GIS

The Geographic Approach for the Nation

ESRI Federal User Conference

Washington, D.C. • February 17–19, 2010

Using ArcGIS and the Cloud

Ismael Chivite, Marwa Mabrouk

What is the Cloud?

~~What is the Cloud?~~

How can the Cloud Help me do my job?

A practical Approach

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CLOUD SERVICES

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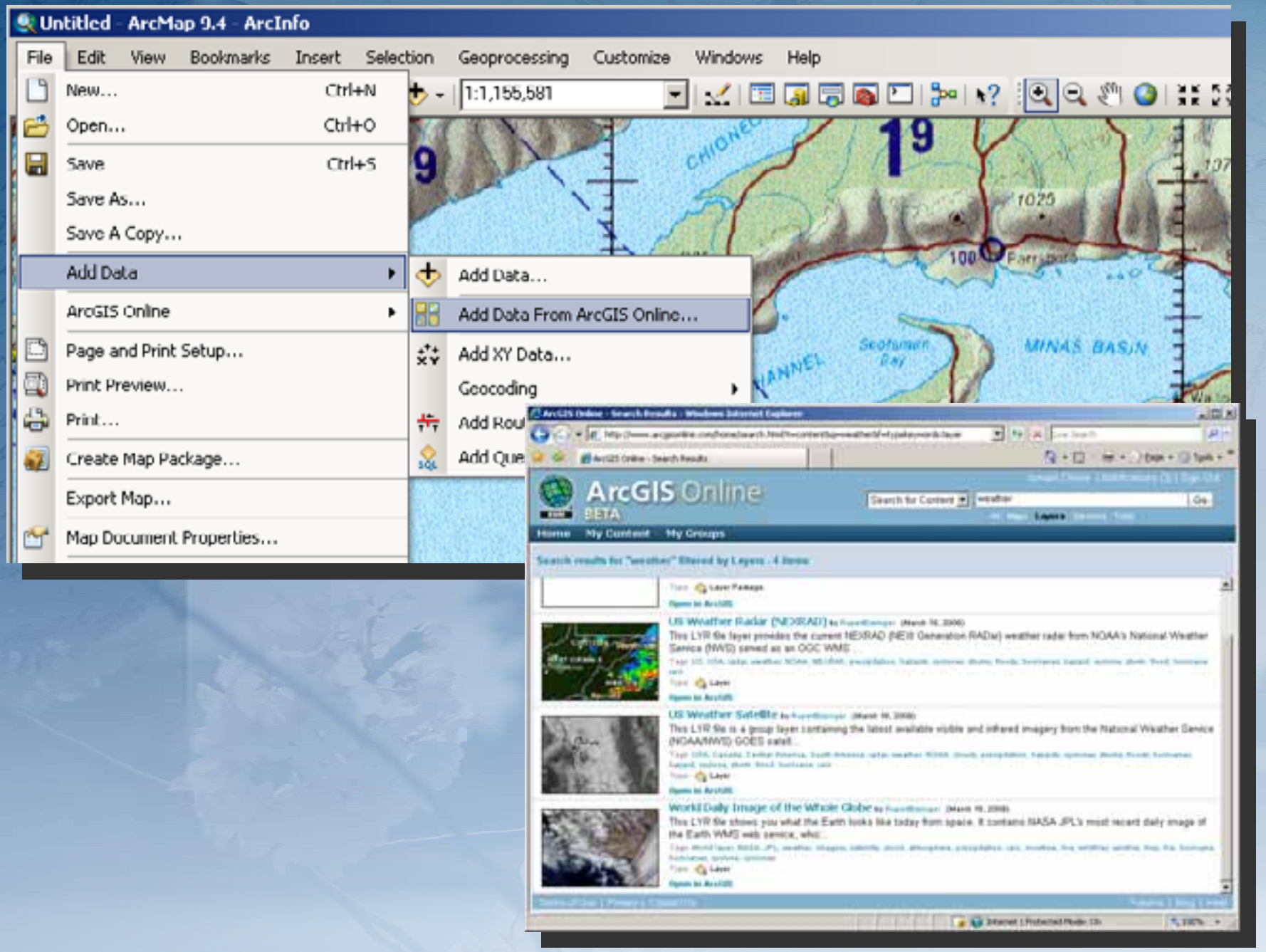
Challenge: Accessing GIS resources

- Massive amounts of data (imagery, vector…)
- Frequent data updates
- Sophisticated GIS functionality

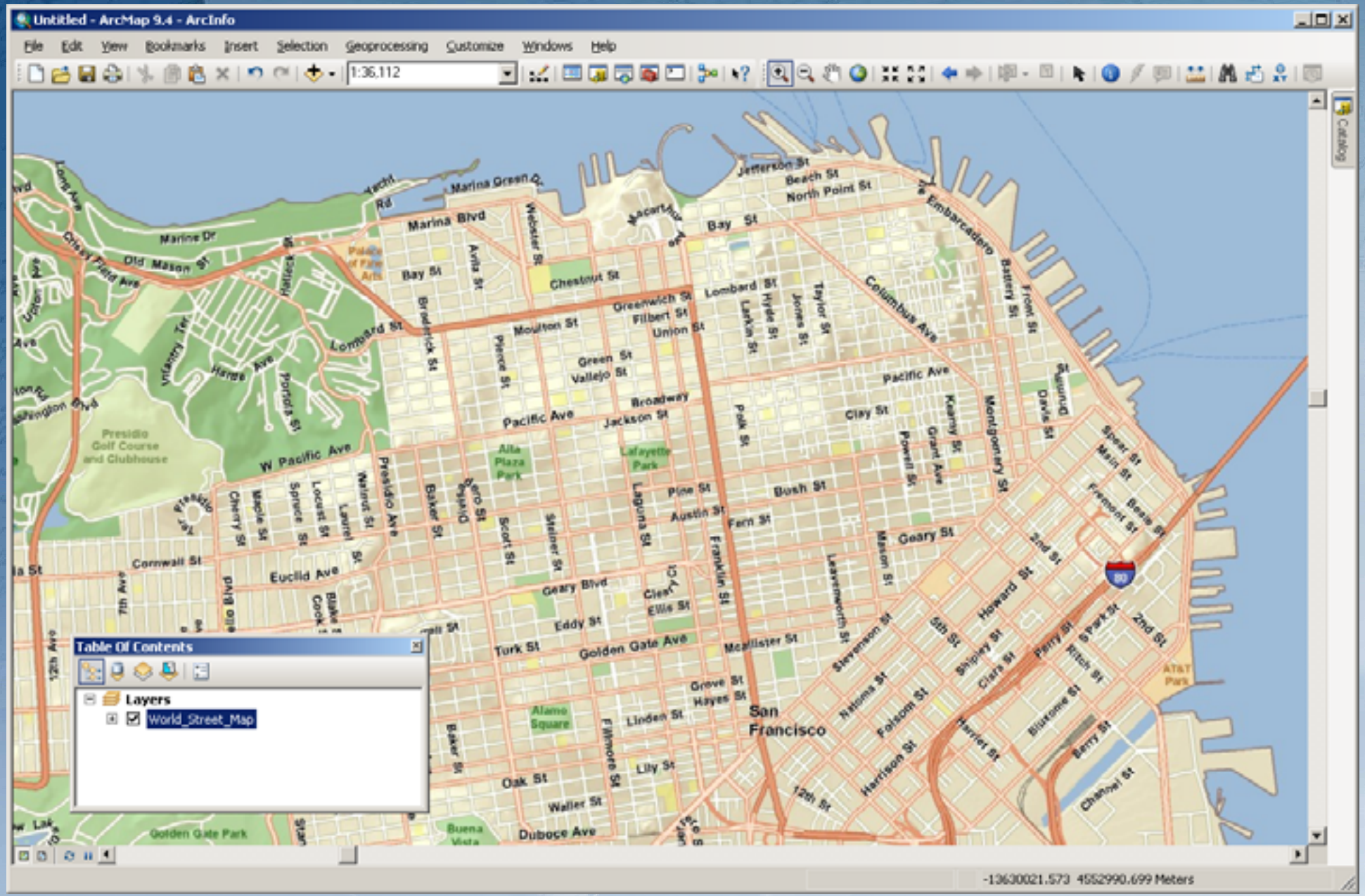
- Solution:
  - Use on-demand GIS services from the cloud

Not a new challenge

Accessing cloud content from ArcMap



World Street Map



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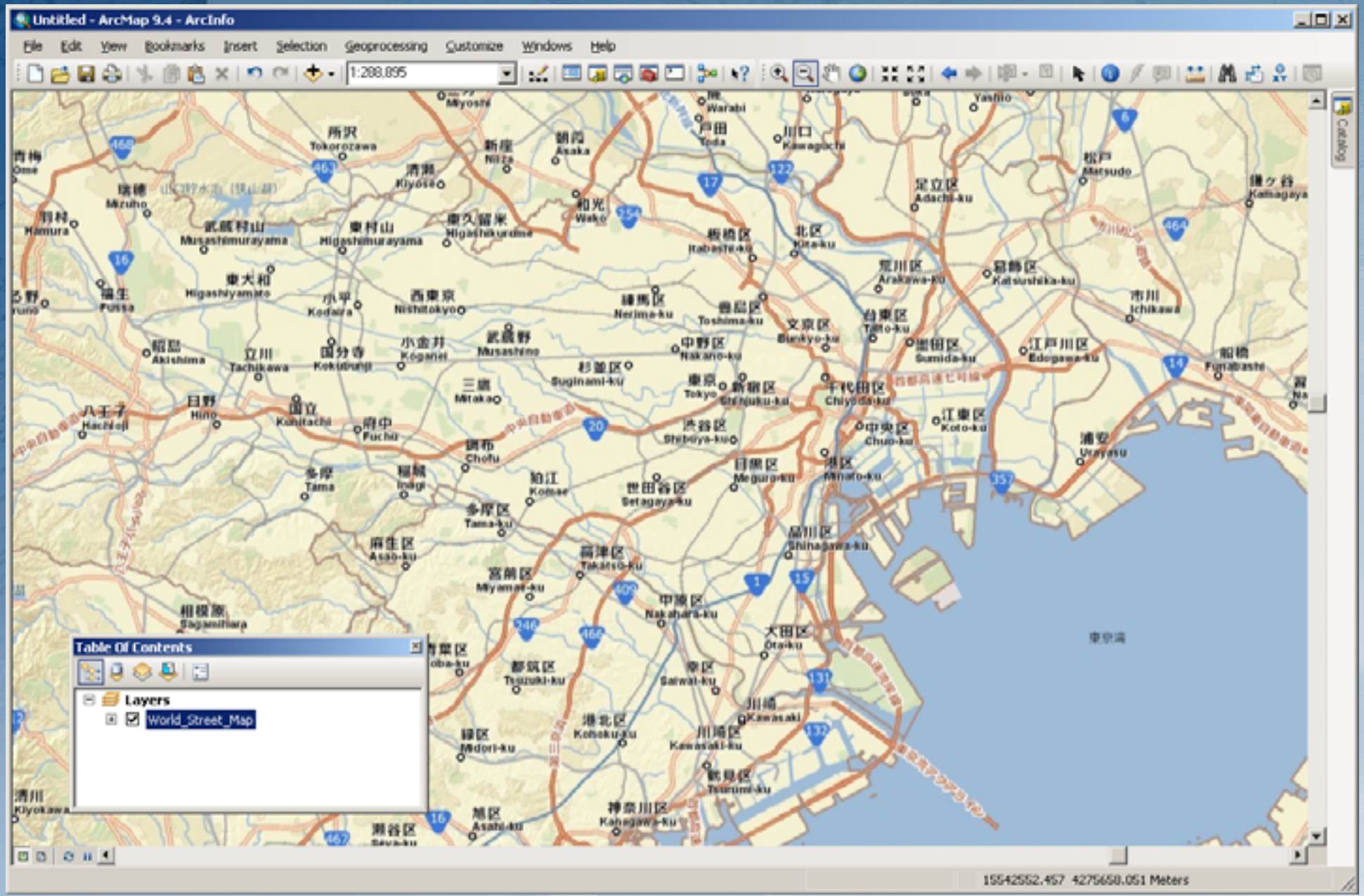
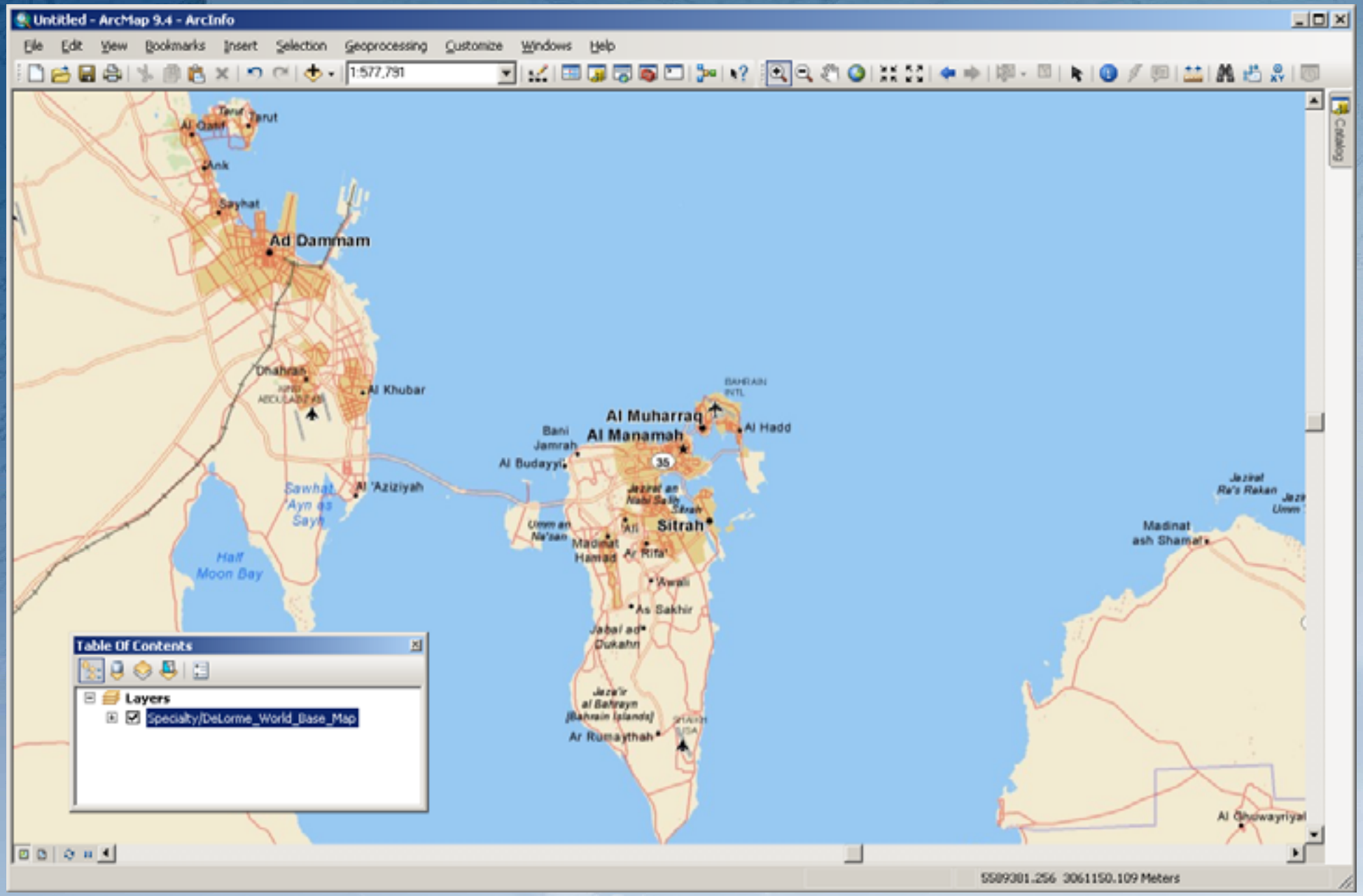


