Appendix A. Description of the elements involved in the inputs/pre-processing steps and post-processing features

Elements	Description	Supplementary figures	Figure label
(i) Inputs/pre-processing			
Image folder path	Path to the folder directory containing the folder of the raw hyperspectral images (.raw format), "UAV" folder containing a GPS file (csv file), "Dark" folder containing the dark reference, "WhiteRef" folder containing the white reference	Appendix B	1(a)
Spectrometer folder	A series of text files (.txt), each containing the absolute irradiance information (μW/cm^2/nm) at wavelengths covering the entire spectral range of the hyperspectral camera	Appendix B	1(b)
Prefix for files	User-assigned label to processed images	Appendix B	1(c)
Location to store processed images	User-defined folder where processed images are stored in	Appendix B	1(d)
Upload config file	Configuration file that contains all the user-defined options that was created during the previous processing can be uploaded. Fields will be automatically filled in to improve efficiency.	Appendix B	1(e)
Launch to select region	A GUI window where user can specify the range of flight regions to conduct stitching (See Appendix H)	Appendix C	2(a)
Drone Height	User-specified height (in metres) at which the drone operates and where imaging is conducted. *Note:* GPS information entails the altitude information but not the height information, where altitude = height + surface topography	Appendix C	2(b)
Upload .txt file	After the selection of flight regions in the GUI window, the GPS indices are stored in a .txt file for future repeated process	Appendix C	2(c)
Range of lines to process	User-defined option to choose how many lines to process	Appendix C	2(d)
Launch image correction	Launch image correction GUI window to conduct time delay correction (See Appendix I)	Appendix C	2(e)
Upload correction indices	For fine tuning of individual lines, the corrected indices (saved from 2(e)) can be uploaded	Appendix C	2(f)

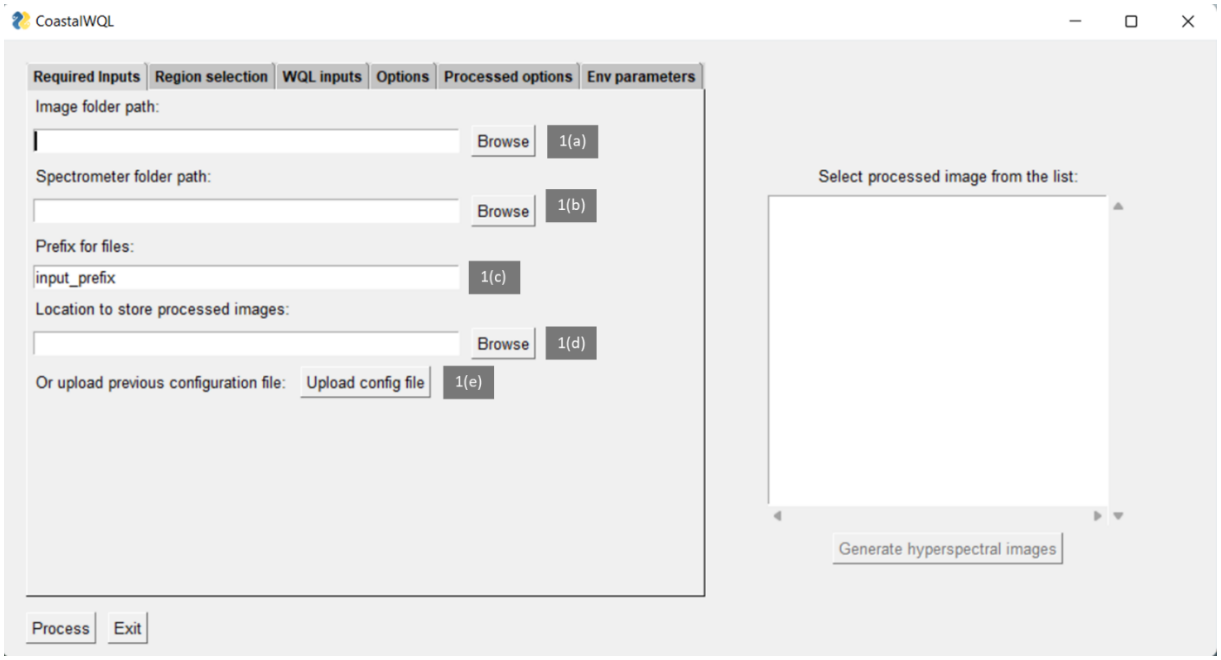
Slider	Global time delay correction can alternatively be used if the user has a prior knowledge on the time delay	Appendix C	2(g)
Water quality .csv file	A csv file containing information of the in-situ water quality measurements. It should contain columns with the measurements of the water quality concentration, and two other columns with its corresponding latitude and longitude information	Appendix D	3(a)
Column of latitude/ longitude/ water quality variable	Drop-down boxes based on the input .csv file's columns will be automatically filled in. User can choose the columns that corresponds to latitude, longitude and the water quality variable. Spectral information and the in-situ measurements will be extracted from the images based on the coordinates supplied	Appendix D	3(b)
Querying & filtering	For querying and filtering the data using SQL syntax using variables in the dropdown box. Users can then view the water quality file by clicking on 'View water quality file'.	Appendix D	3(c)
Pre-processing	Checkboxes that allow users to select the pre-processing methods • Mask objects (masking of non-water objects. *Note:* A pop-up box will appear to allow users to input the segmentation model. Classification is automatically performed, where class 2=caisson/land, 1=vessels, 0=water) • Noise removal (de-striping) • Radiometric correction (only if spectroradiometer folder is provided) • Sun glint correction (see Appendix J for choosing glinted regions interactively)	Appendix E	4(a)
Select RGB bands	Bands to create false-composite images	Appendix E	4(b)
Prediction	Prediction checkbox to produce a predicted map of the water quality variable. Nechad et al (2009)'s algorithm is used for turbidity retrieval ----------Available in python notebook---------- Users have the flexibility to supply their own trained model (e.g. XGBoost model in.json or .model format) that can be used to predict any water quality variable of interest. Users can further specify which bands to be used as predictors, based on the input trained model.	Appendix E	4(c)

