

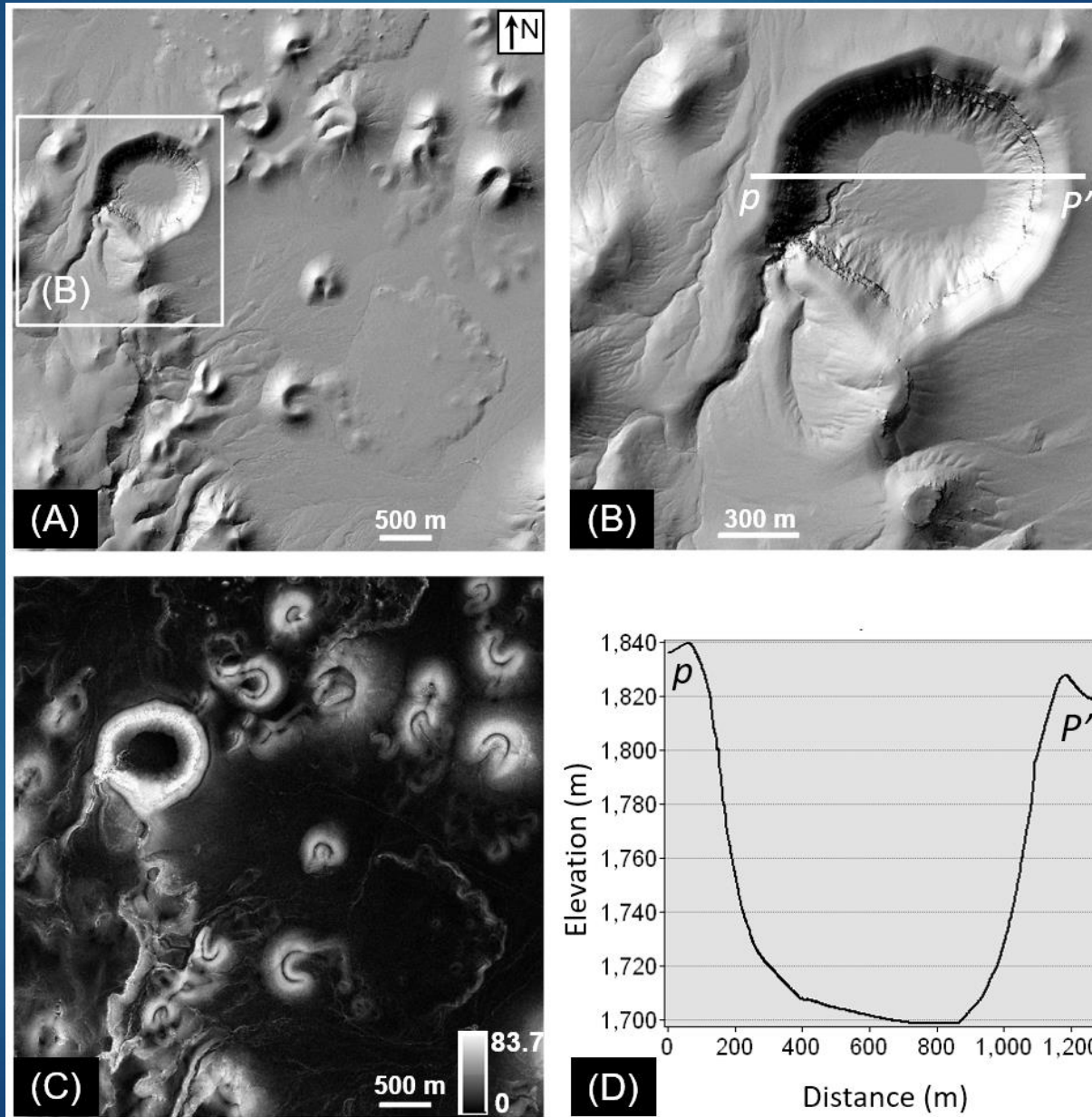


Earth Science Applications of LiDAR (2)

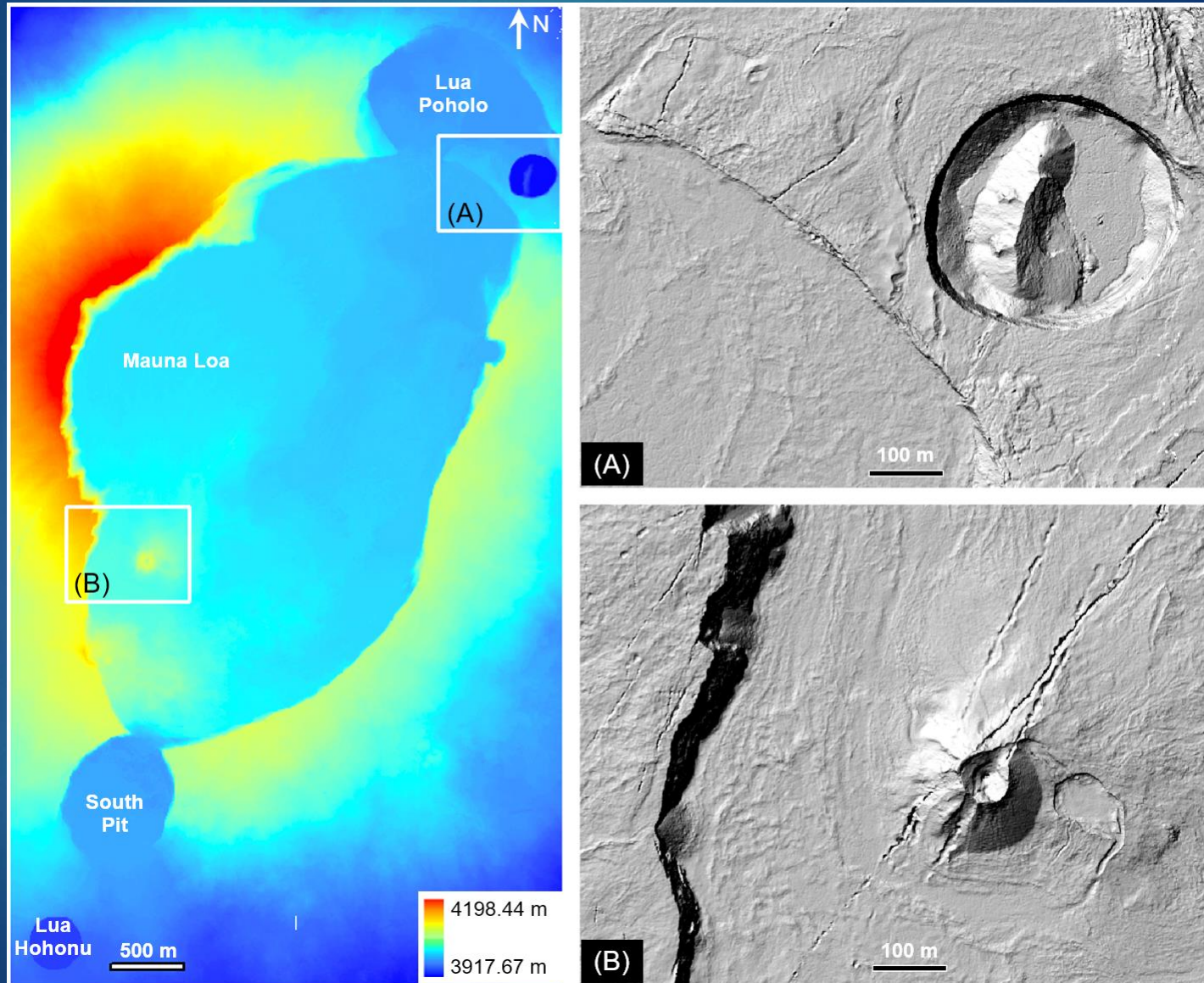
Urban Applications of LiDAR (2)

- 6.1 Introduction
- 6.2 Aeolian Landforms
- 6.3 Fluvial Landforms
- 6.4 Surface Hydrology
- 6.5 Volcanic and Impact Landforms
- 6.6 Tectonic Landforms
- 6.7 Lithology and Geologic Structures

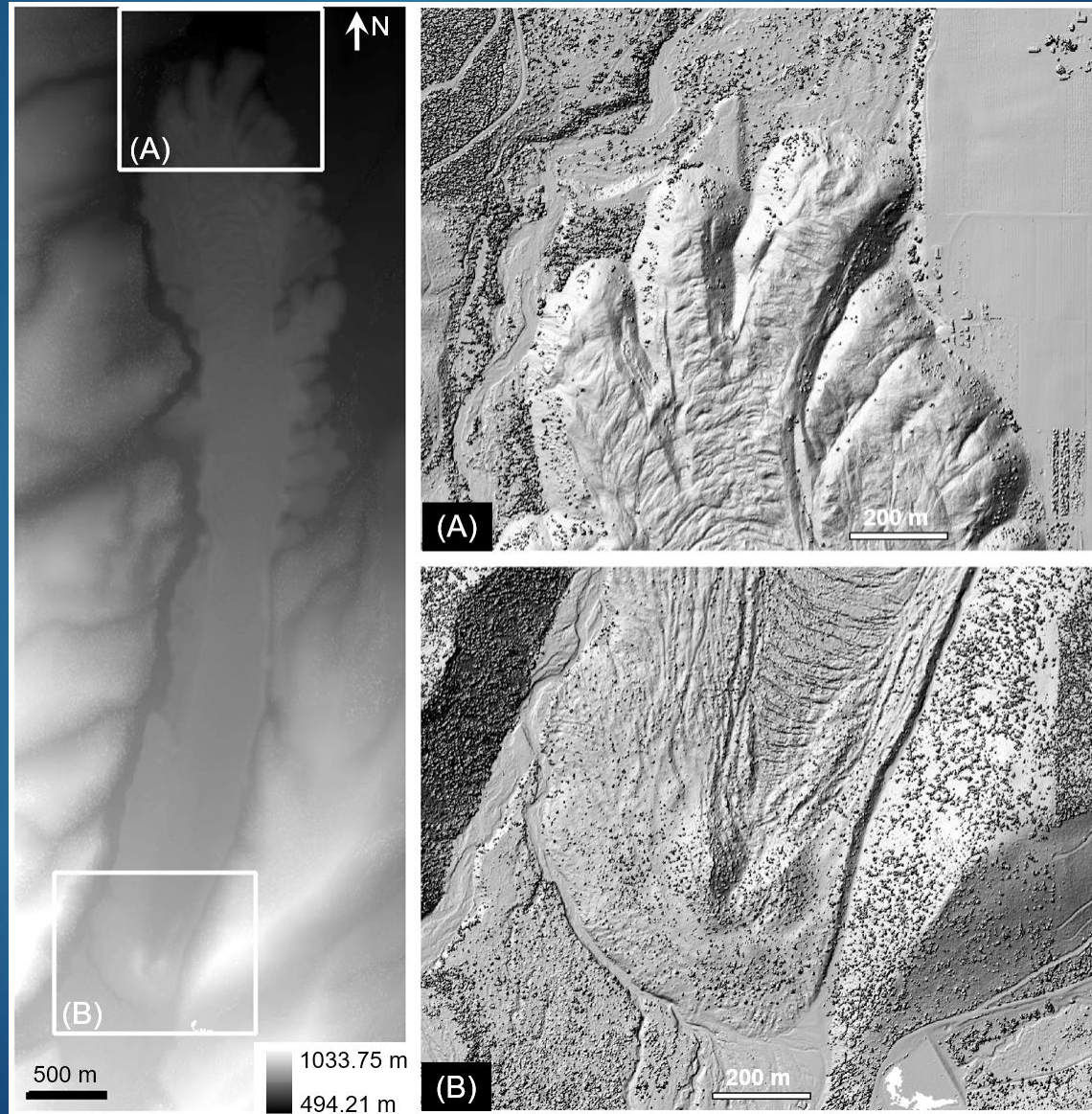
Lunar Crater volcanic field in east-central Nevada (USA)



