“Rainfall kinetic energy and intensity relationships in Mexico City”

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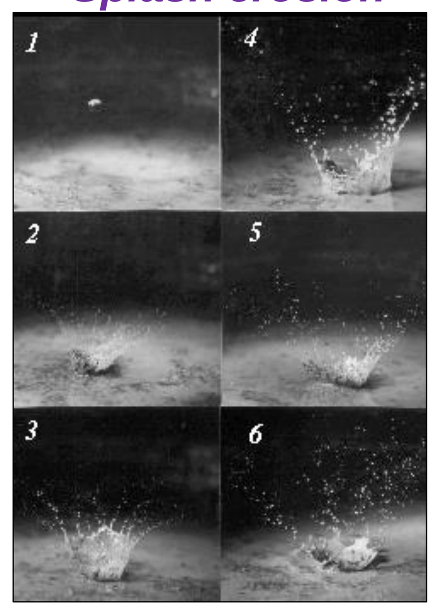
INTRODUCTION

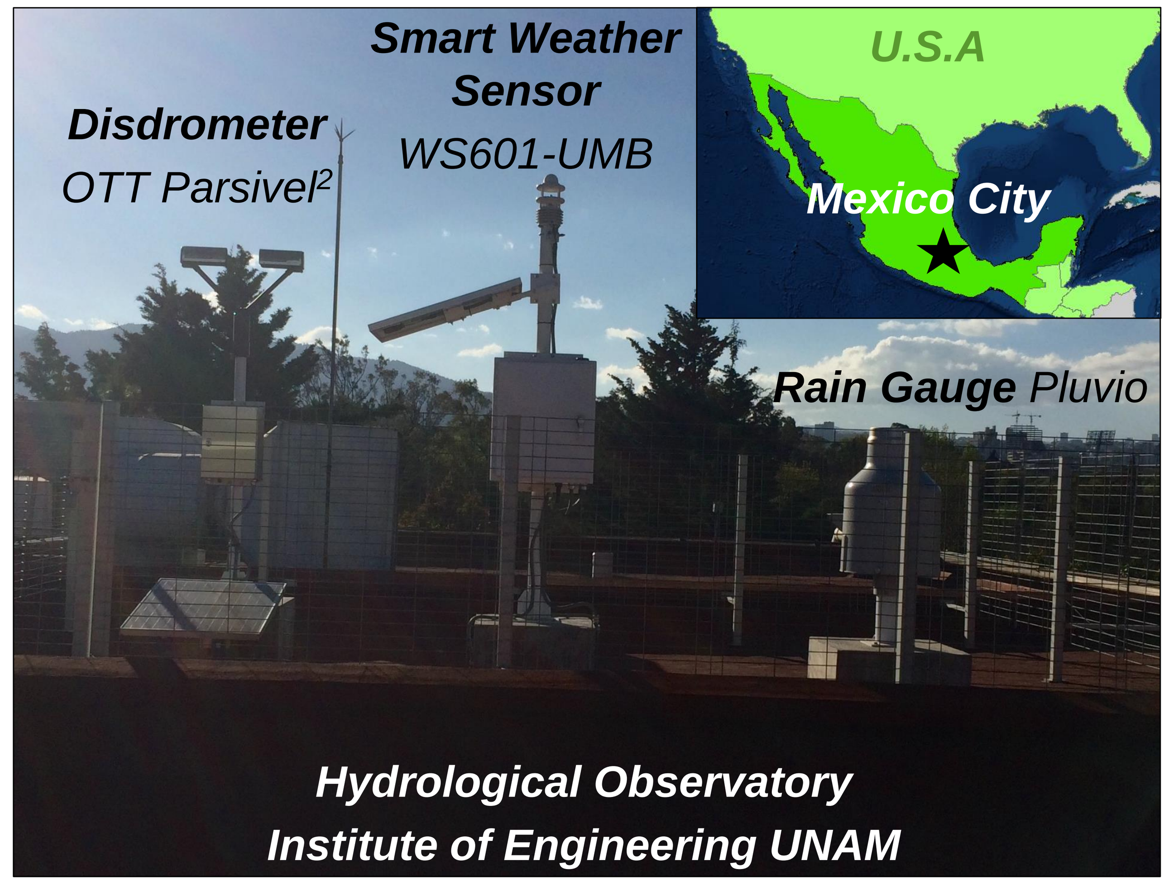
The kinetic energy of rainfall is widely used as erosivity indicator for estimating soil detachment (erosion) induced by the impact of raindrops.



