

# Using moving cars to measure rainfall

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An individual in the car adjusts the wiper speed manually depending on the windscreen visibility. The visibility is related to the intensity of the rain set up by the rain simulator, a machine that uses a sprinkler irrigation system with adjustable nozzles to simulate light to heavy rain. Credit: Daniel Fitzner, [ikg.uni-hannover.de](http://ikg.uni-hannover.de)

Drivers on a rainy day regulate the speed of their windshield wipers according to rain intensity: faster in heavy rain and slower in light rain. This simple observation has inspired researchers from the University of Hanover in Germany to come up with 'RainCars', an initiative that aims

to use GPS-equipped moving cars as devices to measure rainfall. The most recent results of the project are now published in *Hydrology and Earth System Sciences*, an open access journal of the European Geosciences Union (EGU).

Rainfall can be very variable across different parts of a region such as Northern Germany. Conventional [rain](#) gauges are accurate, but are often distributed too sparsely to capture much of this variation. Having good information about precipitation is important for flood prediction and prevention, for example.

"If moving cars could be used to measure rainfall the network density could be improved dramatically," explains project-leader Uwe Haberlandt, who says the idea for RainCars emerged during a brainstorming session between geoinformatics researchers and hydrologists. With over 40 million cars in Germany alone, and with traffic increasing worldwide, the multi-disciplinary team might be onto a winner.

Now, with a lab equipped with a rain simulator, the researchers have been able to put their idea to the test. They placed cars with different wiper systems under the rain machine, which uses a sprinkler irrigation system with adjustable nozzles to simulate light to heavy rain, to find out exactly how wiper speed relates to rainfall intensity.

In one set of experiments, an individual in the car adjusted the wiper speed manually, depending on the windscreen visibility. "The experiments have shown that the front visibility is a good indicator for rainfall intensity," says Ehsan Rabiei, Haberlandt's collaborator and the paper's lead author. But the measurements could depend on the person adjusting the wiper speed so may not be very reliable.

In another set of experiments, the team used the rain machine to test

optical sensors that are installed in many modern cars to automate wipers. The sensors use a system of infrared laser beams that detect when drops of rain accumulate on the surface of the device. Each sensor reading corresponds to a specific amount of water, with more frequent readings corresponding to more intense rainfall.

"The optical sensors measure the rain on the windshield in a more direct and continuous manner so, currently, they would be the better choice for rain sensors in cars," says Haberlandt.

The team could also test the effects of car movement on the measurements by placing the sensors on a rotating device, which simulates car speed, under the rain simulator. By knowing how the readings are affected by car speed, they can correct for this effect when using moving cars to measure rainfall.

But speed is not all that can alter the rain measurements, as Rabiei explains. "Our experiments so far were carried out in an ideal and controlled environment. In nature there are external effects like wind, spray from other cars or shielding trees that can affect the readings, and rainfall characteristics are different from the rain simulator."

However, Haberlandt clarifies, "the value of using moving cars to measure rainfall is not about a higher accuracy of rainfall measurements but about a much higher number of measurement points." In a *Hydrology and Earth System Sciences* study published in 2010, two of the team members showed that a high number of less accurate rain gauges gives more reliable rainfall readings than a low number of very accurate devices.

The researchers are already working on field experiments using cars to measure real [rainfall](#) in and around the city of Hanover. "There are some volunteers, a taxi company and a car company involved in the field

experiments. We certainly would like to have some more people engaged."

**More information:** Paper: [www.hydrol-earth-syst-sci.net/...ss-17-4701-2013.html](http://www.hydrol-earth-syst-sci.net/...ss-17-4701-2013.html)

The 2010 study mentioned above is by U. Haberlandt and M. Sester: Areal rainfall estimation using moving cars as rain gauges – a modelling study, Hydrol. Earth Syst. Sci., 14, 1139-1151, 2010. [www.hydrol-earth-syst-sci.net/...ss-14-1139-2010.html](http://www.hydrol-earth-syst-sci.net/...ss-14-1139-2010.html)

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