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An Examination of Warm Cloud Collision-Coalescence Characteristics using NASA A-Train Data

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Aerosol particles influence cloud formation and precipitation, but the nature and magnitude of these interactions remain highly uncertain. Recent work has demonstrated the utility of a novel procedure that relies on the differing sensitivities of the passive MODIS measurements and the active CloudSat radar measurements to estimate warm cloud droplet collision-coalescence rates and characteristic collision-coalescence time scales. That work is extended here to examine regional differences in collision-coalescence rates and time scales, in addition to their relationships with atmospheric stability and the presence of four different aerosol types. A two-year satellite remote sensing dataset from the NASA A-Train is used for this effort with a focus on warm maritime clouds in different ranges of cloud layer-mean radar reflectivity. Over the global maritime regions, collision-coalescence time scales exhibit a range between 10 and 100 minutes, with the shortest times associated with: (i) more unstable environments; (ii) lower aerosol index values; and (iii) lower values for aerosol fine mode fraction and Ångstrom Exponent. Limitations in identifying aerosol effects on coalescence rates and time scales are discussed.