

Detection of *Emiliana huxleyi* blooms with BioGeoChemical-Argo floats.

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BACKGROUND

- Emiliana huxleyi* : Calcifying phytoplankton covered by small **calcite** platelets named **coccoliths**.
- Optical signature** : Accumulations of detached coccoliths caused by *E. huxleyi* blooms ¹ color waters **milky turquoise**, which are easily detectable with satellite true color images and the **[Particulate Inorganic Carbon]** ^{2,3} composite (fig. 1). However, the frequent cloud coverage in high-latitudes limits the satellite detection of *E. huxleyi* blooms.

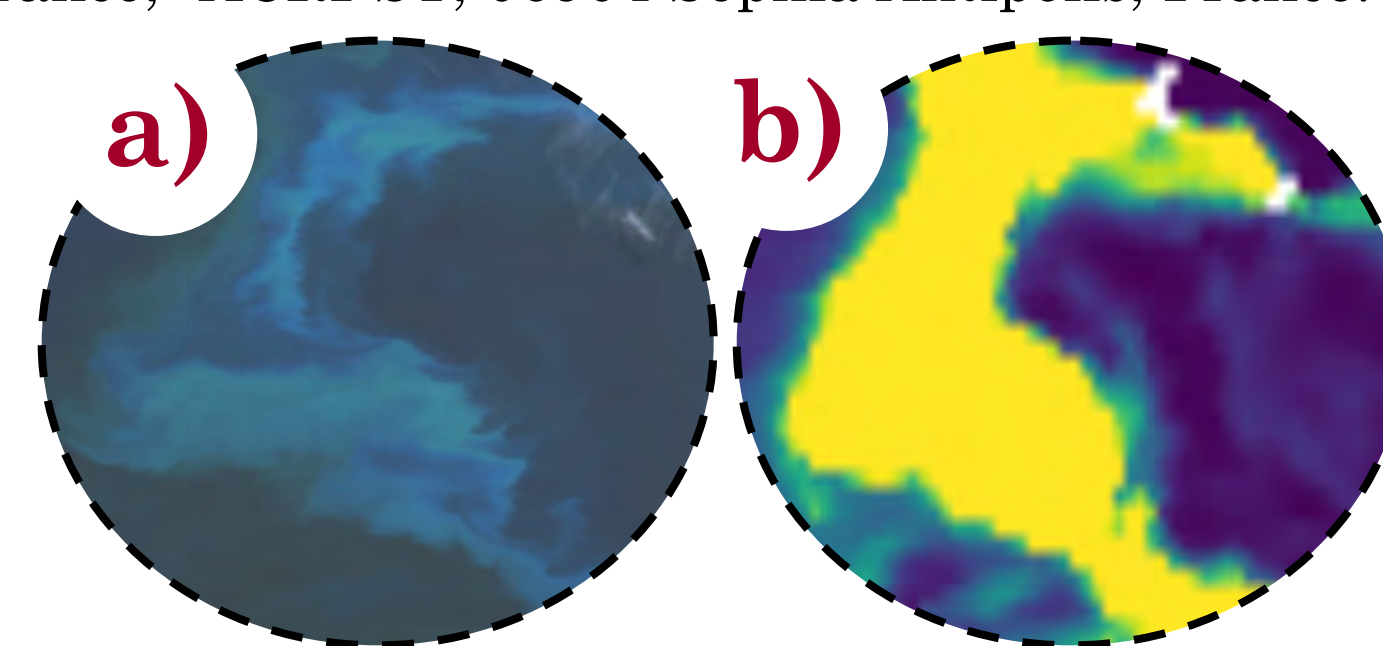


Fig. 1. Satellite observations of an *E. huxleyi* bloom with (a) a true color image and (b) the [PIC] product.

