

TEAM KAPPA

INTRODUCTION

What is your science question?

Can wind streak ratios be used to determine wind velocity differences in the elevation band of 2500-5000m around Alba Patera?

Why is this question important and interesting?

Our question is interesting because we want to see if wind velocities can vary around Alba Patera.

Hypothesis?

Wind streak ratios will be greater in the Northern quadrants around Alba Patera.

Alternate Hypothesis?

Wind streak ratios will all be the same in each quadrant around Alba Patera.

DEFINITIONS

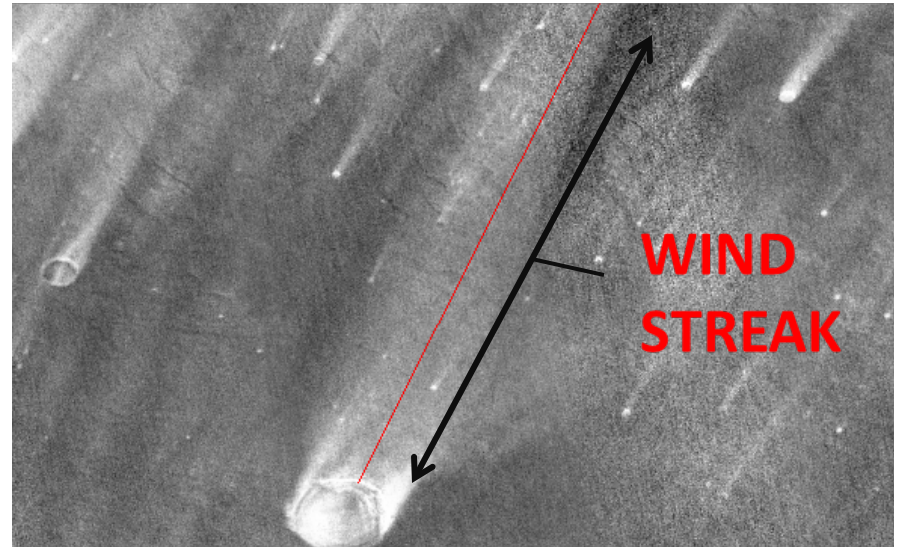
Alba Patera: This is an enormous shield volcano located on the Northern Tharsis region of Mars.

Wind streaks: Are tear-shaped features that appear behind craters, ridges, or cliffs. These features are the result of wind erosion and deposition

Ratio: Is a relationship between are two variables which is wind streak length and crater diameter.