Process	After the user has indicated their selection, clicking on 'Process' will start the processing	Appendix E	4(e)
(ii) Post-processing			
Preview previously processed images	Folder to open that contains the previously processed images		Appendix F
View georeferenced images	Dropdown list that contains prefixes of different batches of images will be filled in after specifying the 'Processed image folder'. Upon clicking the 'View georeferenced images', a GUI window will pop up for users to view the georeferenced images/predicted images and add features to make a production-ready map (see Appendix K)	Appendix F	5(b)
Assess extracted spectral information	Dropdown list that contains different extracted spectral information files will be filled in after specifying the 'Processed image folder'. Upon clicking on 'Plot spectral curve', a GUI window will pop up for users to assess the quality of the extracted spectral information from the supplied water quality .csv file	Appendix F	5(c)
Select hyperspectral bands	A GUI window will pop up for users to create various false composite images by specifying the desired bands (see Appendix L)	Appendix F	5(d)
Select processed image from the list	List of processed images' file name will be automatically filled in upon selecting the 'Processed image folder'. Upon selecting the file name, the processed image will be shown on the right panel	Appendix F	5(e)
Generate hyperspectral images	Users can choose to generate hyperspectral images if desired, as hyperspectral images are not produced as outputs by default due to increased processing time and high storage requirements on the local machine (However, during the extraction of spectral information, hyperspectral images are generated implicitly already).	Appendix F	5(f)
(iii) Retrieval of ancillary data (environmental parameters)			
List of dates/time	Users can select date from a calendar widget by clicking on 'Select Date' for when they want to retrieve the environmental parameters. Users can also optionally indicate the range of time (start time and end time)		Appendix G

