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# Study of the dynamic of the Phytoplankton bloom in the eastern English Channel using an high frequency instrumented station (MAREL) and a naive clustering classification method.

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The presented works is part of the European DYMAPHY project , Development of a DYnamic observation system for the assessment of MArine water quality, based on PHYtoplankton analysis, funded by FEDER. Many fixed or embedded water acquisition stations (Ifremer's coastal MAREL stations, Ferryboxes, cytometer, french Water Agency river stations…) are available and collect a huge amount of data (physical and biological parameters with high temporal resolution). However few of them are analyzed and modelled to allow an optimal marine water quality monitoring. A good knowledge of these data is a hard task because of the important variability in ecosystems dynamics and the nature of the data. Concerning the MAREL Carnot signal database, 16 parameters are collected every 20 minutes and 3 nutrients parameters every 12 hours (Lefebvre, 2009; Zongo et al., 2010). More than 15 percent (up to 60% for nutrient parameters) of this data is aberrant or missing due to sensor failure, sensor maintenance and communication errors.

The monitoring system must be robust to aberrant or missing data, partially labelled or unlabelled data and aims to characterize the Phytoplankton dynamic from MAREL Carnot measures. First we propose a naive clustering method (kmeans or spectral clustering) of MAREL Carnot data over a four years period which is able to detect characteristic clusters without any a priori biologic knowledge. This method delivers observation states that are compared with different interpretation sources in order to label and understand each cluster and state. A biological expertise confirms the relevance and effectiveness of the proposed approach at different scales. With K=2 clusters, results are conform with the methodology implemented for the Water Framework Directive (WFD – 2000/60/EC) needs to assess the environmental status for the phytoplankton quality element which divided the year in two distinct period (productive vs non-productive period). With K=5 clusters, the classification highlights the main biological dynamic of the Phytoplankton bloom and is able to detect change in phytoplankton composition (difference in chlorophylle a concentration illustrated by the dominance of diatoms over Phaeocystis globosa, or reverse) but also to detect rare forcing events such as inputs of huge amount of nutrients which explain the development of regional-controlled minor blooms surimposed on the main pattern generally observed in temperate coastal waters (Caillault et al., 2009). These works have also been applied to various multivariate temporal series in an other ecosystem (Estuary).

The next step is now to predict the dynamic of the Phytoplankton blooms (included Harmful Algal Blooms) or to detect new/unknown effects or controlling factors by coupling unsupervised or semi-supervised clustering and Markovian process theory. With this approach, we will be able to monitor the consistency of the measure, to supervise the acquisition system and to predict biological events.

REFERENCES CITED:

Caillault E., Lefebvre A., Hamad D., 2009. Naive classification of MAREL Carnot data : characterisation of the Phytoplankton bloom process. Working group RNSM on high frequency measurements in marin ecosystems, 23 pages, 22-23 oct. 2009, Wimereux, France.

Lefebvre A., 2009. Implementation of an automatic monitoring program with high frequency measurements (MAREL CArnot) in the eastern English Channel: a close watch on a potential problem area with regard to the eutrophication status. Working group RNSM on high frequency measurements in marin ecosystems, 22 pages, 22-23 oct. 2009, Wimereux, France.

Zongo S.B. , F. G. Schmitt and A. Lefebvre, 2010. Multiscales survey of biological parameters in the English Channel water. Prepared for Biogeosciences.