

### Scientific Data Management and Dissemination

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# What we will cover today

esri

- Scientific Multidimensional Data
- Ingesting and managing
- Visualizing and analyzing
- Disseminating and consuming
- Spatiotemporal Anomaly Detection

# **Scientific Data**



### Oceanographic

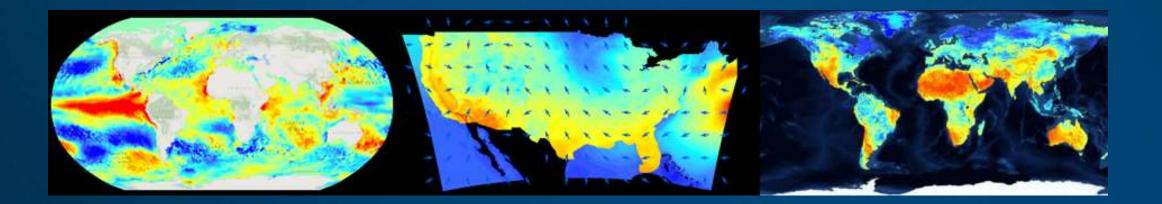
- Salinity
- Sea Temperature
- Ocean current

### Meteorological

- Temperature
- Humidity
- Wind speed/direction

### Terrestrial

- Soil moisture
- NDVI
- Land cover



# Challenges

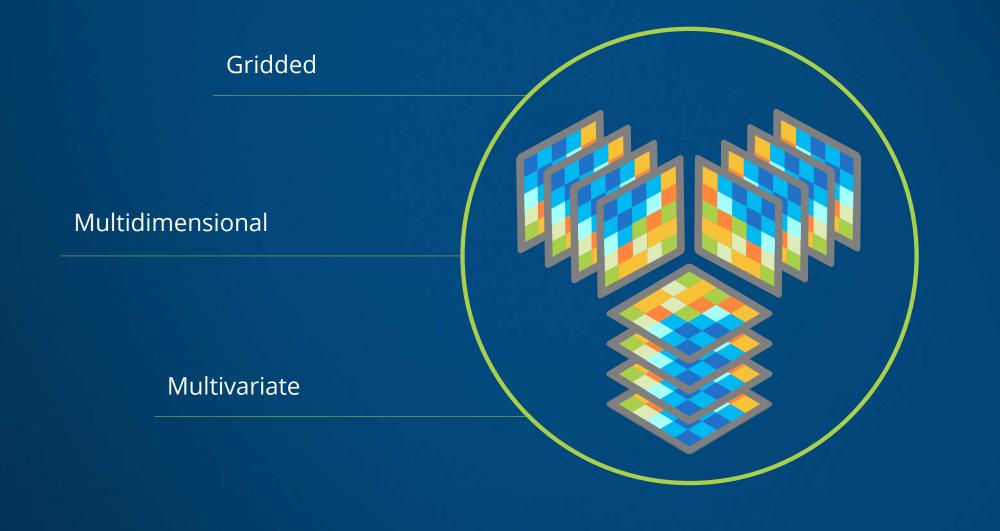




variety of formats volume & velocity redundancy portability scalability reproducibility integration standards accessibility

### **Multidimensional Rasters**







### Demo

#### Using data & information products in a WebGIS



### **Ingesting and Managing Data**



## **Multidimensional Mosaic Dataset**



mosaic



HDF GRIB netCDF *d*-aware rasters

#### mosaic dataset



spatially-indexed catalog multi-resolution, multivariate, multidimensional reduce storage redundancy & pixel resampling defines information products on-demand processing



table



Representing multivariate collection of multidimensional rasters in ArcGIS

## **Tabular View**



Raster	Shape	Variable	StdTime	StdZ
•••	•••	Temperature	3/22/2016	-10
•••	•••	Temperature	3/23/2016	-10
		Temperature	3/24/2016	-10
•••	•••	Salinity	3/22/2016	-10
		Salinity	3/23/2016	-10
		Salinity	3/24/2016	-10
		Temperature	3/22/2016	-20
		Temperature	3/23/2016	-20

Tabular view of items in a multivariate multidimensional mosaic dataset

### Metadata

Variables

### Dimensions

• Values

### Statistics

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Musaic Dataset Properties

Describing the structure of a multivariate multidimensional mosaic dataset

## **Raster Types**

data on disk raster type mosaic dataset

netCDF HDF GRIB *d*-aware rasters crawls disk identifies rasters extracts metadata attaches processing stores no pixels references rasters stores processing & metadata

