The Green Ocean: Precipitation Insights from the GoAmazon2014/5 Experiment

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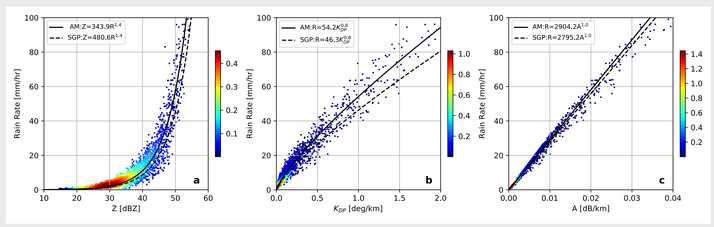
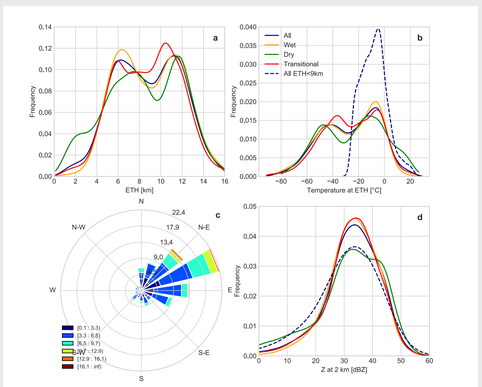
Abstract

GoAmazon2014/5 campaign precipitation properties are summarized, including drop size distribution (DSD) segregations according to seasonal (Wet/Dry regime) variability, cloud echo top height (cloud regime). The study also explores possible aerosol influences on the oceanic character of the precipitation. Overall, Amazon precipitation characteristics straddle behaviors found during previous ARM tropical deployments. Oceanic precipitation traits are predominantly observed during the Amazon Wet season. Exploration of controls on Wet season DSD properties reveals that wind direction provides a solid predictor for those Wet season Amazon events having an oceanic character in their precipitation distributions.

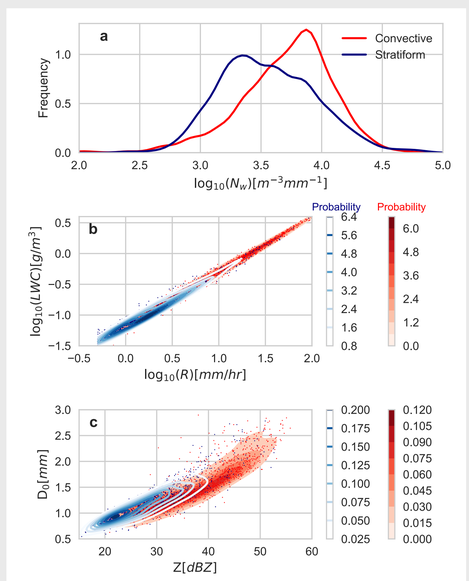
Cumulative Precipitation Properties



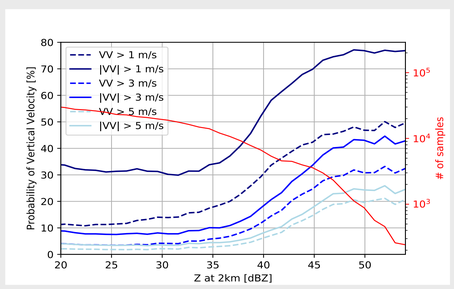
Standard rainfall relationship coefficient fits reflect a tropical character for the Amazon precipitation (compared with ARM SGP).



Cloud breakdown over the ARM T3 site (near Manaus), highlighting the frequency and intensity of congestus to deeper convective events.

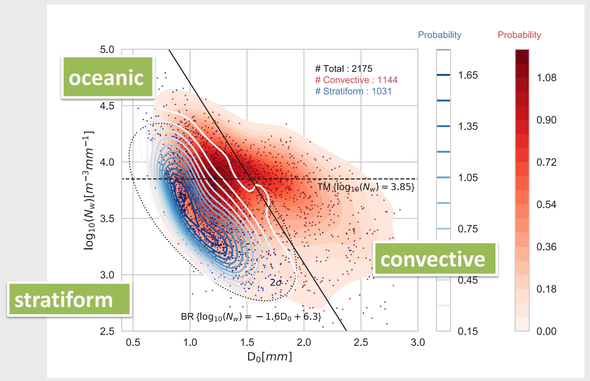


Disdrometer estimates for common DSD quantities according to a collocated profiler-based (RWP) cloud echo classification.

