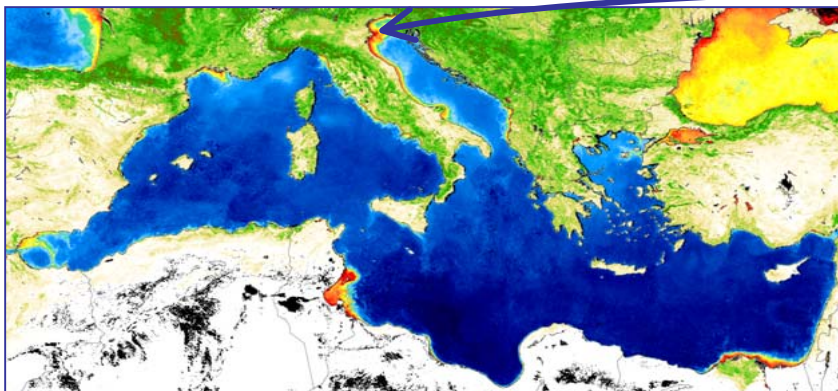




JRC Ocean-Color validation activities

G. Zibordi (Joint Research Centre, Ispra)

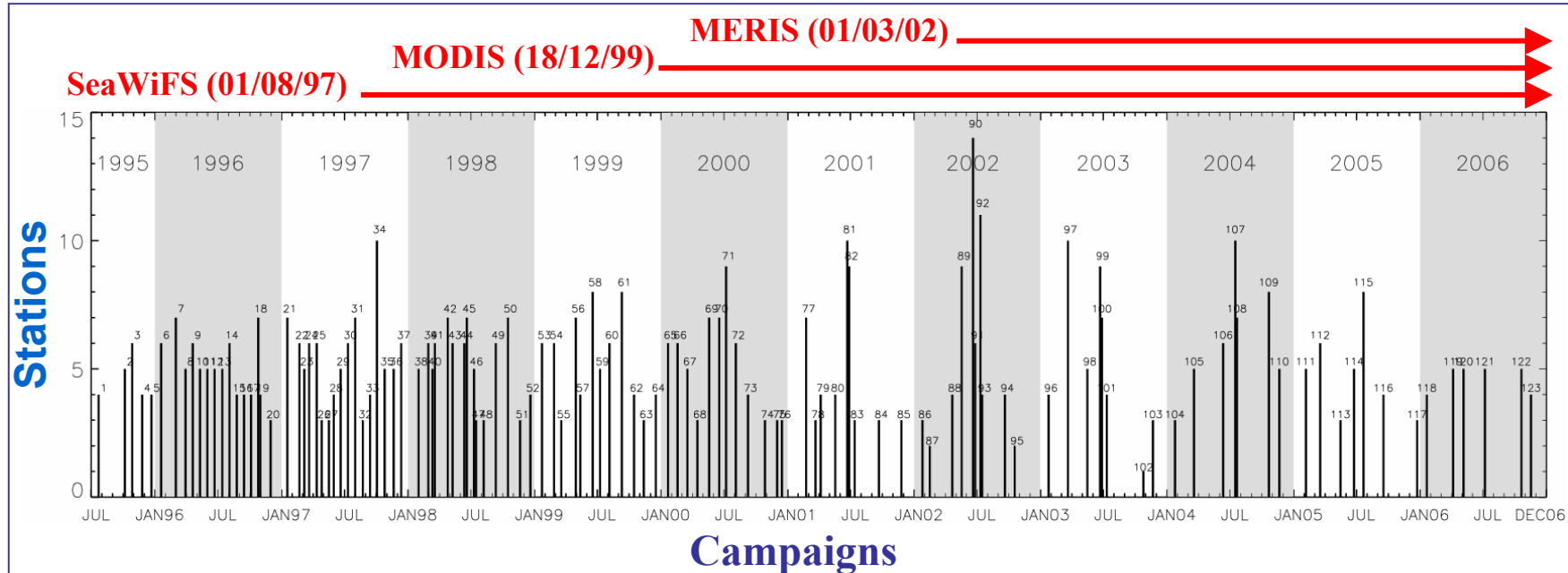
CEOS IVOS 18th
June 11, 2007, NPL



Monthly Chla composite from SeaWiFS imagery (September 1998)



