QUANTIFYING THE EFFECTS OF HURRICANES IRMA AND MARIA ON COASTAL WATER QUALITY IN PUERTO RICO USING MODERATE RESOLUTION SATELLITE SENSORS

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Abstract:

In addition to the physical impacts from wave action and storm surge, hurricanes bring significant rainfall resulting in increased runoff from land. Benthic communities, such as coral reefs, are at particular risk due to poor water quality caused by hurricanes. Extreme weather events, such as Hurricanes Irma and María, can have major impacts on coastal and benthic ecosystems from heavy rainfall and river discharges that caused record or near-record floods at many locations across all regions in the island. Ocean color remote sensing tools that have been used to quantify the effects of hurricanes in water quality parameters include the water attenuation coefficients at the wavelength 490nm and the chlorophyll-a concentration, both important descriptors of water quality. In this study, we use the moderate resolution Visible Infrared Imaging Radiometer Suite (VIIRS) satellite images to quantify the impacts of hurricanes Irma and María on the water quality of the coastal waters of Puerto Rico from Kd490 and chlorophyll-a products. The objectives include: 1) quantify the water quality and light attenuation after the hurricanes, 2) compare this event to the climatology of these parameters, and 3) evaluate long term exposure and exceedances at various coastal areas to high levels of turbidity. The chlorophyll-a inner shelf values for 2017 displayed an increase (in percent) for the months of June (8%), July (17%), August (5%), September (8%), October (19%), and November (28%) when compared to 2012-2016 baseline data. The values for chlorophyll-a concentration reached and exceeded 0.40 µg/L by August 2017, and persisted from September to December 2017 above that value for a total of 5 consecutive months. The Kd490 inner shelf values for 2017 displayed an increase (in percent) for the months of June (4% from baseline), July (9%), August (10%), September (5%), October (12%), and November (7%) when compared to 2012-2016 baseline data. The values of Kd490 in 2017 value for the months of August, September and December are the highest for all the time series analyzed from 2012-2017. Even with the limitations of spatial resolution and loss of data to cloud cover, the 6-year imagery time-series analysis can provide a useful evaluation of the effects of the hurricanes on the coastal water quality in Puerto Rico, and exposure of benthic habitats to higher turbidity waters.