Format-agnostic direct ingestion of rasters into a mosaic dataset

## Geoprocessing

Tools—building blocks for managing data

Data Management > Raster > Mosaic Dataset

Intuitive UI for interactive workflows

ModelBuilder: composite operations

Python: automate or extend

Dired T	a de	
	Toolboxes   Portal     Mosaic Dataset     Add Rasters To Mosaic Dataset     Alter Mosaic Dataset Schema	
	<ul> <li>Analyze Mosaic Dataset</li> <li>Build Boundary</li> <li>Build Footprints</li> <li>Build Mosaic Dataset Item Cache</li> </ul>	
	Build Overviews Build Seamlines Calculate Cell Size R Color Balance Mosai Compute Dirty Area Compute Mosaic Cal Create Mosaic Datas Create Referenced N Define Mosaic Datas Define Overviews	Toolboxes       Portal         Delete Mosaic Dataset         Edit Raster Function         Export Mosaic Dataset Geometry         Export Mosaic Dataset Items         Export Mosaic Dataset Paths         Generate Exclude Area         Import Mosaic Dataset Items         Merge Mosaic Dataset Items         Mosaic Dataset Items         Mosaic Dataset Items
		<ul> <li>Remove Rasters From Mosaic Dataset</li> <li>Repair Mosaic Dataset Paths</li> <li>Set Mosaic Dataset Properties</li> <li>Split Mosaic Dataset Items</li> <li>Synchronize Mosaic Dataset</li> </ul>

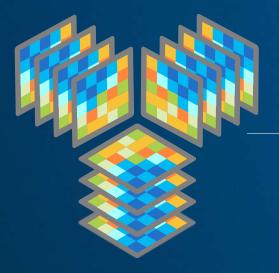
Managing a mosaic dataset



### Demo

Make a netCDF raster layer Populate a mosaic dataset using a raster type Properties of a multidimensional mosaic dataset Attribute table of a mosaic layer

### **ArcGIS for Server**



mosaic dataset



image service

dynamic, on-demand web-based access to data rich information model

Make your mosaic dataset accessible to other users as a web-enabled dynamic image service



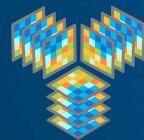
### Visualizing and Analyzing





# Filtering

#### multidimensional filter



variables value range(s) per dimension SQL WHERE clause dimension-orthogonal cutting & chopping

slicing & dicing a multivariate multidimensional mosaic dataset

# Rendering

### Choose and customize

Scalar or vector field

### Export and reuse

Control how original or transformed data is presented on a map

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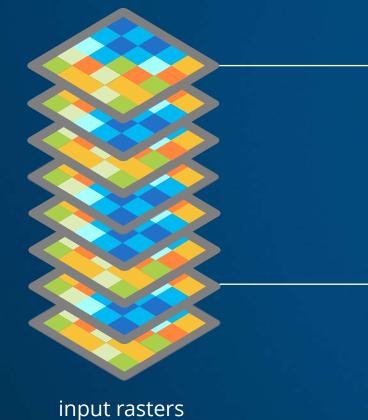


### Demo



Vector-field mosaic dataset Multidimensional mosaic layer on map Dimensional slicing & animation

### **Raster Function: Transforming Raster Data**



#### raster function



raster-valued transformation piecewise, scale-aware local / focal on-demand processing arity: unary, binary, ..., *n*-ary, polyadic output raster



