Fig. 11. Density stratifications (color scale given in cm^{-3}, blue panels); and temperature (color scale given in K, orange panels) of model 7 at $t = 10 \times 10^3$ yrs (top); $t = 18 \times 10^3$ yrs (middle); and $t = 24 \times 10^3$ yrs (bottom). The axes are labeled in units of 10^{16} cm. The broken line delimits the analytic solution proposed in § 2. The color figure can be viewed online.

equations 7–9). The model assumes that the interaction occurs in a very thin layer in which the material from the jet and the ISM mixes well. This situation is likely to occur in radiative flows, where the sizes of the cooling distances are small compared with the flow dimensions. This, however, is not the case for the resulting interaction of the outflow launched from Mira B and its surrounding environment.

The models reach a stationary state with a fixed stand-off distance between the jet head and the outflow source. This configuration might be relevant for the collimated outflow from Mira, in which the forward directed jet head has a very low proper motion with respect to Mira (see Meaburn et al. 2009).

We find that the non-radiative flow configurations (that result from the parameters deduced from the bipolar outflow from Mira) have broad interaction regions which approximately coincide with the predictions from the analytic model (in which a thin shell interaction is assumed). Also, the analytical solutions lie close to the contact discontinuity dividing the material in the jet cocoon from the shocked environment region.

We have tested the convergence of the numerical simulations for increasing resolutions. We find that at different resolutions we obtain similar large-scale flow structures, but with different structures at smaller scales (in which the Kelvin-Helmholtz instabilities associated with shear layers are active). Better convergence is expected only for resolutions higher by at least two orders of magnitude, in which the simulations would start to approach the "high Reynolds number regime" appropriate for the real, astrophysical flow.

We end by noting again that the present model of a bipolar jet/streaming ISM interaction is not completely consistent with the outflow from the Mira system (Meaburn et al. 2009). This is because in the binary Mira AB system, the mass loss rate from Mira A's uncollimated wind (with $\dot{M} \sim 10^{-6}\ M_\odot\ s^{-1}$, Ireland et al. (2007)) clearly dominates the interaction with the ambient medium. The mass loss from the bi-conical jet ($\dot{M}_j \sim 10^{-9}\ M_\odot\ s^{-1}$, inferred from Martin et al. (2007)), will simply modify the morphology created by the interaction from the isotropic wind and the ambient medium, except in the region in which the leading jet from Mira B emerges from the Mira A wind bubble. This is the region to which our model would in principle apply.

Future models of the outflow from Mira should include both the wind from the primary star and the collimated outflow from the secondary. This more complex flow will clearly be the topic of future papers on Mira's outflow/ISM interaction.

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