

# Hydrology Analysis



ISTANBUL **TECHNICAL** UNIVERSITY

Sp. Anly. and Alg. in GIS

Week 9

Res. Assist. Ömer AKIN

# Introduction & Aim of the Study

## *Aim of the Study:*

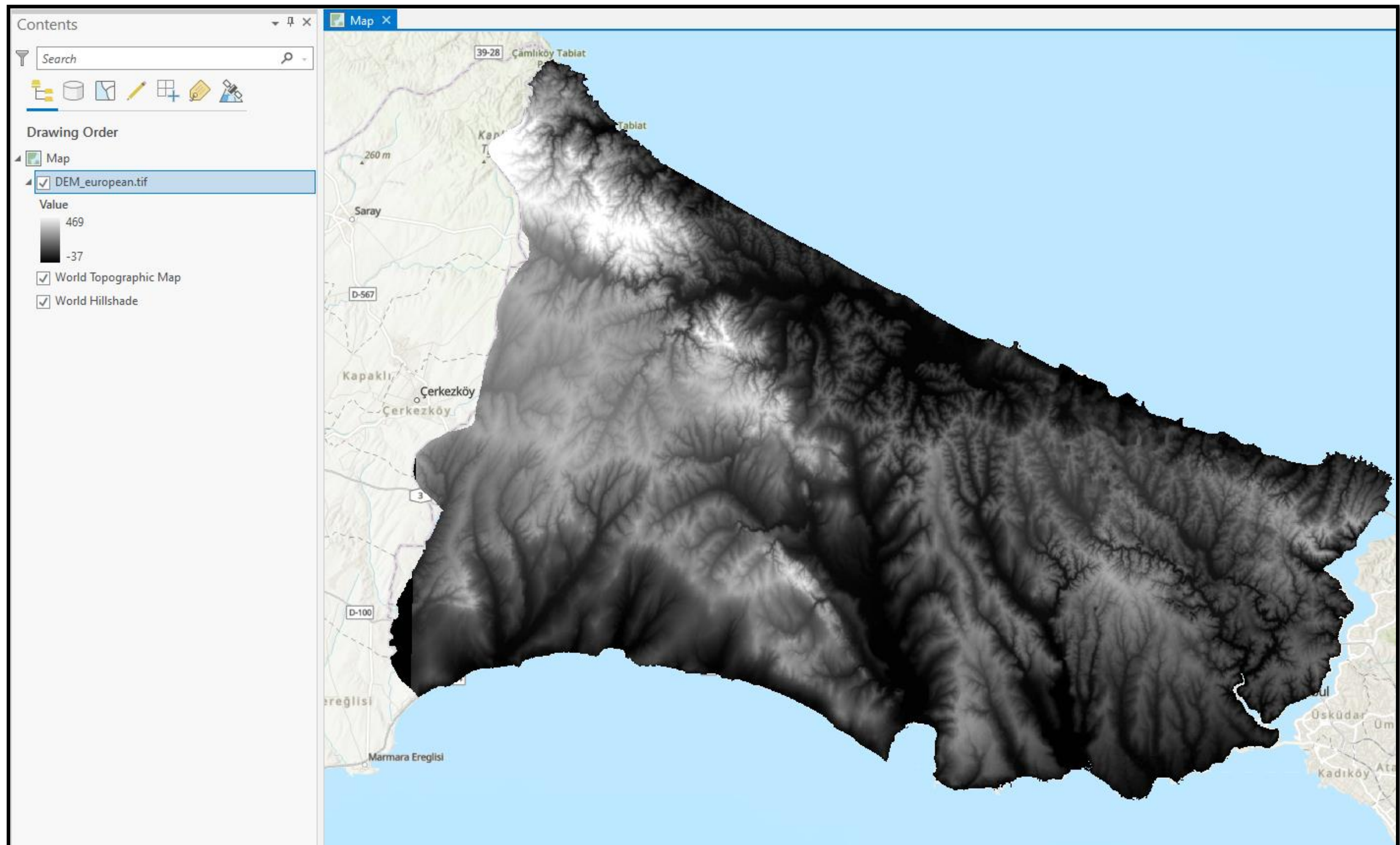
- *Find watersheds and stream networks in the European Side of Istanbul*

## *Input Data:*

- *Digital Elevation Model (Raster/GeoTIFF)*

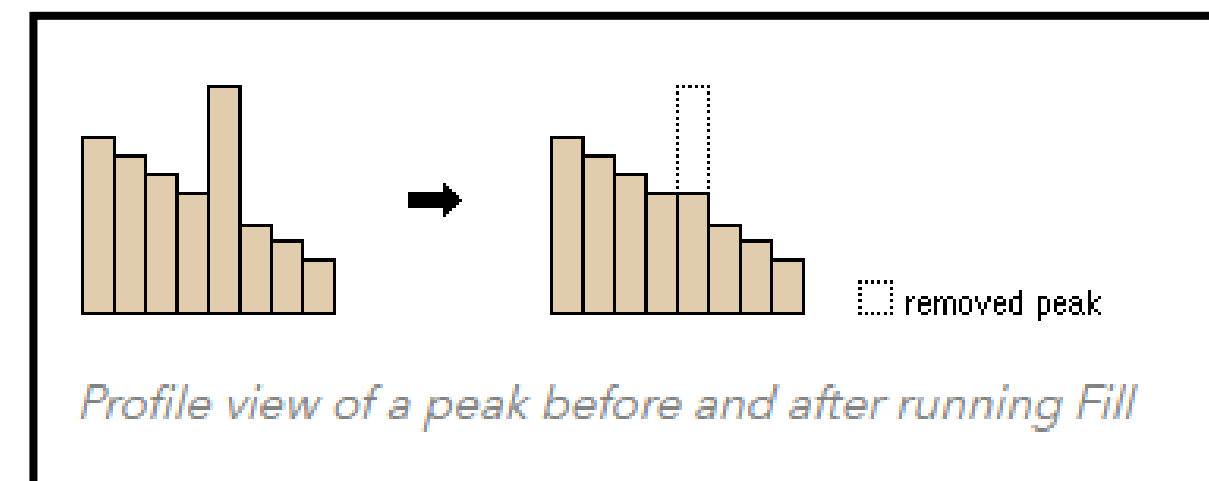
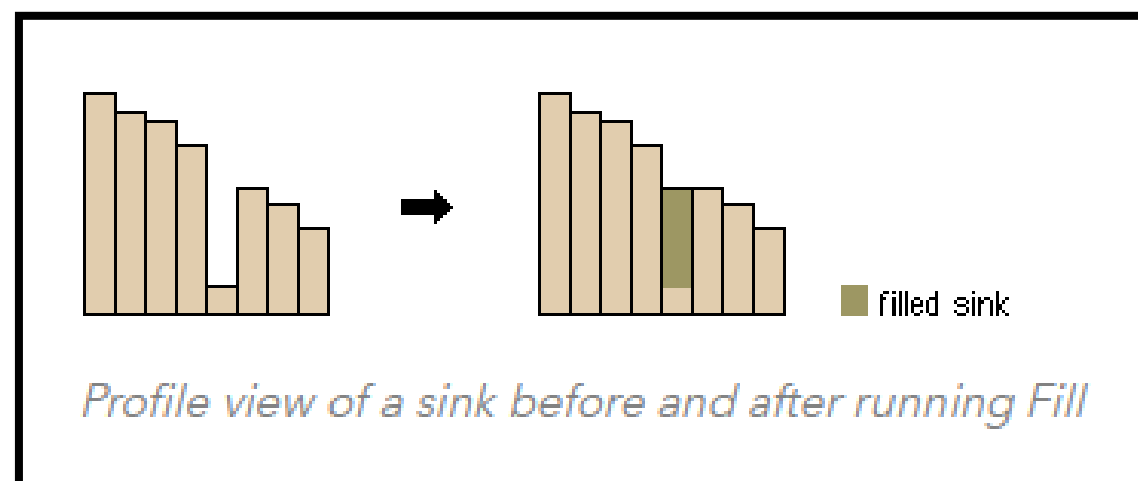


# Study Area & Data

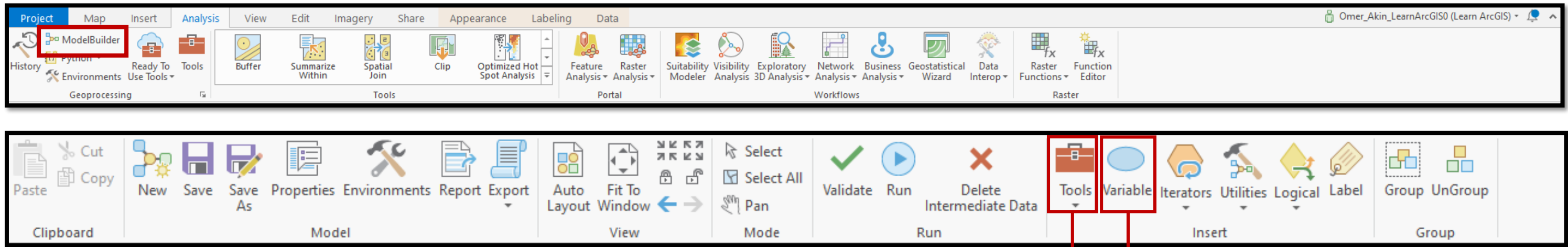


Fills sinks in a surface raster to remove small imperfections in the data.

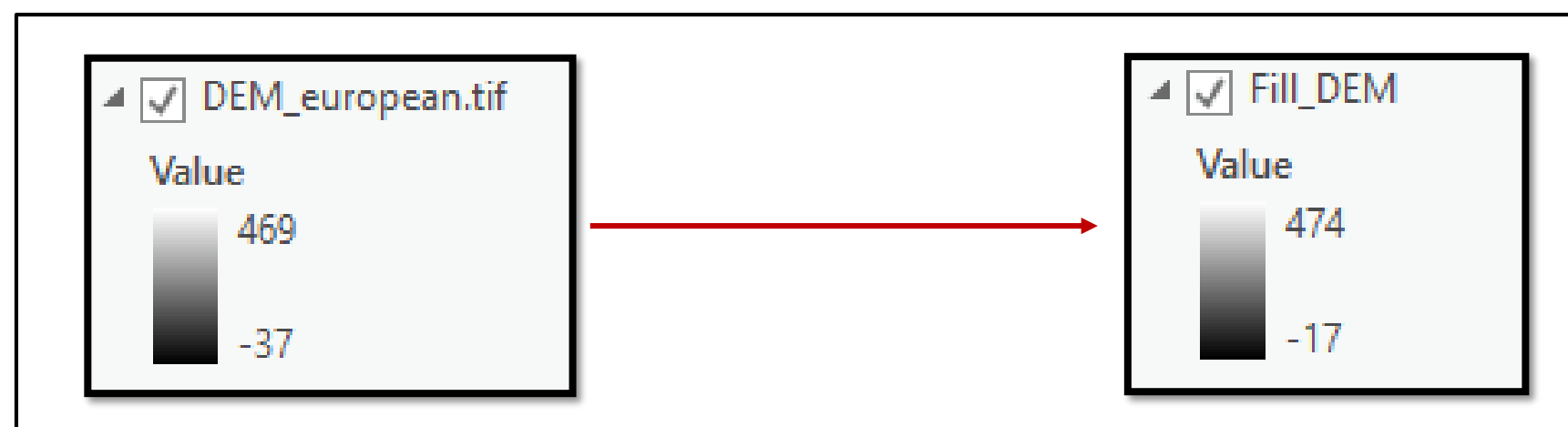
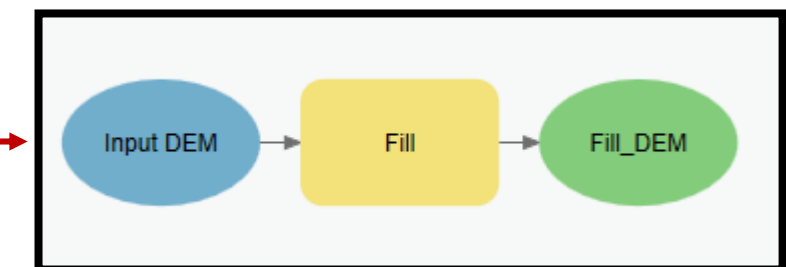
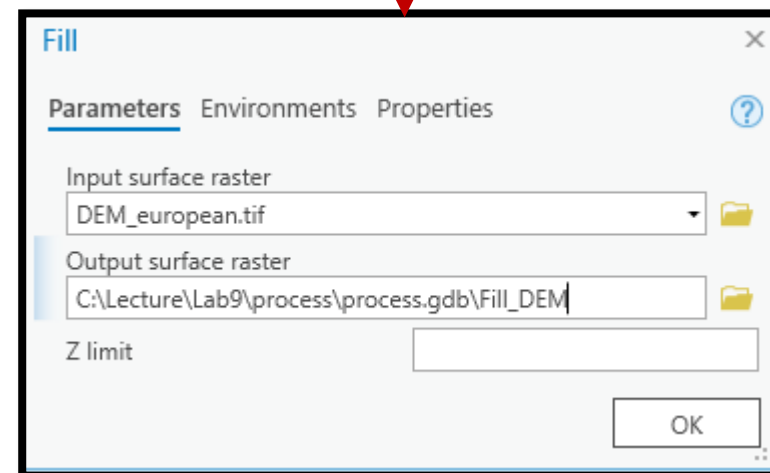
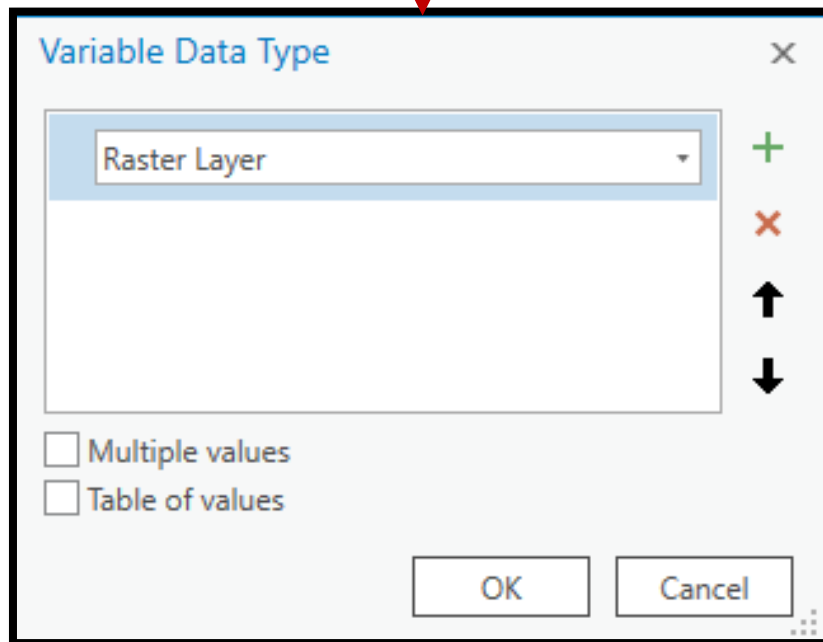
- Sinks (and peaks) are often errors due to the resolution of the data or rounding of elevations to the nearest integer value.
- Sinks should be filled first to ensure proper delineation of basins and streams. If the sinks are not filled, a derived drainage network may be discontinuous.



