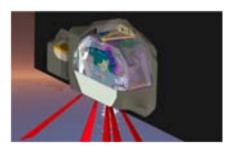
The PACE Level 1C data format

Kirk Knobelspiesse, NASA GSFC

OCI, HARP2 and SPEXone have different viewing geometries, spatial resolutions and coverage

	Ocean Color Instrument (OCI)	Hyper-Angular Rainbow Polarimeter 2 (HARP2)	Spectro-Polarimeter for Planetary Exploration one (SPEXone)
UV-VIS radiance channels	240: continuous coverage in 340-890nm range at 2.5nm spectral resolution (5nm bandwidth)	4: 441, 549, 669, 873 nm	~200: continuous coverage in 385-770nm at 2-5nm spectral resolution
UV-VIS polarimetric channels	-	4: 441, 549, 669, 873 nm	~100: continuous coverage in 385-770nm at 10-40nm spectral resolution
SWIR radiance channels	7: 940, 1038, 1250, 1378, 1615, 2130, and 2260 nm	-	-
Viewing zenith angles at ground or top of atmosphere (TOA) for swath center	1: TOA 20˚ North in northern hemisphere, TOA 20˚ South in southern hemisphere to avoid ocean surface glint	60 angles between ± 57˚ TOA along track for 669nm, 10 angles for the other bands*	5: 0°, ±20° and ±58° at ground
Nadir view, at-ground swath width	2663km$^{@}$	1,556 km	100km
Spatial Resolution	1x1km at nadir$^{@}$	TBD, but roughly 5km^2	5.4 x 4.6 km$^{\#}$ for all view angles



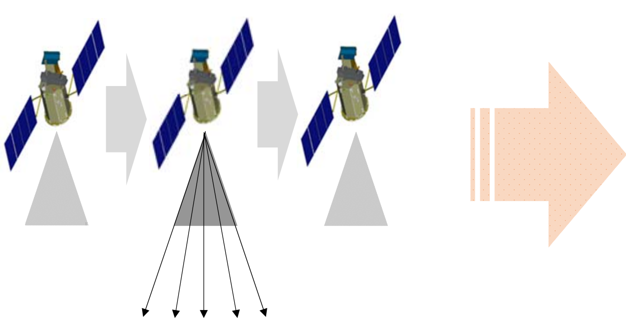
Level 1C: a common grid for all instruments

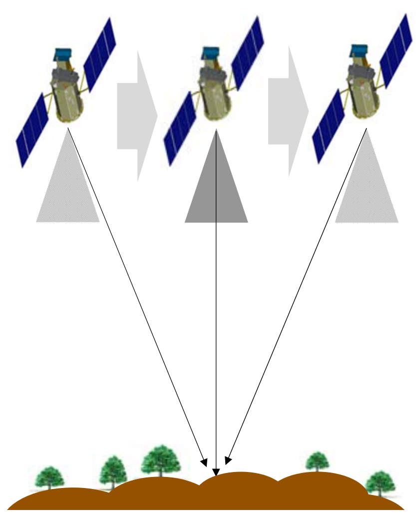
Data Level	Description
Level 0	Lowest level science data
Level 1A	Uncalibrated science data in archive format (e.g., netCDF)
Level 1B	Calibrated, geo-located science data as observed
Level 1C	Calibrated, geo-located, co-registered (resampled) science data
Level 2	Science products derived from Level-1B/C
Level 3	Temporally and spatially composited science products

"The guiding philosophy of the PACE L1C file format is to be a means to gather data from all instruments onto a common sampling grid. This grid will be equal area and contain observations for all instruments and viewing angles for a specified height."