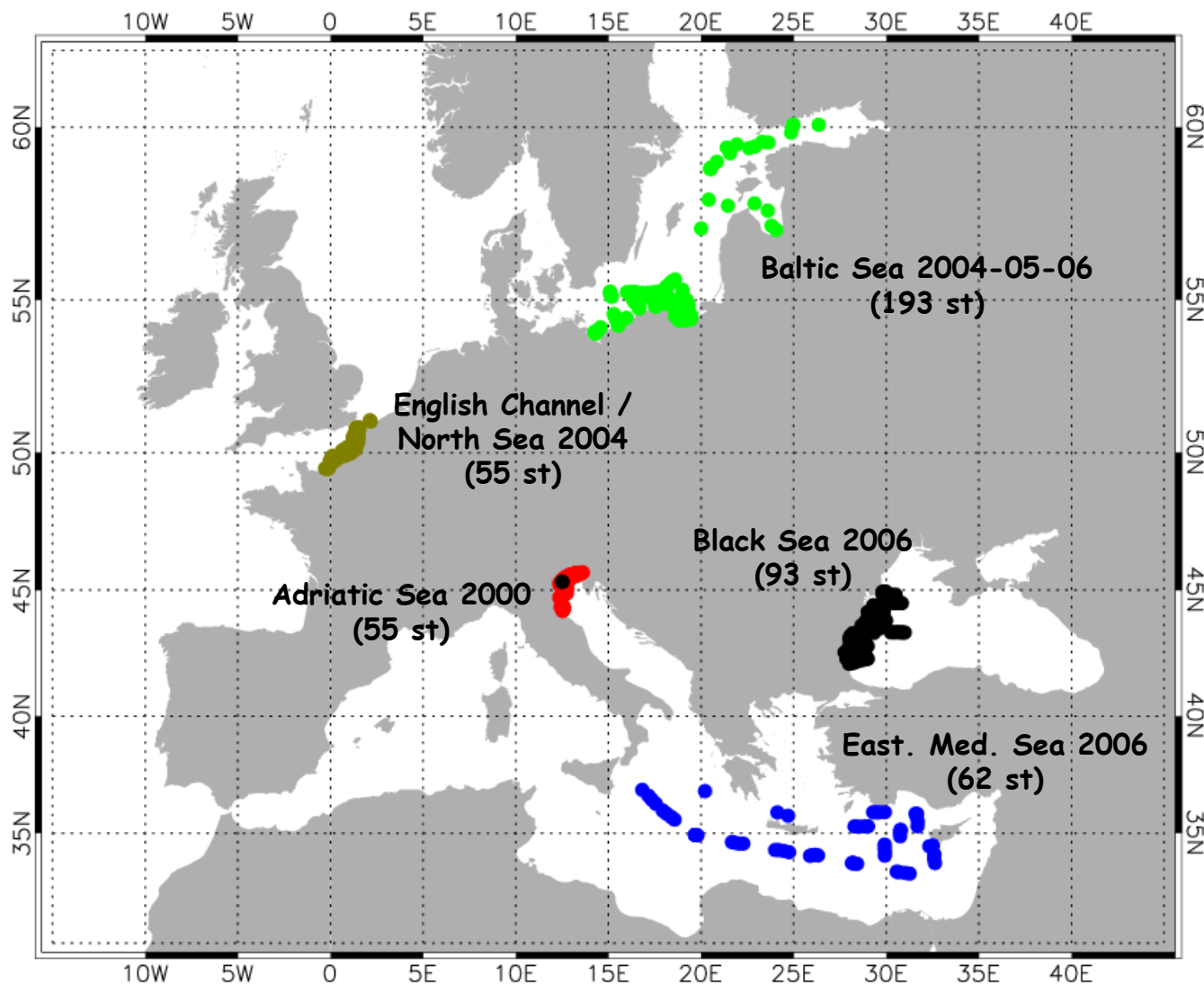
AAOT



G.Zibordi, J.F.Berthon, J.P.Doyle, S.Grossi, D. van der Linde, C.Targa, L.Alberotanza. Coastal Atmosphere and Sea Time Series (CoASTS), Part 1: A long-term measurement program. NASA Tech. Memo. 2002-206892, v. 19, S.B.Hooker and E.R.Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 2002, 29 pp.



