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The effect of sunglint on benthic habitats mapping in Pari Island using worldview-2 imagery

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Abstract

Sunglint is a specular reflection of light from water surfaces that may cause misclassification and poor accuracy for benthic habitats mapping. The aim of this research was to investigate sunglint intensity for each benthic habitats and compared the accuracy result before and after sunglint correction from worldview-2 imagery. Hedley method and analysis coefficient of variation (COV) was used to estimate and remove the glint radiance component, while Mahalanobis distance was used to classify before and after sunglint correction from those imagery. The result showed that the average of sunglint intensity on benthic habitats was 38,9%. The highest sunglint intensity effect found in coral reef class (44%) and the lowest one in sand class (34%). The overall accuracy before and after sunglint correction were 53% and 60%. Sunglint correction well to do in reducing the effect of sunglint and increase the overall accuracy till 7%.

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Keywords: benthic habitats; Pari Island; sunglint correction; worldview-2 imagery

1. Introduction

A coral reef mapping activity in remote sensing using high resolution satellite imagery has been widely used and cost effective compared to field survey over water areas during the last years. Remote sensing has been suggested as a potential tools for monitoring coral reef ecosystem [1] change detection in shallow coral reef environment [2] geomorphic zones mapping of coral reef ecosystem [3] mapping geomorphic and ecological zones on coral reef [4]. The implementation and the accuracy to produce the thematic map in coral reef ecosystem with different accuracy

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result are often impeded by the appearance of glint on the images. The combination of the atmospheric and the water surface conditions with the solar and view angel during image acquisition caused the sunglint effect [5,6,7]. Sunglint is a specular reflection of light from water surface areas into the sensor field of view [6], specular reflection cause misclassification and poor accuracy for benthic habitats map.

There are several methods for glint removal from high resolution satellite imagery [5,6,8,9]. In this study, glint removal was performed on atmospherically corrected image using the technique developed by Hedley et al [6]. This method utilizes IR band, which has similar index of refraction with visible bands, to remove the sunglint on visible bands. There are two assumptions used in this method, first, IR band produces minimum reflectance on the interaction with water body, and thus any NIR reflectance above that minimum value was considered as the offset caused by sunglint, assuming the water is optically deep. Second, the lowest IR value was the sunglint-free pixel [10]. In this approach one or more regions of the image are used to scale the relationship between the NIR band and sunglint. These regions are chosen to include a range of pixel glint levels, but an assumed consistent underlying brightness and very low water-leaving radiance in the NIR (typically deep water areas) are used. For each band a linear regression is made between the NIR radiance and the band radiance, using all the pixels in the selected regions.

Application of sunglint correction of high-resolution images using several approaches to yield better information. Lyzenga et al [11] make corrections sunglint from IKONOS imagery for mapping the depth of water using regression analysis with covariance value between visible and near infrared bands. Most sunglint correction method using near infrared band relationships to obtain the correction coefficients to eliminate the influence of sunglint on the high-resolution image is analyzed by a minimum value [6], the mean value [11].

In this study, we used data input from Worldview-2 imagery to investigate the sunglint intensity using Hedley algorithm on each class benthic habitat in Pari Island. Furthermore, we then test and compare the classification accuracy with commonly used Mahalanobis classification algorithm before and after sunglint correction.

2. Methodology

This research was conducted at shallow waters ecosystems in Pari Islands Thousand Islands District, Jakarta Province Indonesia. Geographically, the study site is located between 5º51’32.94”- 5º 51’37,71” south latitude and 106º34’6,469”-106º38’23,81” west longitude (Fig. 1). Field data were collected in February 2014 using photo transect technique (1 x 1 meters) with 381 observation point and images were analyzed with software CPCe (coral point count with excel extension) [12]. Benthic habitat data collection using the technique of photo transects (photo quadrat transect) with quadrant measuring 1x1 meter placed on the 50-meter transect [13]. Image data that used the Worldview-2 satellite imagery acquired in 19 October 2011. This image has 8 bands (coastal, blue, green, yellow, red, red-edge, NIR1, NIR2) with high spatial resolution of 2 meters (multispectral). This satellite image data type is the standard type 2A level 16bit with projected coordinate system UTM (zone 48 South-WGS84).

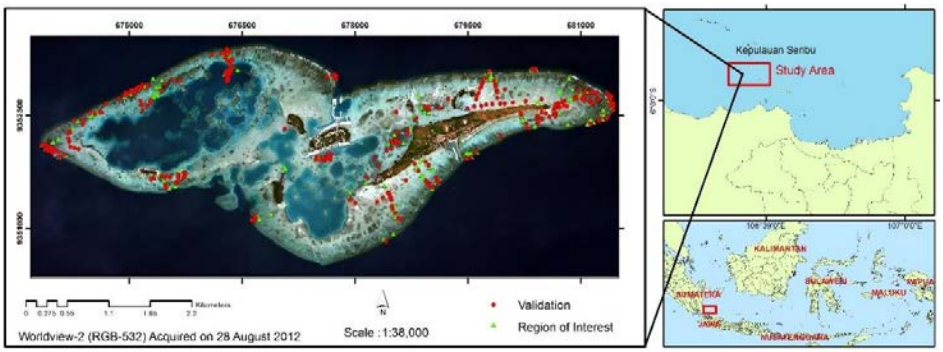

Fig. 1. Research location and Worldview-2 imagery. Red and yellow dots indicated field observation points.