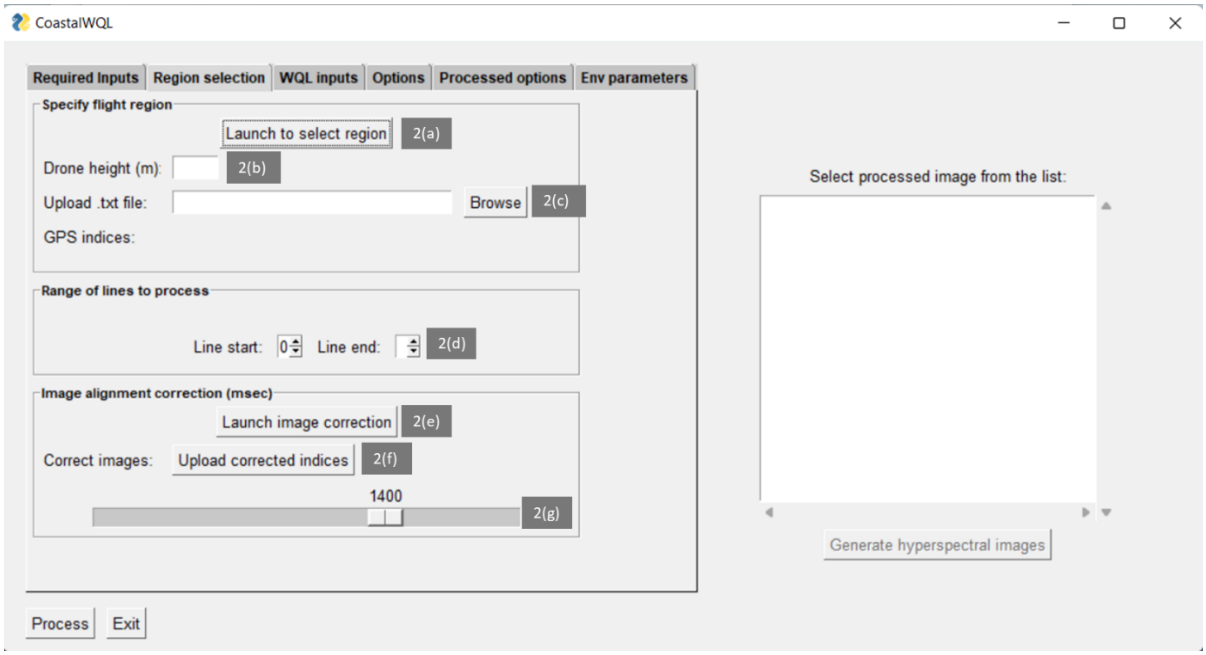
Environmental parameters	Up to four environmental parameters can be selected to retrieve the information from https://data.gov.sg/dataset?groups=environment (*Note*: Currently only configured to retrieve data from stations in Singapore, and are currently only limited to these options)	Appendix G	6(b)
Fetch data	A pop-up window will appear to indicate the directory where the user wants to save the retrieved environmental parameters. After the retrieval of the data, a csv file with the retrieved environmental parameters will be saved in a folder 'retrieved_env_variables'.	Appendix G	6(c)
Plot environmental data	A pop-up window will appear to show the time series plot of the retrieved environmental parameter(s) (see Appendix M)	Appendix G	6(d)

Note: Demonstration video for the workflow can be found here

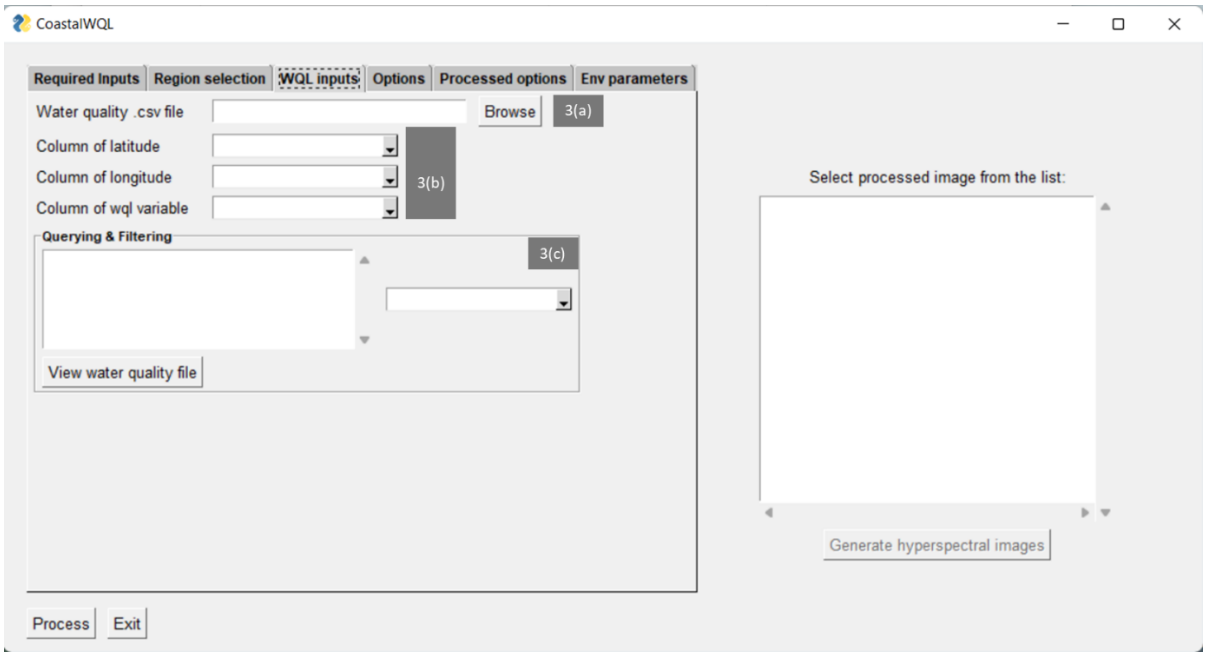
Appendix B. Required inputs for *CoastalWQL*