... using raster functions for on-the-fly processing

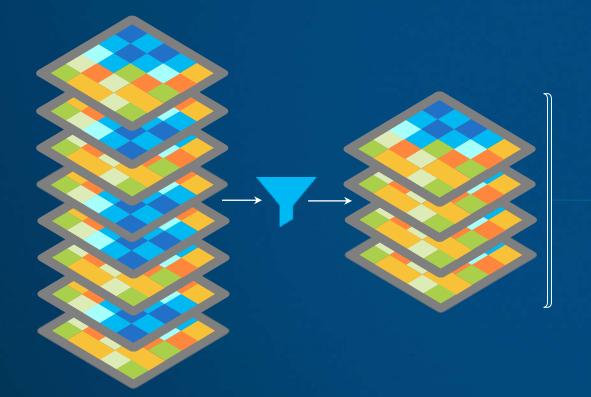






#### Applying a simple transformation

# **Dimensional Aggregation**



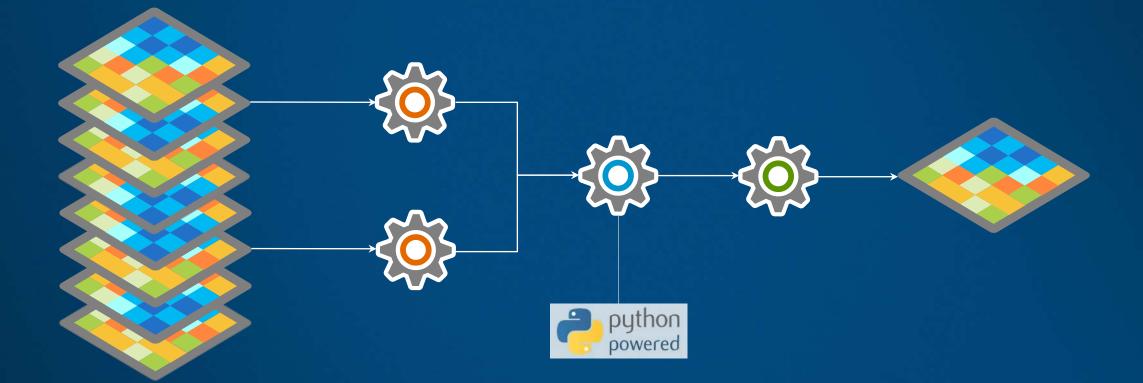




aggregating function

Multidimensional filtering followed by aggregation using a raster function

### Python Raster Functions: Extending Analytic Capabilities



#### Learn more at: <u>github.com/Esri/**raster-functions**</u>

Choose from dozens of built-in functions or implement your own algorithm using Python

### **Raster Models: Raster Function Templates**

raster **variables** 

A portable & reusable chain of raster functions



### Demo



Combining variables using a raster model Raster models on a mosaic dataset

# **Applying a Raster Model**

#### image layer on a desktop map

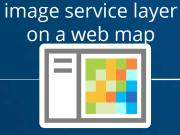


choose & customize a raster model



mosaic dataset mosaic dataset item(s)





