Introduction to the CoastWatch Utilities

Part 2: Command Line Interface

Long Island Sound Training Course
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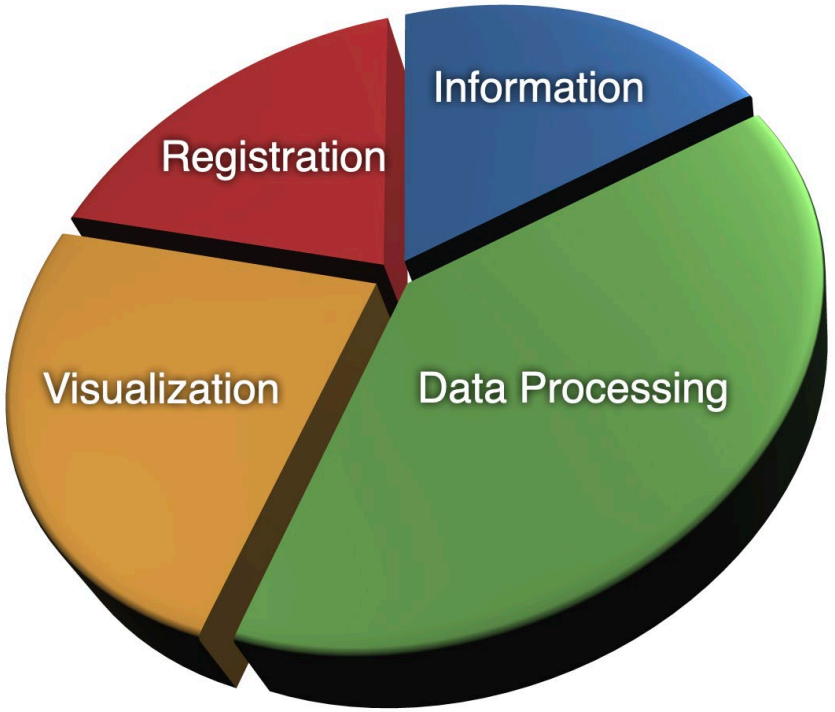
CoastWatch Utilities: Command-Line Interface (CLI)

- Graphics and Visualization
- Information and Statistics
- Data Processing
- Registration and Navigation



Command-Line tools, *Scenarios:*

1. Automating processing of satellite data
   - Series of time-ordered files
   - Incoming satellite data: near real-time data processing
2. Render all images consistently to your specifications
3. Sample data at your study locations for all files
4. Calculate statistics over regions of interest for all files
5. Composite data over a time range into a merged time-interval
   - Daily data averaged monthly
6. Perform mathematical expressions or apply masks to the data
7. Save images or data in a variety of formats
8. Import/export data between data formats

Graphics and Visualization

- **cwrender-** performs earth data visualization
- **cwcoverage-** creates an earth data coverage map
- **cwgraphics-** creates earth data annotation graphics
- **cwanimate-** creates an animation from a time-ordered series of data files

Information and Statistics

- **cwinfo-** prints earth data file information
- **cwstats-** calculates earth data file statistics for a region
- **hdatt-** reads or changes HDF metadata attributes

Data Processing

- **cwimport-** translates earth data into CoastWatch HDF
- **cwexport-** translates earth data into external file formats
- **cwsample-** extracts data values at specified earth locations
- **cwmath-** performs calculations on earth data using a mathematical expression, applies masks to the data
- **cwcomposite-** combines a time series of earth data
- **cwscript-** runs a shell script written in BeanShell

