Using Satellite Data in GIS

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Versioning:
20210429,Soracco
2021,Soracco
2020, Soracco
2019, Soracco

This Training

- Component of the *NOAA CoastWatch Satellite Training Course*
- Comprised of 3 modules: Data, Tools, Exercise(s)
- Uses ESRI ArcMap, but techniques work with QGIS and other GIS software
- Updated from CoastWatch Satellite GIS training originally given in 2000 for avenue-based ArcView 3.1

This slide has no audio

A few notes on ArcMap for NOAA Users

- The exercises and screenshots were created using ArcGIS 10.7
- The current version of ArcMap is 10.8.1
- The EDC has been updated and will install with any version of ArcMap 10.4+
- ArcMap 10.8.1 is the final release of ArcMap and all future development will go into ArcGIS Pro. ArcMap 10.8.1 will continue to be supported until 2026 via the normal Esri support cycle. If you are unsure of which product to choose, consider ArcGIS Pro.
- ESRI support for ArcMap 10.8.1

ESRI support for ArcMap 10.8.1

Product Life Cycle

Product Lifecycle Policy

Product: **ArcGIS Desktop 10.8.1**
Release Date: **July 28, 2020**
Support status: **General Availability**

		General Availability Jul 2020 - Feb 2022	Extended Support Mar 2022 - Feb 2024	Mature Support Mar 2024 - Feb 2026	Retired March 01, 2026
Technical Support	Request Case	✓	✓	✓	
	Phone and Chat	✓	✓	✓	
	Online support resources	✓	✓	✓	✓
Software Support	Software updates and patches	✓	✓		
	Software hotfixes	✓	✓		
	New environment certification	✓			

Note for Software Hotfixes: For details about hotfix policies, please refer to the Developer Technologies section in the Esri Product Lifecycle Support Policy document.

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Using Satellite Data in GIS: Data

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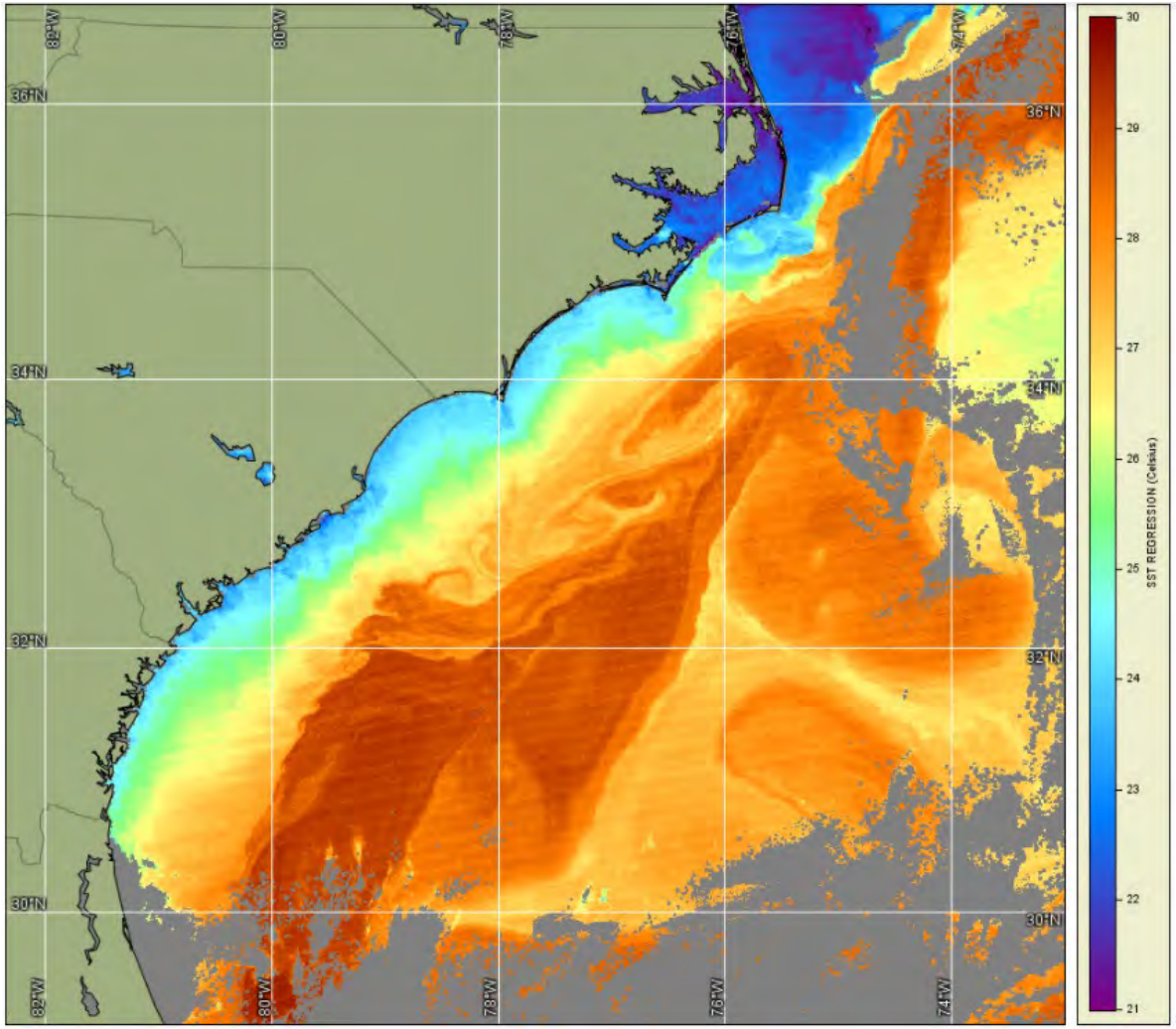
Overview

