



Modeling spatio-temporal variability of algal blooms using MODIS imagery of inland waters

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This study is part of a project aimed at monitoring and assessing past, present and future water quality in inland waters by using MODIS imagery. Water colour satellite data are increasingly used to monitor water quality of oceans and coastal waters, and particularly for monitoring harmful algal blooms (HAB), such as cyanobacterial blooms, which have increased in frequency and intensity over the last decades. However, HAB monitoring techniques could be less effective when it is not specifically designed for inland waters (lakes, rivers and estuaries) where water contains a lot more optically active components like chl-a, total suspended solids (TSS) and coloured dissolved organic matter (CDOM). Furthermore, the deterioration of water quality caused by HAB shows the need of improving our understanding of their spatio-temporal dynamics in order to improve the HAB management, monitoring and forecasting.

The first objective of this study is to develop an automated algorithm generating historical database of HAB episodes designed to perform in inland water bodies. The second objective is to establish a regional portrait of the HAB occurrence on Southern Quebec using a geospatial database including the phenology features of HAB (e.g. beginning, duration, intensity). Finally, the third objective is to develop a statistical model which describes the relations between phenology features (e.g. beginning, duration and intensity) and climatic, physiographic and anthropic characteristics in connection with HAB's development (e.g. temperature, precipitation, lake depth, watershed area, agricultural land uses).

Temporal trends show a significant increase in HAB frequency and extent in the majority of lakes in southern Quebec between 2000 and 2016. Although not significant, there is an increase in the seasonal duration of HAB. Agricultural land cover (relative) of the watershed and total precipitation are significantly linked to HAB frequency, intensity, duration, beginning day and ending day. On the other hand, HAB extent shows a significantly link with agricultural land cover (absolute) and seasonal precipitation. The next step is to develop a statistical model (copulas) that will estimate the predisposition of lakes to develop HAB according to their physiographic and climatic characteristics.