

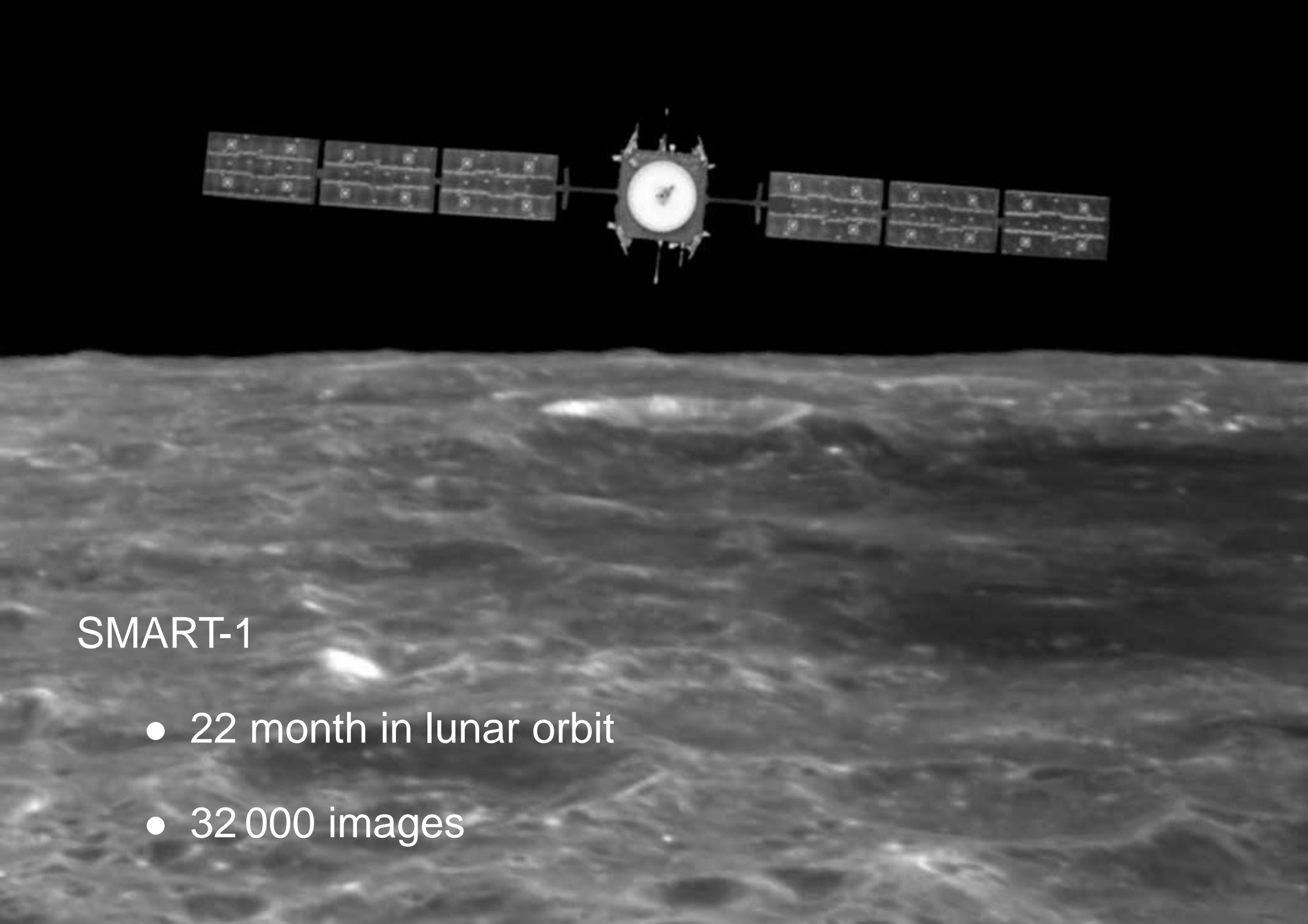
38th COSPAR Scientific Assembly 2010



Synthesis of lunar south pole topography from SMART-1/AMIE imagery and Kaguya Laser Altimeter data

Björn Grieger

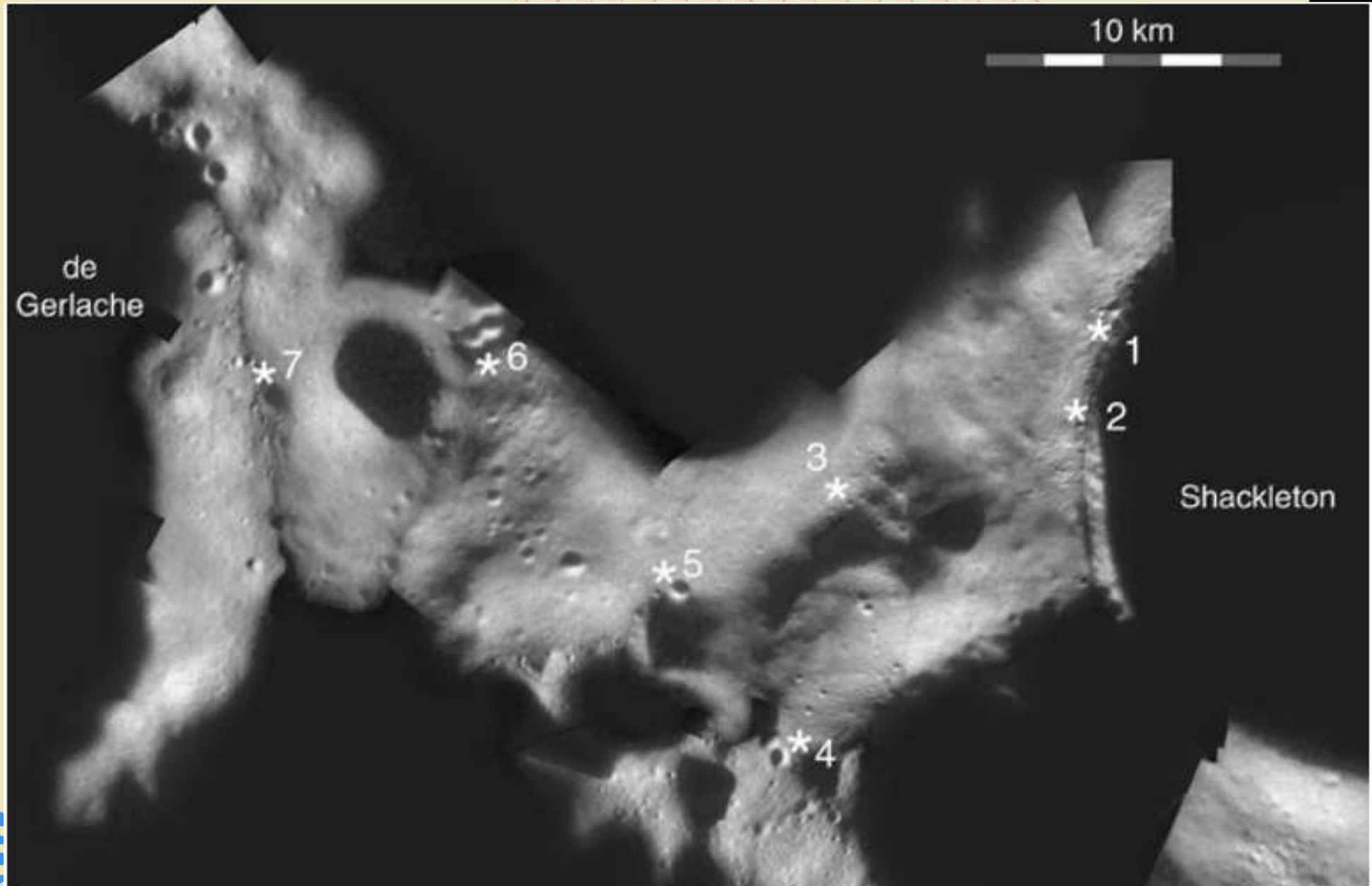
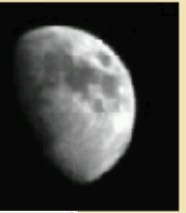
ESA/ESAC, Madrid, Spain



