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Stratocumulus-to-Cumulus transition: Case Studies from North Pacific and North Atlantic

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Marine boundary layer clouds cover vast areas of the eastern subtropical oceans and have a significant impact on the Earth's radiation budget. Marine stratocumulus (Sc) clouds form in regions with cold sea surface temperatures (SSTs) and strong boundary layer inversion that is maintained by a largescale subsidence. As these clouds are advected towards the trade-wind regions that have warmer SSTs and weak inversion, they decouple from the surface and transition to broken cumulus (Cu) clouds. This transition from stratocumulus to cumulus cloud (Sc-to-Cu) regime is thought to occur due to a complex interplay of processes modulated by surface fluxes, boundary layer radiative cooling, inversion strength, and precipitation. Previous modeling studies have shown this transition to occur over a span of three days with the nighttime radiative cooling on the first two days able to recouple (well-mix) the boundary layer after daytime decoupling, with the nighttime radiative cooling on the third day being too weak to be able to recouple the boundary layer. Additionally, there is considerable debate over the relative influence of different mechanisms (precipitation vs entrainment) in causing the decoupling.
In this study, we have used the data collected during the MAGIC field campaign from a five-day period to study the boundary layer cloud transitions. The data collected by in situ and remote sensing instruments were used to retrieve the cloud macro- and micro-physical properties, which were then used to calculate profiles of radiative fluxes. The day-to-day changes in cloud, precipitation, radiation and boundary layer properties for the transition will be presented.\
We will also make an attempt to identify few cases that showcased transition of air-mass from the Atmospheric Radiation Measurement (ARM)'s Eastern North Atlantic site to the Barbados Cloud Observatory (BCO). This will enable us to study the boundary layer cloud transitions in the North Atlantic by contrasting the cloud and boundary layer properties observed at the two locations.