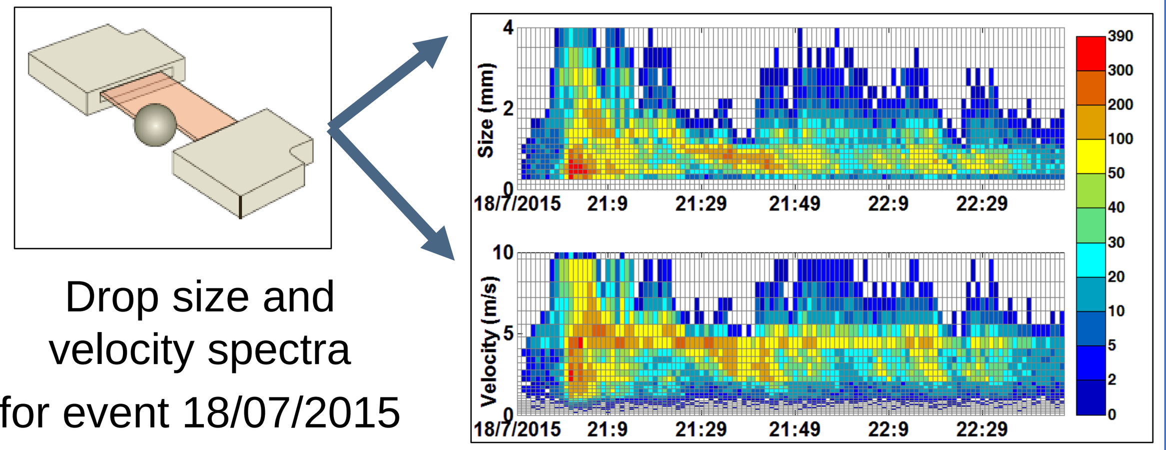
This study considered two ***rainfall erosivity indices***:

- **Kinetic Energy Content** (KE_{mm}, J m^{-2} mm^{-1})
- **Kinetic Energy Expenditure** (KE_{time}, J m^{-2} h^{-1})

The relationships between these rainfall erosivity indices (KE_{time} and KE_{mm}) and rainfall intensity were established by fitting to an functional model based on measurements of the number of drops by size and terminal velocity using laser optical disdrometer OTT Parsivel^2 located in the Hydrological Observatory in Mexico, City.



- The disdrometer captures both the ***size and velocity of falling particles***.
- Classifying them into one of **32** separate **size and velocity classes**.

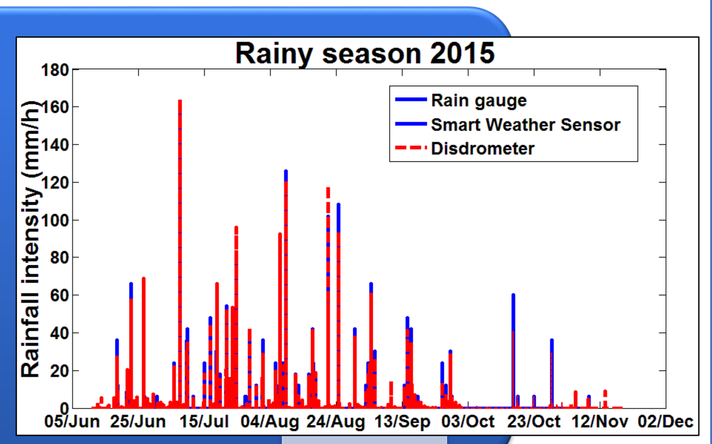


Drop size and velocity spectra for event 18/07/2015

METHODOLOGY

1. Data collection

- 64 rainfall events (June-November 2015)



2. Analysis Data

- Selection of rainfall events
- Comparisson between both instruments (Disdrometer and rain gauge)

✓ 1 mm of rain accumulation
✓ Individual events segmented by 1h
✓ A rainy minute must have at least 10 drops
✓ Rain rate of 0.1 mmh^{-1}