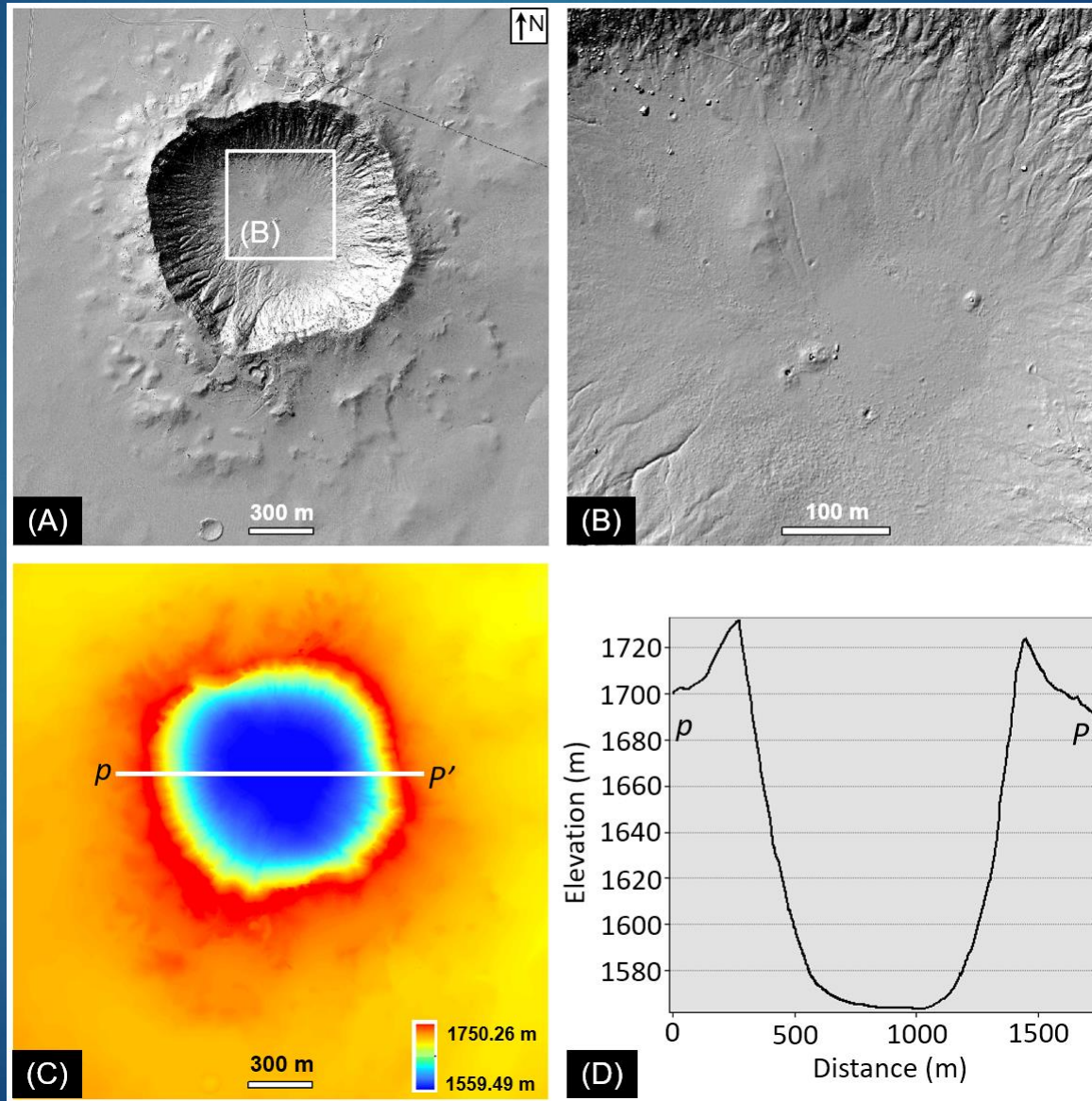
Volcanic landforms in Mauna Loa, Hawaii



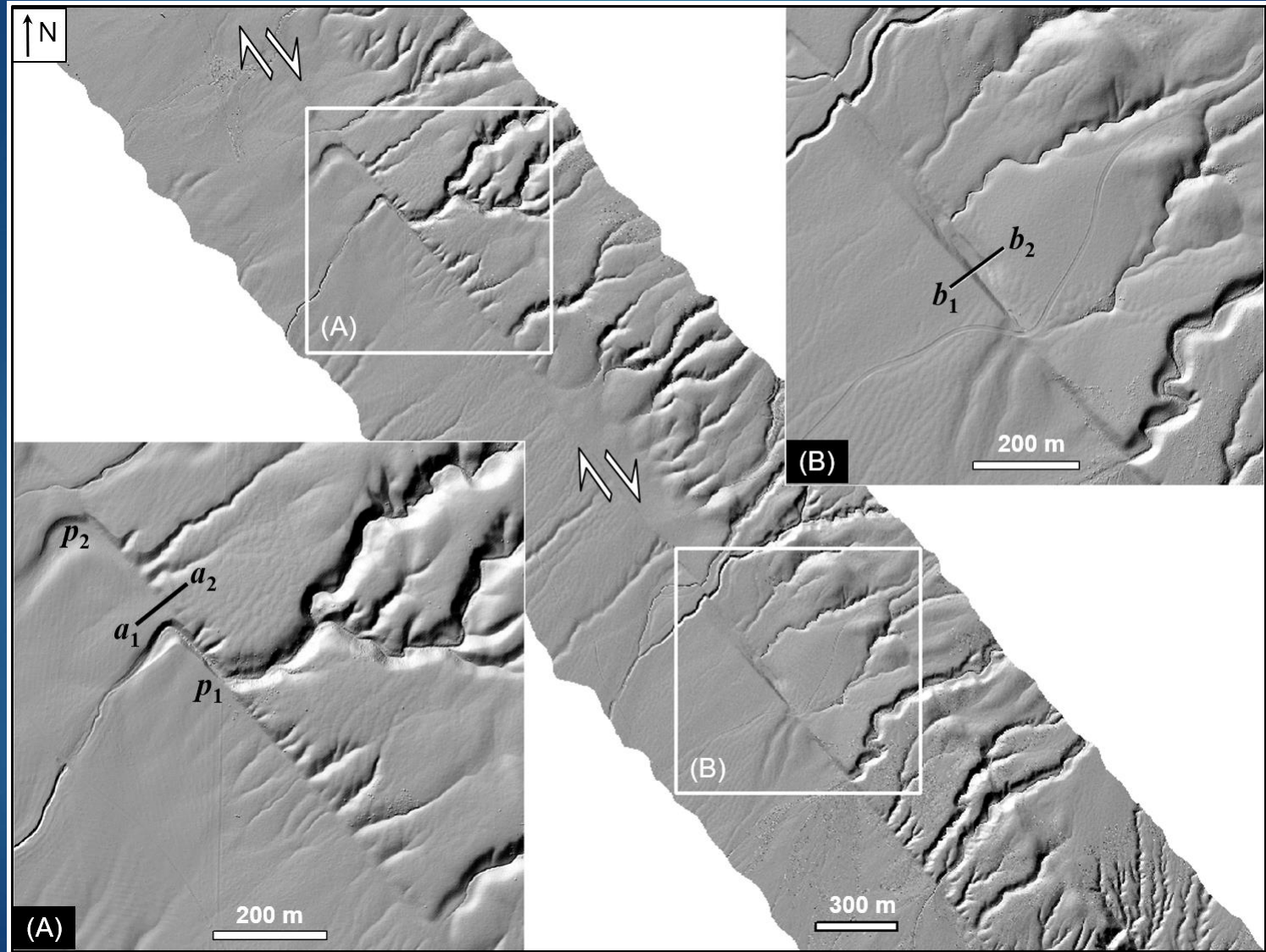
Lava flow in Parkdale, Oregon



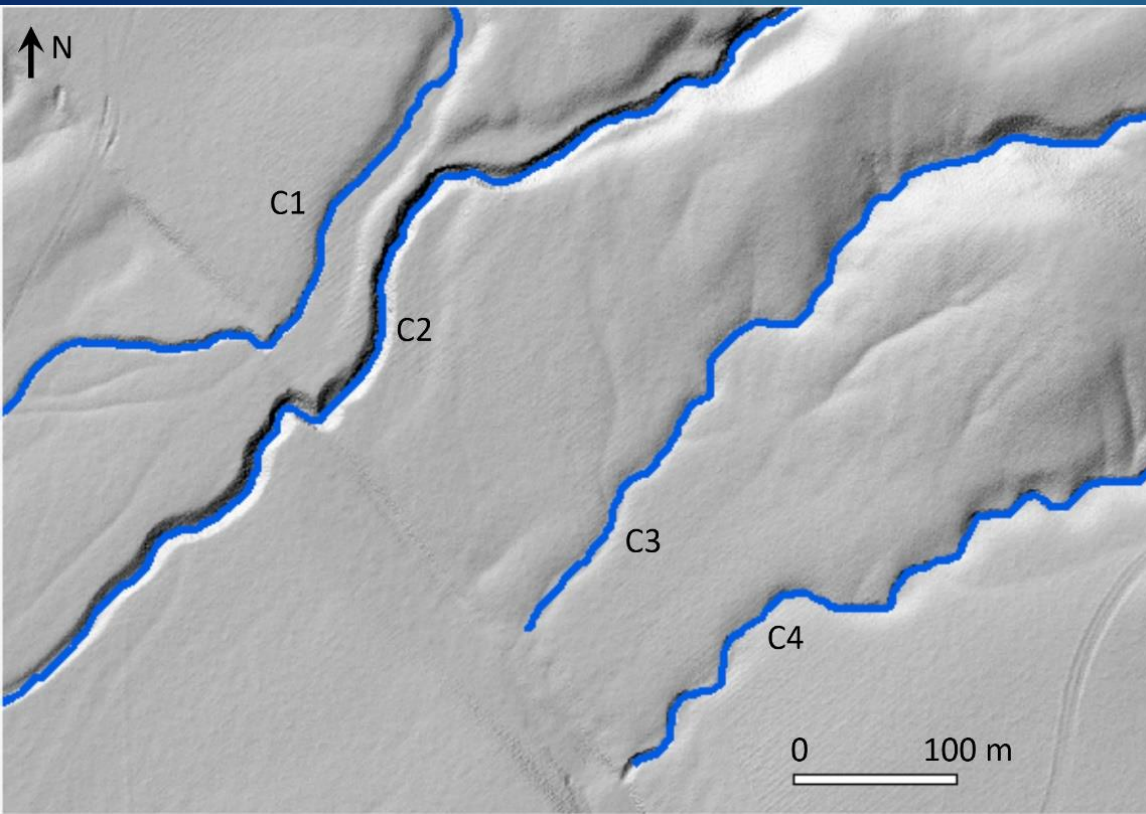
Meteor Crater, Arizona



Offset channels in the south-central San Andreas Fault, California



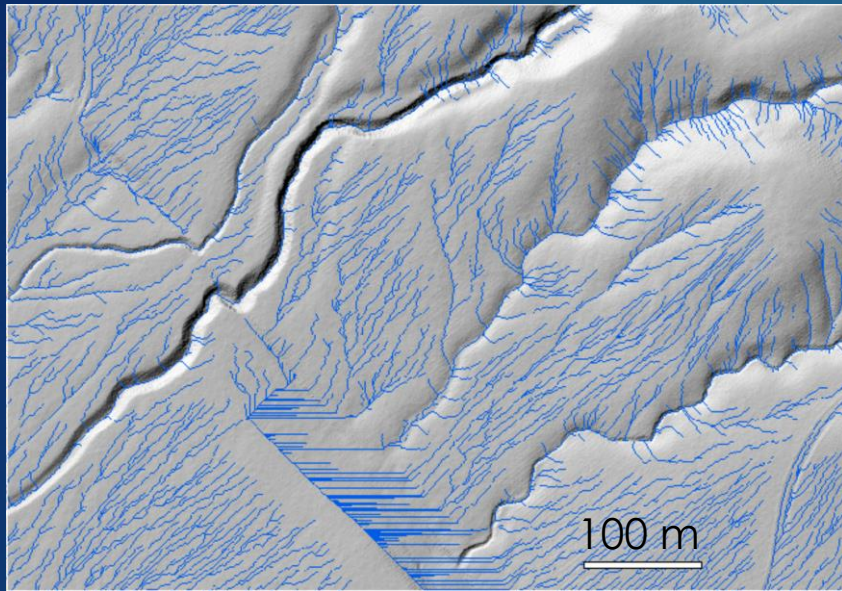
San Andreas Fault, California



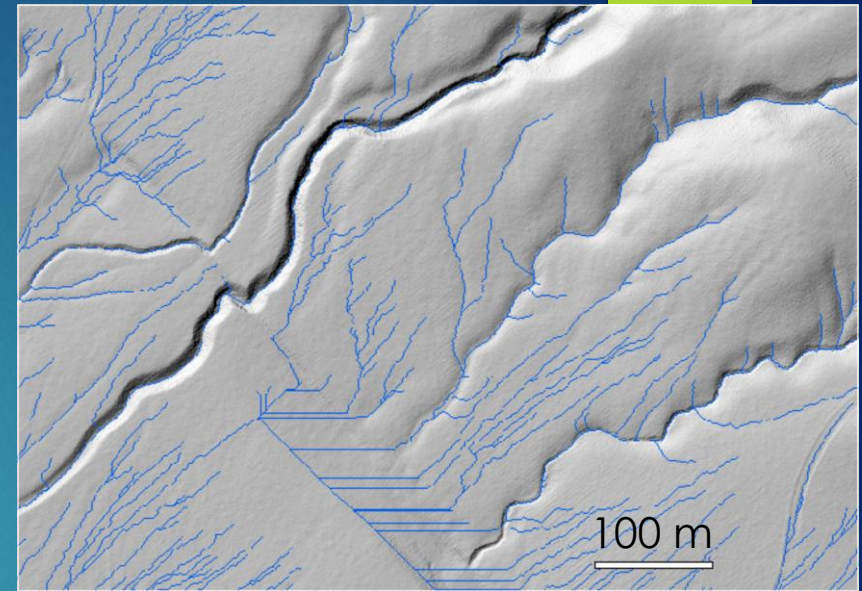
