

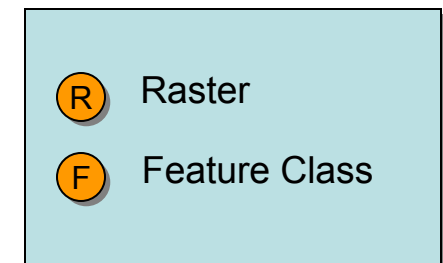
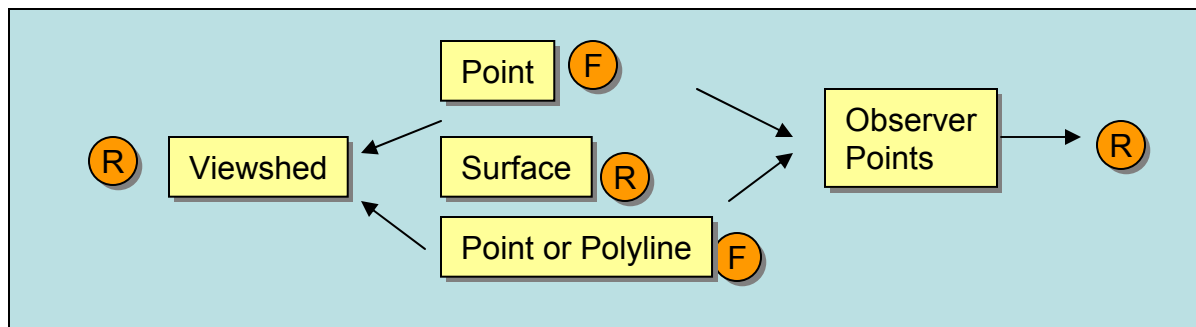
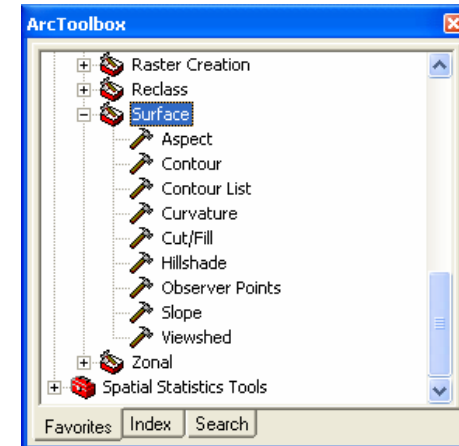
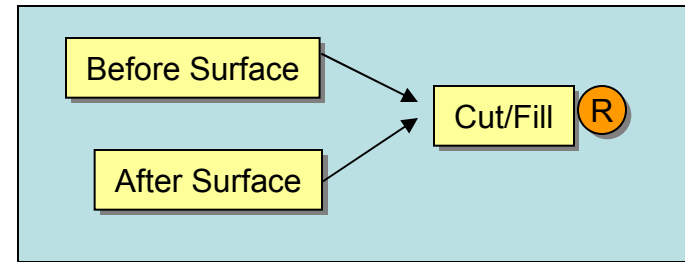
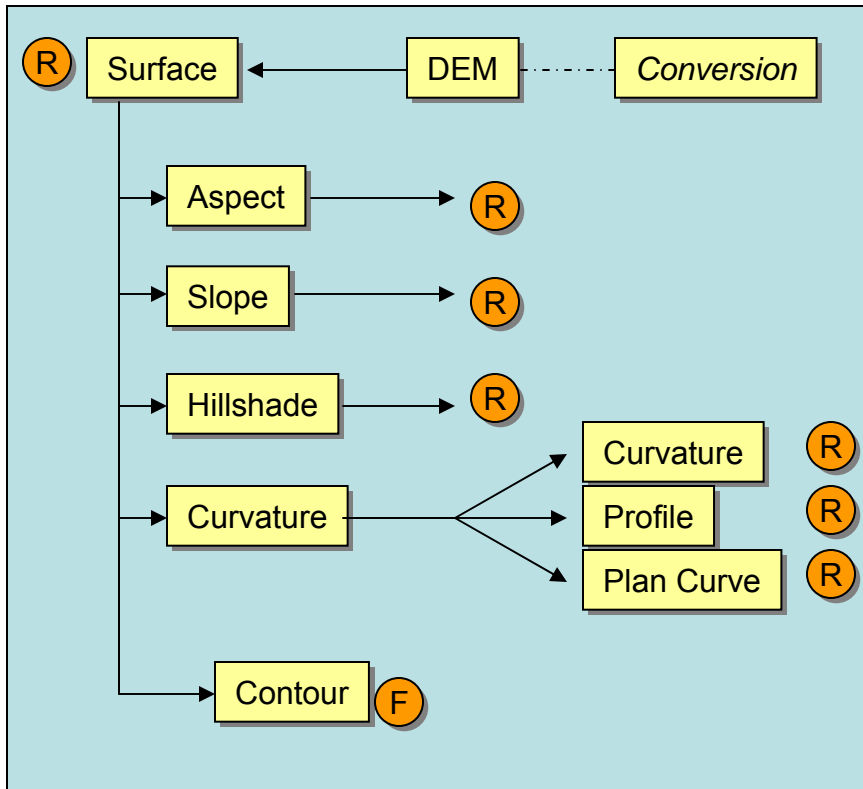


