Hot disk issues

March 18, 2020, Revision: 1.3

1   Convection develops

Convection does develop after all; see Fig. 1. This can be seen nicely in $\overline{\rho u_y}$. However, the timestep became very short and the velocity is still increasing; see Fig. 2. Toward the end, however, the timestep becomes somewhat longer again.
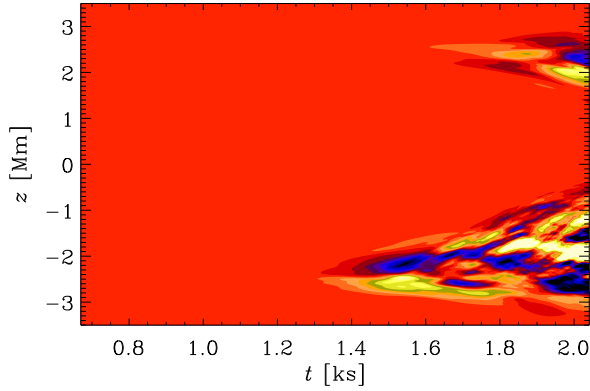

Figure 1: Contours of $\overline{\rho u_y}$. Convection starts first in the lower disk half.
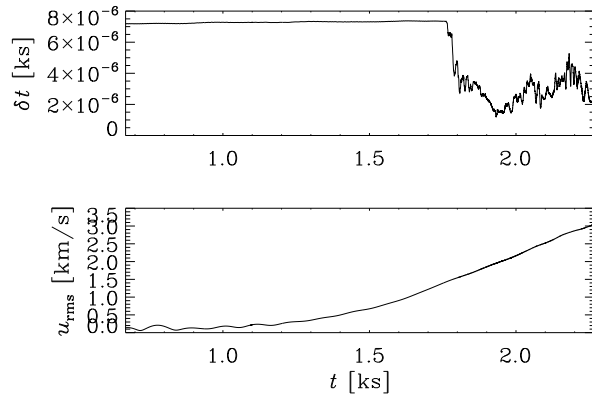

Figure 2: Evolution of timestep and rms velocity.

2   Early energy fluxes

At these early time, the convective flux, i.e., the sum of enthalpy and kinetic flux, goes still inward, i.e., it does not contribute to outward energy transport; see Fig. 4. We have to wait longer (but it is expensive). The temperature profile looks normal; see Fig. 4.
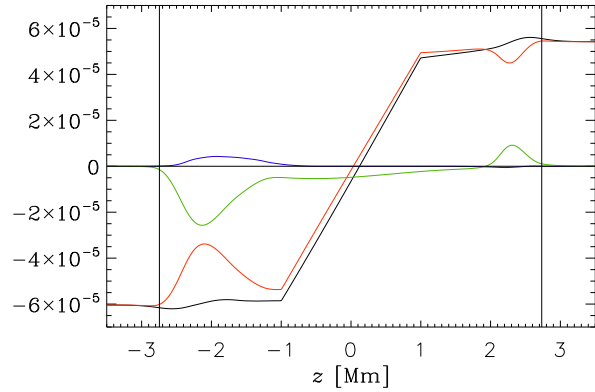

Figure 3: Profiles if total flux (black), radiative flux (red), convective [=kinetic+enthalpy] flux (green), and just kinetic flux (blue) at the last time.
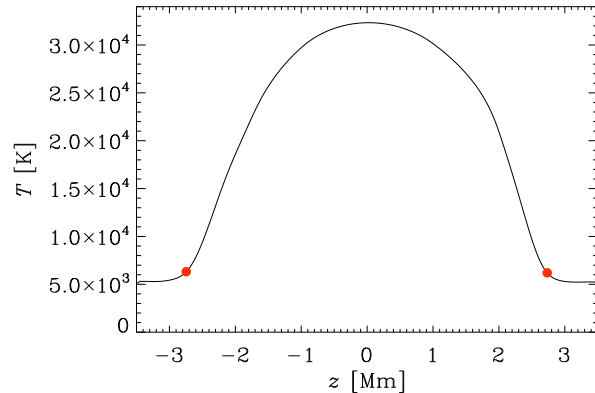

Figure 4: Temperature profile at the last time. The positions where the optical depth is unity are marked as red dots.

$$\nabla - \nabla_{ad} \equiv \frac{ds/c_p}{d\ln P}$$