

# ADVANCED ANALYSIS TOOLS AND TECHNIQUES IN ARCGIS AND SMART MAPPING

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## **Abstract**

*The paper will discuss the advanced analysis tools and techniques for spatial, network, 3D, and image analysis in ArcGIS platform. Topics will cover working with raster data, parallel view of 2D and 3D data, data cleaning and data migration tools. New LIDAR data management tools will be presented.*

*Modern concepts will be discussed for using analysis in geoprocessing tools and web services. The paper will cover the new Smart Mapping concepts and capabilities for fast and comprehensive online on-the-fly mapping and advanced rule-based visualization.*

**Keywords:** Analysis tools, 3D, Dynamic Raster Mosaicking, Smart Mapping

## **INTRODUCTION**

A geographic information system (GIS) lets us visualize, question, analyze, and interpret data to understand relationships, patterns, and trends. GIS is becoming essential to understanding what is happening and what will happen in geographic space. Once we understand, we can prescribe action. This new approach to management and investigation— geographically—is transforming the way organizations and scientists operate. They already have a powerful tool for making better and more reasoned decisions. Nowadays, GIS technology lets us integrate various types of information, such as statistical, attributive as well as satellite images of the Earth's surface. All this data is a wealth of information which can be processed precisely and effectively with GIS. Images capture a permanent record of different features located on the Earth's surface but beside that images go beyond simply recording features. They also record relationships and processes as they occur in the real world. Images are simultaneously snapshots of geography and of reality. They are snapshots of life on the Earth. For that reason, the data in a GIS needs to reflect reality and to be incorporated and accurately transformed into instantaneously ready, easy-to-use information. This circumstance is the trigger mechanism for incessantly improvement and elaboration of the GIS software and the tools that it includes. In the recent paper, the advanced analysis tools and techniques for spatial, network, 3D, and image analysis in ArcGIS platform will be discussed. The benefits of using techniques for parallel view of 2D and 3D data and Smart Mapping will be highlighted.

## **1. GEOSPATIAL ANALYSIS AND TOOLS**

The vast majority of information present in the world has some form of spatial element connected with it. Spatial analysis is one of the more interesting and remarkable aspects of GIS. Using spatial analysis, you can combine information from many independent sources and derive a new set of information (results) by applying a large, rich, and sophisticated set of spatial operators. There are different types of geospatial analysis. In recent study we are going to present the following types:

### **1.1. Spatial analysis**

In the most recent version of ArcGIS - ArcGIS 10.4, the spatial analytics are included with ArcGIS for Server. The same set of analysis tools previously only available in the ArcGIS Online map viewer are now included with ArcGIS for Server. Users with a web GIS implementation (portal, server, and data store) can perform analytical functions, such as finding hotspots, locating streets and addresses, finding a place, routing, or accessing a geodatabase.

### ***Distance toolset***

With the new Cost Connectivity tool you can generate a network of optimum paths connecting multiple areas. This has applications in many areas of planning and operations, such as wildlife management and resource harvesting. The cost distance tools and path distance tools have been enhanced with four new parameters to give customers more control over the impact of distance and the nature of the travelers. With these enhancements it is already possible: different modes of travel from various sources to be modeled; different numbers of resources at different locations to be taken into consideration; to incorporate response times to marshal resources before they can be deployed; to make considerations for the accumulation of effort.

### ***Extraction toolset***

Extraction toolset has been updated to better handle conditions when the locations being sampled are NoData cells for certain output formats. Because the shapefile and Info table formats do not have a concept of <null>, a value of 0 was returned in those cases.

### ***Segmentation and Classification toolset***

With the enhancement of these toolsets, the ArcGIS platform provides an opportunity for: accomplishing better assessments in post-classification accuracy; comparing ground truth points to the classified image; assessing a given classification by using the kappa index; applying more resistant to overfitting classification technique.

