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On Kelvin-Helmholtz instability around unmagnetized planets including a finite boundary layer

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The Kelvin-Helmholtz instability is studied by solving the ideal MHD equations for a compressible plasma. We include a finite boundary layer between the two plasmas, across which the velocity and the density change. We present growth rates for the transverse case, i.e. the interplanetary magnetic field is perpendicular to the flow velocity. The magnetosonic Mach number M, which characterizes compressibility, is an important quantity affecting the growth of the instability, when we include only a velocity profile. Assuming a change of both, the velocity and the density across the finite boundary layer, the results show that the growth rate is very sensitive to the ratio of the density of the upper layer to the density of the lower plasma layer. Including a density profile is very important for the application of the Kelvin-Helmholtz instability to the solar wind interaction with unmagnetized planets, such as Mars and Venus, where the plasma density increases from the magnetosheath to the ionosphere.