- Imagery
- Data
- Data considerations and preparation



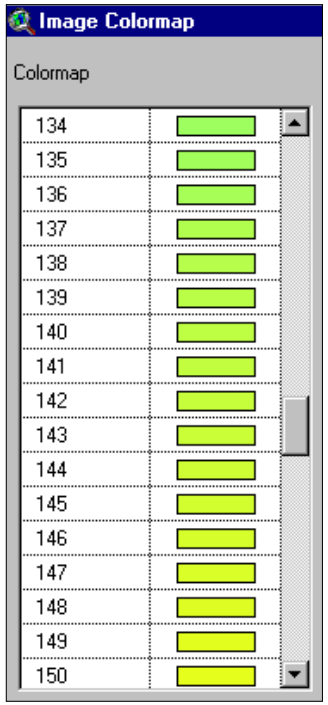
S-NPP VIIRS SST image

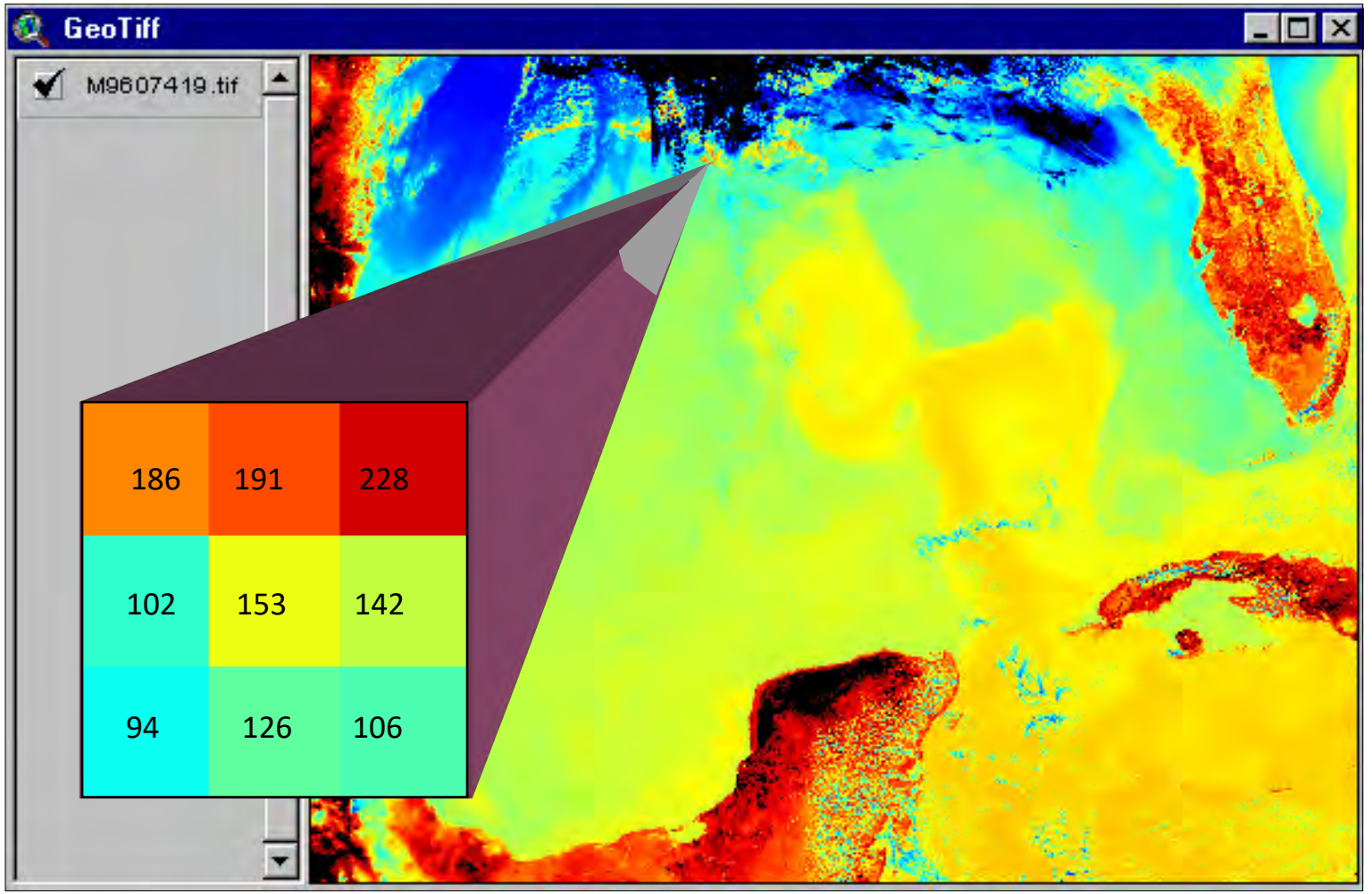
Satellite Imagery

- Visualization
- Scaled data
- Formats: PNG, JPEG, GeoTIFF

S-NPP VIIRS True Color Imagery

Example of 8-bit Image

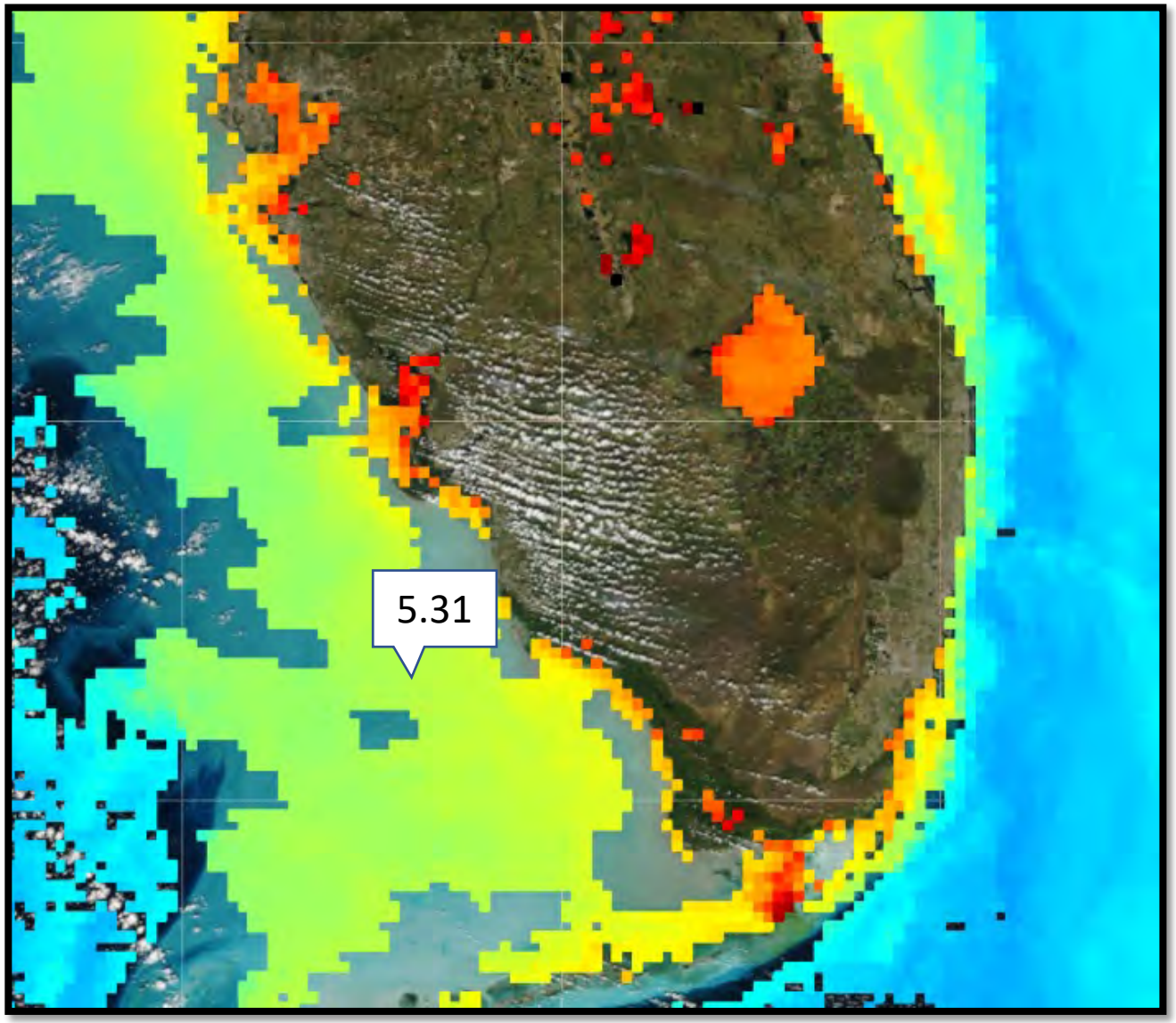




8-bit (0-255) image of Sea Surface Temperature stored in GeoTIFF

Satellite Data

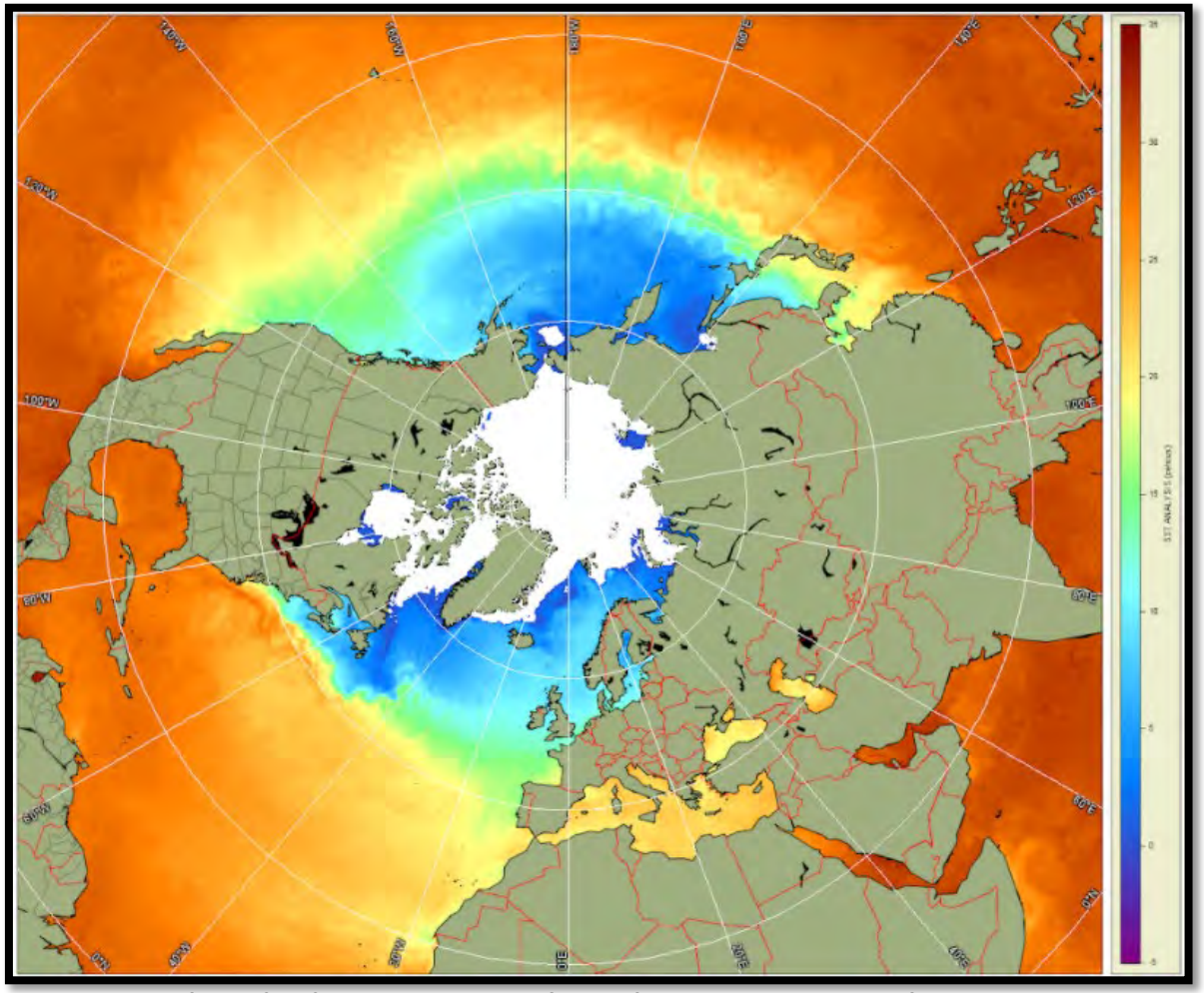
- Calculations
- Values
- Formats: HDF, NetCDF, 32-bit GeoTIFF



S-NPP VIIRS Chlorophyll-a Science Quality

Data Considerations

- Metadata
- Format
- Resolution
- Projection
  - Coordinate system
  - Datum
- Preparation



