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Correction of the chlorophyll-a concentration profile in the Black Sea: *in situ* measurements and measurements from bio-argo floats

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Goal

Using current available data on chlorophyll-a concentration profiles, including *in situ* measurements and measurements from bio-argo floats, to make a correction of the relationship between chlorophyll-a concentration in the upper layer of the Black Sea and its profile with depth, obtained earlier from the results of long-term field data summarizing [Finenko et al., 2005].

Data

634 profiles from three bio-argo floats:

In situ measurements from scientific expeditions:

PI Violeta Slabakova (basbio001d)

RV Pr.Vodyanitsky-70 (August 2011) (Warm: 9 profiles)

PI Pierre-Marie Poulain (Argo-Italy ogsbio007c)

RV Pr.Vodyanitsky-78 (November-December 2014) (Cool: 17 profiles)

PI Sorin Balan (GeoEcoMar gembio001b)

Method

relative error of the integral profile

relative error taking into account profile features

$$rel(I) = \frac{|I(model) - I(float)|}{I(float)}$$

$$rel(I(w)) = \frac{\sum_h |C_a(h, model) - C_a(h, float)|}{\sum_h C_a(h, float)} \cdot w(h, float)$$

$$w(h, float) = \frac{C_a(h, float)}{\sum_h C_a(h, float)}$$

TUNING: BIO-ARGO FLOATS

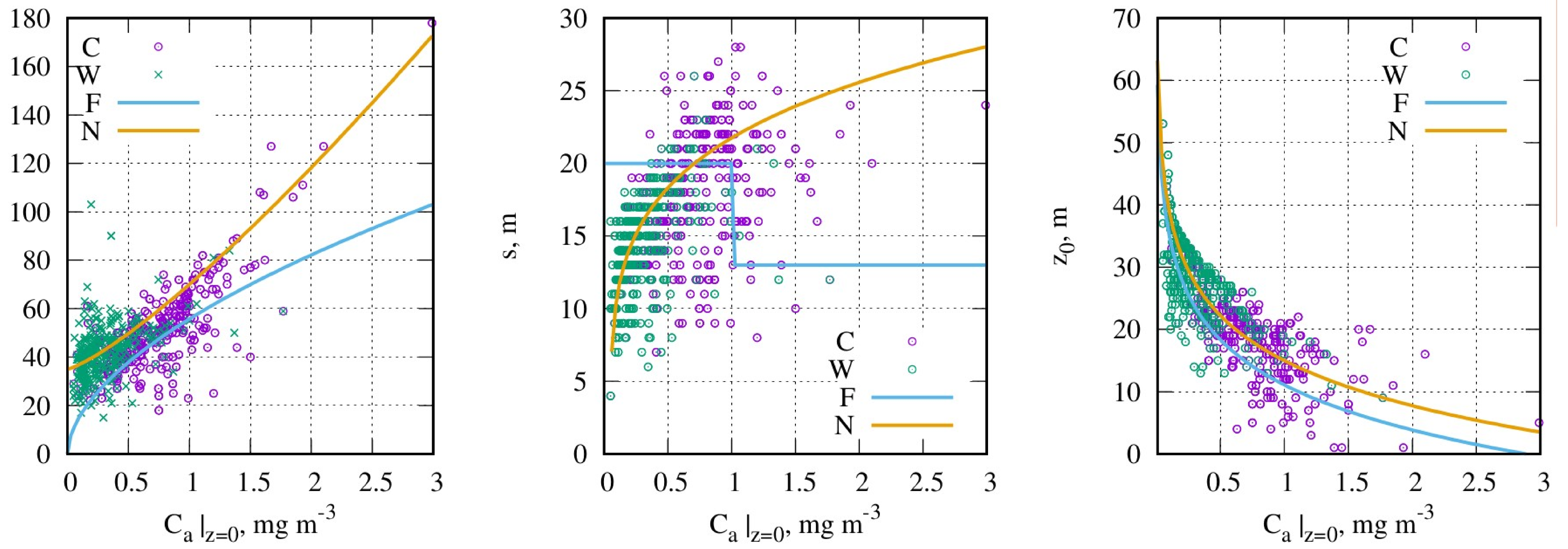


Figure Old (F) and New (N) parameters of the Chla profile. (C) and (W) are float's profiles for Cool and Warm periods, respectively.