Channel extraction
from LiDAR DEM

Channels over
Google image

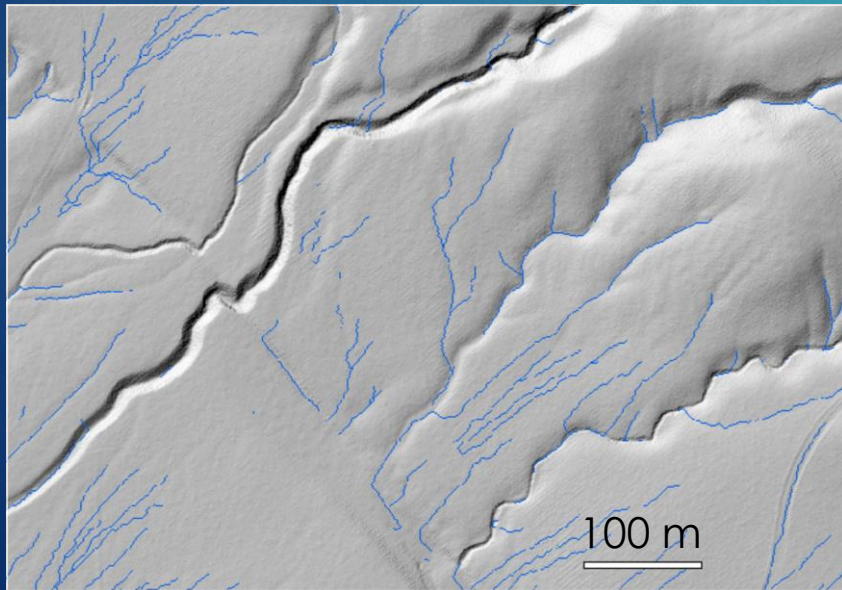




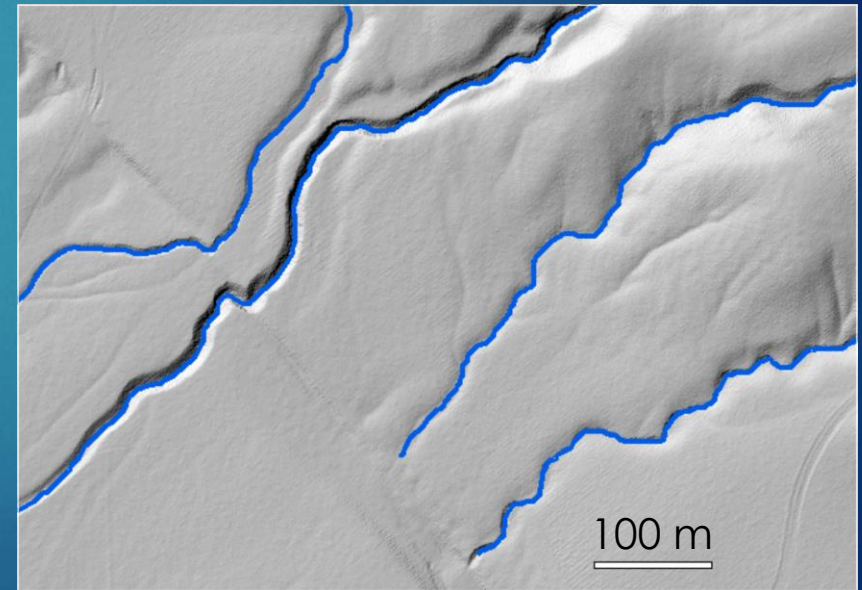
Flow accumulation > 100 (ArcGIS)



Flow accumulation > 500 (ArcGIS)



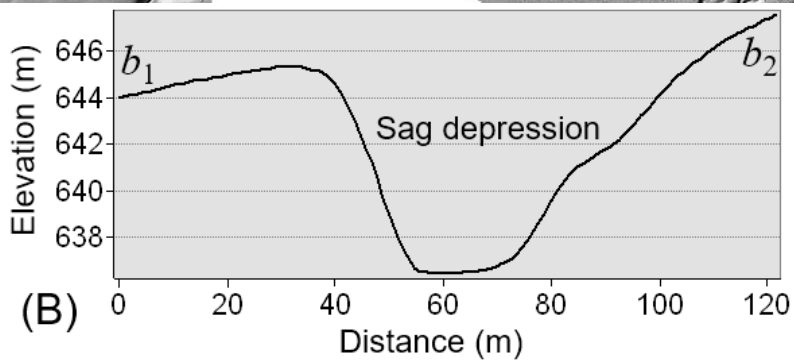
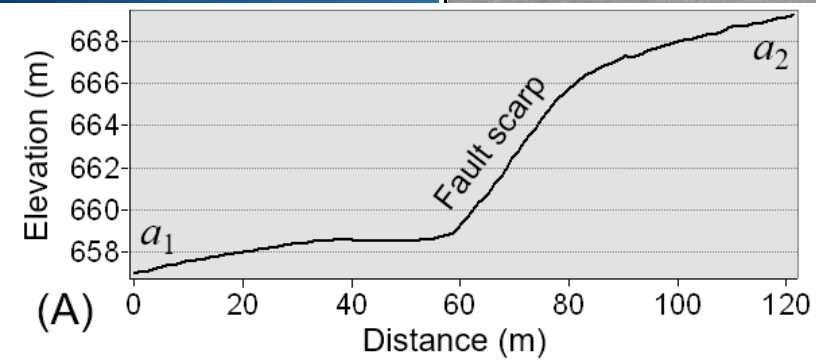
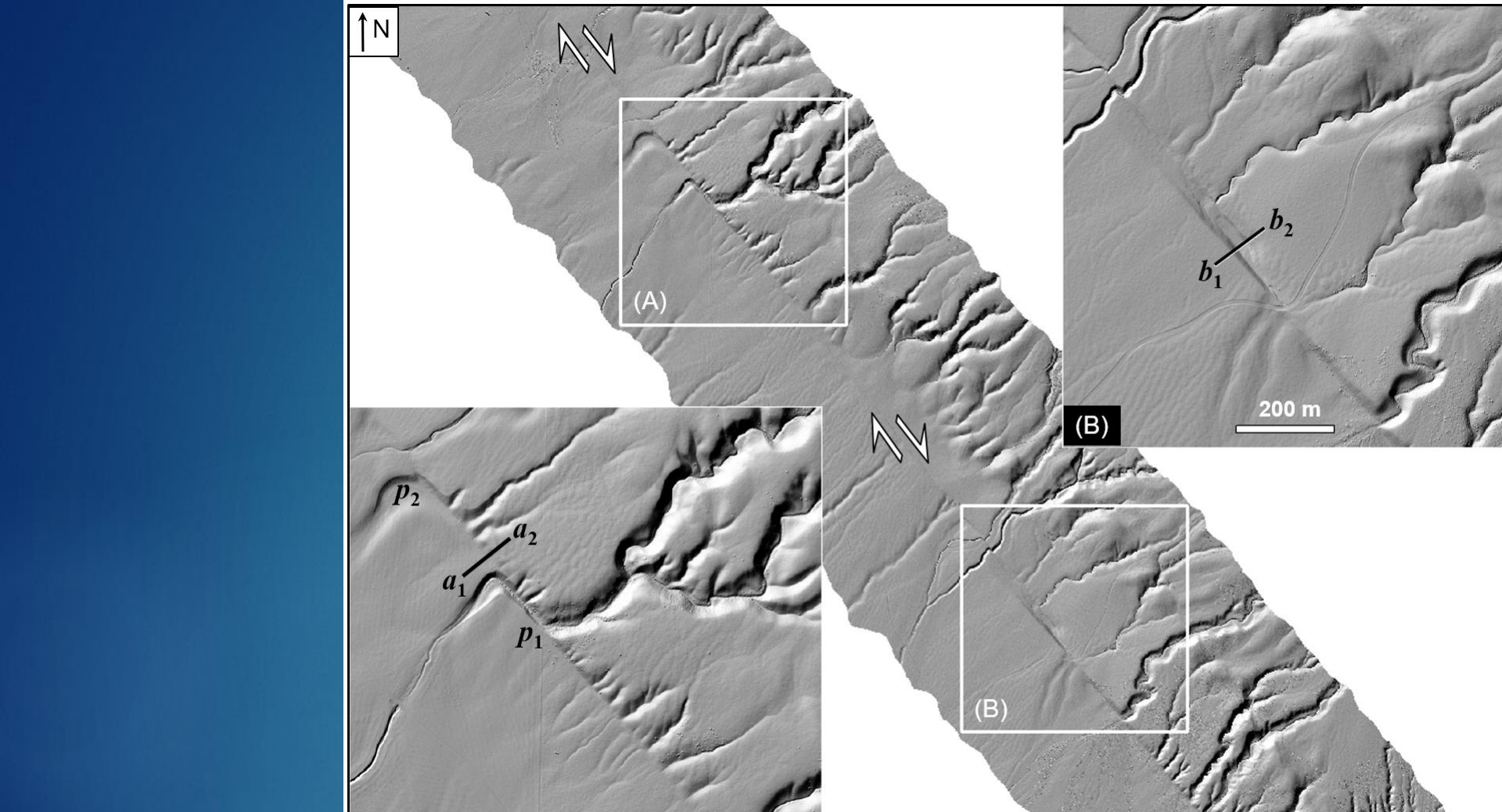
Flow accumulation > 1000 (ArcGIS)



