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Digital Elevation Models in GIS

By

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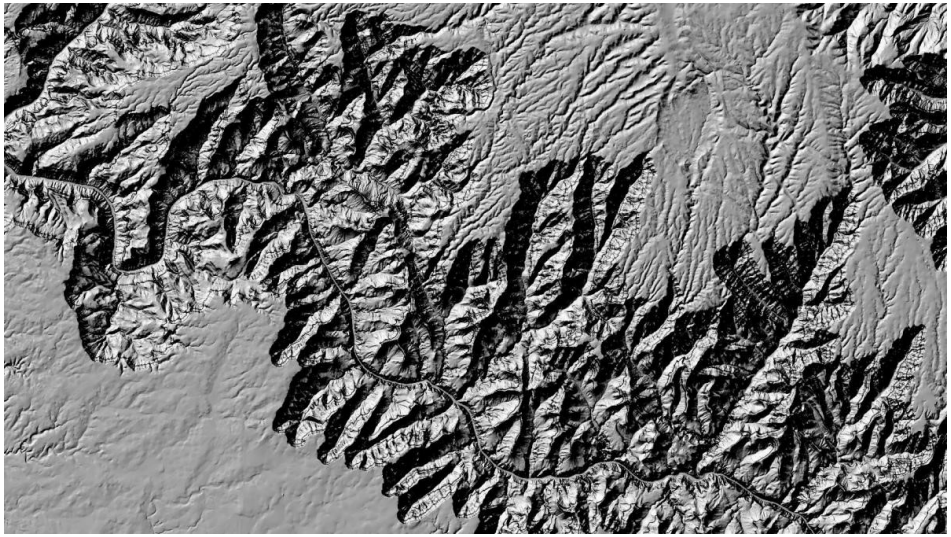
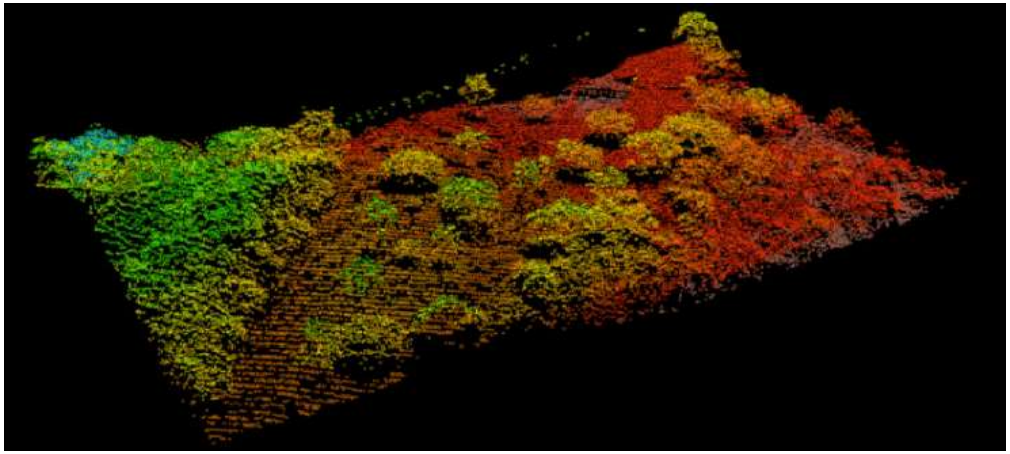
Digital elevation models

- A Digital Elevation Model (DEM) or Digital Terrain Modem (DTM) is a representation of the bare ground (bare earth) topographic surface of the Earth excluding trees, buildings, and any other surface objects.

- A Digital Surface Model (DSM) is an elevation model that captures both the environment's natural and artificial features. It includes e.g., the tops of buildings, trees, powerlines, and any other objects.

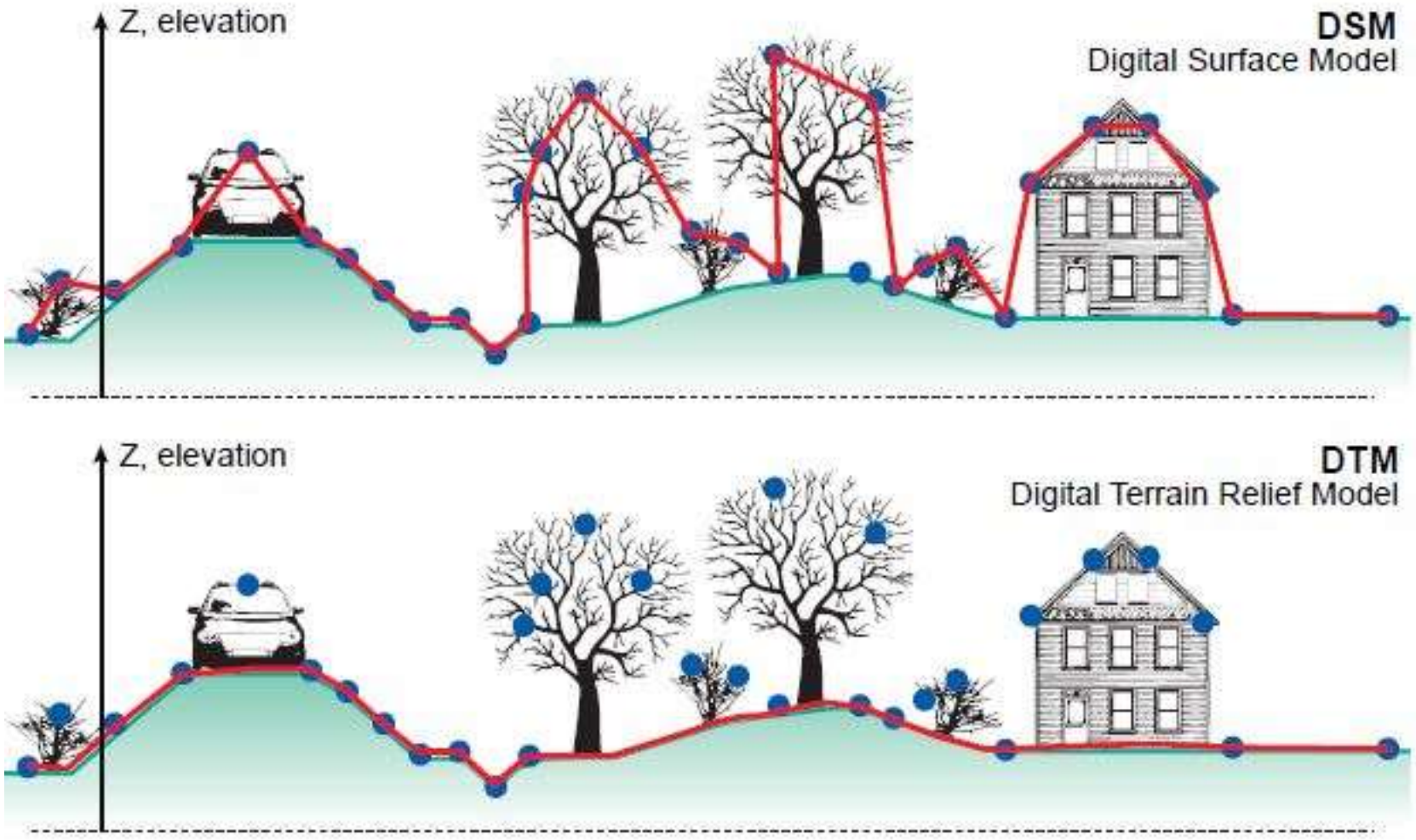


Example of DEM/DTM



Example of DSM

Digital elevation models



The difference between DSM and DTM

Image Source: https://www.cdema.org/virtuallibrary/index.php/charim-hbook/data-management-book/3-base-data-collection/3-2-digital-elevation-models

Digital elevation models

- DEMs can be generated by various field, remote, and laboratory techniques: conventional topographic surveys, kinematic GPS surveys, analogue, radar techniques, laser surveys, and digitizing of contours.

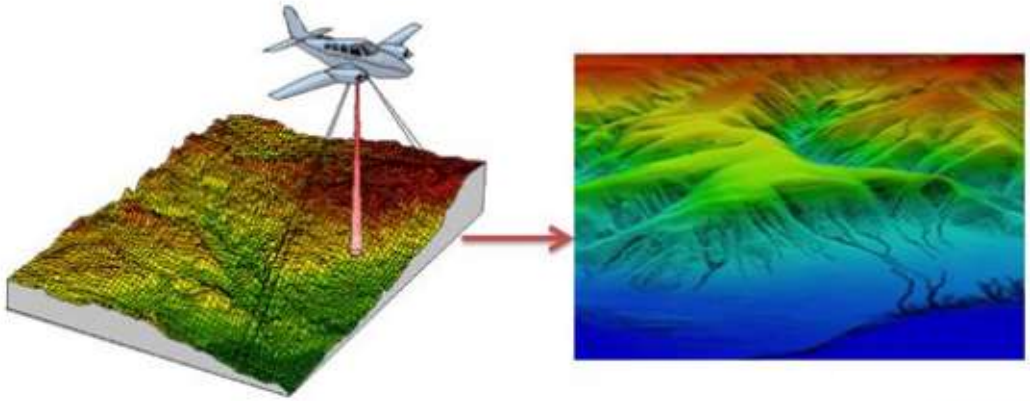


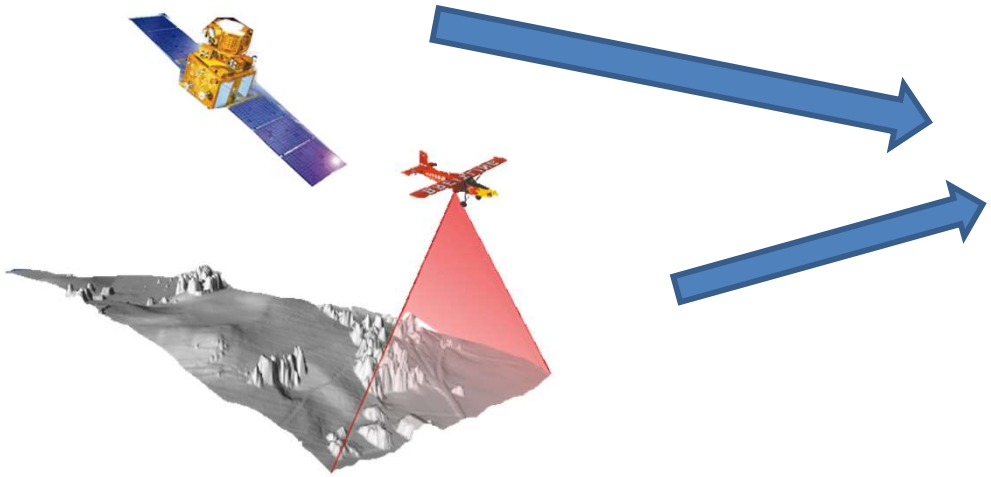
Figure: LiDAR and the DEM

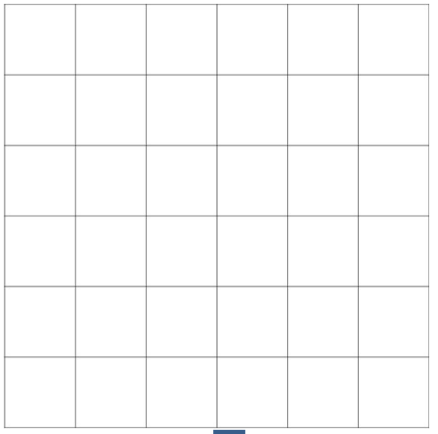
Figure: SPOT 5 Stereo capability and the DEM

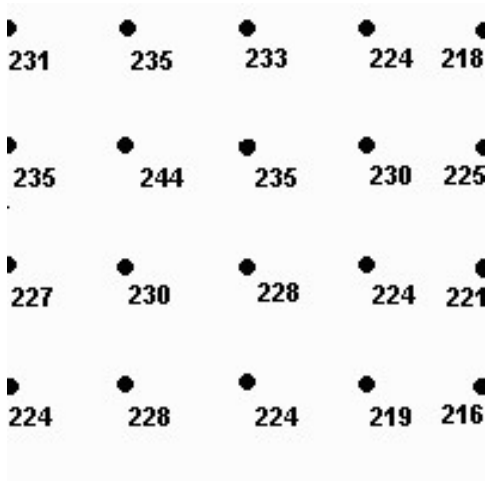
Images Source: https://www.cdema.org/virtuallibrary/index.php/charim-hbook/data-management-book/3-base-data-collection/3-2-digital-elevation-models

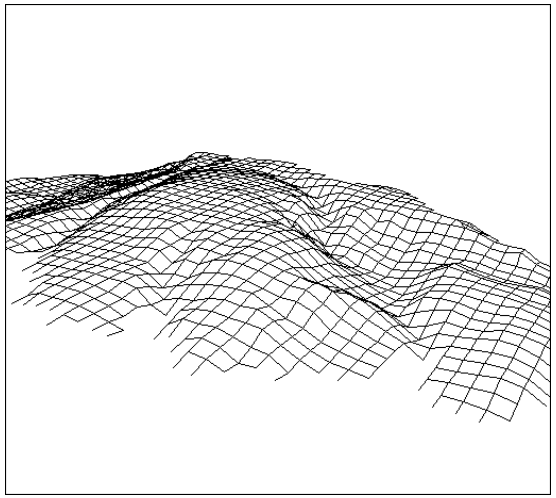
Digital elevation models

DEM: represents to grid formats of the altitude points at specific x,y coordinates and at various resolutions (5m, 30m, 50m, etc.). Each point of the grid (usually the upper left corner of each cell)



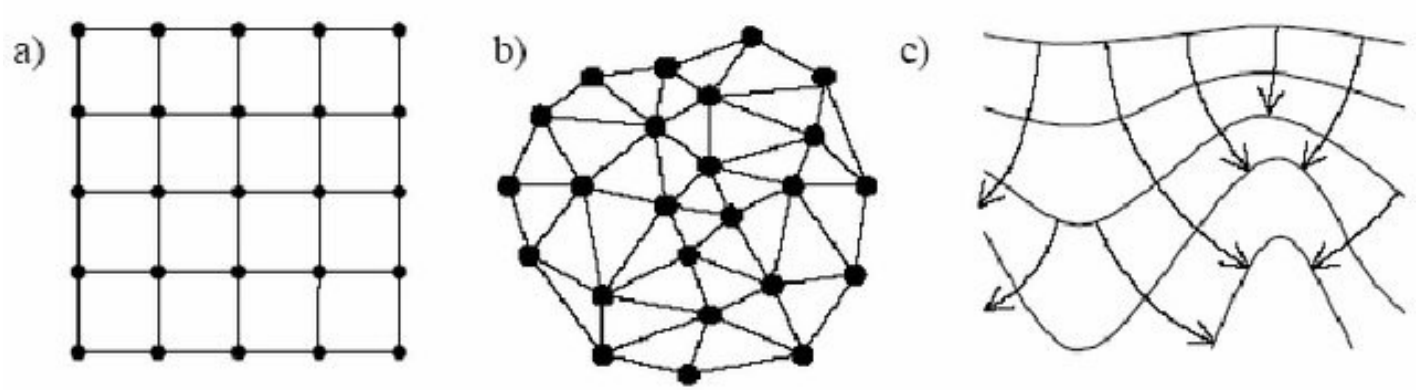






Digital elevation models

The most common type of DEMs:



Typical DEM data structures: a) DEM grid; b)TIN; c) Contours (by Moore et al.,1991).