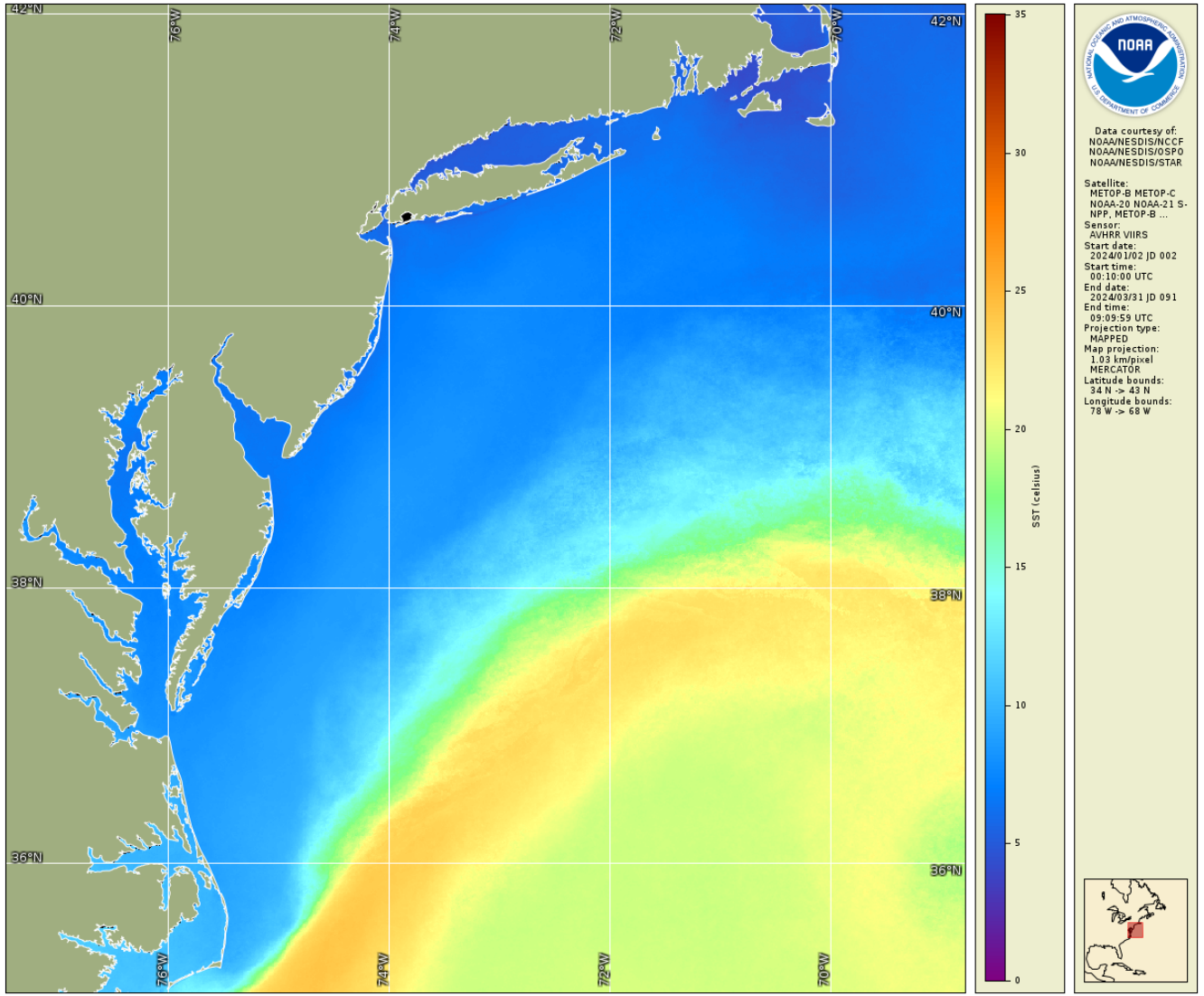
Registration and Navigation

- **cwmaster-** creates map projection master datasets
- **cwregister-** resamples gridded earth data to a master projection
- **cwregister2-** resamples gridded earth data to a master projection using a revised set of high accuracy algorithms
- **cwnavigate-** adds navigation corrections to earth data
- **cwautonav-** automatically determines a navigation correction based on earth image data
- **cwangles-** computes earth location and solar angles

Example **cwcomposite, cwrender, cwstats**

```
/bin/bash     Or use other scripting languages: Python, Perl, etc
# Generate a time series of seasonal average data files from daily data files
# Loop through each season & make composite – list of daily files per season created beforehand
   seasons_to_process=`ls daily_filelist_per_season_*.txt`

   for daily_list_for_season in $seasons_to_process; do
      $CWbin/cwcomposite  --match=sst  --method=mean  --inputs=$daily_list_for_season
                                  $season_datafile".hdf"
      $CWbin/cwrender  –enhance=sst  --palette=Rainbow  --size=$sz  --coast=$cst  --grid=$grd
                        --function=linear  --range=0/35  $season_datafile".hdf"  $output_imgfile".png"
      # run stats if set to 0 (yes)
      if [ $run_stats -eq 0 ]; then
          $CWbin/cwstats  –match=sst  --polygon=$poly_dir/$polygon_name
                                  $season_datafile".hdf"  >>  $stats_output_textfile
      fi
   done   # close the loop
```

