Phytoplankton dynamics in the temperate coastal waters assessed by flow cytometry: the DYMAPHY project

Luis Felipe Artigas*†[1], Natacha Guiselin[2], Melilotus Thyssen[3], Guillaume Wacquet[4], Emilie Caillault[5], Pierre-Alexandre Hébert[6], Denis Hamad[7], Xavier Mériaux[8], Emilie Houliez[9], Fabrice Lizon[10], Jessica Chicheportiche[11], Vincent Cornille[12], Veronique Creach[13], Katy Owen[14], Machteld Rijkeboer[15], Arnold Veen[16], Thomas Rutten[17], Séverine Alvain[18], François Schmitt[19], and Alain Lefèbvre[20]

[1]Laboratoire d'Océanologie et Géosciences - Université du Littoral Côte d'Opale (CNRS UMR 8187 LOG - ULCO) – CNRS UMR 8187 LOG - ULCO – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France

[2]Laboratoire d'Océanologie et Géosciences (CNRS UMR 8187 LOG) – CNRS UMR 8187 LOG – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France

[3]Laboratoire d'Océanologie et Géosciences - Université du Littoral Côte d'Opale (CNRS UMR 8187 LOG - ULCO) – CNRS UMR 8187 LOG - ULCO – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France

[4]Laboratoire d'Informatique Signal et Image de la Côte d'Opale - Université du Littoral Côte d'Opale (LISIC - EA 4491) – LISIC - EA 4491 – Maison de la Recherche Blaise Pascal - ULCO Calais, France

[5]Laboratoire d'Informatique Signal et Image de la Côte d'Opale - Université du Littoral Côte d'Opale (LISIC - EA 4491) – LISIC - EA 4491 – Maison de la Recherche Blaise Pascal - ULCO Calais, France

[6]Laboratoire d'Informatique Signal et Image de la Côte d'Opale - Université du Littoral Côte d'Opale (LISIC - EA 4491) – LISIC - EA 4491 – Maison de la Recherche Blaise Pascal - ULCO Calais, France

[7]Laboratoire d'Informatique Signal et Image de la Côte d'Opale - Université du Littoral Côte d'Opale (LISIC - EA 4491) – LISIC - EA 4491 – Maison de la Recherche Blaise Pascal - ULCO Calais, France

[8]Laboratoire d'Océanologie et Géosciences - Université du Littoral Côte d'Opale (CNRS UMR 8187 LOG - ULCO) – CNRS UMR 8187 LOG - ULCO – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France

[9]Laboratoire d'Océanologie et Géosciences - Université de Lille 1 1 (CNRS UMR 8187 LOG - UL1) – CNRS UMR 8187 LOG - UL1 – Station Marine de Wimereux 28, av. Foch 62930 Wimereux, France

[10]Laboratoire d'Océanologie et Géosciences - Université de Lille 1 1 (CNRS UMR 8187 LOG - UL1) – CNRS UMR 8187 LOG - UL1 – Station Marine de Wimereux 28, av. Foch 62930 Wimereux, France

[11]Laboratoire d'Océanologie et Géosciences - Université du Littoral Côte d'Opale (CNRS UMR 8187 LOG - ULCO) – CNRS UMR 8187 LOG - ULCO – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France

[12]Laboratoire d'Océanologie et Géosciences - Université du Littoral Côte d'Opale (CNRS UMR 8187 LOG - ULCO) – CNRS UMR 8187 LOG - ULCO – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France

[13]Centre for Environment, Fisheries and Aquaculture Science (Cefas) – Pakefield Road, Lowestoft, Suffolk, NR33 0HT, United Kingdom

[14]Centre for Environment, Fisheries and Aquaculture Science (Cefas) – Pakefield Road, Lowestoft, Suffolk, NR33 0HT, United Kingdom

[15]Centre for Water Management, Laboratory for hydrobiological analysis, Waterdienst, RijksWaterStaat (WD - RWS) – WD- RWS – Lelystad, Netherlands

[16]Centre for Water Management, Laboratory for hydrobiological analysis, Waterdienst, RijksWaterStaat (WD - RWS) – WD- RWS – Lelystad, Netherlands
[17]Thomas Rutten Projects – Thomas Rutten Projects – Middelburg, Netherlands
[18]Laboratoire d'Océanologie et Géosciences (CNRS UMR 8187 LOG) – CNRS UMR 8187 LOG – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France
[19]Laboratoire d'Océanologie et Géosciences (CNRS UMR 8187 LOG) – CNRS UMR 8187 LOG – Maison de la Recherche en Environnements Naturels 32, av. Foch 62930 - Wimereux, France
[20]Laboratoire Environnement côtier Ressources aquacoles – IFREMER – Centre IFREMER Manche - Mer du Nord 150, quai Gambetta BP 699 62321 BOULOGNE SUR MER Cedex, France

Abstract

The DYMAPHY project (Development of a DYnamic observation system for the assessment of MArine water quality, based on PHYtoplankton analysis- 2010-2013), co-funded by the European Regional Development Fund (ERDF, INTERREG IV A "2 Mers Seas Zeéen" program) aims at contributing to a better assessment of the quality of marine waters in the North Sea - English Channel Euro-Region, basically through the study of phytoplankton and related environmental parameters at high resolution. In order to assess long term changes (e.g. biodiversity, CO2 uptake, biomass) as well as to detect short term alerting changes in phytoplankton composition (i.e. suddenly increasing concentrations of harmful and/or toxic cells), reflecting the environmental status and water quality, there is a need of fast, cost effective, innovative, robust, reproducible and standardized monitoring procedures that could be applied at high frequency, if necessary. A pulse-shape recording flow cytometer (CytoSense, Cytobuoy©) was employed in the last years to monitor the dynamics of phytoplankton in the coastal waters of the Eastern Channel. This cytometer, not only allows to obtain single cells information with high count precision and a higher ability of distinction of certain cells such as flagellated cells of Phaeocystis globosa or picoplankton species that are difficult to see and identify with a light microscope, but it also defines a complete optic profile of cells from 1μm to 800μm width, and associates the corresponding pictures (when equipped with an image acquisition sytem. The recognition and discrimination of different species and/or pjhytoplankton groups was first carried out on mono-specific cultures before application to natural samples collected in the Wimereux-Slack transect in the Eastern Channel. Semi-supervised classification methods allowed to better discrimination and counting of some phytoplankton groupes and/or species that couyld then been followed over a spring bloom development. By comparing and combining traditional (microscopic counts, pigment analysis) and innovating techniques (as flow cytometry, spectral fluorescence and remote sensing), the DYMAPHY project propose to develop within a cross-border effective work, better-standardized procedures and greater automation in data analysis for monitoring phytoplankton. These procedures would allow an easier integration of the methodology in routine monitoring applications by monitoring agencies and academic institutes and will be validated in common cruises. The results will be shared to the scientific and academic community and the operational results will be shared with stakeholders, environmental agencies and the public.

Keywords: Pulse, shape recording flow cytometer, phytoplankton monitoring, high frequency, DYMAPHY project

*Speaker
†Corresponding author: Felipe.Artigas@univ-littoral.fr