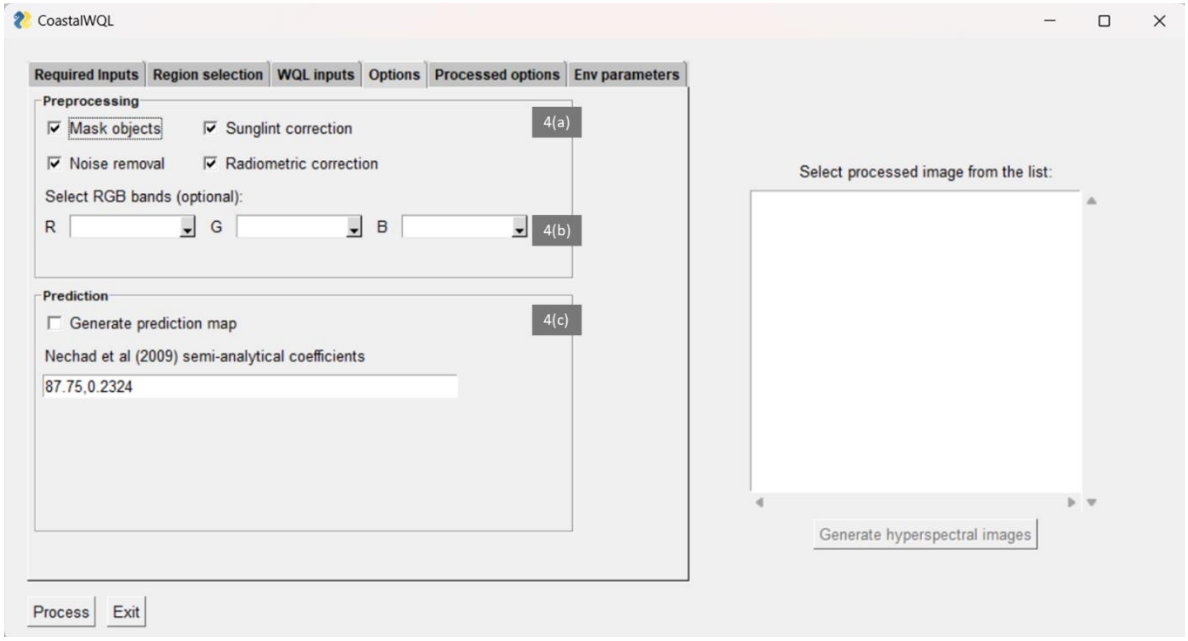
Appendix C. Region selection for image stitching in *CoastalWQL*



