Week	Date	Topic	Reading	Assignment due	Lab due / Exam
1	23-Jan	Introduction, syllabus, class schedule, GIS examples, geospatial datasets, ESRI's ArcGIS			
2	30-Jan	Data management, metadata, ArcCatalog, coordinate systems, map projections, geodesy	Ch 1	Ch 1 Tutoral all, Tutorial questions 1, 2, 3	
3	6-Feb	Categorizing data: thematic maps, graduated colors, graduated symbols, proportional symbols, dot density	Ch 2-3	Ch 2 Tutorial to Step 55, Ch 2 tutorial questions 1-8, 11part 1 and 2 Ch 3 Tutoral to Step 39, Ch 3 tutorial questions 1-3	
4	13-Feb	Scale, layers, paths, data frame, map elements, cartography	Ch 4	Ch 4 Tutoral, all steps, Tutorial questions 1-9	
5	20-Feb	Attribute tables	Ch 5	Ch 5 Tutoral	
6	27-Feb	Map algebra, spatial queries	Ch 6 and 8	Ch 6 and 8 Tutoral	
7	6-Mar	Raster datasets			Exam
8	13-Mar	Spring break	Spring break	Spring break	Spring break
9	20-Mar	Sampling, interpolation, intro to Sand Table Project,	Ch 11	Ch 11 Tutorial	
10	27-Mar	Interpolation			Lab 1
11	3-Apr	Terrain analysis			Lab 2
12	10-Apr	Cartography, projections			Lab 3
13	17-Apr	Hillslope and flood analysis			Lab 4
14	24-Apr	Georeferencing		Ch 3 Steps 46-57	
15	1-May	Final Project presentations			
16	6-11 May	Finals Week	Finals Week	Finals Week	Final project presentations

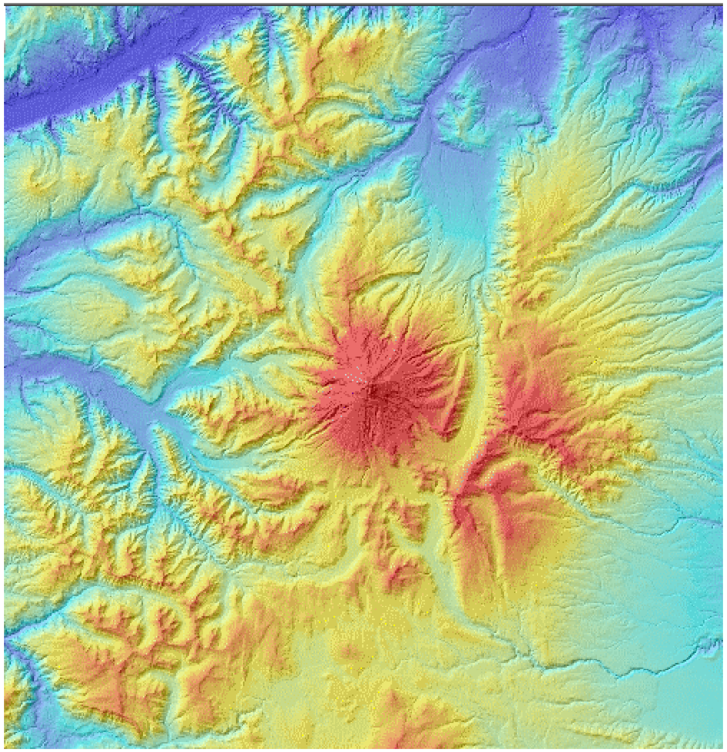
Project reports due April 24th

Terrain Analysis

Slope analysis
Aspect Analysis
Curvature Analysis
Flow Direction
Flow Accumulation

Terrain Analysis

Terrain analysis employs elevation data to describe the landscape, for basic visualization, modeling, or to support decision making.



