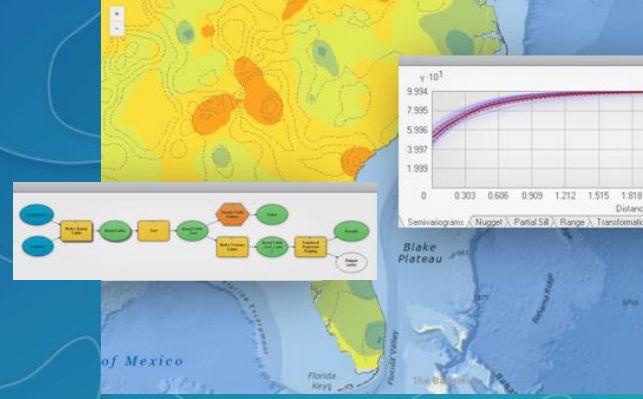
ArcGIS Pro: Analysis and Geoprocessing

Drew Flater and Jian Lange

Analysis & Geoprocessing in ArcGIS Pro



Is it faster?
About 10-20% for many tools. UX is more efficient.

esriurl.com/GPproFAQ

Does it have the same tools?
About 95% of the core ArcMap suite has been ported. Pro also has many new analytic tools that ArcMap does not have.

Can I use ArcGIS Online and Enterprise analysis tools?
Ready-to-Use service tools jump start your analysis and consume credits. Enterprise tools include Standard Feature, GeoAnalytics, and Raster Analysis.

Is interactive input supported? (ArcMap's Feature Sets)
Interactive input was added to a number of system tools in v2.0. Can also be used by custom tools. Full equivalency in 2.1.

What does multi-threaded processing mean?
You can do other tasks in the app while a tool is running.

Are tools licensed differently? How about analysis extensions?
Same as ArcMap.

Can I process the same data?
Personal GDB (.mdb) not supported, all other local and enterprise formats supported. Pro analysis natively supports layers from your Portal, service URLs, KML layers, and WFS layers.

Can I publish a geoprocessing service?
The Web GIS equivalent is sharing a web tool to your Enterprise. Support in 1.4.

What is the benefit of 64-bit processing?
64-bit is not about performance. It lets you load more data into memory. It is more robust and many processes that used to hang, crash, or run out of memory may complete successfully.

Does it use multiple cores to do parallel processing? How about GPU?
A growing list of tools support the PARALLEL PROCESSING FACTOR and GPU.

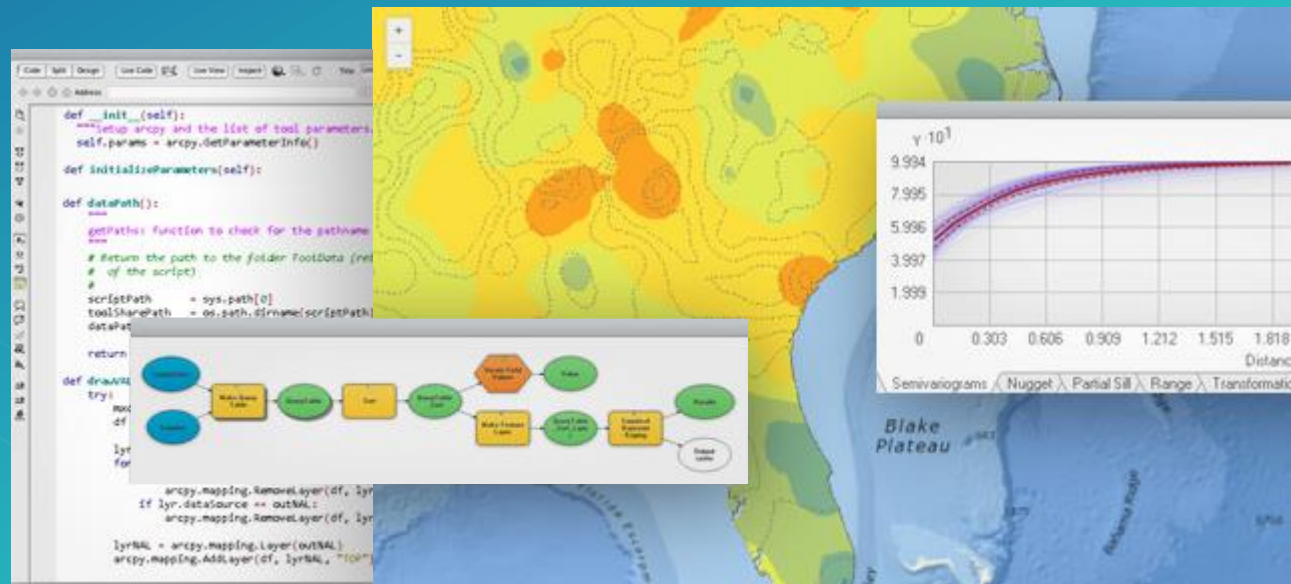
Can Pro run my models and scripts?
With very little or no modification. There are established patterns for writing Python that works in py2 and py3. *arcpy.mp

Any other reason to use Pro?
Charts are integrated in analysis workflow.
R-ArcGIS bridge first-class citizen.
Conda and Python Package Manager.

What is analysis?

Analysis transforms raw data into information or knowledge

Spatial analysis **does this for geographic or spatial data**



Who? What? Where? When? Why?

Spatial analysis is used to answer *where* or location questions

Where is the best location for a new community center?

Where is an area with statistically high crime rates?

Where has the landscape changed in the last 10 years?

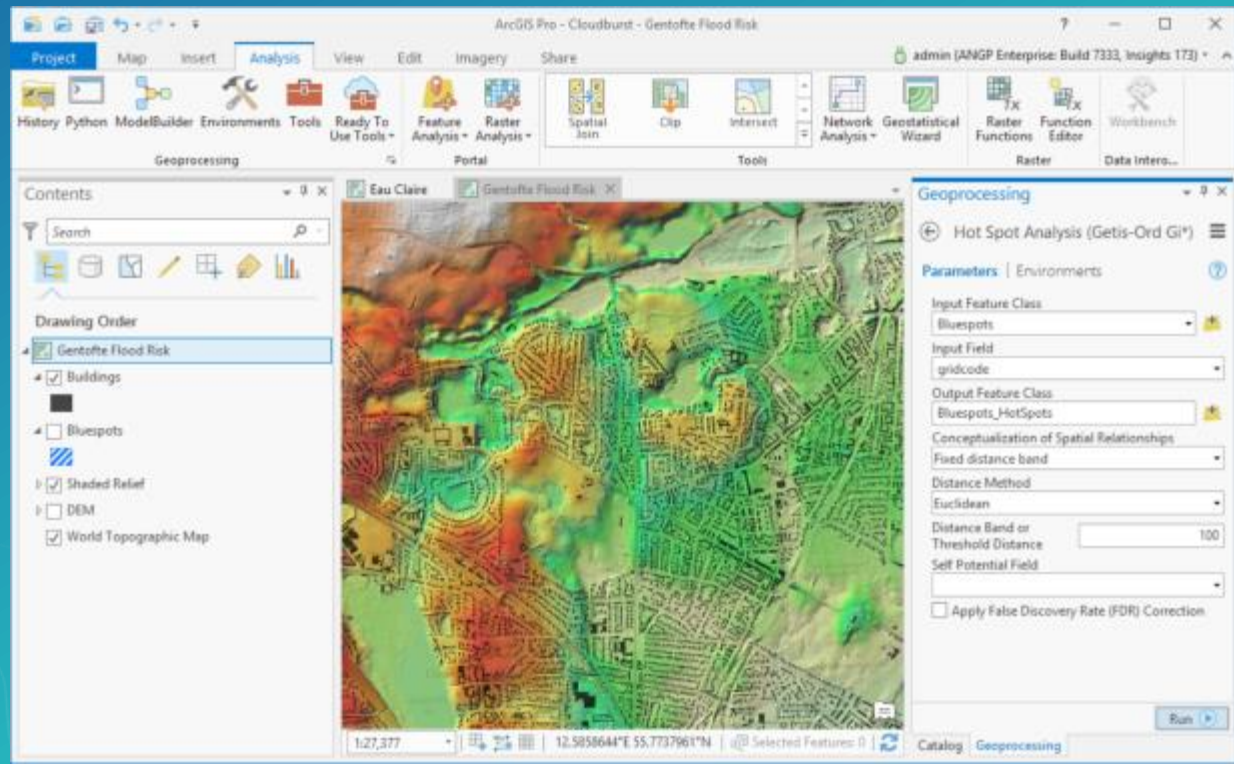
Analysis in ArcGIS Pro

Pro 1.4 – Feb.
Pro 2.0 – Now!

ArcGIS Pro provides incredible analysis capabilities in 2D, 3D, and 4D (time)

Scalable 64-bit execution, non-blocking threading, and improved visualization

Geoprocessing is the technology that enables spatial analysis in the ArcGIS Platform



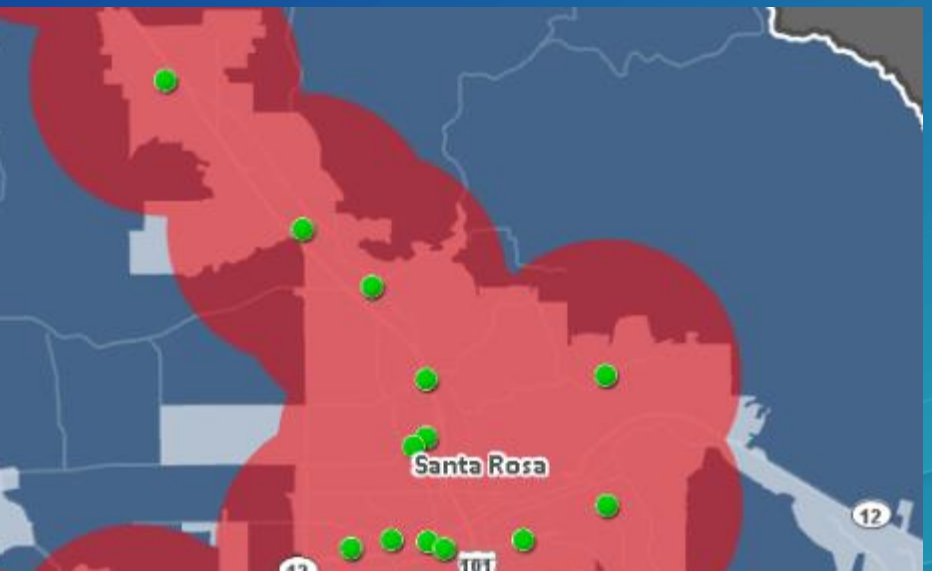
What is geoprocessing?

Geoprocessing is a rich suite of tools for processing geographic data

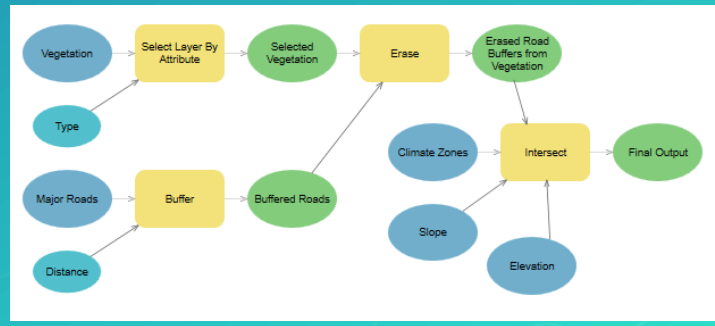
Spatial analysis + GIS data management

A typical geoprocessing tool processes input data and produces an output

E.g. Buffer a map layer to create areas around the layer's features



Geoprocessing is also a framework you can use to model and automate processes using ModelBuilder or Python scripts



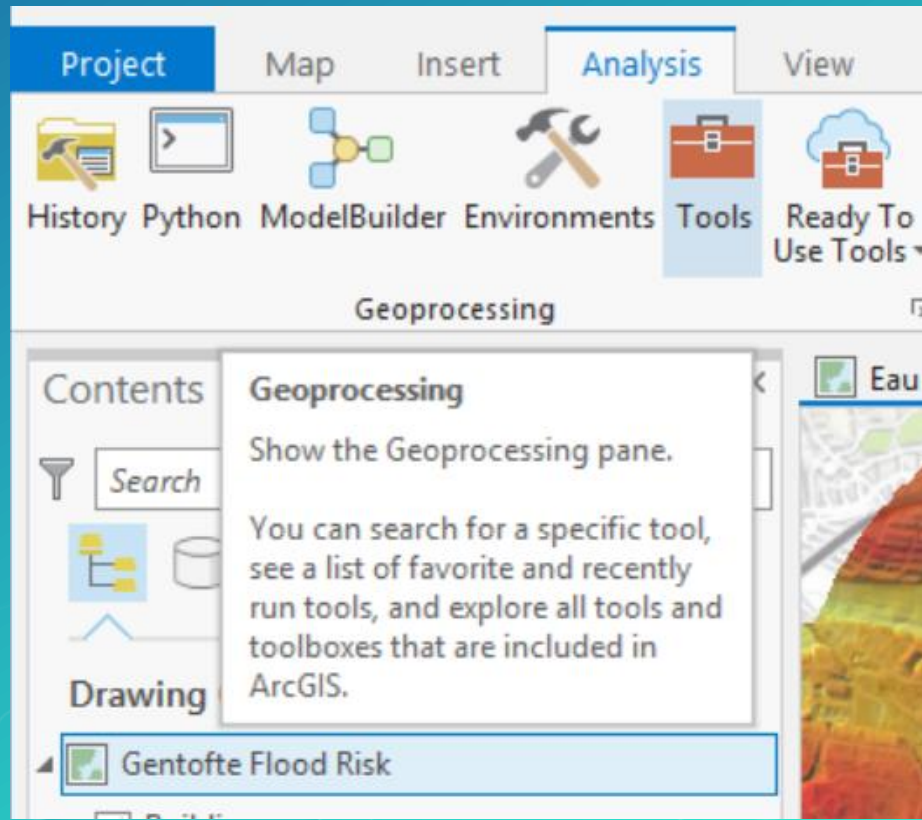
Analysis in ArcGIS Pro

The *Analysis* ribbon tab provides access to

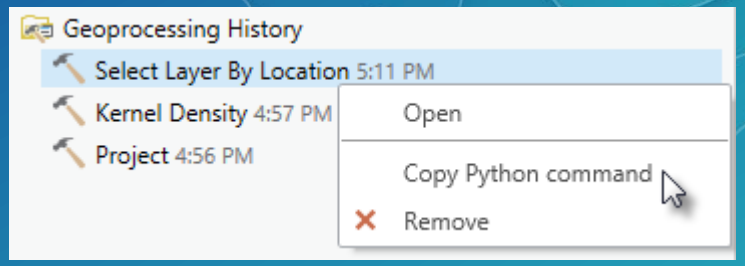
- Gallery of commonly-used tools
- Suite of all ~800 geoprocessing tools
- ArcGIS Enterprise and Online analysis tools
- Geoprocessing History
- Python command line
- ModelBuilder
- Network Analysis
- Imagery processing / raster functions
- Data Interoperability Workbench

