VConstruct: Filling Gaps in Chl-a Data Using a Variational Autoencoder

Chlorophyll-a measurements

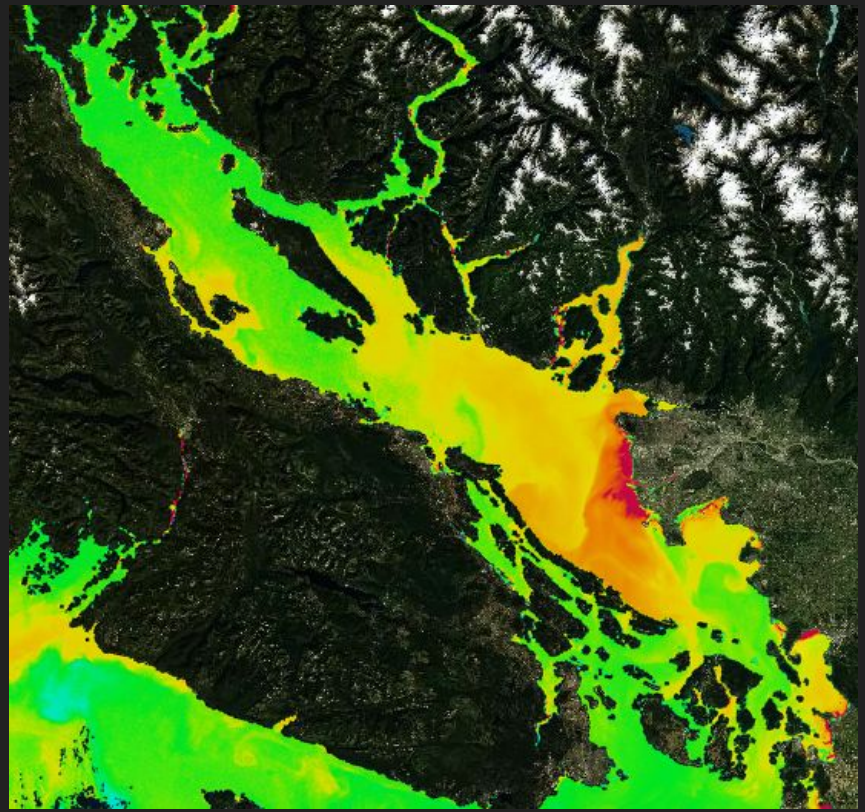


Image from algaeexplorer.ca

- “Essential Climate Variable”
- Useful for measuring phytoplankton
- Measured through satellites (i.e Sentinel-3 or Modis)
- Useful for tracking harmful algae blooms