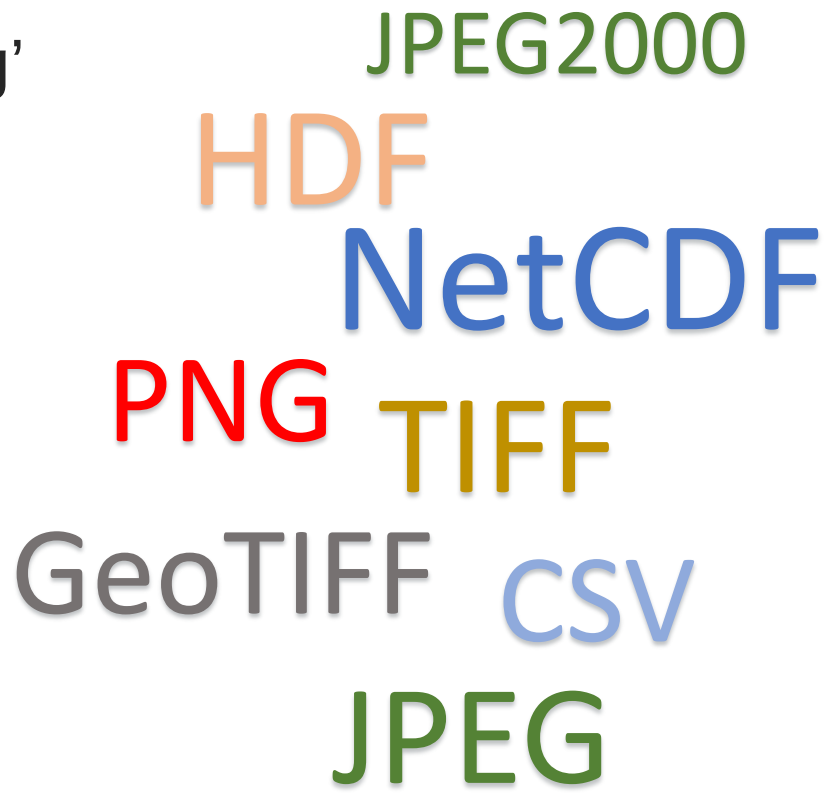
NOAA Blended SST in North Polar Stereographic Projection

Metadata

- Information about the data – usually standardized
- Methods used in collection / processing
- Custodian / Point-of-contact

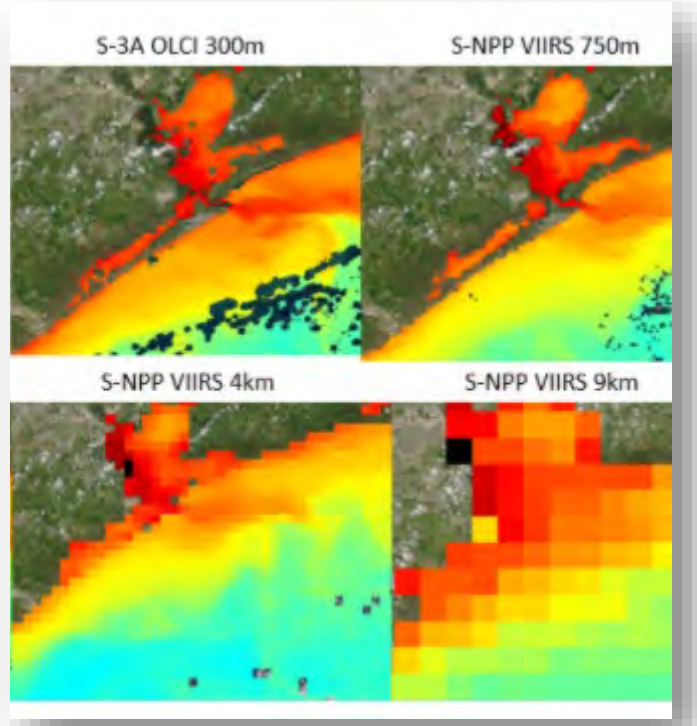
Format

- Level of embedded metadata – ‘self-describing’
- Data storage
  - Scaling / Offset
  - Compression
- Geolocation Information
  - Tags
  - Attributes
- Complexity and Compatibility



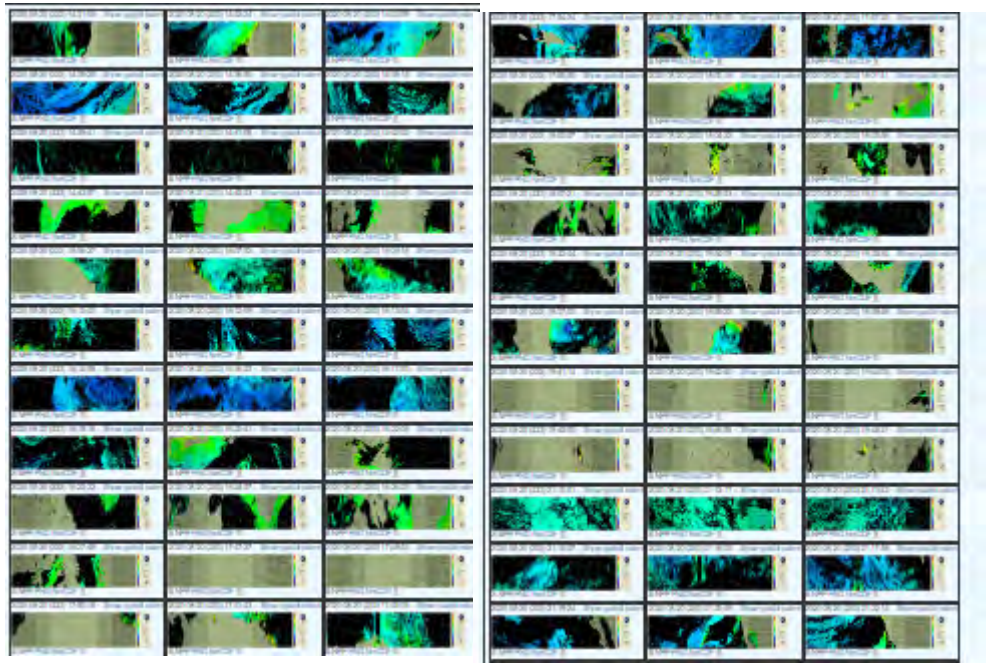
Satellite Data Product Resolution

- Spatial resolutions
  - meters to hundreds of kilometers
- Temporal resolutions
  - Minutes to days, weeks, or months
- How are data combined?



