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The effect of noncondensables on thermocapillary-buoyancy convection TONGRAN QIN, ROMAN GRIGORIEV, Georgia Institute of Technology — We consider convection in a layer of volatile simple fluid with free surface subject to a horizontal temperature gradient in the presence of noncondensable gases, such as air, and driven by a combination of buoyancy and thermocapillary stresses. At ambient conditions a unicellular base flow becomes unstable as the temperature gradient is increased, developing a multicellular structure. Recent experimental studies showed that the composition of the gas phase has a significant effect on the convection pattern. In particular, although varying the average concentration of noncondensables over an experimentally accessible range has almost no effect on the average flow speed, the transition to multicellular convection is significantly delayed when noncondensables are evacuated. Using a combination of numerical simulations and linear stability analysis which account for heat and mass transport in the gas phase we show that this dependence is due mainly to the changes in thermocapillary stresses which are controlled by the variation in the composition of the gas phase that arises in response to evaporation and condensation.

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