Diffuse attenuation coefficient for downwelling irradiance at 490 nm (Kd)

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1 - Product Summary

This algorithm returns the diffuse attenuation coefficient for downwelling irradiance at 490 nm (*Kd*_490) in m^{-1}, calculated using an empirical relationship derived from in situ measurements of *Kd*_490 and blue-to-green band ratios of remote sensing reflectances (R_{rs}).

Implementation of this algorithm is contingent on the availability of Rrs in the blue-green spectral region (e.g., 490 - 565 nm). CZCS, OCTS, MODIS-Aqua and -Terra, MERIS, SeaWiFS, VIIRS, and others are all supported.

For PACE OCI, an updated *Kd* algorithm is used, and it is described here.

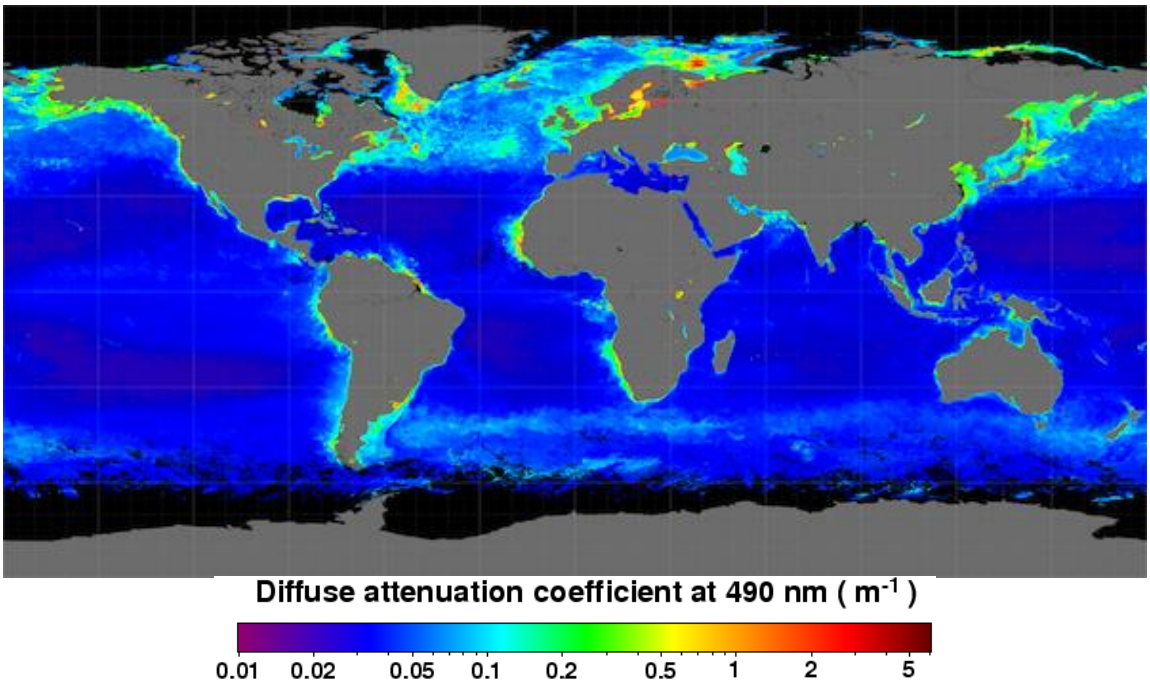


Fig. 1. MODIS Aqua *Kd*_490 seasonal composite for Spring 2014

Algorithm Point of Contact: P. Jeremy Werdell, NASA Goddard Space Flight Center

2 - Algorithm Description

Inputs:

R_{rs} near 490 nm and between 547 and 565 nm

Output:

Kd_490, diffuse attenuation coefficient of downwelling irradiance at 490 nm in m^{-1}

General Algorithm:

