



Overview of SeaDAS 8.4.1 for the Processing, Analysis, and Visualization of Optical Remote Sensing Data for Water Quality Monitoring

Amita Mehta (NASA-UMBC-GESTAR II) Guest Speaker: Daniel Knowles

February 13, 2024



# About ARSET

#### NASA ARSET – Overview of SeaDAS 8.4.1 for the Processing, Analysis, and Visualization of Optical Remote Sensing Data for Water Quality Monitoring

- ARSET provides accessible, relevant, and cost-free training on remote sensing satellites, sensors, methods, and tools.
- Trainings include a variety of applications of satellite data and are tailored to audiences with a variety of experience levels.









# **About ARSET Trainings**

- Online or in-person
- Live and instructor-led or asynchronous and self-paced
- Cost-free
- Bilingual and multilingual options
- Only use open-source software and data
- Accommodate differing levels of expertise
- Visit the <u>ARSET website</u> to learn more.







# **Overview of SeaDAS 8.4.1**

# What is SeaDAS?

#### <u>Sea, earth and atmosphere Data Analysis System</u>

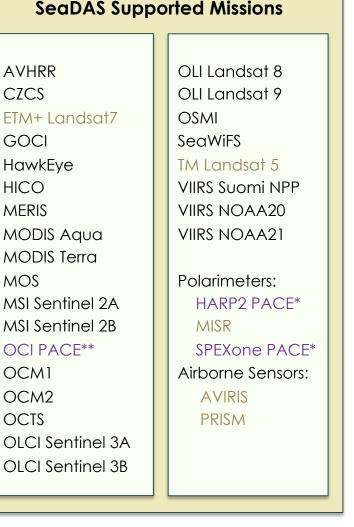
- NASA Software for the processing, visualization, and analysis of Earth science data
- Developed by NASA's Ocean Biology Processing Group (OBPG)
- OB.DAAC (Ocean Biology Distributed Active Archive Center) is a NASA EOSDIS DAAC

https://seadas.gsfc.nasa.gov

https://oceancolor.gsfc.nasa.gov

https://www.earthdata.nasa.gov/eosdis/daacs/obdaac

 EOSDIS – Earth Observing System Data and Information System



\* Limited Support

- \* Planned (Limited Support)
- \*\* Planned Full Support



#### From Daniel Knowles (OB.DAAC)

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# What is SeaDAS Used for?



- SeaDAS software is important for satellite image processing for deriving water quality parameters such as chlorophyll concentration, water surface temperature.
- SeaDAS not only allows calculations of remote sensing reflectances for multiple optical sensors, but it also offers image analysis and visualization options and allows comparison with *in situ* water quality measurements.



# Why SeaDAS 8.4.1?



- The current version of SeaDAS 8.4.1 has evolved with data processing capability for additional sensors such as Sentinel-3 OLCI, Sentinel-2 MSI, and upcoming sensor: PACE OCI.
- The earlier version of SeaDAS science data processing could only be used on the Mac operating system (macOS) and Unix/Linux operating system. The current version can also be used on the Windows system.

OLCI: Ocean and Land Color Instrument PACE: Plankton, Aerosol, Cloud, and Ocean Ecosystem MSI: Multi Spectral Image OCI: Ocean Color Instrument





# **Training Learning Objectives**



By the end of this training, participants will be able to:

- Identify expanded sensor data processing capability of the latest version of SeaDAS 8.4.1 for sensors such as OLCI and MSI.
- Use key SeaDAS tools to analyze and visualize a water quality parameter, such as chlorophyll-a concentration, from Sentinel-3 OLCI for a given water body.
- Improve awareness of the plans for incorporating future PACE data processing into SeaDAS.



# the VIS & NIR

• **SPEXone**: Narrow swath, hyperspectral (UVNIR), 5 viewing angles

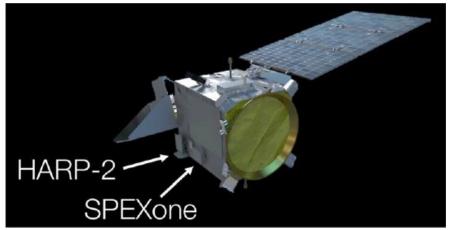
# Plankton, Aerosol, Cloud, and Ocean Ecosystem (PACE)

PACE is NASA's next great investment in hyperspectral earth imagery and multi-angle polarimetry.

- Launch Date: No sooner than February 6, 2024
- 3-year design life; 10-year propellant
- Hyperspectral Imager: Ocean Color Instrument (OCI)
  - Spectral Resolution: UV to SWIR (340-890 nm every 2.5 nm, with 940, 1038, 1250, 1378, 1615, 2130, & 2250 nm)
  - Temporal Resolution: 2 days
  - Spatial Resolution: 1-km<sup>2</sup> at nadir
- Two Multi-Angle Polarimeters
  - HARP-2: Wide swath, hyper-angular, 4 bands across









# **Prerequisites**



- <u>Fundamentals of Remote Sensing</u>
- <u>Monitoring Coastal and Estuarine Water Quality using Remote Sensing and In Situ</u>
   <u>Data</u>



# **Training Outline**



- SeaDAS User Software: General Image Analysis Tools
- SeaDAS Science Processing Software: OCSSW
- SeaDAS Reference Workflows
- SeaDAS for PACE Data Analysis and Visualization
- Demonstration of SeaDAS Workflow Case Study: OLCI Level-2 and Level-3 Data Processing

#### Homework

Opens February 13 – Due February 29 – Posted on Training Webpage

A certificate of completion will be awarded to those who attend this live session and complete the homework assignment(s) before the given due date.

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#### Amita Mehta ARSET Instructor NASA-UMBC-GESTAR II



Daniel Knowles Jr. Software Developer NASA Ocean Biology Distributed Active Archive Center





### Contributors



Aynur Abdurazik

Software Engineer NASA Ocean Ecology Lab/SAIC SeaDAS Application Lead



#### **Bing Yang** Software Developer NASA Ocean Biology Distributed Active Archive Center/SAIC





# How to Ask Questions



- Please put your questions in the Questions box and we will address them at the end of the webinar.
- Feel free to enter your questions as we go. We will try to get to all the questions during the Q&A session after the webinar.
- The remainder of the questions will be answered in the Q&A document, which will be posted to the training website about a week after the training.



# **Useful Definitions**

https://oceancolor.gsfc.nasa.gov/

### OC: Ocean Color

Ocean Color is the apparent hue, shade, or tone of water that results from the interactions of sunlight with the microscopic composition of the water column and water itself. Typical relevant water constituents include phytoplankton, mineral particles, and dissolved organic matter.

### **IOPS:** Inherent Optical Properties

Describe the fundamental optical properties of the ocean (total absorption and backscattering coefficients), from which a host of bio-optical and bio-geochemical properties can be derived.

### **Rrs**<sub> $\lambda$ </sub>: Remote Sensing Reflectance

Surface spectral remote-sensing reflectances observed by the satellite instrument after atmospheric correction.

#### Rhos<sub>a</sub>: Surface Reflectance

Surface spectral reflectances observed by the satellite instrument after Rayleigh correction.









# **SeaDAS Historical Perspective**



- 1987 "System Concept for Wide Field-of-View Observation of Ocean Phenomena from Space"
  - Specifications report outlines SeaWiFS as an improved ocean color sensor
    - Nimbus-7 Coastal Zone Color Scanner (CZCS) had ceased operating (Oct 1978 – June 1986)
      - Early 1990s SeaDAS Vision:
        - » Provide user community with tools to work with the satellite data



- Visualization & Analysis of distributed NASA products: levels 1, 2, and 3
- Processing: Identically reproduce all standard NASA products: levels 1, 2, and 3
- » Continually evolve to keep up with technology



# SeaDAS Historical Perspective (Continued)

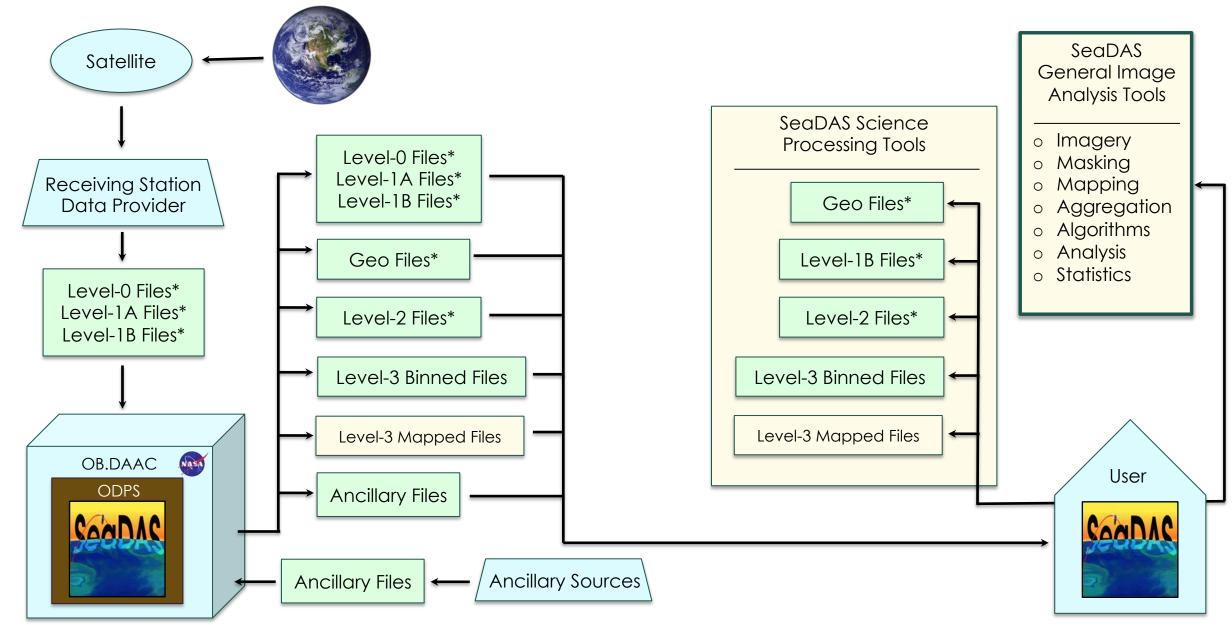
- 1994 July SeaDAS Beta Release
  - SeaDAS (SeaWiFS Data Analysis System)



- 1997 Sep SeaDAS Release (Version 3.0B3): Supports SeaWiFS Operations
- 2012 SeaDAS Integrates BEAM GUI Interface Software
- 2021 SeaDAS Integrates SNAP GUI Interface Software
- **2023** Supports 24 Missions (Version 8.3.0)
  - SeaDAS (Sea, earth and atmosphere Data Analysis System)

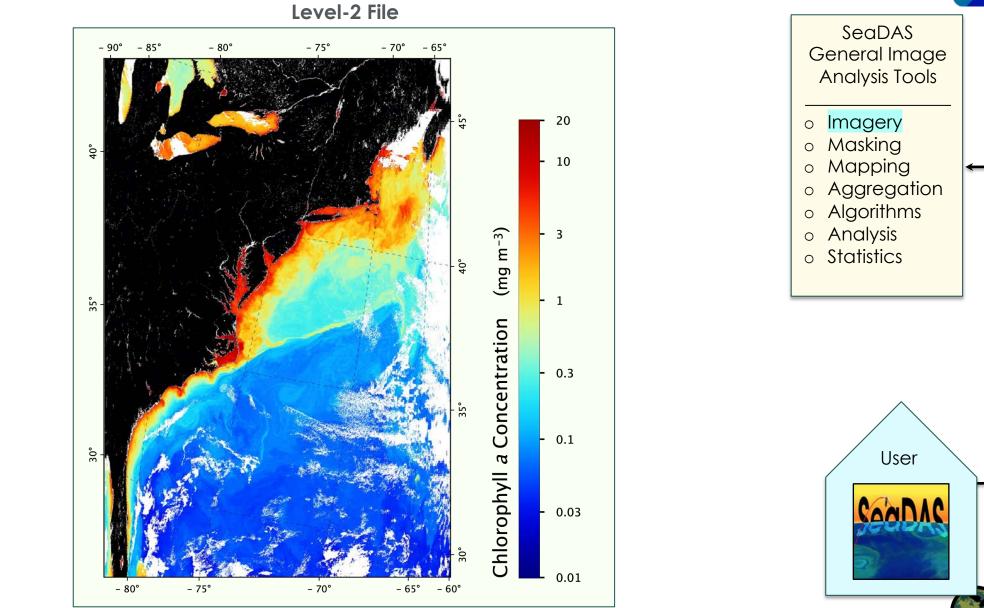






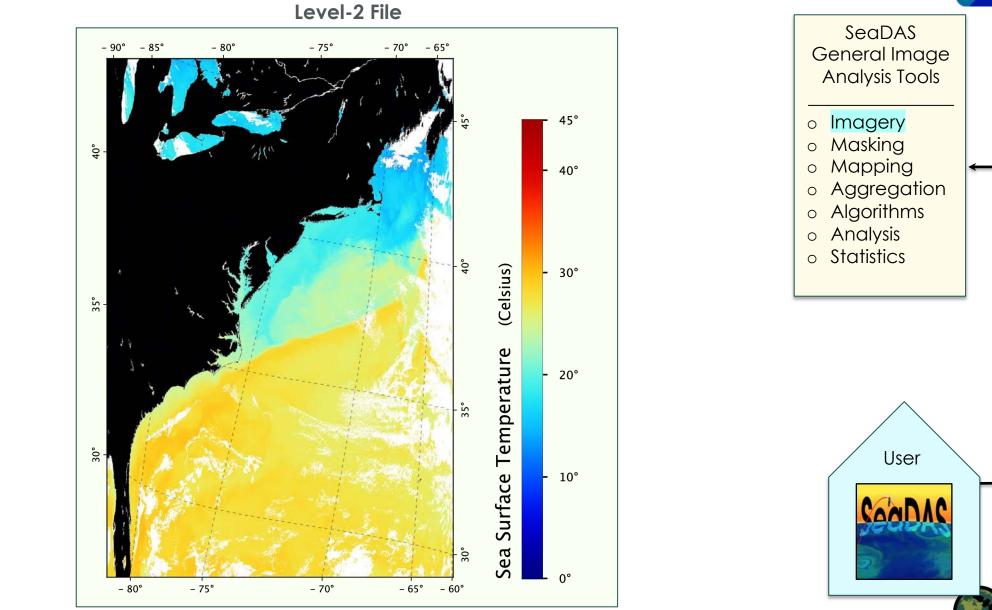
\* Mission Dependent





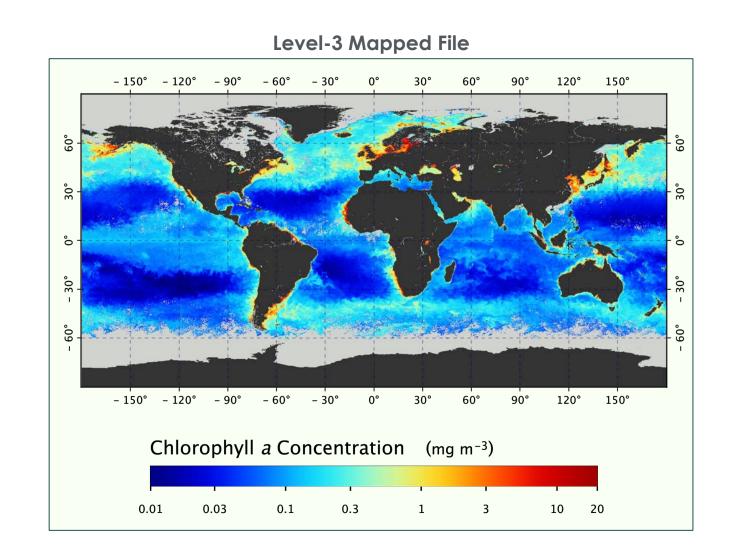
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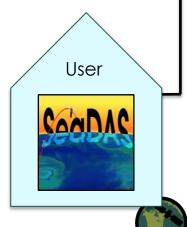


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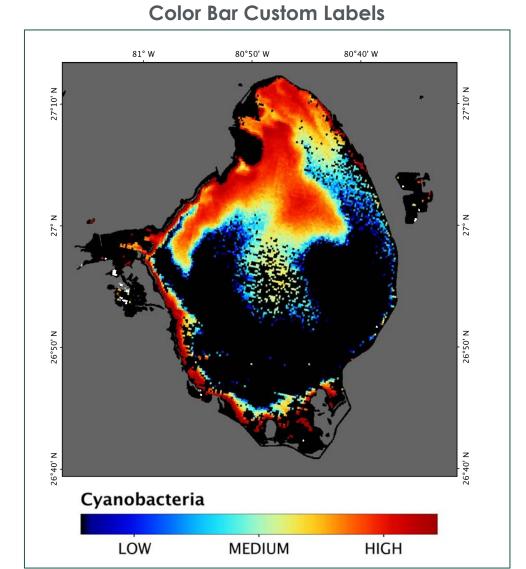


