



Scientific Data Management and Dissemination

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What we will cover today



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



Scientific Data



Oceanographic

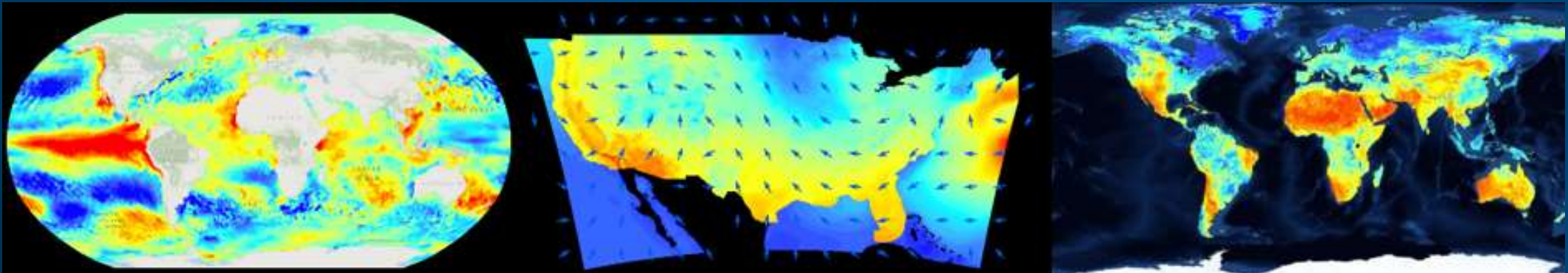
- Salinity
- Sea Temperature
- Ocean current

Meteorological

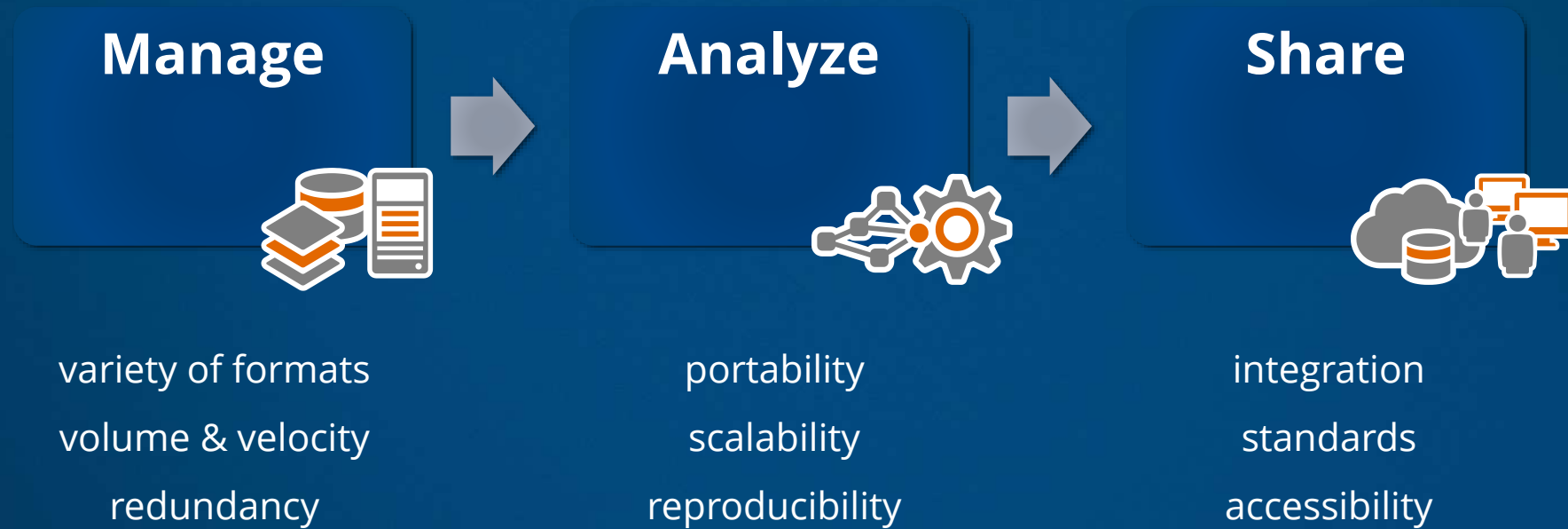
- Temperature
- Humidity
- Wind speed/direction

Terrestrial

- Soil moisture
- NDVI
- Land cover



Challenges



Multidimensional Rasters



Gridded

Multidimensional

Multivariate





Demo

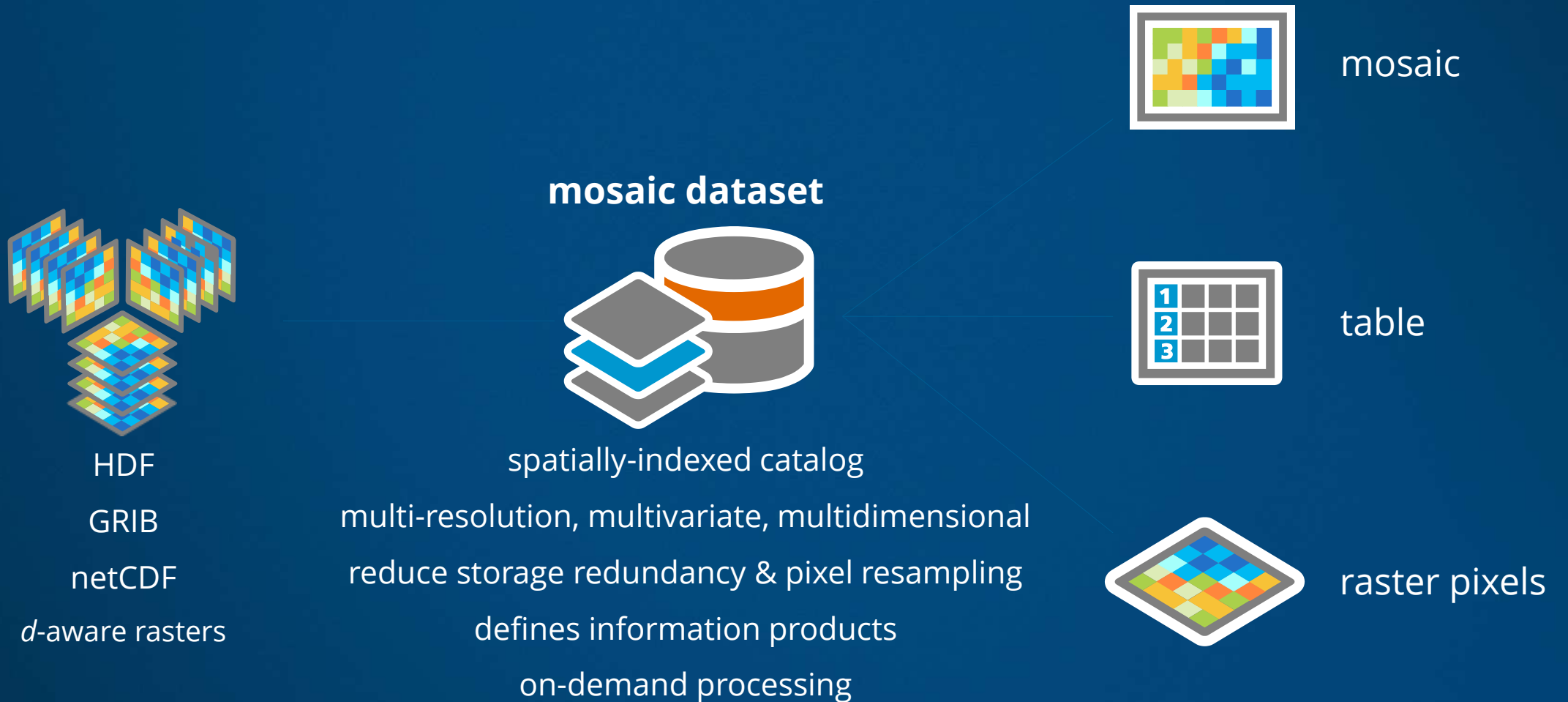
Using data & information products in a WebGIS



Ingesting and Managing Data

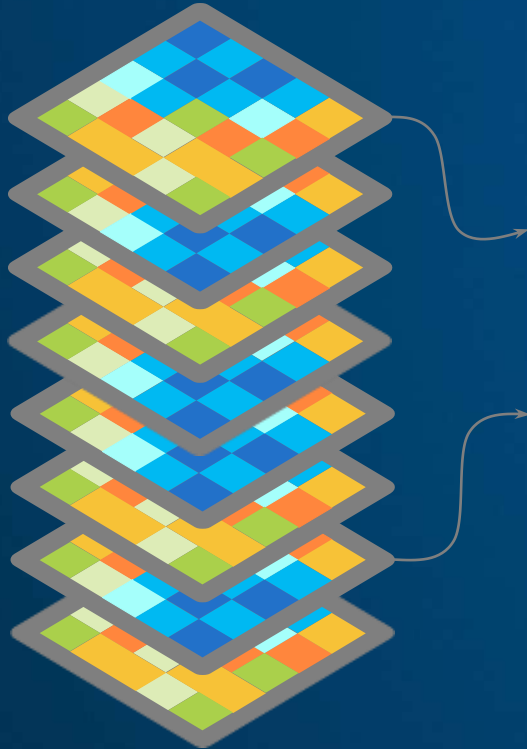


Multidimensional Mosaic Dataset



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

Mosaic Dataset Properties : Sealce

General
Defaults
Multidimension

Variables and Properties

▼ cfsrst (StdTime = 432)