DeLorme World Basemap



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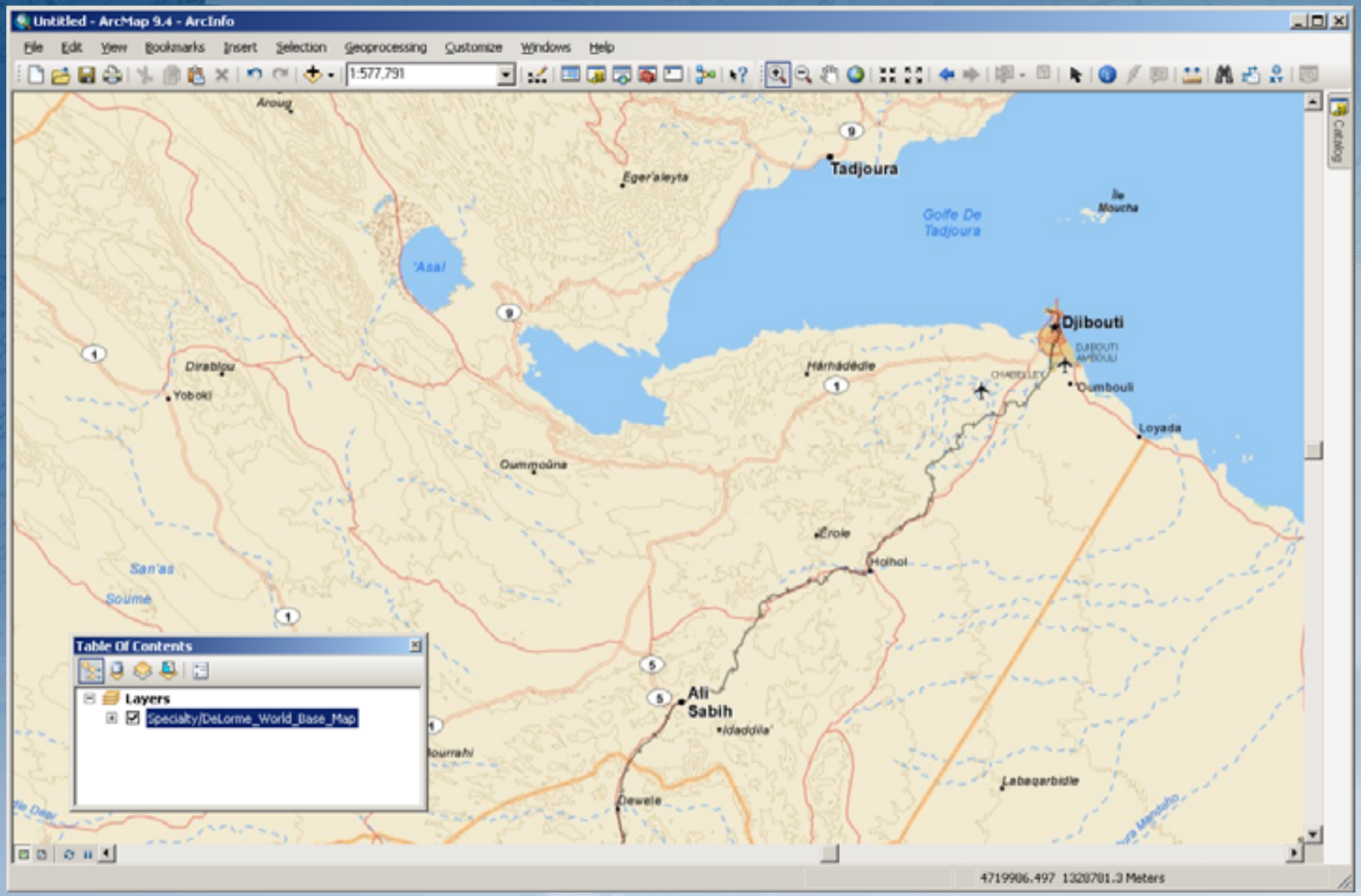
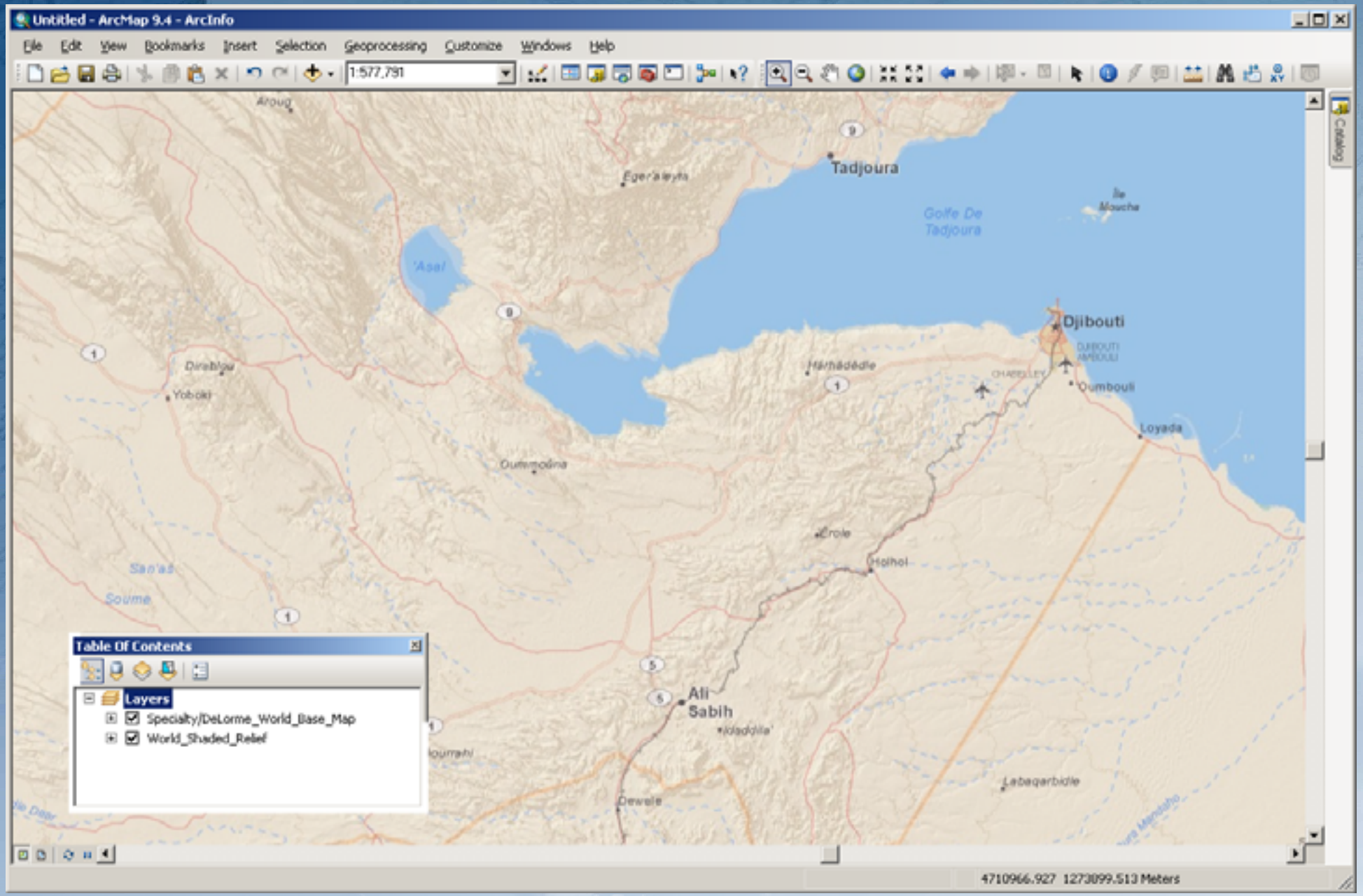
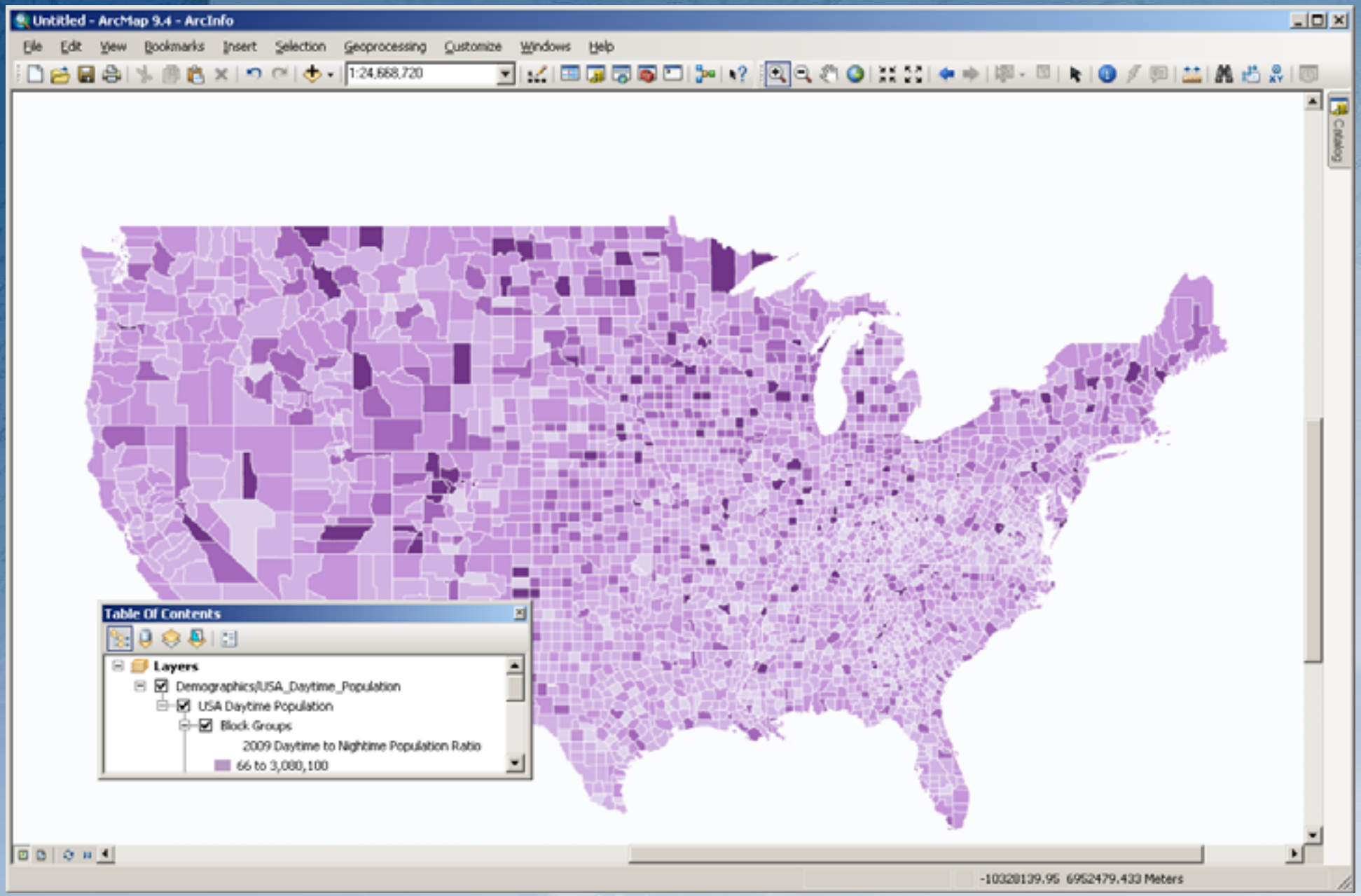