Crater: a cup-shaped depression or cavity on the surface

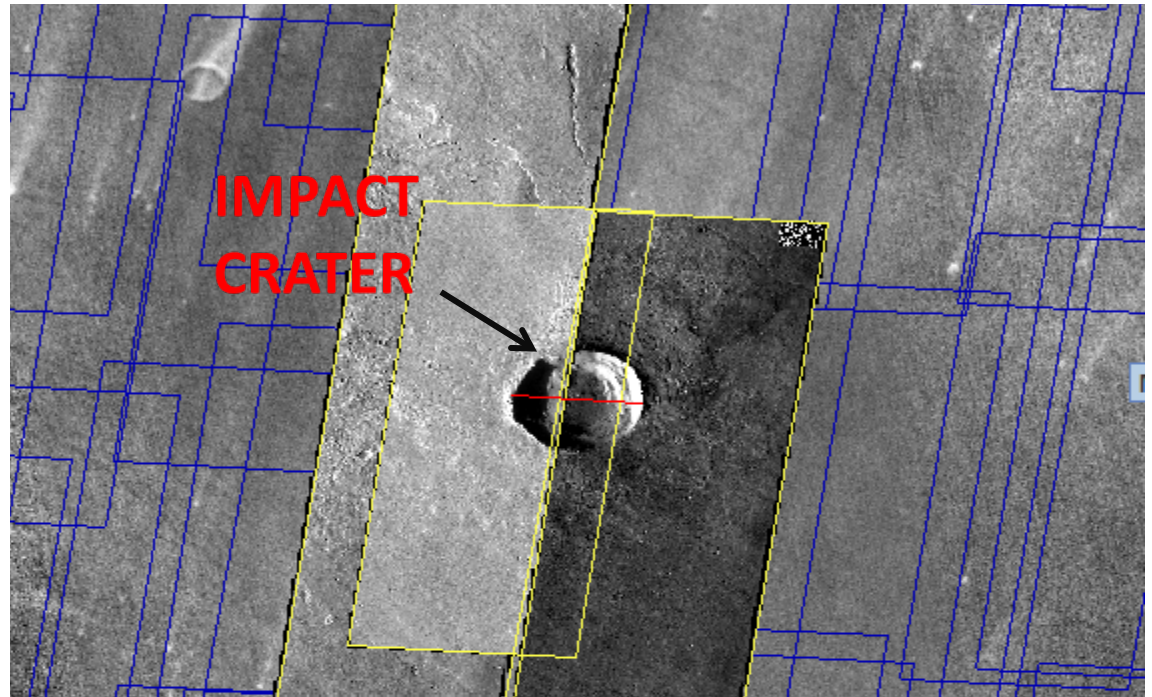
CONTROL IMAGE



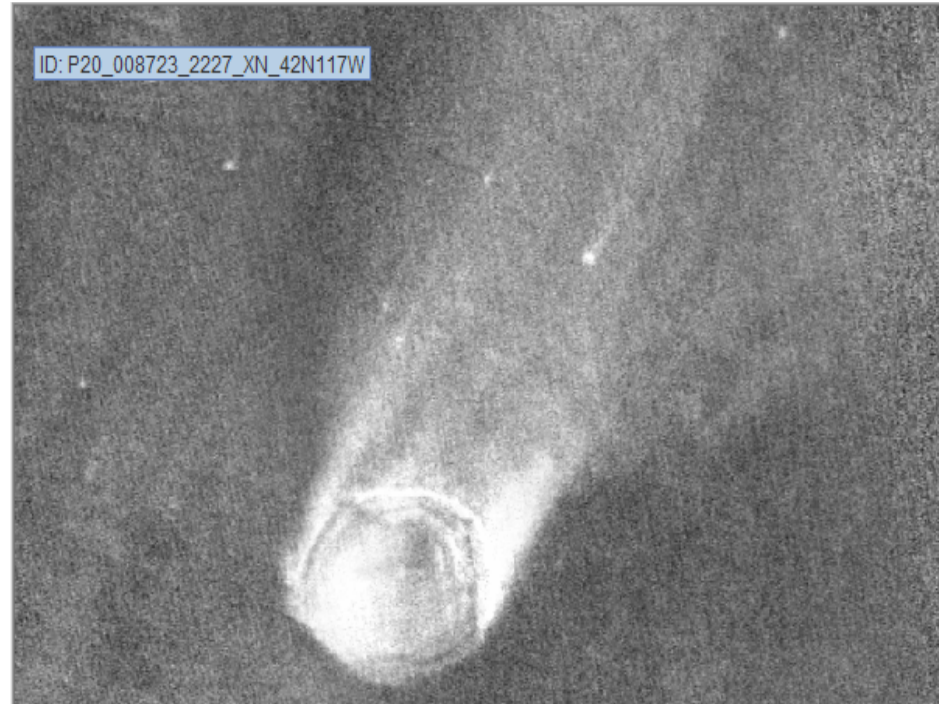
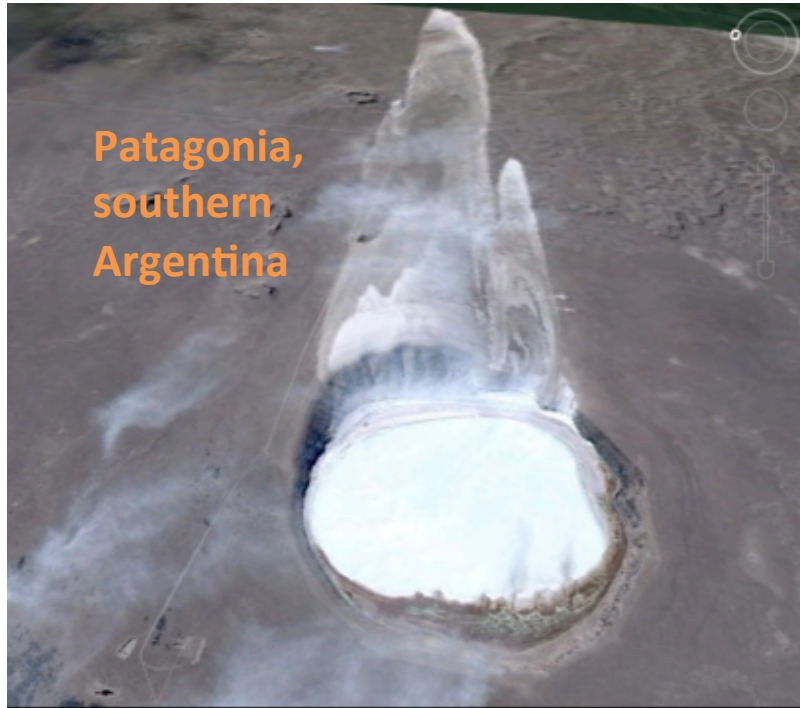
WIND STREAK

ID #:

B17_016226_2233_XN_43N119W



EARTH VS. MARS



<http://www.psi.edu/research/reports/2009/rodriguez09.html>

ID: P20_008723_2227_XN_42N117W

FEATURE FORMATION

- Wind streaks are tear-shaped features appearing behind craters, ridges or cliffs. They may appear light colored or dark colored depending on the nature of the subsurface. These features are the result of wind erosion and deposition.

SCIENCE RESEARCH

Shuttle radar images of wind streaks in the Altiplano, Bolivia
Measurements indicate that winds are strongest and most turbulent in the region of active sand sheets and dunes. Dark streaks originate between closely spaced hills, whereas bright streaks form in the immediate lee of hills.

-Ronald Greeley, Philip Christensen and Raul Carrasco

<http://geology.gsapubs.org/content/17/7/665.abstract>

DATA TABLE

	A	B	C	D	E	F	G	H	I
1	Image ID #'s	Latitude	Longitude	Crater Diameter (km)	Windstreak Lengths (km)	Ratios (wsl/cd)	Region		
2	V2809817	43.434	244.371	2.1	21.6		Alba Patera		
3	V27549023	42.603	242.699	11.1	34.8		Alba Patera		
4	V27000029	41.379	240.992	1.96	17.9		Alba Patera		
5	V18776003	42.055	240.951	1.3	9.5		Alba Patera		
6	V17528012	43.23	241.965	4.3	4.6		Alba Patera		
7	V17740026	42.914	246.453	6.4	33.4		Alba Patera		
8	V13709007	43.328	248.227	4.1	27.1		Alba Patera		
9	V27262028	40.965	242.203	9.1	31.3		Alba Patera		
10	V26950020	43.674	243.854	1.7	11.4		Alba Patera		
11	V27237025	43.367	243.947	0.64	4.38		Alba Patera		
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									

Sheet1 Sheet2 Sheet3 Sheet4

Edit 100%

PROCEDURE A

Layers used

1. Lat /Long grid:
2. Mola 128ppd Elevation:
3. Mola shaded Relief:
4. Mola shaded Relief/ Colorized Elevation
5. THEMIS Day IR 100m Global mosaic v11.5
6. THEMIS Night IR 100m Global mosaic v11
7. Crater counting
8. Plot: MOLA 128ppd Elevations
9. THEMIS stamps

