Analyzing Vector Tile Performance

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@CartoRedux

2020 ESRI FEDERAL GIS CONFERENCE | WASHINGTON, D.C.

Aw, Snap!

Something went wrong while displaying this webpage.

Learn more

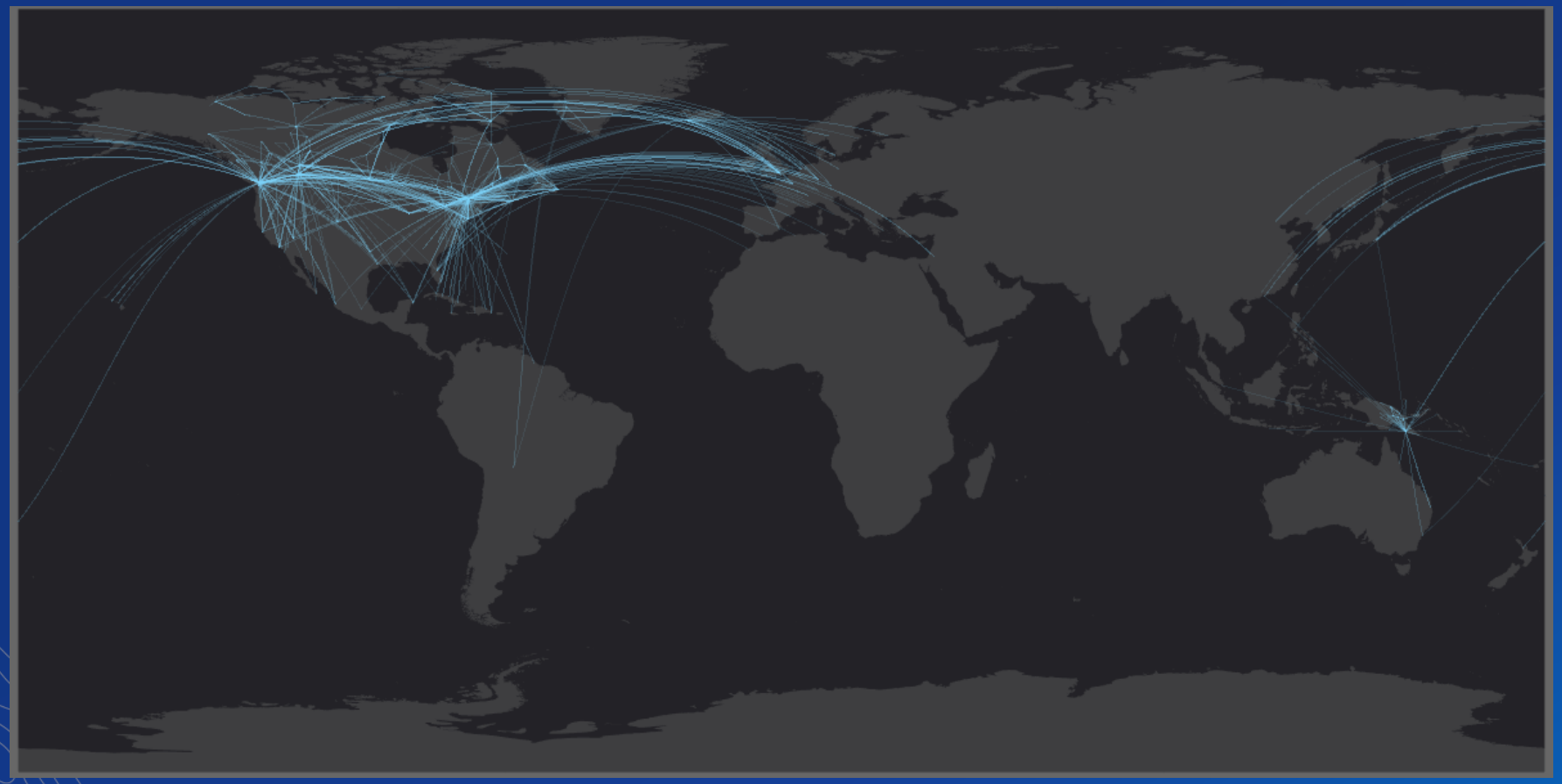
Reload

What went wrong?

- WebGL – graphics card driver issue
- Tiles are too big

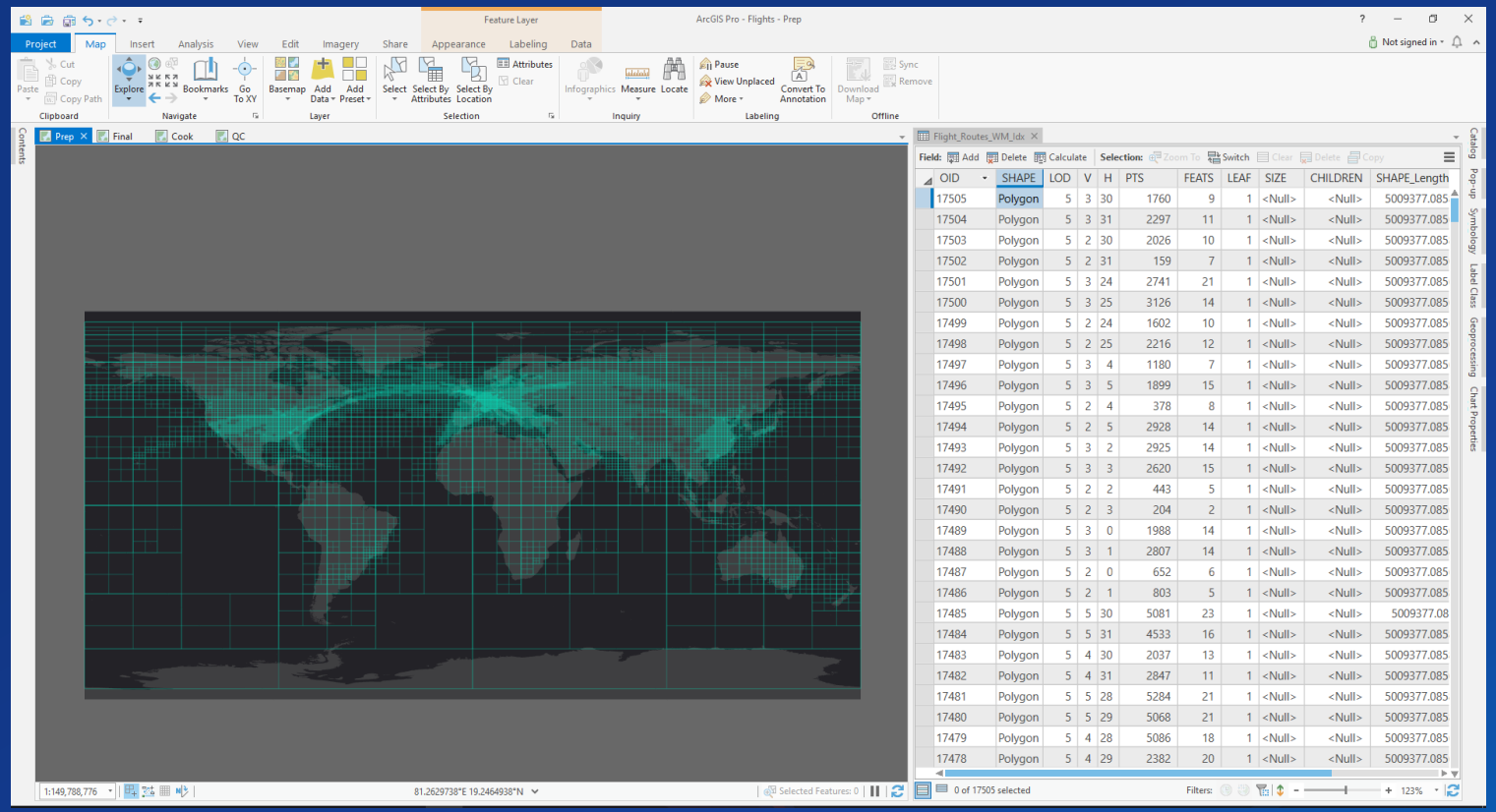
Were there warning signs along the way?