# Fill

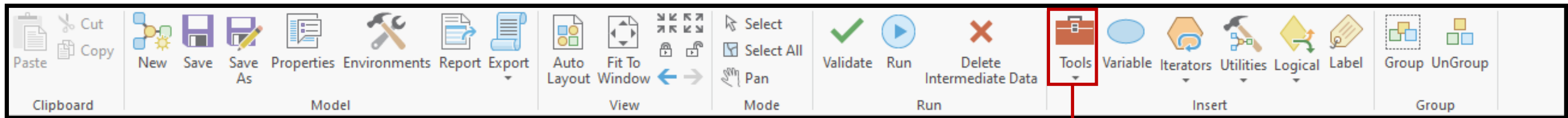


Create a raster input  
for DEM





# Hillshade



**HillShade**

Parameters Environments Properties

Input raster  
DEM\_european.tif

Output raster  
C:\Lecture\Lab9\process\process.gdb\Hillshade

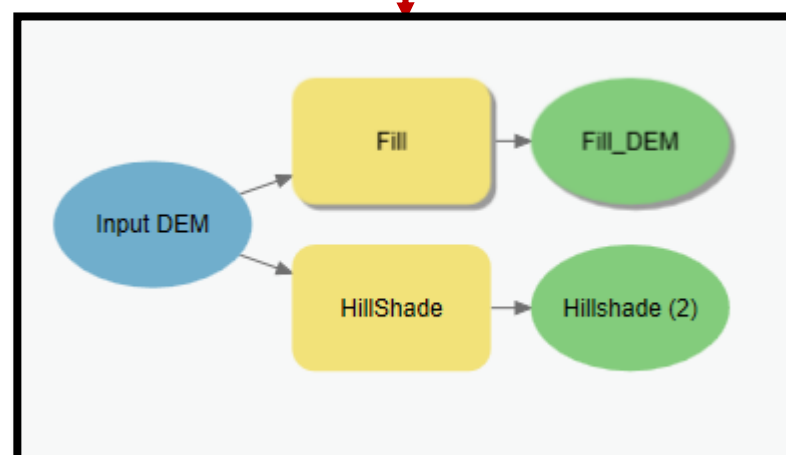
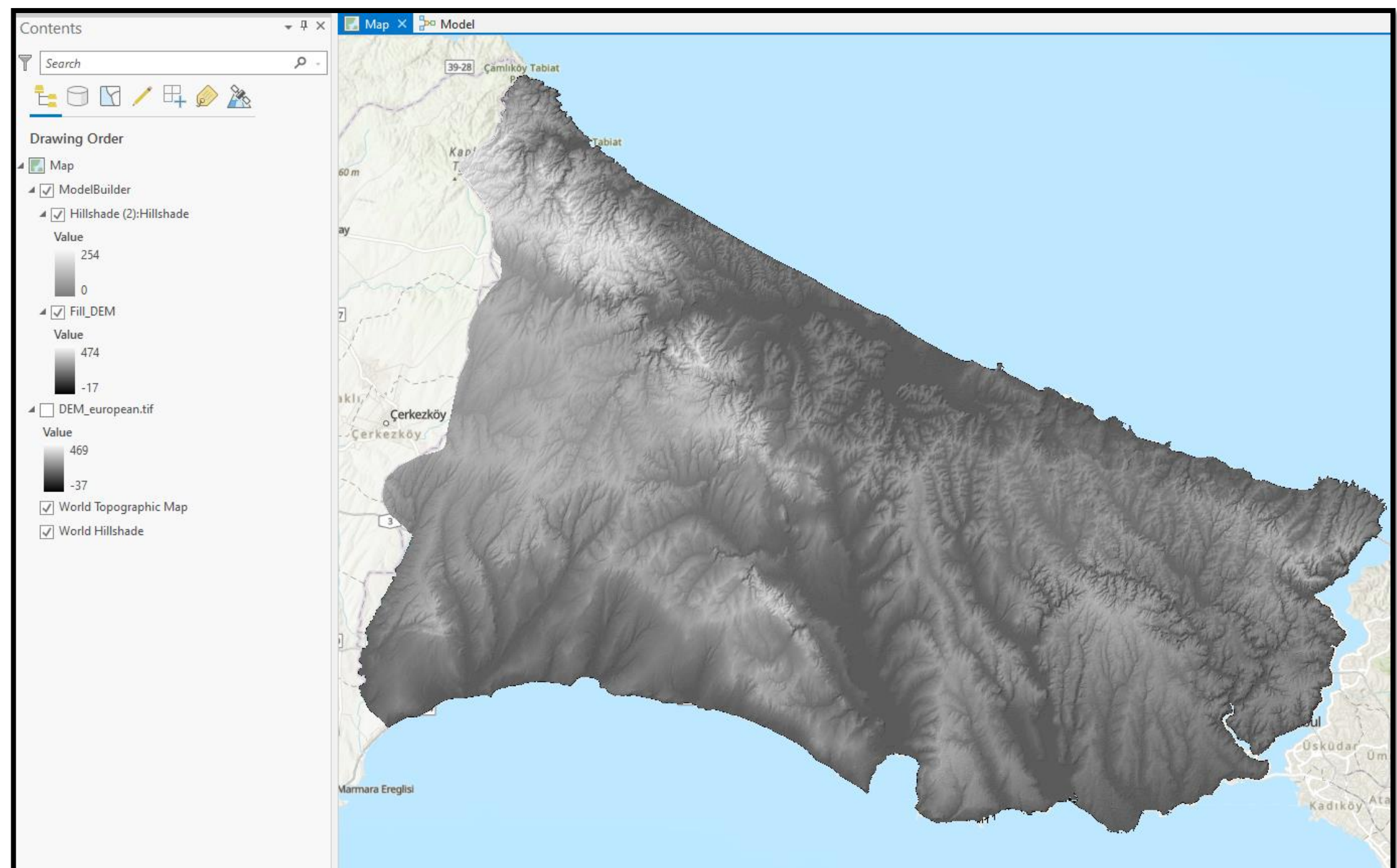
Azimuth 315

Altitude 45

☐ Model shadows

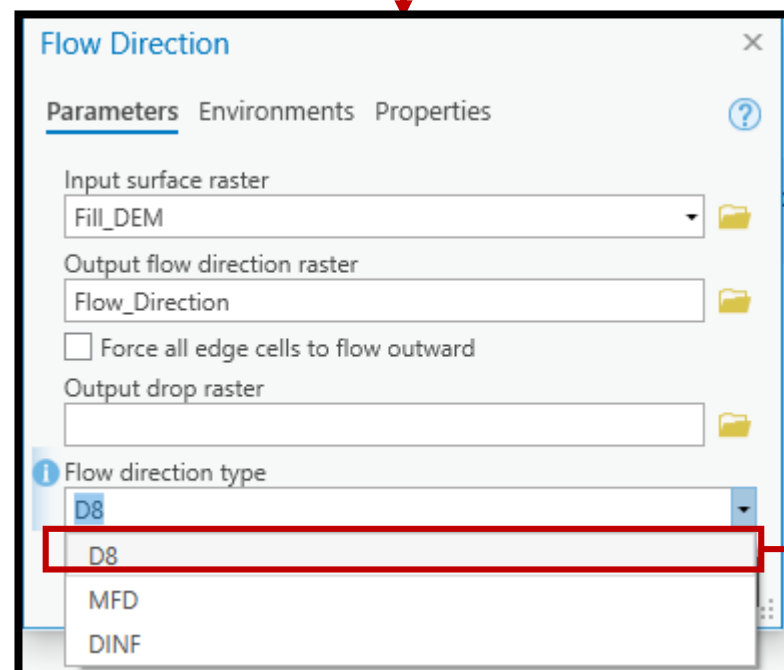
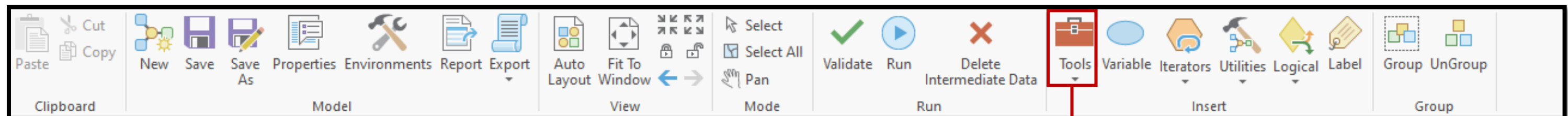
Z factor 1

OK



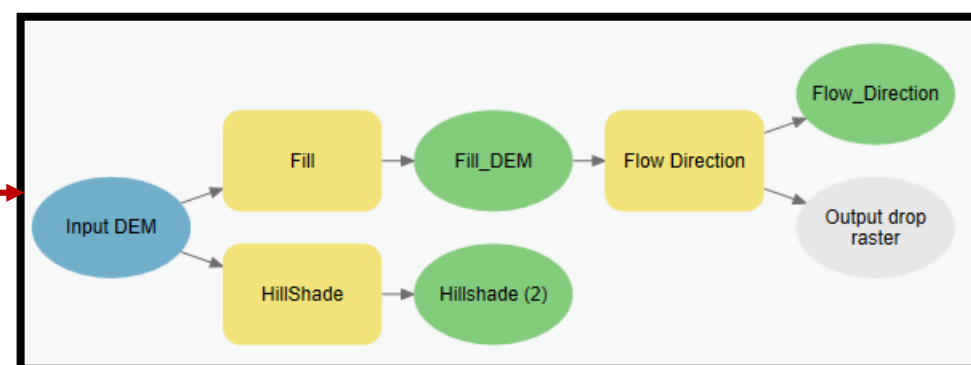
# Flow Direction

Creates a raster of flow direction from each cell to its downslope neighbor, or neighbors

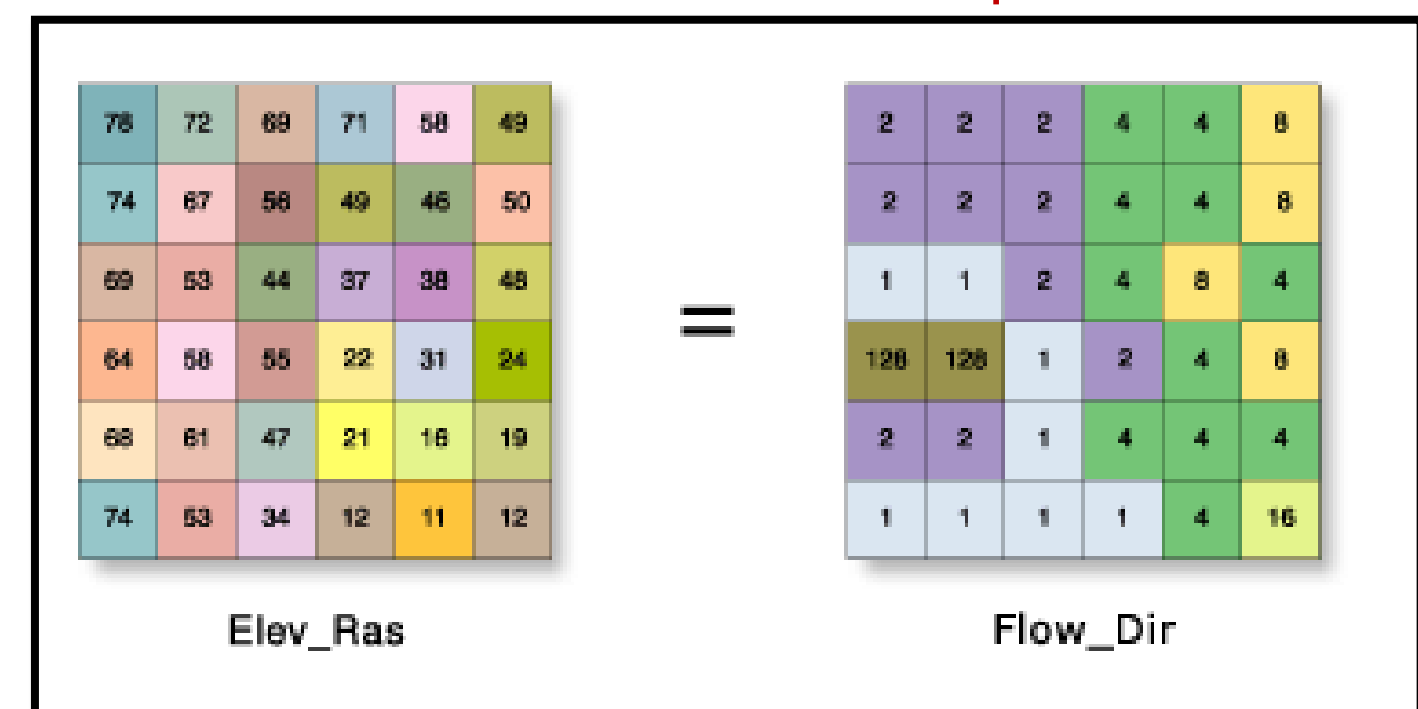


- The D8 flow method models flow direction from each cell to its steepest downslope neighbor.
- The output of the Flow Direction tool run with the D8 flow direction type is an integer raster whose values range from 1 to 255. The values for each direction from the center are:

32	64	128
16		1
8	4	2



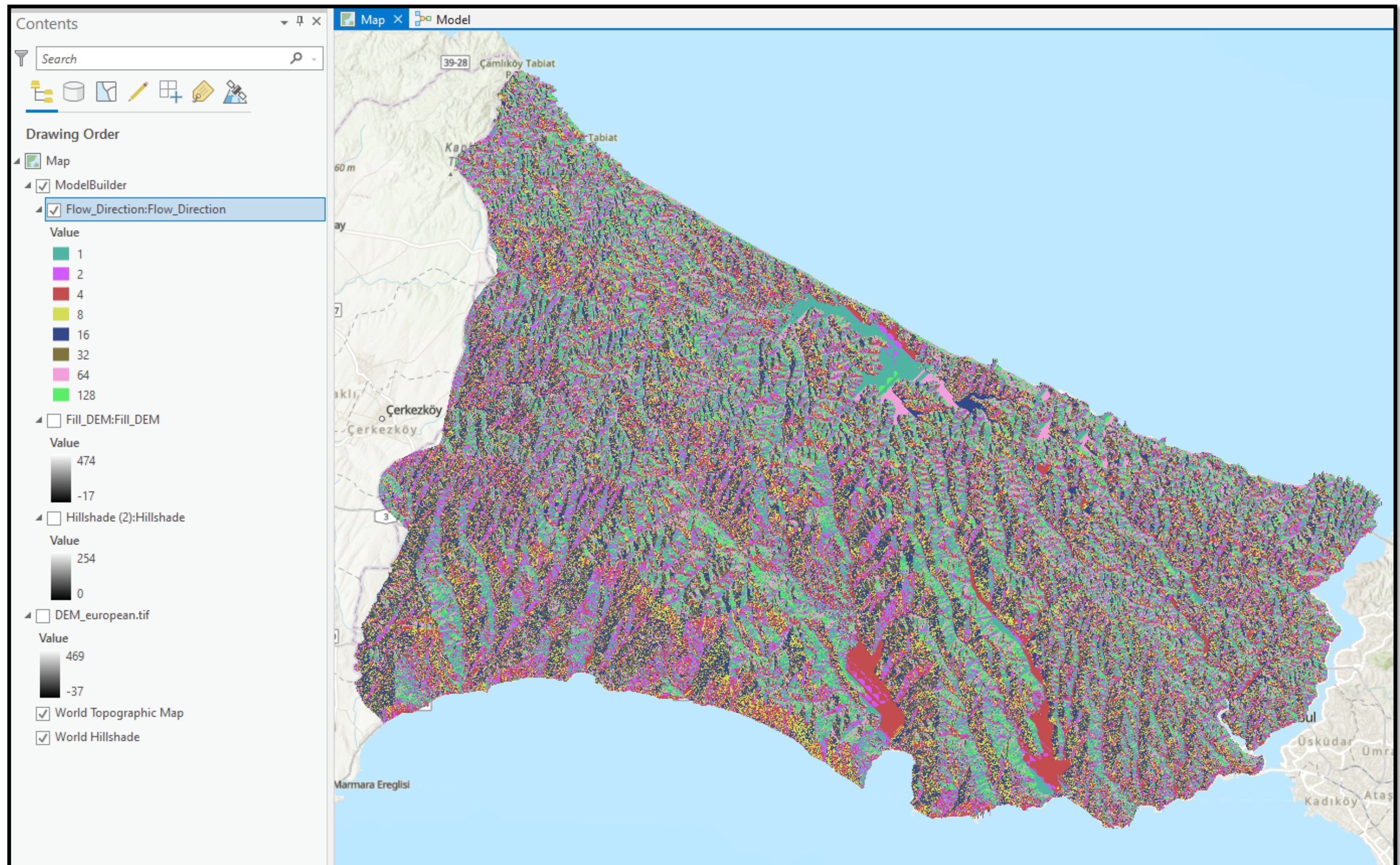
## Flow Direction Example



\*To get more information about the other flow direction algorithms please visit:  
<https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/flow-direction.htm>



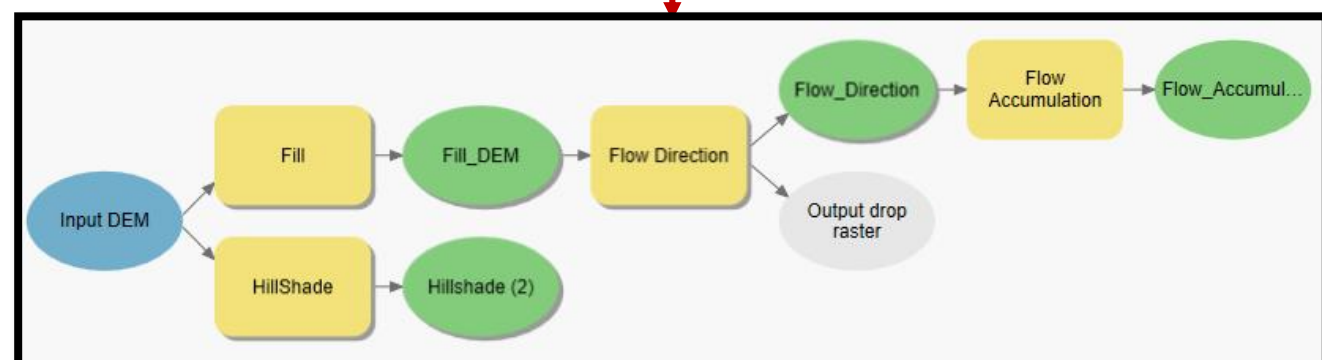
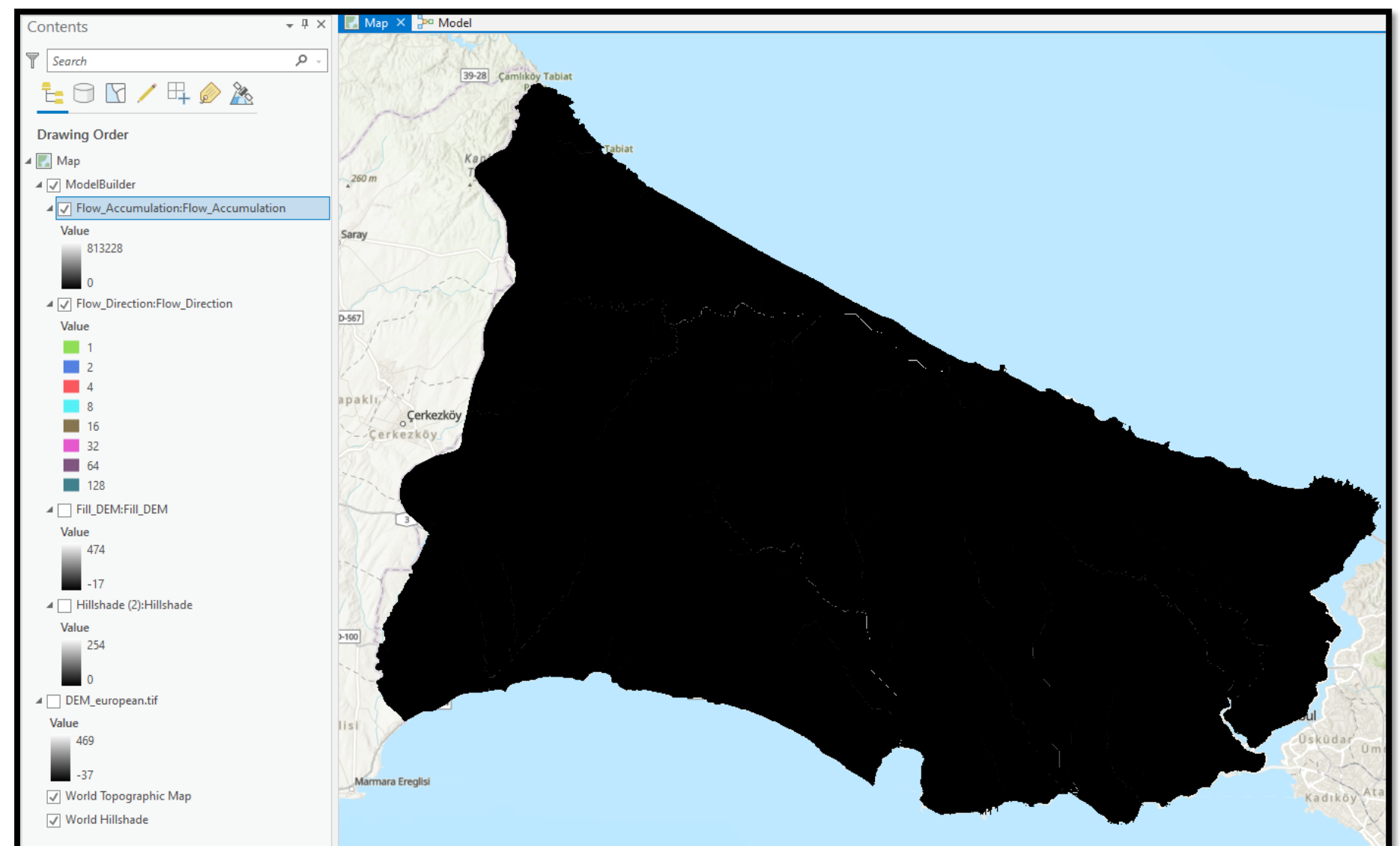
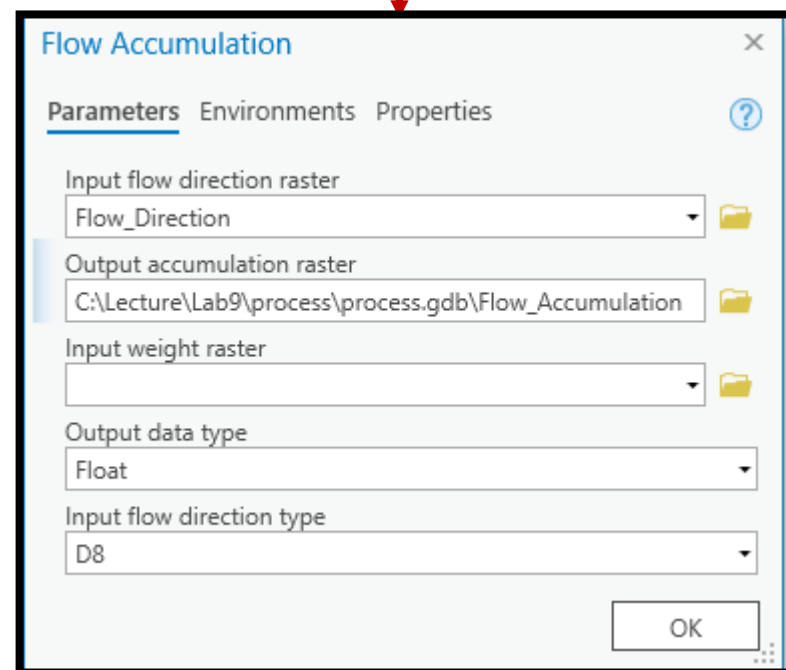
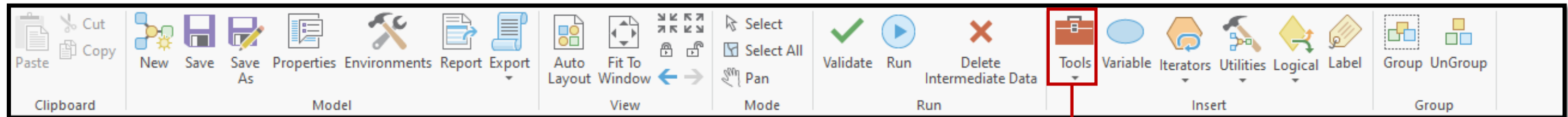
# Flow Direction Results