Resolutions from various chlorophyll-a products

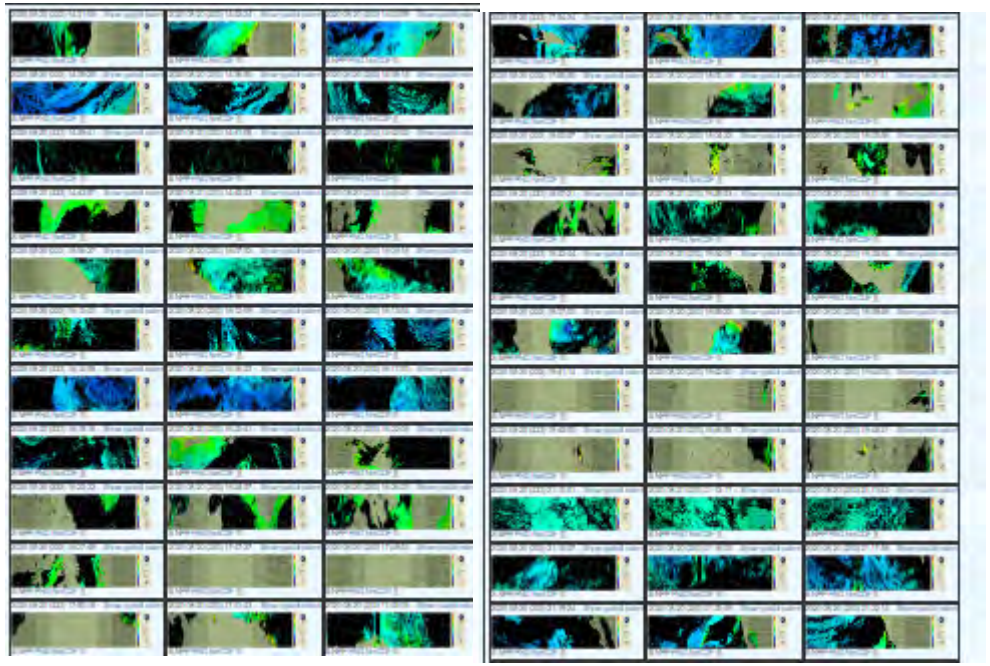
Binning



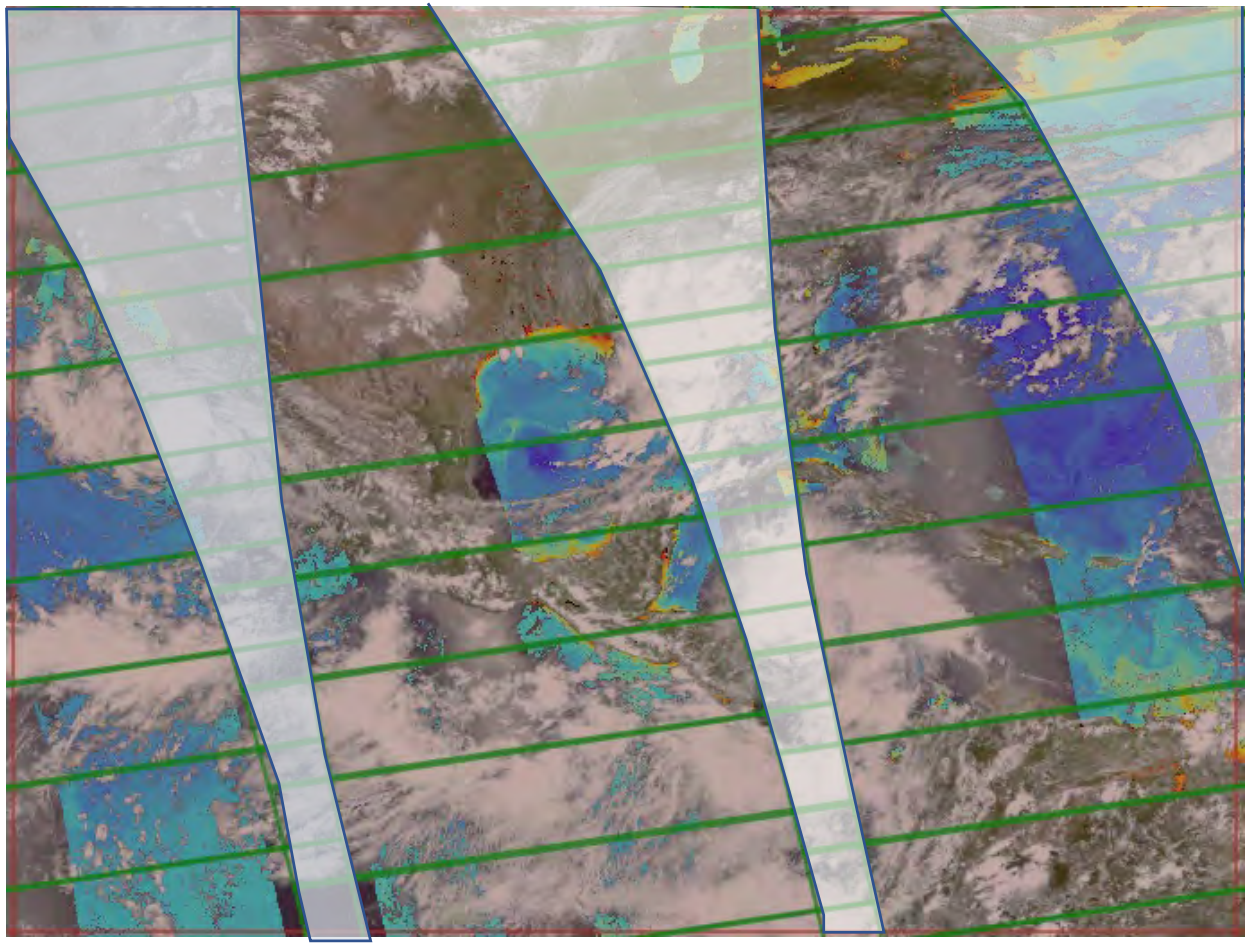
One day of granules used for CoastWatch Sector of chlorophyll-a from VIIRS

One day coverage for CoastWatch ‘Sector’

