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Areal rainfall estimation using moving cars as rain gauges - laboratory and field experiment

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Areal precipitation estimation for fine temporal and spatial resolution is still a challenging task. Beside the fact that newly developed instrumentations, e.g. weather radar, provide valuable information with high spatial and temporal resolutions, they are subject to different sources of errors. On the other hand, recording rain gauges provide accurate point rainfall depth, but are still often poor in density. Equipping a car with a GPS device as well as sensors measuring rainfall makes it possible to implement cars on the streets as the moving rain gauges. Initial results from a modeling study assuming arbitrary measurement errors have shown that implementing a reasonable large number of inaccurate measurement devices (raincars) provide more reliable areal precipitations compared to the available rain gauge network. The purpose of this study is to derive relationships between sensor readings and rain rate in a laboratory and quantify the errors. Sensor readings involve wiper frequency and optical sensors which are on the cars to automate wiper activities. Besides, the influence of car speed on the sensor readings is investigated implementing a car-speed simulator. It has been observed that the manual wiper activity adjustment, according to front visibility, shows a strong relationship between rainfall intensity and wiper speed. Two optical sensors calibrated in laboratory showed a relatively strong relationship with the rain intensity recorded by a tipping bucket. A positive relationship between the velocity and the amount of water has been observed meaning that the higher the speed of a car, the higher the amount of water hitting the car. Additionally, some preliminary results of the field experiments are discussed.