Missing Data - Clouds

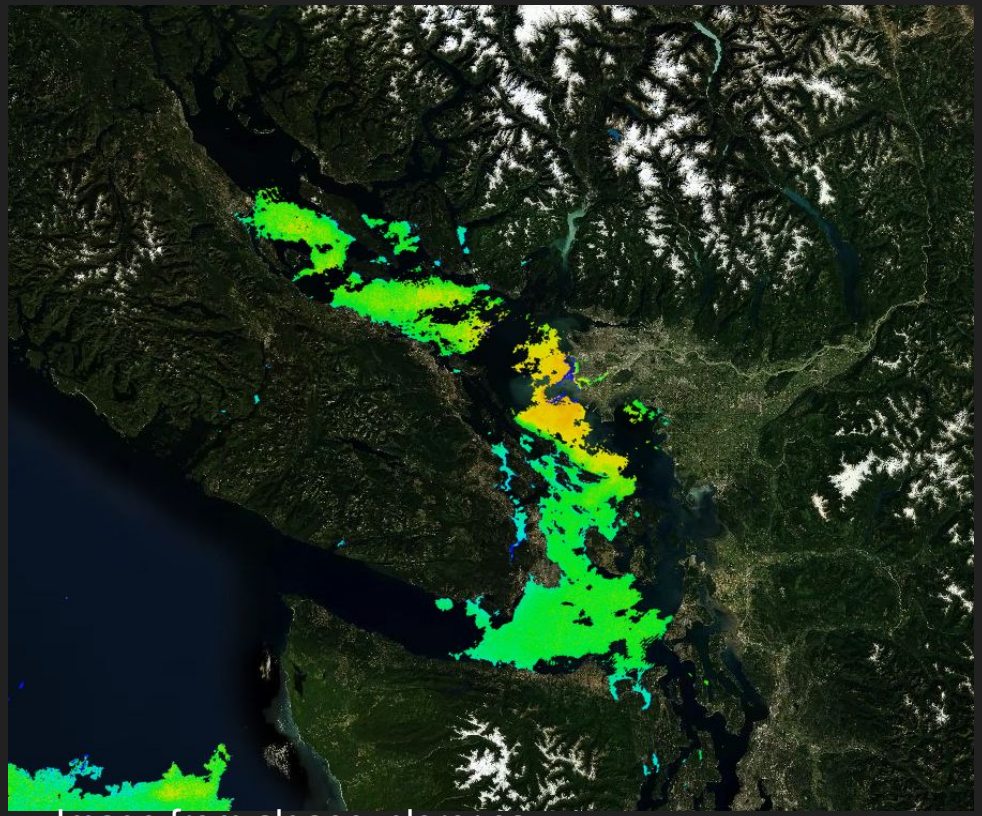


Image from algaeexplorer.ca

- Chl-a measurements based off visible light
- Commonly obstructed by clouds or lost due to other factors