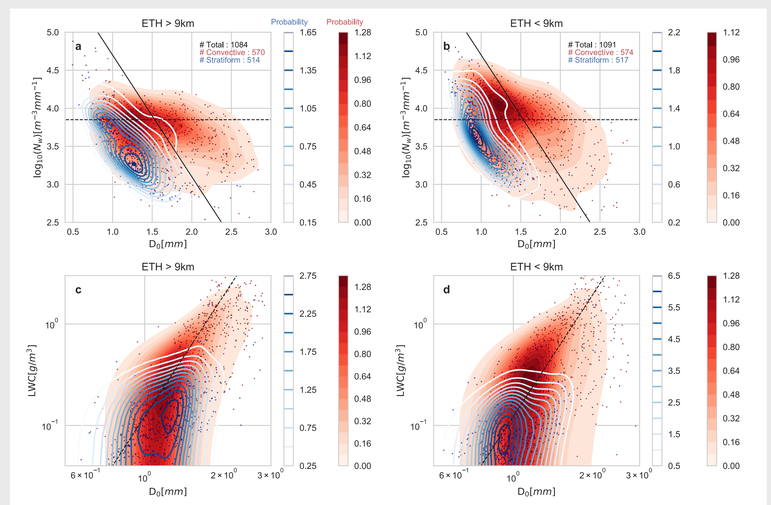


Collocation with the RWP (Giangrande et al., 2016) promotes coupled insights into convective intensity. Above plots reflects the probability to observe stronger convective air motions as a function of the low level storm precipitation intensity (Reflectivity factor, Z)

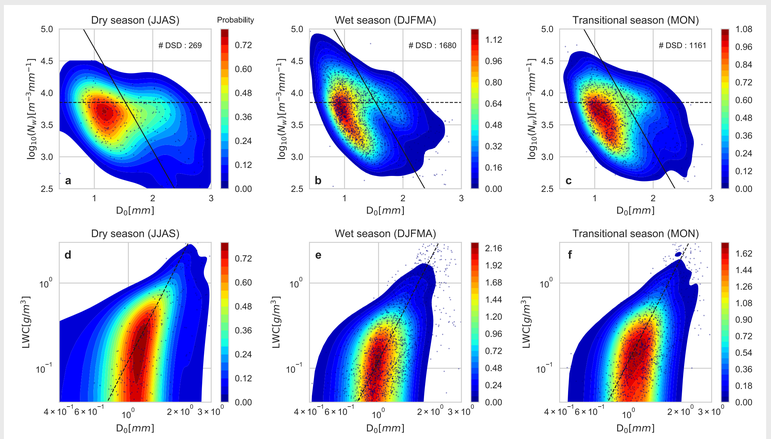
Precipitation Regime Breakdowns



We explore those RWP signatures consistent with DSD methods for cloud classification, including convective – stratiform partitioning (Bringi et al., 2009, solid) and oceanic characteristics (Thompson et al., 2015, dashed).

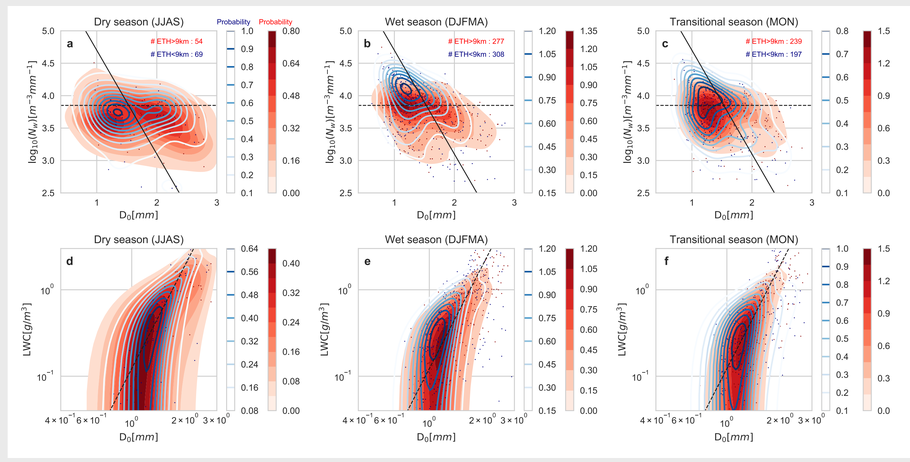


Partitioning according to echo top height ETH helps identify changes in convective and stratiform properties relative to the equally-frequent Amazon congestus and deeper convective events.

