

A Bayesian hierarchical modeling framework for correcting reporting bias in the U.S. tornado database Corey K. Potvin^{1,2}, Chris Broyles³, Patrick S. Skinner^{1,2}, Harold E. Brooks², and Erik Rasmussen^{1,2}

Motivation: Tornadoes often unreported in rural areas, which impedes economic loss models and benefit-cost analyses; evaluation of tornado warning performance; identification of climate signals in tornado activity; verification of NWP systems **Objective:** Estimate 1975-2016 tornado reporting rate (TRR) and actual tornado frequency over central U.S. using Bayesian hierarchical model that avoids major solution non-uniqueness issue that may have impacted other studies (see handout) **Results:** Population density is best covariate of ~10 tested; cross-validation indicates model performs well (green box); TRR decreases sharply away from populated areas (blue box); actual tornado frequency > twice observed (red box) Implications: Supercells and/or QLCS are more efficient tornado producers than we've realized; tornado warning POD and FAR are overestimated Future Work: TRR evolution over time and dependence on tornado attributes (e.g., rating, path length); bias-correct SigHail frequency and mean tornado attributes; incorporate into Monte Carlo framework for examining tornado climo



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Verification of model-predicted tornado report counts (per 100 km²)









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