DEM sources:

- Earth Science Data Systems (ESDS) Program
- EU Copernicus programme

Digital Terrain Models - DTMs
Data availability

http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/Elevation_Products

- Shuttle Radar Topography Mission (SRTM) Research Grade

3 arc second (90 meter)

- Global 30 Arc-Second Elevation Dataset (GTOPO30)

Global 1-km

Geospatial Hydrologic Modeling System GeoHMS

U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC)

- HEC-HMS: Hydrologic Modeling System

http://www.hec.usace.army.mil/software/hec-hms/

- HEC-GeoHMS: Geospatial HMS

http://www.hec.usace.army.mil/software/hec-geohms/index.html

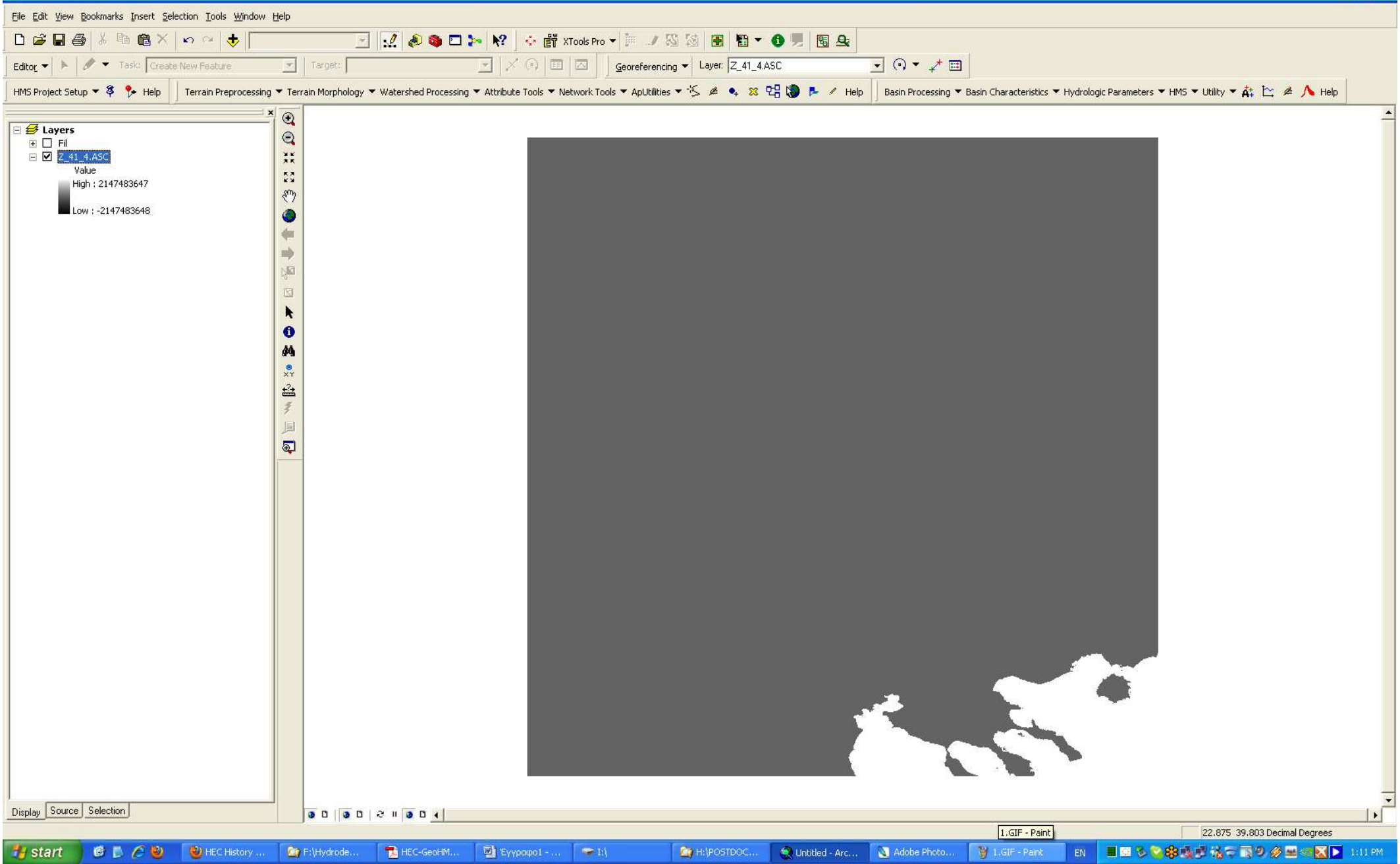
GeoHMS: A cascade of GIS based tools

1. Arc Hydro Tools (ESRI)

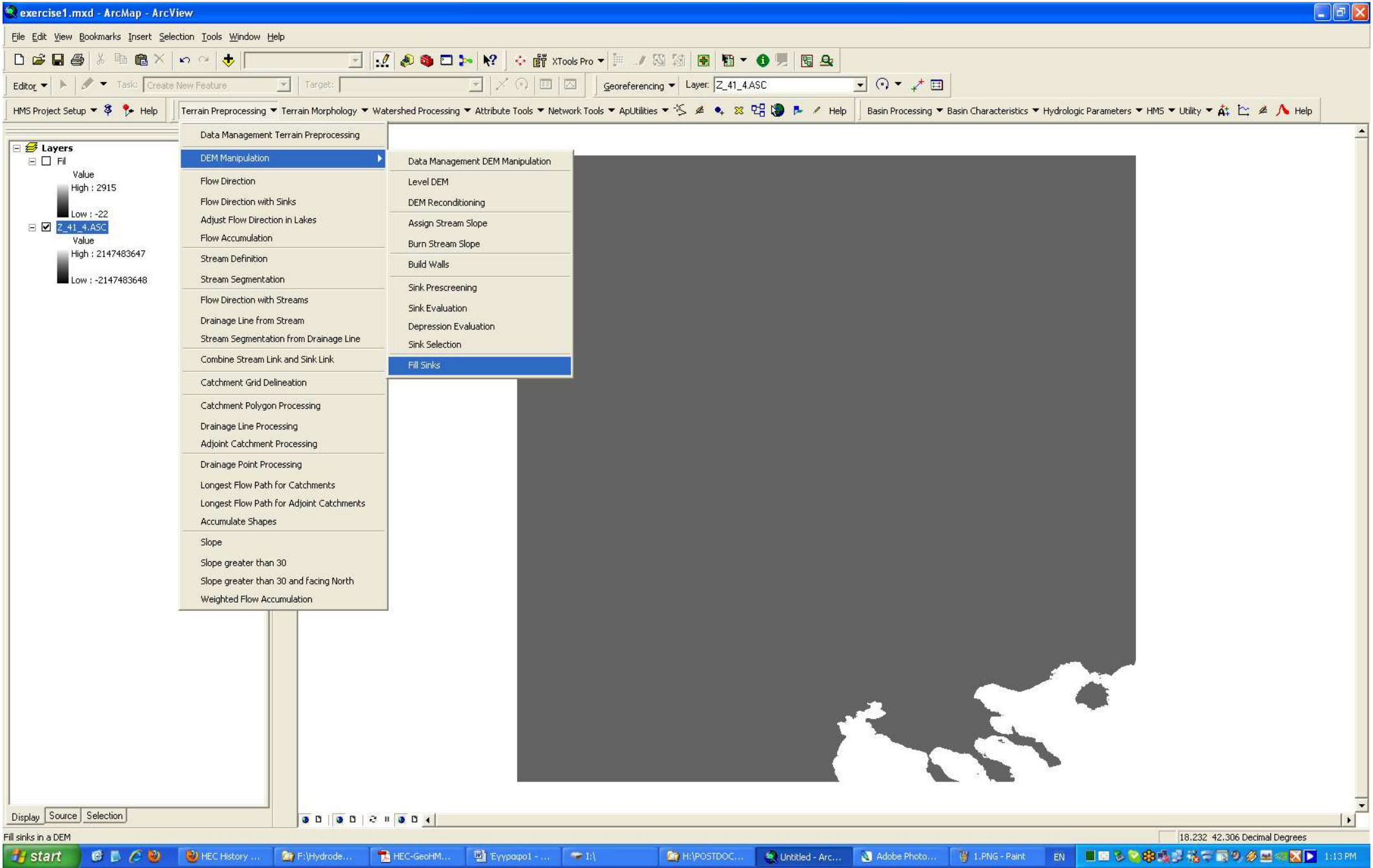
2. HEC-GeoHMS Main View (USAGE)

