PACE OCI Proxy Data Description

I. Introduction

This document describes the derivation and format of datasets that may be useful as a proxy for calibrated top-of-atmosphere radiances that are expected to be provided by the PACE Ocean Color Instrument (OCI). The proxy data is derived from real observations of existing high-altitude airborne and spaceborne hyperspectral instruments that cover a spectral range similar to OCI. The data format is designed to match the expected format of a PACE OCI Level-1B file, with the primary difference being the specific band centers or spectral band sampling. A primary driving consideration in the conversion from native instrument observation to OCI-like observation is to minimize alteration of the observed radiometry. As such, no resampling or interpolation has been applied to the hyperspectral observations of the source instrument. Only aggregation has been performed, where necessary, to better match the expected band widths of the OCI instrument. Such aggregations were performed using a weighted mean, where the weights correspond to the native band widths.

II. PACE OCI assumed spectral channels

The OCI instrument design has not yet been finalized. It is here assumed to be a hyperspectral instrument spanning the range from 315nm to 890nm at 5-nm intervals, with additional spectral bands (band widths) in nm of 940 (20), 1240(20), 1380 (10), 1640 (40), 2130 (50), and 2250 (50).

III. PACE OCI assumed Level-1B format

It is anticipated that OCI Level-1A and higher data products will be produced in a netCDF4 format with CF and ISO-compliant meta-data similar to that currently produced by the OBPG for all standard Level-2 ocean color products. The proxy Level-1B files produced here thus follow that general structure. The data fields in the Level-1B file include per-pixel longitude and latitude, solar and view zenith and azimuth angles, and the observed radiances pixel, line, and band in the form of a data cube. Examples of the full data structure are provided for each proxy data source in the sections that follow.

IV. PACE OCI Proxy data derived from AVIRIS Classic (OCIA)

AVIRIS Classic is an airborne hyperspectral instrument with 224 bands spanning the 360nm to 2500nm spectral range at 10-nm spectral sampling. AVIRIS has been flown on the ER-2 high altitude aircraft during a multitude of field campaigns spanning several decades. As such, there are many existing datasets readily available that may be useful for PACE algorithm development and testing. Table 1 shows the spectral band centers and band widths of AVIRIS Classic, and the corresponding 61 spectral band centers and band widths of the OCI proxy data derived from AVIRIS (OCIA). Note that the mapping is one for one over the 360 to 890nm spectral range,

with the wider AVIRIS band widths maintained. At the longer wavelengths, the 10-nm AVIRIS bands are aggregated to match the wider spectral bands of OCI.

AVIRIS Band	Wavelength	Width	OCI Band	Wavelength	Width
1	365.92981	9.852108	1	365.92981	9.852108
2	375.59399	9.796976	2	375.59399	9.796976
3	385.26254	9.744104	3	385.26254	9.744104
4	394.93552	9.693492	4	394.93552	9.693492
5	404.61288	9.64514	5	404.61288	9.64514
6	414.29462	9.599048	6	414.29462	9.599048
7	423.98077	9.555216	7	423.98077	9.555216
8	433.6713	9.513644	8	433.6713	9.513644
9	443.36621	9.474332	9	443.36621	9.474332
10	453.06552	9.43728	10	453.06552	9.43728
11	462.7692	9.402488	11	462.7692	9.402488
12	472.47729	9.369956	12	472.47729	9.369956
13	482.18976	9.339684	13	482.18976	9.339684
14	491.90665	9.311672	14	491.90665	9.311672
15	501.6279	9.28592	15	501.6279	9.28592
16	511.35355	9.262428	16	511.35355	9.262428
17	521.08356	9.241196	17	521.08356	9.241196
18	530.81799	9.222224	18	530.81799	9.222224
19	540.55682	9.205512	19	540.55682	9.205512
20	550.30005	9.19106	20	550.30005	9.19106
21	560.04767	9.178868	21	560.04767	9.178868
22	569.79962	9.168936	22	569.79962	9.168936
23	579.55603	9.161264	23	579.55603	9.161264
24	589.31677	9.155852	24	589.31677	9.155852
25	599.08191	9.1527	25	599.08191	9.1527
26	608.8515	9.151808	26	608.8515	9.151808
27	618.62543	9.153176	27	618.62543	9.153176
28	628.40375	9.156804	28	628.40375	9.156804
29	638.18646	9.162692	29	638.18646	9.162692
30	647.97357	9.17084	30	647.97357	9.17084
31	657.76508	9.181248	31	657.76508	9.181248
34	664.59937	9.8487076	32	664.59937	9.8487076
35	674.40125	9.7987116	33	674.40125	9.7987116
36	684.19794	9.7584824	34	684.19794	9.7584824
37	693.98938	9.72802	35	693.98938	9.72802
38	703.77563	9.7073244	36	703.77563	9.7073244
39	713.55664	9.6963956	37	713.55664	9.6963956
40	723.33252	9.6952336	38	723.33252	9.6952336
41	733.10309	9.7038384	39	733.10309	9.7038384
42	742.86853	9.72221	40	742.86853	9.72221
43	752.62872	9.7503484	41	752.62872	9.7503484
44	762.38373	9.7882536	42	762.38373	9.7882536
45	772.13348	9.8359256	43	772.13348	9.8359256
46	781.87805	9.8933644	44	781.87805	9.8933644