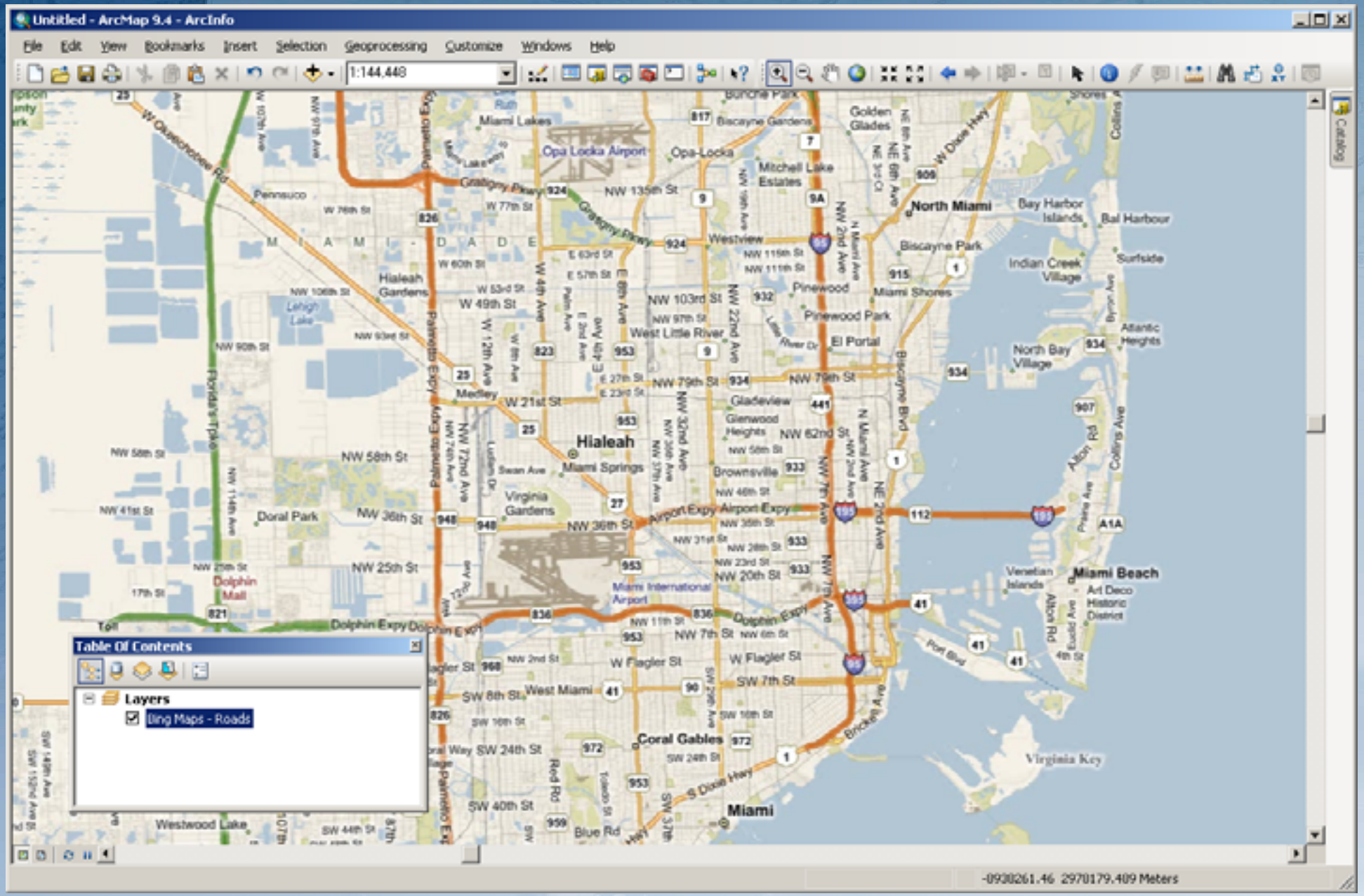
DeLorme World Basemap



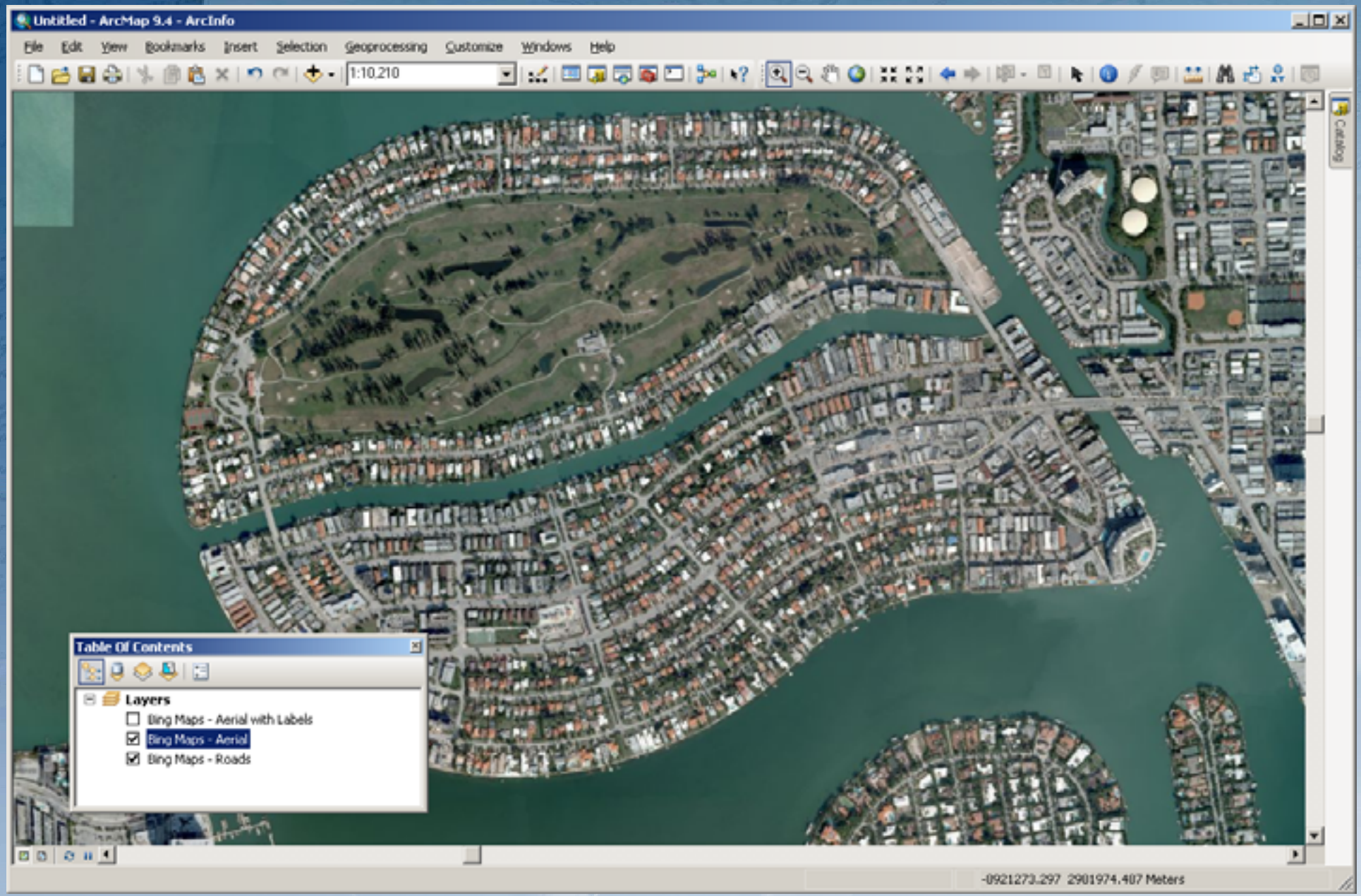
ESRI Demographics Data



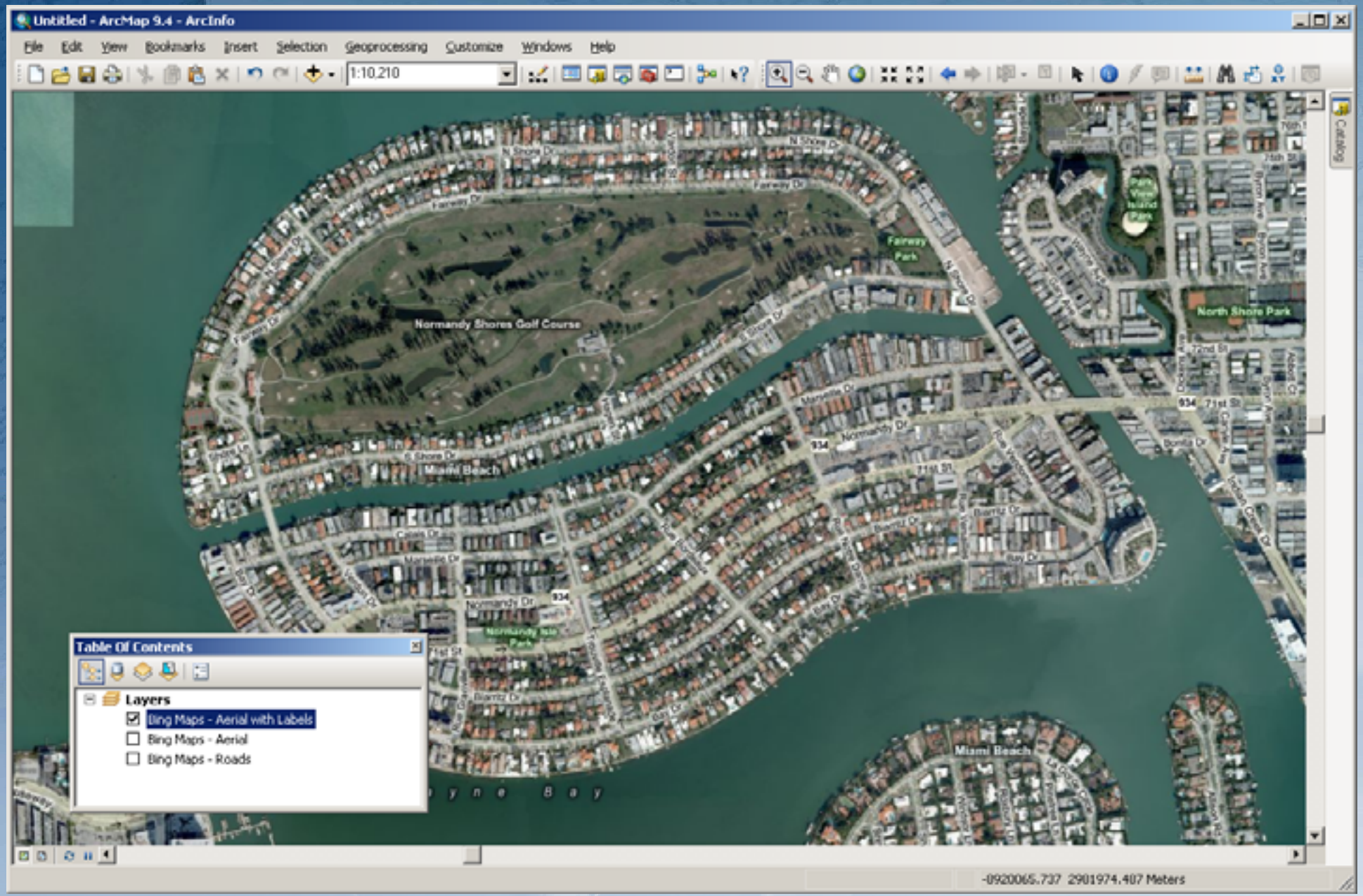
Bing Maps (Roads)