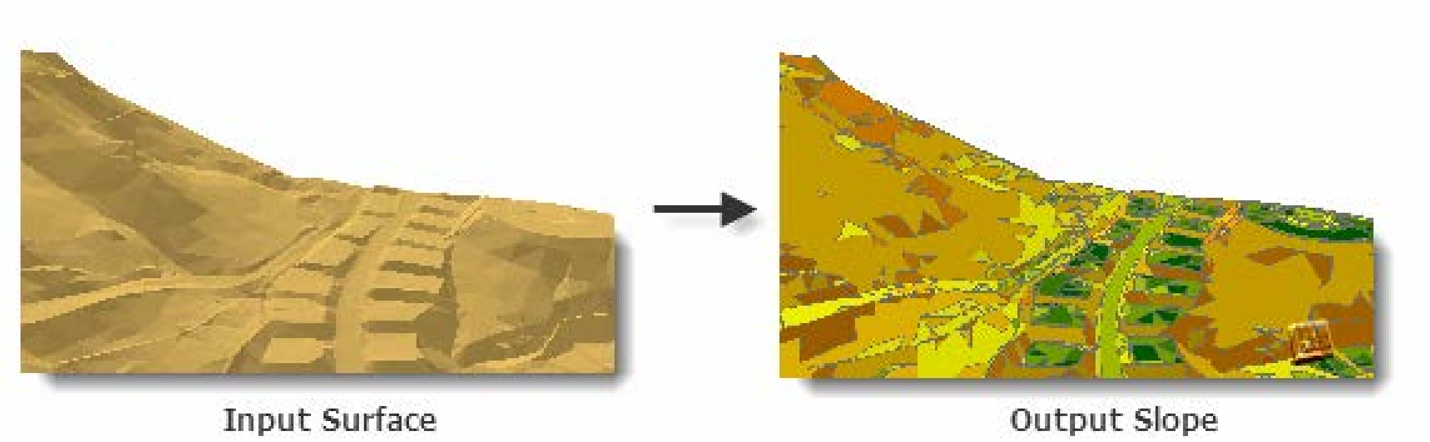
Surface slope analysis

Used to find locations with gradual or steep rates of change

In the case of air pressure, cells with steep slopes could indicate locations with high wind speeds

In the case of elevation, cells with steep slopes might indicate locations unsuitable for buildings

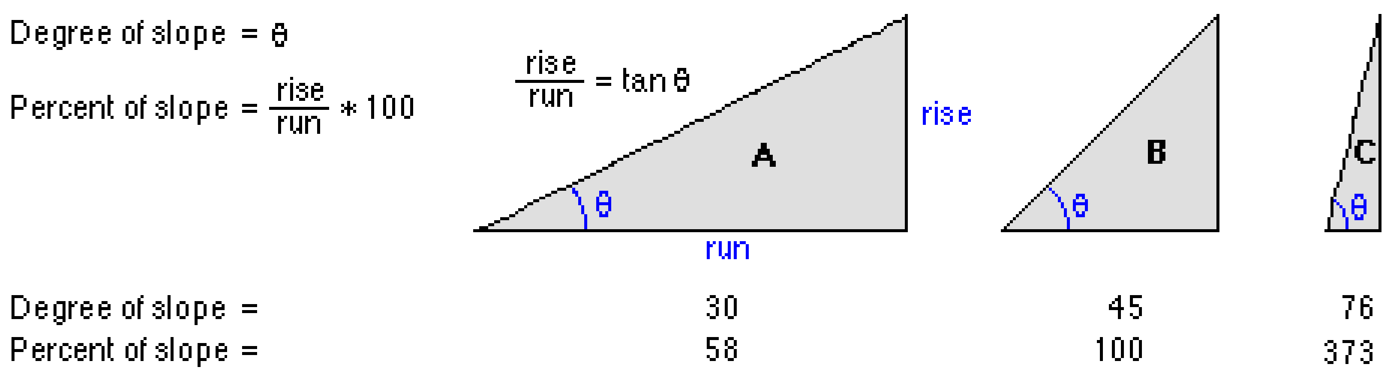
Surface slope analysis calculates the steepest rate of decent (in 2D) in each cell's neighborhood



Units are in degrees or percent

Surface slope analysis

- Used to find locations with gradual or steep rates of change.
- Most frequently performed on an elevation dataset.
- Slope – change in elevation (rise) over the change in horizontal position (run)