Surface Analysis Tools

Lesson 7 overview

- ❑ **Topographic data**
 - Sources
 - Uses
- ❑ **Topographic analysis**
 - Hillshade
 - Visibility
 - Contours
 - Slope, aspect, and curvature
- ❑ **Exercise 11**

Road map — Surface analysis tools



Sources of topographic data

❑ US Federal Government

- **United States Geological Survey (USGS): OEM**
 - Several resolutions

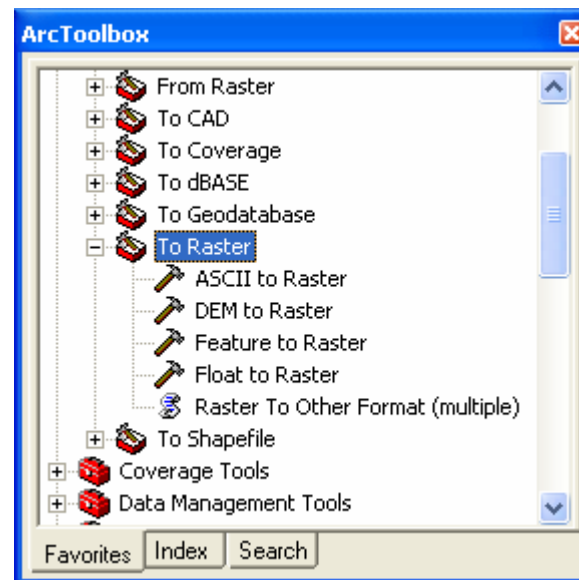
	Spacing	Z Accuracy
7.5 minute	30 meter	± 15 meters
15 minute	2 arc-second	± ½ of contour interval
30 minute	2 arc-second	± ½ of contour interval
1 degree	3 arc-second	± ½ of contour interval

- **National Elevation Dataset (NED)**
- **National Imagery and Mapping Agency (NIMA): DTED**

Surface conversion

□ Convert surface formats into rasters

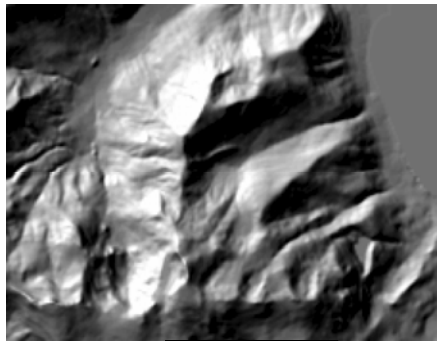
- ASCII to Raster
- DEM to Raster (Digital Elevation Model)
- DTED (Digital Terrain Elevation Data) is a direct read format for ArcGIS