47	791.61743	9.96057	45	791.61743	9.96057
48	801.35156	10.0375424	46	801.35156	10.0375424
49	811.08051	10.1242816	47	811.08051	10.1242816
50	820.80426	10.2207876	48	820.80426	10.2207876
51	830.52277	10.3270604	49	830.52277	10.3270604
52	840.23608	10.4431	50	840.23608	10.4431
53	849.94415	10.5689064	51	849.94415	10.5689064
54	859.64709	10.7044796	52	859.64709	10.7044796
55	869.34479	10.8498196	53	869.34479	10.8498196
56	879.03723	11.0049264	54	879.03723	11.0049264
57	888.72449	11.1698	55	888.72449	11.1698
61	927.42145	11.9269624	56	936.436901	32.47029665
62	937.0827	10.78153			
63	946.73871	9.76180425			
93	1233.99646	10.14481425	57	1238.750321	20.31790325
94	1243.49097	10.173089			
110	1382.39978	10.77621301	58	1382.39978	10.77621301
134	1621.60364	10.72270491	59	1641.530244	53.60979148
135	1631.5675	10.72219411			
136	1641.53101	10.7218208			
137	1651.49438	10.72158499			
138	1661.45752	10.72148667			
185	2106.8042	10.87026375	60	2126.780881	54.18506385
186	2116.8103	10.85395512			
187	2126.81421	10.83732963			
188	2136.81567	10.82038728			
189	2146.81494	10.80312807			
197	2226.72607	10.65364743	61	2246.639718	53.06395905
198	2236.70459	10.63353648			
199	2246.68066	10.61310867			
200	2256.65454	10.592364			
201	2266.62622	10.57130247			

