L1A : Process RAW to L1A

Raw binary to HDF5 and filter data on SZA.

Processing Parameters and metadata:
HyperInSPACE version: 1.0.6
The stuff that dreams are made of.
/version=R0
/investigators=Sam_Spade
/affiliations=Sam_Spade_Detective_Agency
/contact=supersleuth@noir.com
/experiment=sample
/cruise=Sample1
/documents=LogSheet.xls,ProcessReport.xls
/instrument_manufacturer=Satlantic
/instrument_model=HyperSAS
/calibration_date=
/calibration_files=HSE488B.cal,HSL386B.cal,HLD386B.cal,HED488B.cal,SATTHS0045A.tdf,HLD385B.cal,HSL385B.cal,SATNAV0001A.tdf,GPRMC_NMEA0183v3.01.tdf
/data_type=above_water
/data_status=preliminary
/water_depth=NA
/measurement_depth=0
/cloud_percent=NA
/wave_height=NA
/secchi_depth=NA
/station=
/original_file_name=
/start_date=
/end_date=
/start_time=
/end_time=
/north_latitude=
/south_latitude=
/east_longitude=
/west_longitude=
/wind_speed=

Process log:
Process Single Level
ProcessL1a.processL1a: 01-Apr-2021 11:06:25
L1A file produced:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1A/SAMPLE_HYPERSAS_SOLARTRACKER_L1A.hdf
Process Single Level:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1A/SAMPLE_HYPERSAS_SOLARTRACKER_L1A.hdf - SUCCESSFUL

L1B : Process L1A to L1B

Apply factory calibrations.

Processing Parameters: None

Process log:
Process Single Level
ProcessL1b.processL1b: 01-Apr-2021 11:07:11
Applying factory calibrations.
  Group: GPRMC_NMEA0183v3.01.tdf
    File: $GPRMC
  Group: HED488B.cal
    File: SATHED0488
  Group: HLD385B.cal
    File: SATHLD0385
  Group: HLD386B.cal
    File: SATHLD0386
  Group: HSE488B.cal
    File: SATHSE0488
  Group: HSL385B.cal
    File: SATHSL0385
  Group: HSL386B.cal
    File: SATHSL0386
  Group: SATNAV0001A.tdf
    File: SATNAV0001
L1B file produced:
 /Users/daurin/GitRepos/HyperInSPACE/Data/L1B/SAMPLE_HYPERSAS_SOLARTRACKER_L1B.hdf
Process Single Level: /Users/daurin/GitRepos/HyperInSPACE/Data/L1B/SAMPLE_HYPERSAS_SOLARTRACKER_L1B.hdf - SUCCESSFUL

L1C : Process L1B to L1C

Filter data on pitch, roll, yaw, and azimuth angles.

Processing Parameters:
Rotator Home Angle: 0.0Rotator Delay: 60.0Pitch/Roll Filter: 5.0Rel Azimuth Min: 90.0Rel Azimuth Max: 135.0
Process log:
Process Single Level
ProcessL1c:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1B/SAMPLE_HYPERSAS_SOLARTRACKER_L1B.hdf
ProcessL1c.processL1c: 01-Apr-2021 11:07:17
Bad Datetag or Timetag2 found. Eliminating record. 3158326.0 : 758134061.0
Filtering file for high pitch and roll
Percentage of SolarTracker data out of Pitch/Roll bounds: 0 %
Filtering file for bad Absolute Rotator Angle
Percentage of SolarTracker data out of Absolute Rotator bounds: 0 %
Filtering file for bad Relative Solar Azimuth
Percentage of ancillary data out of Relative Solar Azimuth bounds: 3 %
Flag data from TT2: 2016-05-20 07:58:17.566000+00:00 to 2016-05-20 07:59:48.483000+00:00 (HHMMSSMSS)
Eliminate combined filtered data from datasets.**********
Remove ES_DARK Data
Length of dataset prior to removal 1033 long
Length of dataset after removal 8 long
Data end 1025 long, a loss of 1 %
Remove ES_LIGHT Data
Length of dataset prior to removal 3579 long
Length of dataset after removal 23 long
Data end 3556 long, a loss of 1 %
Remove GPS Data
Length of dataset prior to removal 1777 long
Length of dataset after removal 45 long
Data end 1732 long, a loss of 3 %
Remove LI_DARK Data
Length of dataset prior to removal 1027 long
Length of dataset after removal 8 long
Data end 1019 long, a loss of 1 %
Remove LI_LIGHT Data
Length of dataset prior to removal 4753 long
Length of dataset after removal 37 long
Data end 4716 long, a loss of 1 %
Remove LT_DARK Data
Length of dataset prior to removal 245 long
Length of dataset after removal 2 long
Data end 243 long, a loss of 1 %
Remove LT_LIGHT Data
Length of dataset prior to removal 1243 long
Length of dataset after removal 9 long

Data end 1234 long, a loss of 1 %
Remove SOLARTRACKER Data
Length of dataset prior to removal 1776 long
Length of dataset after removal 46 long
Data end 1730 long, a loss of 3 %
L1C file produced:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1C/SAMPLE_HYPERSAS_SOLARTRACKER_L1C.hdf
Process Single Level: /Users/daurin/GitRepos/HyperInSPACE/Data/L1C/SAMPLE_HYPERSAS_SOLARTRACKER_L1C.hdf - SUCCESSFUL

L1D : Process L1C to L1D

Deglitch data and apply shutter dark corrections.