Description:

Unit:

▼ StdTime

Description: Time

Unit: ISO8601

Count: 432

Range: 1980-01-01T00:00:00 — 2015-12-01T00:00:00

Interval: 1 Months (regular)

☒ Values

1980-01-01T00:00:00; 1980-02-01T00:00:00; 1980-03-01T00:00:00;
1980-04-01T00:00:00; 1980-05-01T00:00:00; 1980-06-01T00:00:00;
1980-07-01T00:00:00; 1980-08-01T00:00:00; 1980-09-01T00:00:00;
1980-10-01T00:00:00; 1980-11-01T00:00:00; 1980-12-01T00:00:00;
1981-01-01T00:00:00; 1981-02-01T00:00:00; 1981-03-01T00:00:00;
1981-04-01T00:00:00; 1981-05-01T00:00:00; 1981-06-01T00:00:00;
1981-07-01T00:00:00; 1981-08-01T00:00:00; 1981-09-01T00:00:00;
1981-10-01T00:00:00; 1981-11-01T00:00:00; 1981-12-01T00:00:00;
1982-01-01T00:00:00; 1982-02-01T00:00:00; 1982-03-01T00:00:00;
1982-04-01T00:00:00; 1982-05-01T00:00:00; 1982-06-01T00:00:00;
1982-07-01T00:00:00; 1982-08-01T00:00:00; 1982-09-01T00:00:00;
1982-10-01T00:00:00; 1982-11-01T00:00:00; 1982-12-01T00:00:00;
1983-01-01T00:00:00; 1983-02-01T00:00:00; 1983-03-01T00:00:00;

Mosaic Dataset Properties

General Defaults Processing Templates Key Metadata XY Coordinate System
Raster Coordinate System Fields Indexes Editor Toolbars Feature Editor Multidimension Functions

Variables Dimensions

Validity StdTime, StdZ

water_samp

Properties

water_samp (StdTime=1, StdZ=48)

Description: water Temperature

Unit: degC

StdTime:

Description: Valid Time

Unit: ISO8601

Count: 1

Range: 2014-04-18T00:00:00 — 2014-04-18T00:00:00

StdZ:

Description: Depth

Unit: Meters

Count: 48

Range: -5000 — 0

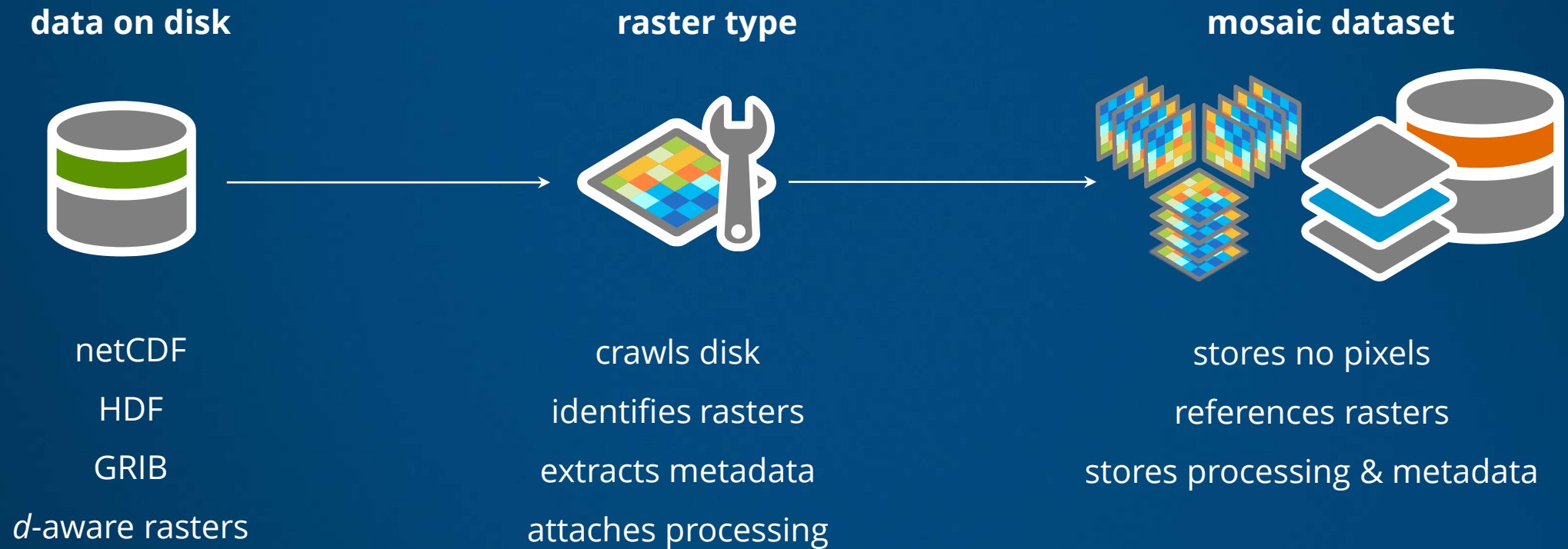
Interval: 2 Meters (irregular)

☐ Show dimension values

OK Cancel Apply

Describing the structure of a multivariate multidimensional mosaic dataset

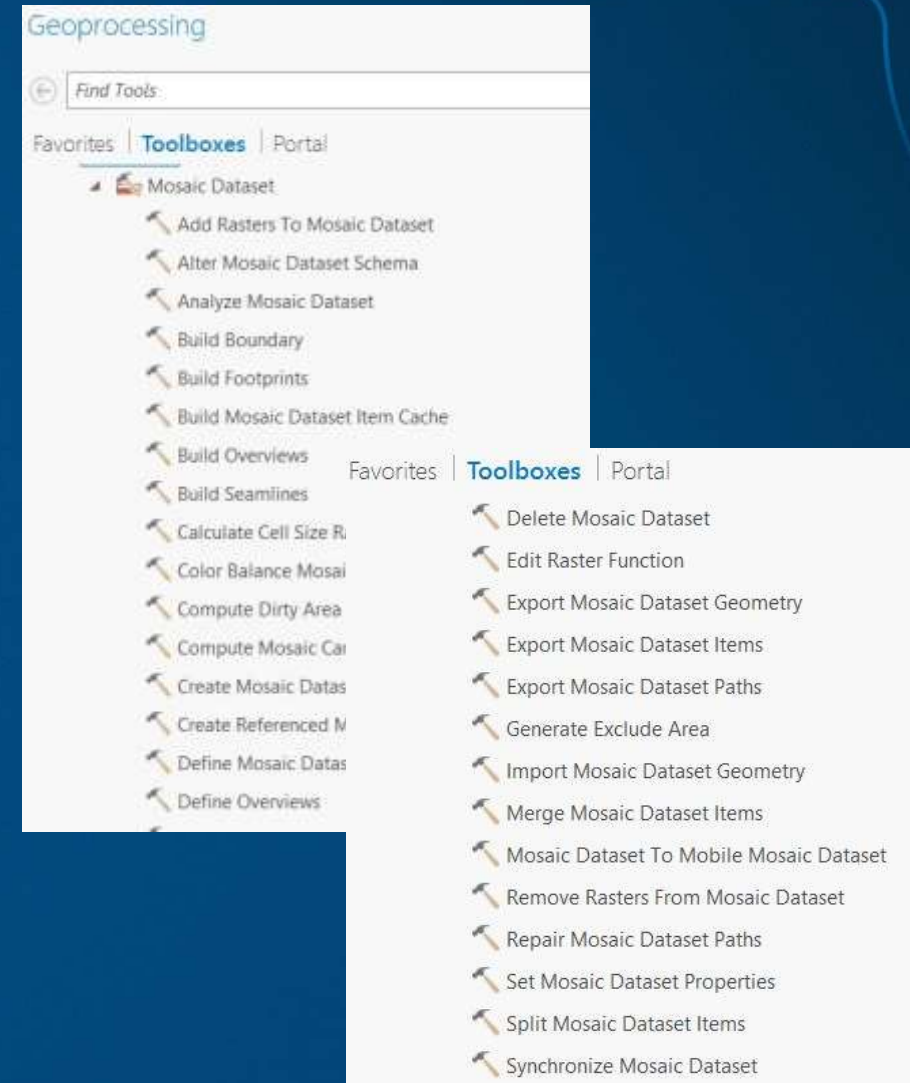
Raster Types



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



Managing a mosaic dataset

Demo

Make a netCDF raster layer

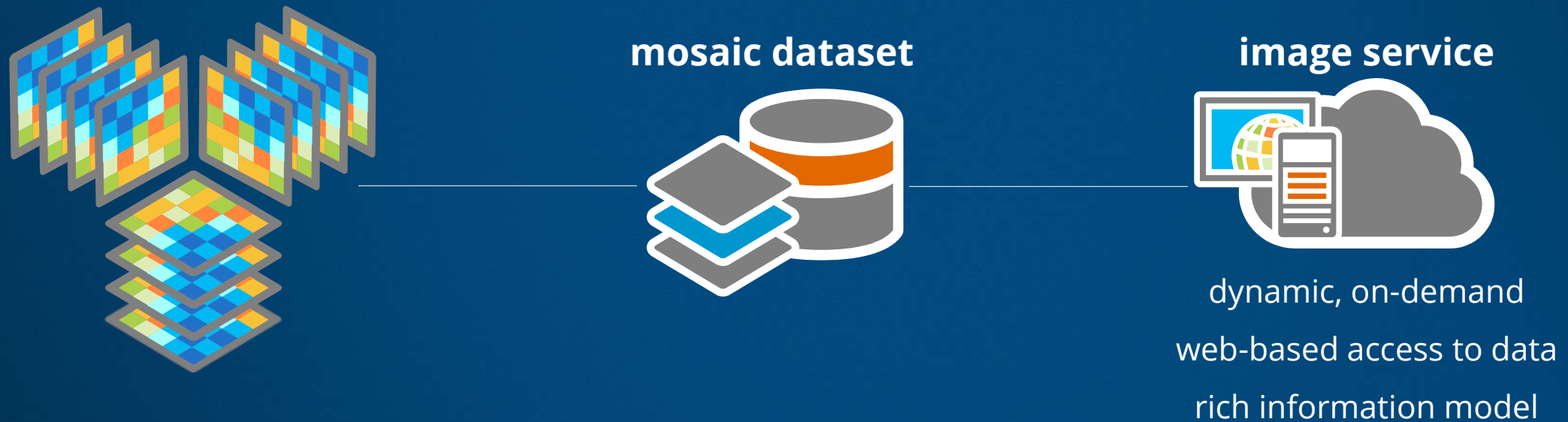
Populate a mosaic dataset using a raster type