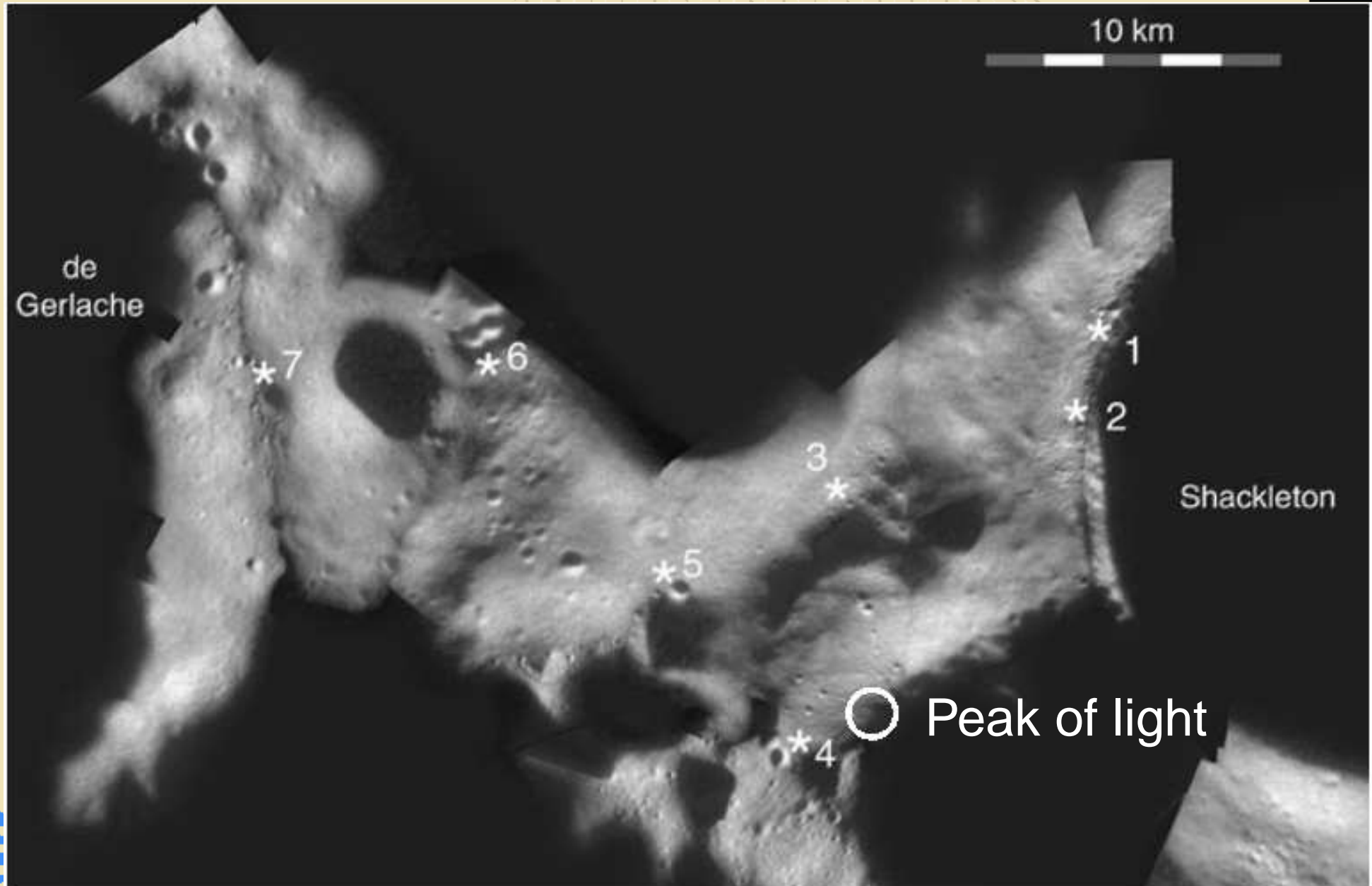
SMART-1

- 22 month in lunar orbit
- 32 000 images

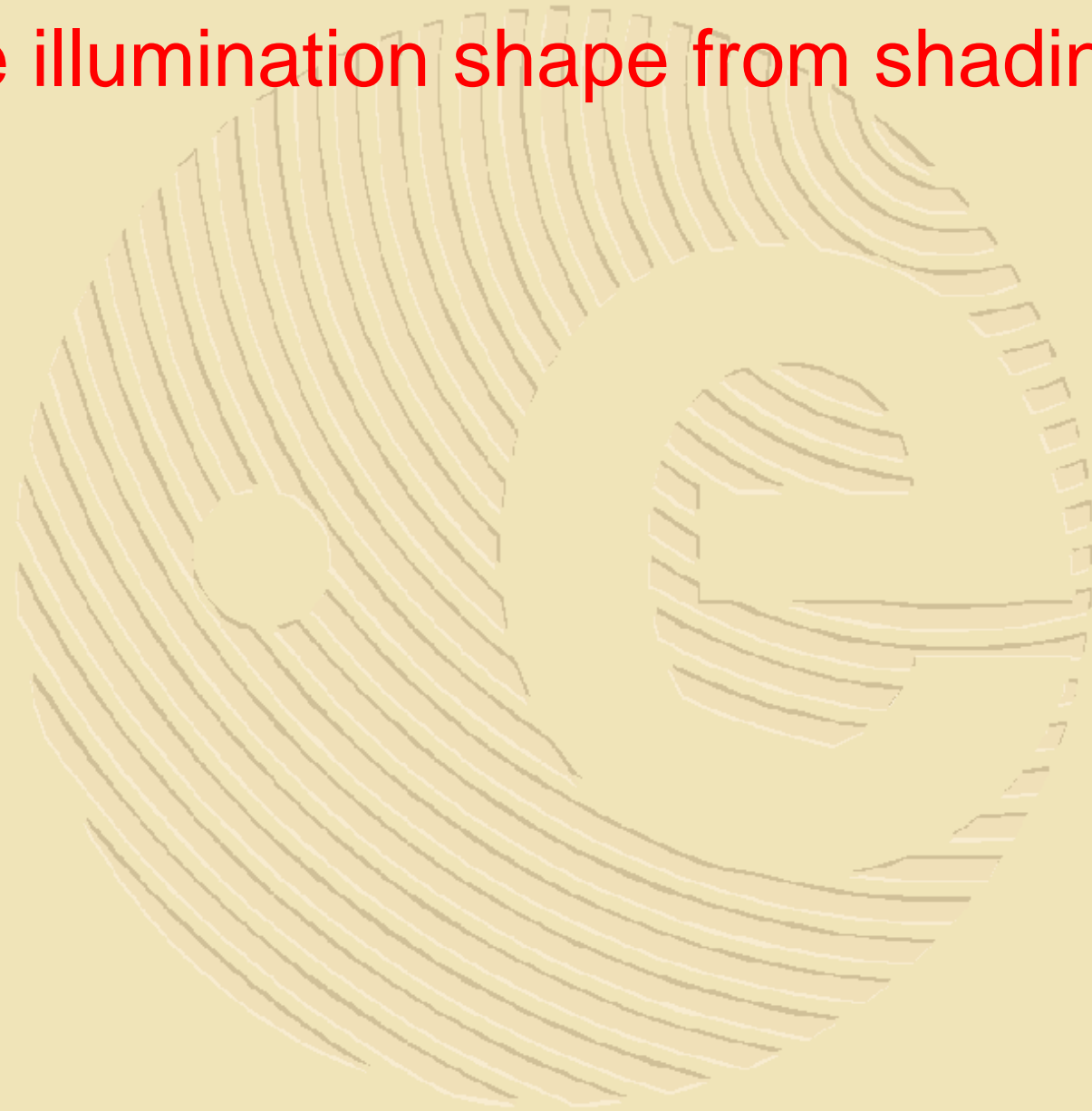
Clementine mosaic by Philip J. Stooke



Clementine mosaic by Philip J. Stooke



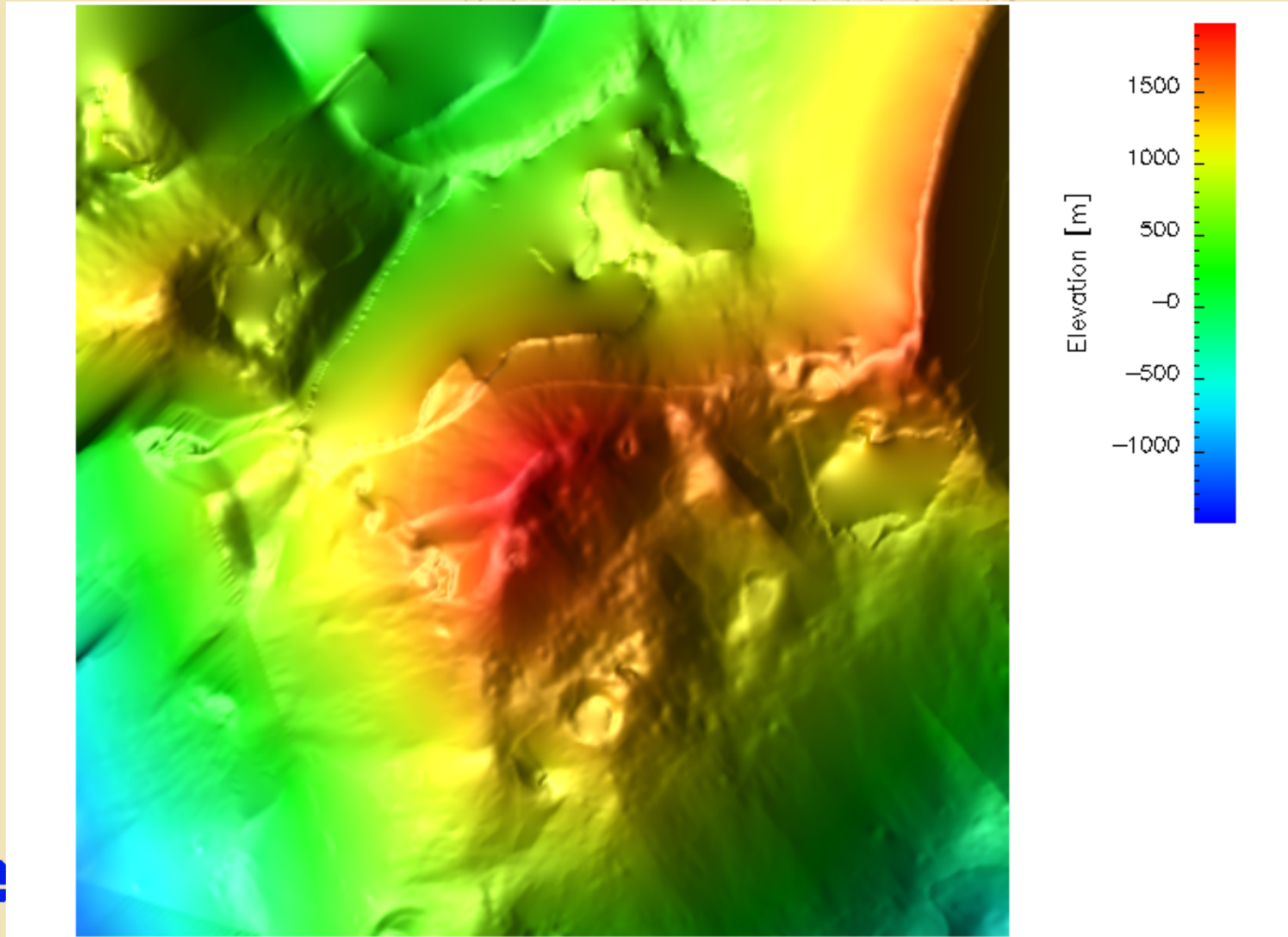
Multiple illumination shape from shading