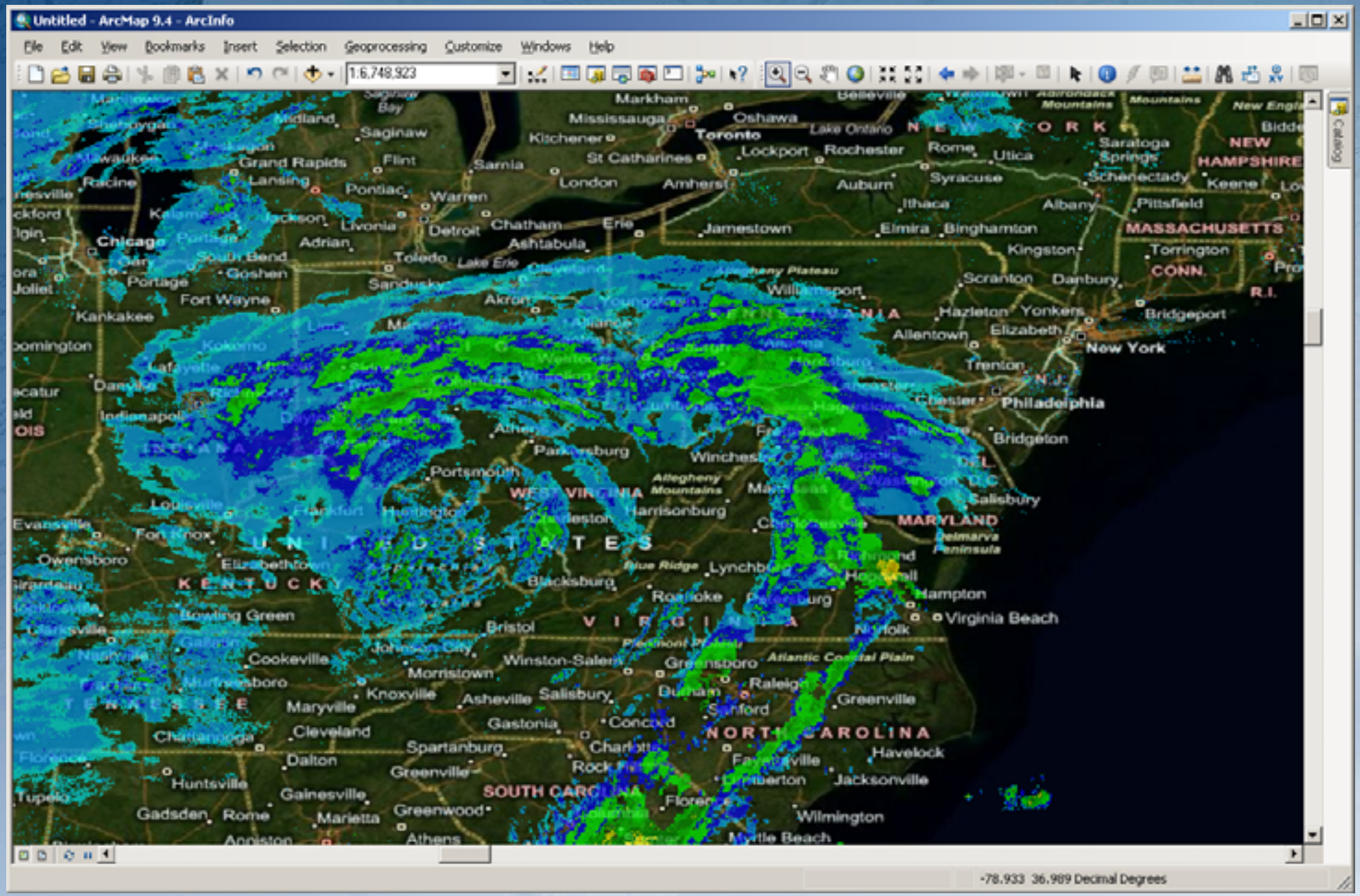
Bing Maps (Imagery)



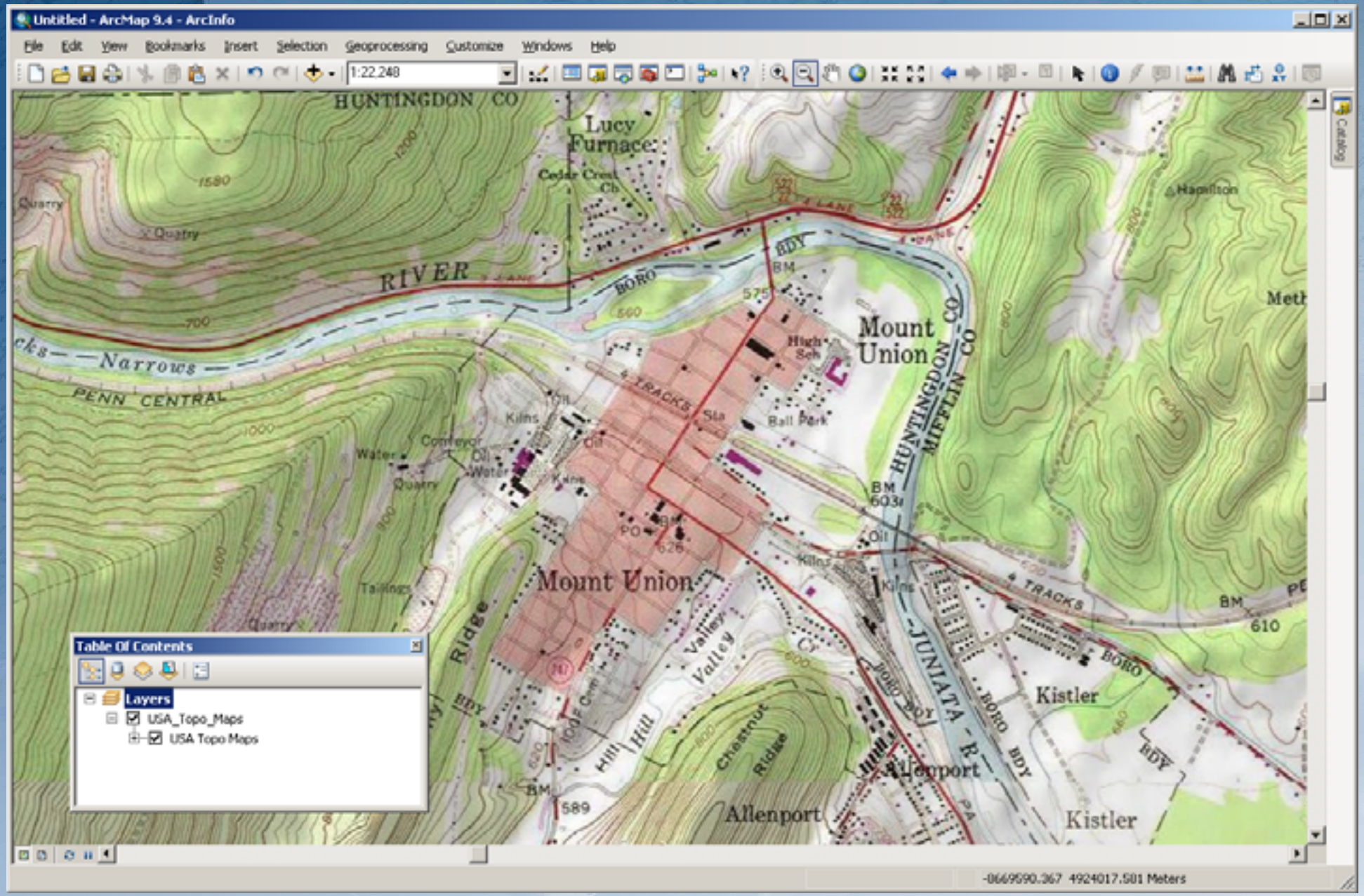
Bing Maps (Imagery + Labels)



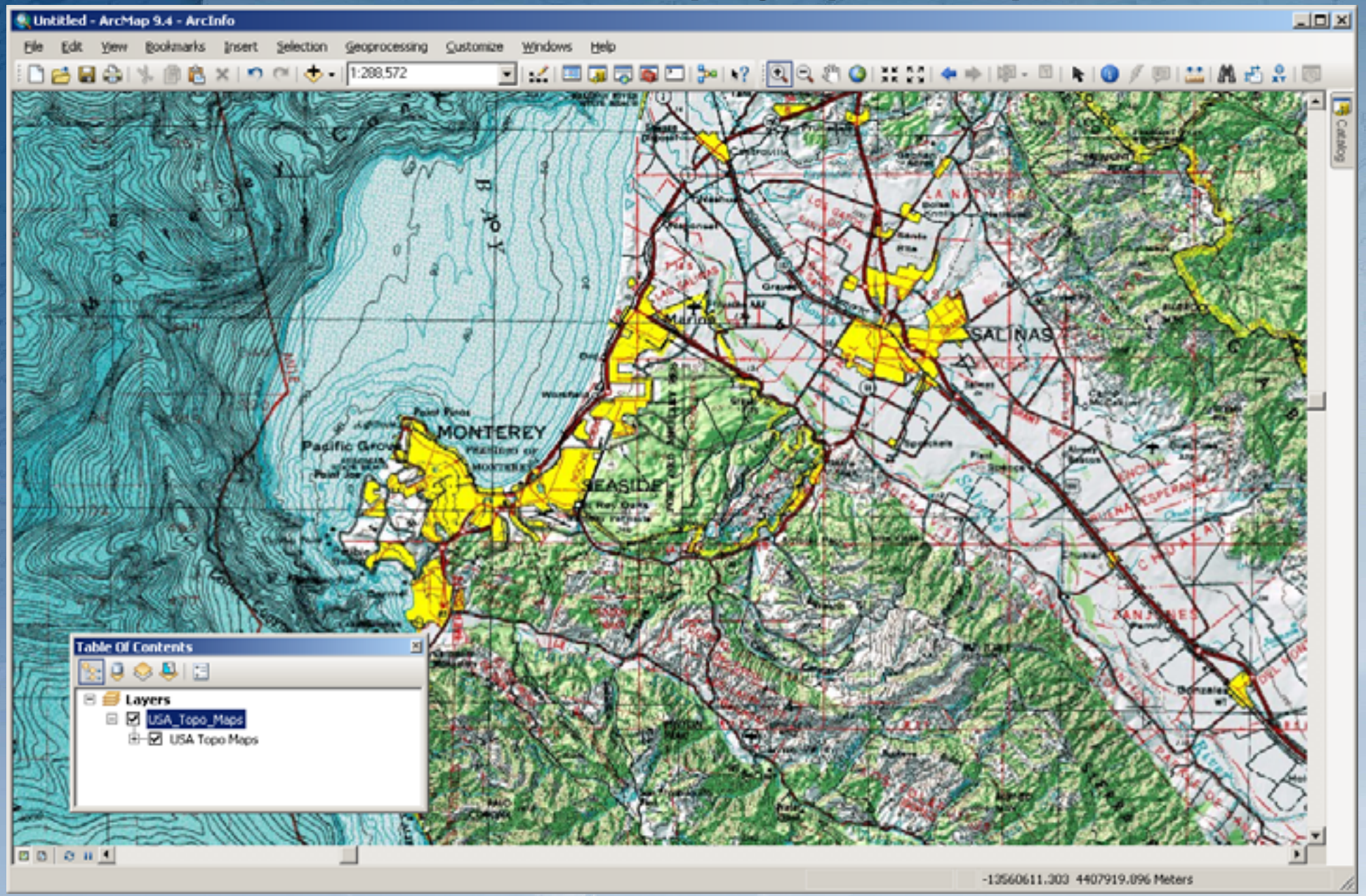
NOAA NEXRAD


Untitled - ArcMap 9.4 - ArcInfo
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:6,748,923
Markham
Mississauga
Oshawa
Toronto
Lake Ontario
Kitchener
St Catharines
Lockport
Rochester
Rome
Utica
Saratoga Springs
Schenectady
Albany
Pittsfield
Keene
NEW HAMPSHIRE
MASSACHUSETTS
CONN.
R.I.
Midland
Saginaw
Grand Rapids
Flint
Sarnia
London
Amherst
Auburn
Syracuse
Ithaca
Jamestown
Elmira
Binghamton
Kingston
Torrington
Racine
Lansing
Pontiac
Warren
Jackson
Livonia
Detroit
Chatham
Erie
Ashtabula
Chicago
Adrian
Toledo
Lake Erie
Cleveland
Goshen
Sandusky
Akron
Williamsport
Scranton
Danbury
Portage
Fort Wayne
Kankakee
Hazleton
Yonkers
Bridgeport
Allentown
Elizabeth
New York
Trenton
Philadelphia
Bridgeton
Indianapolis
Parkersburg
Portsmouth
Louisville
Harrisonburg
Salisbury
MARYLAND
Evansville
Fort Knox
Owensboro
Elizabethtown
Blacksburg
Roanoke
Lynchburg
Hampton
Virginia Beach
Norfolk
Bowling Green
Bristol
Johnson City
Cookeville
Morristown
Winston-Salem
Greensboro
Raleigh
Knoxville
Asheville
Salisbury
Durham
Greenville
Maryville
Gastonia
Concord
Cleveland
Chattanooga
Spartanburg
Charlotte
Havelock
Dalton
Greenville
Huntsville
Gainesville
Jacksonville
Gadsden
Rome
Marietta
Greenwood
Florence
Wilmington
Athens
Myrtle Beach
-78.933 36.989 Decimal Degrees