JRC ship campaigns 2000-2006





CoASTS measurements

Ship

✓

✓

✓

✓

✓

✓

Field

- Profiles of $L_u(z, \lambda)$, $E_u(z, \lambda)$, and $E_d(z, \lambda)$
- Profiles of $c(z, \lambda)$ and $a(z, \lambda)$ (from 01/97)
- Profiles of $b_b(z, \lambda)$ (from 04/00)

Profiles
(manned)

- $E_d(0^+, \lambda)$ and $E_i(0^+, \lambda)$
- $E_s(0^+, \lambda)$ and $L_i(0^+, \theta, \phi, \lambda)$
- $L_w(40^\circ, 90^\circ, \lambda)$ (from 04/02)
- Ancillary ($T_w(z), S_w(z), P_a, RH, T_a, W_s, W_d, C, M$)

Continuous
(autonomous)

Laboratory

(from water samples at 3 depths)

✓

✓

✓

✓

✓

- **Pigments (HPLC)**
- $a_{ph}(\lambda)$ and $a_{dp}(\lambda)$
- $a_{ys}(\lambda)$
- **TSM**
- Ancillary (**PSD**) (up to 10/98)

Samples
(conditioned)

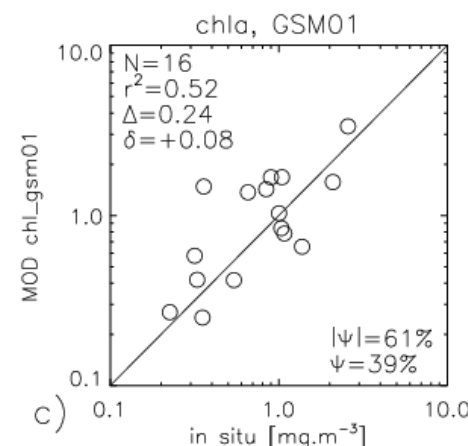
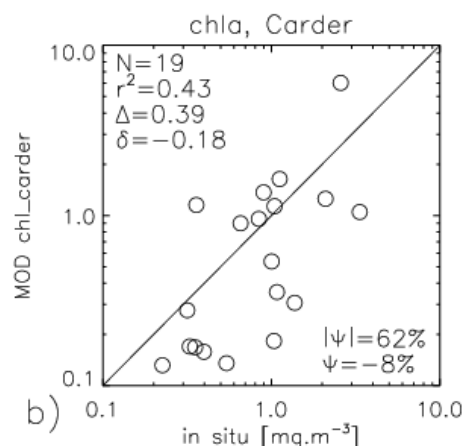
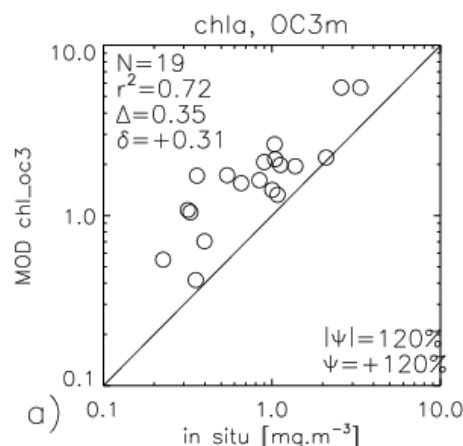
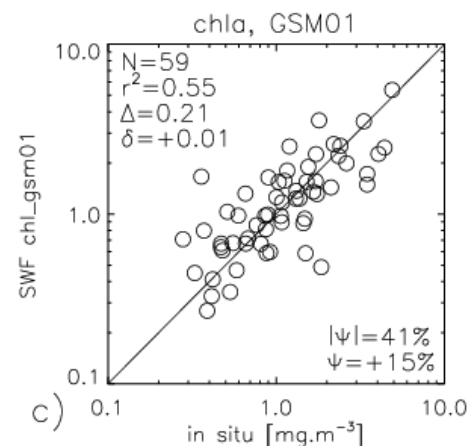
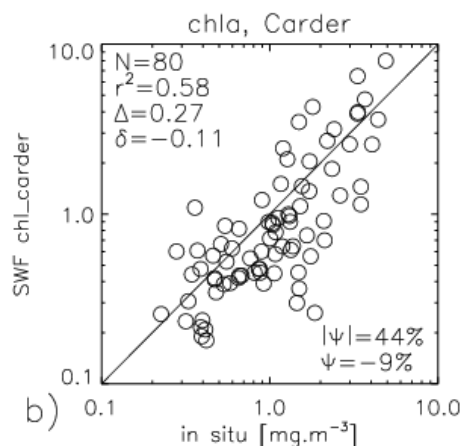
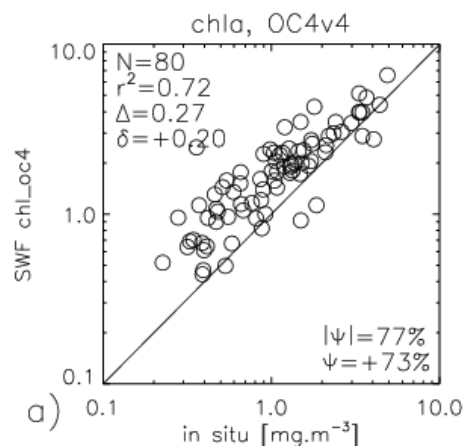
G.Zibordi, J.F.Berthon, J.P.Doyle, S.Grossi, D. van der Linde, C.Targa, L.Alberotanza. Coastal Atmosphere and Sea Time Series (CoASTS), Part 1: A long-term measurement program. NASA Tech. Memo. 2002-206892, v. 19, S.B.Hooker and E.R.Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 2002, 29 pp.