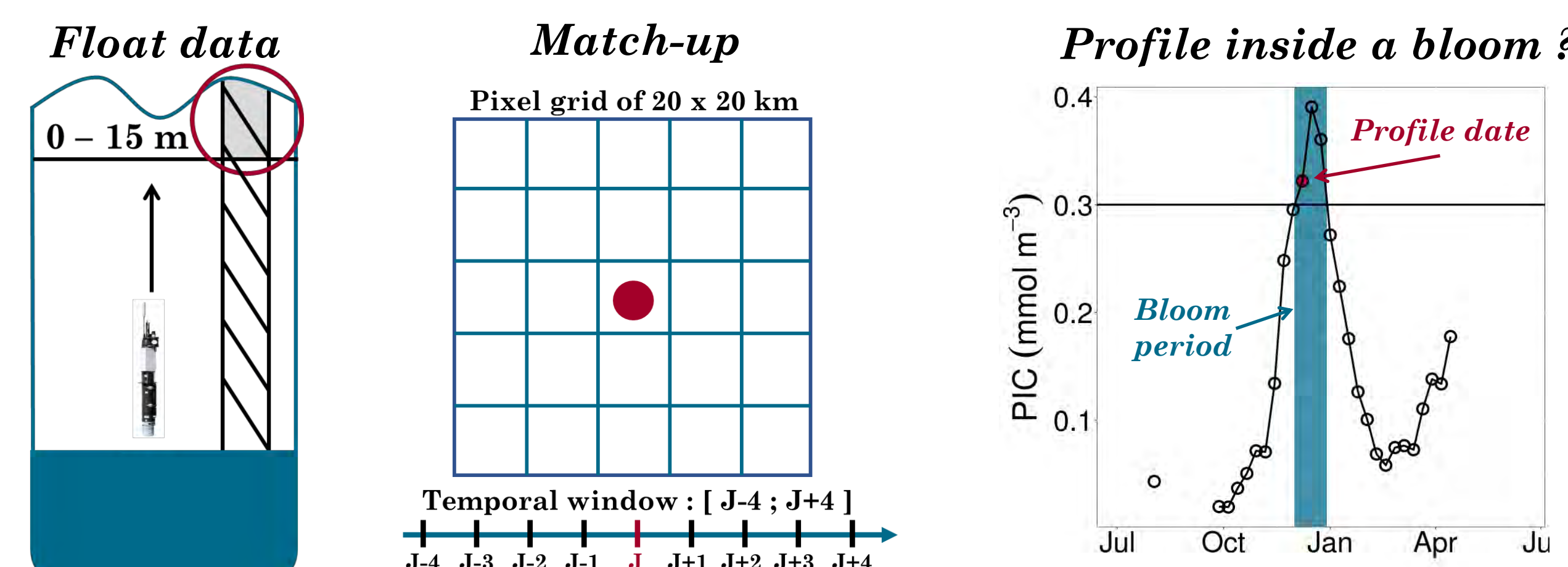
OBJECTIVE

Detect *E. huxleyi* blooms with BGC-Argo floats to :

- Get the optical signature of *E. huxleyi* blooms on BGC-Argo floats.
- Identify all profiles located inside *E. huxleyi* blooms.
- Evaluate the ballast hypothesis that the calcite may play a key role in the transfer efficiency of organic C ⁴ to the depth.

DATA & METHODS

- Two BGC-Argo floats : **6901583** & **6902738**.
- Float measurements : **bbp / cp** (measured by 14 floats). **bbp / [Chl-a]** (measured by **all floats**).
- Satellite data : **[PIC]** from <http://hermes.acri.fr/>.
- Match-up** between satellite data and float profiles : pixel box of **20 x 20km** averaged over **9 days**.
- Identification of **profiles located inside *E. huxleyi* blooms** with the [PIC] time series at each profile location ⁵.



RESULTS & CONCLUSIONS

Both floats drifted in *E. huxleyi* blooms because they were :

- inside the **Great Calcite Belt** that is a large band of elevated summer [PIC] (fig. 2a) caused by *E. huxleyi* in the Polar Frontal Zone ^{6,7}.
- near / inside patches of elevated [PIC] that revealed *E. huxleyi* blooms (fig. 2b-d).

Fig. 2. Float trajectories and *E. huxleyi* bloom occurrence.

(a) Summer climatology of satellite [PIC] (2002-2018).

Trajectories of float 6901583 (b) and 6902738 during periods of (c) low [PIC] and (d) high [PIC].

Both floats drifted in the Polar Frontal Zone ⁸.

