Calibration of a radiative transfer model using BGC-ARGO profiles

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The main objective of my PhD is to **identify the main sources of uncertainty** that impact biogeochemistry in the Black Sea and that have a significant influence on climate and health indicators. This will be achieved using an **ensemble system for the coupled physical-biogeochemical model** NEMO-BAMHBI, to which an upgraded **radiative transfer model** RADTRANS is added.

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1. Context

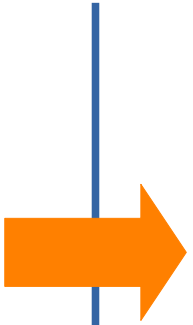
In the coupled physical-biogeochemical system that will be used, the upgrade of the radiative transfer model provides 2 benefits:

- Better simulation of irradiance profiles to improve the modelling of photosynthesis and vertical profiles of temeprature
- Modelling of radiometric quantities, closer to both satellite and *in situ* observations (BGC-ARGO)

Initial modelling in BAMHBI

2 bands in PAR range

1 band in IR



Upgrade with RADTRANS

(based on Dutkiewicz et al., 2015)

25 nm resolution in PAR range

In total, 33 bands between 250 and 4000 nm

2. Calibration method

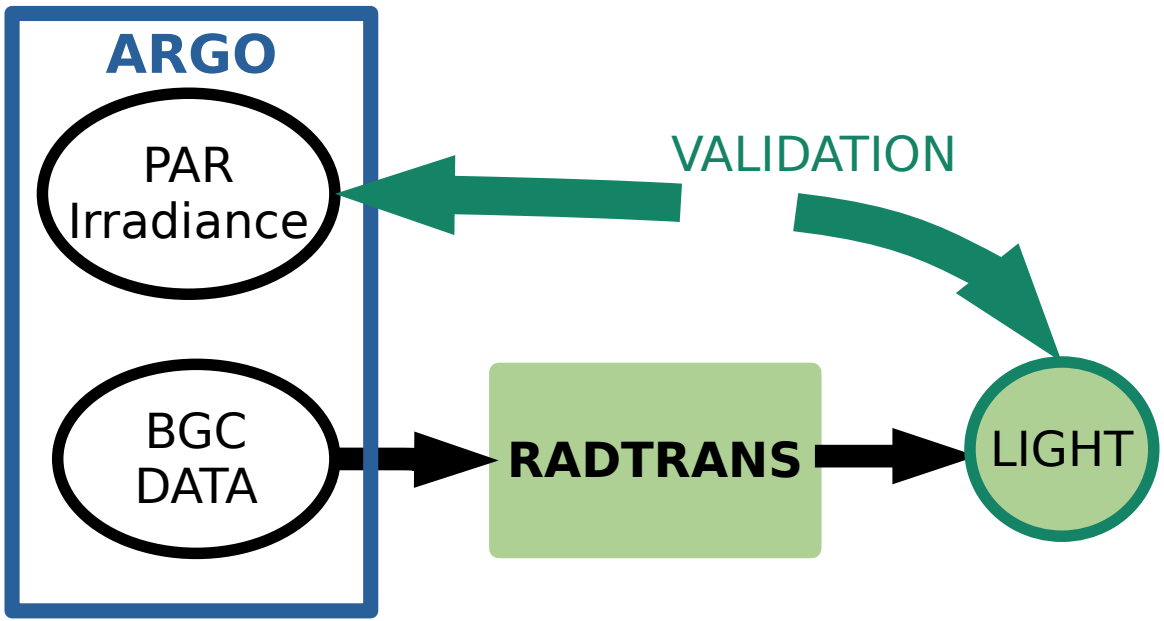
Absorption and scattering modelled as the sum of 4 main contributors:

- Water
- Chlorophyll cells
- Coloured dissolved organic matter (CDOM)
- Particulate detrital matter

