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Sommario/riassunto	The studies in this dissertation aim at advancing our scientific understandings about physical processes involved in the aerosol- cloud-precipitation interaction and quantitatively assessing the impacts of aerosols on the cloud systems with diverse scales over the globe on the basis of the observational data analysis and various modeling studies. As recognized in the Fifth Assessment Report by the Inter- government Panel on Climate Change, the magnitude of radiative forcing by atmospheric aerosols is highly uncertain, representing the largest uncertainty in projections of future climate by anthropogenic activities. By using a newly implemented cloud microphysical scheme in

the cloud-resolving model, the thesis assesses aerosol-cloud interaction for distinct weather systems, ranging from individual cumulus to mesoscale convective systems. This thesis also introduces a novel hierarchical modeling approach that solves a long outstanding mismatch between simulations by regional weather models and global climate models in the climate modeling community. More importantly, the thesis provides key scientific solutions to several challenging questions in climate science, including the global impacts of the Asian pollution. As scientists wrestle with the complexities of climate change in response to varied anthropogenic forcings, perhaps no problem is more challenging than the understanding of the impacts of atmospheric aerosols from air pollution on clouds and the global circulation.
