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Response to Hsu and Blanchard's Comments on "Tropical Cyclone Destructive Potential by Integrated Kinetic Energy"

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We are pleased that Hsu and Blanchard (hereafter HB) have taken up our challenge (in Powell and Reinhold 2007, hereafter PR) to investigate alternative metrics for tropical cyclone impacts. HB first show a relationships between wind destructive potential (W_{dp}) and maximum sustained surface wind speed, V_{ms} (r^2 of 70%), and surge/wave destructive potential, S_{dp} with tropical storm force winds, R_{18} (r^2 of 84%). HB then go on to develop a combined surge/wave and wind destructive potential rating based on relationships of significant wave height (H_{smax}) to surface stress, fetch (using R_{18} as a proxy), V_{ms}, and wave set up. While their surge and wave relationships are reasonable, the W_{dp} relationship with V_{ms} works best when winds are > 55 m s^{-1}. The fit is poor (22% r^2) for winds < 55 m s^{-1}. This is due to the non linear IKE damage multiplier discussed in Powell and Reinhold 2007. Observed residential damage in Hurricanes Andrew, Hugo, and Opal suggests that winds > 55 m s^{-1} can produce 30 times the damage exacted by 25-40 m s^{-1} winds. Therefore a small intense storm can inflict great wind damage

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but (depending on the local bathymetry) relatively low surge damage. Scaling small intense hurricanes continues to be a challenge. While a combined wind and surge damage potential rating provides a new way to rank storms, the prediction fit in HB's Fig. 3 tends to marginalize small but very destructive storms (e.g. Andrew's south Florida landfall results in a combined rating of 3.6 and Camille results in a 3.8 rating). It would be difficult to advise a resident who survived either of these storms that they experienced anything less than a "5". In testing the computation of IKE calculations during the 2007 Atlantic, Central, and Eastern Pacific hurricane seasons, we have found that hurricane wind fields come in all sizes and shapes, challenging some of the IKE and wind radii fits we explored from the small set of 23 storms in PR (see www.aoml.noaa.gov/hrd/ike). HB's introduction of H_{smax} relationships with wind field quantities should be valuable for assessing wave impacts. We recommend that HB and others explore a larger archive of H*Wind gridded wind fields to examine more robust hurricane impact relationships.

References

Hsu, S. A. and B. W. Blanchard, 2008: Comments on "Tropical Cyclone Destructive Potential by Integrated Kinetic Energy" by Powell and Reinhold (2007), submitted to *Bull. Amer. Meteor. Soc.*, **88**.

Powell, M. D. and T. A. Reinhold, 2007: Tropical cyclone destructive potential by integrated kinetic energy. *Bull. Amer. Meteor. Soc.*, **87**, 513-526.