High-resolution Bio-Argo and Argo Measurements to Reveal Specific Oceanic Processes.

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Together with temperature and salinity measurements, Bio-Argo profiling floats now measure a significant range of biogeochemical (e.g. O2, NO3) and bio-optical variables (Chla, backscattering coefficient and radiometry). To transmit the very large amount of data acquired by this **new generation of floats**, it was required to substitute the Argos telemetry (Argo program) with iridium telemetry. The obvious consequence is not only a much **greater flexibly** on data transmission but also on data acquisition thanks to the two-way communication allowed by iridium. Our group has now deployed and managed over 100 Bio-Argo floats of this type. In particular we have set up high-resolution mode of acquisition for certain periods of time or for dedicated portions of the water column. Here we illustrate with three examples the potential of conducting high-resolution measurement to identify and explore certain oceanic processes.

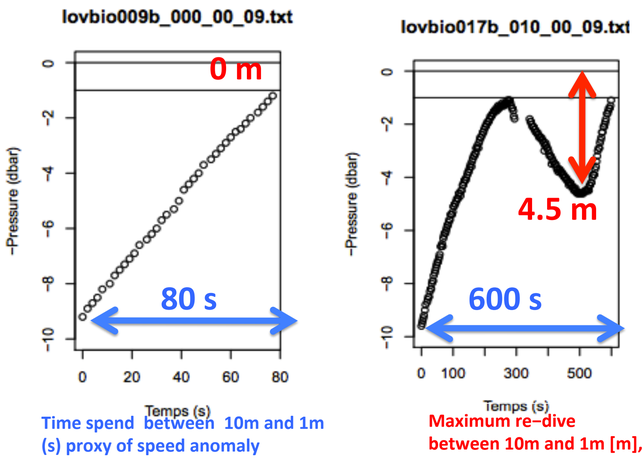
(1) **High resolution measurements** of pressure, temperature and salinity (every 2 s) when the float is finishing its ascent (without any pump action) in the **upper 10 m** layer are analyzed with respect to sea state. We particularly focus on the study of the speed anomaly as compared to a nominal speed expected for a calm sea state. By comparison between speed anomaly of a float in the Mediterranean Sea and concurrent sea state measurements by a weather buoy in the same area, we suggest that float behaviour can be an indicator of sea state.

Characteristics of the NKE CTS4 float in the upper layer:
- when the float passes 10 dbars, it does not activate its pump for a duration of 600 sec
- after 600 sec, the float starts to pump 360 sec to emerge
- under standard (calm) weather conditions, it takes 90-100 sec for the float to rise the surface from 10m.
- data acquisition from 1m to 0 m: mean value
- data acquisition from 10 to 1m : raw data @ 2 sec (0.5Hz)
- data acquisition from 350 to 10m : raw data @ 10 sec (0.1Hz)

CTS4 float , NKE

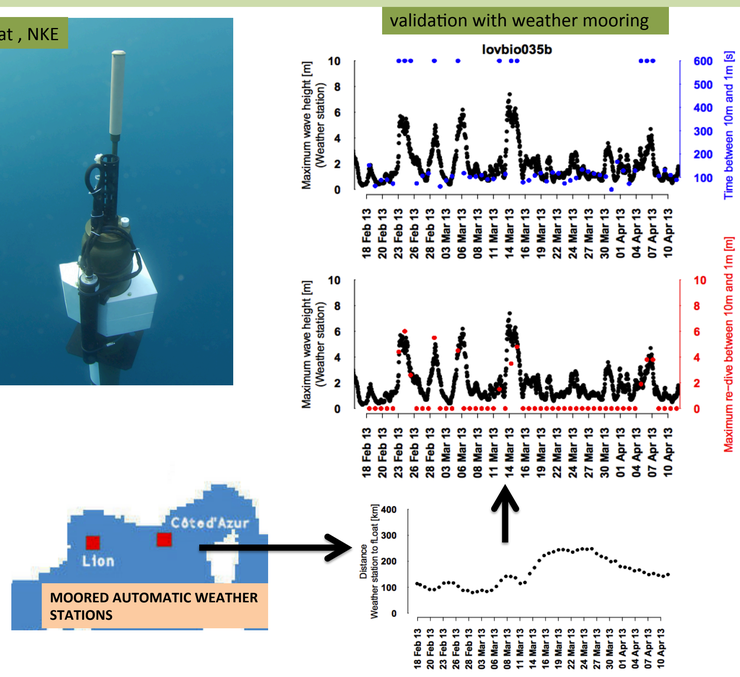
observation of float behavior :