Processing Parameters:
ES Dark Window: 11ES Light Window: 9ES Dark Sigma: 3.2ES Light Sigma: 2.4LT Dark Window: 9LT Light Window: 9LT Dark Sigma: 3.2LT Light Sigma: 2.3LI Dark Window: 11LI Light Window: 9LI Dark Sigma: 3.5LI Light Sigma: 2.4
Process log:
Process Single Level
Deglitching anomaly file found for this L1C. Using these parameters.
ProcessL1d:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1C/SAMPLE_HYPERSAS_SOLARTRACKER_L1C.hdf
ProcessL1d.processL1d: 01-Apr-2021 11:07:19
Screening ES_DARK for clean timestamps.
Screening ES_LIGHT for clean timestamps.
Screening GPS for clean timestamps.
Screening LI_DARK for clean timestamps.
Screening LI_LIGHT for clean timestamps.
Screening LT_DARK for clean timestamps.
Screening LT_LIGHT for clean timestamps.
Screening SOLARTRACKER for clean timestamps.
ES
Deglitching dark
Data reduced by 422 (41.0%)
Deglitching light
Data reduced by 550 (15.0%)
LI
Deglitching dark
Data reduced by 73 (7.0%)
Deglitching light
Data reduced by 1843 (39.0%)
LT
Deglitching dark
Data reduced by 50 (21.0%)
Deglitching light
Data reduced by 219 (18.0%)
Dark Correction: ES
Dark Correction: LI
Dark Correction: LT
L1D file produced:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1D/SAMPLE_HYPERSAS_SOLARTRACKER_L1D.hdf
Process Single Level:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1D/SAMPLE_HYPERSAS_SOLARTRACKER_L1D.hdf - SUCCESSFUL

Example Deglitching

Randomized. Complete plots of hyperspectral deglitching from anomaly analysis can be found in [output_directory]/Plots/L1C_Anoms.

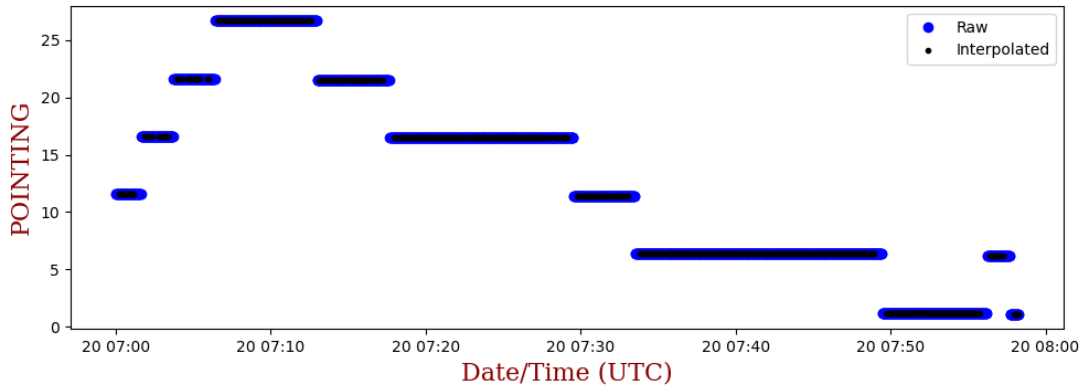
None found.
None found.
None found.

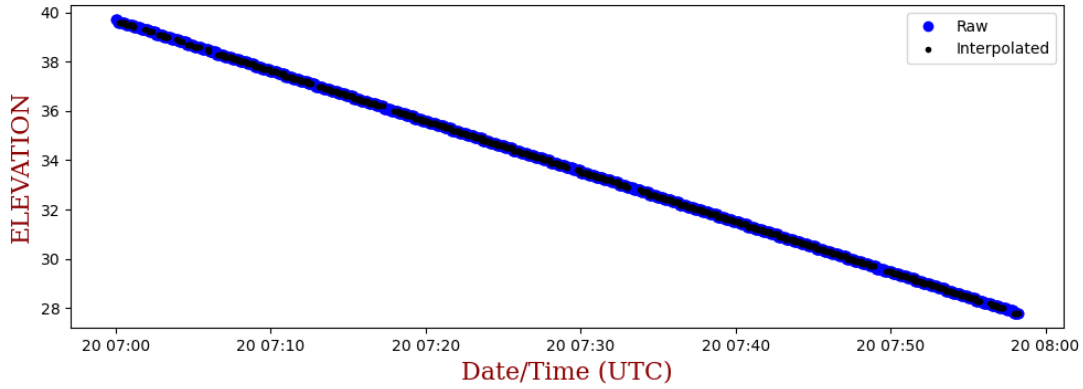
L1E : Process L1D to L1E

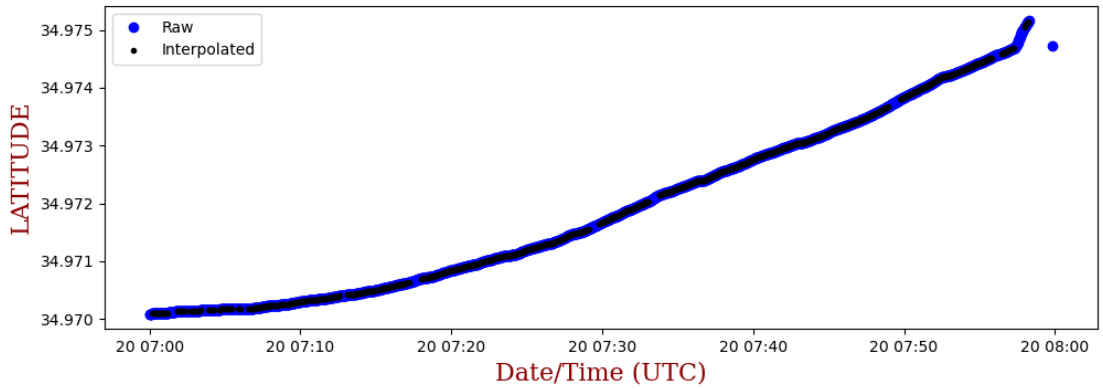
Interpolate data to common timestamps and wavebands.
Processing Parameters:
Wavelength Interp Int: 3.3 nm
Process log:
Process Single Level
ProcessL1e.processL1e: 01-Apr-2021 11:08:14
LT has fewest records (as expected) - interpolating to LT; 1015 records
Interpolate Data ES
Interpolate Data LI
Interpolate Data LT
Skip. Other instruments are being interpolated to this one.
Interpolate Data LATITUDE
Interpolate Data LONGITUDE
Interpolate Data COURSE
Interpolate Data SPEED
Interpolate Data REL_AZ
Interpolate Data ELEVATION
Interpolate Data AZIMUTH
Interpolate Data HEADING
Interpolate Data HUMIDITY
Interpolate Data PITCH
Interpolate Data POINTING
Interpolate Data ROLL
L1E file produced:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1E/SAMPLE_HYPERSAS_SOLARTRACKER_L1E.hdf
Output SeaBASS for HDF: Es, Li, Lt files