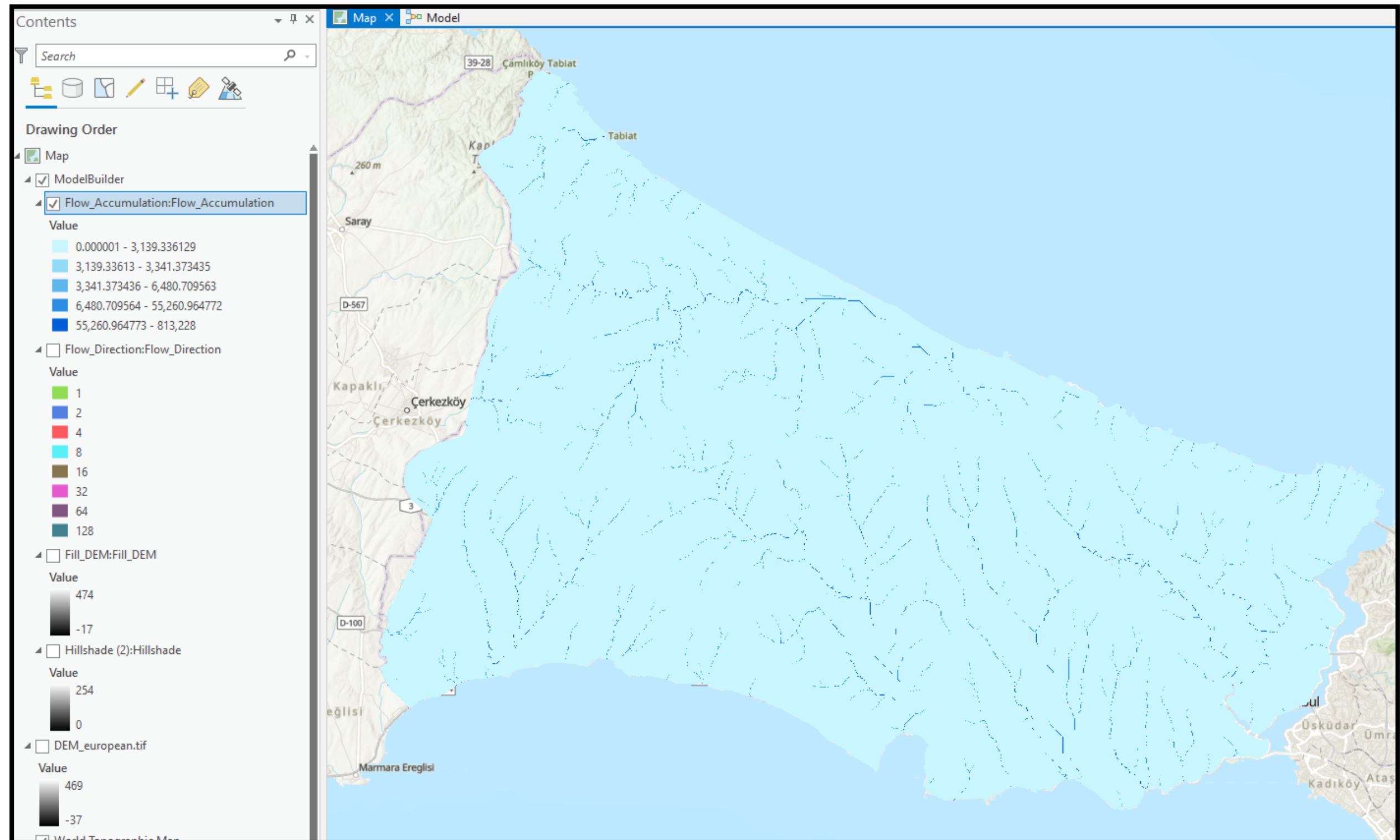
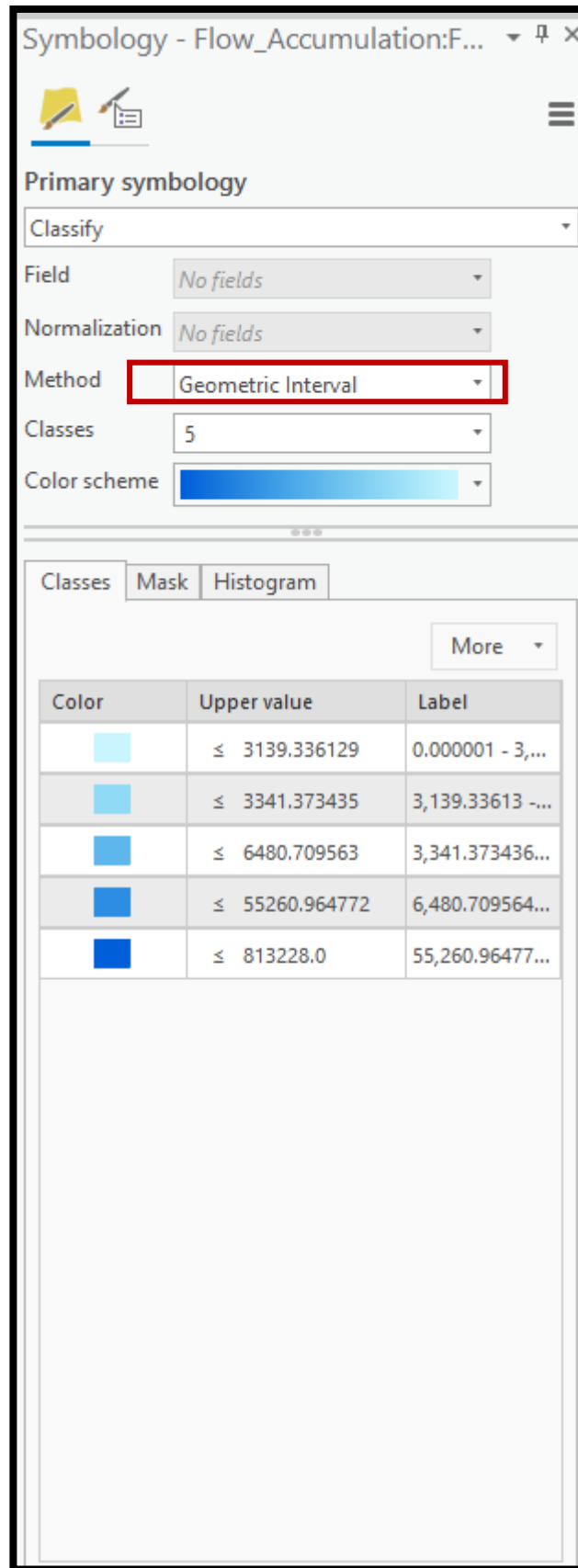


# Flow Accumulation

Creates a raster of accumulated flow into each cell.



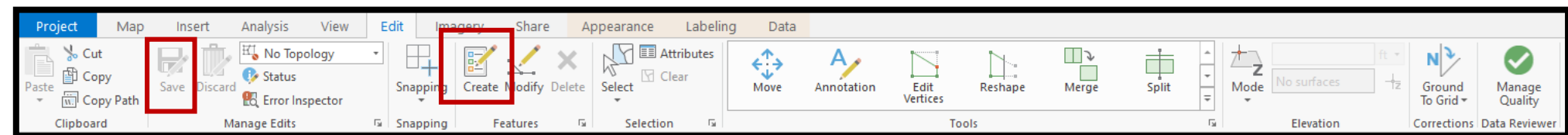
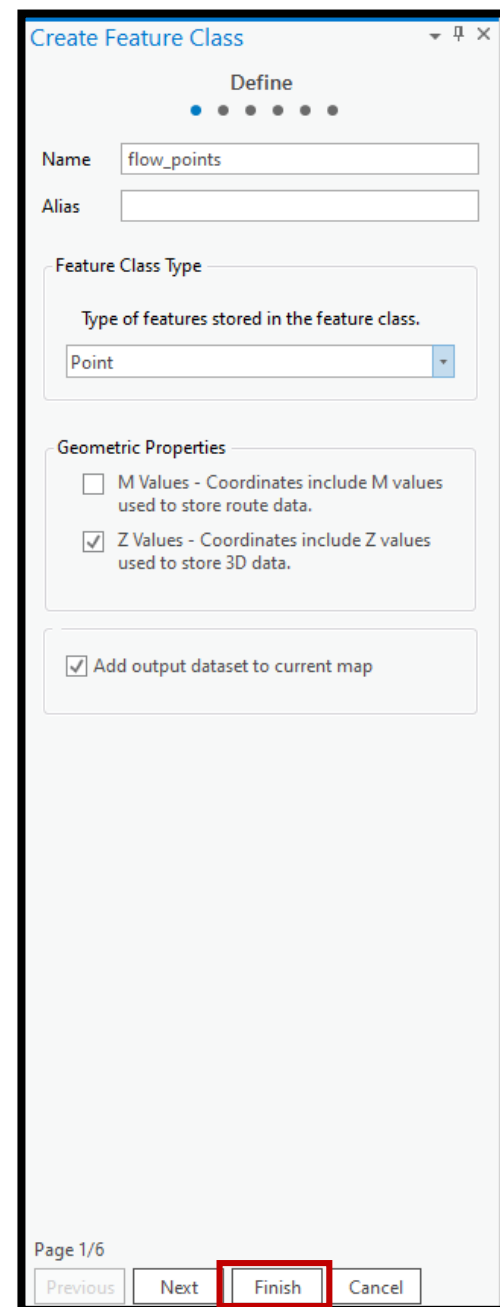
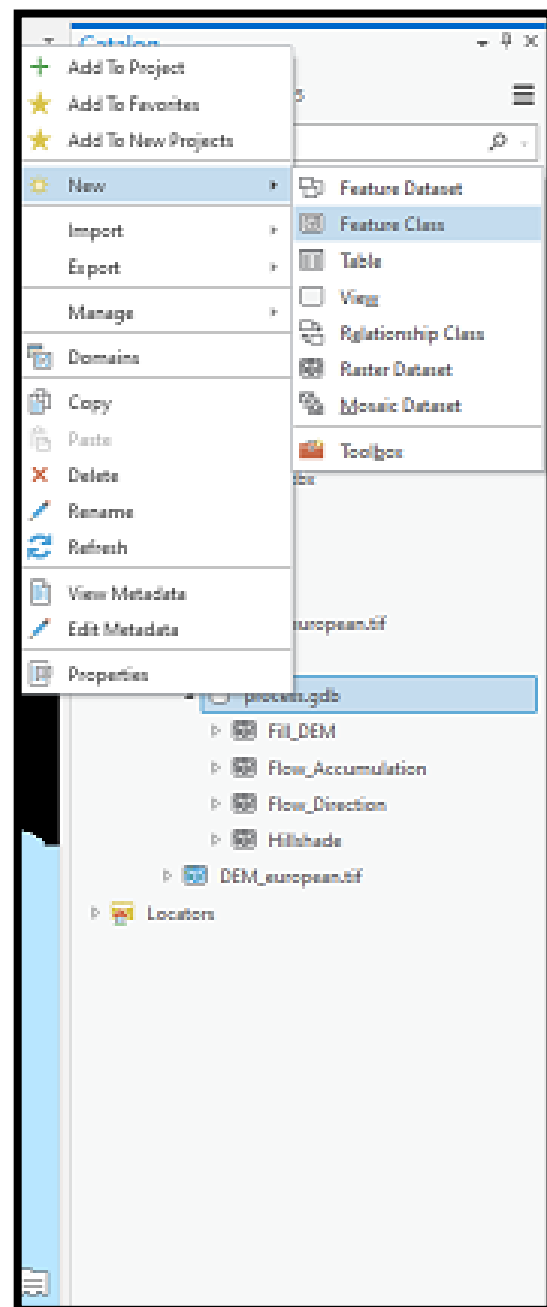
# Flow Accumulation Results