- Map is very slow to draw when authoring



Were there warning signs along the way?

- **Index featureclass contains an excessive amount of records**



Were there warning signs along the way?

- Cooking process took a long time
- VTPK is unreasonably large

Now what?

#ThereWillBeCode and #ItWillBeUgly

Analyze tile sizes

- Manually browse map with dev tools in the browser
- Fine grain PBF inspection courtesy of Hannes Fleischer
  - https://github.com/hfleischer/vector-tile-analysis

Elements Console Network

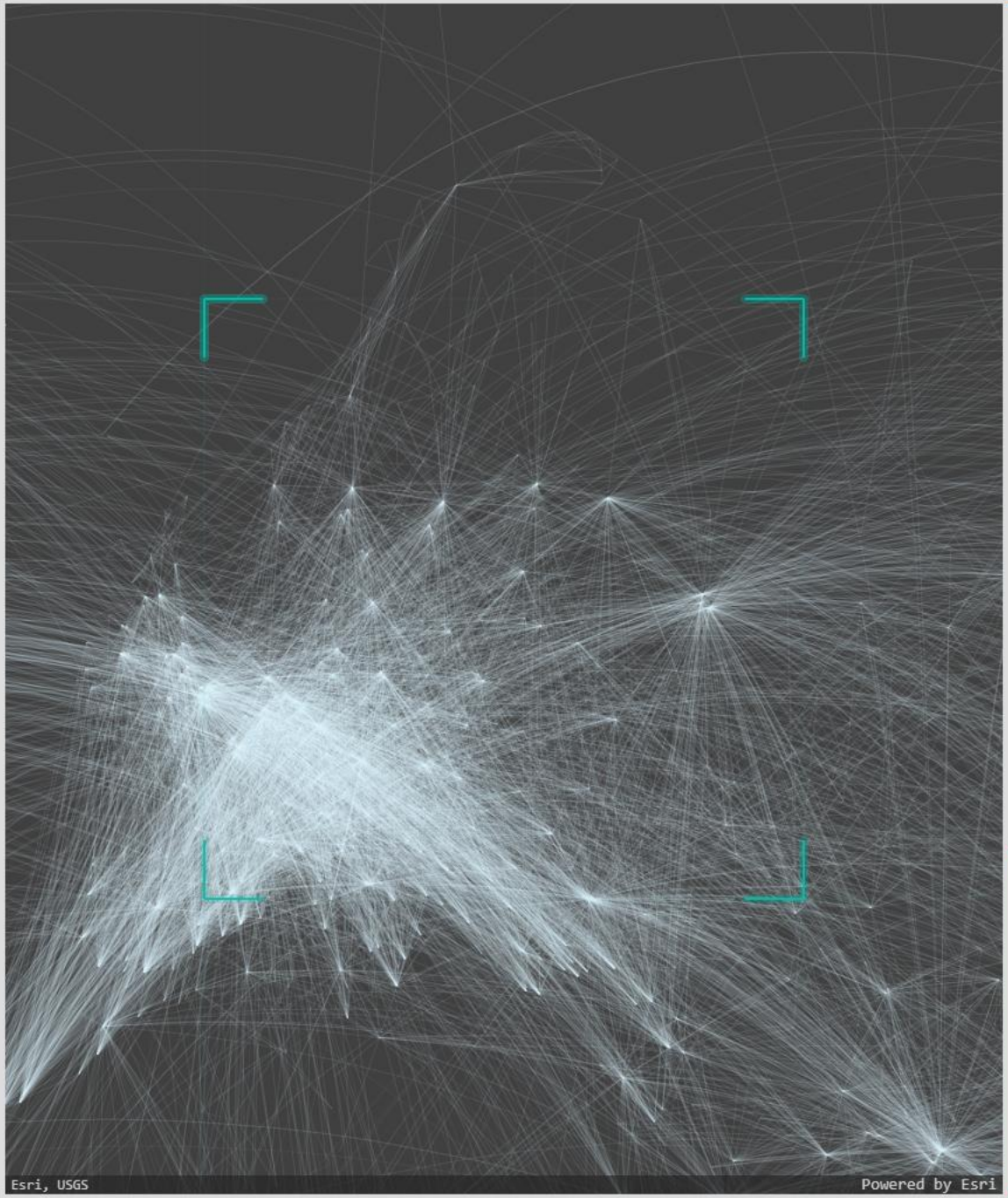
Preserve log Disable cache

pbf Hide data URLs

All XHR JS CSS Img Media Font Doc WS Manifest Other

Name	Size	Time	Waterfall
3.pbf	89.8 KB	222 ms	
4.pbf	78.7 KB	543 ms	
3.pbf	79.7 KB	446 ms	
1.pbf	66.7 KB	262 ms	
0.pbf	41.9 KB	285 ms	
2.pbf	53.3 KB	802 ms	
0.pbf	41.9 KB	508 ms	
4.pbf	194 KB	729 ms	
2.pbf	70.3 KB	822 ms	
3.pbf	89.7 KB	157 ms	
3.pbf	79.7 KB	162 ms	
5.pbf	48.4 KB	138 ms	
5.pbf	43.9 KB	242 ms	
2.pbf	24.3 KB	198 ms	
2.pbf	24.3 KB	187 ms	
1.pbf	23.5 KB	90 ms	
4.pbf	194 KB	271 ms	