3. HEC-GeoHMS Project View (USAGE)

DEMs in ArcGIS



DEM: Fill Sinks



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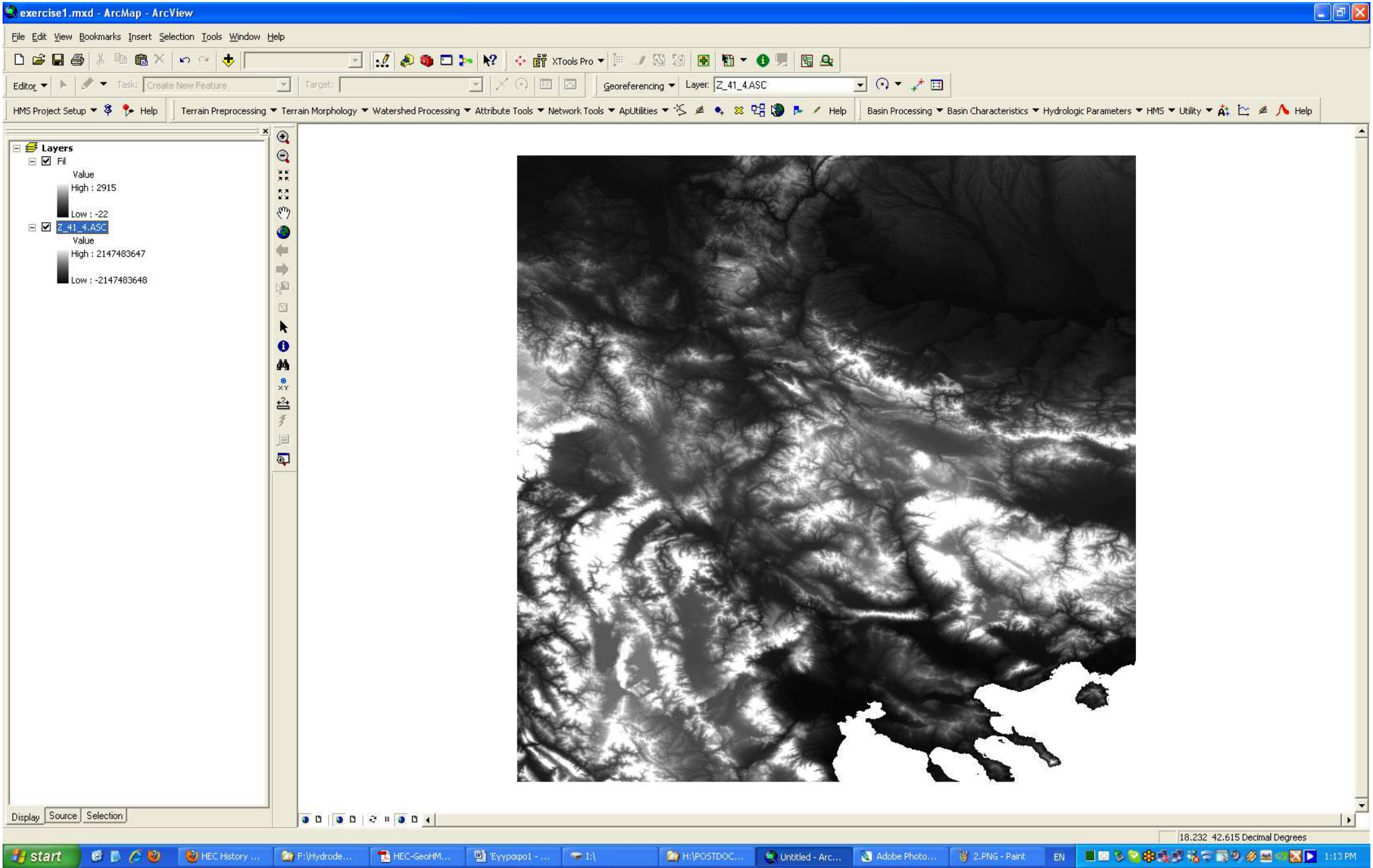
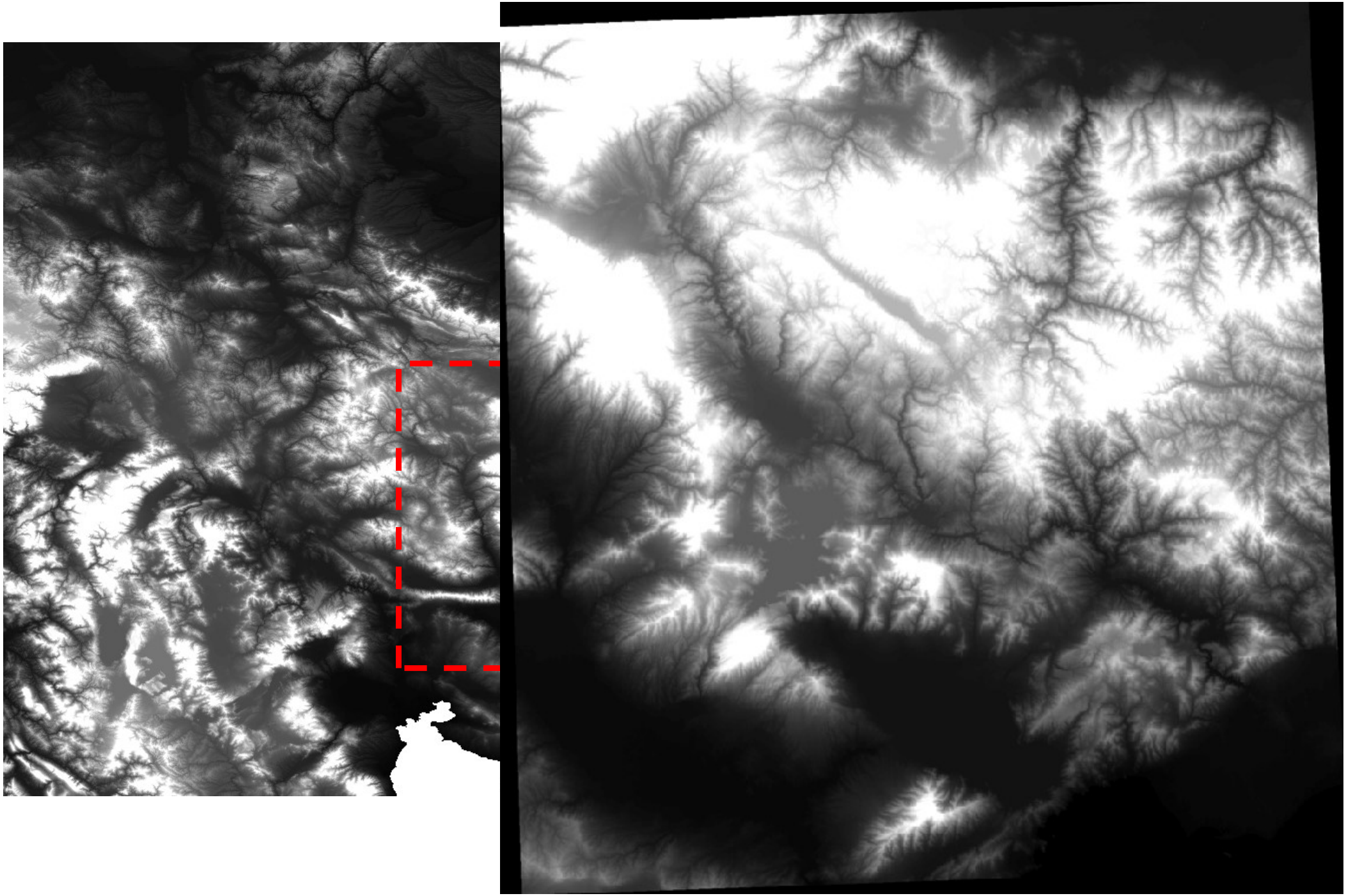


DEM: Focus on a specific area



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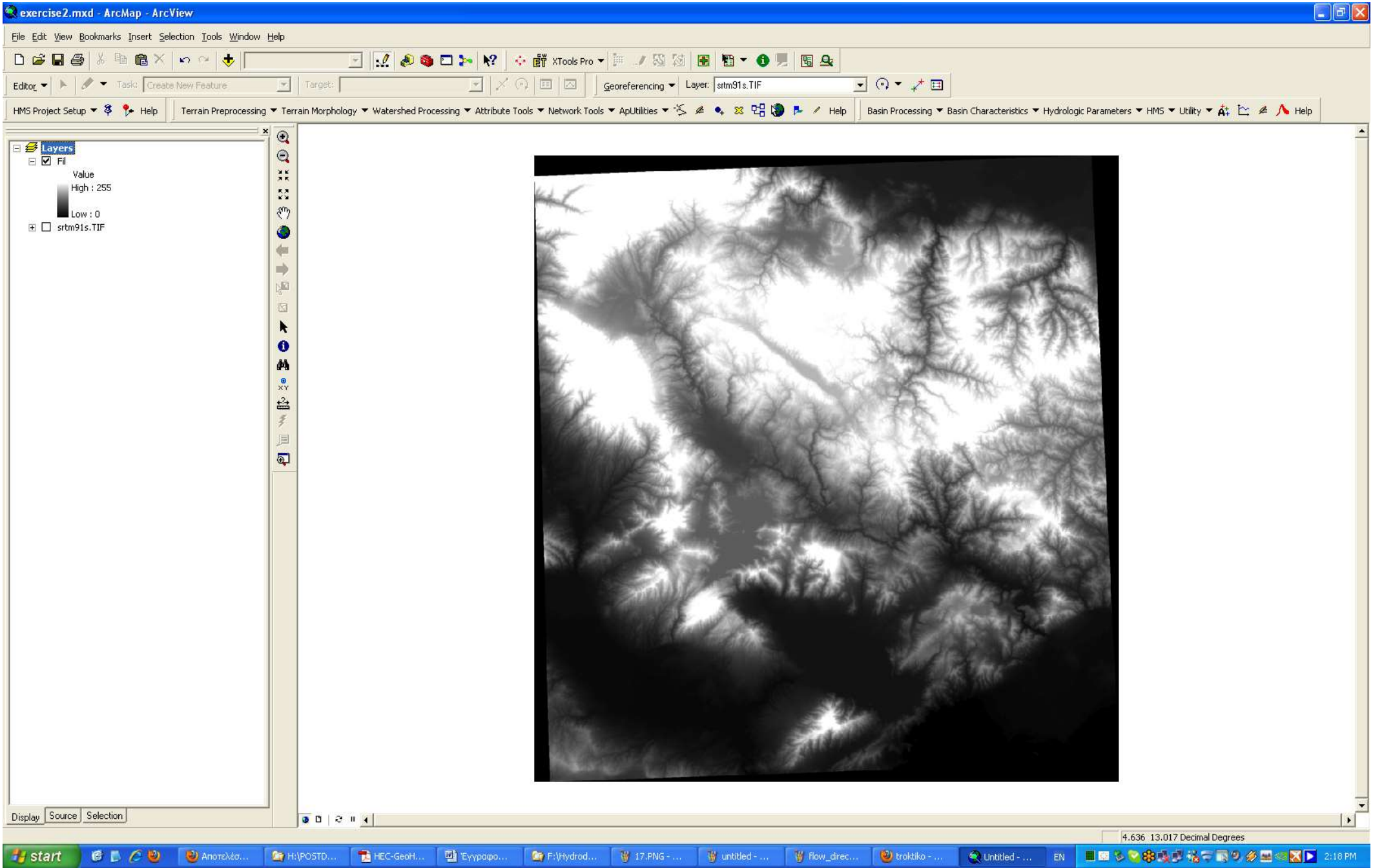
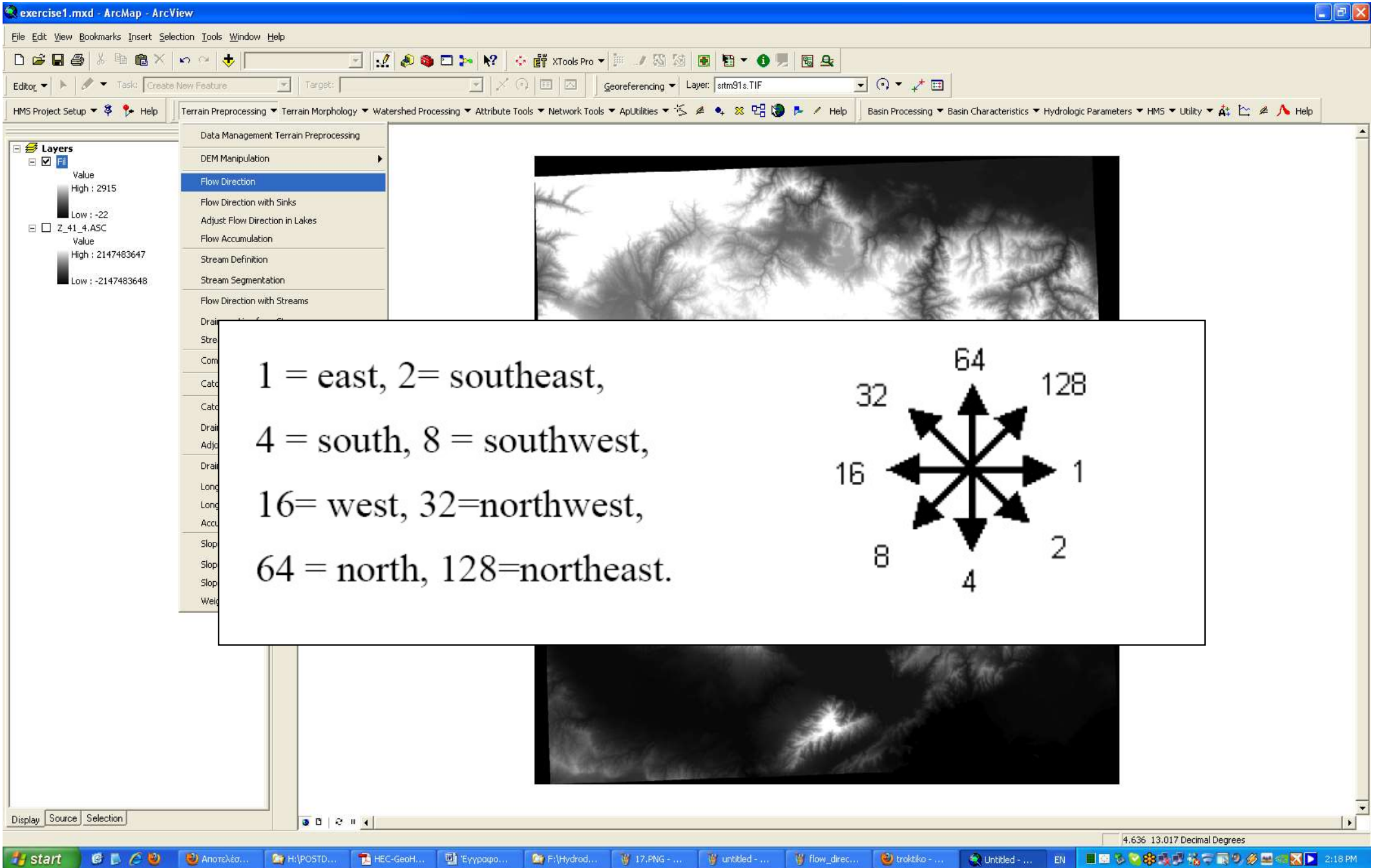
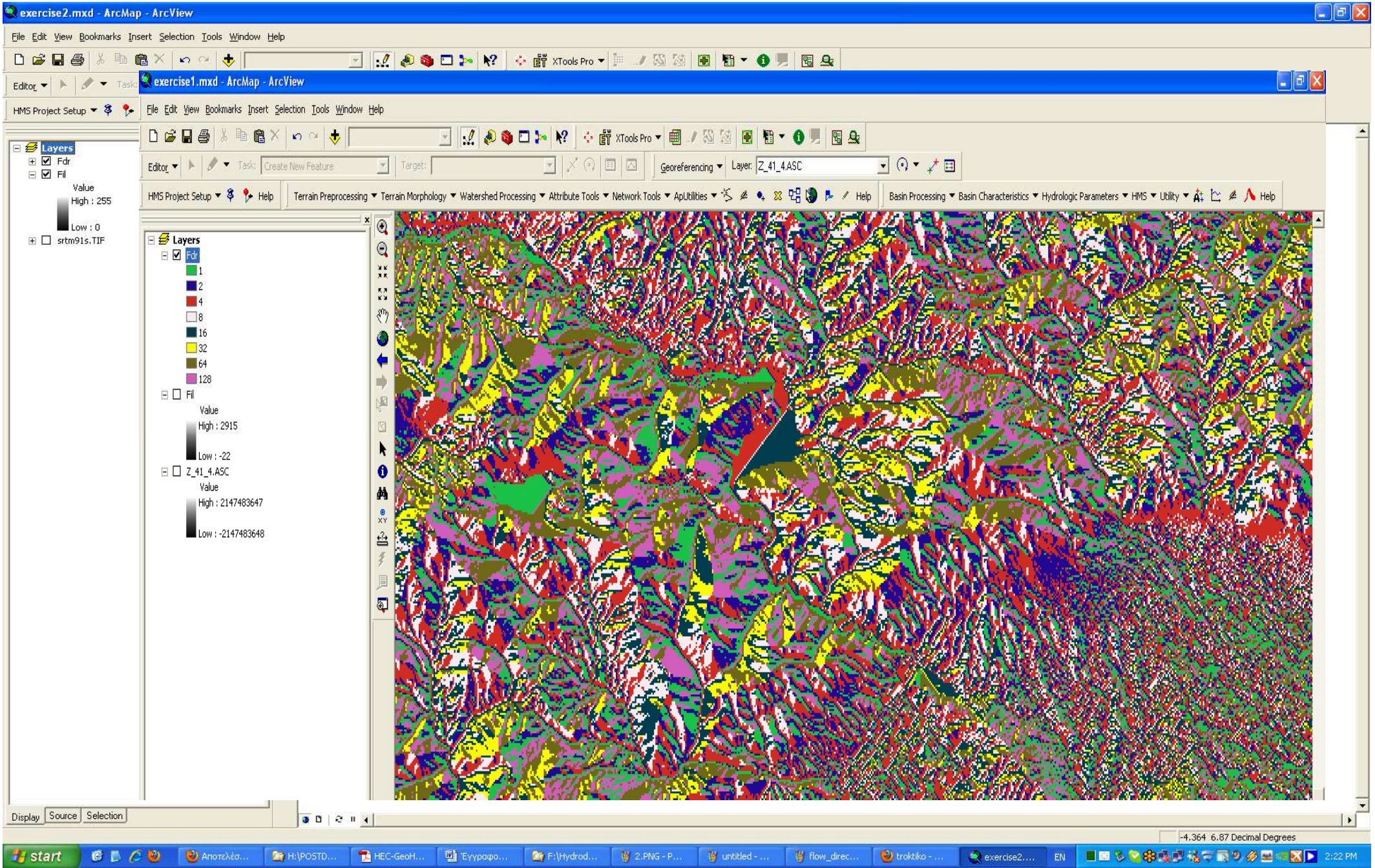