Binning: Overlapping Data



One day coverage for CoastWatch Sector of chlorophyll-a from VIIRS

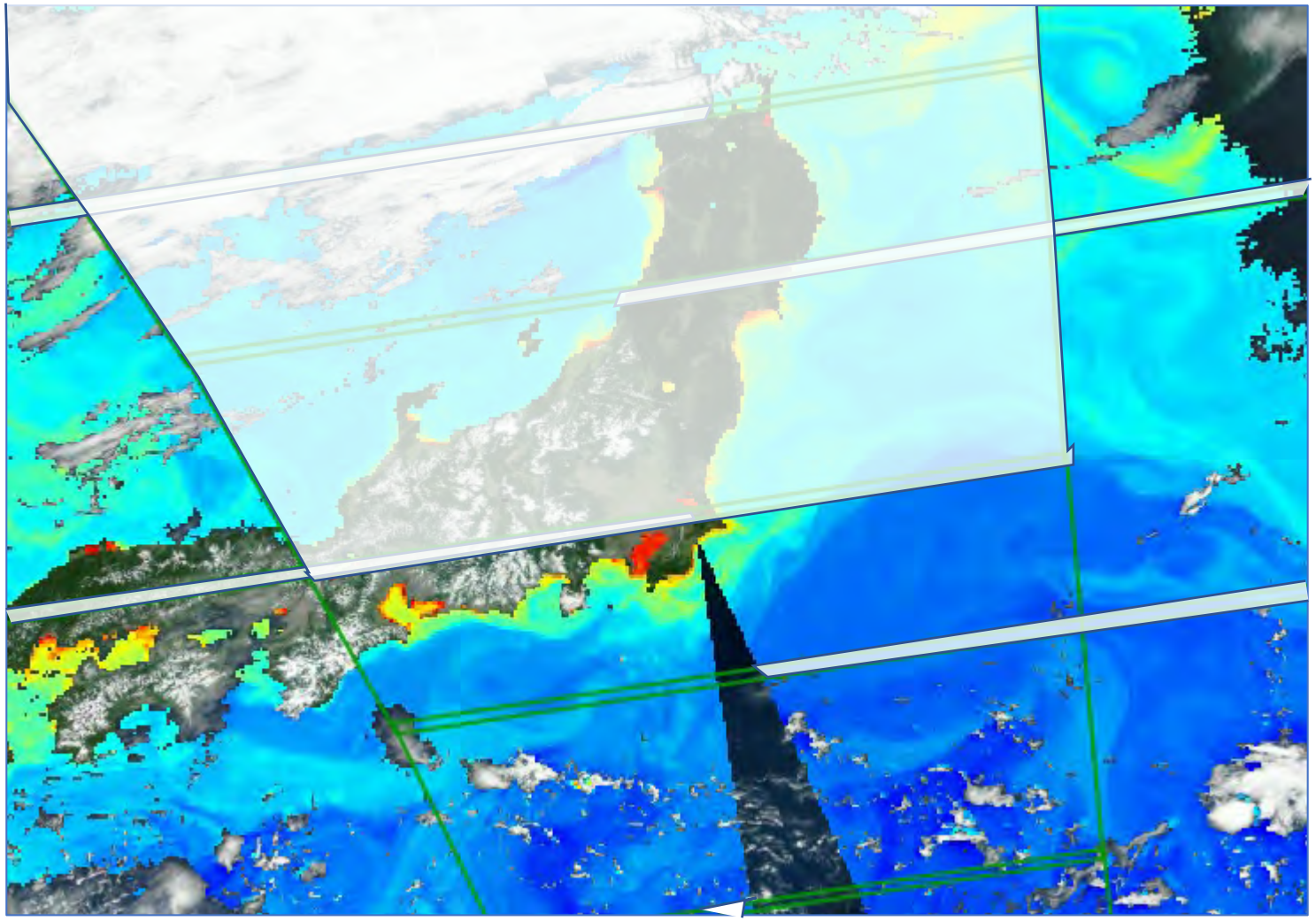


One day coverage for CoastWatch Sector of chlorophyll-a from VIIRS

Binning

- Binning may be the minimum, maximum, average, most recent, or valid value of overlapping pixels

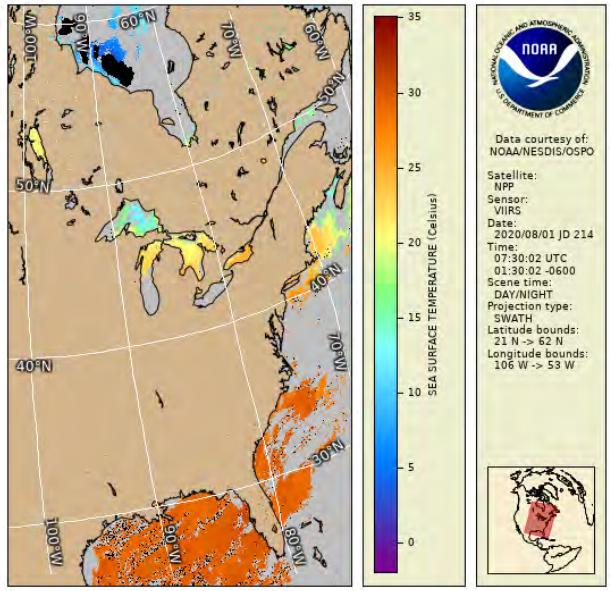
- Shaded area shows pixels affected for a single daily composite



Example of overlapping VIIRS granules in shaded area

Satellite Data Product Projections

- Satellite sensor view (Swath / Level-2)
  - Irregularly/nonlinearly spaced
  - May include unique structure based on sensor
  - Geolocations with respect to Ellipsoid and Datum
- Mapped (Gridded / Level-3, -4)
  - Coordinate system
  - Locations with respect to Ellipsoid and Datum

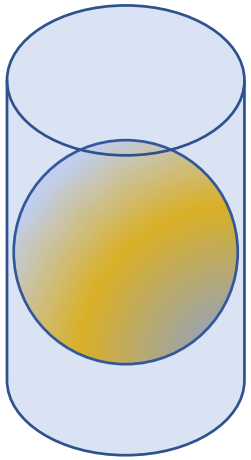


Satellite Data Product Projections

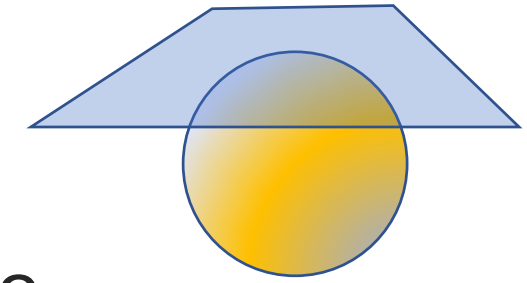
- Coordinate Systems
  - Projection constructs
  - Preserves one of the following (not all are listed):
    - Conformality (Shape)
    - Area
    - Direction
    - Distance
- Chosen based on application / scale

- Spatial distortion results from mapping

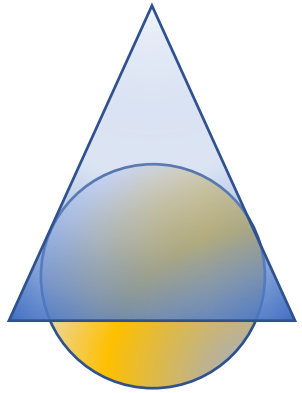
Map construct types
(not all are shown)