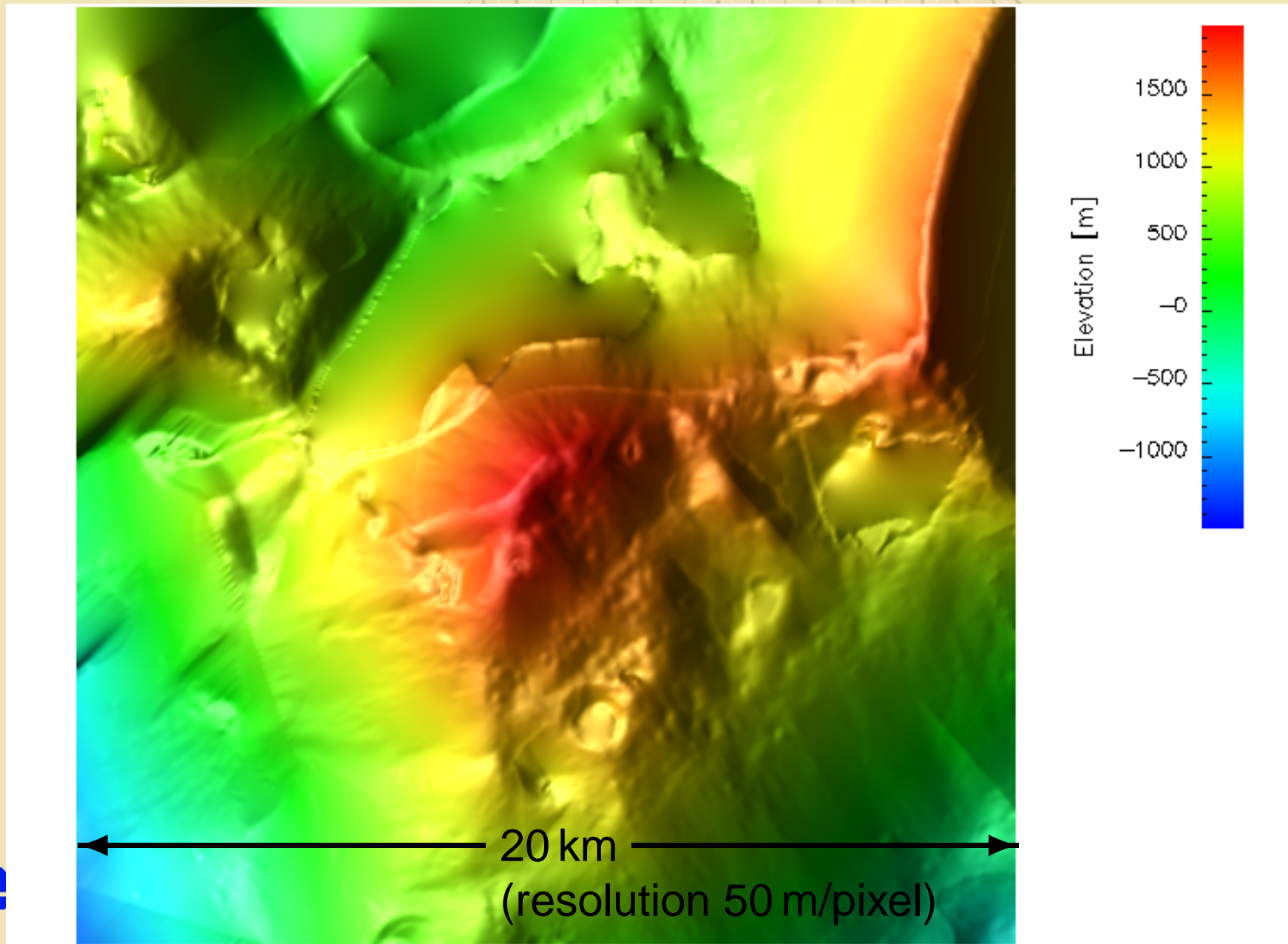
“Peak of Light” sightseeing movie



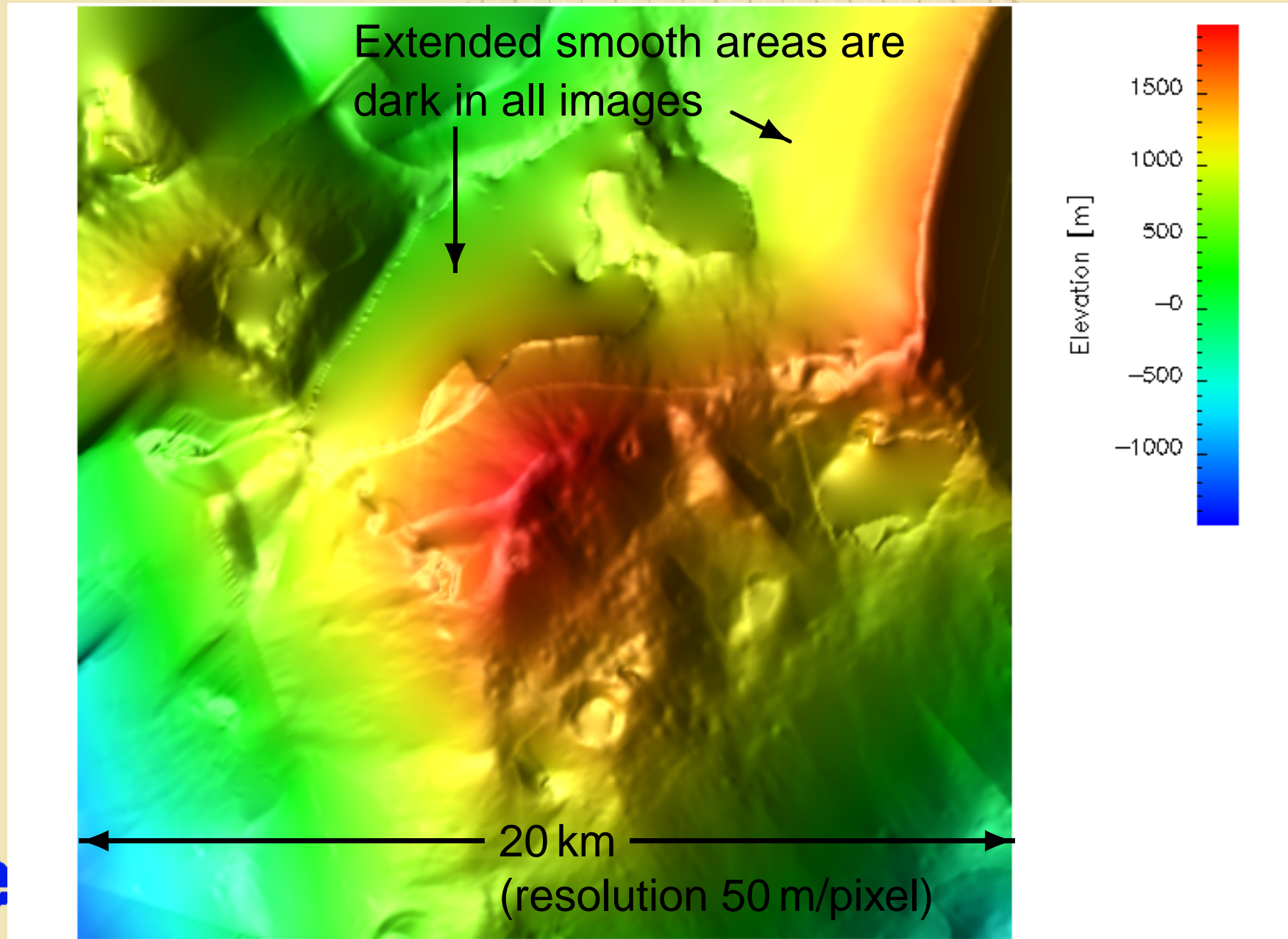
AMIE digital terrain model



AMIE digital terrain model

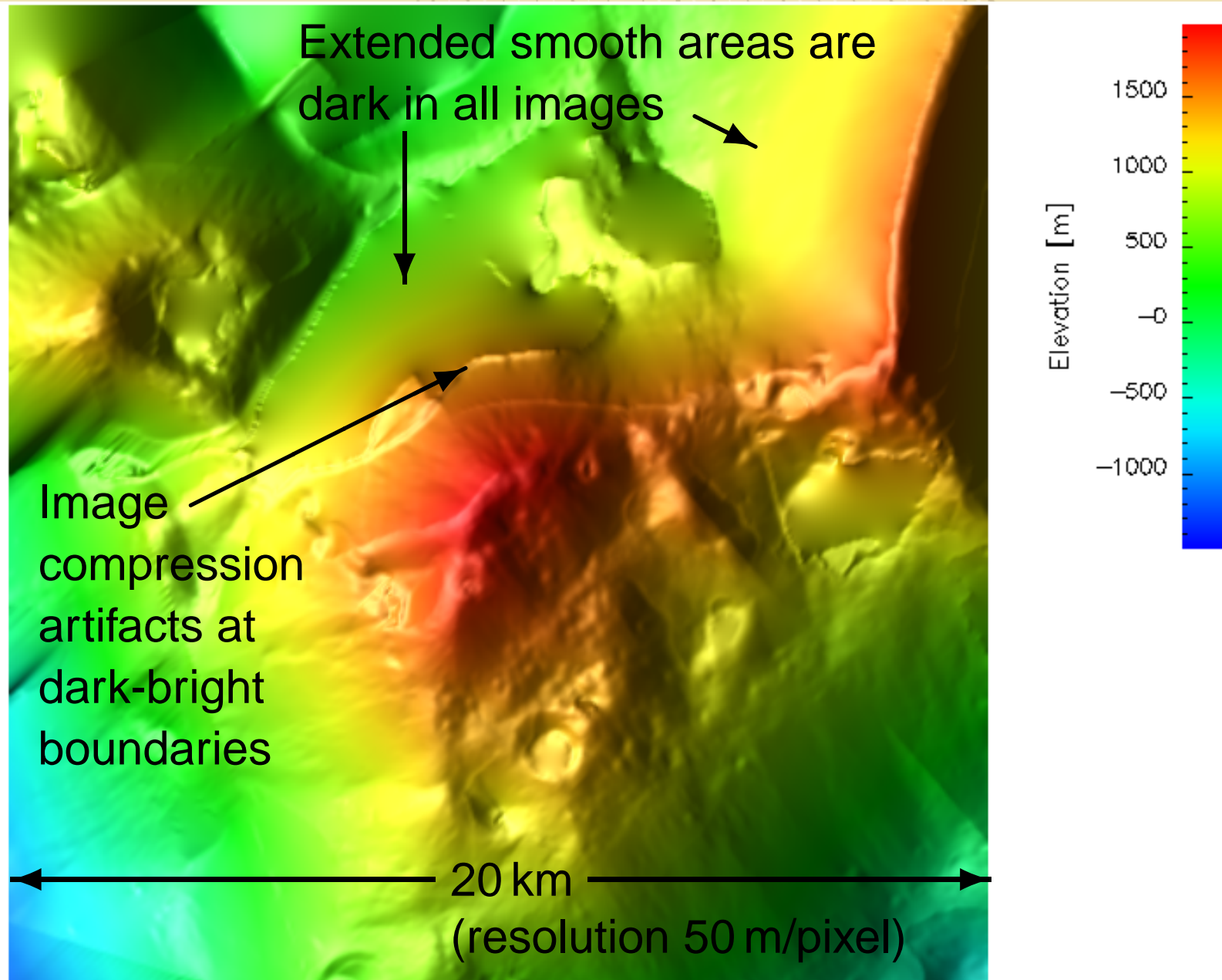


AMIE digital terrain model



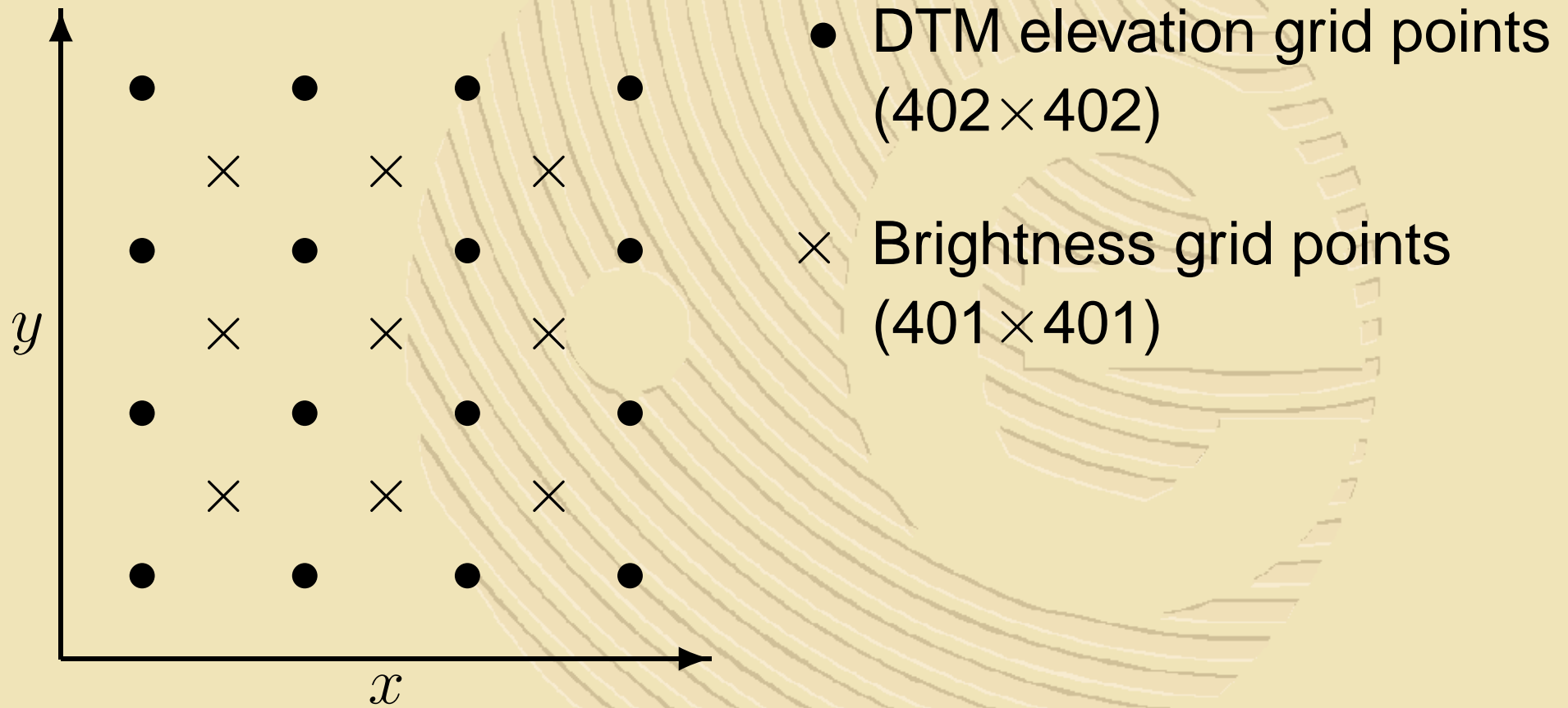


AMIE digital terrain model



