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EFFECTS OF AFRICAN DUST EVENTS ON SEA SURFACE TEMPERATURE PATTERNS IN PUERTO RICO USING EARTH OBSERVATION DATA AND GROUND BASE STATIONS

Abstract

Each year Saharan dust outbreaks are more frequent, carrying tons of mineral dust from Africa to the Atlantic and the Caribbean basin. As a consequence, dangerous levels of aerosols are present, leading to significant negative impact in human health, transportation, commerce and the atmospheric composition. The effects of dust in the climate is not clearly understood, to our best knowledge this is the first study performed of climate variability and extreme events of African dust in Puerto Rico. The purpose of this study is to analyze the sea surface temperature patterns and extreme events caused by Saharan dust events in Puerto Rico using satellite observations and ground base station data. Satellite data from Visible Infrared Imaging Radiometer Suite (VIIRS) and ground base station data from state air quality monitors were collected. The analysis was focused on the following parameters: sea surface temperature (SST), aerosol optical depth (AOD), mass concentration (MC), scattering angstrom exponent (SAE), water vapor (WV) and particulate matter (PM2.5 PM10) from 2012 to 2020. SAE is used as a particle size indicator; high values are associated with small particles from combustion, and low values indicate large particles size like dust. This is a key factor to identify dust events. Time series, Spearman's Rho correlation and trends analysis were performed to identify relationships, patterns, seasonality and extreme events. Colinearity could be present in the analisis. The Spearman's Rho correlation analysis shows a positive correlation (p¡0.05) between SST, PM2.5, PM10, MC, AOD, and WV. A statistically significant negative correlation was found on SAE due to presence of dust. Time series analysis suggests that SST, AOD, WV, and MC have similar patterns. In general, we observe an increment in their levels between May and September. In addition, SAE is the only one who decreases in these months due to the presence of african dust. High AOD values are attributed to the presence of fine particulate matter. Extreme events have been preliminary identified, during the summer/fall seasons, between June and November. These events are directly related to Saharan Dust events and Hurricane season. This study suggests significant changes at atmospheric and ground level during dust events in Puerto Rico. These preliminary findings will help us to understand the climate variability during dust outbreaks and create Early Warning Systems using National Aeronautics and Space Administration (NASA) state-of-the-art earth observation data. This study was funded by NASA, Grant 80NSSC20K1588.