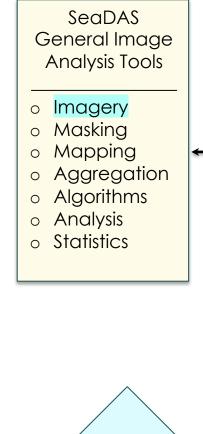


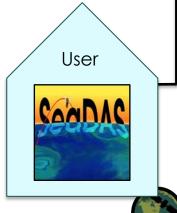


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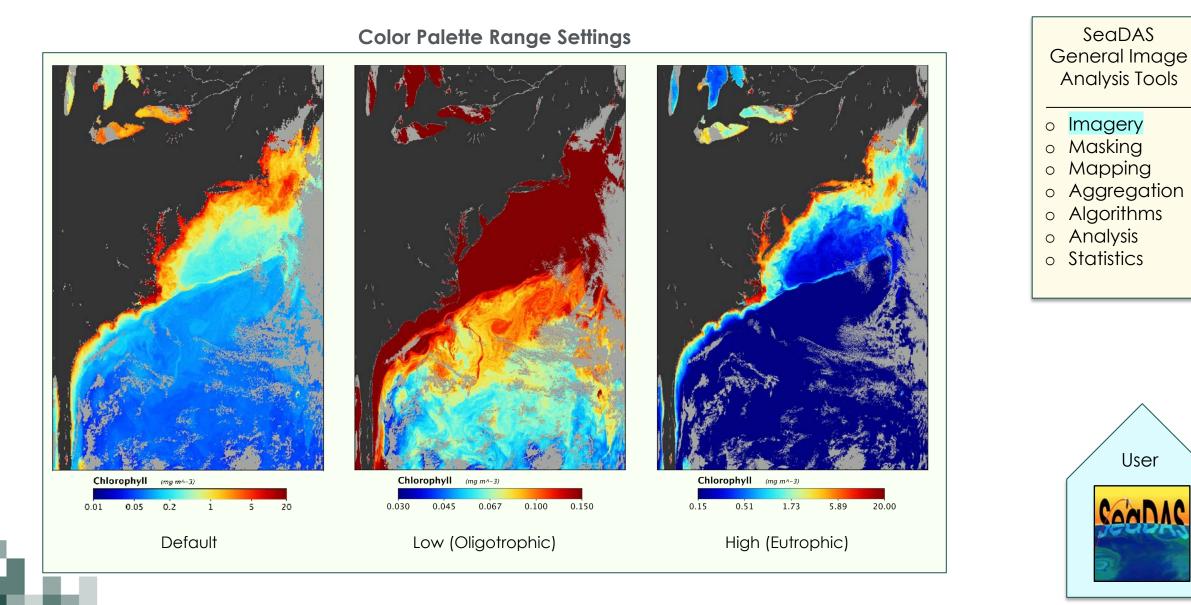






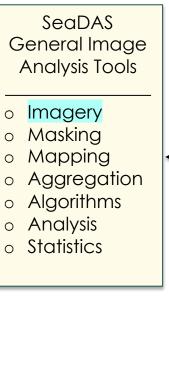
Lake Okeechobee: June 22, 2011 Source Data: MERIS M2011173153504

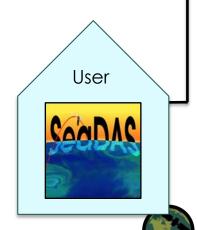






**Band Combinations RGB Imagery** Pseudo True Color Distinguish Ice, Snow, Clouds R=2130, G=1240, B=469 R=645, G=555, B=469

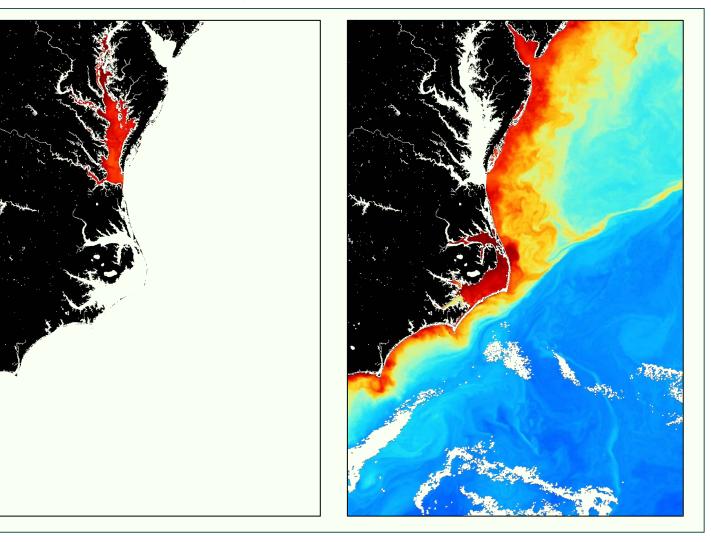




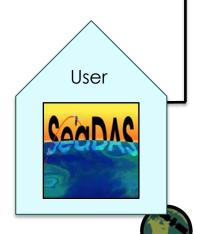
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Masking Regional Areas of Interest



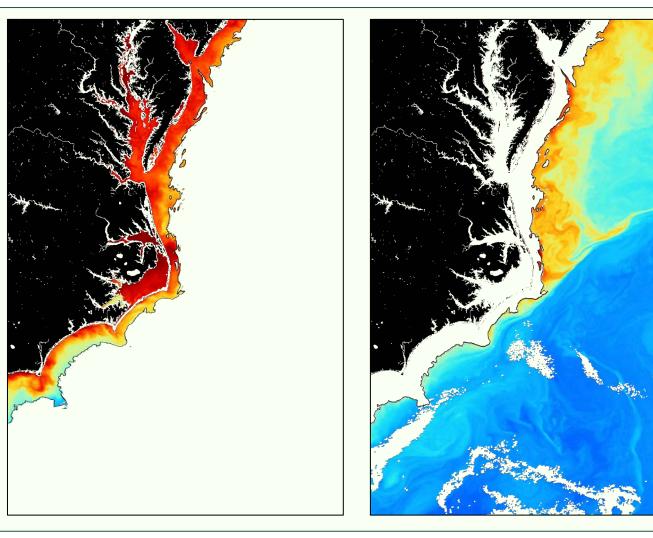


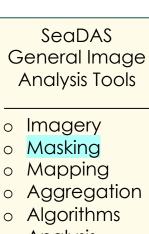


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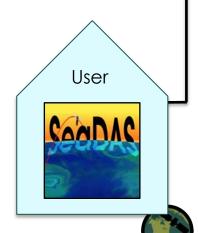


Masking Water Depth (Bathymetry)



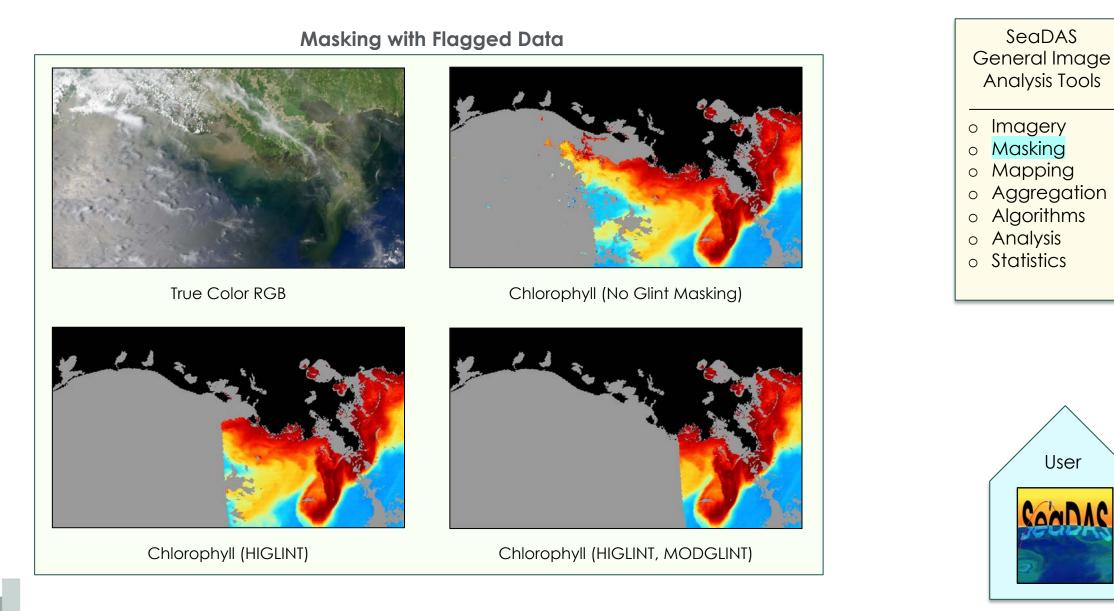


- Analysis
- Statistics



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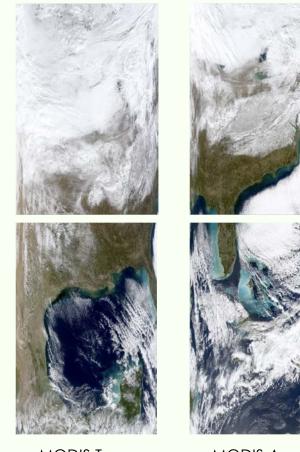




User



Image Aggregation

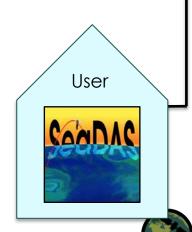


MODIS Terra (Two Level-2 Files)



MODIS Terra/Aqua (Four-File Aggregation) 24 January 2016



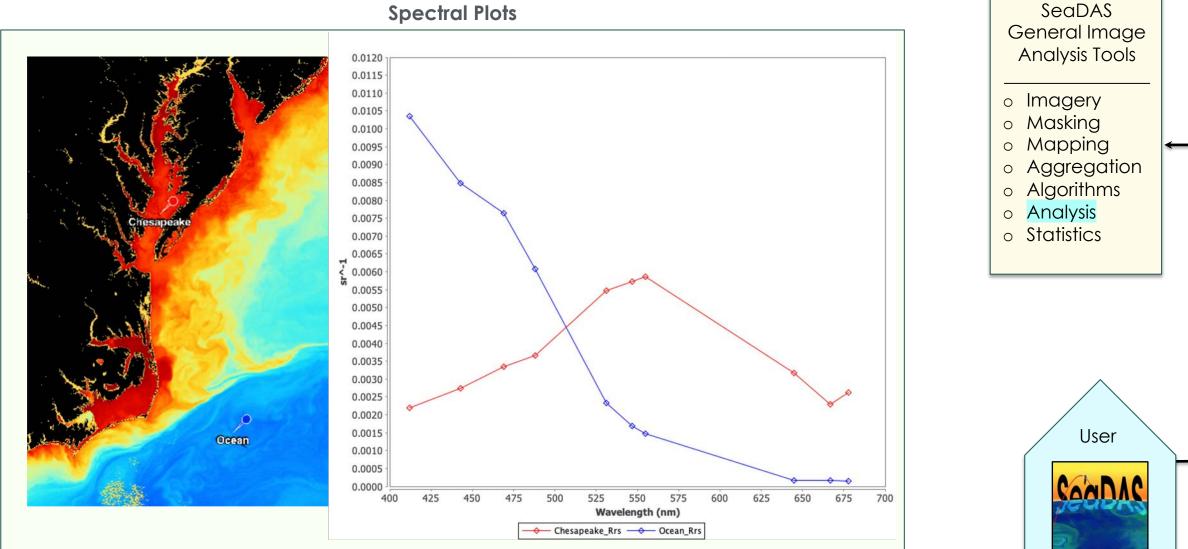


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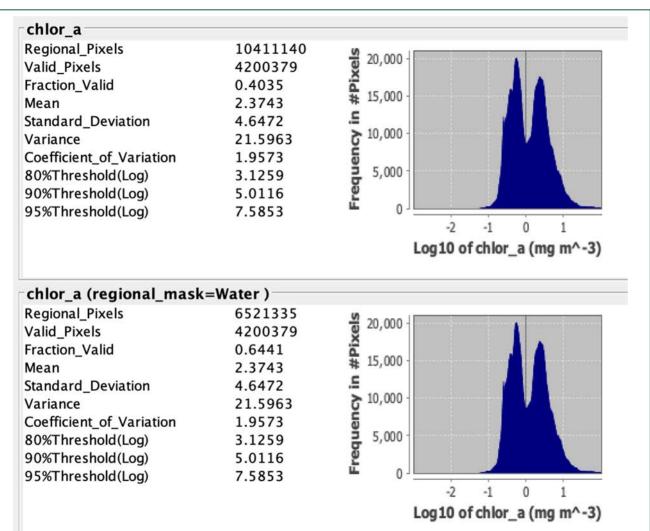
SeaDAS **Custom Math Expression Bands** General Image Analysis Tools Target product: [2] AQUA\_MODIS.20101010T180501.L2.OC.nc o Imagery Kd\_490\_calculated Name: Masking Mapping Diffuse attenuation coefficient at 490 nm, KD2 algorithm Description: • Aggregation Unit: m^-1 Algorithms Spectral wavelength: 490.0 • Analysis o Statistics Virtual (save expression only, don't store data) ✓ Replace NaN and infinity results by NaN Generate associated uncertainty band Band maths expression: exp10( -0.8813 -2.0584 \* pow(log10(Rrs\_488/ Rrs\_547),1) + 2.5878 \* pow(log10(Rrs\_488/ Rrs\_547),2) -3.4885 \* pow(log10(Rrs\_488/ Rrs\_547),3) -1.5061 \* pow(log10(Rrs\_488/ Rrs\_547),4)) + 0.0166 User Edit Expression... Load... Save... Cancel Help

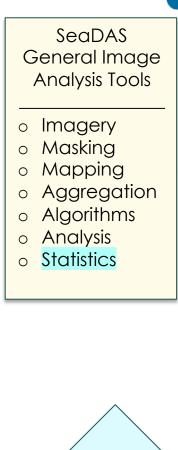


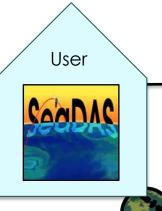




Level-2 File







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SeaDAS General Image

Analysis Tools

o Imagery

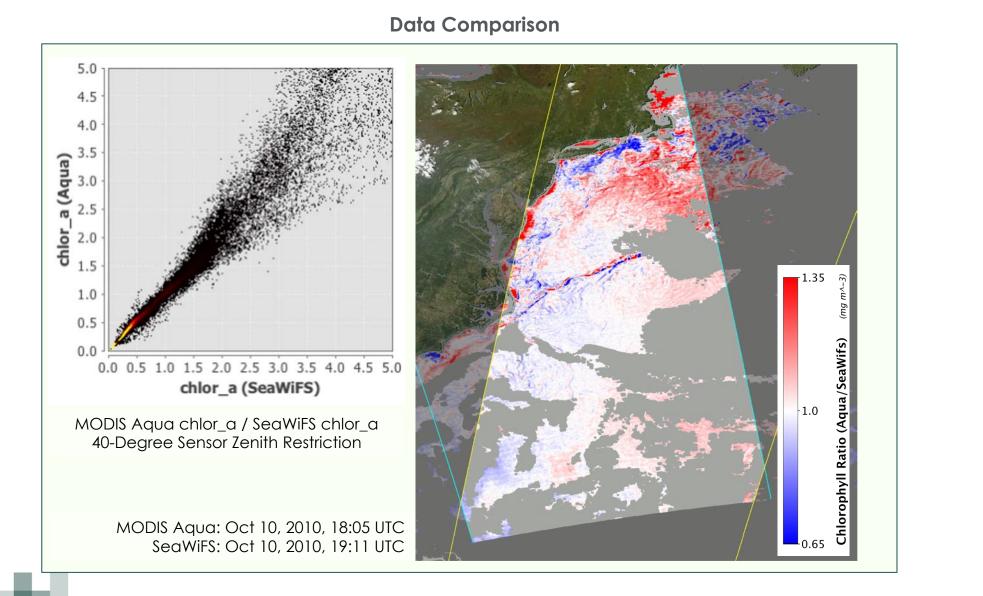
o Masking

• Mapping

• Analysis

o Statistics

o Aggregationo Algorithms

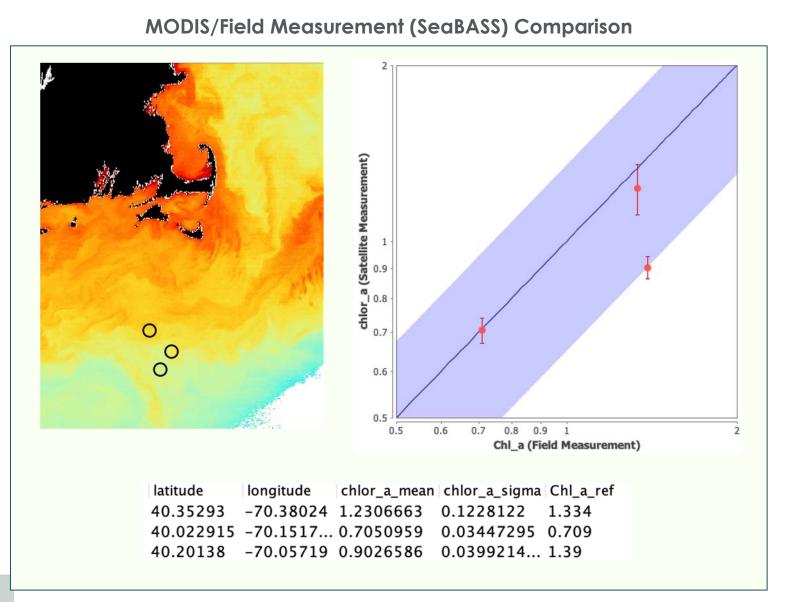


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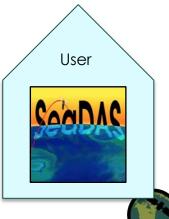
User

# SeaDAS User Software: SeaBASS File Integration



SeaBASS Files Comparison Plots Location Overlays

Matchup Extraction



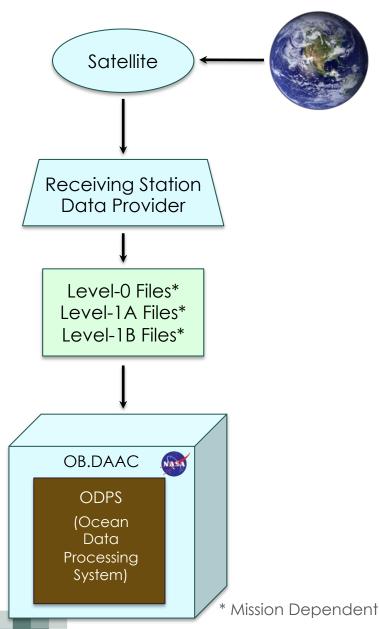
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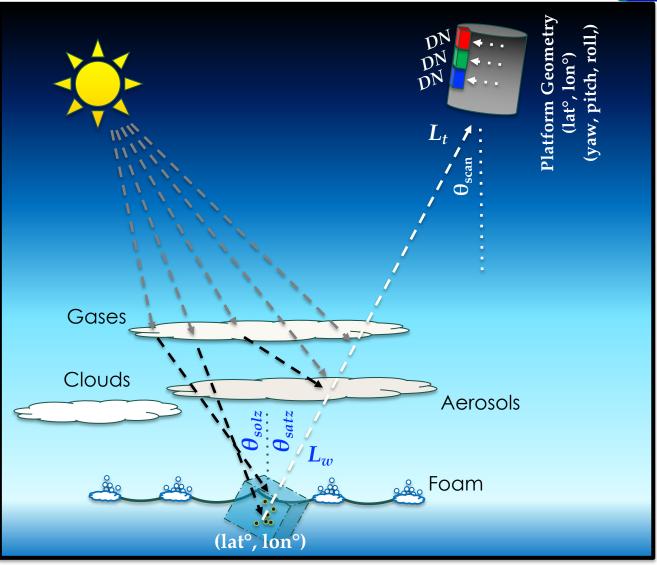


