

Opportunistic Weather Sensing with Phased Array Base Stations

Opportunistic sensing of precipitation through existing wireless communications infrastructure such as satellite ground terminals, commercial microwave links, and mobile communications base stations has gained significant interest in recent years. These systems complement weather radar observations while offering the advantage of a relatively dense deployment at a lower cost. Prior works largely employ single-antenna communications receivers for meteorological observations. In this work, we explore the possibility of re-purposing S-band phased array base stations to estimate low-elevation precipitation in urban areas in an opportunistic fashion. Without any specialized waveform design (other than general-purpose communications signals), our objective is to achieve simultaneous weather sensing and communications operation. To this end, we build a precipitation sensing simulator based on a typical phased array base station setup. Specifically, we investigate the following using numerical results from our simulator: (1) the optimal deconvolution filter for communication signal-based weather radar applications; and (2) estimation accuracy improvement from adopting multiple antennas at the TX or/and the RX end.