Missing Data

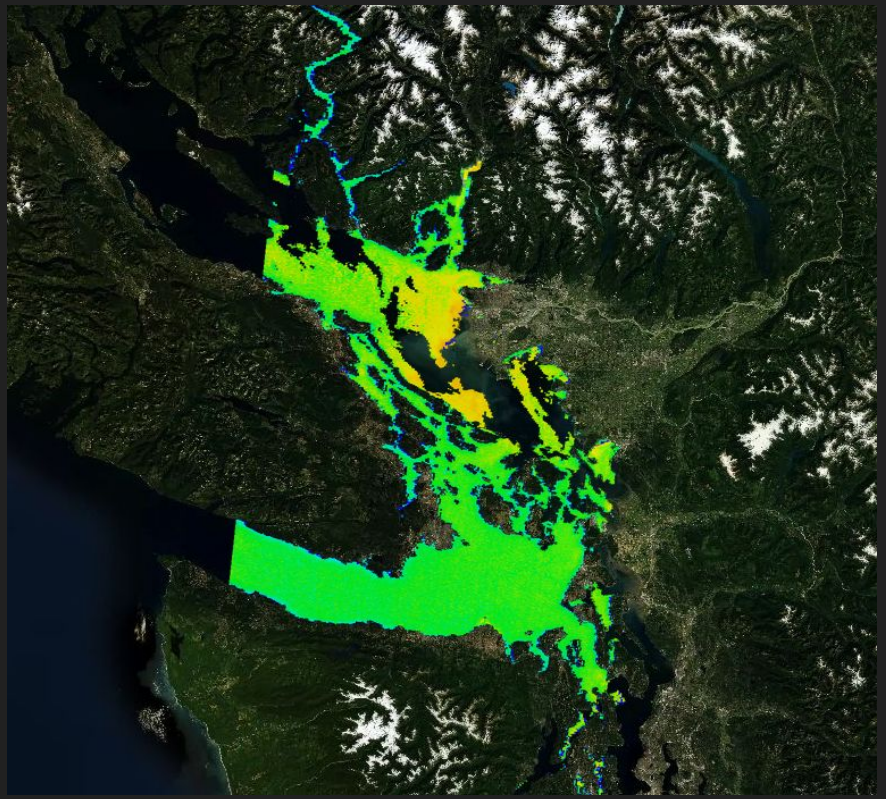


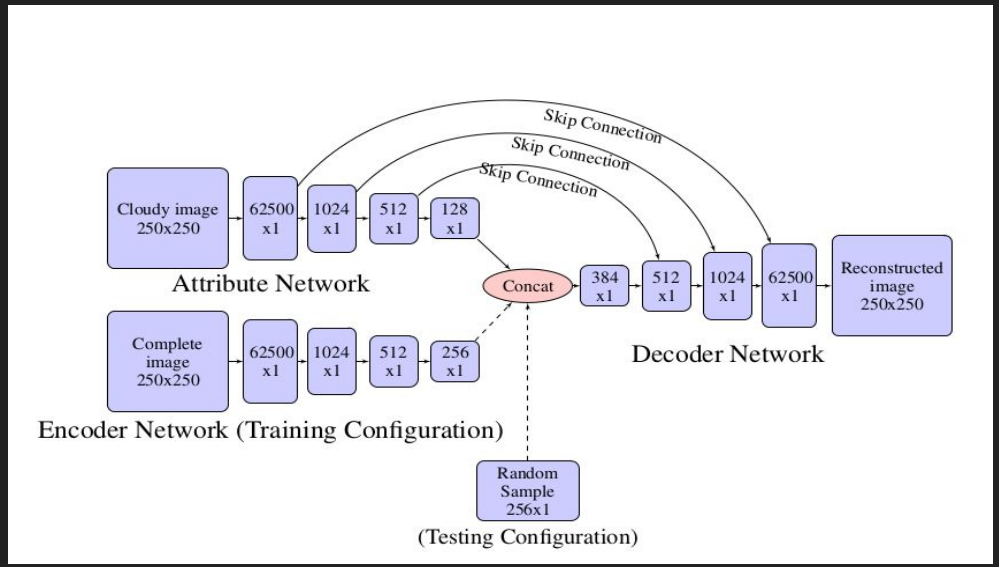
Image from algaeexplorer.ca

- Satellite’s don’t pass over daily
- Sentinel-3 revisit time <2 days

Data INterpolating Empirical Orthogonal Functions (DINEOF)

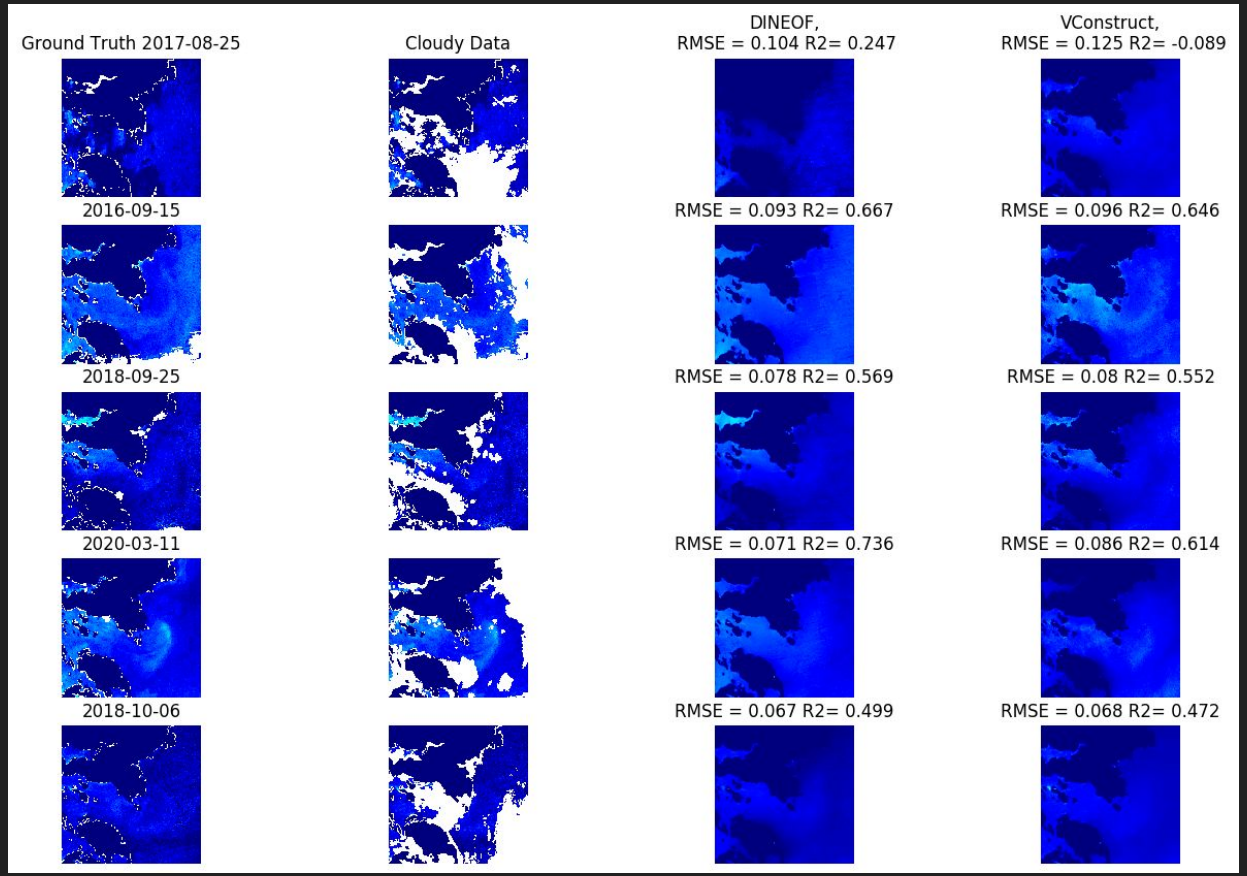
- Most commonly used
- Accurate
- Slow (10 minutes)

VConstruct



- Based off a Conditional Variational Autoencoder
- Fast (~8 ms once trained)
- Comparable accuracy
- Able to generate a range of potential reconstructions
- Atemporal

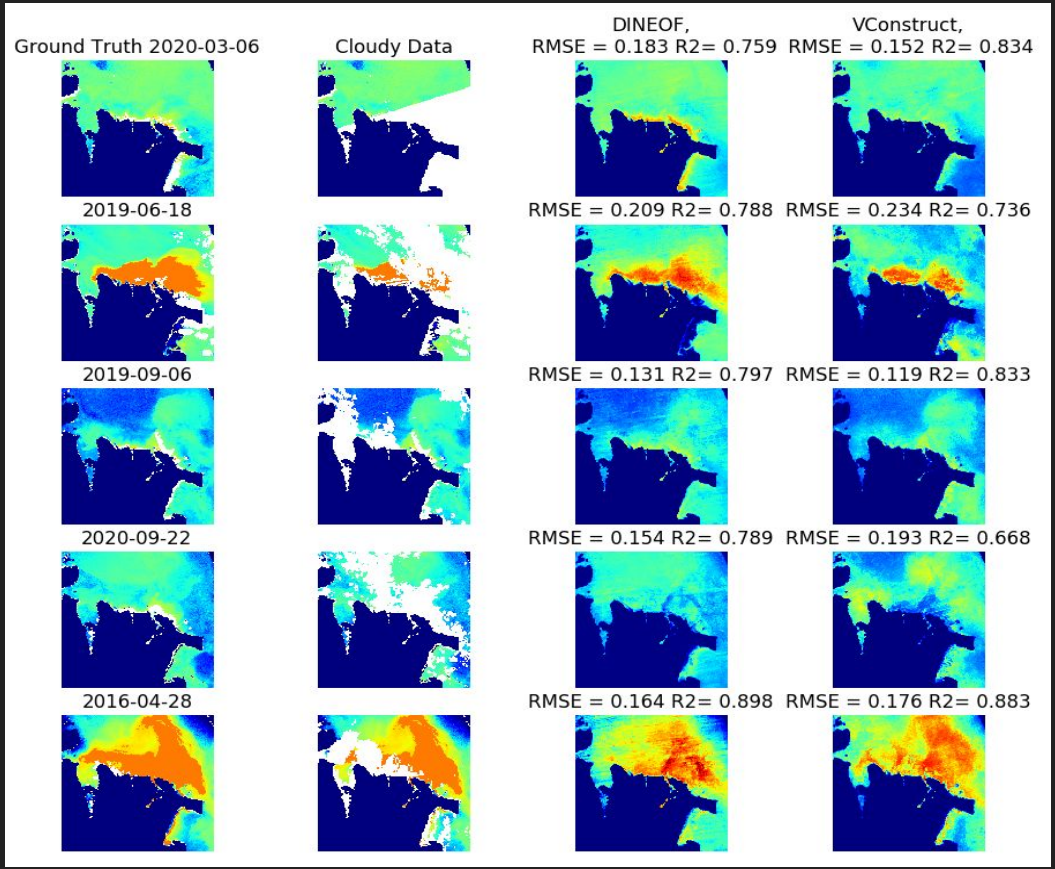
Results



DINEOF RMSE = .0826
R^2 = .5436

VConstruct RMSE = .091
R^2 = .4389

Results



DINEOF RMSE = .1684
R^2 = .8064

VConstruct RMSE = .1748
R^2 = .7908

Future Work

- Improve accuracy
- In-situ testing
- Geographic testing
- SAR Data
- Other datasets