## **1.2. Raster and image analysis**

Raster analysis are especially suited to study continuous data and processes. There are many ways to make analysis operations with raster data. When performing these operations, the main concern is about the data represented by the values of the cells and how to manipulate these values in order to obtain accurate output information. The following capabilities are the newest in that field:

### ***Stereo Analyst for ArcGIS***

Stereo Analyst for ArcGIS creates an accurate 3D digital representation of the Earth's surface and geography using imagery in all of the raster and feature dataset formats supported by ArcMap. In addition to this, existing CAD formats such as DGN, DWG, and DXF can also be used. Personal and multiuser geodatabases created in ArcCatalog can be maintained to include up-to-date feature data not only in 3D, but also in 2D representation. In addition, elevation information can be directly collected from oriented imagery without requiring a digital elevation model (DEM).

### ***3D***

Another capability for analyzing 3D raster images is the "Terrain 3D ".This toolset provide the capability for combination of different layers in ArcGIS Pro, ArcGIS Online Web Scene Viewer, and ArcGIS Earth. The overall quality of the Terrain 3D layer has been improved by adjusting the amount of data compression. Compression of any data is a tradeoff between many variables, mainly quality and file size. To minimize this compression effect, ESRI developed LERC tile format (Limited Error Raster Compression) which preserves data integrity by controlling the maximum amount of vertical change when compressing the data. In this case, the maximum error value of the output data is only 0.1 meters, so the difference between uncompressed and compressed elevation values is no more than 0.1 meters and the relative error between neighboring cells due to compression is no more than 0.2 meters.

### ***Lidar***

Lidar (light detection and ranging) is an optical remote-sensing technique that uses laser light to densely sample the surface of the Earth, producing highly accurate x,y,z measurements. Lidar produces mass point cloud datasets, stored in LAS files, that can be managed, visualized, analyzed, and shared using ArcGIS. Each lidar point can have additional attributes such as intensity, class codes, and RGB color values, which can be leveraged inside ArcGIS. LAS attributes can be used to filter out content and symbolize points in 2D and 3D. In addition, statistical information for LAS files can be produced. ArcGIS provides the tools to conduct analysis on the lidar data as either a collection of points or as a surface. With LAS datasets you can do the following:

- Analyze lidar points against first-return, bare earth, or any desired filter type.
- Manipulate lidar point classification code values to fix classification errors.

- Analyze lidar data using classification codes.
- Run floodplain models against bare-earth lidar points.
- Conduct statistical analysis on lidar points.
- Export statistical information for further analysis.
- Create raster DEMs and DSMs.
- Create intensity images.
- Estimate forest canopy density and height.
- Run initial QA/QC processes on newly acquired postprocessed lidar data.
- Measure heights between points.
- Analyze lidar data as points or as a surface in 2D or 3D.

### ***Parallel 2D/3D view***

3DFences Toolbox provides an option to perform geostatistics on 3D data. These toolset uses a slice in order to obtain a vertical subset of the 3D data. While typically narrow in one dimension it still is a 3D object. A fence is a 2D representation of a slice of 3D data. All points which belong to a slice are projected, or pressed onto a 2D plane. The term of a fence diagram, or a fence, is used in geology to illustrate a cross section of geologic strata generated from an interpolation of the data coming from a linear array of vertical drillings. The equivalent of a fence in the atmospheric sciences is usually referred to as a curtain.

To be explicit, the tools in the 3D Fences toolbox do not perform 3D interpolation. The approach offered by the 3DFences Toolbox does not implement geostatistical analysis directly on the vertical slices of the 3D data. Instead, the tools transform a slice of the 3D data, with its X, Y, Z, and the measure of a phenomenon component by rotating it by 90° to a horizontal 2D plane. The geostatistical interpolation method of Empirical Bayesian Kriging (EBK) is performed on these points producing either the geostatistical surface of Prediction, which is a continuous map of the concentration or intensity of something, or a map of the Prediction Standard Error, which can be explained as a map of a degree of confidence in the Prediction map at each location of the map. The resulting output is converted to a point dataset where the points represent the interpolated value at the center of the raster cells. The points are then placed back into the original coordinate space as a regular matrix of points resembling a fence. The fence is positioned in the center of the selected points of the initial slice. The raster is converted to a point dataset because ArcGIS does not currently support display of raster data as a vertical plane and point symbology options provide added flexibility in displaying results.