Properties of a multidimensional mosaic dataset

Attribute table of a mosaic layer



ArcGIS for Server

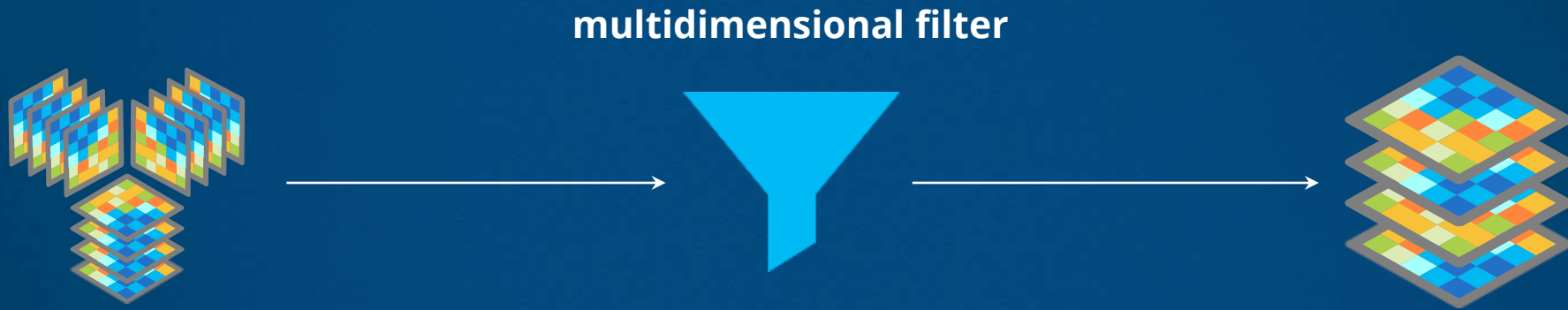


Make your mosaic dataset accessible to other users as a web-enabled dynamic image service

Visualizing and Analyzing



Filtering



variables

value range(s) per dimension

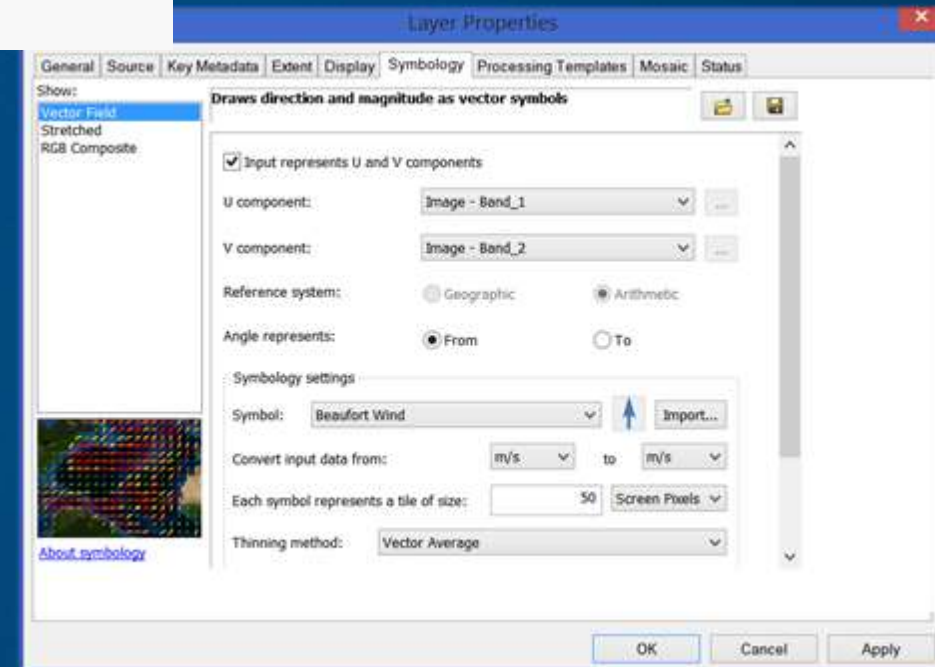
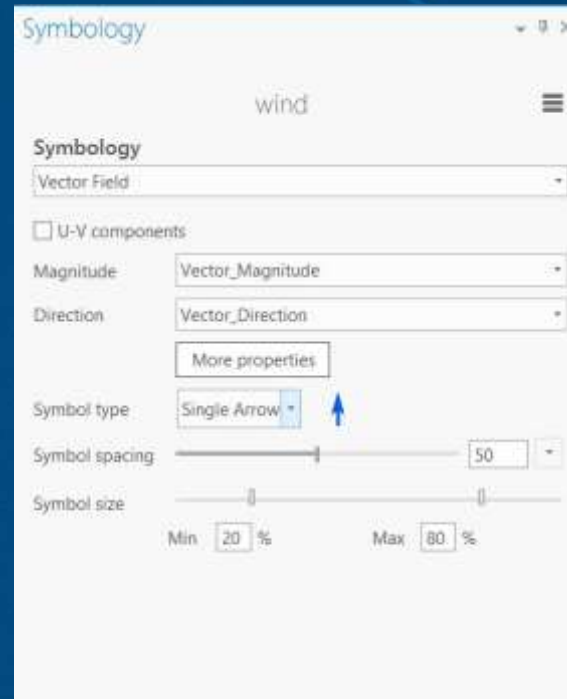
SQL WHERE clause

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

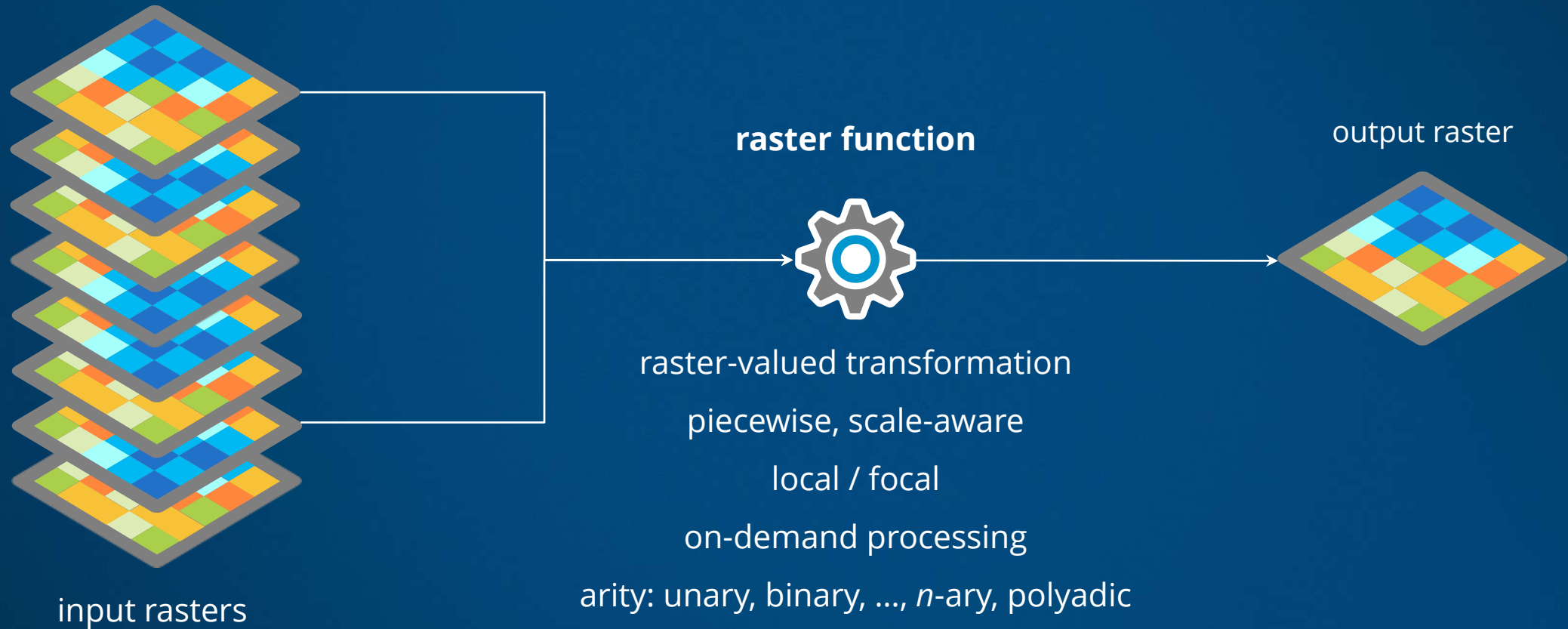
Demo



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



Raster Function: Transforming Raster Data



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

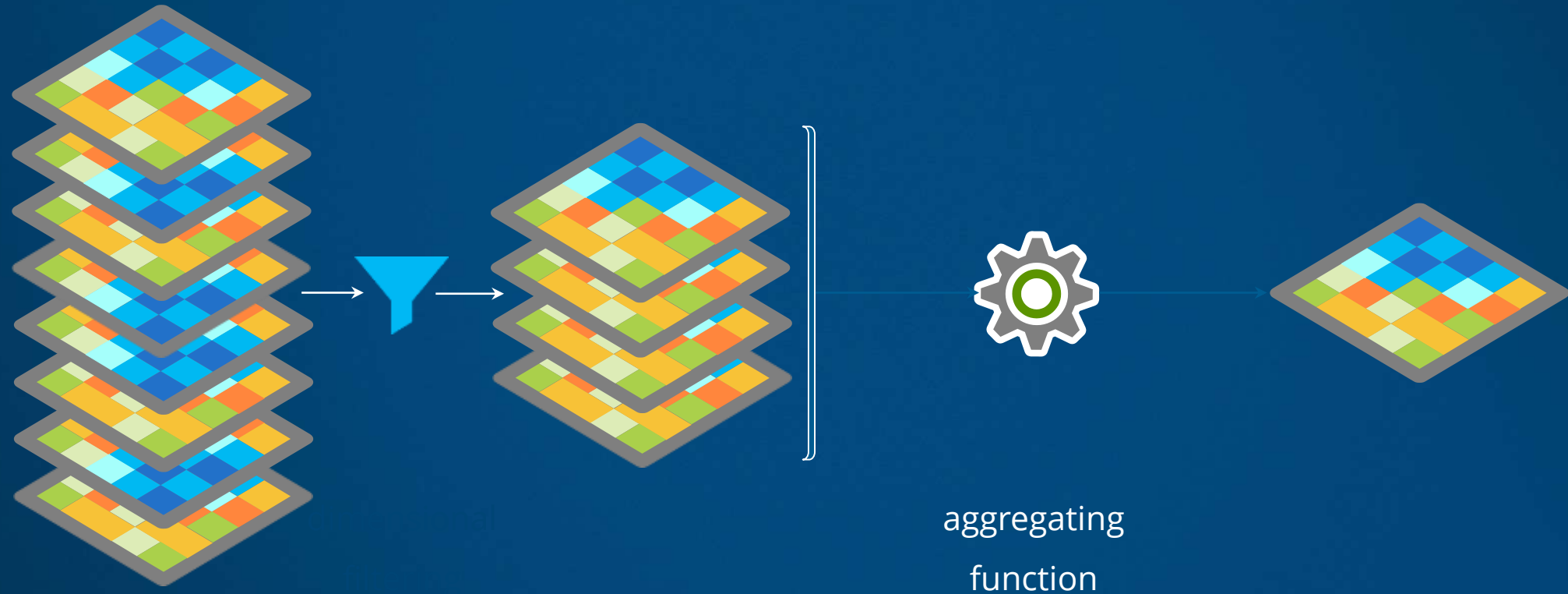
Demo



Applying a simple transformation

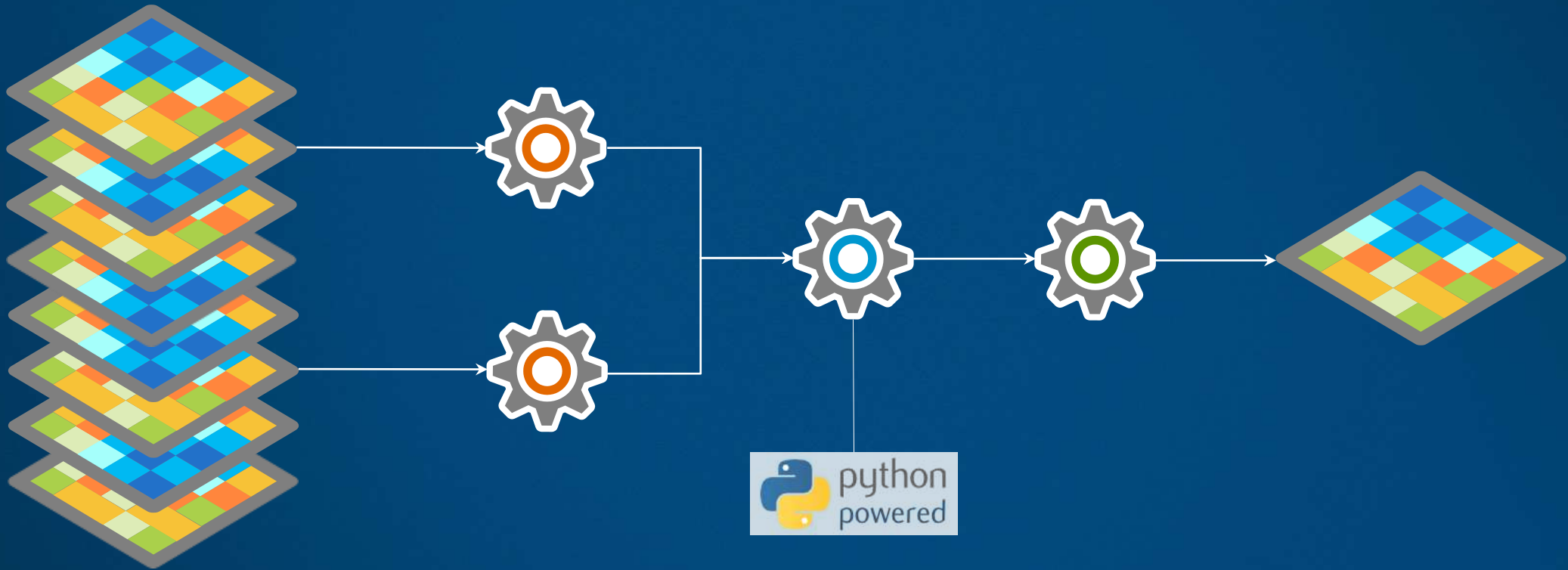


Dimensional Aggregation



Multidimensional filtering followed by aggregation using a raster function

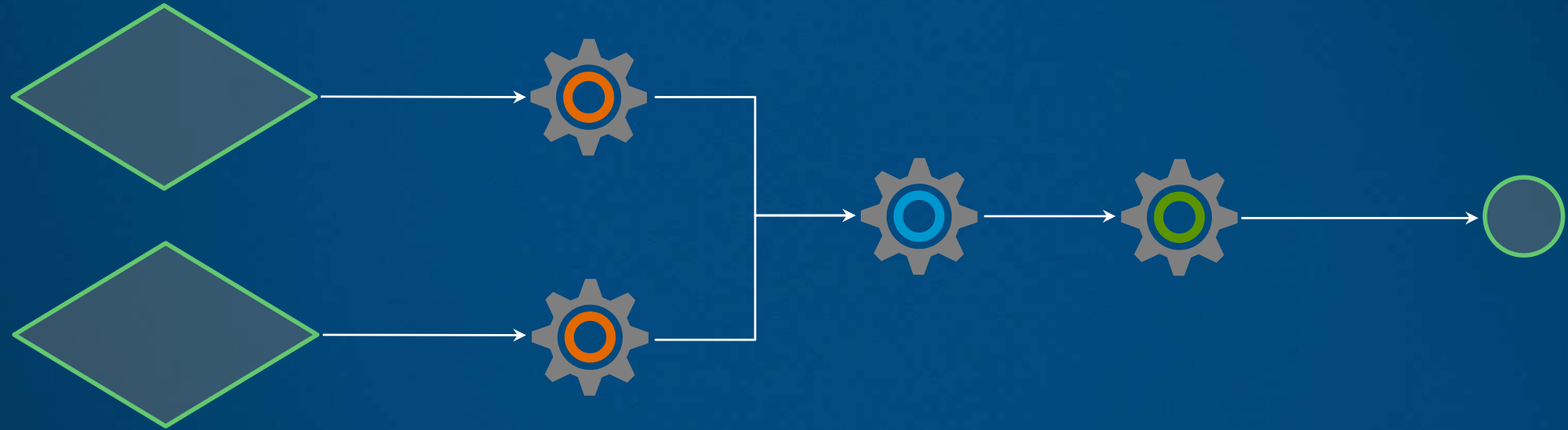
Python Raster Functions: Extending Analytic Capabilities



Learn more at: github.com/Esri/raster-functions

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

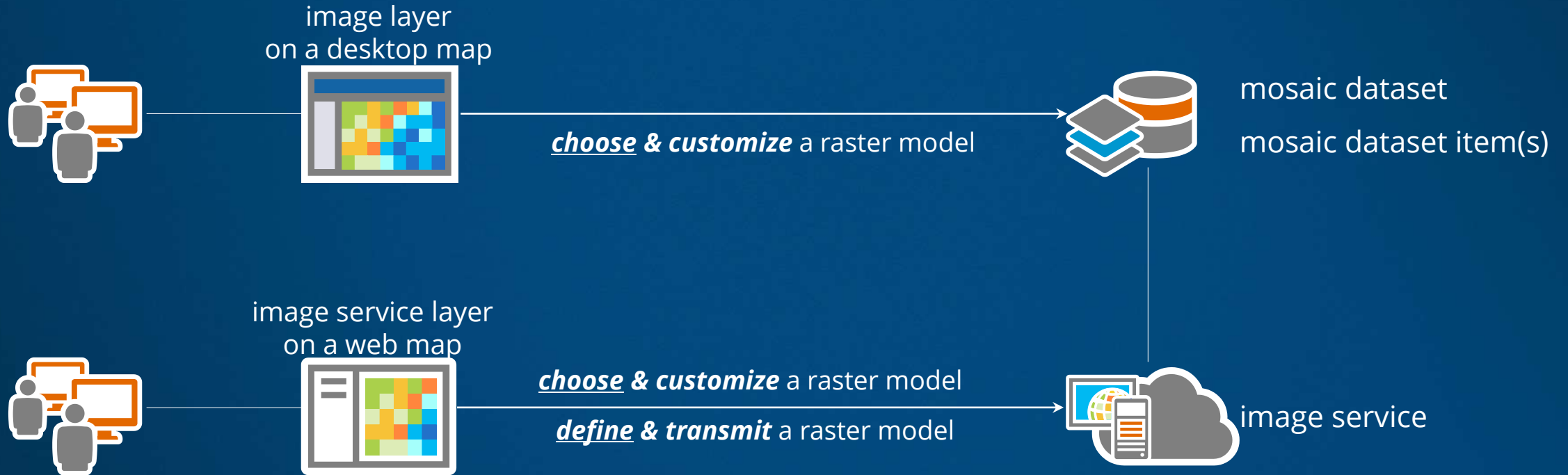
Demo



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



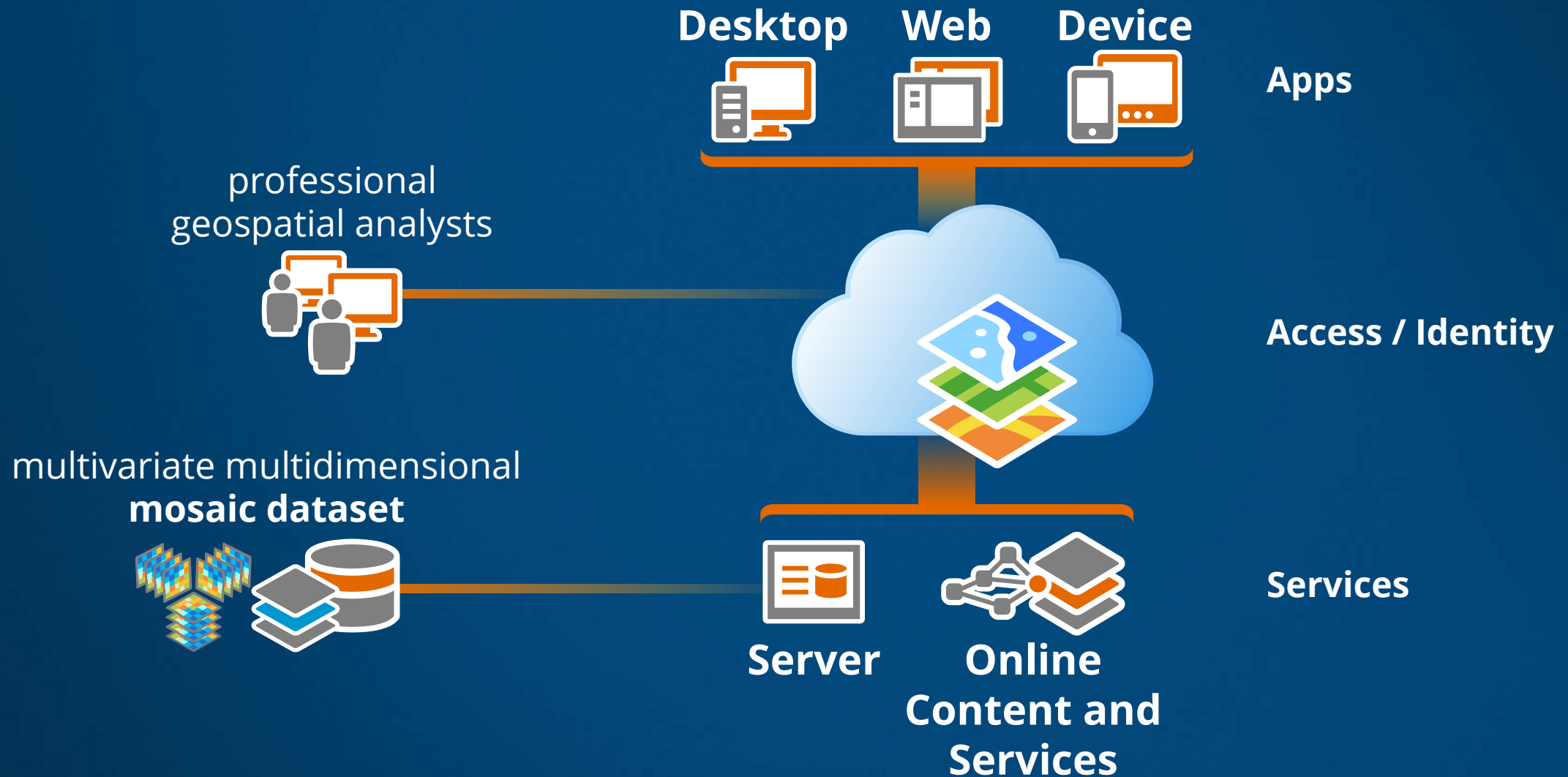
Applying a Raster Model



Disseminating and Consuming



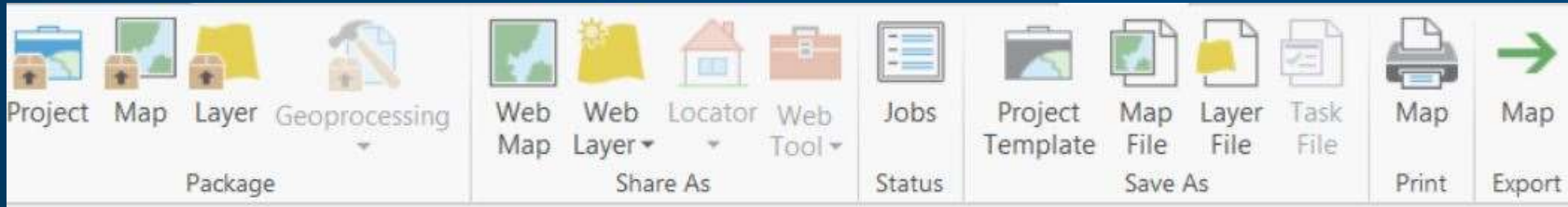
Disseminating



Dissemination Strategies

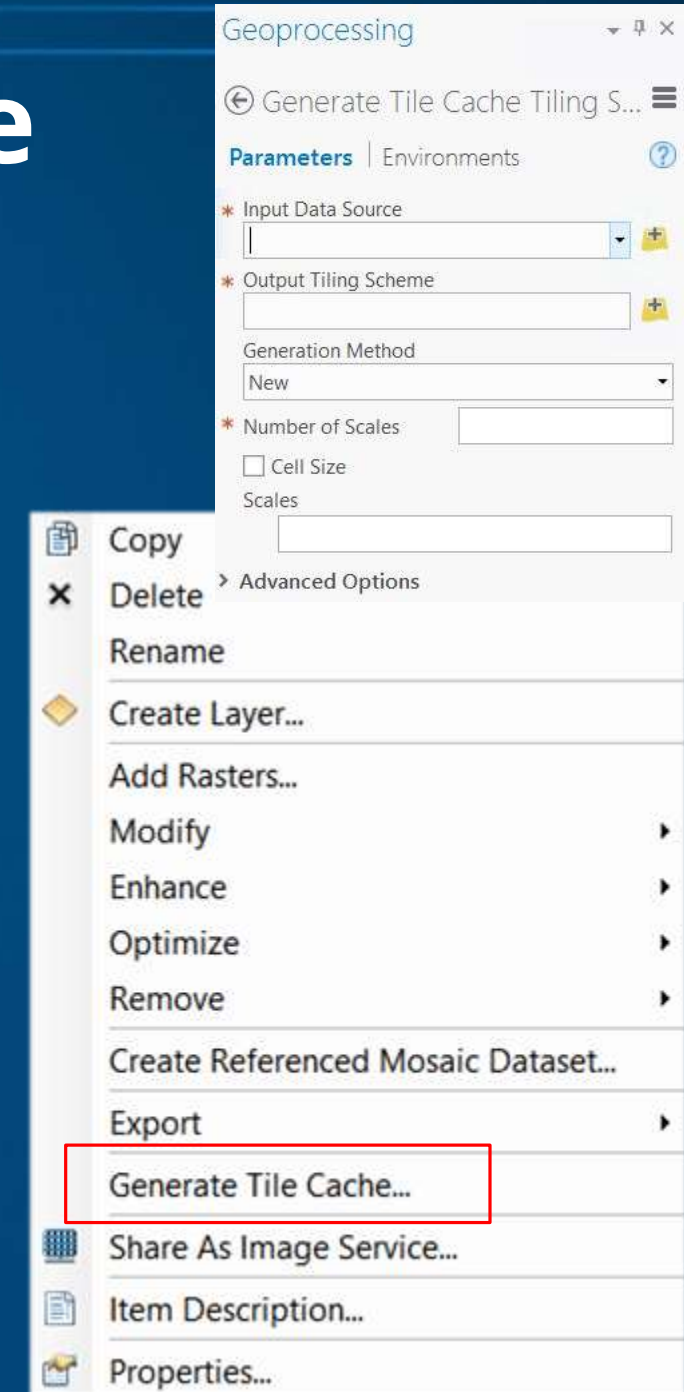
- Tiled map service
- Dynamic map service
- Dynamic image service

Sharing your data as an image



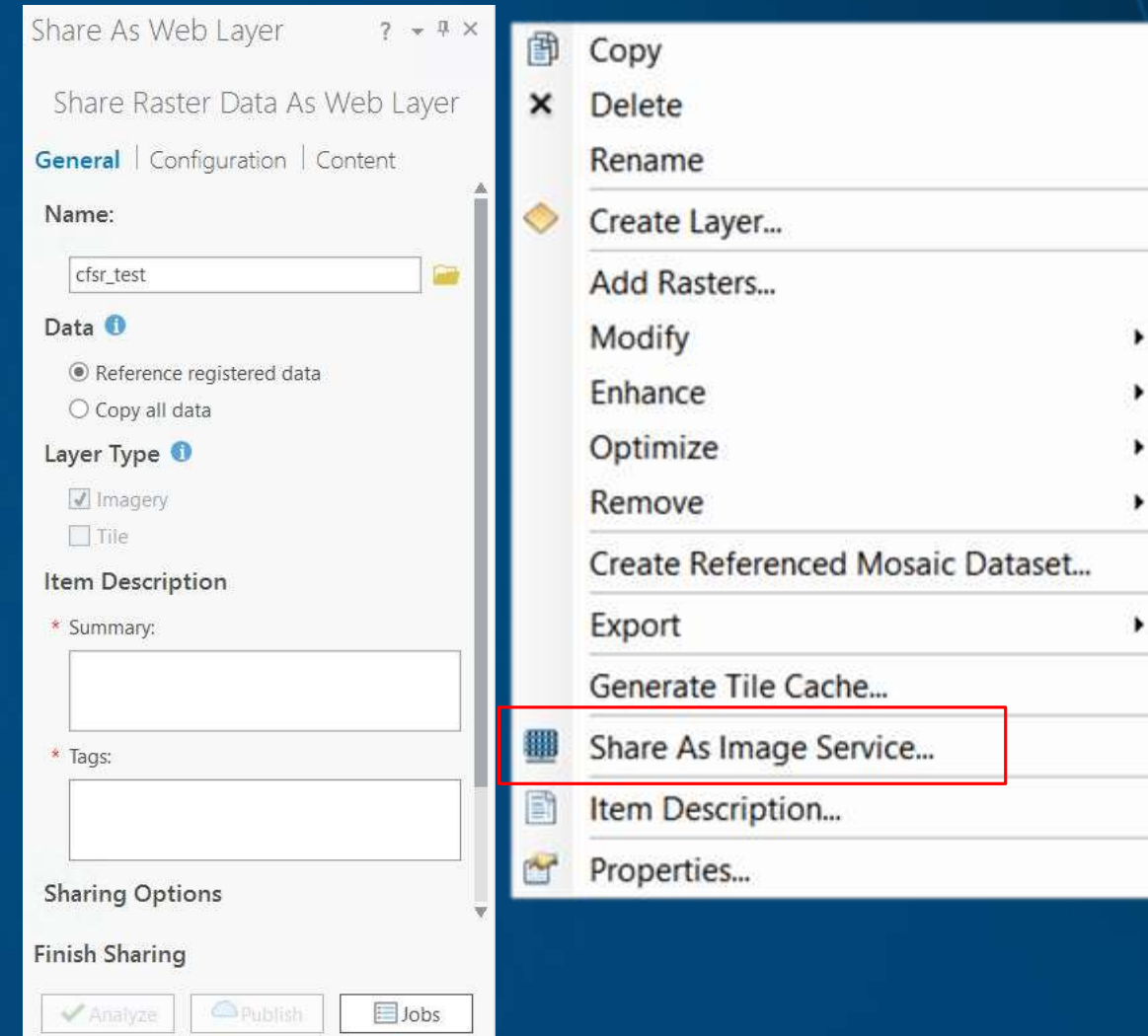
- Mosaic Dataset > Generate Tile Cache
- Avoid copying source image to ArcGIS Online
- Cache tiles generated using ArcGIS for Desktop
- Accessed via **tilled map service**

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



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



Enable access to a dynamic representation of your information product as an image service



Demo



Publishing a multidimensional mosaic dataset

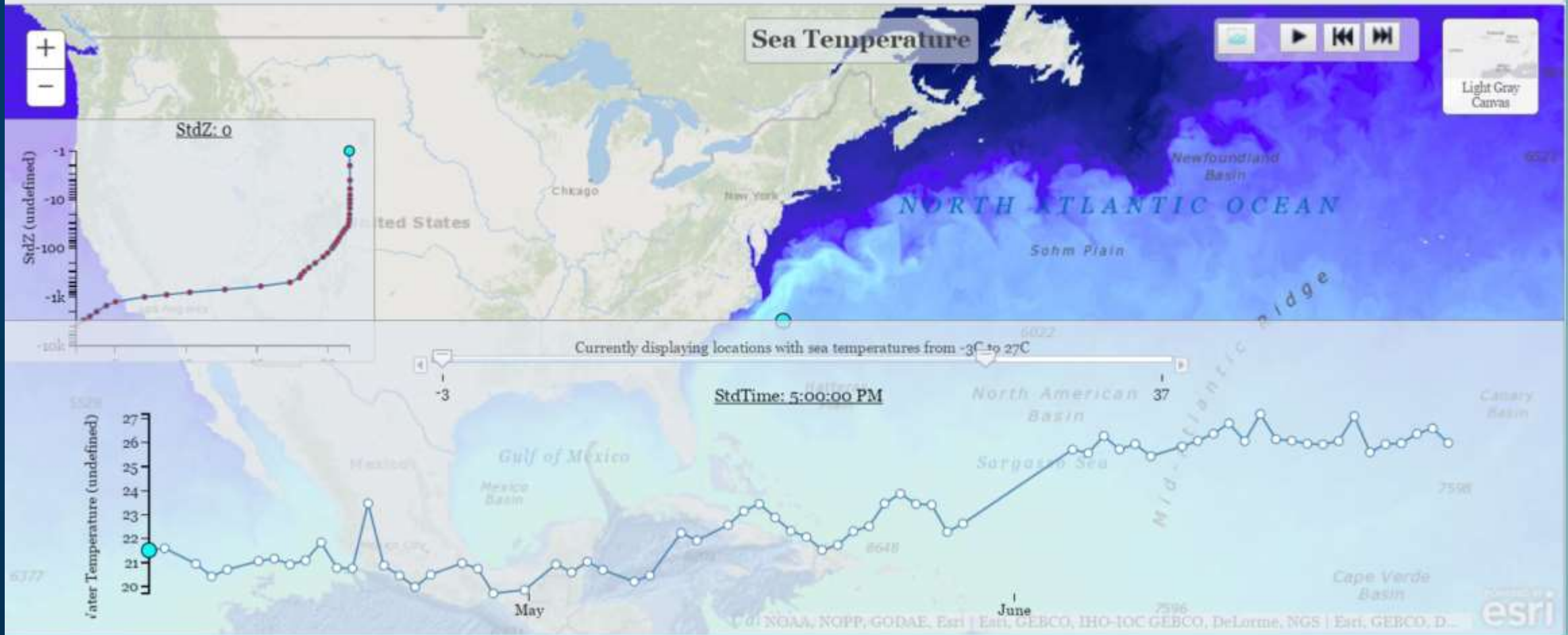


Consuming your services

- 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

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 weather-observing satellites on the horizon, NOAA