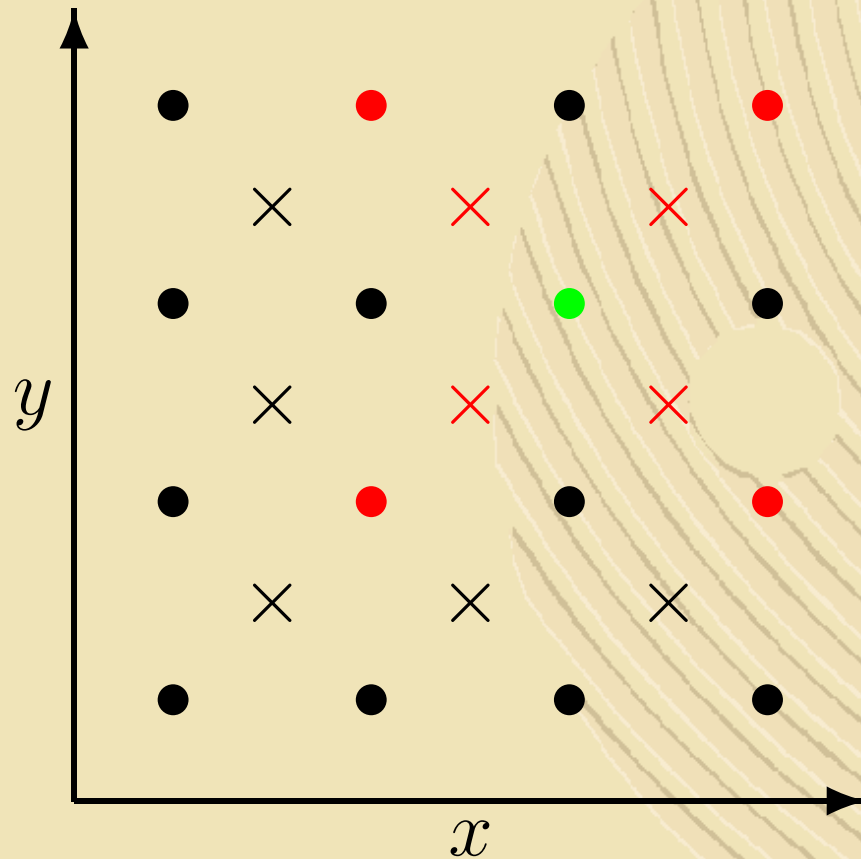


Grids of brightness and elevation





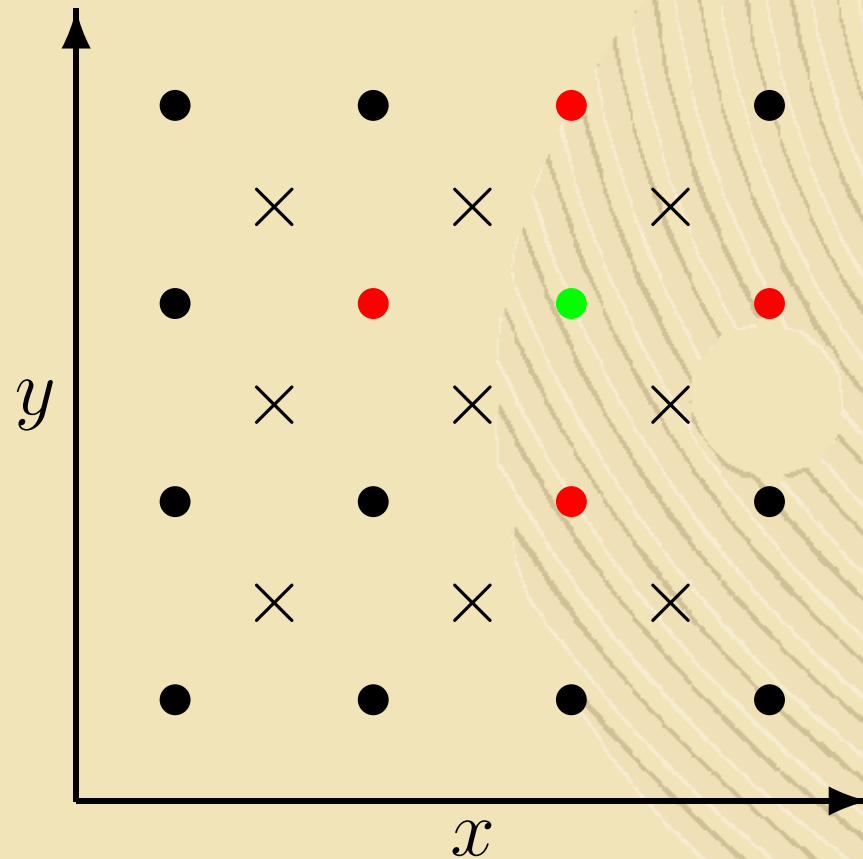
Slope constraints



- DTM elevation grid points (402 × 402)
- × Brightness grid points (401 × 401)
- Set elevation so that the slopes to the neighbouring points are compatible with the observed brightnesses in all AMIE images.



