

# Real-Time Data Management and Visualization for Geostationary Lightning Mapper (GLM) in ArcGIS Platform

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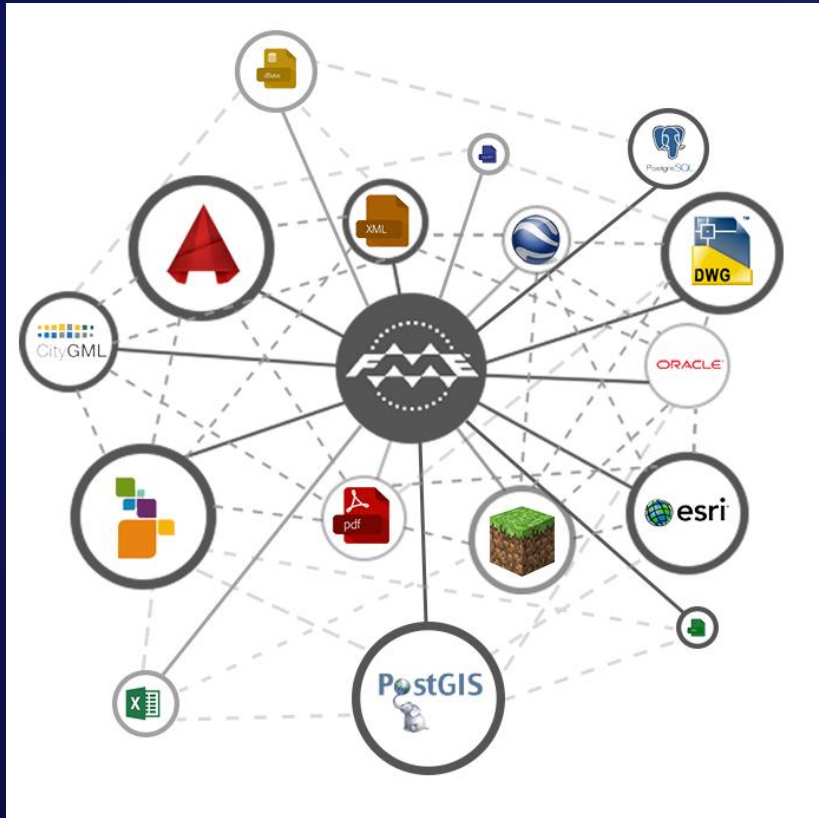
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*Paul J. Meyer, Christopher J. Schultz (NASA MSFC)*

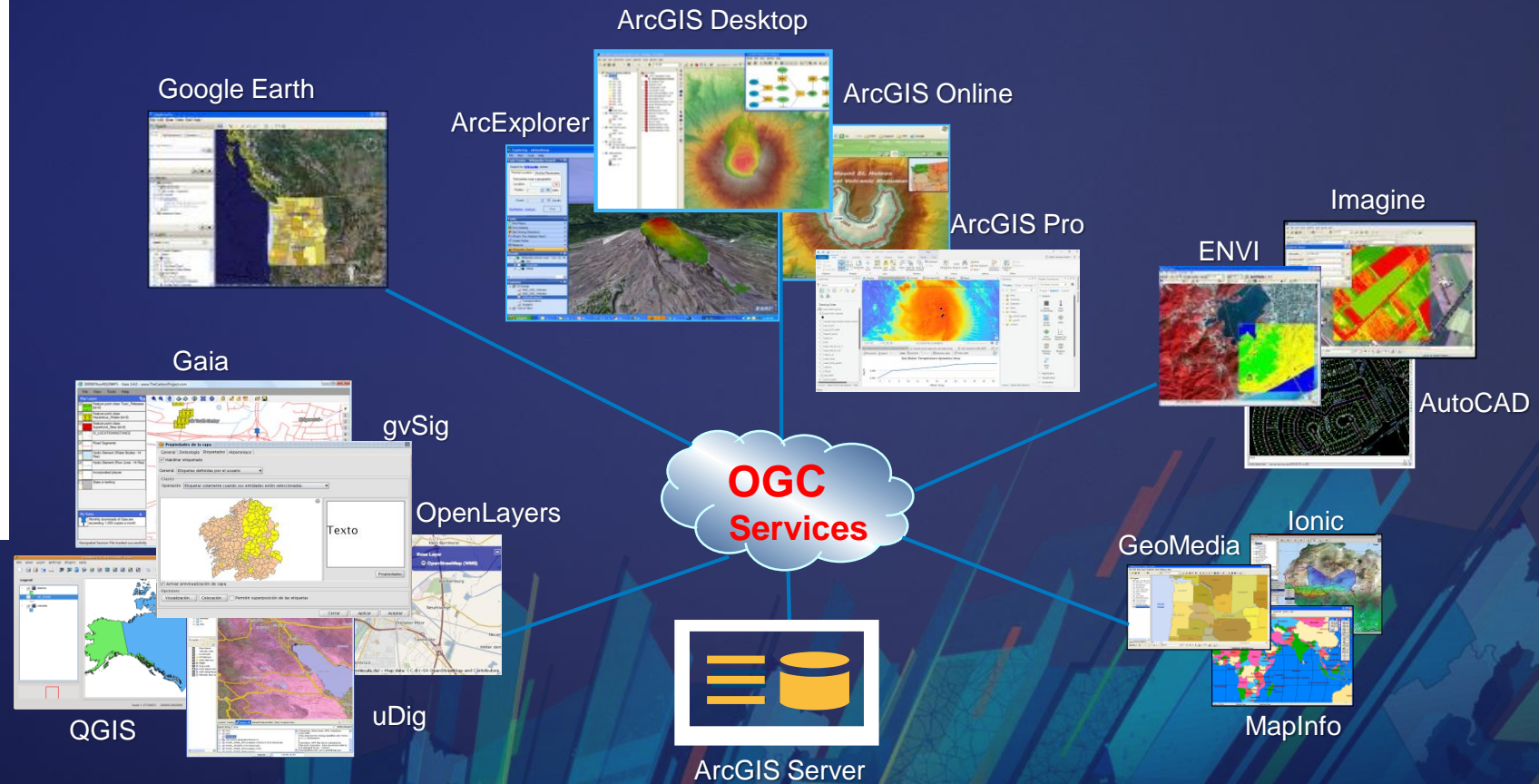
[sshrestha@esri.com](mailto:sshrestha@esri.com)