17 / 139 requests | 1.2 MB / 1.6 MB transferred | 2.3 MB / 2.8 MB



Lat/Lon 42.359 58.799 scale 1:36978595 lod: 3.00

tile details map details

Flights → L03-C0000004-R0000002

Flight Routes (12707 features, 47431 vertices)

Flight Routes (12707 features, 47431 vertices)

Flight Routes (12707 features, 47431 vertices)
398.51 kB

Configure the app

- \js_synergis\main.js

```
VectorTileAnalysisApp_1.VectorTileAnalysisApp.addLayerSet({
    visible: true,
    id: 'ags_basemap',
    title: 'Flights',
    url: 'https://www.arcgis.com/sharing/rest/content/items/2a82bc723e164eb1aacfa6c1a9c7dc3c/resources/styles/root.json'
});
/*VectorTileAnalysisApp_1.VectorTileAnalysisApp.addLayerSet({
    visible: true,
    id: 'ags_basemap',
    title: 'World_Basemap_v2',
    url: 'https://basemaps.arcgis.com/arcgis/rest/services/World_Basemap_v2/VectorTileServer'
});
```

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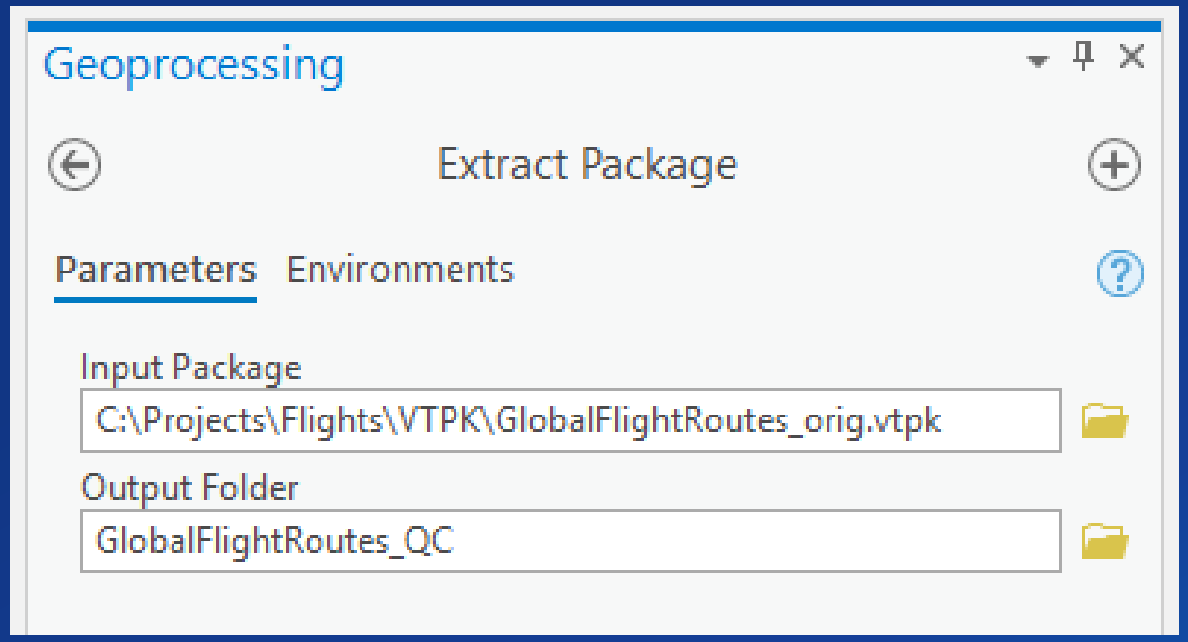
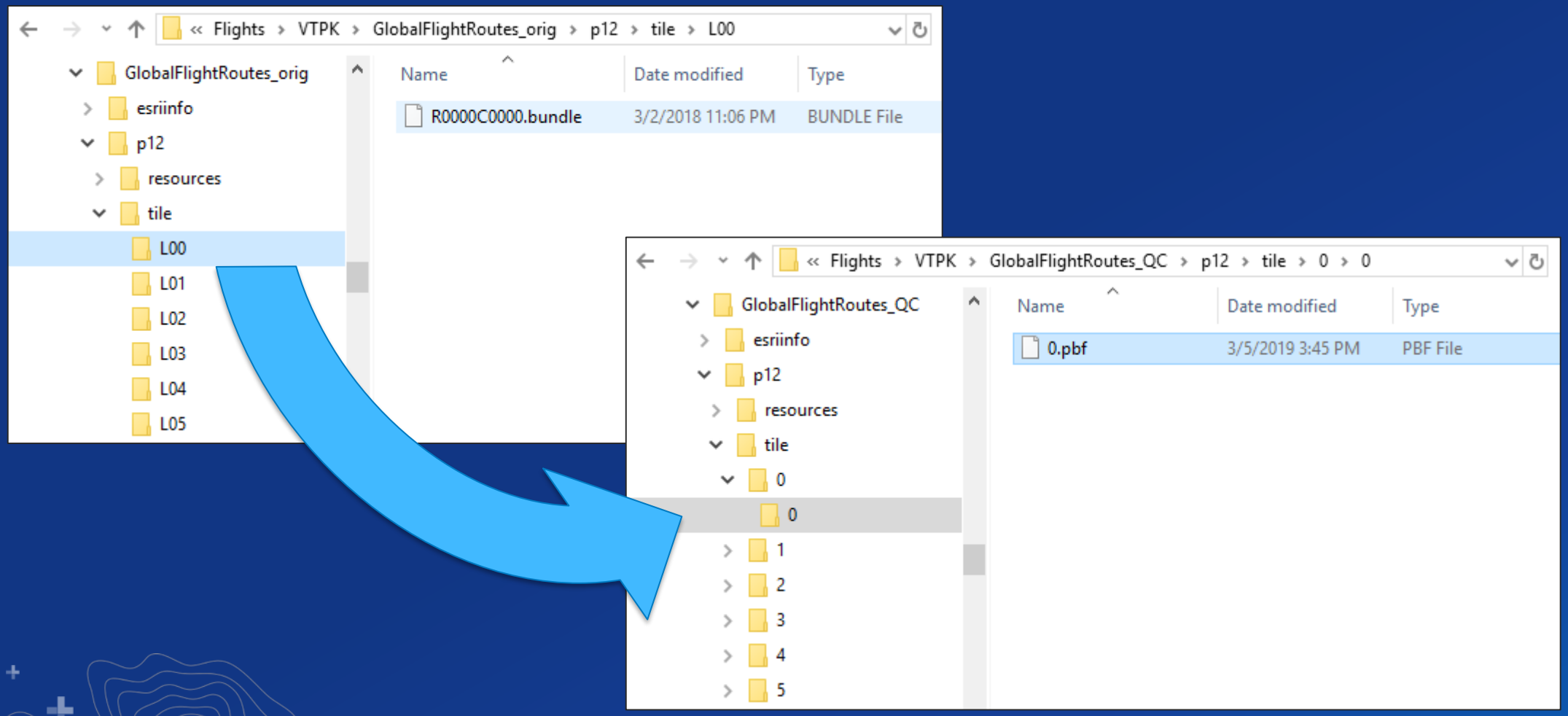
Analyze tile sizes

