Geomorphology: Earth vs. Mars

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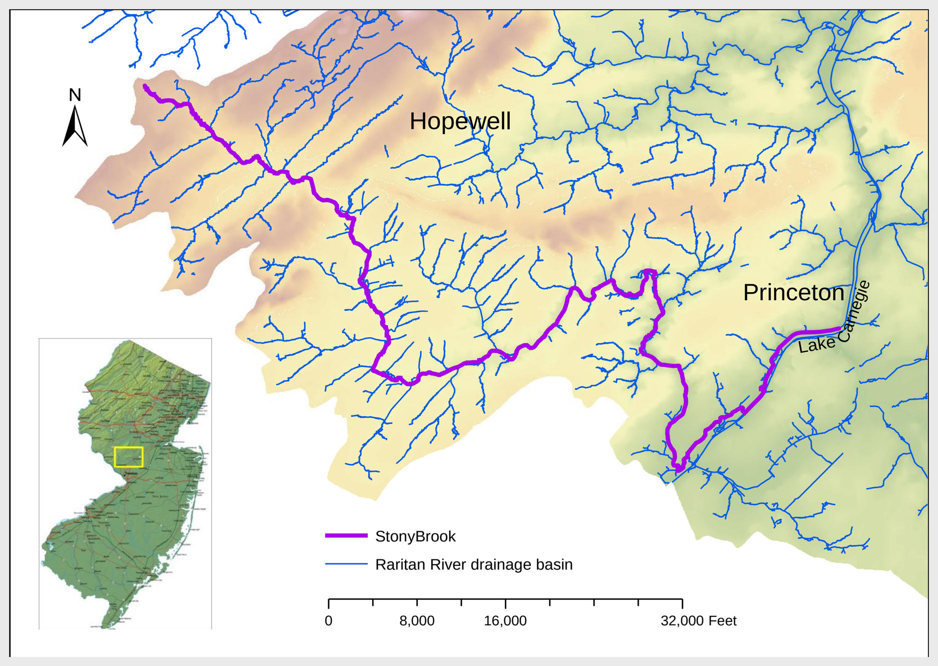
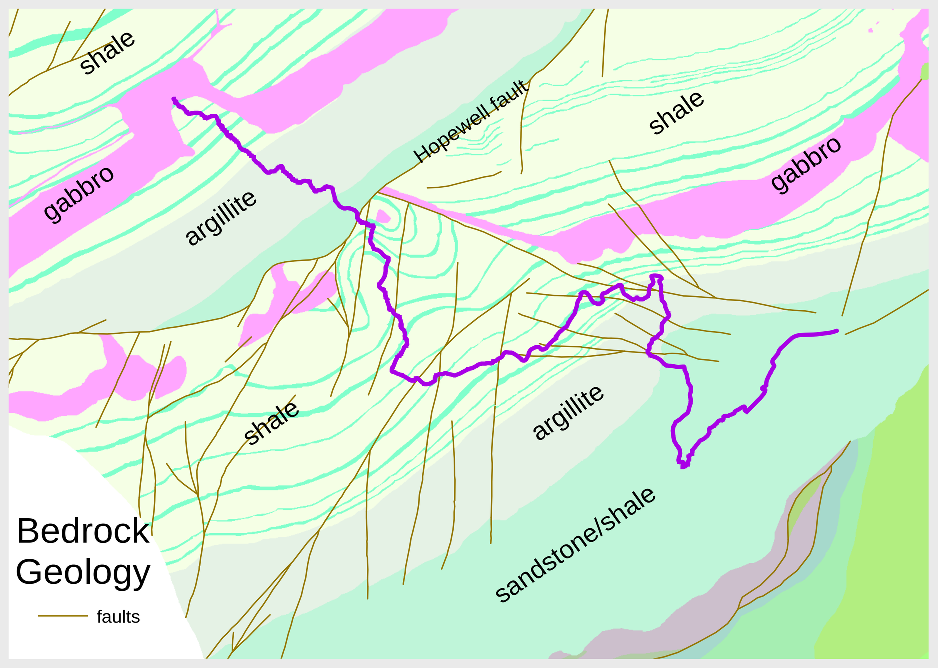
Inspired by Barb Tewksbury's "Did it Rain on Mars" exercise, and SERC's "Discoveries from Mars" workshop. Thanks to PU postdoc Kevin Lewis for help with the Themis and CTX data

In this exercise, students compare geomorphologic features of their local stream, several other US rivers, and channels on Mars in order to 1) become familiar with geomorphologic features and 2) consider whether earth-like river processes were ever present on the surface of Mars.