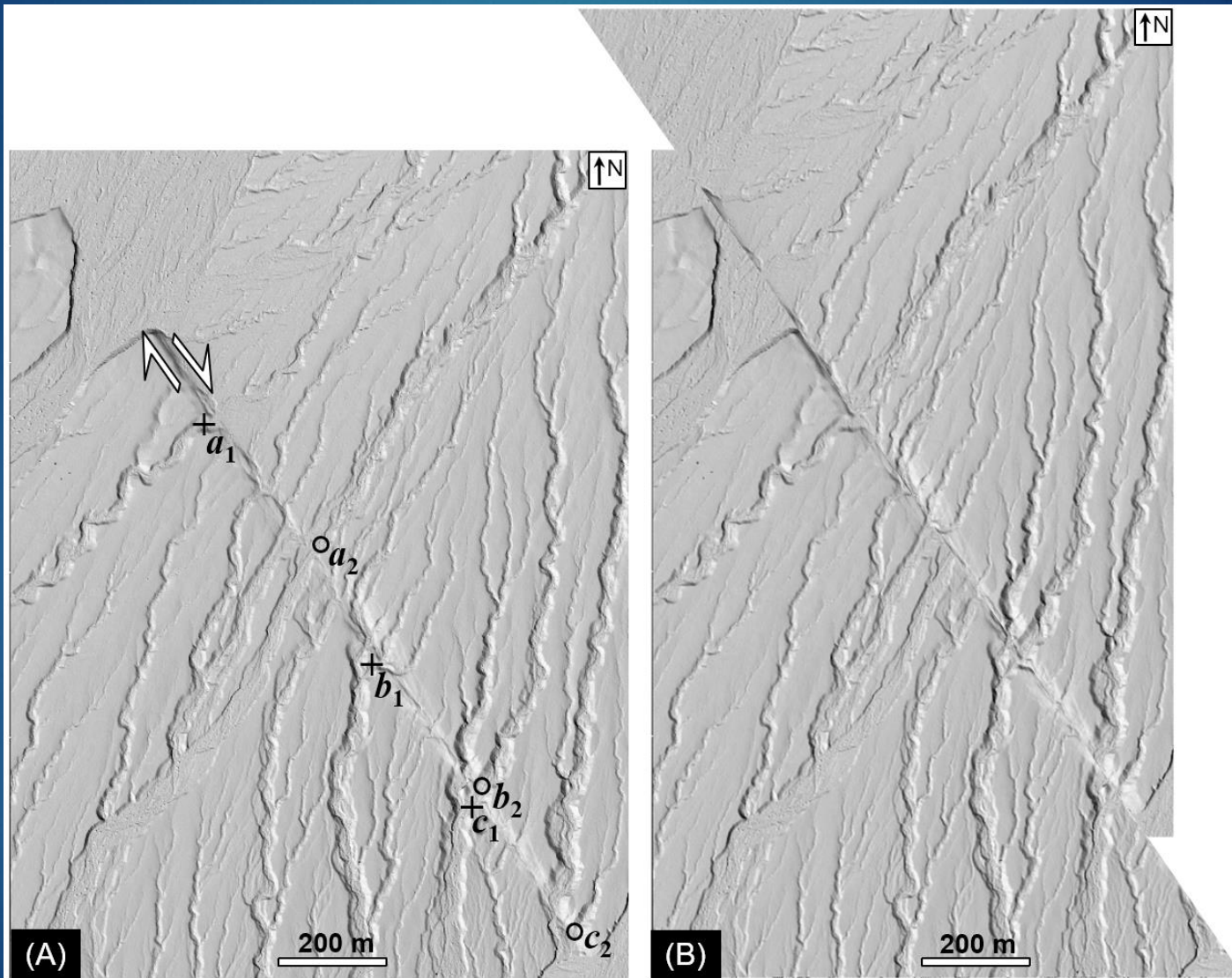
New method

Field photo of Wallace Creek, California (San Andreas Fault)

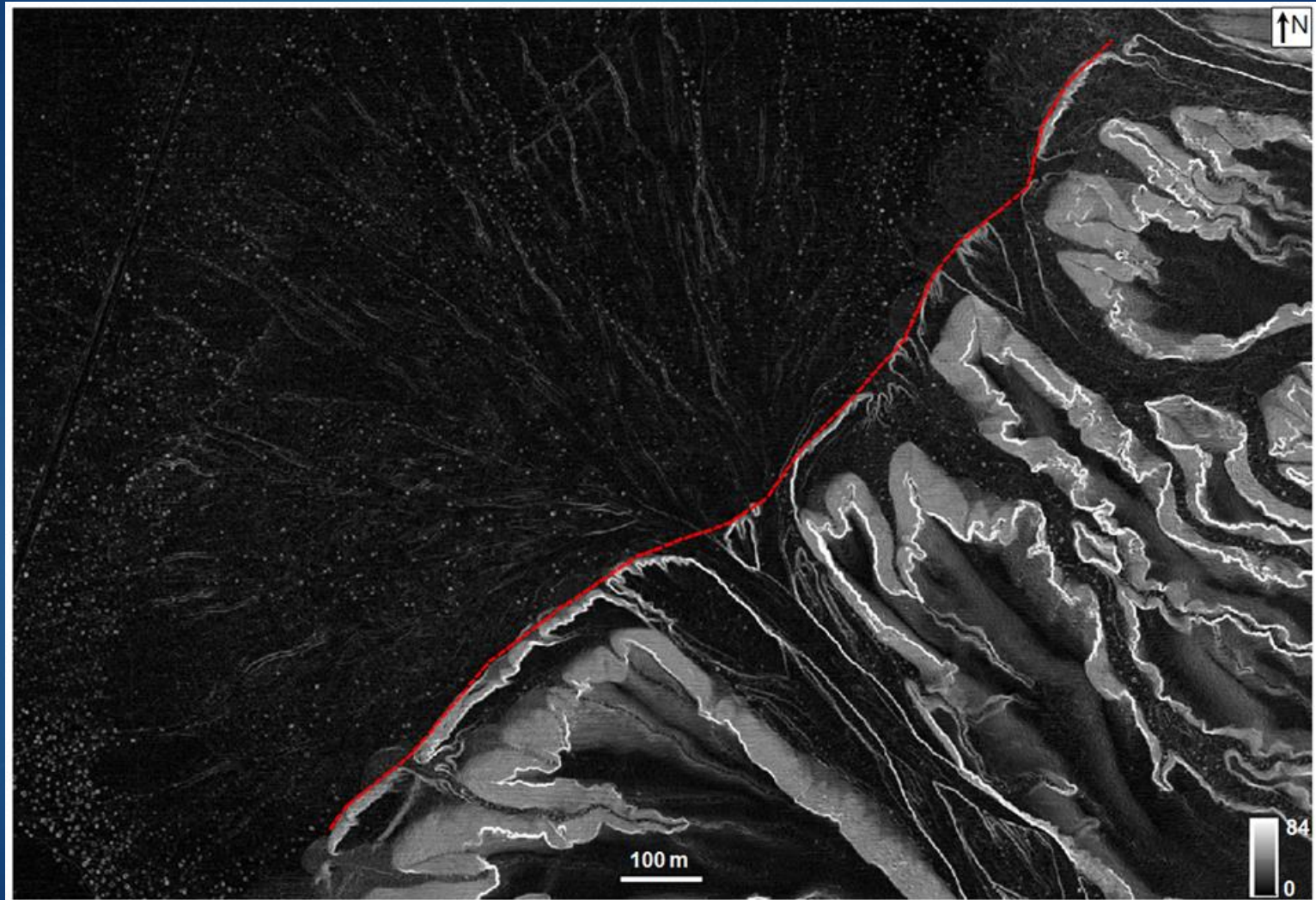




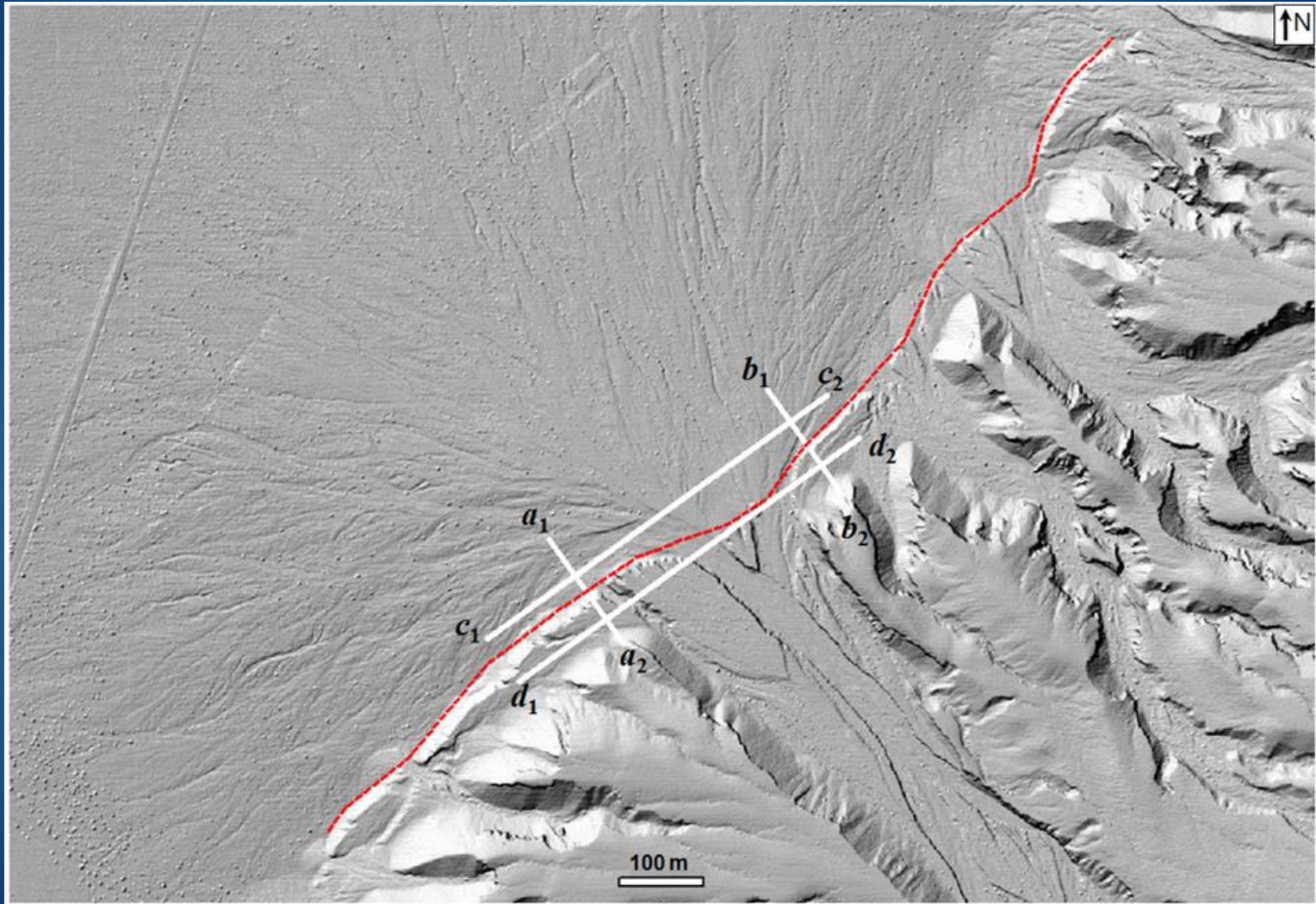
Offset channels along Furnace Creek Fault in Death Valley, California



