MiniFluo fluorescence sensor, advances in FDOM ocean measurements

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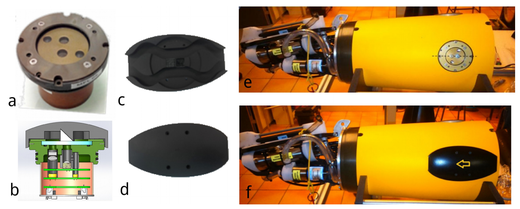
Context

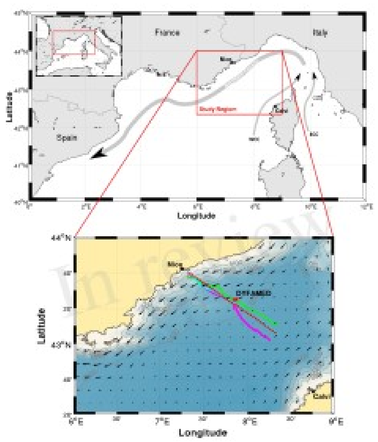
The *MiniFluo* is a new miniaturized optical sensor to characterize fluorescent dissolved organic matter (FDOM) in seawater. It is able of measuring two types of DOM fluorophores: tryptophan (TRY), an aromatic amino-acid issued from autochthonous microbial activities and phenanthrene (PHE), a polycyclic aromatic hydrocarbon, marker of petroleum. It is compatible with the SeaExplorer glider, an autonomous underwater vehicle driven by buoyancy changes.

Method



Glider-compatible MiniFluo

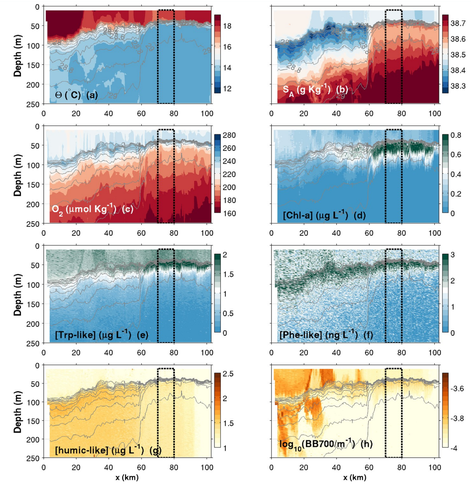
a) Picture of the complete MiniFluo: anodized aluminum for the upper part and copper cylinder for the bottom part; b) Diagram of the MiniFluo; c) Optical cap (view from below). The quartz prisms placed at the center. The two channels for the through flow are also visible; d) Optical cap (view from above); e) MiniFluo on the SeaExplorer glider scientific payload; f) MiniFluo with its optical cap.



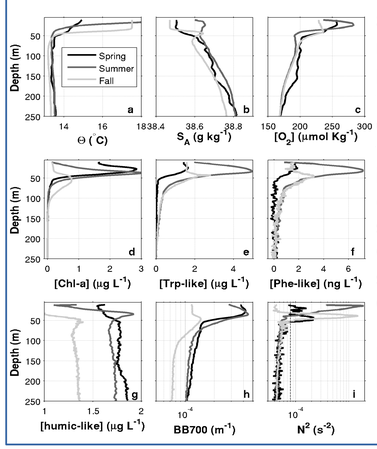
Map of the study area

Upper. NW Mediterranean Sea and a sketch of the Northern Current and the Western and Eastern Corsica Currents (WCC and ECC, respectively).
Lower. Zoom on the study region. Fall (28-31 October 2015), spring (29 April - 3 May 2016) and summer (30 July - 3 August 2016) glider tracks are plotted in Magenta, Green and Cyan, respectively. The red-dashed line is the ~100 km straight line on which glider casts are projected. DYFAMED observation station is identified with a red star. Current arrows from Aviso altimetry product on 1 November 2016 are plotted for reference. (http://www.aviso.altimetry.fr/duacs/).

Observations



Contours plots of variables measured by the glider as a function of depth and along-transect distance (*x*) for the fall transect. Isopycnals are drawn as thin solid lines. The dashed box correspond to the region where seasonal profiles (next figure) are averaged. a) Conservative temperature; b) Absolute salinity; c) Dissolved oxygen; d) Chlorophyll-*a*; e) Tryptophan-like; f) Phenanthrene-like; g) Humic-like; h) Turbidity measured as the backscattering signal at 700 nm.



Seasonal profiles in the offshore region of the Nice-Calvi transect Each panel shows the average profiles over the 70-80 km range of the transect (see dashed box in Figure above).One profile for each of the three glider deployments is presented, respectively for fall 2015 (light grey), spring 2016 (black) and summer 2016 (dark grey). a) Conservative temperature; b) Abs salinity; c) Dissolved oxygen; d) Chlorophyll-*a*; e)Tryptophan-like; f) Phenanthrene-like; g) Humic-like; h)Turbidity measured as the backscattering signal at 700 nm; i) Buoyancy frequency squared..

Highlights

Physical aspects

Frontal dynamics classic of a coastal jet current: the stream limits the exchanges between coastal and offshore regions.
Presence of a subsurface fresher layer near the coast: Origin unknown.
Possible entrainment of biochemical tracers at depth near at the edge of the front.

Biogeochemical aspects

Can the vertical shift between CHL/TRY maxima help assessing the vertical distribution of bacterial communities?
Does the increase in TRY-like concentration in the Fall reflects changes towards heterotrophic communities later during the year?
What is the role of cross-frontal exchanges of DOM?
What is the origin of the intermediate lower-salinity layer?

Future developments

Undergoing research to use the MiniFluo to monitor dissolved hydrocarbon near industrial areas (oil & gas rigs, harbors, urbanized areas, etc.)

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A New Glider-Compatible Optical Sensor for Dissolved Organic Matter Measurements: Test Case from the NW Mediterranean Sea

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