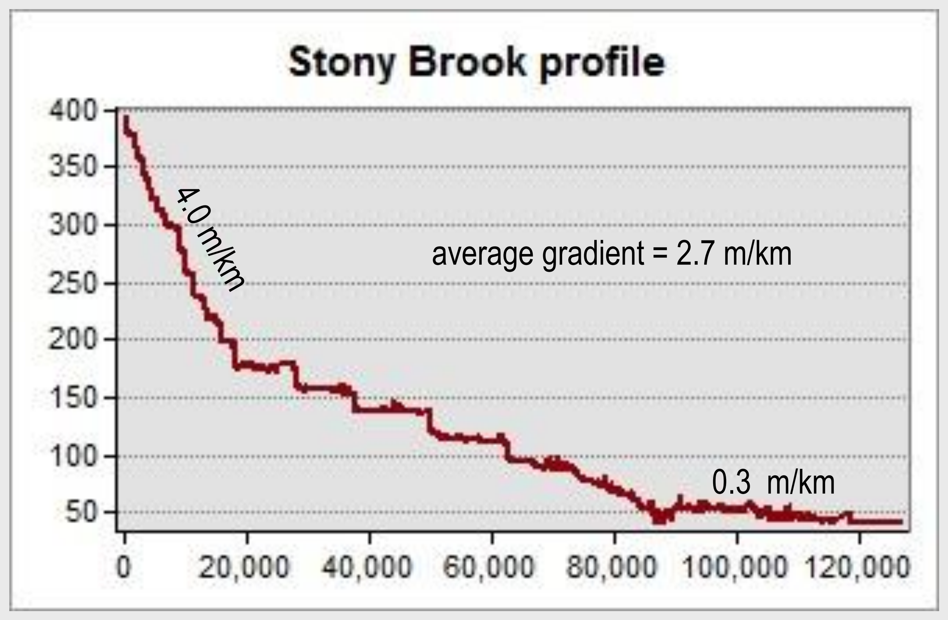
PART I a: STONY BROOK

Our local stream, which students have already visited on field trips



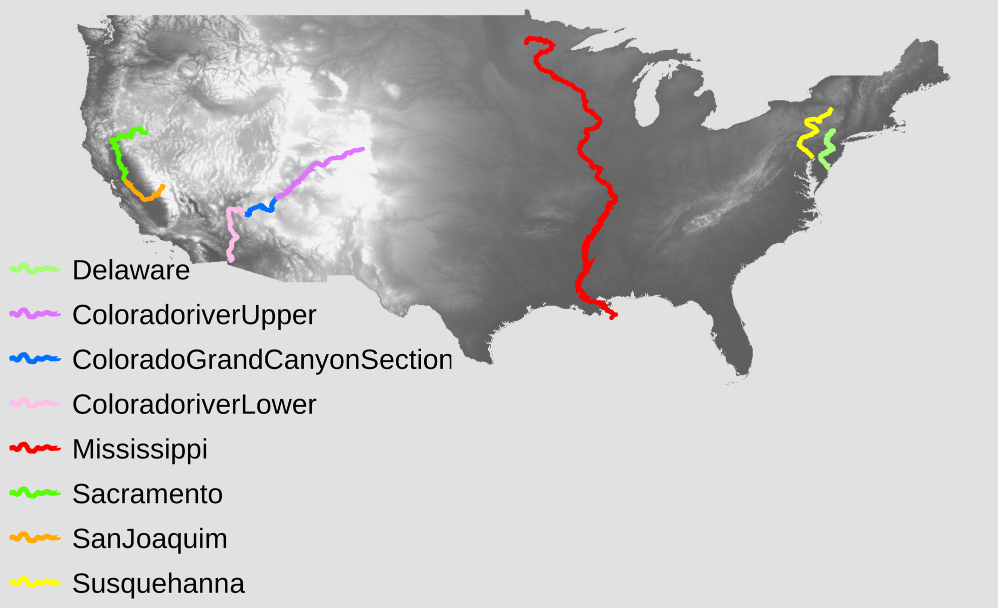


- What is the resolution of the topographic data for this ArcView project? (Zoom waaaaaaaaay in and determine the diagonal length of one pixel.)
- Make and print out a stream profile for Stony Brook .

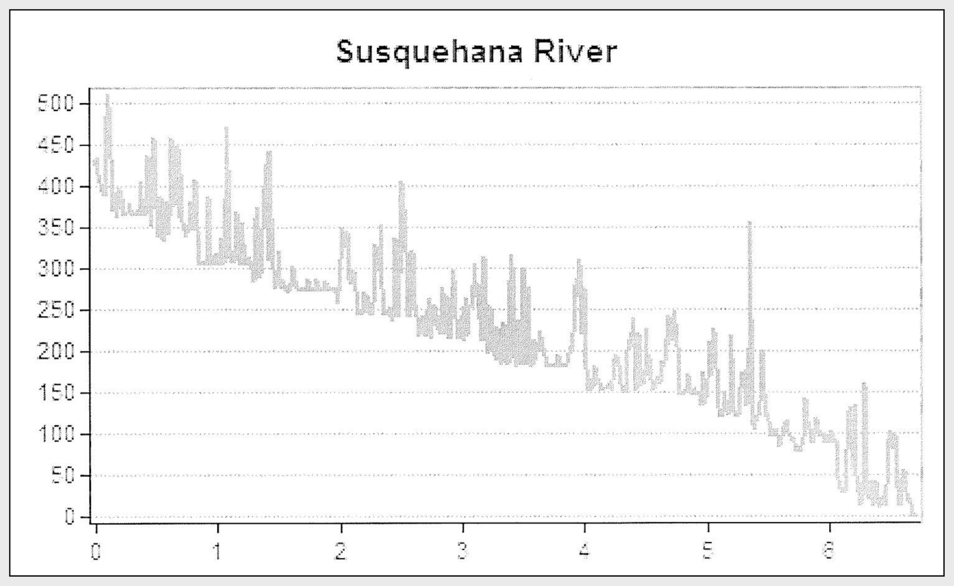


- Why is the profile somewhat jagged and not smooth?
- On the stream profile printout, determine stream gradients for Stony Brook: the steep part, the shallow part, and an average.