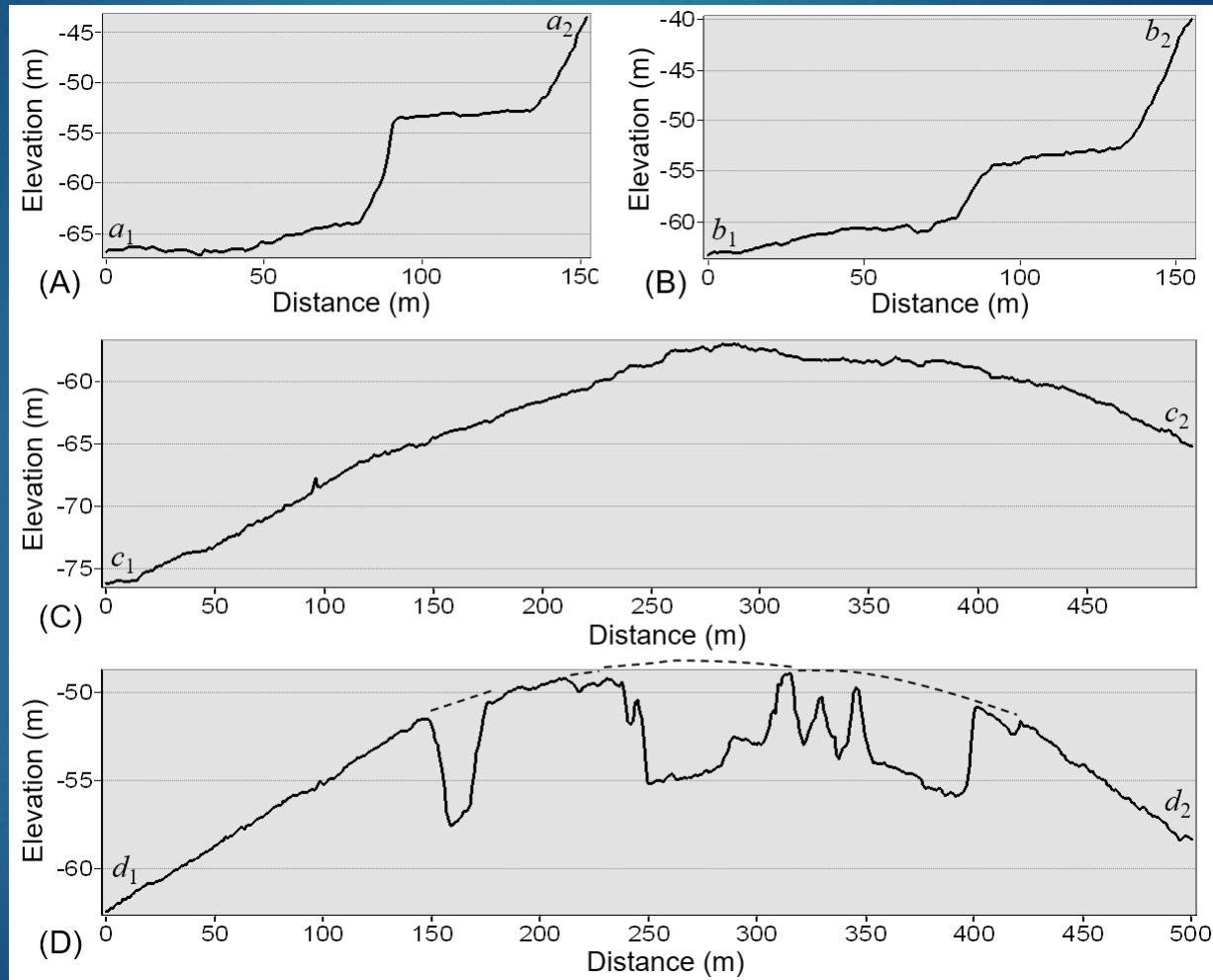
Slope raster created from 1-m resolution LiDAR-derived DEM of Willow Valley in Death Valley, California



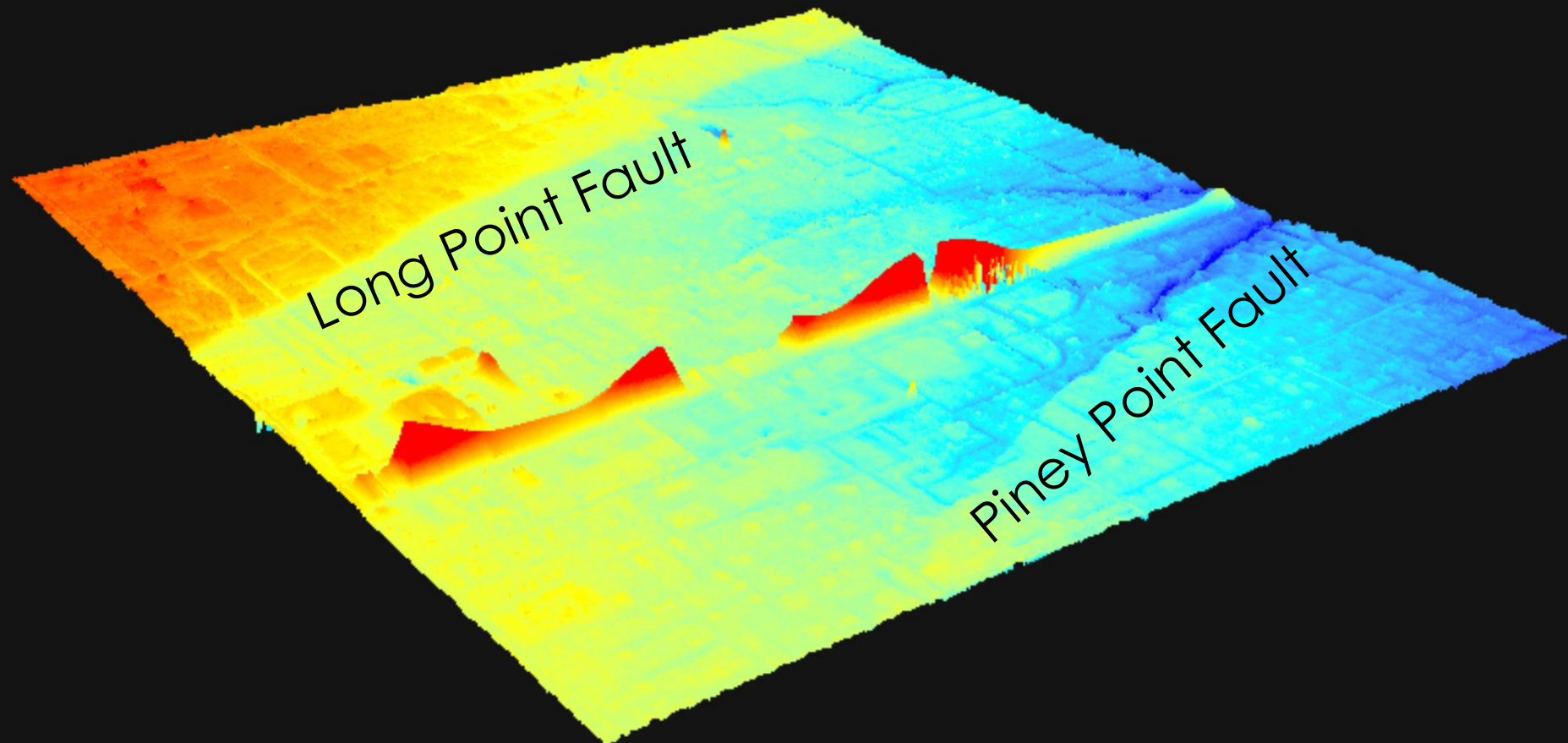
Hillshaded DEM created from LiDAR-derived DEM (1-m resolution) of Willow Valley in Death Valley, California



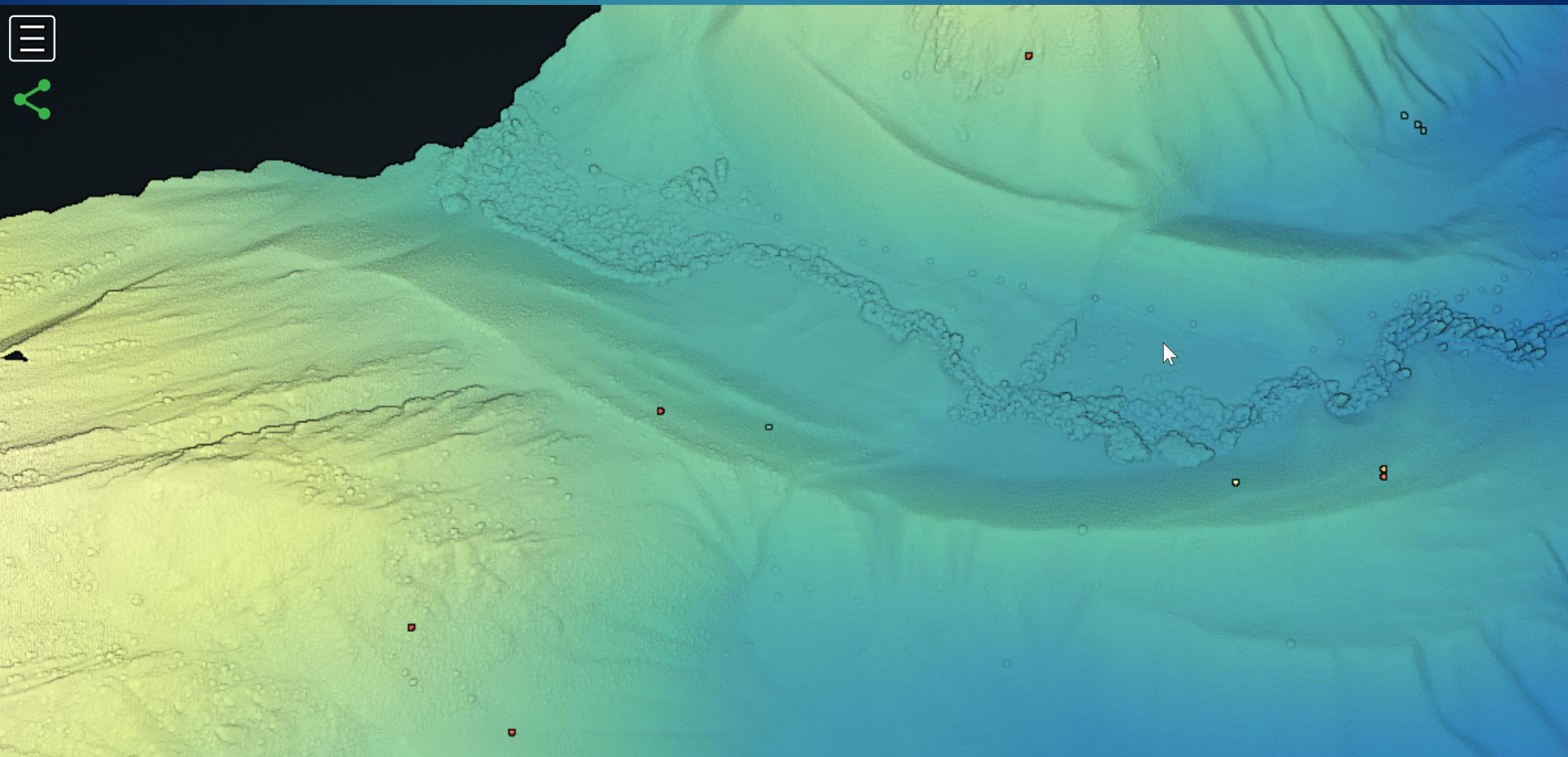
Topographic profiles extracted from 1-m resolution LiDAR-derived DEM



Two Faults in Houston



Hilton Creek Fault, California





Coseismic displacement

Calculation of coseismic displacement from lidar data in the 2016 Kumamoto, Japan, earthquake

Luis Moya¹, Fumio Yamazaki¹, Wen Liu¹, and Tatsuro Chiba²

¹Department of Urban Environment Systems, Chiba University, Chiba 263-8522, Japan

²Research and Development Institute, Asian Air Survey Co., Ltd., Kawasaki 215-0044, Japan

1 Introduction

On 14 April 2016, an M_w 6.2 earthquake struck Kumamoto Prefecture, Japan, at 21:26 JST. The epicenter was located at the end of the Hinagu fault at a shallow depth. After approximately 28 h (at 01:25 on 16 April 2016), another earthquake of M_w 7.0 struck the Futagawa fault, which is near the Hinagu fault. The first event was designated as the foreshock and the second one as the mainshock. Both the events occurred in the town of Mashiki (with a population of approximately 33 000), which is located to the east of Kumamoto City (with a population of approximately 735 000). Many



Figure 3. Examples of surface ruptures caused by the 2016 Kumamoto earthquake. Paddy field (P1), river channel (P2), road crossing in Kamijin and Shimojin districts of the town of Mashiki observed on 17 April 2016 (P3), and crop field in Dozono district of the town of Mashiki observed on 7 June 2016 (P4). The locations of the photographs are shown in Fig. 1.