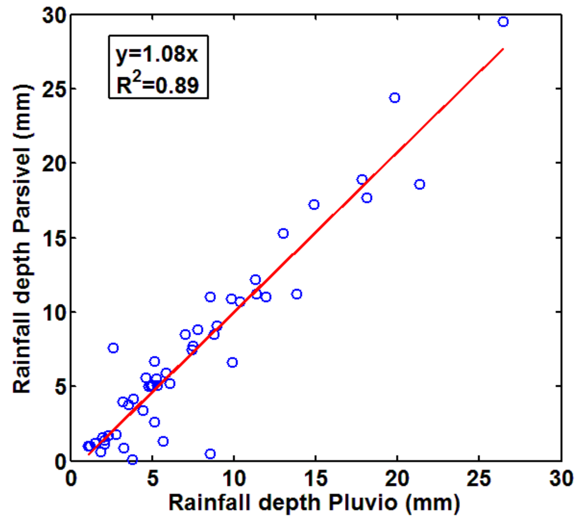
3. Establishment of Kinetic Energy - Intensity relation

- Fitting four models

RESULTS

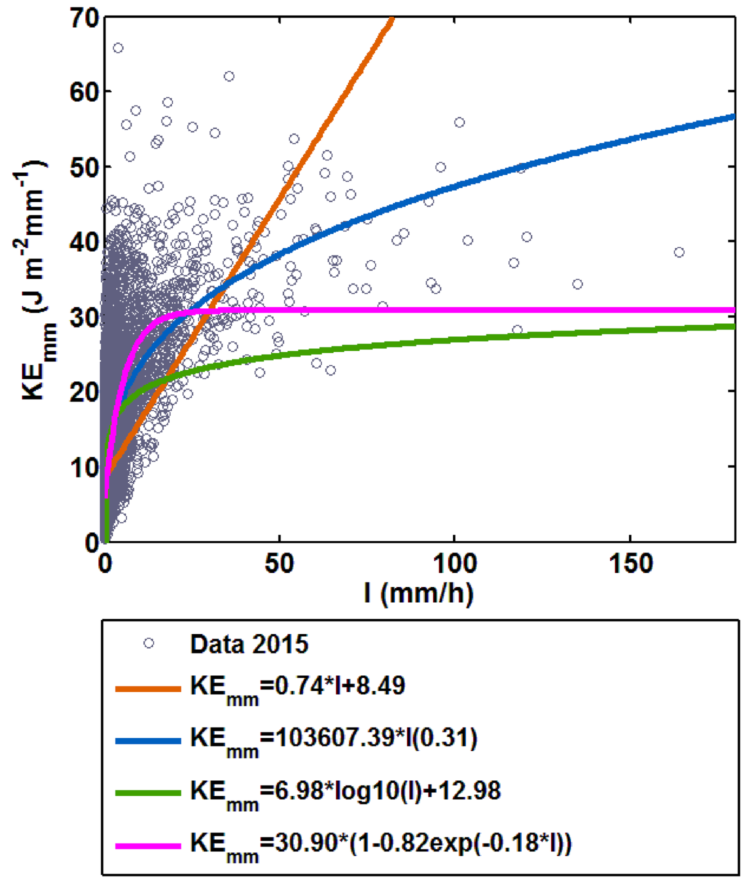
Comparison between disdrometer and rain gauge

The accuracy of the disdrometer Parsivel^2 has been assessed by comparing the 49 events rainfall depth registered to rain gauge Pluvio^2.

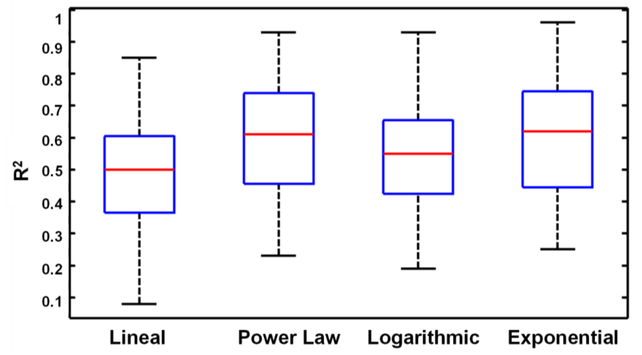


On the kinetic content (KE_{mm}) and rainfall intensity relationship

The KE_{mm}-I plots shows a very wide scatter at the lower (0-40 J m^{-2} mm^{-1}) intensity range. This result is comparable scatterplot of data by Salles et al (2002).