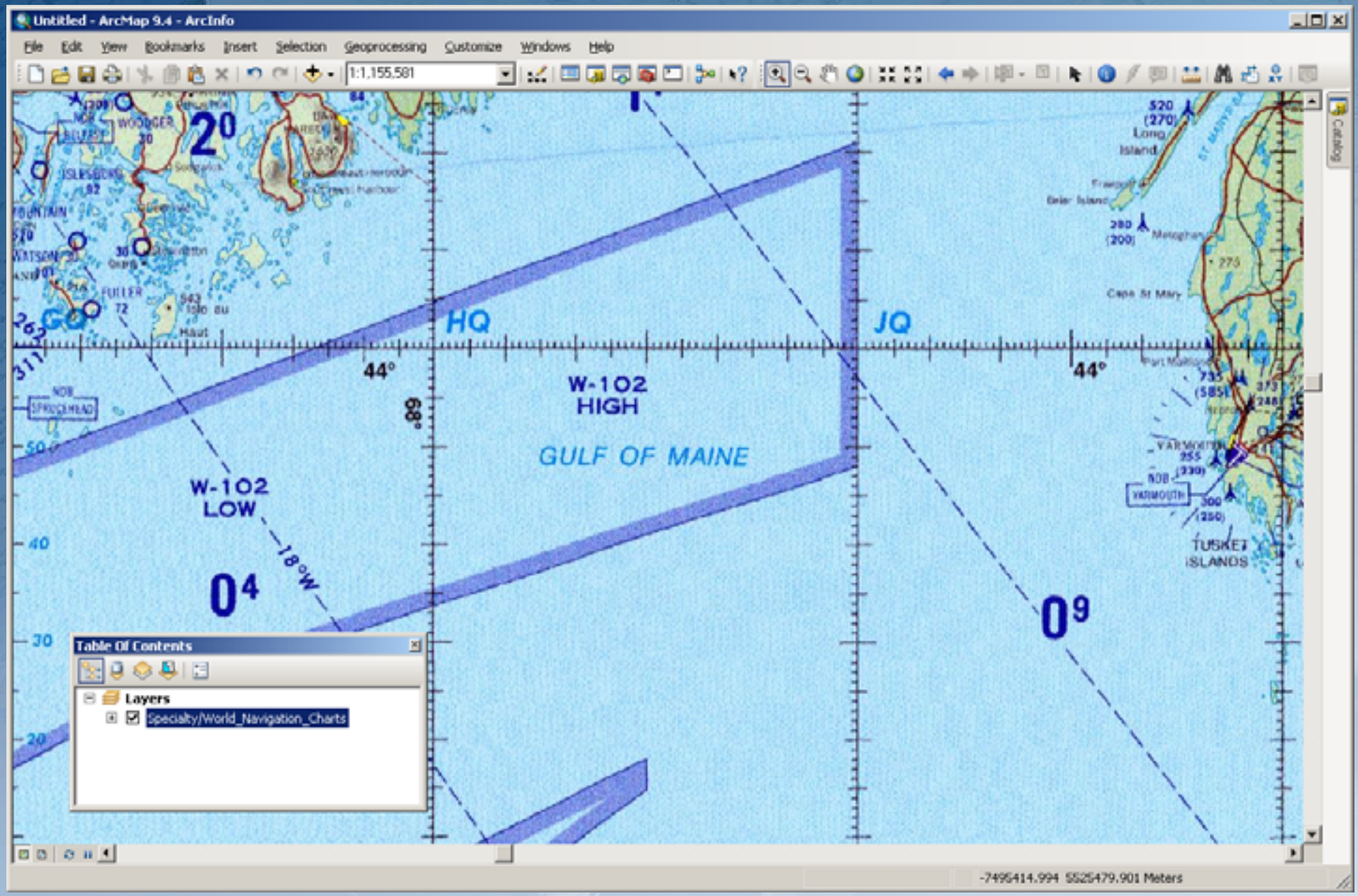
US Topographic Maps



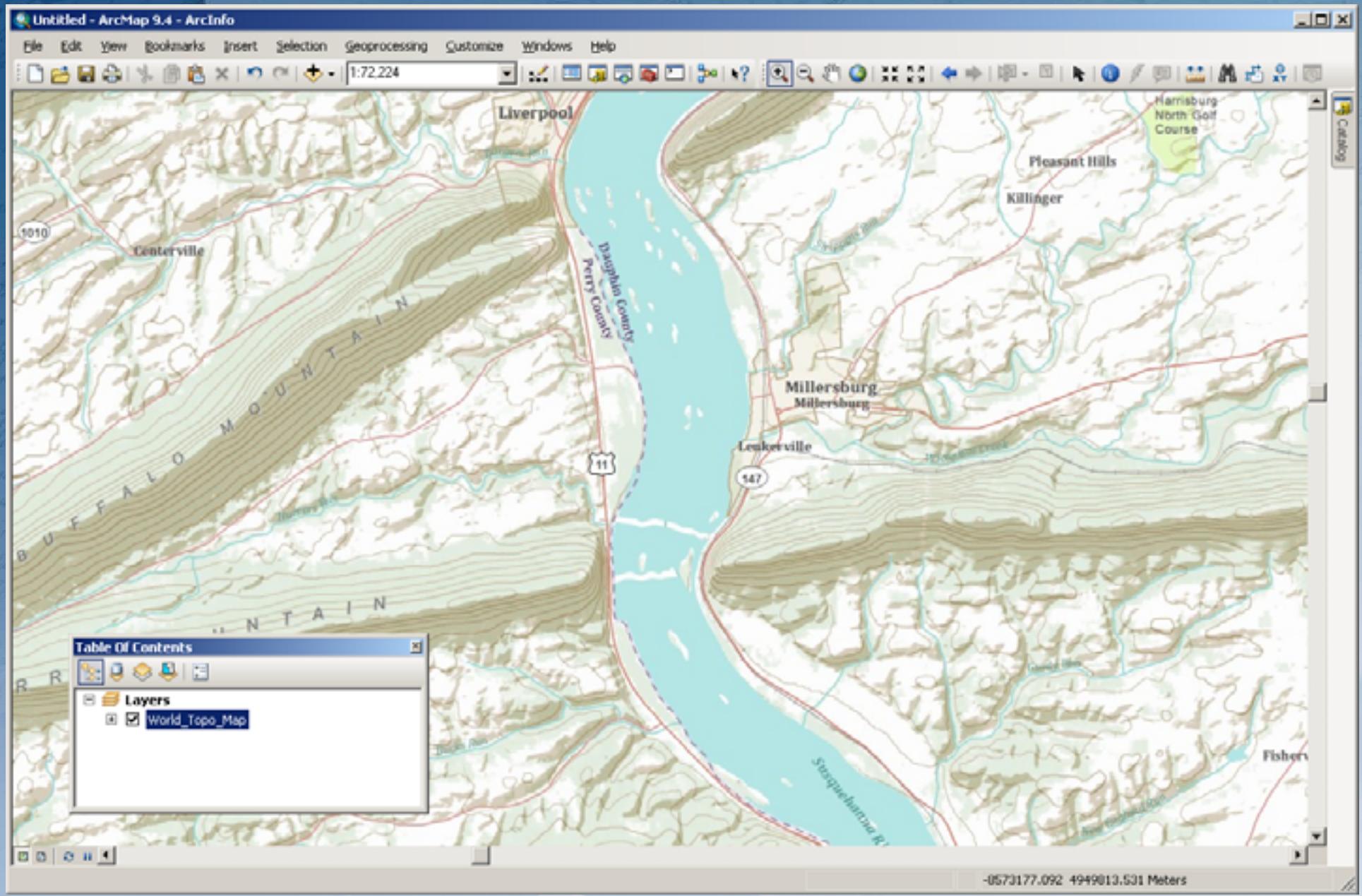
US Topographic Maps



World Navigation Charts (ONC)



World Topographic Map (Community Base Map)



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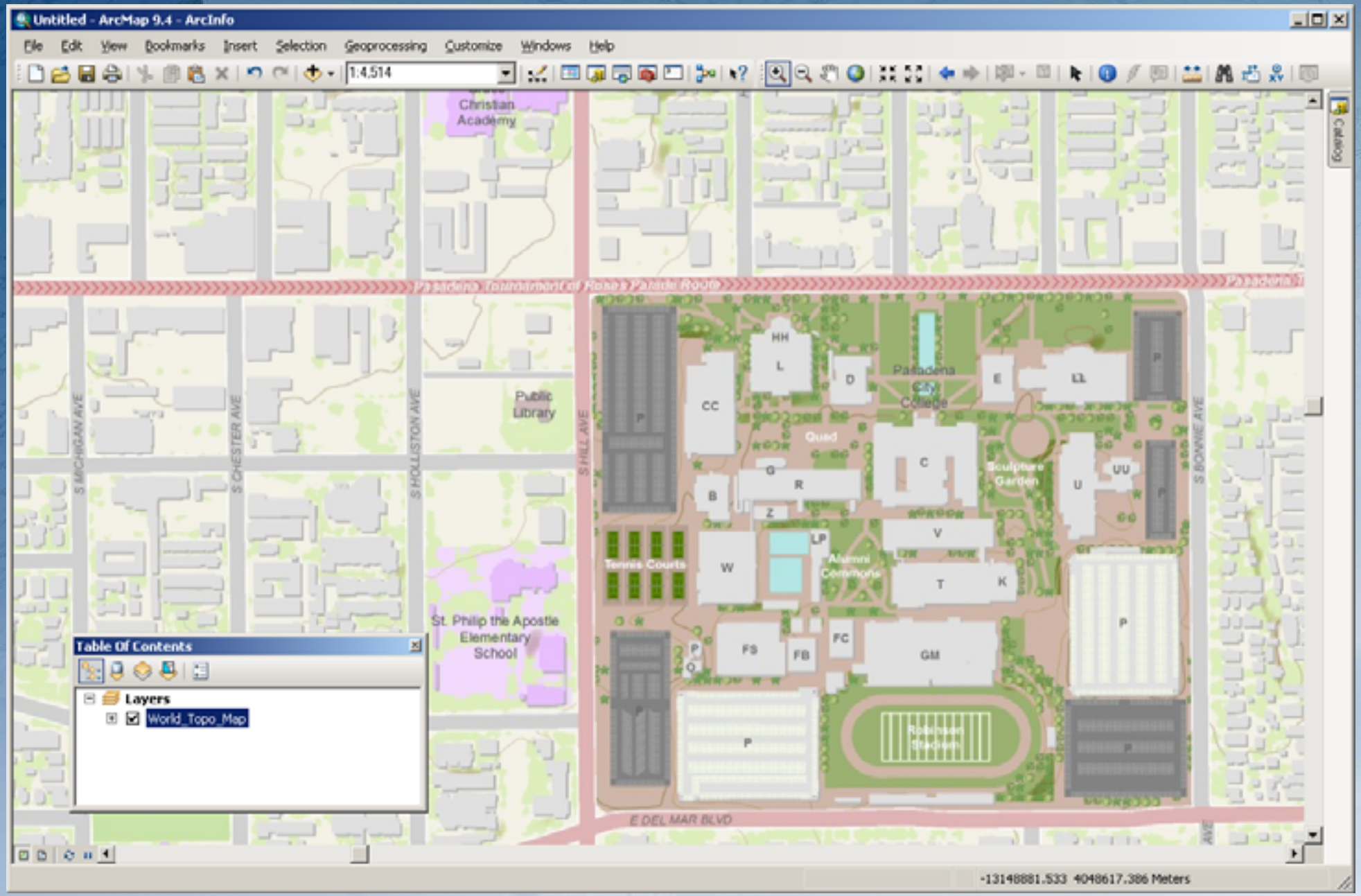
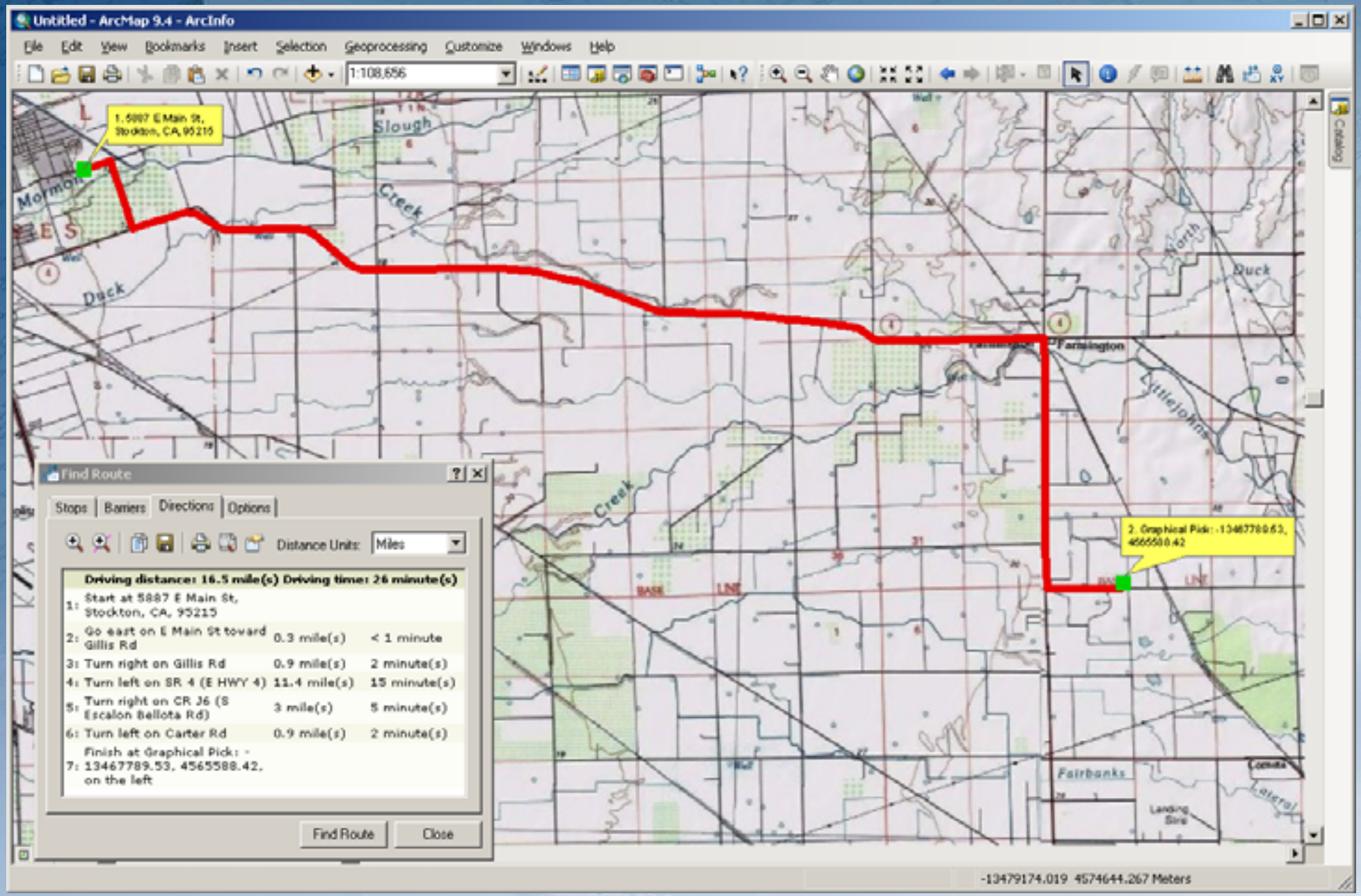