The Interactive Fences tool can generate fences based on lines digitized on the map. The user sets the buffer distance from the digitized line. All points that are located within the buffer will be used for the geostatistical analysis. The user may digitize multiple lines and even self-intersecting lines with many vertices. The third tool, called Feature based Fences, creates fences based on existing features in a polyline feature. In this case the fence shape is determined by the existing feature(s) and extends through the Z dimension of the selected sample points. All of the tools contain options enabling the user to determine the minimum number of sample points and fence size required to generate a reasonable geostatistical surface.

The tools are also time aware. If the sample data contains a date-time field and the option is enabled, a fence will be generated for each time interval if the samples for that interval and location meet the minimum requirements set by the user. The resulting fences representing consecutive time windows are positioned at the same locations. Thus, to enable better visual analysis, these should be displayed as time animations.

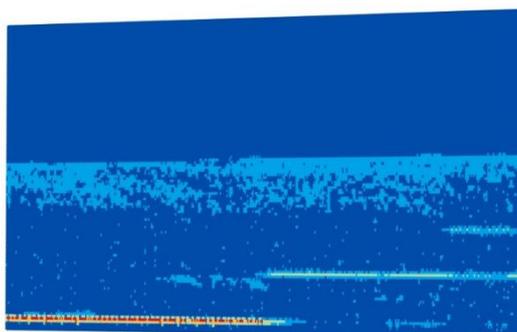


Figure 1 An example of an atmospheric curtain created from backscatter data acquired by NASA from its Calipso satellite orbiting at 32 km above the Earth's surface

### Space-Time Cluster Analysis

Data has both - a spatial and a temporal context. Several tools, including Hot Spot Analysis, Cluster and Outlier Analysis, Emerging Hot Spot Analysis and Grouping Analysis, allow the exploitation of those aspects of the data used. One common approach to understanding spatial and temporal trends is to break data up into a series of time snapshots. In this way, separate datasets for different weeks can be created. After that, each week can be separately analyzed. Representing three-dimensional data (x and y location, plus time) is difficult to do with a two-dimensional map. This problem is well illustrated in the example below.

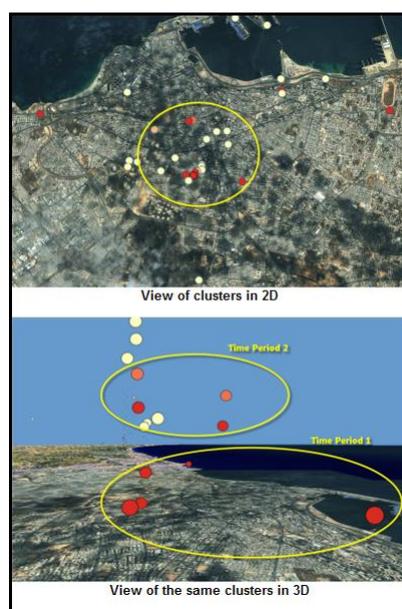


Figure 2 Identical clusters viewed in two and three dimensions

Space-Time Cluster Analysis provides at least two ways to visualize the output from space-time analyses. The first option is presentation of space-time relationships in a single map which is appropriate for a smaller study area distinguished with a limited number of features and visualization the result from analyzing larger territories by using animation in 2D. The second option is to use 3D visualization. With this method, time becomes the third dimension, with point features extruded to reflect temporal progression. In the 3D graphic above, for example, the oldest events are nearest to the ground, and the more recent events hover at higher elevations (appearing closer to the viewer).

