On the possibility of calibrating urban storm-water drainage models using gauge-based adjusted radar rainfall estimates

Susana Ochoa[1], Li-Pen Wang[1], Nuno Simões[2], Christian Onof[1], Čedo Maksimović[1]
[1]*Imperial College London (Urban Water Research Group), United Kingdom*
[2] *Department of Civil Engineering, University of Coimbra*

Preferred presentation format: Full presentation

Urban storm-water drainage models are essential tools for urban planning, real-time operation, and urban flood forecasting and warning. The main input for these models is rainfall; therefore, the quality of rainfall estimates dominates the overall reliability of urban storm-water drainage models [1]. Raingauge and radar are two commonly-used sensors for rainfall estimation at urban scales [2]. Raingauges provide accurate point estimates near the ground surface, but cannot capture the spatial variability of rainfall which has a significant impact on the physical processes of drainage systems [3-5]. In contrast, radars can provide better spatial description of rainfall, but their accuracy is in general insufficient, particularly in the case of extreme rainfall magnitudes [6, 7]. Until recently, urban storm-water drainage models were calibrated using only raingauge data, which usually results in overly conservative models. With the advent of weather radars, radar rainfall estimates with higher temporal and spatial resolution have become increasingly available and have started to be used operationally for urban storm-water model calibration and real-time operation. Nonetheless, the insufficient accuracy of radar rainfall estimates has proven problematic and has hindered its widespread practical use. This work will explore the possibility of improving the applicability of radar rainfall estimates to calibration of urban storm-water drainage models by employing gauge-based radar rainfall adjustment techniques. The Beddington catchment in South London is used as case study. Results suggest that a better calibration could be obtained by using adjusted radar estimates as input, as compared to using only radar or raingauge estimates.

References

1. Golding, B.W., *Uncertainty propagation in a London flood simulation.* Journal of Flood Risk Management, 2009. **2**(1): p. 2-15.
2. Cole, S.J. and R.J. Moore, *Hydrological modelling using raingauge- and radar-based estimators of areal rainfall.* Journal of Hydrology, 2008. **358**: p. 159-181.
3. Syed, K.H., et al., *Spatial characteristics of thunderstorm rainfall fields and their relation to runoff.* Journal of Hydrology, 2003. **271**(1-4): p. 1-21.
4. Tabios, G.Q. and J.D. Salas, *A comparative analysis of techniques for spatial interpolation of precipitation.* JAWRA Journal of the American Water Resources Association, 1985. **21**(3): p. 365-380.
5. Vischel, T., et al., *Generation of High-Resolution Rain Fields in West Africa: Evaluation of Dynamic Interpolation Methods.* Journal of Hydrometeorology, 2011. **12**(6): p. 1465-1482.
6. Einfalt, T., M. Jessen, and B. Mehlig, *Comparison of radar and raingauge measurements during heavy rainfall.* Water Science and Technology, 2005. **51**(2): p. 195-201.
7. Harrison, D.L., R.W. Scovell, and M. Kitchen, *High-resolution precipitation estimates for hydrological uses.* Proceedings of the Institution of Civil Engineers: Water Management, 2009. **162**(2): p. 125-135.

8. Krajewski, W.F., *Cokriging radar-rainfall and rain gage data.* Journal of Geophysical Research, 1987. **92**(D8): p. 9571-9580.
9. Todini, E., *A Bayesian technique for conditioning radar precipitation estimates to rain-gauge measurements.* Hydrol. Earth Syst. Sci., 2001. **5**(2): p. 187-199.
10. Mazzetti, C., *Report on performance of the new methodology. Deliverable 7.4, MUSIC Project (Multiple Sensor Precipitation Measurements, Integration, Calibration and Flood Forecasting)*, 2004.