

SURFACE TIDAL CURRENT OBSERVATION BASED ON SATELLITE REMOTE SENSING

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Satellite remote sensing has been an effective way to acquire surface image sequences of coastal field, and the satellite video at a frame rate of multiple frames per second could provide chance for short-time observations at high temporal resolution such as the observation of surface tidal currents. The observation of surface tidal currents has been facilitated by advanced image preprocessing methods and large-scale image velocimetry, while the space-time volume velocimetry (STVV) was used in this study. STVV can simultaneously obtain the direction and magnitude of the flow velocity through the surface texture without any artificial tracers, hence it is considered as a promising method. Since it has only been proposed in recent years, this study evaluated the accuracy of the STVV algorithm and tested the robustness of the STVV to environmental disturbance factors firstly. The simulated image sequences were used so that the exact accuracy of STVV can be known by comparing the measured and ground truth values since the ground truth of the pixel flow velocity is predictable and modifiable. The effects of the two main STVV parameters, the size of the search area and the selected frames of images, on the results were analyzed, and the robustness against image noise and fog was examined. The size of the search area and selected frames of images were found having the similar effects on the calculation results that the larger both are, the higher the calculation accuracy will be. Although the lower Signal-to-noise ratios lead to more inaccurate results, STVV is robust to image noises from the results in the given cases. Additionally, the accuracy of STVV is acceptable for a small amount of mist, but thicker fog results in large errors. Further research to develop image processing methods to improve the accuracy of STVV in the future is highly necessary. Therefore, based on one satellite video with the frame rate of 10fps and the resolution of 0.95m shooting on September 15th, 2017, surface tidal current observation of the New York Harbor during the flood tide using STVV was achieved. The flow velocity magnitude can reach 3m/s, and the flow direction is consistent with the actual situation. The feasibility of surface tidal current observation using STVV from the satellite video was proved

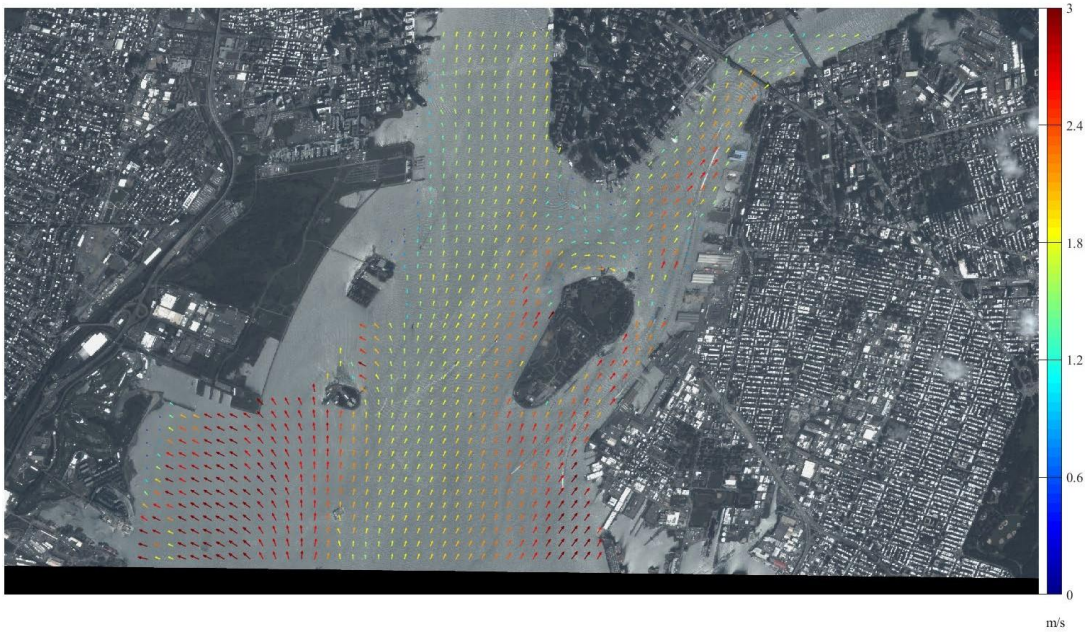


Figure 1. Surface tidal current observation of New York Harbor during flood tide on September 15, 2017