New Parameterization for Turbulent Entrainment-Mixing Processes in Clouds: Different turbulent entrainment-mixing processes (e.g., homogeneous and inhomogeneous) in clouds gives rise to distinct cloud properties, and thus accurate representation of these processes is critical for improving in large scale models; however, there still lacks such a parameterization that spans over spectrum of entrainment-mixing processes. DOE scientists at the Brookhaven National Laboratory tried to fill this gap using in-situ aircraft measurements collected by the U. S. Department of Energy's Atmospheric Radiation Measurement at the Southern Great Plains site and numerical simulations with the Explicit Mixing Parcel Model (EMPM). They introduced a new microphysical measure named as homogeneous mixing degree, and explored the potential of using this measure to quantify a continuum of entrainment-mixing mechanisms and relate it to the entrainment-mixing dynamics. The parameterization is readily applicable to models with two-moment microphysics schemes; scientists at BNL are currently implementing it into a cloud-resolving model and investigating its influence on model results.

Reference: Lu, C., Y. Liu, S. Niu, S. Krueger, T. Wagner (2012), Exploring parameterization for turbulent entrainment-mixing processes in clouds, J. Geophys. Res. *118, 185-194, doi:10.1029/2012JD018464.*

Contact: Dorothy Koch, SC23.1, 301-903-0105.

Exploring Parameterization for Turbulent Entrainment-Mixing Processes in Clouds

Motivation

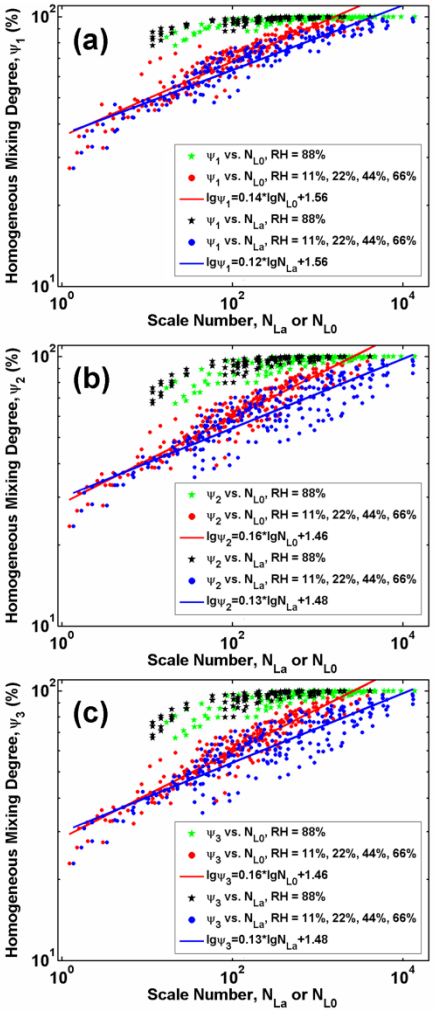
- Different turbulent entrainment-mixing processes occur in clouds; accurate representation of these processes is critical for improving cloud-related parameterizations in large scale models. However, there lacks a general parameterization to cover a range of entrainment-mixing processes.

Approach

- Parameterization of entrainment mixing is explored using aircraft observations over the U. S. Department of Energy's Atmospheric Radiation Measurement Southern Great Plains site collected during the March 2000 cloud Intensive Observation Period and numerical simulations with the Explicit Mixing Parcel Model (EMPM).

Result

- Relationships are established between degree of homogeneous mixing (newly defined) and transition scale numbers (measures of entrainment-mixing dynamics). Based on the relationships, a parameterization of the entrainment-mixing processes is advanced.



Relationships between the three microphysical measures of homogeneous mixing degree (ψ_1, ψ_2, ψ_3) and the two transition scale numbers (N_{La}, N_{L0}), respectively. The results shown here are from the EMPM simulations.

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