## SeaDAS User Software Science Processing Software OCSSW

## SeaDAS-OCSSW OB.DAAC: Data Downlink and Acquisition

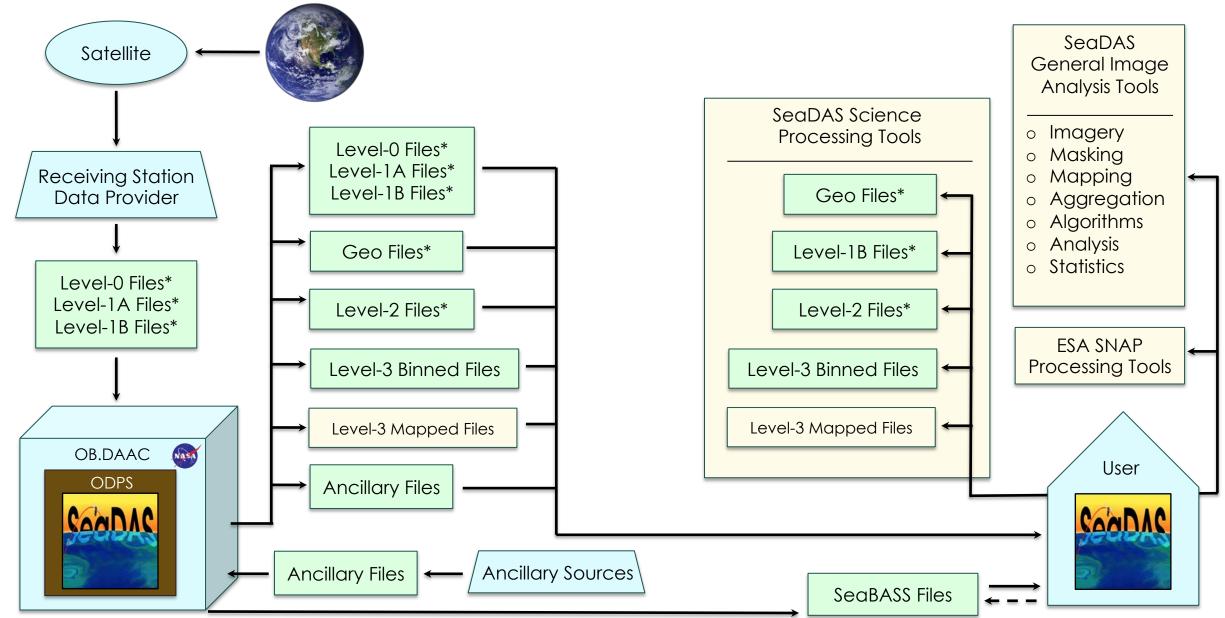








### SeaDAS-OCSSW OB.DAAC: Software Data Flow and Tools

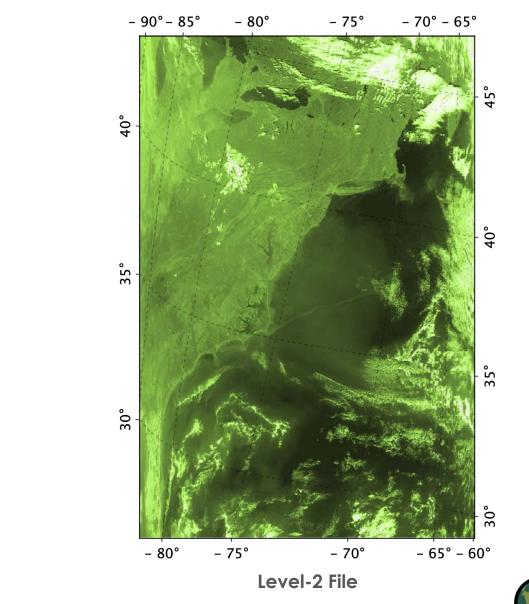


\* Mission Dependent

Level-2 File: Key Points

• Each pixel gridded same as corresponding L1A and L1B files





Each pixel contains time and location 0 Adjacent pixels may or may not be geographically adjacent 0 • MODIS has some 500m and 250m bands\* o Contains derived geophysical variables o OC, IOP, SST Suites Contains level-2 flags 0 Instrument Calibration has been applied 0 Atmospheric correction has been applied 0 Vicarious Calibration has been applied Ο Ancillary data has been applied 0 File format is mission independent 0

#### User Options

- $_{\odot}$  Many additional geophysical, ancillary, and geometric products
- Atmospheric correction and processing options
- $_{\odot}$  Users can set many of the flag thresholds

Native Resolution

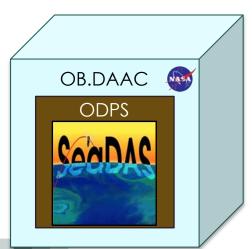
 $_{\odot}\,$  MODIS has some 500m and 250m bands

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Level-2 Files Geophysical Products OC IOP SST Flags Native Pixels (Location, Time) Atmospheric Correction Vicarious Calibration Terrain Correction



-	DB.DAAC Level-2 Data: Dhysical Products: OC Suite
Rrs	Remote Sensing Reflectance
chlor_a	Chlorophyll Concentration
Kd_490	Diffuse Attenuation Coefficient
pic	Particulate Inorganic Carbon
рос	Particulate Organic Carbon
aot	Aerosol Optical Thickness
par	Photosynthetically Available Radiation
ipar Available Radiation	Instantaneous Photosynthetically
nflh	Normalized Fluorescence Line Height
angstrom	Aerosol Angstrom Exponent

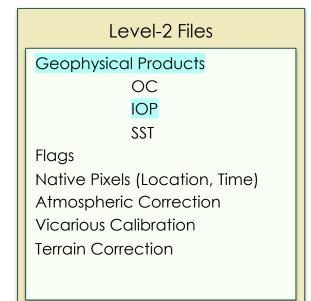
Product (Rrs) for each applicable visible band of the satellite sensor

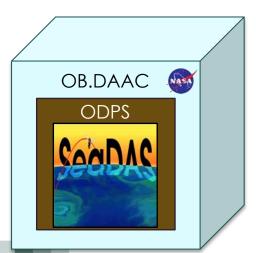
"par" is currently estimated as above the surface, new algorithm will be developed for below the surface.

Algorithms available at: <u>https://oceancolor.gsfc.nasa.gov/resources/atbd</u>









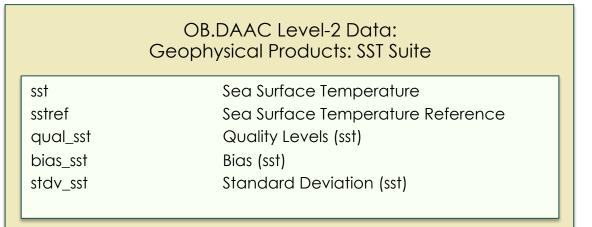
	OB.DAAC Level-2 Data: Geophysical Products: IOP Suite
a	Total Absorption
bb	Total Backscattering
aph	Absorption due to Phytoplankton
aph_unc	Uncertainty (aph)
adg	Absorption due to gelbstoff and detrital
matter	
adg_s	Spectral Parameter (adg)
adg_unc	Uncertainty (adg)
bbp	Particulate Backscattering
bbp_s	Spectral Parameter (bbp)
bbp_unc	Uncertainty (bbp)
rrsdiff	Fractional Mean Rrs Difference

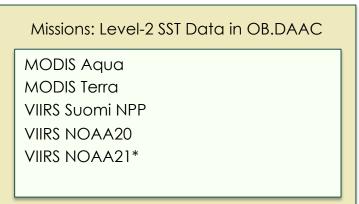
Products (a, bb) for each applicable visible band of the satellite sensor





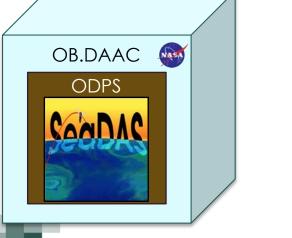
Level-2 Files Geophysical Products OC IOP SST Flags Native Pixels (Location, Time) Atmospheric Correction Vicarious Calibration Terrain Correction





\* In production, will be available soon

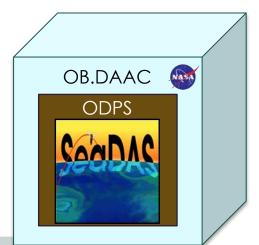
SST (Day and Night: 11 and 12 microns) MODIS: SST4 (Nighttime: 3.9, 11, 12 microns) VIIRS: SST3 (Nighttime: 3.7, 11, 12 microns)



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Level-2 Files
Geophysical Products
Flags
Native Pixels (Location, Time)
Atmospheric Correction
Vicarious Calibration
Terrain Correction



	OB.DAAC Level-2 Data: Flags
CLDICE	Cloud/Ice Determined
COCCOLITH	Coccolithophores Detected
FILTER	Insufficient Data for Smoothing Filter
HIGLINT	High Glint Determined
HILT	High (or Saturating) TOA Radiance
HIPOL	High Degree of Polarization Determined
LOWLW	Low Lw @ 555nm (Possible Cloud Shadow)
MODGLINT	Moderate Glint Determined
SEAICE	Sea Ice Determined
STRAYLIGHT	Straylight Determined
TURBIDW	Turbid Water Determined
COASTZ	Shallow Water (<30m)
HISATZEN	Large Satellite Zenith Angle
HISOLZEN	High Solar Zenith Angle
LAND	Land

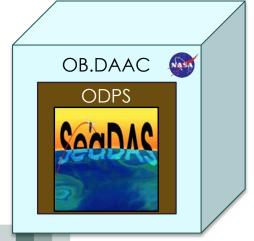




Level-2 Files
Geophysical Products
Flags
Native Pixels
Atmospheric Correction
Vicarious Calibration
Terrain Correction

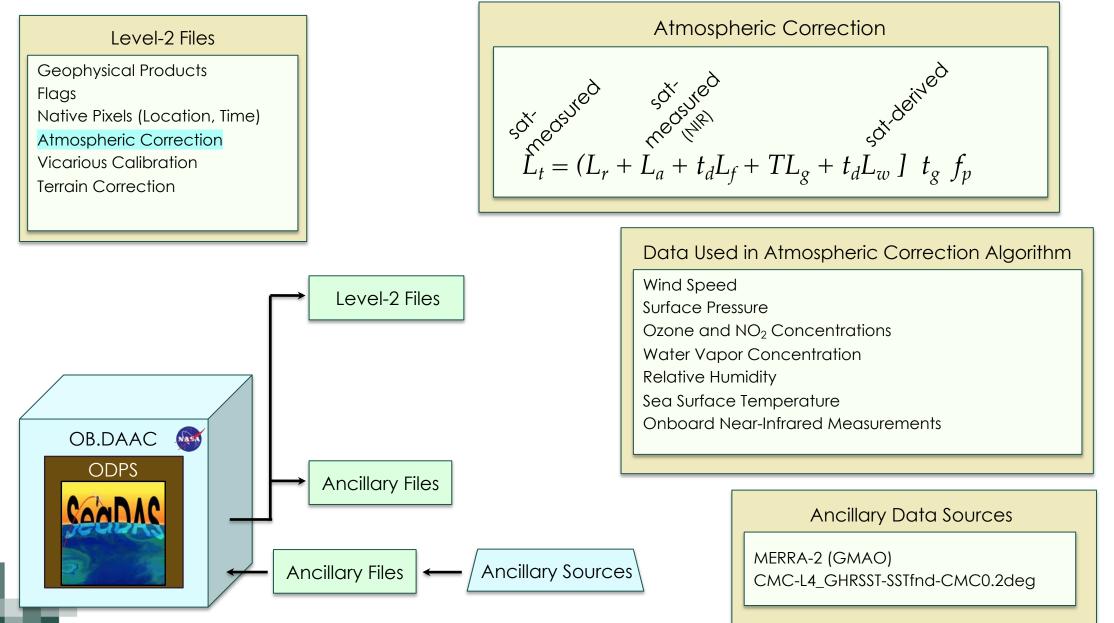
#### **OB.DAAC Level-2 Data: Native Pixels**

- Same pixel gridding as L1A and L1B files
- Each pixel contains time and location
  - No assumed mapping projection
- Adjacent pixels are based on instrument data and not scene location
  - Adjacent pixel may not be geographically adjacent
  - Bow-tie effect



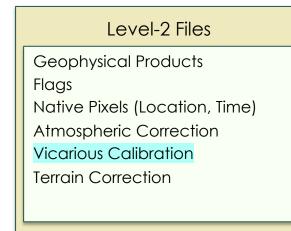


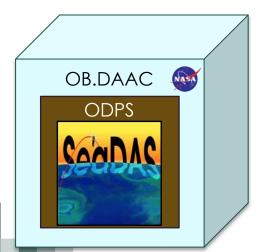












Vicarious Calibration Methodology
Apply inverted atmospheric correction
$L_t$ (vicarious derived) = $f(L_w$ (vicarious measured) )
Determine vicarious gain correction coefficient
$g_i = rac{L_t}{L_t}$ (vicarious derived)
Average vicarious gain correction coefficient
$g = \frac{1}{n} \sum_{i=1}^{n} g_i$
Apply to satellite measurement
$gL_t = (L_r + L_a + t_dL_f + TL_g + t_dL_w] \cdot t_g \cdot f_p$

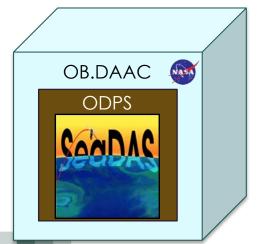


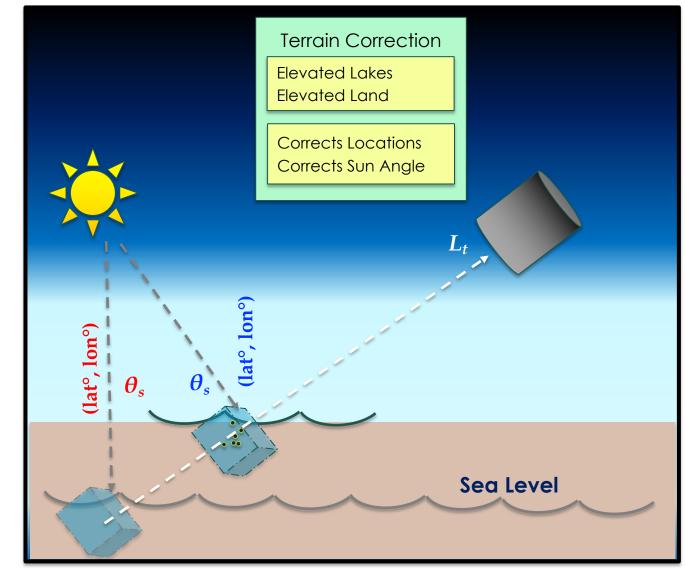




#### Level-2 Files

Geophysical Products Flags Native Pixels (Location, Time) Atmospheric Correction Vicarious Calibration Terrain Correction







## SeaDAS-OCSSW OB.DAAC: Level-3 Binned Files

Level-3 Binned Data: Key Points	seam longitude = 180° meridian
<ul> <li>Accumulated data from L2 products</li> <li>Equal surface area bins <ul> <li>Projection: Integerized Sinusoidal</li> </ul> </li> <li>Applies level-2 flags (suite specific) <ul> <li>Each "valid" level-2 pixel goes in a single level-3 bin</li> </ul> </li> <li>Bin Contents: <ul> <li>Product Value (Mean)</li> <li>Count</li> <li>Standard Deviation, Sum, Sum Squared, Weight</li> </ul> </li> <li>Bin Resolutions (OB.DAAC): <ul> <li>4.64 km (Lat Span=1/24°, Rows=4320)</li> </ul> </li> <li>Time Resolutions (OB.DAAC): <ul> <li>Day, 8 Day, Month, Seasonal, Annual, Mission</li> </ul> </li> <li>Global Files (OB.DAAC)</li> <li>Handles "Bow-Tie" Pixels</li> </ul>	$\int_{10}^{10} \frac{41}{42} \frac{42}{43} \frac{43}{43} \frac{43}{44} $
User Options	
<ul> <li>Many Bin Resolutions</li> <li>Any Time Resolution</li> </ul>	

		central row latitude	bins per row $^{\star}$
seam longitude = 180° meridian		17 85	3
101 00 100 404 405 404 407 408	-102	16 75	9
305 387 388 289 550 581 300 283 394 395 396	397 398 397 400	15 65	15
205 000 000 000 000 000 000 000 000 000	379 380 381 383 383 883 83	14 55	21
340 341 342 343 344 345 346 347 543 349 350 351 352 363 394 355	356 357 359 359 360 381 382 363 381	13 45	25
311 312 313 314 315 316 317 318 310 320 321 322 323 324 325 326 327 328	229 300 317 332 329 324 325 325 337 338 339	12 35	29
278 279 280 281 282 283 24 28 286 287 288 289 290 291 292 283 294 295 296 297	298 299 400 301 302 303 304 305 306 307 308 309 310	11 25	33
243 244 245 246 247 248 249 250 261 282 253 254 255 256 257 258 259 260 261 262 263	284 265 265 267 258 267 270 271 272 273 274 275 276 277	10 15	35
207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 234 225 226 227 2	28 229 230 231 232 233 237 235 236 237 238 239 240 231 232	9 5	36
171 172 173 174 175 176 177 178 179 180 1 181 182 183 184 1425 186 187 188 189 190 191 1	22 193 194 195 196 197 198 199 200 201 202 201 201 205 205	8 -5	36
125 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156	157 153 159 160 161 162 163 164 165 166 167 168 169 170	7 -15	35
103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122	123 124 125 126 127 128 129 130 131 132 131 134 135	6 -25	33
74 75 76 77 78 79 80 81 82 83 84 85 66 87 88 89 90 91	92 93 94 95 96 97 98 93 100 101 502	5 -35	29
49 50 51 52 53 54 55 30 57 58 59 60 61 62 63 64	65 66 67 68 69 70 71 72 75	4 -45	25
28 29 30 31 32 33 34 35 38 37 38 39 40 41	42 43 44 45 46 47 48	3 -55	21
numrows = 18	34 23 26 27	2 -65	15
$(10^\circ \text{ of latitude per row})$	12	1 -75	9
1 2 3		0 -85 per row =	3
		k numows x cos(c rounded to the r	

