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Linear and nonlinear analyses of convective instabilities in evaporating liquid layers PIERRE DAUBY, MIREILLE DONDLINGER, JONATHAN MARGERIT, University of Liege, Belgium, PIERRE COLINET, Universite Libre de Bruxelles, Belgium — The present work consists in a theoretical study of Rayleigh-Bénard-Marangoni instabilities in an evaporating horizontal liquid layer which is surmounted by a mixture of its vapour and an inert gas. The fluid and the gas mixture form a 2-layer system but simplified models can be built to analyse the behaviour of the system. In particular, a 1-layer model can be deduced by introducing a generalized Biot number. In the so- called 1.5-layer approximation, the behaviour of the gas is simplified by only keeping the linear equation of vapour diffusion. In the linear study of thermoconvective instabilities, both simplified models are shown to be in good agreement with the complete 2-layer system. For the non linear approach, only the simplified models are considered. A Galerkin Eckhaus method is used to deduce amplitude equations for the weakly nonlinear analysis of the problem. The stability domains for the rolls, squares and hexagonal patterns emerging above threshold are determined. Both water and ethanol are used as fluids, while the inert gas is assumed to be air.

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