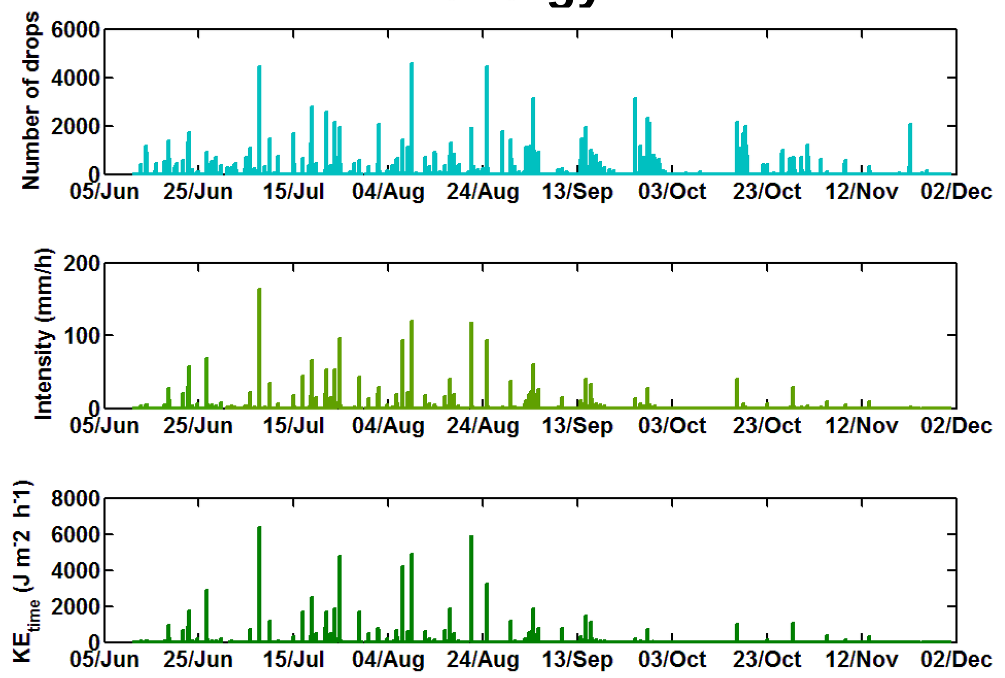


The best coefficient of determination (R^2) for KE_{mm} was obtained with power law and exponential equation.



