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The Performance of IMERG Over the Eastern Pacific Fresh Pool: A Comparative Evaluation Using In Situ and Space-based Observations

Zhe Li[1], Haonan Chen[1], Elizabeth Thompson[2]

1. Colorado State University, Fort Collins, CO 80523
2. NOAA Physical Sciences Laboratory, Boulder, CO 80305

Abstract:

The accurate measurement of oceanic precipitation is vital for understanding the global water cycle, as more than 75% of the Earth's rainfall occurs over oceans. In the past decades, global multisensor satellite precipitation (MSP) products such as NASA's IMERG have become a valuable (and often the only) source of information for estimating oceanic rainfall amount and variability. However, MSP product performance remains unclear due to extremely limited reference rainfall observations over the ocean. To fill this gap, the International Precipitation Working Group (IPWG) and the GPM Ground Validation team have urged the need for exploring high-quality benchmarks to support validation of MSP retrievals over oceans. This work addresses two possible solutions to this challenge. The first is to utilize in situ rainfall measurements from ocean field campaigns such as the Salinity Processes in the Upper Ocean Regional Study-2 (SPURS-2, August 2016 – October 2017) over the Eastern Pacific Fresh Pool. A wide range of fixed and moving platforms (e.g., moorings, ships, passive aquatic listeners, and sea gliders) were deployed during SPURS-2 to collect in situ rainfall data at high frequency. The second method hypothesizes that space-borne radar such as the GPM Dual-frequency Precipitation Radar (DPR) can serve as an alternative reference (instantaneous, ~5 km) to facilitate error characterization of MSP retrievals globally, including over oceans. In this study, we focus on the Eastern Pacific Fresh Pool under the Intertropical Convergence Zone (ITCZ), where convective and stratiform rain often occurs, and exhibit strong spatiotemporal variability. We evaluate the performance of IMERG using reference rainfall data from SPURS-2 in-situ measurements and DPR-based products, based on the same Censored Shifted Gamma Distribution (CSGD) model. This error modeling approach provides a way to diagnose the conditional bias and random error in IMERG retrievals, and reconcile them based on location, season, sensor type, and rainfall type. Through this comparison work, we also highlight the similarities and differences between the two references, and suggest future directions for validating MSP retrievals over oceans.