- **Extract Package**



Analyze tile sizes



Analyze tile sizes

- Run some nasty looking python from Tommy
- https://github.com/tfauvell/qc_vt_tileset

File Edit Selection View Go Debug Terminal Help • QC_VT.py - qc_vt_tileset - Visual Studio Code [Administrator]

DEBUG

VARIABLES

WATCH

CALL STACK

BREAKPOINTS

Raised Exceptions

Uncaught Exceptio

math.py C:\Pr... 12

```
statsLookUp[7] = "[   256KB - 512KB ]"
statsLookUp[8] = "[     512KB   1MB ]"
```

GlobalFlightRoutes_QC

File Home Share View

Navigation pane | Preview pane | Details pane | Panes

Extra large icons | Large icons | Medium icons | Small icons | List | Details | Layout

Sort by | Current view

Item check boxes | File name extensions | Hidden items | Hide selected items | Show/hide

Options

« OSDisk (C:) › Projects › Flights › VTPK › GlobalFlightRoutes_QC

Search GlobalFlightRoute...

OneNote
Public
Videos
This PC
3D Objects
Apple iPhone
Desktop
Documents
Downloads
Music
Pictures
Videos
OSDisk (C:)

Name	Date modified	Type	Size
esriinfo	3/5/2019 3:45 PM	File folder	
p12	3/5/2019 3:45 PM	File folder	

2 items

master*+ 0↓ 1↑ Python 2.7.14 32-bit 0 0 Python: Current File (Integrated Terminal) (qc_vt_tileset) Ln 37, Col 8 Spaces: 4 UTF-8 CRLF Python

File Edit Selection View Go Debug Terminal Help

QC_VT.py - qc_vt_tileset - Visual Studio Code

EXPLORER

OPEN EDITORS
- QC_VT.py M

QC_VT_TILESET
- .vscode
  - launch.json
  - settings.json
- VTPK \ QC
  - Update1
    - esriinfo
    - p12
      - resources
      - tile
      - tilemap
      - root.json
  - UpdateMin
    - esriinfo
    - p12
      - resources
      - tile
      - tilemap
      - root.json
- __init__.py
- .gitignore
- LICENSE
- QC_VT.py M
- README.md

OUTLINE

QC_VT.py > main

```python
def main():
    print "Analyzing tileset...\n"

    # generator - walk all file paths within vt
    all_files = (os.path.join(basedir, filename)
                 for basedir, dirs, files in os.walk(vt) for filename in files)

    # generator - tuples of files, sizes
    files_and_sizes = ((path, os.path.getsize(path)) for path in all_files)
    sorted_files_with_size = sorted(
        files_and_sizes, key=operator.itemgetter(1), reverse=True)
    print "Collecting statistics..."
    min_PBF = min(sorted_files_with_size, key=operator.itemgetter(1))
    max_PBF = max(sorted_files_with_size, key=operator.itemgetter(1))

    fCount = 0
    flaggedPBF = list()
    totalSize = 0

    for filePath in sorted_files_with_size:
        # flag large files and collect stats
        totalSize += filePath[1]
        statsD[group_size(filePath[1])] += 1
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

2: Python Debug Consc

```
Analyzing tileset...

Collecting statistics...

-------------------------------------------------------
TILESET STATS: Tier 3 Test
263 tiles, smallest tile: 989.0 B, largest tile: 2.06 MB, total size: 29.03 MB
[    size range   ] [    distribution    ] # of files
[       0KB - 1KB ] [#...................] 1
[      1KB - 16KB ] [#...................] 12
[     16KB - 32KB ] [##................] 25
[     32KB - 64KB ] [#####.............] 58
[    64KB - 128KB ] [#########.........] 116
[   128KB - 256KB ] [###................] 37
[   256KB - 512KB ] [#...................] 7
[     512KB - 1MB ] [#...................] 4
[ larger than 1MB ] [#...................] 3

