A232 Actual Evaporation Measurement with a Glass Fiber Optic Cable

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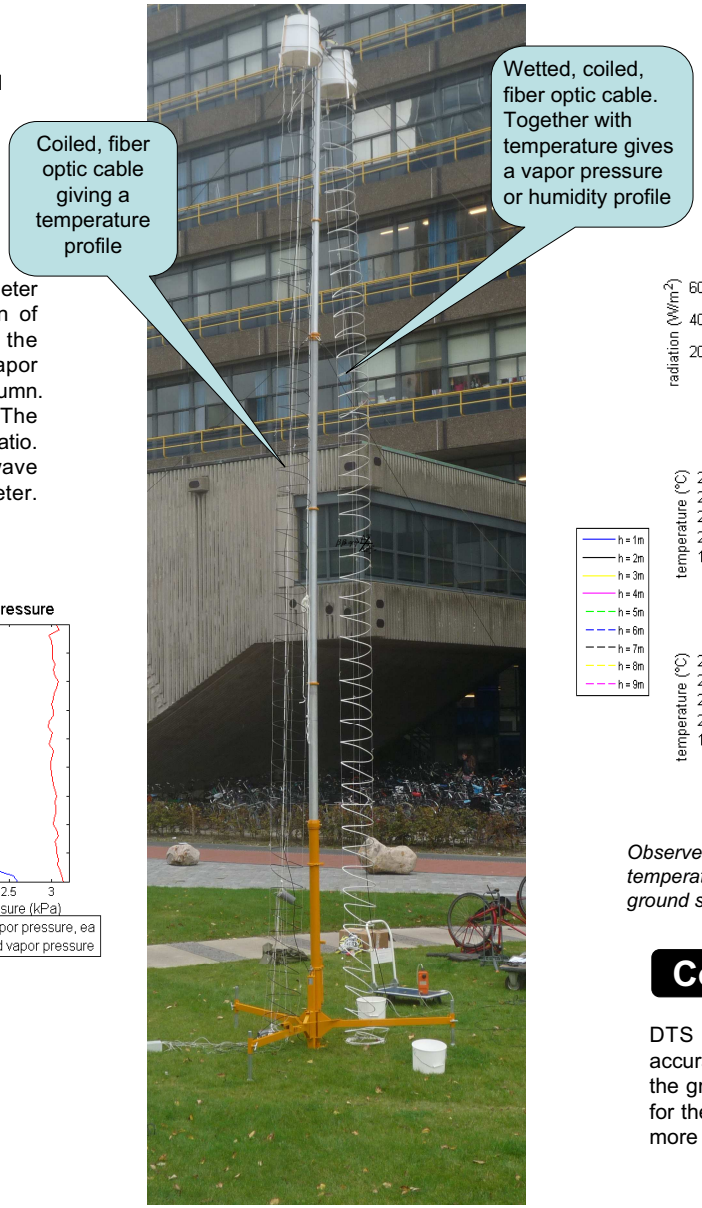
Research question

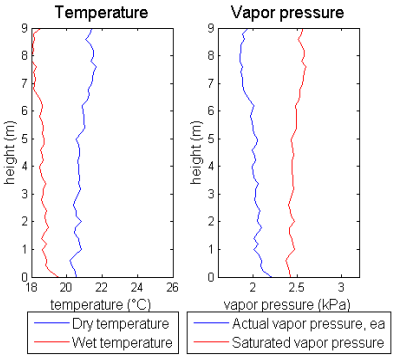
Can Distributed Temperature Sensing with a fiber optic cable be used to obtain actual evaporation using the Bowen ratio method, and what does it add to existing methods.

Measurement

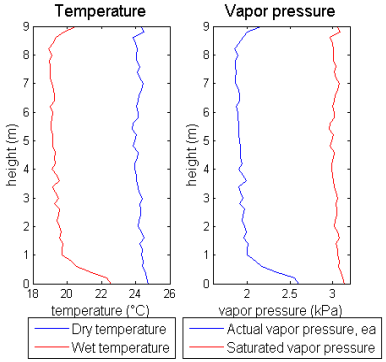
Both a wetted and dry cable have been installed hanging from a 10 meter (inflatable) mast. Cables were coiled to obtain a 20cm resolution of temperature over the column of air. By using the principle of the psychrometer, a near continuous distributed profile of actual vapor pressure (and hence humidity) can be created of the 10 meter air column. The DTS equipment delivers a complete profile every minute. The humidity profile and temperature profile allow determining a Bowen ratio. Additionally continuous measurements of net short and long wave radiation were performed with the Kipp & Zonen CNR1 radiometer.



Observations



Moment 1

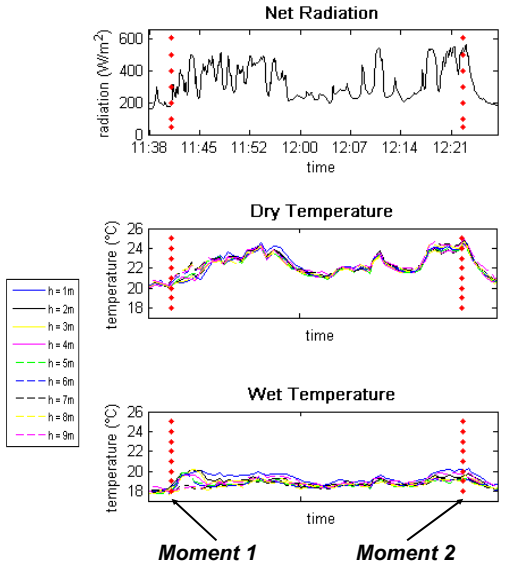


Moment 2

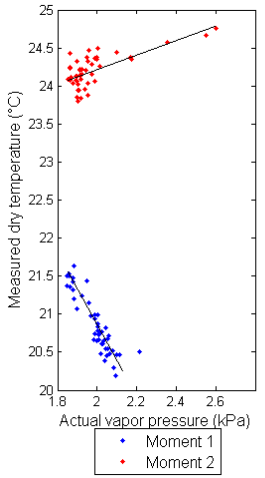
Every minute a complete vertical profile is delivered of
a) Observed temperature from the dry and wetted cable
b) Calculated actual vapor pressure and saturated vapor pressure

Results

At any moment in time a Bowen ratio can be defined from gradients of temperature over actual vapor pressure. The observations show Bowen ratios that were to be expected. It was noticed that temperatures of the (black) glass fiber cable are higher than air temperature due to direct sunlight. This effect on the Bowen ratio requires further investigation during longer observations.



Observed net radiation and dry and wet temperature between 1m and 9m above ground surface over time.



Temperature from the dry cable against actual vapor pressure over the full vertical profile for moment 1 and moment 2. The gradient is used for the Bowen ratio.

Conclusions

DTS observations have a high spatial and temporal resolution. Hence, accurately the evolvement of temperature and humidity in a column of air near the ground surface can be observed. In this sense it is a valuable tool to apply for the Bowen ratio method in comparative evaporation studies with other often more expensive equipment such as scintillometers and eddy covariance towers

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