J.F.Berthon, G.Zibordi, J.P.Doyle, S.Grossi, D. van der Linde, C.Targa. Coastal Atmosphere and Sea Time Series (CoASTS), Part 2: Data analysis. NASA Tech. Memo. TM-2002-206892, v. 20, S.B.Hooker and E.R.Firestone, Eds., NASA Goddard Space Flight Center, Greenbelt, Maryland, 2002, 25 pp.

Chlorophyll a

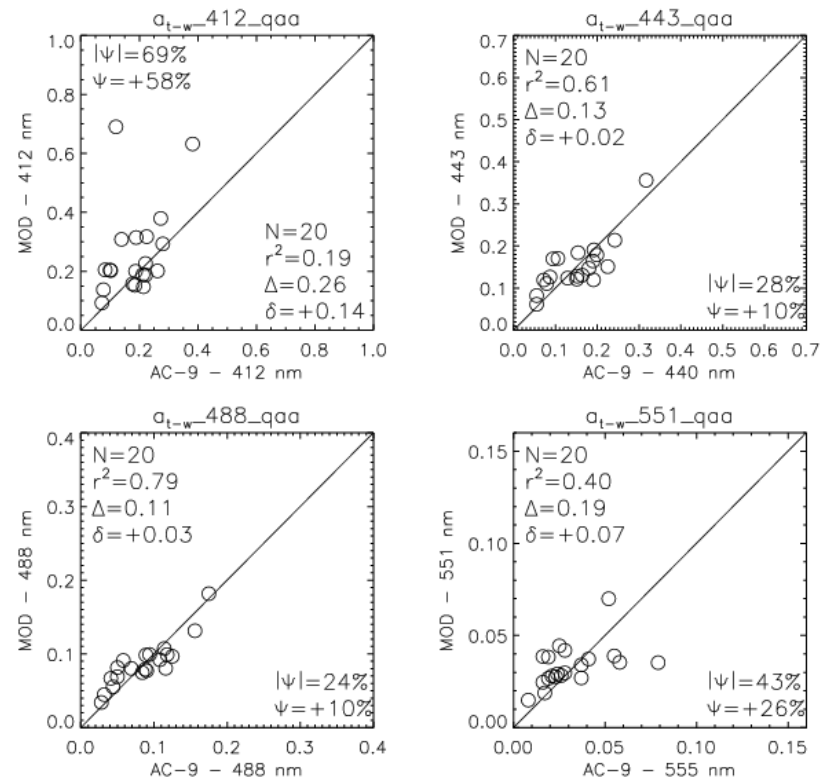
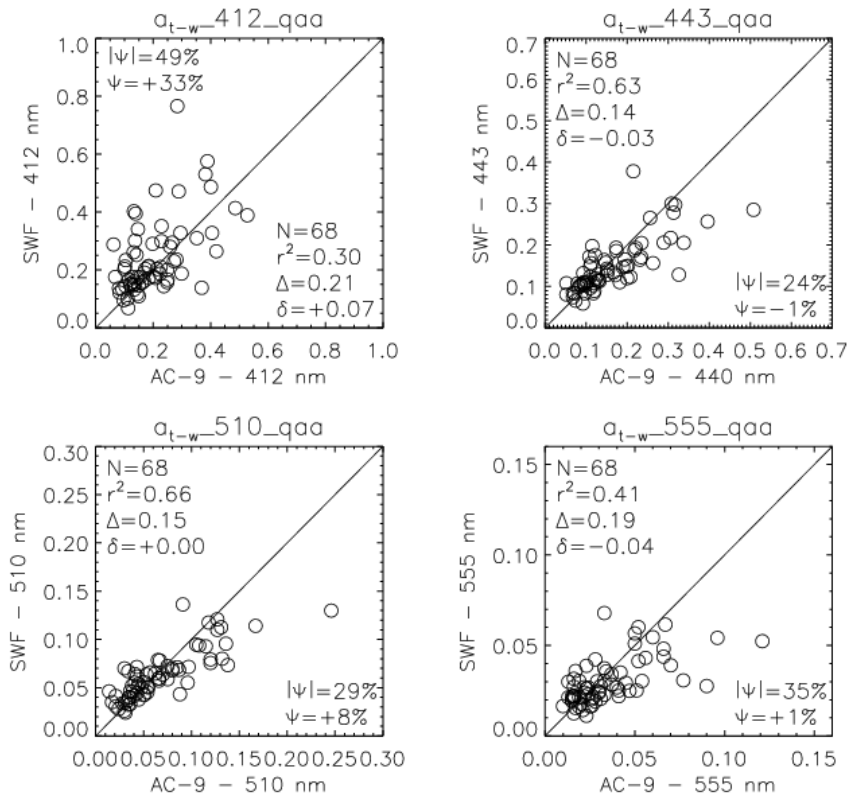
SeaWiFS

