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Three-dimensional front-tracking model for evaporation of drops¹ SAUL PIEDRA, CONACYT-CIDESI Centro Nacional de Tecnologias Aeronauticas, ALFONSO CASTREJON-PITA, University of Oxford, EDUARDO RAMOS, UNAM, GRETAR TRYGGVASON, Johns Hopkins University — We present the development of a full three-dimensional model to simulate the evaporation of falling drops. The evaporation model is based on the simultaneous solution of the mass, momentum, energy and vapor mass fraction conservation equations for incompressible fluids, properly adapted to incorporate the possibility of mass transfer at the boundary between the phases. The mass reduction of the drop is influenced by local thermodynamic conditions which in turn are modified by the dynamics of the drop motion. The vapor mass fraction at the interface is computed through the Clausius-Claperyon relation. The set of equations is defined in the whole domain, including the interface, and are solved using the finite volume/front-tracking method. The solution of the resulting linear equations systems are solved using the CUSP library implemented in a GPU in order to reduce the computational time. The validation for the evaporative flux calculation was done by comparison with a one-dimensional analytical solution for the evaporation of a planar surface. The simulation results for a static drop showed very good agreement with the d^2 law. Simulations for a single and multiple falling drops are also presented.

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