M.S. Defense Announcement
Drew Koeritzer
Monday, March 15 at 1:30 p.m.

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Defense
Virtually through Teams (full link below)

Post Defense Meeting
Virtual

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TRENDS IN REGIONAL ATMOSPHERIC WATER CYCLES ACROSS OCEAN BASINS DIAGNOSED USING MULTIPLE PRODUCTS

The importance of water within the earth system, especially its practical effects on weather and climate through its presence and transport in the atmosphere, cannot be understated. Accordingly, it is critical to obtain an accurate baseline understanding of the current state of the atmospheric branch of the water cycle if we are to infer future changes to the water cycle and associated influences on weather and climate. Technological advances in both remote and in situ observing systems have made it possible to characterize water and energy budgets on global scales fairly accurately. However, relatively little work has been done to study the degree of closure of regional water budgets, especially over remote ocean regions. This is a task complicated by the lack of long-term continuous data records of the variables of interest, including ocean surface evaporation, atmospheric water vapor flux divergence, and precipitation. This work aims to fill these gaps and contribute to the establishment of a baseline understanding of the water cycle within the current TRMM and GPM era.

The evolution of water cycle closure within five independent regions in the equatorial Pacific, Atlantic, and Indian Oceans has been established previously using atmospheric reanalysis and gridded observational and pseudo-observational data products. That research found that while the water budgets closed extremely well in most basins, the water cycle within the West Pacific was found to trend out of closure within the first decade of the 21st century. The current study aims to extend this analysis temporally, in addition to including a wider variety of independent data sources to confirm the presence of this emerging lack of closure and hypothesize the reason for its existence. Differences between independent products are used within the context of each region to infer whether the emerging lack of closure is a data artifact or is a result of a more fundamental shift in the physical

mechanisms and characteristics of the evaporation, precipitation, or water vapor flux divergence within a specific region.

Results confirm an initial hypothesis that the emerging lack of water cycle closure in the West Pacific is not due to satellite or instrument drift. Rather, it is likely a combination of data artifacts as well as a fundamental shift in the degree of convective organization which is responsible for influencing the retrieved precipitation to the point that the overall water cycle is no longer closed. Trends in precipitation and differences between various remotely sensed precipitation datasets were determined to likely be related to changes in the partitioning between deep isolated and deep organized convection in the West Pacific region and associated effects on the accuracy of passive microwave precipitation retrieval algorithms. Temporal inflection points were found within reanalysis depictions of water vapor flux divergence in the West Pacific and were inferred to result from inhomogeneities within the observational record. Evaporation was found to be stable over time. Therefore, the emerging lack of closure of the water cycle in the West Pacific was concluded to be a combination of physical changes limited to the West Pacific region.