Cylindrical

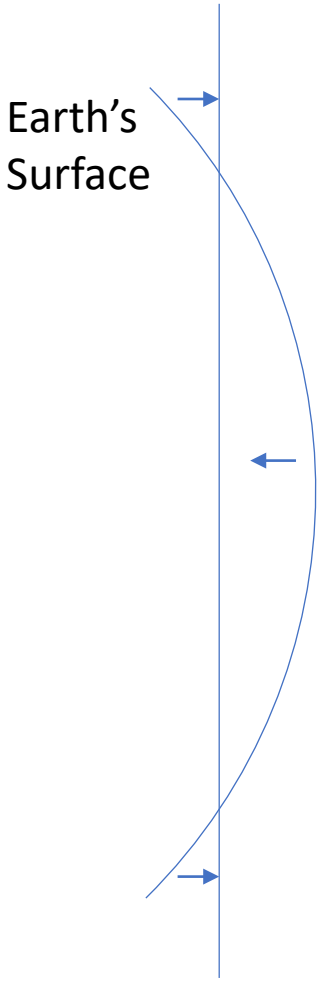


Azimuthal

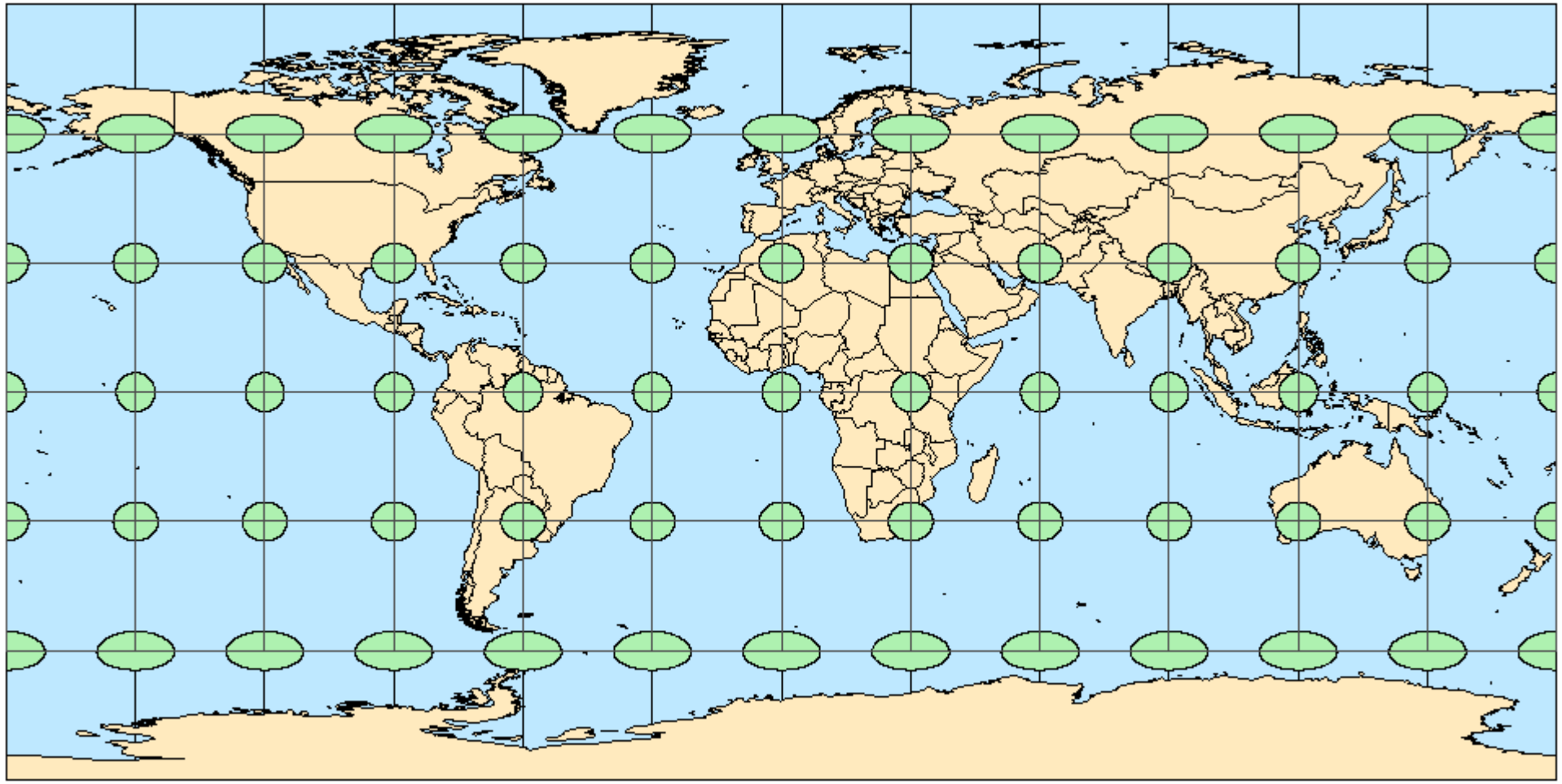


Conic

Geographic (WGS84)

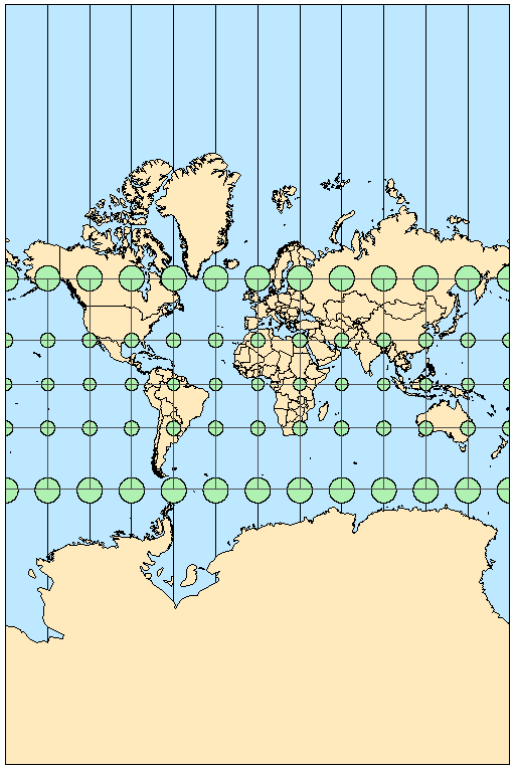


Projection Plane

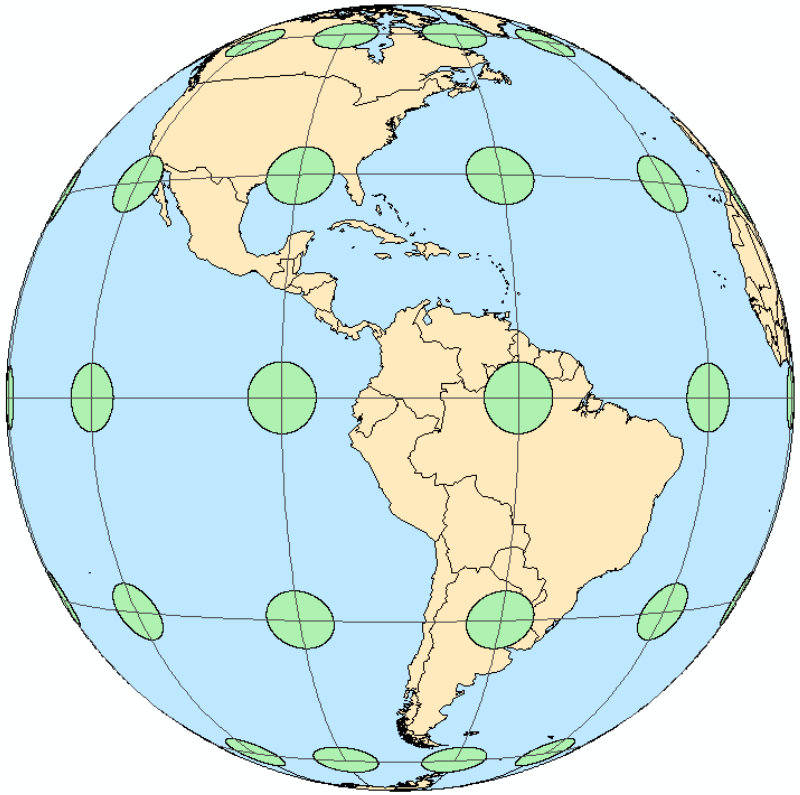


Tissot's indicatrix of circles illustrating distortion across a map

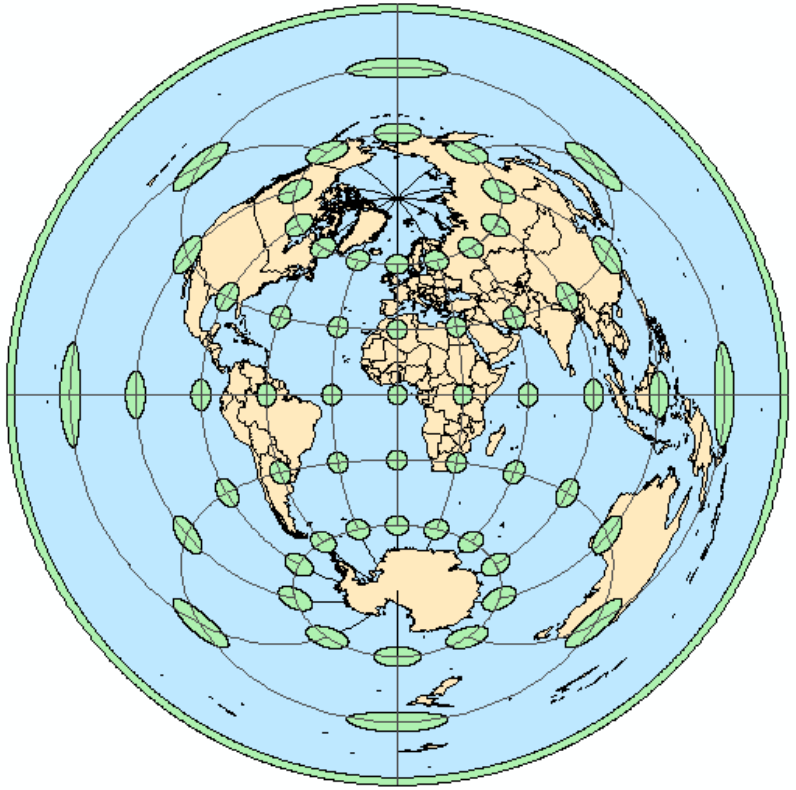
Mercator (WGS84)



