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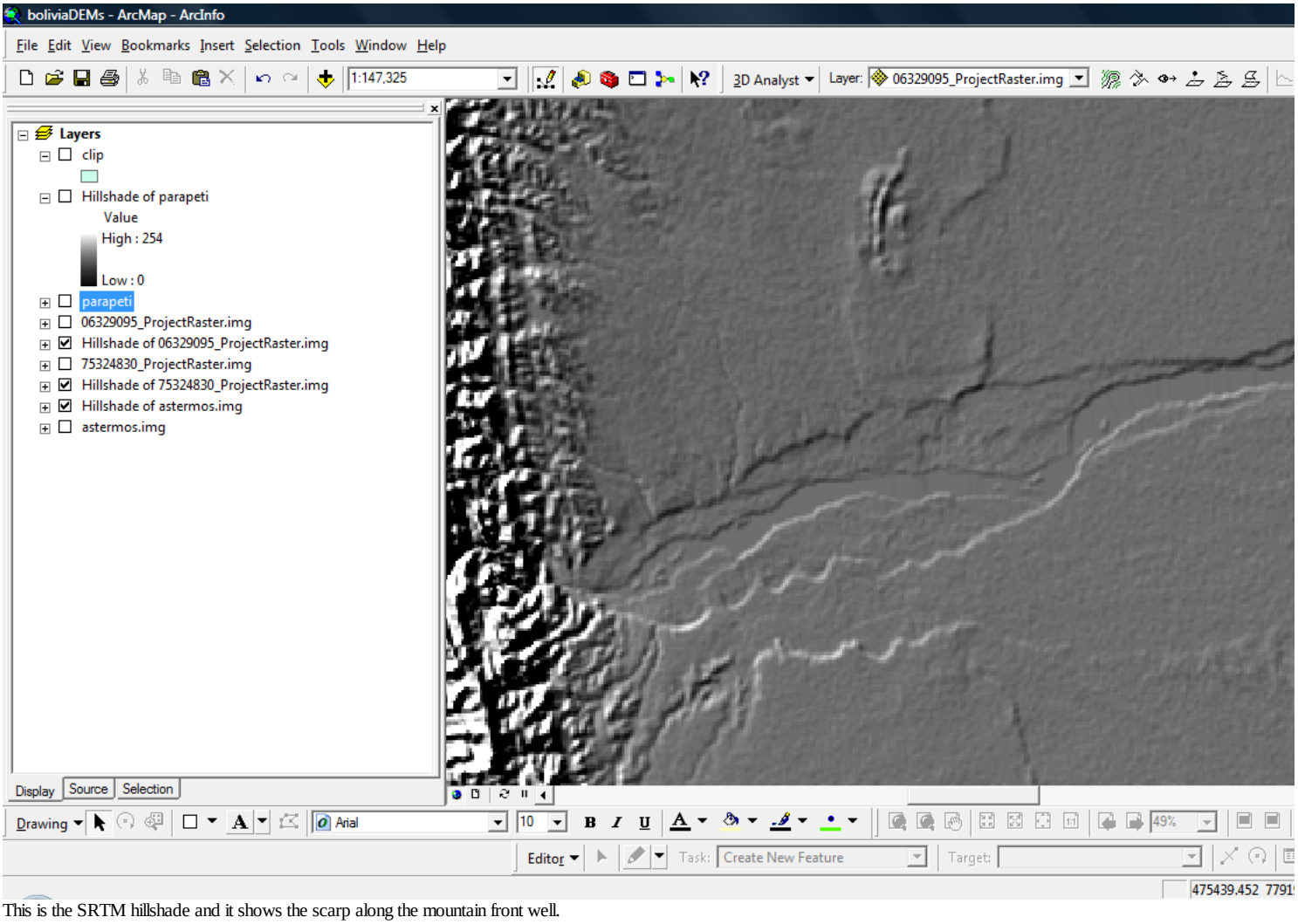
Looking at the new ASTER 30 m DEMs–not so impressive relative to SRTM 90 m

Earlier this month, a new global digital elevation model data set derived from the ASTER satellite system was released. Here is some general information: http://asterweb.jpl.nasa.gov/gdem.asp. Here is a tutorial for how to download it: http://www.echo.nasa.gov/reference/astergdem_tutorial.htm.

