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# Bidirectional fluxes of size-resolved fog droplets

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It is a challenge to study microphysical processes in fog under natural conditions. Energy fluxes, production and dissipation of turbulence, as well as droplet microphysical processes merge into complex regimes with large spatial and temporal heterogeneity. It has been convincingly shown that positive (upward) fog droplet fluxes fit well into concepts of the atmospheric boundary layer. The Köhler theory helps to understand the formation and growth of cloud condensation nuclei at conditions near 100 % relative humidity. At the same time, turbulent transport leads to highly variable microphysical conditions in fog layers very close to the surface. Former studies showed bidirectional fluxes of fog droplets with smaller droplets being transported upwards while larger ones being transported downward. These processes were shown to happen during various fog types and at various sites. The exact conditions to lead to such bidirectional fog droplet fluxes still need to be described.
The scope of this investigation is to further analyze physical and chemical processes in fog in conjunction with turbulent processes. This research studies the temporal variability of the fog droplet size distribution and the coincident size-resolved fog droplet fluxes. What are sources and sinks of small droplets? What causes bidirectional fluxes of fog droplets? Where exactly is the tipping point of flux direction? Is it dependent on air pollution or other boundary layer conditions?
We employed the eddy covariance method at two meteorological masts in Taiwan and SW China to quantify turbulent fog droplet fluxes. Our measurement periods were during the dry seasons, respectively. We measured from January to March 2016 in Ailaoshan, Yunnan, China and in March 2017 in Xitou, central Taiwan. Both studies sites are located in evergreen subtropical forests and mountainous terrain.
Preliminary results indicate that fluxes of smaller droplet can turn upwards to the atmosphere. Turbulent fluxes of larger droplet are always orientated downwards to the surface. Because of size-depended bidirectional fluxes, the total droplet number flux is frequently oriented upwards while the liquid water flux is oriented downwards. The tipping point between positive and negative flux direction is similar at both study sites, near 10 $\mu$m diameters. Data analysis is underway.
This research continues applications of the eddy covariance on size-dependent fluxes of fog droplets. Parameters and typical conditions are further described. The potential effect of global and regional warming on the dynamics of fog regimes in the evergreen, subtropical mountain forest belt will be estimated.