- Consider the underlying geology and discuss why the profile of the Stony Brook changes abruptly in a couple of places, instead of changing in a smooth manner.
- Determine the highest stream order of the Stony Brook/Millstone/Raritan River system

Part I b: OTHER US RIVERS



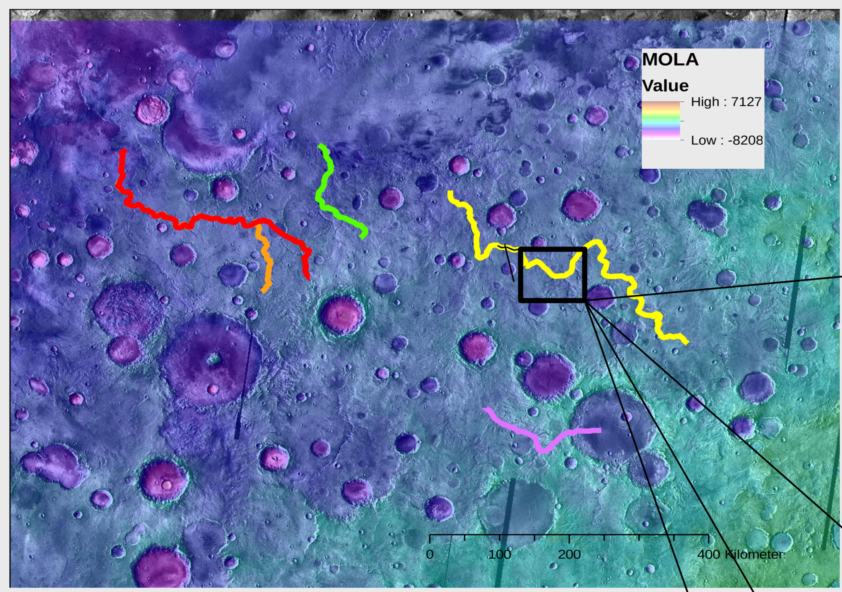
- What is the resolution of the topographic data for this ArcView project? (Zoom waaaaaaaaay in and use the measuring tool to determine the diagonal length of one pixel).
- Choose a river, then make and print the stream profile for your river.