MODIS



F.Mélin, J.F.Berthon and G.Zibordi. Assessment of standard satellite ocean color products at a coastal site. *Remote Sensing of Environment*, in press, 2007.

Absorption coefficient



SeaWiFS

MODIS

F.Mélin, J.F.Berthon and G.Zibordi. Assessment of standard satellite ocean color products at a coastal site. *Remote Sensing of Environment*, in press, 2007.



CE-318 (sea-viewing)



CE-318 (sky-viewing)

$$(\varphi = \varphi_0 + 90^0; \theta = 40^0; \theta' = 140^0)$$

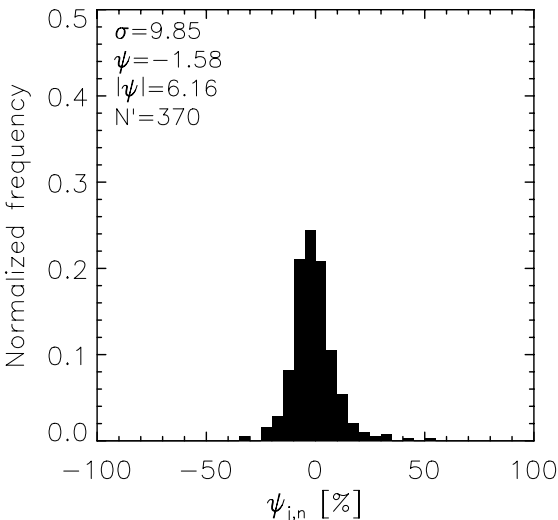
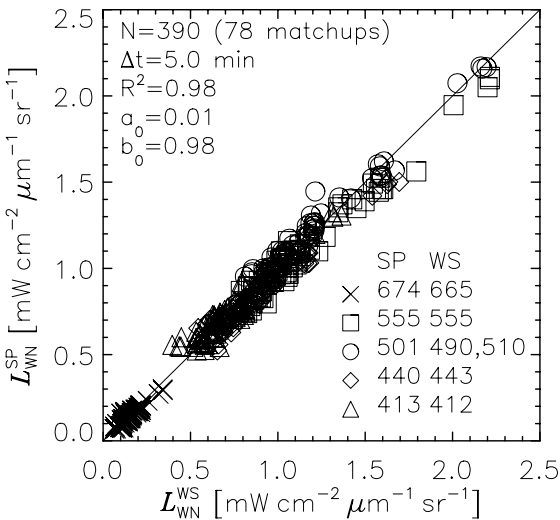
Above water radiometry

