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Linear stability analysis of an evaporating binary liquid layer with fully transient reference profiles[1] HATIM MACHRAFI, Universite de Liege, ALEXEY REDNIKOV, PIERRE COLINET, Universite Libre de Bruxelles, PIERRE DAUBY, Universite de Liege — This study deals with an evaporating horizontal binary-liquid layer (aqueous solution of ethanol; mass fraction 0.1) in contact with air with an imposed transfer distance. Fully transient solutions for the reference state are first calculated by means of a finite difference method. Then, the linear stability problem is solved using the frozen-time approach. After decomposition into normal modes, we obtain a problem for the eigenvalues, depending on the time as a parameter, which is numerically solved using the Chebyshev decomposition. Solutal and thermal Rayleigh-Benard-Marangoni instabilities are taken into account together with the Soret effect. The critical times needed for instability to occur and corresponding liquid thicknesses, are calculated, showing that a critical liquid thickness can be found under which no instability can occur. The latter point coincides approximately with the diffusive boundary layer reaching the bottom of the liquid layer. For instance, for a gas/liquid thickness layer ratio fixed at 10, the critical liquid thickness appears to be rather small, about 18.5 μm, which is illustrative of the general tendency.

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