Appendix D. Water quality inputs for extraction of spectral information

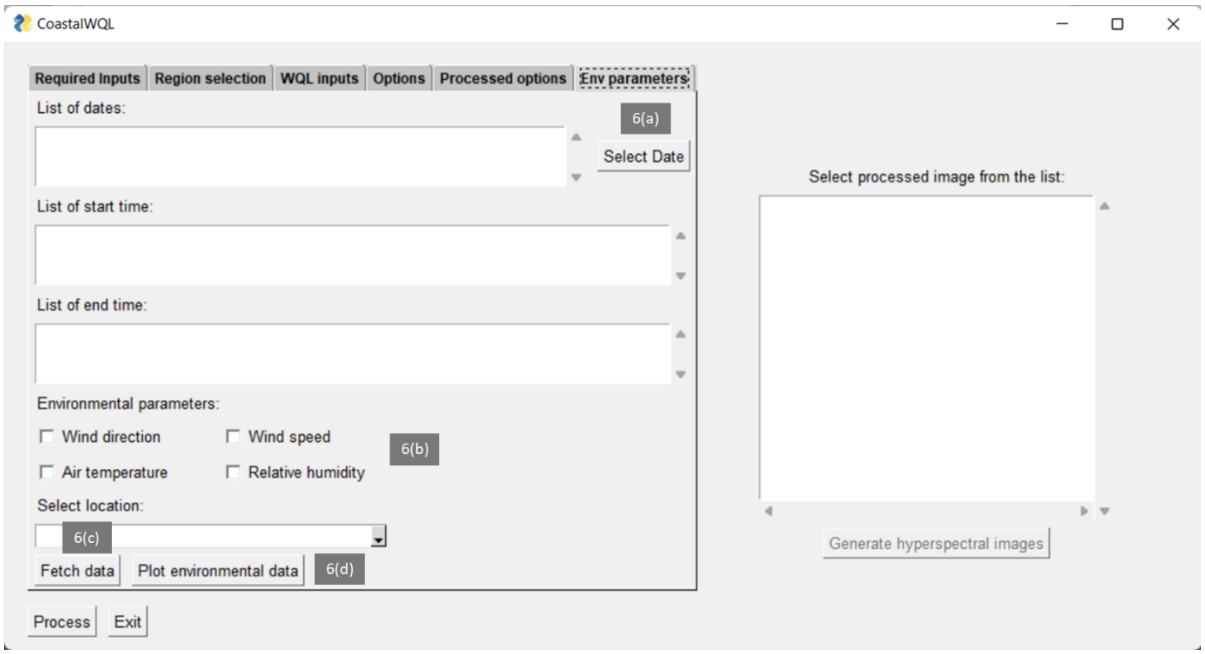


Appendix E. Additional options for pre-processing and prediction (Updated)