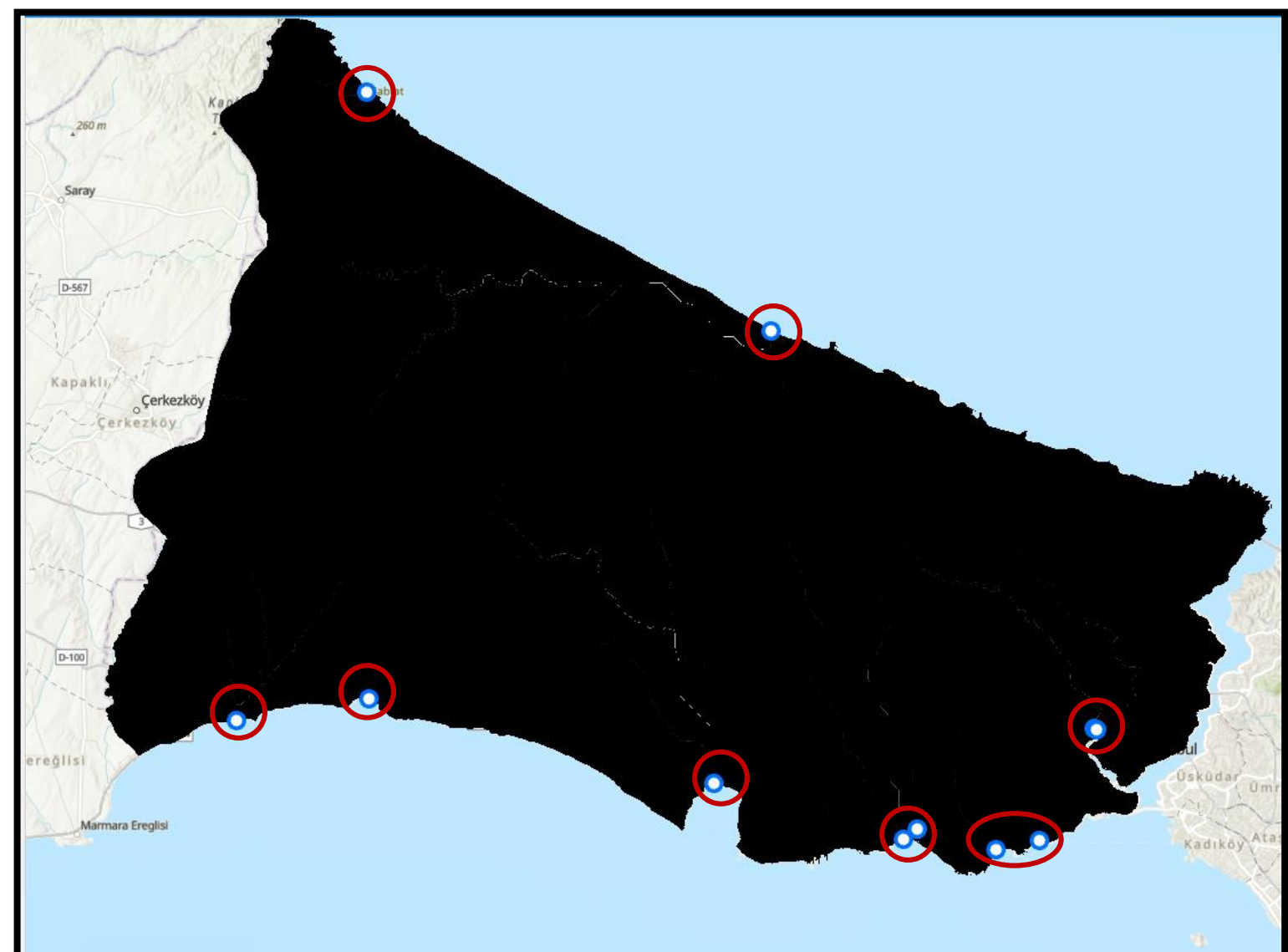


# Watersheds

Create an empty point feature class to specify the start of streams.

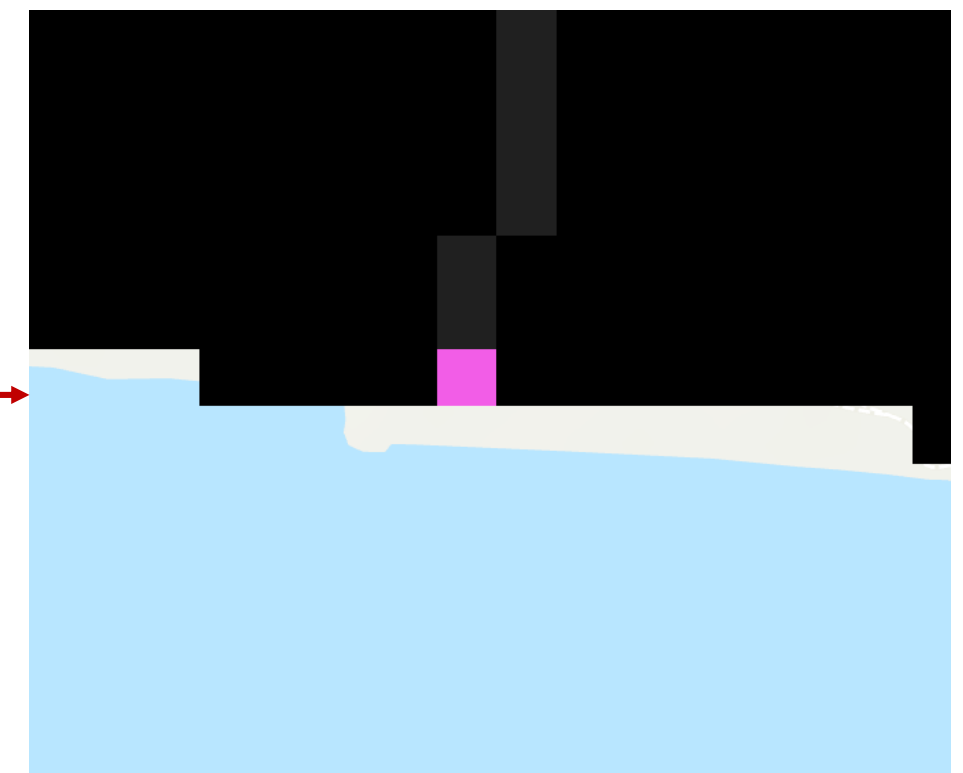
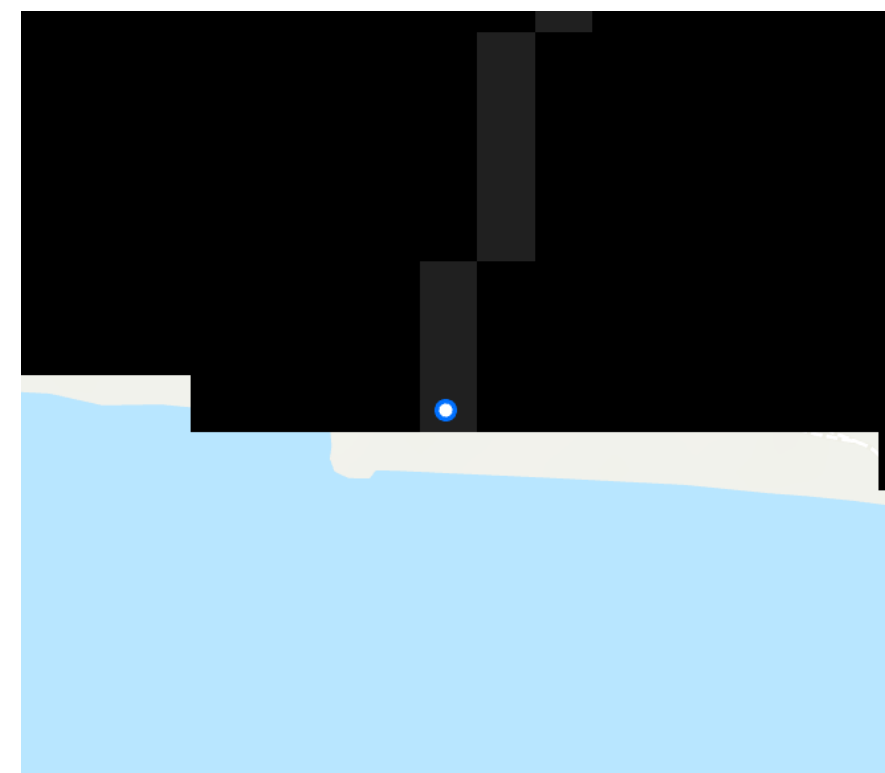
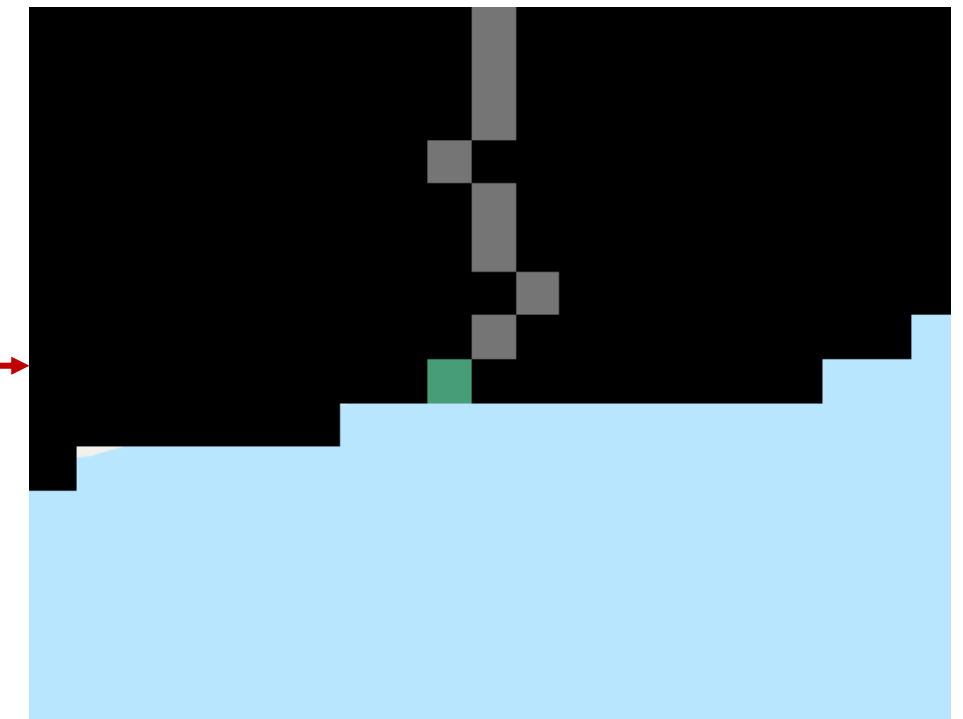
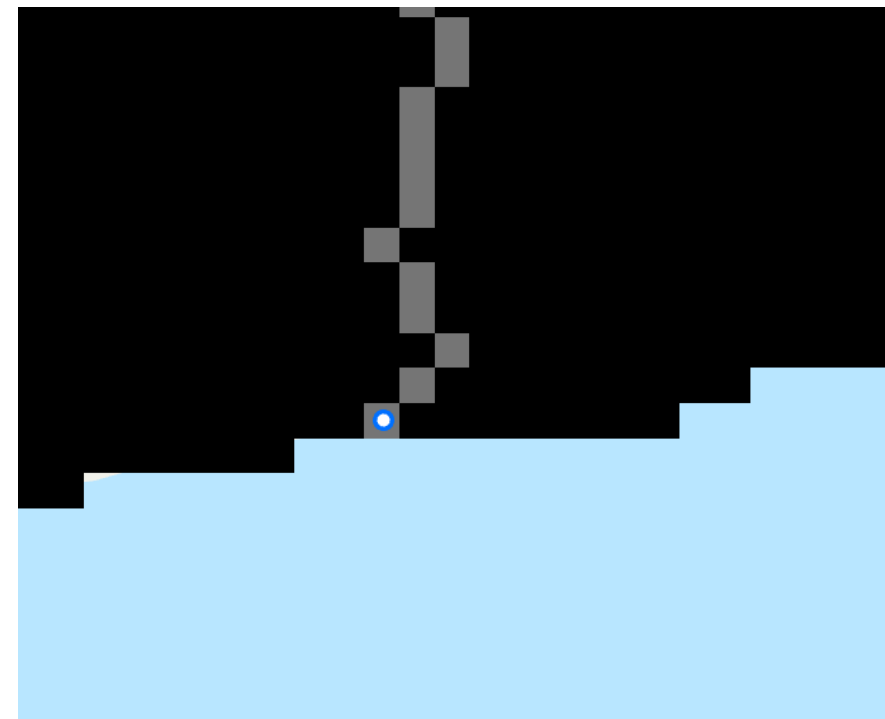
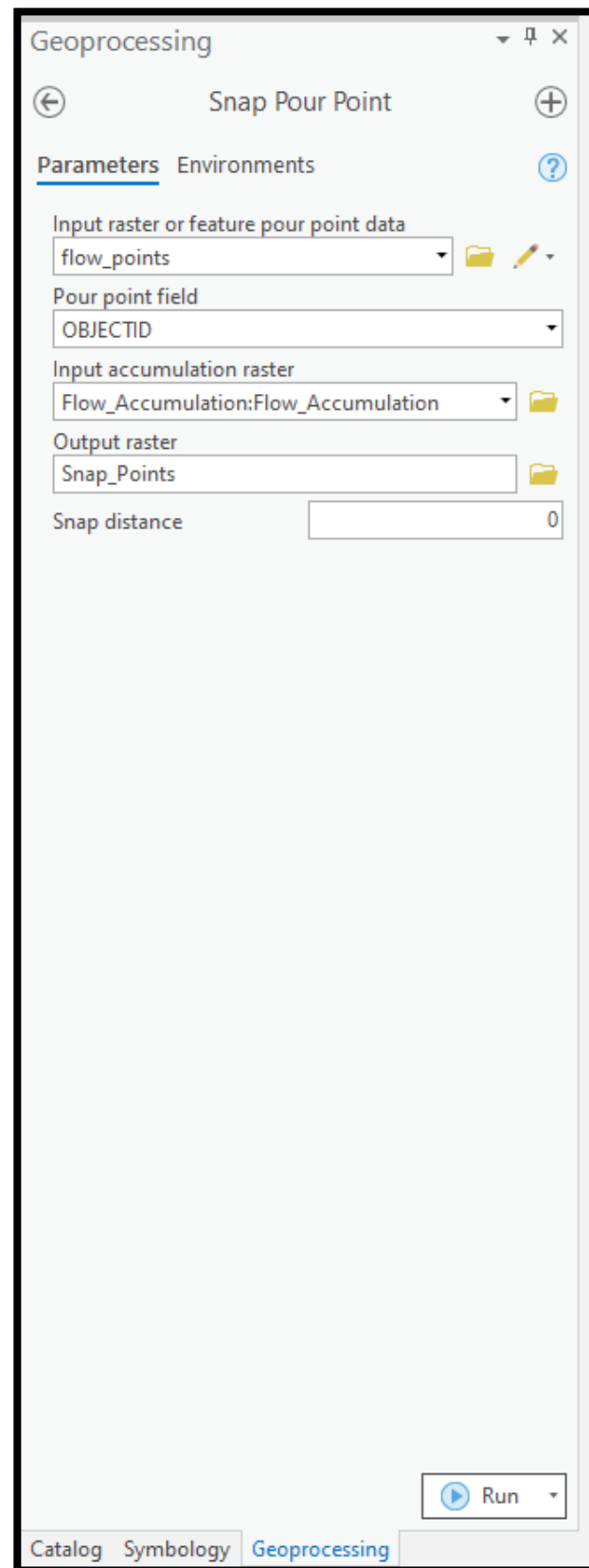