The algorithm is a fourth-order polynomial relationship between a ratio of R_{rs} and Kd_490:

$$\log_{10}(K_{bio}(490)) = a_0 + \sum_{i=1}^{4} a_i \left(\log_{10} \left(\frac{R_{rs}(\lambda_{blue})}{R_{rs}(\lambda_{green})} \right) \right)^i$$

$$Kd\_490 = K_{bio}(490) + 0.0166$$

the coefficients for which are sensor-specific:

	sensor	blue	green	a0	a1	a2	a3	a4
KD2S	SeaWiFS	490	555	-0.8515	-1.8263	1.8714	-2.4414	-1.0690
KD2M	MODIS	488	547	-0.8813	-2.0584	2.5878	-3.4885	-1.5061
KD2E	MERIS	490	560	-0.8641	-1.6549	2.0112	-2.5174	-1.1035
KD2V	VIIRS	490	550	-0.8730	-1.8912	1.8021	-2.3865	-1.0453
KD2O	OCTS	490	565	-0.8878	-1.5135	2.1459	-2.4943	-1.1043
KD2C	CZCS	443	520	-1.1358	-2.1146	1.6474	-1.1428	-0.6190
KD2L	OLI/Landsat 8	482	561	-0.9054	-1.5245	2.2392	-2.4777	-1.1099

The coefficients were derived using version 2 of the NASA bio-Optical Marine Algorithm Dataset (NOMAD).

3 - Implementation

Click get_Kd.c to view source code.

Calling in L2GEN

- `l2prod = Kd_490`
- `each satellite will use its sensor-specific coefficients and wavelengths (e.g., SeaWiFS defaults to KD2S)`
- `to override the coefficients: kd2_coef = [a0,a1,a2,a3,a4]`

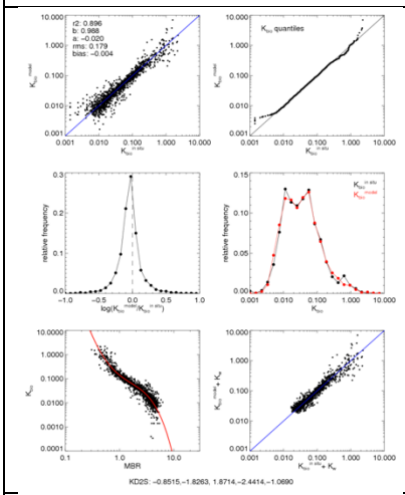
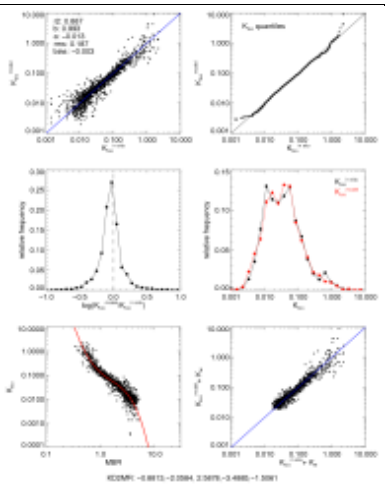
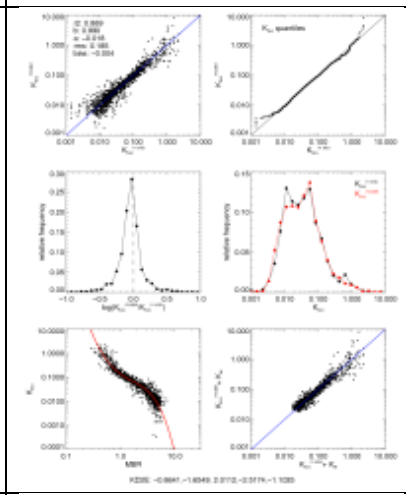
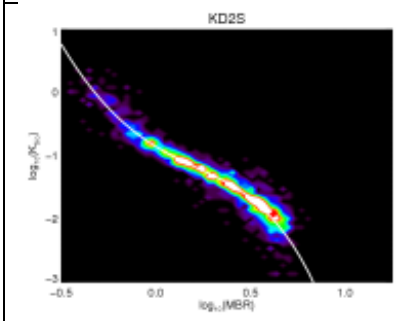
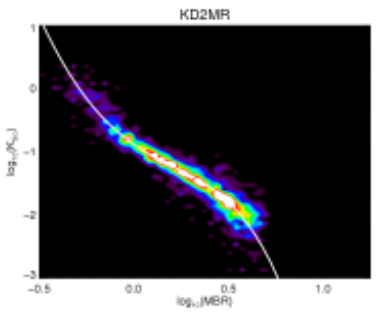
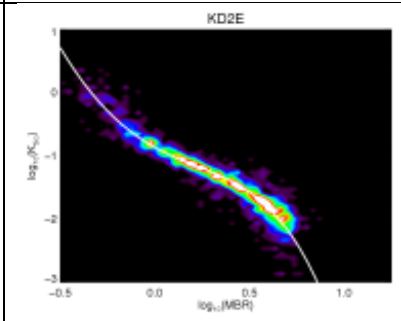
- to override the wavelengths: kd2_wave = [numerator wavelength, denominator wavelength]