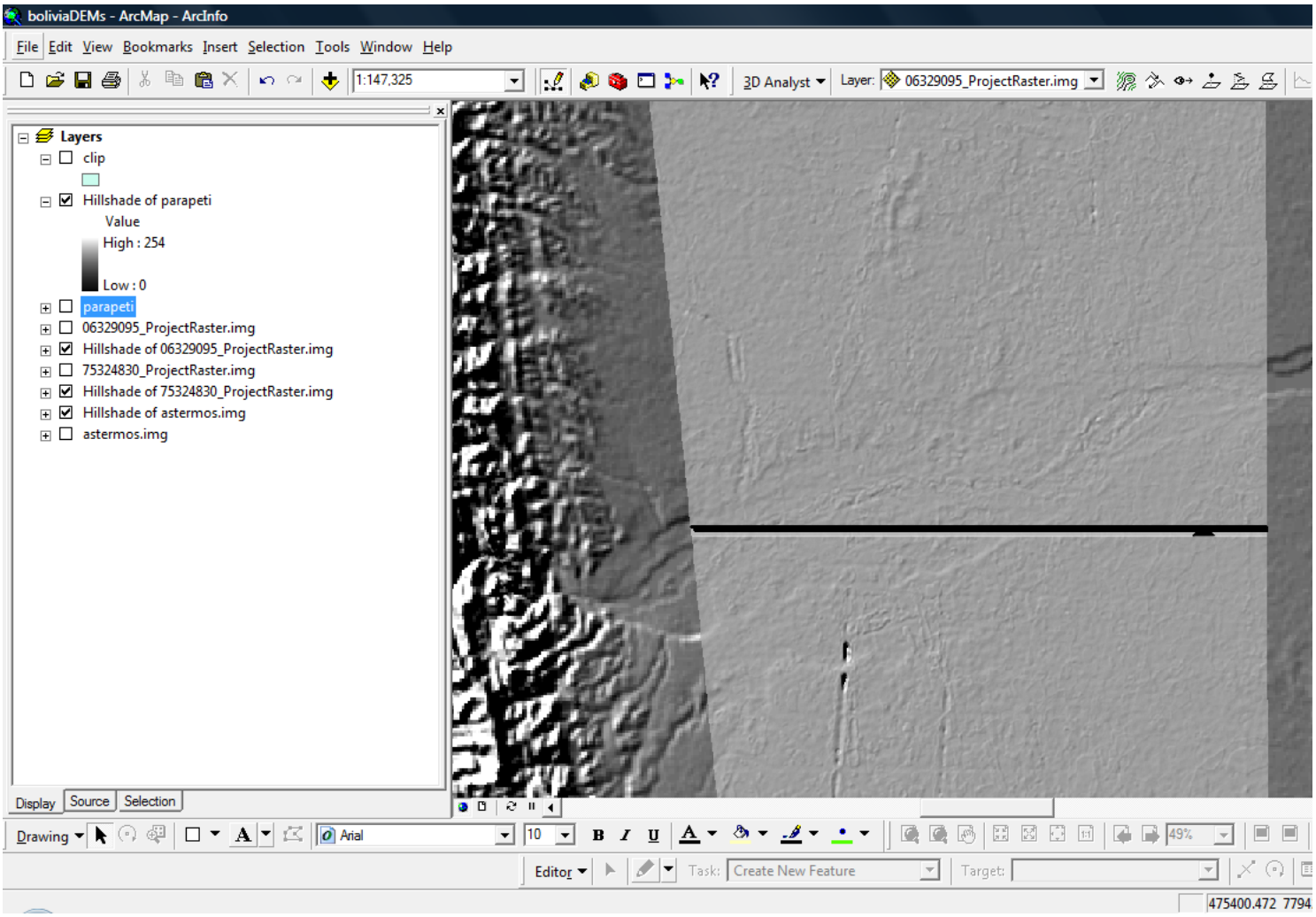
The readme that comes with the data summarizes, and I agree that while the data interesting, they have substantial artifacts in the couple of areas I tested outside the US (Bolivia and China; my emphasis):