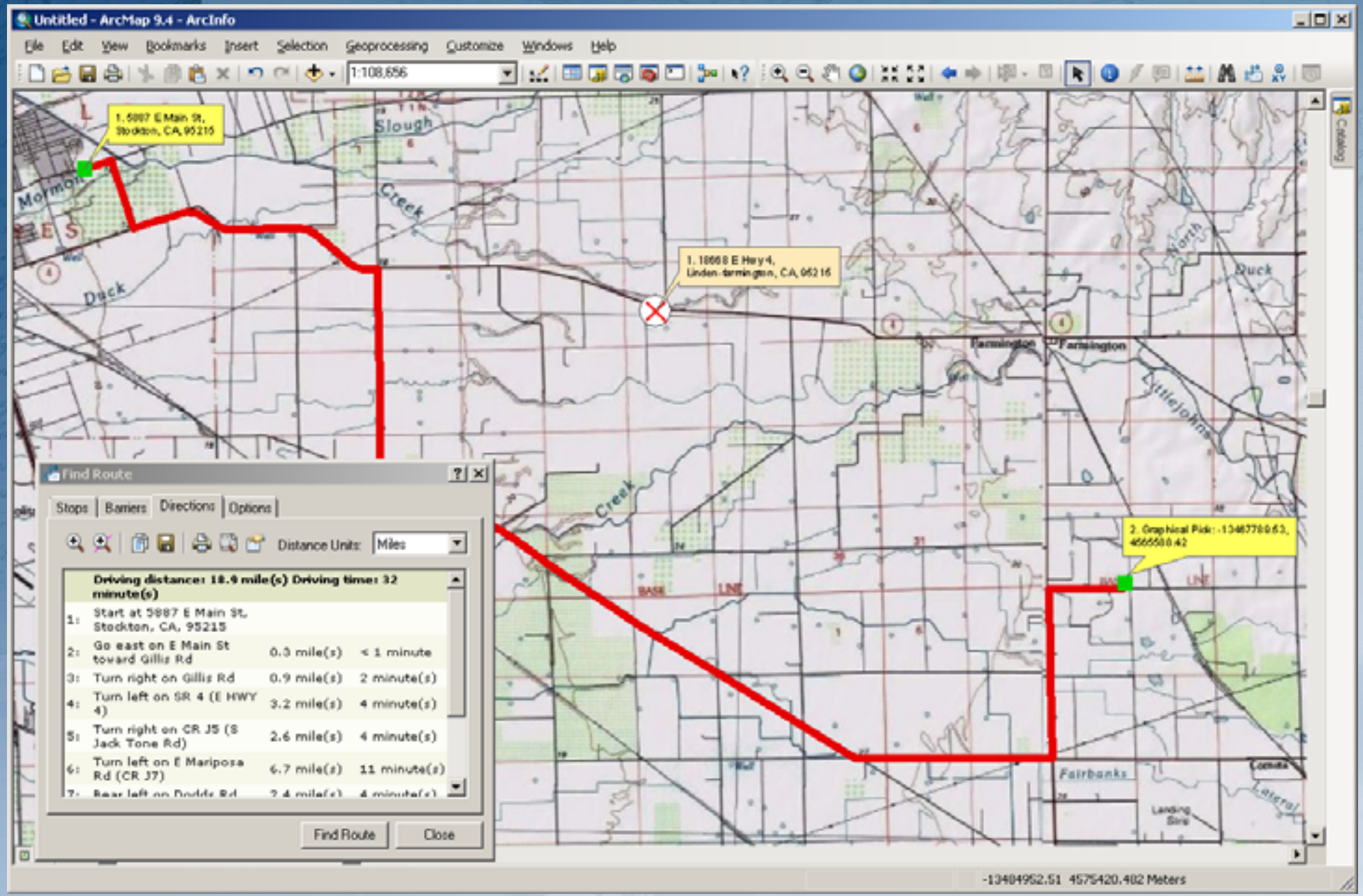
Quick Demo!

Not just map content…
GIS Services too

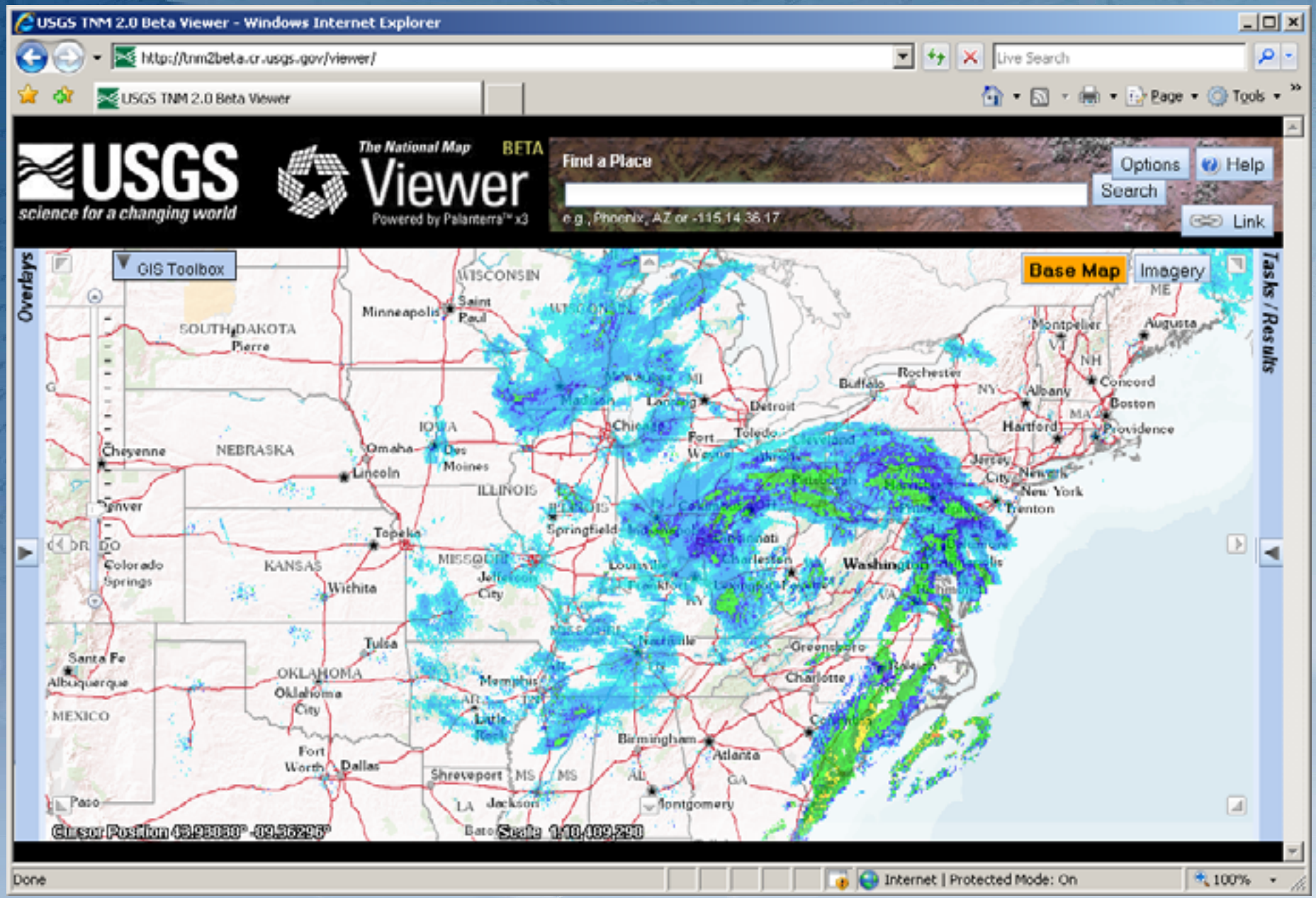
ArcGIS Routing and Geocoding Cloud Services



ArcGIS Routing and Geocoding Cloud Services



Accessing Cloud Services from Web apps



GeoMine System for
Easement Recording & Search
USDOI Office of Surface& Mining

Climate Change & Strategic Habitat
Conservation Mapper
Fish&Wildlife Service

Easement Recording&Search
USDA NRCS

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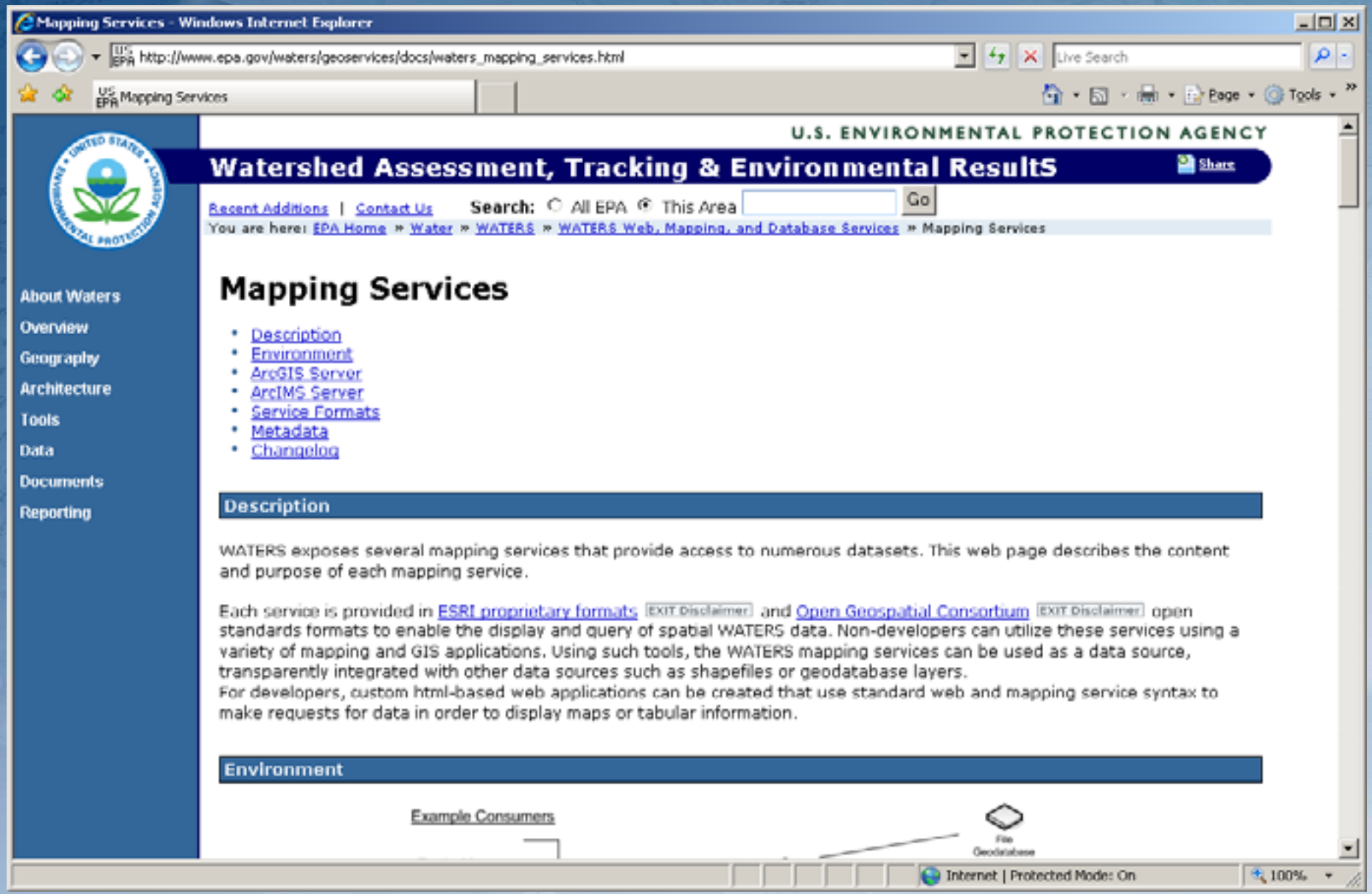
Tracking Stimulus Dollars
U.S.Department of Transportation

Common Operational Picture
Louisiana National Guard

Flood Inundation Modeling
DHS/NPPD/IP/IICD

Collecting Storm Damage Information
National Weather Service

You, as a service provider



Software + Cloud Services

- Accessing massive amounts of information without hassle
  - No need to copy, load, maintain data
  - No need to update data (it just happens)
- Easy access via ArcGIS Online (and other portals)
- Works in private clouds via the ArcGIS Data Appliance
- For the Desktop and Web Map Application builder
- Other features in ArcGIS Online: Sharing and Layer Packages

