Universal fluctuations in tropospheric radar measurements

Andrea Barucci (2), Giovanni Macaluso (2), Daniele Mecatti (2), Linhsia Noferini (2), Duccio Fanelli (3), Angelo Facchini (4), Massimo Materassi (1), Massimiliano Pieraccini (2), and Carlo Atzeni (2)

(1) Istituto dei Sistemi Complessi CNR, Sesto Fiorentino, Italy (massimo.materassi@fi.isc.cnr.it), (2) Department of Electronics and Telecommunications. University of Florence, Italy, (3) Dipartimento di Energetica "S.Stecco", University of Florence and INFN, Firenze, Italy, (4) Department of Information Engineering and Center for the Study of Complex Systems, University of Siena, Siena, Italy

Radar data collected at an experimental facility arranged on purpose suggest that the footprint of atmospheric turbulence might be encoded in the radar signal statistics. Radar data probability distributions are calculated and nicely fitted by a one parameter family of generalized Gumbel (GG) distributions, "Ga". A relation between the wind strength and the measured shape parameter "a" is obtained. Strong wind fluctuations return pronounced asymmetric leptokurtic profiles, while Gaussian are eventually recovered as the wind fluctuations decrease. Besides stressing the crucial impact of air turbulence for radar applications, we also confirm the adequacy of "Ga" statistics for highly correlated complex systems.