INSTITUT FÜR METEOROLOGIE UND KLIMATOLOGIE

# An experimental study on drying paved surfaces

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# Motivation

- Restricted quality of operational water film thickness measurements on a paved surface
  - Small size of the sensor surface
  - Differing physical characteristics between sensor and paved surface

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=> **Eddy correlation** (EC) method useful?

- Benefits
  - + Physical characteristics unimportant
  - + Large source area
- Drawbacks
  - - Air layer between sensor and paved surface
  - - Large source area
  - - 30 min averaging time

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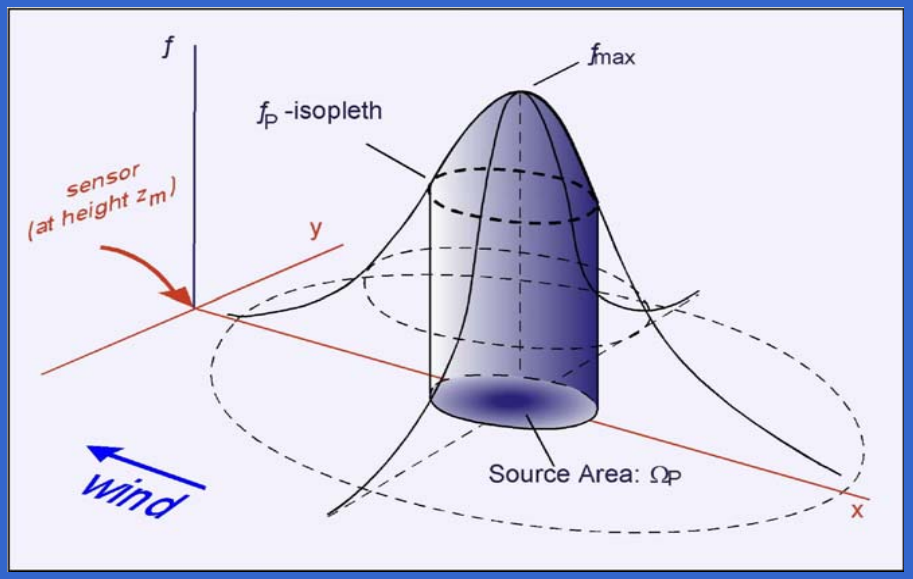
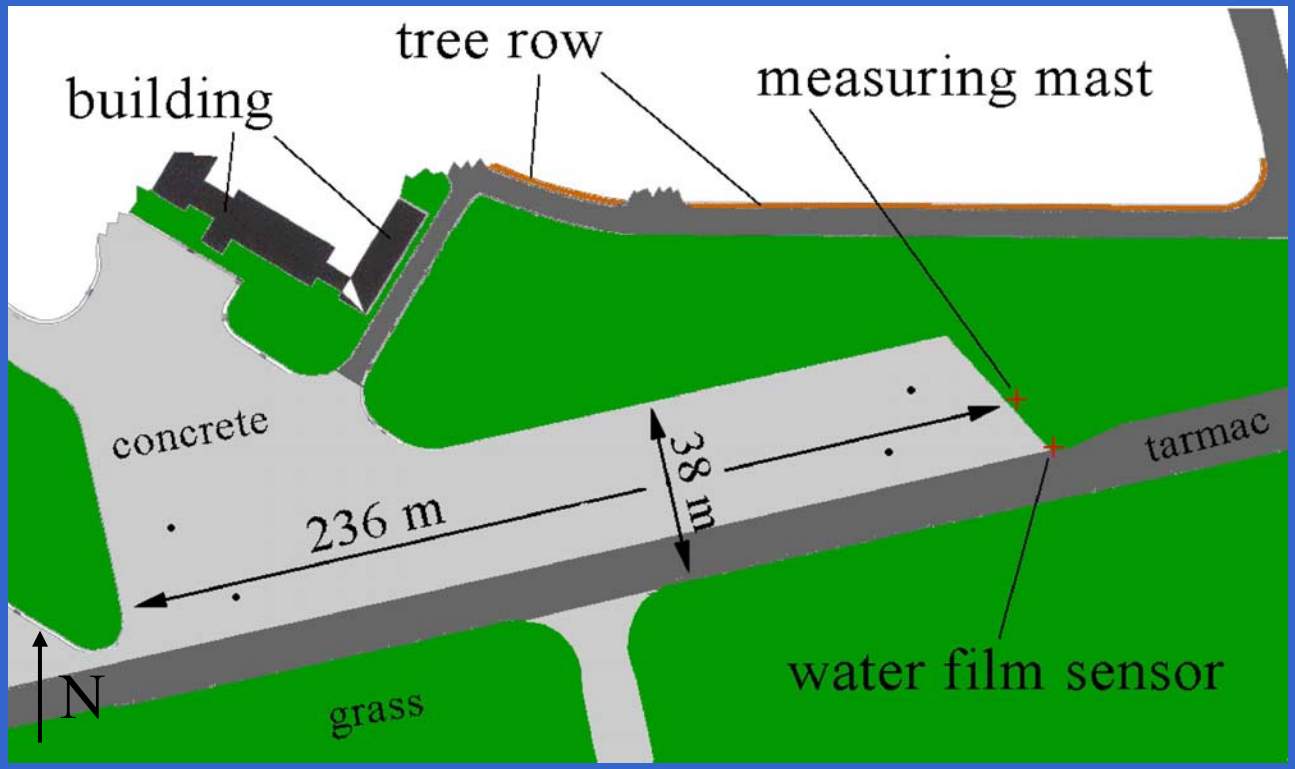



taken from Schmid (1994)