"Statistically, the ASTER GDEM appears generally to meet its pre-production estimated vertical accuracy of 20 m at 95% confidence, globally. Some tiles have substantially better than 20 m accuracy, and **some tiles have substantially worse than 20 m vertical accuracy**. **The ASTER GDEM contains anomalies and artifacts that will reduce its usability for certain applications, because they can introduce large elevation errors on local scales**."
I was interested to play with the data for sites outside the US because they are higher resolution (30 m) than the Shuttle Radar Topography System (SRTM) data available for most of the globe at 90 m. I note that the best SRTM data are available from here: http://srtm.csi.cgiar.org/.
The ASTER G-DEM download interface is a little clunky (see tutorial), but I was able to get it to work and it is great that the data are free.

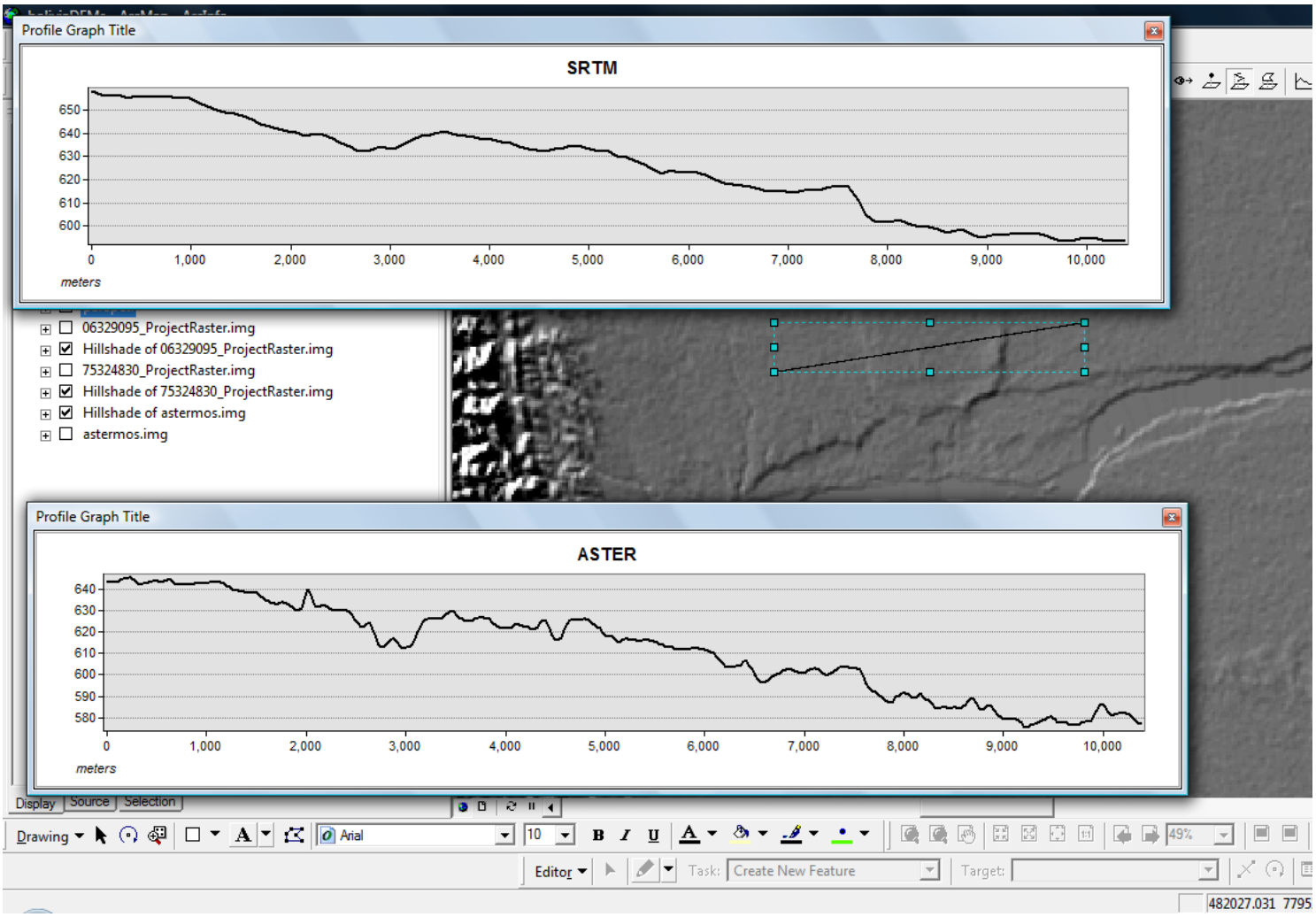
I downloaded data for a study area along the eastern Andean front in Bolivia. I chose an area called the Parapeti River because we (Ben Brooks and I) See the figures below:



This is the SRTM hillshade and it shows the scarp along the mountain front well.

