



Measuring rainfall with low-cost cameras

Paola Allamano, Paolo Cavagnero, Alberto Croci, and Francesco Laio
Politecnico di Torino, Torino, Italy (paola.allamano@polito.it)

In Allamano et al. (2015), we propose to retrieve quantitative measures of rainfall intensity by relying on the acquisition and analysis of images captured from professional cameras (SmartRAIN technique in the following). SmartRAIN is based on the fundamentals of camera optics and exploits the intensity changes due to drop passages in a picture. The main steps of the method include: i) drop detection, ii) blur effect removal, iii) estimation of drop velocities, iv) drop positioning in the control volume, and v) rain rate estimation. The method has been applied to real rain events with errors of the order of $\pm 20\%$.

This work aims to bridge the gap between the need of acquiring images via professional cameras and the possibility of exporting the technique to low-cost webcams. We apply the image processing algorithm to frames registered with low-cost cameras both in the lab (i.e. controlled rain intensity) and field conditions. The resulting images are characterized by lower resolutions and significant distortions with respect to professional camera pictures, and are acquired with fixed aperture and a rolling shutter. All these hardware limitations indeed exert relevant effects on the readability of the resulting images, and may affect the quality of the rainfall estimate.

We demonstrate that a proper knowledge of the image acquisition hardware allows one to fully explain the artefacts and distortions due to the hardware. We demonstrate that, by correcting these effects before applying the image processing algorithm, quantitative rain intensity measures are obtainable with a good accuracy also with low-cost modules.