Geoprocessing in ArcGIS Pro

- Full user experience driven through the Geoprocessing pane
  - Search for tools or browse Toolboxes tree-view
  - Open tool and set parameter and environment settings
  - Run the tool and track progress
- Easy migration for ArcMap users
- Supports most* tools, models, and Python scripts that work in ArcMap
  - *ArcObjects-based custom tools are not supported
- Supports traditional feature and raster data sources as well as web layers
- History provides a log of all tools you run
  - Share as a geoprocessing package or web tool



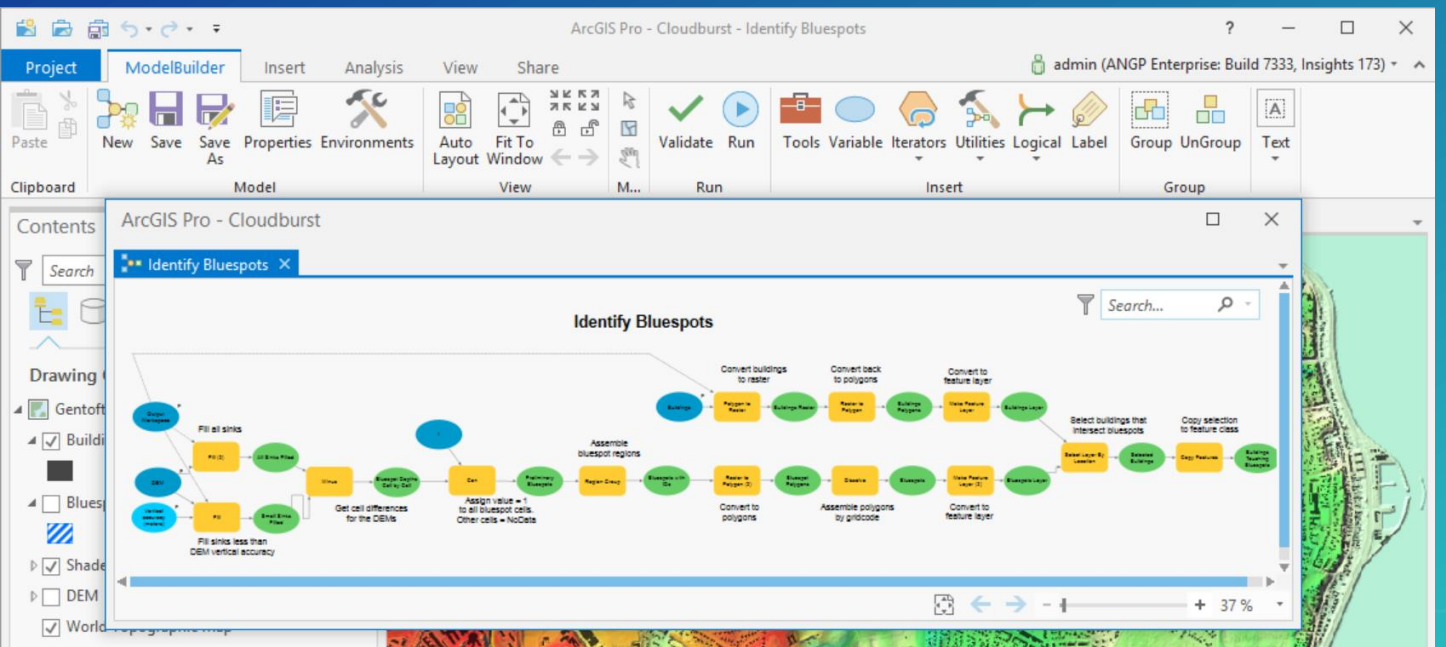
Create a geoprocessing workflow



Automate geoprocessing in a Python script

To get started, run the tool in Pro, then *Copy Python command* and paste into script

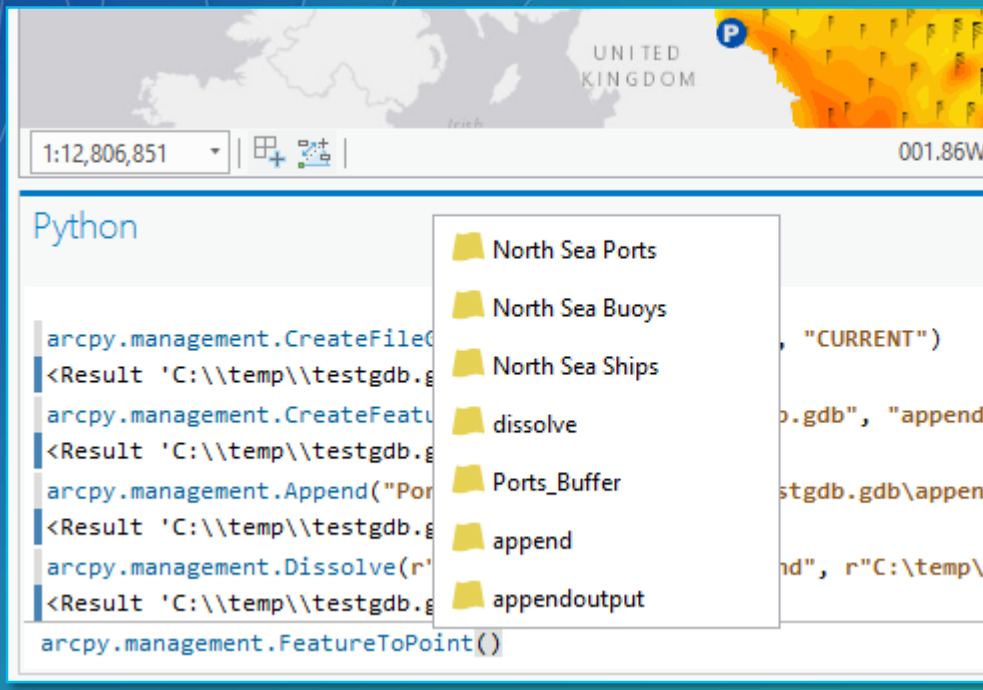
```
arcpy.Buffer_analysis(input, output, "10 Miles")
```



Build a model of your workflow using ModelBuilder

Connect tools and data to make a diagram that represents your workflow

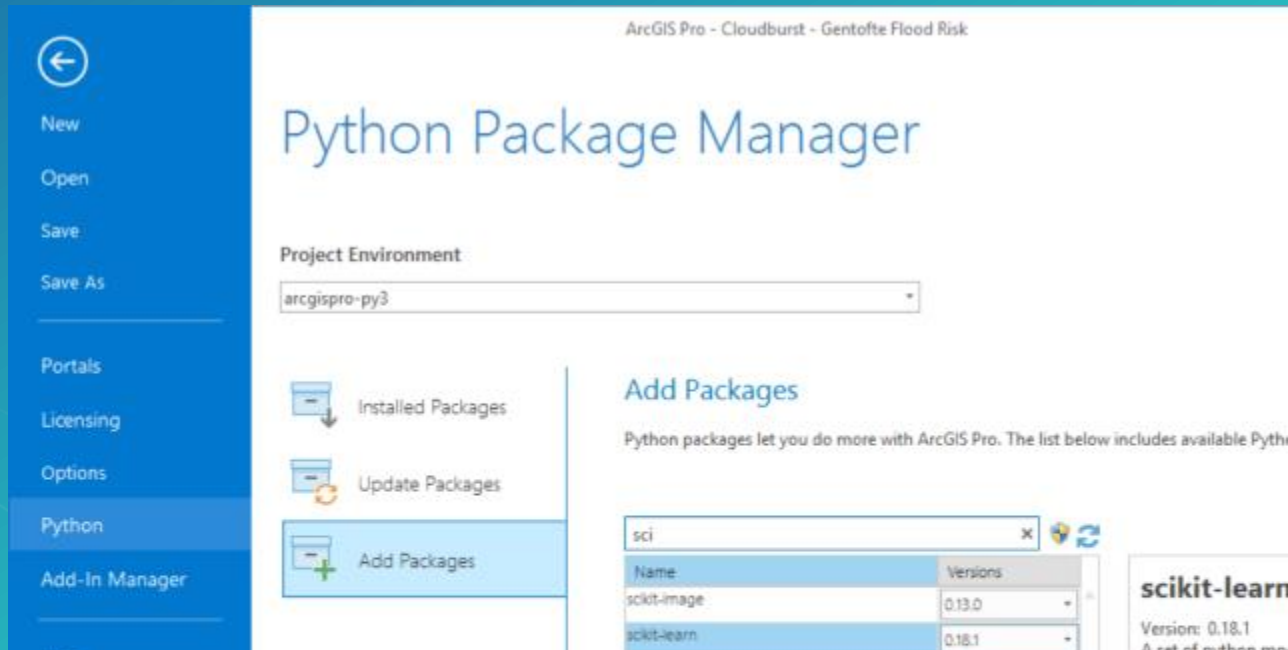
Python in ArcGIS Pro



Uses Conda environment manager and enhanced with built-in Python Package Manager

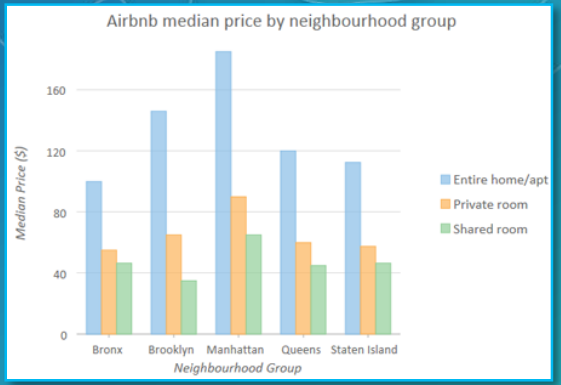
- Makes it easy to find and install additional libraries, including Python API for ArcGIS for scripting portal operations

Includes new libraries: Pandas, SciPy, NetCDF4



Charts

Use charts to explore your data and communicate a message

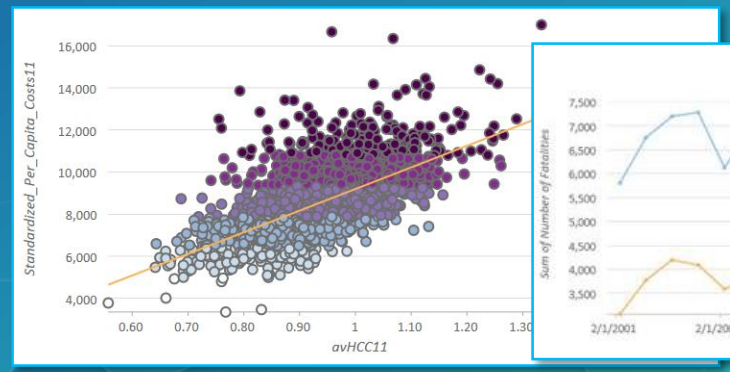


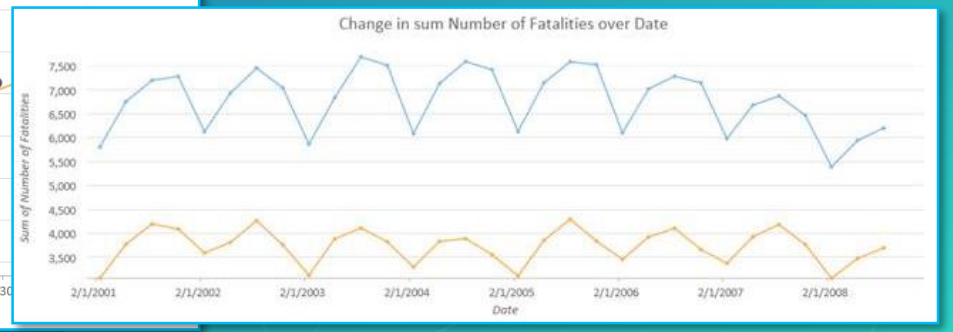
Include as part of your analysis workflow to:

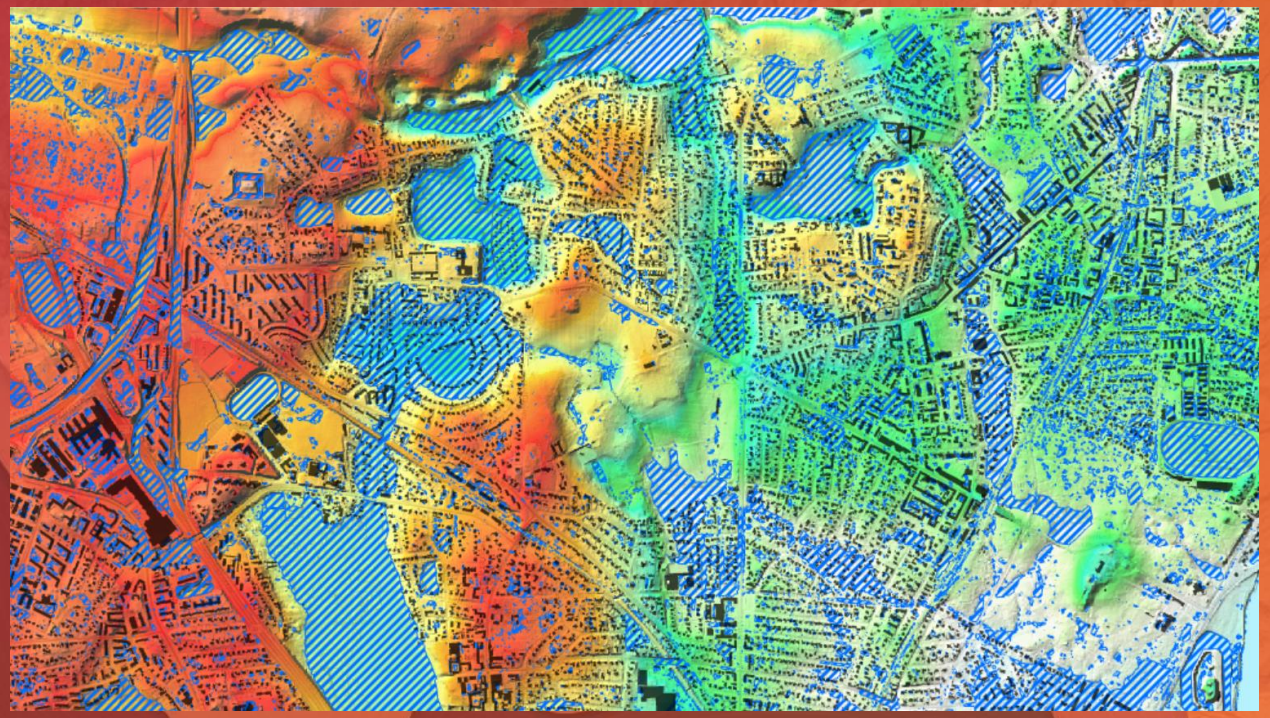
- Understand patterns and relationships before running an analysis
- Communicate information about your analysis results

