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Field survey of the coastal impact of the March 11, 2011 great East Japan tsunami

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The March 11, 2011 Mw 9.0 Great East Japan Earthquake triggered a large tsunami that caused extensive damage in the NE coast of Japan. A field survey was performed in the tsunami-devastated areas, Sendai Airport, Yuriage, Natori, Sendai port, Taro, Miyako, Yamada, Kamaishi, Rikuzentakata, Ofunato and Kesennuma. The narrow and long bays of the indented Sanriku coast that protection from wind-generated waves focused and amplified the tsunami energy. Large volumes of water overtopped tsunami walls, penetrated estuaries and propagated inland along rivers, inundating the low lands and causing extensive damage on coastal settlements.

We report measurements and observations of nearshore tsunami amplitude, flow and overtopping characteristics, current velocities, flow depth and impact on structures. We present numerical simulations of the tsunami evolution and inundation, using three different published initial conditions and compare results with actual tide gage records. The best-fitting deformation model is then used to calculate nearshore evolution and inundation. Fine-grid tsunami simulations are performed for Kamaishi bay using the bathymetric data with and without the offshore breakwater. We find a smaller effect on inundation by the breakwater than has reported earlier.