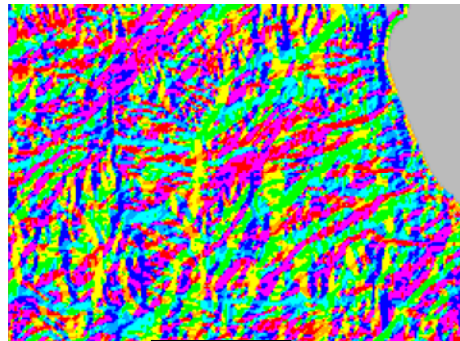
- Output name with no extension returns a grid

Using surfaces in ArcGIS Spatial Analyst

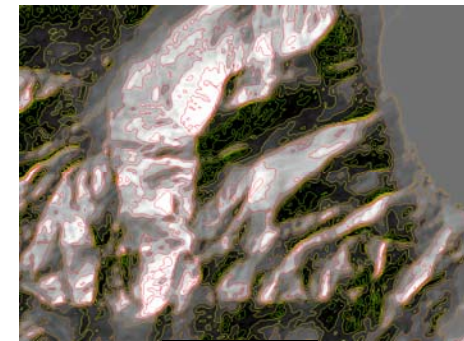
- • ArcGIS Spatial Analyst provides tools to derive



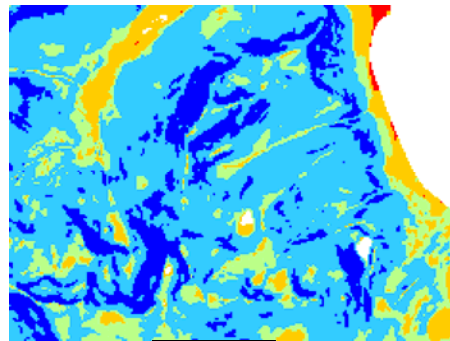
Hillshade



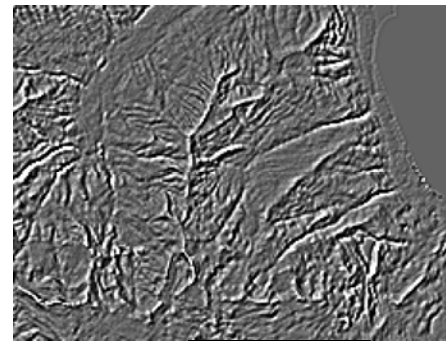
Aspect



Contour



Slope

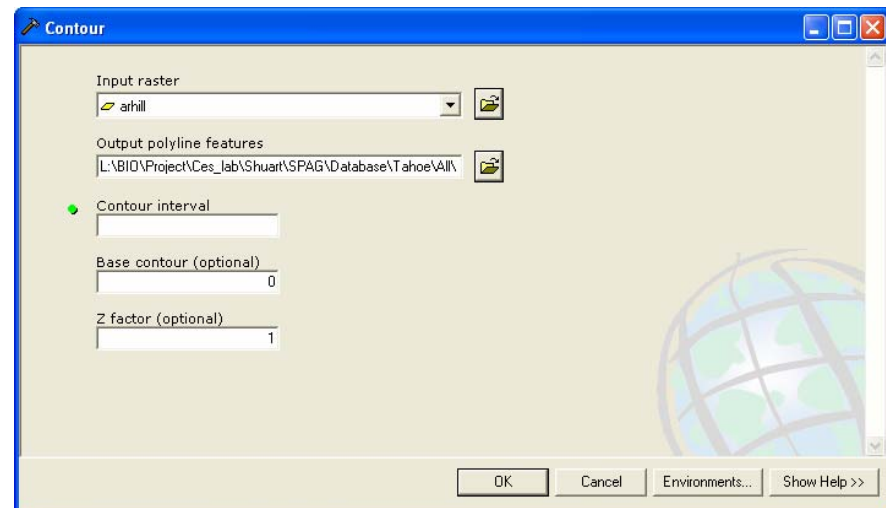
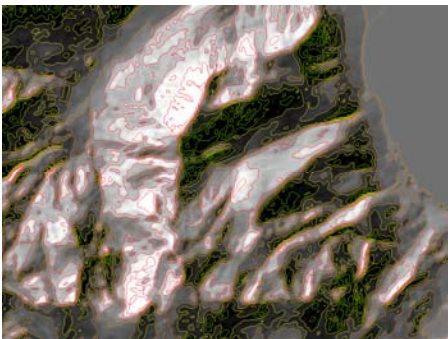