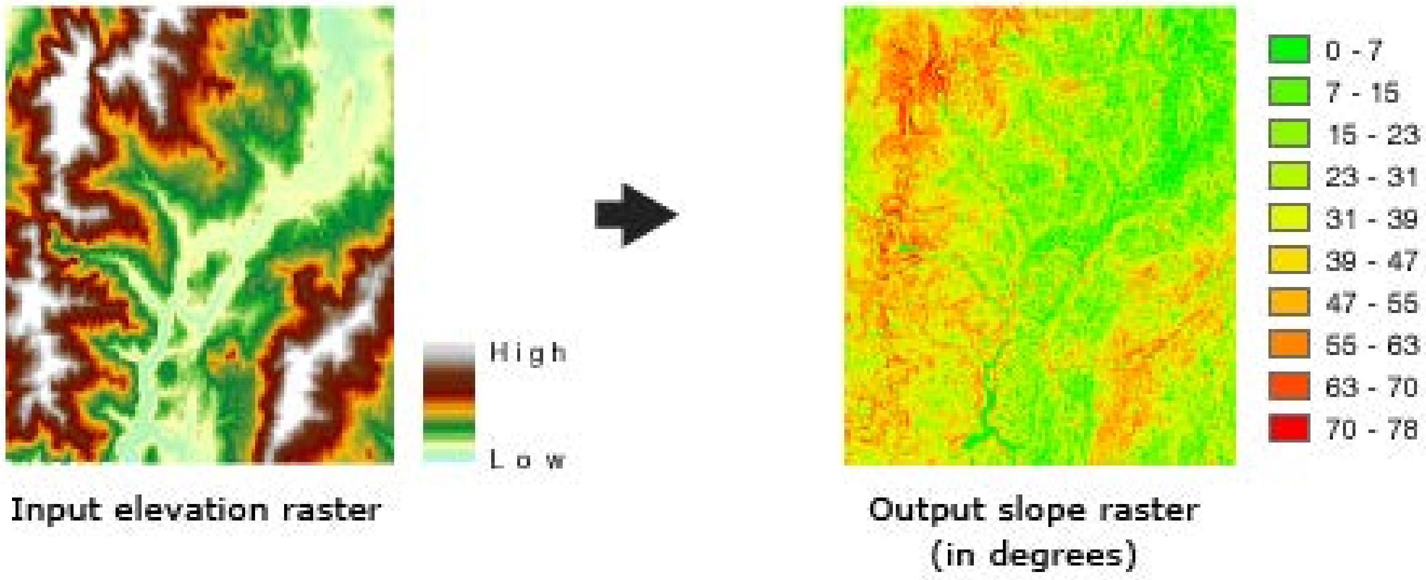
45 degree slope = 100%

Percent rise examples:
When the angle is 45 degrees (as in triangle B), the rise is equal to the run, and the percent rise is 100 percent

As the slope angle approaches vertical (90 degrees), as in triangle *C*, the percent rise begins to approach infinity.

Surface slope analysis

Used to find locations with gradual or steep rates of change.
Most frequently run on an elevation dataset.



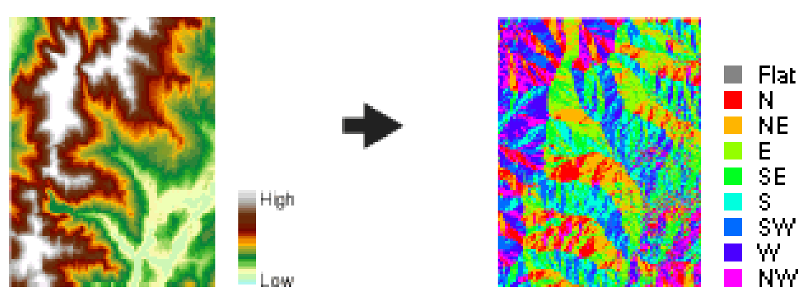
Surface slope analysis

2 methods for calculating slope in ArcGIS

- **Four nearest** – uses 4 nearest neighbors – good for <u>smooth terrain</u>
- **3rd order finite difference**- gives 4 closest neighbors a greater weight than corner cells. All 8 cells are used. Good for <u>rough terrain</u>

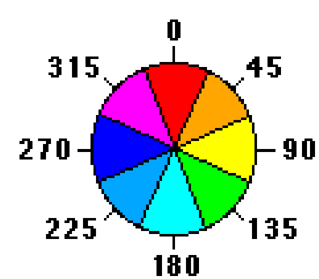
Surface aspect analysis

- Calculates the direction of steepest decent in each cell’s neighborhood
- Can be thought of as the slope direction
- Each aspect value is reported as an azimuth measured in degrees clockwise from grid north
- Aspect defined as 0 to 360 degrees