WARNING! Tileset contains 31 tiles larger than 150 KB
C:\Projects\Flights\VTPK\QC\Tier3\p12\tile\0\0\0.pbf  2.06 MB
C:\Projects\Flights\VTPK\QC\Tier3\p12\tile\1\0\1.pbf  1.31 MB
C:\Projects\Flights\VTPK\QC\Tier3\p12\tile\2\1\2.pbf  1.01 MB
C:\Projects\Flights\VTPK\QC\Tier3\p12\tile\1\0\0.pbf  895.65 KB
C:\Projects\Flights\VTPK\QC\Tier3\p12\tile\3\2\4.pbf  787.7 KB
C:\Projects\Flights\VTPK\QC\Tier3\p12\tile\2\1\1.pbf  708.7 KB
C:\Projects\Flights\VTPK\QC\Tier3\p12\tile\4\5\8.pbf  646.71 KB
```

master* Python 2.7.14 32-bit ⊗ 0 ⚠ 0 Python: Current File (Integrated Terminal) (qc_vt_tileset) Ln 148, Col 50 Spaces: 4 UTF-8 CRLF Python

Contents

Search

Drawing Order

- Prep
  - Flight_Routes_WM_Idx
  - Flight_Routes_RAW
  - Prep
  - Background

Prep | Final | Cook | QC

1:137,563,498 | 79.2131290°E 33.0600249°N

Geoprocessing

Select Layer By Attribute

Parameters | Environments

Input Rows

Flight_Routes_WM_Idx

Selection type

New selection

Expression

Load | Save | Clear

Clause | SQL

Invert Where Clause

Run

Catalog | Pop-up | Symbol... | Label Cl... | Geoproce... | Chart Pro...

Contents

Search

Drawing Order

- Prep
  - Flight_Routes_WM_Idx
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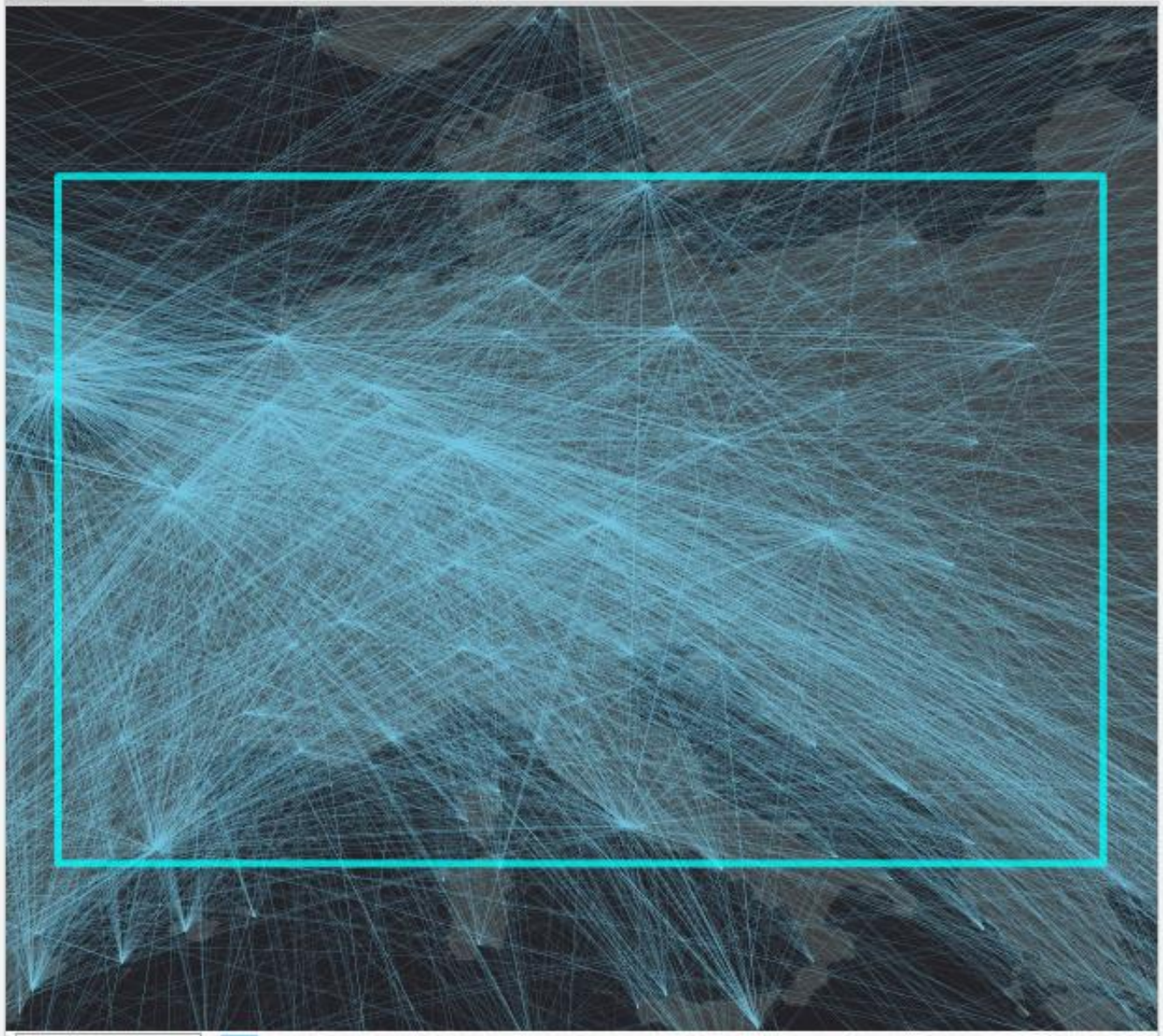

1:16,890,242 | 22.1846990°E 50.3174694°N

Geoprocessing

Select Layer By Attribute

Parameters | Environments

Input Rows

Flight_Routes_WM_Idx

Selection type

New selection

Expression

Load | Save | Clear

Clause | SQL

