Rainfall intensity and DSD at sea level and at 1500 m altitude in southern India - studies using TRMM and Disdrometer data

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Rainfall intensity and rain drop size distribution were studied using TRMM data and a Joss-Waldvogel type disdrometer installed at Kochi (Lat: 9.9 N, Long: 76.2 E, 15 m amsl) and Munnar (Lat: 10.1 N, Long: 77.1 E, 1500 m amsl) during the south-west monsoon period. The stations are situated in Kerala, an elongated coastal state in the south-west tip of peninsular India. Kochi is an important commercial city in Kerala situated close to the western coast and on the shores of the state's largest estuary. Munnar is a beautiful hill station about 130 km east of Kochi on the Western Ghats in South India. The average annual rainfall is 310 cm at Kochi, and 380 cm at Munnar. The TRMM data were retrieved for Kochi and Munnar regions and the 3-hourly intensity values obtained. The data from the disdrometer were used to compute rainfall intensities and were compared with the intensities from the TRMM data. Generally, above 95% of the rain events has rainfall intensity less than 5 mm/hr for both the stations. Kochi experiences intensities greater than 100 mm/hr while the rainfall intensity in Munnar is rarely close to 100 mm/hr. The disdrometer data were also used to derive rain drop size distribution at the two stations. Rain drop size distributions for different intensity ranges from the disdrometer data. The entire data were divided into periods of different rainfall intensity. The intensity ranges used were from $<$ 0.01 mm/hr to $>$ 100 mm/hr, with boundaries of 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20 and 50 mm/hr. The mean DSD for each intensity range was computed. The DSD values were fitted with the lognormal distribution function. Three physically significant parameters, viz. total number of drops (NT), geometric mean diameter (Dg) and standard geometric deviation () were derived from the fit parameters. NT increases gradually with rainfall intensity. The values were fitted with the expression NT = b0Rb1, as suggested by Verma and Jha (1996). The fit was found to be good at Kochi., whereas at Munnar NT was found to increase with rainfall intensity initially and then decrease. The geometric mean diameter values were also fitted with a similar expression. At Kochi, Dg was found to increase with rainfall intensity up to about 2.5 mm. But at Munnar, Dg remains more or less constant for intensities up to about 1 mm/hr and then steadily increases exponentially. The standard geometric deviation did not show any significant dependence on rainfall intensity.