Geophysical Research Abstracts
Vol. 20, EGU2018-15347-1, 2018
EGU General Assembly 2018

Estimation of turbulent kinetic energy dissipation rate in the marine boundary layer clouds

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Small-scale turbulence plays an important role in the cloud microphysical properties and cloud evolution through internal mixing and entrainment processes. A good way to estimate turbulence behavior is to measure the turbulent kinetic energy (TKE) dissipation rate (ϵ). However, it is difficult to measure directly in the clouds because it involves gradients at the smallest scales of air motion that the airborne instruments usually can not measure. As a consequence the information of TKE ϵ based on *in situ* airborne measurements is scarce and usually is focused on a single flight or campaign.
In this study we apply the novel zero-crossing methods introduced by Wacławczyk et al. [*Atmos. Meas. Tech.* 10, 2017] to aircraft measurements from five independent research campaigns (e.g., POST, DYCOMS-II, ASTEX, RICO and EPIC) to estimate TKE ϵ in the marine boundary layer as well as compare to other traditional indirect methods (e.g., power spectra and structure functions). Comparison of these methods in different campaign, we expect to find an appropriate and universal method for estimation TKE ϵ from low- and moderate-resolution airborne measurements.
In addition, we analyze the characteristics of TKE ϵ in the marine stratocumulus (Sc) and cumulus (Cu) clouds, such as its vertical distribution in the cloud and its relationship with cloud properties (e.g., liquid water content, droplet effective radius, and droplet concentration). These various measurements performed at different location and different time may allow us to get some universal statistical characteristics of TKE ϵ in the marine Sc and Cu.