Create a bar chart, scatter plot, histogram, line chart, profile graph or box plot

Fully interactive with the map layers and extent, attribute table, and range and time filters







Demo

Flood risk assessment

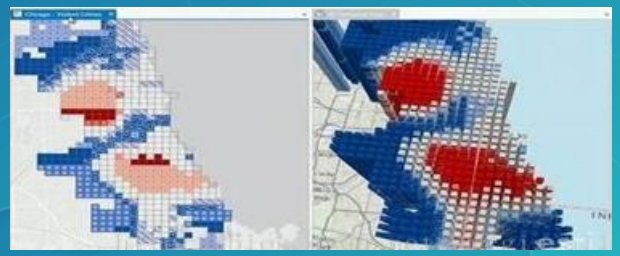
Spatial Statistics

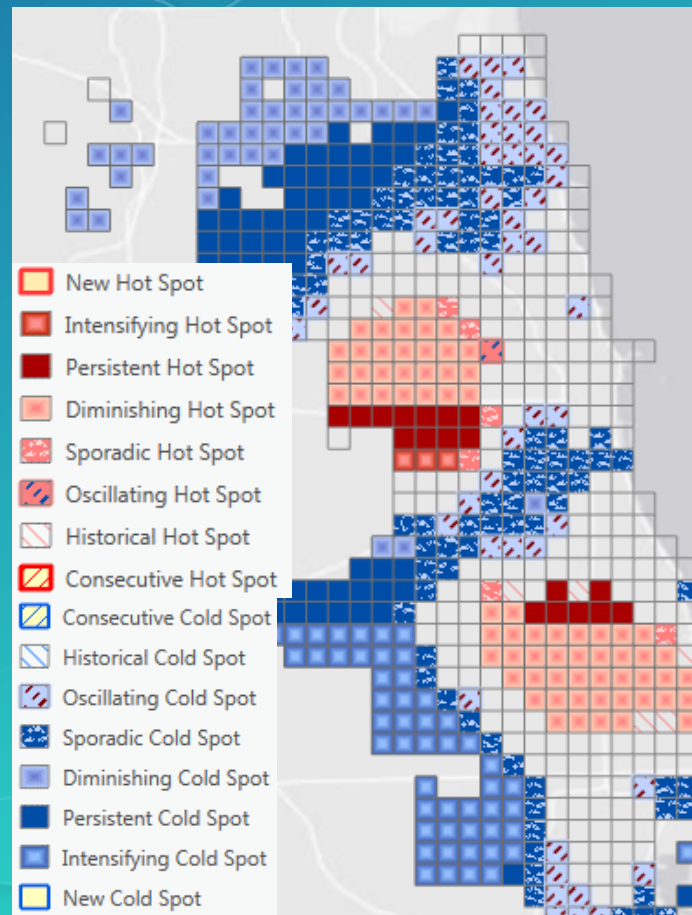
Statistical tools for analyzing spatial distributions, patterns, processes and relationships

- Summarize key characteristics of a spatial distribution
- Identify significant clusters and outliers, hot and cold spots
- Model and explore spatial relationship through regression

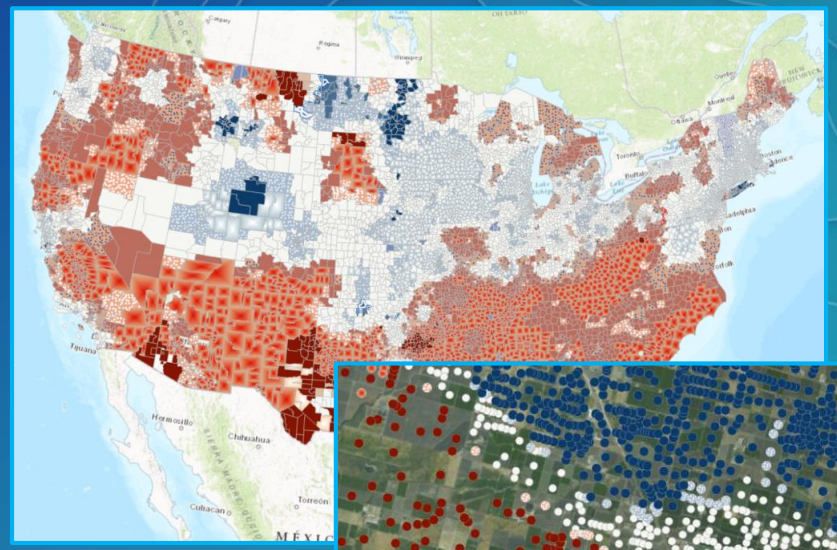
Space-Time Pattern Mining

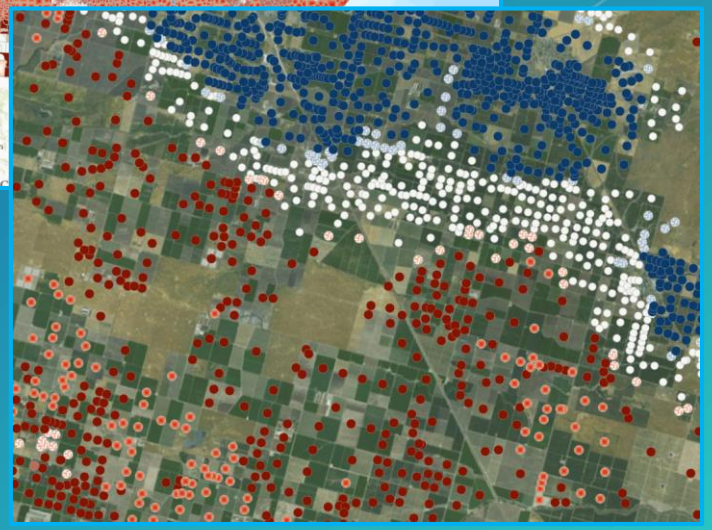
- Aggregate data into cube data structure and identifies hot and cold spot trends and outliers
- Visualize the cube in 3D (add-in makes it easy)





Spatial Statistics advancements



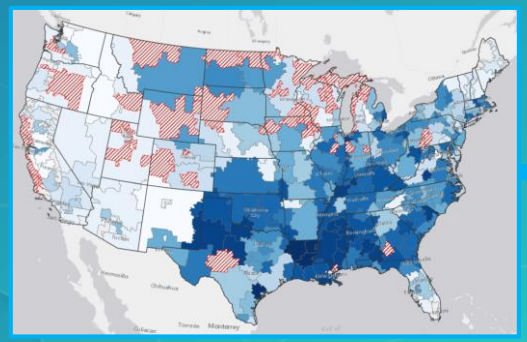


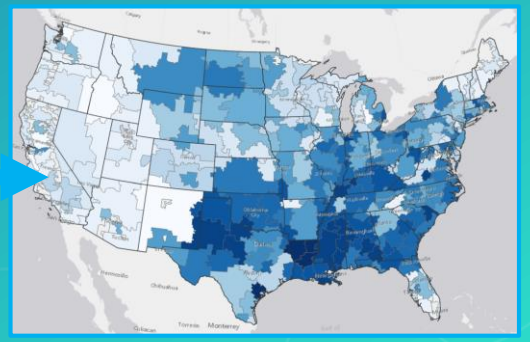
Create Space Time Cube From Defined Locations

Uses point or polygon locations where geography does not change but attributes are changing over time

Fill Missing Values

Replaces missing or null values with estimates based on spatial and temporal neighbors





R-ArcGIS Bridge

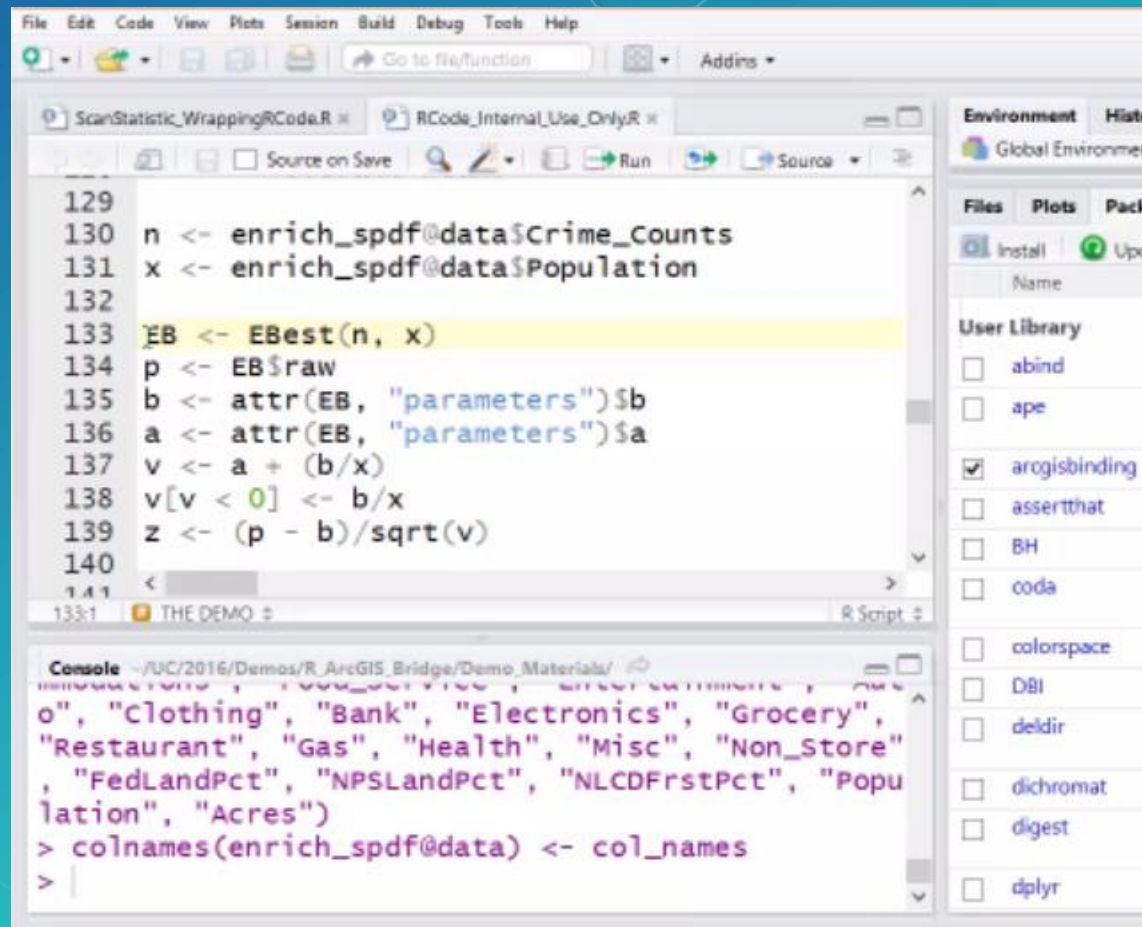
R is the most widely-used statistical computing language in the world

Includes thousands of libraries for diverse applications

R-ArcGIS Bridge makes it easy to use GIS data in an R script

R-based script tool provides familiar geoprocessing tool for GIS users, but executes in the R engine

Requires installation of R and R-ArcGIS bridge



Connected GIS

Integration with Web GIS

ArcGIS Pro

- Pro is designed to be connected directly with ArcGIS Online and ArcGIS Enterprise
- Access information and layers stored in your web GIS
- Share custom analytics to ArcGIS Enterprise
- Leverage the full analytic power of ArcGIS, including ArcGIS Online and ArcGIS Enterprise tools and services

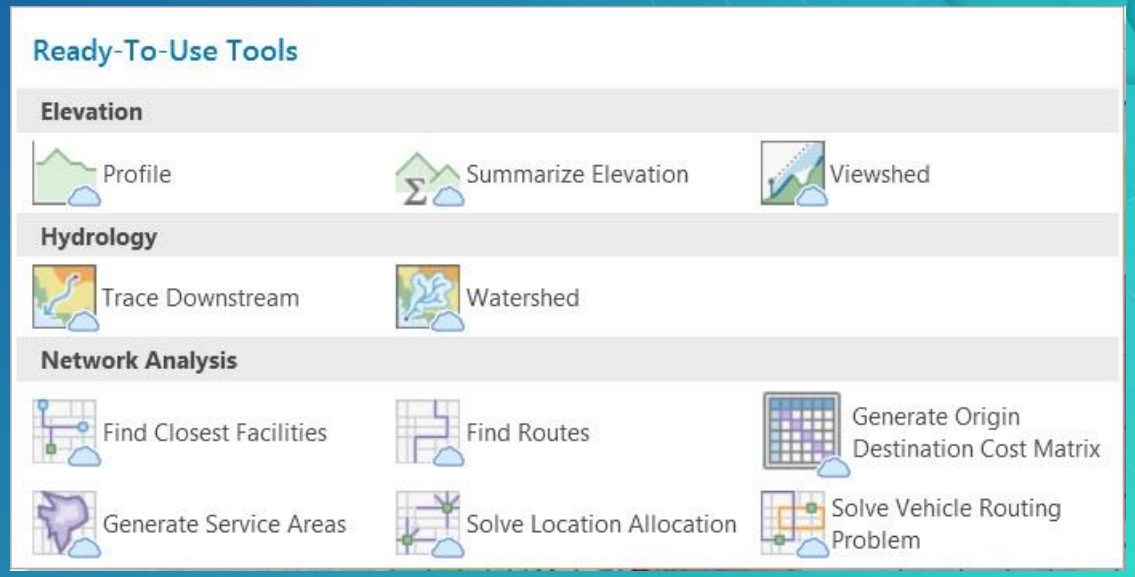
Ready to use tools

ArcGIS Online

Analytical operations hosted by ArcGIS Online, using Esri curated elevation, hydrologic, and street network data