# Objectives

- **Comparison between non-contact (EC method) and contact measuring principle (water film sensor)**
  - **Field campaign** involving a large paved surface. Measurements during **wet** and **dry** conditions
    - EC system: Evaporation rates $E_{wet}$ and $E_{dry}$
    - Water film sensor: Calculational water film thickness *d*
  - **Data analysis** with regard to representativeness
    - EC system: Location of the source area
    - Water film sensor: Comparison of *d* with the water film on the paved surface

# Field Campaign



# Field Campaign

EC mast

Water film sensor

# EC System

- Characteristics of the measured evaporation rates
  - $E_{wet} > E_{dry}$
  - $E_{dry} \neq 0$

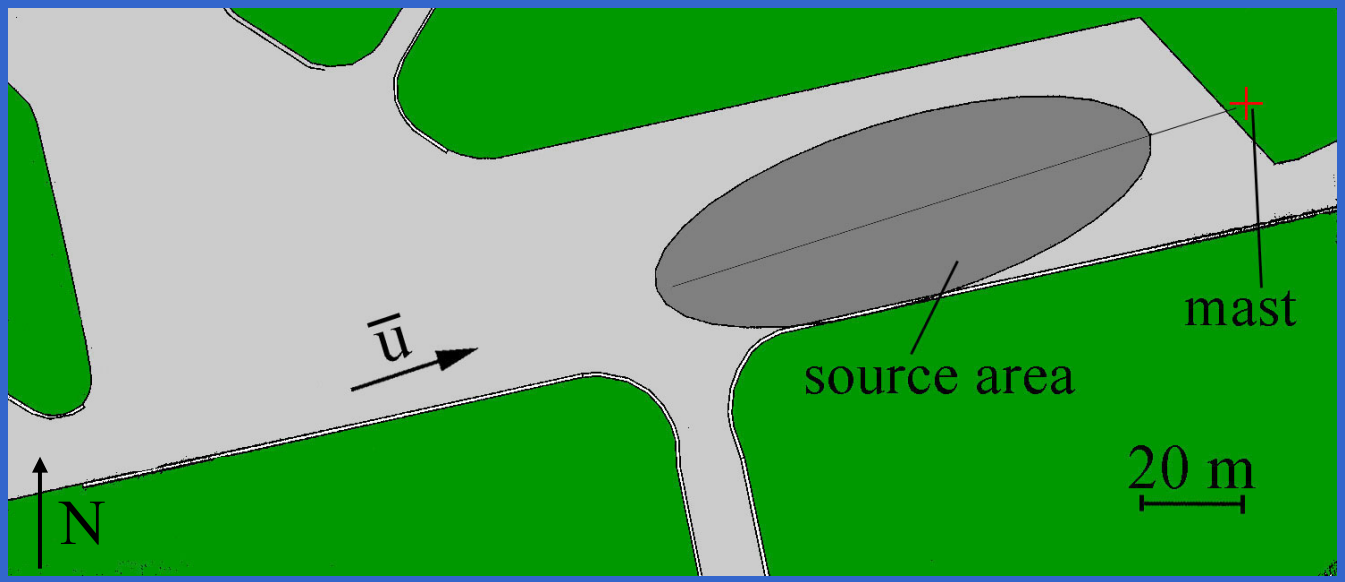
=> Does the source area extend into the surrounding evapo-transpirating grassland?

| Day | $E_{wet}$ [mm/h] | $E_{dry}$ [mm/h] |
|---|---|---|
| 03/10 | — | 0.03 |
| 04/02 | 0.28 | — |
| 04/28 | 0.21 | 0.07 |
| 05/12 | — | 0.06 |
| 05/14 | 0.15 | — |
| 05/15 | — | 0.03 |
| 05/18 | 0.13 | — |
| 05/20 | — | 0.11 |

# EC system

Numerical source area model by Schmid (2001)

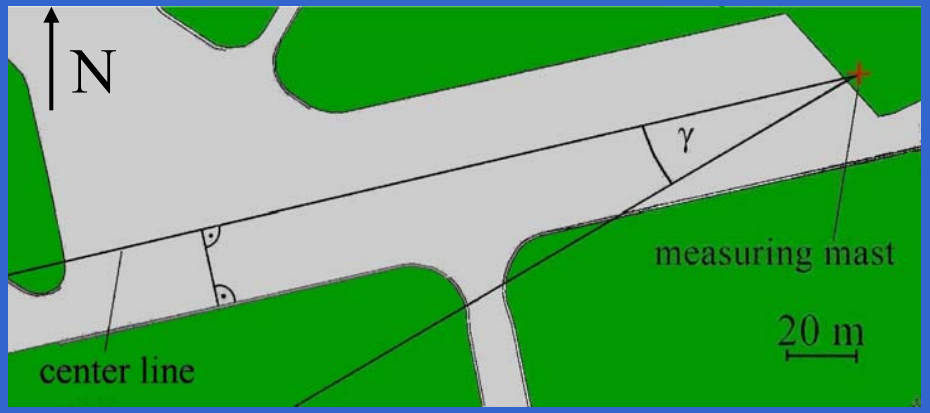
- Input: Measured data (30 min averages)
- Result: Source area confined to dry paved surface
  => Contradiction with $E_{dry} \neq 0$