Curvature

- • Also hydrologic modeling

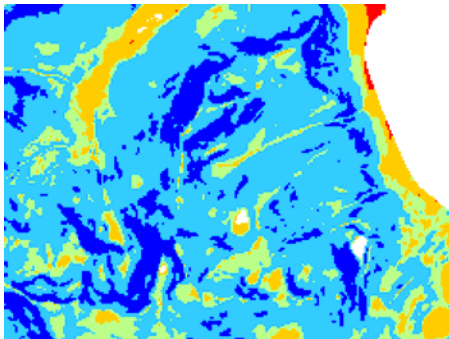
Contouring

- ❑ Isolines connect locations of equal value
- ❑ Generate contour lines from a surface
 - May specify contour interval and base contour

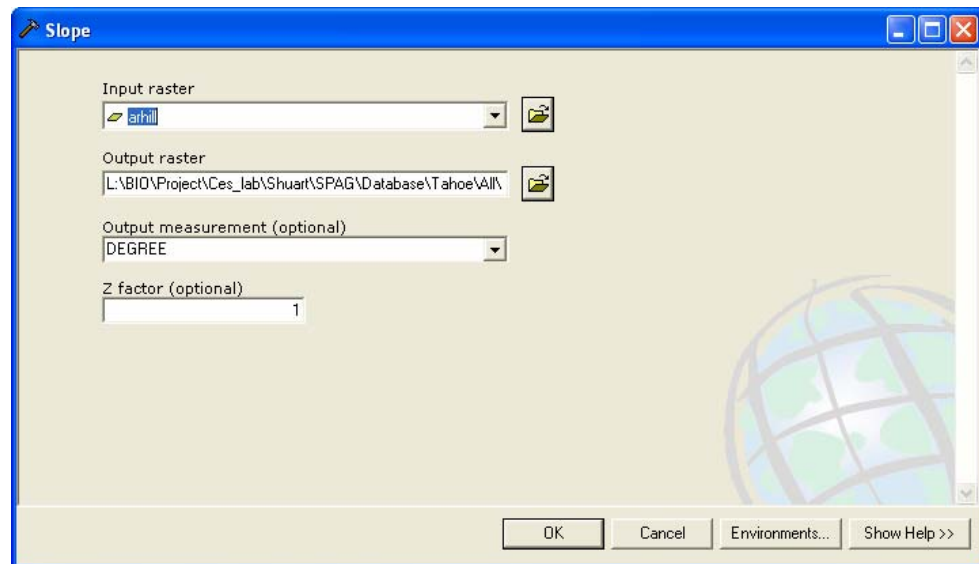


Derive slope

- ❑ Maximum rate of change of Z through the cell
- ❑ Uses neighboring cell Z values
- ❑ Returns degrees or percent