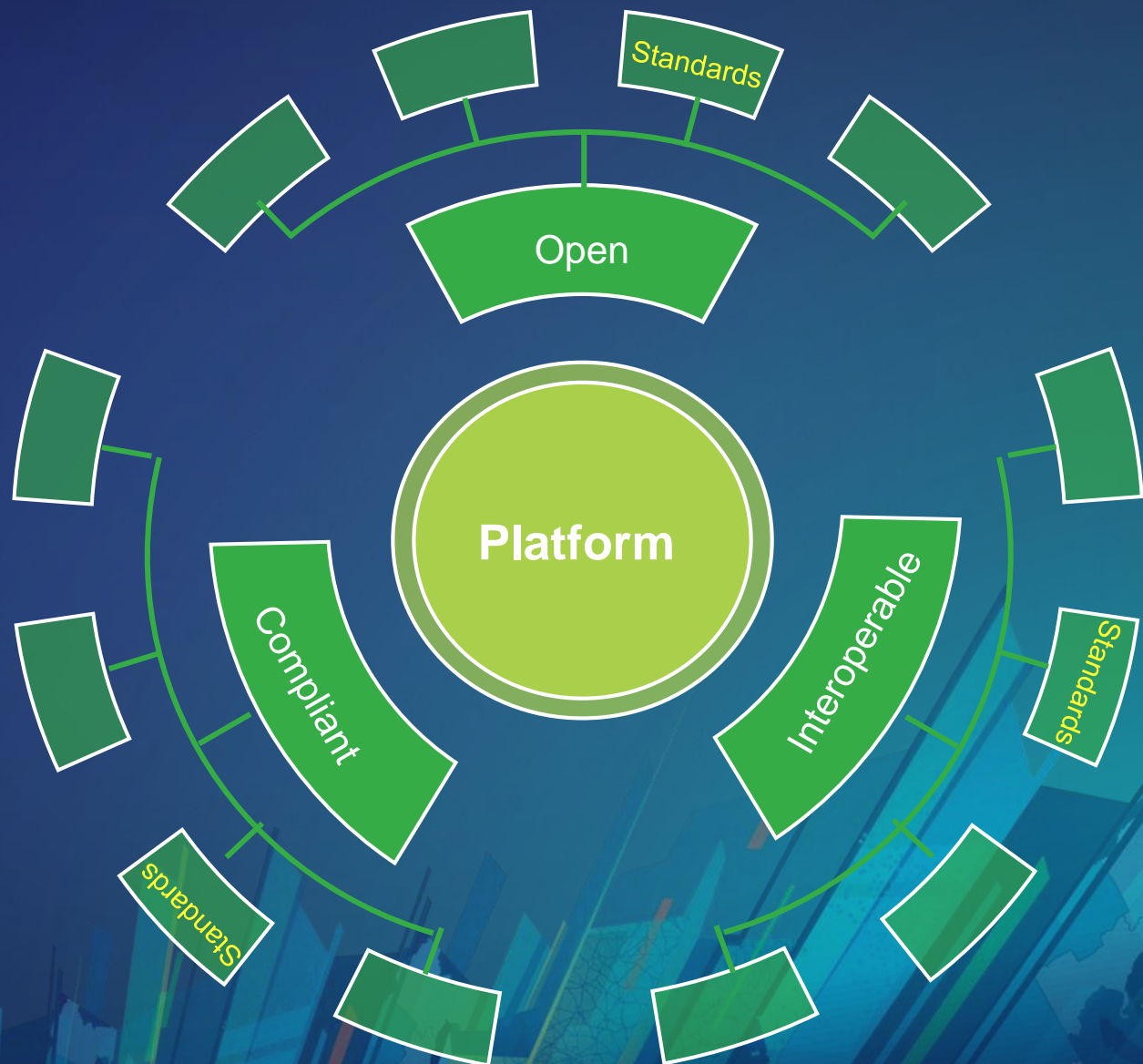
