Supplementary Guidelines for ENVSOCTY 3GI3

Exercise 2

Haoran Xu

SEES, McMaster University

xu976@mcmaster.ca

Key Knowledge before working on E2

Slide 06: Map Algebra

1. Operators
   - Arithmetic
   - Logical: Boolean, Relational
2. Functions
   - Local
   - Neighborhood: Focal, Block
   - Zonal
   - Global
3. Distance Calculations

Slide 07: DEM

1. Definition
2. Creation
3. Considerations for Use

E2 Video + Overview Notes

Slide 08: Absolute/Relative-relief Portrayal

1. Absolute/Relative-relief Portrayal
   - Contours / Isobaths
   - Hypsometric Tinting
   - Vertical Profiles
2. Relative-relief Portrayal
   - Perspective views
   - Hillshading

Slide 09: Spatial Interpolation

1. What, Why, When, How
2. Important types: Global Polynomial Interpolation (Trend), IDW, Natural Neighbour,

Proclamation

You should first view Patrick's *course slides*, *course videos*, *Exercise 2 Overview Notes (3GI3-W25)*, *EX2 - Instructions (3GI3-W25)*, *Ex2 Introductory Video*, *Ex2 Introductory Video (12 min)* before reading this **Supplementary Slide**.

This **Supplementary Slide** only provides some tips and tricks to help you deal with tasks and questions, but should not become a rigid workflow sheet to limit your imagination or inner drive to learn and explore things.

Database Specifications

Horizontal Coordinate System: NAD1983 UTM Zone 17N (CSRS v8)

Vertical Coordinate System: Canadian Geodetic Vertical Datum (2013)

Pixel Type: 32-Bit Float

Spatial Extent: Clipped to the borders of Stoney Creek

0. Boundaries for StoneyCreek

- Make sure:
    - PCS: NAD1983 UTM Zone 17N (CSRS v8)
    - GCS: Canadian Geodetic Vertical Datum (2013)
- Might use **Project** to change coordinate systems

1. LIDAR

- **Create Mosaic Dataset**
    - Take care of vertical coordinates (z-axis)
    - Under Pixel Properties: set number of bands = 1, Pixel Type is 32 bit floating point.
- **Add Rasters to Mosaic Dataset**
    - Check “folder”
- **Export Raster**
    - What’s the difference between this and Copy Raster?
    - Is it a tool?
    - Might take slow, but if exceeding 20min that might be somewhere wrong.
- How to clip the data to StoneyCreek layer?
- **Hillshade**
    - Check course slides and video

2. Imagery DTM (SWOOP)

- Similar Steps as LIDAR
- Mind the resolution difference
- Because of projection discrepancies, should use **Project Raster** to change HCS/VCS
    - Think about Resampling methods when projecting

3. CDED DTM

- Since the raw data is integer raster, we should turn it into a floating-point raster.
    - What tool can we use to do this?
- If it's missing a vertical reference, what tool can you use to give it a vertical coordinate system?
- After that, when doing **Project Raster:**
    - Mind the possibly enforced geometric transformation.
- Again, cell size (resolution), spatial reference, …, these are very important!

4. SRTM DSM

- Similar as CDED
- You can do it!

Question 1: 4 Maps (15 * 4 marks)

- Make sure you have 3 DEMs, 1 DSM, and 4 corresponding Hillshade raster and the feature class of Stoney Creek
- Map elements:
    - **Inset Map**
    - **Hillshade Effect**
    - same minimum and maximum elevation value applied for **Legend**
    - **Vertical Profile (title/axis name/notes)** and same linear/polyline **Transect** on the map
    - Other Rubrics (also refer to Map Guideline Sheet posted on A2L)
        - ✓ **boundary line**
        - ✓ **title** (theme, location, type of DEM, resolution)
        - ✓ **Legend** (units = should be *m.a.s.l. (meters above sea level)*, decimals, …)
        - ✓ some form of **orientation** (north arrow? graticule? measured grids?)
        - ✓ a **scale** indicator (scale bar? texted scale ratio?)
        - ✓ **credits** (data source, projection (HCS/VCS) info, (c) your name, creation of the map, …)

Question 2: Interpolation (10 marks)

- What is Spatial Interpolation?
- Database Specifications
    - five DTMs with a cell size resolution of 30 meters
    - clipped to Stoney Creek's boundary
    - correct GCS/VCS
- Check spatial reference of Spot Heights and MRDEM before you go
- When using Interpolation tools:
    - You can change Environment settings to change coordinate systems and mask (so that you can save the step for Extract by Mask)
- For **TIN to Raster**, remember to change the cell size

Question 2: Interpolation (10 marks)

- What is RMSE?
  - Really Mean Software Engineer? 🧑‍💻💢
  - Rave Music Speaker Explosion? 🔊💥
  - Or Really Miserable Student Experience? 📚😩
- ModelBuilder
  - Remember to Refresh the geodatabase after running the model
- 1. Make a **table** that indicates the *mean*, *standard deviation*, *minimum* and *maximum* z-values and the *zRMSE* for **each DTM**
- 2. Submit a **picture** of your model for evaluation (remember to **add label** AND **rename output files**!!!)
  - one picture would be enough as all 5 models are actually the same

Question 3: Map 5 (15 marks)

- Again, check the Requirements for map on **slide 9**.
- This one does not need an insert map, vertical profile.
- But do need to address which **interpolation model** and its **parameters**.

Question 4: 1 Layout consisting 3 maps and 1 vertical profile (15 marks)

- This part is detailed-ly demonstrated in Patrick's lecture.
- 1. Contour Intervals
    - Try **Contour** Tool or "Contour" in Raster Functions (under Analysis)
    - pick a sensible contour interval
- 2. hypsometric tinting
    - Under **Contour** tool, you can change contour type into polygon
    - should follow the contour intervals in last step
- 3. 3D perspective
    - Try doing "**Convert**" **To Global/Local Scene** (under View)
    - Then you can keep pressing your mouse's middle scrolling key to change the angles from the sky
- 4. Vertical profile
- **Four separate panels** should be combined on **one single layout**.
- Again, check the Requirements for map on **slide 9**. But some are not needed or need to be adjusted for this layout.

Question 5: 1 Screenshot (unknown marks)

- A screen shot of their geodatabase with no cropping
- Will need to apply a penalty if missing

Final Submission

- 1 single PDF Document
    - *Make sure all the map pictures and models are **clear** and having **high resolution**!!*
    - *Cover page contains: the exercise number and name (Exercise 2: Working with DEMs), your name, submission date, and your TA's name.)*
    - *Use 12-point font, 1.5 spacing between lines and 1-inch borders*
    - *Correct all spelling and grammatical mistakes/issues*
- Due date: please submit to the Avenue Drop Box by **Monday, February 24, 2025 at 8:00AM.**