**Batch Processing README**

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**Purpose**

Batch process Level 2 images obtained from Landsat 8 and Sentinel 2A & 2B to derive estimates of Secchi disk depth at the Virginia Coastal Reserve Long Term Ecological Research site in MATLAB. It applies the Quasi-Analytical Algorithm (version 6) from Lee et al. 2002, diffuse attenuation coefficient algorithm from Lee et al. 2004, and Landsat 8 Secchi disk depth algorithm from Lee et al. 2016 to each image (Z. Lee et al., 2016; Z. P. Lee et al., 2005; ZhongPing. Lee et al., 2002).

**Inputs**

Level 2 NetCDF images processed from Level 1 images with l2gen in SeaDAS 8.2. The Level 2 images have a .L2\_LAC\_OC file extension. The l2gen function was adapted to crop the Level 1 images to the extent of the area of interest and to apply vicarious atmospheric calibrations to Sentinel 2 Level 1 images. Level 1 images were downloaded from USGS Earth Explorer.

**Contents**

*Scripts* - Sensor specific scripts for batch processing imagery

* L8\_BatchDataExtraction
* S2A\_BatchDataExtraction
* S2B\_BatchDataExtraction
* S2\_Reproject\_Resample

*Functions* - Associated functions that the scripts call upon to run. Each folder contains the same filenames, but the functions are adapted to each sensor.

l8functions

* iop2kd
* lMask
* maskL2
* qaa\_v6\_l8
* readL2
* readL2\_crop
* secci\_l8

s2functions

* iop2kd
* lMask
* maskL2
* qaa\_v6\_l8
* readS2a
* readS2a\_crop
* readS2b
* readS2b\_crop
* secci\_l8

**Procedure**

1. Launch MATLAB and open scripts.
2. Edit paths to lead to your directory and folders on lines 7, 8, and 9. You may have to edit the input and output path names in the rest of the first section if you decide on another file structure for your processing.
3. Change target year as you move through your image folders. Files are split by year to stay organized and keep processing time reasonable.
4. Run the code. Each run should take about 10-15 minutes. Check the output PNGs to make sure that your results make sense.
5. Run ‘S2\_Reproject\_Resample’ to reproject the Sentinel 2 imagery to meters and resample the Sentinel imagery to the same resolution as Landsat 8.

**Comments & Suggestions**

1. Use a computing cluster (I used Rivanna Computing cluster) to process these images to speed up the process via parallel processing and to have access to more storage.
2. For Landsat 8, the spatial resolution is coarser than Sentinel images, so I was able to process all files within each target year in one run within a reasonable processing time. Since Sentinel images have a lot more data, I split up the runs within each year by adding a wildcard selecting for images associated with specific months. I found that 8-12 images will run within a reasonable processing time.
3. The readX\_crop files are a modification of the ncread function used in readX. It allows you to crop the input image by indexing. There is an additional start and count variable, where you need to provide the starting target coordinate and the count of rows and columns associated with your area of interest. You can also crop the images in l2gen before bringing them into MATLAB, which helps cut down on processing time.
4. The ‘S2\_Reproject\_Resample’ script requires an install of python for using gdalwarp, which is outlined in the ‘S2\_Reproject\_Resample\_python\_setup’ powerpoint.

**References**

Original code: <https://github.com/ocean-slang/Coastal-OC-Remote-Sensing>

L2gen code: <https://github.com/ocean-slang/SeaDAS>

Lang, S., Luis, K., Doney, S., Castorani, M. (2022). Modeling Coastal Water Quality Using Landsat-8 and

Sentinel-2. Unpublished manuscript.

Lee, Z. P., Du, K. P., & Arnone, R. (2005). A model for the diffuse attenuation coefficient of downwelling irradiance. *Journal of Geophysical Research: Oceans*, *110*(C2), 1–10. https://doi.org/10.1029/2004JC002275

Lee, Z., Shang, S., Qi, L., Yan, J., & Lin, G. (2016). A semi-analytical scheme to estimate Secchi-disk depth from Landsat-8 measurements. *Remote Sensing of Environment*, *177*, 101–106. https://doi.org/10.1016/J.RSE.2016.02.033

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