

Monitoring of anthropogenic influence on Mamala Bay water area (Hawaii) using IKONOS and QuickBird imagery

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The results of satellite monitoring of anthropogenic effects on coastal water areas using IKONOS and QuickBird high resolution imagery and sea truth data are given in this paper. Monitoring of deep outfall in Mamala Bay (Oahu Island, Hawaii) performed in 2002-2004 is taken as an example. Detection of propagation areas of surface anomalies caused by the deep outfall was carried out by means of spatial-spectral analysis of panchromatic satellite image fragments in accordance with the method of remote spatial-frequency spectrometry. Besides satellite images, data on hydrophysical and hydrobiological fields in the ocean obtained for the studied area using shipboard instruments and stationary buoy stations over three years, as well as archive satellite imagery acquired in 2000 – 2002 were used. Anomalous areas of the ocean surface were detected as a result of high resolution optical image processing. Within these areas "quasi-monochromatic" spectral components of surface waves having lengths of 30-150 m (depending on hydrometeorological conditions) are generated. These components are caused by internal waves appearing in the density jump layer under the action of deep outfalls. This fact agrees with the results of modeling. Such harmonics are not observed in spectra of satellite image background fragments. Anomaly propagation areas have rather large dimensions reaching 12 – 18 km. A dependence of anomaly propagation area shape on hydrometeorological conditions on the days of experiment was determined. During the monitoring, near-surface wind speed and direction fields were evaluated by spatial spectra of IKONOS and QuickBird imagery. Verification of remote sensing results using in situ data showed their good correlation. Recommendations how to decrease the anthropogenic load on the water area of Oahu (Hawaii) Island are worked out basing on the satellite monitoring results.