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CLOUD SERVICES

On-Line GIS

ArcGIS.com

- Search / Sharing /Storage
- Caching
- Feature Services
- Web Map hosting
- And more…

Desktop 10.next

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CLOUD INFRASTRUCTURE

Dilemma: Time to service

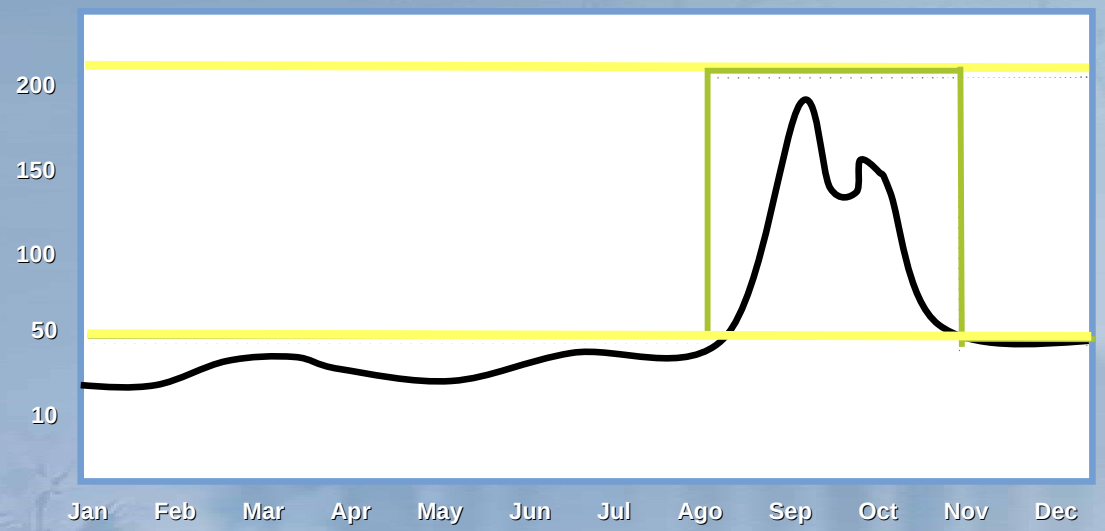
Procure Hardware

Setup Application/Database Server

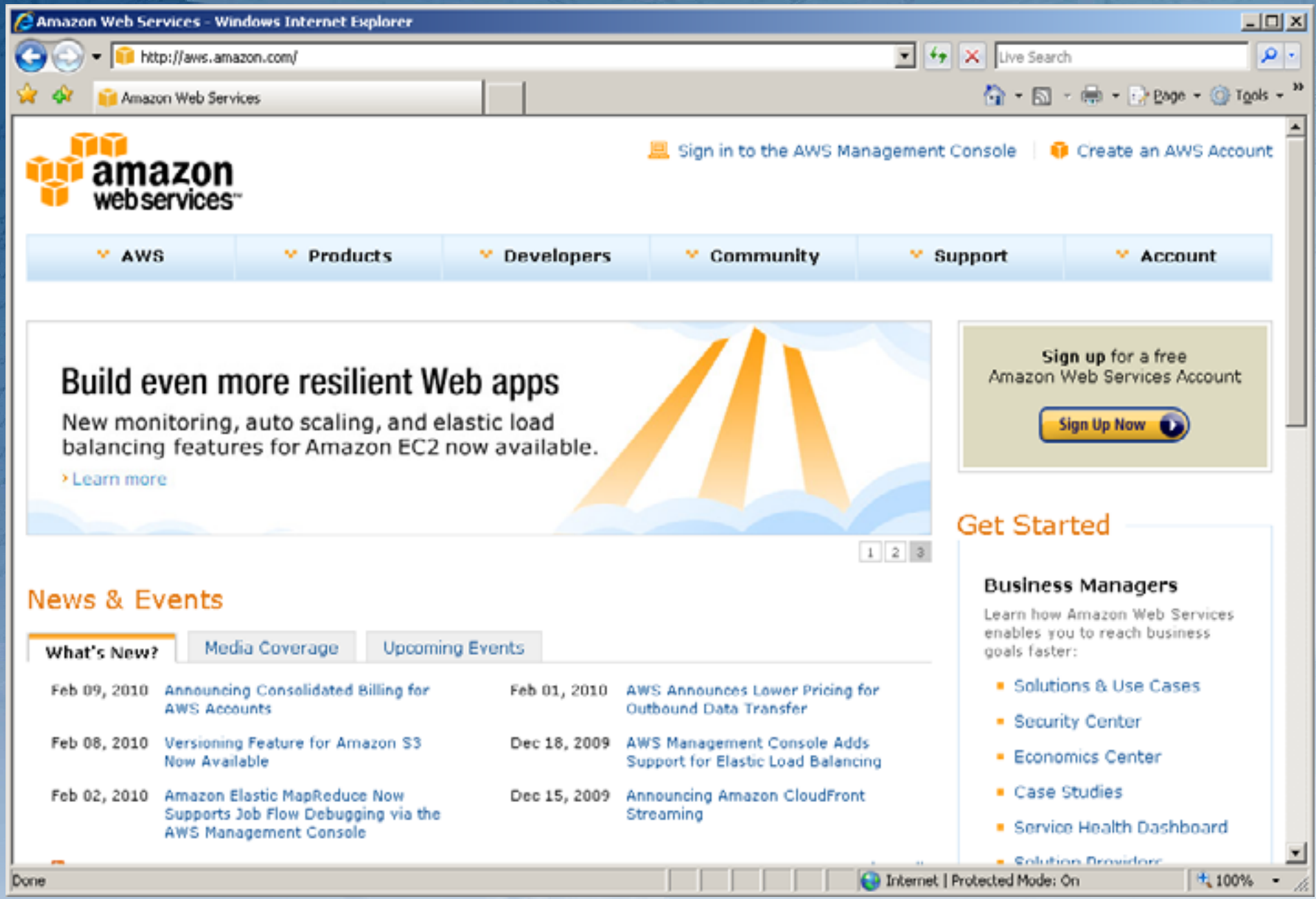
Load Data and Applications

Make available

Dilemma: Capacity vs Demand



Elastic Cloud Computing with Amazon



Ready to use ArcGIS Server 10 AMIs

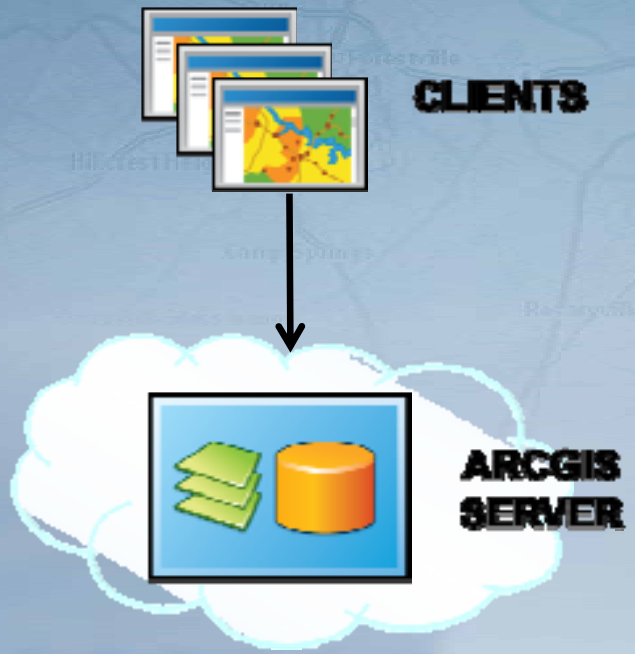
ArcGIS Server Advanced Enterprise 10
- On Windows 2008 R2
- Image Extension (optional)

ArcGIS Enterprise Geodatabase 10
- On PostGreSQL

Quick Demo!

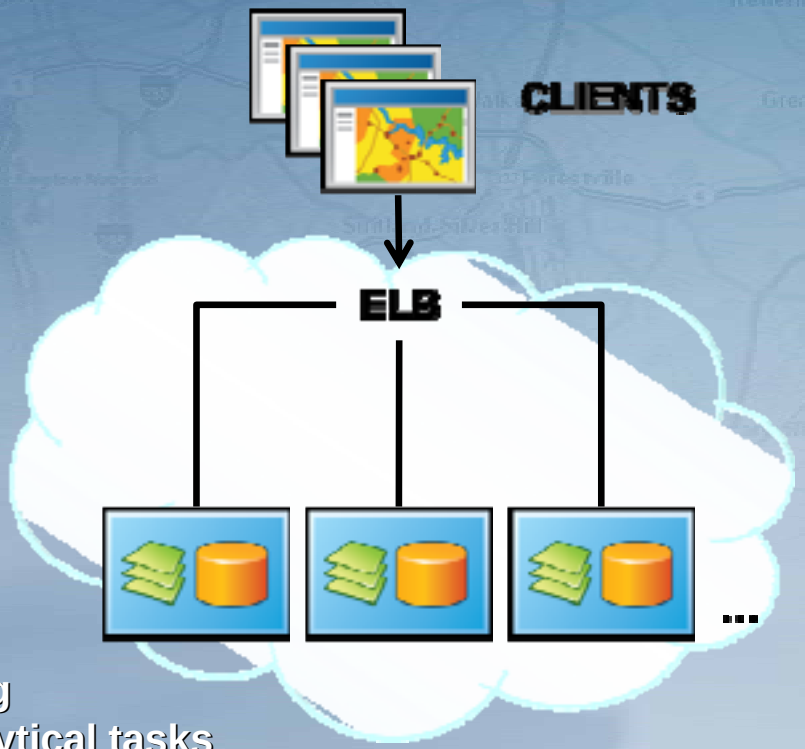
Typical deployment Patterns for ArcGIS Server in the Amazon Cloud

Workgroup deployment



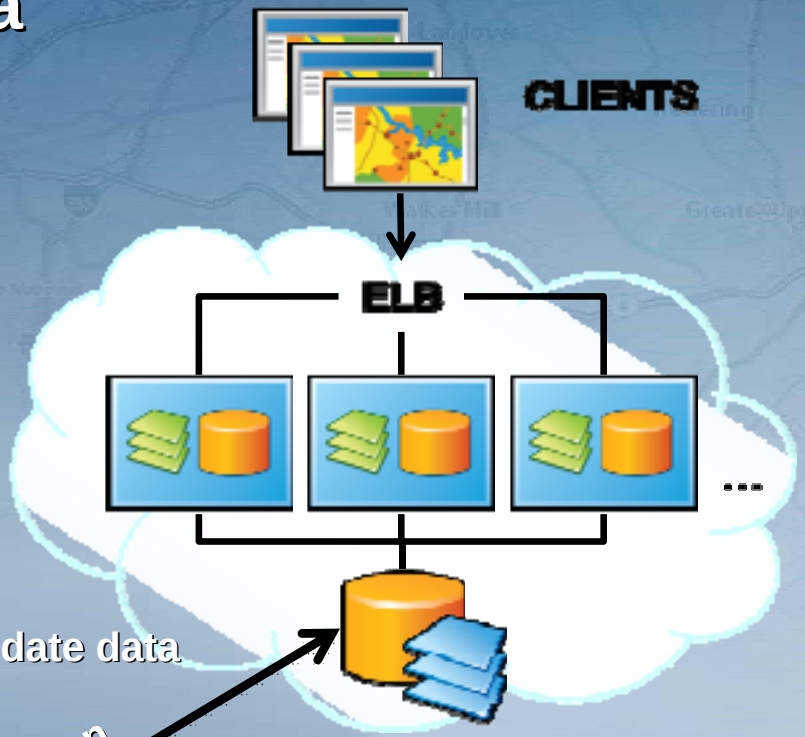
- Sandbox
  - Deployment on-premise
  - Deployment on cloud
- One server
- Static data
- Non HA: Single point of failure

Elastic Cluster of Workgroups

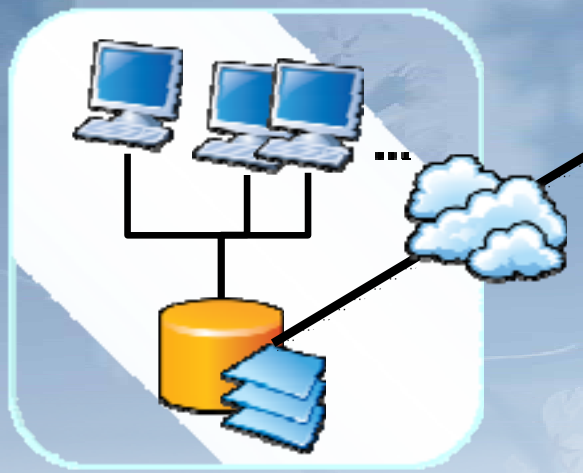


- ELB clustering Workgroups
- Scheduled or demand-based sizing
- For apps and ad-hoc massive analytical tasks
- HA: No single point of failure
- Variation: Clone across regions

Cloud replica



- Complements on-premise deployment
- Transactional database in-house
- Public facing services on the cloud
- Replicated Geodatabase for most up to date data
- One way vs Two Way



