Bathymetry estimation from video imagery via the linear dispersion relations and the assimilation of wavenumber observations.

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Abstract: Our goal is to produce accurate bathymetry estimates with valid uncertainties from video imagery of the nearshore zone. We formulate a data assimilation scheme, maintaining Kalman filters for wavenumber associated to each of a list of plausible frequencies. We use the resulting distributions for wavenumber to compute the distribution of depth using the linear dispersion relations and Bayes’ formula. We apply this algorithm to the wavenumber data that the cBathy algorithm [1] produces from video imagery. We produce bathymetry estimates with uncertainties over a 12 month period from September 2015 to August 2016 at the US Army Corps of Engineers Field Research Facility (FRF) in Duck, NC and compare the results to monthly ground truth surveys. The results show similar bathymetry estimates to cBathy [1] with an improvement in errors shoreward of the sandbar, as well as improved uncertainties over the entire nearshore.

References