Review of "Technical Note: General Formulation For the Distribution Problem: Prognostic Assumed PDF Approach Based on The Maximum–Entropy Principle and The Liouville Equation" by Yano et al. (egusphere-2023-2278)

This study presents the application and required mathematical background of an approach to predict a small number of relevant parameters that characterize the evolution of a distribution function rather than the full distribution's evolution, using the maximum entropy principle and Liouville equation. The manuscript shows that this approach is relevant for various aspects of the atmospheric sciences (subgrid-scale processes, hydrometeors, and assimilation) and highlights its applicability for the evolution of droplet size distributions under condensational growth. Overall, the paper is well written, interesting, and balances mathematical rigor with an educational introduction to the topic, i.e., an excellent *Technical Note* that deserves prompt publication in *Atmospheric Chemistry and Physics*.

All line numbers refer to the document that underwent the access review.

Minor Comments

Ll. 51 – 52: Lognomal or gamma distributions are frequently used to describe the droplet size distribution, especially for the condensation mode.

Ll. 56 – 52: I recommend referencing the work by Seifert and Beheng (2001; 2006) on cloud microphysics.

Ll. 195 – 196: Observational evidence is often used to determine distributions (e.g., Marshall and Palmer 1948).

Eqns. 3.2a, 3.17, 3.18: A definition of distributions as $p = dP/d\phi$ could be useful to the reader to understand subsequent derivations.

Ll. 665 – 668: While I get the argument, the example is not appropriate. While Z is indeed proportional to the radar reflectivity, it primarily represents the variance of droplet masses and is thus an important parameter to constrain the width of the droplet size distribution.

Technical Comments

Figures: Many figures miss units.

References

Seifert, A., & Beheng, K. D. (2001). A double-moment parameterization for simulating autoconversion, accretion and selfcollection. *Atmospheric Research*, *59*, 265-281.

Seifert, A., & Beheng, K. D. (2006). A two-moment cloud microphysics parameterization for mixed-phase clouds. Part 1: Model description. *Meteorology and Atmospheric Physics*, *92*(1-2), 45-66.

Marshall, J. S., & Palmer, W. M. K. (1948). The distribution of raindrops with size. *Journal of Atmospheric Sciences*, *5*(4), 165-166.