Space Communications 20 (2005/2006) 1
IOS Press

Introduction

This special issue on "Propagation Modelling for Space Radio Frequency Link" is based on extended papers presented during the second Workshop on Propagation, held in Toulouse from October 13th to October 15th 2004 and organised by CNES, the French Space Agency. The issue offers an overview of industrial needs in terms of propagation models for systems design and performance assessment and the related research activities on propagation modelling, addressing the needs of a range of space applications from telecommunications, satellite navigation to earth exploration. This workshop is part of the activities supported by the so-called CNES Technical Competence Centres (CCT) in Signal and Image Processing and in Electromagnetism. These networks of specialists, created in 1998 by CNES, are structured around the main technical disciplines used in space. The sixteen centres are now working in close cooperation together with the French and international community involved in the space sector but also in other sectors such as aeronautics, defence, automobile, etc. Additional information can be found at http://cct.cnes.fr.

It is well known that propagation effects play a major role in the design and performance of a radio frequency link for both radio-navigation and communication satellite services. Therefore, simple but efficient models have to be made available to the various players involved in the design and operation of satellite systems, from system designer, subsystem and equipment manufacturers to satellite operators and service providers. The International Telecommunication Union (ITU) is providing global and well-validated tools to assess the propagation effects. Nevertheless, a deeper knowledge of propagation phenomena, although less validated, may also be needed. These needs are fulfilled by the models being developed by research laboratories based on propagation measurements.

The Special Issue of the *Space Communications* Journal deals with two aspects of propagation phenomena, ionospheric and tropospheric effects. Indeed, the ionosphere has a strong impact on radio frequency links operating in the UHF/VHF, L and S bands for radio-navigation satellite services or mobile systems. On the other hand, the troposphere strongly affects transmission links in X, Ku and Ka bands (and even more Q/V bands) operated for Earth exploration or broadcasting and multimedia telecommunications systems. In each case, the need is to identify, assess and model with accuracy the power attenuation, the delay and the frequency shift of the signal due to the propagation phenomena. Nowadays, statistical models are used to compute a link budget for a given probability of link interruption. In the near future, dynamic models will allow a full assessment of the statistical behaviour of radio frequency links and will provide a real-time estimation of the status of the propagation channel that is useful to implement fade mitigation techniques.

Therefore the issue is divided into two parts addressing ionospheric and tropospheric issues, each section introduced by a state-of-the art overview paper. Seven technical papers then present the latest models available to estimate accurately the behaviour of the propagation channel for space services.

Alban Duverdier and Frédéric Cornet

DCT/RF/TT – Satellite Air Interface Engineering
CNES, French Space Agency, Toulouse