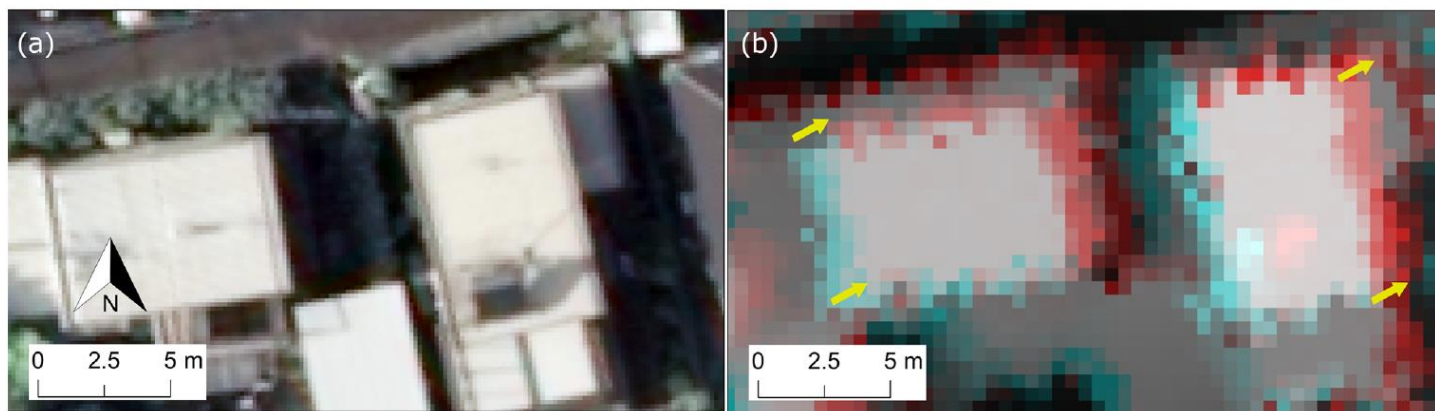


Figure 4. Example of coseismic displacement extracted from lidar data: (a) aerial image of buildings near the Mashiki KiK-net station acquired on 15 April 2016; (b) color composite of the post-event (red) and pre-event (cyan) DSMs for the same area where the yellow arrows depict the direction and amplitude of the coseismic displacement.

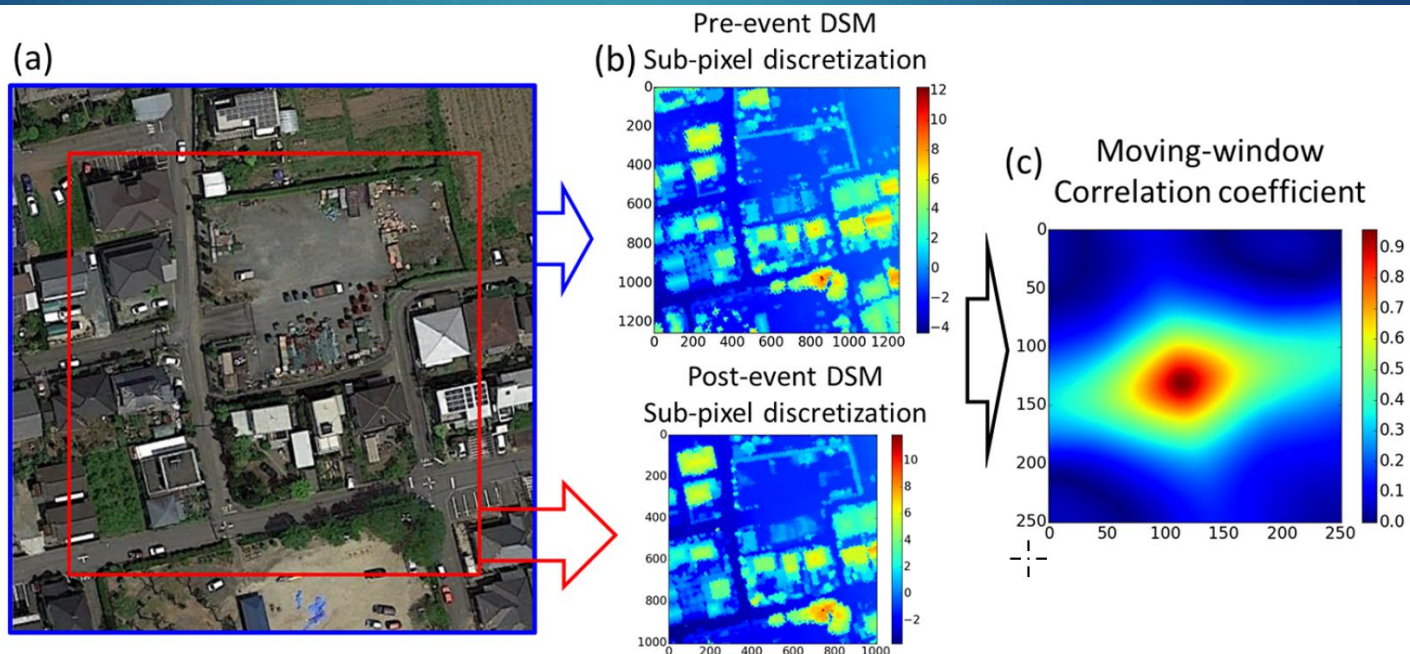


Figure 5. Schematic image of the maximum correlation search algorithm. Selection of the pre-event DSM (blue) and post-event DSM (red) windows (a), subpixel discretization of the DSMs (b), and calculation of correlation coefficient by moving the window of the post-event DSM over the pre-event one (c).