Input elevation raster

Output aspect raster



Aspect value

Surface curvature analysis

- Slope and aspect tell us how much and in what direction, but curvature tells us the shape of the slope
- Used to describe the physical characteristics of a drainage basin
- Used to find soil erosion patterns

  Profile curvature affects the acceleration and deceleration of flow and, therefore, influences erosion and deposition

Surface curvature analysis

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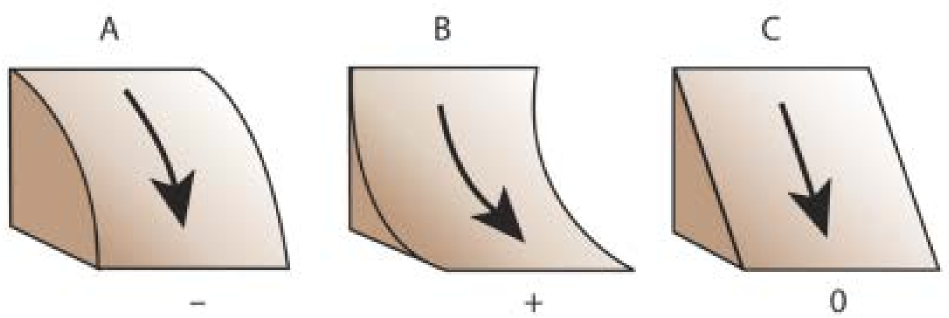
  Profile curvature affects the acceleration and deceleration of flow and, therefore, influences erosion and deposition

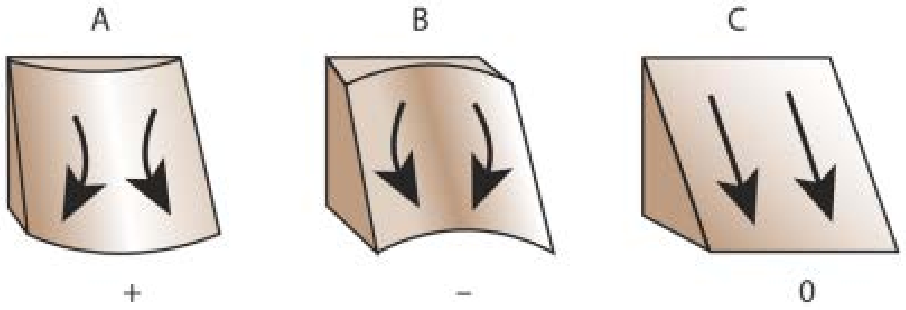
Profile curvature – used to determine if a material will <u>accelerate</u>, flow at a <u>constant rate</u>, or <u>decelerate</u> is it moves downhill. Denoted by -, +, 0



Convex – flow accelerates
Concave – flow decelerates
Planer – flows at constant rate

Surface curvature analysis

Plan curvature– used to determine if material will converge, flow straight, or diverse as it moves downhill. Denoted by +, -, 0



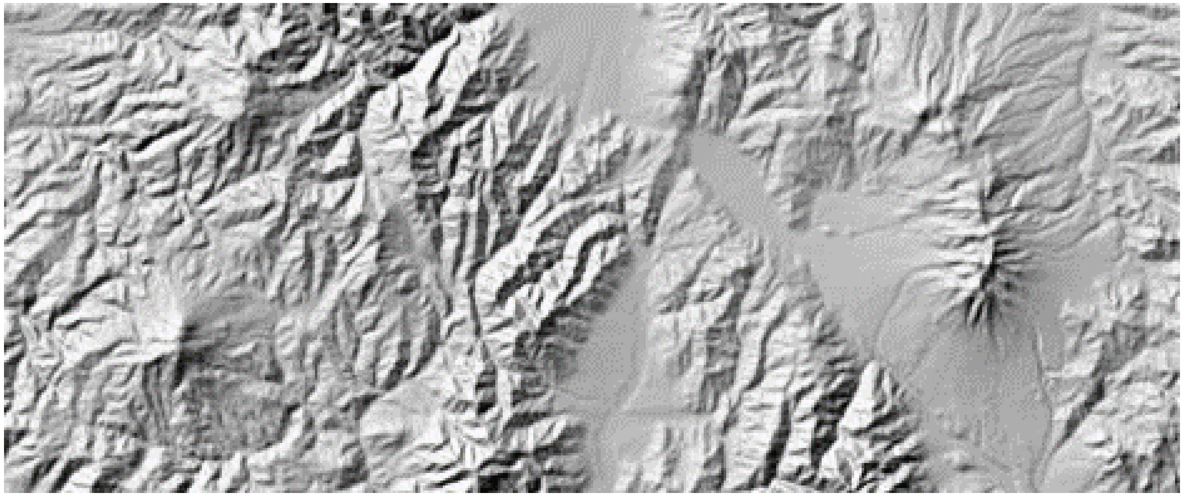
Concave – flow diverges
Convex – flow converges
Planer – flows straight