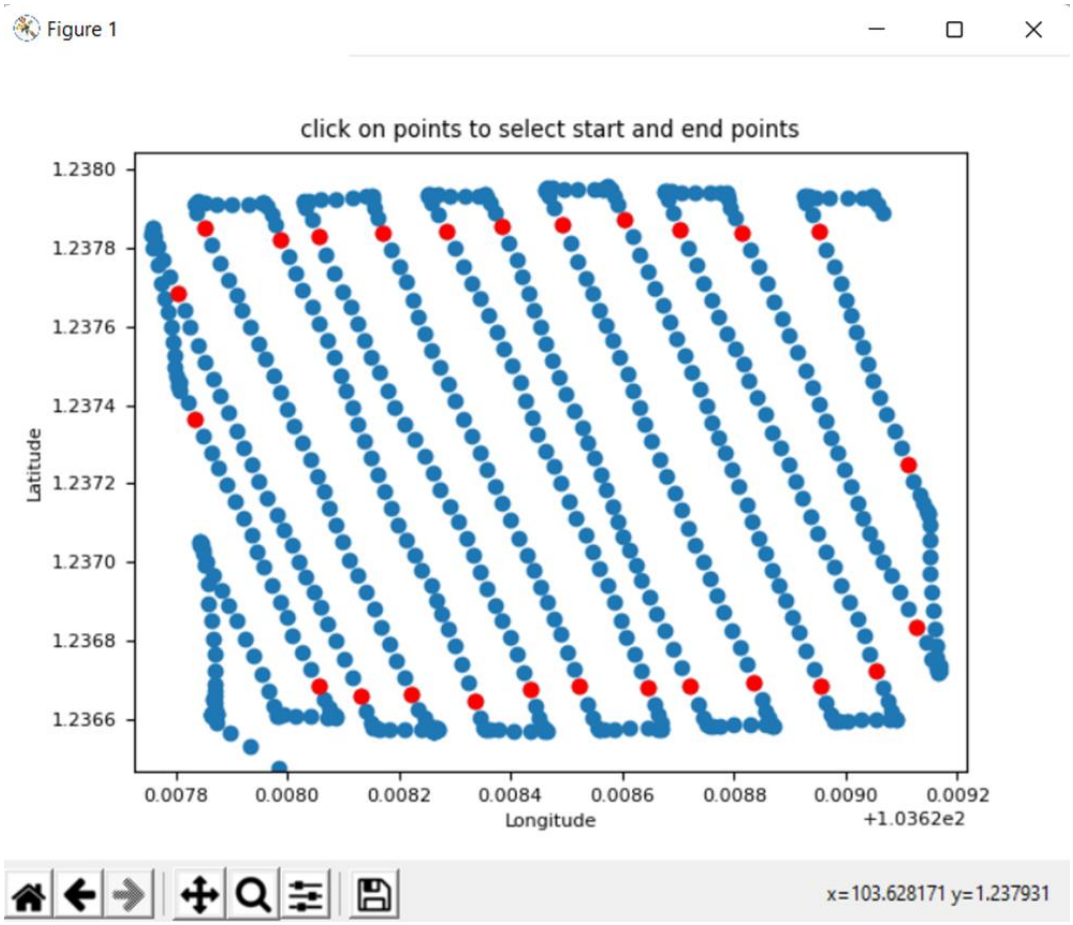


Appendix F. Visualisation features post-processing

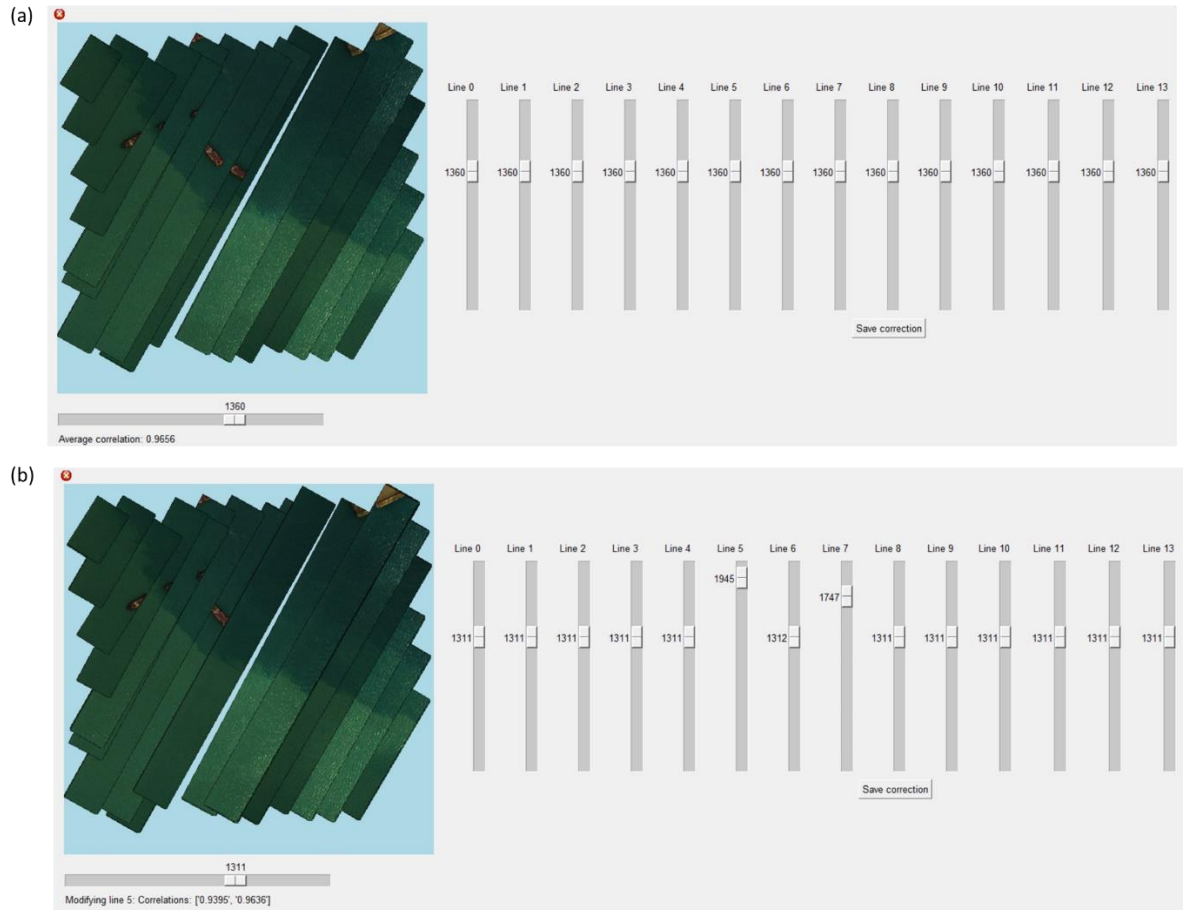
Appendix G. Retrieval of environmental parameters