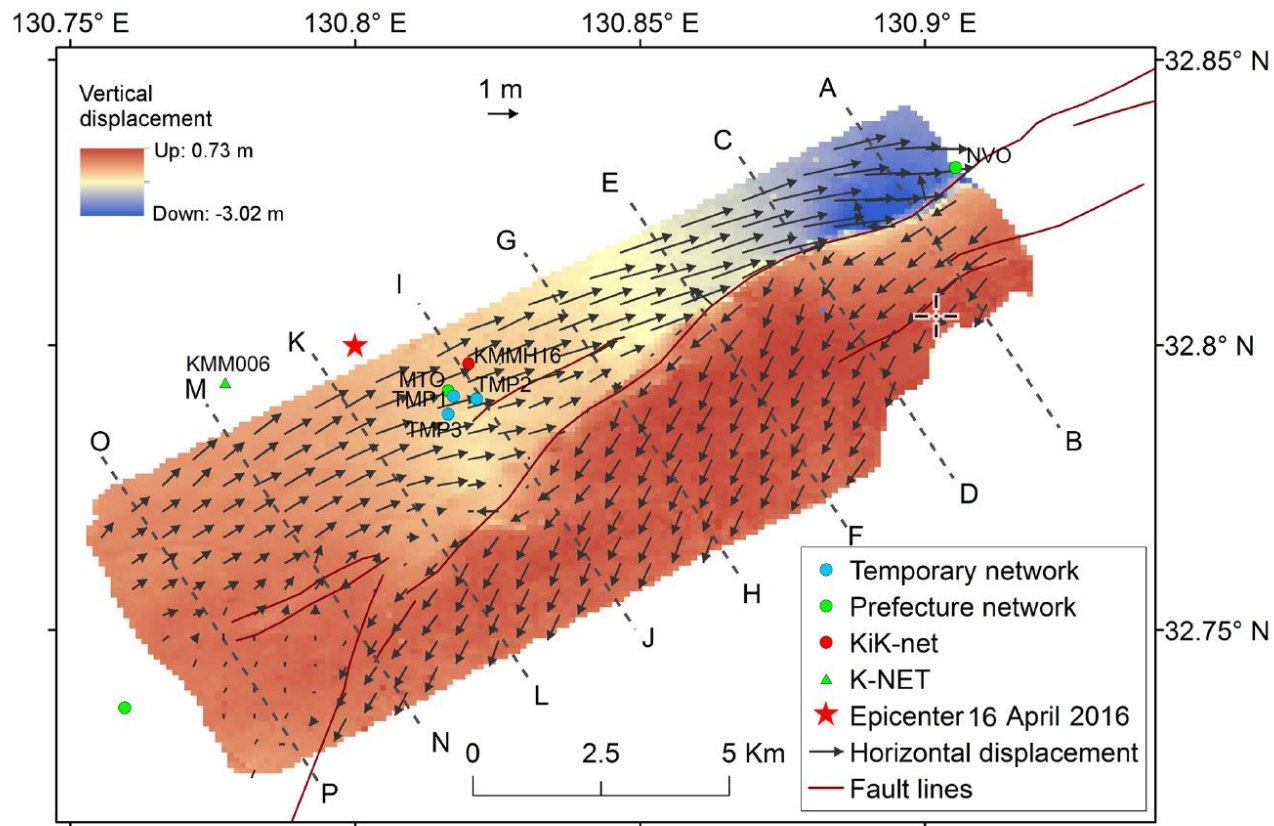
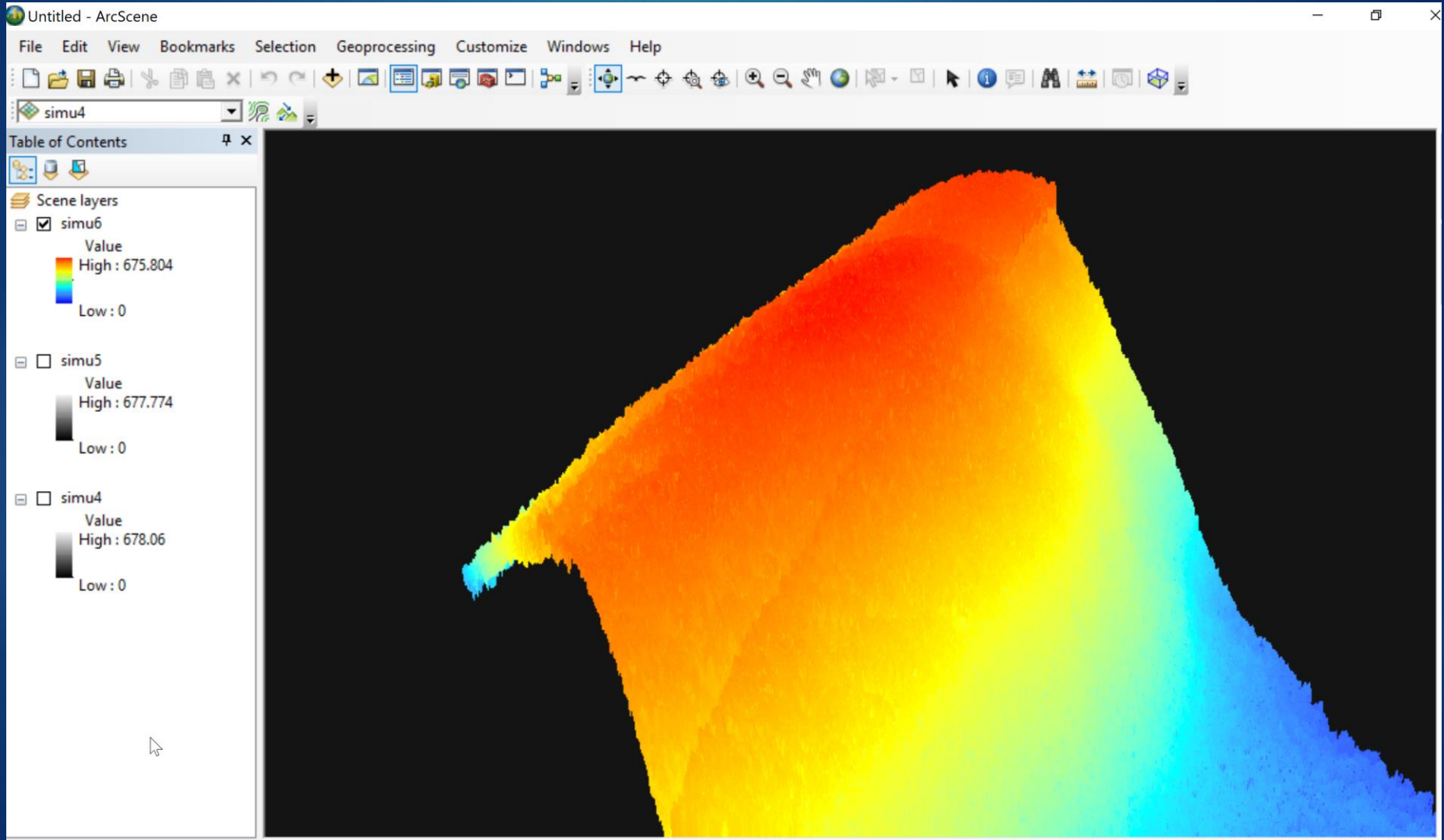
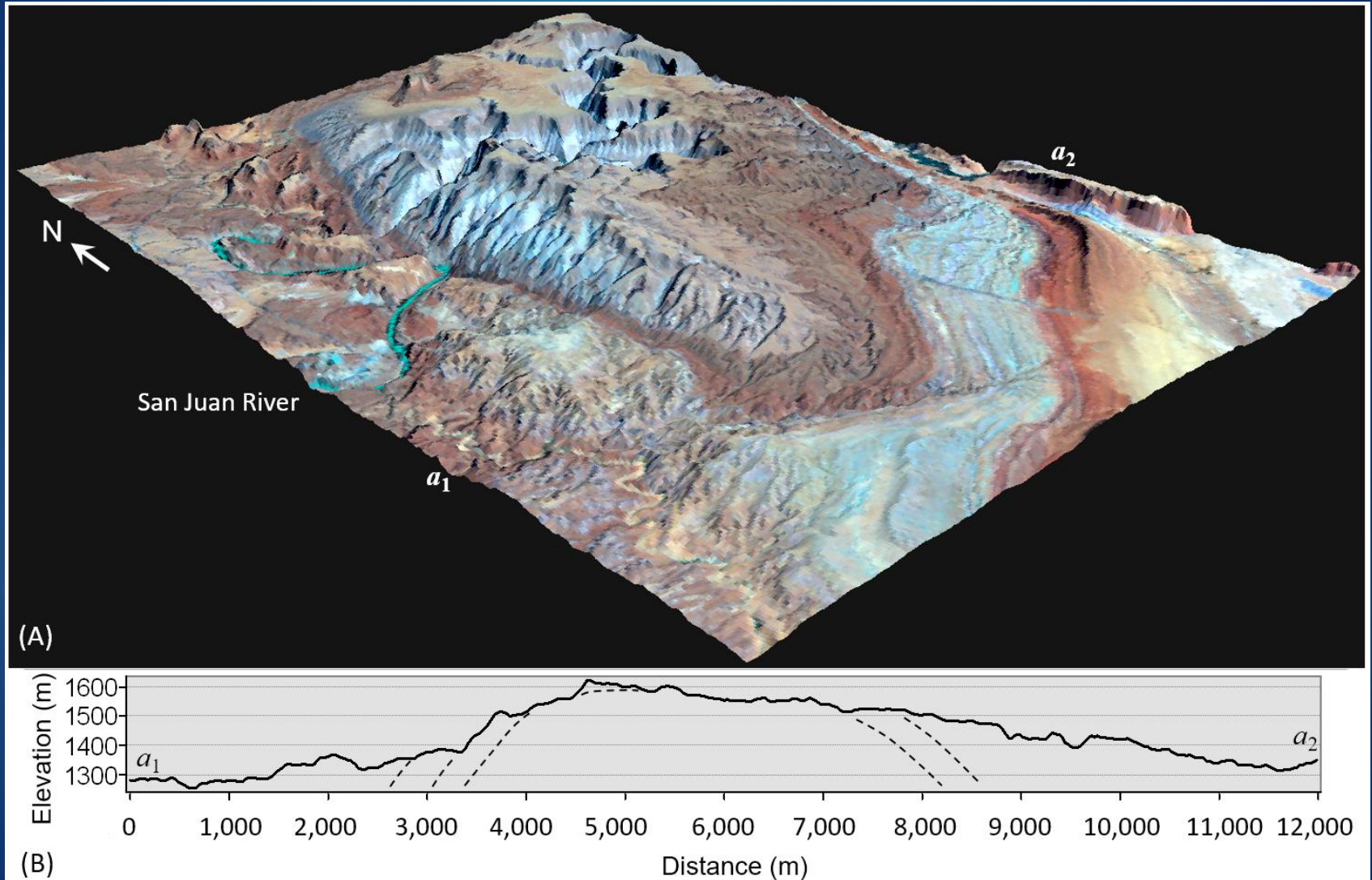
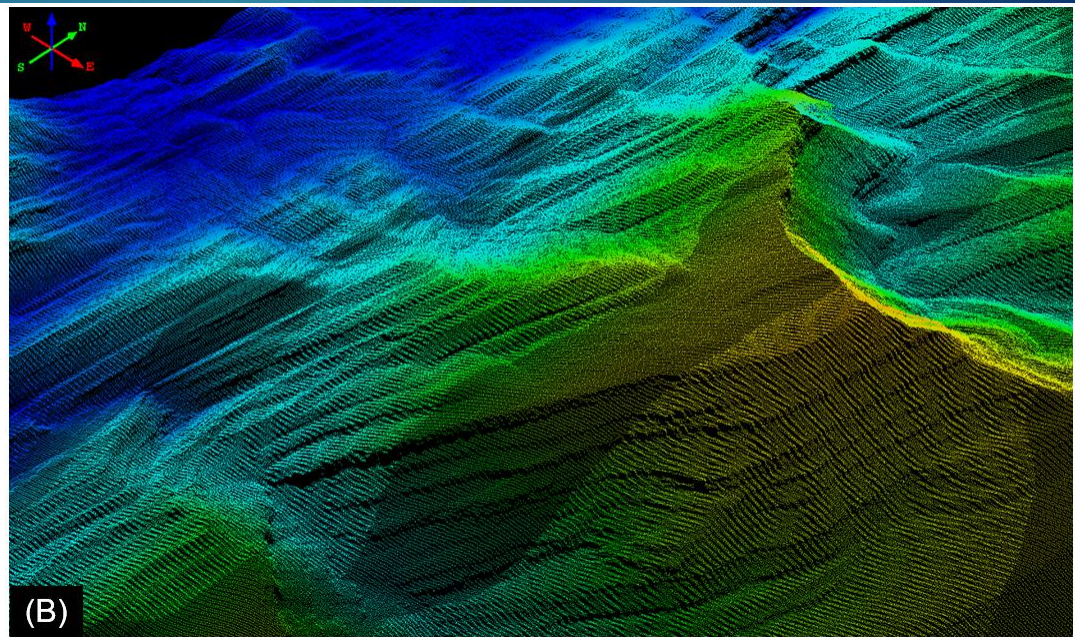
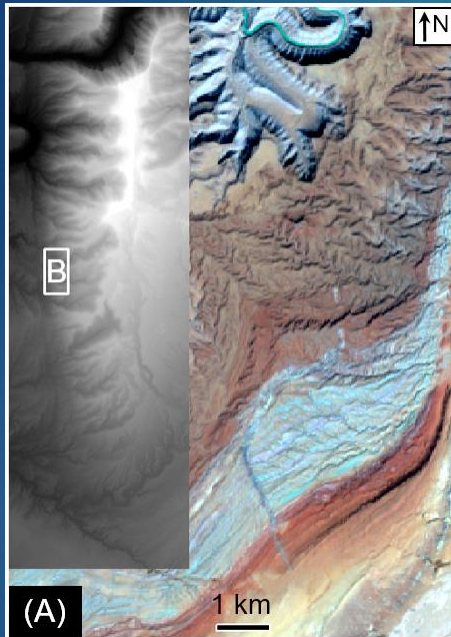


Figure 9. Estimated three-dimensional coseismic displacement produced by the mainshock of the 2016 Kumamoto earthquake. The arrows indicate the amplitude and direction of the horizontal displacement at 500 m grid points.