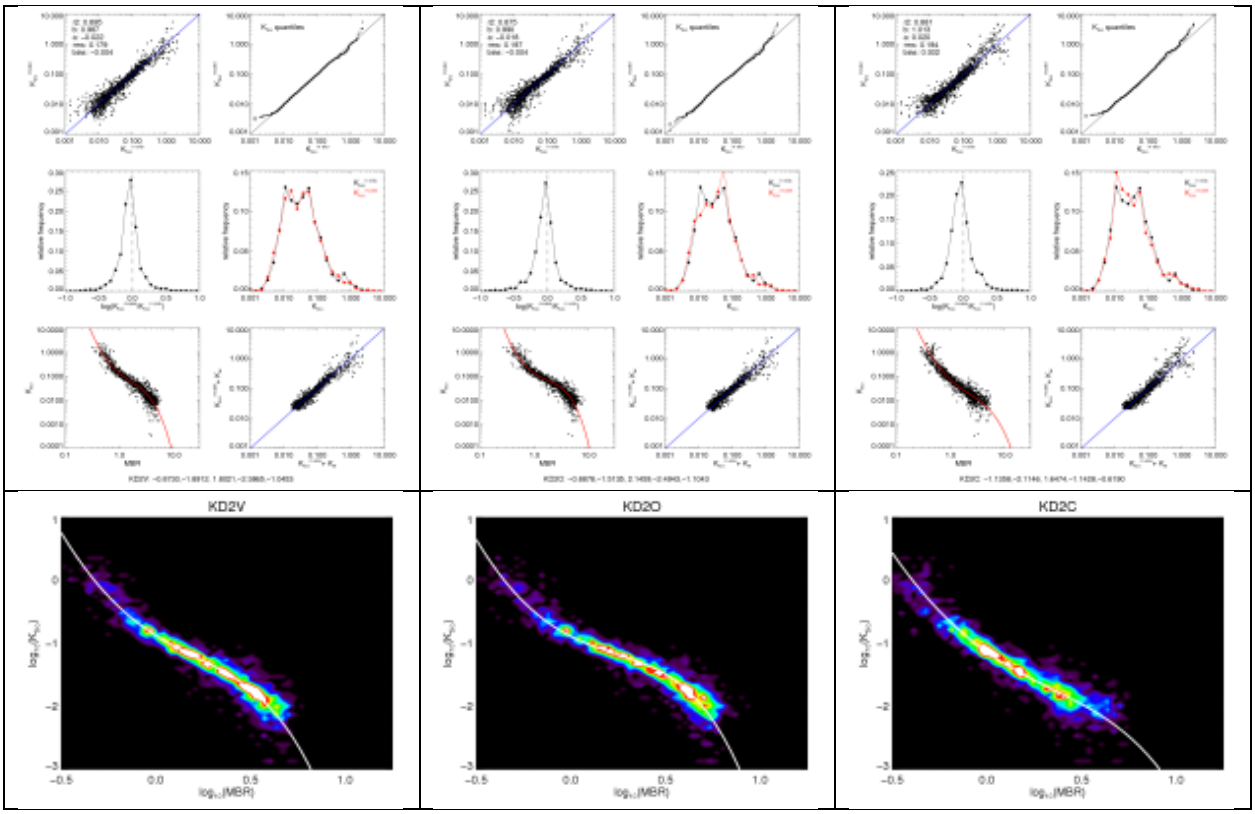
4 - Assessment

Satellite-to-in-situ validation results are available from the SeaWiFS Bio-Optical Archive and Storage System (SeaBASS):