ARGO data in the Black Sea:
BGC and radiometric

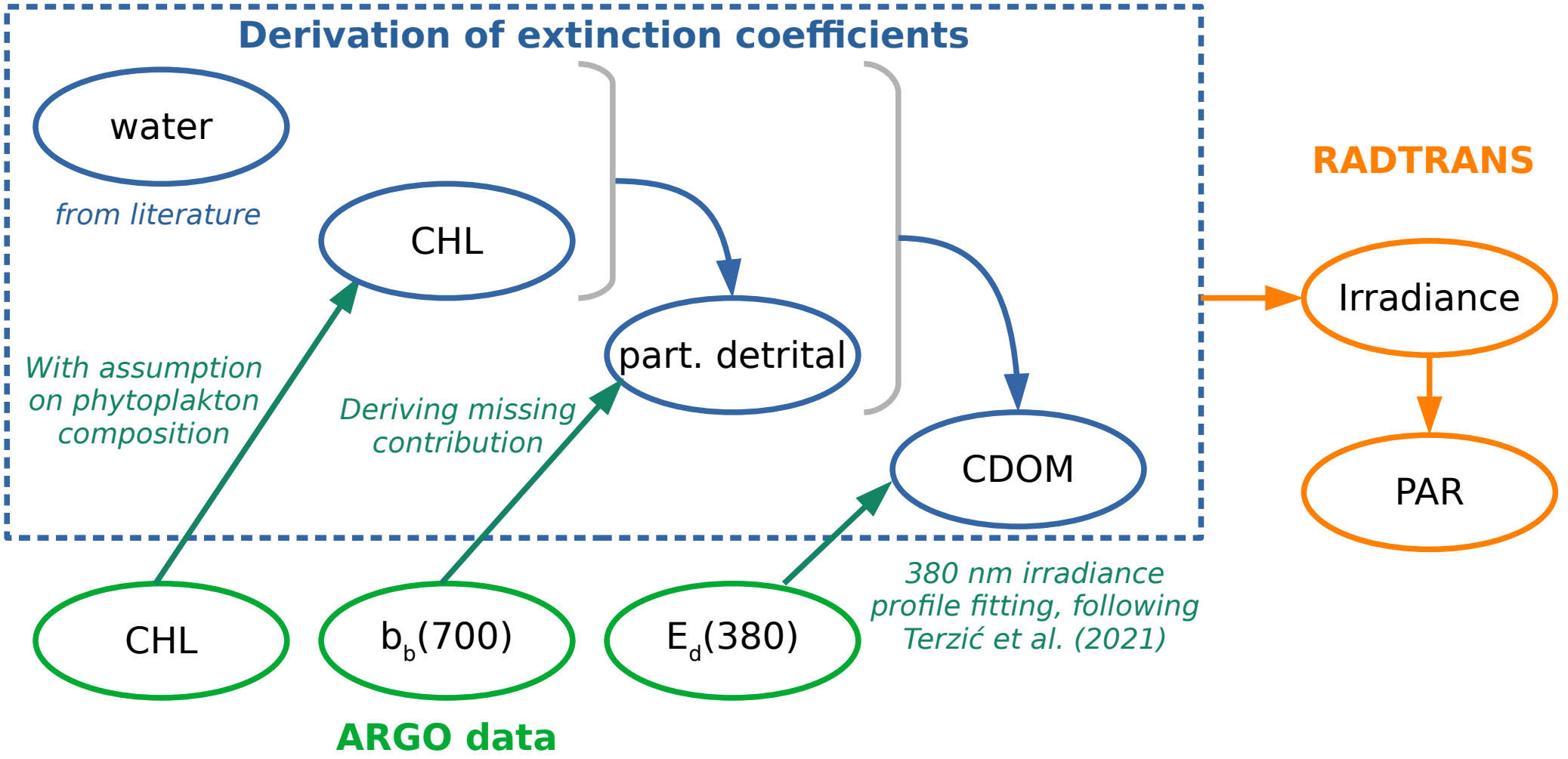
- chl-a, CDOM, $b_b(700)$

- Irradiance and PAR profiles



Calibration is performed by deriving each contribution from ARGO data

3. Forced mode with ARGO data



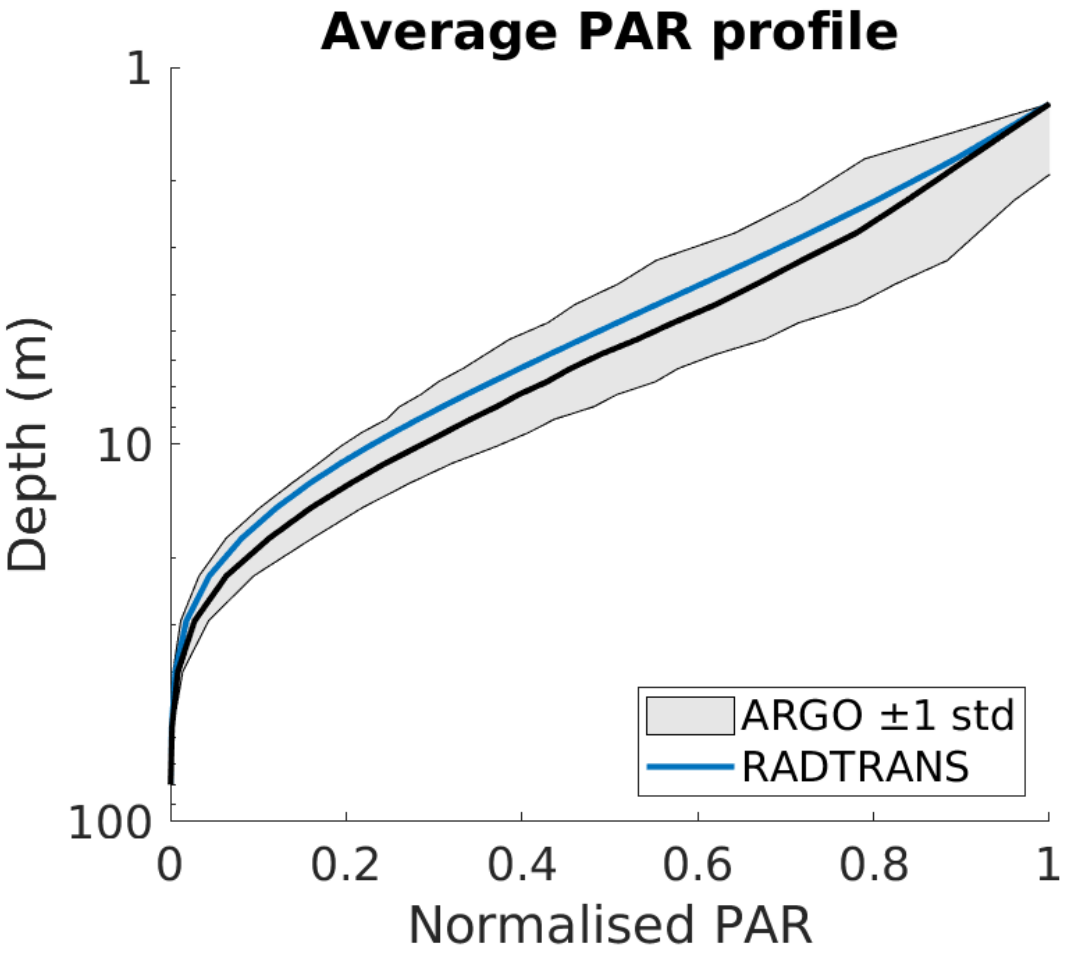
4. Results

After fitting 380 nm irradiance profiles, the agreement decreases with higher wavelengths as attenuation is too strong.

Error and bias on PAR (400-700 nm range) remain satisfactorily low.

		Downward irradiance		