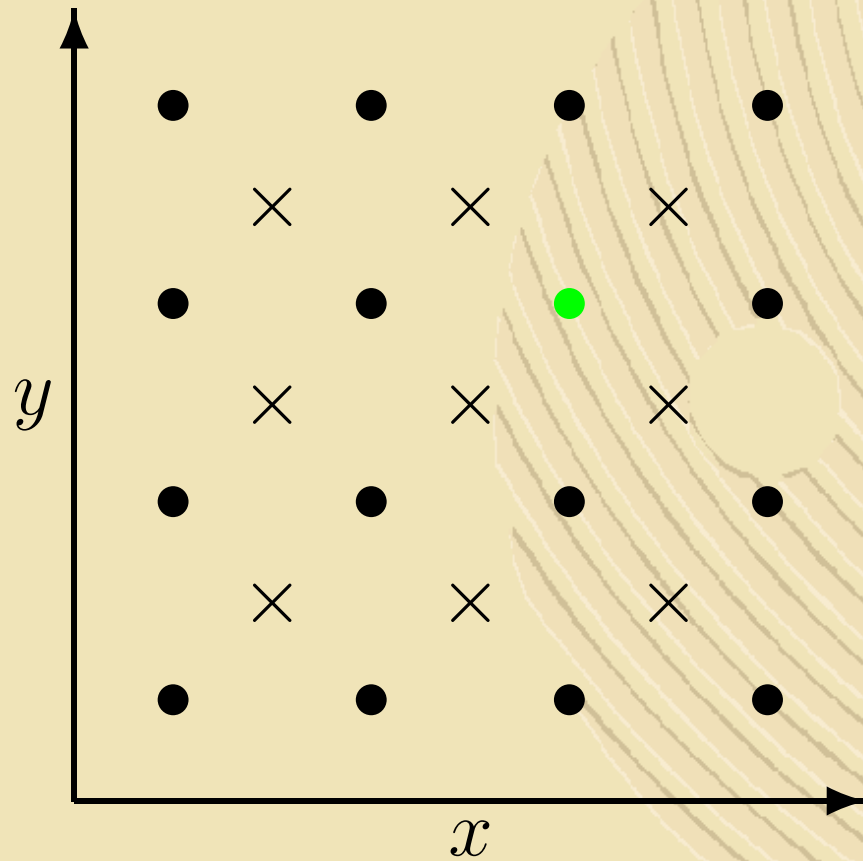
Smoothness constraints



- DTM elevation grid points (402 × 402)
- × Brightness grid points (401 × 401)
- Set elevation to the mean of the neighbouring points (weight λ_1).



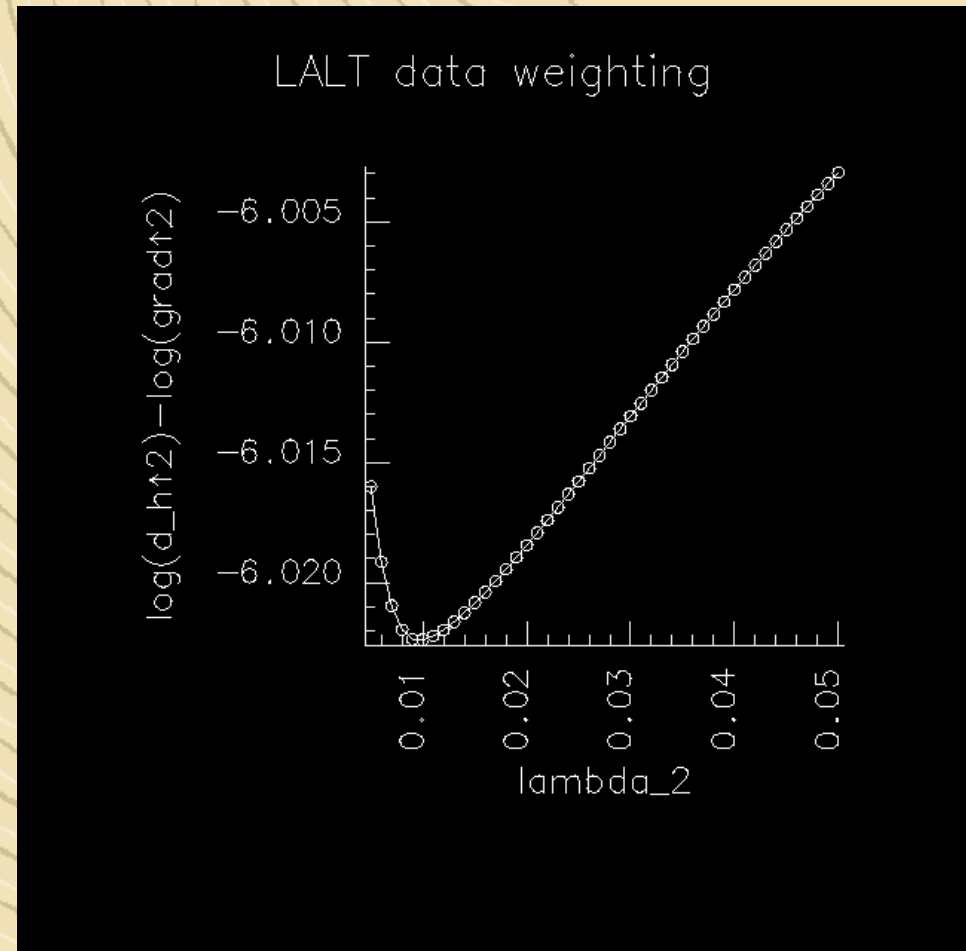
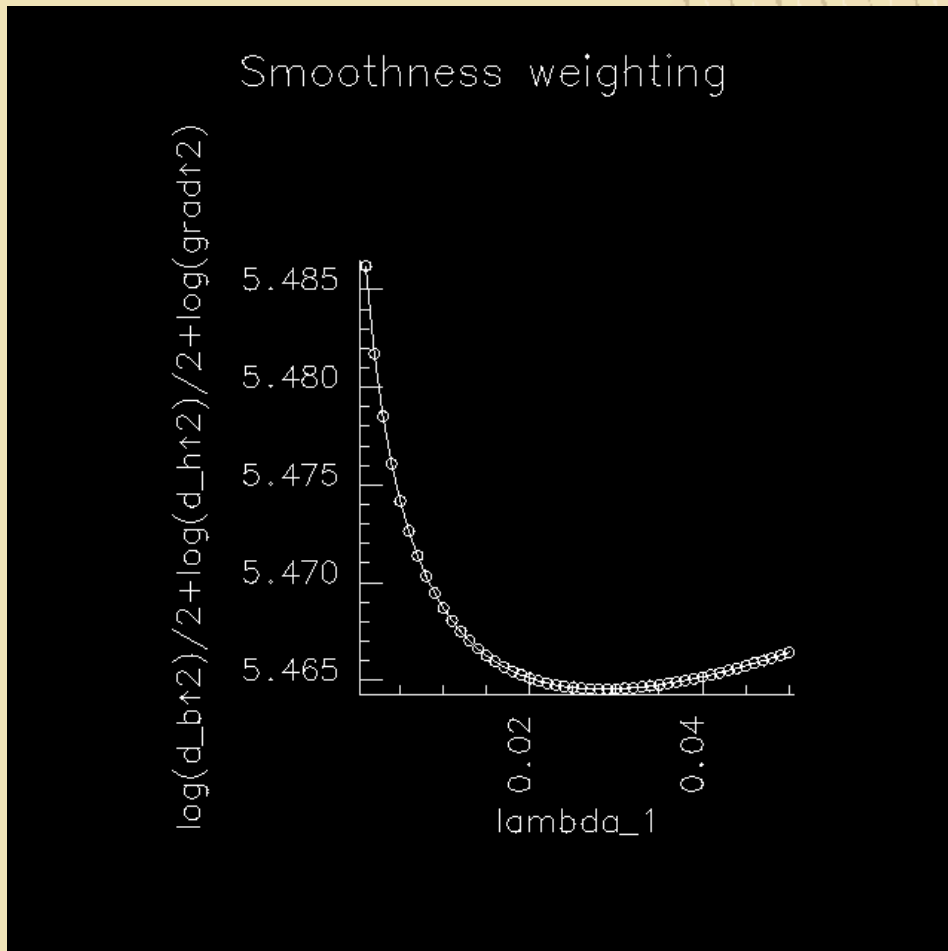
Kaguya/LALT constraints