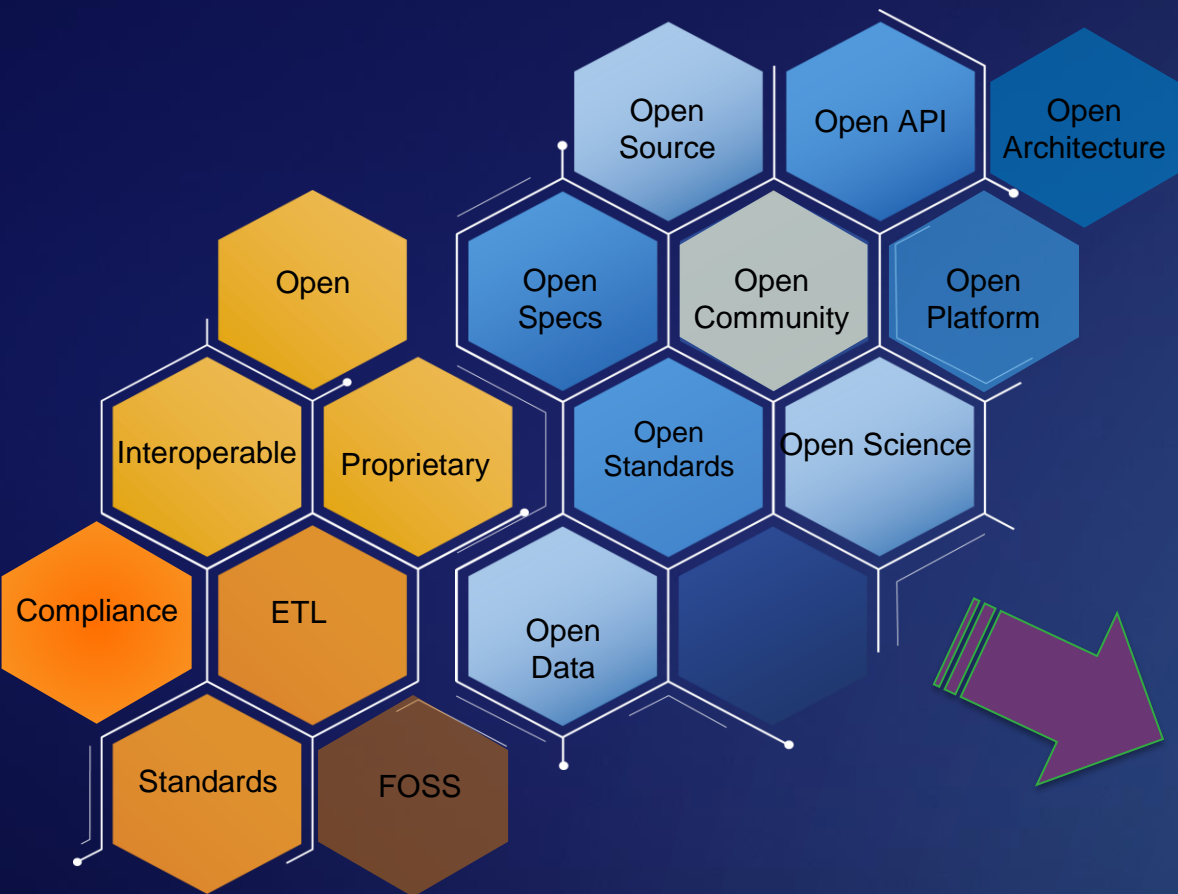
# Living in Interoperable Open World