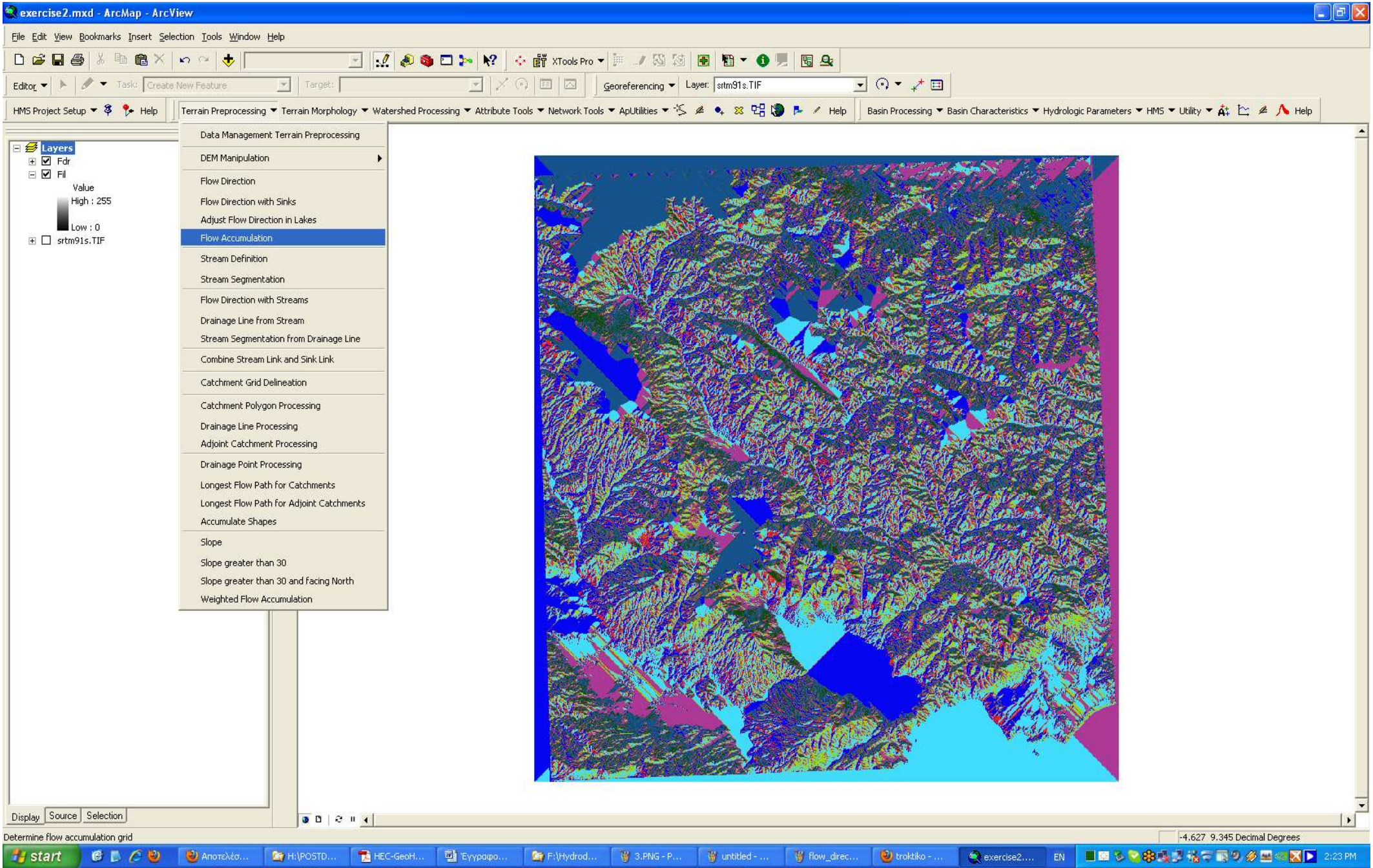
DEM: Flow Direction



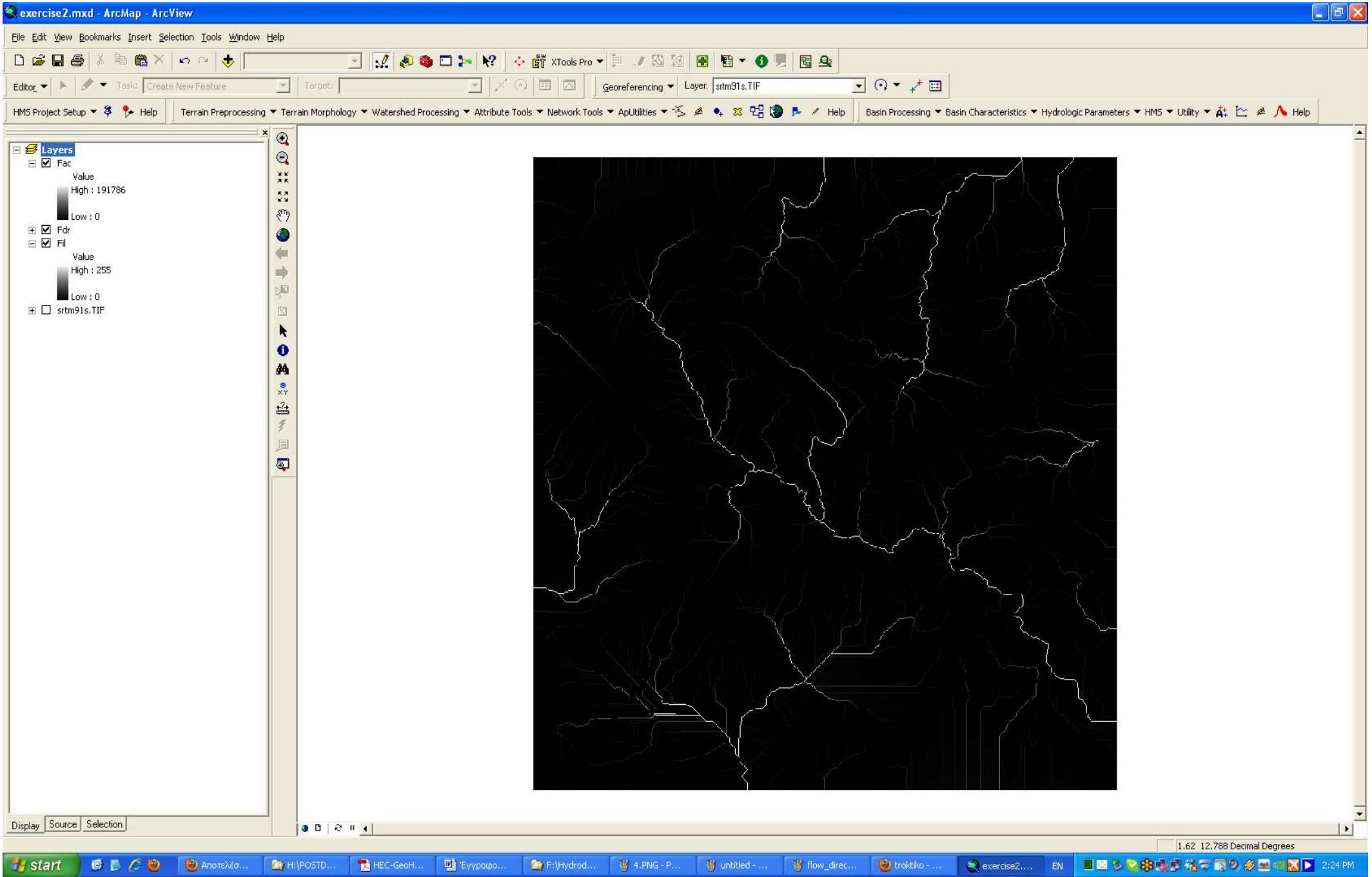
DEM: Flow Direction



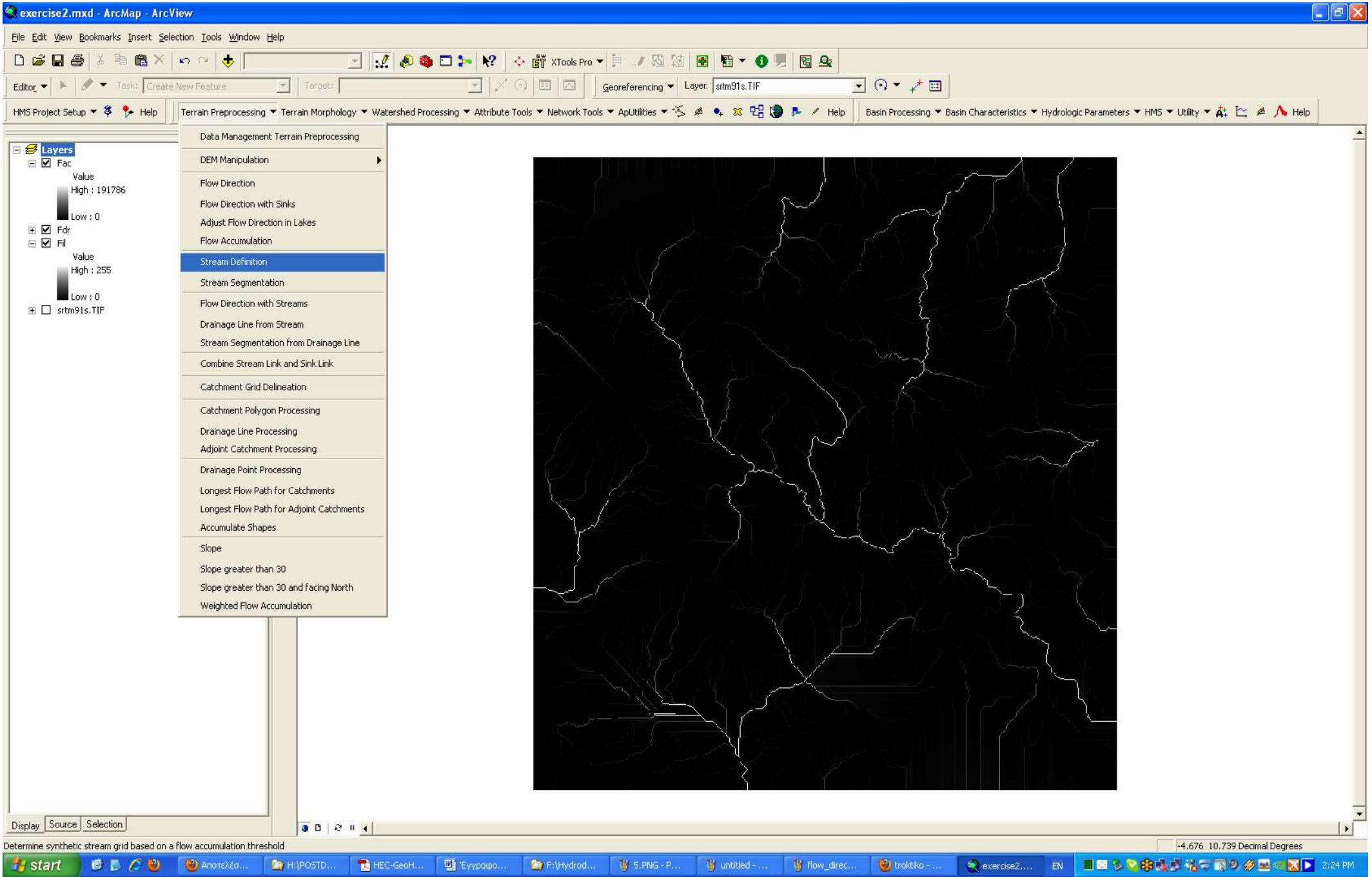
DEM: Flow Accumulation



DEM: Flow Accumulation



