GIS Assignment III
Hydrological modeling of Achern

Aim of the Assignment: To develop the Hydrological modeling of Achern by using the tools of "Spatial Analyst" of ArcGIS based on digital terrain models.

Description of the Steps:

1. **Identifying the Flow direction:** Firstly, in order to know the Water Flow direction the ArcToolbox is used as "ArcToolbox > Spatial Analyst > Hydrology > Flow Direction". The Fig 1 below describes the water flow direction of Achern.

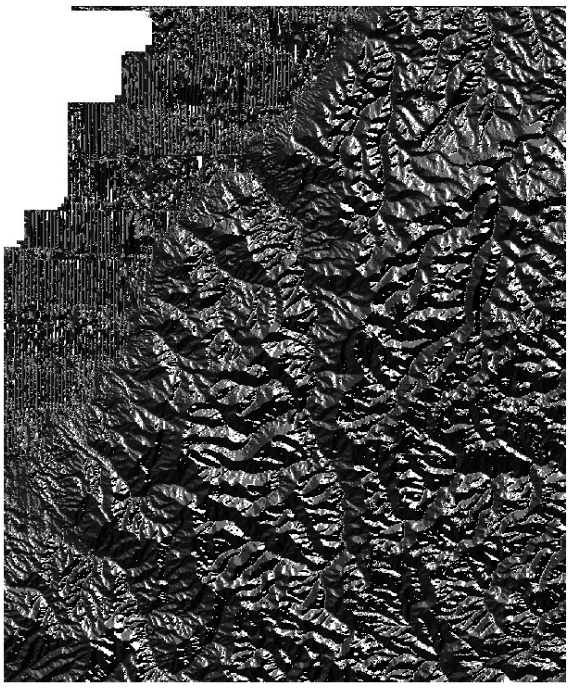


Fig 1. Water Flow direction of Achern

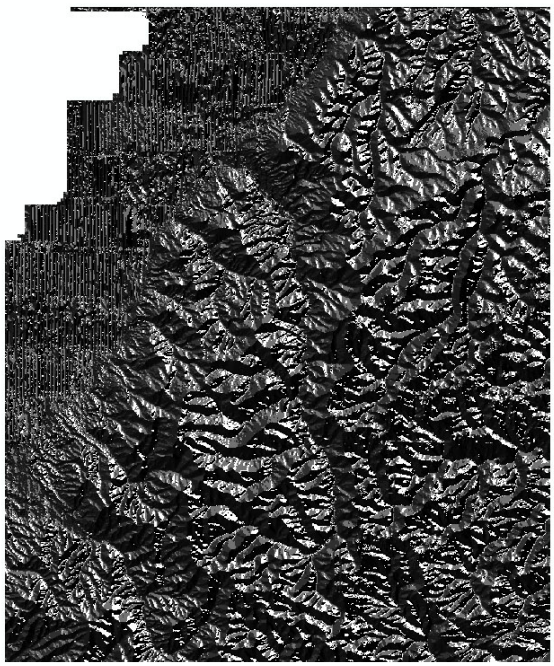


Fig 2. Sink positions of the DEM of Achern

2. **Finding the Sink positions:** Finding the sink positions of the DEM, which identify the errors of the terraria with irregular holes. In order to measure that the steps of "ArcToolbox > Spatial Analyst > Hydrology > Sink" were performed. The Fig 2 shows the sink positions of the DEM.
3. **Filling the Sink Positions:** Filling the sink positions are used to minimize the errors of the terrain with irregular holes. In order to measure that the steps of "ArcToolbox > Spatial Analyst > Hydrology > Fill" were performed. The Fig 3 shows the Filling positions of the DEM.
4. **Defining Flow Accumulation:** The next step is to flow of accumulation of the water bodies by using the raster data. In order to measure that the steps of "ArcToolbox > Spatial Analyst > Hydrology > Flow Accumulation" were performed. The Fig 4 shows the flow of accumulation of the water bodies of the DEM.