ETL

## Web Services

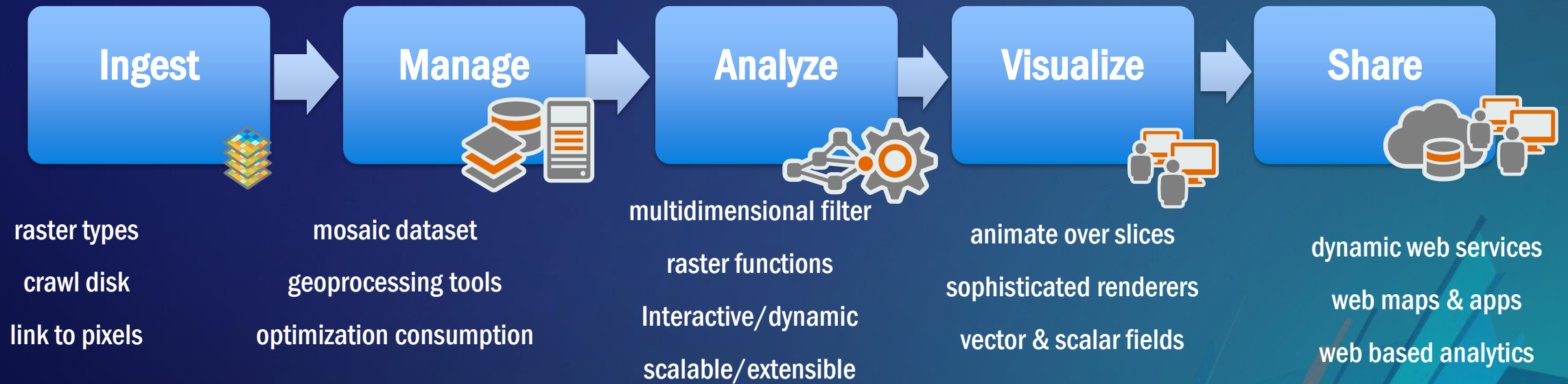






# GIS workflows that scale

Designed for the characteristics of Earth Observations scientific data



**Data**

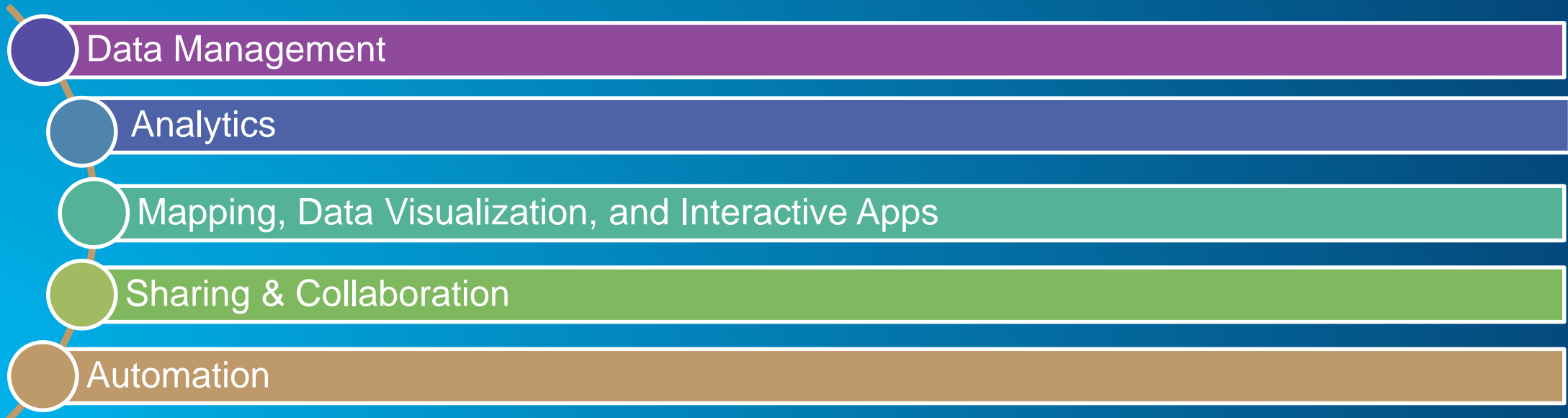


**Service**

# ArcGIS Platform and Scientific Data

## ➤ An Open, Interoperable, and Standards-Compliant Platform

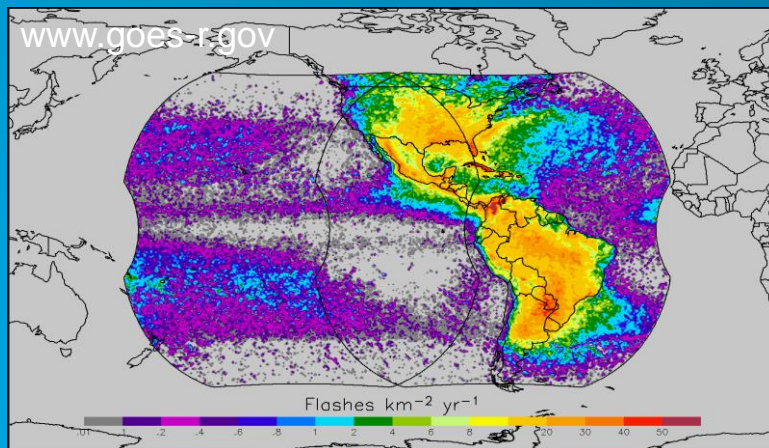
- Scalable in different Operating Systems
- Open Standards (NetCDF, HDF, GRIB)
- Open Software and Product Integration