GOES-16 (GRS80)

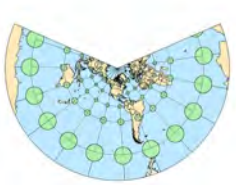


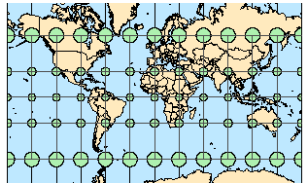
Azimuthal Equidistant



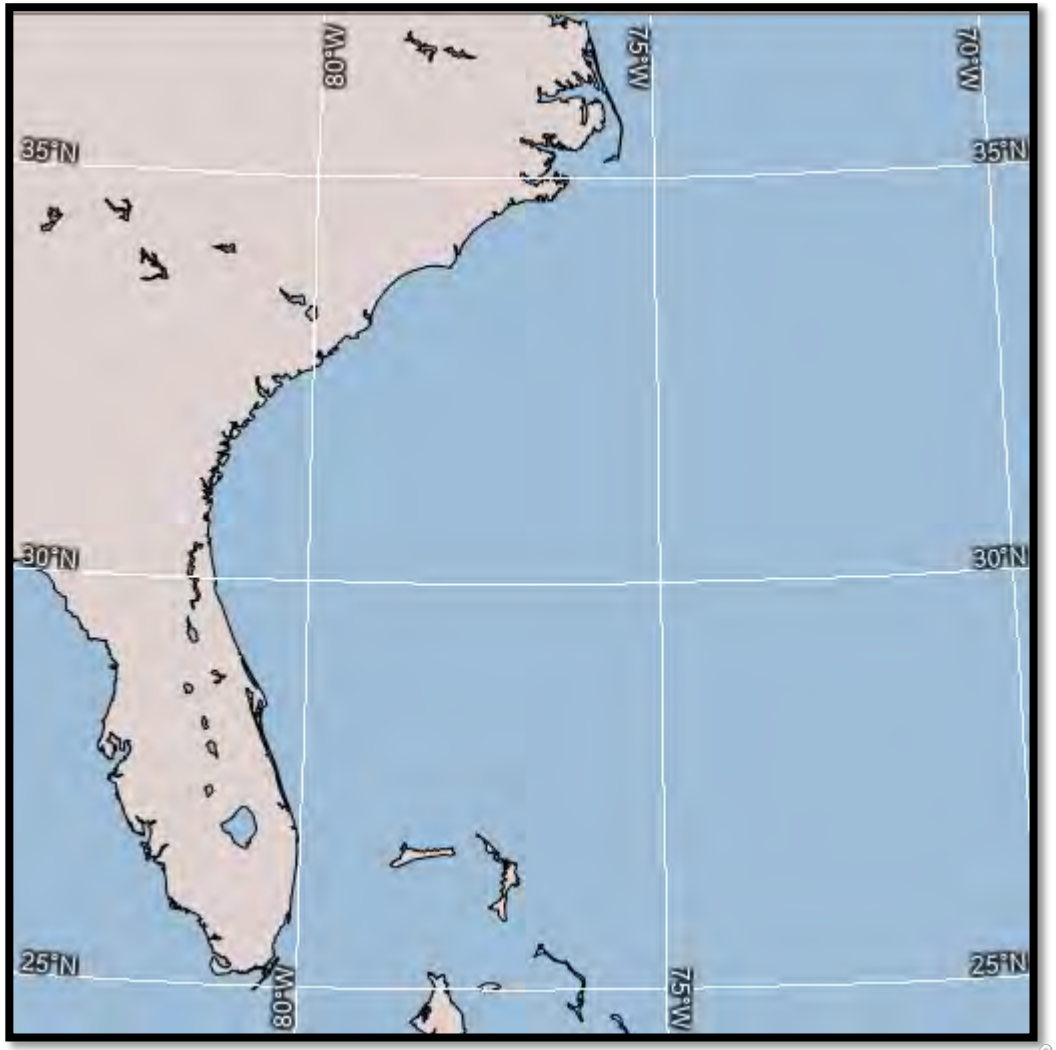
Tissot's indicatrix of circles illustrating distortion across a map

Satellite Data Product Projections - Conformality



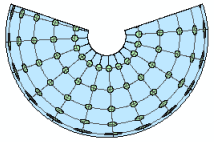


- Shape is preserved
- Representative of actual feature
- Useful for preserving shape
- Lambert Conformal Conic
- Mercator
  - Straight lines have constant bearing