At least 3 SAT members will use multi-sensor fusion and require data in a L1C format

Level 1b → Level 1c

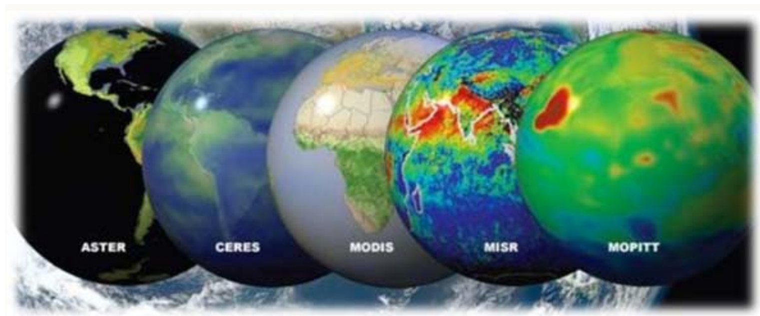




Level 1b:
Calibrated, geolocated data in spacecraft reference frame

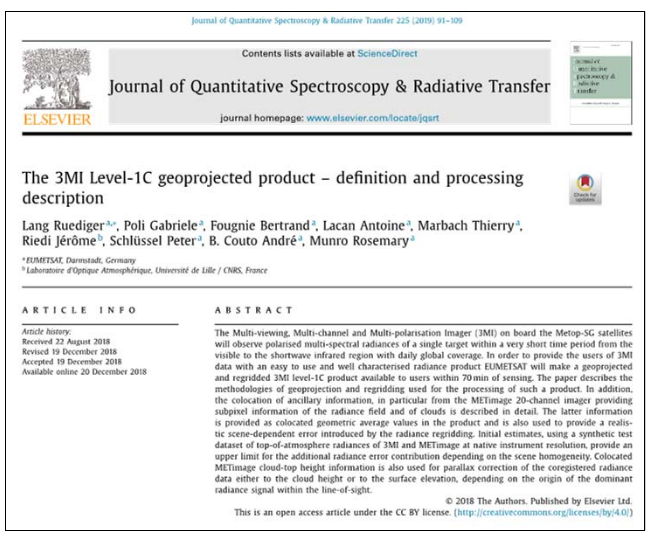
Level 1c:
Calibrated, geolocated data *mapped to location of interest to input to L2 algorithms*

We are not alone in our desire for universal L1c



The “Terra Data Fusion Project”, PI Larry Di Girolamo, seeks to merge five NASA Terra sensors into a universal grid

The 3MI team is also working on this



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The 3MI Level-1C geoprojected product – definition and processing description

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ABSTRACT

The Multi-viewing, Multi-channel and Multi-polarisation Imager (3MI) on board the Metop-SG satellites will observe polarised multi-spectral radiances of a single target within a very short time period from the visible to the shortwave infrared region with daily global coverage. In order to provide the users of 3MI data with an easy to use and well characterised radiance product EUMETSAT will make a geoprojected and regridded 3MI level-1C product available to users within 70 min of sensing. The paper describes the methodologies of geoprojection and regridding used for the processing of such a product. In addition, the colocation of ancillary information, in particular from the METimage 20-channel imager providing subpixel information of the radiance field and of clouds is described in detail. The latter information is provided as colocated geometric average values in the product and is also used to provide a realistic scene-dependent error introduced by the radiance regridding. Initial estimates, using a synthetic test dataset of top-of-atmosphere radiances of 3MI and METimage at native instrument resolution, provide an upper limit for the additional radiance error contribution depending on the scene homogeneity. Colocated METimage cloud-top height information is also used for parallax correction of the coregistered radiance data either to the cloud height or to the surface elevation, depending on the origin of the dominant radiance signal within the line-of-sight.

