Satellite ocean color remote sensing in Arctic Ocean

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The Arctic Ocean (AO) is currently experiencing significant changes caused by the sea-ice cover decline, opening a whole new environment for phytoplankton growth, and thus enhancing primary production (PP). Considering the difficulty to access the region, remote sensing is the best method to monitor the effects of ice cover decrease on the marine ecosystem.

This lecture will cover the topics of Arctic Ocean and global warming. The ocean color remote sensing in high latitude and its limitations. The retrieval of ocean properties from ocean color and some examples of studies done in AO using remote sensing data.

The Arctic Ocean is an optically complex environment and presents unique challenges for ocean color satellite remote sensing. Phytoplankton pigment packaging, high concentrations of chromophoric dissolved organic matter (CDOM) because of the important freshwater inputs, low solar elevations, persistent fog, contamination of the signal by the ice and the frequent presence of subsurface chlorophyll a (Chl a) maxima (SCM), complicate satellite measurement of surface Chl a.

Empirical and semi-analytical algorithms already exist to link remote sensing reflectance to phytoplankton biomass. These algorithms have, however, been developed mostly using non polar open ocean data and have been shown to be biased for polar waters. This is particularly true in the coastal waters of the Canadian Arctic and Subarctic as those waters contain high concentrations of colored dissolved organic matter (CDOM) leading to an overestimation of the chlorophyll a (Chl a) concentrations using current operational algorithms. Regionally adapted algorithms have been proposed for the Arctic to improve the retrieval of the Chl a concentration. Thus, primary production algorithms that use remotely sensed surface Chl a concentrations as a proxy for phytoplankton abundance will be more accurate. Documenting the year-to-year changes in Arctic Ocean PP is essential to understand the impact of climate change on marine ecosystems.