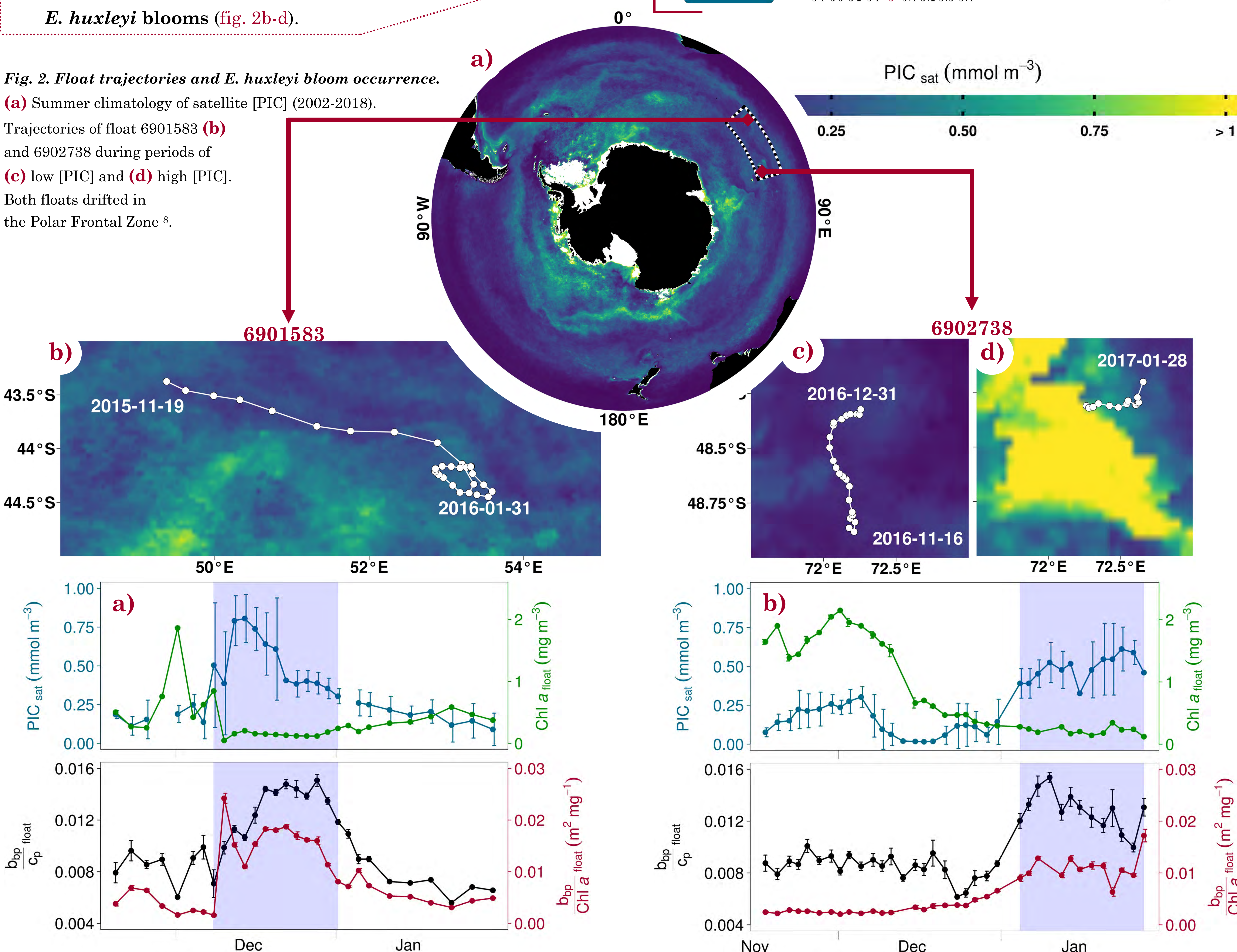


Fig. 3. Satellite products and in situ optical measurements during operations of floats 6901583 (a) and 6902738 (b). Blue periods indicate profiles inside *E. huxleyi* blooms.