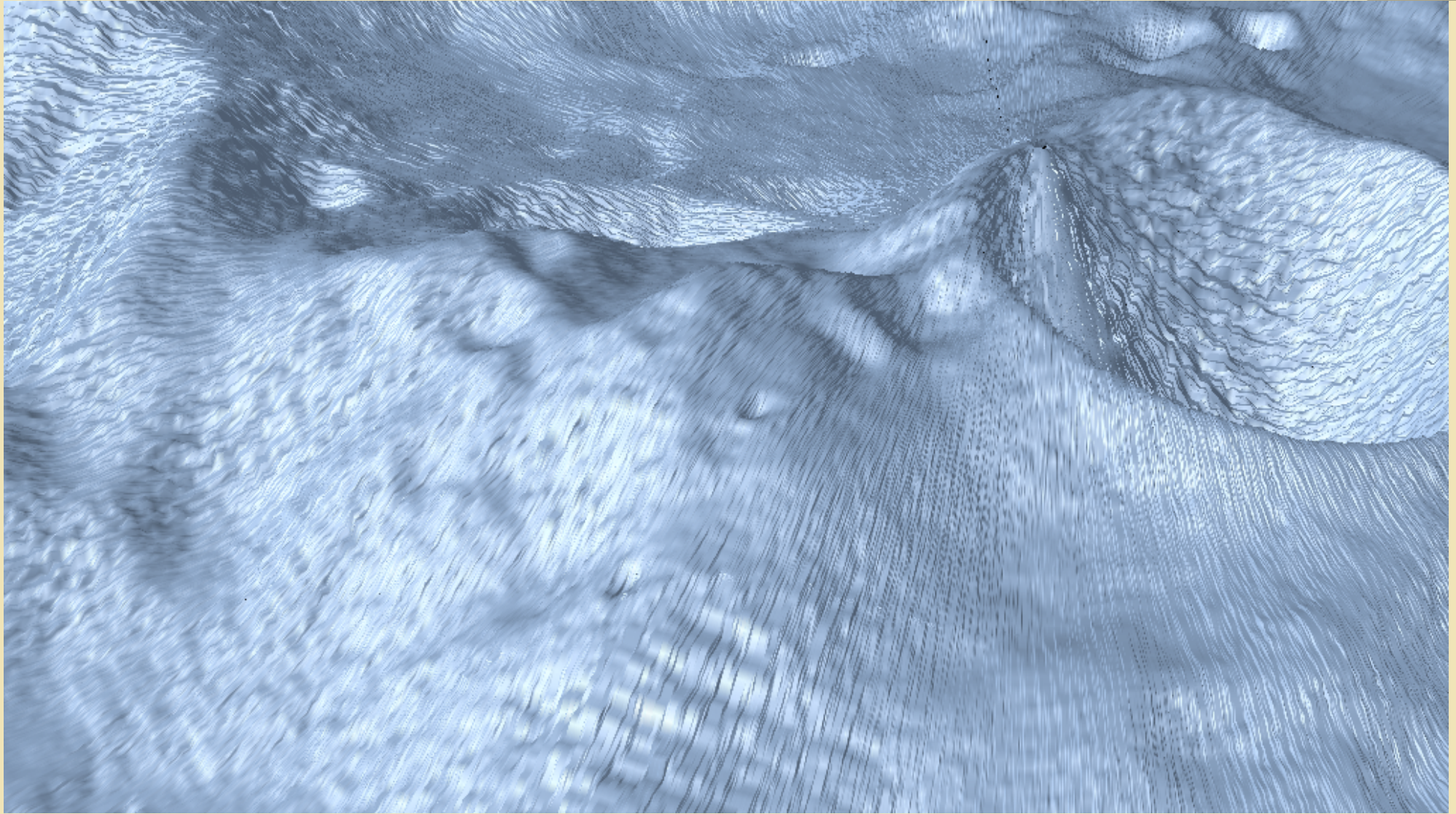
- DTM elevation grid points (402 × 402)
- × Brightness grid points (401 × 401)
- Set elevation to the LALT value (weight λ_2).