Simply provide a few basic inputs

Uses ArcGIS.com credits and you must be connected to an ArcGIS online organization with analysis privileges



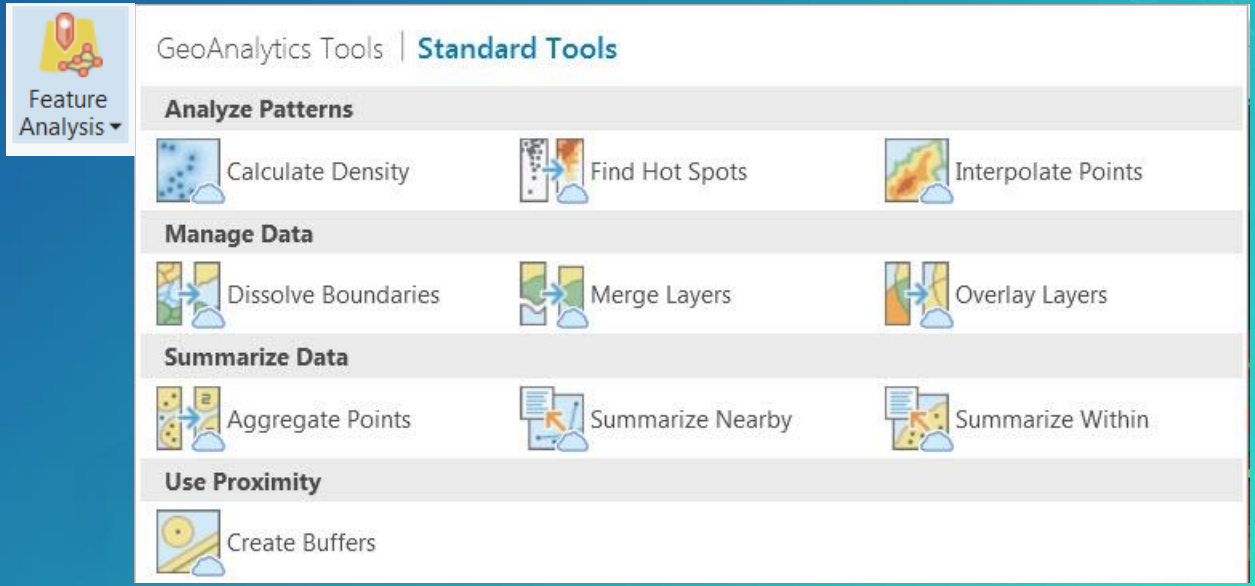
ArcGIS Enterprise Standard Feature Tools

Contains tools for performing spatial analysis on feature data in your ArcGIS Enterprise

Only the use of ArcGIS Online utility services will consume credits

Run on a single server machine and are optimal for your standard sized data

Output layers in My Contents



ArcGIS Enterprise GeoAnalytics Tools

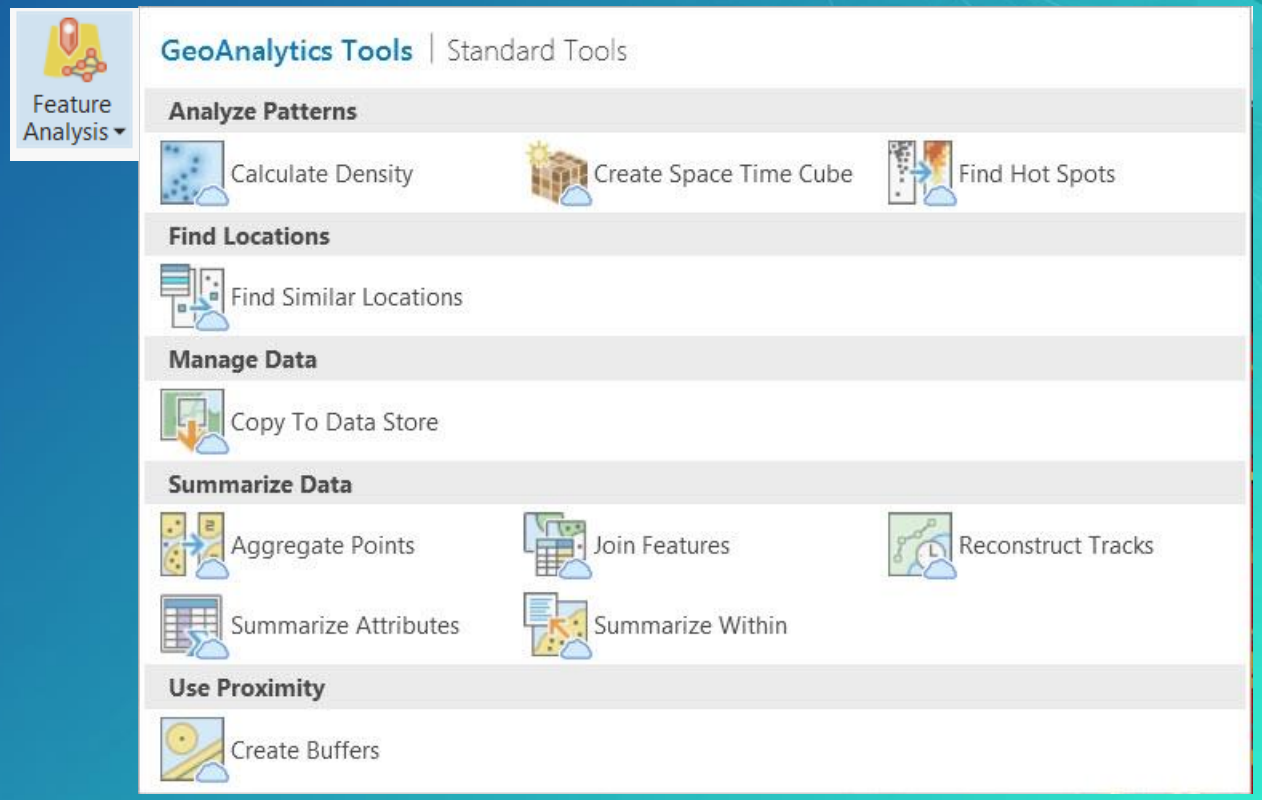
Run analytics against vector and tabular data that is too big for a single desktop machine, normally stored in a big data file share

Distributed processing using Spark on cluster of server nodes

Includes both spatial (location) and temporal (time) components

Output to a spatiotemporal datastore

Requires GeoAnalytics Server



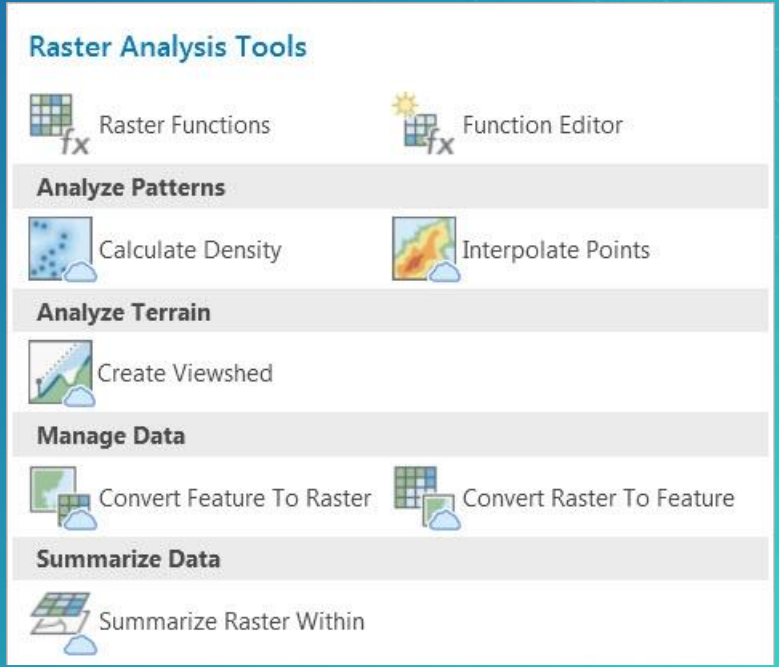
ArcGIS Enterprise Raster Analysis Tools

Enable massive distributed processing and analysis of imagery and rasters

Leverage distributed processing

A capability of Image Server

A preconfigured set of tools, additionally supports custom raster function chains uploaded to image server



Analysis Extensions

ArcGIS Pro

Analysis Extensions

Extensions build on the core analysis capabilities of ArcGIS Pro

ArcGIS 3D Analyst	ArcGIS Spatial Analyst
ArcGIS Geostatistical Analyst	ArcGIS Data Interoperability
ArcGIS Network Analyst	ArcGIS Data Reviewer

Primarily comprised of additional geoprocessing toolboxes

Licensing same as ArcMap

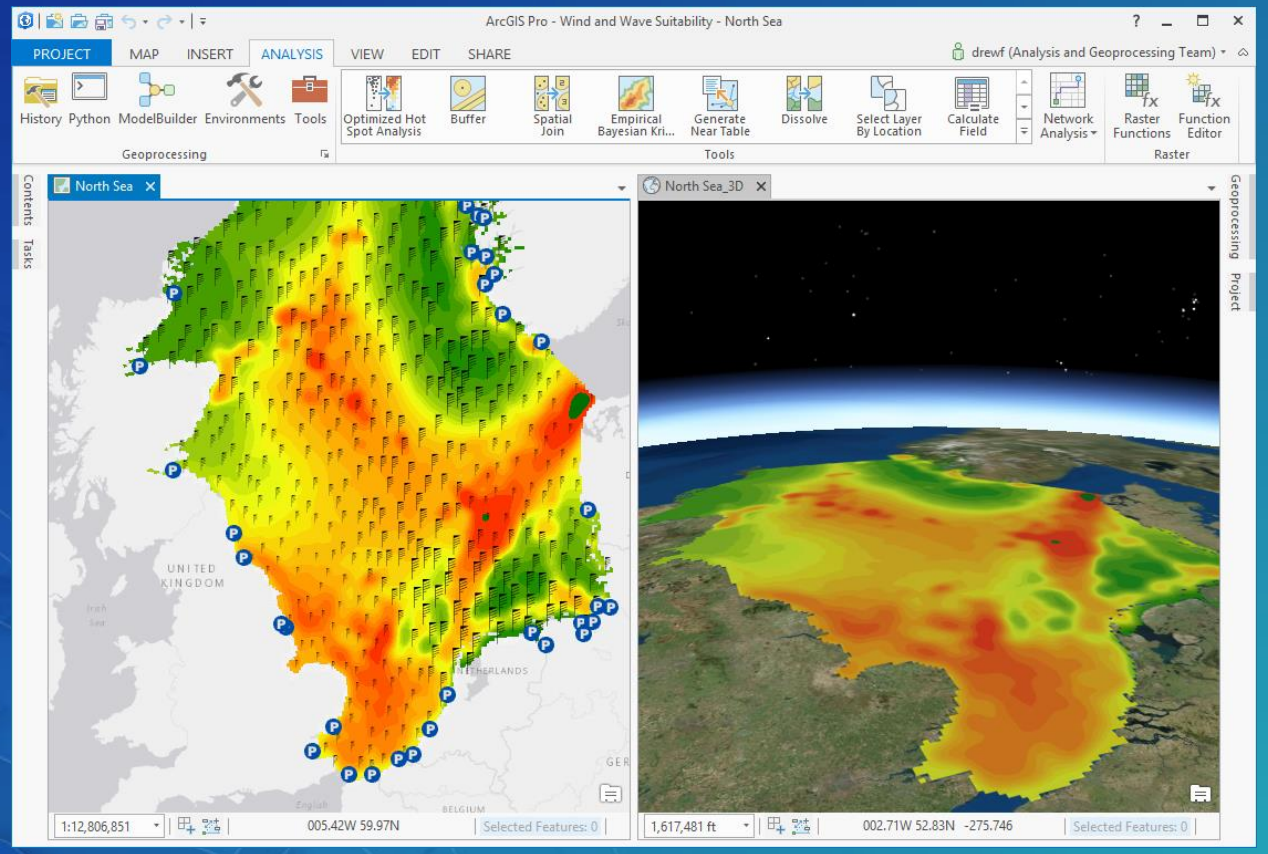
- **Manage extension licenses the same way you license Pro (Named User, Single Use, Concurrent Use)**

