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The Global Distribution of Hail and Tornado Environments

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How can we capture the global frequency of the environments favorable to hail and tornadoes given the wide variety of formative environments? A global climatology of severe thunderstorm-related environments (1979-2018) has been developed from a suite of reanalysis products (the Modern Retrospective Reanalysis for Research and Analysis versions 1 & 2, ERA-Interim Reanalysis, NCEP-NCAR Reanalysis and JRA-55) using a consistent framework for calculation of parameters. Typically, analysis of convective environments has been performed using a single reanalysis dataset, and thus any individual result is subject to the limitations of that reanalysis, rather than providing a comprehensive picture of the incidence of these impactful phenomena. Using derived composite parameters and their constituents, this presentation will explore the suitability of various indices to represent the frequency of tornadoes, and the size and incidence of hail across the globe.

This work is motivated by the disproportionate share of research focusing on the United States (U.S.) for convectively favorable environments. In particular, this presentation will focus on the issues associated with applying parameters developed over the U.S. outside of their domain of formulation. Preliminary results suggest that unsurprisingly there are differences between the continents, and regions therein, in the parameters most effective at identifying convective events. Furthermore, this evidence highlights the need to consider a wider range of parameters than those focusing on assumed highly deviant storm motions, for example right moving supercells in the Great Plains. In analyzing this climatology, global reanalyses are shown to not perform equally in rendering convective environments. These factors suggest that care must be taken to ensure that parameters, particularly those with calibration for a given region, are applied with the knowledge that they are unlikely to capture all favorable environments.