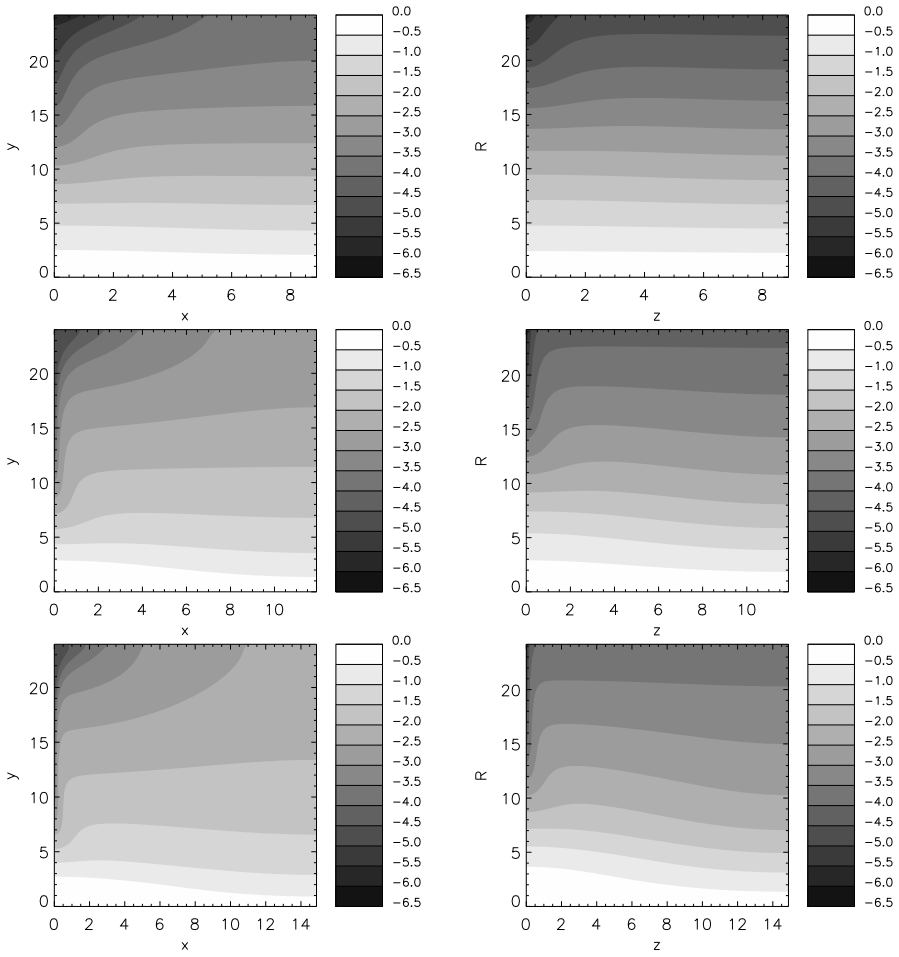

Fig. 9. Magnetic pressure maps, normalized to their value on the z-axis at the initial state, in the six final states of Figure 6.

are:

$$\frac{\rho_0(R)}{\rho_0(0)} = \frac{B_0^2(R)}{B_0^2(0)} = \left(1 + \frac{R^2}{8H_\star^2}\right)^{-s}, \qquad (32)$$

where s is defined by $s \equiv 2\sigma_\star^2/[(1+\alpha)c_s^2]$. If we define the scale height of the gas, H, as the radial distance at which the density of the gas is reduced to $1/e$ of its value at $R = 0$, then $H^2 = 8(\exp(1/s) - 1)H_*^2$.

To illustrate the effect of using a non-constant gravitational acceleration, we useed $\alpha = 1$ but different values of s. We ran models where the upper cap was located at the distance $R_{\rm max}$ at which the density decreases to $(1 - 5) \times 10^{-6}$ of its value at $R = 0$. We have empirically derived that the larger the s-value is, the smaller the critical wavelength becomes. For $s = 4$, perturbations with $\lambda_z/2 = 3.85H_\star = 2.55H$ are marginally unstable, whereas they become marginally unstable at $\lambda_z/2 = 1.5H$ when $s = 8$. In terms of H, this result implies that the critical wavelength for $s = 4 - 8$ is smaller by almost a factor of $1.5 - 2.5$ than that for the model with constant gravity (see § 4.1) and, therefore, the growth timescale is shorter for larger s-values. Figure 11 shows the final equilibrium state for $s = 4$ and $\lambda_z/2 = 5.3H$. This λ_z-value is close to the horizontal wavelength with maximum growth rate. By comparing with Figure 6, we note that although the global appearance is similar to the case with constant gravity and $\lambda_z/2 = 15$, the field lines appear slightly more deformed. The main effect of a non-constant gravitational acceleration strength is to shorten the separation of the magnetic valleys. The projected surface density that an observer would see if the axis of the filament lies in the plane of the sky is shown in Figure 12 for a model with $s = 4$. The enhancement in the column density over a line of sight passing through the core of a condensation is 2.1 in this model. This factor is appreciably larger than