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Cellular network infrastructure- the future of fog monitoring?

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Severe visibility limitations resulting from fog may lead to acute transportation accidents, high losses of property and lives. Thus, reliable monitoring facilities are of extreme importance. Nevertheless, current monitoring instruments suffer from low spatial resolution, high costs or lack of precision at near- surface levels. It has, however, recently been shown, that the commercial microwave links that form the
infrastructure of cellular communication networks, can provide crucial information regarding the appearance of dense fog and its intensity. Typical microwave systems currently in operation, make use of frequencies between 6 and 40 GHz, and thus, can only monitor heavy fog. However, there is a growing demand for high data rates and expanded bandwidth in modern mobile radio networks. As a result, higher frequencies, e.g. around 80 GHz, are being implemented in order to fulfill these increased requirements. Notably, the attenuation induced as a result of fog at a given intensity increases as operating frequency rises, allowing, for the first time, the possibility of using this system to monitor typical fog intensities, at high resolution and low cost. Here, a theoretical simulation is presented in which simulated fog patches are introduced into an area where a network of links is deployed. 2-D maps are generated utilizing the simulated microwave network to represent sensitivity thresholds for fog detection at three different frequencies- 20, 38 and 80 GHz. Real data measurements of fog are also demonstrated using 38 GHz band links. The results indicate the vast future potential of commercial microwave links as an opportunistic system for monitoring fog.