

Ph.D. in Information Technology:

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REGONESI ERIC – XXXIII CYCLE

PhD thesis title

A comprehensive model for the investigation and prediction of depolarization along high frequency Earth-space links

Short Abstract

Satellite communication systems working in microwave bands are impacted by the phenomenon of depolarization, induced by rain and ice particles present in the troposphere. Current models available in the literature do not fully characterize the large variability observed in beacon based depolarization measurements.

The work exploits the Italsat satellite propagation campaign carried out in the 90s, by means of the data recorded at the Italian sites of Spino d'Adda and Pomezia at three different microwave bands (Ka, Q and V).

First, data are processed to remove system biases and errors, and filtered to counteract the noise.

Second, the data analysis is performed, with the aid of the construction of rain microphysical models. The activity is carried out both on a statistical and an event basis. Cross Polar Discrimination (XPD) and quasi-physical parameters are the main quantities investigated and compared to literature models. For dual polarized signals, it is also evaluated the contribution by rain and ice particles to the overall electric field transfer matrix.

Finally, a physical modelling part is presented. The ice integrated content is used to propose an ice induced XPD distribution model. Furthermore, with the aid of the data extracted from the ECMWF database, an average model relating the ice XPD and the ice integrated content is proposed, for the site of Spino d'Adda. Last, a methodology is proposed and validated to scale the overall transfer matrix to different link conditions, by separate processing on the previously extracted rain and ice contributions.

Committee Members

Riva Carlo	Politecnico di Milano - Deib
Riera José Manuel	Universidad Politecnica de Madrid
Vanhoenacher-Janvier Danielle	Université Catholique de Louvain-la-Neuve