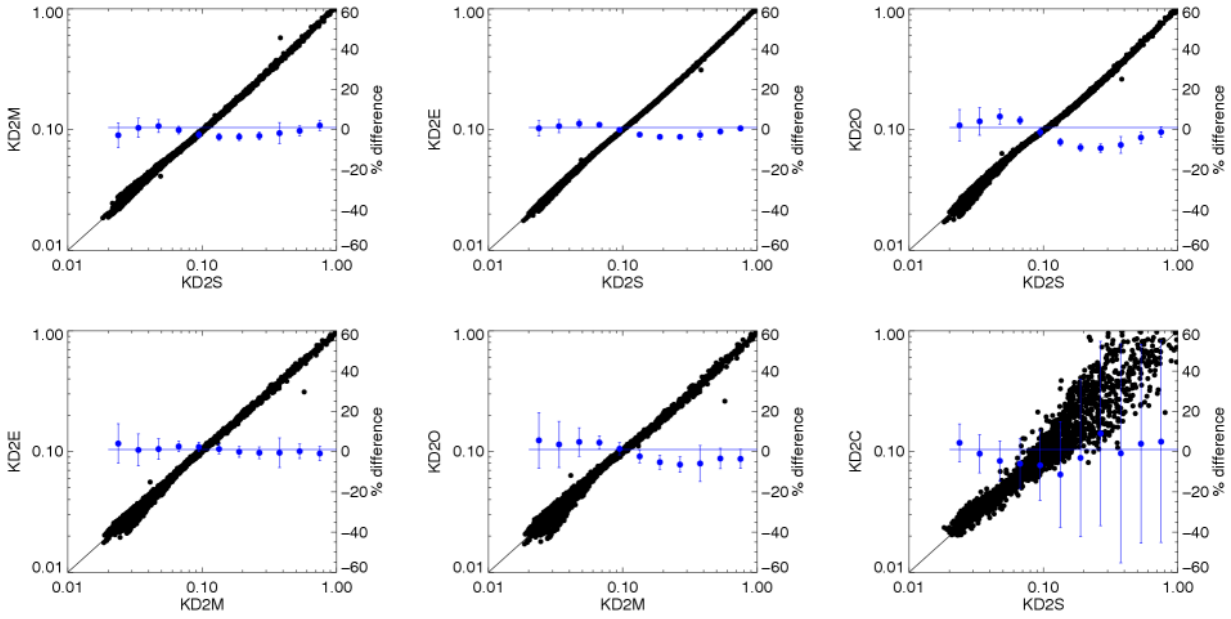
- SeaWiFS
- MODIS Aqua
- MODIS Terra
- VIIRS
- OCTS
- CZCS
- MERIS

Algorithm Development:

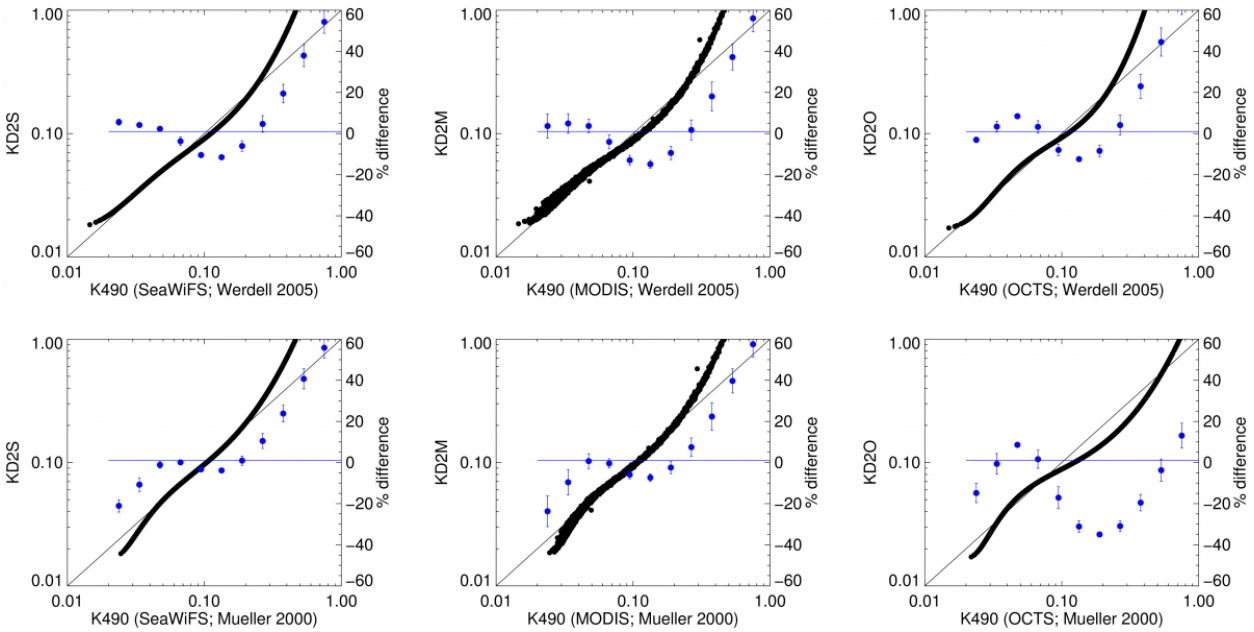
KD2S	KD2M	KD2E
		
		
KD2V	KD2O	KD2C



Algorithm Verification: internal consistency between operational algorithms

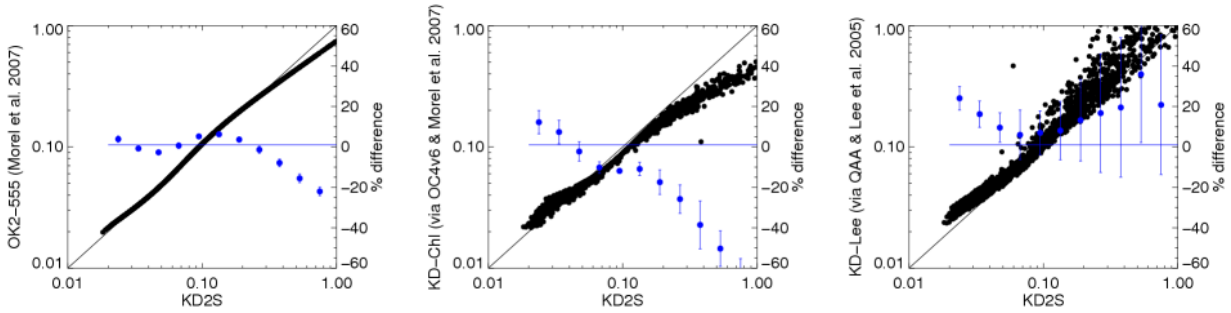


Algorithm Verification: comparison with previous versions



Algorithm verification: comparison with alternate models

KD2S is compared with (Morel et al. 2007) (both Rrs- and Chl-driven) and (Lee 2005)



5 - References

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