MODELLING EVAPORATION OF A WATER DROPLET IN HUMID ENVIRONMENT

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ABSTRACT The influence from the external flow around a water droplet on the evaporation rate is here numerically investigated. Boundary conditions are set with special focus on a humid environment and the external flow is driven by natural convection. The numerical results are validated against experimental data available in the literature and are also verified through comparison between the heat and mass transfer analogy and Fick's law. The study shows that external temperature only marginally affects the evaporation rate if the air is dry and the droplet temperature is maintained. A distinct decrease in drying rate is, however, displayed for high relative saturation, and the dependence is increased at low temperature differences. The influence of natural convection induced by the heated droplet is furthermore shown to be of high importance since an increase of almost 120 % is observed in the heat transfer coefficient when compared to a value obtained from correlations based on conduction. The simulations indicate that the drying rate vary slightly with contact angle while experiments by others have yielded that the drying rate is invariable to the contact angle. Additional studies are therefore required.