Standard behavior | Non Standard behavior



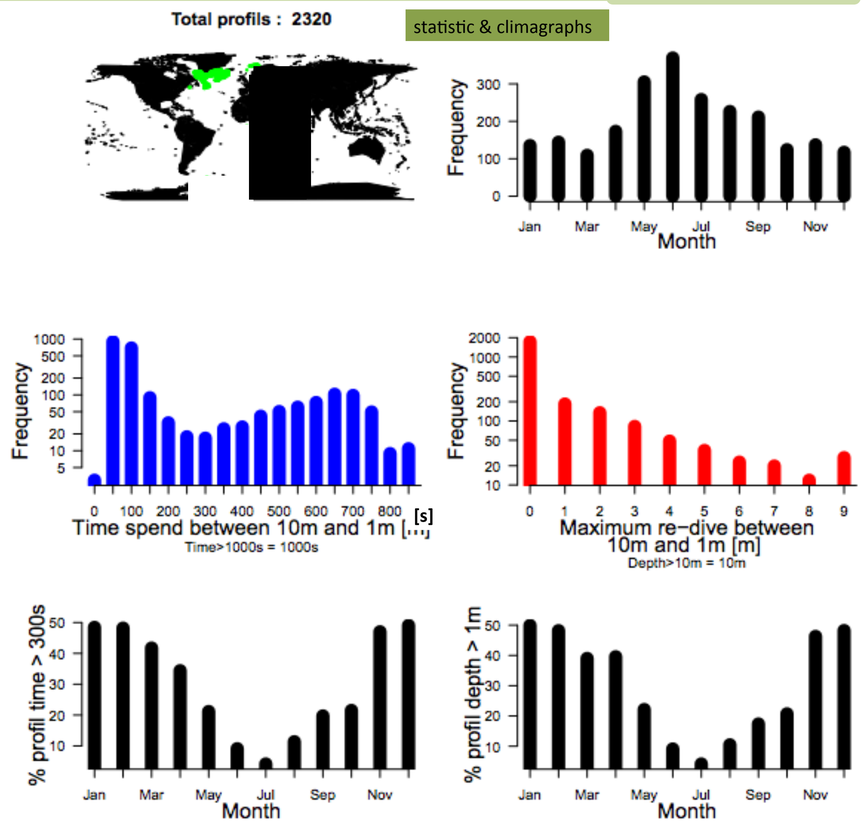
Characteristics of the NKE CTS4 float in Indicators of float behavior in the upper layer
In this poster we explore the idea that the float behavior is related to the sea state.

