COLOR: *CDOM-proxy retrieval from aeOLus ObseRvations*

Preliminary results

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Context

COLOR (*CDOM-proxy retrieval from aeOLus ObseRvations)* is an on-going (**KO: 10/3/2021**) 18 month feasibility study approved by **ESA** within the **Aeolus+ Innovation program. COLOR objective** is to evaluate and document the **feasibility of deriving an in-water AEOLUS prototype product** from the analysis of the ocean sub-surface backscattered component of the 355 nm signal. COLOR project focuses on the AEOLUS potential retrieval of: 1) Diffuse attenuation coefficient for downwelling irradiance,(Kd [m^{-1}]); 2) Sub-surface hemispheric particulate backscatter coefficient (b_{bp} [m^{-1}]).

Methods

The **core activity** of the project is the **characterization** of the backscattered radiation signal (B_{grd}) from the **AEOLUS ground bin** (Δr_{grd}):

$$B_{grd} = B_{atm} + B_{srf} + B_{wat}(K_L, \beta_{wat}^{par}, \beta_{wat}^{mol})$$

Through:

- ***Radiative transfer modeling***
- ***AEOLUS Signal Analyses***

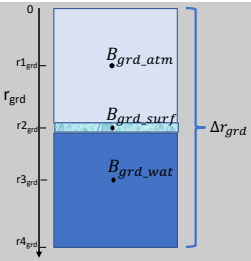
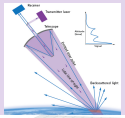


Fig. 1 Schematic geometry description of the AEOLUS ground bin.

Radiative transfer modeling



- Development and validation of a MC based RTM to simulate AEOLUS signal propagation in ocean.
  - Assessment of validity of assumptions (e.g. effect of surface wind)
  - Sensitivity study to relevant variables (Chl, CDOM, bathymetry)

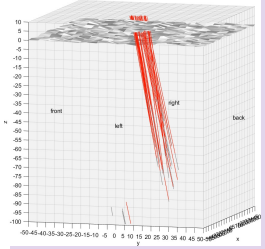


Fig. 2 Schematic view of the RTM tool.

Simulation identified "**expected**" **conditions** where the **echoed lidar signal** can be informative of **optically active sea-water constituents** (e.g., v_w<8 ms^{-1}, Chl-a > 0.1 mg m^{-3} if $z_b \approx 100$ m).

On-going activities

- ❖ Closure assessment between ocean simulated signal and measured signal of the ground bin
- ❖ Estimation of the atmospheric contribution
- ❖ Estimation of the Brillouin contribution on the Rayleigh channels
- ❖ Implementation of specific Q/C tests (e.g. cloud detection)
- ❖ Design of the inversion algorithm and implementation to assess the robustness of the assumptions

Algorithm Cal/Val activities

1) Processing and Q/C of BGC-ARGO relevant observations
2) Definition of Region of Interests on the basis of marine optical properties
3) Statistical charaterization of ROI's

AEOLUS Signal Analyses

BGC-ARGO

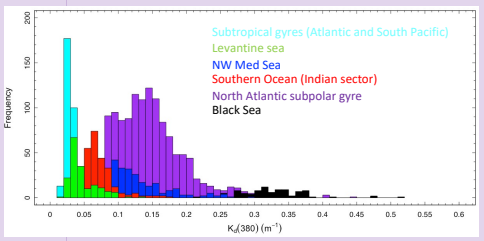


Fig. 3 Frequency distribution of Kd(380) coefficients acquired in the first optical depth across different ROI's. All data have been collected using BGC-Argo floats between October 2012 and January 2016.

AEOLUS

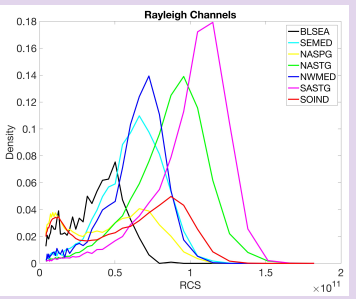


Fig. 4 Histogram plots for the Rayleigh RCS of the #23 bin for the different ROI's. December 2020-January-February (DJF) 2021 AEOLUS dataset have been used.

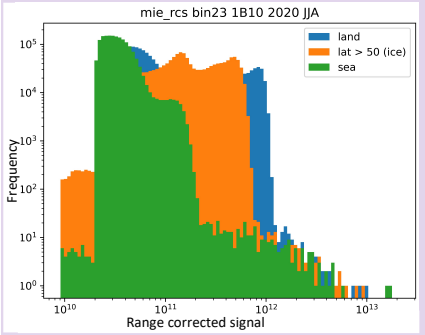
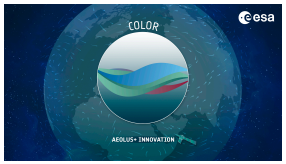


Fig. 5 Analysis of the different contributions of the ground bin: distinction among land, ice and sea signal.

Bin #23 contains the atmosphere-ocean interface (98% of the cases). Water portion is around 20% of the bin.

SNR>10 on bin #23 removes the majority of cloud contaminated bins. There is still the presence of residual ice/low level clouds/aerosol in the ground bin.



References

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