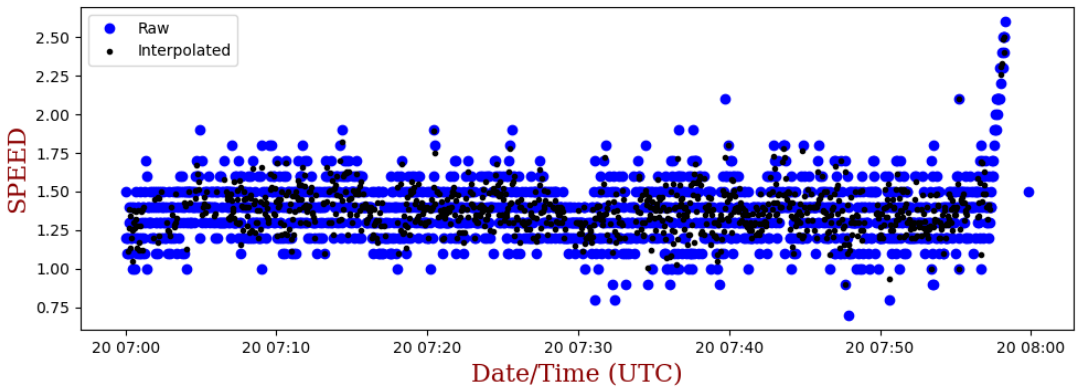
Example Temporal Interpolations

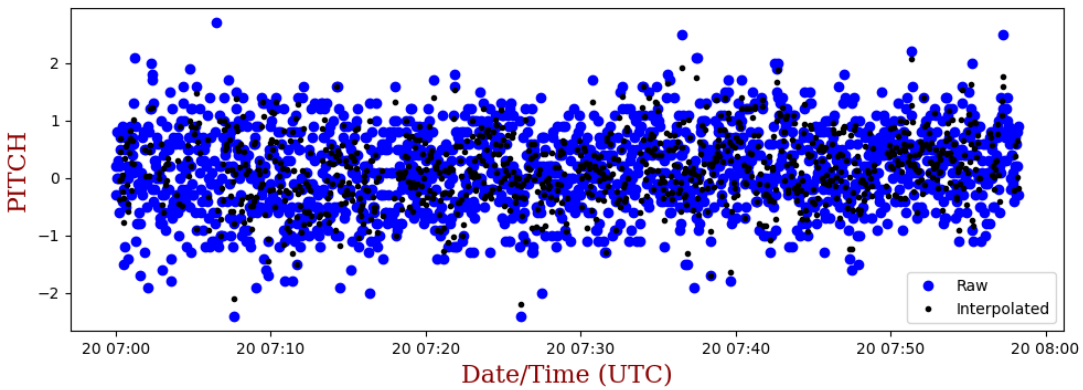
Randomized. Complete plots of hyperspectral interpolations can be found in [output_directory]/Plots/L1E.

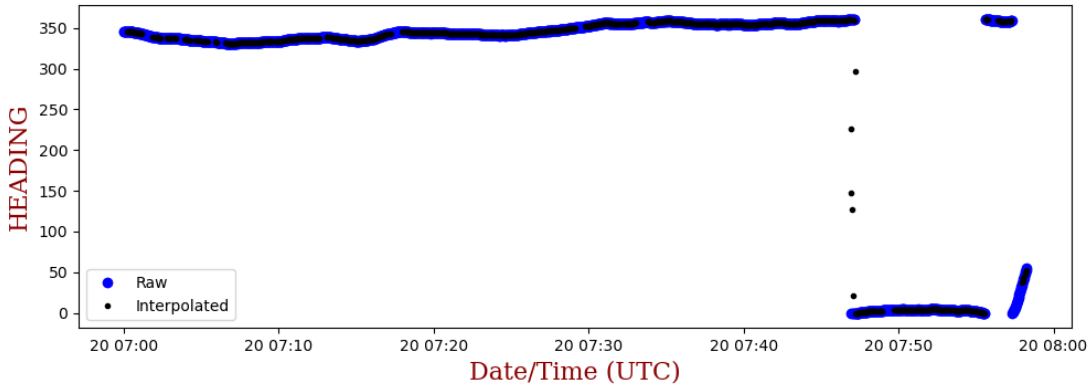


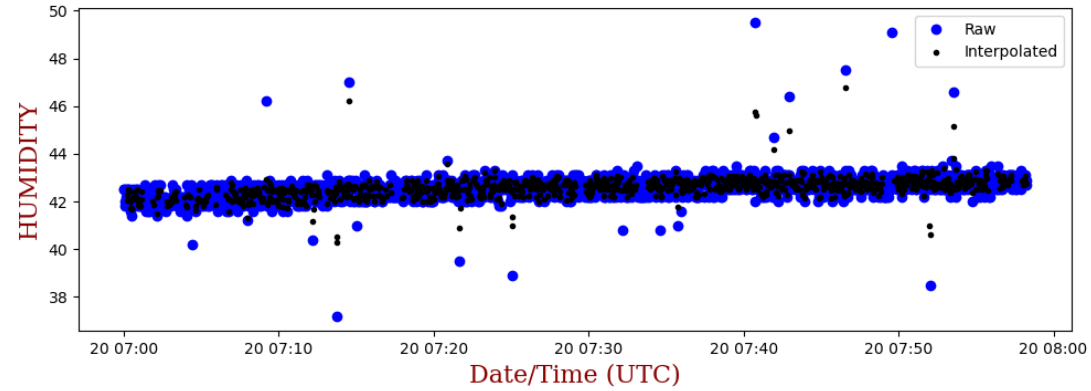

ELEVATION
Raw
Interpolated
40
38
36
34
32
30
28
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

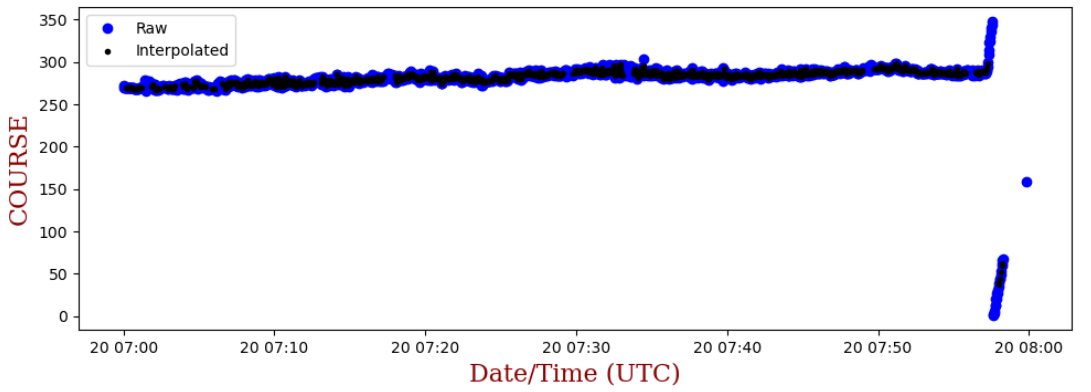

LATITUDE
Raw
Interpolated
34.975
34.974
34.973
34.972
34.971
34.970
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