	PAR	380 nm	412 nm	490 nm
%bias	**-5.5**	0.4	-3.7	-7.2
%rmsd	**2.6**	1.1	2.0	3.4
R	**0.979**	0.994	0.987	0.971

Mean bias, RMSD and correlation for irradiance and PAR profiles

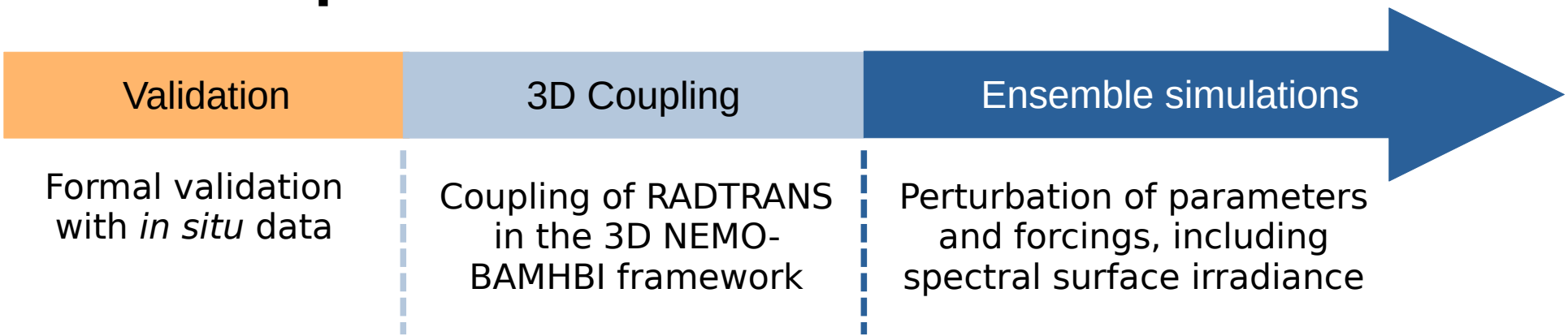


Average of ARGO PAR profiles and of the associated RADTRANS simulations

5. First conclusions

- RADTRANS is able to simulate PAR profiles with low error relatively to ARGO measurements
- CDOM appears to be the main contributor to irradiance attenuation

6. Next steps



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