## SeaDAS-OCSSW OB.DAAC: Level-3 Binned Files



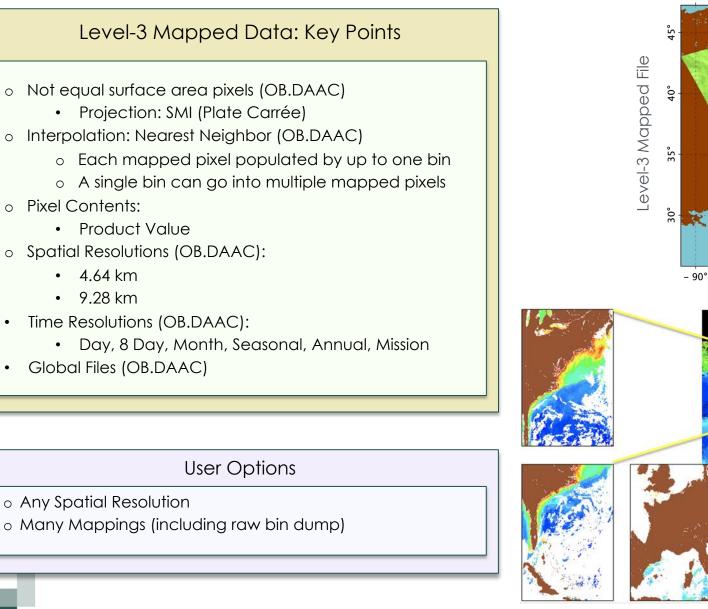
Level-3 Bin Spatial Resolutions					
Angular Span (Latitude)	Rows	Bin Resolution	Short Name		
۱°	180	111.32 km	1D		
1/2°	360	55.66 km	HD		
1/3°	535	37.45 km	36		
1/4°	720	27.83 km	QD		
1/6°	1080	18.55 km	18		
1/12°	2160	9.28 km	9		
1/24°	4320	4.64 km	4		
1/48°	8640	2.32 km	2		
1/96°	17280	1.16 km	1		
1/192°	34560	580 m	Н		
1/384°	69120	290 m	Q		
1/1920°	345600	58 m	HH		

\* Bin height displayed is average and approximate based on a spherical Earth having a radius of 6378.145 kilometers \*\* Short name is subject to change in the future

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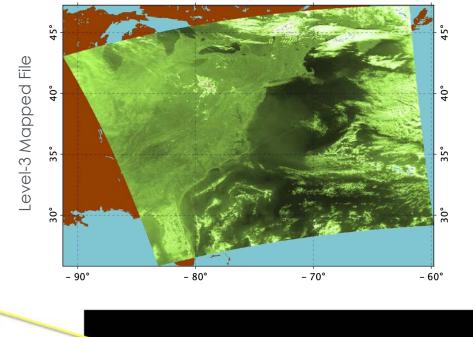
## SeaDAS-OCSSW OB.DAAC: Level-3 Mapped Files





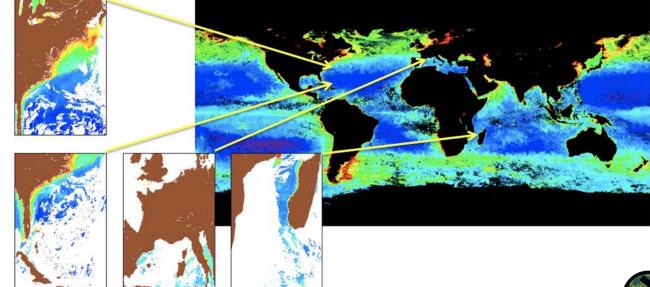
٠

٠



- 70°

- 60'



## SeaDAS-OCSSW: OB.DAAC vs. User Generated Files



#### **OB.DAAC**

#### Level-2

- Limited geophysical products available
- No ancillary and geometric products
- Default flag thresholds
- Only 1 resolution

#### Level-3 Binned

- Only 4km resolution available
- Limited time resolutions available
- Already processed and available

#### Level-3 Mapped

- 4km and 9km resolution available
- SMI Mapping

#### **User Generated**

#### Level-2

- Many geophysical products available
- Many ancillary and geometric products
- Flag thresholds
- Resolution choices (MODIS only)

#### Level-3 Binned

- Many resolutions available
- Any time resolution available
- Could involve substantial runtime and resources

#### Level-3 Mapped

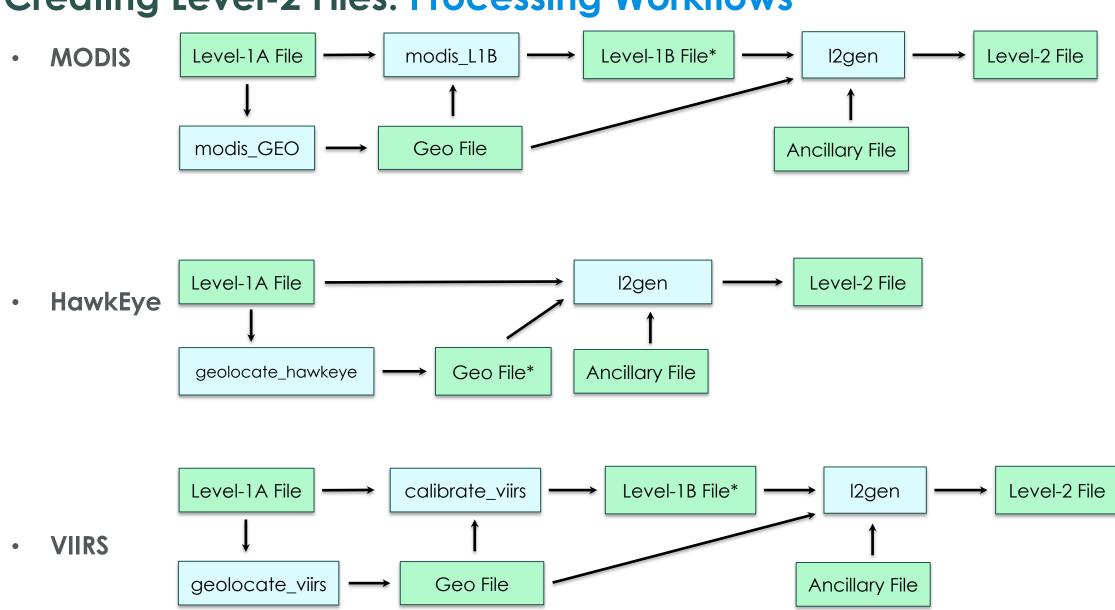
- Any spatial resolution available
- Many mappings, raw bin dump





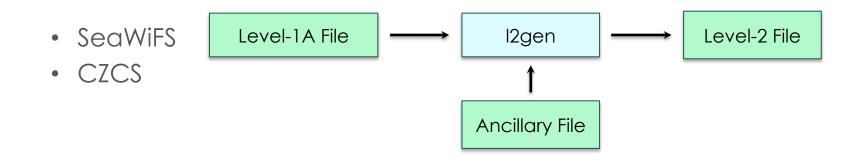
## SeaDAS Reference Workflows

## Creating Level-2 Files: Processing Workflows

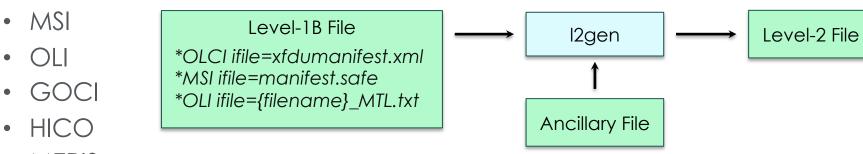


## **Creating Level-2 Files: Processing Workflows**





• OLCI

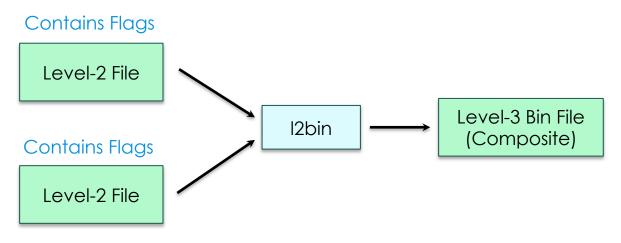


• MERIS

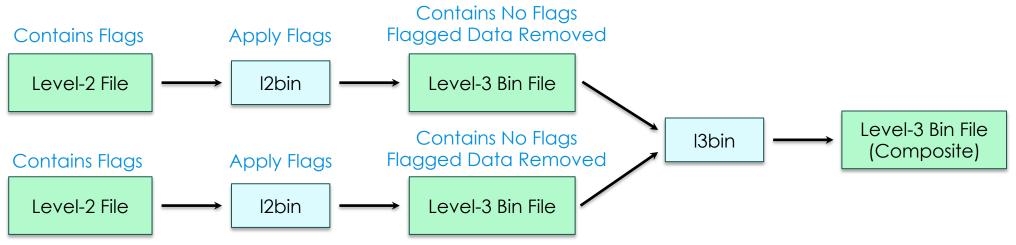
\* Input files contained in directory with Level-1B file

## L3 Binning Workflows (Temporal: I2bin, I3bin)

• Combining Files with I2bin



• Combining Files Later with I3bin

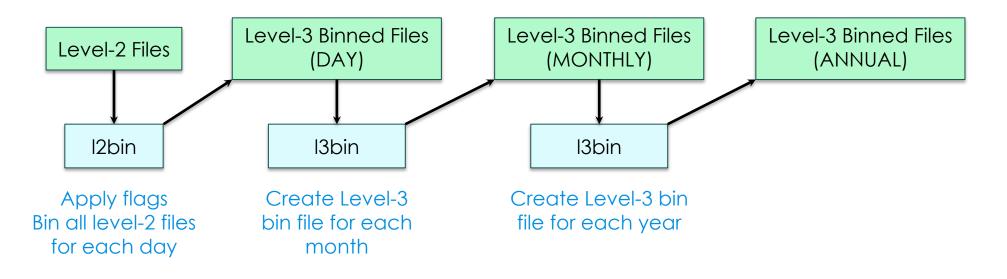




## L3 Binning Workflows (Temporal: I2bin, I3bin)

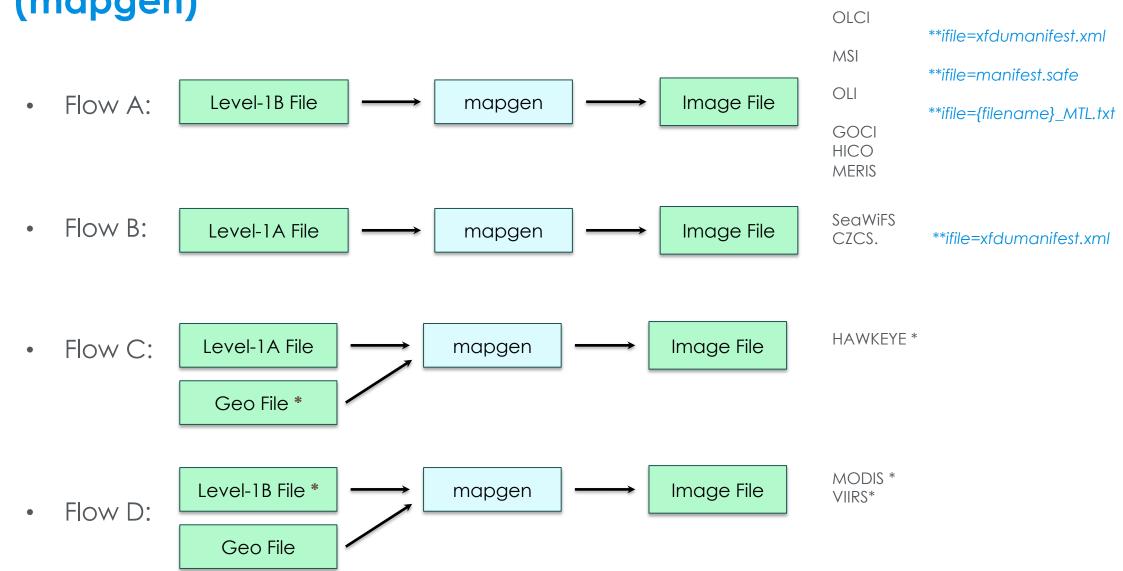


• Avoid Impacts due to Uneven Temporal Distribution of Data



## Creating RGB and Product Images: Processing Workflows (mapgen)





\* Level-1B file (MODIS) and Geo file (HawkEye) not available at NASA OB.DAAC

\*\* Input file contained with Level-1B file directory

## SeaDAS Science Processors (Run I2bin from GUI or User Terminal)

				JAVA APT OF USER TERMINAL
2bin GUI	Primary I/O Files	I2bin		l2bin par=parfile.par
	ifile /Users/dknowles	/Demo/MODIS_AQUA/AQUA_MODIS.2	20101010T180501.L2.OC 😒	
	ofile /Users/dknowles/	Demo/MODIS_AQUA/AQUA_MODIS.2	010101020101010.L3b.DAY.nc	
	I3bprod chlor_a sday	<ul> <li>prodtype</li> <li>regional</li> <li>eday</li> <li>suite</li> </ul>	flaguse	Level-2 File
	Suay	euay suite	pversion	
		gual prod	oformat	
	rowgroup	qual_prod qual_max 2	netCDF4 \$	
	-		hetcDr4 v	
		night		· · ·
	Load Parameters	Save Parameters	Open in SeaDAS	$\begin{array}{c} & L2bin \\ \hline Executable File \end{array} \longrightarrow \qquad Level-3 Bin File \\ \end{array}$
			Run Cancel Apply ?	
	parfile.par*	Ļ		
	ifile - /lleers / dl/see		01010110050110 00 20	
	ofile=/Users/Oknov	wles/Demo/AQUA_MODIS.201 wles/Demo/AQUA_MODIS.20	1010101180501.LZ.OC.nC	
	I3bprod=chlor_a		TOTOTOZOTOTOTOLSB.DAT.NC	
	prodtype=region			
	resolution=2			



## Demonstration SeaDAS Workflow for Sentinel-3 OLCI



## Source Files:

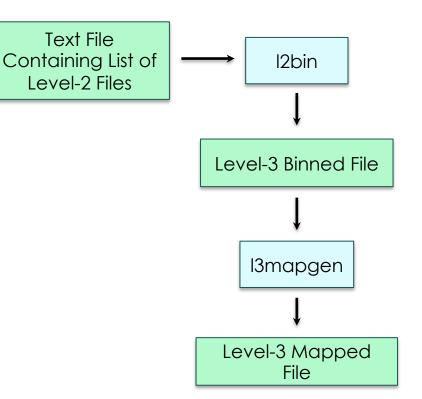
S3A\_OLCI\_EFRNT.20230106T161140.L2.OC.nc S3A\_OLCI\_EFRNT.20230106T161440.L2.OC.nc S3A\_OLCI\_EFRNT.20230106T161740.L2.OC.nc S3B\_OLCI\_EFRNT.20230106T153231.L2.OC.nc S3B\_OLCI\_EFRNT.20230106T153531.L2.OC.nc S3B\_OLCI\_EFRNT.20230106T153831.L2.OC.nc





#### File: level2\_files\_OLCI\_BOTH.txt

S3A\_OLCI\_EFRNT.20230106T161140.L2.OC.nc S3A\_OLCI\_EFRNT.20230106T161440.L2.OC.nc S3A\_OLCI\_EFRNT.20230106T161740.L2.OC.nc S3B\_OLCI\_EFRNT.20230106T153231.L2.OC.nc S3B\_OLCI\_EFRNT.20230106T153531.L2.OC.nc S3B\_OLCI\_EFRNT.20230106T153831.L2.OC.nc





## Workflow: Create L2 Binned File (Select"ifile")

	rs/dknowles/SeaD		flow2/level2_files_OL low2/CROSS_SENSOR	CI_BOTH.txt .2023010620230106.L3b.D	Image: AY.nc
	13bprod	prodtype	resolution	flaguse	
	sday	eday	suite	pversion	
	rowgroup	qual_prod	qual_max 2	oformat netCDF4 ≎	
			night		
Load Para	imeters Sa	ve Parameters	)		Open in SeaDA

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### Workflow: Create L2 Binned File (Specify" 13bprod" and "prodtype")



ofile /Users/	/dknowles/SeaDA	STraining/Workflov	w2/CROSS_SENSOR	.2023010620230106.L3b.I	DAY.nc
	I3bprod chlor_a ≎ sday rowgroup	prodtype regional \$ eday qual_prod	resolution  suite  qual_max 2  night	flaguse pversion oformat netCDF4 \$	



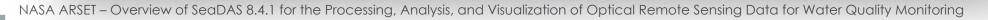
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## Workflow: Create L2 Binned File (Specify "resolution=2")



- Multiscene file could be big

<u>7050</u>				.2023010620230106.L3b.DAY.n	
	l3bprod chlor_a ≎	prodtype regional 🗘	resolution 2 ≎	flaguse	
	sday	eday	suite	pversion	
	rowgroup	qual_prod	qual_max	oformat	
			2 night	netCDF4 \$	