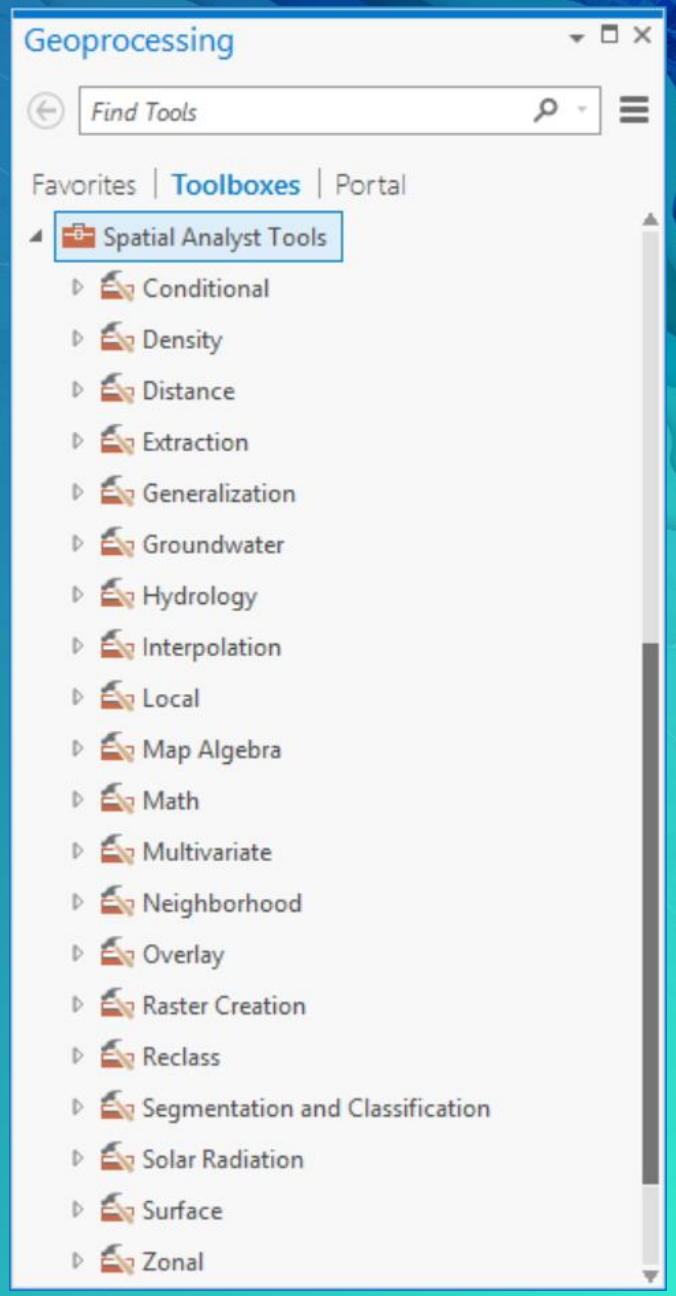
Spatial Analyst

Spatial Analyst

Extension available across the ArcGIS platform

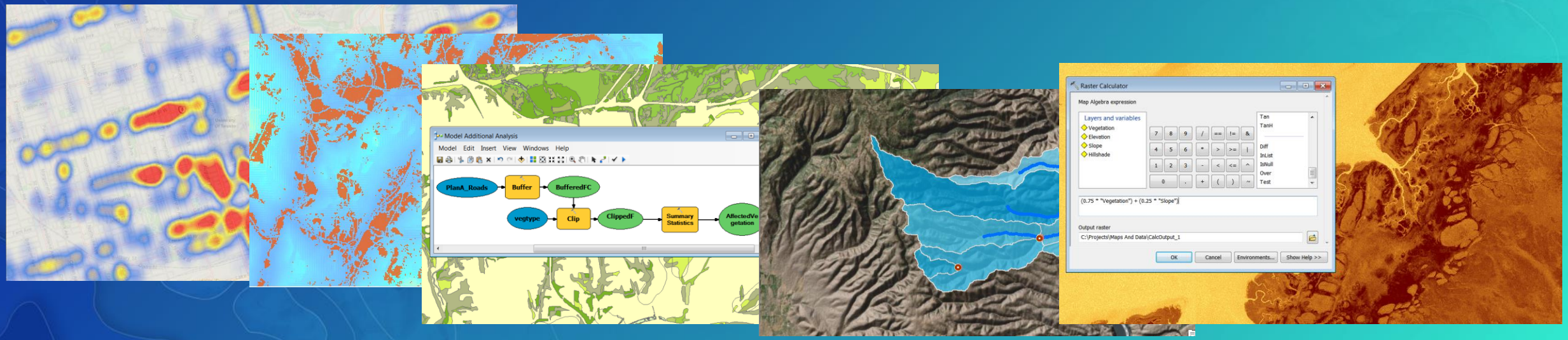
Provide spatial modeling and analysis tools for raster data





Spatial Analyst key features

- Suitability modeling
- Density analysis
- Distance and cost of travel analysis
- Interpolation
- Hydrologic analysis, watersheds
- Powerful Map Algebra language & Raster Calculator



Spatial Analyst Highlights (1.3)

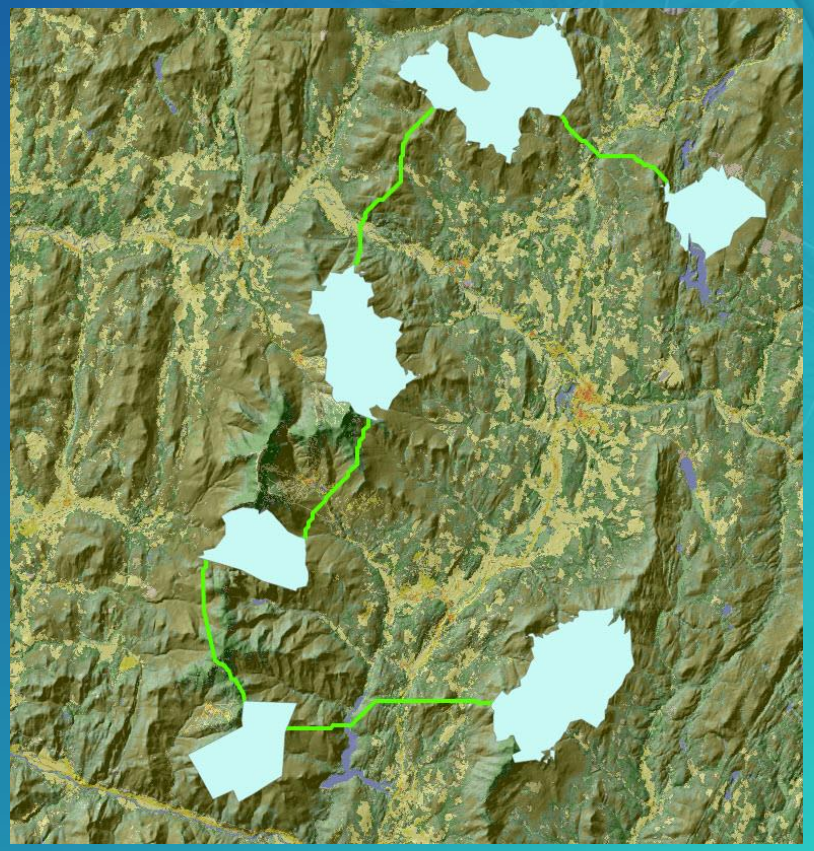
Site Selection Suitability Modeling

New Rescale By Function tool for assigning weights to model criteria

New Locate Regions tool for identifying most suitable regions from a suitability map.

Cost Distance Analysis

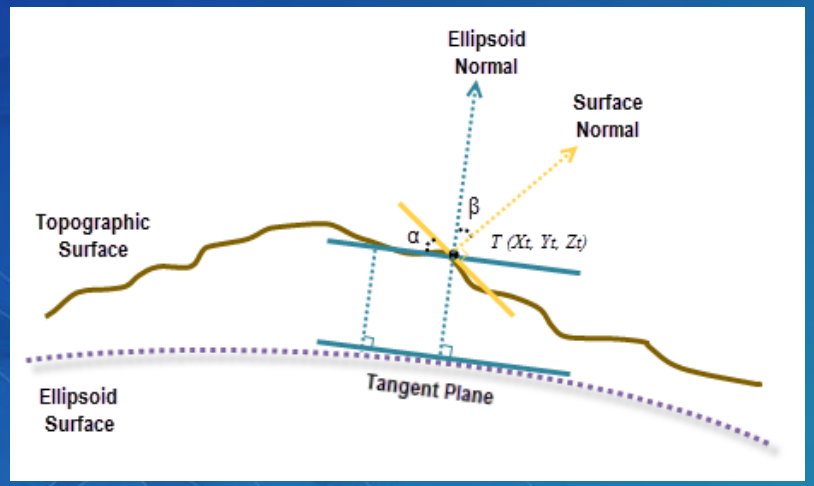
New Cost Connectivity tool makes it possible to quickly identify the optimal path between multiple locations in a non-networked cost distance problem.



New in 2.0: Slope and Aspect calculation improvements

More accurate, geodesic calculation

- No scale factor needed with lat/long DEM
- Locally parallel and **GPU aware**



Spline with Barriers

Now available in Pro

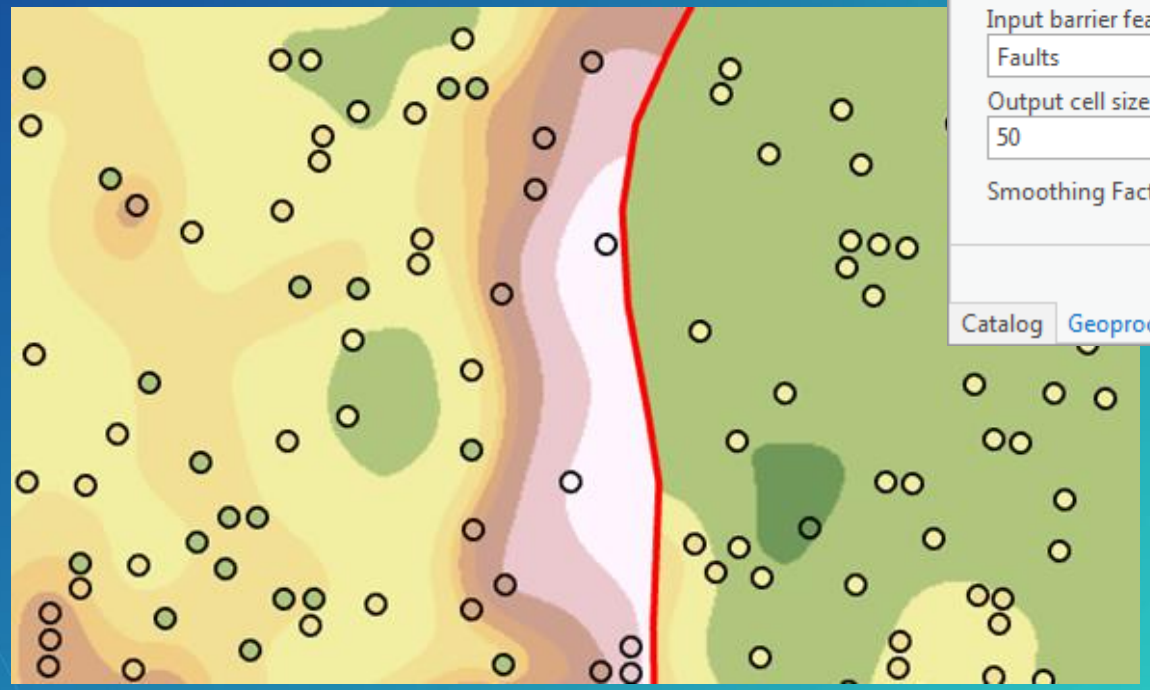
Create interpolated surfaces with discontinuities (faults)

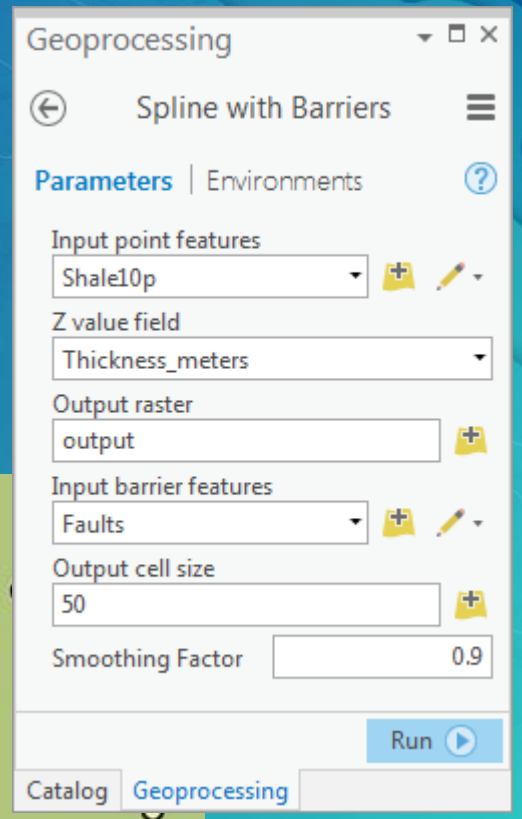
Important tool for oil/gas industry and others

