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Use of stratocumulus cloud properties to separate precipitation and non-precipitation areas

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The microphysical parameters cloud optical depth (COD) and effective radius (REF) of stratocumulus cloud systems are studied with the SEVIRI instrument on MSG geostationary satellite in order to discriminate precipitating areas from non-precipitating areas, especially for drizzle.
The region over the subtropical eastern Atlantic Ocean off the Namibian coast is characterized by constant stratocumulus cloud cover, and frequent drizzle events. Drizzle is hardly detectable with microwave sensors. Otherwise drizzle is an important part of radiation and water budget of the atmosphere.
COD and REF are retrieved by the standard Nakajima-King approach. This employs simultaneous measurements in a conservative scattering channel in the visible (0.6 micron) and in a weakly absorbing channel in the near-infrared (1.6 microns). Under the assumption of an adiabatic cloud we derive liquid water path (LWP).
We will present an approach for a cloud system, which uses COD, REF and LWP to detect weak precipitation. The approach is based on a conceptual model of the microphysical properties. Non-drizzling clouds are dominated by the process of condensation growth. The cloud optical thickness increases with particle growth, increase of the effective radius. On the contrary in the drizzling clouds, collision-coagulations process is active, particle growth due to the loss of cloud water by conversion into drizzle. The precipitation tends to reduce the correlation between cloud optical thickness and effective radius. Following the approach we studied the daily cycle of the cloud properties within the context of precipitation process in a stratocumulus cloud.
SEVIRI provides continuous daytime and nighttime radiances. It is therefore perfectly capable to study the diurnal cycle behavior of cloud systems. We applied a Lagrangian approach to follow a cloud system and build up a data set of stratocumulus diurnal cycles to analyse this. 148 tracked cloud systems during the month of September, October and November in the year 2006, 2007 and 2008 are subtracted. A pronounced diurnal cycle of LWP are found. The maximum of the LWP are in the morning, which agrees with the climatology and other observations. It is found that in the morning hours most of the cases are drizzling. We compared the LWP with a climatology of a passive microwave observation. The climatology of the LWP based on 18yr of satellite passive microwave observations. The daytime variation of the LWP are in good agreement with the climatology.