The surge standard for "events of Katrina magnitude"

Hurricane Katrina was historic in magnitude. From ref. 1: "The large size of Katrina throughout its history, combined with the extreme waves generated during its most intense phase, enabled this storm to produce the largest storm surges (reliable observations up to 28 ft) that have ever been observed within the Gulf of Mexico, as determined from analyses of historical records." The analysis by Grinsted et al. (2) of the effects of rising temperatures on the frequency of Atlantic hurricane surge invokes "events of Katrina magnitude" as a standard by which other events are judged. However, we believe the Katrina benchmark, as used, is seriously flawed, in large part because the tide gauge spatial resolution used was so coarse that none of the locations forming the index ever experienced a true surge event of Katrina magnitude. This casts doubt on the claim that Katrina-level surge events may occur many times per decade by the late 21st century.

As shown in Fig. 1, the closest tide gauge used by Grinsted et al. (2) was 230 km from landfall in Pensacola; it thus had much lower surge than was found over the near-landfall region. Fig. 2 compares recorded time series of water surface elevations [in North American Vertical Datum of 1988 (NAVD88)] at the Pensacola tide gauge with measured and computed surge levels at high water mark (HWM) KMSC-05-05 (overall simulation $R^2 = 0.933$) (1, 3). This HWM has a peak magnitude four times greater than the Pensacola gauge, and there are many other locations with similarly high surges: Fig. 1 shows locations of the 59 good-quality HWMs with greater than 7-m elevation NAVD88 and 70 more from 6 to 7 m (1). Because the Pensacola elevations are so low (<2 m NAVD88), their use by Grinsted et al. (2) degrades the Katrina standard to such an extent that it becomes possible to conceive of multiple Katrina events per decade; this would not be possible using more appropriate surge values. The danger of using spatially distant measurements to represent the magnitude of surge events thus becomes clear. Inappropriate comparisons with Hurricane Katrina have their own unique dangers, as this storm has great emotional resonance. Instead of a Katrina-magnitude event, the authors computed the probabilities of far more moderate surges.

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1 Interagency Performance Evaluation Task Force (2009) *Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System* (US Army Corps of Engineers).
2 Grinsted A, Moore JC, Jevrejeva S (2013) Projected Atlantic hurricane surge threat from rising temperatures. *Proc Natl Acad Sci USA* 110(14):5369–5373.
3 Dietrich JC, et al. (2012) Performance of the unstructured-Mesh, SWAN+ADCIRC model in computing hurricane waves and surge. *J Sci Comput* 52(2):468–497.

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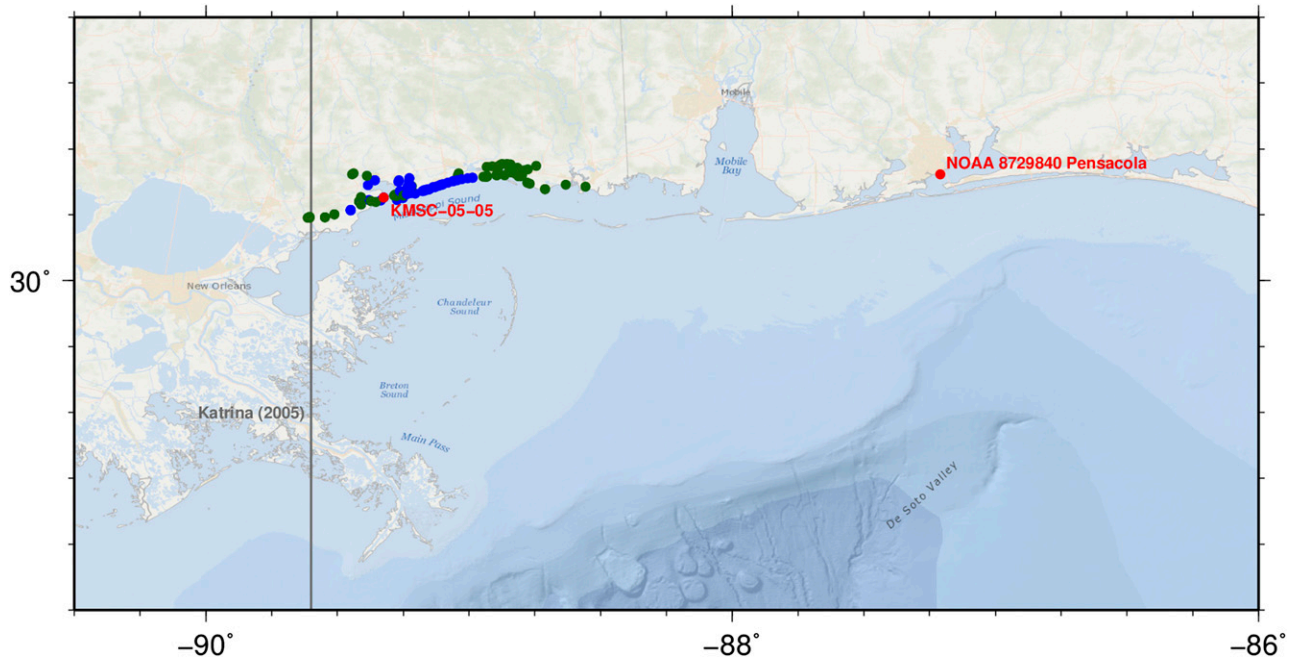

Fig. 1. Locations of Hurricane Katrina track, Pensacola tide gauge, and HWM KMSC-05-05. Locations of the 59 good-quality HWMs greater than 7 m (blue) and 70 HWMs from 6 to 7 m NAVD88 (green) are also shown.

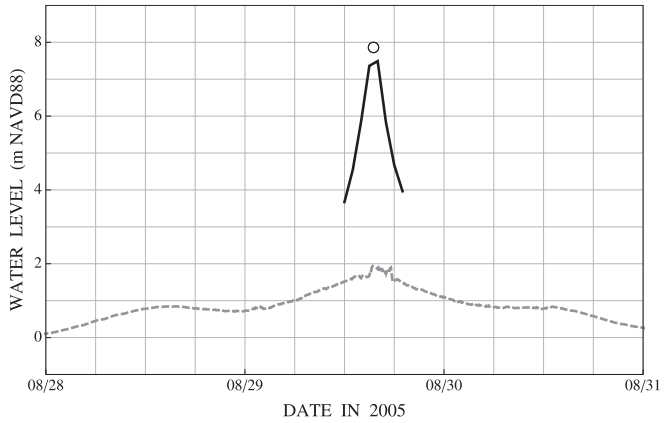

Fig. 2. Computed (solid line) and measured (open circle) water levels at HWM KMSC-05-05 (while inundated) compared with measured water levels at Pensacola tide gauge (dashed line).