BNL-77718-2007-AB

NEW PERSPECTIVES ON THE ROLE OF 'LUCKY DROPS' IN DRIZZLE FORMATION

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For Presentation at the
Seventeenth Atmospheric Radiation Measurement (ARM)
Science Team Meeting
Monterey, CA
March 26-30, 2007

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ABSTRACT

The fact that ordinary cloud droplets outnumber drizzle droplets by several million to one leads naturally to notion of drizzle drops as somehow 'lucky'. One approach, taking into account the distribution of waiting time interval between collection events, shows a few lucky drops experiencing a succession of unusually small time intervals between successive collection events early on in their growth history [Kostinski and Shaw, BAMS 86, 235 (2005)]. In this poster we show that the new kinetic potential (KP) theory, which treats drizzle formation as an activated barrier crossing phenomenon, offers a new perspective: Lucky drops are the ones that cross the barrier first. The KP theory is shown to be a generalization of the Kostinski-Shaw model in that it includes turbulence-induced stochastic fluctuations in the condensation growth rate as well as collection -thus yielding a unified description of evolving droplet size distributions in non-precipitating clouds as well as drizzle formation [McGraw and Liu, GRL 33, L03802 (2006)]. Parameterizations based on the new theory have already been incorporated into global simulation models and are in the process of being further validated through comparisons with MASE and MASRAD measurements. These latest ARM results are presented together with new efforts currently underway to quantify the role of turbulence.