cwrender output



cwstats output

Chesapeake Bay Main Stem Wintertime SST Avg - main stem polygon

Winter: Dec 1 - Feb 28

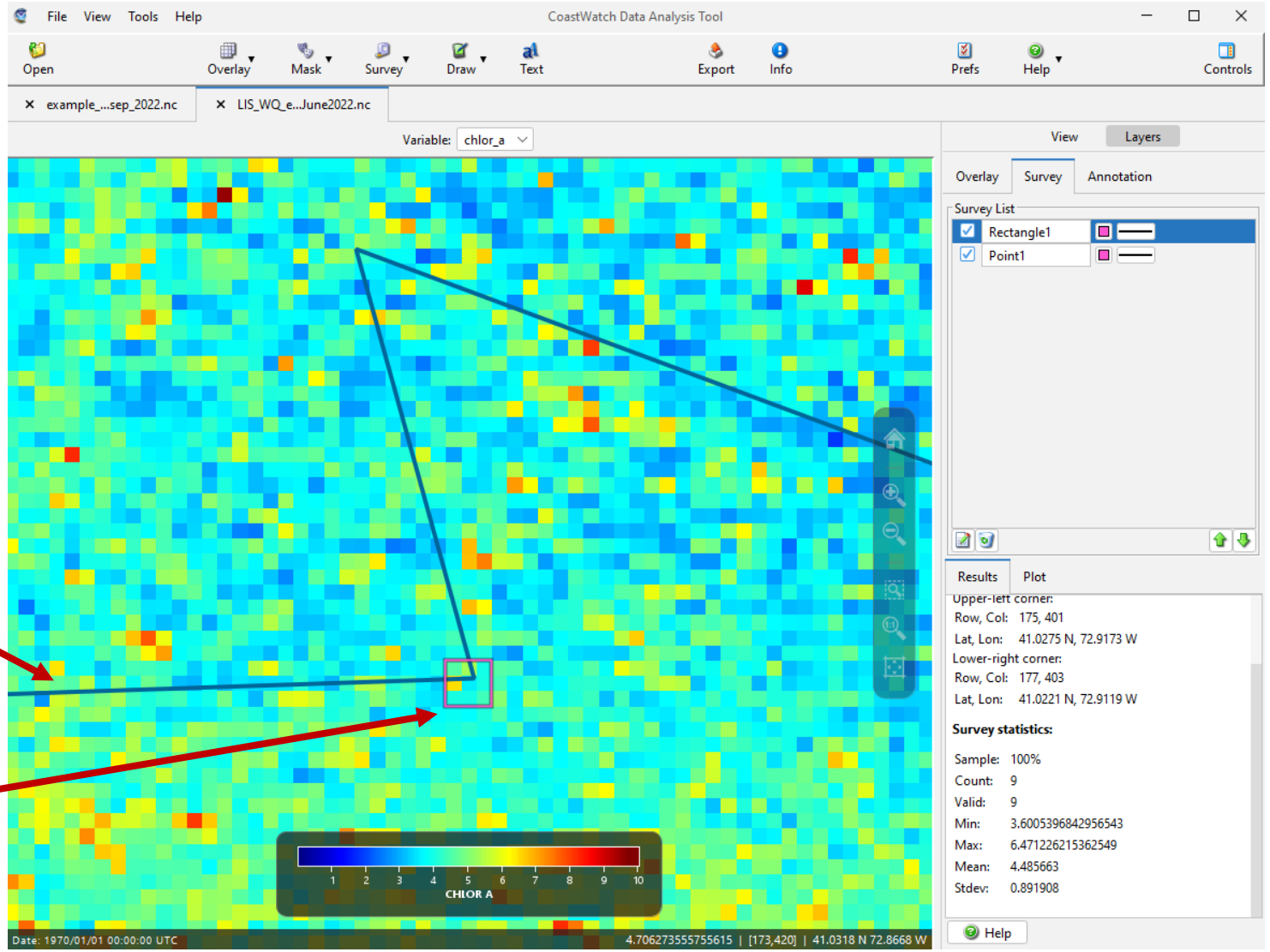
Year	Count	Valid	Min	Max	Mean	Stdev	Median
2009	14000	6517	1.52	12.9	4.987978	1.049141	4.97
2010	14000	6237	-0.59	10.89	4.6427	0.863596	4.67
2011	14000	6218	-1	12.89	3.940121	0.968498	3.97
2012	14000	6366	2.19	10.8	7.546799	0.964726	7.6
2013	14000	6357	-0.08	11.88	6.345035	1.105279	6.35
2014	14000	6455	-0.72	8.38	4.836297	0.97595	4.97
2015	14000	6421	0.42	11	4.919555	0.669765	4.89
2016	14000	6360	0.31	13.9	7.439682	1.084286	7.55
2017	14000	6423	2.15	11.15	6.697553	0.994094	6.85
2018	14000	6299	0.54	17.45	5.510498	1.477741	5.23
2019	14000	6406	0.26	11.1	5.871781	0.952214	5.8
2020	14000	6409	0.61	11.52	6.917823	1.021228	7.05
2021	14000	6413	0.06	15.3	6.516613	1.133536	6.69