$$L_W^{SP}(\varphi,\theta,\lambda) = L_T(\varphi,\theta,\lambda) - \rho(\varphi,\theta,\theta_0,W)L_i(\varphi,\theta',\lambda)$$

$$L_W^{SP}(\lambda) = L_W^{SP}(\varphi,\theta,\lambda)C_{\mathfrak{R}Q}(\lambda,\theta,\varphi,\theta_0,\tau_a,Chla,W)$$

$$L_{WN}^{SP}(\lambda) = L_W^{SP}(\lambda)\frac{1}{D^2t_d(\lambda)\cos\theta_0}C_{f/Q}(\lambda,\theta_0,\tau_A,Chla)$$

Major uncertainties (L _w)	412	440	500	555	670
Absolute calibration	2.2	2.1	2.1	2.1	2.1
Viewing angle correction	1.0	1.0	1.6	1.8	0.9
Environmental perturbations	4.0	3.7	3.1	3.0	12.0
Quadrature sum	4.7	4.4	4.1	4.1	12.2



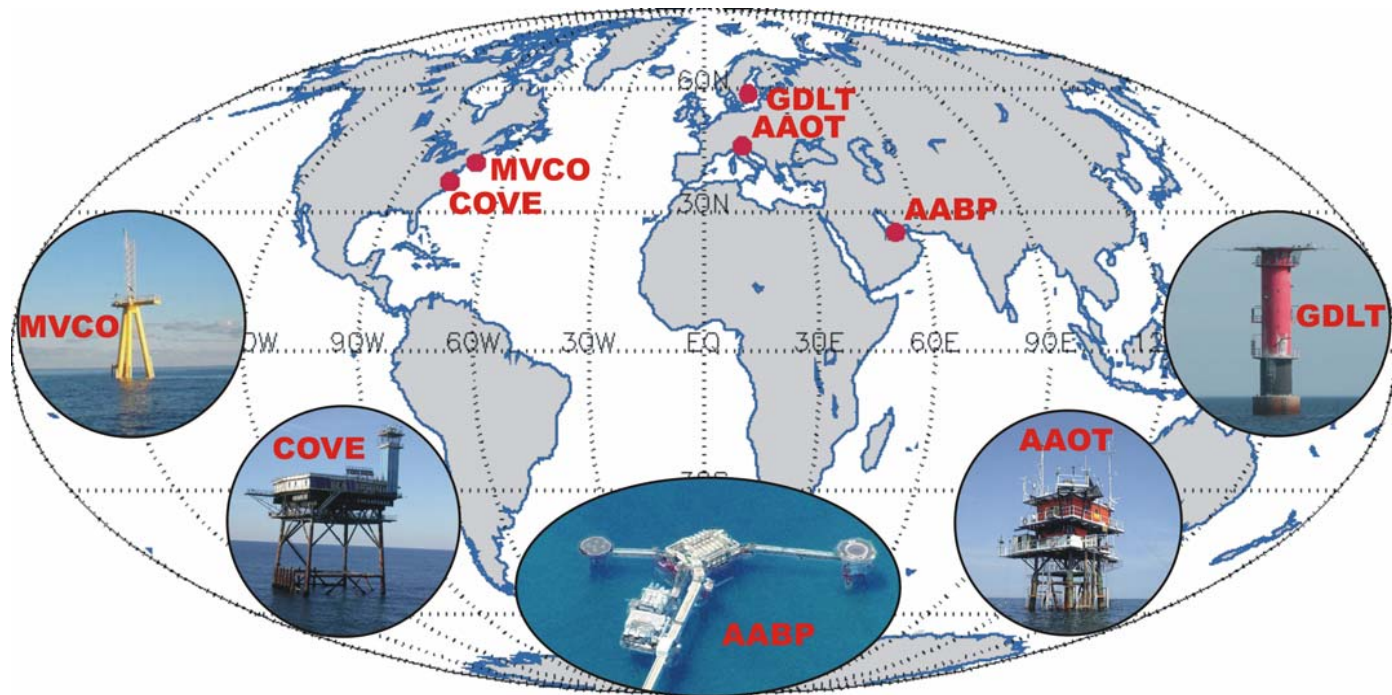
G.Zibordi, F. Mélin, S. B. Hooker, D. D’Alimonte and B. Holben. An autonomous above-water system for the validation of ocean color radiance data. *IEEE Transactions in Geoscience and Remote Sensing*, 42:401-415, 2004.