5x faster

Works with bigger data

Fixed many bugs



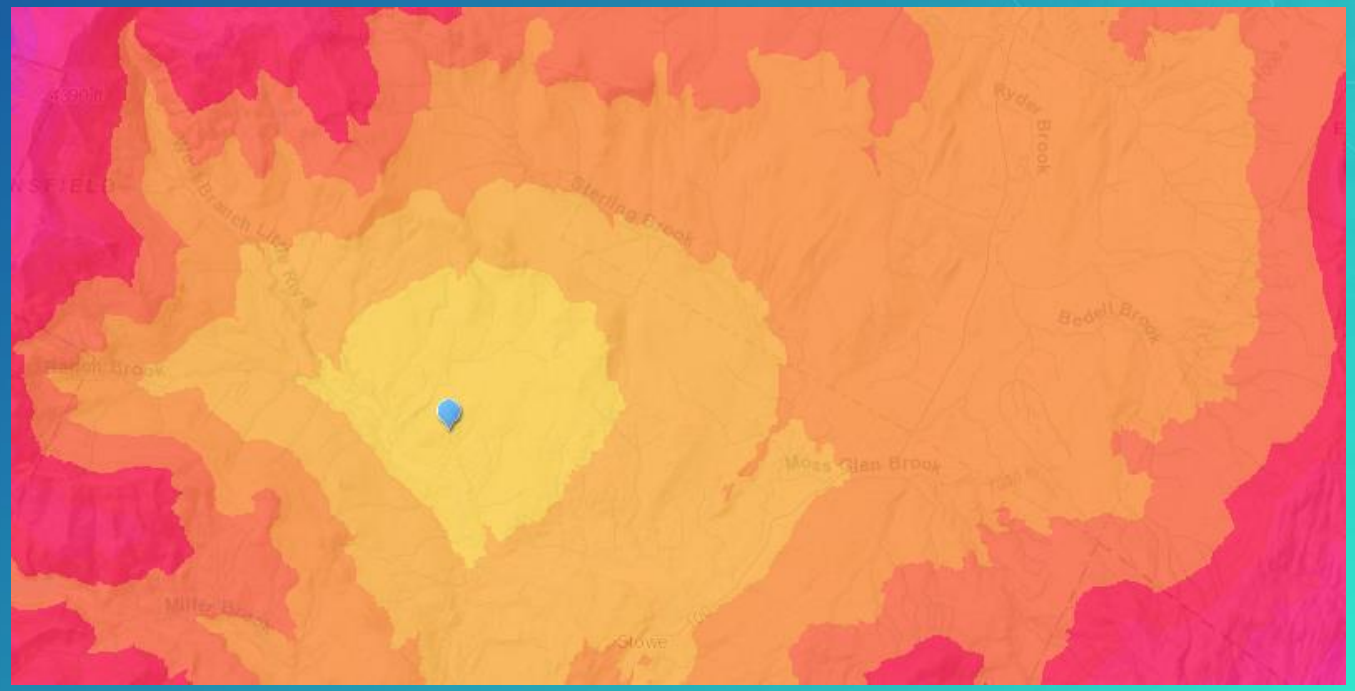


Distance Analysis improvements

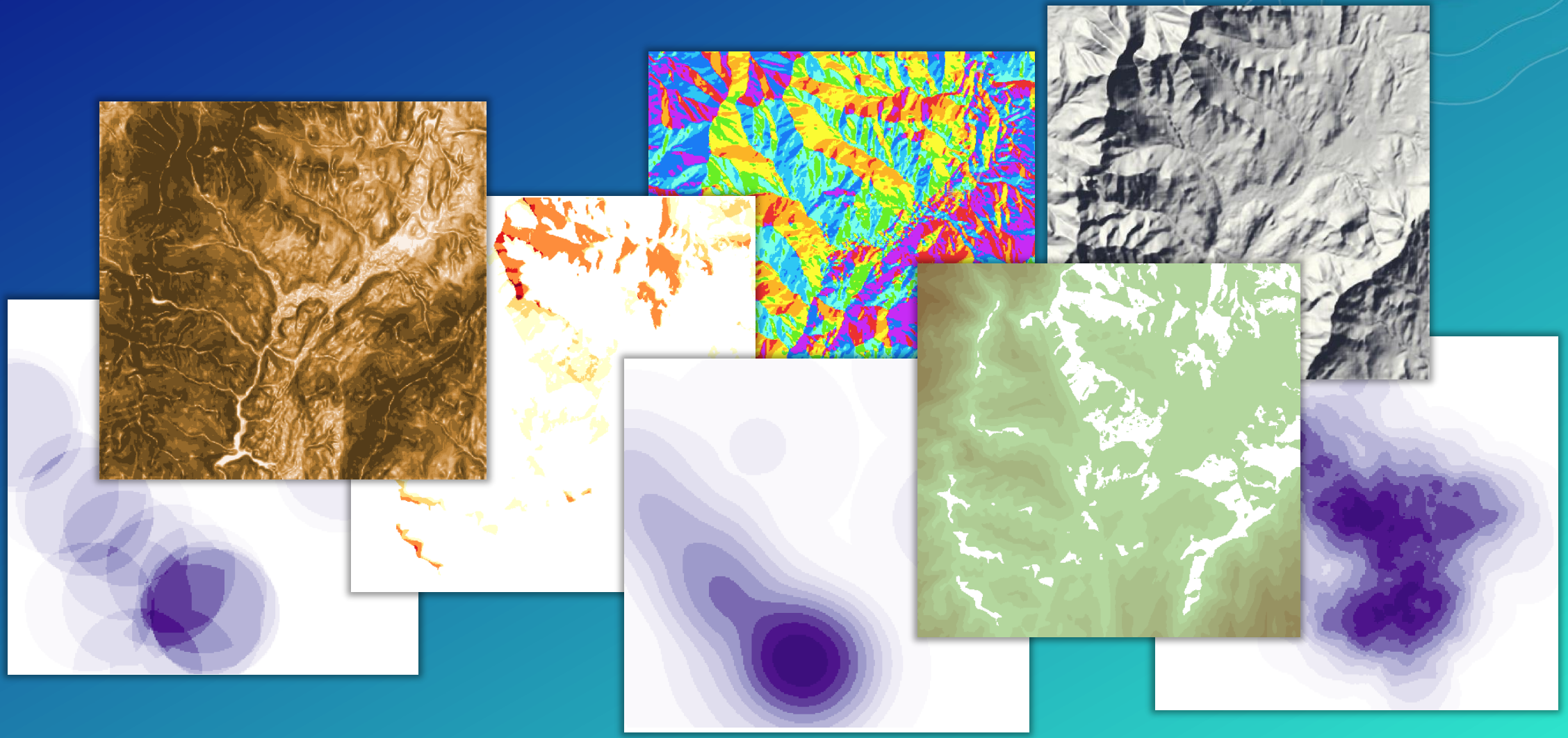
More accurate algorithm

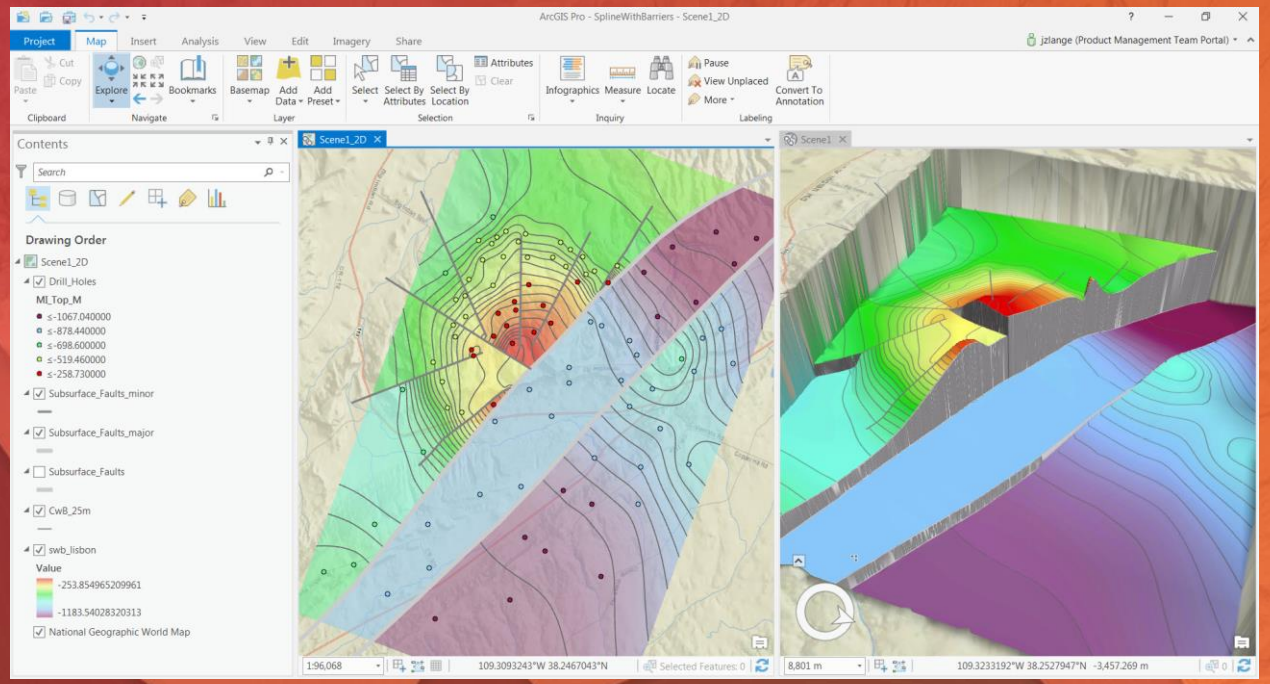
Better performance, especially with large data

Now supports direction of travel (moving toward or away from a location)



Improved default rendering of analysis results in Pro





Demo

Spline with Barriers

Geostatistical Analyst

Geostatistical Analyst

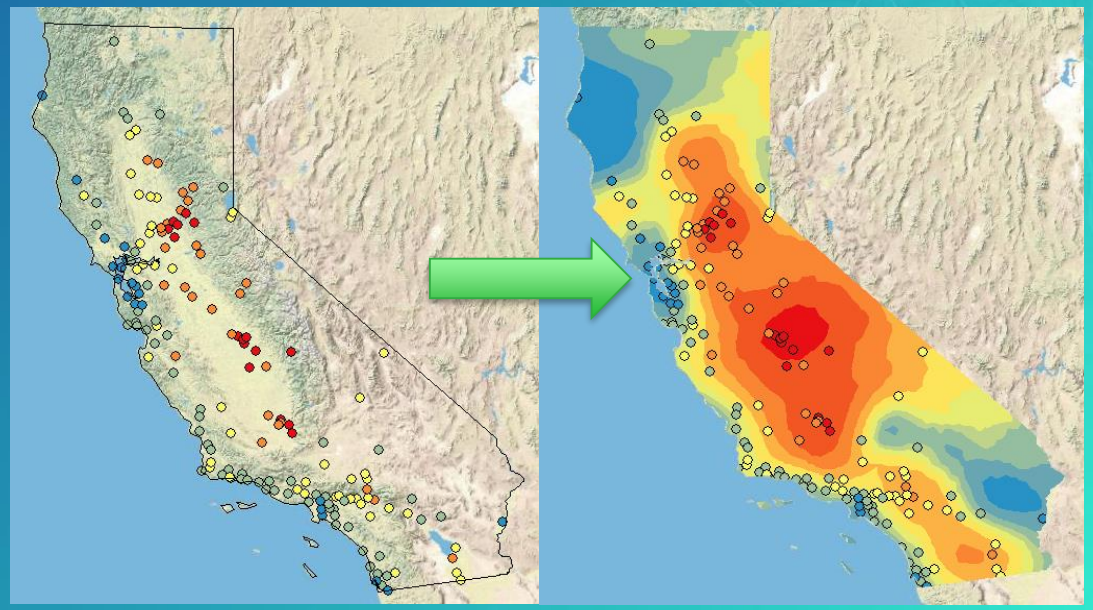
Statistical models and tools for interpolation

- Predict values at new locations based on measurements in known locations
- Creates statistically valid prediction surfaces along with prediction uncertainty or error

Off-the-shelf tool for calculating extremely accurate interpolation without configuration of statistical models

- Empirical Bayesian Kriging

Interactive geostatistical modeling wizard



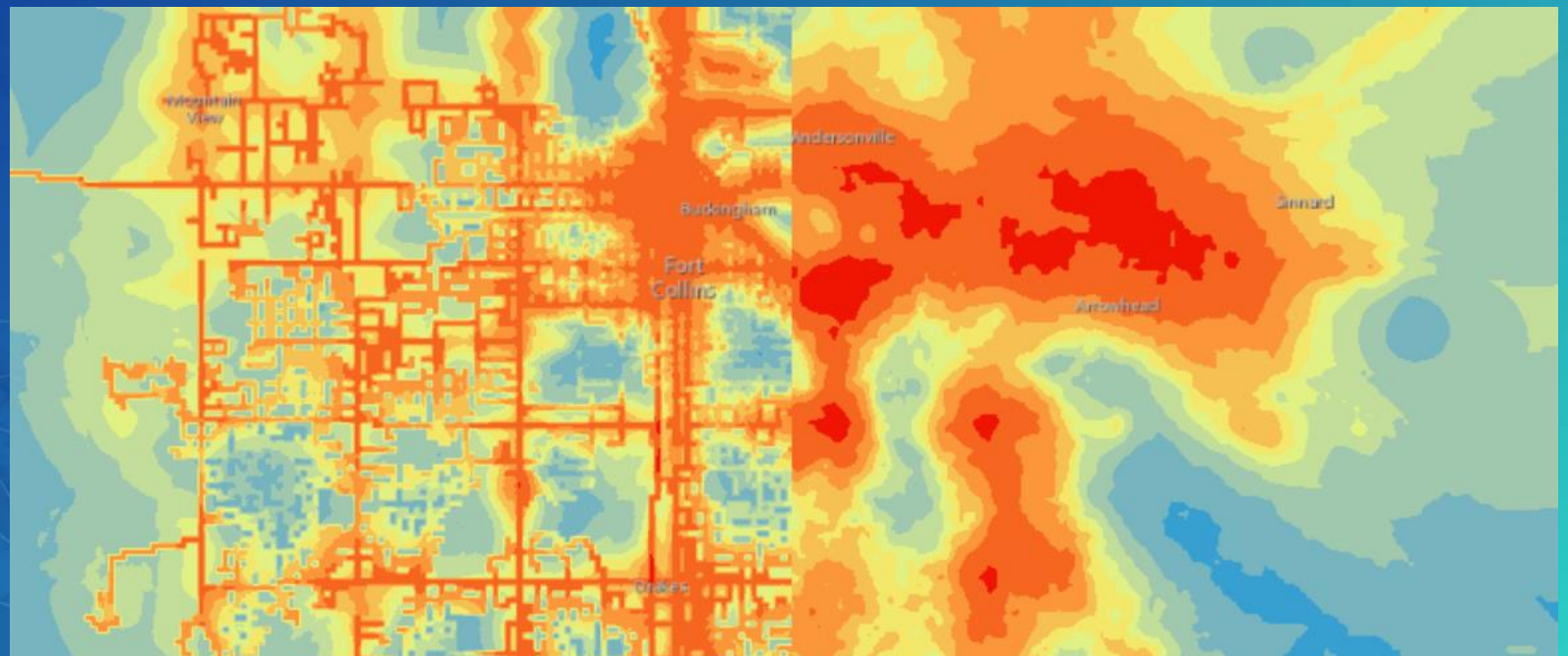
New in 1.3…

EBK Regression Prediction

A geostatistical multivariate prediction tool:

- to predict values of phenomena using secondary variables and,
- provide improved predictions at un-sampled locations

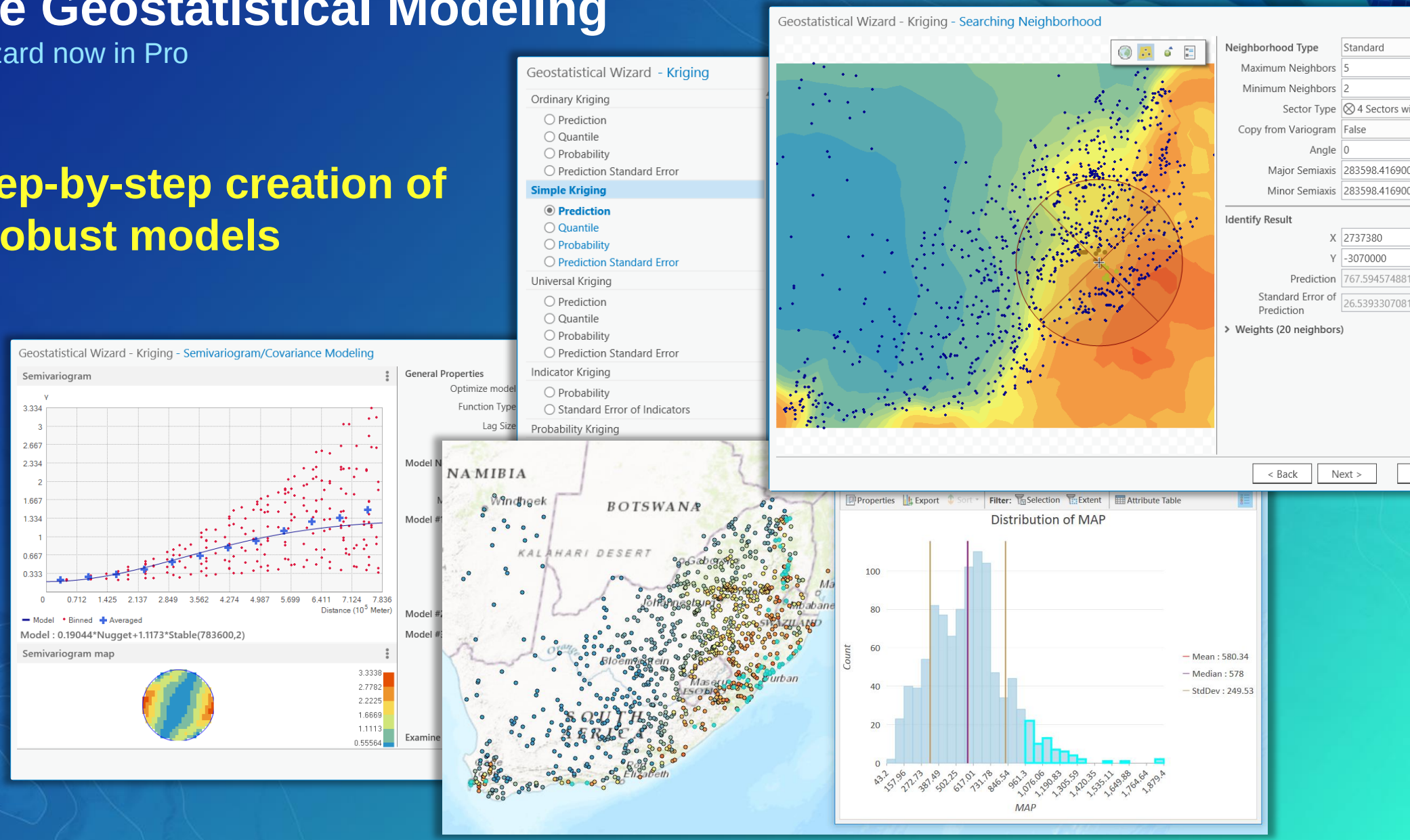
Better results by combining regression and kriging