Hillshading

A grayscale 3D representation of the surface, with the sun's relative position taken into account for shading the image. This function uses the **altitude** and **azimuth** properties to specify the sun's position.

Altitude and azimuth together indicate the sun's relative position

Used for visualization purposes

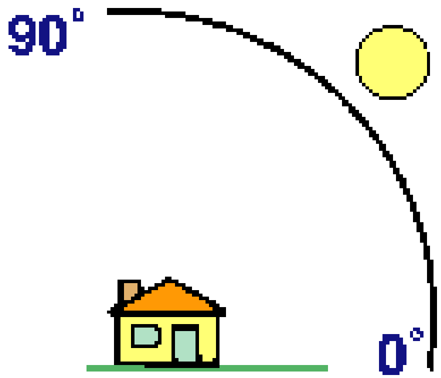


Example hillshaded image

Hillshading

Altitude - sun's angle of elevation above the horizon and ranges from 0 to 90

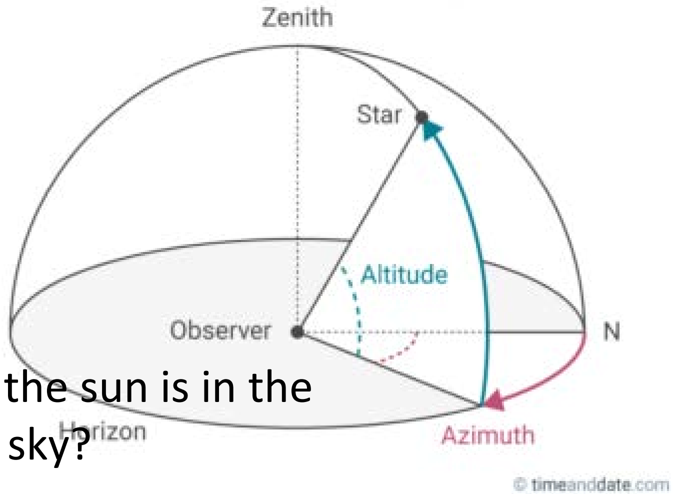
- 0 degrees indicates that the sun is on the horizon,
- 90 degrees indicates that the sun is directly overhead.



What is the sun’s altitude?

Azimuth - sun's relative position along the horizon (in degrees)

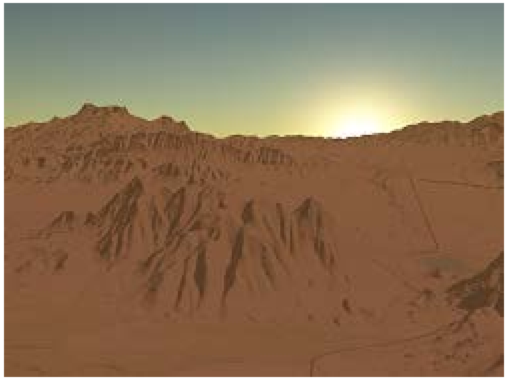
- Indicated by the angle of the sun measured clockwise from due north
- 0 degrees is north
- 90 degrees is east
- 180 degrees is south
- 270 degrees is west



What is the azimuth if the sun is in the north west sky?