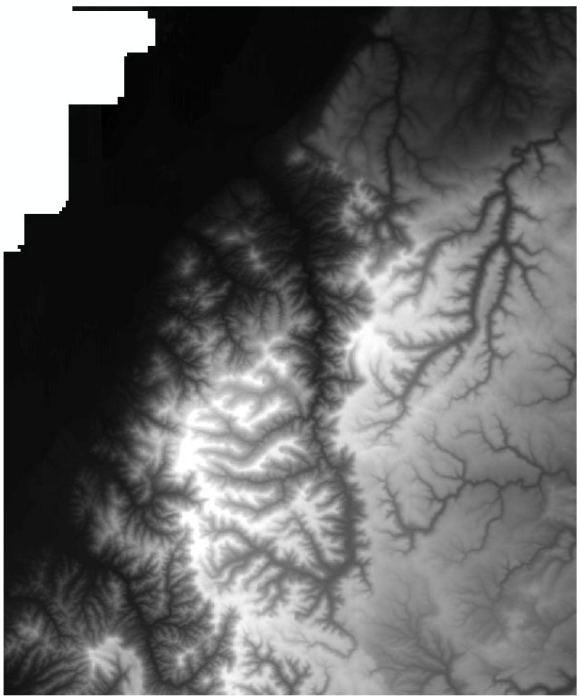


Fig 3. Sink positions of the DEM of Achern

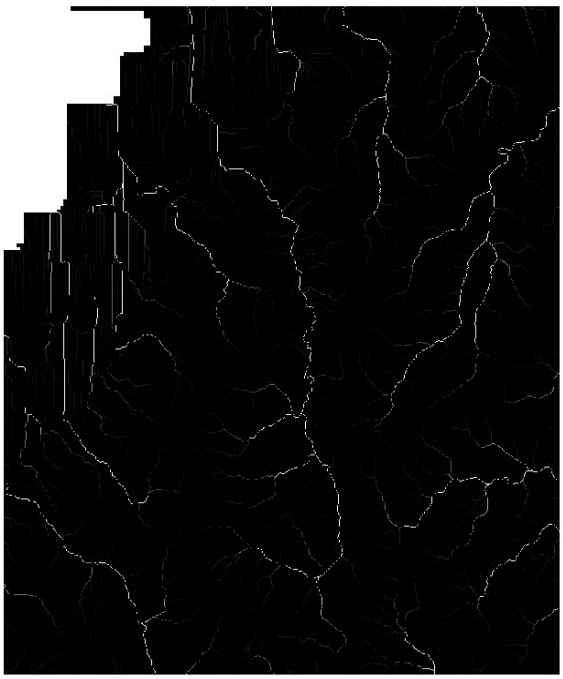


Fig 4. flow of accumulation of the water bodies

5. **Importing pour points:** Importing the XY coordinates from the coordinates table and adding them into the flow accumulation of the water bodies. The Fig 5 shows the pour points importing of the water bodies. A snap distance of 150 m was performed through "ArcToolbox > Spatial Analyst > Hydrology > Snap Pour Point". Fig 6 shows the Snapping of 150 m of the pour points.