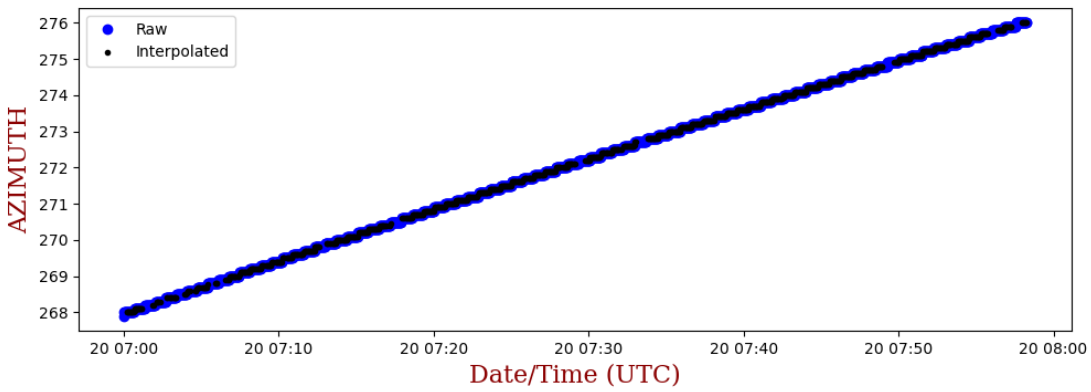

SPEED
Raw
Interpolated
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

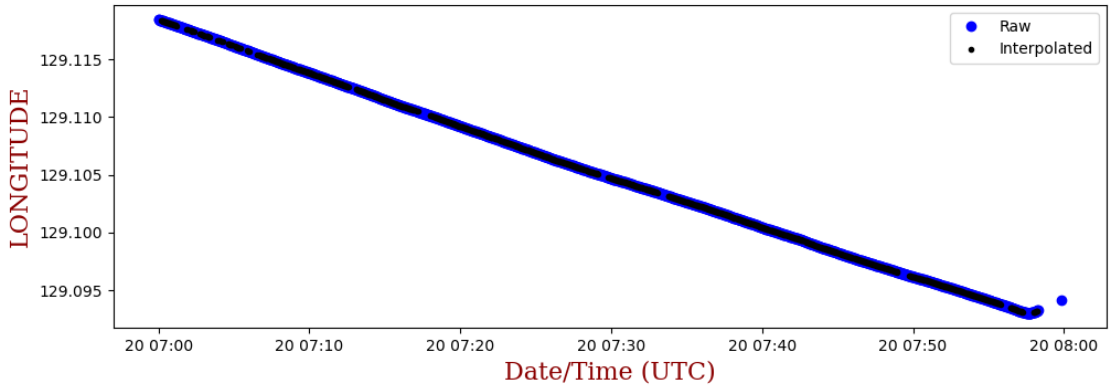

PITCH
Raw
Interpolated
2
1
0
−1
−2
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

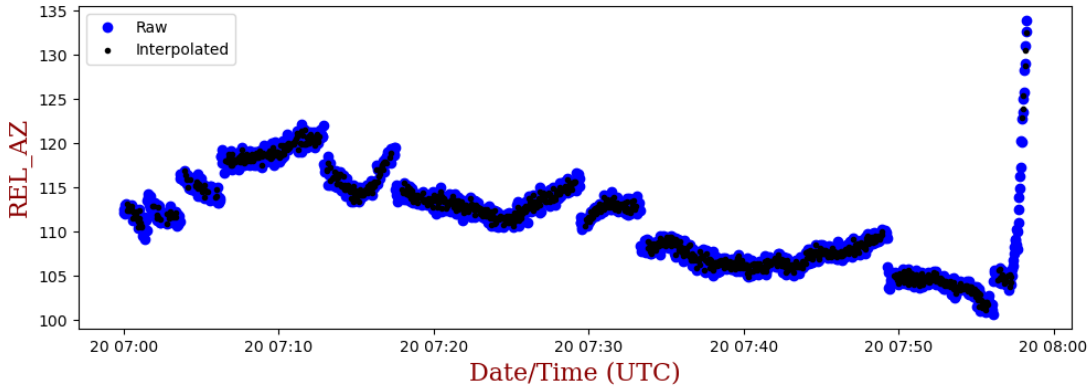

HEADING
350
300
250
200
150
100
50
0
Raw
Interpolated
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

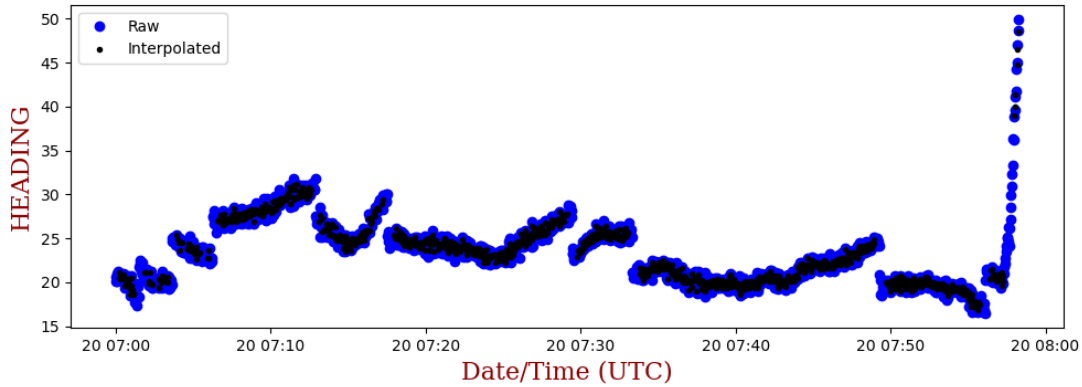

HUMIDITY
50
48
46
44
42
40
38
Raw
Interpolated
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

