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# Observing Storm Surges from Space: A New Opportunity

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Coastal tide gauges can be used to monitor variations of a storm surge along the coast, but not in the cross-shelf direction. As a result, the cross-shelf structure of a storm surge has rarely been observed. In this study we focus on Hurricane Igor-induced storm surge off Newfoundland, Canada. Altimetric observations at about 2:30, September 22, 2010 UTC (hours after the passage of Hurricane Igor) reveal prominent cross-shelf variation of sea surface height during the storm passage, including a large nearshore slope and a mid-shelf depression. A significant coastal surge of 1 m derived from satellite altimetry is found to be consistent with tide-gauge measurements at nearby St. John's station. The post-storm sea level variations at St. John's and Argentia are argued to be associated with free equatorward-propagating continental shelf waves (with phase speeds of 11-13 m/s), generated along the northeast Newfoundland coast hours after the storm moved away from St. John's. The cross-shelf e-folding scale of the shelf wave was estimated to be $\sim$100 km. We further show approximate agreement of altimetric and tide-gauge observations in the Gulf of Mexico during Hurricane Katrina (2005) and Isaac (2012). The study for the first time in the literature shows the robustness of satellite altimetry to observe storm surges, complementing tide-gauge observations for the analysis of storm surge characteristics and for the validation and improvement of storm surge models.