Example **cwsample, cwstats**

```
/bin/bash
# From a list of ship sampling locations, print the corresponding satellite data
  value as the average of a 3x3 grid-cell box around that location
   # Note: all samples were collected on the same day

 # These two commands give nearly equivalent output
 # (the first prints all statistical measures as in the previous slide, the second prints only the mean)

 $CWbin/cwstats  –match=chlor_a  --region=$lat/$lon/$radius  $input_datafile
                >>  $statsfile.txt

 $CWbin/cwsample  –match=chlor_a  --sample=$lat/$lon  --window=3  --statsvar=mean
                $input_datafile  $statsfile.txt


 # This variation reads the ship lat & lon values from an ASCII text file and only prints the satellite data value
   # at the corresponding grid cell (not a 3x3 average) because no 3x3 grid-cell box was specified
 $CWbin/cwsample  –match=chlor_a  --samples=lat_lon_sample_locs.txt  $input_datafile  $statsfile.txt
```

Example **cwsample, cwstats**

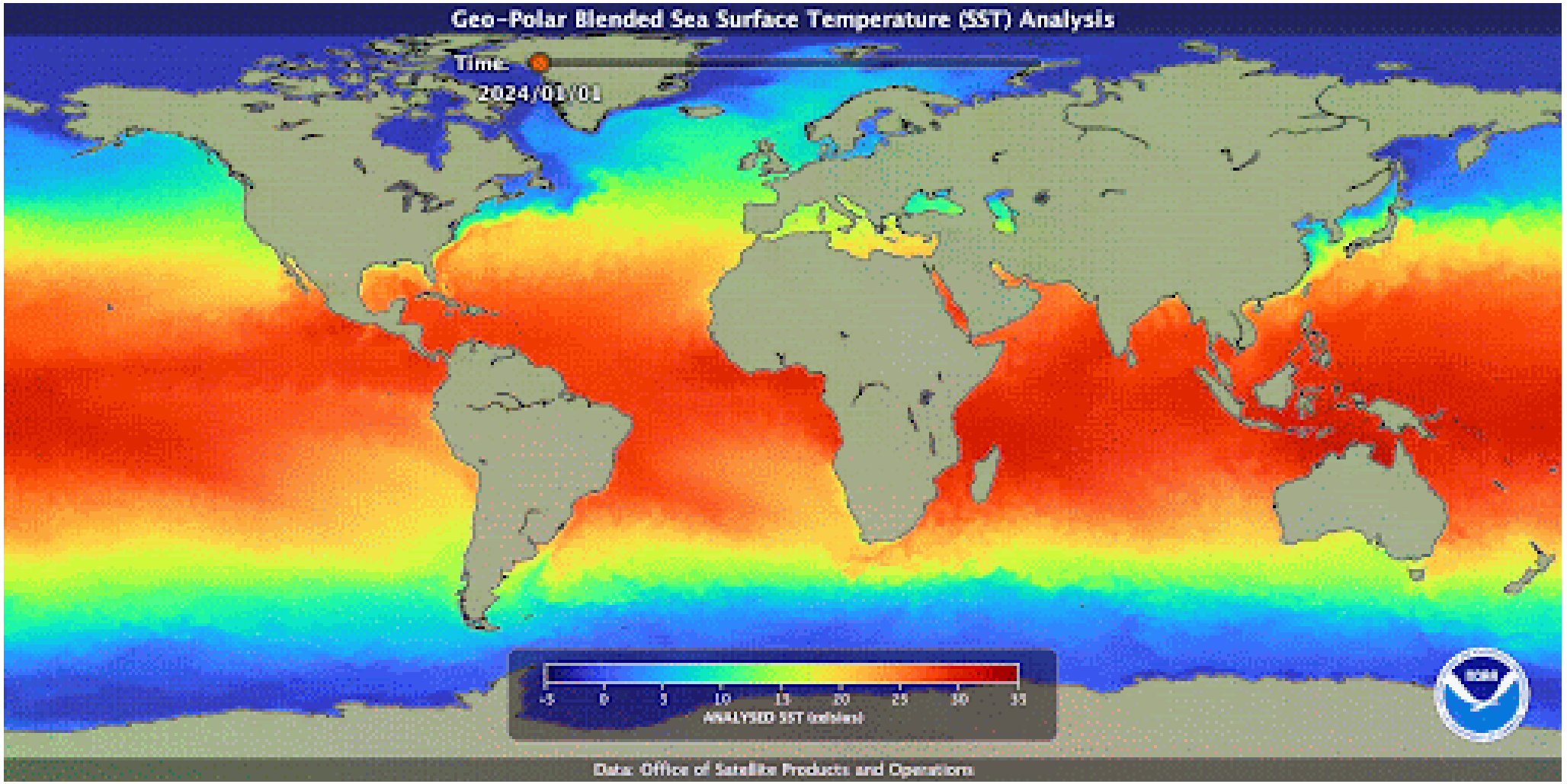
Using a 3x3 grid-cell average from the satellite data to compare with an in-situ data point at a ship sampling location



Ship track

3x3 grid cell box around the ship sampling location

Example **cwanimate:** sea surface temperature for 2024



Example **cwrender**: Hybrid image

True color image but shows SST where clouds not present