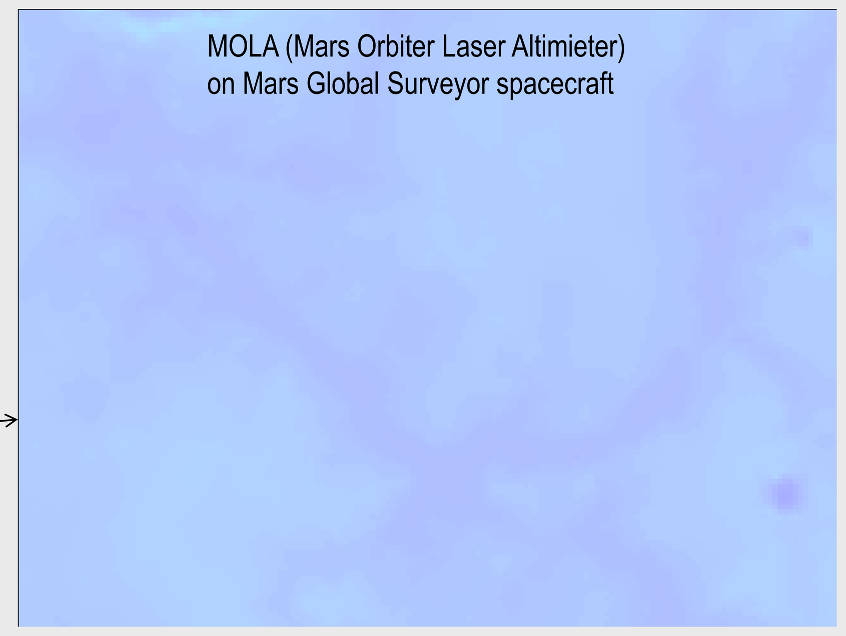
- Why is the profile jagged and not smooth?
- Determine the average stream gradient for your river.
- Fill out the class spreadsheet for your river.