AERONET – Ocean Color

AERONET-OC is an integrated network supporting ocean color validation with highly consistent time-series of standardized $L_{WN}(\lambda)$ measurements.



Autonomous system



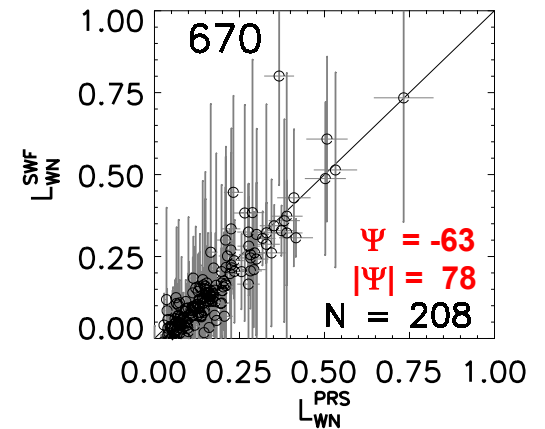
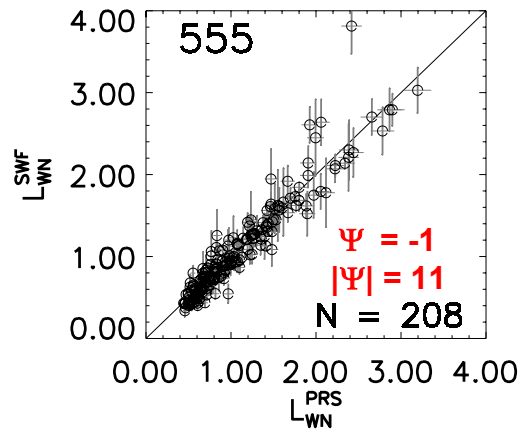
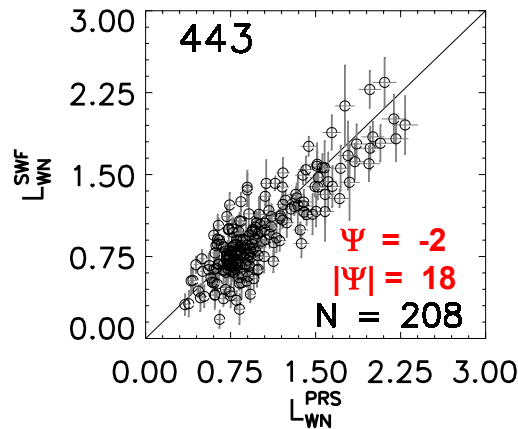


