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Title: Using Landsat 8 Satellite Imagery to Analyze Biogeochemical Constituents in the Waters of the San Francisco Bay Area and Beyond

Abstract: The ocean's coastal zones play a key role in our planet's health and mitigate the adverse effects of climate change. Building on the success of NASA satellite imagery in mapping land cover changes around the globe in response to climate change, deforestation, and natural disasters, I have worked to determine how aquatic reflectance images from the Landsat 8 sensor could be correlated with biogeochemical constituents within the waters of the San Francisco Bay Area and California coastline. By analyzing Landsat 8 satellite imagery from the years 2013-2020 in collaboration with data from the United States Geological Survey (USGS), San Francisco Estuary Institute (SFEI), and universities involved with the Harmful Algal Bloom Monitoring and Alert Program (HABMAP), I investigated which areas of the San Francisco Bay and California coastline demonstrated significant correlations with values extracted from the satellite imagery. Using a Chlorophyll Index (CI) ratio calculated from two Landsat 8 satellite reflectance bands, it was found that there is a positive correlation between the CI and calculated oxygen, suspended particulate matter, and silicate from several USGS sampling points. In contrast, there is a significant negative correlation between the CI and salinity, nitrite, and phosphate at those same locations. Moreover, large suspected harmful algal blooms (HABs) along the California coastline seen in the Landsat 8 imagery were corroborated with HAB data from various institutions. Understanding the effectiveness of Landsat 8 aquatic reflectance images will allow scientists to predict HABs and other nutrient cycling that may be harmful to aquatic ecosystems around the world.