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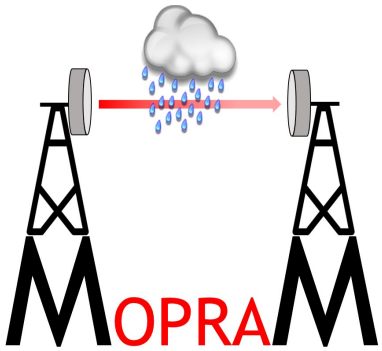
Roberto Nebuloni received the Laurea degree in electronic engineering and the PhD degree in information engineering from the Politecnico di Milano, Milan, Italy in 1997 and 2004, respectively. In 2005, he joined the Italian National Research Council (CNR), where he is currently a researcher at the Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni (IEIIT), in Milan. His research interests include theoretical and experimental aspects of radio and optical wave propagation through the atmosphere for applications in the areas of telecommunications, meteorology and environmental monitoring. He is the author of about 60 papers on the above subjects. He participated in the European framework for Cooperation in Science and Technology (COST) and in the Satellite Communications Network of Excellence (SatNEx). He has been involved in projects funded by the European Space Agency and focused on the study of fade mitigation techniques for advanced satellite systems.

Publications

- R. Nebuloni, C. Capsoni, M. Luccini, “Advanced time series synthesizer for simulation of joint rain attenuation conditions”, *Radio Science*, Vol. 49, No. 9, pp. 699-708, 2014
- R. Nebuloni, C. Capsoni, V. Vigorita, “Quantifying Bird Migration by a High-Resolution Weather Radar”, *IEEE Transactions on Geoscience and Remote Sensing*”, Vol. 46, No. 6, pp. 1867-1875, 2008.
- R. Nebuloni and C. Capsoni, “Effects of Adverse Weather on Free Space Optics”, in *Optical Wireless Communications*, Spring-Verlag Publishing, Berlin (Germany), 2016 (this book can be purchased at http://www.springer.com/gp/book/9783319302003)

ricerche

MOPRAM



Roberto Nebuloni is the principal Investigator and responsible of the activities carried out by IEIIT in the frame of the national project “MOnitoring of PRecipitation through A network of Microwave radio links” (MOPRAM), funded by Fondazione CARIPLO. MOPRAM is a multidisciplinary project that intends to use measurements carried out by a commercial network of microwave radio links to improve the characterization of the space-time variability of rainfall. MOPRAM is expected to contribute significantly beyond the state of the art in the area of hydrometeorology, in particular in river discharge prediction. The results of the project can help to address other problems as well, e.g. the triggering of shallow landslides, or the soil erosion that is important for agricultural purposes.
Project start: April 2017, duration: 36 months
Partners:

- Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni (IEIIT), Consiglio Nazionale delle Ricerche (leaders)
- Dipartimento di Elettronica, Informazione e Bioingegneria (DEIB), Politecnico di Milano, Italy
- Dipartimento di Ingegneria Civile e Ambientale (DICA), Politecnico di Milano, Italy

instruments

A “METEK USA-1” sonic anemometer is installed on the rooftop of Building 20 of DEIB, within the campus of Politecnico di Milano. It carries out measurements of the 3D wind components (x, y, z) and of the sonic temperature of the air based on the propagation time of ultrasound waves between three pairs of transducers. This sensor provides accurate measurements of wind and turbulence parameters. Data are sampled every 1-s and stored on daily .txt files. The sensor is not operated continuously, however historical data or on-demand measurements can be requested by contacting ClimateLab staff.

The RPG (Radiometer Physics GmbH) HATPRO radiometer, installed on the rooftop of Building 20 of DEIB, collects brightness temperature measurements at 4 channels in the Ka (23.8 and 31.6 GHz) and V band (72.5 and 82.5 GHz) with 1-second sampling time. Such data allow inferring the liquid water content in clouds and the water vapor content in the troposphere. The instrument is also useful to quantify the attenuation induced by the troposphere (in nonrainy conditions) on EM waves. The HATPRO radiometer also features meteorological sensors monitoring pressure, temperature and relative humidity

The tipping bucket rain gauge, installed on the rooftop of Building 20 of DEIB, monitors precipitation events. The instrument provides as output the number of tips occurred every minute, from which rain rate time series can be derived (1-minute integration time). The tip resolution is 0.1 mm.

The Thies CLIMA laser disdrometer, installed on the rooftop of Building 20 of DEIB, provides detailed information on hydrometeors by measuring their particles size, their falling velocity and their state (liquid drops, snow flakes, hail particles, …). Results are output with 1-minute integration time and they are of key importance for the in-depth investigation of the effects of precipitation on EM waves.

The beacon receivers installed on the rooftop of Building 20 of DEIB monitor the oscillations of the signal emitted by the Alphasat satellite (geosynchronous with orbital position at 25° E) at two frequencies: 19.7 GHz and 39.4 GHz. The measurements (the sampling frequency is 8 Hz) allow the deep analysis of the effects of the troposphere on EM waves, including: absorption by water vapor and oxygen, attenuation induced by clouds and hydrometeors, depolarization effects due to cloud ice crystals and signal rapid fluctuations (scintillation) due to atmospheric turbulence.