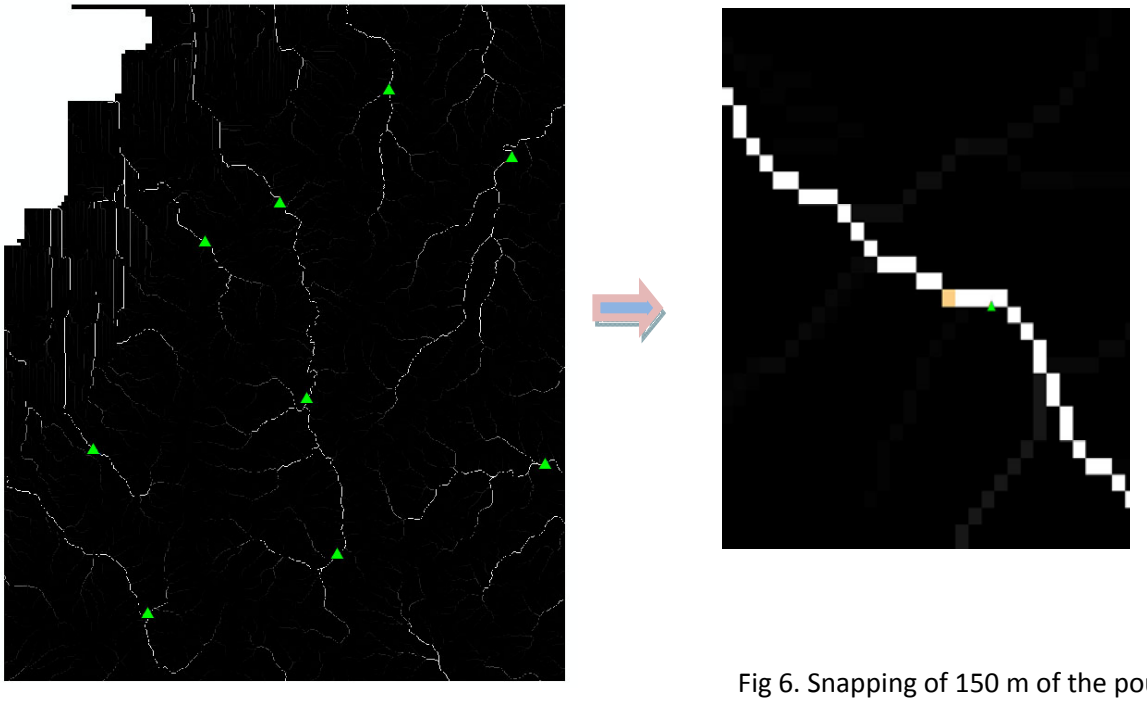


Fig 5. Importing pour points in the flow accumulation

Fig 6. Snapping of 150 m of the pour points

6. **Watershed on Pour points:** the next step is to generate the watershed based on coordinates. The step was performed through "ArcToolbox > Spatial Analyst > Hydrology > Watershed". Fig 7 shows the watershed generation through the pour points.

7. **Derivation of conditional value:** Figure 8 shows the classified value of the flow accumulation raster dataset which describes the generalization of the streams with a classification of the symbology (using standard deviation value based on "value > 3352"). The result is a raster visualization of less stream pixels.

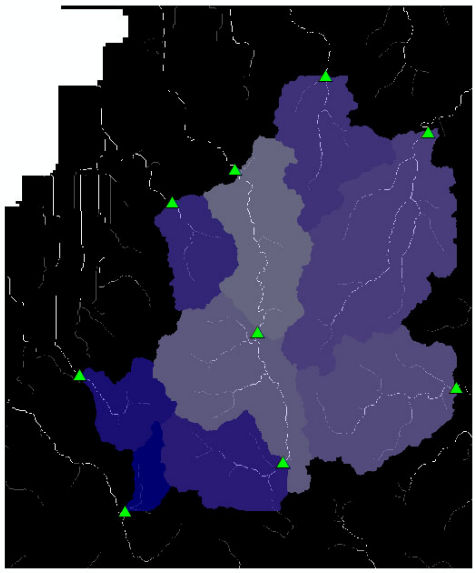


Fig 7. Watershed generation through the pour

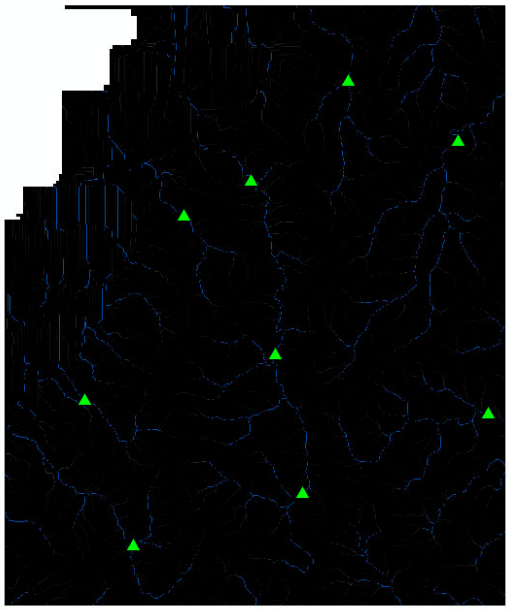


Fig 8. Watershed generation through the pour

8. **Deriving the stream network:** The step was performed through "ArcToolbox > Spatial Analyst > Hydrology > Stream to Feature". It shows the vectorization of the generalized raster dataset. The result is a vector stream work.

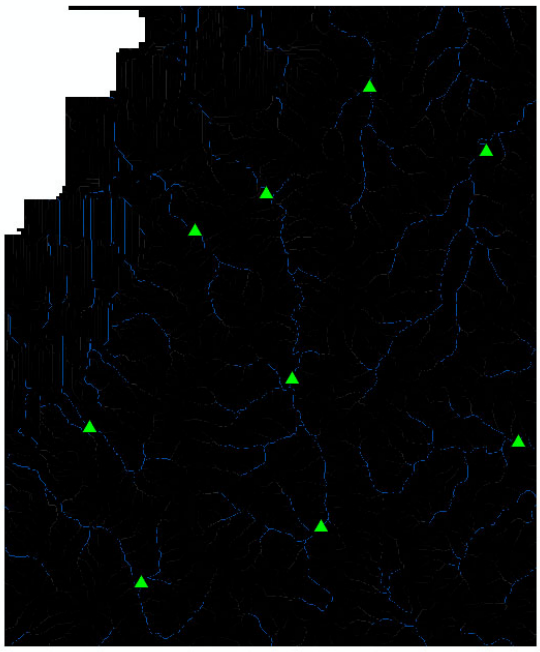


Fig 9. derivated stream network (Raster)