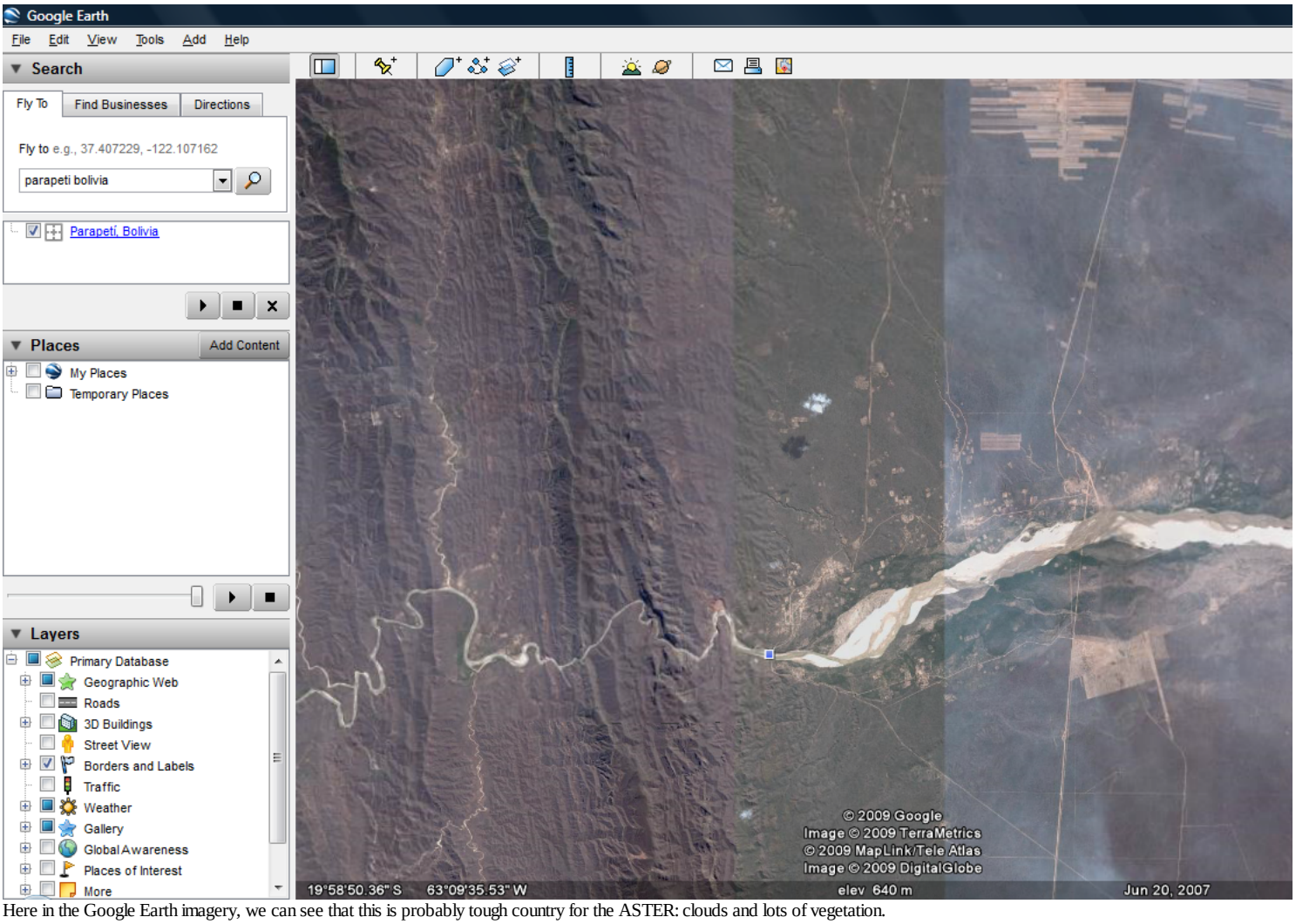


This one shows a piece of the ASTER data (yes I projected it using the cubic to minimize those kinds of artifacts). It is nice and sharp relative to the SRTM (above and on left in this image), but full of high frequency features.