<u>choose</u> & customize a raster model

define & transmit a raster model

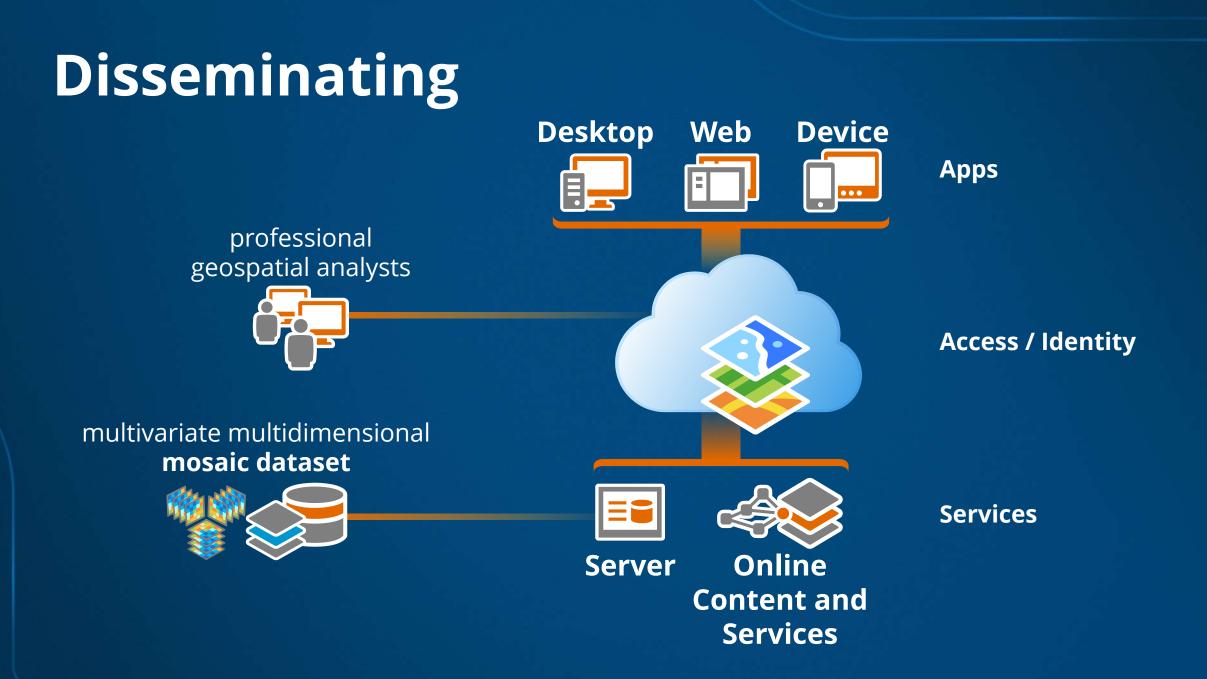




### **Disseminating and Consuming**







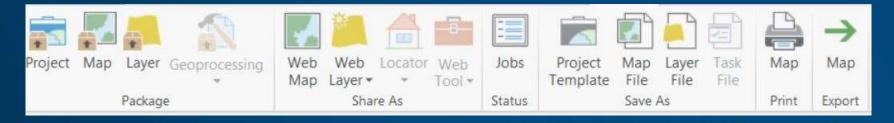
### **Dissemination Strategies**

Tiled map service

Dynamic map service

Dynamic image service

# Sharing your data as an image



Mosaic Dataset > Generate Tile Cache
Avoid copying source image to ArcGIS Online
Cache tiles generated using ArcGIS for Desktop
Accessed via tiled map service

Enable access to a static representation of your data as a map service

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	Generate Tile Cache	
	Share As Image Service	
Đ	Item Description	
2	Properties	

# **Sharing data & information products**

- Mosaic Dataset > Share As
   Image Service
- · Pixels & item metadata
- On-demand server-side processing
- Raster models: predefined or client-specified
- multidimensional info, filtering, vector fields

Share As Web Layer ? 👻 🤻 🗙	Ø	Сору					
Share Raster Data As Web Layer	×	Delete					
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Name:	$\diamond$	Create Layer					
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Data 🕕		Modify					
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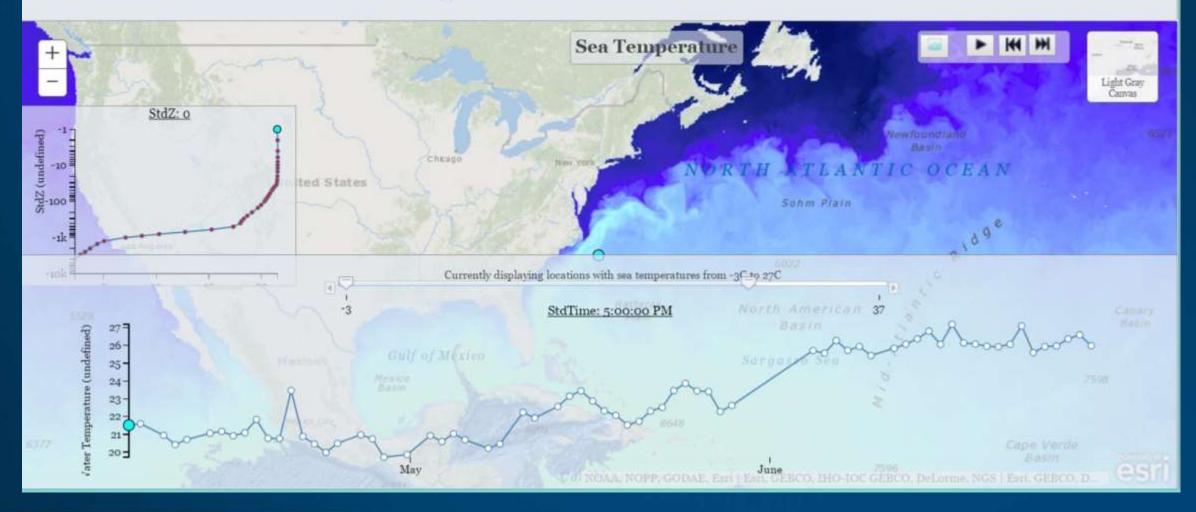
#### Publishing a multidimensional mosaic dataset

## **Consuming your services**

- In any ArcGIS application or any WMS client
- 🛚 In a web map 🔡
  - · Identify web services driven by maps or datasets
  - Bring service layers into a web map
- In a map-based application 🔜
  - Configurable apps
  - Story Maps
  - Web AppBuilder
  - Custom web apps using ArcGIS API for JavaScript

# Maps & Apps

#### The Multidimensional Data Explorer



# Maps & Apps

NOAA Satellite and Information...