Manually add start of the streams as a point feature to create watersheds. To detect the start points we should zoom-in to accumulation raster



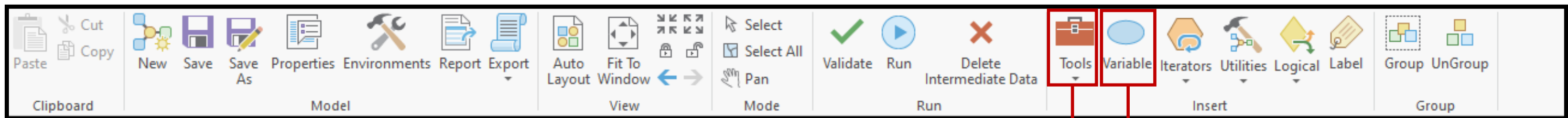
# Watersheds

Add created points into accumulation raster as raster cells

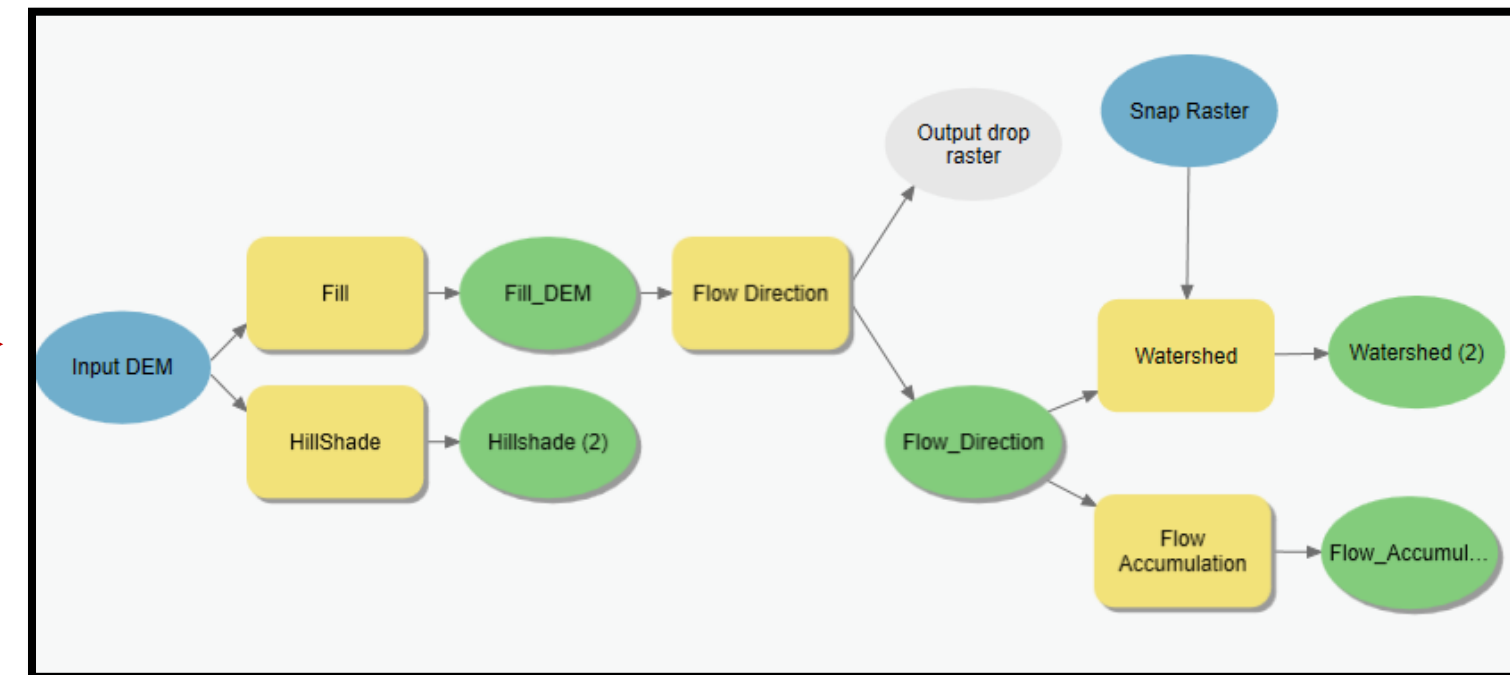
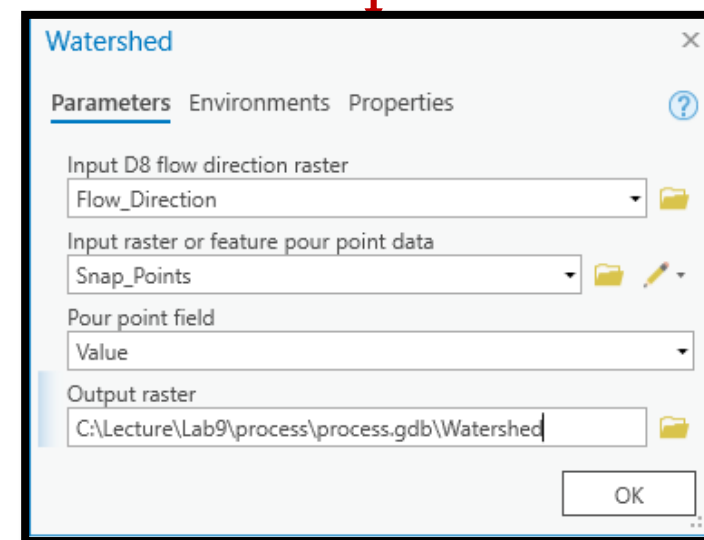
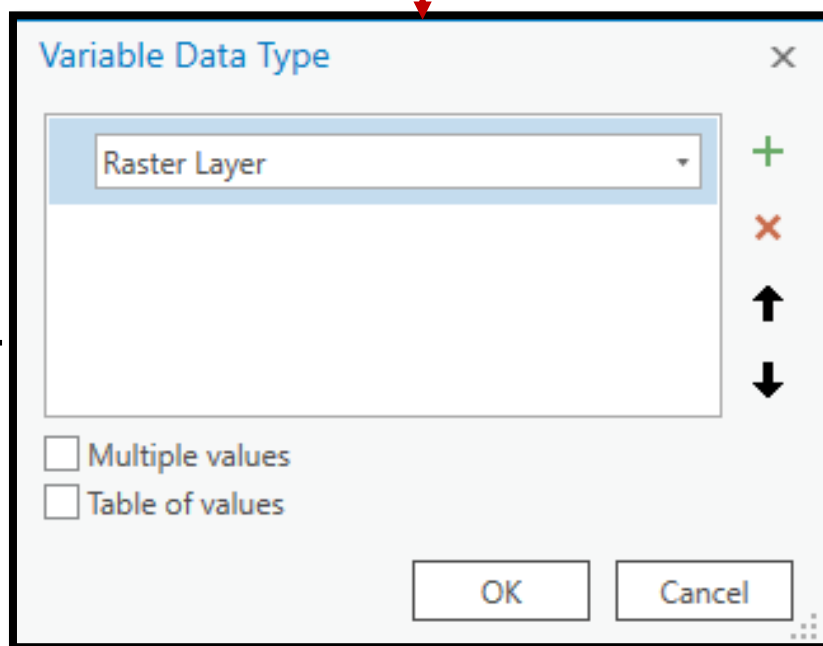