Table 1: AVIRIS Classic Band Centers and Widths and Mapping to OCIA Bands

The full structure of PACE OCI proxy netCDF4 data file produced from AVIRIS is shown for one sample scene (OA2011281160543.L1B_LAC) in Table 2.

```
netcdf OA2011281160543.L1B_LAC {
dimensions:
        number_of_lines = 1502 ;
        pixels_per_line = 837 ;
        number_of_bands = 61 ;

// global attributes:
        :title = "OCIA Level-1B Data" ;
        :sensor = "OCIA" ;
        :product_name = "OA2011281160543.L1B_LAC.nc" ;
        :processing_version = "V1.0" ;
        :Conventions = "CF-1.6" ;
        :institution = "NASA Goddard Space Flight Center" ;
        :license = "http://science.nasa.gov/earth-science/earth-science-data/data-information-policy/";
        :naming_authority = "gov.nasa.gsfc.sci.oceandata" ;
```

```
                    :date_created = "2016266163258000" ;
                    :keywords_vocabulary = "NASA Global Change Master Directory (GCMD) Science Keywords" ;
                    :stdname_vocabulary = "NetCDF Climate and Forecast (CF) Metadata Convention" ;
                    :creator_name = "NASA/GSFC" ;
                    :creator_email = "data@oceancolor.gsfc.nasa.gov" ;
                    :creator_url = "http://oceancolor.gsfc.nasa.gov" ;
                    :project = "PACE Project" ;
                    :publisher_name = "NASA/GSFC" ;
                    :publisher_url = "http://oceancolor.gsfc.nasa.gov" ;
                    :publisher_email = "data@oceancolor.gsfc.nasa.gov" ;
                    :processing_level = "L1B" ;
                    :cdm_data_type = "swath" ;
                    :orbit_number = 0 ;
                    :history = "Generated by avirisbil2oci; cdlfile=OCI_Level-1B_Data_Structure.cdl";
                    :startDirection = "Descending" ;
                    :endDirection = "Descending" ;
                    :day_night_flag = "Day" ;
                    :time_coverage_start = "2011-10-08T16:05:43.418Z" ;
                    :time_coverage_end = "2011-10-08T16:07:57.108Z" ;
```

```
group: sensor_band_parameters {
  variables:
        float wavelength(number_of_bands) ;
                wavelength:_FillValue = -32767.f ;
                wavelength:long_name = "wavelengths" ;
                wavelength:valid_min = 350.f ;
                wavelength:valid_max = 2250.f ;
                wavelength:units = "nm" ;
        float fwhm(number_of_bands) ;
                fwhm:_FillValue = -32767.f ;
                fwhm:long_name = "fwhm" ;
                fwhm:valid_min = 0.f ;
                fwhm:valid_max = 100.f ;
                fwhm:units = "nm" ;
  } // group sensor_band_parameters
```

```
group: observation_data {
  variables:
        float Lt(number_of_bands, number_of_lines,
pixels_per_line) ;
                Lt:_FillValue = -999.f ;
                Lt:long_name = "Top of Atmosphere
Radiance" ;
                Lt:valid_min = 0.f ;
                Lt:valid_max = 500.f ;
                Lt:units = "W m-2 sr-1" ;
        short altitude(number_of_lines) ;
                altitude:_FillValue = -32767s ;
                altitude:long_name = "altitude" ;
                altitude:valid_range = 0s ;
                altitude:valid_max = 25000s ;
                altitude:units = "meters" ;
  } // group observation_data
}
```

```
group: navigation_data {
  variables:
        float lon(number_of_lines, pixels_per_line) ;
                lon:_FillValue = -999.f ;
                lon:long_name = "Longitude" ;
                lon:valid_min = -180.f ;
                lon:valid_max = 180.f ;
                lon:units = "degrees_east" ;
        float lat(number_of_lines, pixels_per_line) ;
                lat:_FillValue = -999.f ;
                lat:long_name = "Latitude" ;
                lat:valid_min = -0.f ;
                lat:valid_max = 90.f ;
                lat:units = "degrees_north" ;
        short range(number_of_lines, pixels_per_line) ;
                range:_FillValue = -32767s ;
                range:long_name = "Aircraft-to-surface
distance (range)" ;
                range:valid_range = 0s ;
                range:valid_max = 25000s ;
                range:units = "meters" ;
        float senz(number_of_lines, pixels_per_line) ;
                senz:_FillValue = -999.f ;
                senz:long_name = "Solar zenith angle" ;
                senz:valid_min = 0.f ;
                senz:valid_max = 90.f ;
                senz:units = "degrees" ;
        float sena(number_of_lines, pixels_per_line) ;
```

```
group: scan_line_attributes {
  variables:
        double scan_start_time(number_of_lines) ;
                scan_start_time:_FillValue = -999. ;
                scan_start_time:long_name = "Scan start
time (UTC)" ;
                scan_start_time:valid_min = 0. ;
                scan_start_time:valid_max = 2000000000.
;
                scan_start_time:units = "seconds" ;
        double scan_end_time(number_of_lines) ;
                scan_end_time:_FillValue = -999. ;
                scan_end_time:long_name = "Scan end
time (UTC)" ;
                scan_end_time:valid_min = 0. ;
                scan_end_time:valid_max = 2000000000.
;
                scan_end_time:units = "seconds" ;
        short altitude(number_of_lines) ;
                altitude:_FillValue = -32767s ;
                altitude:long_name = "altitude" ;
                altitude:valid_range = 0s ;
                altitude:valid_max = 25000s ;
                altitude:units = "meters" ;
  } // group scan_line_attributes
```

sena:_FillValue = -999.f ; sena:long_name = "Solar azimuth angle" ; sena:valid_min = 0.f ; sena:valid_max = 90.f ; sena:units = "degrees" ; float solz(number_of_lines, pixels_per_line) ; solz:_FillValue = -999.f ; solz:long_name = "Solar zenith angle" ; solz:valid_min = 0.f ; solz:valid_max = 90.f ; solz:units = "degrees" ; float sola(number_of_lines, pixels_per_line) ; sola:_FillValue = -999.f ; sola:long_name = "Solar azimuth angle" ; sola:valid_min = 0.f ; sola:valid_max = 90.f ; sola:units = "degrees" ; } // group navigation_data	

Table 2: Level-1B data file structure

V. PACE OCI Proxy data derived from PRISM (OCIP)

Etc.