Impact of the tropospheric turbulence on the propagation of radiowaves: models for new communication systems

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The main effect of turbulent atmosphere on the propagation of radiowaves is rapid variations in the phase and amplitude of the signal. Tatarskii and Ishimaru have developed a well-known theory for the propagation of radiowaves through turbulent layers, characterised by their structure constant Cn2, the inner and outer scale. The variance of the amplitude and phase of the received signal is calculated, for fixed earth-satellite and terrestrial links, assuming fully developed turbulence. Time series of scintillation can be generated either on a statistical basis or by using multiple phase screens. They are useful for the simulation of antenna tracking systems and fade mitigation techniques for low availability systems. New communication and remote sensing systems however encounter some difficulties: wideband communications with LEO satellites crossing the full troposphere in half an hour, radio-occultation link crossing a very large turbulent zone, degradation of SAR precision due to the presence of turbulence between the SAR and the ground surface… For these applications, a time-space description of the turbulence is necessary and frozen turbulence hypothesis is not valid. This paper briefly reviews the impact of turbulence on communication and remote sensing systems and the classical simulation methods, stresses their limits and proposes improved solutions and models.

Biography – Danielle Vanhoenacker-Janvier

Danielle Vanhoenacker-Janvier received the electrical engineer degree and the Ph.D. degree in Applied Sciences from the Université catholique de Louvain (UCL), Louvain-la-Neuve, Belgium, in 1978 and 1987, respectively. She is currently with UCL, where she was an Assistant from 1979 to 1987, a Senior Scientist from 1987 to 1994, an Associate Professor from 1994 to 2000, a Professor from 2000 to 2007, and has been a Full Professor since 2007. She was the Head of the Microwave Laboratory from 2001 to 2007, Deputy Academic Secretary (2001 to 2011) of the Faculty of Applied Sciences and Vice-Dean of the Polytechnic School (since 2011) in charge of the Students Affairs.

She has been involved in the study of atmospheric effects on propagation above 10 GHz for more than 30 years, and she is also interested in the analysis and modelling of the mobile propagation

channel and the evaluation of its impact on communication systems. In 1989, she extended her research activity to microwave circuits. She is involved in the analysis, design, and measurement of microwave planar passive and active circuits, with a special interest, since 1994, in microwave ICs on SOI. She is author of more than 140 technical papers and a co-author of a book.

D. Vanhoenacker-Janvier was Chair of the European Microwave Conference EuMC2010 in Paris and is a reviewer for various international conferences, IEEE and IET journals. She has also been a member of evaluation committees for Grants and projects at FWO (Belgium) and is member of FRIA evaluation committee from 2001. She is member of the evaluation committee of various Laboratories and Research Centres in The Netherlands, France (AERES) and Finland.