**Does WRF have a warm rain problem?**

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The past two decades have seen dramatic advancements in microphysical parameterization schemes in the WRF model. Yet, over that time, improvements to warm rain physics have largely been neglected in favor of improving ice processes.  As early as Colle et al. (1999), there was evidence of too little precipitation falling in environments conducive to warm rain. In subsequent years, data from Colle et al. (2000), Minder et al. (2008), Conrick and Mass (2019), and others have suggested that warm rain may suffer from deficiencies and, more importantly, these biases are model agnostic (MM5 and WRF) and occur regardless of parameterization scheme choice.

The United States has an excellent natural laboratory for warm rain studies: the Pacific Northwest. An abundance of terrain-forced winter precipitation has encouraged field experiments in the region, most recently OLYMPEX (2015-16). Observational evidence from OLYMPEX (Zagrodnik et al. 2018, 2019, and 2021) has shown that warm rain processes are fundamental to overall precipitation production near terrain, yet evaluations have demonstrated that WRF struggles to produce the proper microphysical characteristics of warm rain.

Work from the OLYMPEX campaign (2015-16) has demonstrated that warm-sector environments experience the greatest underprediction of precipitation and greatest microphysical biases relative to other types of environments. Surface-level evidence will be presented for a warm rain bias by examining drop size distributions (DSDs) over short-term and extended periods, highlighting that WRF retains cold rain characteristics even when warm rain enhancement is occurring. Satellite observations from GPM will also be used as an evaluation tool, further demonstrating that WRF underpredicts cloud and rain water contents.

To find a solution to the regional precipitation biases, we go back to basics and show that a lognormal distribution is optimal for describing cloud water during warm rain events. When used during other events, the lognormal distribution boosts precipitation in places of warm rain and reduces microphysical DSD biases, offering a potential fix to a decades-old problem.