Position in Figure	Old model* [Finenko et al., 2005]	New model based on bio-argo floats
left	$h(x) = 55.73 \cdot x^{0.56}$	$h(x) = 35 \cdot x^{1.25} + 35$
center	$s(x) = (x < 1 ? 20 : 13)$	$s(x) = 25 \cdot (x - 0.05)^{0.2} - 3$
right	$z_0 = 11.1 - 10.46 \cdot \log(x)$	$z_0 = 15 - 10.46 \cdot \log(x)$

* warm period from 15.04 to 15.10

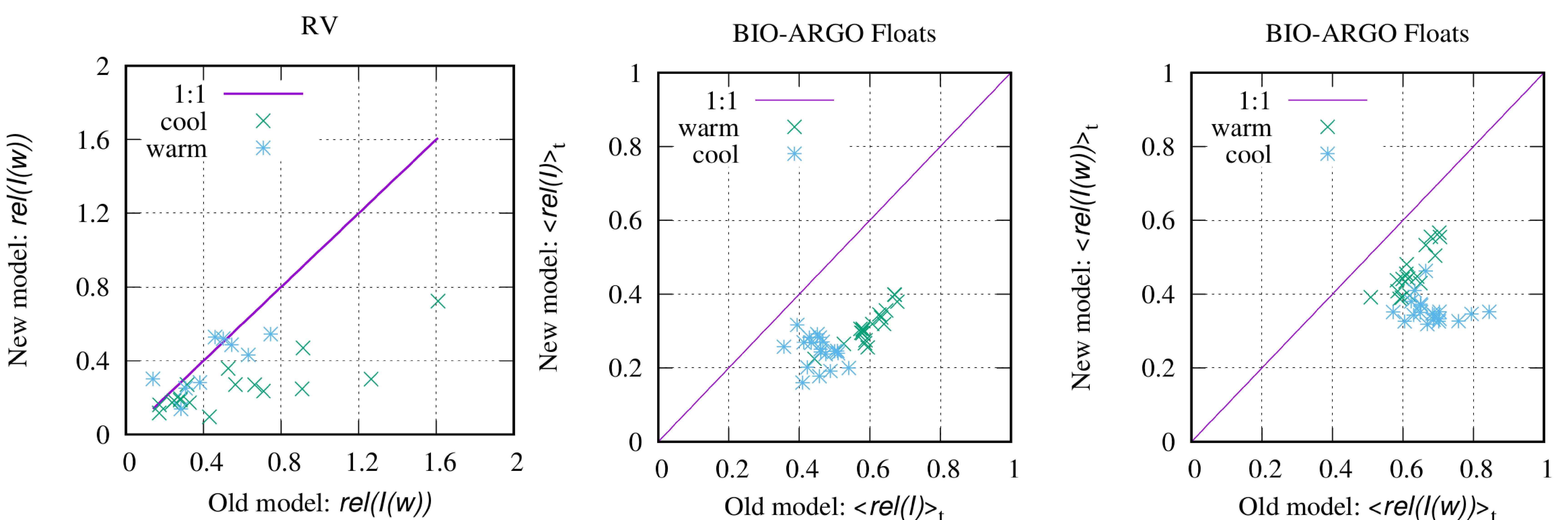
$$Chla(z) = \frac{h(x)}{s(x) \cdot (2 \cdot \pi)^{0.5}} \cdot \exp\left(-\frac{(z - z_0)^2}{2 \cdot s^2(x)}\right), \quad x = Chla(0)$$

cool period: from 15.10 to 15.04, $Chla(z) = Chla(0)$

$$\min_{s, h, z_0} = \sum_z [C_a(z, mod) - C_a(z, float)]^2$$

TEST#IN SITU (RV): NEW vs OLD MODEL

TEST#BIO-ARGO: NEW vs OLD MODEL



Conclusion: the corrected expression for the recovery of the chlorophyll-a concentration profile by its value in the upper layer of the Black Sea for all seasons has obtained

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