```
LOD = 4 AND V = 5 AND H = 8
```

Invert Where Clause

Run

Select Layer By Attribute completed.
View Details Open History

Catalog | Pop-up | Symbol... | Label Cl... | Geoproce... | Chart Pro...

Next Steps?

Did you make an efficient map?

¯_(ツ)_/

Did you make an efficient map?

- https://pro.arcgis.com/en/pro-app/help/mapping/map-authoring/author-a-map-for-vector-tile-creation.htm

- https://pro.arcgis.com/en/pro-app/help/mapping/map-authoring/author-a-multiscaled-map.htm

Did you make an efficient map?

- Fix the Data
- Fix the Cartography

Optimizing | Data

- Use a local FGDB copy / extract of your data
- Clean your data
  - Eliminate duplicates
  - Check/fix geometry errors
- How dense is your data?
  - Set reasonable scale dependencies
  - Generalize

Optimizing | Data

- Use a local FGDB copy / extract of your data
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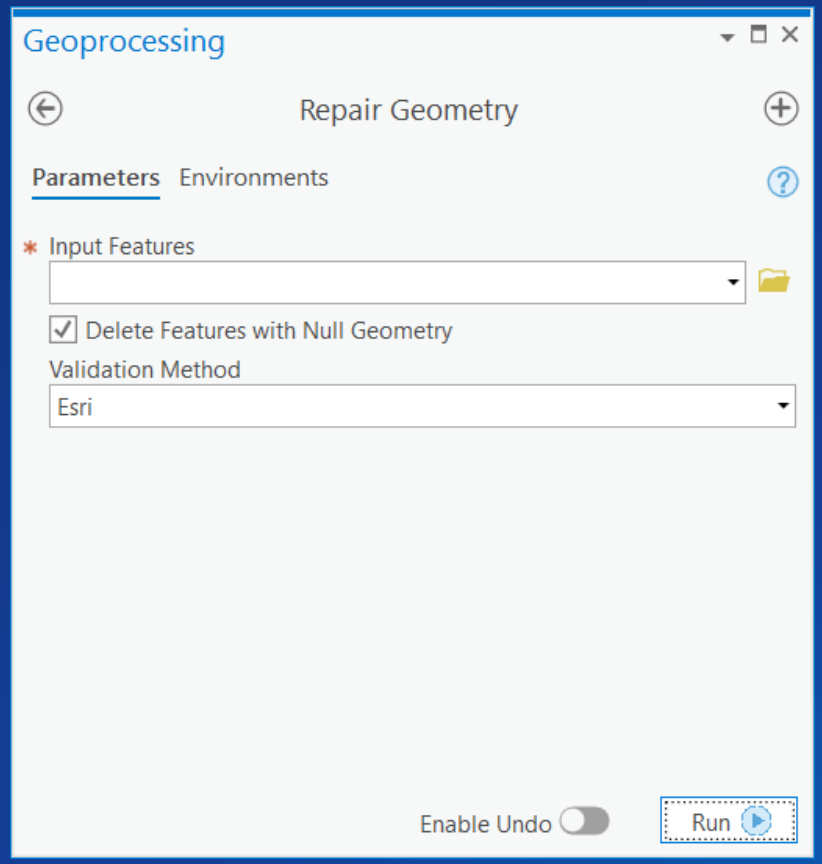
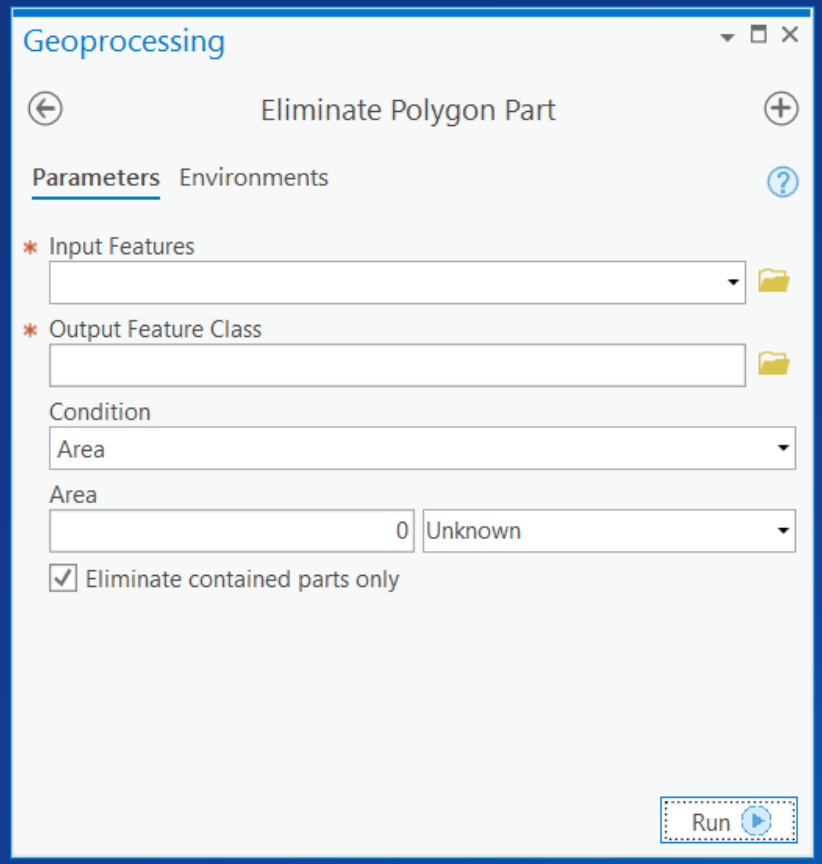
Generalization | Repair Geometry

- **Sanitizes input**



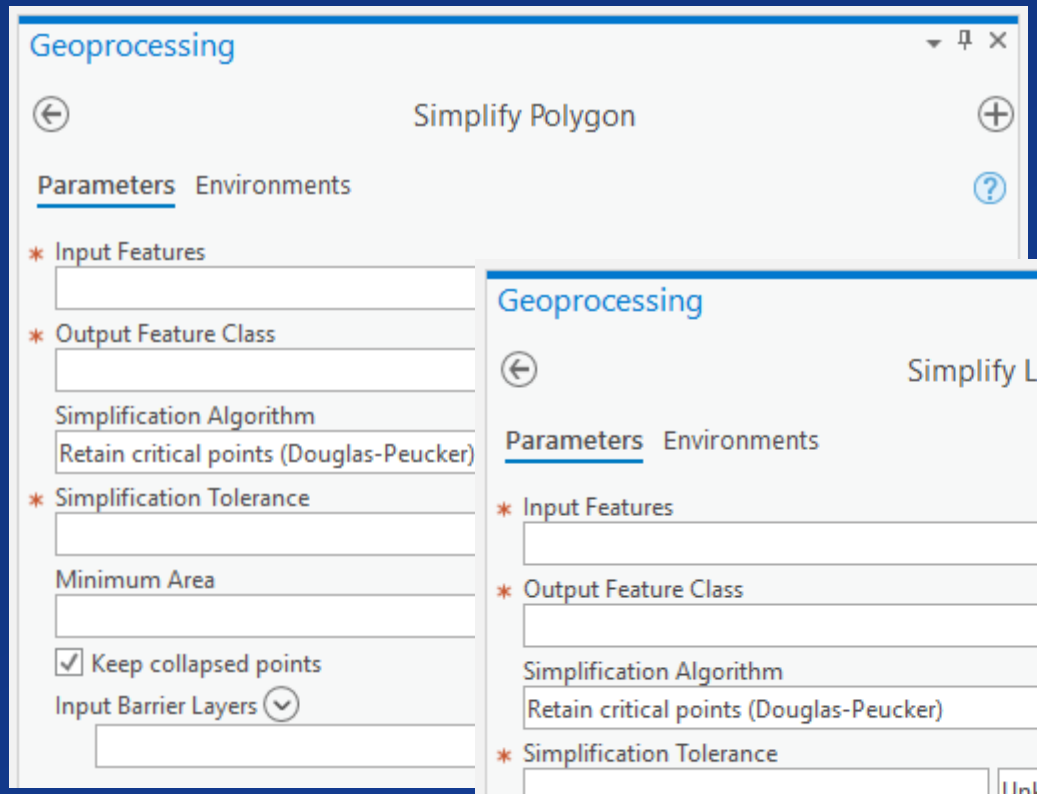
Generalization | Eliminate Polygon Part