Hillshading

No atmospheric affects

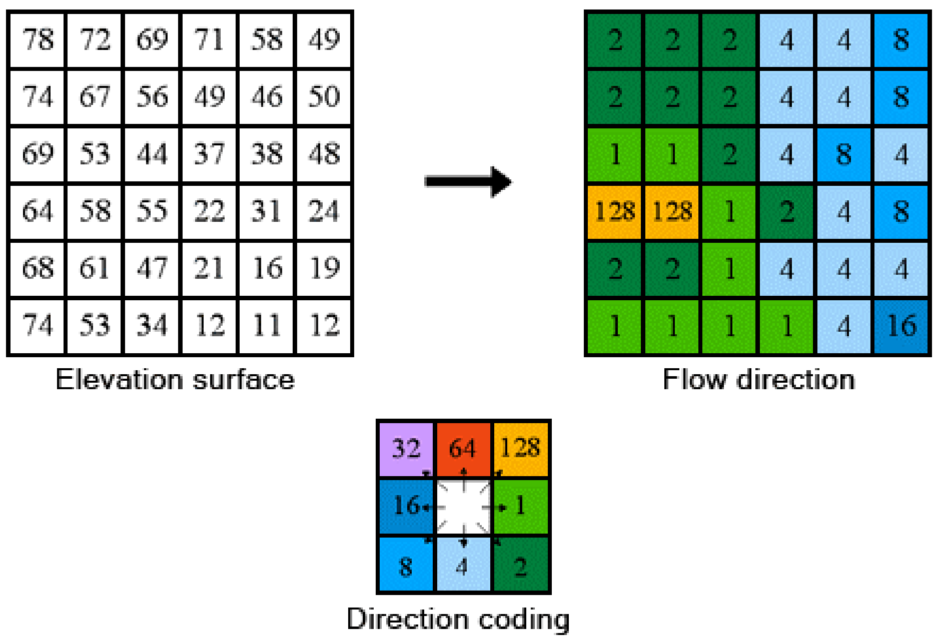


Atmospheric affects

https://www.youtube.com/watch?v=Vf0mAmxLU4M

Flow Direction

- Uses surface as input and outputs a raster showing the direction of flow out of each cell
- There are eight valid output directions relating to the eight adjacent cells into which flow could travel. This approach is commonly referred to as an eight-direction (D8) flow model



Flow Direction

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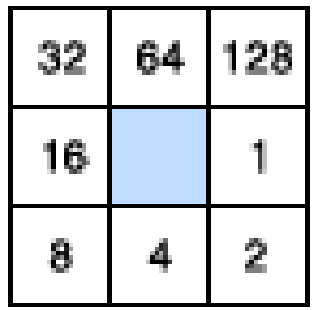
<u>D8 Flow Model</u>

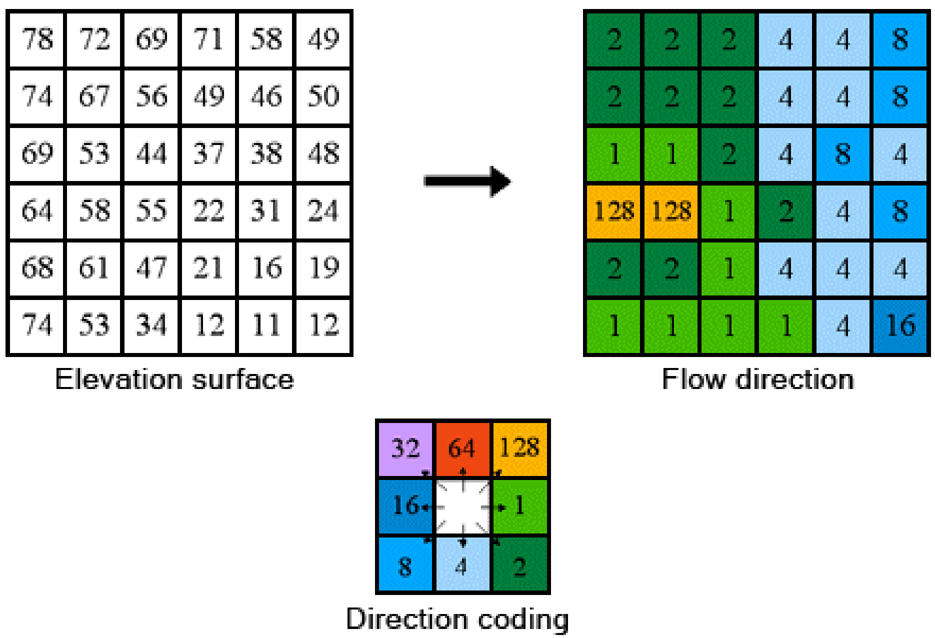
- The output of the Flow Direction tool run with the D8 flow direction type is an integer raster whose values range from 1 to 255
- The values for each direction from the center are the following:

32	64	128
16		1
8	4	2

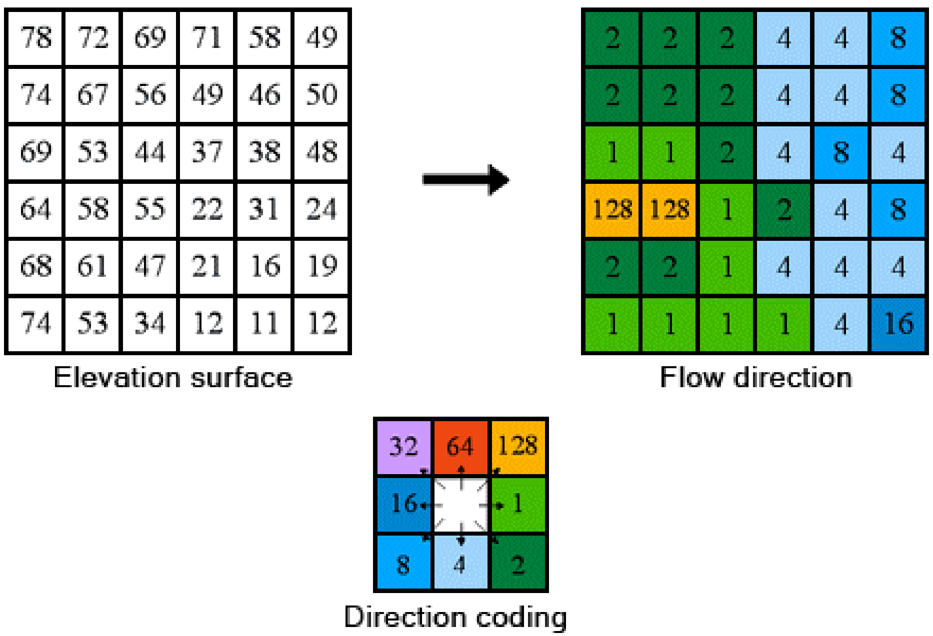
Flow Direction

- For example, if the direction of steepest drop was to the left of the current processing cell, its flow direction would be coded as 16



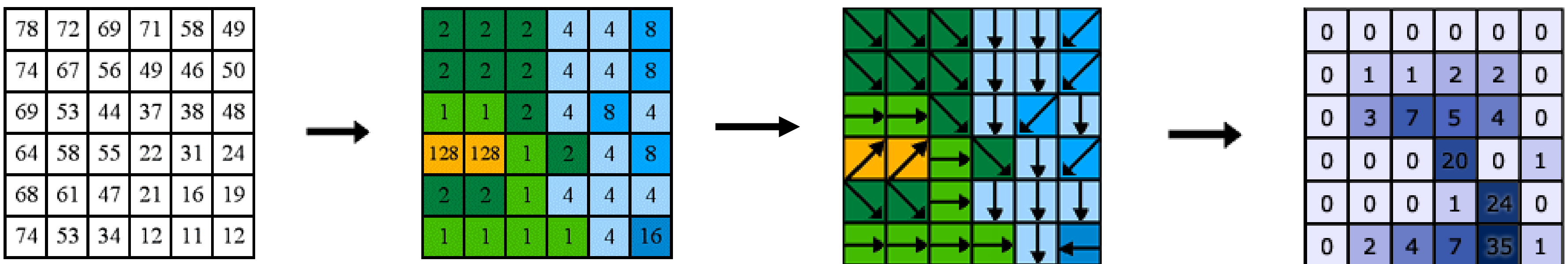


Flow Direction

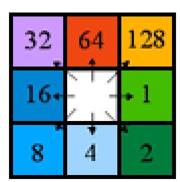


Flow Accumulation

- Calculates accumulated flow of all cells flowing into each downslope cell in the output raster
- The value of cells in the output raster is the number of cells that flow into each cell



Elevation surface | Flow direction | Flow direction | Flow accumulation



Direction coding

Flow Accumulation

- Cells with a high flow accumulation are areas of concentrated flow and may be used to identify stream channels
- Cells with a flow accumulation of 0 are local topographic highs and may be used to identify ridges.

- Results of Flow Accumulation can be used to create a stream network by applying a threshold value to select cells with a high accumulated flow.

For example, the procedure to create a raster where the value 1 represents the stream network on a background of NoData could use one of the following: