



Using Satellite Data in ArcGIS

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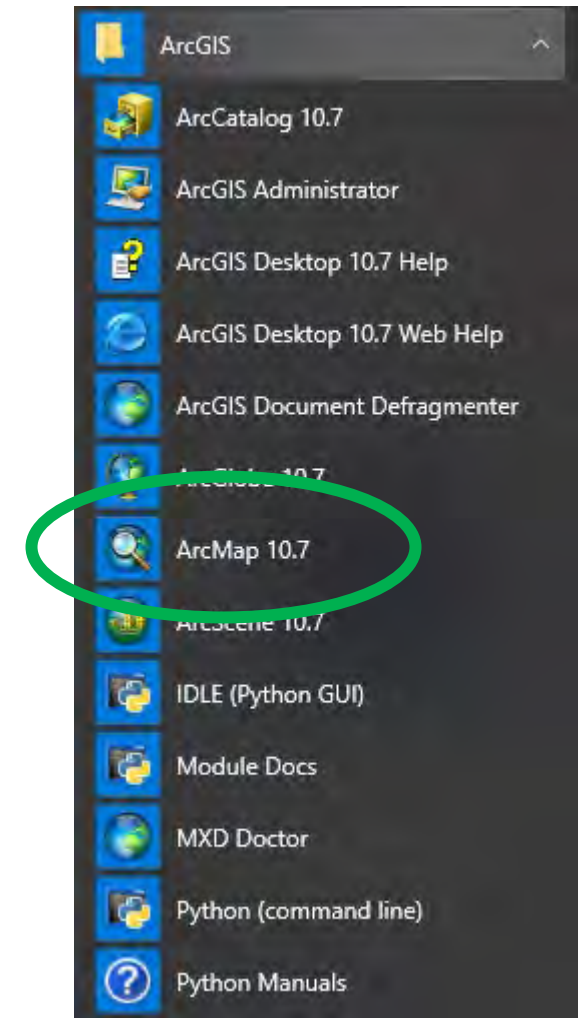
<https://coastwatch.noaa.gov>
Coastwatch.info@noaa.gov

Versioning:
2020, Soracco
2019, Soracco



ArcGIS 10.7 (10.7.1 latest release)

- ArcMap is the primary user interactive GIS application
- Based on Python 2.7
 - Being the last of the 2.x series, 2.7 will receive bugfix support until 2020. Support officially stops January 1 2020, but the final release will occur after that date.
 - Planned future release dates:
 - 2.7.18 code freeze January, 2020
 - 2.7.18 release candidate early April, 2020
 - 2.7.18 mid-April, 2020
- All the Python 2.7 code in ArcGIS will continue to work. Also, Esri will continue to support Python 2.7 in ArcMap, ArcCatalog, ArcMap extensions (including ArcScene and ArcGlobe, which are part of the ArcGIS 3D Analyst extension), ArcGIS Engine, and ArcGIS Server.

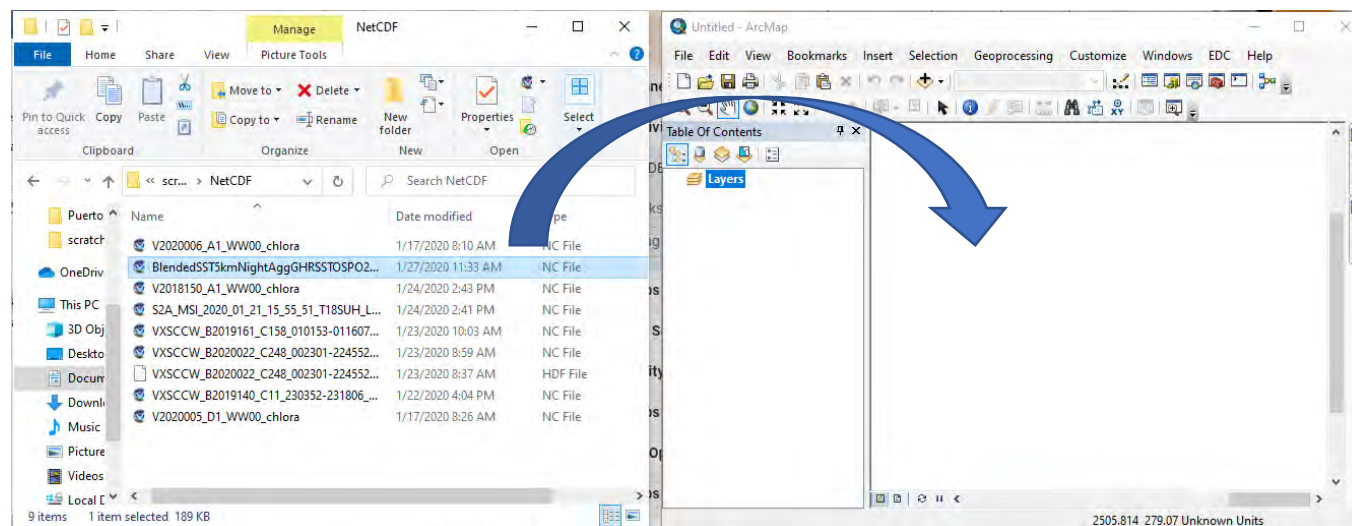


Useful Extensions / Add-ons

- ArcGIS Spatial Analyst (license) – ESRI
 - Raster tools
- Environment Data Connector (EDC)
 - Helper tool to obtain multidimensional data (space-time-+)
 - <https://www.pfeg.noaa.gov/products/EDC/EDCdownloads.html>

Methods to add Satellite Data

- WMS and WCS
- Drag-n-drop
 - GeoTIFF, NetCDF, JPEG2000

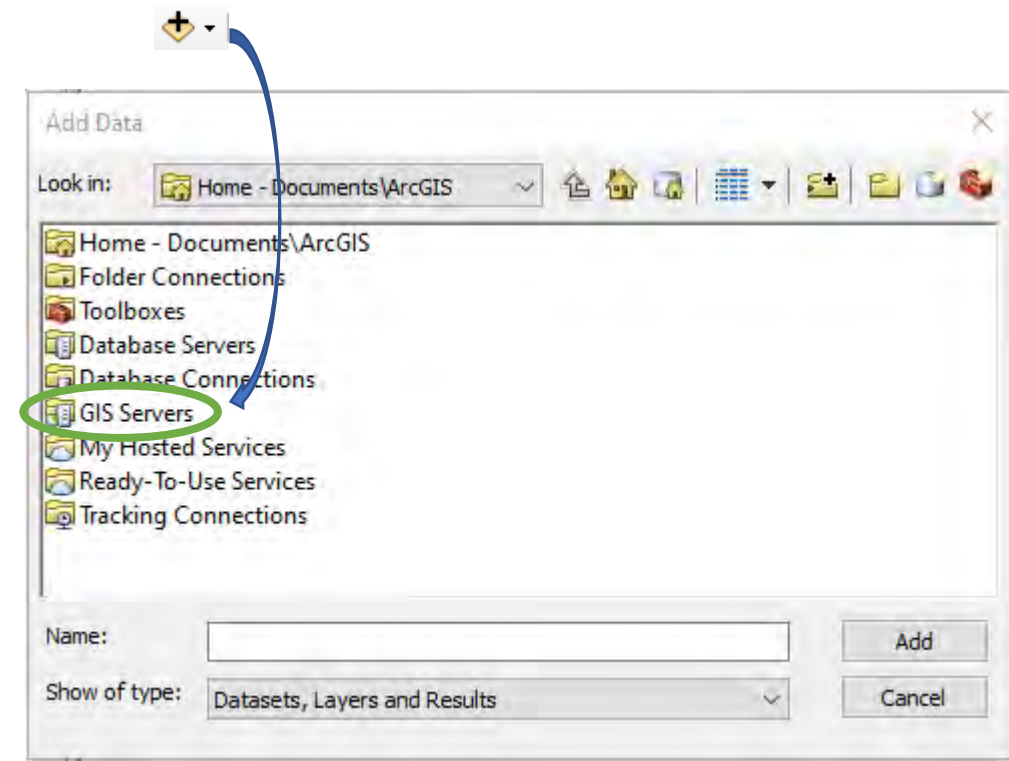


- Multidimension Toolbox
 - Make OpenDAP Raster Layer (ArcToolbox->Multidimensional Tools)
 - Make NetCDF Raster Layer (ArcToolbox->Multidimensional Tools)

- EDC • EDC (Environmental Data Connector)

Web Mapping and Coverage Services (WMS and WCS)

- WMS: the image
- WCS: the data values
- Ok for single time/place
- Can be frustrating on finding the correct URL
- Each change in PZI results in refresh call....and sometimes errors



Add WMS Server

URL:

Examples: <http://www.myserver.com/arcgis/services/mymap/MapServer/WMSServer?>
<http://www.example.com/servlet/com.esri.wms.Esrimap?ServiceName=Name&>

Version:

Custom Parameters

Parameter	Value

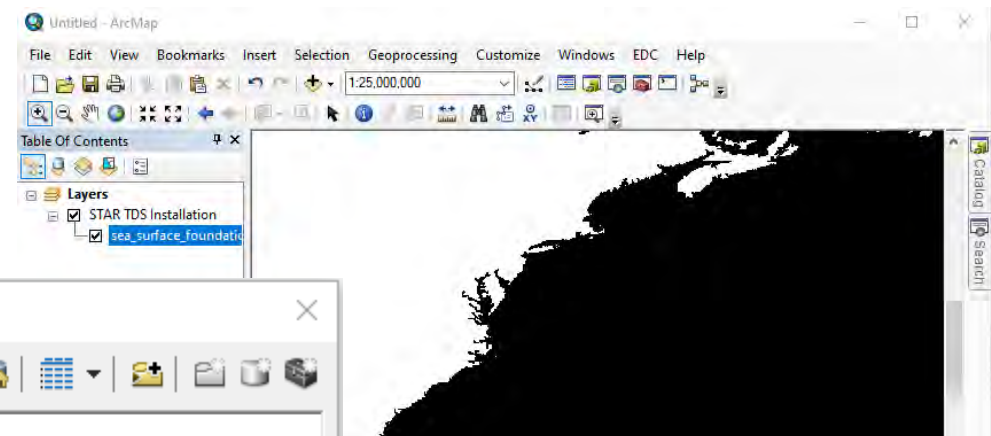
Server Layers

- STAR TDS Installation
 - STAR TDS Installation
 - Analysed blended sea surface temper.
 - sea_land_ice_bit_mask
 - sea_ice_area_fraction
 - estimated error standard deviation
 - sea_surface_foundation_tempera

Account (Optional)

User:

Password: ☒ Save Password



ArcMap Drawing Errors

One or more layers failed to draw:

STAR TDS Installation: WMS service exceptions:Service Error
 Description: Unexpected error of type java.io.IOException

ArcMap Drawing Errors

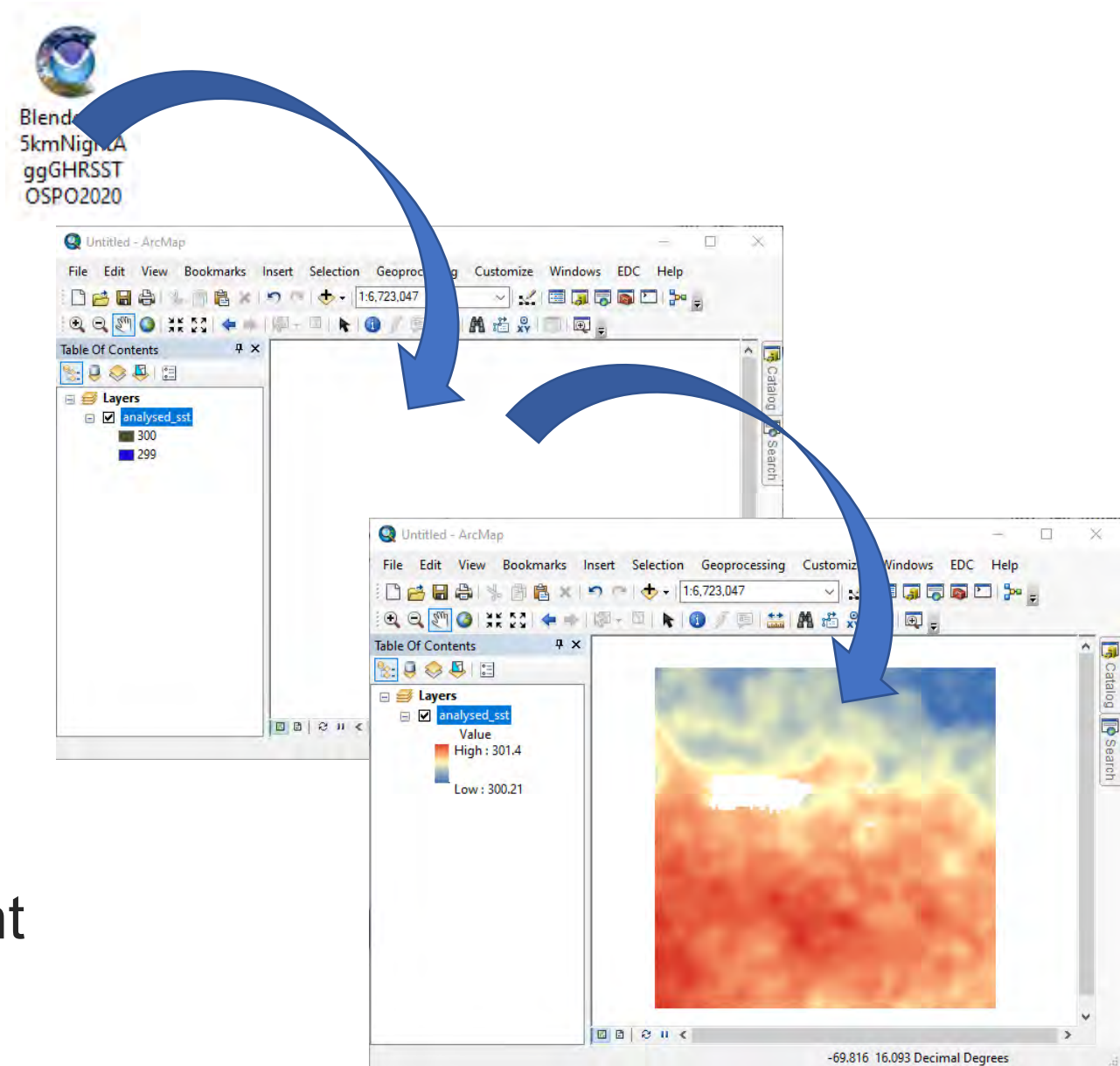
One or more layers failed to draw:

STAR TDS Installation: This WMS Service has a layer limit of 1 per request. Try to add each WMS sub layer individually to send multiple requests.
 STAR TDS Installation: WMS service exceptions:Service Error
 Description: You may only create a map from 1 layer(s) at a time



Drag -n- Drop

- Quick and easy
- Requires additional configuration [symbology, NetCDF, time, time slider]
- Defaults to first variable
- Don't always get what you want



Make OpenDAP Raster Layer

- A few clicks, but results may vary
- Menu-driven configuration to maximize usefulness
- Handles file or aggregates. Enter URL without extension
- Requires additional configuration [time, time slider] to maximize usefulness
- Unexpected Errors

ArcToolbox->Multidimension Tools->Make OpenDAP Raster Layer

Make OPeNDAP Raster Layer

Input OPeNDAP URL

Variable

X Dimension

Y Dimension

Output Raster Layer

Extent (optional)

Y Maximum

X Minimum

X Maximum

Y Minimum

Clear

Dimension Values (optional)

Dimension	Start Value	End Value
time	01/25/2020 12:00:00 PM	01/28/2020 12:00:00 PM


Value Selection Method (optional)

Cell Registration (optional)

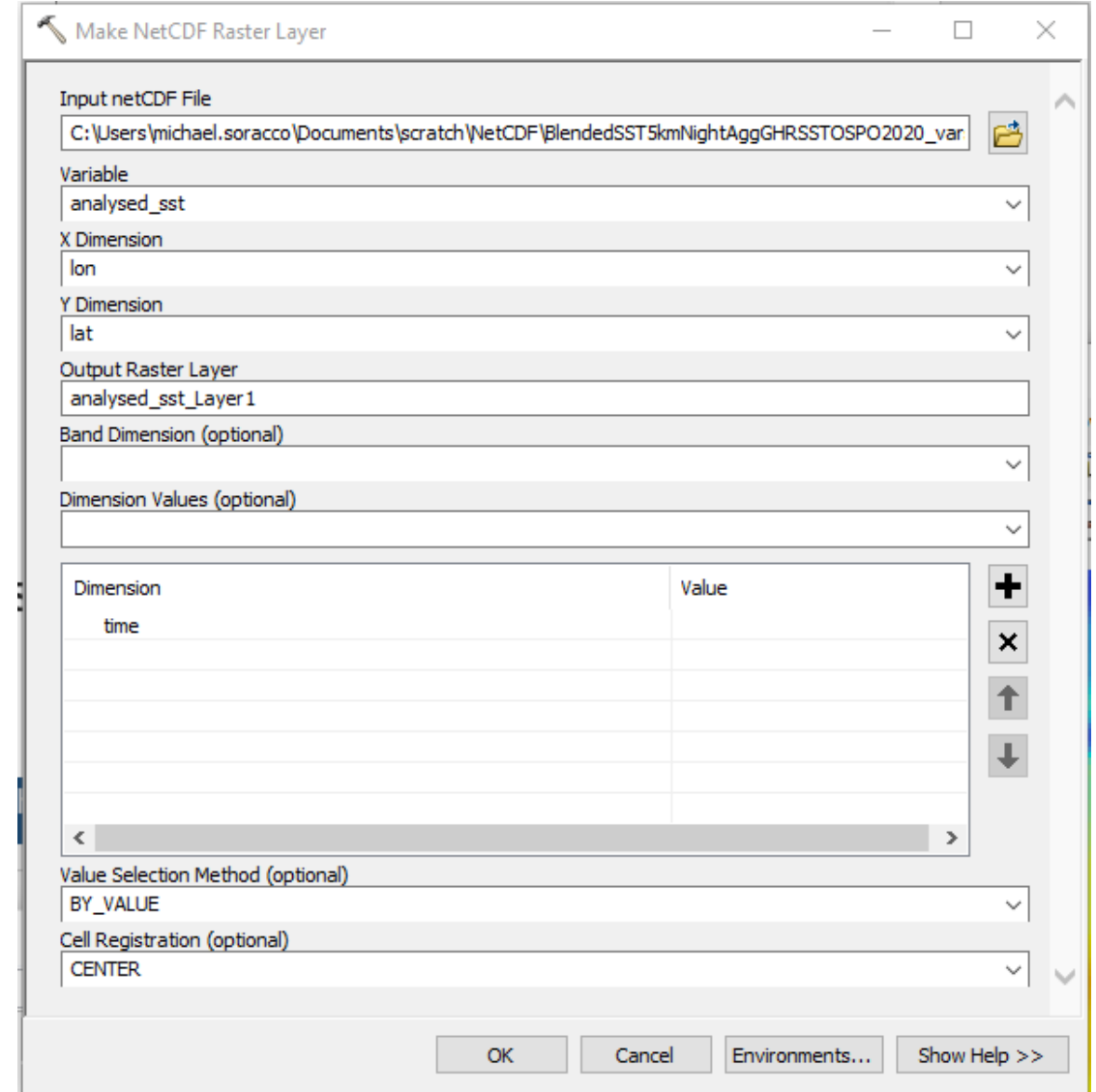
OK Cancel Environments... Show Help >>



Make NetCDF Raster Layer

- A few clicks 
- Menu-driven configuration to maximize usefulness
- Requires additional configuration [time, time slider] to maximize usefulness

ArcToolbox->Multidimension Tools->Make NetCDF Raster Layer



Make NetCDF Raster Layer

Input netCDF File
C:\Users\michael.soracco\Documents\scratch\NetCDF\BlendedSST5kmNightAggGHR.SSTOSPO2020_var

Variable
analysed_sst

X Dimension
lon

Y Dimension
lat

Output Raster Layer
analysed_sst_Layer1

Band Dimension (optional)

Dimension Values (optional)

Dimension	Value
time	

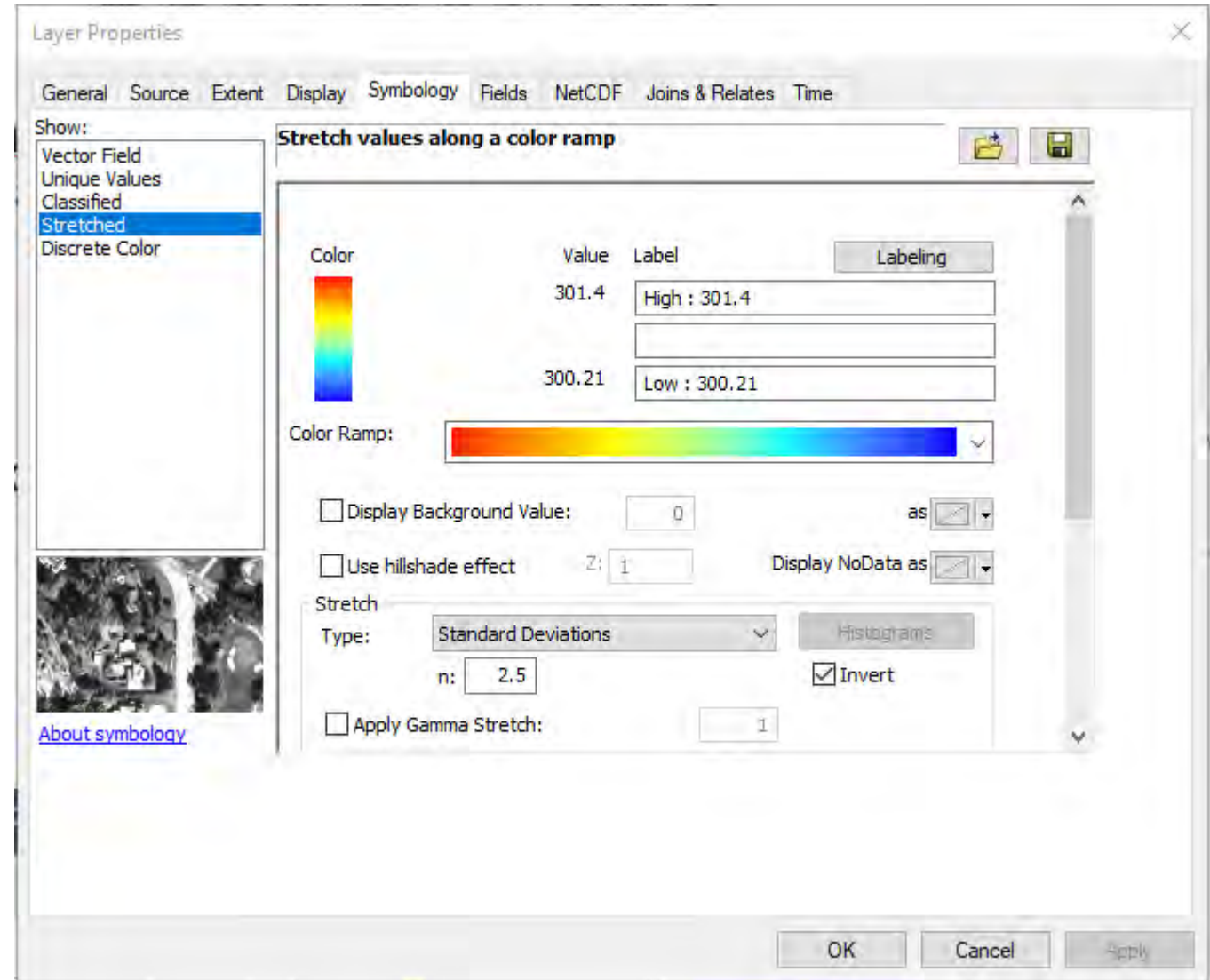
Value Selection Method (optional)
BY_VALUE

Cell Registration (optional)
CENTER

OK Cancel Environments... Show Help >>

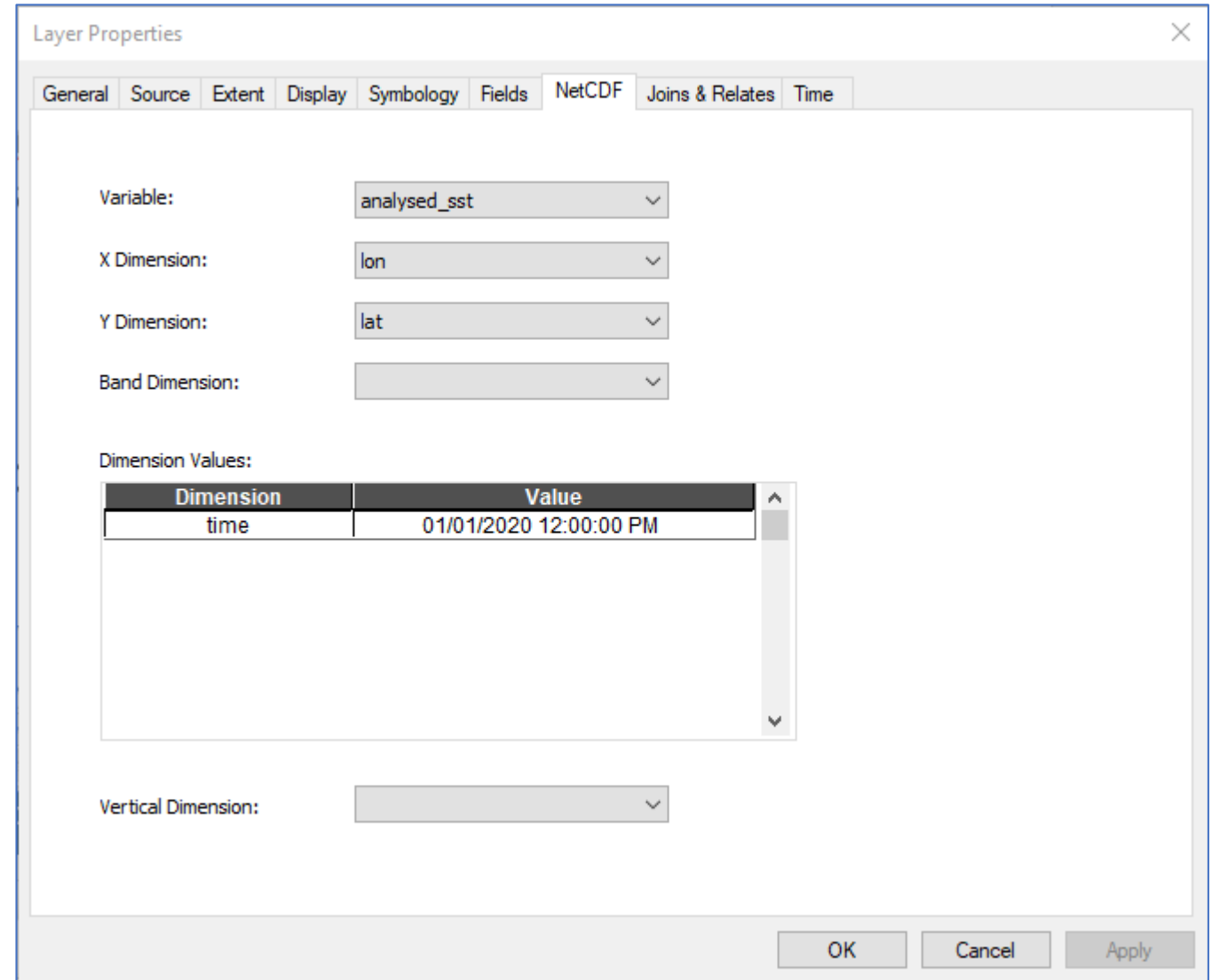
Layer Properties: Symbology

- ArcToolbox->
Multidimension Tools->
Make NetCDF Raster
Layer
- Menu-driven
configuration to
maximize usefulness



Layer Properties: NetCDF

- ArcToolbox-
 - >Multidimension Tools-
 - >Make NetCDF Raster Layer
- Menu-driven configuration to maximize usefulness

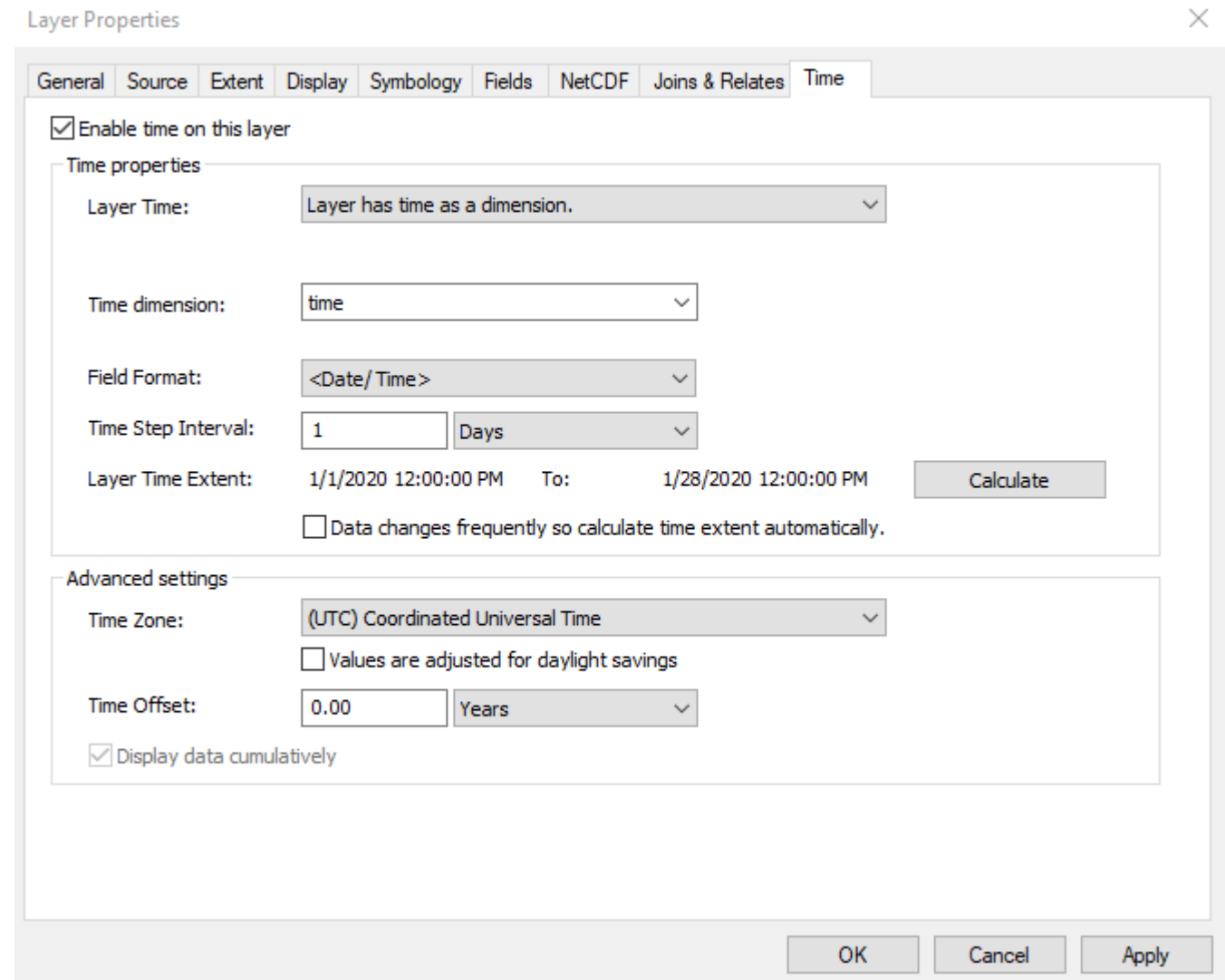


The screenshot shows the 'Layer Properties' dialog box with the 'NetCDF' tab selected. The 'Variable' is set to 'analysed_sst'. The 'X Dimension' is 'lon' and the 'Y Dimension' is 'lat'. The 'Band Dimension' is empty. The 'Dimension Values' table shows a single row for 'time' with the value '01/01/2020 12:00:00 PM'. The 'Vertical Dimension' is empty. The 'OK', 'Cancel', and 'Apply' buttons are at the bottom right.

Dimension	Value
time	01/01/2020 12:00:00 PM

Layer Properties: Time

- ArcToolbox->Multidimension Tools->Make NetCDF Raster Layer
- Menu-driven configuration to maximize usefulness



The screenshot shows the 'Layer Properties' dialog box with the 'Time' tab selected. The 'Enable time on this layer' checkbox is checked. Under 'Time properties', 'Layer Time' is set to 'Layer has time as a dimension.', 'Time dimension' is 'time', 'Field Format' is '<Date/ Time>', 'Time Step Interval' is '1' days, and 'Layer Time Extent' is from '1/1/2020 12:00:00 PM' to '1/28/2020 12:00:00 PM'. A 'Calculate' button is next to the extent. The 'Data changes frequently so calculate time extent automatically' checkbox is unchecked. Under 'Advanced settings', 'Time Zone' is '(UTC) Coordinated Universal Time', 'Values are adjusted for daylight savings' is unchecked, 'Time Offset' is '0.00' years, and 'Display data cumulatively' is checked. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

Layer Properties

General Source Extent Display Symbology Fields NetCDF Joins & Relates Time

☒ Enable time on this layer

Time properties

Layer Time: Layer has time as a dimension.

Time dimension: time

Field Format: <Date/ Time>

Time Step Interval: 1 Days

Layer Time Extent: 1/1/2020 12:00:00 PM To: 1/28/2020 12:00:00 PM Calculate

☐ Data changes frequently so calculate time extent automatically.

Advanced settings

Time Zone: (UTC) Coordinated Universal Time

☐ Values are adjusted for daylight savings

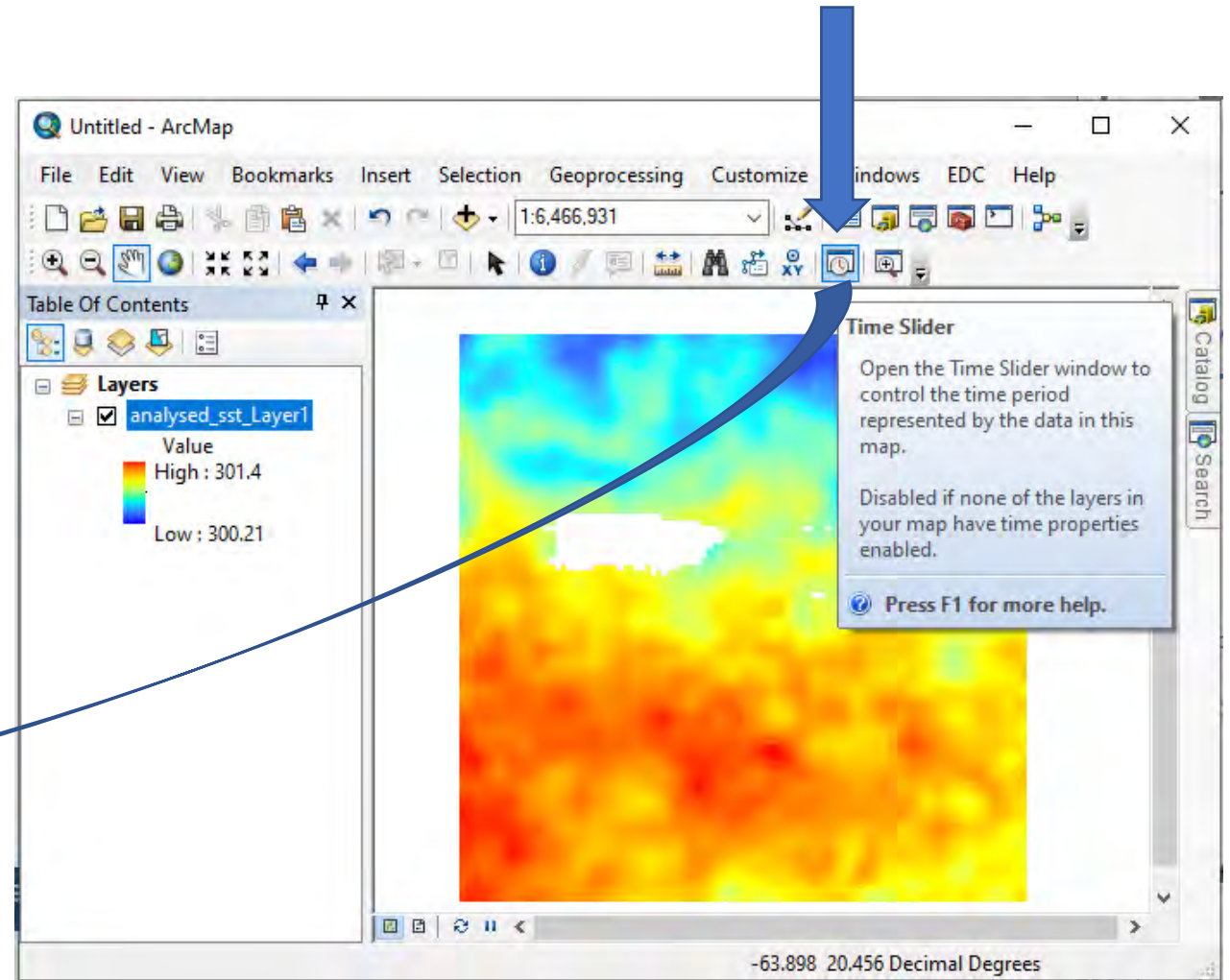
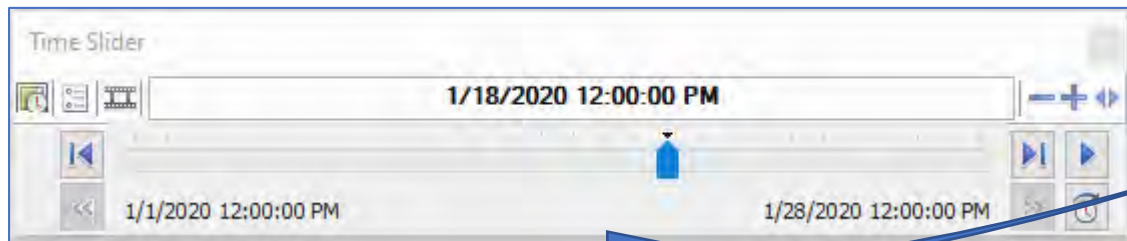
Time Offset: 0.00 Years

☒ Display data cumulatively

OK Cancel Apply

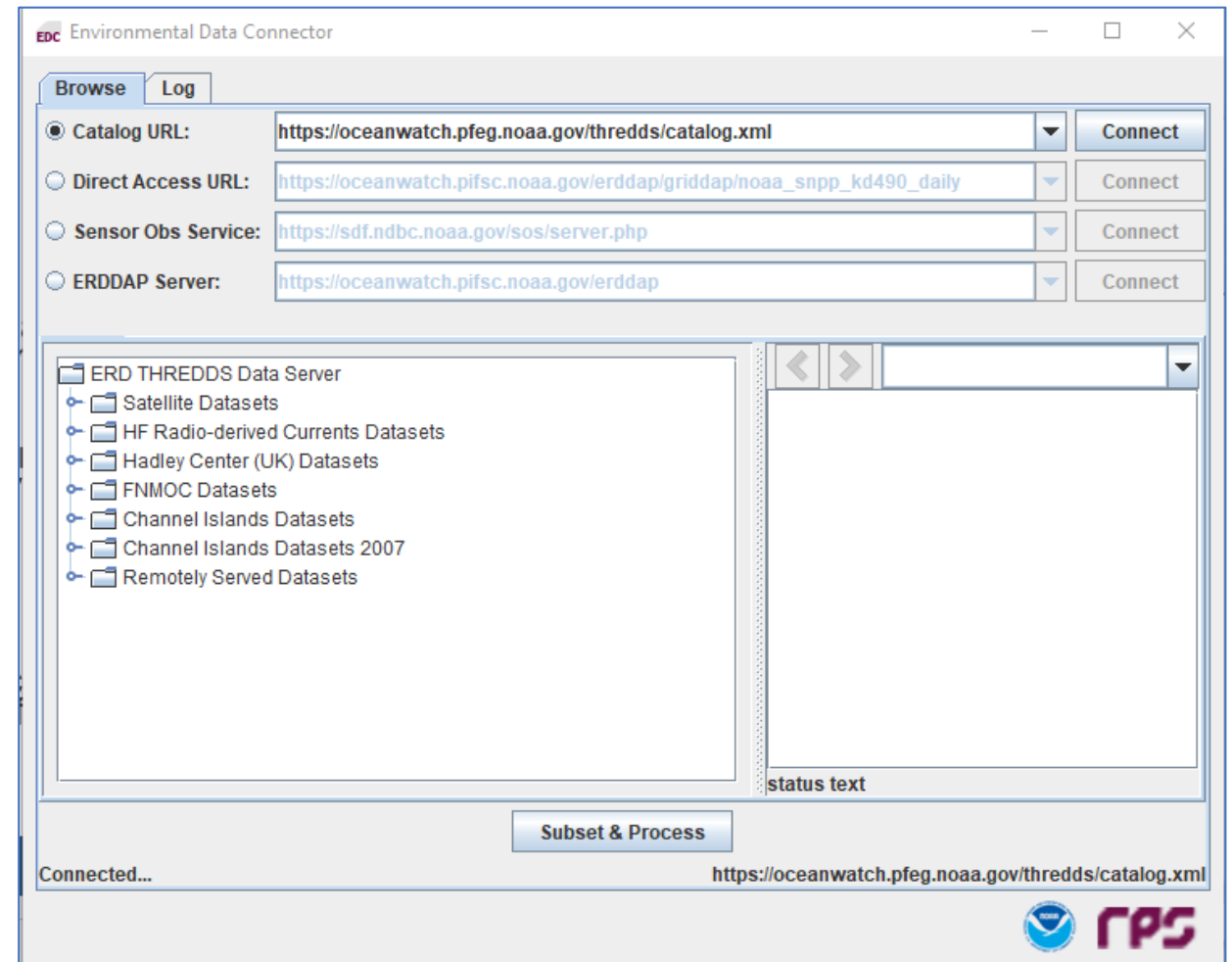
Enable Time Slider for the Map

- Select the 'Time Slider' icon to activate the slider control



Environmental Data Connector

- Updated for ArcMap 10.7, a few tweaks remain
- Connects to a variety of services
- Provides data listings
- Subsets by space and time to only retrieve data that is needed
- Simplifies import by automating the 'layer properties' steps



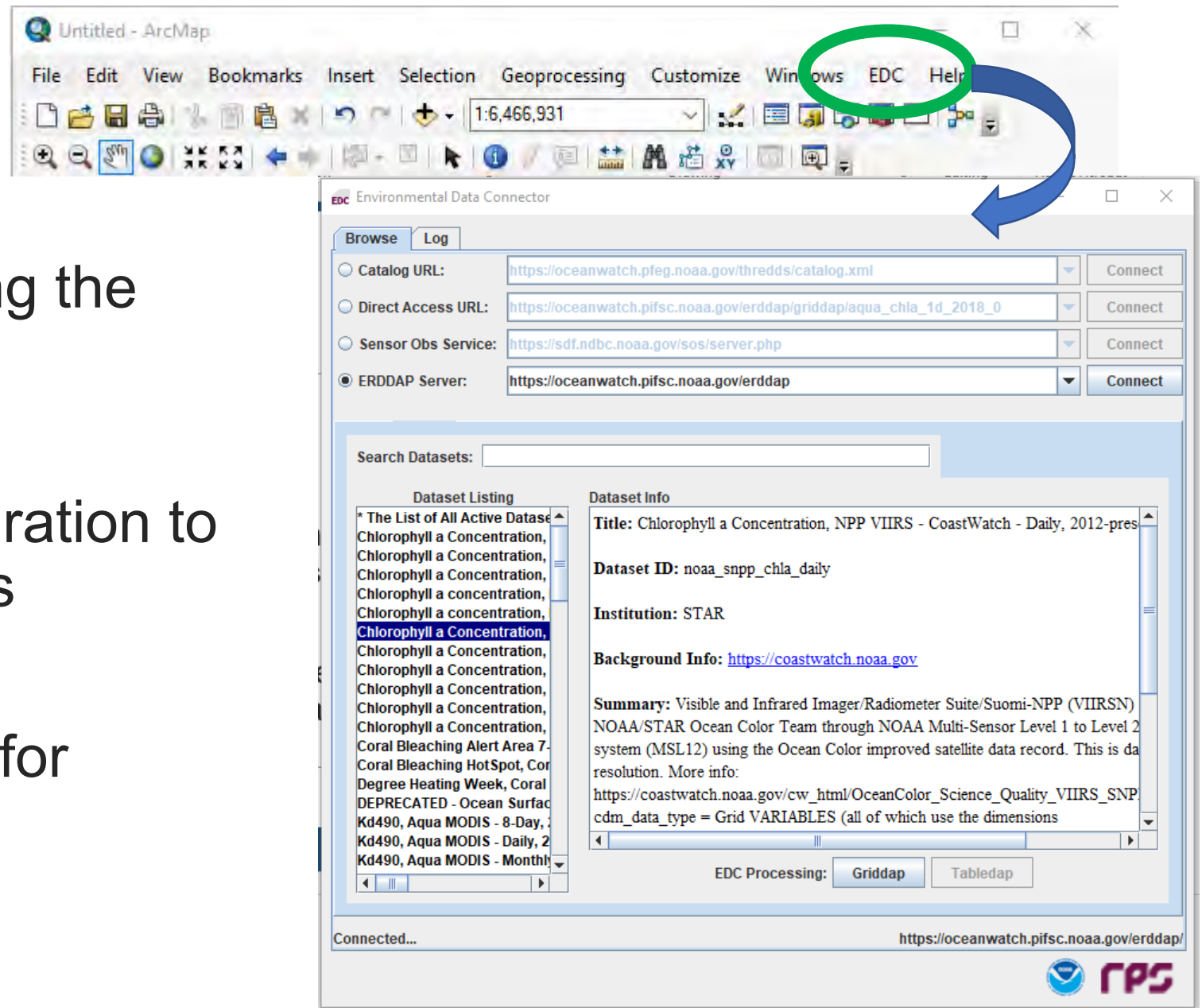
Installing EDC

- Use Java to run the 'setup.jar' file
 - Java -jar <path>\setup.jar
 - Upon execution, it will re-launch under wscript with command-line options
- Installation:
 - Creates directory for EDC standalone programs
 - Integrates with ArcMap
 - Extra steps/permissions if installed within Program Files.

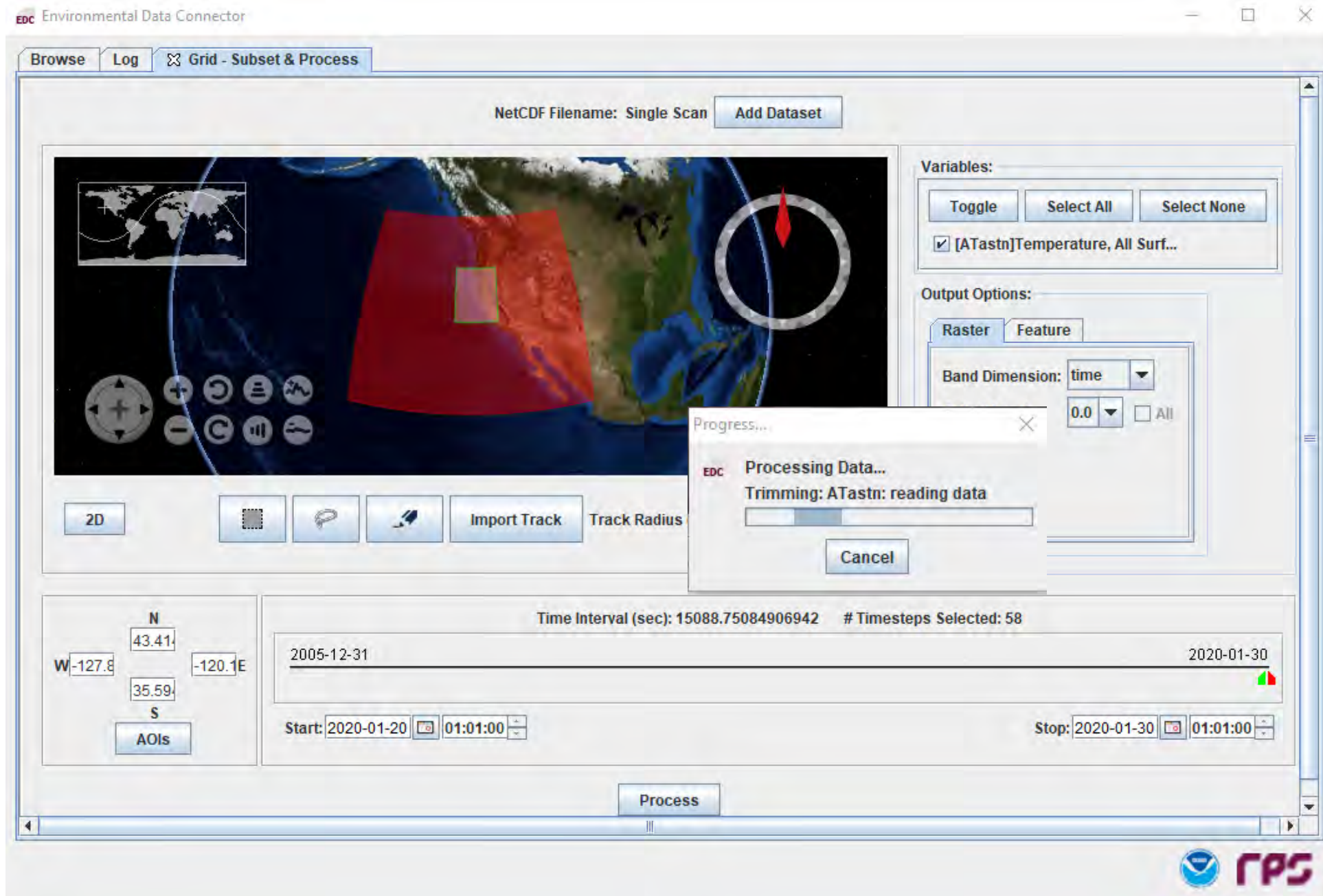


Activating EDC

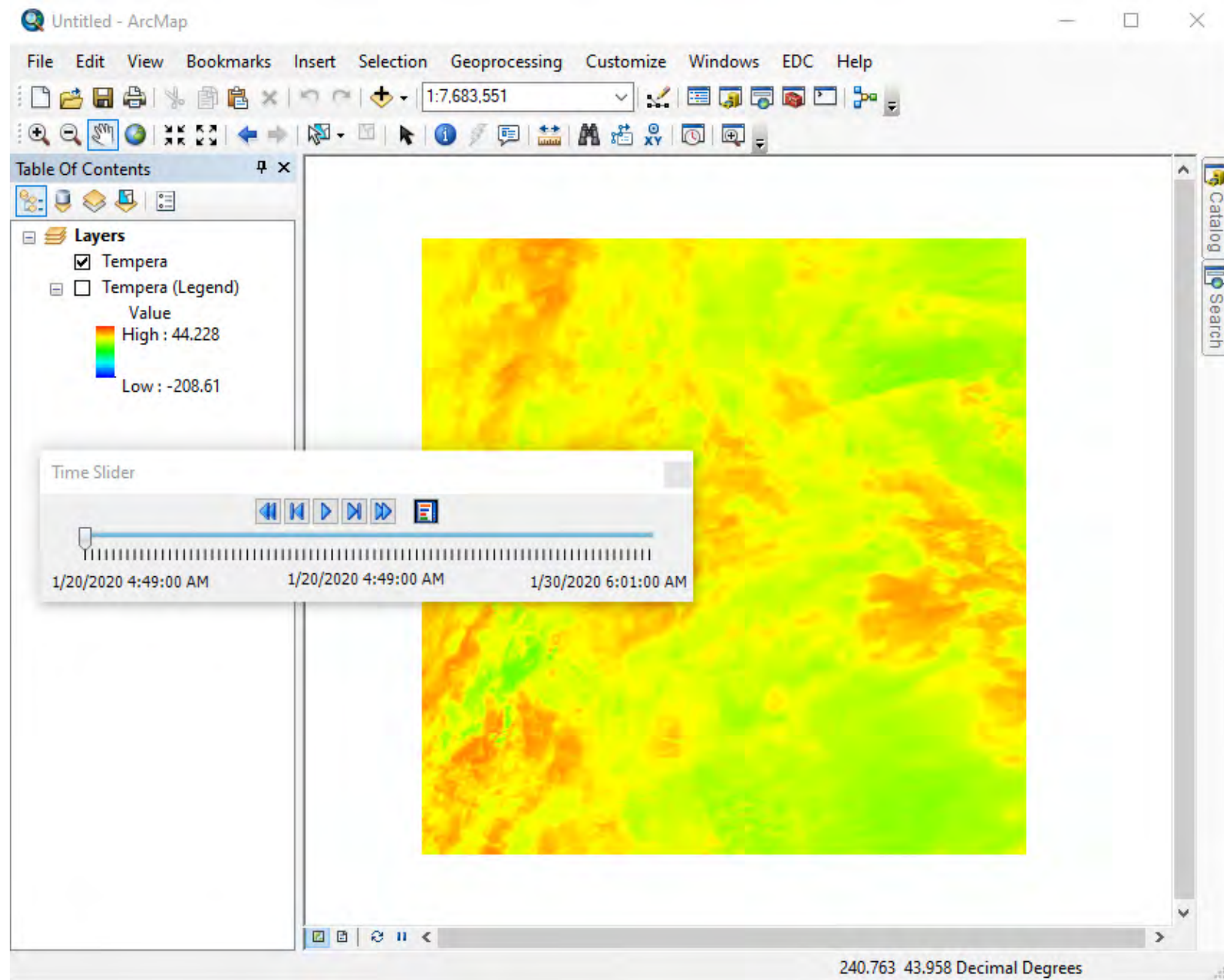
- Activated by selecting the EDC menu
- Menu-driven configuration to maximize usefulness
- Custom Time Slider for syncing data