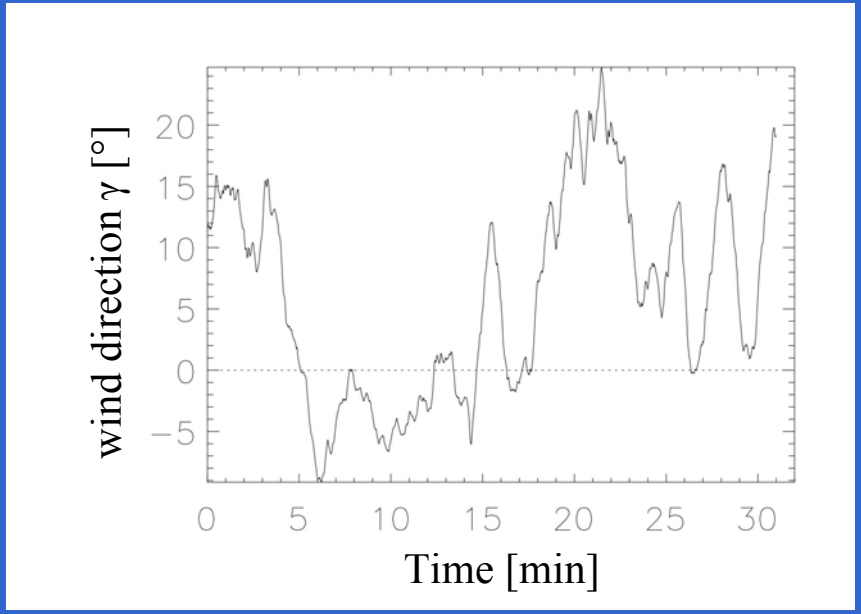


# EC system

Explanation: Model relies on a steady wind direction (30 min averaging interval)

=> Modeled source area too narrow




1 min running mean

# Water film sensor

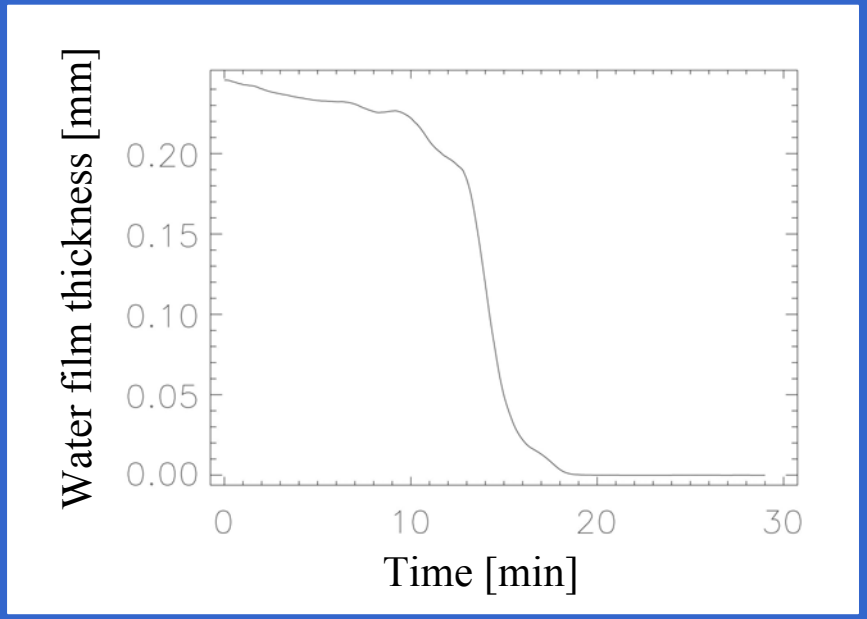
Sensor dryes more quickly than paved surface

Sensor surface much smaller than dry patches

# Water film sensor

- Patchy drying sensor surface

  => Measured water film thickness depends on water film area rather than thickness

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# Conclusion: Comparison

- EC method
  - Benefits
    - + Physical characteristics unimportant
    - + Source area (size is principally adjustable)
  - Drawbacks
    - - Dependence on meteorological conditions
    - - Intensive monitoring necessary
    - - Influence of road traffic on turbulence statistics not known
    - - 30 min averaging time
- Water film sensor
  - Benefits
    - + No dependence on meteorological conditions
    - + Influence of road traffic unimportant
    - + No averaging time
  - Drawbacks
    - - Small surface area
    - - Differing physical characterstics