DEM: Stream definition



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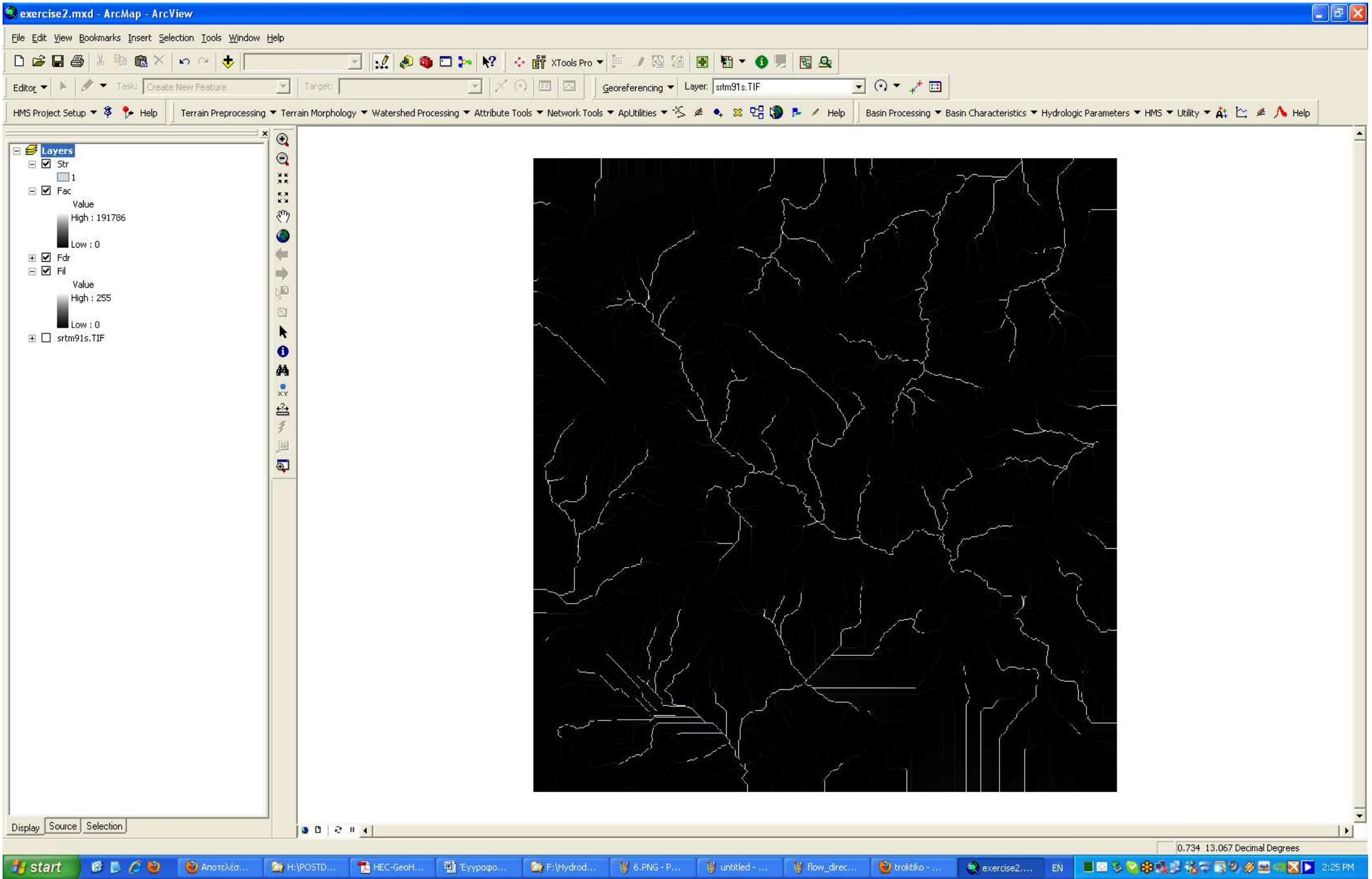
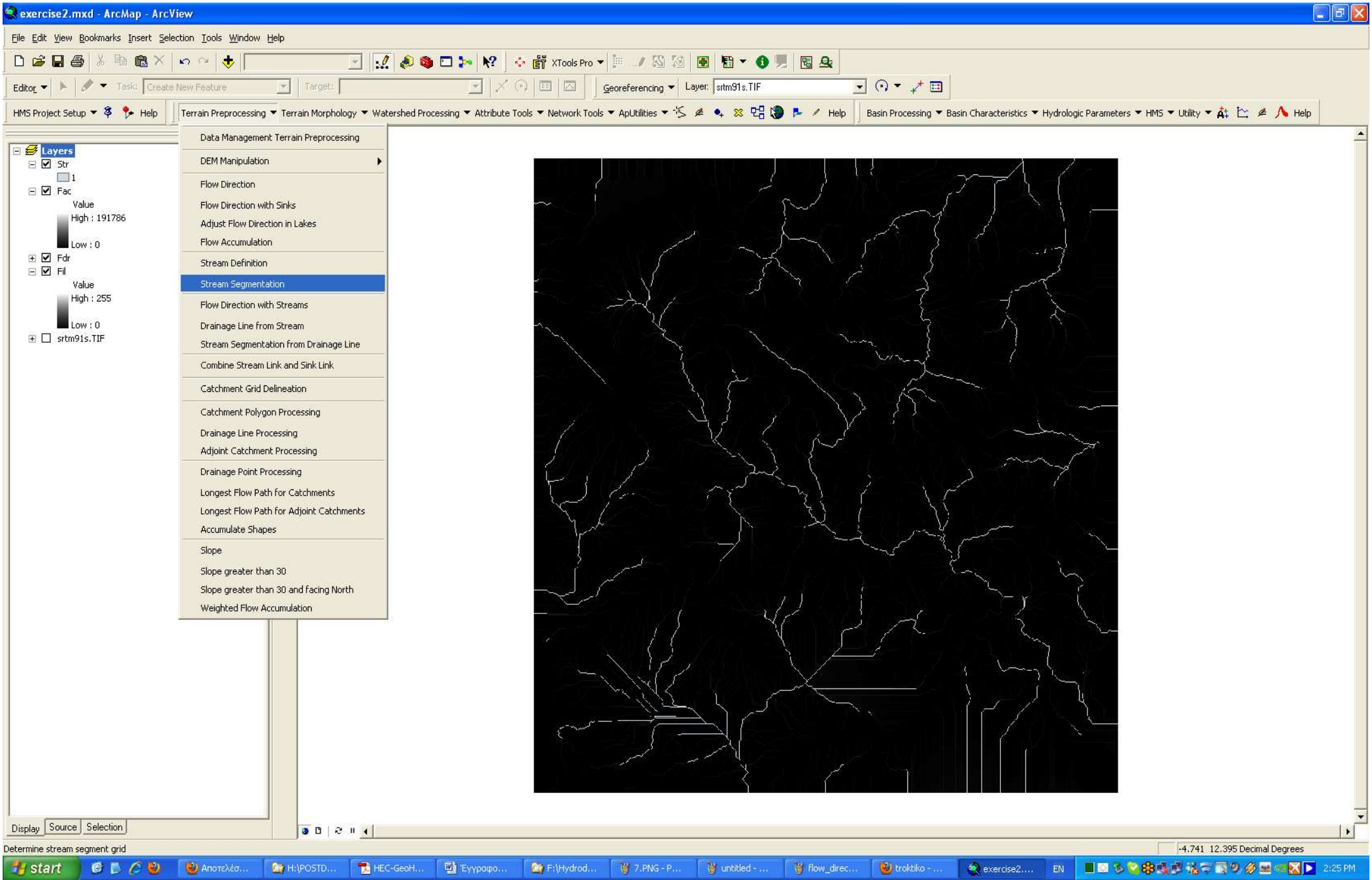
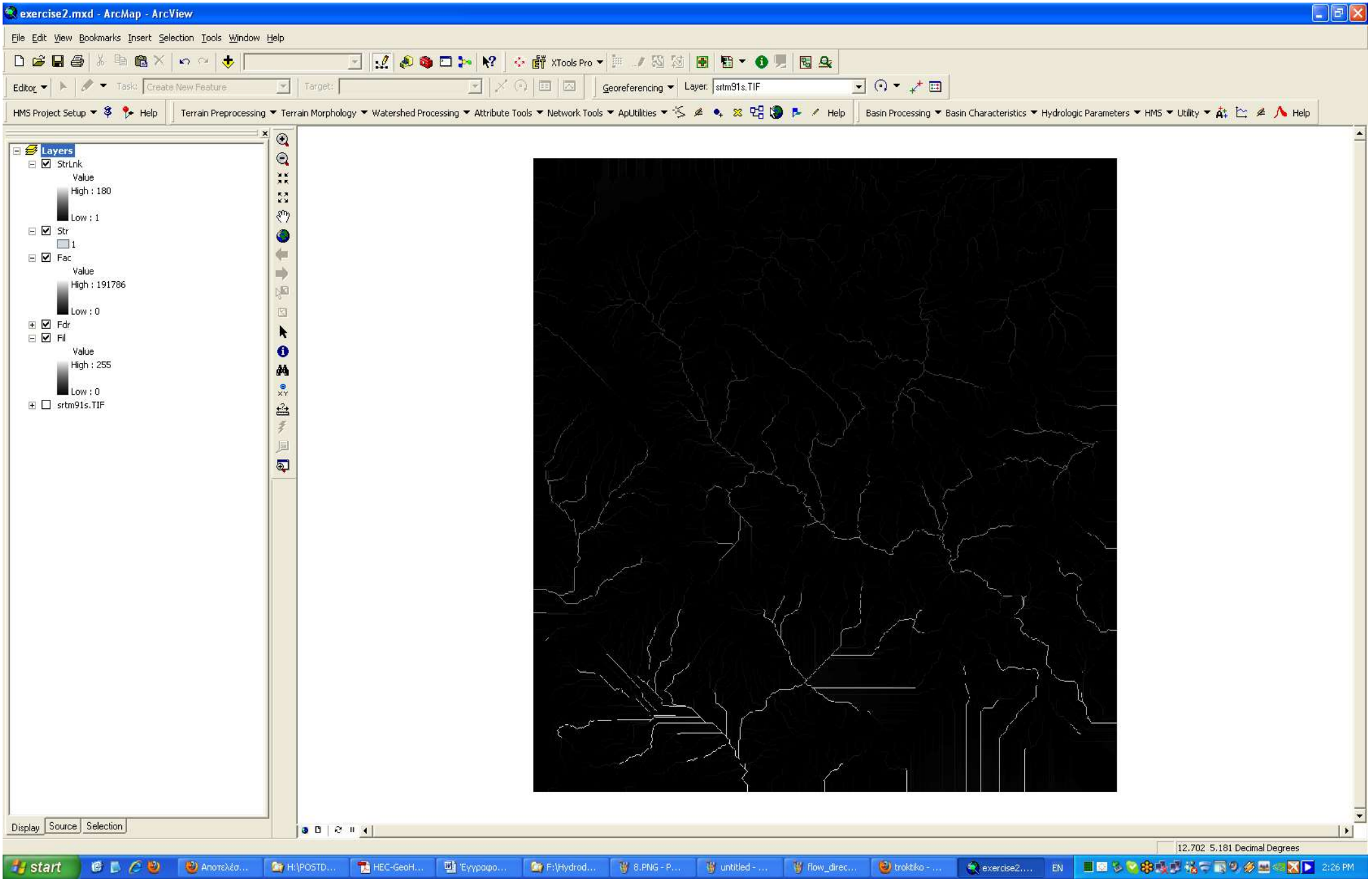