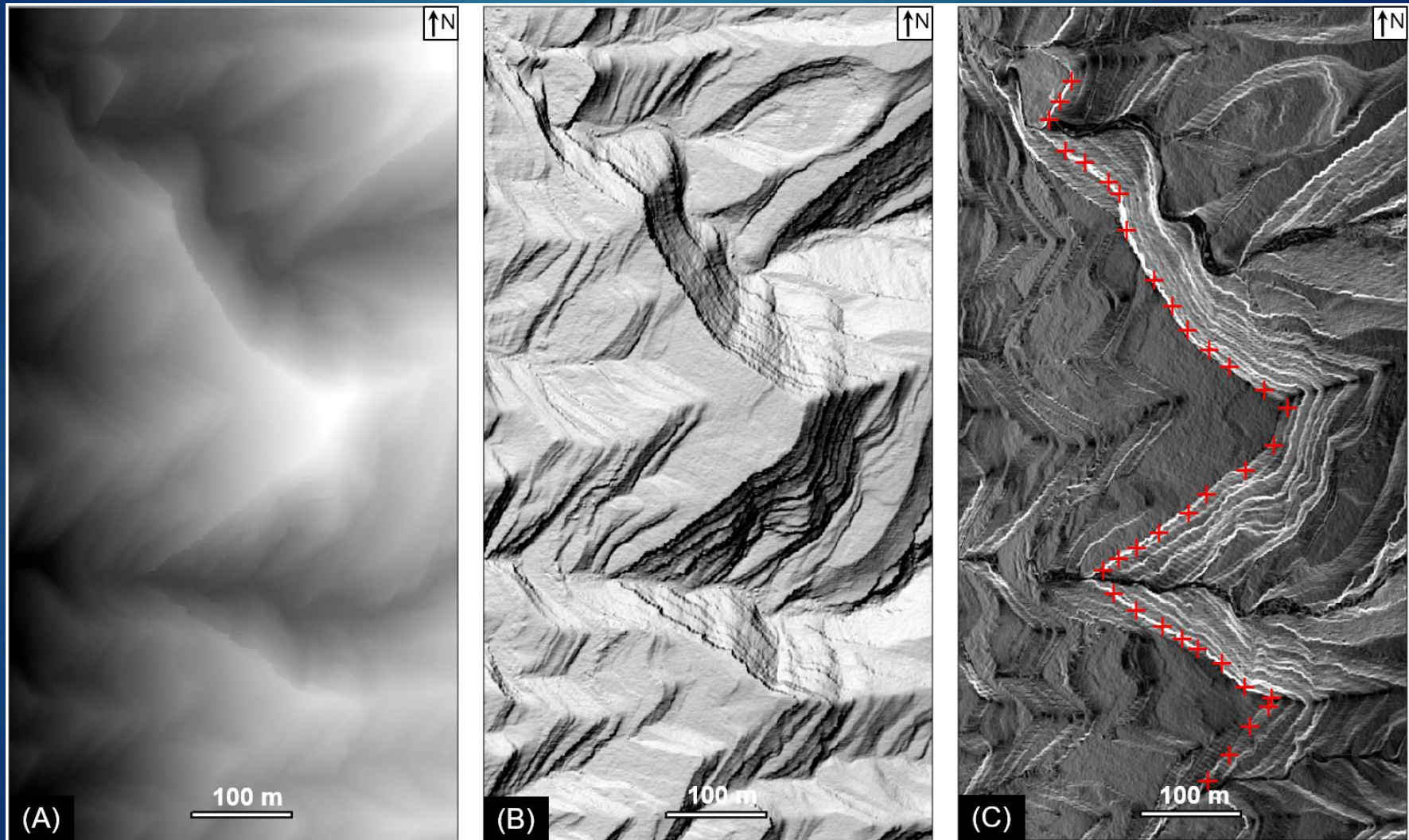


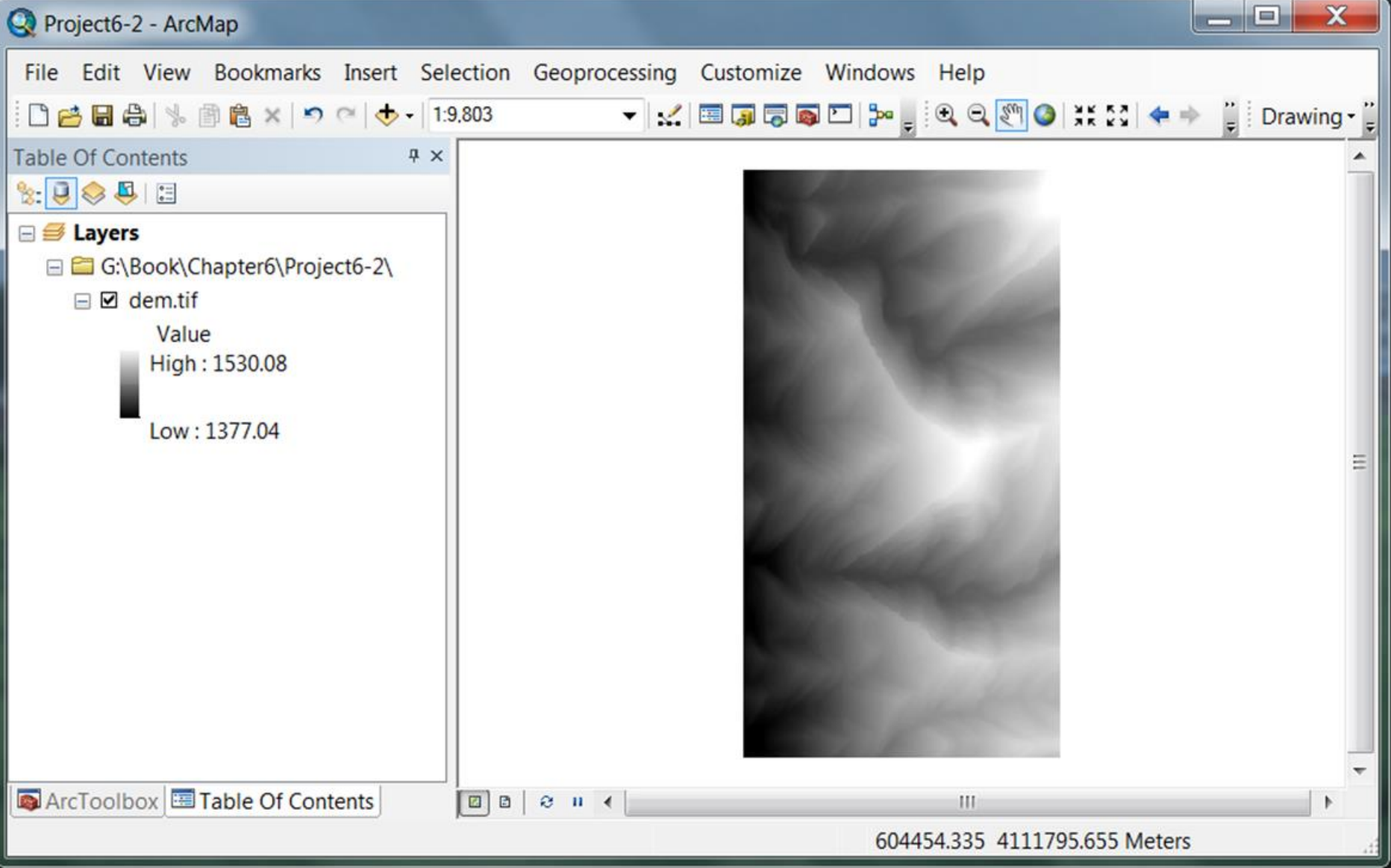
Raplee Ridge monocline in southwest Utah





Project 6.2







Hillshade

Input raster

dem.tif



Output raster

G:\Book\Chapter6\Project6-2\hillshade



Azimuth (optional)

315

Altitude (optional)

45

☐ Model shadows (optional)

Z factor (optional)

1

Hillshade

Creates a shaded relief from a surface raster by considering the illumination source angle and shadows.

OK

Cancel

Environments...

<< Hide Help

Tool Help



Project6-2 - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:9,803

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Layers

G:\Book\Chapter6\Project6-2\

☒ hillshade

Value

High : 255

Low : 1

☒ dem.tif

Value

High : 1530.08

Low : 1377.04



ArcToolbox

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603956.335 4111606.83 Meters



Project6-2 - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:9,803

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Layers

G:\Book\Chapter6\Project6-2\

☒ slope

Value

High : 80.9254

Low : 0.0578866

☒ hillshade

Value

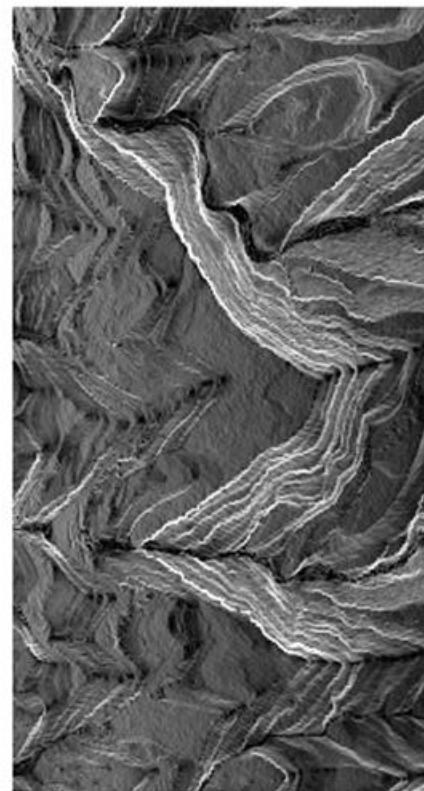
High : 255

Low : 1

☒ dem.tif

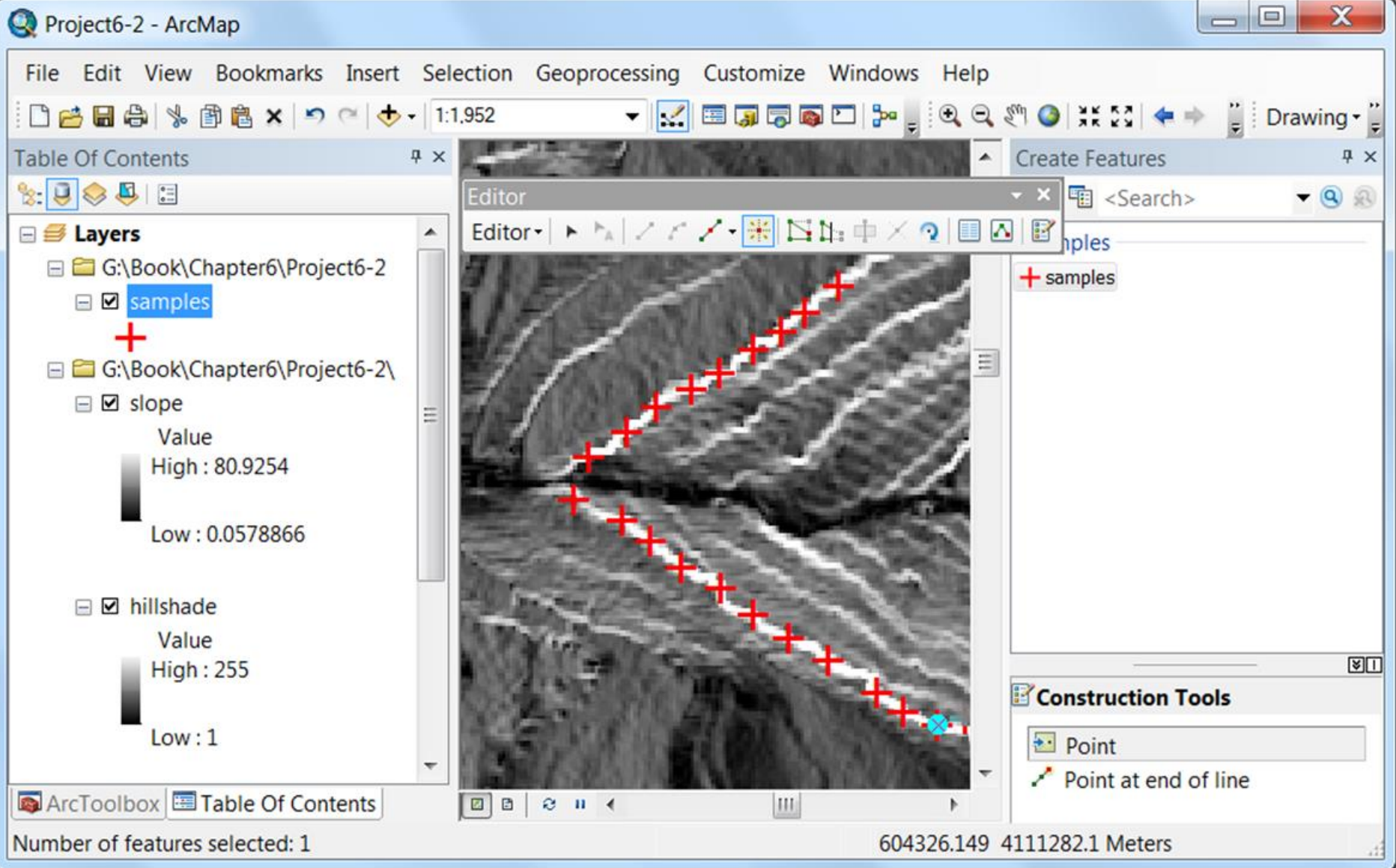
Value

High : 1530.08



ArcToolbox Table Of Contents

604728.235 4111608.905 Meters





Extract Values to Points

Input point features

samples



Input raster

dem.tif



Output point features

G:\Book\Chapter6\Project6-2\pnt-elevation.shp



☐ Interpolate values at the point locations (optional)

☐ Append all the input raster attributes to the output point features (optional)

Extract Values to Points

Extracts the cell values of a raster based on a set of point features and records the values in the attribute table of an output feature class.

OK

Cancel

Environments...

<< Hide Help

Tool Help



Trend

Input point features

pnt-elevation

Z value field

RASTERVALU

Output raster

G:\Book\Chapter6\Project6-2\trend2

Output cell size (optional)

1.0

Polynomial order (optional)

2

Type of regression (optional)

LINEAR

Output RMS file (optional)

G:\Book\Chapter6\Project6-2\rms2.txt

Trend

Interpolates a raster surface from points using a trend technique.

OK

Cancel

Environments...

<< Hide Help

Tool Help

Layer Properties

General Source Extent Display Symbology Base Heights Rendering

Elevation from surfaces

☐ No elevation values from a surface

☒ Floating on a custom surface:

G:\Book\Chapter6\Project6-2\dem.tif



Raster Resolution...

Elevation from features

☒ No feature-based heights

☐ Use elevation values in the layer's features

Factor to convert layer elevation values to scene units:

custom

1.0000

☐ Use a constant value or expression:

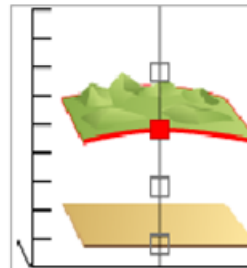
0

Layer offset

Add a constant elevation offset in scene units:

0

[About setting base heights](#)



OK

Cancel

Apply

Layer Properties

Time		Extrusion			Rendering		HTML Popup	
General	Source	Selection	Display	Symbology	Fields	Definition Query	Joins & Relates	Base Heights

Elevation from surfaces

☒ No elevation values from a surface

☐ Floating on a custom surface:

G:\Book\Chapter6\Project6-2\dem.tif



Raster Resolution...

Elevation from features

☐ No feature-based heights

☐ Use elevation values in the layer's features

Factor to convert layer elevation values to scene units:

custom

1.0000

☒ Use a constant value or expression:

[RASTERVALU]

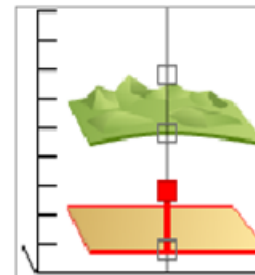


Layer offset

Add a constant elevation offset in scene units:

0

[About setting base heights](#)



OK

Cancel

Apply