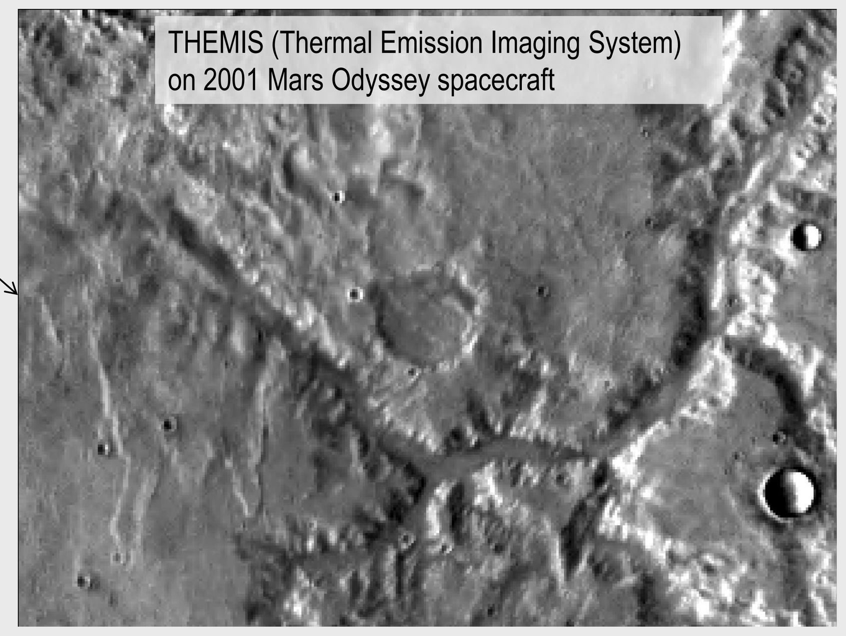
Part II: MARS

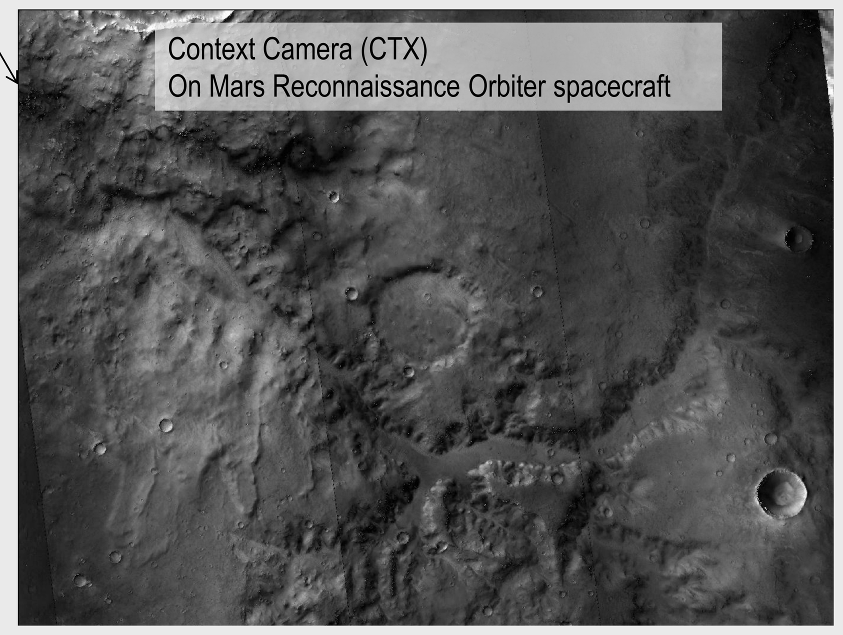
- Load the Mars.mxd file into ArcView and explore it. It includes 3 data sets (see handout describing MOLA, CTX and THEMIS data).