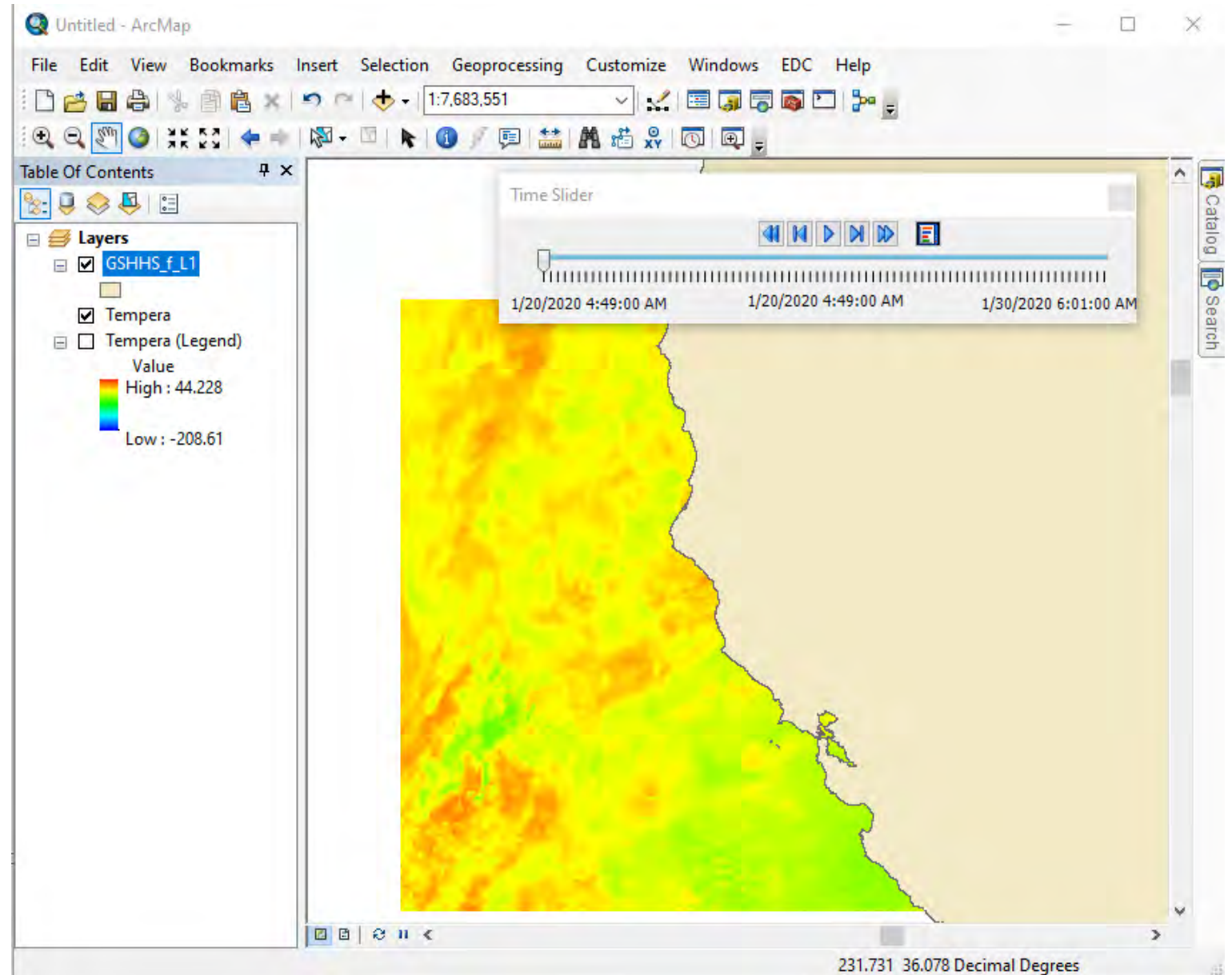
- Activated by selecting the EDC menu
- Menu-driven configuration to maximize usefulness
- Custom Time Slider for syncing data



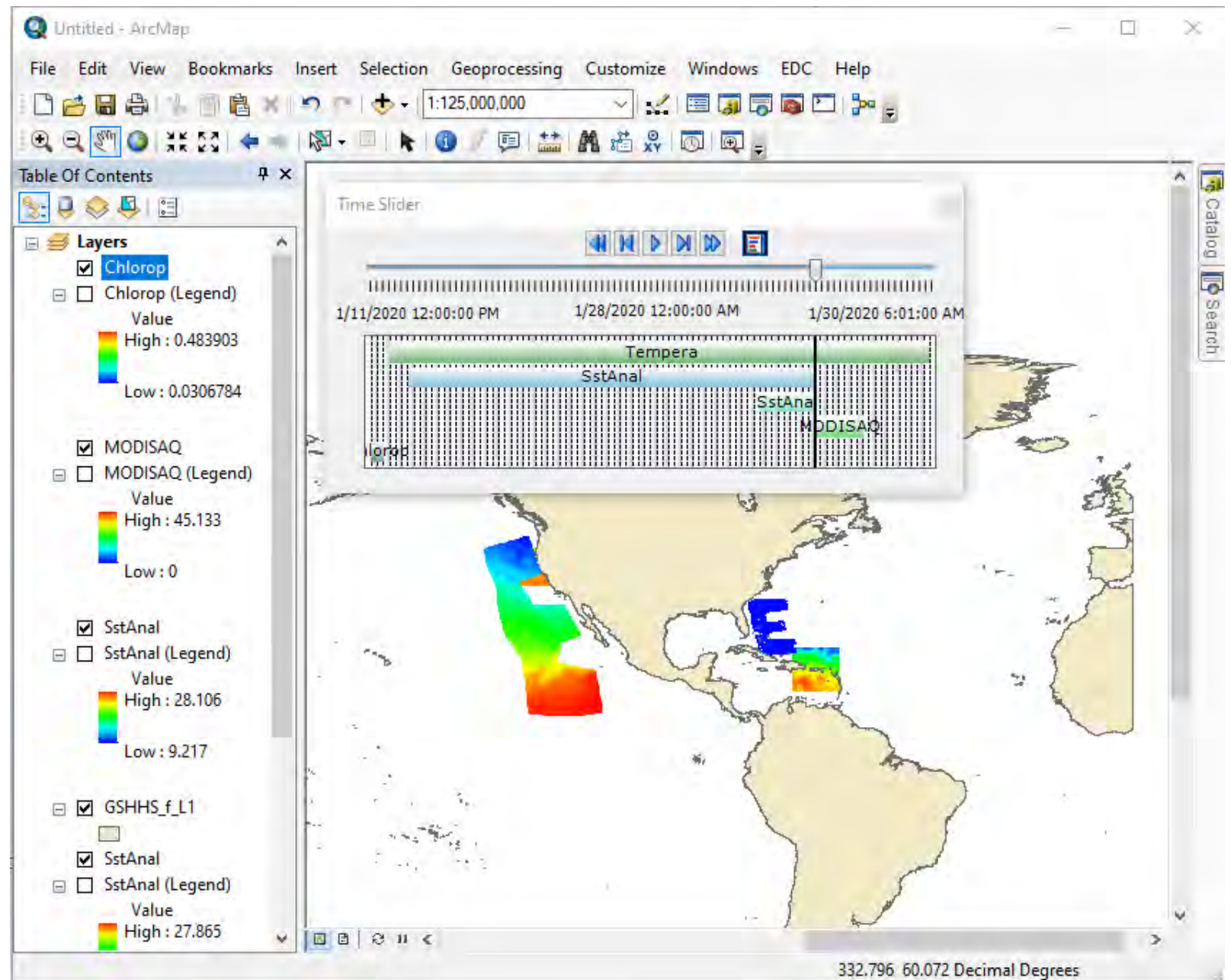
- Layer and Layer's Legend are loaded time-enabled with default scaling and color bar applied.



- Spatial alignment



- Time Slider shows alignment/range of temporal data



Things to keep track of

- Data Units:
 - SST may come in Kelvin or degrees Celsius (rarely Fahrenheit)
 - Chl comes in several units that do not necessarily change the values
- Time: Check the time zones for data – likely UTC
- Dateline: Most satellite data on services are composited daily products and may span 180W-180E
 - May introduce a mismatch in actual data collection time across the dateline
- Projection / Map Units:
 - Note units within ArcMap – usually the first data loaded sets projection and units
 - Ellipsoids/Datum – satellite data is most likely WGS84, land/coastal data may be NAD83



Additional Resources

- Environmental Data Connector
 - Download: <https://www.pfeg.noaa.gov/products/EDC/EDCdownloads.html>
 - User Guide: https://www.pfeg.noaa.gov/products/PFELData/EDC/EDC-1.3.6-ReleaseNotes_UserGuide.pdf
- ArcGIS [w/EDC] Satellite Data Tutorials/Examples*
 - Tutorial for EDC and Make NetCDF Raster
 - ArcGIS_EDC_Training_PFEG.pdf
 - <https://coastwatch.pfeg.noaa.gov/projects/arcgis/>
 - Tutorial for Make NetCDF Raster matchup with XY data
 - ArcGIS_XYMatchup.pdf
 - Tutorial for Make NetCDF Raster and data extraction by polygon, etc
 - ArcGIS_training_NetCDF_ex1_2_3.pdf

*Tutorials and accompanying data files are included in the Google Drive “ArcGIS_Tutorials_and_Data”