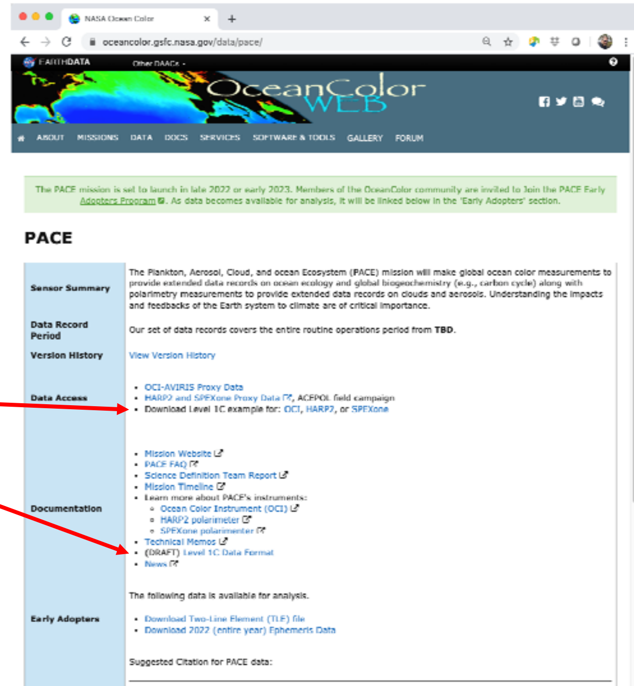
Documentation, examples

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

Example template files

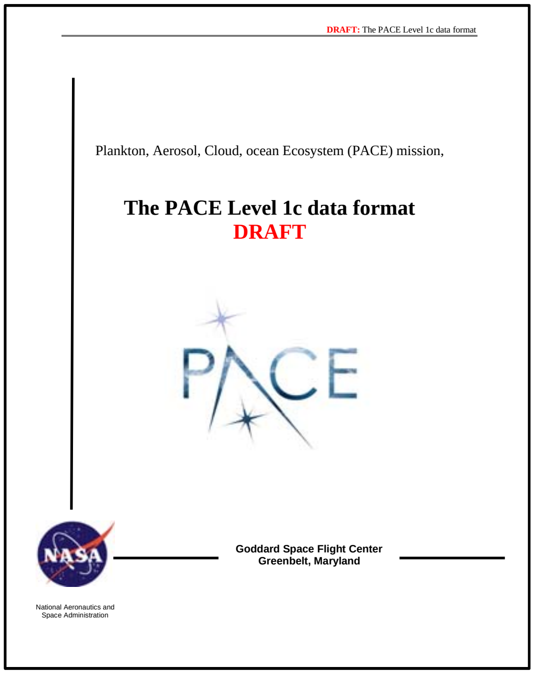
(Draft) Level 1C data format document

Future: simulated data in L1C format



L1c guiding philosophy: gather data from the three instruments onto a common grid, which *may* need to be re-projected or otherwise processed depending on the specific L2 algorithm

We can do this without making a product that is the "lowest common denominator"



DRAFT: The PACE Level 1c data format

Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission,

The PACE Level 1c data format
DRAFT

PACE

Goddard Space Flight Center
Greenbelt, Maryland

National Aeronautics and Space Administration

Level 1c data format document overview

- Projection
- Spatial resolution, swath
- Multi-view aggregation
- Polarization units
- Data dimensions
- Observation data structure
- Additional tools and other matters

Projection

Spacecraft Oblique Cylindrical Equal Area (SOCEA) orbit based projection

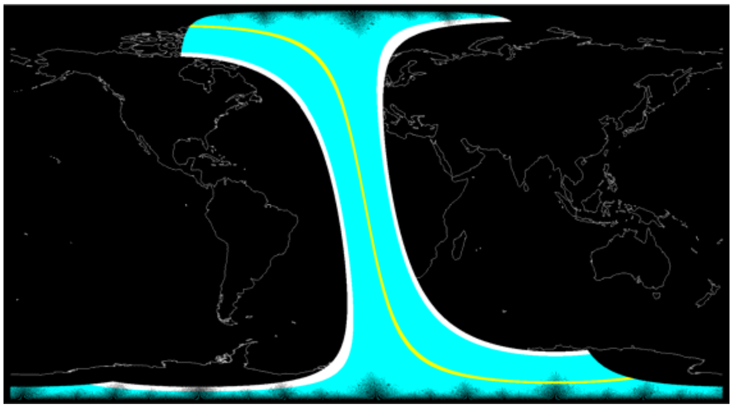
- Vertical center line aligned with sub-satellite track
- Bins align with equator
- Cross-track bin spacing represents equal distances
- Along-track bin spacing preserves equal bin area

Goal: easily viewed as stored, preserves equal area for all bins

Bins will represent footprint weighted mean of OCI/HARP2/SPEXone observations for that wavelength and view angle