### Space time pattern mining

The Space Time Pattern Mining toolbox contains statistical tools for analyzing data distributions and patterns in the context of both space and time. It includes a toolset for visualizing the data stored in the space-time netCDF cube in both 2D and 3D. Create Space Time Cube takes point datasets and builds a multidimensional cube data structure for analysis. Emerging Hot Spot Analysis then takes the cube as input and identifies statistically significant hot and cold

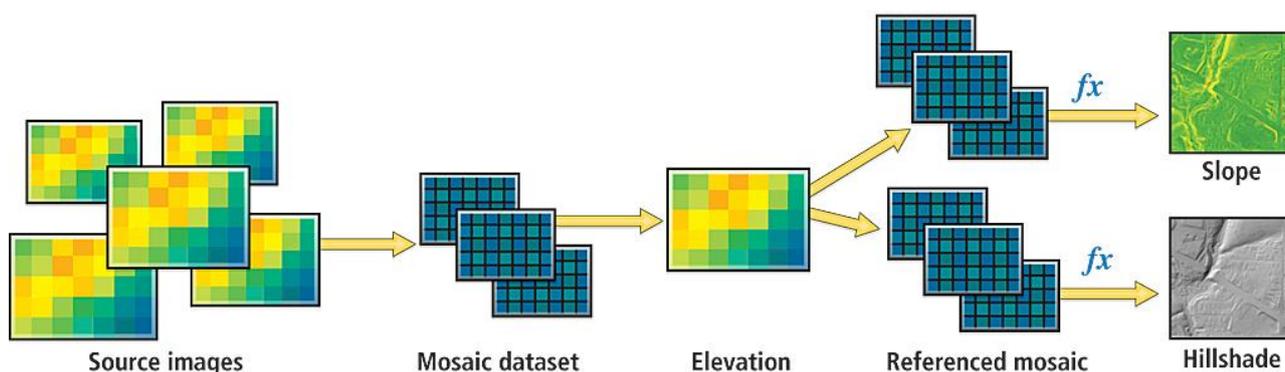
spot trends over time. The Utilities toolset contains tools for visualizing the data stored in the space-time cube in two and three dimensions. These visualization tools can be used to understand the structure of the cube, how the cube aggregation process works, and also to visualize the patterns over time at specific locations of interest.

### ***Dynamic Raster Mosaicking***

Dynamic Raster Mosaicking is a powerful and exciting new geodatabase data model for managing raster data that reduces processing time; maintains information from overlapping imagery; and easily handles large, disparate datasets. The mosaic dataset allows making catalog collections of raster and image data as well as defining and refining the metadata. These collections can range in size and can be accessed as dynamically mosaicked images. Geoprocessing models and Python may be used to automate and manage mosaic datasets. By specifying a raster type, data can be directly incorporated from sensors or files that include detailed properties such as spatial reference metadata, acquisition dates, and sensor type, as well as defined optional details for additional processing such as orthorectification.

Mosaic datasets represent a data model in the geodatabase. In this model, participating rasters may be accessed either as a dynamic mosaic composed of images processed on the fly or as a catalog with tables containing geometry and metadata. This provides multiple options for organizing/managing raster data. Functions can be applied to each input raster added to the mosaicked dataset to define how it is processed when creating the mosaicked image on demand. A mosaic dataset may also have associated mosaic methods that define the default ordering of the imagery.

In addition, creating referenced mosaic datasets allows the generation of different sets of products (each with specific mosaicking methods and mosaic dataset functions) from the same source. For example, you could create a mosaic dataset to manage all your digital elevation model (DEM) data, then create a referenced mosaic dataset to produce a hillshade and another reference mosaic to define slope. Updating the elevation data automatically updates the hillshade and slope. Other patterns for managing very large image collections can involve creating a mosaic dataset that uses other mosaic datasets as input.



*Figure 3 Referenced mosaic datasets can generate different sets of products, each with specific mosaicking methods and mosaic dataset functions, from the same source*

Mosaic datasets resolve many of the traditional raster management issues by cataloging large collections of imagery and performing on-the-fly processing and dynamic mosaicking. The benefits of using mosaic datasets include

- Reducing processing time because imagery can be directly used without extensive preprocessing;
- Maintaining information on overlapping imagery that is traditionally lost when creating a static mosaicked image;
- Easily handling large disparate datasets such as imagery along pipelines or transportation corridors;
- Handling datasets with different resolutions without the need to sample the imagery up or down;
- Reducing resampling of source rasters thereby retaining image quality and integrity;
- Reducing storage by removing redundancy traditionally created with multiple image products;
- Easing maintenance because imagery can be added or changed as required;
- Retaining valuable information by maintaining metadata.

