Review on Millimeter Wave Propagation Through Sand and Dust Storm-Impact of Humidity

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Eltahir E.I. [a, b, c]; Islam, Md. Rafiqul [b]; Elsheikh, Elfatih A. A. [d]; Zyoud, Alhareth [e]; Abdalla, Aisha H. [b]; +3 authors

[a] Omdurman Ahia University, Department of Applied Physics and Mathematics, Omdurman, 768, Sudan

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Abstract

In this paper, sand and dust storm characteristics and attenuation prediction methods were reviewed and summarized comprehensively. The impact of humidity on the attenuation prediction process is focally discussed while highlighting the need to incorporate it in the modeling process for accurate attenuation prediction. This review is driven by the need to develop precise prediction models that account for the impact of meteorological factors, particularly humidity, on millimeter-wave attenuation during dust storms. By addressing these shortcomings, the review seeks to improve the design of resilient communication systems to support the ultra-reliable 5G and 6G networks in challenging environments. A critique of the previous studies that highlight the contributions and drawbacks is presented in the paper. This is followed by a taxonomy of models based on their prediction concepts and the timeline of developments. Furthermore, open issues and challenges for research were presented. The review study found that existing theoretical models

have failed to predict measured attenuation accurately, often deviating significantly. Most of the theoretical and analytical approaches for estimating dust storm attenuation are found to neglect the critical influence of humidity. Few empirical and machine-learning models proposed recently, have demonstrated closer alignment with measurements after considering humidity and other metrological parameters. © IEEE. 2013 IEEE.

Author keywords

attenuation predictions; complex permittivity; micro and millimeter wave propagation; relative humidity; sand and dust storm; Terrestrial communication

Indexed keywords

Engineering controlled terms

Dust; Forecasting; Learning systems; Machine learning; Millimeter waves; Prediction models; Storms; Wave propagation

Engineering uncontrolled terms

Attenuation prediction; Complex permittivity; Dust storm; Micro and millimeter wave propagation; Millimeter wave propagation; Prediction methods; Prediction process; Sand storms; Storm impacts; Terrestrial communication

Engineering main heading

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Corresponding authors

Corresponding author	M.R. Islam
Affiliation	International Islamic University Malaysia, Faculty of Engineering, Department of Electrical and Computer Engineering, Kuala Lumpur, 53100, Malaysia
Email address	rafiq@iium.edu.my
Corresponding author	E.A.A. Elsheikh
Affiliation	King Khalid University, College of Engineering, Department of Electrical Engineering, Abha, 62529, Saudi Arabia
Email address	eelsheikh@kku.edu.sa

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Corresponding authors