Snyder, J.P., 1987. *Map projections--A working manual* (Vol. 1395). US Government Printing Office. https://pubs.usgs.gov/pp/1395/report.pdf

Spatial resolution, swath



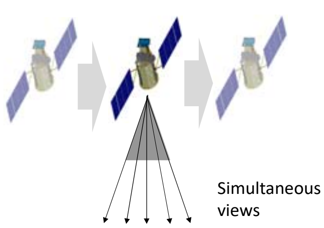
OCI: white; HARP2: teal; SPEXone: yellow

Spatial resolutions are multiples of each other, so they can be easily compared

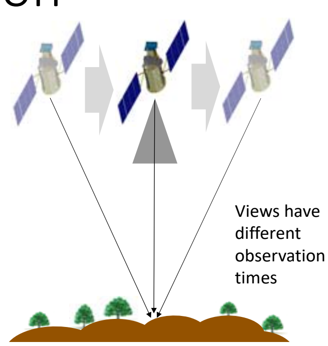
- OCI: 5.2 x 5.2 km
- SPEXone: 2.6 x 2.6 km
- HARP2: TBD

Full swath to be included, even for HARP2, which may not have nadir views at edges

Multi-view aggregation



Level 1b:
Calibrated, geolocated data in spacecraft reference frame



Level 1c:
Calibrated, geolocated data *mapped to location of interest for input to L2 algorithms*

Projection accomplishes this by aggregating to:

- Ocean: ellipsoid surface
- Land: Digital elevation model (DEM) altitude

Aggregation to other altitudes will be enabled with additional software

Polarization units

Stokes' vector

$$\boldsymbol{I} = \begin{bmatrix} I \\ Q \\ U \\ V \end{bmatrix} \begin{matrix} total \\ linear\ polarization \\ linear\ polarization \\ \cancel{circular\ polarization} \end{matrix}$$

'little' q and u

$$q = \frac{Q}{I}; u = \frac{U}{I}$$

Degree of Linear Polarization (DoLP)

$$DoLP = \frac{\sqrt{Q^2 + U^2}}{I}$$

	OCI	HARP2	SPEXone
UV-VIS radiance channels	240: continuous coverage in 340-890nm range at 2.5nm spectral resolution (5nm bandwidth)	4: 441, 549, 669, 873 nm	~200: continuous coverage in 385-770nm at 2-5nm spectral resolution
UV-VIS polarimetric channels	-	4: 441, 549, 669, 873 nm	~100: continuous coverage in 385-770nm at 10-40nm spectral resolution
SWIR radiance channels	7: 940, 1038, 1250, 1378, 1615, 2130, and 2260 nm	-	-
View zenith angles	1: 20˚	60 angles between ± 57˚ TOA along track for 669nm, 10 angles for the other bands	5: 0°, ±20° and ±58° at ground

Total radiance only

Inherent polarimetric units: Q & U
View angles vary for each spectral ch

Inherent polarimetric units: q & u
Different spectral sampling for total; q&u

Data dimensions

Dimension	OCI	HARP2	SPEXone
NUMBER_OF_VIEWS	2[a]	90[b]	5
INTENSITY_BANDS_PER_VIEW	249	1	200
POLARIZATION_BANDS_PER_VIEW	0	1	100
BINS_ALONG_TRACK	TBD	TBD	TBD
BINS_ACROSS_TRACK	512	TBD	40

[a] OCI has a 20˚ fore or aft tilt depending on spacecraft hemisphere
[b] HARP2 will have 60 view angles for the channel centered at 669nm, 10 angles otherwise. Each channel will access unique viewing angles.