# The Geostationary Lightning Mapper

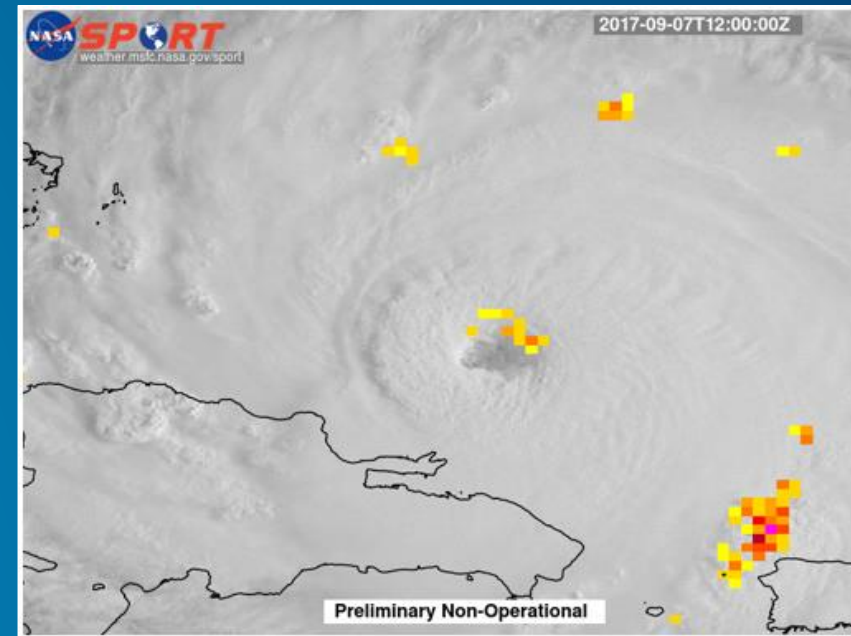


- Operates in the near IR – 777.4 nm
- Spatial resolution is 8 km x 8 km at nadir
- CCD: 1372 x 1300 pixels, sampling every 2 ms
  - CCD is not at a fixed resolution
- Detection efficiency: Day: 85% Night: ~99%



## Applications of GLM Data:

- Lightning Safety
- Severe thunderstorm identification
- Heavy snowfall identification
- Continuing current for wildfire starts
- Detection of meteorites



GLM Lightning Detections during Hurricane Irma  
on 7 September 2017

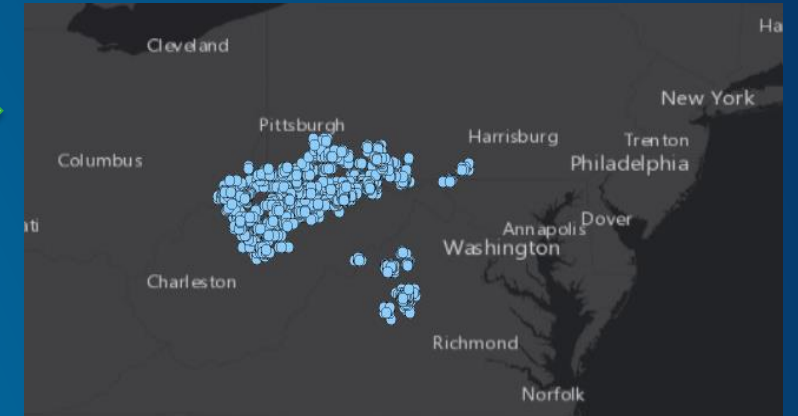
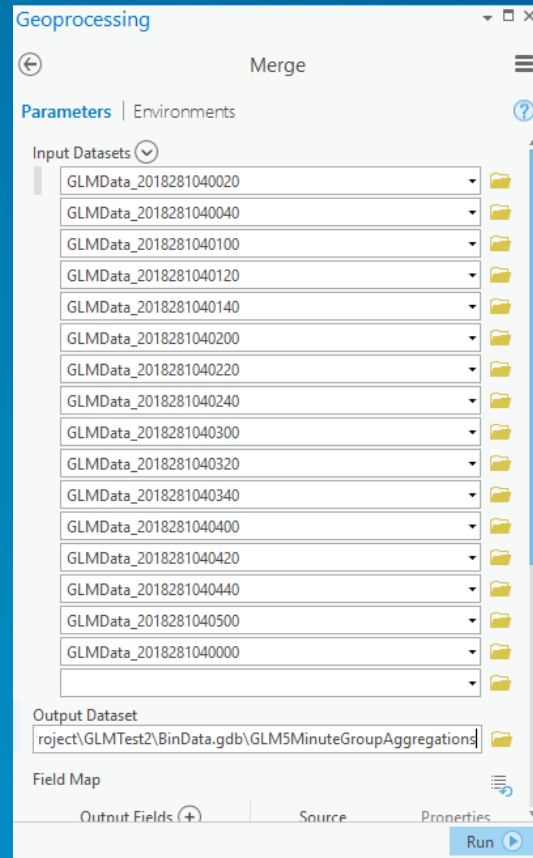
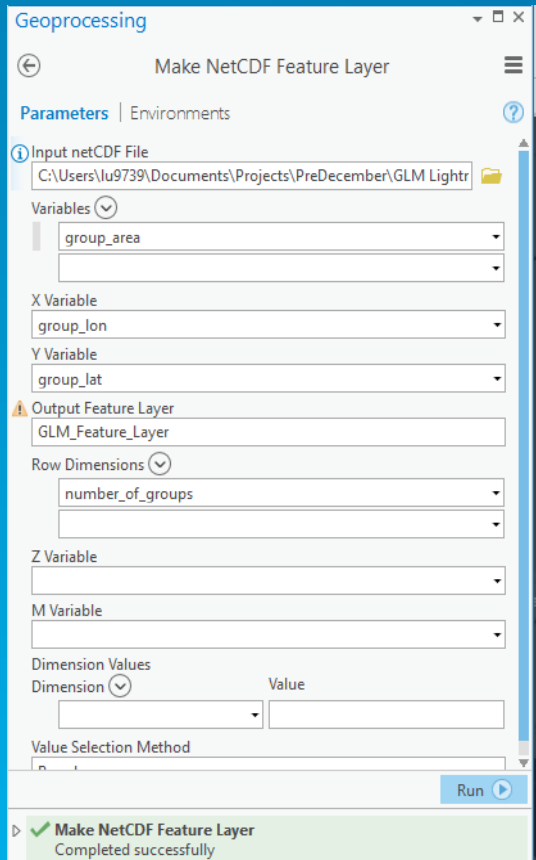
# What are we trying to achieve ?