Interactive Geostatistical Modeling

Geostatistical Wizard now in Pro

Visual step-by-step creation of robust models



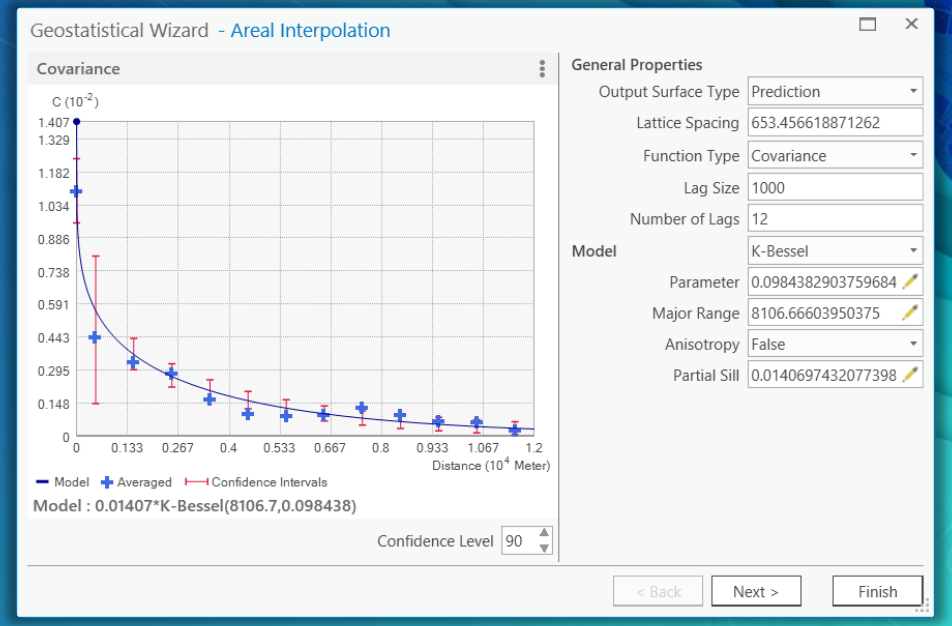
Areal Interpolation

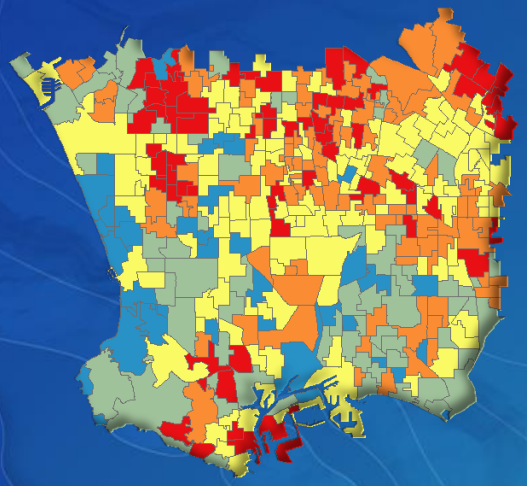
Now in the Pro Geostatistical Wizard

Transform aggregated polygon data to continuous surfaces or to other polygons

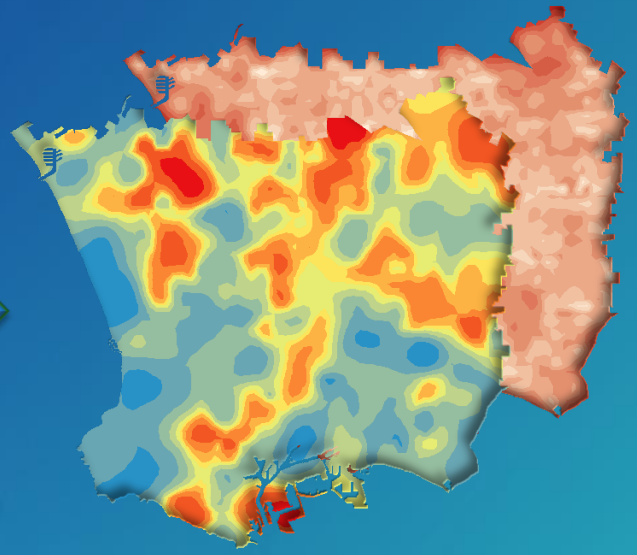
With an error estimate

Easy interactive model fitting

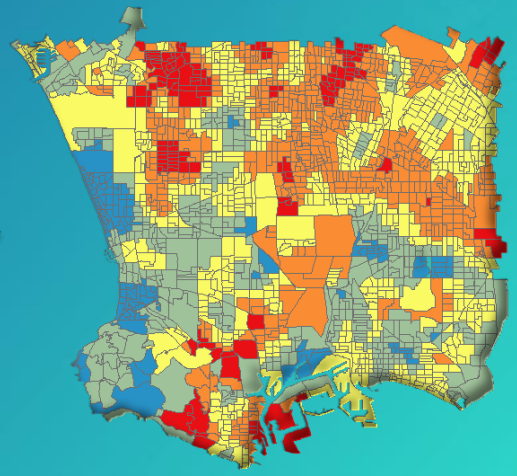




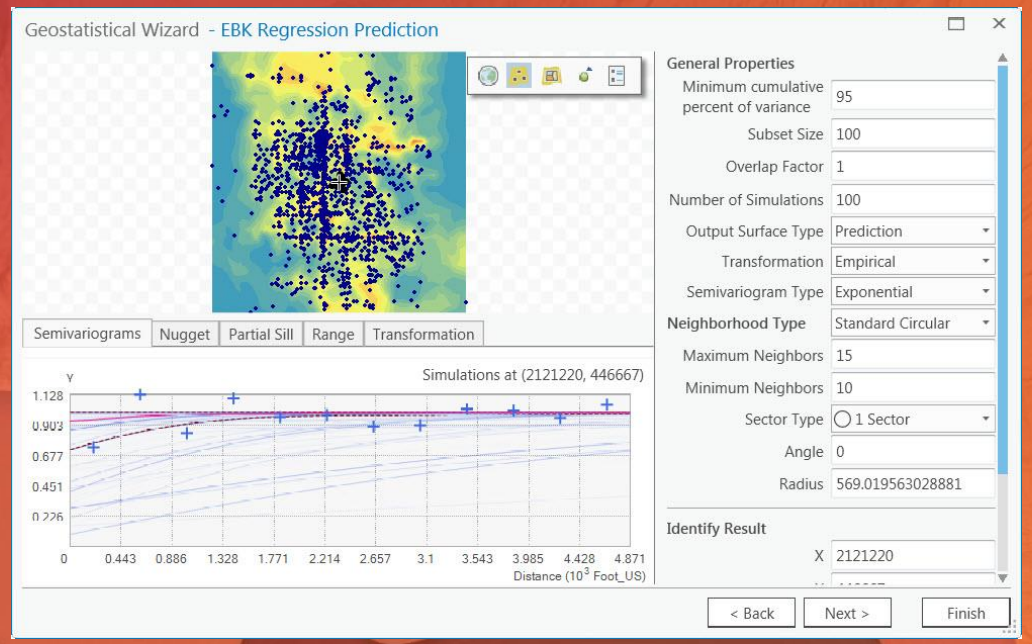
Obesity by school zone



Obesity surface and error surface



Obesity by census block

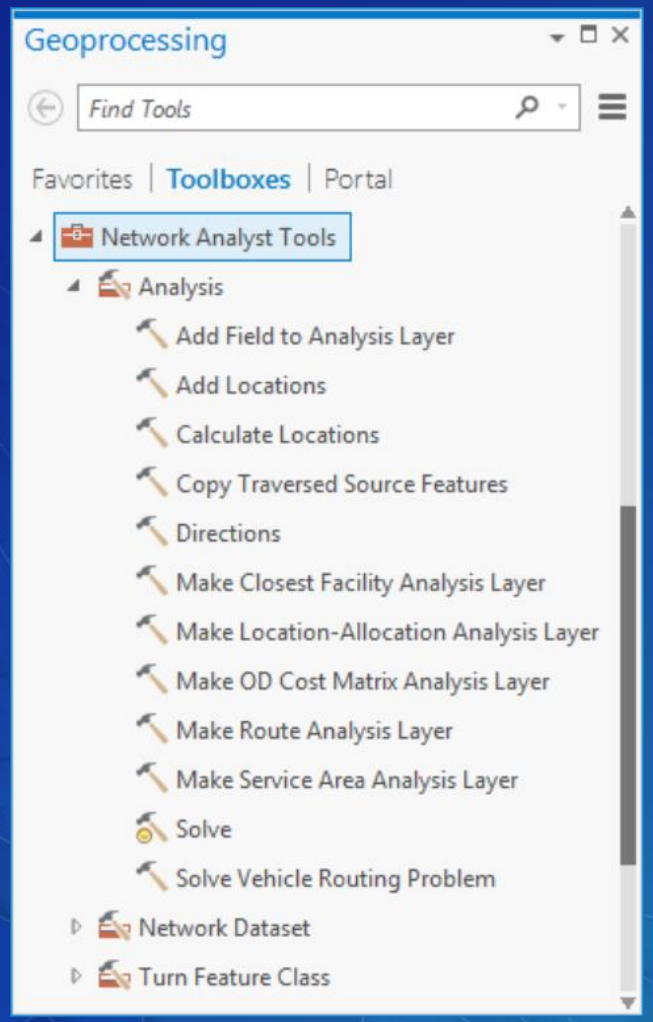


Demo

EBK Regression Prediction

Network Analyst

Network Analyst



Extension drives street network analysis capabilities across ArcGIS Platform

20+ geoproccessing tools that automate network analysis

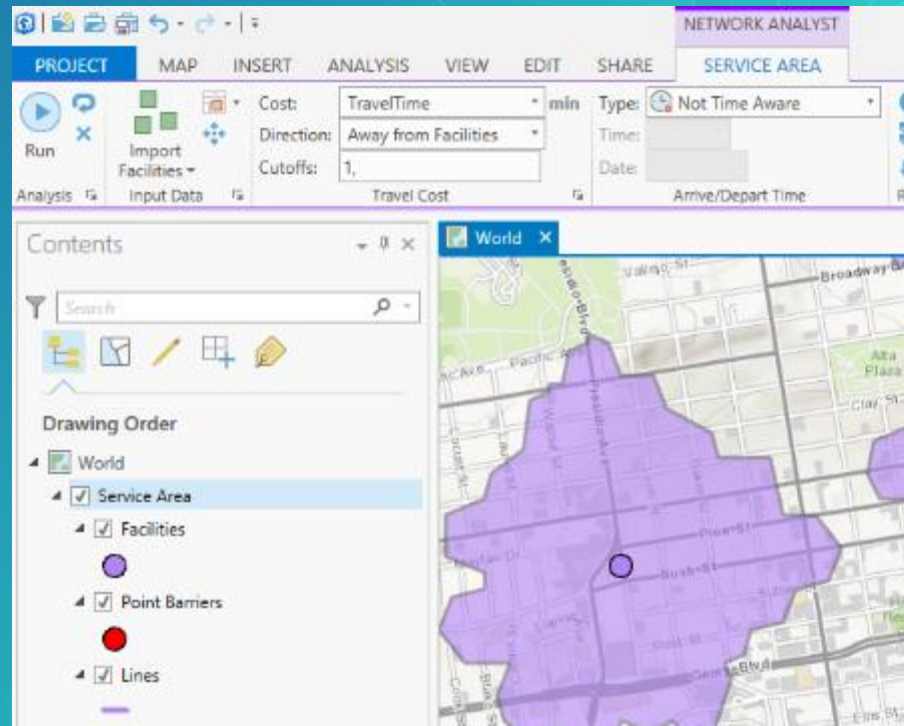
Ribbon-based workflow makes it fast and easy to get routes/directions, create service-area buffers, etc.

