compare to the size of the entire Ice Sheet? What do you think are some advantages of using airborne missions rather than local ground-based measurements in polar ice studies? (Use examples from the exercises you completed in Parts 1-3 to support your response).

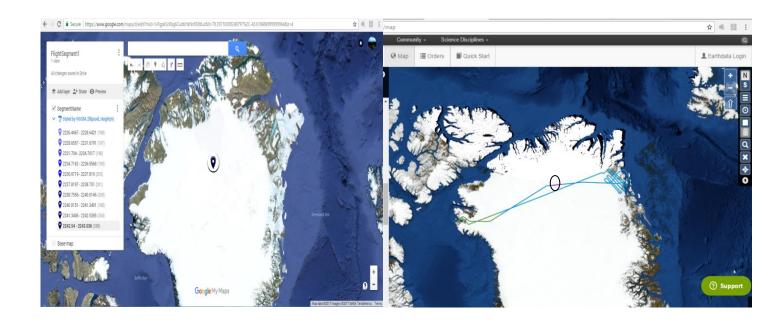
DELIVERABLES:

In a Microsoft Word Document or new Google Doc, take a screenshot of the flight path we collected data from on the NSIDC OIB portal. Mark, circle, highlight, or otherwise note the location of the segment of data we worked with on your map. *A sample is shown on the following page.* In that document, respond to the following discussion questions:

Q1.) What is the benefit of using airborne remote sensing techniques to collect data on polar ice? How might these techniques help us learn about other regions of our planet (tropics, deserts, cities, oceans, etc.). Be specific in your response and include any evidence you used to support your responses on page 16.

Q2.) If you could create your own data collection project using an airborne remote sensing campaign, what would you study? Briefly describe the timeline and geographic extent of your study including reasons for your choice.

Q3.) Ground measurements, airborne science measurements, and satellite imagery help provide a complete picture of our changing planet. In your own words, explain how these three techniques complement one another in polar ice studies. (Think: Do we need all three to understand our ice sheets fully? If we stopped one of the three, would we still gain sufficient information to support scientific models?) Cite any additional sources you use to respond to this question.



Part 4: Team Flight Segment Profiles

Instructions: Now that you've worked through the process of extracting and mapping data from a specific science flight segment completed by NASA's Operation IceBridge, you and your team are challenged with creating a data story for a series of flight segments over outlet glaciers in Northeastern Greenland. You may choose to look for Zachariae-79N flight paths from other years in addition to the 2016 data. Watch the NSIDC Quickstart videos to learn how to search for data from a specific region in addition to using the temporal filters that we used in this activity.

- With your team members, choose a series of flight segments covering the 'lawn mower' lines over the tidewater glaciers Zachariae and 79 N. Using the process you followed in Parts 1-3, each of you should reformat your data files into a csv file that can be imported into Google MyMaps.
- Select a group leader to open a new map in MyMaps. That person should 'share' the map with all group members. (It works just like any Google Doc. Make sure to allow your team members to edit).
- 3. Each group member will title and add a new layer to that map for his or her chosen lawn mower line segment.
- 4. Using the MyMaps overlay you constructed as a team and the information from the NSIDC portal, create a visual representation of the tidewater glaciers in Northeastern Greenland. Be creative in your representation and use any media you'd like (PPT, YouTube, old-fashioned poster board, Prezi, etc.).