The mosaic method, defined as part of the mosaic dataset properties, defines how overlapping imagery is handled in the mosaic dataset. Mosaic methods define the order of the rasters that are mosaicked together to create the mosaicked

image. The “By Attribute” mosaic method is commonly used to order imagery based on an attribute such as date. For example, Date can be set to 'Latest' or 'Closest to May 2001.' Alternatively, the same method can be used to set the order of imagery by other attributes (e.g., 'Highest Sun Angle'). Similar mosaic methods can be used to set the image orientation from the north, south, east, or west, which may improve the ability to see features such as the sides of houses in wide angle or oblique imagery.

### ***On-the-Fly Processing***

On-the-fly is a function which allows a nonpermanent processing applied to one or more rasters as they are accessed. Because mosaic datasets are dynamically mosaicked and processed on the fly, the processes for a mosaic dataset are transactional and executed on demand in contrast to traditional methods for handling rasters that deal with image processing and image mosaicking as separate and linear steps. There is no loss of pixel data or metadata when using mosaic datasets because the source pixels are never altered or converted. Consequently, no data is lost when using overlapping datasets. Users can reorder imagery to ensure the most appropriate image is on top. This dynamic handling of overlapping imagery differs greatly from the traditional approach to processing and mosaicking imagery into new products that must be stored and maintained and results in significant storage requirements and information loss. (Childs, 2010)

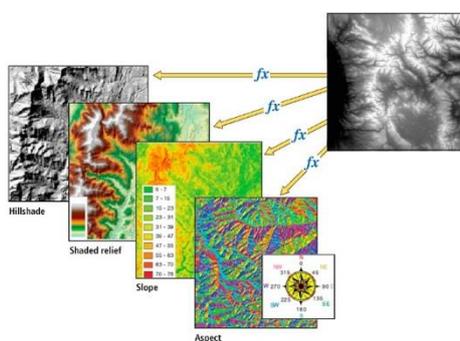


Figure 4 Mosaicking functions applied on the fly to each raster in the mosaic dataset or to the contents of the mosaic dataset deliver dynamically processed raster data and allow multiple products to be created from a single raster source

### **1.3. Visibility analysis**

The enhancements in visibility analysis is related with Viewshed analysis tools and Sun Shadow Volume tools. The Viewshed analysis tools are useful when you want to know how visible objects might be, whereas Sun Shadow Volume is a tool that creates closed volumes for modeling shadows cast by each feature using sunlight for a given date and time. Shadows modeling sunrise and sunset conditions can be made by providing only a date in the Start Date and Time and End Date and Time parameters, respectively. Shadow volumes will not be produced if the sun is not visible for a given date and time or if the relative position of the sun is at a vertical angle of 90 degrees from the input features.

