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9-year distributions of rain intensities measured in Prague and their utilization in telecommunications

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Experimental research in the Department of Frequency Engineering of the Czech Metrology Institute (CMI) in Prague, the Czech Republic, is focused on stability of received signals on terrestrial radio and optical communication paths. Hydrometeors (rain, snow, fog, hails) can cause serious attenuation of electromagnetic waves in the frequency bands above 10 GHz and the availability performances of terrestrial radio communication systems are seriously affected by heavy hydrometeors events. The rain intensity data is usually used for the calculations of attenuation due to rain on terrestrial radio links in accordance with either the relevant ITU-R Recommendation or other methods. Therefore, our experimental research is also focused on our own meteorological measurements in the vicinity of experimental radio and optical paths.

The heated tipping-bucket rain gauge with the collector area of 500 cm2 and the rain amount per tip of 0.1 mm is used at CMI for the measurements of intensities of hydrometeors. The time of tips is recorded with uncertainty of 1 second. Hydrometeors intensity data obtained from January 2003 to December 2011 (9 years of observation) was statistically processed over the individual years. All the recorded individual hydrometeor events were compared with the concurrent meteorological conditions and were carefully categorized according to the types of individual hydrometeors, i.e. rain, rain with snow, rain with hails, snow, fog, fog with rain, fog with snow, and fog with rain and snow. The obtained cumulative distributions (CDs) of intensities of individual hydrometeors over 9 years of observation will be presented and compared with the CD of intensities of all hydrometeors together.

The rain amounts were examined too. The obtained rain amounts for individual years and the average rain amounts for individual months over the 9-year period will be given.

The obtained CD of average 1-minute rain intensities for the average year over the 9-year period of observation was used for the calculations of CDs of attenuation due to rain on terrestrial radio paths in accordance with the relevant recommendation of the ITU-R. The examples of the calculated CDs of attenuation due to rain will be presented for radio communication links with different path lengths working in different frequency bands.

The obtained CDs can be used for the assessment of availability performances of terrestrial radio communication links in the climatic region where the rain intensities were measured. The examples will be given.

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