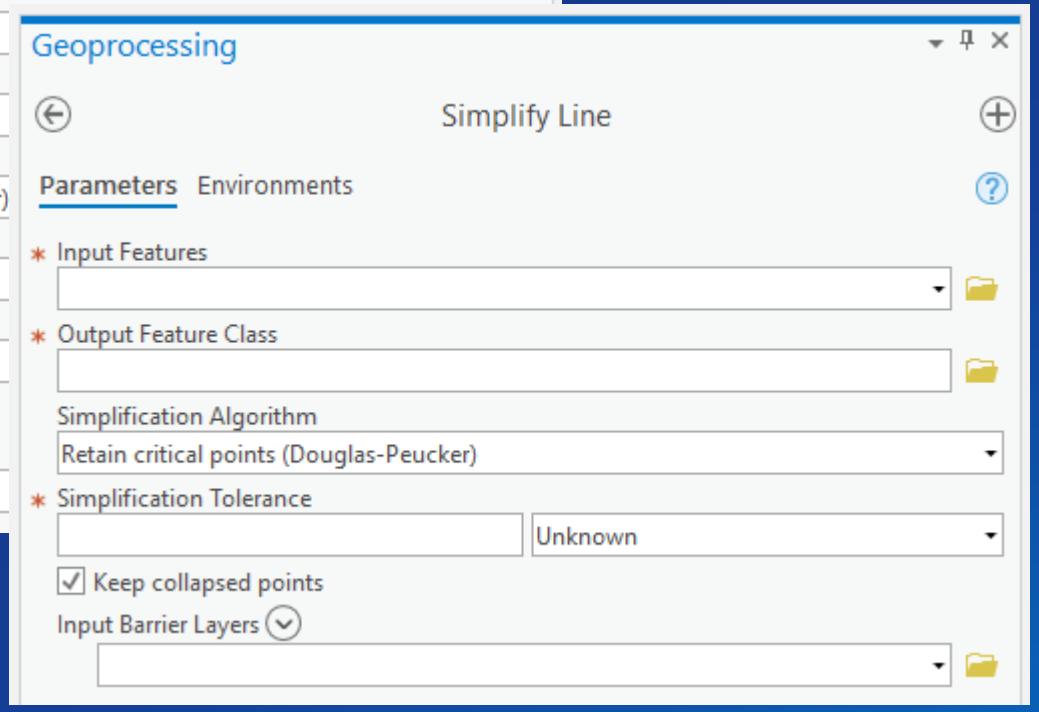
- **Eliminate Parts that are too small to show**
  - Be aware of pixel size
  - Optionally remove holes only

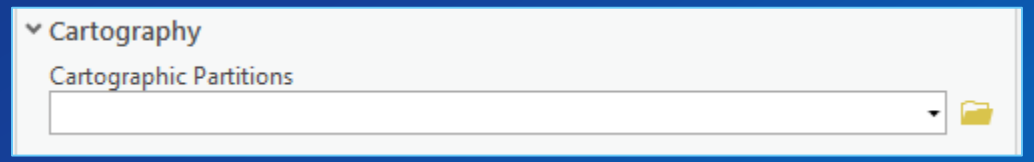


Generalization | Simplify Polygon / Line

- **Reduce polygon / line vertices**
  - Be aware of pixel size
  - Utilize cartographic partitions with large datasets

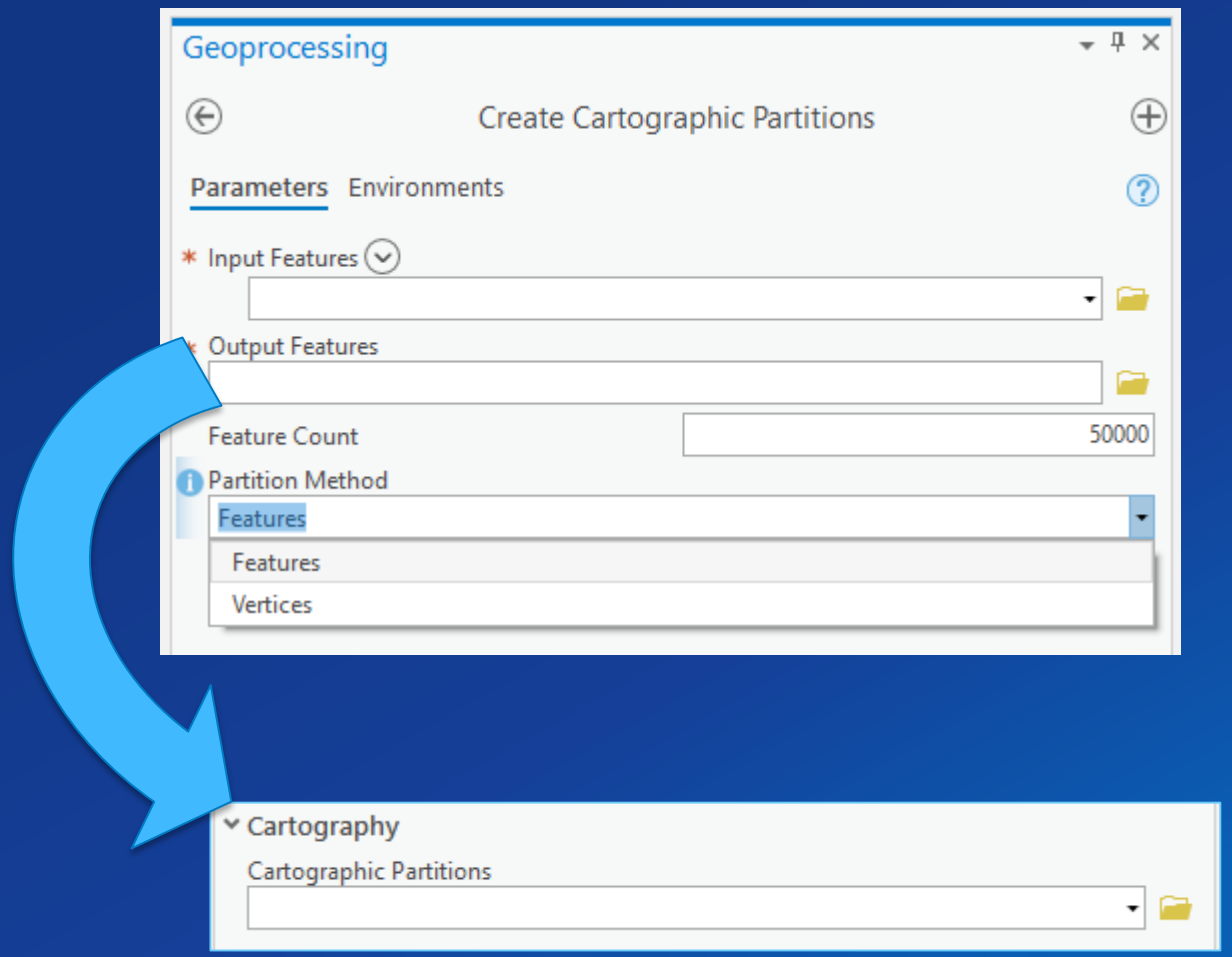






Generalization | Create Cartographic Partitions

- **Minimize “out of memory” errors with large datasets**
  - Use with Simplify Polygon / Line
  - Enhanced at Pro 2.5 to also evaluate vertex counts



Optimizing | Cartography

- Set your scales according to the tiling scheme you select
- Remember scale logic in Pro is different from ArcMap
  - Uncheck the box
- Convert representations to unique value symbols
- Limit…
  - number of layers
  - duplication of content
  - inclusion of additional fields / data in the tileset

Optimizing | Cartography

- Avoid…
  - group layers
  - complex symbols and unsupported symbol effects: hatched / gradient fills
  - unsupported layer types: annotations, basemaps

- Be mindful of users that want to re-style your maps