Limitations

1. Not visible when zoomed in
2. If opacity is too high it covers features
3. Doesn't show elevation
4. Don't get features clearly
5. Can't see Wind streaks
6. Can't see from far distance
7. Can cover up features
8. Won't be accurate measurement
9. They don't cover large area of land

Step-by-Step to each Layer

Lat /Long grid: Layer already on

MOLA 128ppd Elevation: Add new layer, Maps by Instrument, MOLA, Plot and View Numeric

MOLA shaded relief: Add new layer, Maps by Instrument, MOLA, MOLA shaded relief, Graphic Data

MOLA shaded relief/ Colorized Elevation: Add new layer, Maps by Instrument, MOLA, View Graphic Data

THEMIS Day IR 100m Global Mosaic v11: Add new layer, Maps by Instrument, THEMIS, THEMIS Day IR

THEMIS Night IR 100m Global Mosaic v13: Add new layer, Maps by Instrument, THEMIS, THEMIS Night IR, View Graphic Data

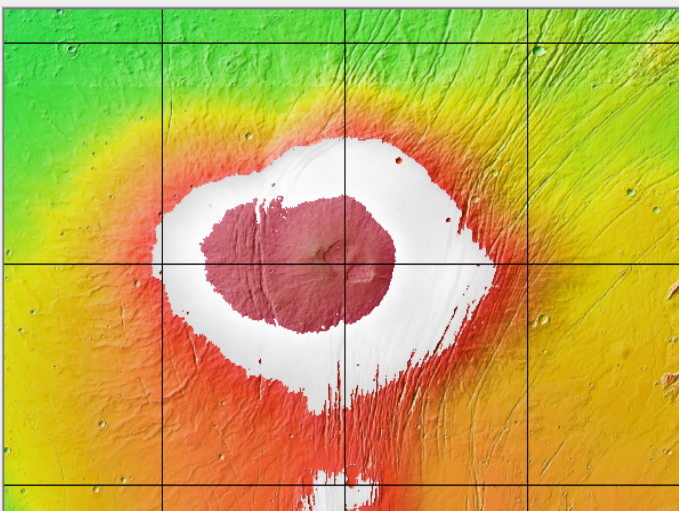
Crater Counting: Add new layer, Crater Counting

PLOT: MOLA 128ppd Elevations: Add new layer, Maps by Instrument, MOLA, MOLA 128ppd Elevations, Plot Numeric Data

THEMIS STAMPS: Add new layer, STAMPS, THEMIS STAMPS

PROCEDURE B

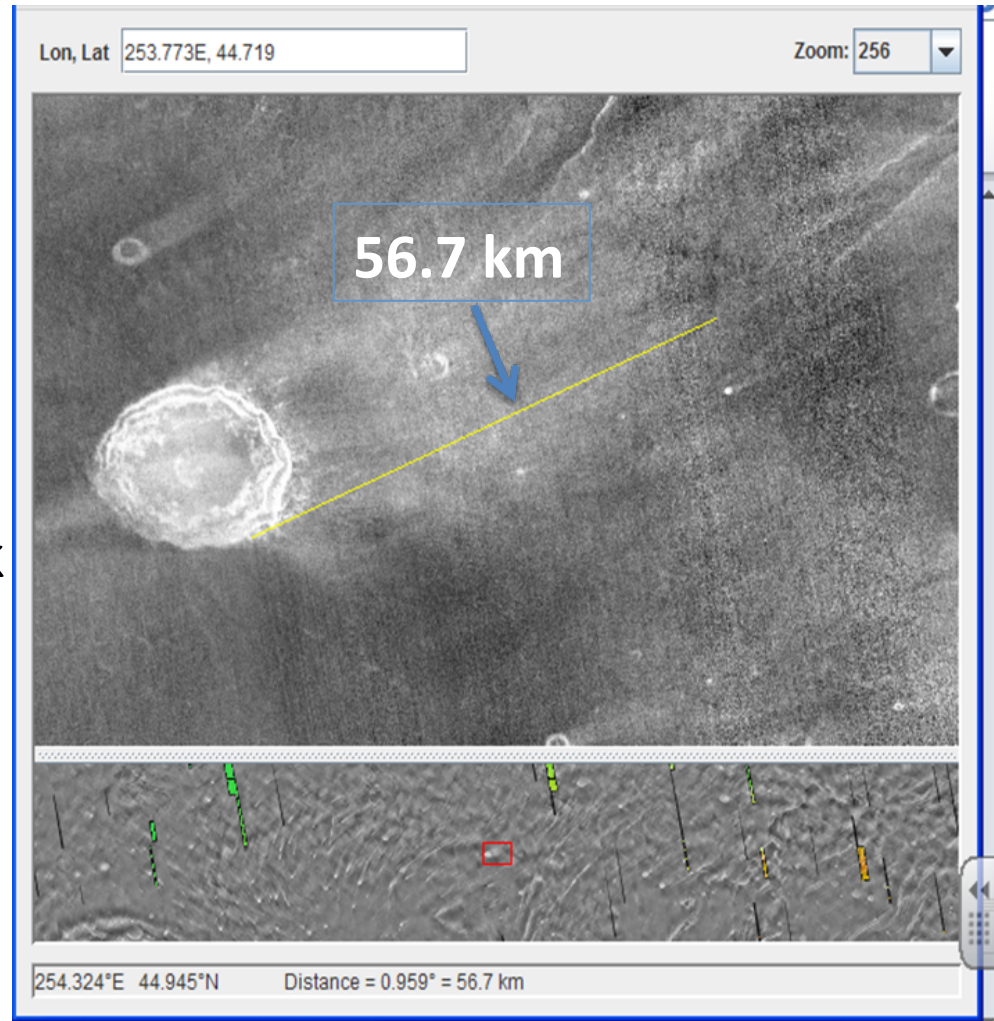
1. Add new layer, Maps by Instruments
2. Load MOLA Elevation 128ppd plot and view numeric
3. Change grayscale to threshold
4. Add minimum elevation of 2500
5. Add maximum elevation of 5000