- Interoperable GLM Web Services
  - Create a rolling 5 minute GLM Group Density Feature Services
  - Using out of the box Geoprocessing Tools developed by Esri
- Workflow automation using the ArcPy Python Module and ArcGIS Python API
- Processed using the GeoAnalytics Server
  - Incorporates distributed computing to vector-based feature data and can be used to analyze big data or accelerate GIS Workflows



# GLM Workflow: Ingesting GLM-L2-LCFA Data

Automated Using ArcPy



A 5 Minute aggregation of GLM Group showing a bow echo storm system

Assigning 'GLM Group' as Points Features, and storing in the Geodatabase

Point Features are Merged to create a 5 minute GLM group aggregated product

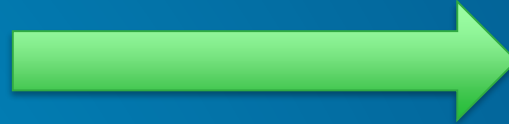
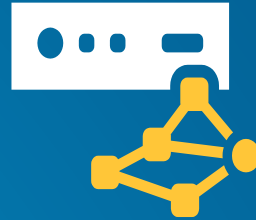


# GLM Workflow: Analysis and Publishing

OBJECTID	Shape	number_of_groups	group_area	Timestamp	Time
1	Point	1	221.5585	201810080439	10/8/2018 4:39:00 AM
2	Point	2	73.86211	201810080439	10/8/2018 4:39:00 AM
3	Point	3	221.5585	201810080439	10/8/2018 4:39:00 AM
4	Point	4	73.86211	201810080439	10/8/2018 4:39:00 AM
5	Point	5	73.86211	201810080439	10/8/2018 4:39:00 AM
6	Point	6	73.86211	201810080439	10/8/2018 4:39:00 AM
7	Point	7	147.7103	201810080439	10/8/2018 4:39:00 AM
8	Point	8	147.7103	201810080439	10/8/2018 4:39:00 AM
9	Point	9	73.86211	201810080439	10/8/2018 4:39:00 AM
10	Point	10	221.5585	201810080439	10/8/2018 4:39:00 AM
11	Point	11	73.86211	201810080439	10/8/2018 4:39:00 AM
12	Point	12	73.86211	201810080439	10/8/2018 4:39:00 AM
13	Point	13	215.7962	201810080439	10/8/2018 4:39:00 AM
14	Point	14	215.7962	201810080439	10/8/2018 4:39:00 AM
15	Point	15	143.9193	201810080439	10/8/2018 4:39:00 AM

## 5 Minute GLM Group Product (with Timestamps Added)

~Millions of features to be aggregated per hour to create a density-based product