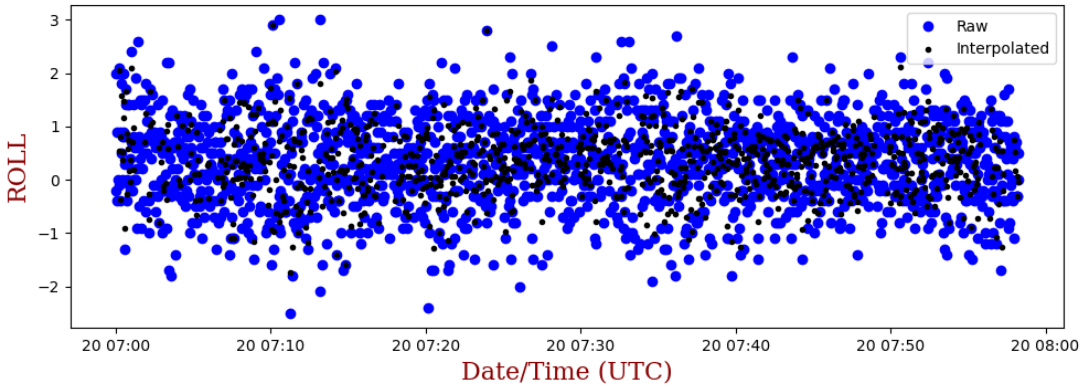

COURSE
350
300
250
200
150
100
50
0
Raw
Interpolated
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

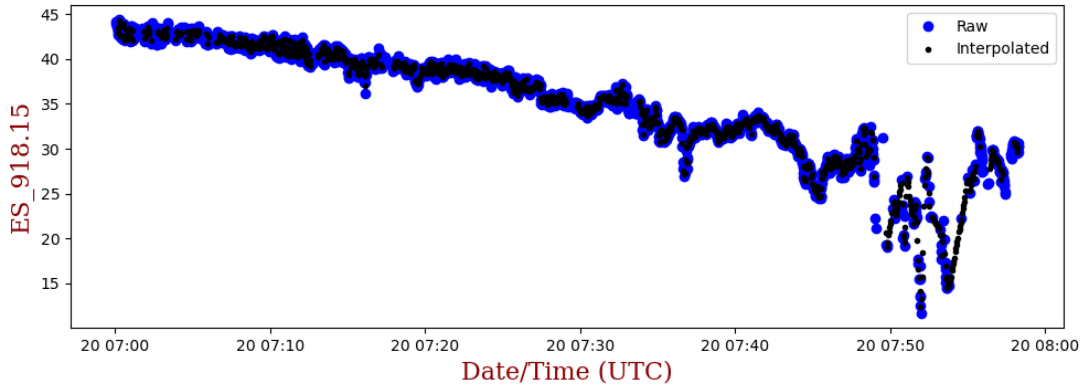

AZIMUTH
276
275
274
273
272
271
270
269
268
Raw
Interpolated
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

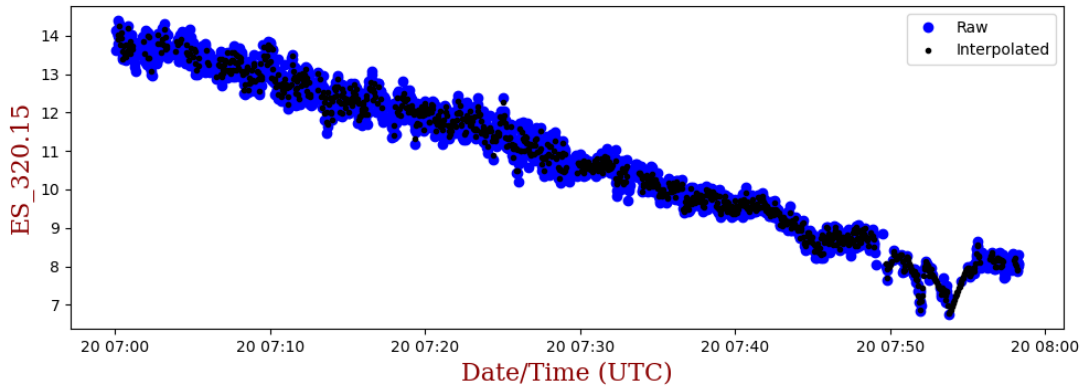

Raw
Interpolated
LONGITUDE
129.115
129.110
129.105
129.100
129.095
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

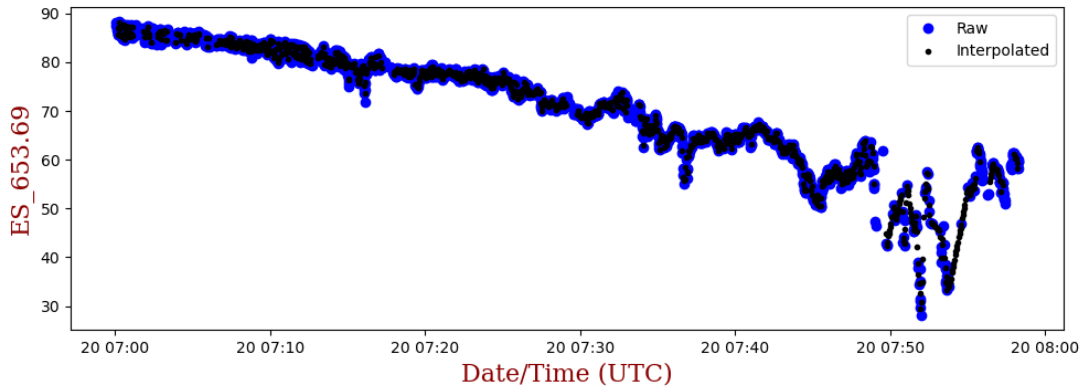

Raw
Interpolated
REL_AZ
135
130
125
120
115
110
105
100
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