The image shows two overlapping software windows. The 'Layer Manager' window on the left has tabs for 'MOLA 128ppd Elevation', 'Lat/Lon Grid', 'MOLA Shaded Relief / Colorized Elev', and 'MOLA Shaded Relief'. The 'MOLA 128ppd Elevation' tab is active, showing 'Source' (MOLA 128ppd Elevat), 'Map Properties' (Max PPD: 128.0, Ignore Value: empty), and two 'Threshold' sections. The first threshold is set to '>' with a value of 3500. The second threshold is set to '<' with a value of 5000. The 'Grayscale' section is visible at the bottom. The 'Add THEMIS stamp layer' window on the right has sections for 'Image Location Parameters' (Image ID(s): empty, Image Type: VIS, Longitude (East): 240 to 250, Latitude (North): 30 to 50), 'Viewing Conditions Parameters', and 'Observation Parameters' (Processing Stage: empty, Resolution (km): empty to empty, Duration (sec): empty to empty). At the bottom, there are fields for 'Use stamp color:' (a blue dropdown) and 'Custom layer name:' (an empty text box), and 'Okay', 'Cancel', and 'Help' buttons.

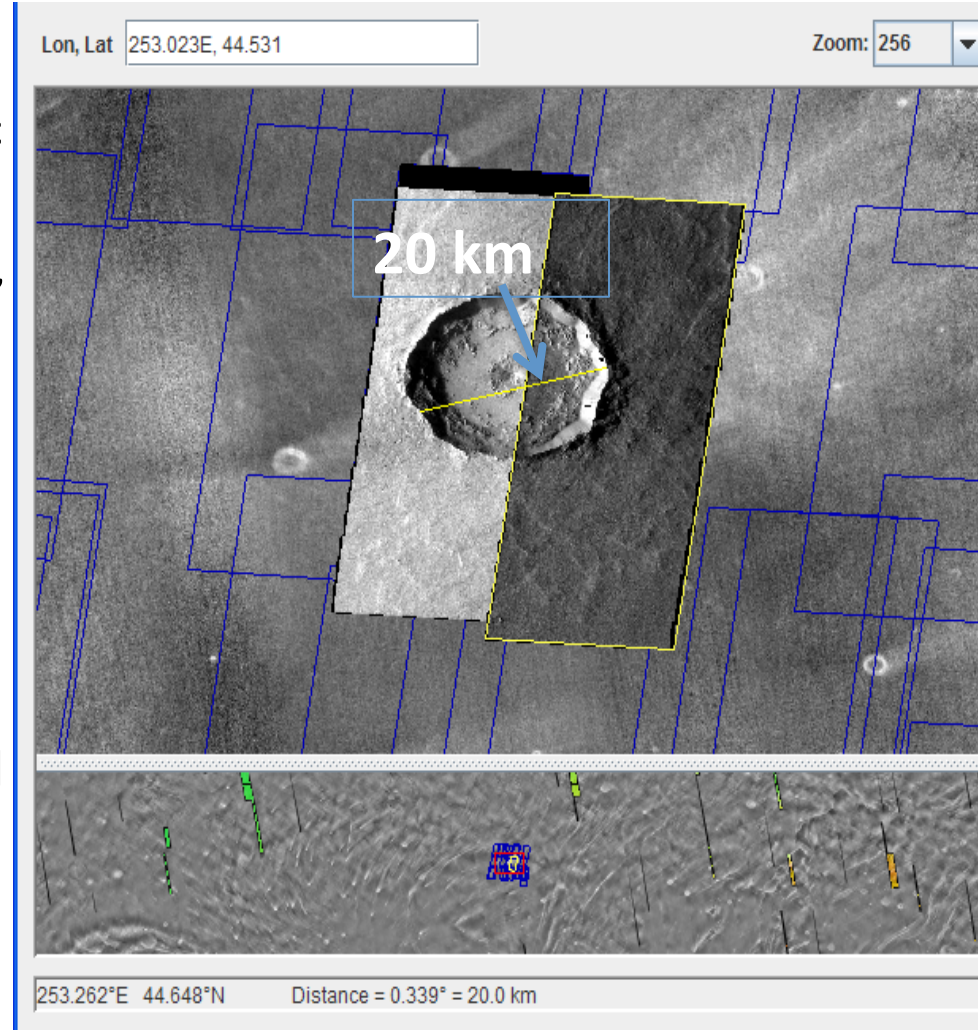
PROCEDURE C

- 1) Add new layer, Maps by instrument
- 2) Load 128ppd elevation plot numeric layer
- 3) Add new layer, maps by instrument, THEMIS, THEMIS night IR, view graphic data
- 4) Zoom in to the wind streak feature for you can see it and its not blurry
- 5) Then click at the start of the wind streak and click at the end of the wind streak
- 6) Then get the measurement from the bottom of the screen



PROCEDURE C

- 1) Add new layer, Maps by instrument
- 2) Load 128ppd elevation plot numeric layer
- 3) Add new layer, Maps by instrument, Stamps, THEMIS Stamps
- 4) Go to the stamps that are on your feature then right click
- 5) View THEMIS Stamp, Stamp V#, Render ABR
- 6) Zoom in on feature
- 7) Click on the start of the feature, and then click at the end of the feature
- 8) Get measurement from the bottom of the screen