## Calculate GLM Group Density Using the ArcGIS GeoAnalytics Server

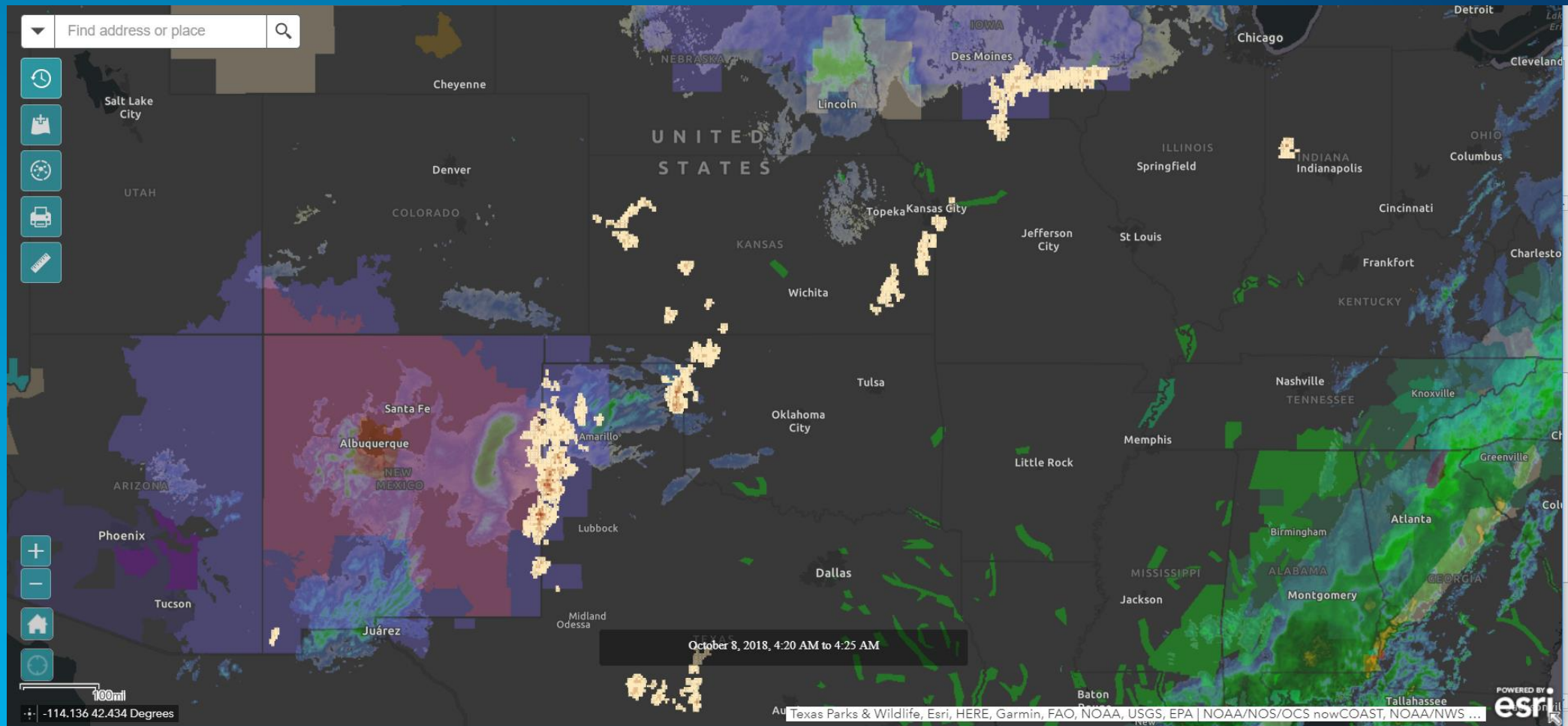
- Distributed computing to vector-based feature data
- Analyze big data
- Accelerate traditional ArcGIS Desktop analysis workflows.

A screenshot of the ArcGIS GeoAnalytics Server web interface. The title is "GLM5MinuteAggregation". There are tabs for "Overview", "Data", "Visualization", and "Settings". Below the tabs, there is an "Edit Thumbnail" section with a text input field and a "★ Add to Favorites" button. The "Description" section contains the text "CalculateDensity - Result" and "Arguments:". Under "Arguments:", there is a list of parameters: "Input Points : &lt;feature record set&gt;", "Population Field : group\_area", "Weight : Kernel", "Output Bin Type : Square", "Output Bin Size : 4", "Output Bin Size Unit : Kilometers", "Time Step Interval :", "Time Step Interval Unit :", "Time Step Repeat Interval :", "Time Step Repeat Interval Unit :", and "Time Step Reference :".