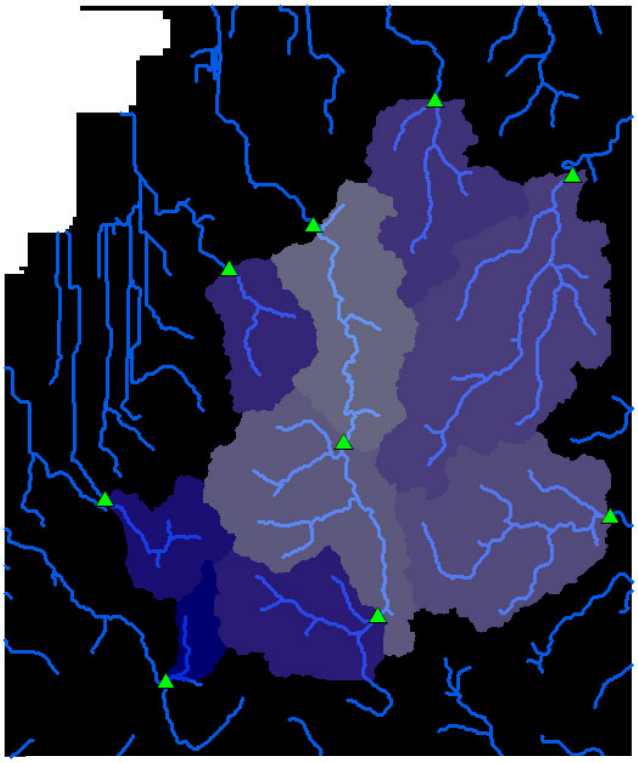


Fig 10. Derivating into the vector network

9. **Harmonizing the Resolution:** The next step is to harmonize the resolution of the data sets of landuse and rain. In order to perform that "ArcToolbox > Raster > Raster processing > Resampling", was selected. As the resolution of DEM is 50*50, so with the output cell size was selected as 50 also for the landuse and rain, the use of nearest neighborhood method of interpolation was also used. Fig 11 represents the resampling of landuse and Fig 12 shows the resampling of Rain.

10. **Combination:** the combination of resampled landsuse and resampled rain with the watershed is done with the "ArcToolbox > Local > Combine". Fig 13 represents the combination.

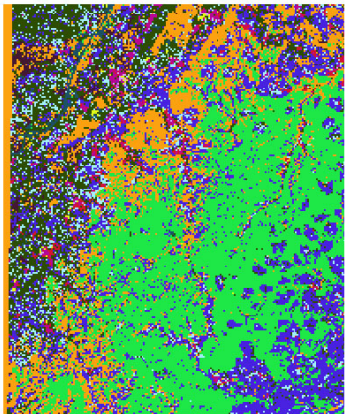


Fig 11. Resampling of Landuse

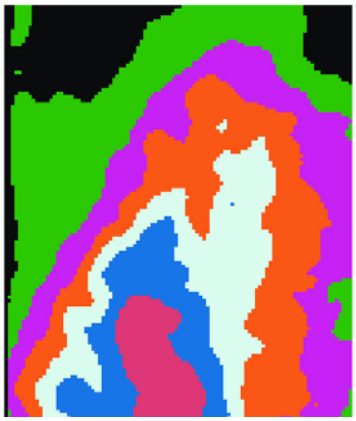


Fig 12. Resampling of Rain

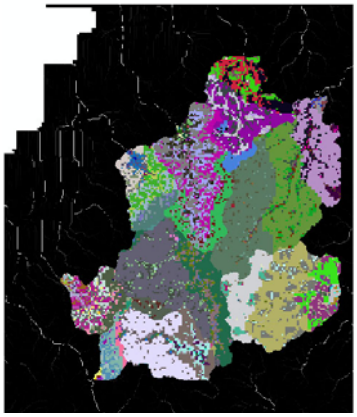


Fig 13. Combination

11. **Joining table:** adding "water storage" column in the "landuse_Resample" attribute table, setting the percentage values to the "water storage" column and inserting the given values of the task.

