Morphometry

- Slope, curvature, relief
- Drainage network properties
- Wavelets (e.g., Hilley, et al., 2010)
- Spectral analysis (e.g., Delong, et al., 2010; cf. T. Perron pubs)
Watershed Delineation Using TauDEM

A tutorial for using TauDEM to delineate a single watershed

http://hydrology.usu.edu/taudem/taudem5/
Representation of Flow Field

Steepest single direction

\[ \begin{array}{cc}
48 & 52 \\
56 & 67 \\
\end{array} \]

\[ \frac{67 - 52}{30} = 0.50 \]

Proportion flowing to neighboring grid cell 4 is \( \frac{\alpha_1}{\alpha_1 + \alpha_2} \)

Proportion flowing to neighboring grid cell 3 is \( \frac{\alpha_2}{\alpha_1 + \alpha_2} \)

Steepest direction downslope

Table 2. Differences Between Theoretical and DEM-Computed Upslope Area for Test Examples Expressed in Terms of the Mean Error and Mean Square Error

<table>
<thead>
<tr>
<th></th>
<th>Outward Cone</th>
<th></th>
<th>Inward Cone</th>
<th></th>
<th>Plane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (A - \hat{A})</td>
<td>Mean (A - \hat{A})^2</td>
<td>Mean (A - \hat{A})</td>
<td>Mean (A - \hat{A})^2</td>
</tr>
<tr>
<td>D8</td>
<td>-0.13</td>
<td>2.13</td>
<td></td>
<td>1.76</td>
<td>118.88</td>
</tr>
<tr>
<td>MS</td>
<td>-0.81</td>
<td>0.69</td>
<td></td>
<td>-1.07</td>
<td>5.70</td>
</tr>
<tr>
<td>Lea's [1992] method</td>
<td>-1.29</td>
<td>2.41</td>
<td></td>
<td>-4.05</td>
<td>44.00</td>
</tr>
<tr>
<td>DEMON</td>
<td>-0.37</td>
<td>0.17</td>
<td></td>
<td>-0.37</td>
<td>19.23</td>
</tr>
<tr>
<td>D∞</td>
<td>-0.13</td>
<td>0.20</td>
<td></td>
<td>1.87</td>
<td>30.58</td>
</tr>
</tbody>
</table>

WATER RESOURCES RESEARCH, VOL. 33, NO. 2, PAGES 309–319, FEBRUARY 1997
### 2. Point Cloud Data Download

- **Point cloud data in LAS format**
- **Point cloud data in LAZ format**
- **Point cloud data in ASCII format**

### 3A. DEM Generation (Streaming TIN)

#### Gridding Method
- **Calculate TIN**

#### Gridding Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grid Resolution</strong> (Default = 1 meter)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Max. triangle size</strong> (Default 50 units)</td>
<td>50</td>
</tr>
</tbody>
</table>

#### Grid Format
- GeoTiff

### 4. Derivative products

- **Generate hillshade and slope grids in grid format**
  - GeoTiff

### 5. Visualization

- **Generate hillshade images and Google Earth files from DEMs**
- **Generate additional color-relief and colored hillshades**
- **Generate additional KMZ files**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Altitude of the light</strong> (in degrees)</td>
<td>45</td>
</tr>
<tr>
<td><strong>Azimuth of the light</strong> (in degrees)</td>
<td>315</td>
</tr>
</tbody>
</table>
### 6. Hydrologic Terrain Analysis Products (tauDEM)

- ✔️ Hydrologically correct DEM with pits filled
- ✔️ D-Infinity Flow Direction
- ✔️ D8 Flow Direction:
  - ✔️ D-Infinity Specific Catchment Area
  - ✔️ D8 Contributing Area
- ✔️ Topographic Wetness Index

---

### Job Description

These options allow users to describe and keep track of their jobs. Information entered below is recorded along with other job parameters in your personal lidar Job archive accessed via [myOpenTopo](https://myopentopo.com) (available only to registered OpenTopography users).

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job title</strong></td>
<td>(up to 100 characters)</td>
</tr>
<tr>
<td></td>
<td>B4 demo</td>
</tr>
<tr>
<td><strong>Job description</strong></td>
<td>(up to 500 characters)</td>
</tr>
<tr>
<td></td>
<td>For <a href="https://www.unavco.org">UNAVCO</a> workshop</td>
</tr>
<tr>
<td><strong>Enter your e-mail address</strong></td>
<td>for notification upon completion of processing</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:ramon.arrowsmith@asu.edu">ramon.arrowsmith@asu.edu</a></td>
</tr>
</tbody>
</table>
## Download Job Results

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Point Cloud Results</strong></td>
<td>• Download point cloud data in LAS format <a href="#">points.las</a> (454.6 MB)</td>
</tr>
<tr>
<td><strong>DEM Results</strong></td>
<td>• Download DEM (TIN) <a href="#">dems.tar.gz</a> (11.6 MB)</td>
</tr>
<tr>
<td><strong>Derivative Products</strong></td>
<td>• Download Hillshade &amp; Slope Products (TIN) <a href="#">viz.tar.gz</a> (21.8 MB)</td>
</tr>
<tr>
<td><strong>TauDEM Products</strong></td>
<td>• Download PitRemove file <a href="#">pitRemove.tar.gz</a> (11 MB)</td>
</tr>
<tr>
<td></td>
<td>• Download D-Infinity: Flow Direction file <a href="#">dinfFlowDirection.tar.gz</a> (11.9 MB)</td>
</tr>
<tr>
<td></td>
<td>• Download D-Infinity: Slope file <a href="#">dinfSlope.tar.gz</a> (12.6 MB)</td>
</tr>
<tr>
<td></td>
<td>• Download D-Infinity - Area Contribution file <a href="#">Dinfarea.tar.gz</a> (16 MB)</td>
</tr>
<tr>
<td></td>
<td>• Download Topographic Wetness Index file <a href="#">TWI.tar.gz</a> (16.6 MB)</td>
</tr>
<tr>
<td></td>
<td>• Download D8 - Flow Direction file <a href="#">d8FlowDirection.tar.gz</a> (1.7 MB)</td>
</tr>
<tr>
<td></td>
<td>• Download D8: Slope file <a href="#">d8Slope.tar.gz</a> (8.5 MB)</td>
</tr>
<tr>
<td></td>
<td>• Download D8 - Area Contribution file <a href="#">D8area.tar.gz</a> (5.2 MB)</td>
</tr>
</tbody>
</table>
Topographic relief

Input raster
output.tin.tif

Output raster
C:\Users\ramon\Desktop\B4demo\100mrelief.tif

Neighborhood (optional)
Circle

Neighborhood Settings
Radius: 100.000000

Units: □ Cell □ Map

Statistics type (optional)
RANGE

☑ Ignore NoData in calculations (optional)
100 m radius

10 m radius
Need to mosaic the grids
Log10 of the drainage area

Map Algebra expression:

Layers and variables:
- B4_dinf.tif
- scap0r0c0.tif
- scap1r0c0.tif

Map Algebra expression:

Log10("B4_dinf.tif")

Output raster:
C:\Users\yamon\Desktop\B4demo\B4_dinf_log10.tif
Drainage area $\geq 100\,m^2$
Scene layers background black

Elevation from surfaces
- No elevation values from a surface
- Floating on a custom surface:
  - C:\Users\ramon\Desktop\B4demo\output.tin.tif

Raster Surface Resolution
This dialog is used to specify an approximate maximum resolution for the base surface.

- Cellsize X: 1.000000
- Cellsize Y: 1.000000
- Rows: 3374
- Columns: 3374