#### GOES-R

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The Future of NOAA's

**Geostationary Weather Satellites** 

Operating from two primary locations, GOES-East and Goes-West, NOAA's Geostationary Operational Environmental Satellites (GOES) have been providing continuous imagery of and data on atmospheric conditions, solar activity and Earth's weather systems for nearly 40 years.

Now, with the next generation of weatherobserving satellites on the horizon, NOAA



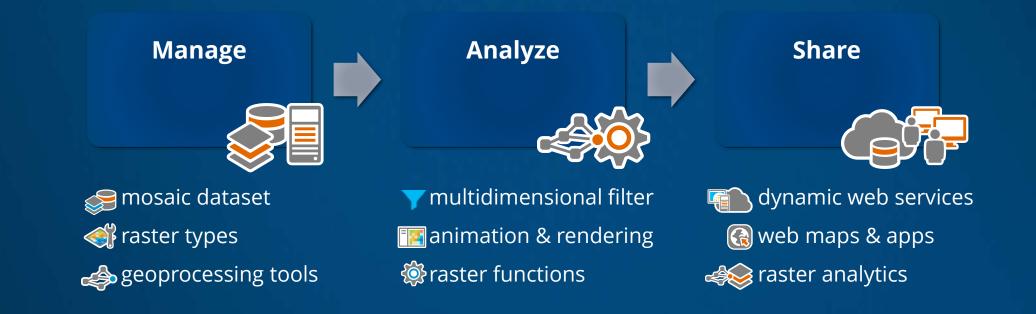


### Demo



#### Using image service layers in ArcGIS Online map viewer

### **GIS workflows that scale**



... built for the characteristics of multidimensional scientific data

## Announcements and Follow up

Please join me for my another workshop tomorrow:

2:45 PM (Room #144C): Scientific Data Management and Dissemination 4 PM (Room # 144C): Analyzing Multidimensional Scientific Data in ArcGIS

**Connect with us:** 

Twitter: @Sud\_Shrestha @EsriScience GeoNet: https://geonet.esri.com/groups/sciences/ Facebook: https://www.facebook.com/esrigis/ Email: sshrestha@esri.com

### Announcements (Cont)

# Join us and continue the conversation in the FedGIS 2017 group on GeoNet:

#### https://geonet.esri.com/community/events/fedgis

#### **Print Your Certificate of Attendance**

Print stations located in the 140 Concourse

#### Monday

12:30 рм – 6:30 рм GIS Solutions Expo, Hall B

5:15 рм – 6:30 рм **Expo Social,** Hall B

#### Tuesday

10:45 AM — 5:15 PM GIS Solutions Expo, Hall B

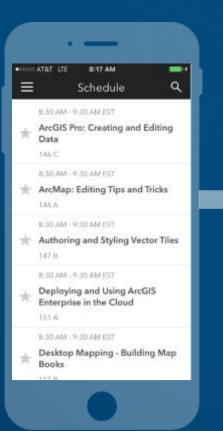
6:30 PM – 9:30 PM Networking Reception, Smithsonian National Air and Space Museum

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

#### Download the Esri Events app and find your event



#### Select the session you attended



# the survey

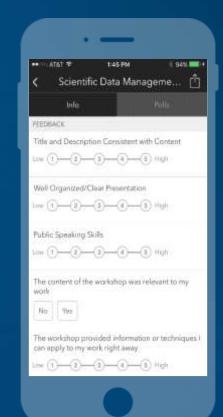
using various capabilities, including spatial and

dimensional aggregation. This workshop will teach

you about the enhanced capabilities of the mosaic dataset for managing multidimensional data, better