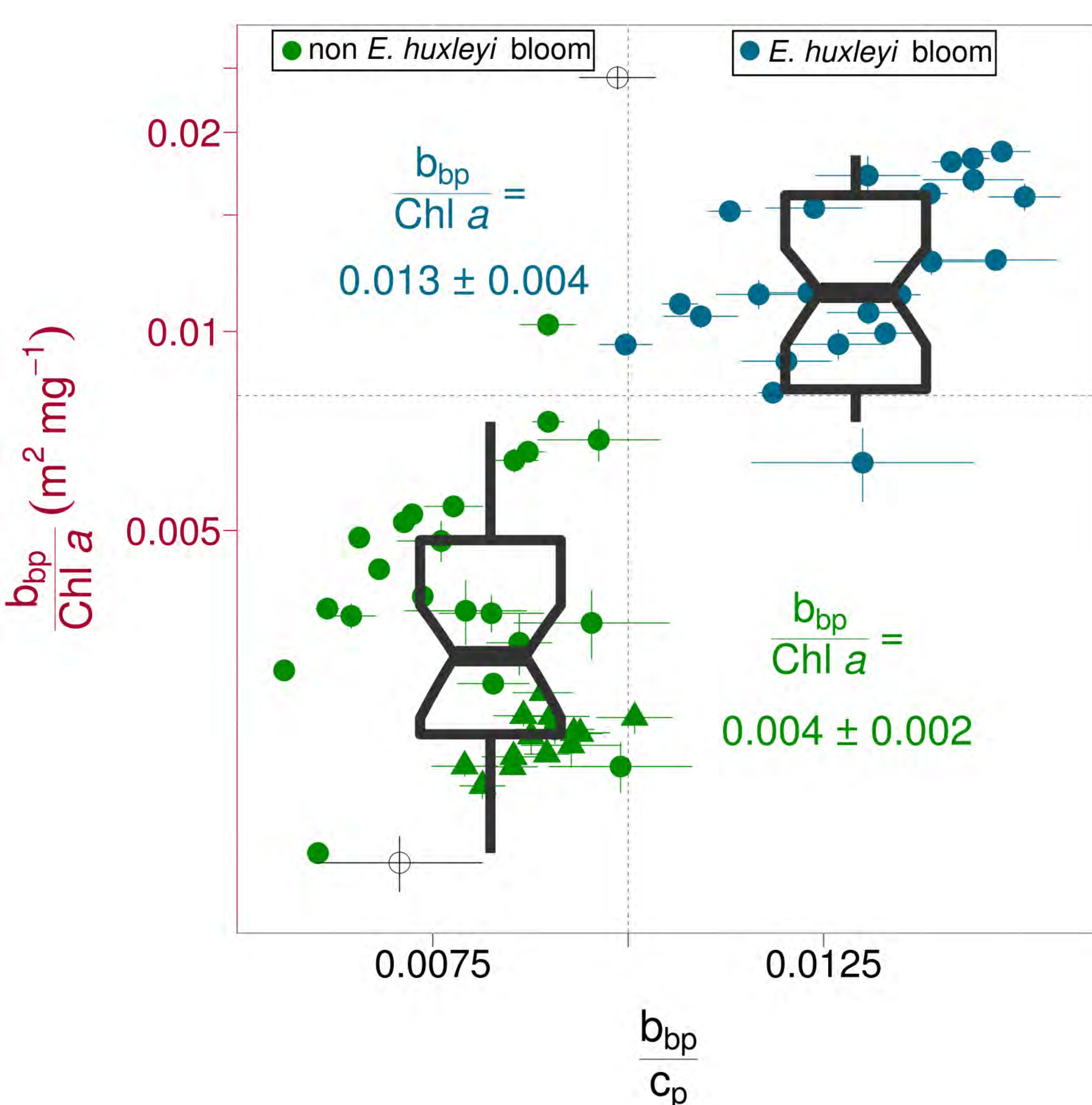


Fig. 4. $b_{bp}/[Chl-a]$ ($m^2 mg^{-1}$) and b_{bp}/c_p inside (blue dots) and outside (green dots) *E. huxleyi* blooms.

Empty circles are float profiles not clearly identified as occurring inside an *E. huxleyi* bloom.

The whiskers represent the 0.025 and 0.975 quantiles.

BGC-Argo floats successfully identified *E. huxleyi* blooms (fig. 3 & 4) :

- Surface **b_{bp}/c_p** and **$b_{bp}/[Chl-a]$** were significantly ($p < 10^{-9}$) higher inside *E. huxleyi* blooms.
- E. huxleyi* blooms were characterized by : **$b_{bp}/c_p = 0.013 \pm 0.001$** . **$b_{bp}/[Chl-a] = 0.013 \pm 0.004 m^2 mg^{-1}$** .
- Potential threshold** for detecting *E. huxleyi* blooms with all BGC-Argo floats : **$b_{bp}/[Chl-a] > 0.008 m^2 mg^{-1}$** , which correctly identified 96% of profiles inside *E. huxleyi* blooms.
- Recommendations** : Check the satellite [PIC] closest to the profile in time and The seasonal occurrence of *E. huxleyi* blooms in the study area.

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