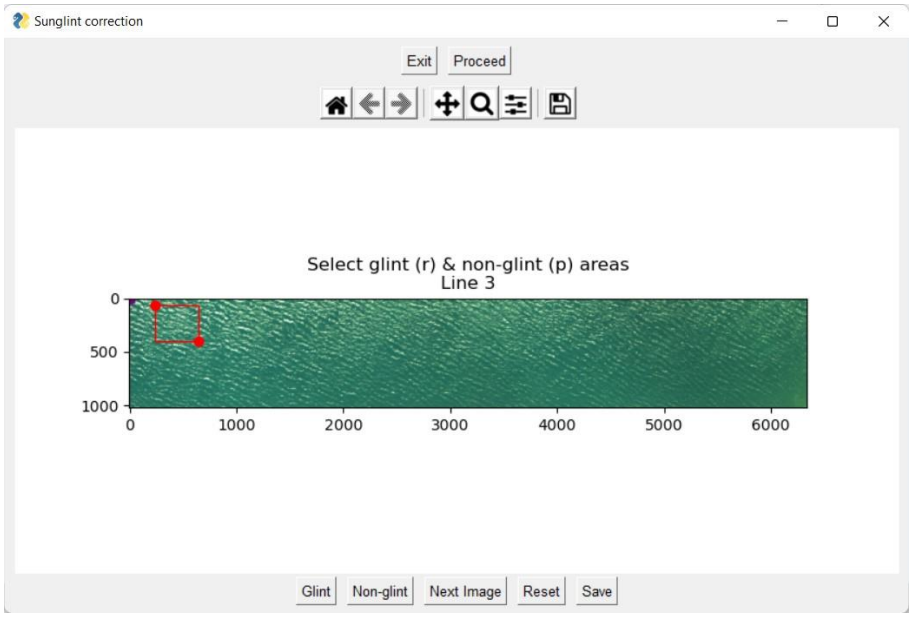
Appendix H. Selecting flight regions based on GPS points *(Note*: Red points are user-selected points to indicate the start and end of each flight line)



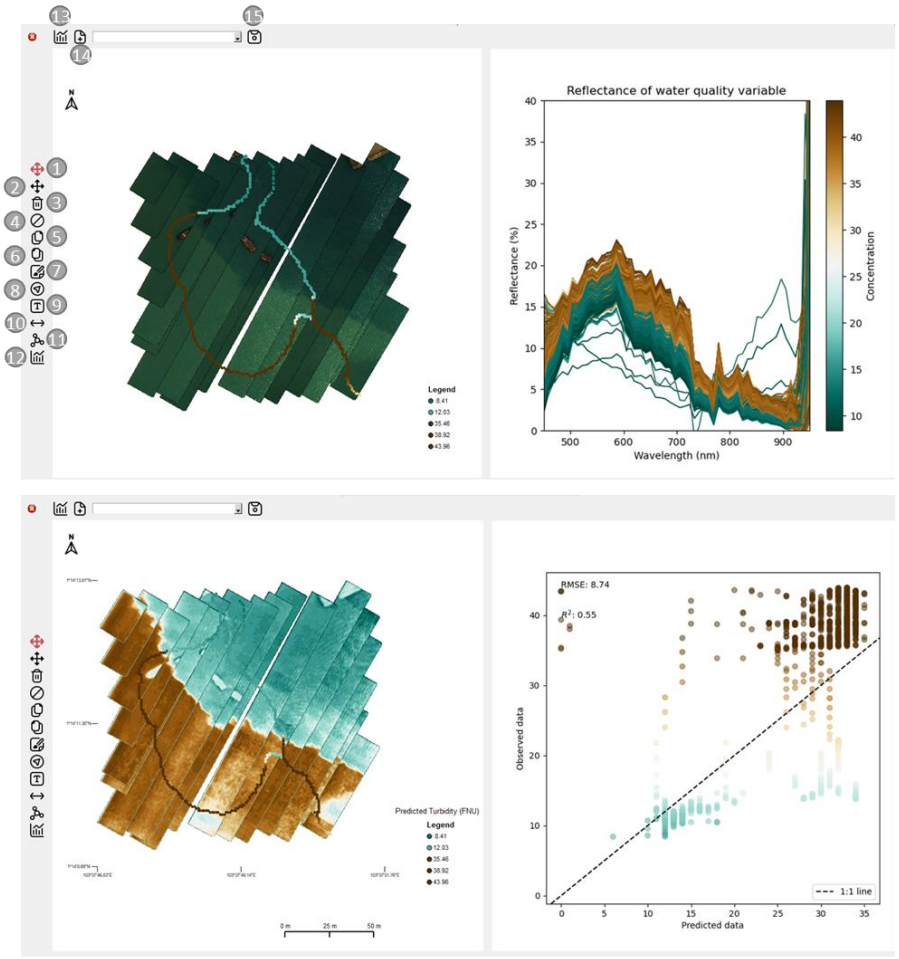
Appendix I. Interactive image alignment (a) global alignment using the horizontal slider (b) fine-tuning of image alignment of individual image line using the vertical sliders