### Workflow: Create L2 Binned File (Specify "flaguse" and click "Run")

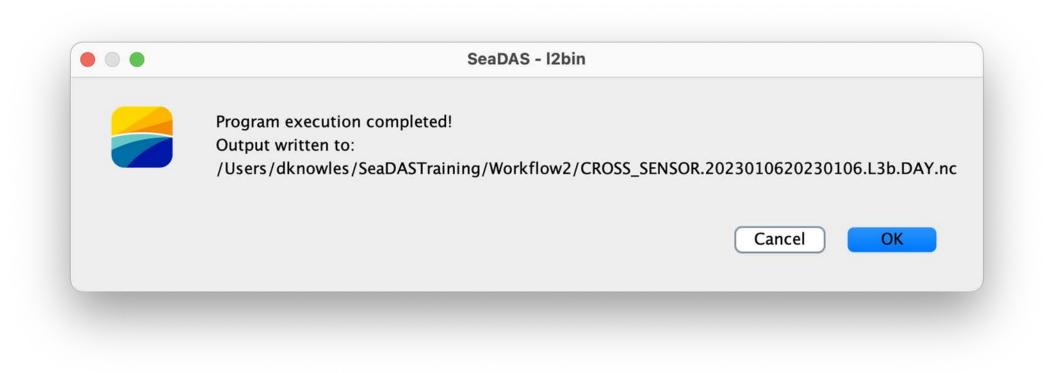


ofile /User	rs/dknowles/SeaDASTraining/Workflow2/CROSS_SENSOR.2023010620230106.L3b.DAY.nc				
	I3bprod chlor_a ≎ sday rowgroup	prodtype regional \$ eday qual_prod	resolution 2 suite qual_max 2 night	flaguse ,FILTER,HIGLIN pversion oformat netCDF4 \$	



## Workflow: Create L2 Binned File (Results Message)

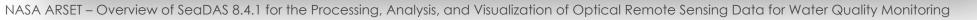






## Workflow: Create L3 Mapped File (Select "ifile")

file /U	sers/dknowles/Se	eaDASTraining/Workflow2/	CROSS_SENSOR.20	023010620230106.	L3m.DAY.nc	
	product	projection	resolution	interp	pversion	
		platecarree 🗘	9km ≎	nearest 🗘	Unspecified	
	north	south	east	west	oformat	
	-999	-999	-999	-999	netCDF4 🗘	
	deflate	central_meridian	palfile	palette_dir	datamin	
	4	0		ommon/palette		
	datamax	scale_type	product_rgb	fudge	threshold	
		٥		1.0	0	
		apply_pal	use_quality u 🔽	se_rgb		





# **Workflow: Create L3 Mapped File** (Specify "product=chlor\_a" and "resolution=2km")

ofile CR	OSS_SENSOR.2023010620230106.L3m.DAY.chlor_a.2km.nc					
	product	projection	resolution	interp	pversion	
	chlor_a	platecarree 🗘	2km ≎	nearest 🗘	Unspecified	
	north	south	east	west	oformat	
	-999	-999	-999	-999	netCDF4 🗘	
	deflate	central_meridian	palfile	palette_dir	datamin	
	4	0		ommon/palette		
	datamax	scale_type	product_rgb	fudge	threshold	
		\$		1.0	0	
		apply_pa	l use_quality u 🔽	se_rgb		

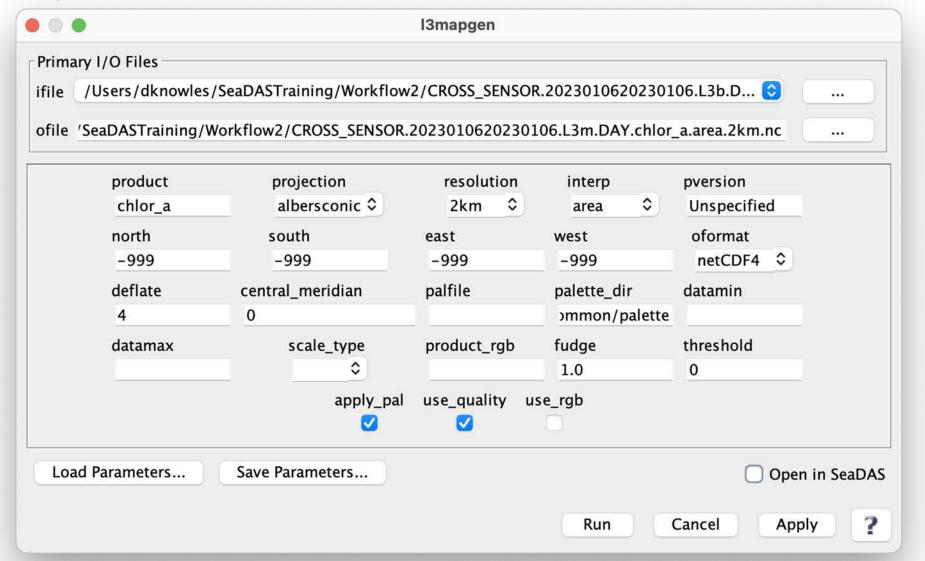


# **Workflow: Create L3 Mapped File** (... or perhaps select "projection=albersconic" for statistics)

	3010620230106.L3m.DAY.	enior_d.zkinine			
product	projection	resolution	interp	pversion	
chlor_a	albersconic 🗘	2km 🗘	nearest 🗘	Unspecified	
north	south	east	west	oformat	
-999	-999	-999	-999	netCDF4 🗘	
deflate	central_meridian	palfile	palette_dir	datamin	
4	0		ommon/palette		
datamax	scale_type	product_rgb	fudge	threshold	
	•		1.0	0	
	apply_pal	use_quality u V	se_rgb		



# **Workflow: Create L3 Mapped File** (Select "interp=area" and click "Run")



## Workflow: Create L3 Mapped File (Results Message)

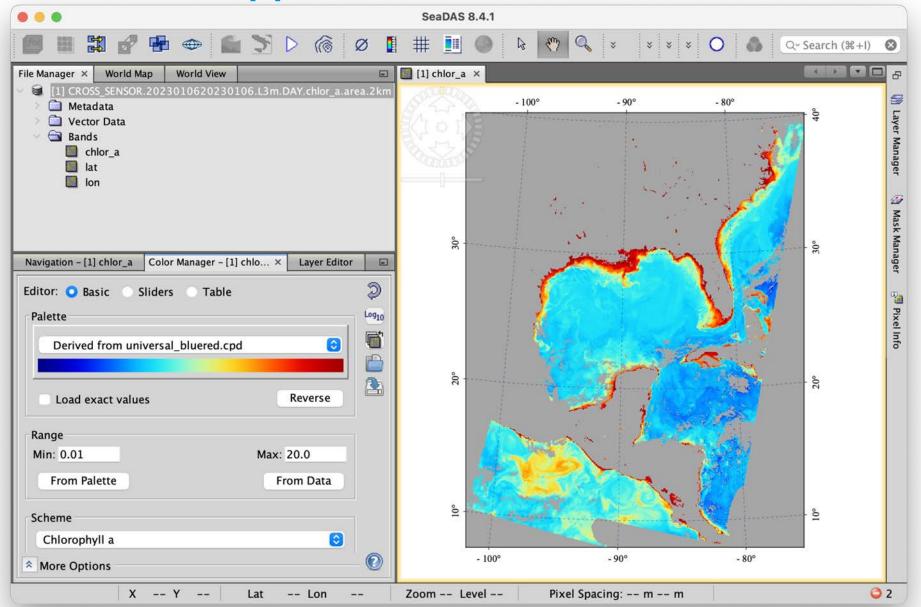


	SeaDAS - I3mapgen					
	Program execution completed! Output written to:					
	/Users/dknowles/SeaDASTraining/Workflow2/CROSS_SENSOR.2023010620230106.L3m.DAY.chlor_a.area.2km.nc					
	Cancel OK					
_						



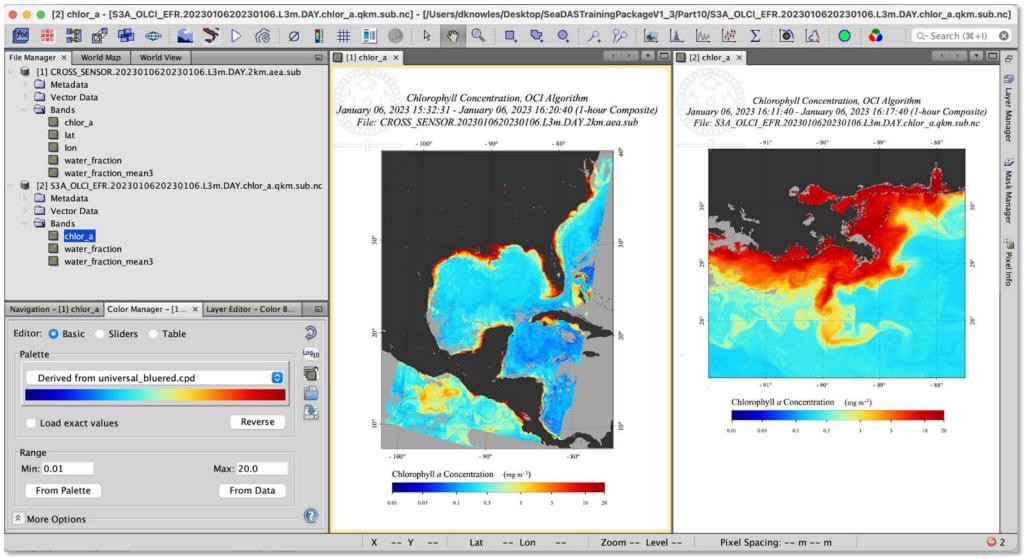


#### Workflow: View L3 Mapped File



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### Workflow: View L3 Mapped File (Right-Side Image Processed at 250 m)





#### Workflow: multilevel\_processor

	~
1	

0 •		multilevel_proce	ssor	
		Main Processor	Chain	
Primary I/O Files				
ifile /Users/dknowles	/SeaDASTraining/Workflow2/I	evel2_files_OLCI_BOTH.txt		
odir				
Main Options				
overwrite	use_existing	deletefiles	use_ancillary	🗹 combine_files
Parfile				
Load Parameters	Retain Selected IFILE			Save Parameters
3bprod=chlor_a prodtype=regional resolution=2 flaguse=ATMFAIL,LAND #area_weighting=1 verbose=1 [13mapgen] product=chlor_a projection=albersconic resolution=2km interp=area		CLDICE,LOWLW,CHLWARN,C	HLFAIL,NAVWARN,MAXAERITER	R,HISOLZEN,NAVFAIL,FILTER,HIGLINT
interp=area				





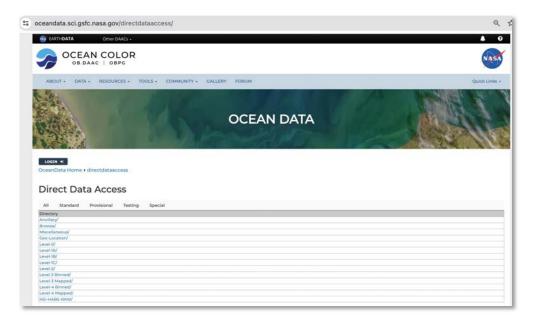
# SeaDAS for PACE Data Analysis and Visualization

#### **PACE Data Access**



- Pace data will be available from the following link after April 2024
- Currently simulated data are available.

https://oceandata.sci.gsfc.nasa.gov/directdataaccess/



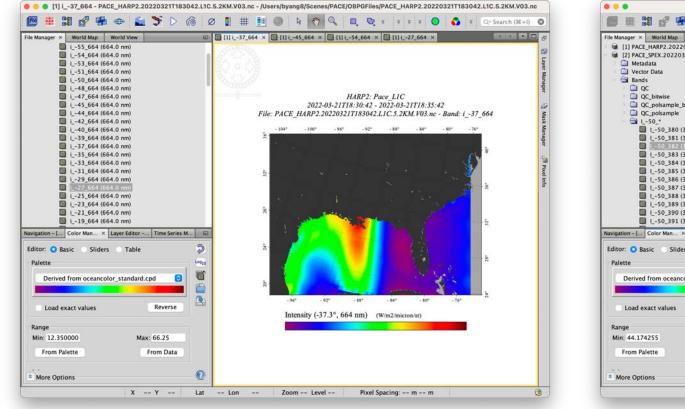




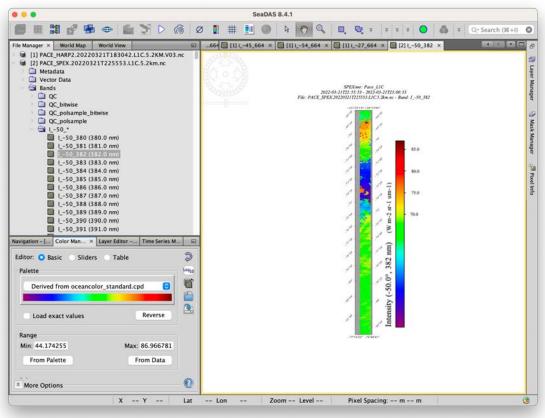
#### Level 1C Data Images



#### HARP-2



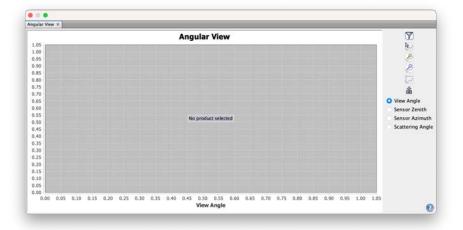
#### **SPEXone**





#### SeaDAS New Feature: HARP-2 Angular View of I Stokes Vector

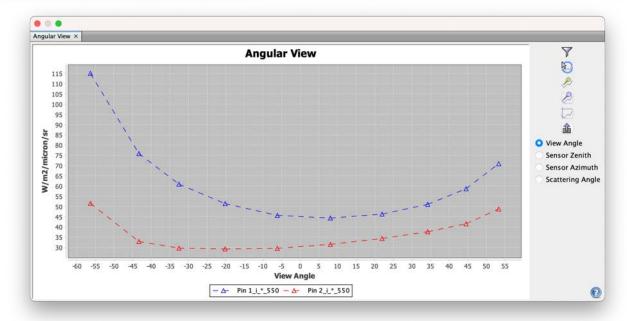




#### HARP-2 Angular View GUI

#### Angular View Chooser

		Available	Spectra				
*	Spectrum Name i_*_867	Unit L W/m2/micron/sr	ine Style	Symbol \$	0	Symbol 3	Size
* 🖸	i_*_550	W/m2/micron/sr	🕄	Δ	٢	3	6
*	i_*_664	W/m2/micron/sr		V	0	3	0
*	i_*_440	W/m2/micron/sr	🕄	*	0	3	6
*	q_*_867	W/m2/micron/sr		×	0	3	0
*	q_*_550	W/m2/micron/sr	••••••	4	0	3	0
*	q_*_664	W/m2/micron/sr		0	٥	3	6





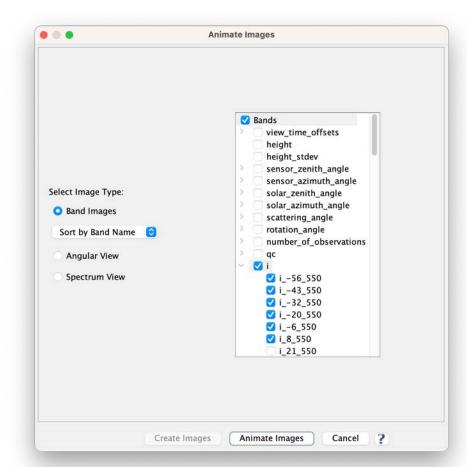
#### **SeaDAS New Feature: Animation**



#### **SeaDAS GUI Allows:**

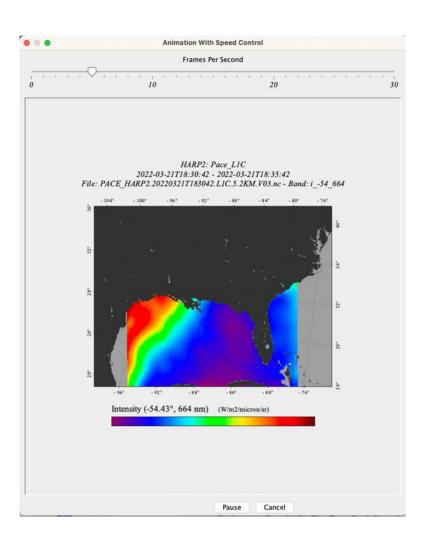
- Animation of band images
- Animation of angular view or spectral view at a location(s)
- Animation speed control

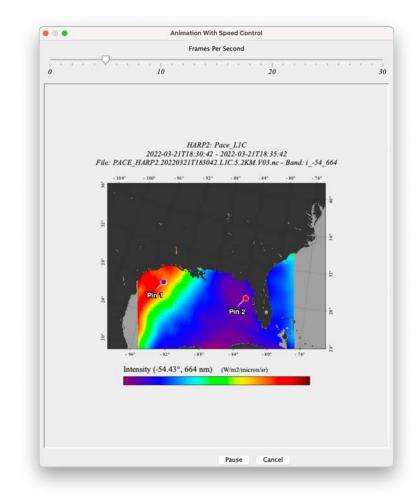
#### **Animation GUI**



#### SeaDAS: HARP-2 Band Image Animation







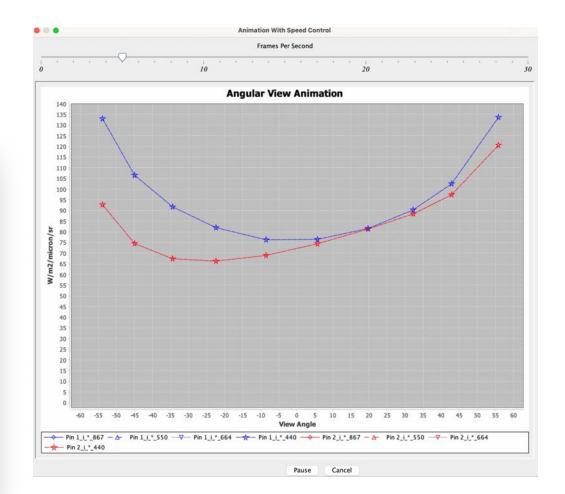
#### Selected Locations with pin-1 and pin-2