$$\frac{\text{Rise}}{\text{Run}} = \tan \theta$$

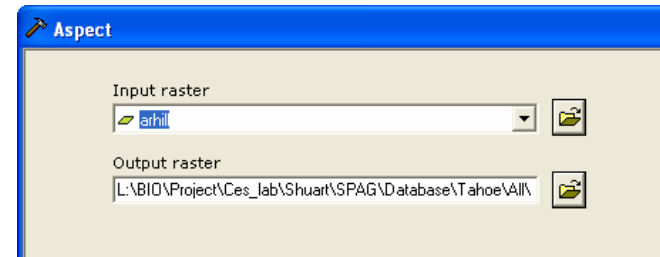
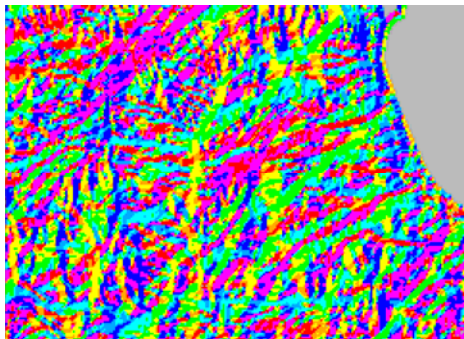
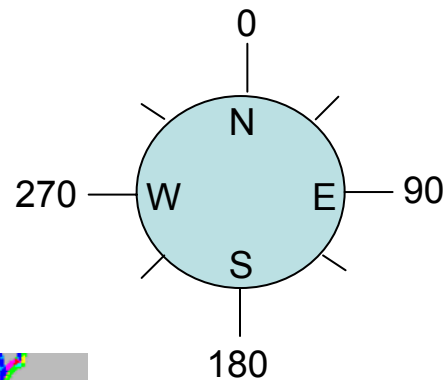


Derive aspect

□ Direction of the maximum rate of change in Z

- Orientation of cell relative to north
- Returns compass direction 0 to 360
- Flat areas are given a value of -1

- aspect
 - Flat (-1)
 - North (0-22.5)
 - Northeast (22.5-67.5)
 - East (67.5-112.5)
 - Southeast (112.5-157.5)
 - South (157.5-202.5)
 - Southwest (202.5-247.5)
 - West(247.5-292.5)
 - Northwest (292.5-337.5)
 - North (337.5-360)

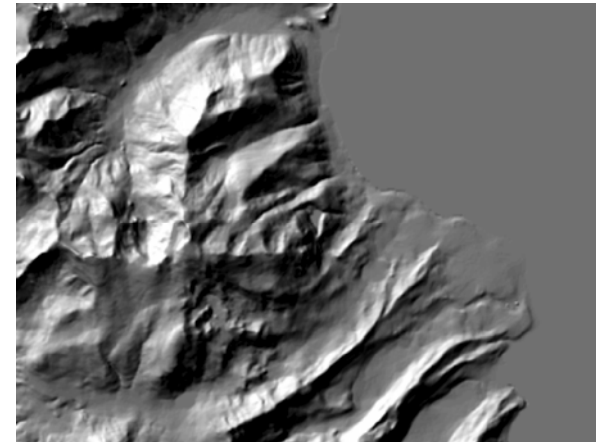


Hillshade

- ❑ **Illuminates a surface**
 - Sets sun position
 - Returns gray scale 0 - 255
- ❑ **Cartographic and analytic uses**

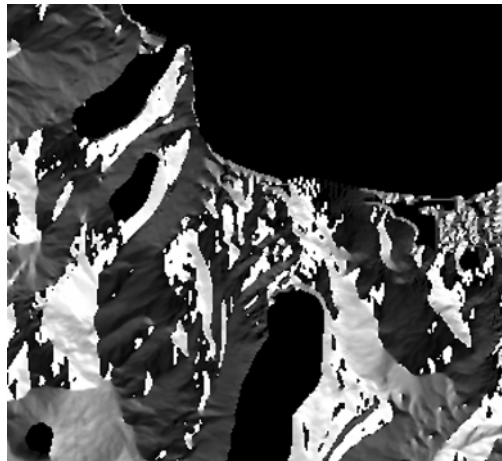
```
HillShade_sa <in_raster> <out_raster> {azimuth} {altitude} {model_shadows} {z_factor}
```

```
HillShade_sa |
```



Visibility analysis

- ❑ Visibility of cells from observation points or lines
- ❑ Output attributes identify observer count or ID



Visibility outputs

- ❑ **FREQUENCY (Viewshed tool)**
 - No limit to the number of observation points
- ❑ **OBSERVERS (Observer Points tool)**
 - Only with the POINT option
 - When number of observation points LE 16