Here are a couple of quick topographic profiles across the same path which show that high frequency signal in the ASTER.

I think that some of the high frequency features are real. For example, some roads and other cuts in the dense vegetation in the region may show up better in the ASTER data.

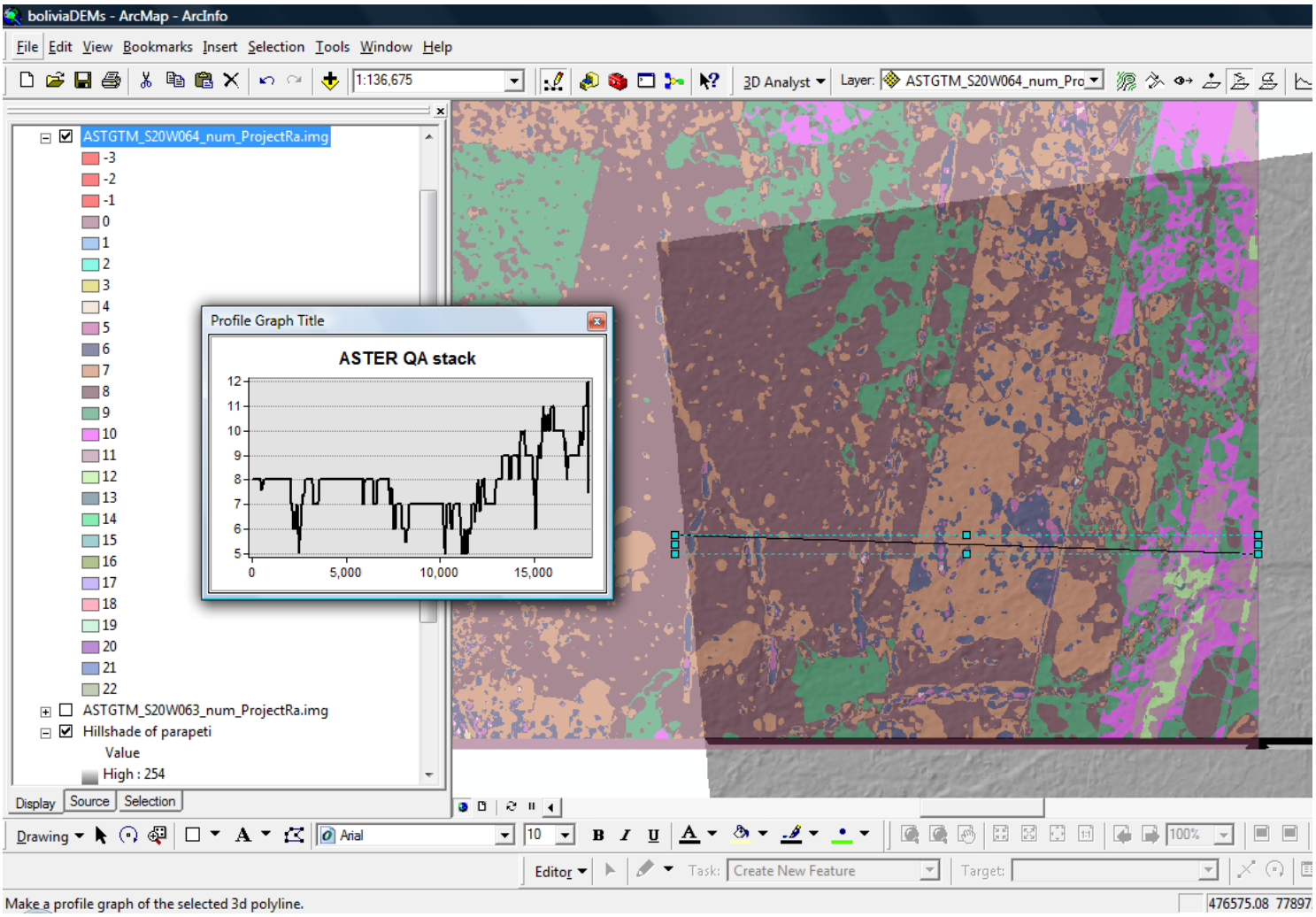


Here in the Google Earth imagery, we can see that this is probably tough country for the ASTER: clouds and lots of vegetation.