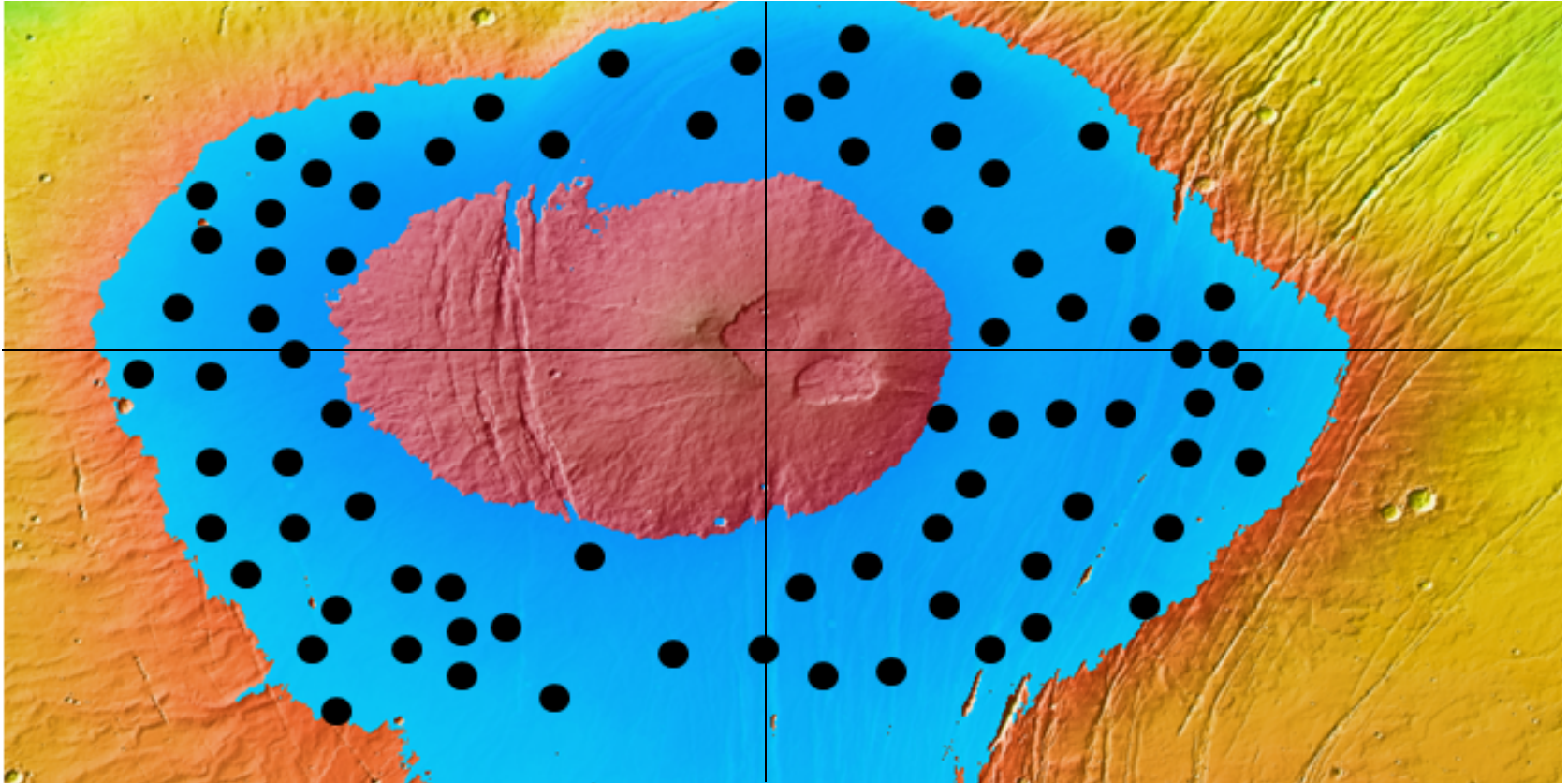


Spacecraft and Camera

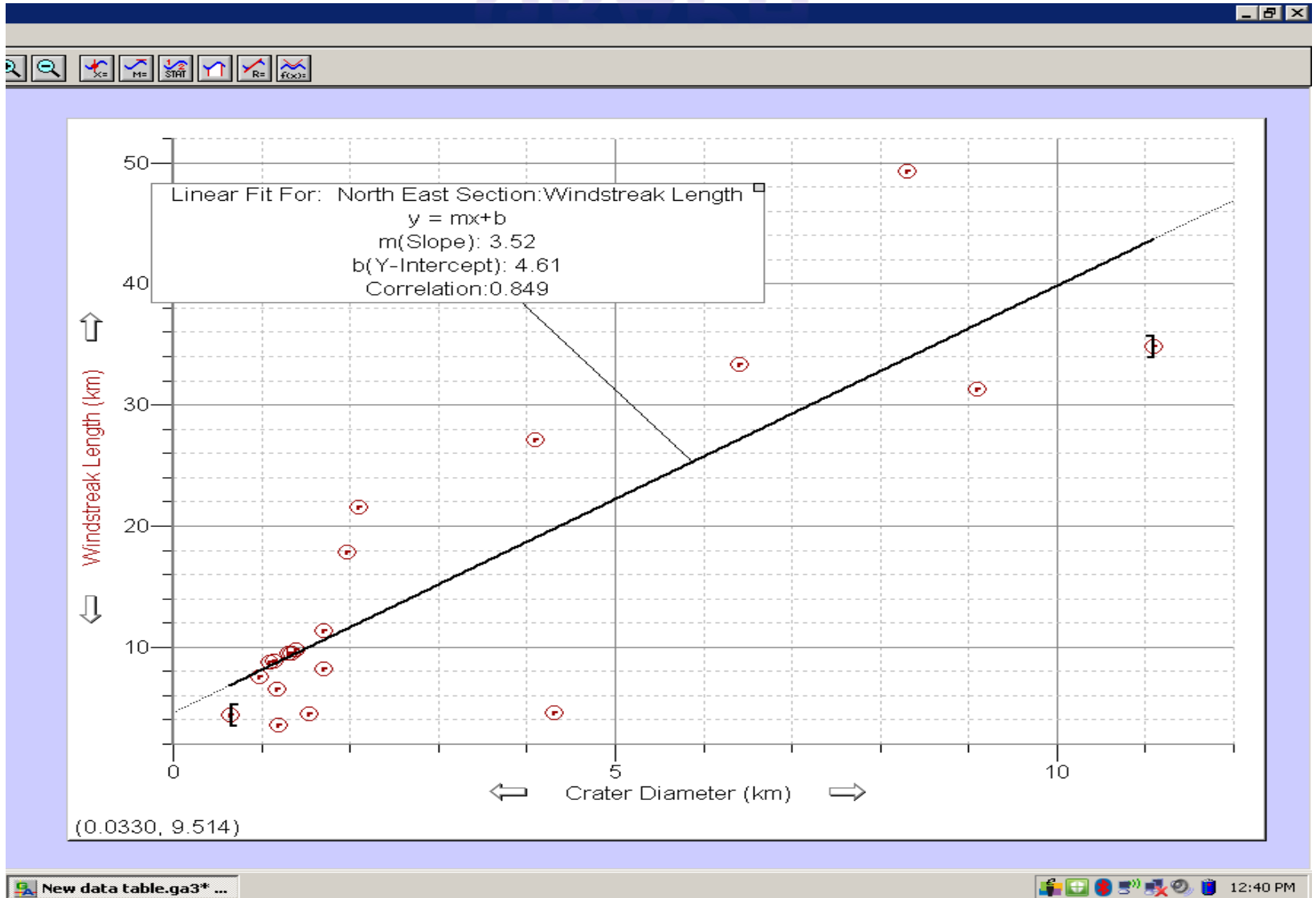
- The Spacecraft and Camera used for this research was Mars Odyssey. We used visible and infrared images to find craters and wind streaks.
- We used 80 THEMIS images to answer our science question.