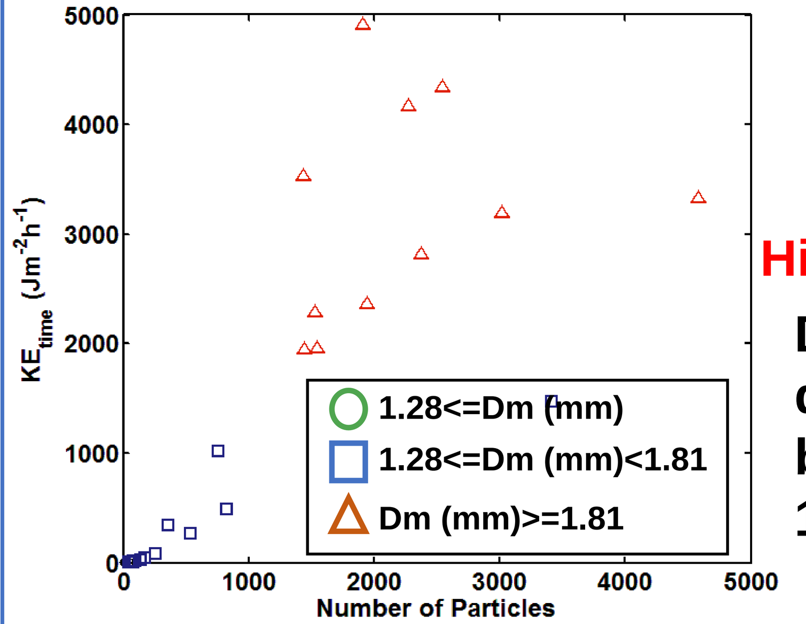
RESULTS

Time series of intensity rainfall and kinetic energy



Diameter raindrop observed in two rainfall events

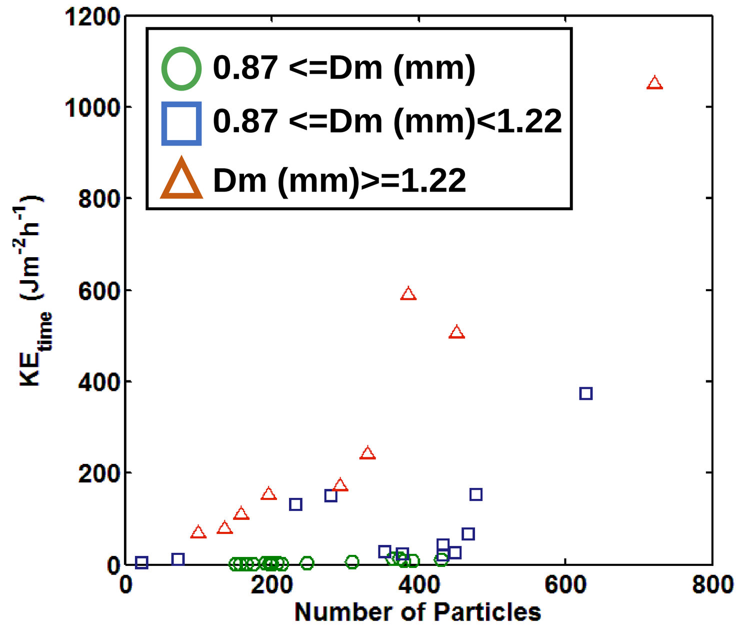
Event:08/08/2015



High value Ke_{time}

Drops with diameter between 1.28-1.81 mm

Event:28/10/2015

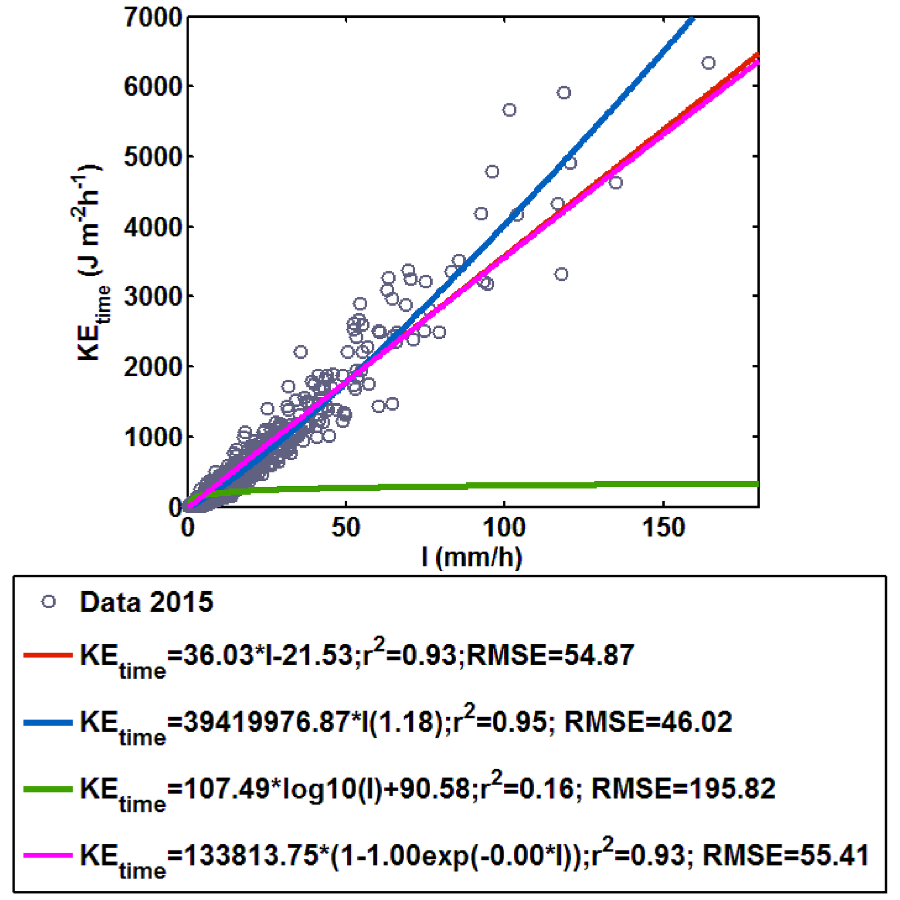


Low value Ke_{time}

Drops with diameter range between 0.87-1.22 mm

On the kinetic expenditure (KE_{time}) and rainfall intensity relationship

The KE_{time}-I plots indicates values between (0-2000 J m^{-2} h^{-1}) for rainfall intensity range of 0-40 mm/h. The worst fit was obtained with logarithmic equation.



CONCLUSIONS

- Rainfall kinetic energy represents the total energy available for detachment and transport by rainsplash. Therefore, the knowledge of the relationship KE-I is important for the prediction of erosion.
- It was found that in all cases the disdrometer OTT Parsivel^2 registered greater depth of rainfall than the rain gauge OTT Pluvio^2, which was previously established by Tokay (2013)
- The best fit for the relationship between the two kinetic energy indices and rainfall intensity, with a similar distribution is power law and exponential.