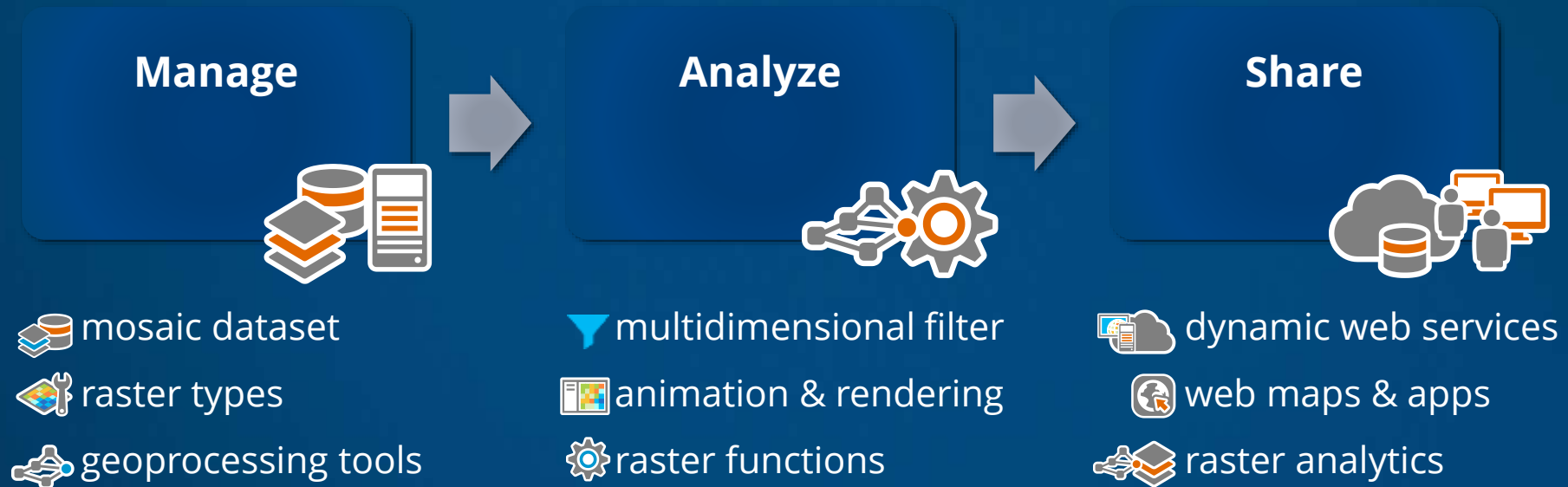
Demo



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 PM – 6:30 PM

**GIS Solutions Expo,
Hall B**

5:15 PM – 6:30 PM

**Expo Social,
Hall B**

Tuesday

10:45 AM – 5:15 PM

**GIS Solutions Expo,
Hall B**

6:30 PM – 9:30 PM

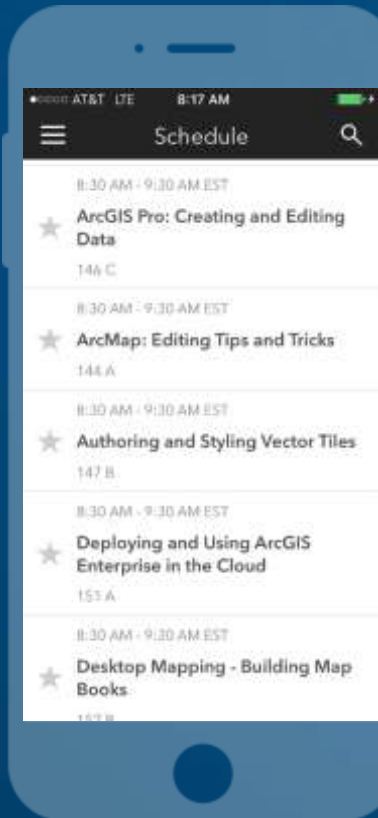
**Networking Reception,
Smithsonian National Air
and Space Museum**

Please Take Our Survey on the Esri Events App!

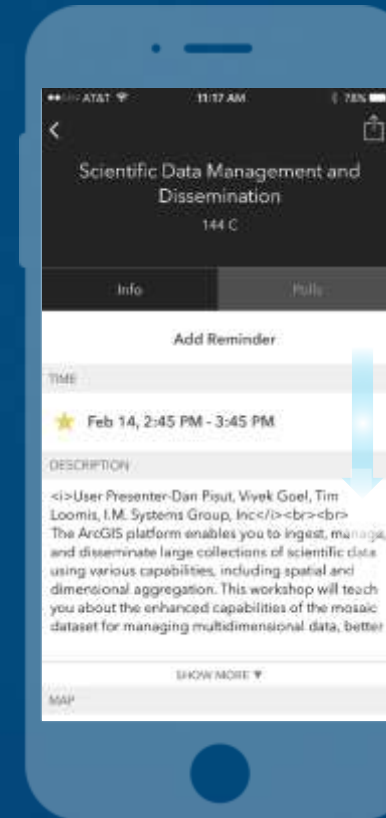
Download the Esri Events app and find your event



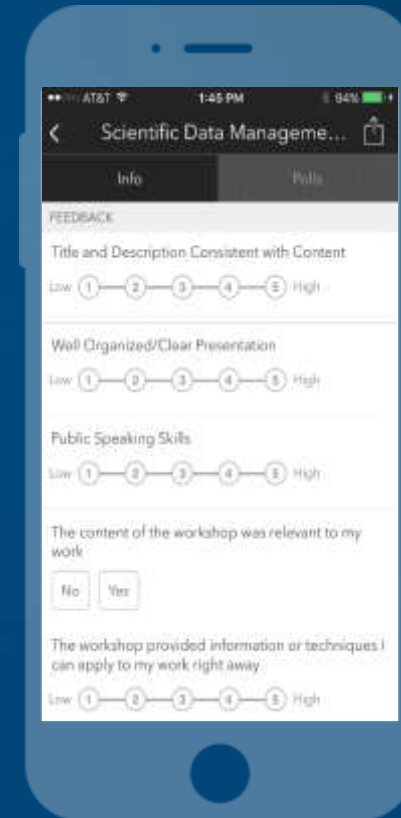
Select the session you attended



Scroll down to find the survey



Complete Answers and Select "Submit"





esri

THE
SCIENCE
OF
WHERE

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

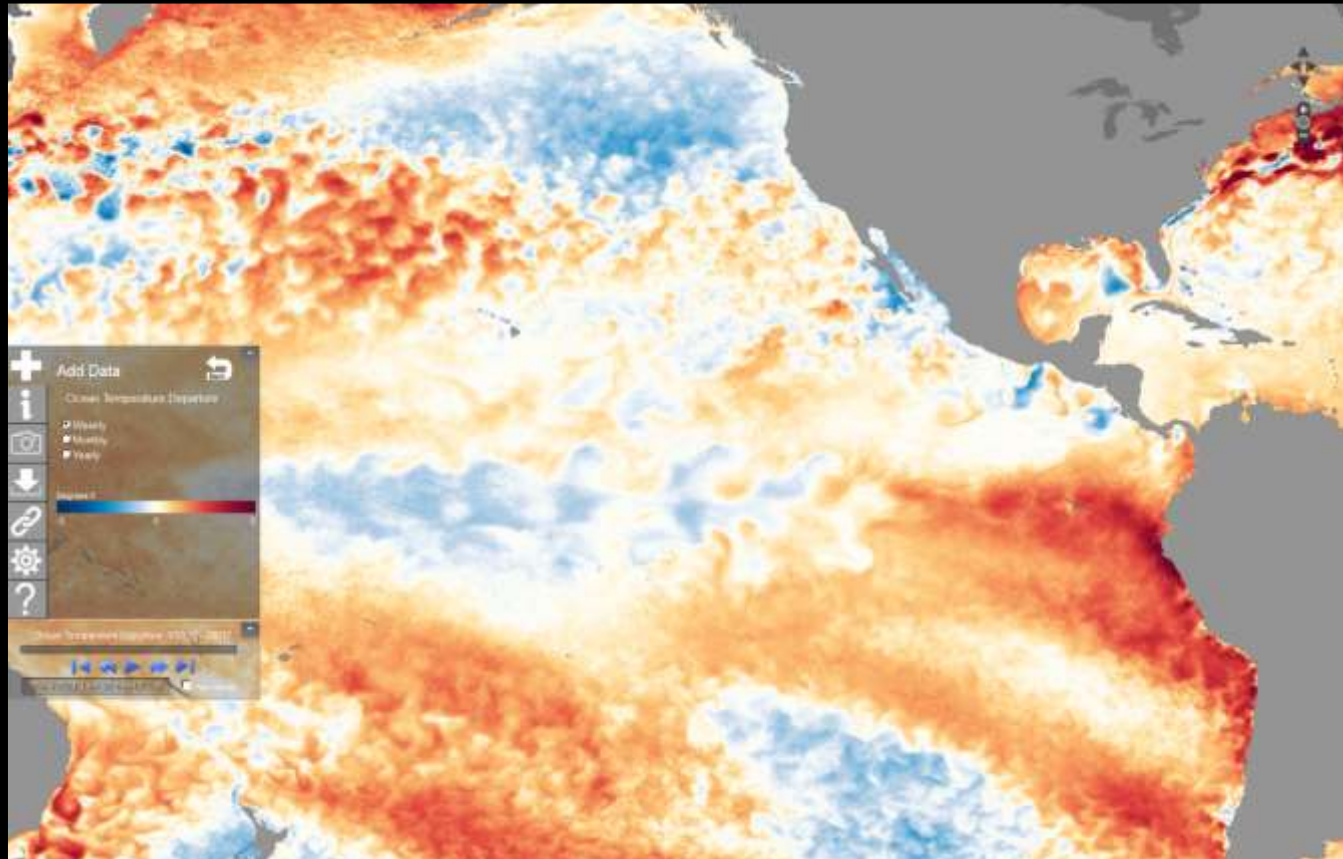
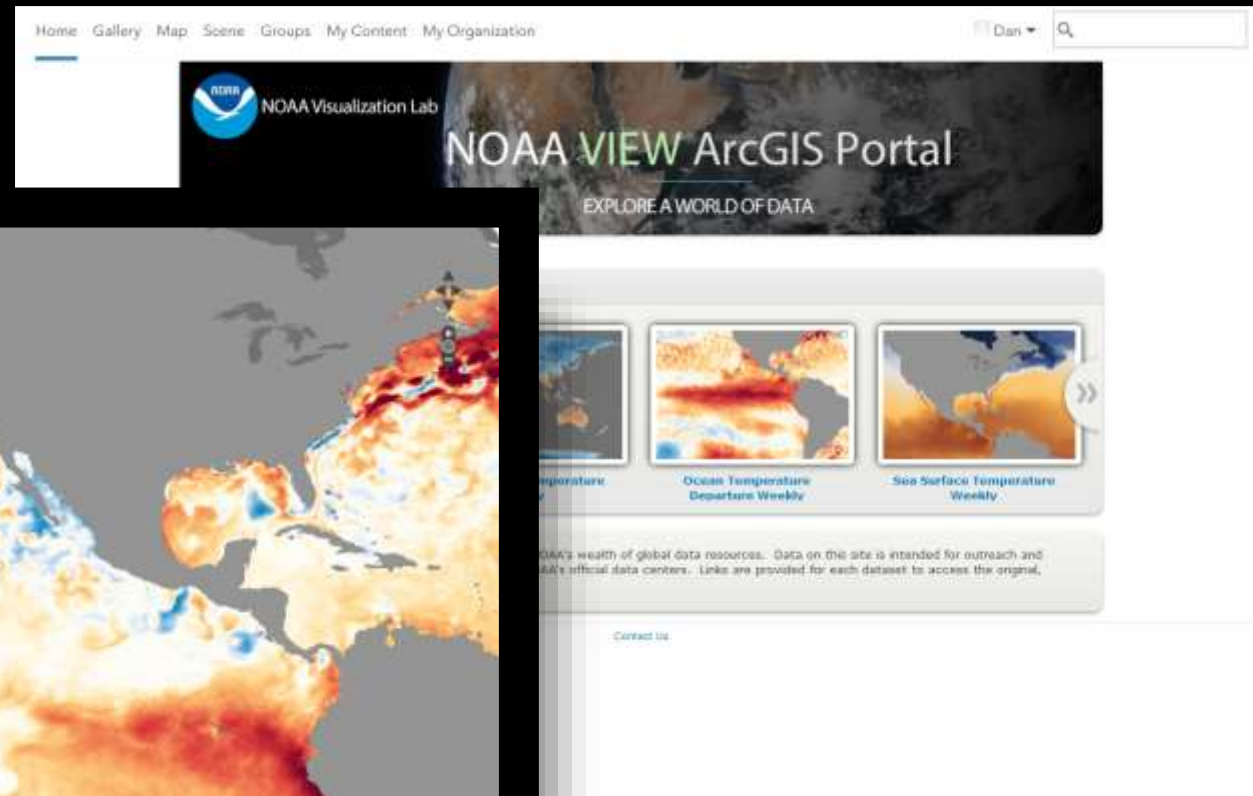