Current AERONET-OC sites

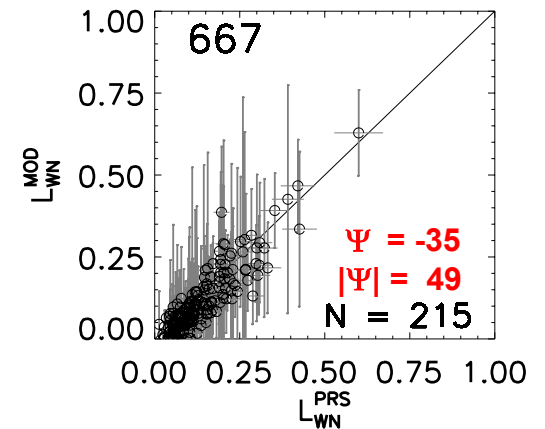
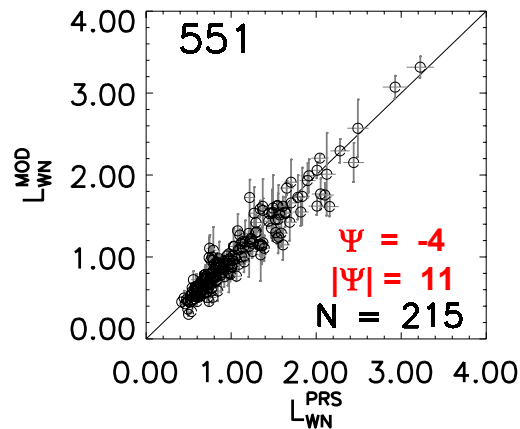
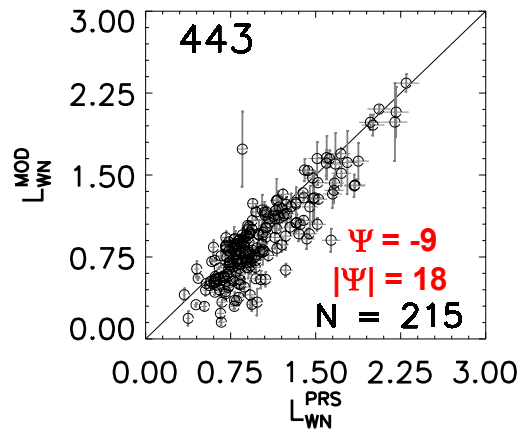
Site	PI	Time frame	Collaborations
AAOT (Adriatic Sea)	G. Zibordi (JRC)	2002 - present	JRC
GDLT (Baltic Sea)	G. Zibordi (JRC)	2005 – present (summer deployments)	JRC
HLT (Baltic Sea)	G. Zibordi (JRC)	2006 – present (summer deployments)	JRC - FIMR
AABT (Persian Gulf)	G. Zibordi (JRC)	2006 – present	JRC - NASA
MVCO (US East Coast)	D. Vandemark (UNH)	2004 - present	UNH
COVE (US East Coast)	B. Holben (NASA)	2006 - present	NASA



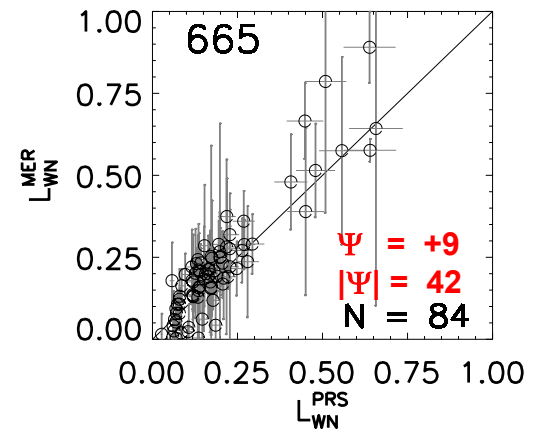
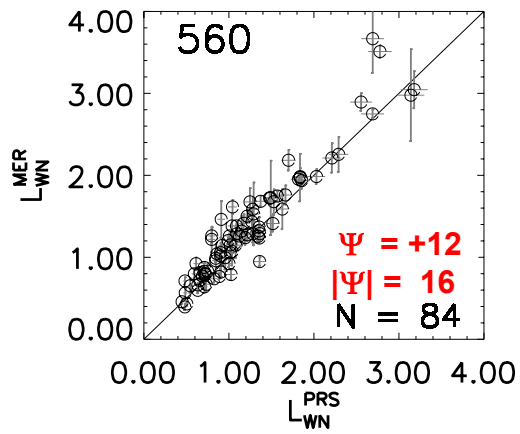
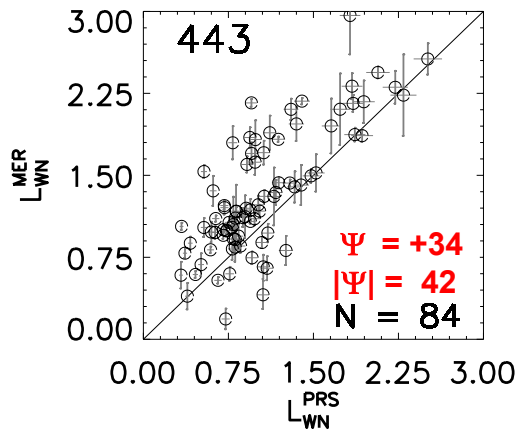
Match-Ups Analysis



SeaWiFS



MODIS



MERIS



Recommendation

Put in place ways to reinforce extensive (space and time) field activities through state-of-the-art measurement protocols, for ocean color products validation and merging (specifically support and extend AERONET-OC).