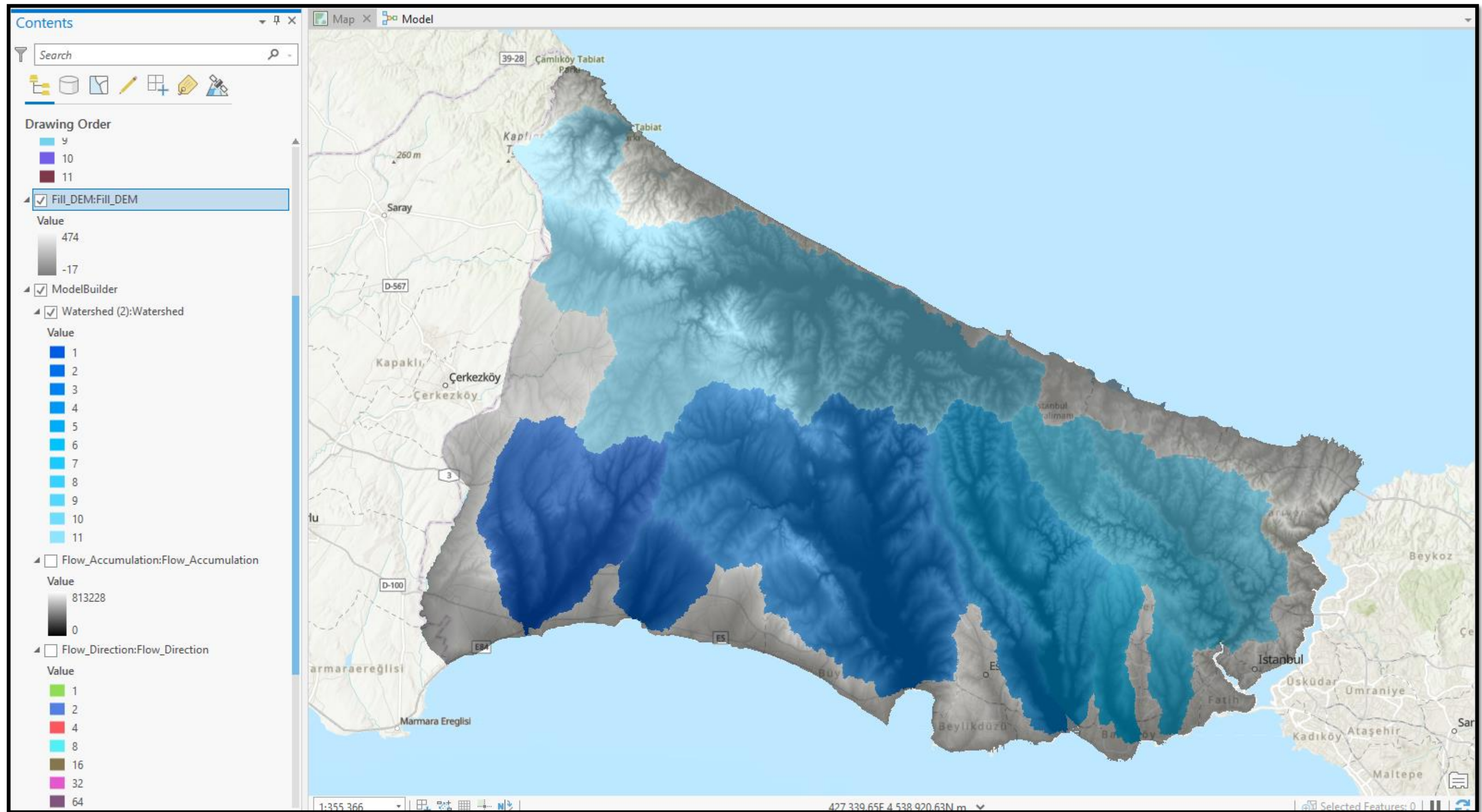
# Watersheds



Create a raster input  
for Snap Raster

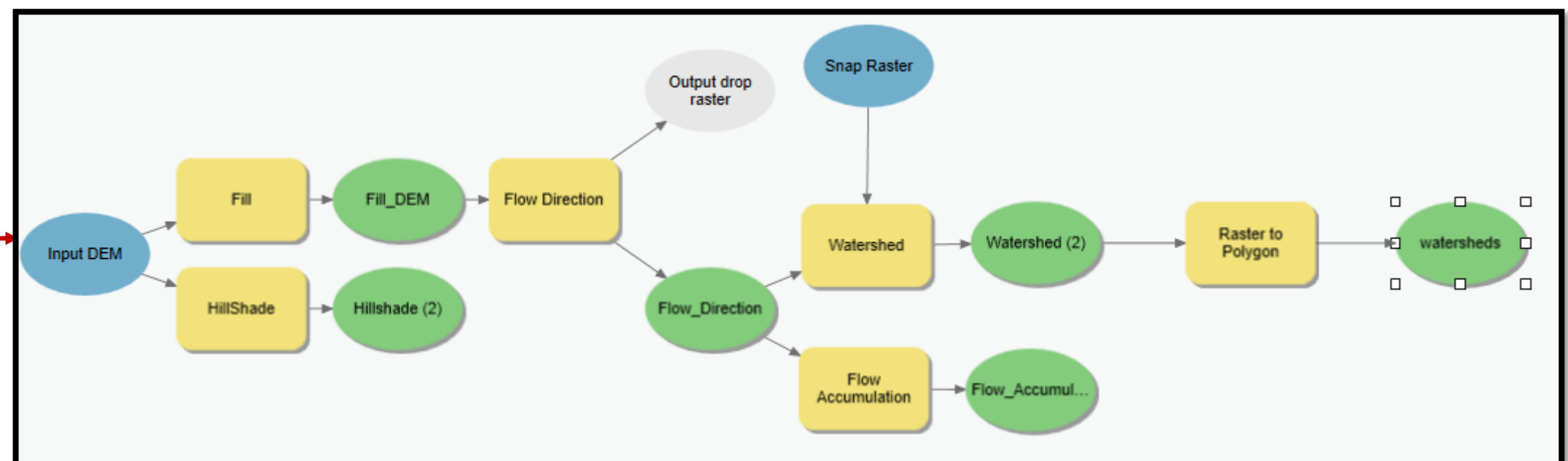
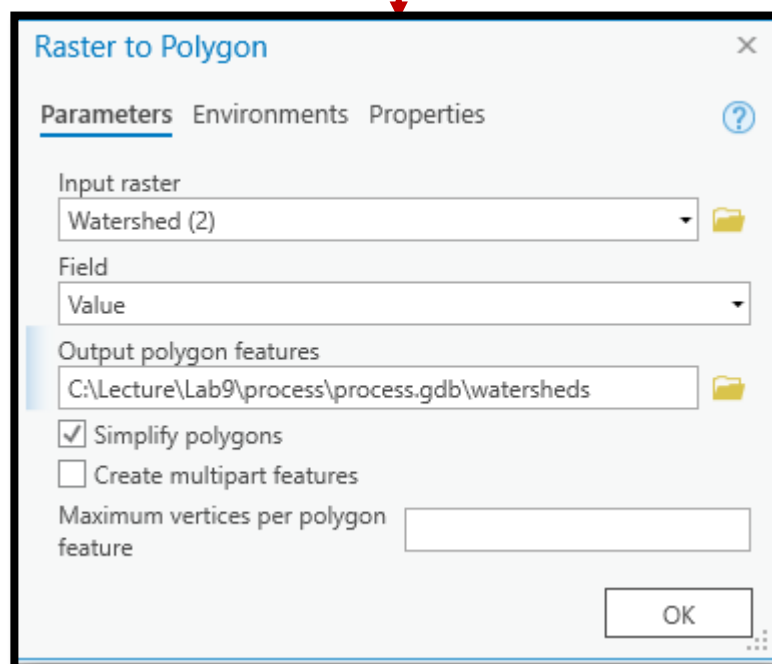
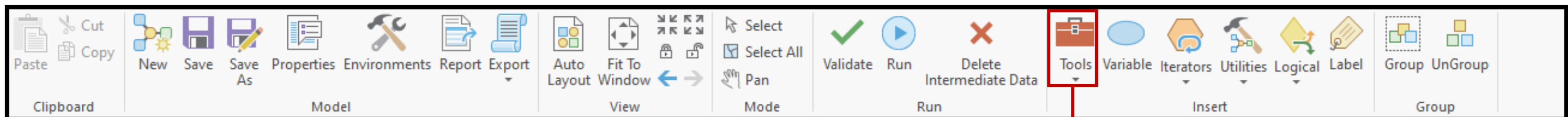


# Watershed Results





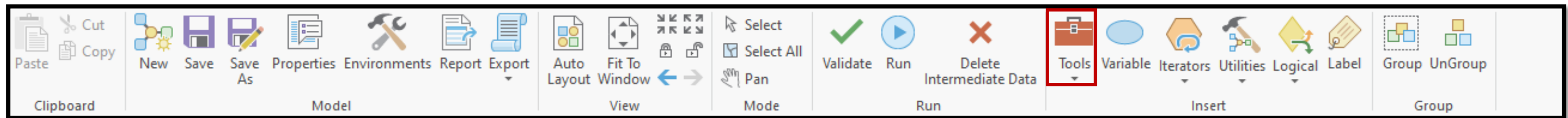
# Export Watersheds



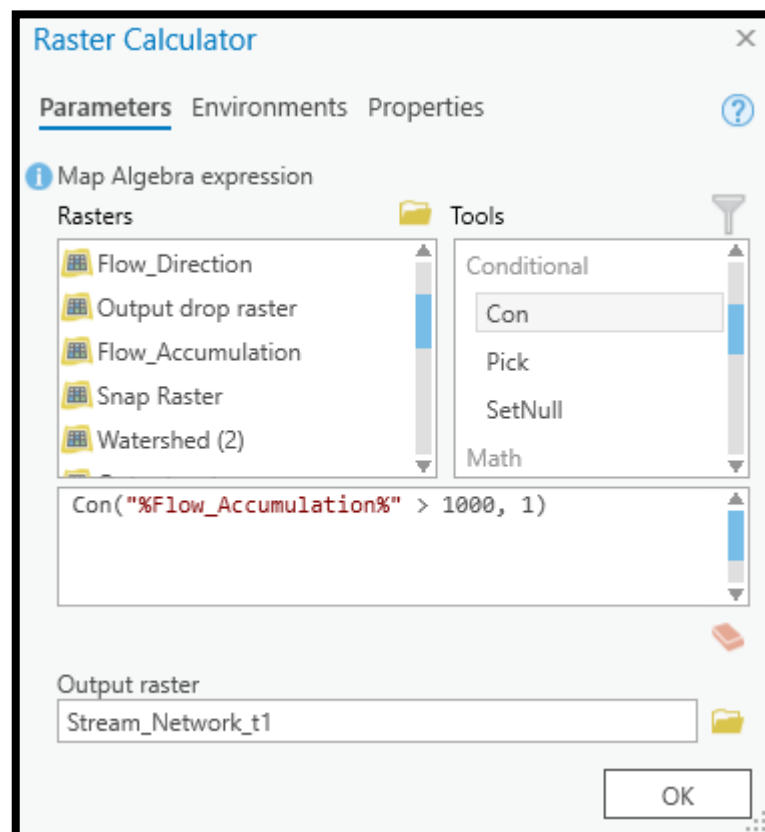
# Stream Networks

Apply a threshold value to generate stream networks from flow accumulation raster.

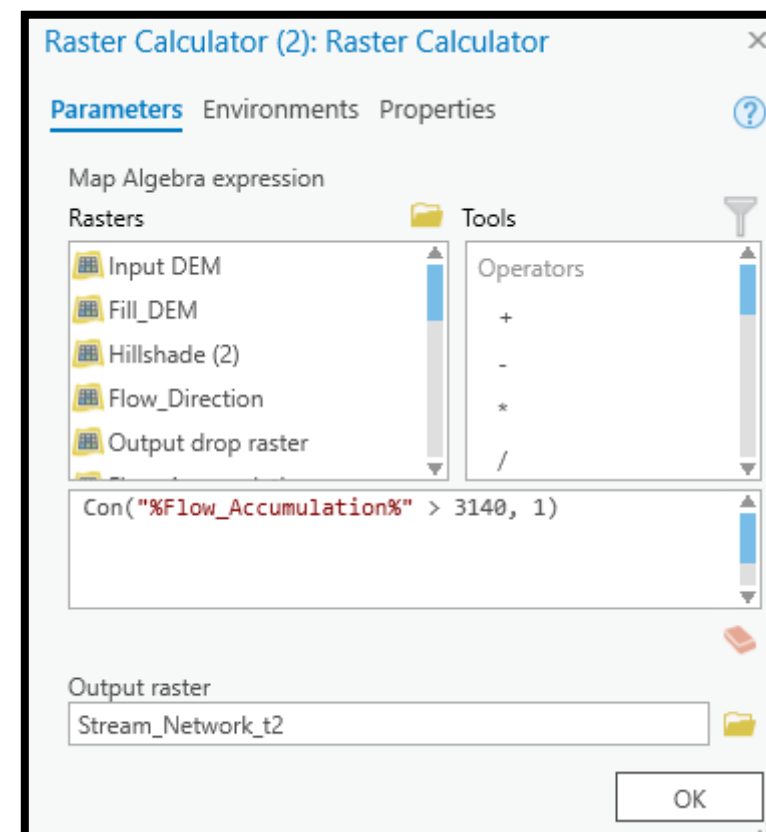
- Geometric intervals could be used to find appropriate threshold value
- Also determined by the scale and scope of the project



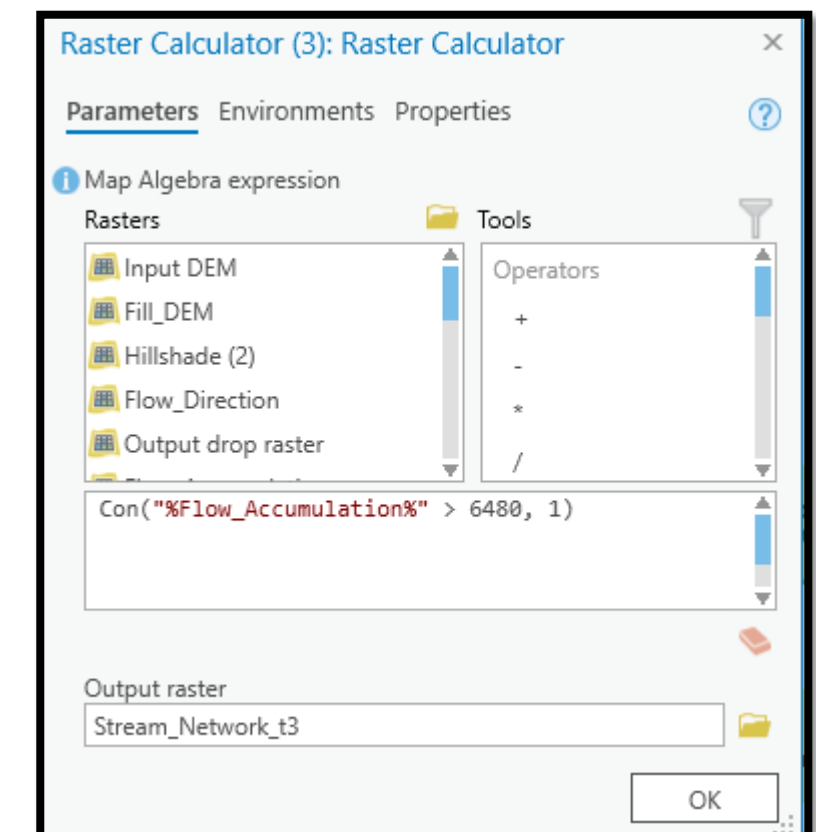
*Threshold 1: 1000*



*Threshold 2: 3140*



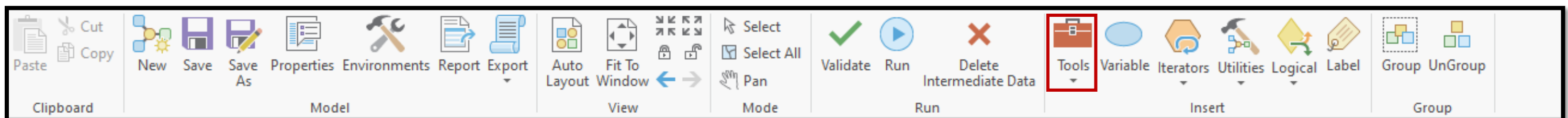
*Threshold 3: 6480*



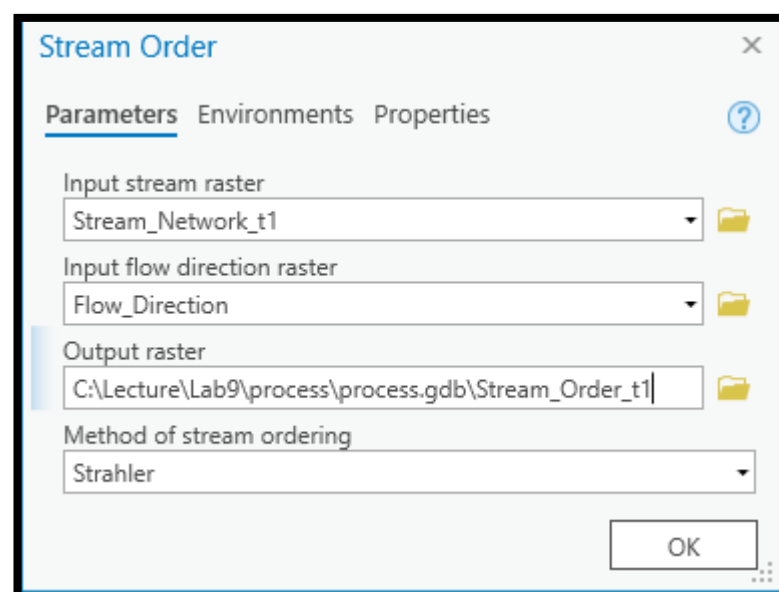


# Stream Order

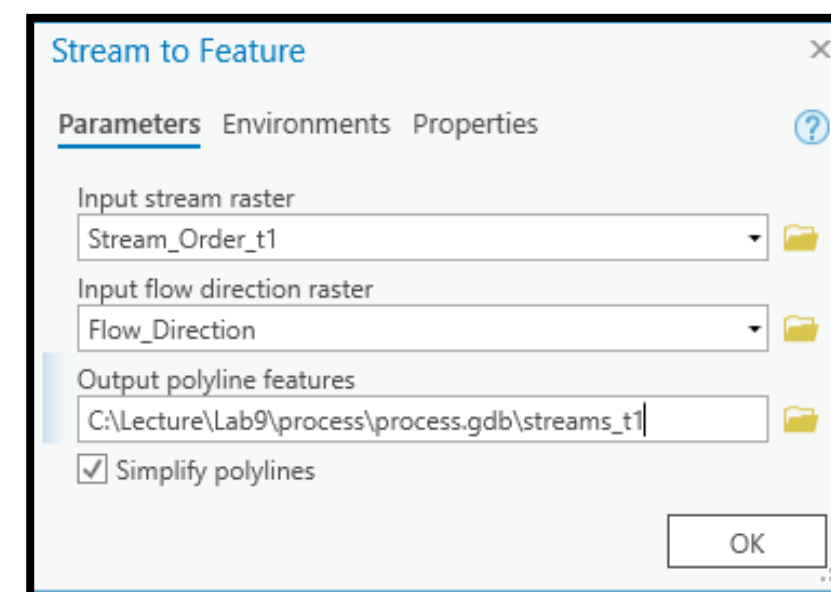
By using stream networks and flow direction, order of the streams will be generated for each threshold value. Then, we'll convert stream order rasters to polyline to better interpret the results.



