

Use of satellite images as a tool to estimate tsunami destruction and to identify mitigation measures

K P S C Jayaratne^{1*} and Hasitha Wijethilake²

¹*Department of Physics, University of Colombo, Colombo 03*

²*Arthur C Clarke Institute of Modern Technologies, Moratuwa*

The tsunami on 26th December 2004 caused severe damage to the livelihood systems of the people who lived in many coastal areas in Sri Lanka. The integration of GIS with Remote Sensing data may facilitate greatly the assessment and monitoring of environmental resource management. This paper describes an attempt made to see the feasibility of using Remote Sensing (RS) and Geographical Information System (GIS) to monitor tsunami effects. In this study we selected Hambantota District, a coastal area in southern Sri Lanka. The study area occupies about 15 sq. km. Two multispectral satellite images from IKONOS earth observation satellite with 1 m resolution and with geo-reference, purchased from US Space Imaging Co. were used for this study. One set of images has been acquired on 13.02.2003 (before tsunami) and the other on 28.01.2005 (after tsunami).

By using maximum likelihood method in supervised classification of ENVI 3.5 image processing software, the vegetation, mangroves, structures, land area and sea of the two images were classified. After the classification, five different land cover classes were produced and respective vector maps were formed by using raster to vector data interpretation. The change detection map of study area was extracted by superimposing and subtracting these two vector maps. To represent a potential class from the study area, training samples were used with pattern recognition.

The result indicates that due to the tsunami, in the study area concerned, there was a 10% vegetation loss (13.9 ha) and 5% increase in the beach area. The use of satellite images for accurate identification of tsunami damages and to suggest mitigatory measures should be done with extra care. Several problems were encountered which need to be studied further. Firstly it is very difficult to find two high resolution satellite images having no cloud cover in the correct time frame i.e. just before and just after the disaster due to the variable orbits of those satellites covering Sri Lanka. Secondly, the supervised classification process of high resolution images provided by the satellites insert errors due to mixing of classes. To avoid the mixed pixel issue, linear contrast stretching method was used to improve the visible contrast of a classified image and the Laplacian filter was used to detect edges between classes.

Moreover, the green areas indicated in the image after the tsunami gives false signals on vegetation where the actual ground based observations indicate little grass. As such, it is recommended to incorporate supervised classification even for different green shadings of the image and to conduct ground truth observations before using satellite data in forecasting mitigatory measures.