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The drizzle signature influence on radiation at different observation scales

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Stratocumulus (Sc) cloud types are low altitude, liquid water clouds that stretch at a great distance in horizontal direction. They cover vast portions of our planet beneath the level of about 3km, consequently affecting the radiation balance at surface.
One of the major factors that impacts Sc cloud lifetime is the drizzle formation process within it. Objective of this paper is to investigate potential of obtaining radiation balance influence of drizzle when its signature is detected by means of active ground based remote sensing instruments.
A Large Eddy Simulation model output reproducing the low altitude Sc cloud observed during the ASTEX campaign is re-created in a modified version of the EarthCARE simulator(ECSIM). ECSIM is used as computational tool in this work in order to generate simultaneous, synthetic radar and lidar observations as well as running the radiative transfer model for shortwave narrow- and broad-band. This 3-dimensional cloud scene measures 25.6x25.6 km with a horizontal resolution of 50 m and a vertical resolution of 15 m. The surface is set to lambertian in order to obtain the same reflections at any observer's viewing angle.
The drizzle fraction is determined by means of synergy of active simulated instruments: the Cloud Profiling Radar (94 GHz) and the atmospheric lidar, using the Russchenberg-Krasnov technique. We calculated the ratio between simultaneously simulated and collocated radar reflectivity and lidar extinction profiles. After the characterization of drizzle in the cloud domain, the 3D Monte Carlo radiative transfer model (RTM) is run to calculate the shortwave fluxes at surface and also reflectances and fluxes at the top of the atmosphere. With this method we record the presence of drizzle in radiation measurements accounting for the horizontal and vertical variability. Using this method we recorded the radiative drizzle signature, and evaluated the impact on radiation in areas where drizzle occurs, compared to surrounding drizzle-free areas.
In cases where drizzle presence is detected using synthetic ground based observations, we further evaluate how it impacts the radiation when the observation scale decreases. Radiative calculation are run for 0.25, 0.5, 1.0 and 3.0 km, in order to match the current meteorological satellite observations. These simulations at different scales will describe the possibility to see drizzle presence using radiation measurements.
In order to have a comprehensive understanding of drizzle signature in different situations, the same simulations are run for 5 different solar zenith angles ranging from 0 to 70 degrees.