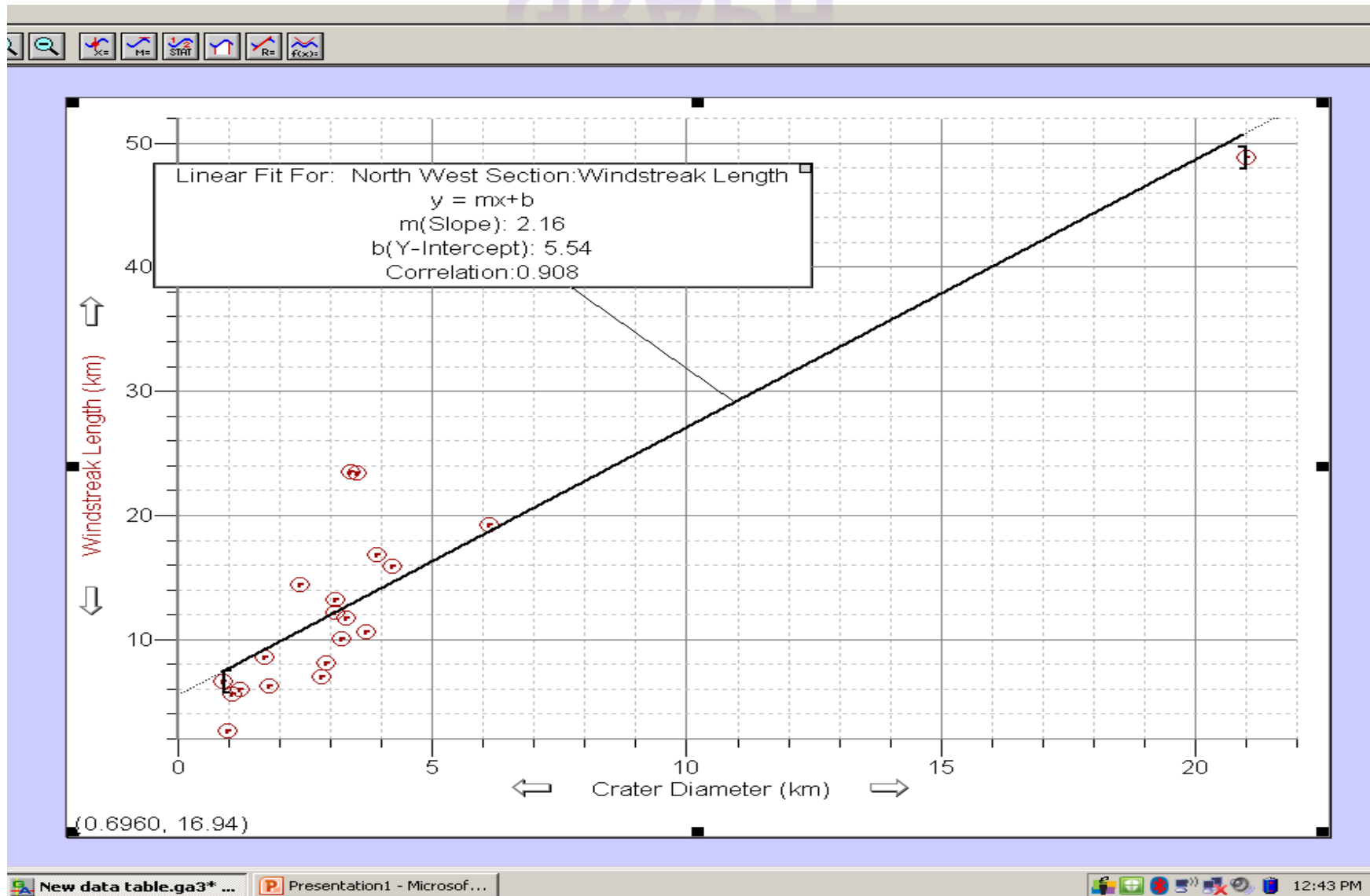
Bias Reduction



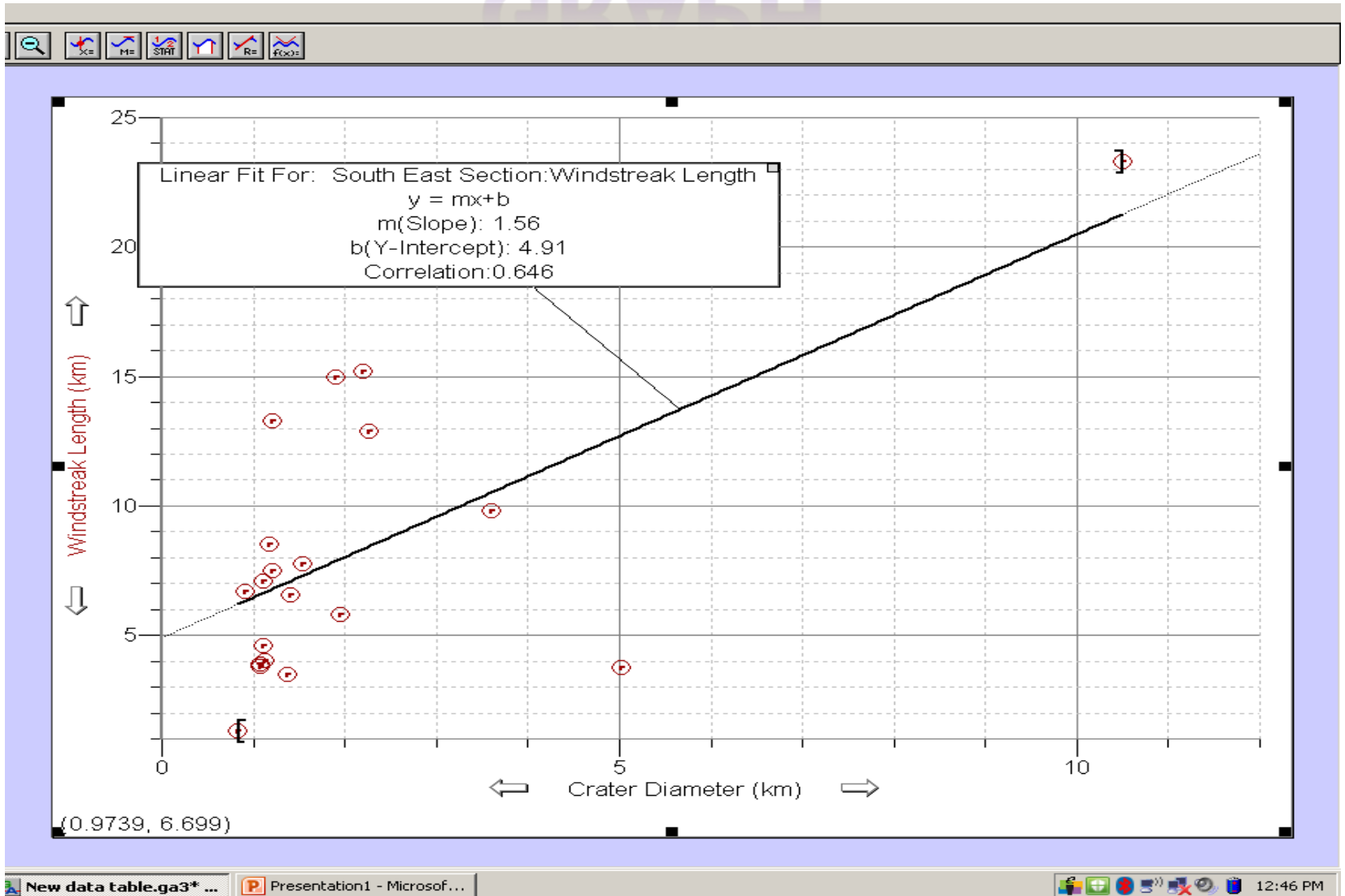
GRAPH



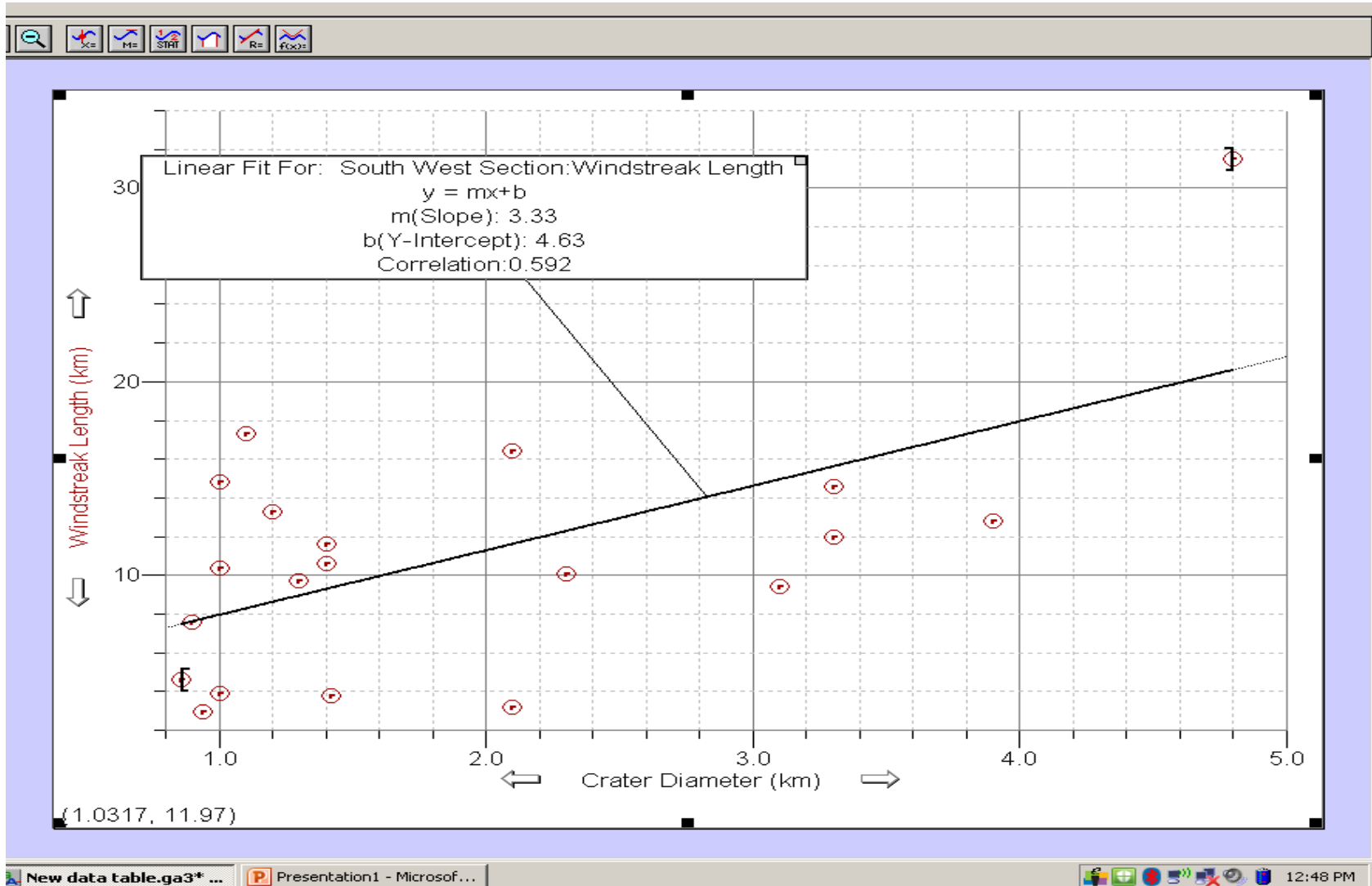
GRAPH



GRAPH



GRAPH



Correlation & Slope

- **Northeast:** Correlation: .849 Slope: 3.52
- **Northwest:** Correlation: .908 Slope: 2.16
- **Southeast:** Correlation: .646 Slope: 1.56
- **Southwest:** Correlation: .592 Slope: 3.33

DATA TABLE

	A	B	C	D	E	F	G
1	Image ID #s	Latitude	Longitude	Crater diameter (km)	Wind streak length (km)	Ratio (wsl/cd)	Region
2	V11475006	44.641	253.027	21	48.8	2.3	NW
3	V12074010	42.421	253.039	6.1	19.3	3.16	NW
4	V27037029	40.977	253.213	3.4	23.5	6.9	NW
5	V12386005	43.027	252.993	3.1	13.2	4.25	NW
6	V26463018	43.039	253.239	1.22	6	4.91	NW
7	V27062029	43.932	252.463	2.4	14.4	6	NW
8	V05409019	47.455	252.529	3.1	12.2	3.93	NW