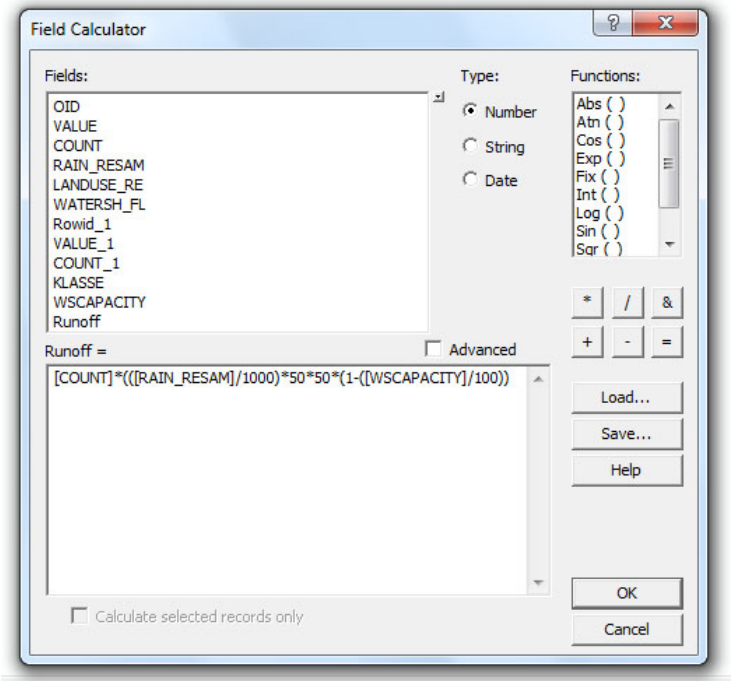
Attributes of landuse_Resample

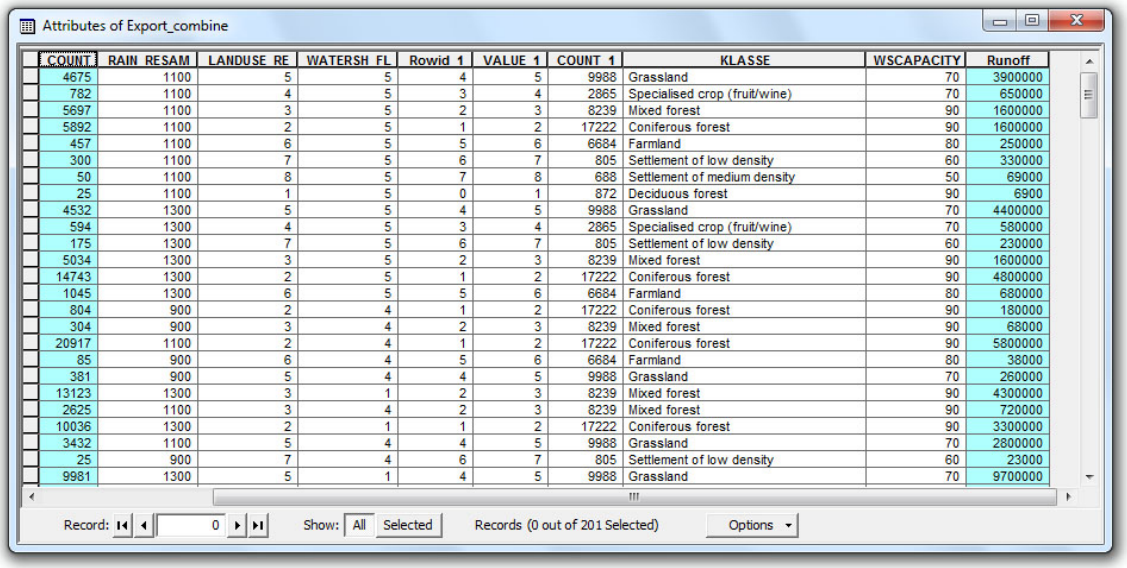
OID	VALUE *	COUNT	KLASSE	Waterstora
0	1	872	Deciduous forest	90
1	2	17222	Coniferous forest	90
2	3	8239	Mixed forest	90
3	4	2865	Specialised crop (fruit/wine)	70
4	5	9988	Grassland	70
5	6	6684	Farmland	80
6	7	805	Settlement of low density	60
7	8	688	Settlement of medium density	50
8	9	73	Settlement of high density	20
9	10	173	Industry / traffic / gravel	0
10	11	391	Water	100

Record: 1 Show: All Selected Records (0

12. **Calculation of run off in the combine table:** The next step is to calculate the runoff from the attribute table of Export combine. So a new column is added as Runoff and calculating the Runoff with the Field Calculator with the following formula.

Runoff= [COUNT]*(([RAIN_RESAM]/1000)*50*50*(1-([WSCAPACITY]/100))





13. **Summarizing**: The final task was to summarize the Runoff of each watershed and visualize them in the following.