University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

ANDREA HILBORN

BSc (University of Victoria, 2014)

"Applications of DINEOF to satellite-derived chlorophyll-a from a productive coastal region"

Department of Geography

Thursday, September 13, 2018
10:00 A.M.
Clearihue Building
Room B017

Supervisory Committee:
Dr. Maycira Costa, Department of Geography, University of Victoria (Supervisor)
Dr. David Atkinson, Department of Geography, UVic (Member)
Dr. Akash Sastri, Department of Biology, UVic (Outside Member)

External Examiner:
Dr. Emmanuel Devred, Bedford Institute of Oceanography, Fisheries and Oceans Canada

Chair of Oral Examination:
Dr. Laura Cowen, Department of Mathematics and Statistics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

A major limitation for remote sensing analyses of oceanographic variables is loss of spatial data. The DINEOF method has demonstrated effectiveness for filling spatial gaps in remote sensing datasets, making them more easily implemented in further applications. However, dataset reconstructions with this method are sensitive to the characteristics of the input data used. The spatial and temporal coverage of the input imagery can heavily impact the reconstruction outcome, and thus, further metrics derived from these datasets, such as phytoplankton bloom phenology. In this study, the DINEOF method was applied to a three-year time series of MODIS-Aqua chlorophyll-a of the Salish Sea, Canada. Spatial reconstructions were performed on an annual and multi-year basis at daily and week-composite time resolutions, and assessed relative to the original, clouded *chla* datasets and a set of extracted *in situ chla* measurements. A sensitivity test was performed to assess stability of the results with variation of cross-validation data and simulated scenarios of lower temporal data coverage. Daily input time series showed greater accuracy reconstructing *chla* (95.08-97.08% explained variance, $RMSE_{xval}$ 1.49-1.65 mg m^{-3}) than week-composite counterparts (68.99-76.88% explained variance, $RMSE_{xval}$ 1.87-2.07 mg m^{-3}), with longer time series of both types producing a better relationship to original *chla* pixel concentrations (R^2 0.91 over 0.88, RMSE 1.29 over 1.35 mg m^{-3}, slope 0.88 over 0.84). Original daily *chla* achieved a better relationship to *in situ* matchups than DINEOF gap-filled *chla*, with annual DINEOF-processed data performing better than the multi-year. The results of this study are of interest to those who require spatially continuous satellite-derived products, particularly from short time series, aiming to produce ocean-colour datasets with consistent processing for global purposes such as climate change studies (Mélin et al., 2017).