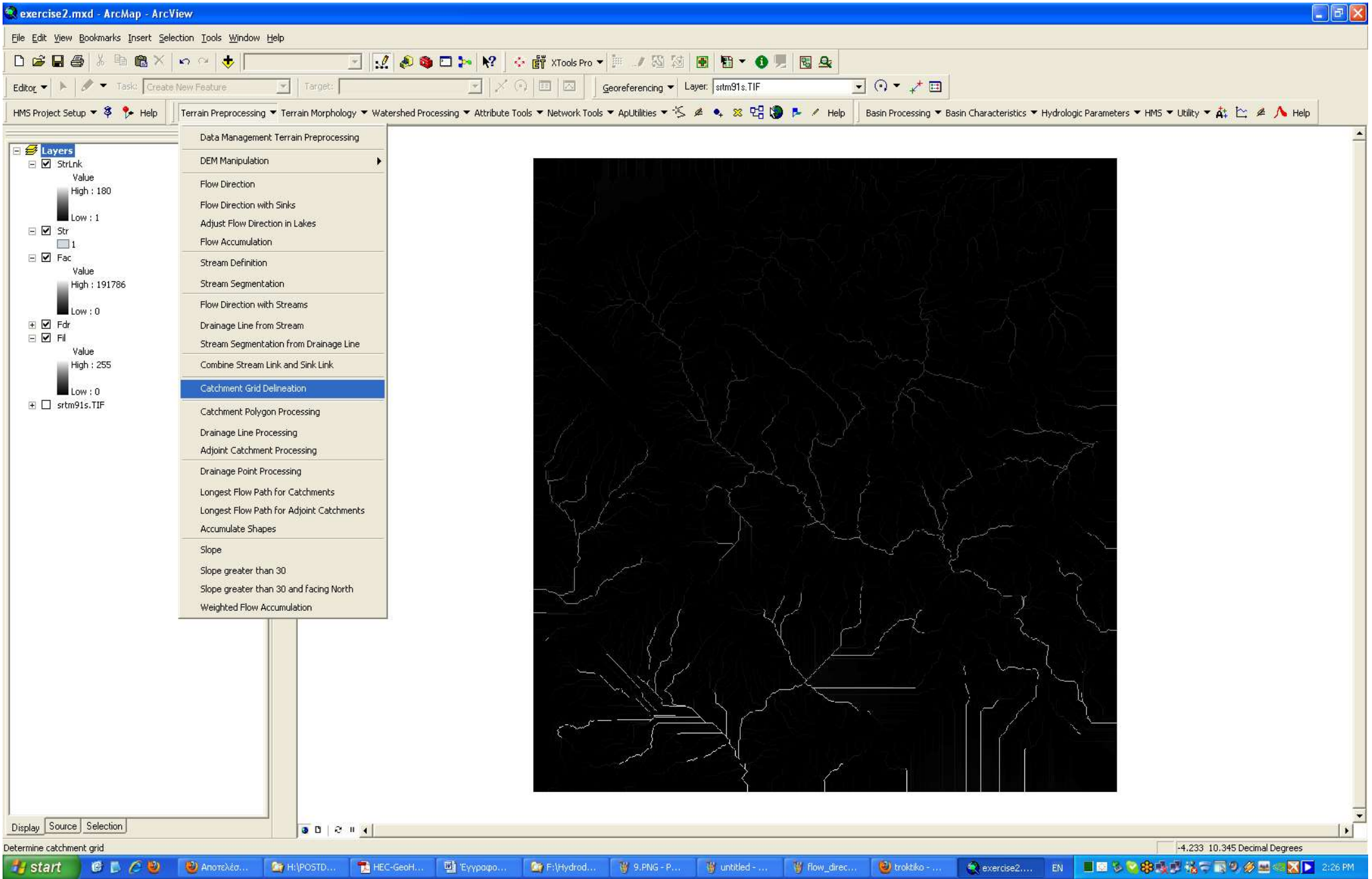
Επεξεργασία ΨΜΕ: Stream segmentation



DEM: Stream segmentation



DEM: Catchment Grid Delineation



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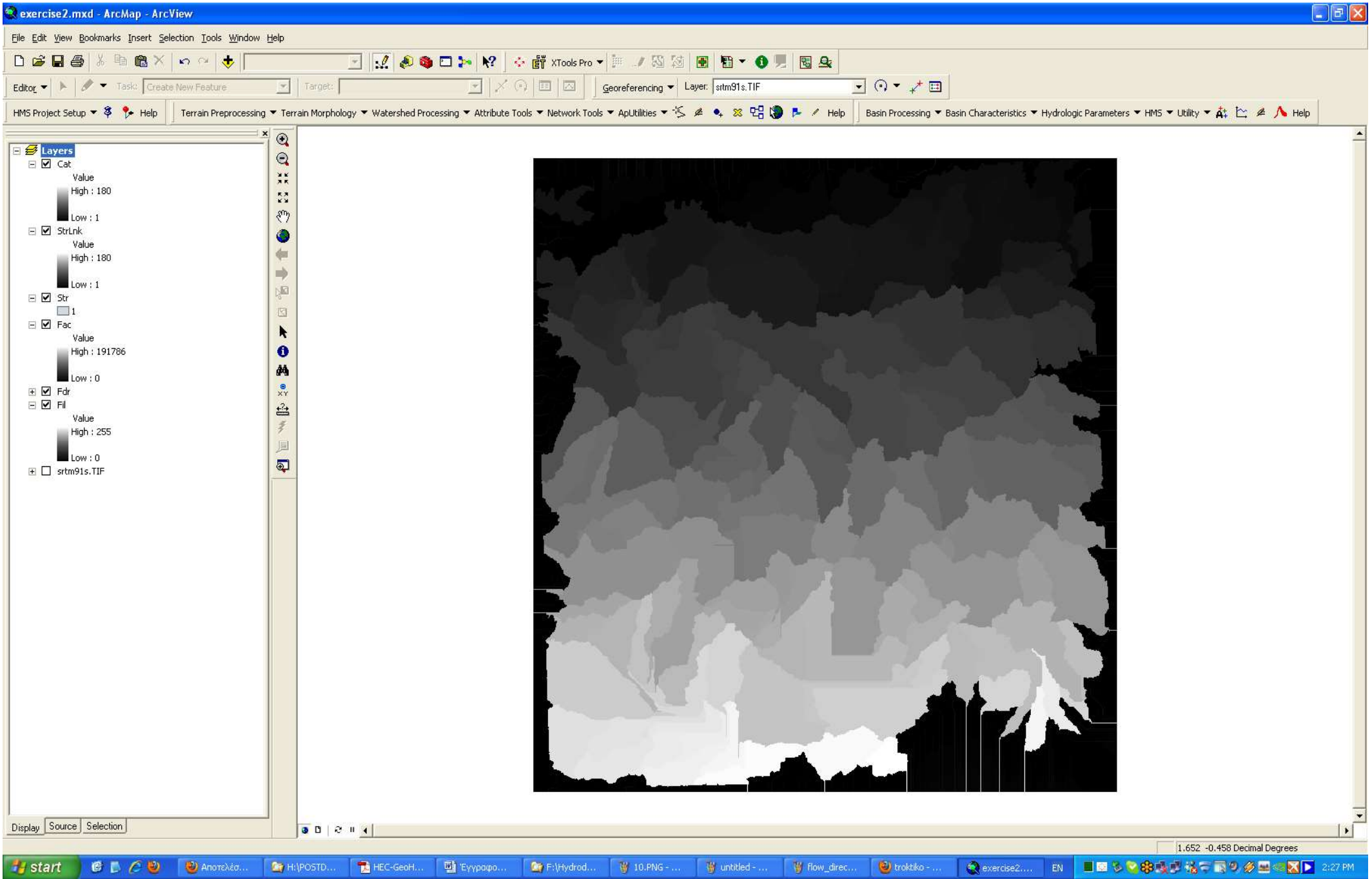
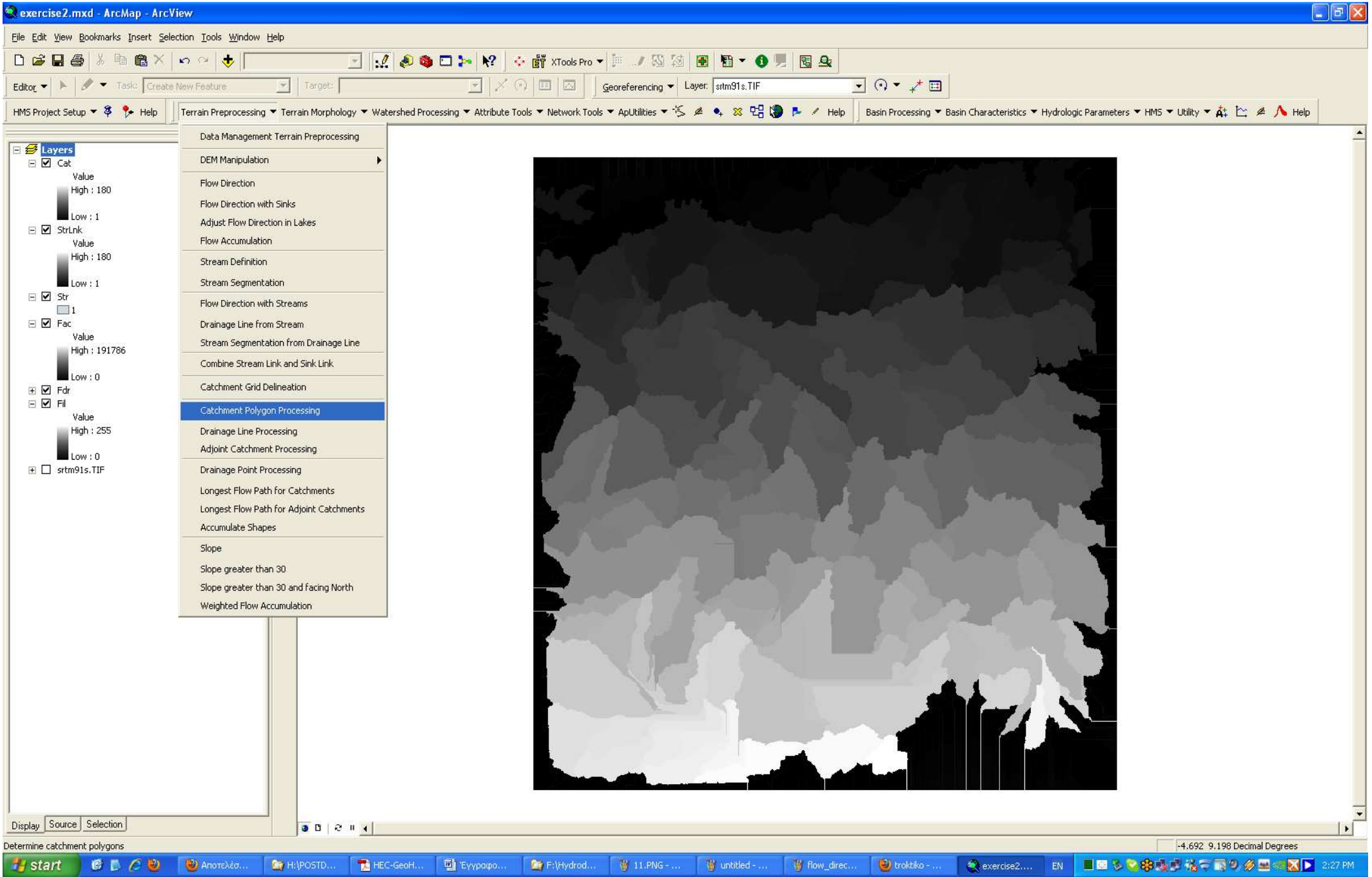


DEM: Catchment polygon processing



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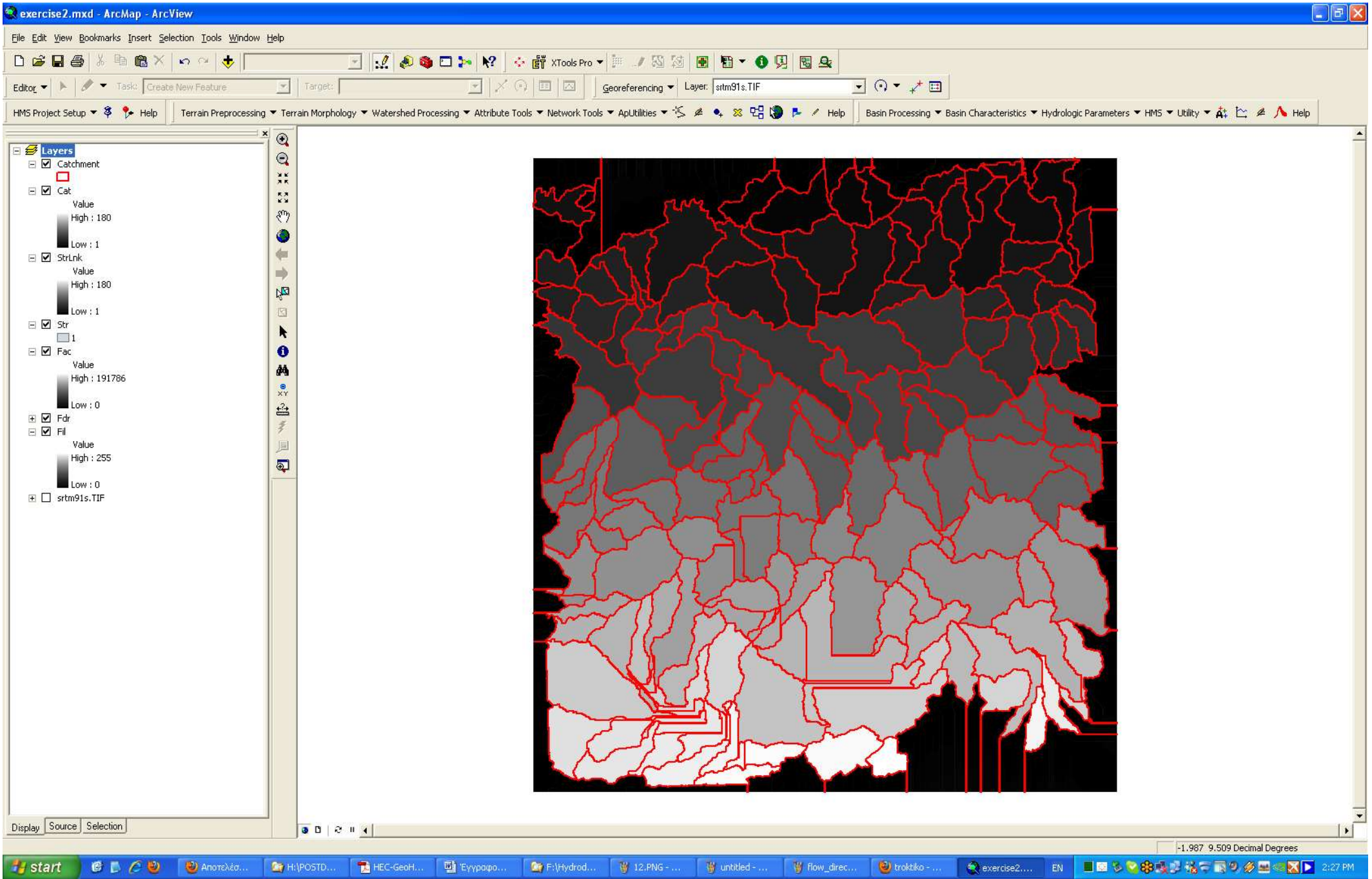
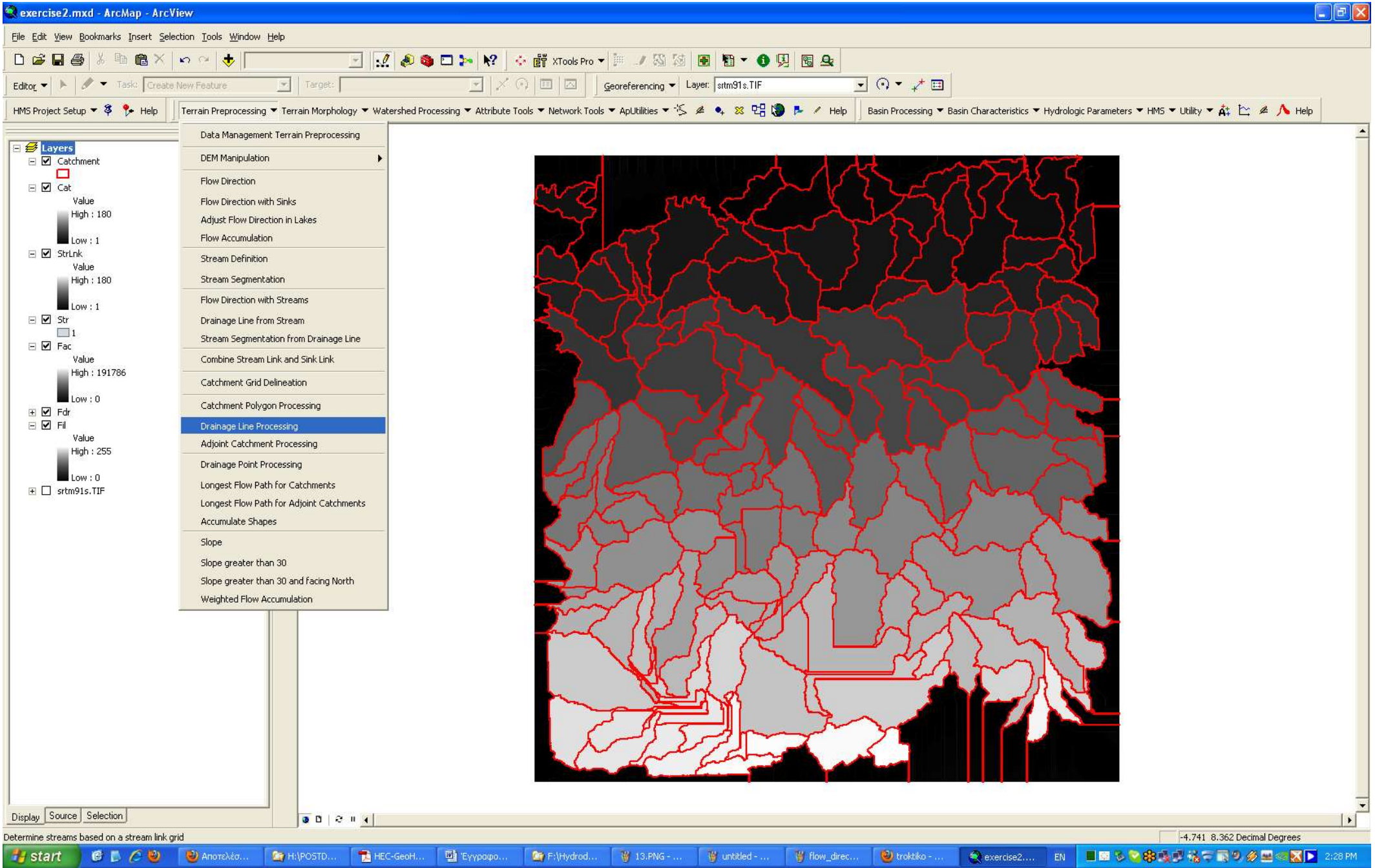