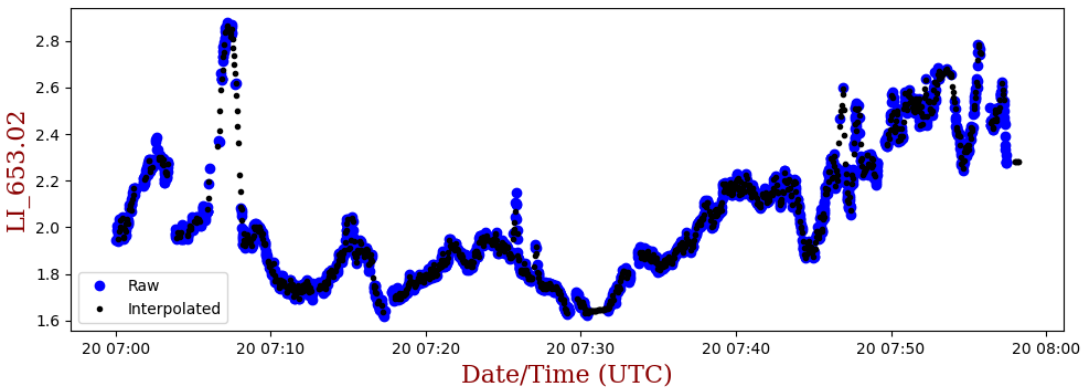

Raw
Interpolated
HEADING
50
45
40
35
30
25
20
15
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

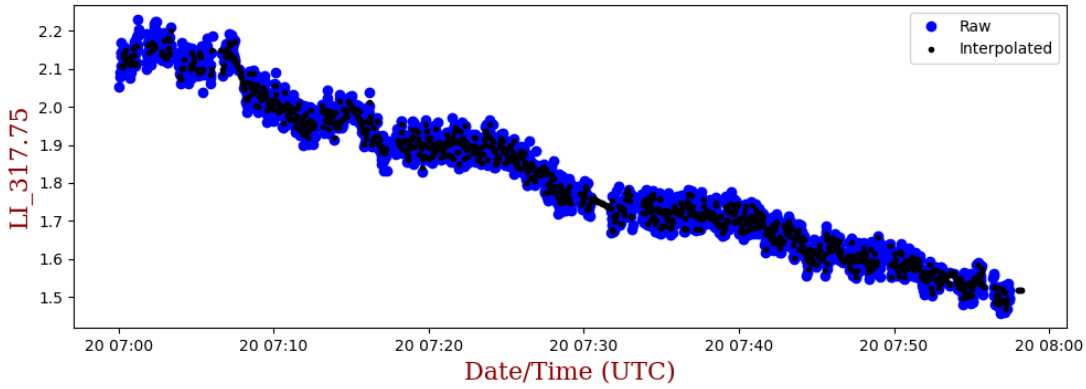

Raw
Interpolated
ROLL
3
2
1
0
−1
−2
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

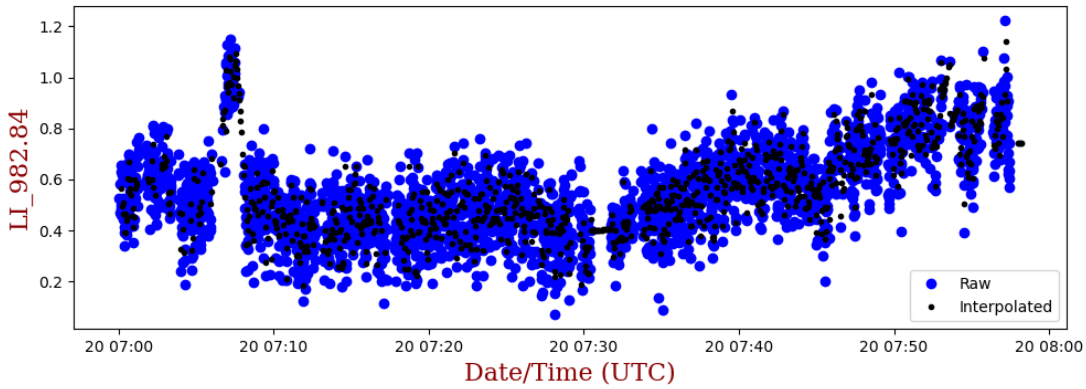

ES_918.15
Raw
Interpolated
45
40
35
30
25
20
15
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)


ES_320.15
Raw
Interpolated
14
13
12
11
10
9
8
7
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

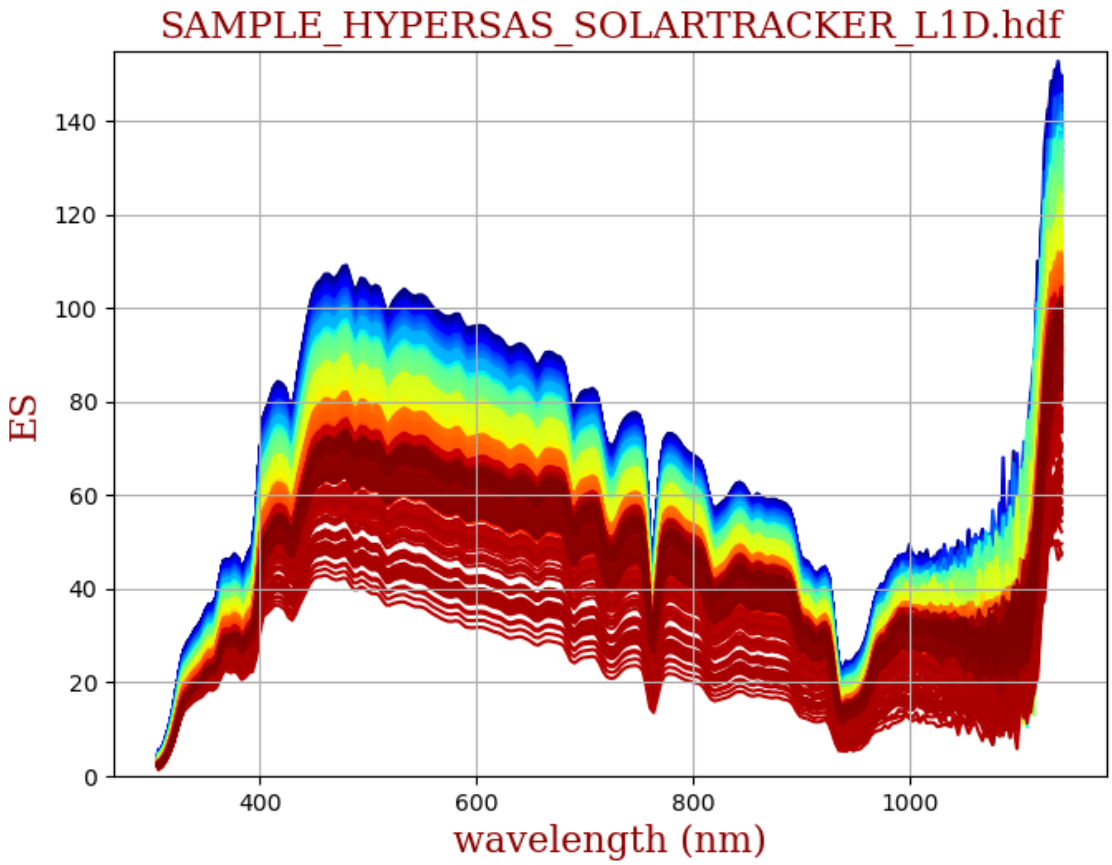

ES_653.69
Raw
Interpolated
90
80
70
60
50
40
30
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