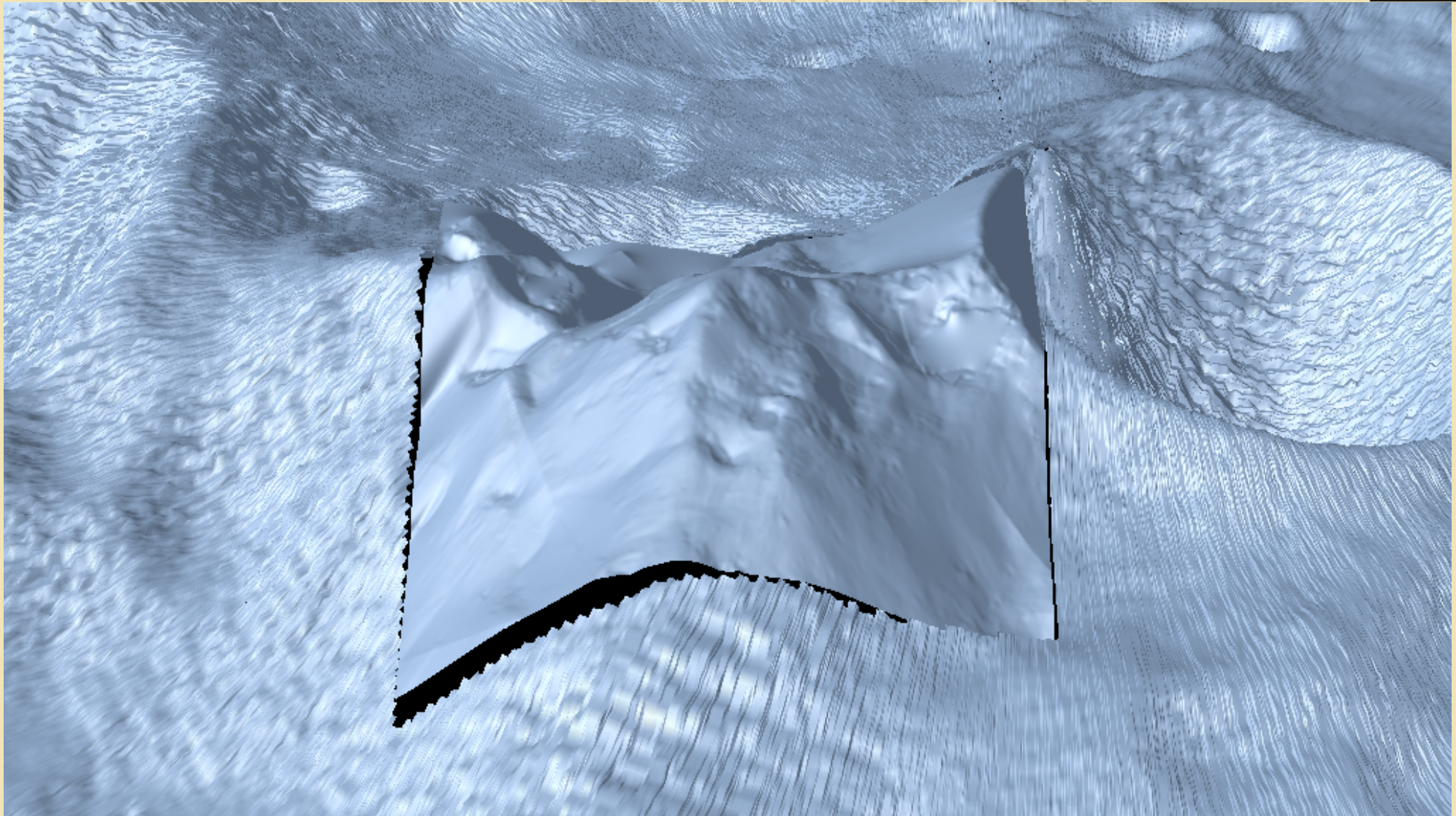
Determining weighting parameters



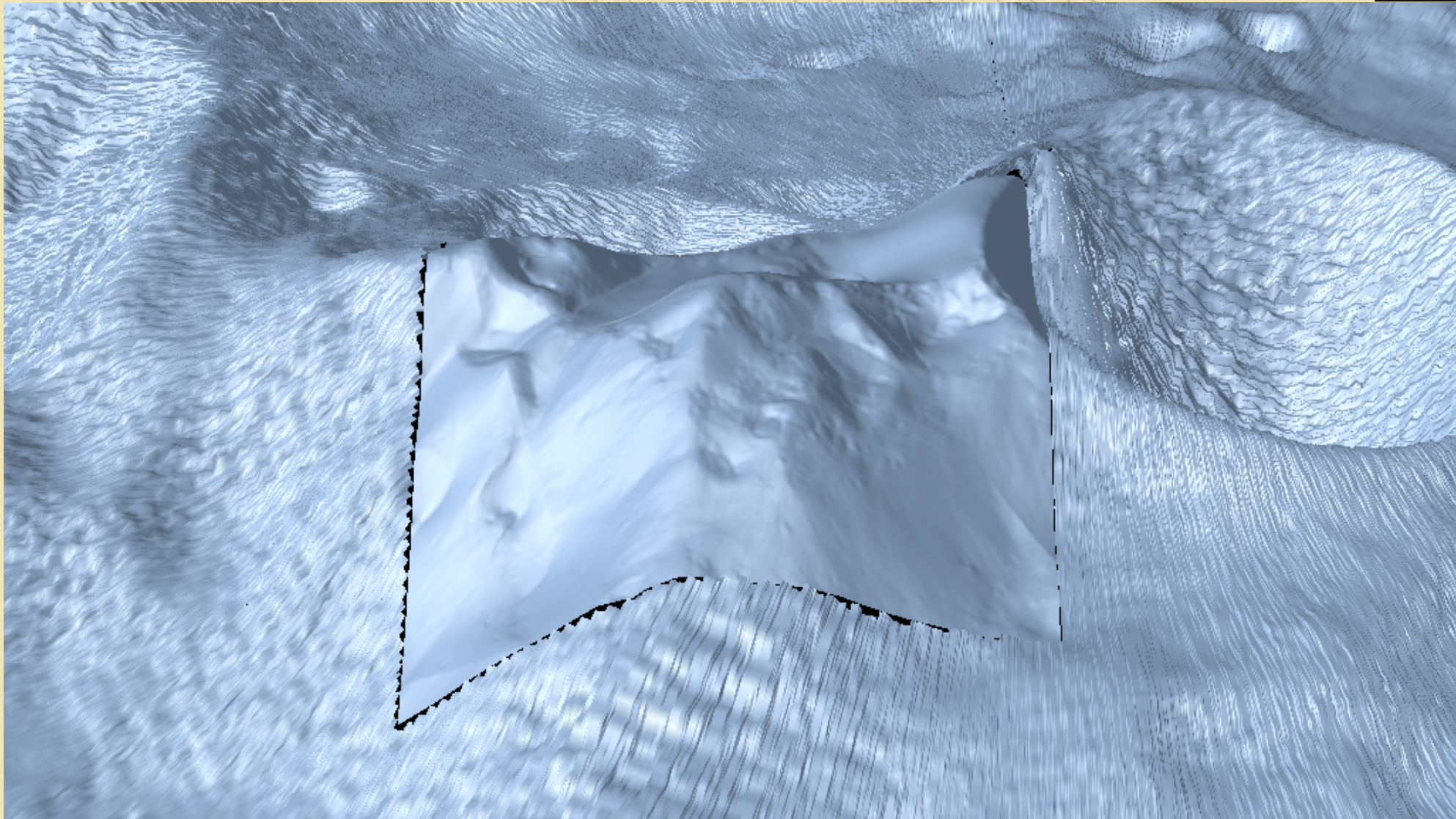
LALT DTM



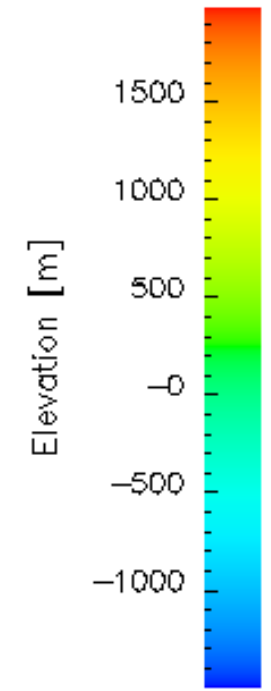
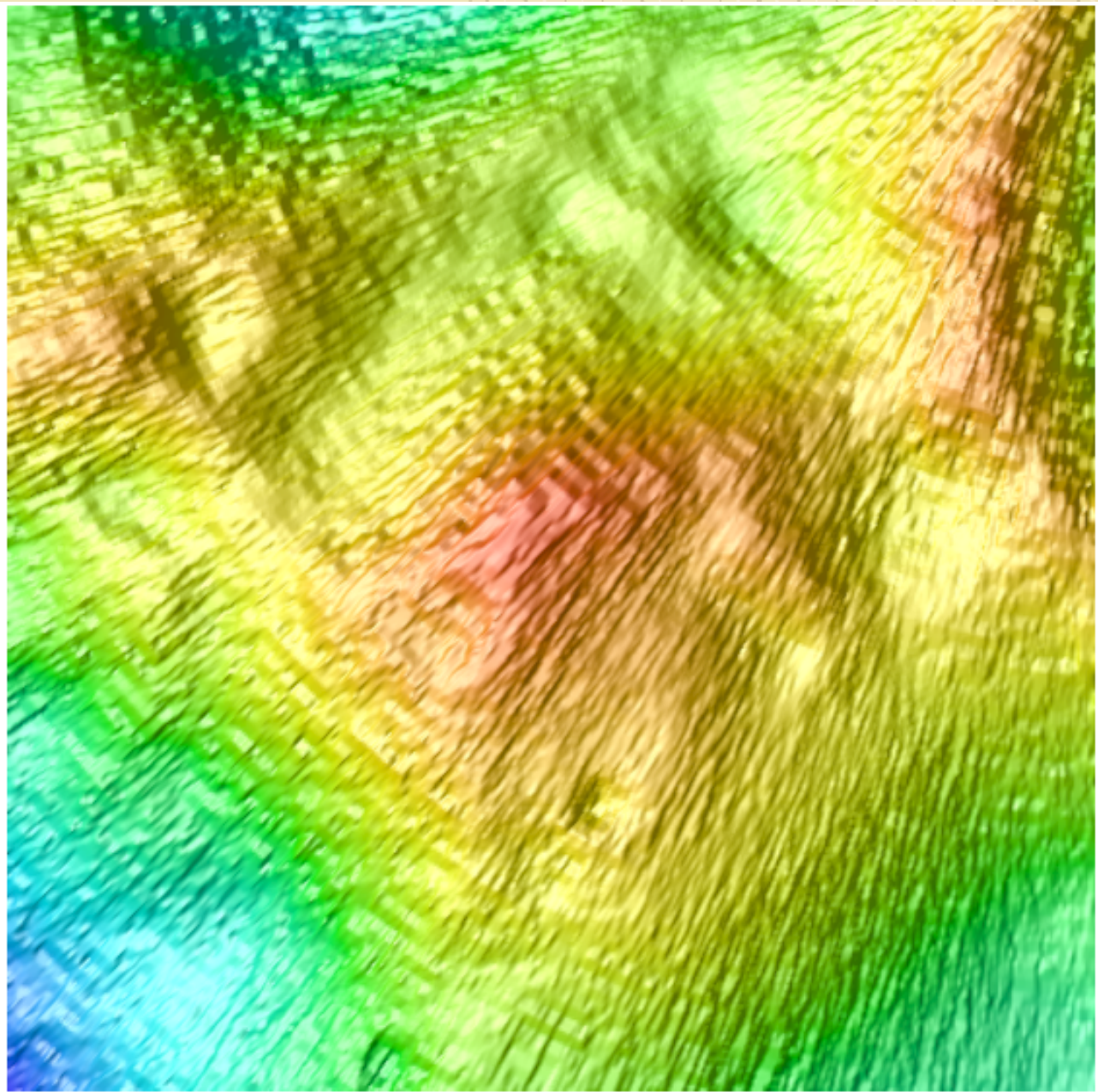
Inserted AMIE only DTM