## Creates a GLM Product Service with a REST Endpoint

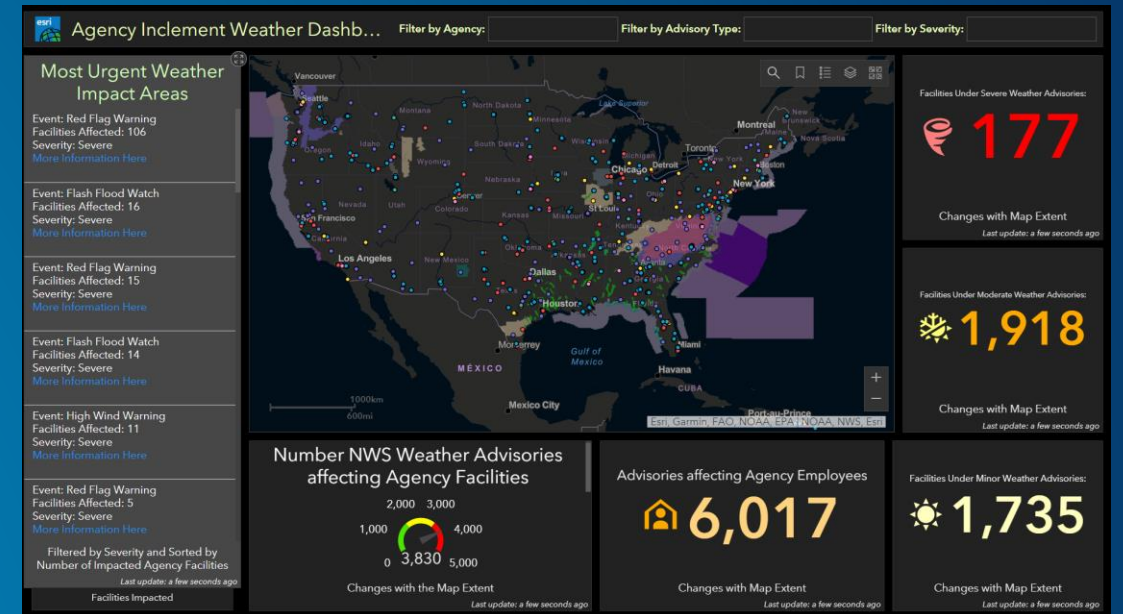
# GIS Applications with GLM Data

- Create a operational and user friendly Web Map Application



# Potential Use Cases / Next Steps

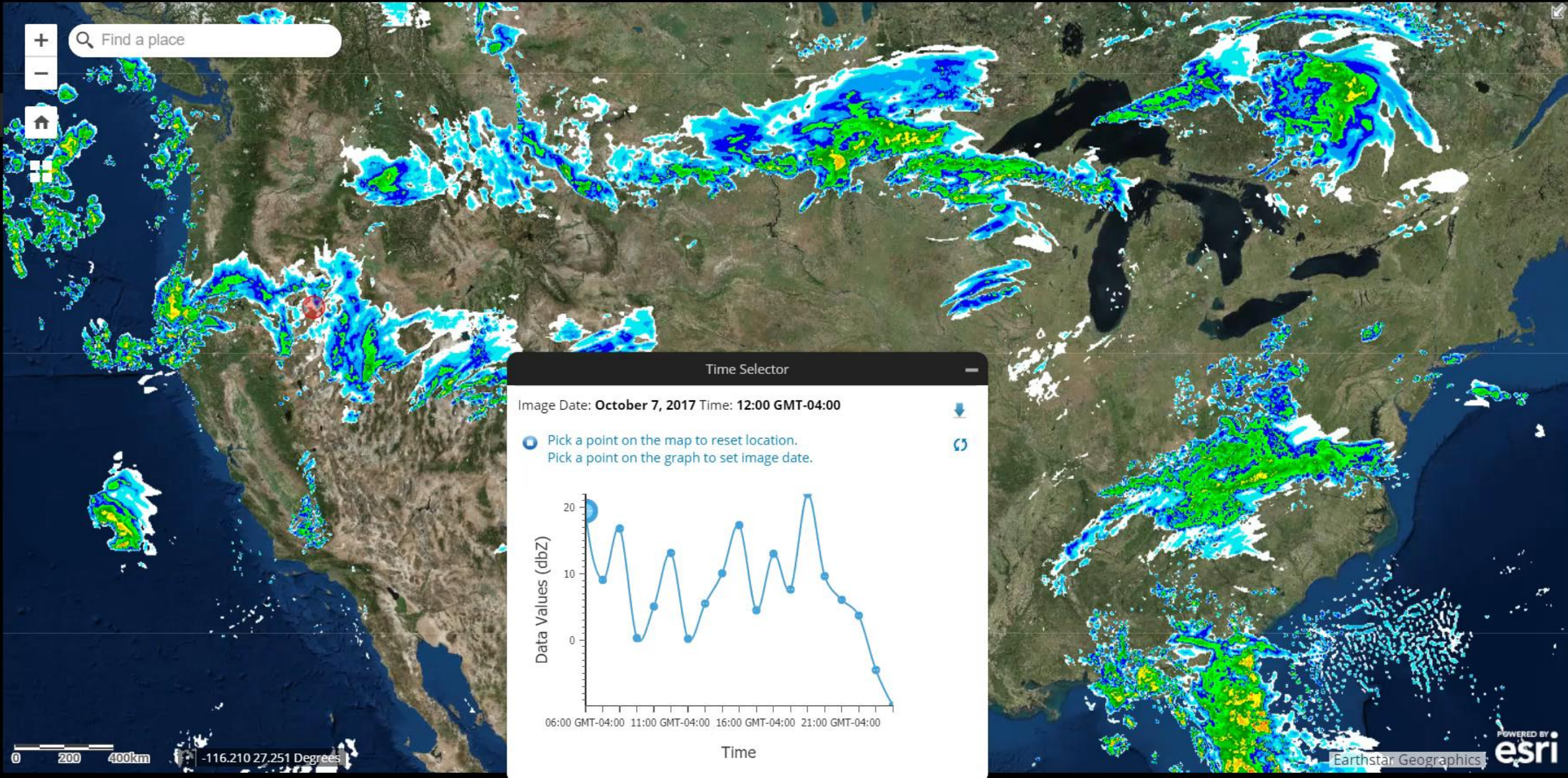
- GLM products hosted as a web service provides:
  - Accessibility to a large and diverse pool of users
  - Industry Uses
    - Power Companies
  - Insurance Sector
    - Risk Analysis
  - Government Agencies
    - NWS, NOAA, NASA, FEMA...
  - Forest Fire Hazard Management
- Real-time GLM data can be *operationalized*





# Dynamic scientific data computing processing: Web Map Application: HRRR

## HRRR Explorer





## Conclusion

- Interoperability is powerful capabilities to support the varying and extended applications
- Utilization of GeoAnalytics Server to support the analytical capabilities of GLM
- Improved automation and interoperability with Geoprocessing tools and ArcGIS Python API
- Web Services and WebMap Application to support the scientist and large pool of users including policy makers
- What Next: Expand the application and services of GLM in collaboration with users such as NASA SPORT, NOAA.