#### HARP-2 Angular View Animations



	Spectrum Name	Unit	Line Style	Symbol		Symbol S	Size
* 🔽	i_*_867	W/m2/micron/sr		\$	٢	3	0
* 💟	i_*_550	W/m2/micron/sr	📀	Δ	0	3	0
* 🗸	i_*_664	W/m2/micron/sr	· [		٢	3	3
* 🗸	i_*_440	W/m2/micron/sr	· ( 🔕	☆	٢	3	6
*	q_*_867	W/m2/micron/sr		×	0	3	0
*	q_*_550	W/m2/micron/sr	• [ ••••••••	÷	0	3	0
*	q_*_664	W/m2/micron/sr	· [ - + - + 📀	0	0	3	0
*	q_*_440	W/m2/micron/sr	· ( 📀		0	3	0
*	qc_*_867		😒		0	3	0
*	qc_*_550				0	3	0



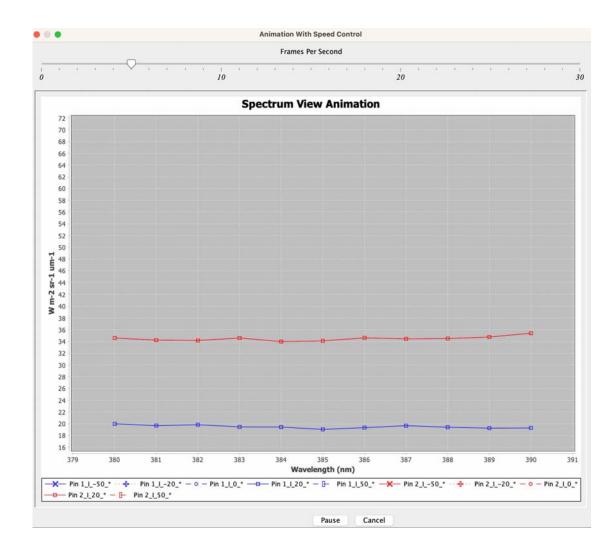
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#### **SPEXone Spectral View Animations**



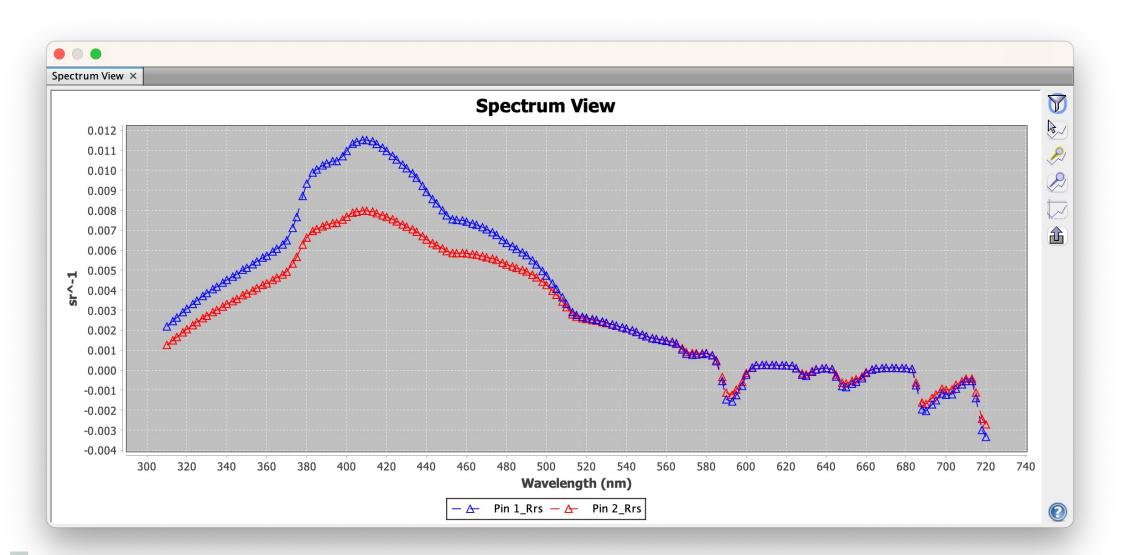
#### **GUI for Choosing Bands**

oc	1			\$	0	3	0
QC bitwise	1		(3)	Δ	0	3	0
QC_DITWISE	1			-			
QC_polsampl	e_bitwise 1			V	0	3	0
QC_polsampl	e 1		😒	☆	0	3	6
☐ I50_*	W m-2 sr-	-1 um-1		×	0	3	0
Band name	Band description	Spectral wa	velength Spectra	al bandw	idth Unit	t	
✓I50_380	1		380.0		0.0 W m	n-2 sr-1 u	ım-1
VI50_381	1		381.0		0.0 W m	n-2 sr-1 u	um-1
✓I50_382	1		382.0		0.0 W m	1-2 sr-1 u	um-1
✓I50_383	1		383.0		0.0 W m	n-2 sr-1 u	um-1
✓I50_384	1		384.0		0.0 W m	n-2 sr-1 u	ım-1
✓I50_385	1		385.0		0.0 W m	n-2 sr-1 u	um-1
✓I50_386	1		386.0		0.0 W m	n-2 sr-1 u	um-1
✓I50_387	1		387.0			n-2 sr-1 u	
✓I50_388	- 1		388.0			n-2 sr-1 u	
✓I50_389	1		389.0			1-2 sr-1 u	
I50_390	1		390.0			n-2 sr-1 u	
I50_391	1		391.0			n-2 sr-1 u	
I50_392	1		392.0			1-2 sr-1 u	
I50_393	1		393.0			1-2 sr-1 u	
I50_394	1		394.0			n-2 sr-1 u	
I50_395	1		395.0			n-2 sr-1 u	
I50_396	1		396.0			n-2 sr-1 u	
[50_397	1		397.0			n-2 sr-1 u	
[50_398	1		398.0		0.0 W m	n-2 sr-1 u	ım-1
I50_399	1		399.0			n-2 sr-1 u	
TI 50 400	<u> </u>		400.0		0.01// ~	7 er 1 :	im 1





#### **PACE OCI Remote Sensing Reflectance Spectra**







# Summary

#### Summary



In the training today, we:

- Identified sensor data processing capability and workflow for: OLCI, MODIS, VIIRS, OLI, and MSI
- Demoed Sentinel-3 OLCI data processing and analysis for the Chesapeake Bay:
  - True-color image display
  - Level-2 and Level-3 Data: binning and mapping, adding quality flags, statistical and band math analysis
  - OCSSW Tool
  - Analyzed and visualized chlorophyll-a concentration, and remote sensing reflectances
- Previewed plans for incorporating PACE data



### **Homework and Certificates**

- Homework:
  - One homework assignment
  - Opens on 02/13/2014
  - Access from the training webpage
  - Answers must be submitted via Google Forms
  - Due by 02/29/2024
- Certificate of Completion:
  - Attend all three live webinars (attendance is recorded automatically)
  - Complete the homework assignment by the deadline
  - You will receive a certificate via email approximately two months after completion of the course.



#### Acknowledgement

#### **OB.DAAC SeaDAS Team**

- Aynur Abdurazik SeaDAS Lead Developer
- Donald Shea SeaDAS Processors Lead Developer
- **Daniel Knowles** SeaDAS Developer, SeaDAS Instruction
- Bing Yang SeaDAS Developer, SeaDAS Processors Developer
- Sean Bailey DAAC Manager
- Alicia Scott Deputy DAAC Manager
- Guoqing Wang DAAC Scientist
- **OBPG** (NASA's Ocean Biology Processing Group) Many Scientists and Algorithm Developers





### Trainers:

• Amita Mehta

**Contact Information** 

- <u>amita.v.mehta@umbc.edu</u>
- Daniel Knowles
  - <u>daniel.s.knowles@nasa.gov</u>
- Aynur Abdurazik
  - <u>aynur.abdurazik@nasa.gov</u>
- Bing Yang
  - bing.yang@nasa.gov

- ARSET Website
- Follow us on Twitter!
  - <u>@NASAARSET</u>
- <u>ARSET YouTube</u>

Visit our Sister Programs:

- <u>DEVELOP</u>
- <u>SERVIR</u>



#### Resources



- <u>NASA Ocean Biology Distributed Active Archive Center (OB.DAAC)</u>
- Official NASA/OB.DAAC Data Analysis Software SeaDAS
- NASA Ocean Color
- NASA Ocean Ecology: Missions and Projects
- NASA Earth Data Forum
- NASA PACE







#### Thank You!



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#### **Miscellaneous Reference Notes**

## SeaDAS Reference Notes: Adding Custom User Band Lookup Schemes



Edit the following 2 files in the directory ~/.seadas8/auxata/color\_schemes/ Note: setting up color scheme lookup for NDVI (next release will be a default)

# SeaDAS Reference Notes: Boosting Performance (Virtual Memory Issues)

					0	ptions				
ومعند المعند eneral Laye	Performanc	e WWW	Keymap	Appearance	S-2 SoptTbx	SeaDAS Toolbo	x ZNAP	ESA-Snappy	Q Filter (\$	β+F) <b>⊗</b>
System VM Param Cache Pat		rs/dknov		12m -Xveri adas8/var/o		-Dnetbeans	.maincla	ss=org.esa	.snap.main.Main	•••
Processing									Compute	Reset
Tile size	(px)	SNAP Val	ues	Benchmarl 128;256;5		alues				
	of Threads	12 StoredG	raph	12;						
									Compute	Reset
Export	Im	port				H	lelp	Cancel	Apply	ОК

### SeaDAS Reference Notes: Boosting Performance (Virtual Memory Issues)

Most of these get overridden in the System Performance GUI (with the exception of snap.dataio.reader.tileWidth and snap.dataio.reader.tileWidth).

\${SEADAS\_HOME}/etc/snap.properties

# Boost the virtual memory (by factors of gigabyte - adding in increments of 1024)

```
default_options="--branding snap --locale en_GB -J-Xverify:none -J-Xms512M -J-Xmx7044M -J-
Dnetbeans.mainclass=org.esa.snap.main.Main -J-Dsun.java2d.noddraw=true -J-
Dsun.awt.nopixfmt=true -J-Dsun.java2d.dpiaware=false"
```

	<pre>\${SEADAS_HOME}/etc/seadas.conf # Consider modify these lines</pre>
	<pre># Tile cache size [Mb] snap.jai.tileCacheSize=2048 # Default tile size in pixels snap.jai.defaultTileSize=512</pre>
-	# Reader tile size in pixels snap.dataio.reader.tileWidth= <mark>512</mark> snap.dataio.reader.tileHeight= <mark>512</mark>

Note:

snap.dataio.reader.tileWidth and snap.dataio.reader.tileWidth could be temporarily optimized to a particular file shape.

#### SeaDAS-OCSSW OB.DAAC: True Color Wavelengths

#### True Color Wavelengths

Mission	R	G	В	
GOCI_COMS	660	555	490/412*	
\$OCSSWROOT/	share/goci/msl12_sensor_info.			
HawkEye_SE1**	670	556	488	
\$OCSSWROOT/	'share/hawkeye/msl12_sensor_			
MERIS	665	560	490/413*	
-	share/meris/msl12_sensor_info			
MODIS_AQUA	645	555	469	
	'share/modis/aqua/msl12_sen			
MODIS_TERRA	645	555	469	
	'share/modis/terra/msl12_sens			
OLCI_S3A	665	560	490/412*	
	/share/olci/s3a/msl12_sensor_i		100/110*	
OLCI_S3B	665	560	490/412*	
	share/olci/s3b/ms112_sensor_ir/ 655		482	
	soo share/oli/msl12_sensor_info.dc/	561	482	
OLI LANDSAT9	655	561	482	
—	/share/oli/msl12_sensor_info.dc		402	
SeaWiFS SEASTAR	670	555	<b>490/</b> 412*	
	'share/seawifs/msl12_sensor_in		4707412	
VIIRS NOAA20**	667	556	489	
	/share/viirs/j1/msl12_sensor_info			
VIIRS NOAA21**	667	556	489	
	/share/viirs/j2/msl12_sensor_info			
VIIRS Suomi NPP	671	551	486	
	/share/viirs/np/msl12_sensor_in			

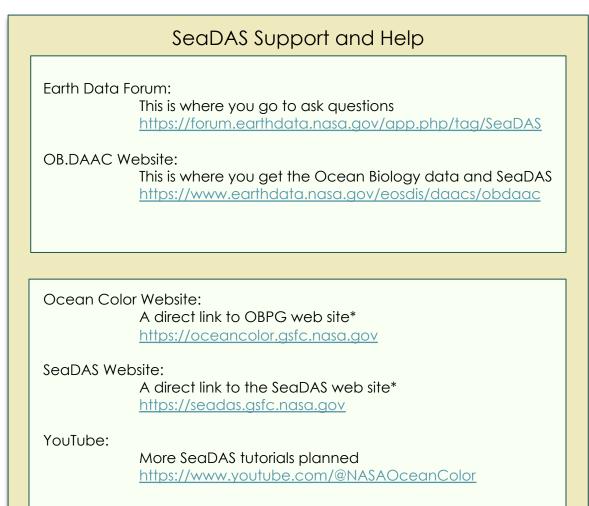
\*\* rgb profile configuration file not yet added to SeaDAS (~/.seadas8/auxdata/rgb\_profiles)

#### SeaDAS: OB.DAAC User Software

NASA

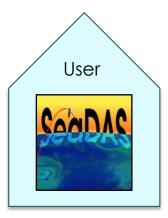
OB.DAAC

**ODPS** 



\* Website URL subject to change in future





SeaDAS Workflow: OLCIS3B



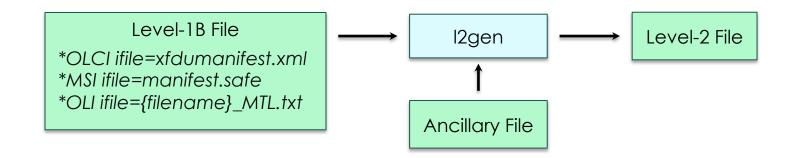
#### **Source File:**

#### S3B\_OL\_1\_EFR\_\_\_\_20230723T145850\_20230723T150150\_2023072 3T231635\_0179\_082\_082\_2340\_PS2\_0\_NT\_003.SEN3/xfdumanifest. xml



#### SeaDAS Demo: Workflow 1





\* Input files contained in directory with Level-1B file



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#### Workflow 1: Create OLCI S3B L2 File (Select "ifile")

		1
-	-	
1.0		

			l2gen	
	Main Products Pro	ocessing Options Subsetting Options Th	resholds Ancillary Inputs IOP Options Miscell	aneous Calibration Options
Primary I/O Files	17			
ile /Users/byang8/A	RSET_training/S3B_OL_1_EFR	_20230723T145850_20230723T150150_202	30723T231635_0179_082_082_2340_P52_0_NT_003.	SEN3/xfdumanifest.xml 🔕 🦲
file /Users/byang8/Al	RSET_training/S3B_OL_1_EFR	_20230723T145850_20230723T150150_2023	0723T231635_0179_082_082_2340_PS2_0_NT_003.5	EN3/S3B_OLCI_EFR.20230723T145850.L2.OC.nc
arfile				
Load Save	Exclude i/o Files	Show Defaults	Suite OC 💿	Get Ancillary Options 📀
# SUITE uite=OC			30723T231635_0179_082_082_2340_PS2_O_NT_003.	
Keep params when new	/ ifile is selected			Open in St

#### Workflow 1: Create OLCI S3B L2 File (Select "Get Ancillary")



			l2gen					
	Main Products Proc	essing Options Subsetting Option	ns Thresholds Ancillary	Inputs IOP Options	Miscellaneous	Calibration Options		
Primary I/O Files								
ifile /Users/byang8/ARSE	T_training/S3B_OL_1_EFR	20230723T145850_20230723T150	150_20230723T231635_0179	0_082_082_2340_PS2_	O_NT_003.SEN3/xfd	lumanifest.xml	0	
ofile /Users/byang8/ARSET	T_training/S3B_OL_1_EFR2	20230723T145850_20230723T1501	50_20230723T231635_0179	_082_082_2340_PS2_0	_NT_003.SEN3/S3B	_OLCI_EFR.20230723T14585	0.L2.OC.nc	
Parfile								
Load Save	Exclude i/o Files	Show Defaults	Suite	oc 🙁		Get Ancillary Options -	-	
# PRIMARY INPUT OUTPUT F ifile=/Users/byang8/ARSET ofile=/Users/byang8/ARSET # SUITE suite=OC	T training/S3B OL 1 FFR 2	0230723T145850_20230723T1501 20230723T145850_20230723T1501	50_20230723T231635_0179 50_20230723T231635_0179	_082_082_2340_PS2_0 _082_082_2340_PS2_0	_NT_003.SEN3/xfdi D_NT_003.SEN3/S3B	Get Ancillary m Refresh C Near Real-Time NO2 Force Download	nc	
	ult = climatology (select 'Get A	ncillary' to download ancillary files)						
Keep params when new ifile	e is celerted						🖸 Oper	n in Sea
neep parants when new init	e is selected							
						Run Ca	ancel App	ly