validation with weather mooring

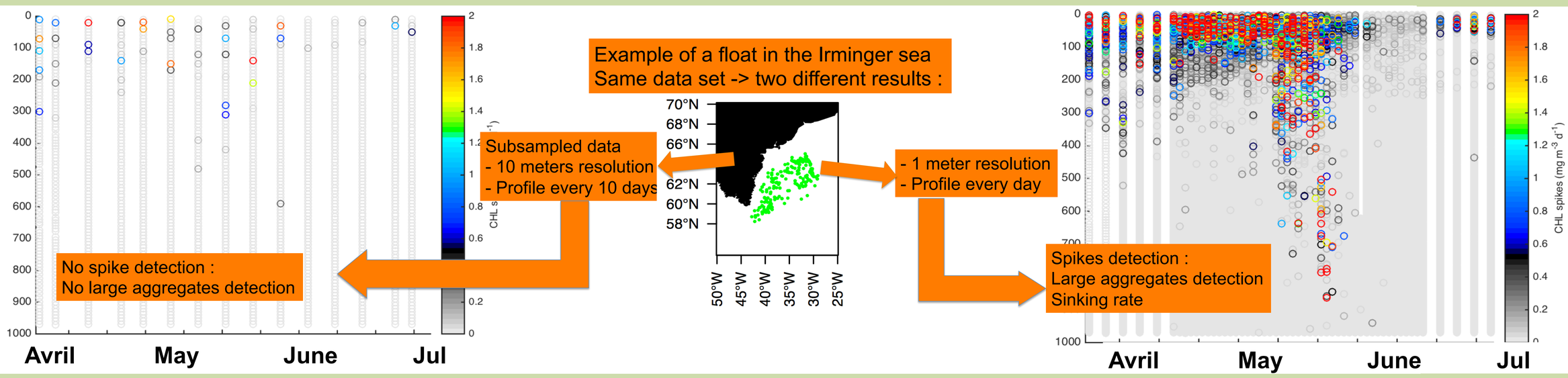


Time-serie of behavior indicators of two floats compared to meteorological buoy data in the North-Western Mediterranean Sea.
Even if the distance of the floats to the mooring are greater than 100 km, the comparison of both time series confirms that float behavior indicators can be used with a certain confidence to track sea-state. These indicators can thus be extracted from all the CTS4 floats we manage to date.

statistic & climagraphs

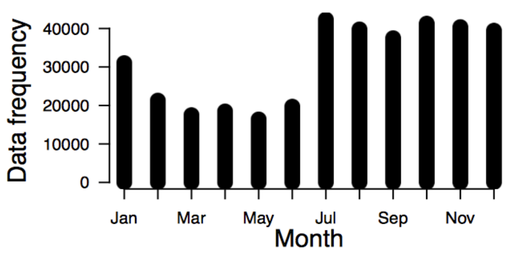


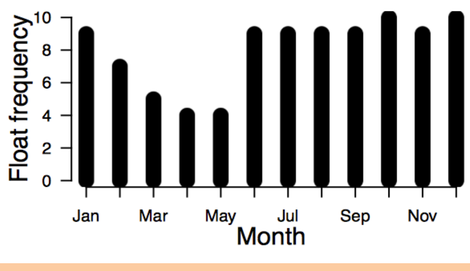
(2) Each year, in response to springtime phytoplankton blooms, the resolution of bio-optical variables (backscattering and Chla) in the **top 1000 m was increased to at least 1m** (every 10 s) for all floats in the North Atlantic and Southern Ocean. This resolution allowed accurate estimation of the concentration of large phytoplankton aggregates and revealed systematic differences in bulk aggregate sinking rate between ocean basins.



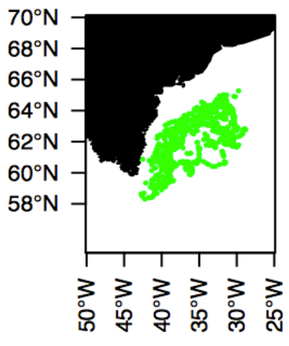
(3) Finally we continuously record all the variables at a **10 min resolution during the float drift at 1000m**. This allows us to characterize some events at this depth that can be related to bottom currents, high mixing or massive export of aggregates.