Appendix J. An interactive toolkit for user-selection of an ROI affected by sun glint in *CoastalWQL* (**Note: Deprecated, this has been replaced by the SUGAR algorithm where user input is no longer required anymore**)

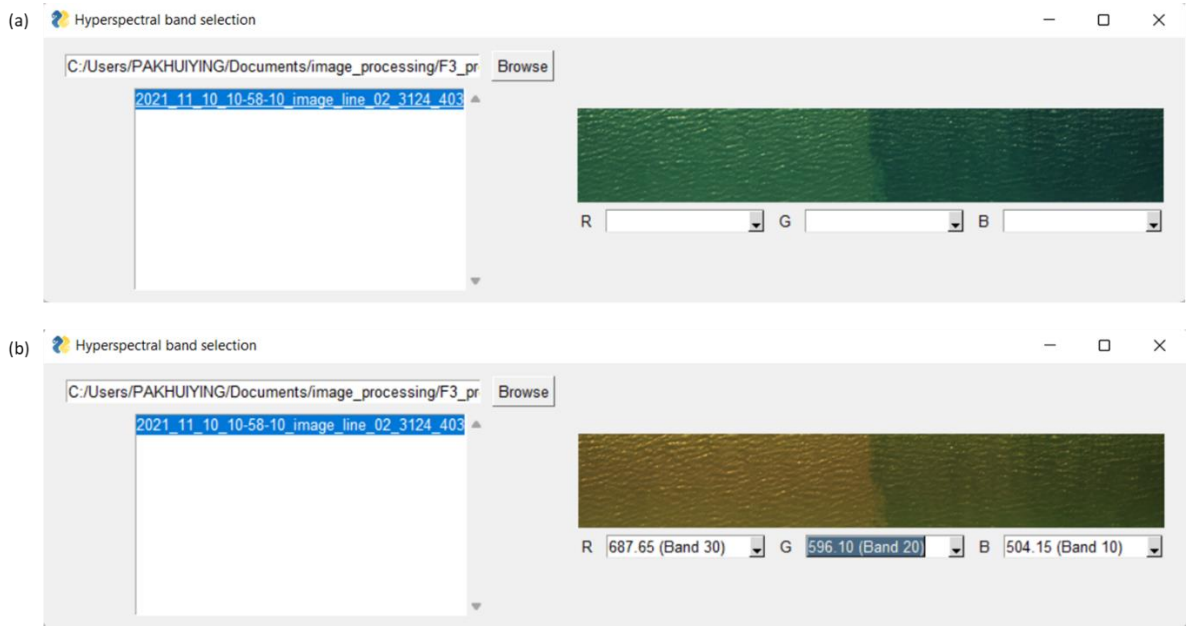


Appendix K. Visualisation and map generation toolkit (a) Viewing false composite images (b) Viewing predicted images



1. Move element
2. Move all
3. Delete element
4. Clear figure
5. Move to front
6. Move to back
7. Change background colour
8. Change compass
9. Add text
10. Add map scale
11. Add water quality points
12. Add predicted images
13. View spectral graph
14. Add images
15. Save

Appendix L. Selection of bands to create different false composite images



Appendix M. Time series of retrieved user-defined environmental variables