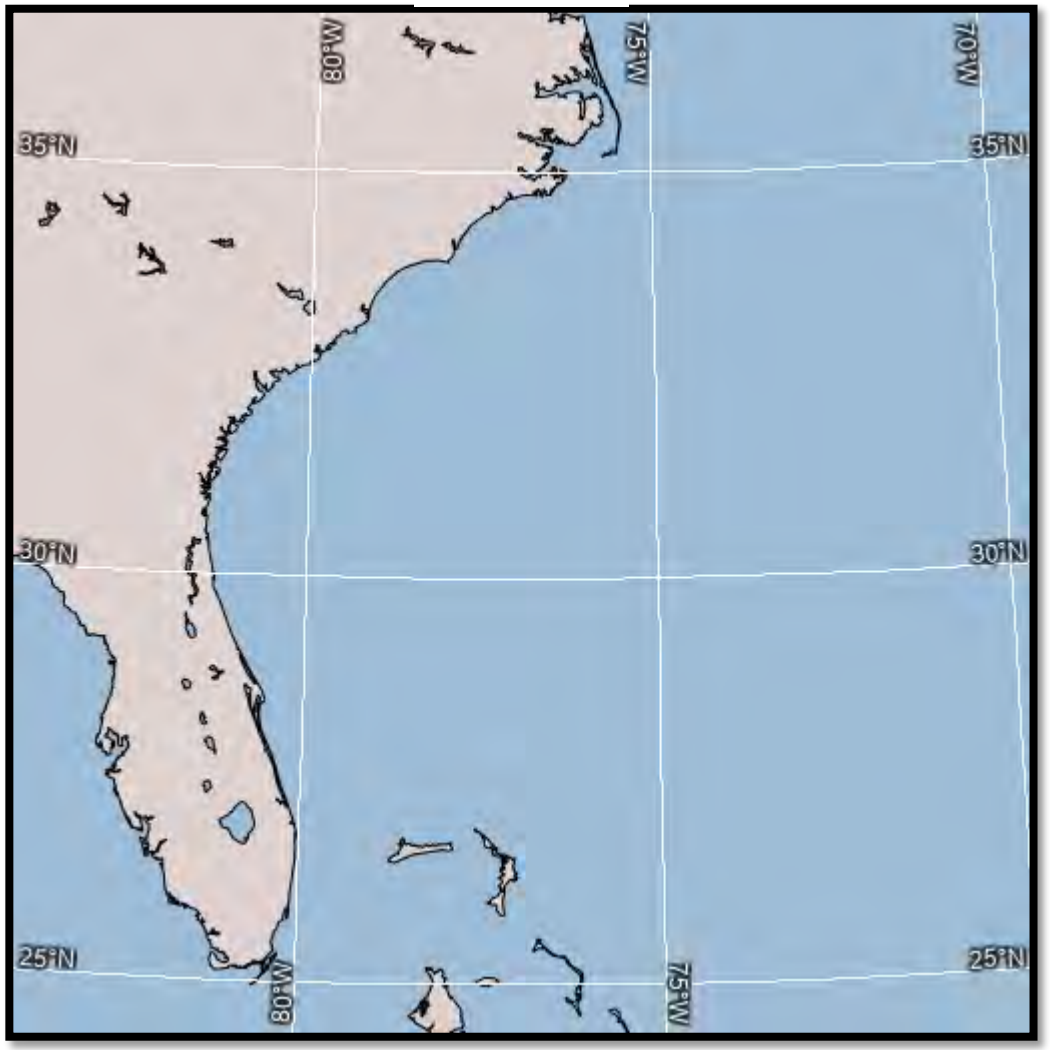


Lambert Conformal Conic preserves shape

Satellite Data Product Projections - Area



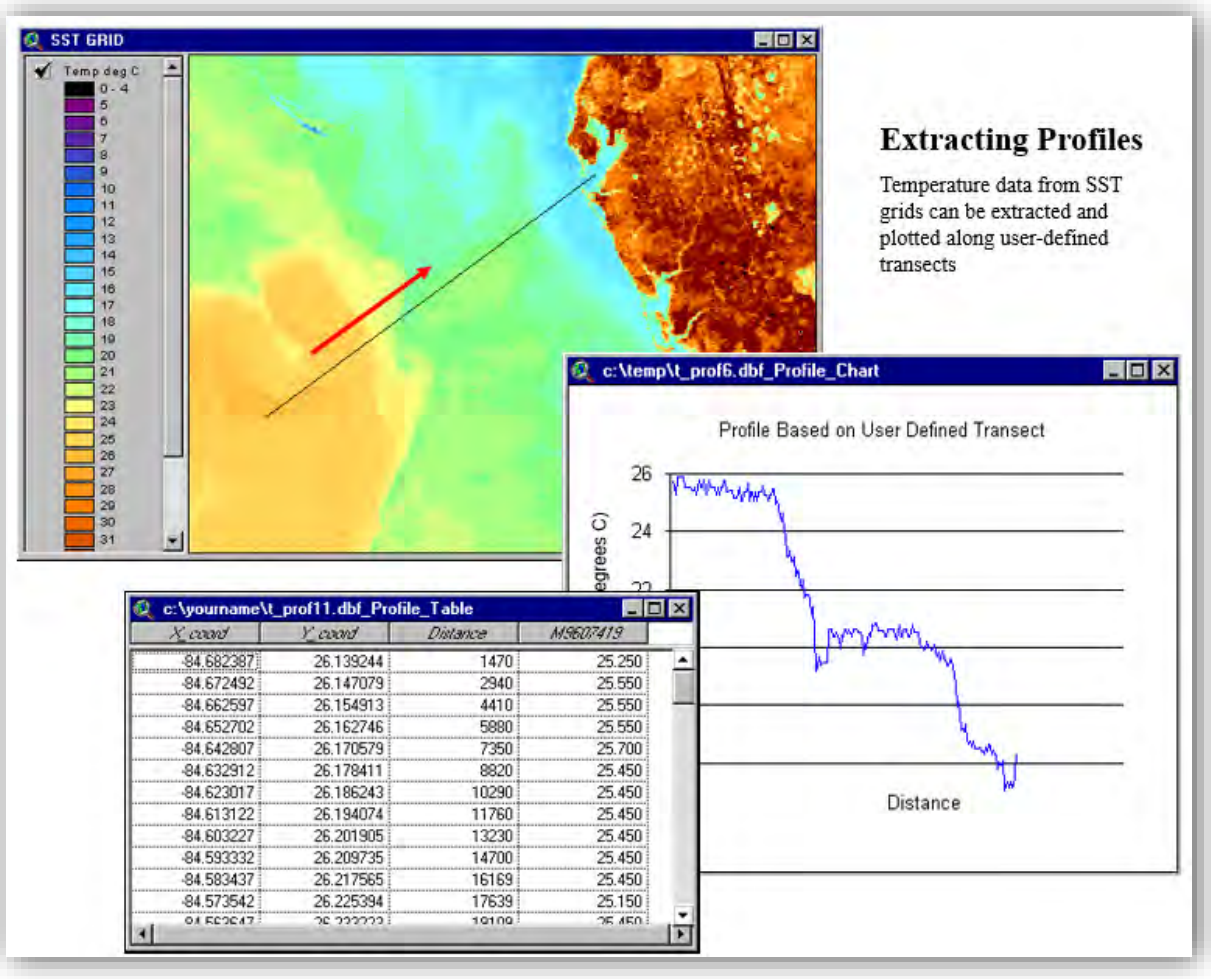
- Area is preserved
- Area measurements consistent across map
- Useful for comparison



Albers Equal-area preserves area

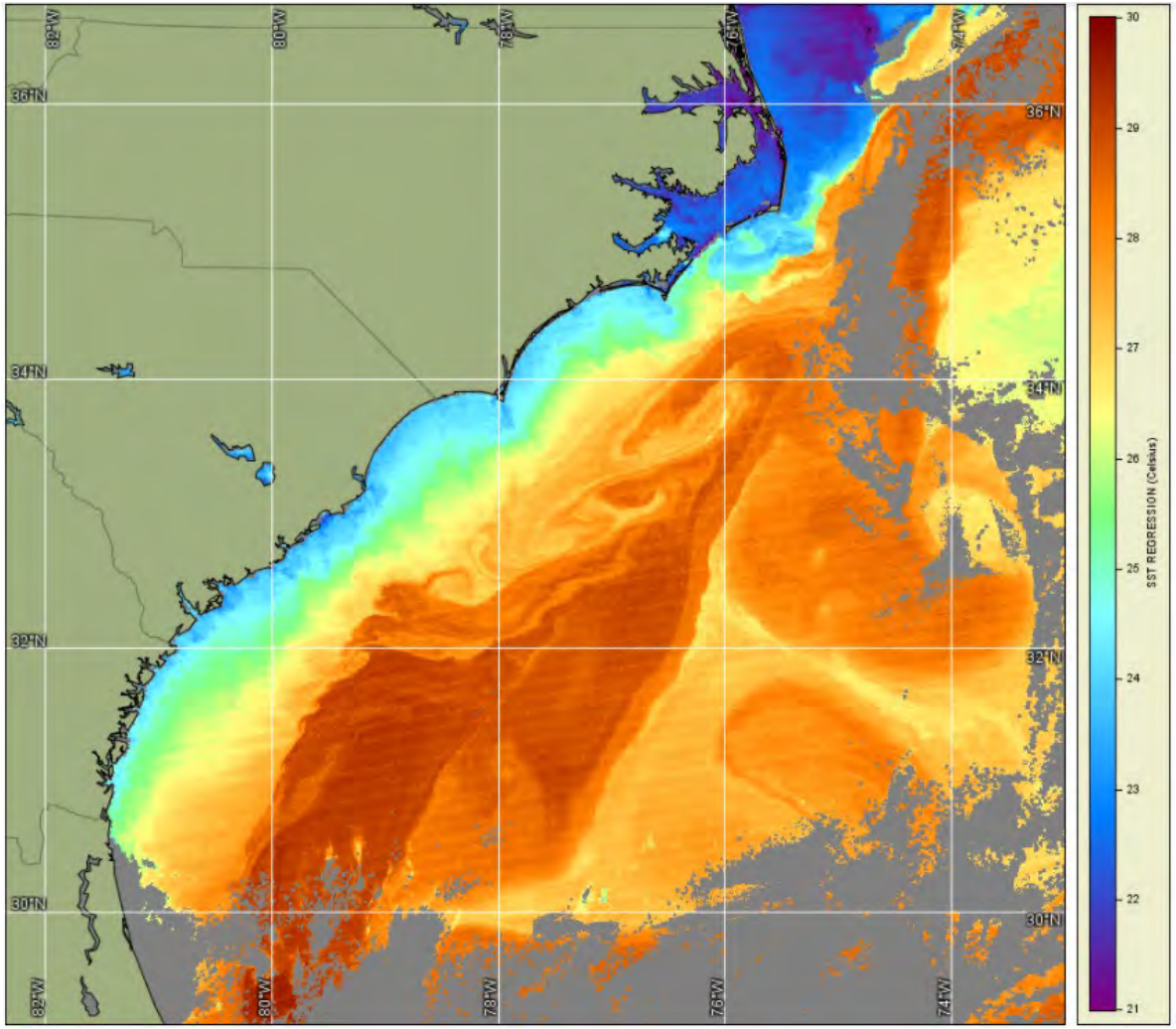
Satellite Data Preparation

- Reprojection required?
- Metadata complete?
- Values accessible?
- Compositing or binning required?



Summary

- Imagery
- Data
- Data considerations and preparation



S-NPP VIIRS SST image

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