Assessing the Accuracy of Remotely Sensed Sea Surface Temperature and Chlorophyll-a Concentrations in the South Pacific Ocean

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Introduction

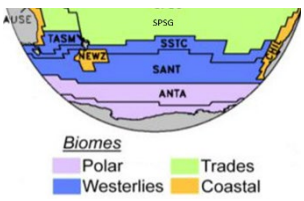
Variations in oceanic biological and physical processes can be detected by observing changes in sea surface temperature (SST) and chlorophyll-a (chl-a) concentrations using remote sensing techniques. It is important for these values to be accurate because this approach provides a method of studying of large scale variations in SST and chl-a without investing large amounts of time and money for in-situ sample collection.

We assessed the reliability of NASA's Ocean Color Longwave SST product, and the OC3/OC4 (OCx) and Garver–Siegel–Maritorena (GSM) chlorophyll-a products, within a transect of the South Pacific Ocean from Christchurch, New Zealand to Pape'ete, Tahiti (1, 2). The GSM algorithm is an optimized semi-analytical algorithm while the OCx algorithm is an empirical algorithm utilizing band ratios This transect was analyzed by comparing values from the MODIS satellite to in-situ values obtained from the research vessel, *SSV Robert C. Seamans*, in conjunction with SEA Semester's Oceans and Climate program.

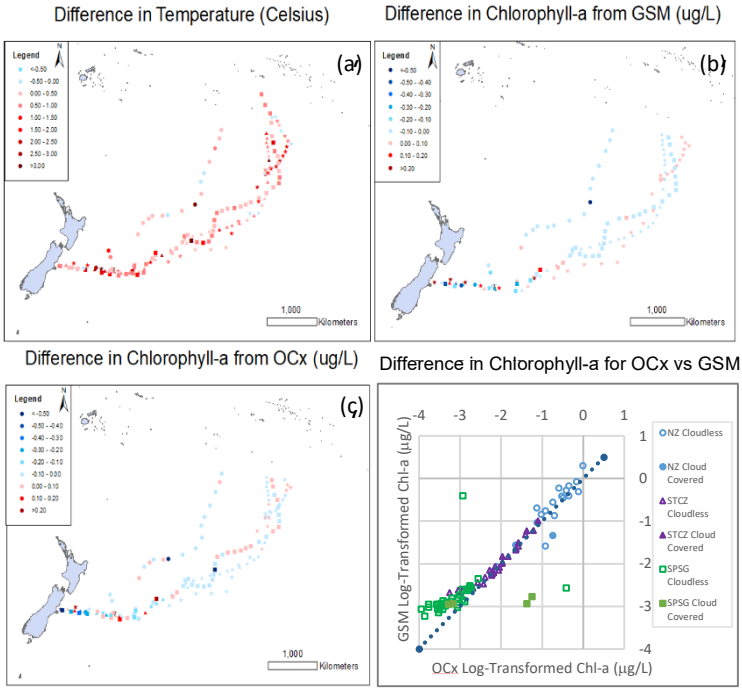
Methods

The SST data were obtained using the surface flow through thermosalinograph onboard. Surface water samples were obtained using a surface station bucket. Chlorophyll was extracted using in-vivo fluorimeters after running the samples through a 0.45µg filter.

Differences between the in-situ and MODIS values were mapped and analyzed by region. The regions chosen were New Zealand (NZ), the Subtropical Convergence Zone (STCZ), and the Southern Pacific Subtropical Gyre (SPSG) The robustness of the dataset was augmented by using data collected by the Seaman's 2015, 2016 and 2017 cruise tracks.



Results



Maps of cruise track surface samples showing the difference between satellite values and in-situ values for each of the three products: SST (a), OCx (b), and GSM (c). The satellite derived values for OCx vs. GSM were compared on a one-to-one line (d). The circle, square, triangle, and star symbols correspond to the 2018, 2017, 2016, and 2015 cruise tracks respectively.

Summary of Results

1.The SST algorithm showed strong agreement with in-situ values across the transect, with an R^2 of 0.92.

2.The two chl-a algorithms showed more variability than the SST algorithm. The OCx had an R^2 of 0.54 and GSM had an R^2 of 0.64.

3.The most variability for both OCx and GSM was near the coastal zones of New Zealand and the least variability in the SPSG. The coastal chlorophyll-a products could potentially be made more accurate by accounting for the effects of chromophoric dissolved organic matter (CDOM) (3).

4.We found no statistical difference between the performance of the OCx and GSM algorithms (R^2 of 0.72).

5.The OCx algorithm returned higher chl-a values in the SPSG than GSM

Conclusion

1. The SST algorithm can be generalized across waters with differing spectral characteristics.

2. The OCx and GSM algorithms cannot be generalized across waters with differing inherent optical properties, especially within coastal waters

References

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(3) Lin et al. (2018), *Int J Remote Sens, 39:5, 1421-1440.*

Acknowledgments

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