Observation data structure

Field	Dimension	Dimension	Dimension	Dimension	Unit	Description
OBS_PER_VIEW	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	-	Unitless	Observations contributing to bin from each view
I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector component
I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I in bin
I_POLSAMPLE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector at polarimeter spectral sampling
I_POLSAMPLE NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I_POLSAMPLE in bin
Q	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Q Stokes vector component
Q_NOISE	BINS_ALONG_TRACK	[illegible]	[illegible]	[illegible]	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of Q in bin
U	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	U Stokes vector component
U_NOISE	BINS_ALONG_TRACK	[illegible]	[illegible]	[illegible]	[illegible]	Random noise of U in bin
Q_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Q over I (little q) Stokes vector component
Q_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of Q_OVER_I in bin
U_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	U over I (little u) Stokes vector component
U_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of U_OVER_I in bin
DOLP	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Degree of linear polarization
DOLP_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of DOLP in bin

Field for capturing (variable) number of observations in each bin

Observation data structure

Field	Dimension	Dimension	Dimension	Dimension	Unit	Description
OBS_PER_VIEW	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	-	Unitless	Observations contributing to bin from each view
I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector component
I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I in bin
I_POLSAMPLE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector at polarimeter spectral sampling
I_POLSAMPLE NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I_POLSAMPLE in bin
Q	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Q Stokes vector component
Q_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of Q in bin
U	BINS_ALONG_TRACK	[illegible]	[illegible]	[illegible]	[illegible]	U Stokes vector component
U_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of U in bin
Q_OVER_I	BINS_ALONG_TRACK	[illegible]	[illegible]	[illegible]	[illegible]	Q over I (little q) Stokes vector component
Q_OVER_I_NOISE	BINS_ALONG_TRACK	[illegible]	[illegible]	[illegible]	[illegible]	Random noise of Q_OVER_I in bin
U_OVER_I	BINS_ALONG_TRACK	[illegible]	[illegible]	[illegible]	[illegible]	U over I (little u) Stokes vector component
U_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of U_OVER_I in bin
DOLP	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Degree of linear polarization
DOLP_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of DOLP in bin

I has dimensions of the intensity spectra. I_POLSAMPLE, for SPEXone only, has been downsampled to the polarimetric spectral sensitivity.

Observation data structure

*_NOISE indicates random noise in a bin

Field	Dimension	Dimension	Dimension	Dimension	Unit	Description
OBS_PER_VIEW	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS		Unitless	Observations contributing to bin from each view
I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	I Stokes vector component
I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of I in bin
I_POLSAMPLE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	I Stokes vector at polarimeter spectral sampling
I_POLSAMPLE NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of I_POLSAMPLE in bin
Q	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Q Stokes vector component
Q_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of Q in bin
U	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	U Stokes vector component
U_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of U in bin
Q_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Q over I (little q) Stokes vector component
Q_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of Q_OVER_I in bin
U_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	U over I (little u) Stokes vector component
U_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of U_OVER_I in bin
DOLP	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Degree of linear polarization
DOLP_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of DOLP in bin

Observation data structure

Q, U for HARP2

Q_OVER_I, U_OVER_I (q,u) for SPEXone

DoLP (in both) is redundant but convenient

Field	Dimension	Dimension	Dimension	Dimension	Unit	Description
OBS_PER_VIEW	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS		Unitless	Observations contributing to bin from each view
I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	I Stokes vector component
I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of I in bin
I_POLSAMPLE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	I Stokes vector at polarimeter spectral sampling
I_POLSAMPLE NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of I_POLSAMPLE in bin
Q	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Q Stokes vector component
Q_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of Q in bin
U	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	U Stokes vector component
U_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of U in bin
Q_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Q over I (little q) Stokes vector component
Q_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of Q_OVER_I in bin
U_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	U over I (little u) Stokes vector component
U_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of U_OVER_I in bin
DOLP	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Degree of linear polarization
DOLP_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of DOLP in bin

Observation data structure

OCI

Field	Dimension	Dimension	Dimension	Dimension	Unit	Description
OBS_PER_VIEW	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	-	Unitless	Observations contributing to bin from each view
I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector component
I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I in bin
I_POLSAMPLE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector at polarimeter spectral sampling
I_POLSAMPLE NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I_POLSAMPLE in bin
Q	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Q Stokes vector component
Q_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of Q in bin
U	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	U Stokes vector component
U_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of U in bin
Q_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Q over I (little q) Stokes vector component
Q_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of Q_OVER_I in bin
U_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	U over I (little u) Stokes vector component
U_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of U_OVER_I in bin
DOLP	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Degree of linear polarization
DOLP_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of DOLP in bin