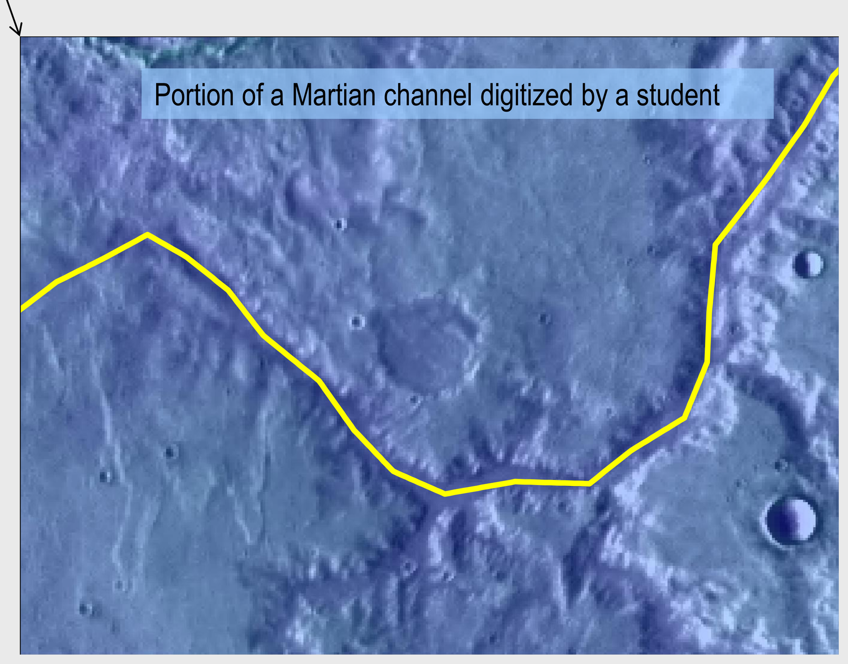


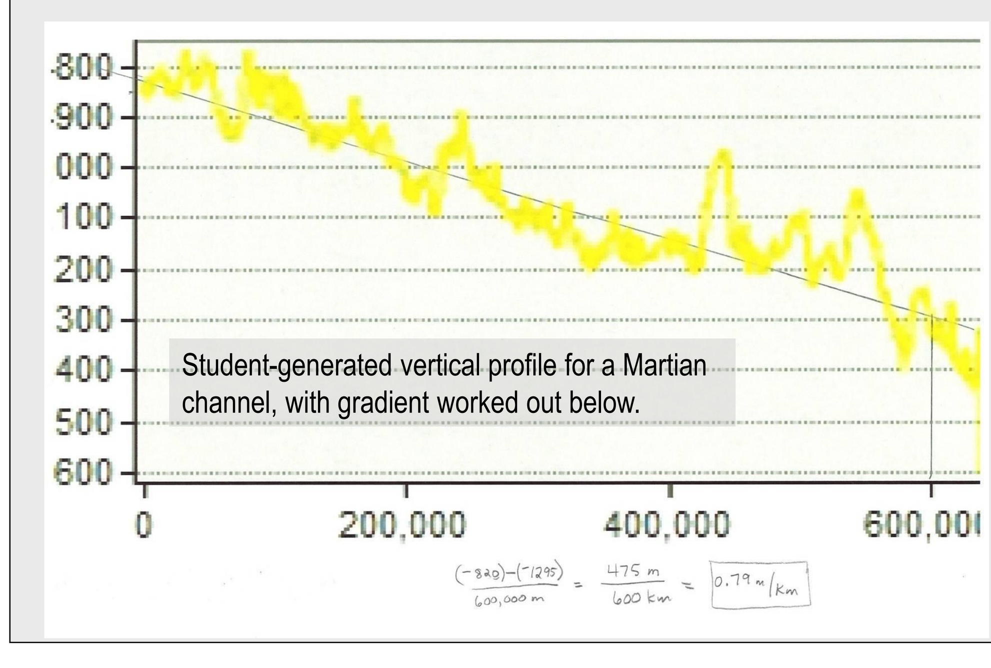
- Using principles of relative dating describe the (relative) geologic history of this area of Mars, giving supporting evidence.
- What is the resolution of the topographic data for this ArcView project? (Zoom waaaaaaaaay in and use the measuring tool to determine the diagonal length of one pixel).
- Pick a channel and trace it, then turn it into a graphic feature.
- Make and print out the profile of this channel.
- Why is the profile jagged and not smooth?
- On the channel profile printout, determine the average stream gradient for your channel.
- Determine the highest stream order of Martian channels in this area.











Class results		Stream gradient (m/km)	Strahler stream order	Stream density (km^{-1})
Stony Brook	steep	4.0	Stony Brook - 4th Millstone - 5th Raritan - 6th	0.07 - 0.2
	shallow	0.3		
	average	2.7		
US rivers	Mississippi	0.1	Mississippi - 10th Amazon - 12th	
	Susquehanna	0.2		
	upper Colorado	0.4		
	Grand Canyon section	1.5		
	Sacramento	5.8		
	San Joachim	6.3		
Mars channels	A	0.7	3rd	0.007
	B	0.8	3rd	
	C	1.3	7th (?!)	
	D	1.7	4th	
	E	2.5	3rd	

Lab write-up: using your and the class' data and images, compare river/channel characteristics of Earth and Mars, and discuss evidence for Earth-like river systems on Mars.