9	V19150009	43.414	252.729	1.8	6.3	3.51	NW
10	V29037029	40.984	253.223	3.5	23.4	6.68	NW
11	V43483004	40.184	253.993	3.9	16.8	4.31	NW
12	V19512025	45.87	250.61	2.9	8.1	2.79	NW
13	V45568016	45.94	250.53	3.2	10.1	3.15	NW
14	V20585006	37.65	45.94	3.7	10.6	2.86	NW
15	V29146003	45.85	249.98	1.7	8.6	5.05	NW
16	V20161001	45.81	249.64	0.96	2.68	2.71	NW
17	V30094010	39.84	258.047	2.8	7	2.5	NW
18	V45006010	41.06	257.28	4.21	15.96	3.79	NW
19	V27224034	40.47	258.24	1.05	5.61	5.34	NW
20	V26987017	42.37	256.21	0.88	6.6	7.5	NW
21	V28909009	45.12	247.24	3.3	11.7	3.54	NW
22							
23							

CONCLUSION

Restate your science question:

Can wind streak ratios be used to determine wind velocity differences in the elevation band of 2500-5000m around Alba Patera?

Restate your hypothesis:

Wind streak ratios will be greater un the Northern quadrants around Alba Patera.

Hypothesis was *supported*.

Our hypothesis was supported as shown in our data tables and graphs. The Northern quadrants showed more consistency in their relationships and slope/ratios.

Further Research

- **Collect more data plots**
- **Re-evaluate measurements**
- **Seasonal wind changes**

REFERENCES

Christensen, P.R., N.S. Gorelick, G.L. Mehall, and K.C. Murray, *THEMIS Public Data Releases*, Planetary Data System node, Arizona State University, <<http://themis-data.asu.edu>>.

Christensen, P.R., B.M. Jakosky, H.H. Kieffer, M.C. Malin, H.Y. McSween, Jr., K. Nealon, G.L. Mehall, S.H. Silverman, S. Ferry, M. Caplinger, and M. Ravine, The Thermal Emission Imaging System (THEMIS) for the Mars 2001 Odyssey Mission, *Space Science Reviews*, 110, 85-130, 2004.