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Aerosol-cloud-drizzle interactions in warm boundary layer clouds using ground-based measurements from Atlantic and continental European sites

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Aerosol impacts the climate directly through scattering and absorbing radiation, and indirectly through altering properties of clouds and precipitation. With increasing ambient aerosol concentration, it is agreed that the redistribution of cloud water to more numerous, but smaller cloud droplets suppresses precipitation. However, the magnitude of precipitation suppression is uncertain, and the response of total cloud water to aerosol concentration remains poorly observed and understood. To better understand how aerosols regulate macro- and microphysical properties of boundary-layer clouds, and to establish statistical relationships of aerosol-cloud-precipitation interactions, we analyze high-temporal resolution observations from the Atmospheric Radiation Measurement (ARM) Mobile Facility deployments in Germany in 2007 and in the Azores during 2009–2010. Through synergy between ground-based aerosol observing systems, active and passive remote sensing instruments, we will show how the drizzle rate at cloud base varies with aerosol concentration. We will also demonstrate how the probability of precipitation and the precipitation susceptibility respond to ambient aerosol concentration, and whether these responses agree with results from state-of-the-art satellite observations and climate models.