Ex. of IRMINGER SEA

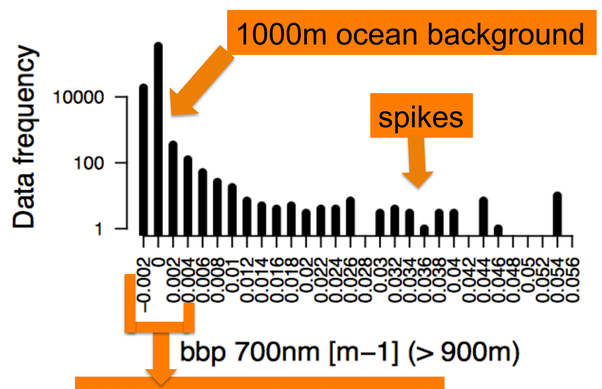


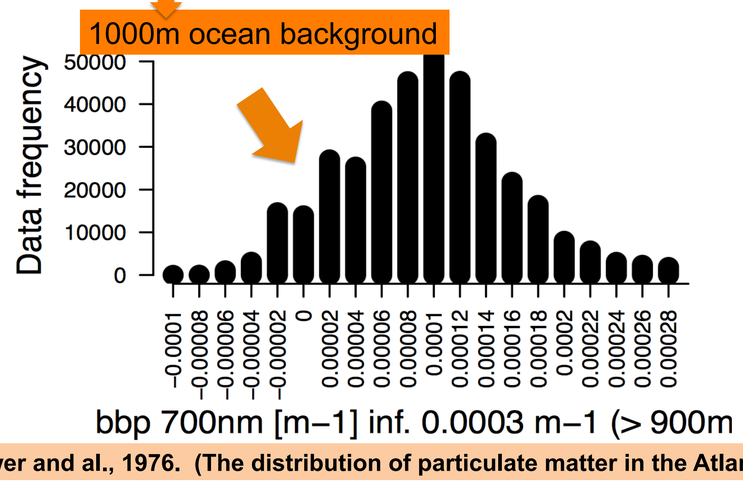


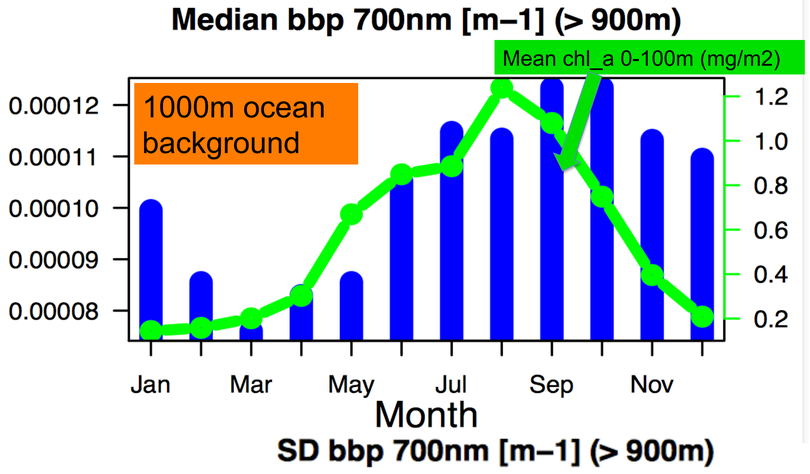
375976 data with 12 floats

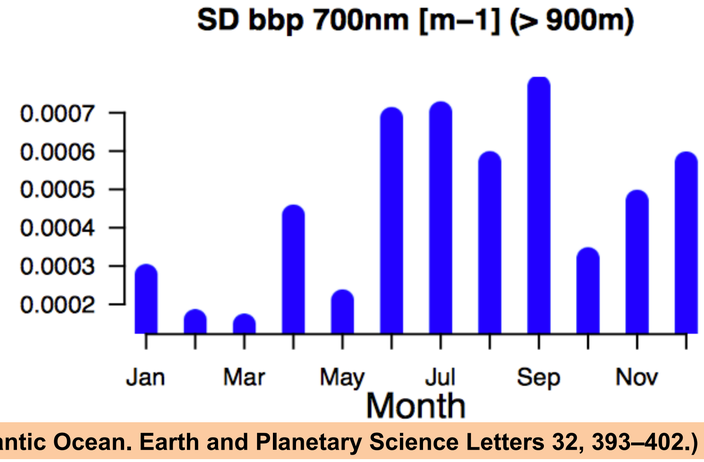


Data set of 375976 acquisitions of back-scattering coefficient of particles (bbp) in the IRMINGER SEA.
This data set was made with 12 bioargo, equipped with a bbp sensor, during the period of 2013-2016









Median values of bbp at 1000m are consistent with mass measurement of Brewer and al., 1976. (The distribution of particulate matter in the Atlantic Ocean. Earth and Planetary Science Letters 32, 393–402.)