Geodatabase replication

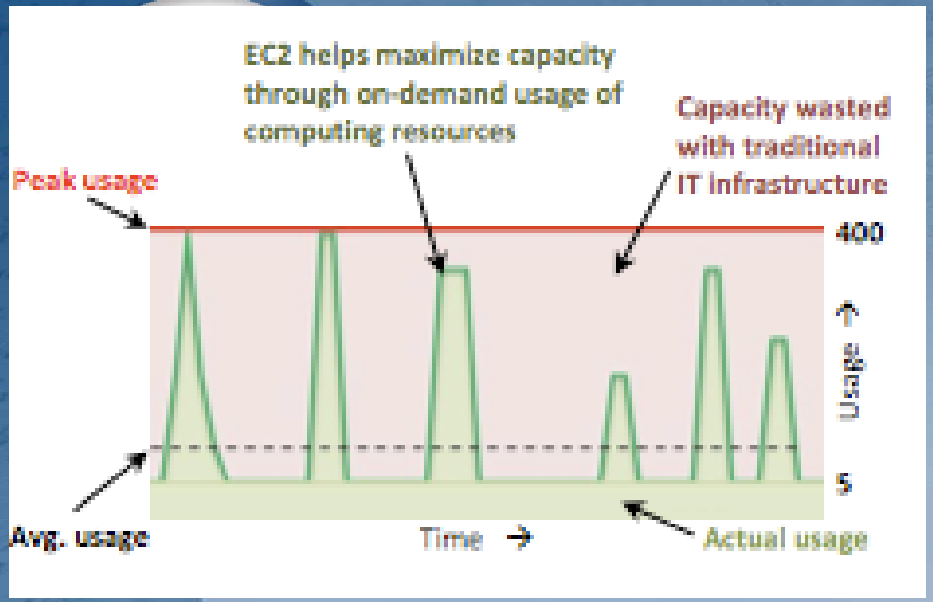
Over http/s

Software in the Cloud

- Quick deployment of ArcGIS Server in the Amazon Cloud
- Transparently Leveraging Amazon services
  - Elastic Computing Cloud
  - Cloud Watch
  - Cloud Front
  - S3 storage
  - Etc

Understanding the costs and benefit of cloud computing

Amazon Use Case
High-Performance Computing



Assumptions

- 5 servers running constantly at 100% full capacity
- 400 servers utilized as needed for compute intensive projects, with average annual utilization of only 10%
- 5 GB average monthly data transfer "in" and 15 GB average monthly data transfer "out" per instance
- Region: US East (Northern Virginia)
- Operating System: Linux/Unix

Note: These assumptions are used for demonstration purposes only. You may input your own assumptions in the Amazon EC2 Cost Comparison Calculator for an accurate cost comparison based on your own use case and computing needs.

Co-Located Data Center

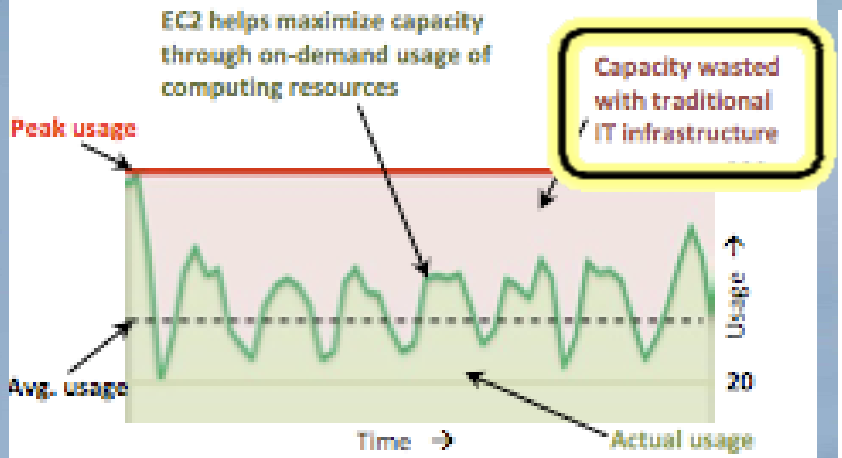
	Annual Cost
Server Hardware	$49,005
Network Hardware	$9,801
Hardware Maintenance	$17,642
Co-Location Expense	$504,187
Remote Hands Support	$6,075
Data Transfer	$2,686
Total	$589,395

Amazon EC2*

	Annual Cost
Instance Hours	$33,415
Data Transfer	$1,215
Total	$35,061

Other Costs?

Amazon Use Case
Web Hosting with Occasional Traffic Spikes



Assumptions

- 20 servers running constantly at 100% full capacity
- 200 servers needed during occasional traffic spikes, with average annual utilization of only 20%
- 10 GB average monthly data transfer "in" and 50 GB average monthly data transfer "out" per instance
- Region: US East (Northern Virginia)
- Operating System: Linux/Unix

Note: These assumptions are used for demonstration purposes only. You may input your own assumptions in the Amazon EC2 Cost Comparison Calculator for an accurate cost comparison based on your own use case and computing needs.

Co-Located Data Center

	Annual Cost
Server Hardware	$26,620
Network Hardware	$5,324
Hardware Maintenance	$9,583
Co-Location Expense	$274,293
Remote Hands Support	$3,300
Data Transfer	$9,401
Total	**$328,521**

Amazon EC2*

	Annual Cost
Instance Hours	$44,554
Data Transfer	$5,400
Total	**$49,954**

Other Costs?

Different types of Costs

Setup

Maintenance

Operations

Setup Costs

- Before the system is considered up and running for use.

- Configuration and Verification
  - Software
  - Data

- Software testing and trials

- Data upload
  - Time Vs Cost
  - EC2 Vs S3

Operations costs

- Staging Environment
- Testing
  - Functional
  - Load testing
- Monitoring
- Troubleshooting

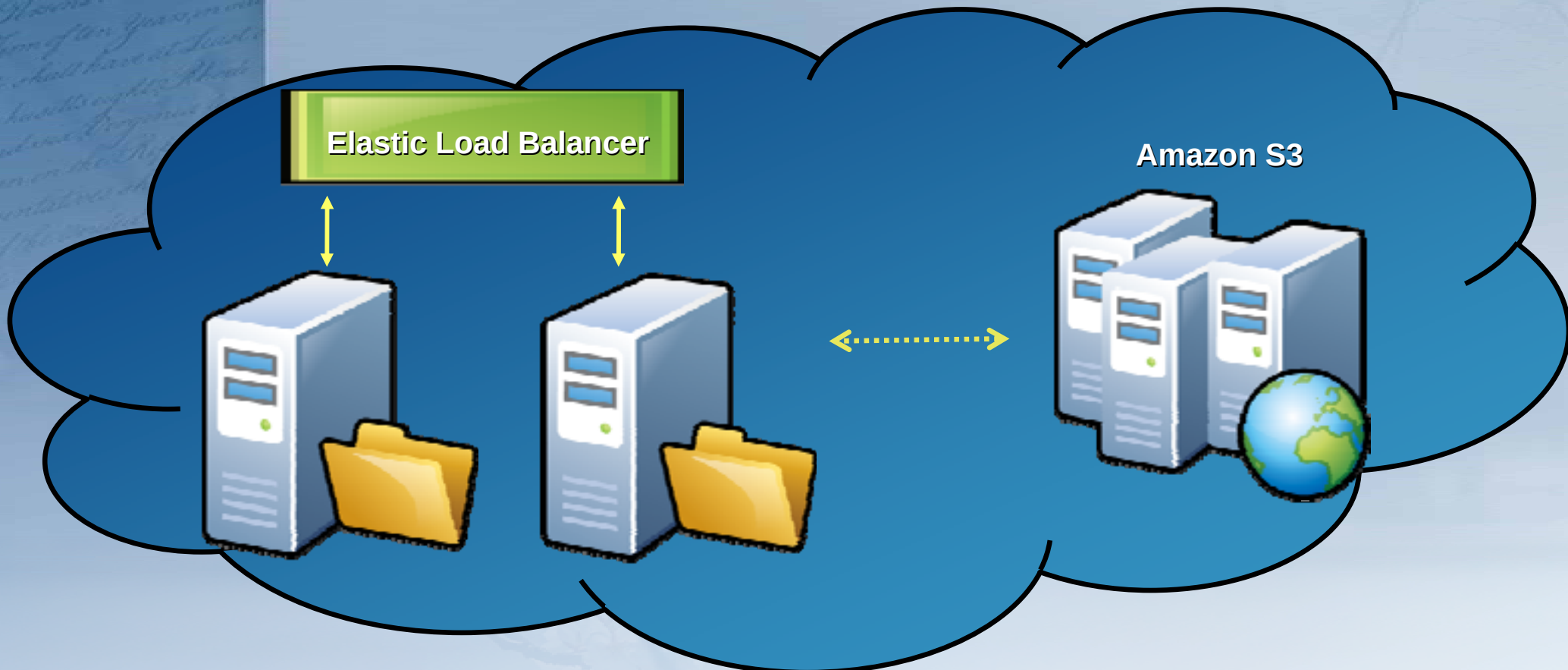
Maintenance Costs

- Data updates
  - Data upload costs
  - Data Testing and Verification
- Configuration Changes
  - System capacity
  - System features
- Managing load changes

Example Application Deployment in the Amazon Cloud

- Hosted components
  - AGS Server w/ 3 services
  - Web Application
- Hosting requirements
  - High Availability
  - Data updates

Example Application Deployment Architecture



Example Application Deployment Cost List

Amazon Service	Cost model
3 Instances 2 production 1 staging	Hourly rate / instance Data In - out / GB
Elastic Load Balancer	Data In – out / GB
2 EBS drives	Hourly rate / GB Data In – out / GB
S3 account	Hourly rate / GB In - out / GB

Real World Implementation
DataBasin

Data Basin is an online system that connects scientists and practitioners with spatial datasets and tools.

Explore and download datasets

Connect to external data sources

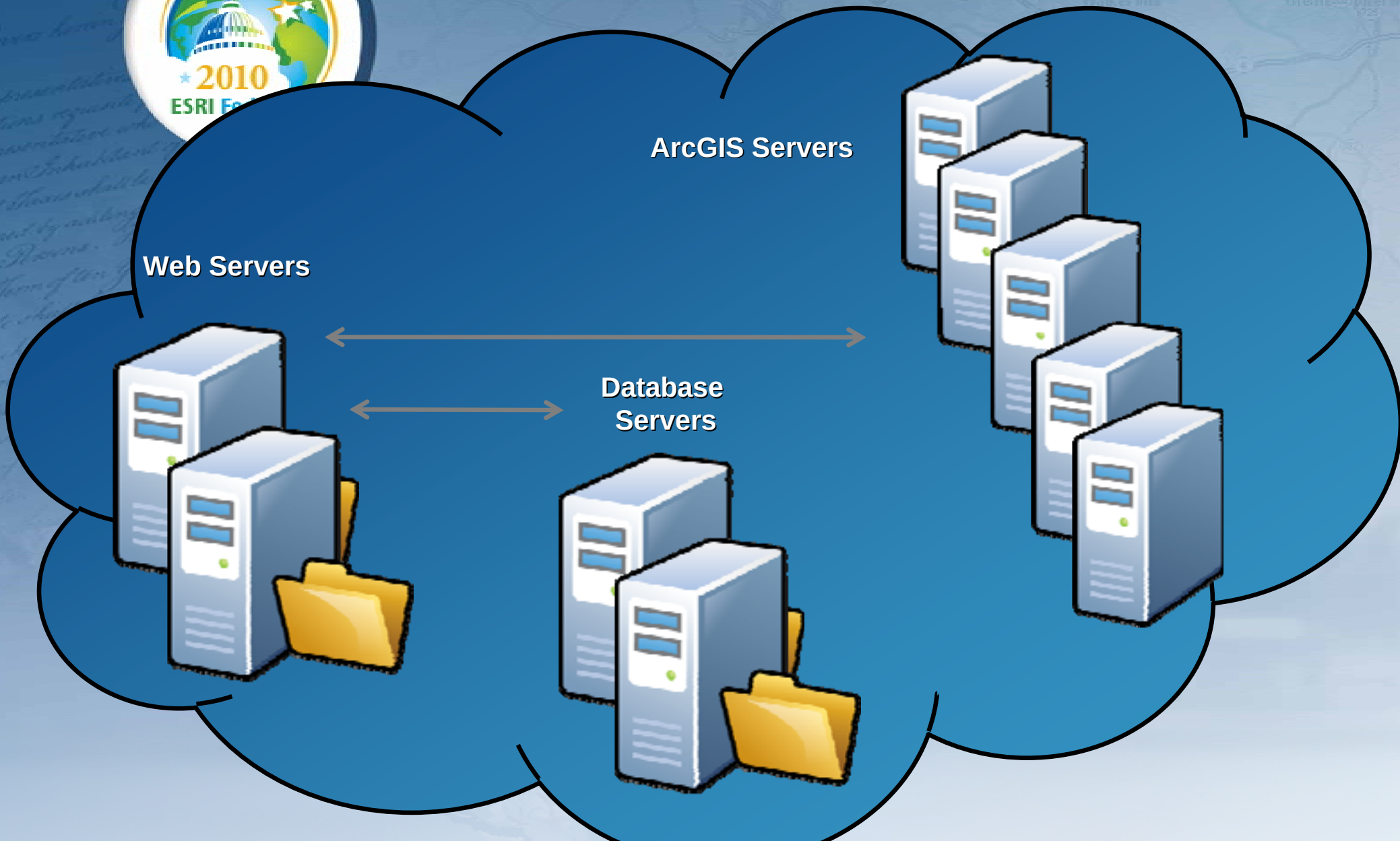
Upload and publish your datasets

Connect to experts

Create working groups

Produce customized maps that can be easily shared

DataBasin Cloud Deployment Architecture



Real World Example
USDA

Summary