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Satellite-based Global Storm Tracking, Climatology, and Non-linear Life Cyle Evolution

Rebekah Esmaili (1,2), Yudong Tian (2,3), and Daniel Vila (4)

(1) Dept. of Atmospheric and Oceanic Science, University of Maryland, College Park, United States, (2) Earth System Science Interdisciplinary Center, University of Maryland, College Park, United States, (3) NASA/Goddard Space Flight Center, Greenbelt, Maryland, United States , (4) INPE/CPTEC, Sao Jose dos Campos, Brazil

A global and Lagrangian view of storm systems will advance our understanding of storm evolution during their lifetimes, help improve space-borne precipitation measurements, and facilitate model validation. By examining the storm tracks globally, this study identified regions of intense activity and determined the properties of short and long-lived systems. Since the frequency and duration of events leads to differences in overall rainfall, exploring this relationship is key to furthering understanding of the global water cycle. Additionally, now that over a decade of satellite data are available, our results can serve as a climatological baseline to validate retrievals and evaluate climate models. Such work is critical for the development of the upcoming Global Precipitation Measurement (GPM) mission.

To track and characterize our planet's storm systems, we utilized ForTraCC (Vila et al., 2008), a cloud area-overlap tracking algorithm. This technique was applied to 10 years of the half hourly NCEP/CPC 4km IR dataset (Janowiak et al., 2001). While passive microwave directly estimates rainfall, infrared measurements have the fine spatial and temporal resolutions that are needed to capture a wide range of storms. Using the methods described, we examined: (1) the global trajectories, (2) the storm life cycle through the evolution of cloud top temperatures and effective sizes for differing life spans, (3) the climatological concentration and properties of storms. This work will provide a satellite-derived storm climatology baseline to assess GPM-based retrievals, products and climate studies.