#### Workflow 1: Create OLCI S3B L2 File (Ancillary files have been



Non Pedecci Processing Options Subsetting Options Therabidia Accillary riputs PO Options Miscellaneous Calibration Options         Non Pedecci Processing Options Subsetting Options Therabidia Accillary riputs PO Options Miscellaneous Calibration Options         Non Pedecci Processing Options Subsetting Options Therabidia Accillary riputs PO Options Miscellaneous Calibration Options         Non Pedecci Processing Options Subsetting Options Therabidia Accillary riputs PO Options Miscellaneous Calibration Options         Non Pedecci Processing Options Subsetting Options Therabidia Accillary riputs PO Options Miscellaneous Calibration Options         Non Pedecci Processing Options Subsetting Options Therabidia Accillary riputs PO Options Miscellaneous Calibration Options         Non Pedecci Processing Options Subsetting Options Subsetting Options Postport Pistons P	oaded)	000		l2gen	
Ifte:       (Juere, Hyangk JAKSET, Training / SB, Q., L.FR 202307237145850, 202307237151500, 202307237125165, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, Q.C.J. (FRA. 200307237145850, 2023072371510500, 202307237125165, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, Q.C.J. (FRA. 200307237145850, 2023072371510500, 202307237151055, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, Q.C.J. (FRA. 200307237145850, 2023072371510500, 202307237151055, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, Q.C.J. (FRA. 200307237145850, 2023072371510500, 202307237151055, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, D.L. (FRA. 200307237145850, 2023072371510500, 202307237151055, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, D.L. (FRA. 200307237145850, D2023072371510500, D202002371231055, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, D.L. (FRA. 200307237145850, D20230723715000, D202002371231055, D179, 002, 002, 202, 2240, FS2, Q.NT, 003, SSN3/SB, D.L. (FRA. 200307237145850, D202307237145850, D20230723	louucuj	Main Products	Processing Options Subsetting Options	Thresholds Ancillary Inputs* IOP Options Mis	cellaneous Calibration Options
<pre>dif (/ker/yheeg8/AKST_training/SB_Q_L_LRR0020723T145850_00209723T13656 0/19/00_002_02_202_017_003589/SB_QL_DLRAC0209723T148580_L02 PILIE</pre>		Primary I/O Files			
Perfile         State         C         Get Anciliary         G           # PRUAR MUTCHTUPT FEAST         Taming SSB QL, LFR20230737114555, 202307237135155, 0.179, 082, 082, 2430, PS2, Q.NT, 003, SSN1/x5BB, OLCLEFR, 202307237145555, 202307237135155, 0.202307237135000, MET nc           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg (select 'Gst Antillary' to dominad actillary field'           # AVCLUAR INUTS: Default - climationg' (		ifile /Users/byang8/ARSET_training/S3B_OL_1_E	FR20230723T145850_20230723T150150_2	0230723T231635_0179_082_082_2340_PS2_0_NT_0	03.SEN3/xfdumanifest.xml 0
Lad       See       Detadats       See       Of Ancilay       O         PRIMARY INPUT OFTER FLUSS       Implementation (SSL 0.1, FR2023073114550, 20230731150150, 2023073115000, 2014, 2023073116000, 2014, 202307311600, 2014, 202307311600, 2014, 202307311600, 2014, 202307311600, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014,		ofile /Users/byang8/ARSET_training/S3B_OL_1_EF	FR20230723T145850_20230723T150150_20	)230723T231635_0179_082_082_2340_PS2_0_NT_00	3.SEN3/S3B_OLCI_EFR.20230723T145850.L2.OC.nc
<pre>*RMARW WRUT URUTY FELDS Inter_Ubers/byang8.0.0.1_EFR0230703T145850_2030733T150150_20330723T31555_0179_082_082_2340_FS2_0.NT_003_S5N3/s5B_0.0.1_EFR20330723T145850_12.20.c. #J Tore Ubers/byang8/scssw/wa/acc/2013/04/201307231120000-CWC-14_CHRST-STITerCMC0.1deg-c.0.8+v02.0+tv03.0cc Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201307231120000-CWC-14_CHRST-STITerCMC0.1deg-c.0.8+v02.0+tv03.0cc Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201307231120000-CWC-14_CHRST-STITerCMC0.1deg-c.0.8+v02.0+tv03.0cc Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201307231120000-CWC-14_CHRST-STITerCMC0.1deg-c.0.8+v02.0+tv03.0cc Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201307231120000-CWC-14_CHRST-STITerCMC0.1deg-c.0.8+v02.0+tv03.0cc Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201307231120000-CWC-14_CHRST-STITerCMC0.1deg-c.0.8+v02.0+tv03.0cc Inter-Ubers/byang8/ccssw/wa/acc/2013/04/20120372711100000/HTTre Inter-Ubers/byang8/ccssw/wa/acc/2013/04/2012037211100000/HTTre Inter-Ubers/byang8/ccssw/wa/acc/2013/04/2012037211100000/HTTre Inter-Ubers/byang8/ccssw/wa/acc/2013/04/2012037211100000/HTTre Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201203721110000/HTTre Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201203721110000/HTTre Inter-Ubers/byang8/ccssw/wa/acc/2013/04/201203721110000/HTTre Inter-Ubers/byang8/ccssw/wa/acc/2013/201/20120000-CWC-14_CHRST-SSTITerC-CWC0.1deg-C.08+v02.0+tv03.0nc Inter-Ubers/byang8/ccssw/wa/acc/2013/201/2012000-CWC-14_CHRST-SSTITerC-CWC0.1deg-C.08+v02.0+tv03.0nc Inter-Ubers/byang8/ccssw/wa/acc/2013/201/201203723110000-CWC-14_CHRST-SSTITerC-CWC0.1deg-C.08+v02.0+tv03.0nc Inter-Ubers/byang8/ccssw/wa/acc/2013/201/201203723110000-CWC-14_CHRST-SSTITerC-CWC0.1deg-C.08+v02.0+tv03.0nc Inter-Ubers/byang8/ccssw/wa/acc/2013/201/201203723110000-CWC-14_CHRST-SSTITerC-CWC0.1deg-C.08+v02.0+tv03.0nc Inter-Ubers/byang8/ccssw/wa/acc/2013/201/201203723110000-CWC-14_CHRST-SSTITerC-CWC0.1deg-C.08+v02.0+tv03.0nc Inter-Ubers/byang8/ccssw/wa/acc/2013/201/201203723110000-CWC-14_CHRST-SSTITerC-WC0.1deg-C.08+v02.0+tv03.0nc Inter-Ubers/byang8/ccssw/wa/acc/2013/2014</pre>		Parfile		· · · · · · · · · · · · · · · · · · ·	
InteUker, Iyaang/AKST_training/SB, OL_LER20230723T14550, 20230723T31505, D179, 002, 002, 2240, F52, O.MT. 003, SNM / Kdumanifest.xml         InteUker, Iyaang/AKST_training/SB, OL_LER20230723T14550, 20230723T31505, D179, 002, 002, 2240, F52, O.MT. 003, SNM / Kdumanifest.xml         # SUTT         InteUker, Iyaang/AKST_training/SB, OL_LER20230723T14550, 20230723T315050, D179, 002, 002, 202, 2340, F52, O.MT. 003, SNM / Kdumanifest.xml         # SUTT         InteUker, Iyaang/AKST_training/SB, OL_LER20230723T150000, MT: Rc         # SUTT         Inte		Load Save Exclude i/o Files	Show Defaults	Suite OC 🗢	Get Ancillary
		ifile=/Users/byang8/ARSET_training/S3B_OL_1_EF ofile=/Users/byang8/ARSET_training/S3B_OL_1_EF # SUITE suite=OC # ANCILLARY INPUTS Default = climatology (select icefile=/Users/byang8/ocssw/var/anc/2023/204/C met2=/Users/byang8/ocssw/var/anc/2023/204/C met3=/Users/byang8/ocssw/var/anc/2023/204/C ozone1=/Users/byang8/ocssw/var/anc/2023/204/C ozone2=/Users/byang8/ocssw/var/anc/2023/204/O ozone3=/Users/byang8/ocssw/var/anc/2023/204/O	FR20230723T145850_20230723T150150_2 t 'Get Ancillary' to download ancillary files) /20230723120000-CMC-L4_GHRSST-SSTfnd-CN SMAO_MERRA2.20230723T140000.MET.nc SMAO_MERRA2.20230723T160000.MET.nc //GMAO_MERRA2.20230723T160000.MET.nc //GMAO_MERRA2.20230723T160000.MET.nc //GMAO_MERRA2.20230723T160000.MET.nc	0230723T231635_0179_082_082_2340_P52_O_NT_00	
Run Cancel Apply ?		Keep params when new ifile is selected			✓ Open in SeaDAS
					Run Cancel Apply ?



# Workflow 1: Create OLCI S3B L2 File (Select some more products)

		I2gen
Main	Products* Processing Options Subsetting Options Th	resholds Ancillary Inputs* IOP Options Miscellaneous Calibration Option
Product	ct Selector	Wavelength 3–Way Toggle Selection
~ Radi	iances/Reflectances	Deselect All Visible
>	🗋 tt	The second se
>	ຼີ Lu	Deselect All NIR
2		✓ 400 ✓ 412
2   2   2		🗹 443 🗹 490
- \$ }	La Lw	✓ 510 ✓ 560
8		✓ 620 ✓ 665
> 1	TLg	✓ 674 ✓ 681
2	Es	✓ 709 ✓ 754
×	nLw .	☑ 762 ☑ 765
	✓ Rrs	✓ 762 ✓ 763 ✓ 768 ✓ 779
	rhom	
2	rhot ✓ rhos	✓ 865 ✓ 884
	rhos rho_cirrus	☑ 899 ☑ 939
	BT	☑ 1013
Deriv	ived Geophysical Parameters	
> Inher	rent Optical Products	
	illary/Meterological/Geometric Parameters	
	ospheric Correction Intermediates	
	ertainties/Error Estimates	
MISCE	cellaneous	
Colorto	- d Developeration	
	ed Products	
Izprod	I Kd_490 Rrs_nnn angstrom aot_865 chlor_a cloud_albedo rho	is_nnn
	Restore	Defaults (Products only)
Keep p	params when new ifile is selected	🗹 Open in Sea[



# Workflow 1: Create OLCI S3B L2 File (Parameter "12prod" has beeppended)

				l2gen				
	Main Products	* Processing Options	Subsetting Options T	hresholds Ancillary In	outs* IOP Options	Miscellaneous	Calibration Options	
Primary I/O Files								
ifile /Users/byang8/ARSET	_training/S3B_OL_1_	EFR20230723T14585	0_20230723T150150_202	30723T231635_0179_08	2_082_2340_PS2_0	NT_003.SEN3/xfdu	manifest.xml	
ofile /Users/byang8/ARSET	_training/S3B_OL_1_F	FR20230723T145850	20230723T150150_2023	30723T231635_0179_082	_082_2340_PS2_0_	NT_003.SEN3/S3B_0	DLCI_EFR.20230723T14585	50.L2.OC.nc
Parfile								
Load Save	Exclude i/o Files	Show D	efaults	Suite OC	0		Get Ancillary	٢
ifile=/Users/byang8/ARSET_ ofile=/Users/byang8/ARSET_ # SUITE suite=OC # PRODUCTS I2prod=Kd_490 Rrs_nnn ang # ANCILLARY INPUTS Defaul icefile=/Users/byang8/ocsss met1=/Users/byang8/ocsss met3=/Users/byang8/ocss ozone2=/Users/byang8/ocs ozone2=/Users/byang8/ocs sozone3=/Users/byang8/ocs stfile=/Users/byang8/ocss	_training/S3B_OL_1_ strom aot_865 chlor_ it = climatology (sele w/var/anc/2023/204 v/var/anc/2023/204 v/var/anc/2023/204 sw/var/anc/2023/20 sw/var/anc/2023/20 sw/var/anc/2023/20 sw/var/anc/2023/20	a cloud_albedo rhos_nnn t 'Get Ancillary' to downle /20230723120000-CMC- GMAO_MERRA2.2023072 GMAO_MERRA2.2023072 4/GMAO_MERRA2.202307 4/GMAO_MERRA2.202307 4/GMAO_MERRA2.202307	Dad ancillary files) L4_GHRSST-SSTfnd-CMC0 T140000.MET.nc T150000.MET.nc 23T150000.MET.nc 23T150000.MET.nc 23T150000.MET.nc	30723T231635_0179_082 0.1deg-GLOB-v02.0-fv03	_082_2340_PS2_O_ 0.nc			50.L2.OC.nc
Keep params when new ifile	is selected							🕑 Open in Sc



### Workflow 1: Create OLCI S3B L2 File (Rename "ofile" and click



"Run")	• • •		l2gen	
	Main Products* F	Processing Options Subsetting Options Three	sholds Ancillary Inputs* IOP Options Miscell	aneous Calibration Options
	Primary I/O Files			
	ifile /Users/byang8/ARSET_training/S3B_OL_1_EFR2	20230723T145850_20230723T150150_20230723	T231635_0179_082_082_2340_P52_0_NT_003.SEN3	/xfdumanifest.xml
	ofile //Users/byang8/ARSET_training/S3B_OL_1_EFR2	0230723T145850_20230723T150150_20230723	1231635_0179_082_082_2340_PS2_0_NT_003.SEN3/	S3B_OLCI_EFR.20230723T145850.L2.OC.custom.hc
	Parfile			
	Load Save Exclude i/o Files	Show Defaults	Suite OC 😒	Get Ancillary 💿
	<pre># PRIMARY INPUT OUTPUT FIELDS ifile=/Users/byang8/ARSET_training/S3B_OL_1_EFR20 ofile=/Users/byang8/ARSET_training/S3B_OL_1_EFR2 # SUITE suite=OC</pre>			
	# PRODUCTS 12prod=Kd_490 Rrs_nnn angstrom aot_865 chlor_a cloud_	albedo rhos_nnn		
	<pre># ANCILLARY INPUTS Default = climatology (select 'Get Ar icefile=/Users/byang8/ocssw/var/anc/2023/204/202307 met1=/Users/byang8/ocssw/var/anc/2023/204/CMAO_M met3=/Users/byang8/ocssw/var/anc/2023/204/CMAO_N ozone1=/Users/byang8/ocssw/var/anc/2023/204/CMAO ozone2=/Users/byang8/ocssw/var/anc/2023/204/CMAO ozone3=/Users/byang8/ocssw/var/anc/2023/204/CMAO sstfile=/Users/byang8/ocssw/var/anc/2023/204/202307</pre>	23120000-CMC-L4_GHRSST-SSTfnd-CMC0.1deg 4ERRA2.20230723T140000.MET.nc 4ERRA2.20230723T150000.MET.nc 4ERRA2.20230723T160000.MET.nc _MERRA2.20230723T140000.MET.nc _MERRA2.20230723T150000.MET.nc _MERRA2.20230723T150000.MET.nc		
	Keep params when new ifile is selected			🗹 Open in SeaDAS
				Run Cancel Apply ?



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# Workflow 1: Create OLCI S3B L2 File (Results Message)

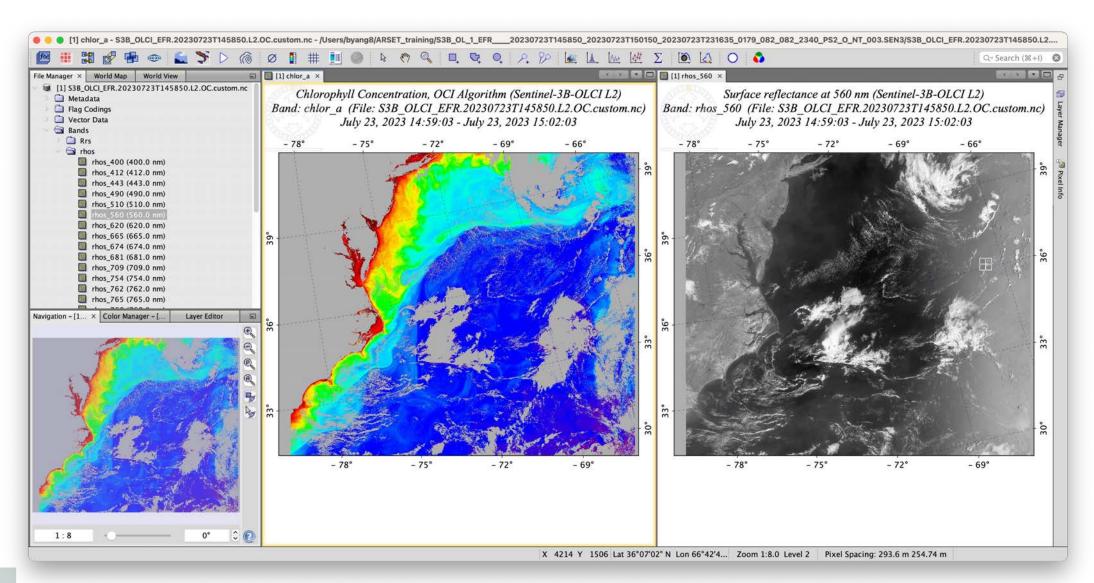






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#### Workflow 1: View the Created OLCI S3B L2 File





#### Workflow 1: Create L3 Binned File (Select "ifile")

				l2bin				
Primary I/O Files								
ifile /Users/byang8/ARSET_training/S3B_OL_1_E	FR20230723T14	45850_202307231	150150	20230723T231635_01	79_082_082_23	40_PS2_	O_NT_003.SEN	EN3/S3B_OLCI_EFR.20230723T145850.L2.OC.nc 😒
ofile /Users/byang8/ARSET_training/S3B_OL_1_EF	R20230723T14	5850_20230723T	150150_	20230723T231635_017	9_082_082_234	0_PS2_0	D_NT_003.SEN3	N3/S3B_OLCI_EFR.20230723T145903.L3b.DAY.nc
	l3bprod		prodtype	resolution	area_weighti	hting		
				regional 🗘		٥	0	•
	flaguse							
	latnorth	latsouth		lonwest	loneast		suite	
	sday	eday		pversion	rowgroup		qual_prod	
	qual_max	oformat						
	2	netCDF4	٥					
				night				
Load Parameters Save Parameters								
								Run Cancel Apply



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# Workflow 1: Create L3 Binned File (Select "I3bprod", "prodtype", and "resolution")

file /Users/byang8/ARSET_training/S	3B_OL_1_EFR20230723T1	45850_202307231	F150150	_20230723T231	635_01	79_082_082_23	40_PS2_	_O_NT_003.SEN3	/S3B_OLCI_E	FR.20230723T145903.L3b.DAY.nc	
	I3bprod		^	prodtype	^	resolution	•	area_weightin			
	chlor_a flaguse		٥	regional	٥	Q	\$	0	0		
	latnorth	latsouth		lonwest		loneast		suite			
	sday	eday		pversion		rowgroup		qual_prod			
	qual_max	oformat									
	2	netCDF4	\$								
				nigl	ht						