Workflow steps include

1. **Create a network analysis layer**
2. **Add locations and configure layer**
3. **Solve**

2D and 3D network analysis

Works with your network dataset or ArcGIS Online network service

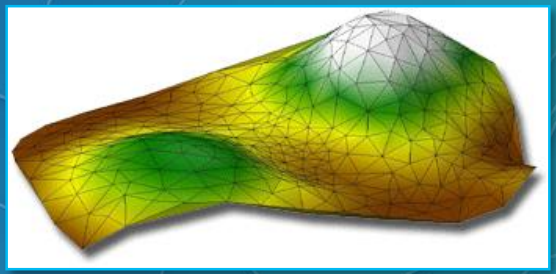


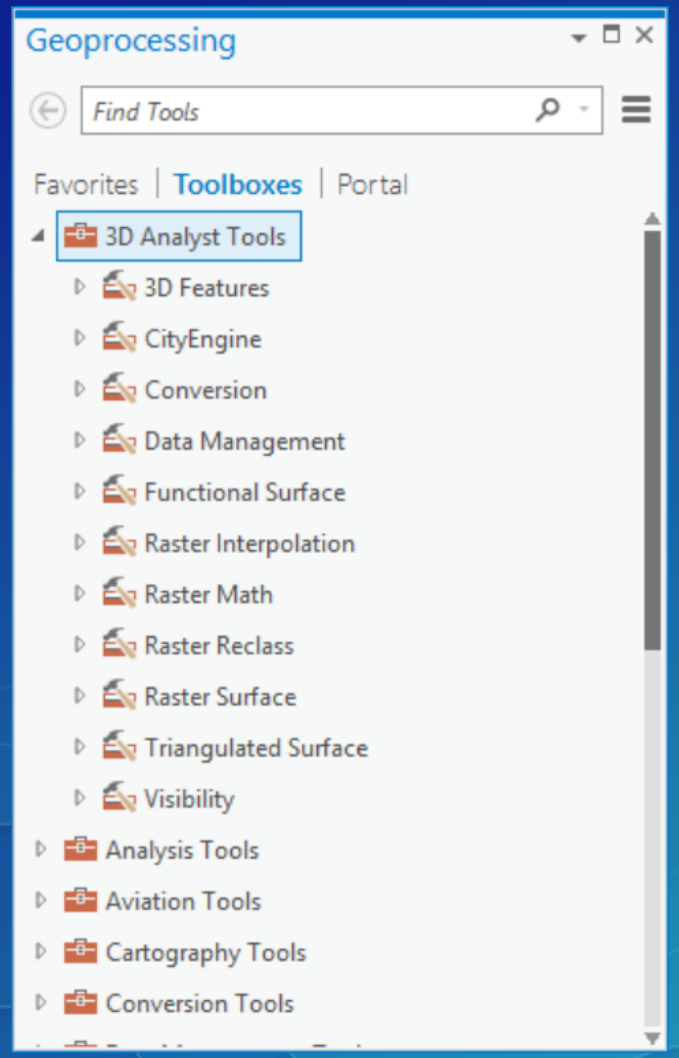
Network Analyst key features

- Routing / Directions
- Closest facility
- Drive-time / service areas
- Location – Allocation
- Vehicle routing problem
- Origin – Destination matrix

3D Analyst

3D Analyst Extension



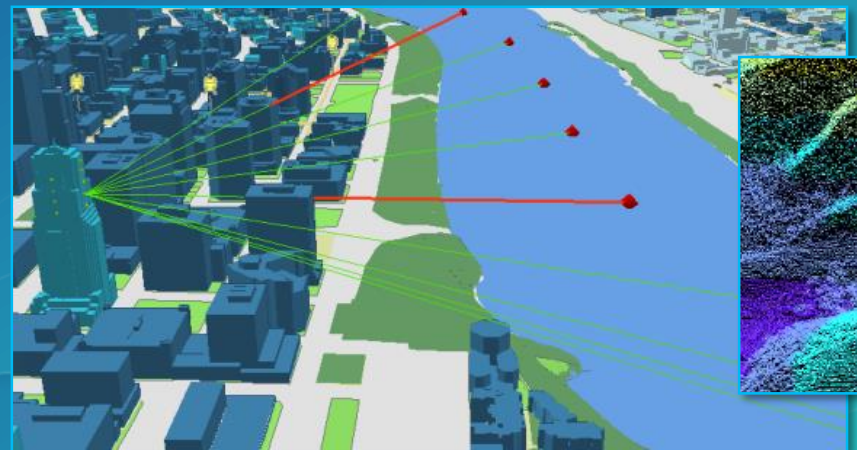


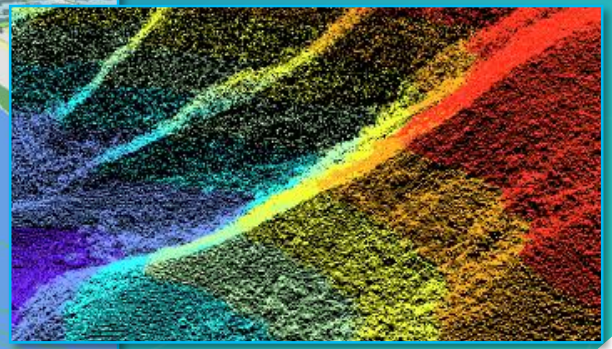
Elevation surface creation and analysis, using 3D vector geometries (multipatch), rasters, 3D TINs, terrains, and point clouds

Support for analysis, visualization, and classification of Lidar and point-cloud data through the LAS dataset format

Measuring distances/proximity and evaluating spatial relationships in 3D

Volumetric and visibility analysis





NOTE: 3D mapping and visualization does not require 3D Analyst extension

3D Analyst Highlights

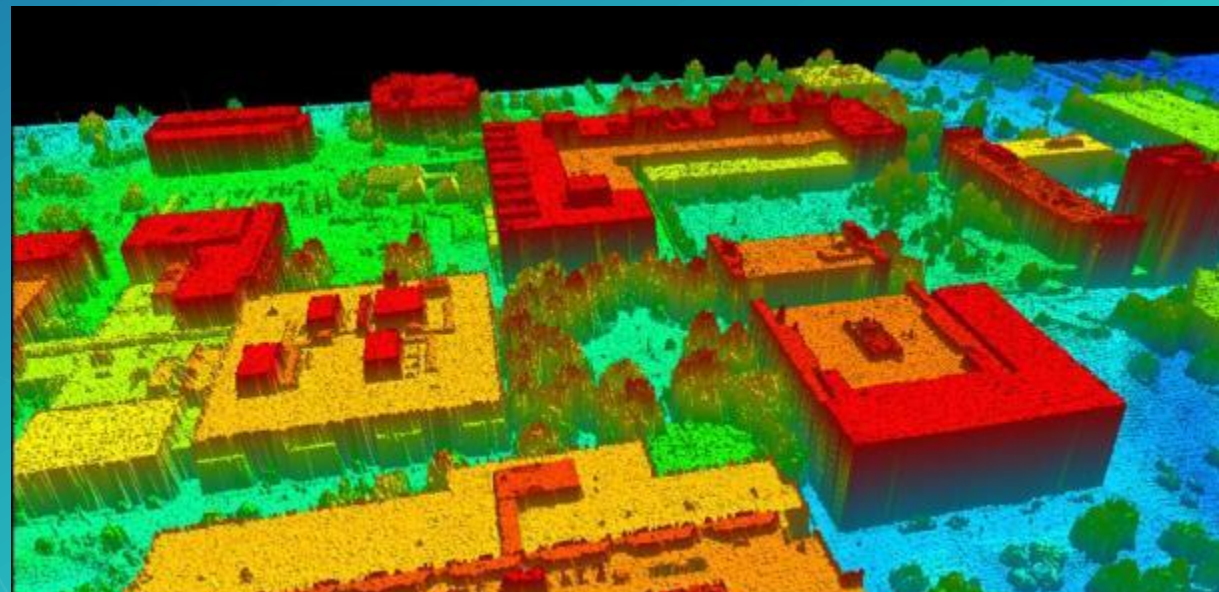
Extract and Regularize Building Footprints from Lidar / LAS dataset

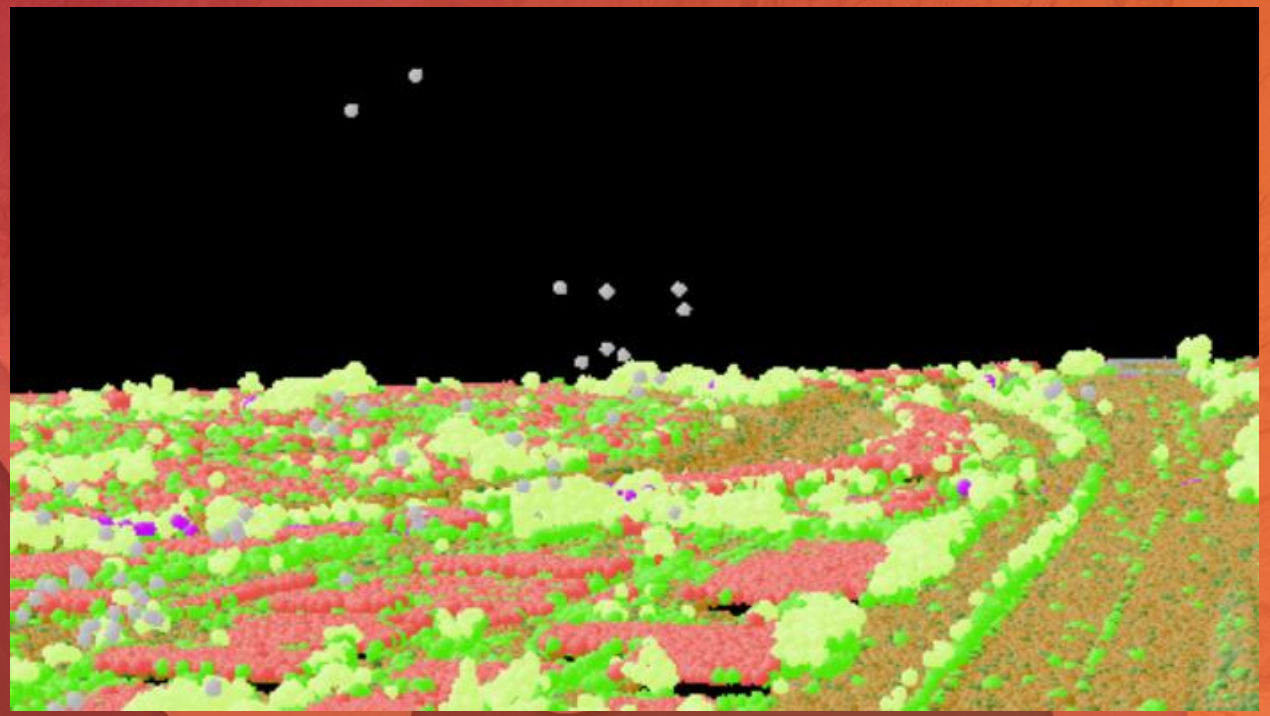
The Classify LAS Noise tool detects LAS points that likely represent anomalous measurements and classifies them as noise

The Classify LAS Overlap tool detects LAS points from overlapping flight lines and classifies the points with larger magnitude scan angle values as overlap

The LAS Building Multipatch tool creates building shells using existing footprints and Lidar rooftop points

The Update Feature Z tool updates feature z-values through interpolation on an elevation surface





Demo

Lidar Noise Classification

Learn more about spatial analysis & geoprocessing in Pro

pro.arcgis.com/en/pro-app/help/analysis

desktop.arcgis.com/en/analytics/casestudies/

Many more analysis sessions this week!

Please Take Our Survey on the **Esri Events App!**

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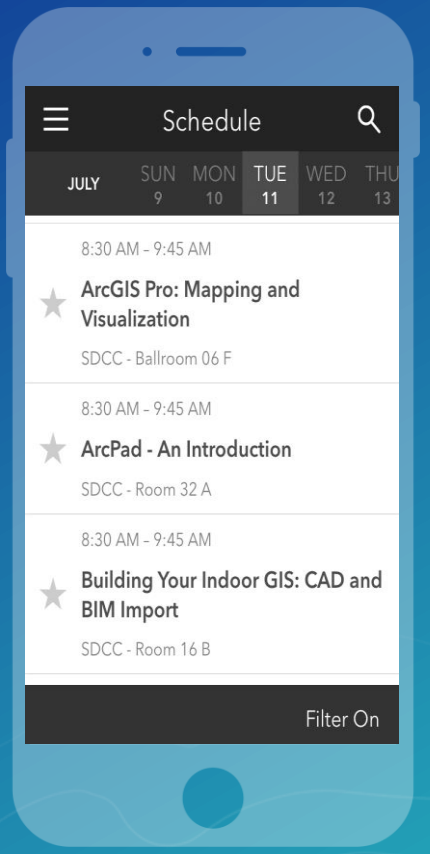
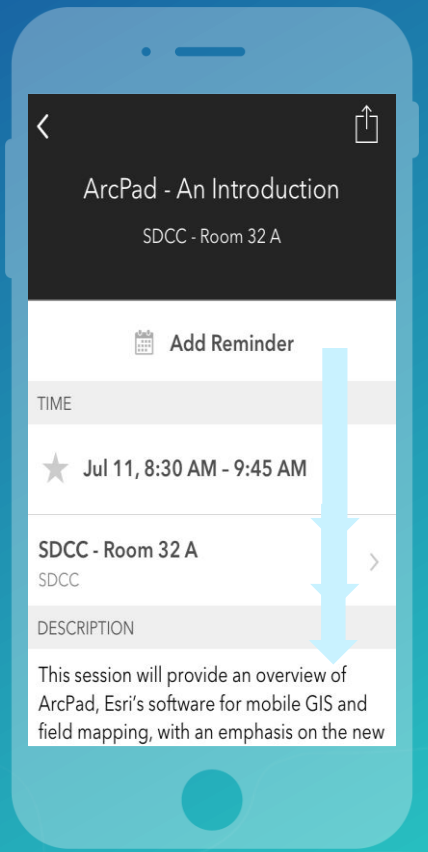
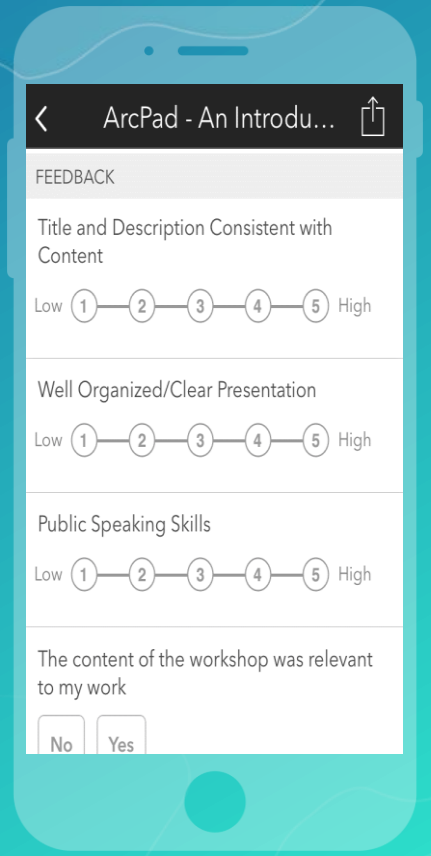
Select the session you attended



Scroll down to find the survey



Complete Answers and Select "Submit"



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