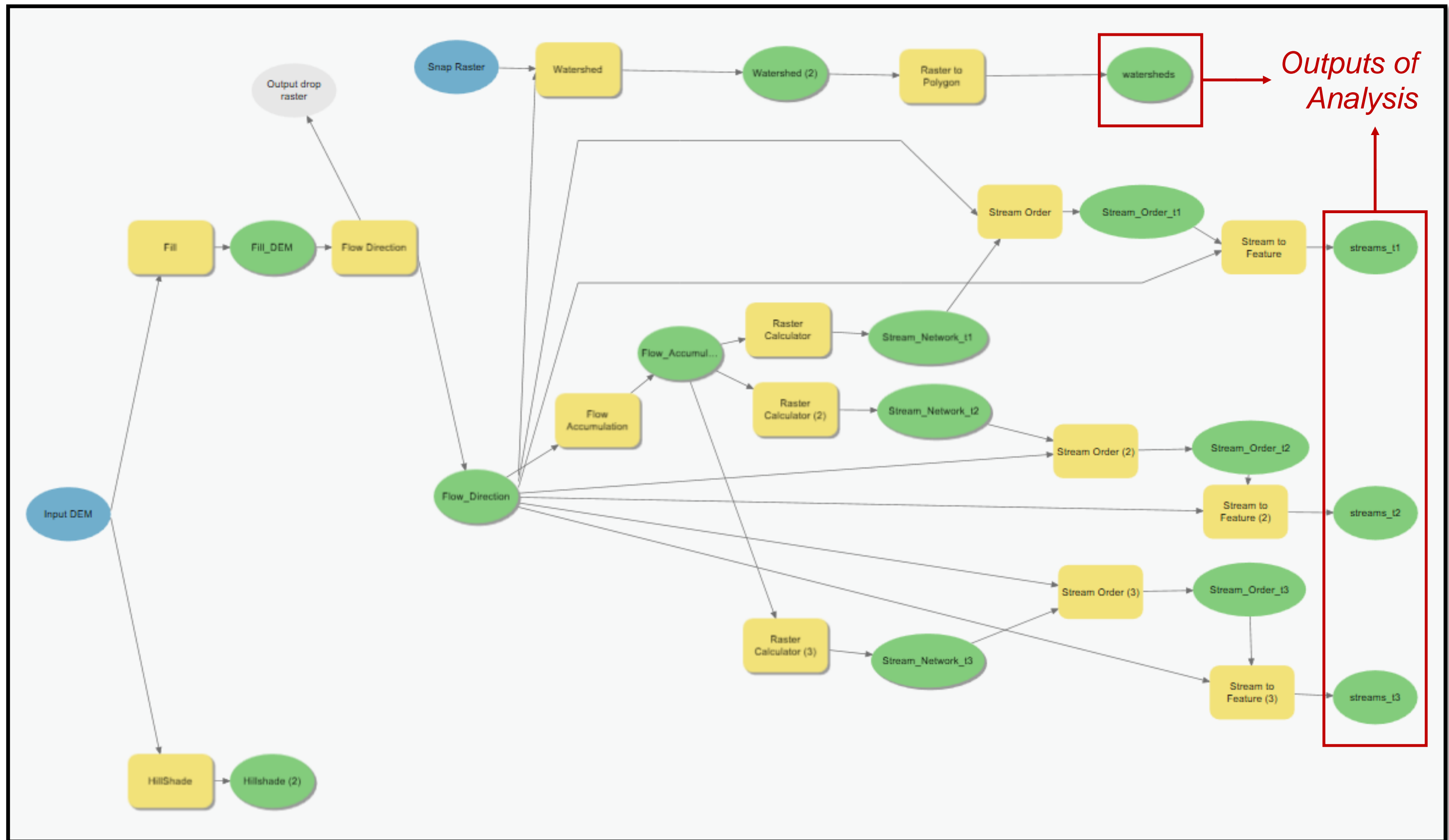
*Use Stream order for each threshold*



*Use Stream to Feature for each threshold*



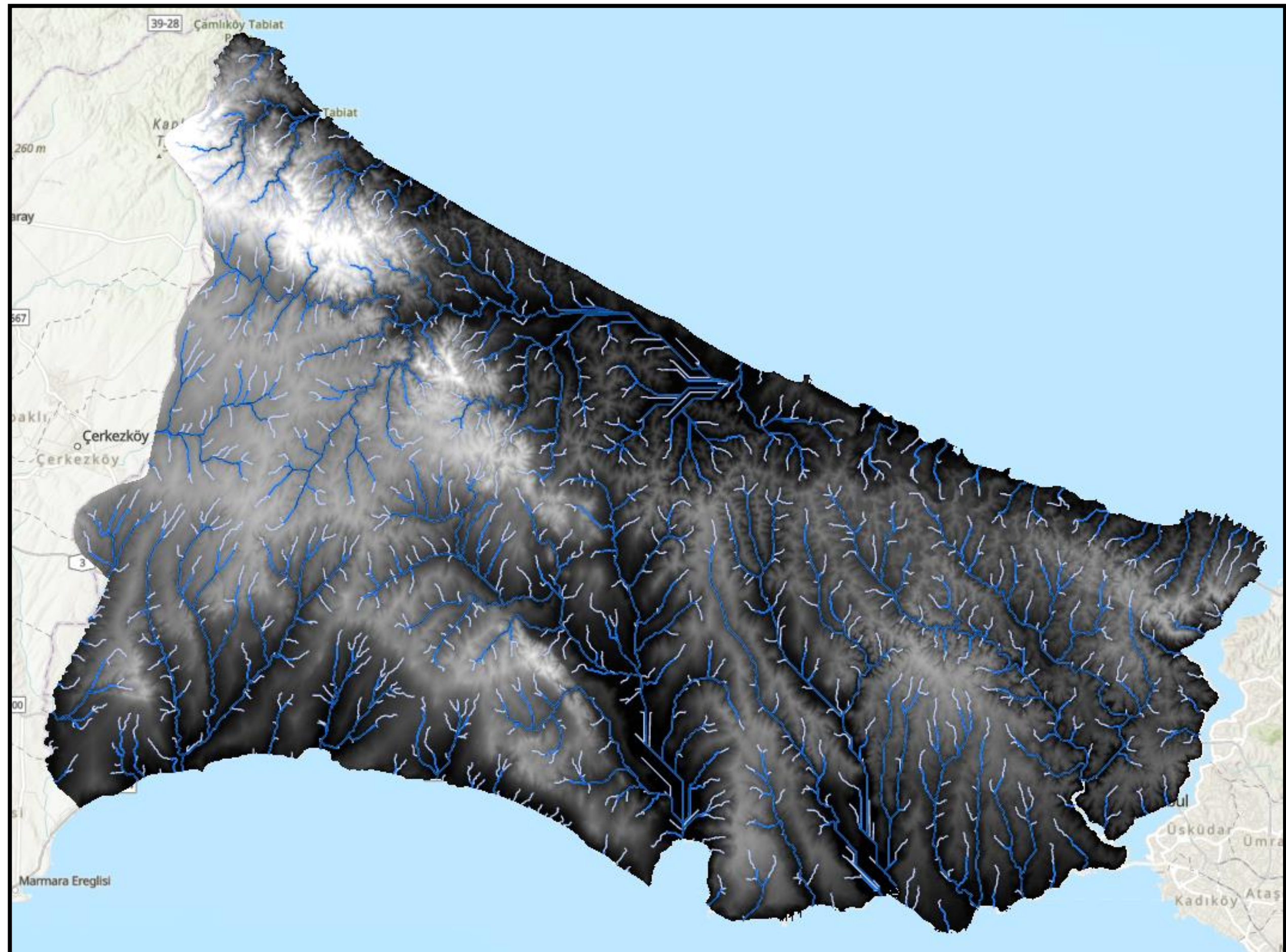
# Hydrology Model





# Results of Analysis

- ▲ ☒ Streams\_T3
- ▲ ☒ Streams\_T2
- ▲ ☒ Streams\_T1





# Classify Stream Order

Symbology - Streams\_T3

Primary symbology

Graduated Symbols

Field: **grid\_code**

Normalization: <None>

Method: Natural Breaks (Jenks)

Classes: 4

Minimum size: 0.5 pt

Maximum size: 2 pt

Template: —

Classes Histogram

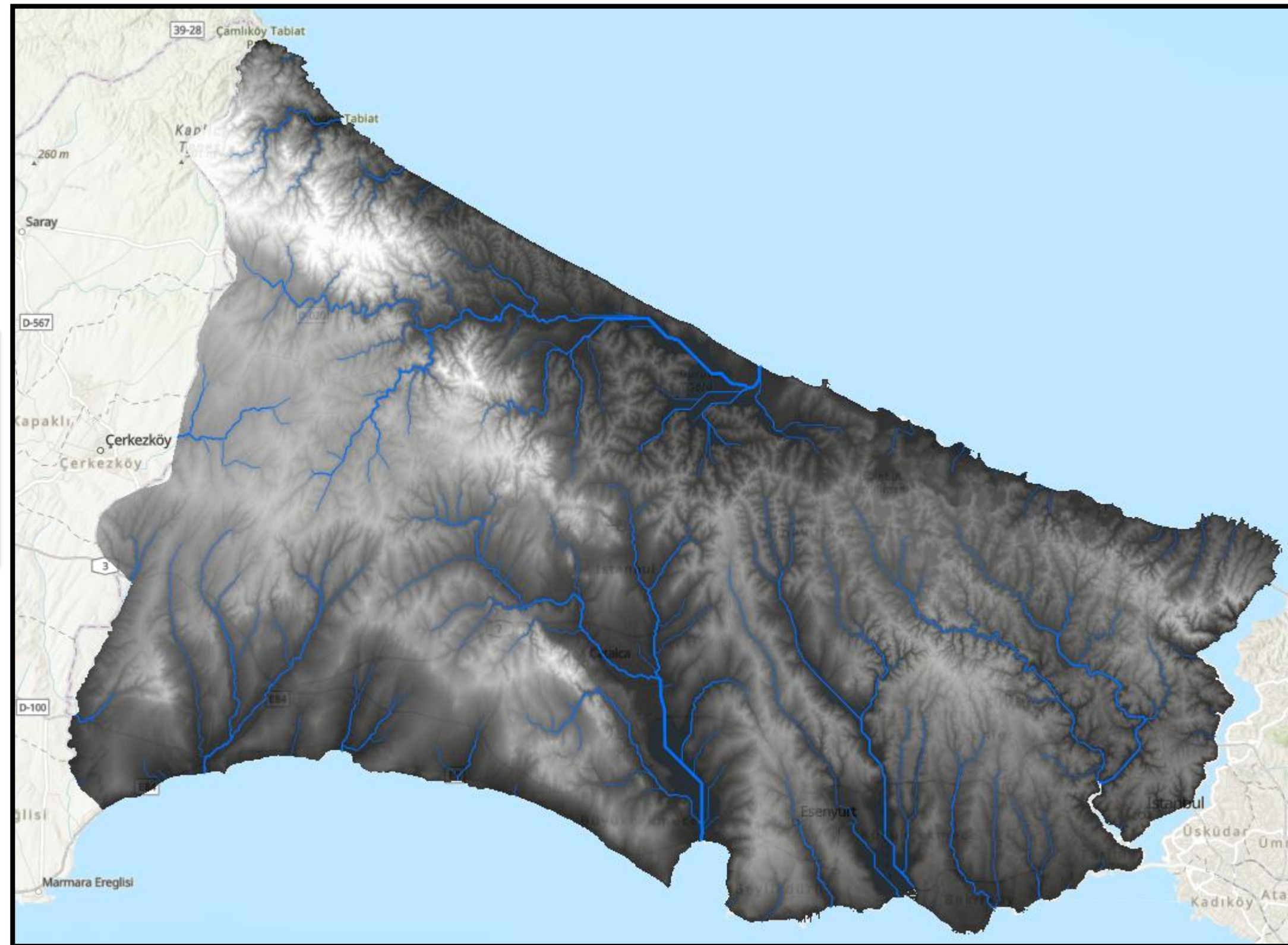
Symbol	Upper value	Label
—	≤ 1	1
—	≤ 2	2
—	≤ 3	3
—	≤ 4	4

Catalog Symbology Geoprocessing

Streams\_T3

grid\_code

- 1
- 2
- 3
- 4





# Results



## *Aim of the Study:*

- *Find watersheds and stream networks in the European Side of Istanbul*

## *Output Data:*

- *Watersheds (Vector-Polygon)*
- *Stream Networks for 3 different threshold value (Raster)*
- *Stream Orders for 3 different threshold value (Vector-Polyline)*



*Contact:*

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