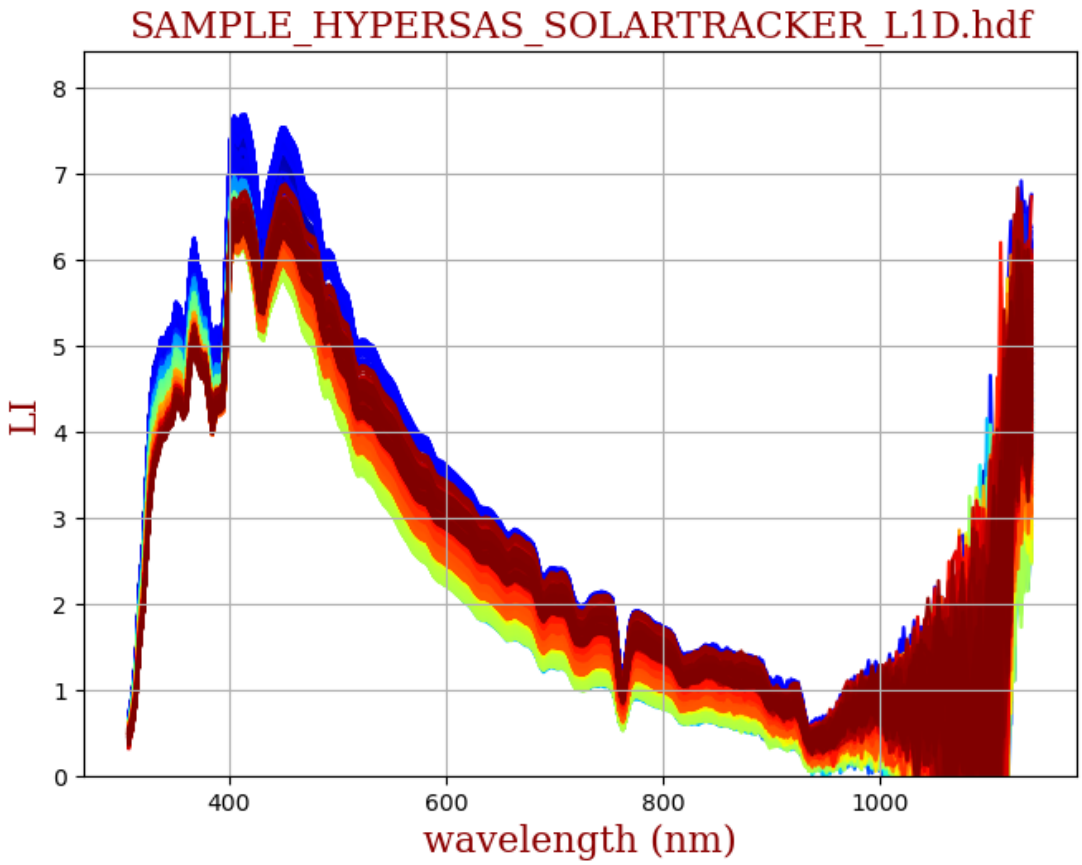

LI_653.02
Raw
Interpolated
2.8
2.6
2.4
2.2
2.0
1.8
1.6
20 07:00
20 07:10
20 07:20
20 07:30
20 07:40
20 07:50
20 08:00
Date/Time (UTC)