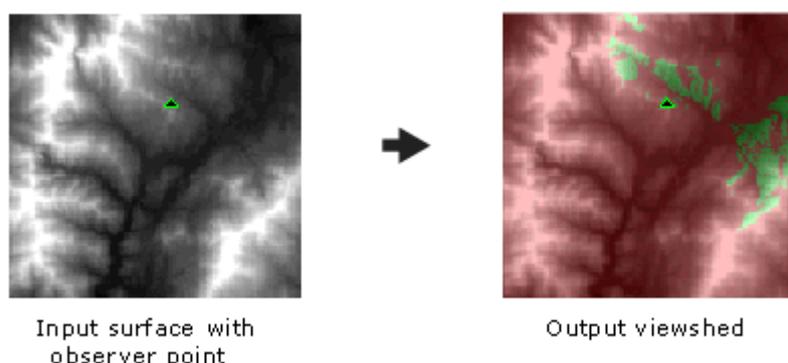


Figure 5 Viewshed example

## 1.4. Geoprocessing tools

Geoprocessing provides a large suite of tools for performing GIS tasks. It is based on a framework of data transformation. One of the latest enhancement in geoprocessing tools is related to Data migration. Data migration is needed if you want to access your spatial or raster data using structured query language (SQL) or if you have to move from a data type that may not be supported in a future to one that is supported. In these cases you can use the Migrate Storage geoprocessing tool to migrate existing binary, spatial, or raster columns from one storage type to another. This is done by specifying a configuration keyword to include the correct parameter and value.

## 2. WEB

The rapidly growing functionalities of web-based GIS platform make it a preferable instrument in various scientific researches and customer services. The web-based GIS is widely used for modeling and assessment of risk processes; in the archeology; transport; etc (Kulkarni et al., 2014; Aye et al., 2016; McCool, 2014 ). Kong et al. (2015) have identified the major GIS functionalities that web GIS offers for information seeking purposes: a clear starting point, predictable map interaction, flexible customization capabilities, and familiar web experiences. Assessment functionalities are also amongst the priorities of Arc GIG developers. The most recent enhancement of web-based GIS platform are related to ArcGIS Portal and ArcGIS Online:

- Mobile Map Packages allows zipping up base maps, including vector tile maps, and operational layers into one neat, highly-compressed package and sharing them to given portal, or to ArcGIS Online and ArcGIS for Server.
- Simplified High Availability on-premises and in the cloud which help the sustain performance, mitigation the single points of failure, minimization of downtimes, and provides the ability site failures to be detect.
- Disaster Recovery is supported by a new tool that backs up a web GIS deployment (web adaptor, portal, server, and data store). The exported file contains portal items and settings, including group information, hosted web layers, federated and hosting server settings, the configuration store, and the data store, including the hosted feature layer data (a relational data store) and hosted scene layer tile caches (a tile cache data store). Users can store the exported file in a secure place (a separate machine is best practice) and use it to restore a web GIS deployment or a server site, or use the file to replicate the implementation to a standby deployment that can be brought online if the primary deployment fails.
- Configurable apps for Scenes (3D) - Web scenes support the display of 3D content. They can be authored and viewed using the scene viewer. Configurable apps enable creation of user or workflow-focused apps that meet specific needs. This release includes new configurable apps that allow you to create 3D web apps that compare, visualize, and showcase scenes, as listed below:
- 3D Data Visualization - Visualize numeric data based on a global scene.

Present your geographic data from a scene in 3D.

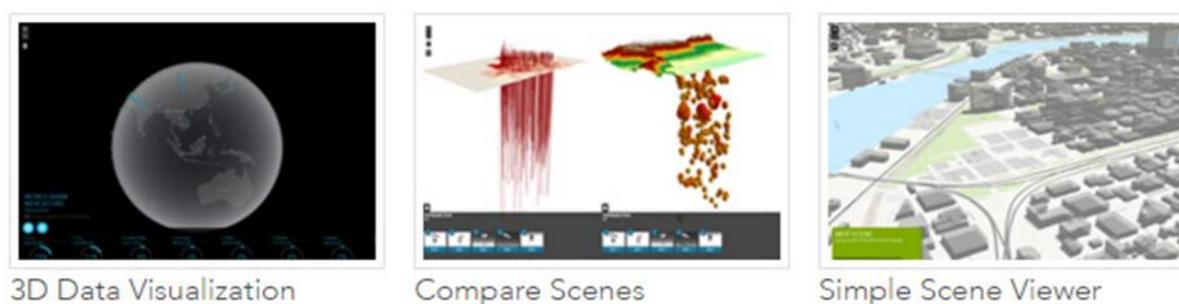


Figure 6 Presenting geographic data in 3D

Compare Scenes - Explore different scenarios or locations with a side-by-side comparison of two local or global scenes.

Map Viewer enables customers to author and share web maps, perform analysis, and work with layers. Multilayer Basemaps is a tool that enables creation of multilayer maps directly in the map viewer. This is useful when there are two or more layers that have to be used together as a background for other operational layers.