THOW NOTE ¥

#### Complete Answers and Select "Submit"





#### Using Mosaic Datasets for Managing and Displaying Multidimensional Data at Highly Variable Scales

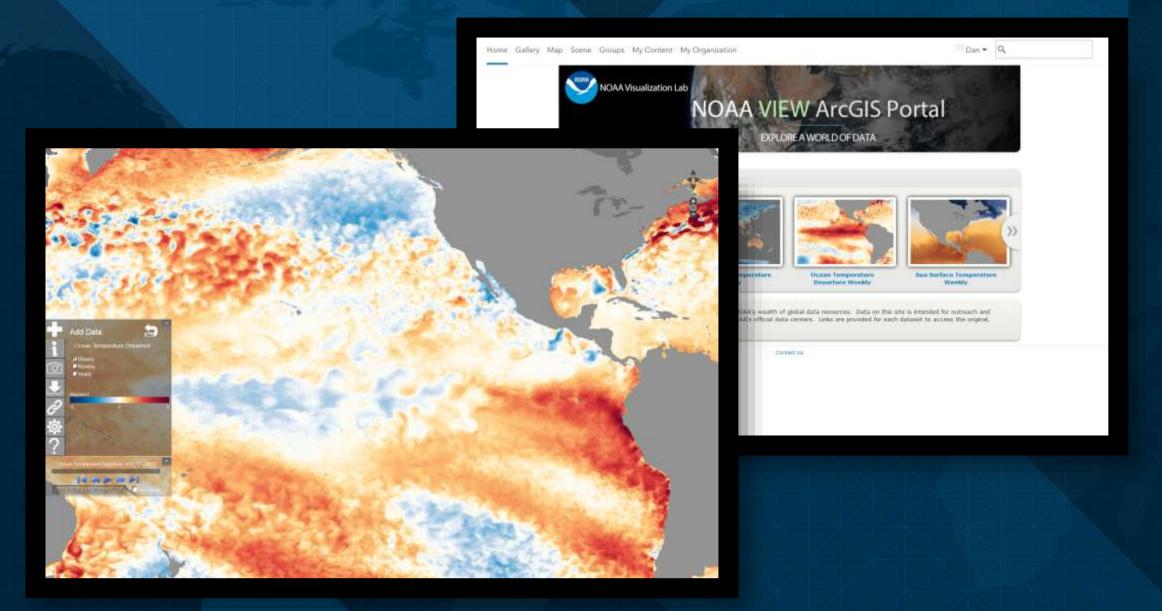


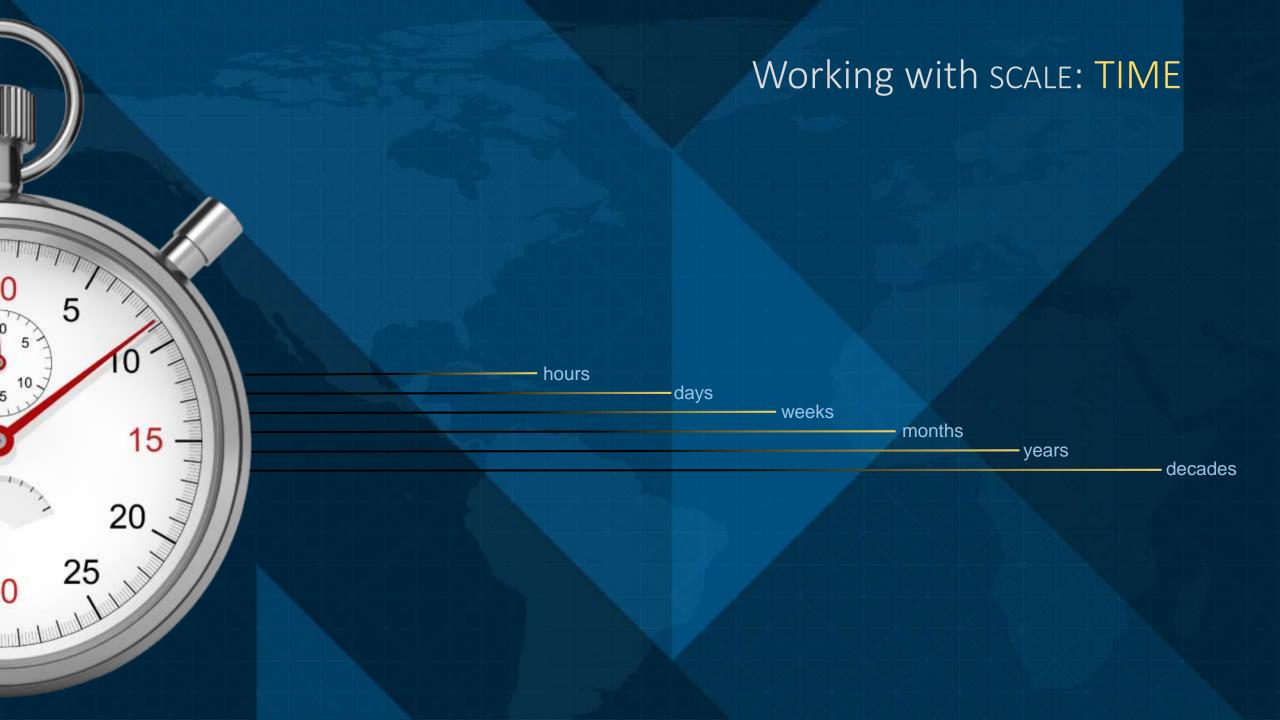


IMSG at the NOAA Visualization Lab

dan.pisut@noaa.gov

#### The NOAAView Data Portal





#### Working with SCALE: REFRESH

Global Forecast System: updates every 6hrs with non-uniform temporal output for 2 weeks