DEM: Drainage line processing



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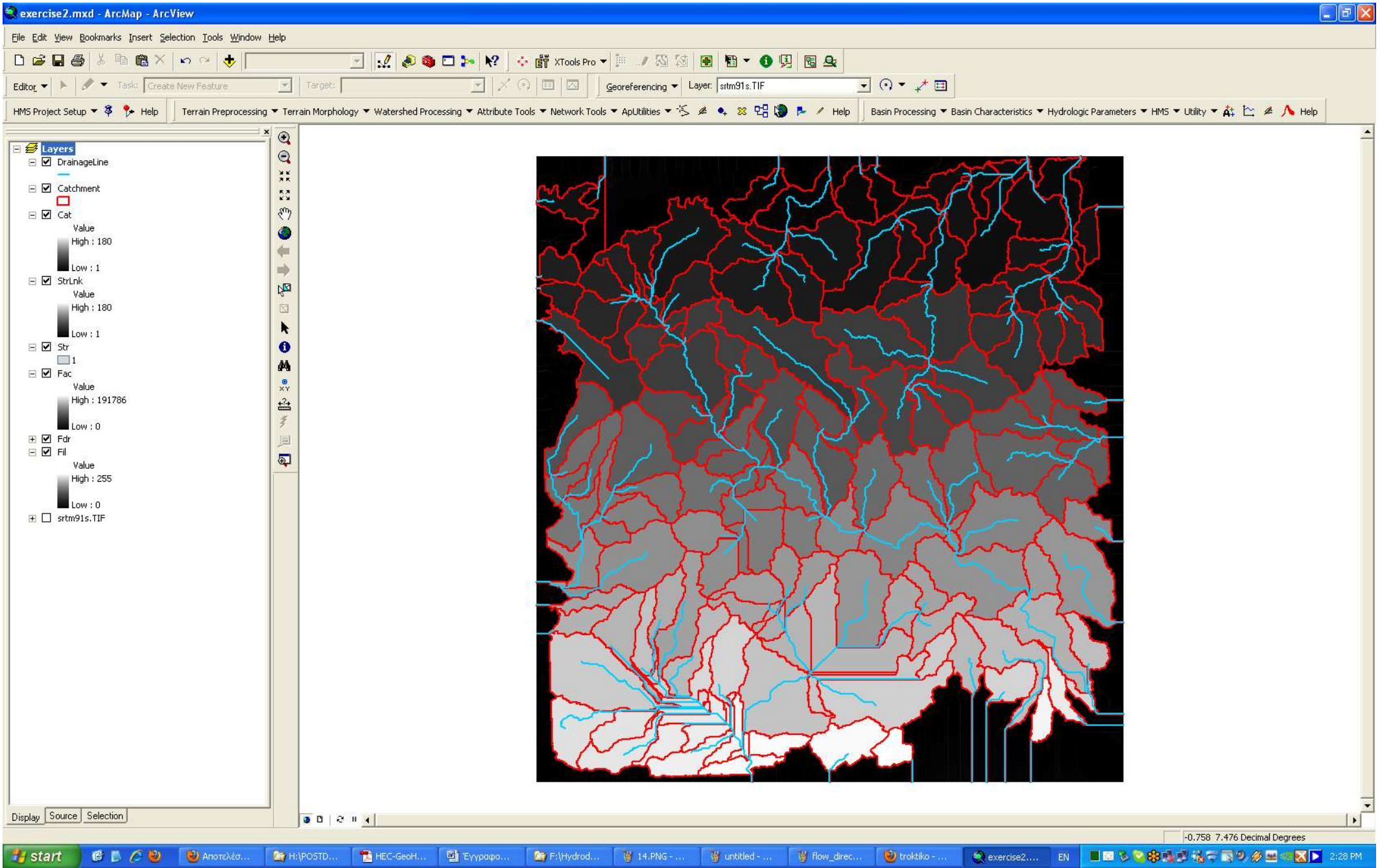
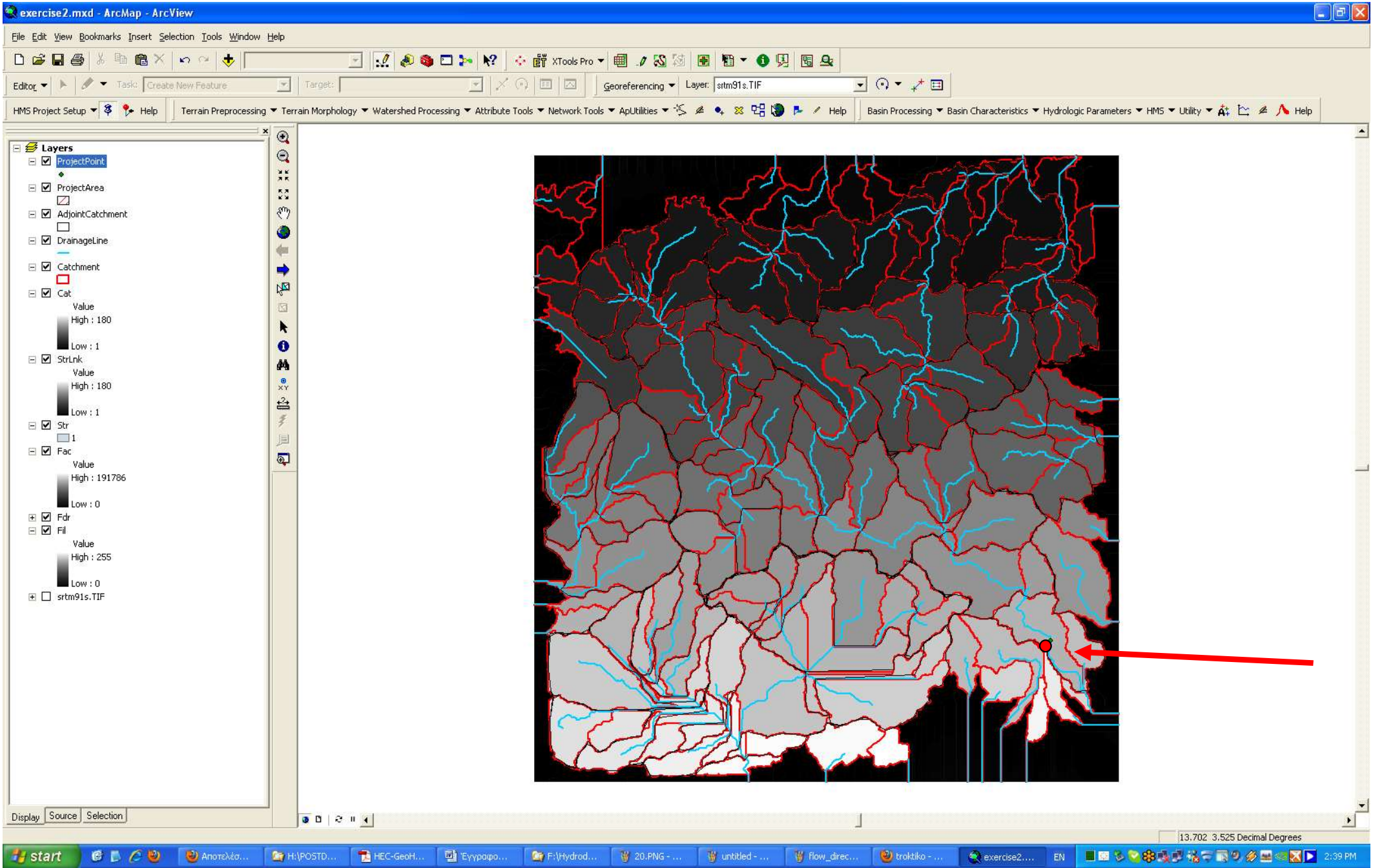
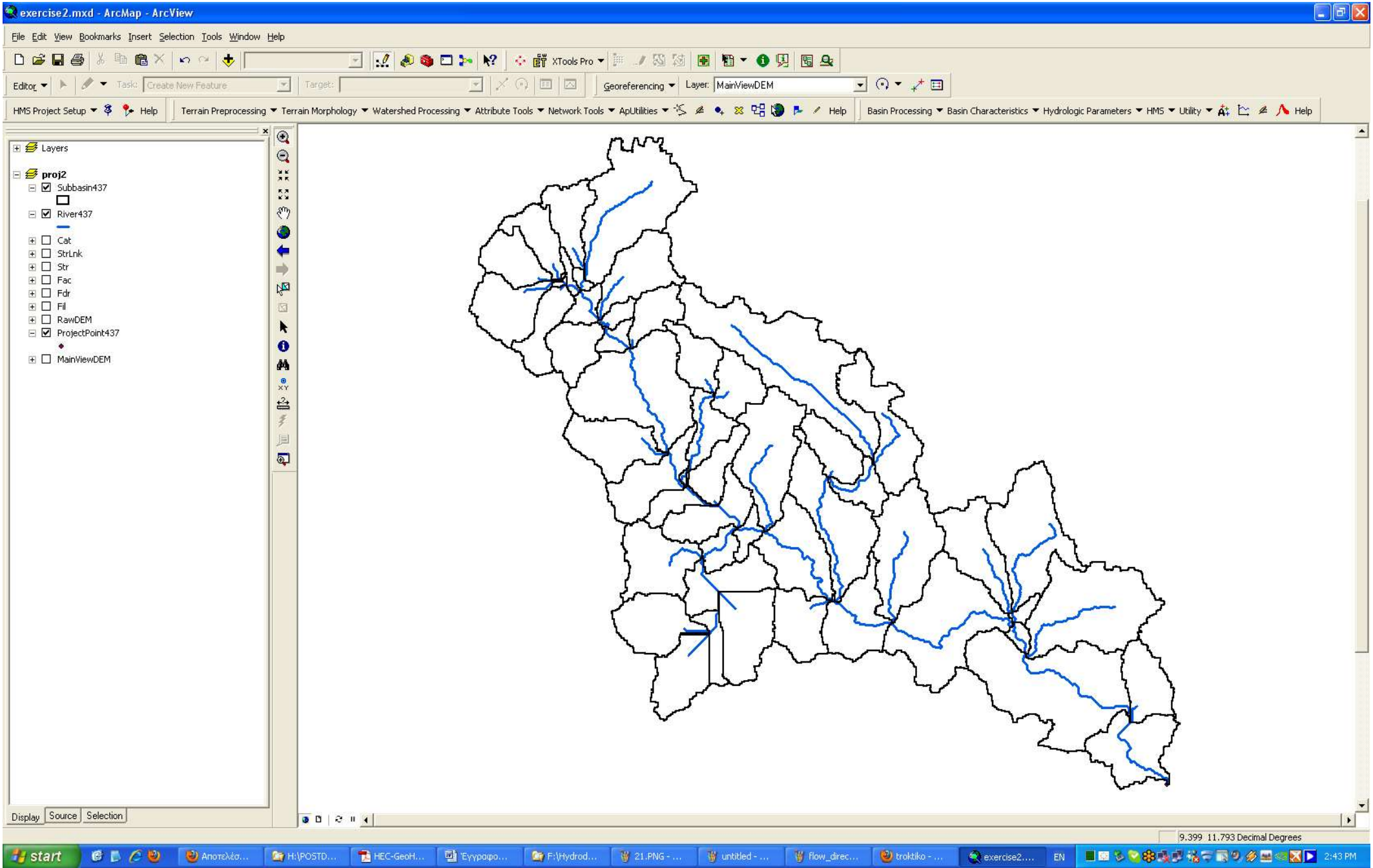


