



## **Modelling storage heat flux and evapotranspiration of a greened façade in an urban environment**

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Vertical greening systems contribute to a functioning urban green infrastructure, especially in highly sealed areas, and thus can help counteract the adverse effects of urbanisation. To estimate the overall water consumption of horizontal vegetation and its performance in transpiration, the Penman-Monteith formula, adjusted by the American Society of Civil Engineers (ASCE, 2005) is a well-established approach with a high temporal resolution. In this study, its applicability for a vertical greening system is assessed based on collected meteorological data and lysimeter measurements carried out at a western oriented façade greening test facility at Technical University of Berlin, Germany with five groups of six climbing plants (*Fallopia baldschuanica*) (Hölscher, 2016). This study aims to gain further knowledge on the energy exchange between wall and vertical greening system and questions whether the neglect of storage heat flux leads to a systematic error in the calculation of potential evapotranspiration. Using a calculation tool written in R, the potential evapotranspiration is calculated and the dynamics are analysed for three different phases in August 2014 and in different periods during the day. Key input parameters are identified and their impact on the potential evapotranspiration is quantified. In addition, the conductive and radiative heat fluxes of the wall are calculated separately for the greened and the non-greened scenario of different conductivity values. Although the sums of potential evapotranspiration are 3.7% higher than those of actual evapotranspiration, the daily patterns reveal higher deviations in the afternoon and at night. The shortwave and longwave radiation is identified as the main driving factor. Because an excess of actual evapotranspiration over potential evapotranspiration occurs at night, during periods without incoming shortwave radiation, this study suggests that storage heat flux fuels the actual evapotranspiration at this time in the form of longwave radiation. Further research is recommended to evaluate the energy exchange between the plant leaves and longwave radiation from the wall.

### References

ASCE (2005). ALLEN R.G., I.A. WALTER, R. ELLIOTT, T. HOWELL, D. ITENFISU, D. JENSEN. The ASCE standardized reference evapotranspiration equation. ASCE-EWRI Task Committee Report, January, 2005.  
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