Resources

- Vector Tile PBF viewer web app
  - https://github.com/hfleischer/vector-tile-analysis

- Python file size report
  - https://github.com/tfauvell/qc_vt_tileset

- Protobuf Editor
  - https://sourceforge.net/projects/protobufeditor/files/ProtoBufEditor/Test_Releases/
  - Version_0.97k
  - You'll also need:
    - Protobuf-2.6.1.zip → protoc.exe
    - vector_tile.proto file

Print Your Certificate of Attendance

Print Stations Located in 150 Concourse Lobby

Tuesday

12:30 pm – 6:30 pm
Expo
Hall B

5:15 pm – 6:30 pm
Expo Social
Hall B

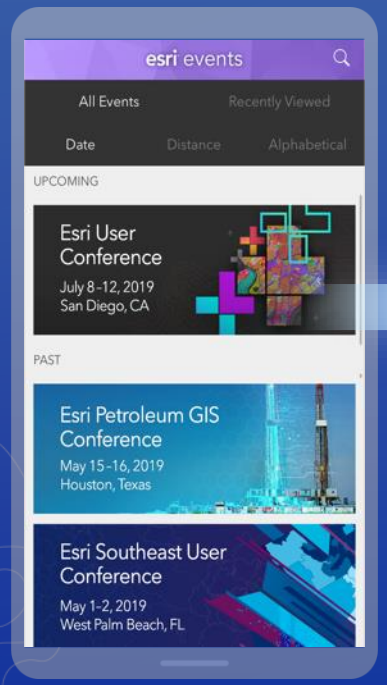
Wednesday

10:45 am – 5:15 pm
Expo
Hall B

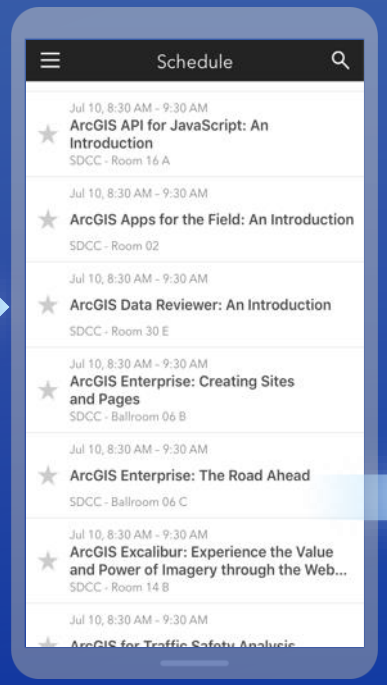
6:30 pm – 9:30 pm
Networking Reception
Smithsonian National Museum
of Natural History

Please Share Your Feedback in the App

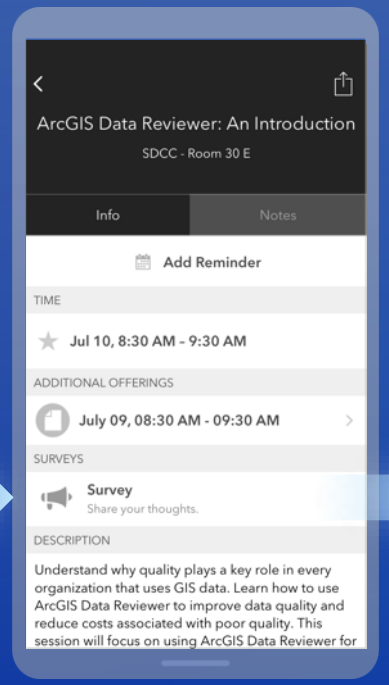
Download the Esri Events app and find your event



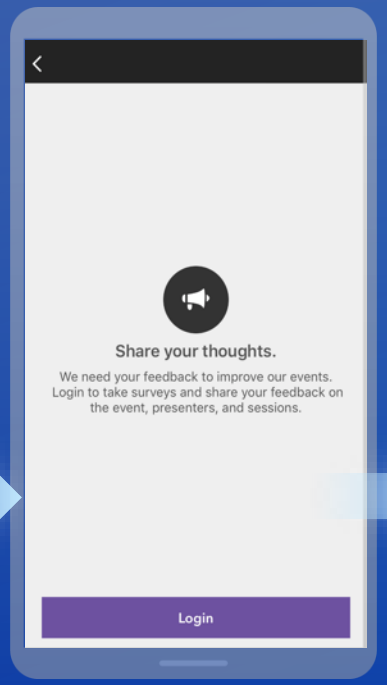
Select the session you attended



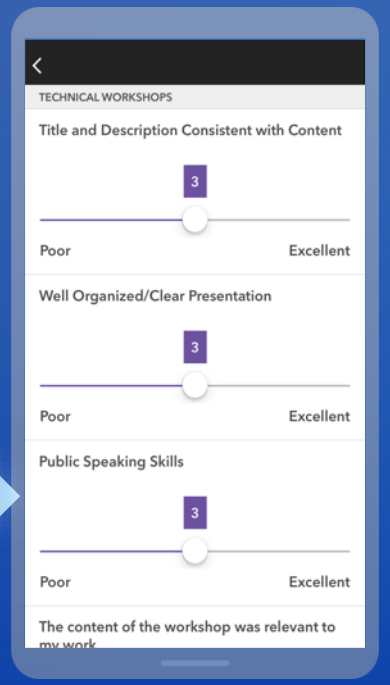
Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"



Questions?

And maybe some answers?