Figure 7 Multi-Directional Terrain with USA Geology and the World Reference Overlay.

## 2.1. Smart Mapping

Smart mapping - Smart mapping provides data-driven tools that enable customer to explore their data to unlock information and easily author visually appealing web maps. When feature layers are added, the data is analyzed and appropriate layer styling, options are presented in a streamlined user experience appropriate for your data. With smart mapping:

- Workflows analyze your data and suggest the best way to represent it;
- Smart defaults take the guesswork out of setting up many of the map properties;
- Based on the selected basemap, coordinate colors and other map styling can be automatically suggested;
- Visible ranges can also be suggested so you'll see your data at scales that makes sense;
- You get to preview your styling choices on your screen.

Smart mapping empowers data experts, project managers, business analysts and many others to explore their data by simply mapping one, or more, attributes in that data. Anyone can analyze and map multiple columns of related data, in order to determine which has the highest, or predominant, value for each feature. The classification type can be presented in two ways – “predominant category” and “predominant category and size”.



Figure 8 The two ways of classification type's visualization

## 2.2. Web AppBuilder

AppBuilder enables you to easily create HTML/JavaScript apps that run on any device, using a gallery of ready-use-widgets. The look of the apps can be customized with configurable themes, and they can be hosted online or on server. Enhancements for Web AppBuilder for the newest release include the following:

- Support for 3D Scenes - Custom apps that use 3D scenes can be created by Web AppBuilder;
- Improved building experience, allowing modification of the map from Web AppBuilder;

- New Plateau theme supporting a modern and minimalist-styled app with flat toolbars and widget containers;
- The Edit widget includes a display field in the setting page so attributes can be choose for display only when performing editing;
- The Situational Awareness widget has been released, it is no longer in beta. This widget allows customers to create or select an incident on the map and analyze information from feature layers, either within the incident area or within a specified distance of the incident;
- New Near Me widget to find features near a specified location, view more detailed information about those features, and get directions to a selected feature;
- New District Lookup widget to find point features related to a selected polygon, view more detailed information about the related point features, and get directions to a selected point feature;
- New Related Table widget to display values in a related table as pie or bar charts.

### 2.3. Publishing Hosted Web Layers

Hosted web layers are used to publish maps and data in ArcGIS Online, outsourcing the need for your own server and infrastructure, or complementing what you do using ArcGIS for Server. This release introduces the following new capabilities and features:

- Hosted scene layers can be published from scene packages, supporting fast map visualization of 3D data using cached tiles;
- Vector tile packages can now be published as hosted tile layers. ArcGIS Pro 1.2 can be used to publish vector tile layers to ArcGIS Online as hosted tile layers;
- When publishing CSV files as hosted feature layers, customer can now specify the time zone of their date and time data and manage the offset introduced when converting their date and time data to universal coordinated time (UTC);
- A new set of data collection templates is available for creating hosted feature layers to use with Collector for ArcGIS.

### 2.4. Maps for Office

Maps for Office brings mapping to Microsoft Office. With this easy-to-install add-in, interactive maps from Excel data can be quickly created. The new insights let managers make better, more informed decisions immediately. With this release, ArcGIS Maps for Office has been enhanced with the following:

- Smart mapping has been added, enabling you to explore the data and create effective, aesthetic maps;
- Find patterns in your locations over time with time-based animations;
- Improved experience in PowerPoint enables finding maps more easily and the interaction with the map during presentations;
- Focus on the rows that are important by using map-based filtering;
- Support for dynamic data via layer refresh intervals.

