# A Single Device for Simultaneous Simulation of Wind and Water Erosion in the field


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## Introduction

Soil degradation and desertification is often caused by wind and water erosion. For many years researchers have been studying both processes separately. Laboratory investigations with wind tunnels that include rainfall simulators have shown the existence of very complex interactions between wind and water erosion. These results were confirmed in recent field research, especially for semi-arid regions. It was stated, that for future quantification and prediction of soil desertification both processes need to be measured together.

## Main Objectives

General objective of this study is to simultaneously measure erosion rates by wind and water erosion with a single device operational in the field. To reach this goal following problems need to be solved:

(1) Development of a procedure for the field experiments

(2) Integration of a nozzle type rainfall simulator into the portable wind tunnel

(3) Development of a combined sediment trap

## Methodology

### Current situation

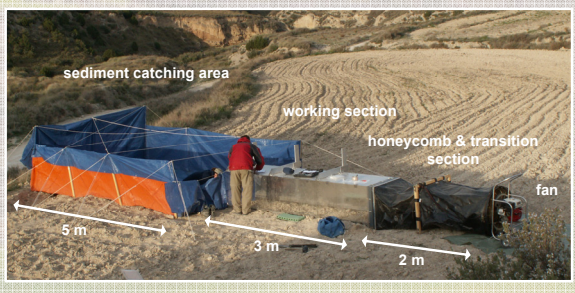


Fig. 1: Portable wind tunnel (*push type*) at María de Huerva (NE-Spain)

### Integration of rainfall simulator

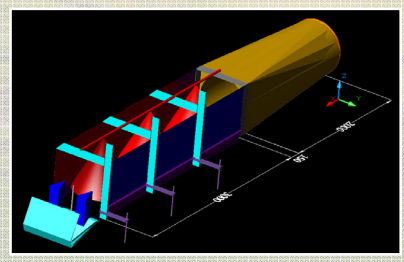

Fig. 2: Dimensional sketch of included rainfall simulator

Fig. 3: Small nozzle type rainfall simulator and pressure pump

### Test procedure in the field

**Installation of device:**

- Installation of plot boundaries and sediment trap
- Preparation of test plot (e.g. ploughing or sheep trampling)
- Inventory of test plot characteristics (e.g. vegetation cover, ridge orientation)
- Build-up of tunnel
- Measurement of wind velocity and direction in 2 m above ground

**Test characteristics:**

- Wind speed ~ 8 m/s (measured 15 cm above surface at the end of tunnel)
- Rain intensity ~ 40 mm/h (controlled by flow rate and pressure)
- Test duration 30 min
- Measurement interval water erosion: a) runoff => every 5 min b) splash => once at the End of test
- Measurement interval wind erosion: Two GTW traps and three MWAC samplers => once at the end of test

**Post preparation:**

- Taking soil samples from plot (soil moisture and texture)
- Installation of drag plate and measurement of shear stress

### Sediment trap

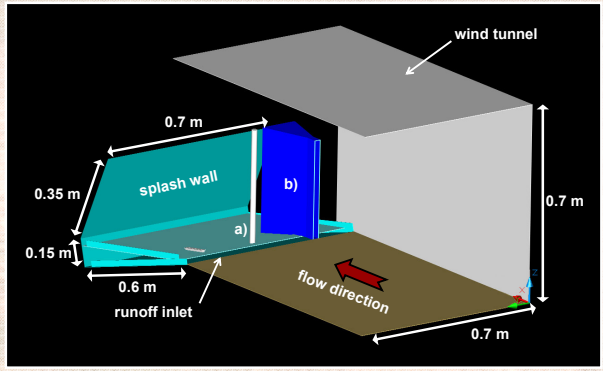


Fig. 4: Dimensional sketch of combined sediment catcher

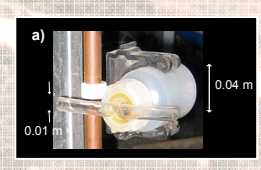


Fig. 5: Modified Wilson and Cooke Sampler (MWAC)
*Wilson & Cooke 1980*

- passive trap
- horizontally installed
- low cost
- good calibration results

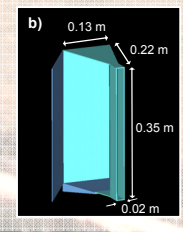


Fig. 6: Modified Guelph-Trent Wedge Trap (GTW)
*Nickling & McKenna-Neuman 1997*

- passive trap, vertically integrating
- outlet (back side) is covered with stainless steel wire mesh (mesh 200 µm)
- side can be opened for cleaning
- low cost
- good calibration results

## Outlook

**With this single device we expect to be able to obtain quantitative information regarding the relative impact of wind and water erosion on soil degradation and desertification. The ability to carry out in-situ tests in remote areas, especially taking into account different soil surfaces or different soil treatments, is its advantage compared to laboratory wind and rainfall simulators.**

## Literature


NICKLING, W. G. & MCKENNA-NEUMAN, C. (1997): Wind tunnel evaluation of a wedge-shaped aeolian sediment trap. – Geomorphology, 18, p. 333-345.

WILSON, S. J. & COOKE, R. U. (1980): Wind erosion. – In: Kirkby, M. J. & Morgan, R. P. C.: Soil erosion, Chichester.


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