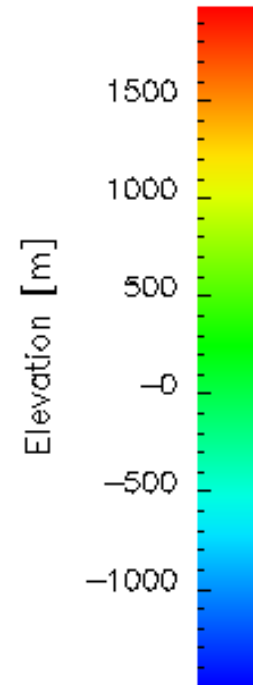
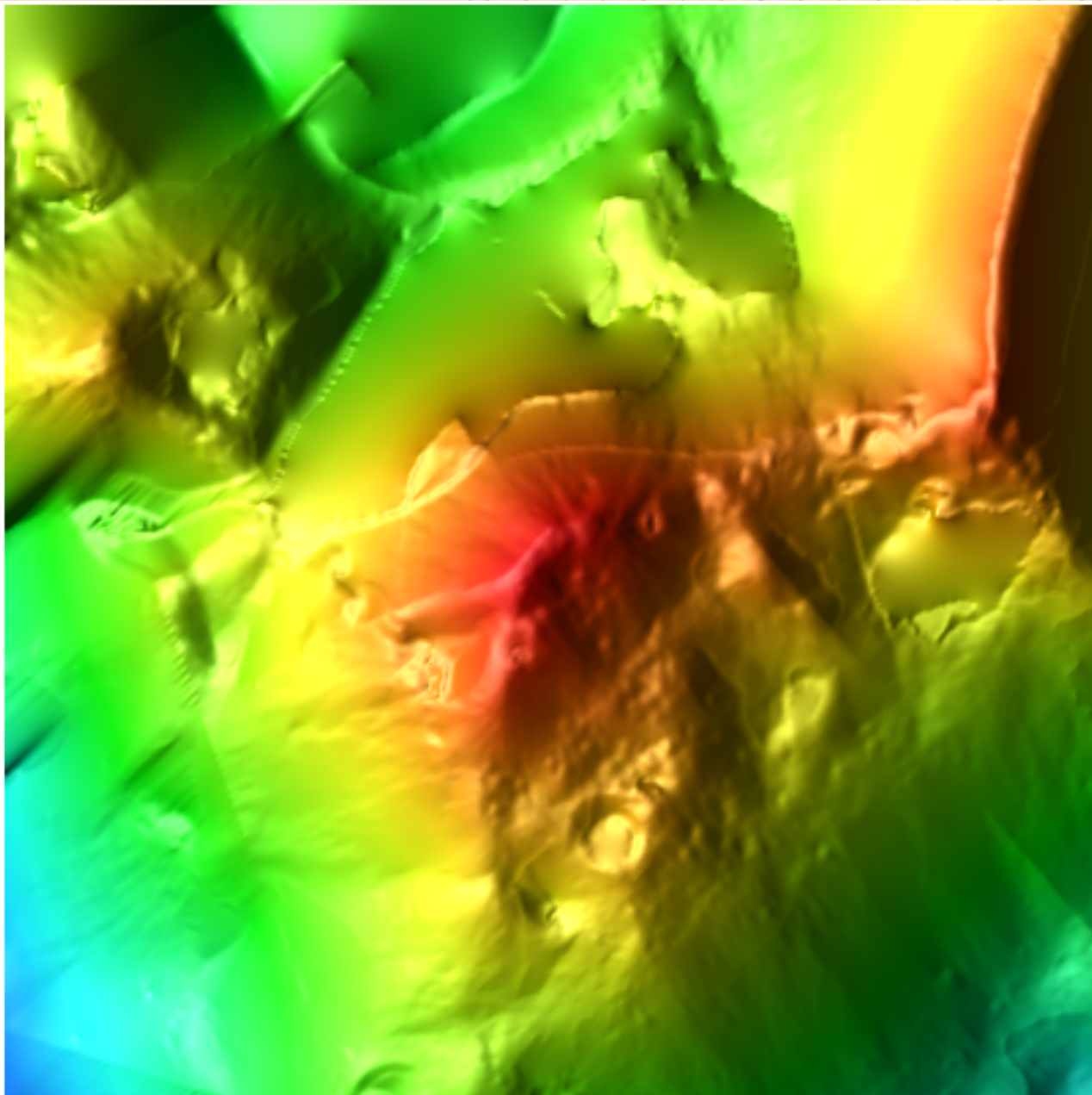
Inserted AMIE and LALT synthesized DTM



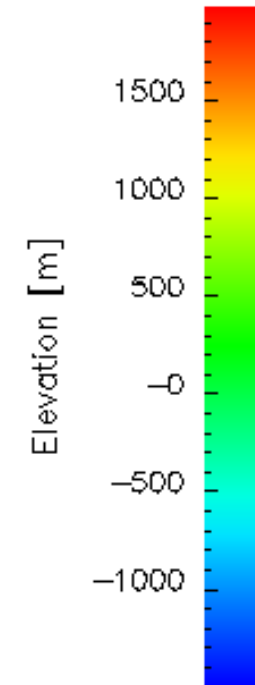
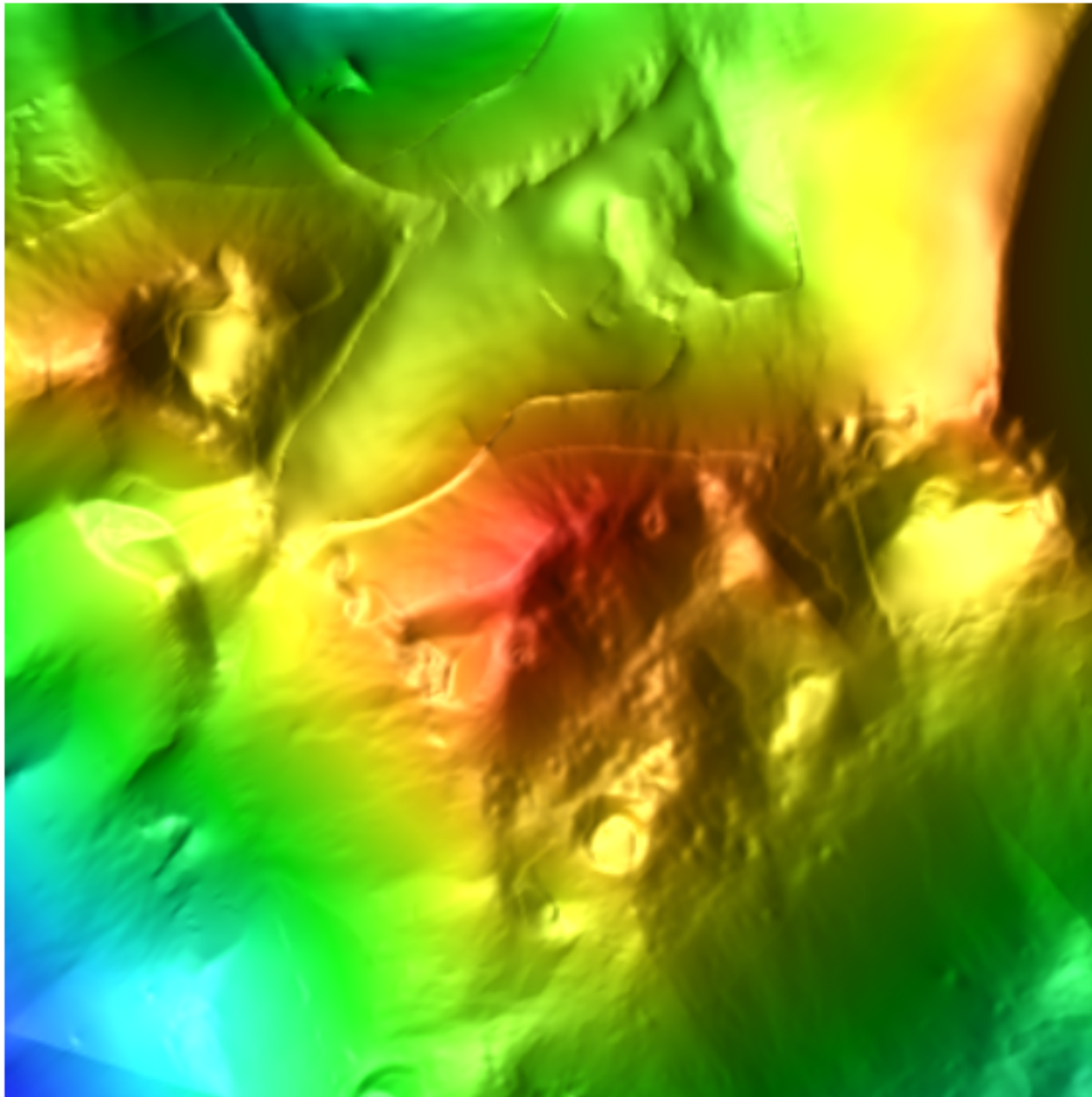
LALT only DTM



AMIE only DTM



Synthesized DTM



Conclusions



- We have synthesized a DTM from SMART-1/AMIE and Kaguya/LALT data which is significantly superior to results from either data alone.
- The combination of shape from shading in high resolution imagery with (lower resolution) laser altimeter data is quite powerful.

Movie “The Peak of Light”



- http://www.esa.int/SPECIALS/SMART-1/SEMIYBE3GXF_0.html
- <http://astronomy2009.esa.int/science-e/www/object/index.cfm?fobjectid=45362>