Looking at the README that comes with the data helps explain the source of the artifacts. Each of the pixels of the DEM comes from stacking (looks maybe like a weighted(?) average) of numerous individual elevation estimates from ASTER, or where the data were not good (like cloud cover) from other sources:

"The vast majority of QA plane values are positive and directly correspond to the number of individual ASTER DEM scenes that contributed to determining the final GDEM elevation value for that corresponding pixel in the DEM file. Negative values designate a specific reference data set that was used to replace bad values in the ASTER GDEM."

So as you can see below: the stacking is pretty heterogeneous around the Parapeti and so the artifacts are notable:



Such artifacts are called "mole runs" (too bad it is not a real mole track as might be created in an earthquake!)

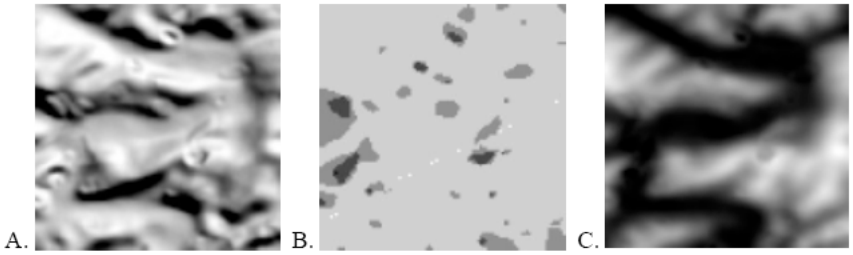


Figure 2. Examples of "pit" artifacts in an ASTER GDEM shaded-relief image (A) that are clearly related to the stack number boundaries (B). Pits typically are less apparent in the normal intensity ASTER GDEM images (C).

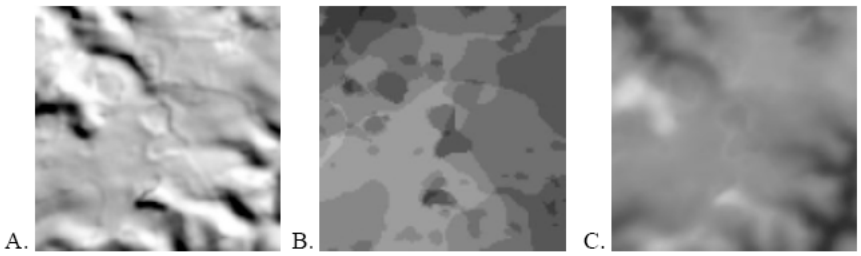
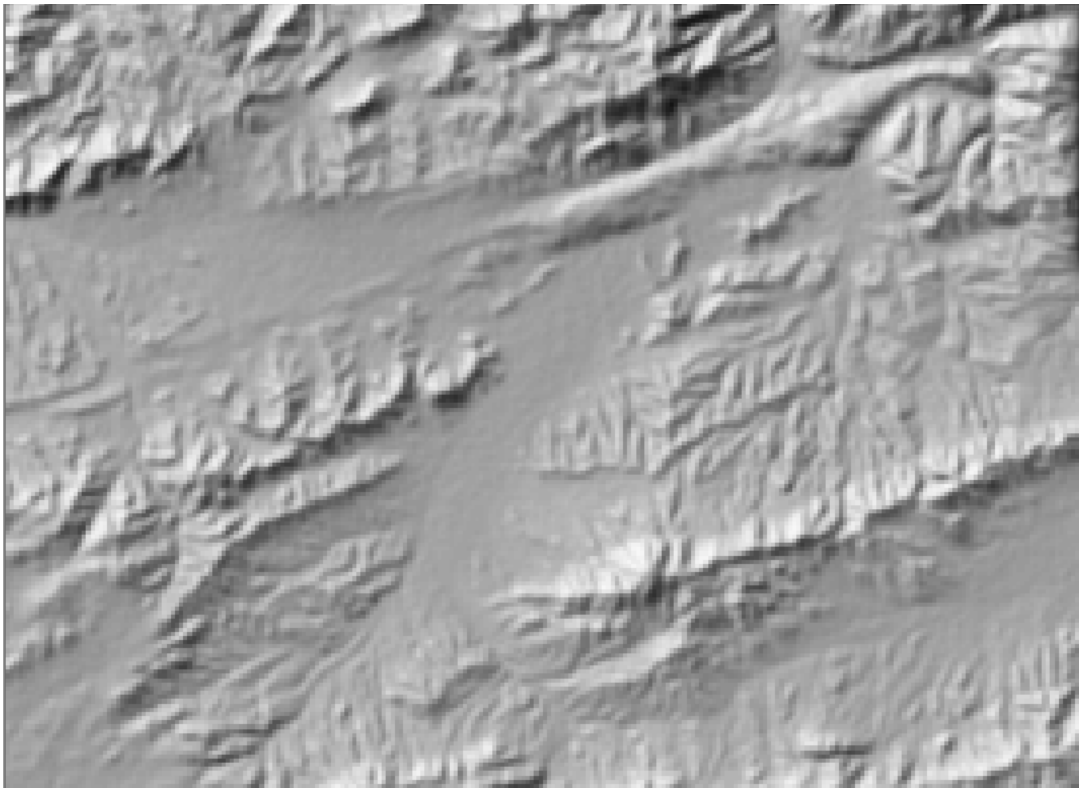


