



Space dependence of fog visibility and its influence on availability of free space optical links

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A free space optical (FSO) communication system can be used for both terrestrial last mile broadband access and Earth-space communication between Earth station and High Altitude Platform situated in troposphere. However, dense fog events which occur on the Earth surface can cause serious attenuation of optical waves or even the total outage of optical communication. Fog is the most important impairment factor for FSO communication links. Therefore, the availability performances of FSO links are seriously affected by lower atmospheric visibility.

The fog visibility data is measured and stored in meteorological stations or airports. The data can be used for the calculation of attenuation due to fog in accordance with the relevant ITU-R Recommendation. The results obtained provide a good estimate for the assessment of the availability performance of FSO links situated in the similar climatic conditions. Fog visibility data obtained by the Vaisala transmissometer at both the Prague-Ruzyně airport and the Czech Metrology Institute (CMI) in Prague, the Czech Republic, was statistically processed from January 2004 to December 2008 (5 years of observation). The distance between the Prague-Ruzyně airport and the CMI is about 20 km. The cumulative distributions (CDs) of fog visibilities over the whole period of processing were obtained for both sites. A site dependence as well as a great year-to-year variability of these distributions were observed. For both sites, fog events occurred most frequently in November and January, sporadically during the spring and summer months. The reduced fog visibility most frequently occurred during the sunrise due to the fact that the radiation caused dense fog events.

The CDs of fog visibility for the average year over the entire 5 year period of processing obtained at two sites were converted to CDs of attenuation due to fog by a suitable method. It was found that differences between the obtained CDs of attenuation due to fog occurred for the attenuation values greater than 10 dB. These calculated CDs were used for the assessment of availability performances of the FSO communication links situated in the both sites where fog visibilities were measured.

The Czech Science Foundation supported the described work under Project No. P102/11/1376. The authors would like to thank the Czech Hydrometeorological Institute for providing fog visibility data.