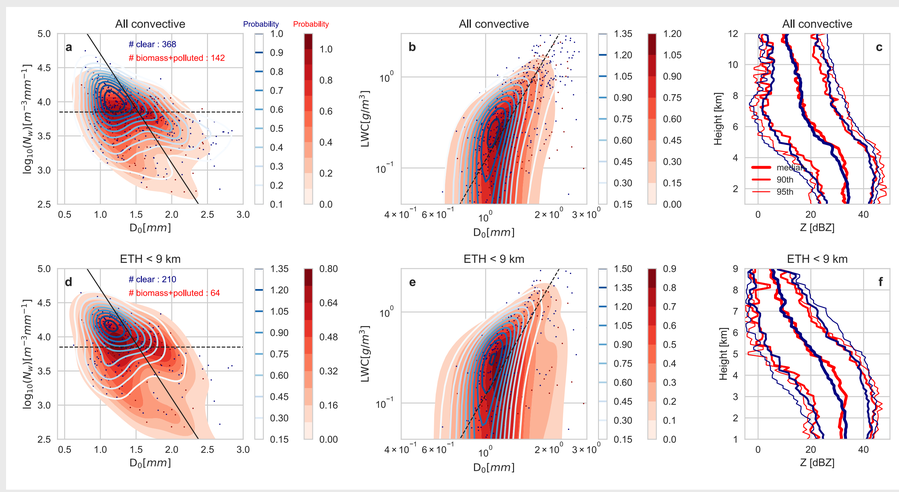


Seasonal breakdowns highlight the significant changes in DSD properties between Wet, Dry and Transitional months. Tropical and oceanic DSD conditions found mostly under Wet regimes.

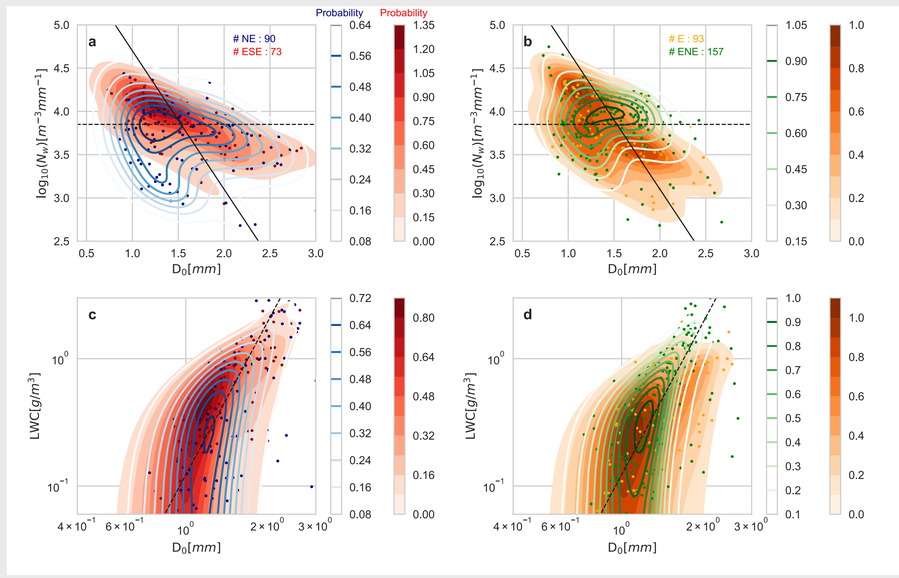
Aerosol, Winds, and Other Factors



Additional breakdowns by ETH and season highlight that Wet season, Congestus DSD exhibit the most oceanic qualities. Dry season events demonstrate the most intense convective precipitation characteristics.



When considering only 'convective' echoes, breakdowns according to aerosol conditions indicate 'clean' conditions as the more oceanic (warm rain process Z profile signatures, right panels). Differences most pronounced when including deeper convective cores.



However, partitioning according to prevailing wind indicates that DSD characteristics shift related mostly to direction, with flows from the NE exhibiting the least oceanic DSDs. One suggestion is that the oceanic DSDs tended to be those associated with these shallower, but widespread convective events initiated or enhanced by sea-breeze influences.

See this paper at ACPD: *https://www.atmos-chem-phys-discuss.net/acp-2018-101/*

Giangrande, S. E., T. Toto, M. P. Jensen, M. J. Bartholomew, Z. Feng, A. Protat, C. R. Williams, C. Schumacher, and L. Machado (2016), Convective cloud vertical velocity and mass-flux characteristics from radar wind profiler observations during GoAmazon2014/5, J. Geophys. Res. Atmos., 121, 12,891-12,913

Bringi, V. N., C. R. Williams, M. Thurai, and P. T. May (2009), Using dual-polarized radar and dual-frequency profiler for DSD characterization: A case study from Darwin, Australia. J. Atmos. Oceanic Technol., 26, 2107-2122.

Thompson, J. E., S. A. Rutledge, B. Dolan, and M. Thurai (2015), Drop size distributions and radar observations of convective and stratiform rain over the equatorial Indian and west Pacific Oceans. J. Atmos. Sci., 72, 4091-4125.