Figure 3. Examples of "mole run" artifacts in an ASTER GDEM shaded-relief image (A) that are clearly related to the stack number boundaries (B). Mole runs, particularly, are less apparent in the normal intensity ASTER GDEM images (C).

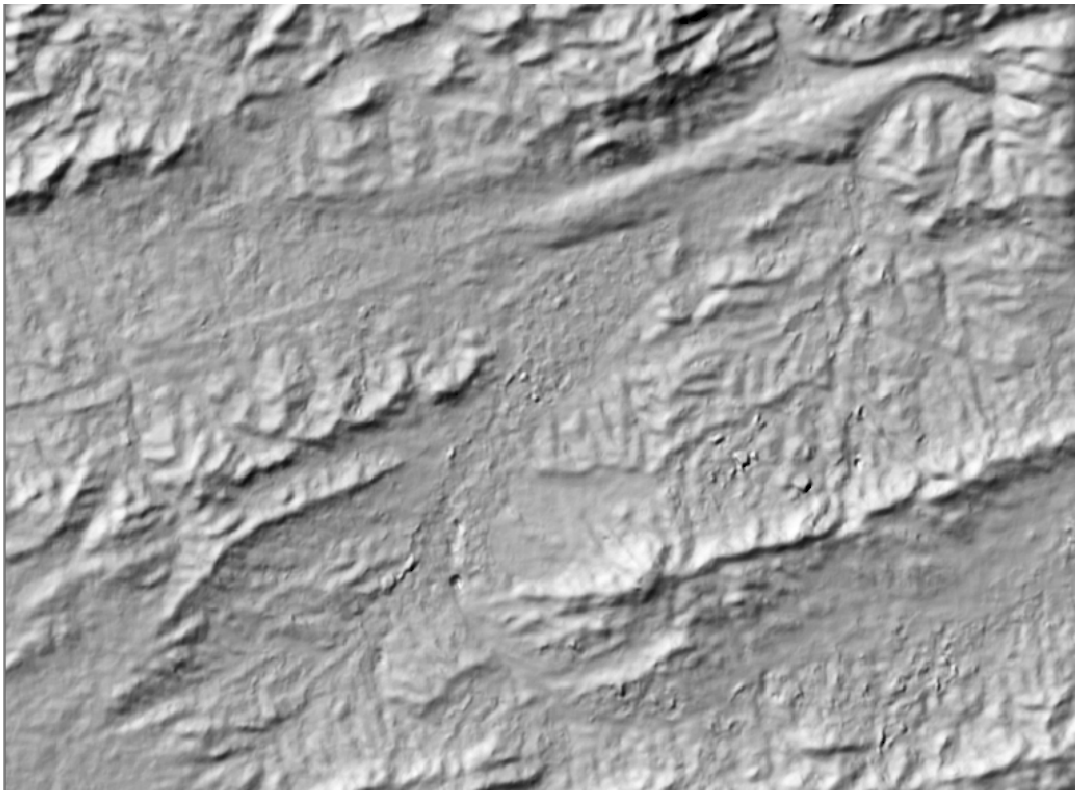
–Figures 2 and 3 from the readme for the ASTER DEMS.