Dan Pisut, Vivek Goel, Tim Loomis

IMSG at the NOAA Visualization Lab

dan.pisut@noaa.gov

The NOAAView Data Portal



Working with SCALE: TIME



hours

days

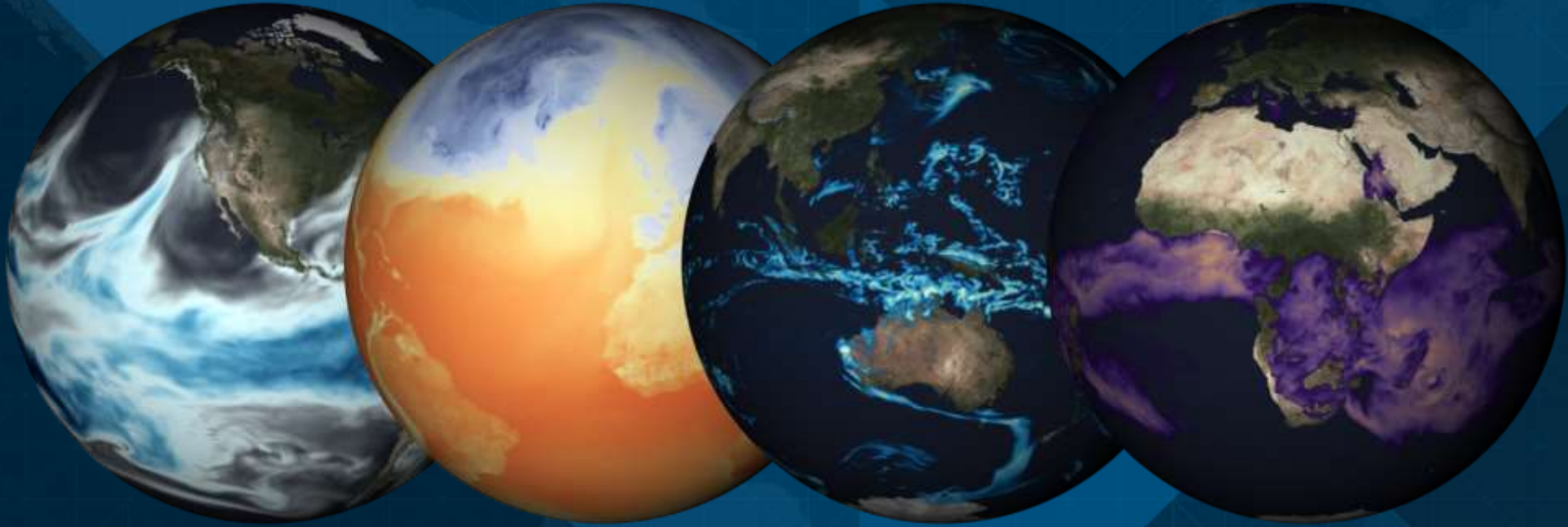
weeks

months

years

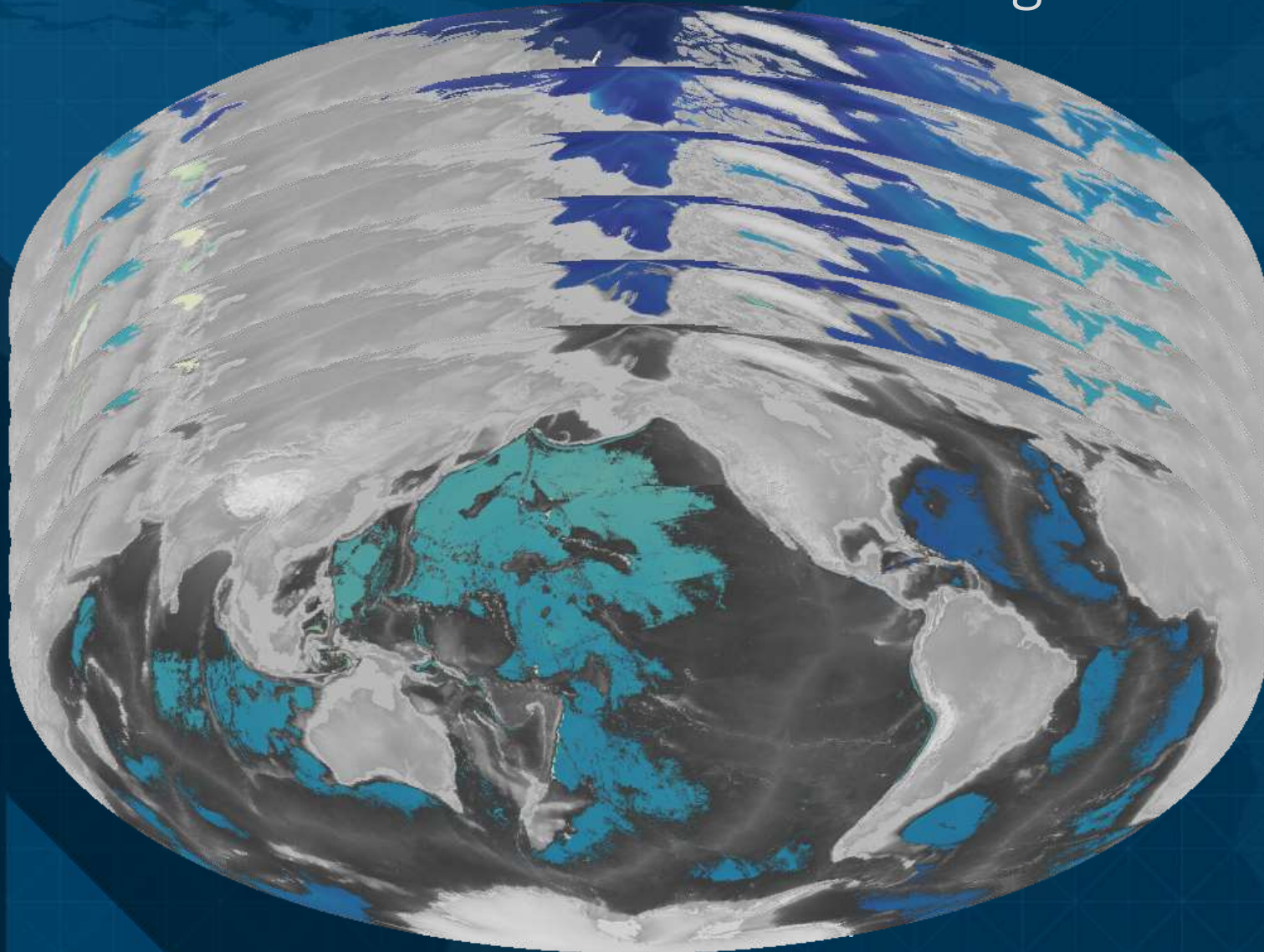
decades

Working with SCALE: **REFRESH**



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

Working with SCALE: **SPACE**



Dissolved O₂: 5,000m

Working with SCALE: RESOLUTION



750m daily resolution



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



<javascript>



weekly

monthly

yearly



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

thank you

dan.pisut@noaa.gov