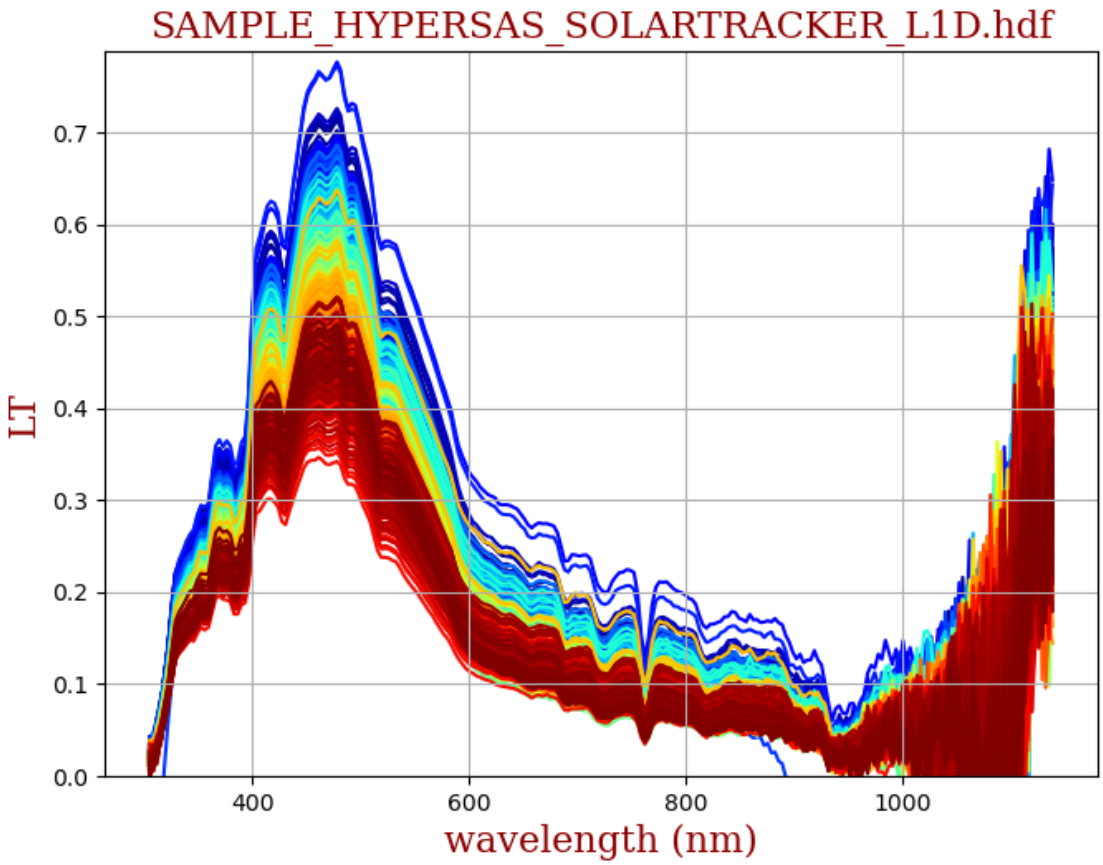




Complete spectral plots


SAMPLE_HYPERSAS_SOLARTRACKER_L1D.hdf
ES
0
20
40
60
80
100
120
140
400
600
800
1000
wavelength (nm)


SAMPLE_HYPERSAS_SOLARTRACKER_L1D.hdf
LI
wavelength (nm)
0
1
2
3
4
5
6
7
8
400
600
800
1000


SAMPLE_HYPERSAS_SOLARTRACKER_L1D.hdf
LT
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
400
600
800
1000
wavelength (nm)

L2 : Process L1E to L2

Apply more quality control filters, temporal binning, station selection, glint correction, NIR corrections, reflectance calculation and OC product calculation.

Processing Parameters:
Max Wind: 10.0
Min SZA: 20.0
Max SZA: 60.0
Filter Sigma Es: 5.0
Filter Sigma Li: 8.0
Filter Sigma Lt: 3.0
Cloud Filter: 1.0
Es Filter: 2.0
Dawn/Dusk Filter: 1.0
Rain/Humidity Filter: 1.095
Ensemble Duration: 300 sec
Percent Lt Filter: 10.0
Glint_Correction: Ruddick et al. 2006
NIR Correction: Carder et al. 1995
Remove Negatives: ON

Process log:
Process Single Level
Found data: station
Found data: lat
Found data: lon
Found data: wind
Found data: wt
Found data: sal
Found data: speed_f_w
ProcessL2:
/Users/daurin/GitRepos/HyperInSPACE/Data/L1E/SAMPLE_HYPERSAS_SOLARTRACKER_L1E.hdf
Model data for Wind and AOD may be used to replace blank values. Reading in model data...
Ancillary file found locally: N201614107_MERRA2_1h.nc
Ancillary file found locally: N201614107_AER_MERRA2_1h.nc
Field wind data has 6 NaNs out of 1015 prior to using model data
Field salt data has 1015 NaNs out of 1015 prior to using model data
Field sst data has 1015 NaNs out of 1015 prior to using model data
Field aod data has 1015 NaNs out of 1015 prior to using model data
Field station data has 1015 non-stations out of 1015
Filling in field data with model data where needed.
Filling in ancillary data with default values where still needed.
Applying Lt(NIR)>Lt(UV) quality filtering to eliminate spectra.
0.0% of spectra flagged
Low SZA. SZA: 60
Percentage of data out of SZA and Wind limits: 18 %
  Flag data from TT2: 2016-05-20 07:47:38.115000+00:00 to 2016-05-20 07:58:13.339000+00:00
Remove IRRADIANCE Data

Length of dataset prior to removal 1015 long
Length of dataset after removal 834 long: 18% removed
Remove RADIANCE Data
Length of dataset prior to removal 1015 long
Length of dataset after removal 834 long: 18% removed
Remove ANCILLARY Data
Length of dataset prior to removal 1015 long
Length of dataset after removal 834 long: 18% removed
Applying spectral filtering to eliminate noisy spectra.
1.2% of Es data flagged
0.5% of Li data flagged
5.4% of Lt data flagged
Remove IRRADIANCE Data
Length of dataset prior to removal 834 long
Length of dataset after removal 780 long: 6% removed
Remove RADIANCE Data
Length of dataset prior to removal 834 long
Length of dataset after removal 780 long: 6% removed
Remove ANCILLARY Data
Length of dataset prior to removal 834 long
Length of dataset after removal 780 long: 6% removed
Applying meteorological filtering to eliminate spectra.
0.0% of spectra flagged
Binning datasets to ensemble time interval.
53 spectra in slice (ensemble).
5 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027150 Wind: 3.1 m/s
Perform simple residual NIR subtraction.
74 spectra in slice (ensemble).
7 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027176 Wind: 3.2 m/s
Perform simple residual NIR subtraction.
85 spectra in slice (ensemble).
8 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027229 Wind: 3.3 m/s
Perform simple residual NIR subtraction.
80 spectra in slice (ensemble).
8 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027005 Wind: 2.9 m/s
Perform simple residual NIR subtraction.
97 spectra in slice (ensemble).
10 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027029 Wind: 2.9 m/s
Perform simple residual NIR subtraction.

83 spectra in slice (ensemble).
8 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.026929 Wind: 2.7 m/s
Perform simple residual NIR subtraction.
88 spectra in slice (ensemble).
9 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027060 Wind: 3.0 m/s
Perform simple residual NIR subtraction.
97 spectra in slice (ensemble).
10 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027104 Wind: 3.0 m/s
Perform simple residual NIR subtraction.
84 spectra in slice (ensemble).
8 spectra remaining in slice to average after filtering to lowest 10.0%.
Calculating Ruddick glint correction
Rho_sky: 0.027158 Wind: 3.1 m/s
Perform simple residual NIR subtraction.
Filtering reflectance spectra for negative values.
0.0% of Rrs_HYPER spectra flagged
0.0% of nLw_HYPER spectra flagged
Processing chlor_a
Processing avw
Processing CDOM, Sg, DOC
Processing qaa
Processing Wei QA
L2 file produced:
/Users/daurin/GitRepos/HyperInSPACE/Data/L2/SAMPLE_HYPERSAS_SOLARTRACKER_L2.hdf
Output SeaBASS for HDF:
/Users/daurin/GitRepos/HyperInSPACE/Data/L2/SAMPLE_HYPERSAS_SOLARTRACKER_L2.hdf
Process Single Level:
/Users/daurin/GitRepos/HyperInSPACE/Data/L2/SAMPLE_HYPERSAS_SOLARTRACKER_L2.hdf -
SUCCESSFUL