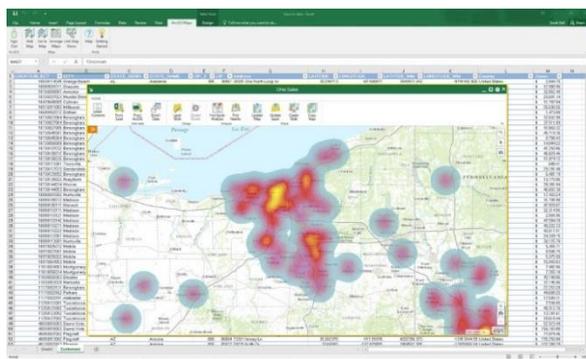


Figure 9 Maps for office

## 2.5. Maps for IBM Cognos

Esri Maps for IBM Cognos enables your enterprise to integrate dynamic maps in your BI applications for more complete and actionable reports, and location-enabled insights, using your business data. The newest capabilities are:

- Edit IBM Cognos layer properties after data has been added;
- Style data using manual breaks classification;
- View a new floating, resizable map legend;
- Change the order of groups in the legend;
- Customize the availability of map tools and elements in the map;
- Change the map look and feel using predefined or custom themes;
- Modify the default symbols and color ramps available for styling layers, or add your own custom symbol sets;
- Improved heat map algorithm with support for weighted measure heat maps;
- Improved user experience for working with feature attribute tables;
- Support for transparency in PDF reports;
- Support for ArcGIS Web Map Service (WMS) layers.

## 2.6. Content

ArcGIS includes a Living Atlas of the World, a curated and continually updated collection of authoritative maps and layers covering thousands of topics. These data can be directly integrated into workflows, and used to complement data when authoring maps and apps. The enhancements of the applications are:

- Beta versions of Esri vector basemaps have been updated. Vector basemaps are available as vector tile layers and maps for display in the map viewer and use in custom basemap galleries;
- World Street Map, Light Gray Canvas, Dark Gray Canvas, and Reference layers have been updated with more recent data for North America;
- A new Imagery Hybrid map, with added detail and improved cartography, is now available as a custom basemap;
- The World Imagery map has been updated at small-to-medium scales with the latest available 15-meter TerraColor imagery, with several updates in the Arctic region, Asia, and other parts of the world using recent Landsat 8 imagery. The Arctic Imagery map has also been updated with the latest imagery;
- A new Imagery map in Geographic Coordinate System (GCS) WGS84 projection is available. The imagery map includes the same imagery as the standard World Imagery map in Web Mercator, with added coverage in the Polar Regions. The new imagery map supports 3D display in apps such as ArcGIS Earth as well 2D display for apps that use the GCS coordinate system;
- A new Historical Imagery map is available that provides access to medium-to-high resolution imagery for the United States and selected other areas going back as much as 50 years.

ArcGIS Open Data - ArcGIS Open Data is an Esri hosted and managed solution that is included with ArcGIS Online. Using it, customers have a free access to various type of data from all over the world and different organizations. In this way, citizens have a connection with local authorities and at the same way can monitor their work and community directed activities.

## 2.7. ArcGIS Earth

ArcGIS Earth is an interactive globe viewer that enables the exploration of any part of the world and working with 3D and 2D map data including KML, shapefiles, and Esri RESTful services. Data can be displayed on the globe, placemarks can be sketched, distances and areas can be measured, and annotations can be added so spatial data is easily understandable.

ArcGIS Earth extends the ArcGIS platform by enabling any user in given organization to explore data from Esri and to allow users to access secured data inside an organization. One of the strengths of using Earth and other ArcGIS clients, such as the web scene viewer in the cloud with ArcGIS Online or on-premises with Portal for ArcGIS, is that with these lightweight clients, you can simultaneously consume many data types coming from multiple sources.

ArcGIS Earth 1.0 is focused on:

- Navigating and exploring the globe and map data;
- Viewing KML, KMZ, Shapefiles, and ArcGIS services;
- Basic interaction such as measurement on the globe and popups for KML and shapefiles;
- Simple sharing through email and screenshots.

## CONCLUSION

The advanced analysis tools and techniques for spatial, network, 3D, and image analysis in the newest ArcGIS platform provide a range of benefits for their user in various fields of interest. With applying the above mentioned techniques, the analysis and assessments performed distinguished with an objectivity and users can make informed and well-founded decisions.

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