DEM: Selecting of basin outlet

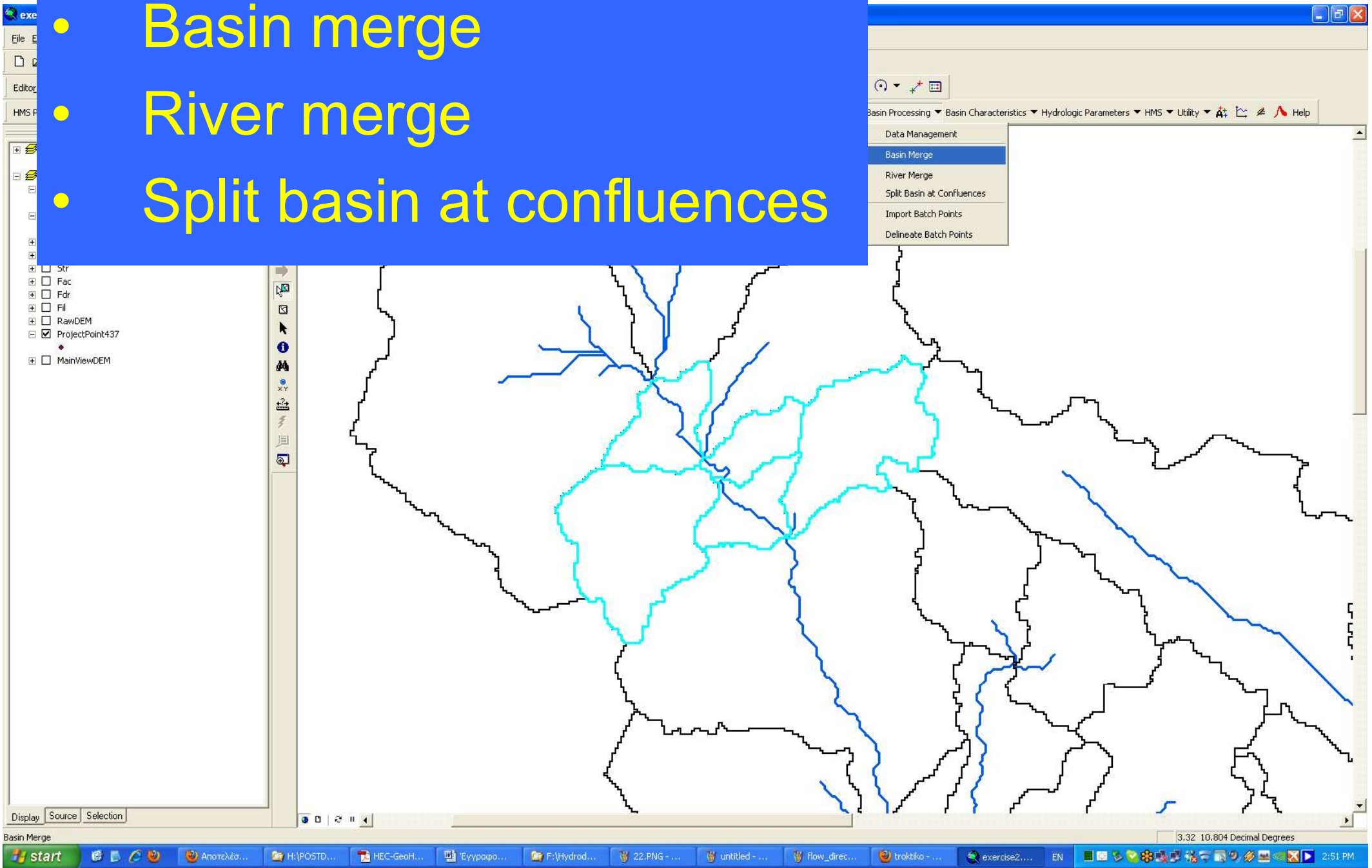


Basin and subbasins creation

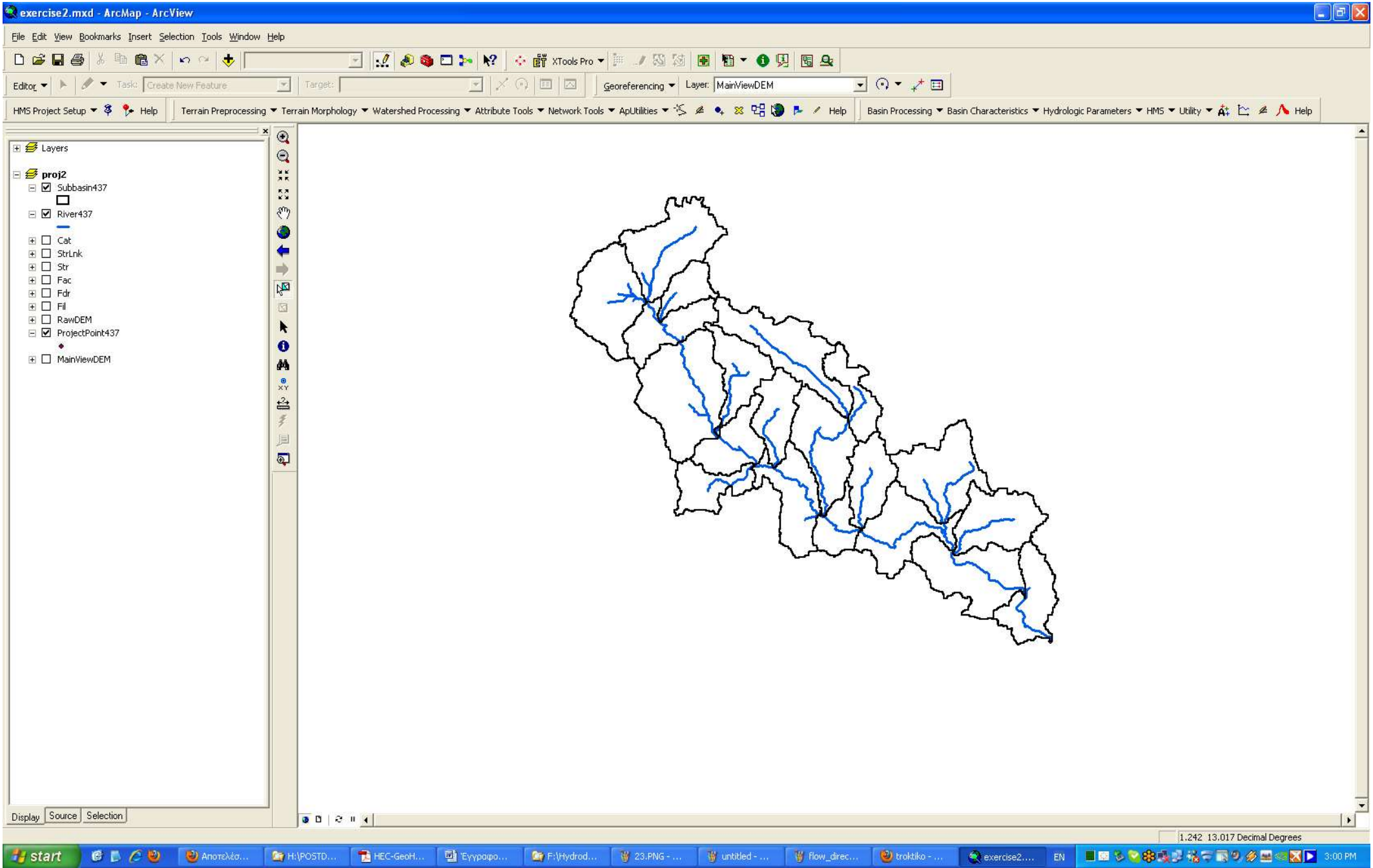


Utilities for basin editing

- Basin merge
- River merge
- Split basin at confluences



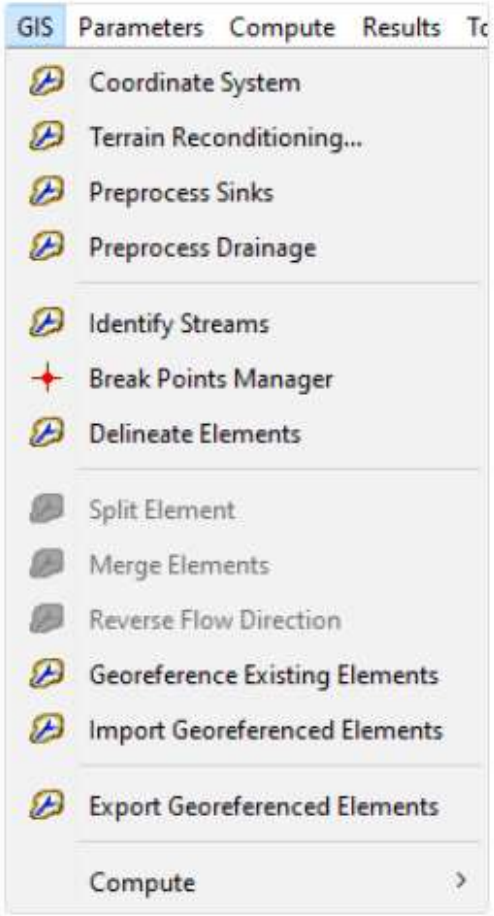
Final basin model

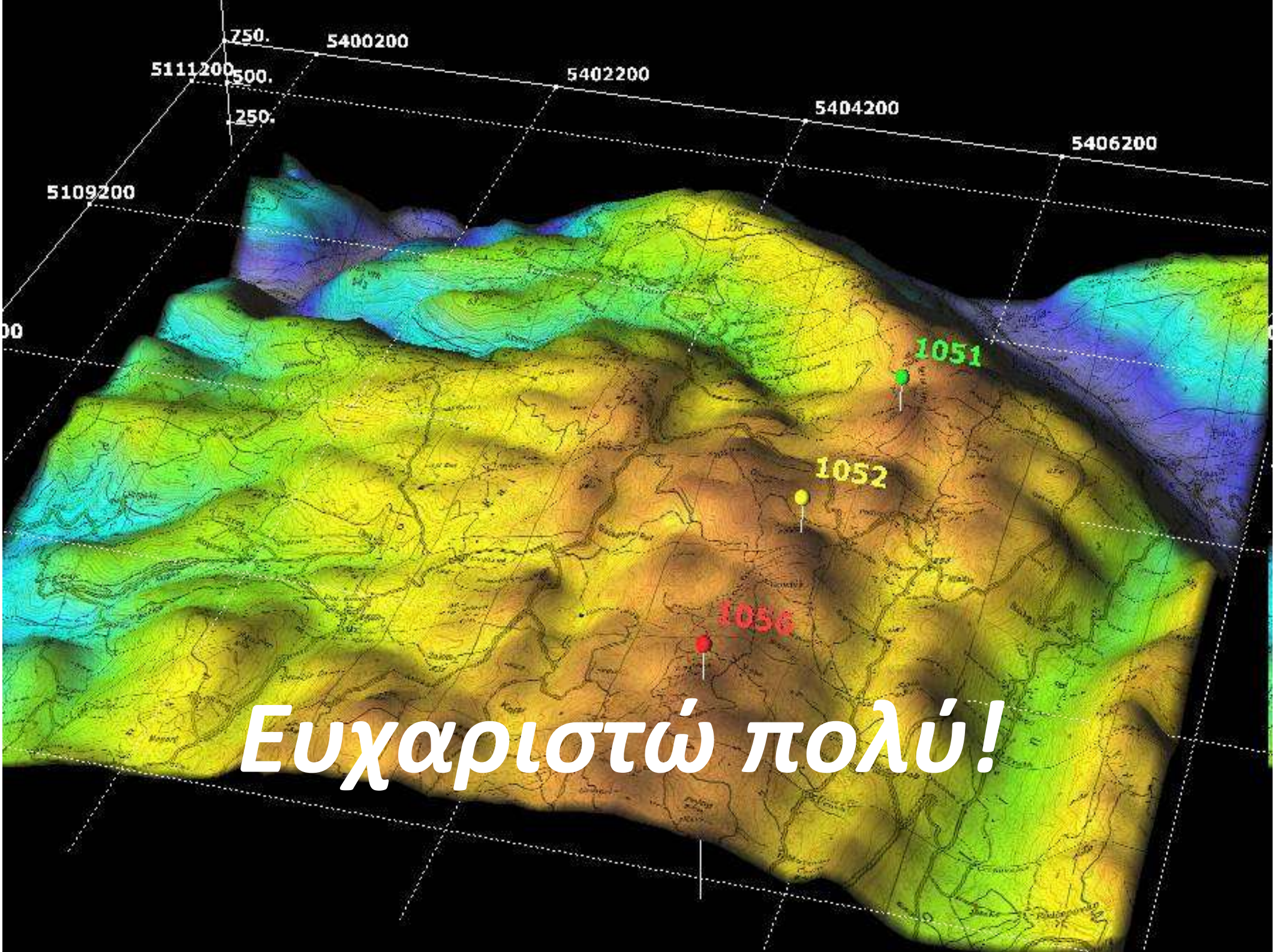


HEC GeoHMS

As of the release of HEC-HMS version 4.8 in April 2021, there is no longer a requirement that modelers use HEC-GeoHMS to delineate elements for an HEC-HMS project.

HEC-HMS 4.9 includes GIS tools that allow modelers to delineate elements, define a discretization, compute subbasin and reach characteristics, and estimate model parameters.





Ευχαριστώ πολύ!