Here is a pair of figures from another study site in Xinjiang China which should not have the cloud cover and vegetation problems, but does have notable pit artifacts (SRTM pixels give

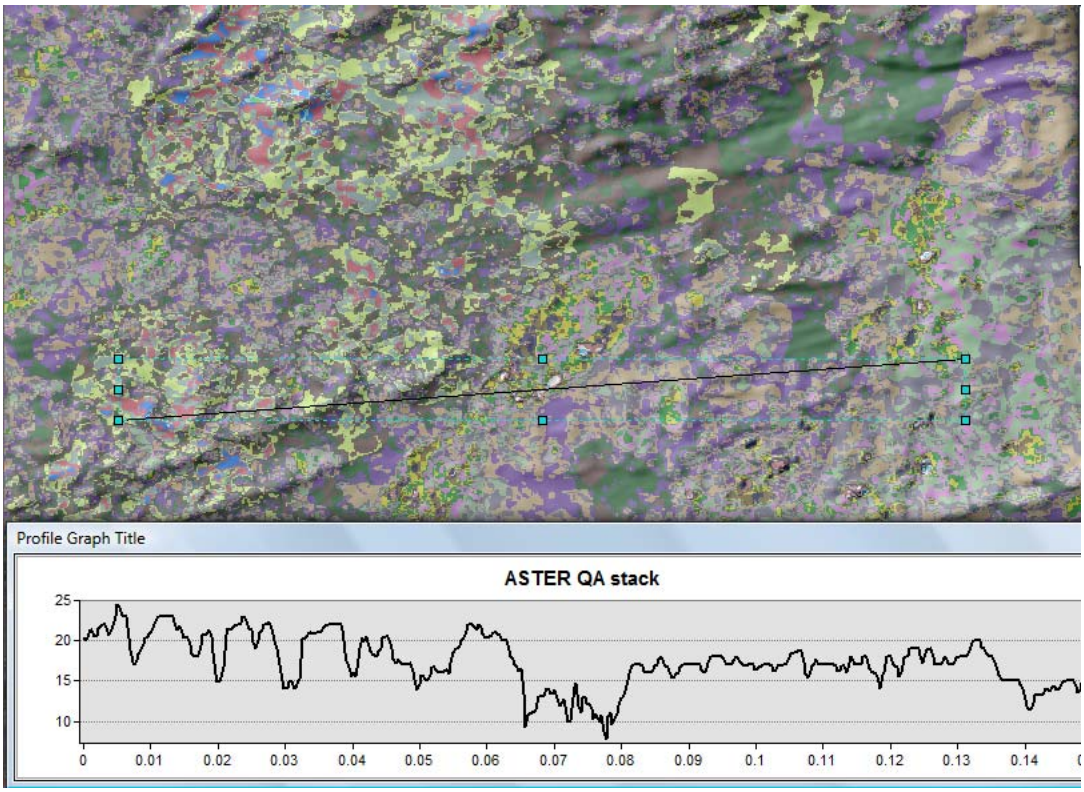
scale):



SRTM above and ASTER below



Here is the associated QA stack (pretty much all ASTER data, not replacements, but large hetereogeneity again):



This entry was posted on Monday, July 27th, 2009 at 6:32 pm and is filed under General commentary. You can follow any responses to this entry through the RSS 2.0 feed. You can leave a response, or trackback from your own site.

One Response to "Looking at the new ASTER 30 m DEMs–not so impressive relative to SRTM 90 m"

1. *newramprasad@live.com* Says:
   November 23rd, 2009 at 12:44 am e

   Nice pictures, and one has to appreciate them.Thanks for posting.

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