### Working with SCALE: SPACE

Dissolved O<sub>2</sub>: 5,000m

#### Working with SCALE: RESOLUTION



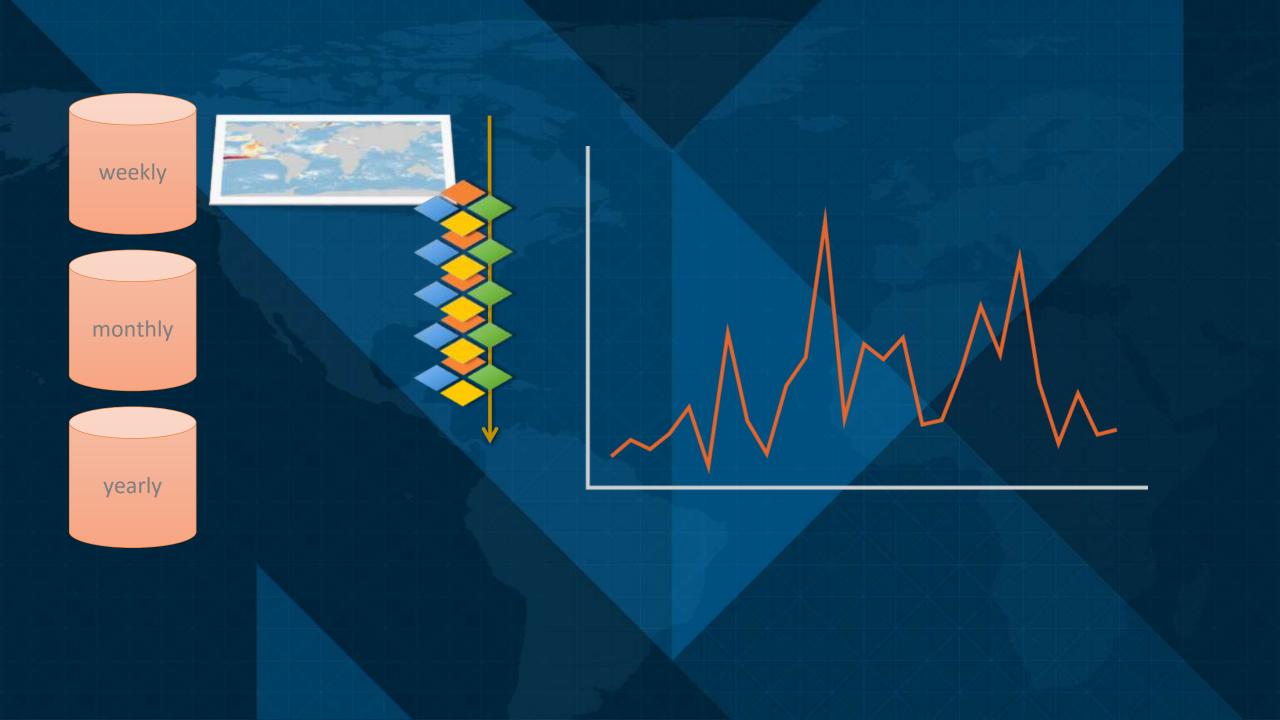
750m daily resolution

67 global datasets 207 variables ~35,000 time steps ~140,000 tile levels



<javascript>





NOAAVIEW: www.nnvl.noaa.gov/view Esri Portal: portal.nnvl.noaa.gov

# thank you

dan.pisut@noaa.gov