## Workflow 1: Create L3 Binned File (Click "flaguse" and specify any desired flags)

e /Users/byang8/ARSET_training/S	3B_OL_1_EFR20230723T1	45850_20230723	F150150	)_20230723T231635_0	179_082_082_2				45850.L2.OC.nc 🗘
le /Users/byang8/ARSET_training/S3	3B_OL_1_EFR20230723T1	45850_20230723T	150150	_20230723T231635_03	79_082_082_2	ATMFAIL	LAND	PRODWARN	15903.L3b.DAY.nc
	I3bprod			prodtype	resolution	HIGLINT	HILT	HISATZEN	
	chlor_a		٥	regional 🗘	Q			<	
	flaguse					COASTZ	STRAYLIGHT		
	latnorth	latsouth		lonwest	loneast	COCCOLITH	TURBIDW	HISOLZEN	
	sday	eday		pversion	rowgroup	LOWLW		NAVWARN	
	qual_max	oformat				ABSAER	MAXAERITER	MODGLINT	
	2	netCDF4	٥						
				night		CHLWARN	ATMWARN	SEAICE	
						NAVFAIL	FILTER	SSTWARN	1
oad Parameters Save Paramet	ters								
						SSTFAIL	HIPOL	PRODFAIL	
						NONE			Cancel Apply

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### Workflow 1: Create L3 Binned File ("flaguse" has been updated) 🥏

l3bprod			prodtype		resolution		area_weig	hting		
chlor_a		٥		0	Q	٥	0	٥		
flaguse	ATMFAIL,LAND,HIG	LINT,HIL	T,HISATZEN,STRAY	LIGH	T,CLDICE,HISOL	ZEN,LO	WLW,CHLFAIL	.,NAVW		
latnorth	latsouth		lonwest		loneast		suite			
sday	eday		pversion		rowgroup		qual_prod			
qual_max	oformat									
2	netCDF4	\$	night							



### Workflow 1: Create L3 Binned File (... or select area\_weighting)

								3_OLCI_EFR.20230723T145850.L2.OC.nc 📀 .
	13bprod		prodtype	resolution		area_weigh	ting	
	chlor_a	0	regional 0	Q	٥	2	٥	
	flaguse	ATMFAIL, LAND, HIGLINT, HIL	T,HISATZEN,STRAYLIGH	HT,CLDICE,HISOLZE	EN,LO	WLW,CHLFAIL,	NAW	
	latnorth	latsouth	lonwest	loneast		suite		
	sday	eday	pversion	rowgroup		qual_prod		
	qual_max	composite_scheme	composite_prod	oformat				
	2			netCDF4	0			
			night					
Load Parameters Save Parar	meters							





### Workflow 1: Create L3 Binned File (...or select "day" temporal range)

offie /Users/byang8/ARSEI_training/S		145850_202307231150150_				OLCI_EFR.20230723T145903.L3b.DAY.nc
	I3bprod chlor_a	0	prodtype day ≎	resolution Q \$	area_weighting 2 \$	
	flaguse	ATMFAIL,LAND,HIGLINT,HIL				
	latnorth	latsouth	lonwest	loneast	suite	
	sday	eday	pversion	rowgroup	qual_prod	
	2023204 qual_max	2023205 composite_scheme	composite_prod	oformat		
	2			netCDF4		
			night			



#### 0 0 12bin Primary I/O Files ifile /Users/byang8/ARSET\_training/S3B\_OL\_1\_EFR\_\_\_\_20230723T145850\_20230723T150150\_20230723T231635\_0179\_082\_082\_2340\_PS2\_0\_NT\_003.SEN3/S3B\_OLC1\_EFR.20230723T145850.L2.OC.nc ... ofile /Users/byang8/ARSET\_training/S3B\_OL\_1\_EFR\_\_\_\_20230723T145850\_20230723T150150\_20230723T231635\_0179\_082\_082\_2340\_PS2\_0\_NT\_003.SEN3/S3B\_OLCI\_EFR.20230723T145903.L3b.DAY.nc ... 13bprod prodtype resolution area\_weighting 0 cumulative 0 0 0 chlor\_a Q 2 flaguse ATMFAIL, LAND, HIGLINT, HILT, HISATZEN, STRAYLIGHT, CLDICE, HISOLZEN, LOWLW, CHLFAIL, NAVW latsouth loneast latnorth lonwest suite sday eday pversion qual prod rowgroup 2023201 2023210 qual\_max composite\_scheme oformat composite\_prod \$ 2 netCDF4 night Load Parameters... Save Parameters... ? Run Cancel Apply

### Workflow 1: Create L3 Binned File (... or select custom temporal range and click "Run")



### Workflow 1: Create L3 Binned File (Results Message)







#### Workflow 1: Create L3 Mapped File (Select "ifile")



							EFR.20230723T145903.L3b.DAY.ı FR.20230723T145903.L3m.DAY.ı	
	product		projection platecarree	\$	resolution	interp nearest	٥	
	north 90	south -90	west -180	east 180	central_meridian 0	fudge 1.0		
	datamin	datamax	scale_type	threshold 0	deflate 4	pversion Unspecified		
	oformat netCDF4 ≎	product_rgb	palette_dir \$OCDATAROOT/common/palette		palfile	onspective		
				use_rgb apply_pal				
Load Parameters Save	Parameters							🗹 Open in SeaDAS

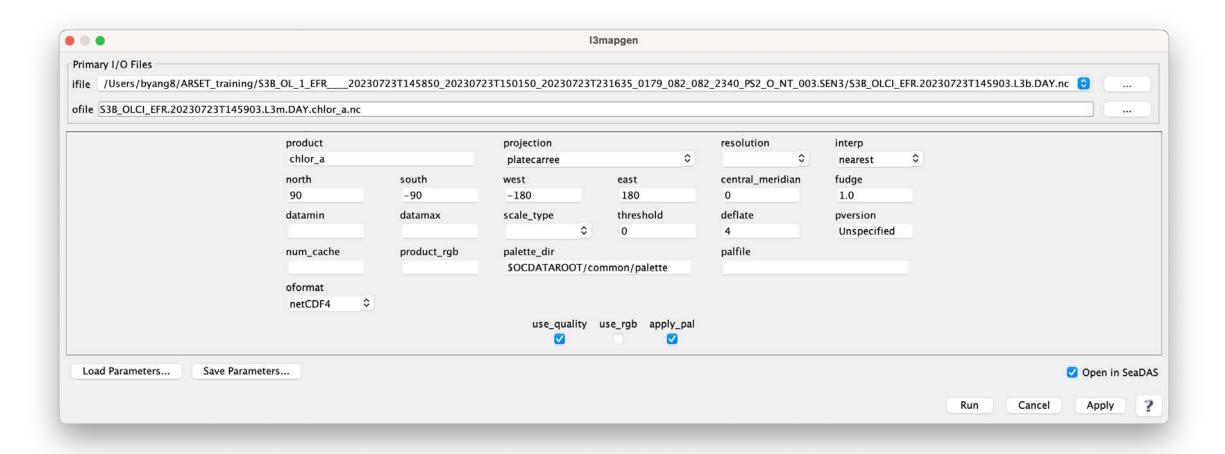
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ofile S3B_OLCI_EFR.2023072	3T145903.L3m.DAY.chlor_a.nc							
	product		projection		resolution	interp		
	chlor_a		platecarree	\$	0	nearest	0	
	north	south	west	east	central_meridian	fudge		
	90	-90	-180	180	0	1.0		
datamin	datamin	datamax	scale_type	threshold 0	deflate	pversion		
			0	0	4	Unspecified		
	num_cache	product_rgb	palette_dir \$OCDATAROOT/co	mmon (nalette	palfile			
	oformat		30CDATAKOOT/CO	minon/palette				
	netCDF4 0							
			use_quality	use_rgb apply_pal				

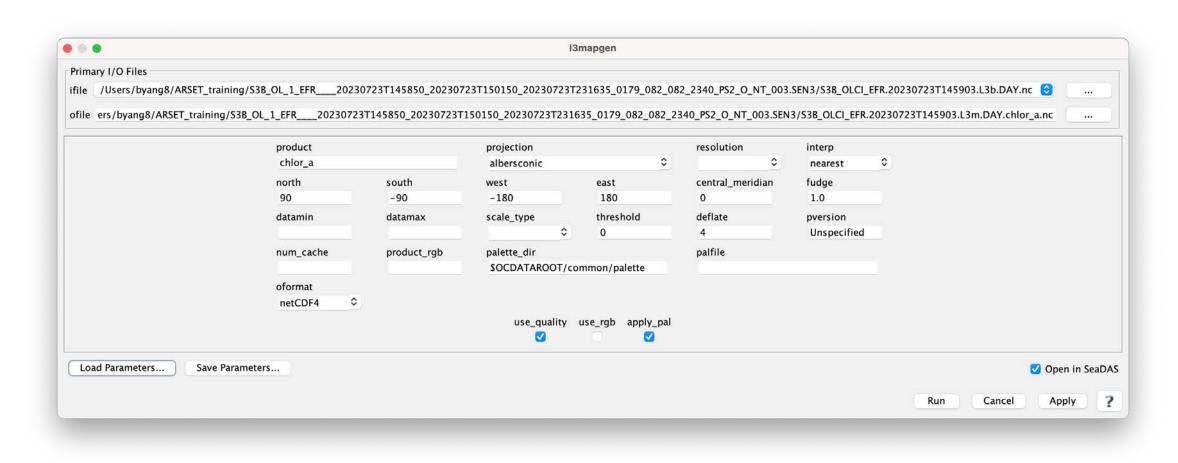


#### Workflow 1: Create L3 Mapped File (Specify Projection – "platecarree" is common for visualization)





### **Workflow 1: Create L3 Mapped File** (Specify Projection – or perhaps "albersconic" for statistics)





## Workflow 1: Create L3 Mapped File (Specific Resolution – Perhaps comparable with bin resolution)

• • •			13	Imapgen					
Primary I/O Files									
ifile /Users/byang8/ARSET_t	raining/S3B_OL_1_EFR20230	0723T145850_202307	23T150150_20230723T2	231635_0179_082_082	_2340_PS2_O_	NT_003.	SEN3/S3B_OLCI_E	FR.20230723T145	5903.L3b.DAY.nc 📀
ofile S3B OLCI EFR.20230723	T145903.L3m.DAY.chlor_a.qkm.i	nc							
	product		projection		resolution		interp		
	chlor_a		albersconic	٥	qkm	0	nearest	0	
	north	south	west	east	central_me	ridian	fudge		
	90	-90	-180	180	0		1.0		
datamin	datamin	datamax	scale_type	threshold	deflate		pversion		
			0	0	4		Unspecified		
	oformat	product_rgb	palette_dir		palfile				
	netCDF4 0		\$OCDATAROOT/co	ommon/palette					
			use_quality	use_rgb apply_pal					
Load Parameters Sav	e Parameters								🗹 Open in SeaDA
								Run	Cancel Apply

### Workflow 1: Create L3 Mapped File (Select interp="area" to help counteract some missing bins)

• • •			13	mapgen					
Primary I/O Files									
ifile /Users/byang8/ARSET_training/S38 ofile S3B_OLCI_EFR.20230723T145903.L3			23T150150_20230723T2	31635_0179_082_082	_2340_PS2_O_	NT_003.	SEN3/S3B_OLCI_E	FR.20230723T145903.L3b.DAY.nc	<b>.</b>
	product		projection		resolution		interp		
	chlor_a		albersconic	0	qkm	٥	area	0	
	north	south	west	east	central_me	ridian	fudge		
	90	-90	-180	180	0		1.0		
	datamin	datamax	scale_type	threshold	deflate		pversion		
			\$	0	4		Unspecified		
	oformat	product_rgb	palette_dir	r	palfile				
	netCDF4 🗘		\$OCDATAROOT/co	mmon/palette				_1	
			use_quality	use_rgb apply_pal					
Load Parameters Save Parameter	rs								🗹 Open in SeaDAS
								Run Cancel	Apply ?

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### Workflow 1: Create L3 Mapped File (Select Desired Region – Otherwise scene has default boundaries)

	۲_training/S3B_OL_1_EFR20230 23T145903.L3m.DAY.chlor_a.qkm.ı		231130130_2023072312	31033_0173_082_08	2_2340_132_0	_141_003.	3EN37338_OLCI_L	- K.202307231143303.L3D.DA	
	product		projection	<b>^</b>	resolution	•	interp	<u>^</u>	
	chlor_a north	south	albersconic west	east	qkm central_me	≎ ridian	area fudge	\$	
	40	36	-77	-74	0		1.0		
datamin num_cache	datamin	datamax	scale_type	threshold	deflate 4		pversion		
	num_cache	product_rgb	¢ palette_dir \$OCDATAROOT/cor	0 mmon/palette	4 palfile		Unspecified		
	oformat netCDF4 ♀								
			use_quality u	use_rgb apply_pal					
Load Parameters S	ave Parameters								🗹 Open in SeaDA

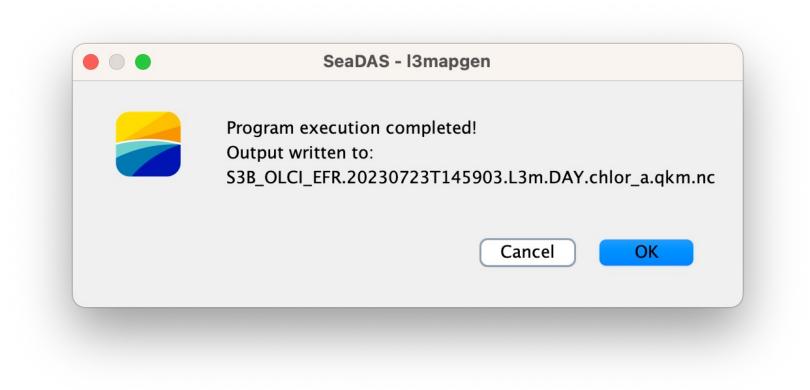
#### Workflow 1: Create L3 Mapped File (Click "Run")



• 0 •			131	napgen					
Primary I/O Files									
ifile /Users/byang8/ARSET_t	training/S3B_OL_1_EFR2023	30723T145850_202307	723T150150_20230723T2	31635_0179_082_08	2_2340_PS2_O	_NT_003.	SEN3/S3B_OLCI_I	FR.20230723T145903.L3b.D	AY.nc 😌
ofile S3B_OLCI_EFR.20230723	T145903.L3m.DAY.chlor_a.qkm	i.nc							
	nroduct		nucleation		resolution		Intern		
	product chlor_a		projection albersconic	0	qkm	٥	interp area	0	
	north	south	west	east	central_me		fudge		
	40	36	-77	-74	0	inanan	1.0		
	datamin	datamax	scale_type	threshold	deflate		pversion		
num_cache			•	0	4		Unspecified		
	product_rgb	palette_dir		palfile					
			\$OCDATAROOT/con	mmon/palette					
	oformat								
	netCDF4 🗘								
			use_quality i	use_rgb apply_pal					
Load Parameters Sav	ve Parameters								🗹 Open in SeaDAS
								Run Canc	el Apply ?

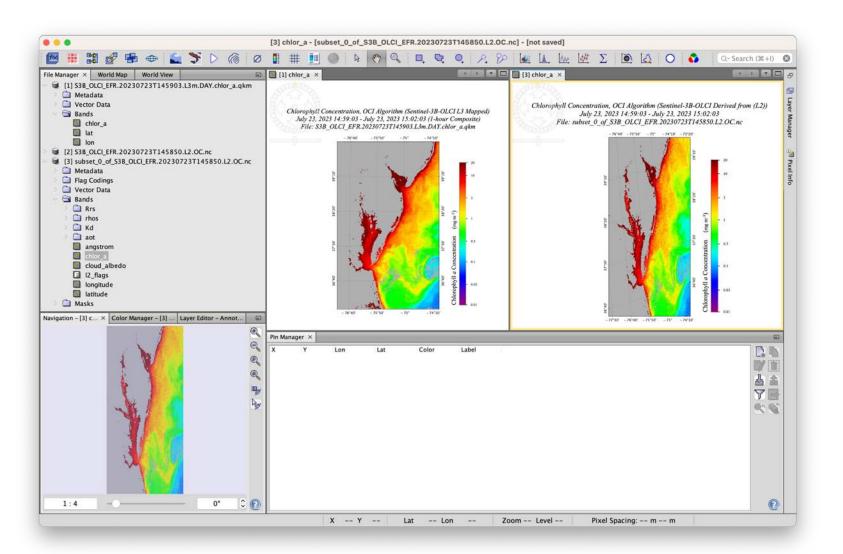
### Workflow 1: Create L3 Mapped File (Results Message)





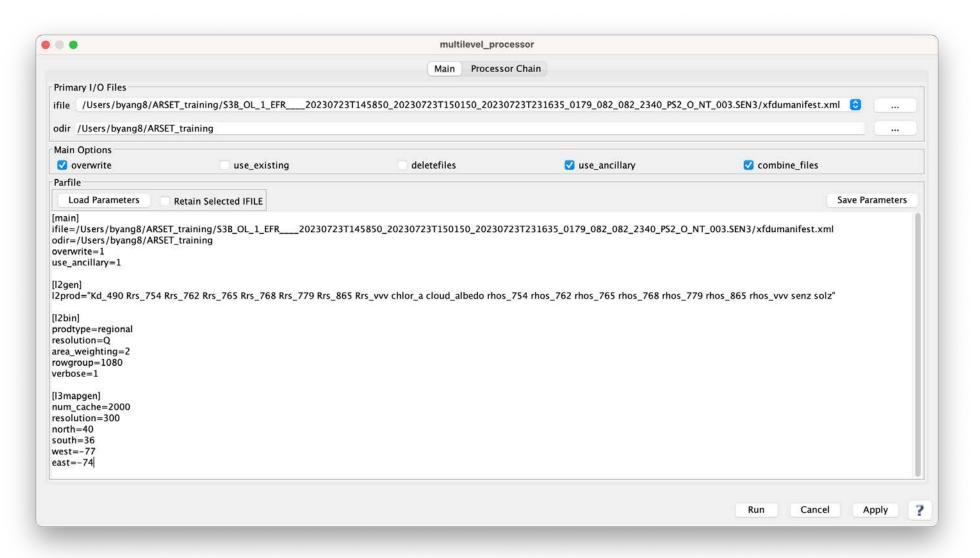


#### Workflow 1: View L3 Mapped File alongside L2 File





#### Workflow 1: multilevel\_processor (smi – platecarree)





#### Workflow 1: View L3 Mapped File