Observation data structure

HARP2

INTENSITY_BANDS_PER_VIEW =
POLARIZATION_BANDS_PER_VIEW = 1

Field	Dimension	Dimension	Dimension	Dimension	Unit	Description
OBS_PER_VIEW	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	-	Unitless	Observations contributing to bin from each view
I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector component
I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I in bin
I_POLSAMPLE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	I Stokes vector at polarimeter spectral sampling
I_POLSAMPLE NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of I_POLSAMPLE in bin
Q	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Q Stokes vector component
Q_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of Q in bin
U	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	U Stokes vector component
U_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	Random noise of U in bin
Q_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Q over I (little q) Stokes vector component
Q_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of Q_OVER_I in bin
U_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	U over I (little u) Stokes vector component
U_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of U_OVER_I in bin
DOLP	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Degree of linear polarization
DOLP_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of DOLP in bin

Observation data structure

SPEXone

Field	Dimension	Dimension	Dimension	Dimension	Unit	Description
OBS_PER_VIEW	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	-	Unitless	Observations contributing to bin from each view
I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	I Stokes vector component
I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	INTENSITY_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of I in bin
I_POLSAMPLE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	I Stokes vector at polarimeter spectral sampling
I_POLSAMPLE NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of I_POLSAMPLE in bin
Q	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Q Stokes vector component
Q_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of Q in bin
U	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	U Stokes vector component
U_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	W m^{-2} sr^{-1} μm^{-1}	Random noise of U in bin
Q_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Q over I (little q) Stokes vector component
Q_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of Q_OVER_I in bin
U_OVER_I	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	U over I (little u) Stokes vector component
U_OVER_I_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of U_OVER_I in bin
DOLP	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Degree of linear polarization
DOLP_NOISE	BINS_ALONG_TRACK	BINS_ACROSS_TRACK	NUMBER_OF_VIEWS	POLARIZATION_BANDS_PER_VIEW	Unitless	Random noise of DOLP in bin

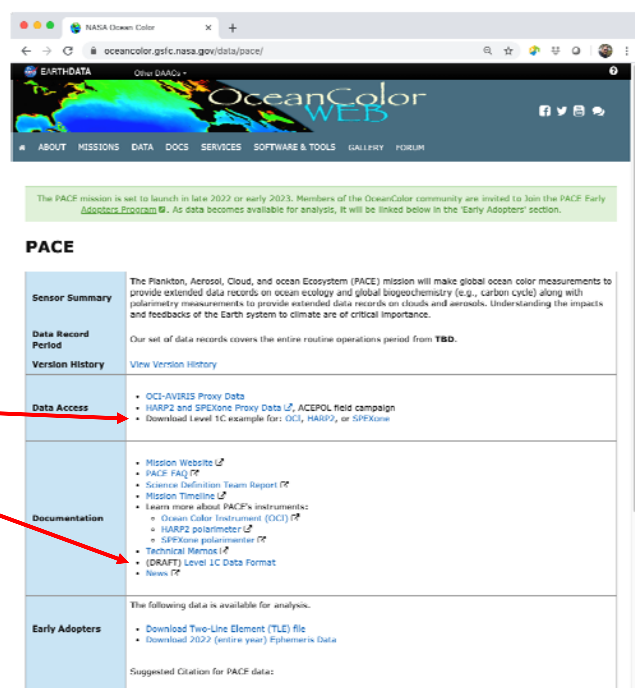
Observation data structure

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

Example template files

(Draft) Level 1C data format document

Future: simulated data in L1C format



Additional tools and other matters

Reaggregation tool: Recreates L1c file for a different altitude

Downsampling tool: Regenerates L1c file on a coarser spatial grid

Instrument uncertainty models: One sigma systematic uncertainty estimate for all parameters given the observations, geometries, calibration coefficients, etc.

Ancillary and cloud data derived from OCI will be put in L1C format to aid L1C – L2 algorithms