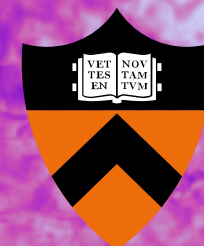


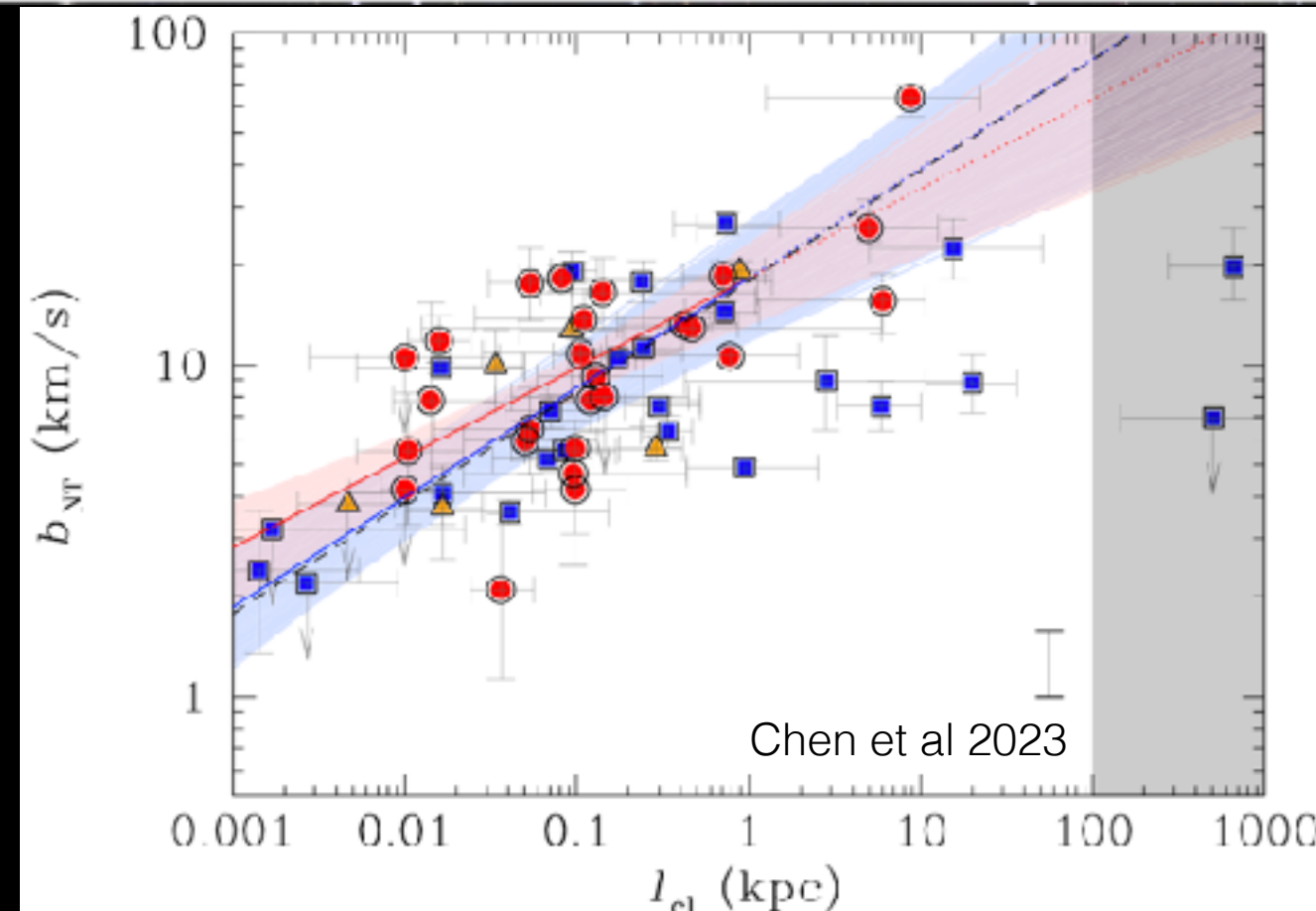
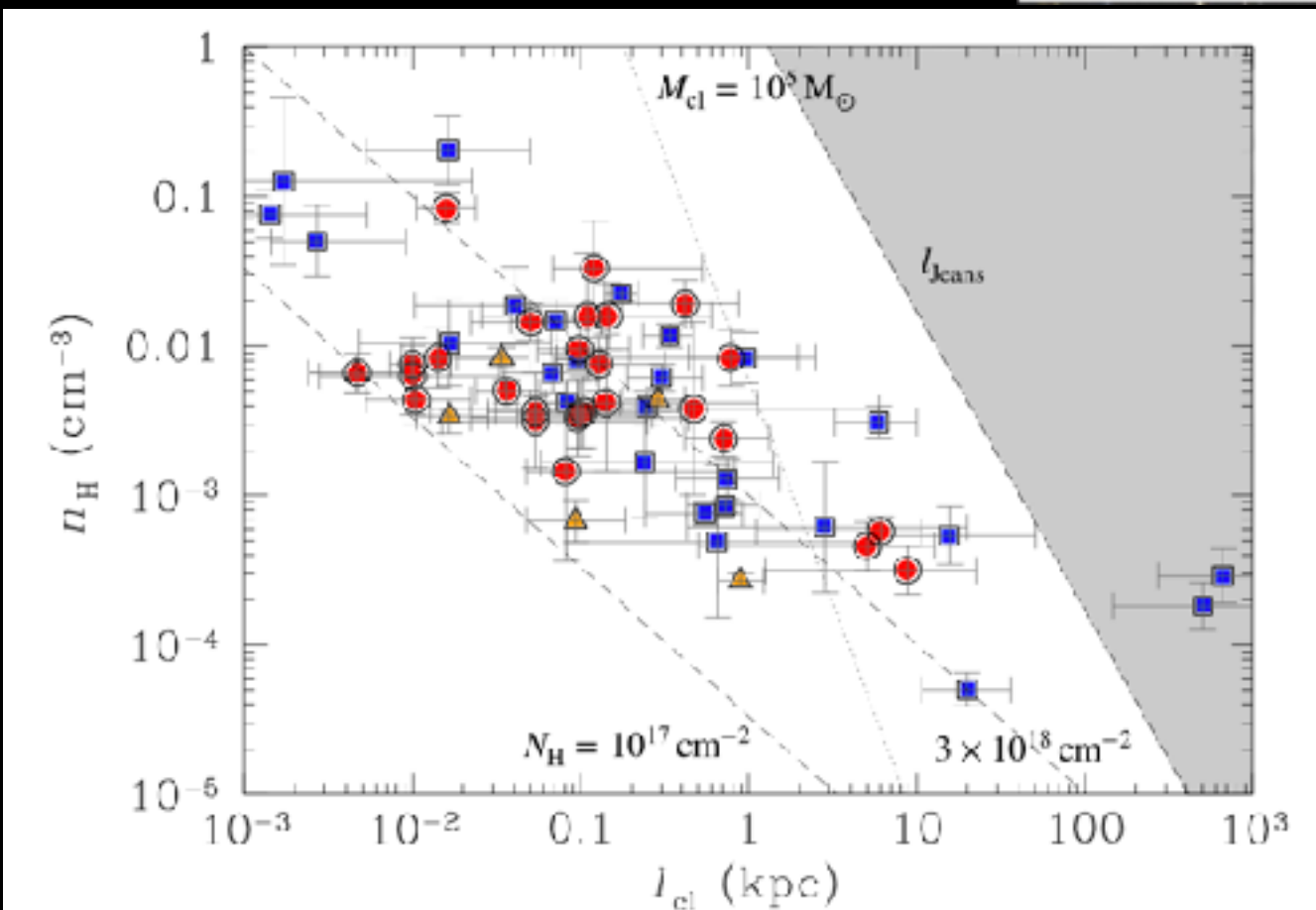
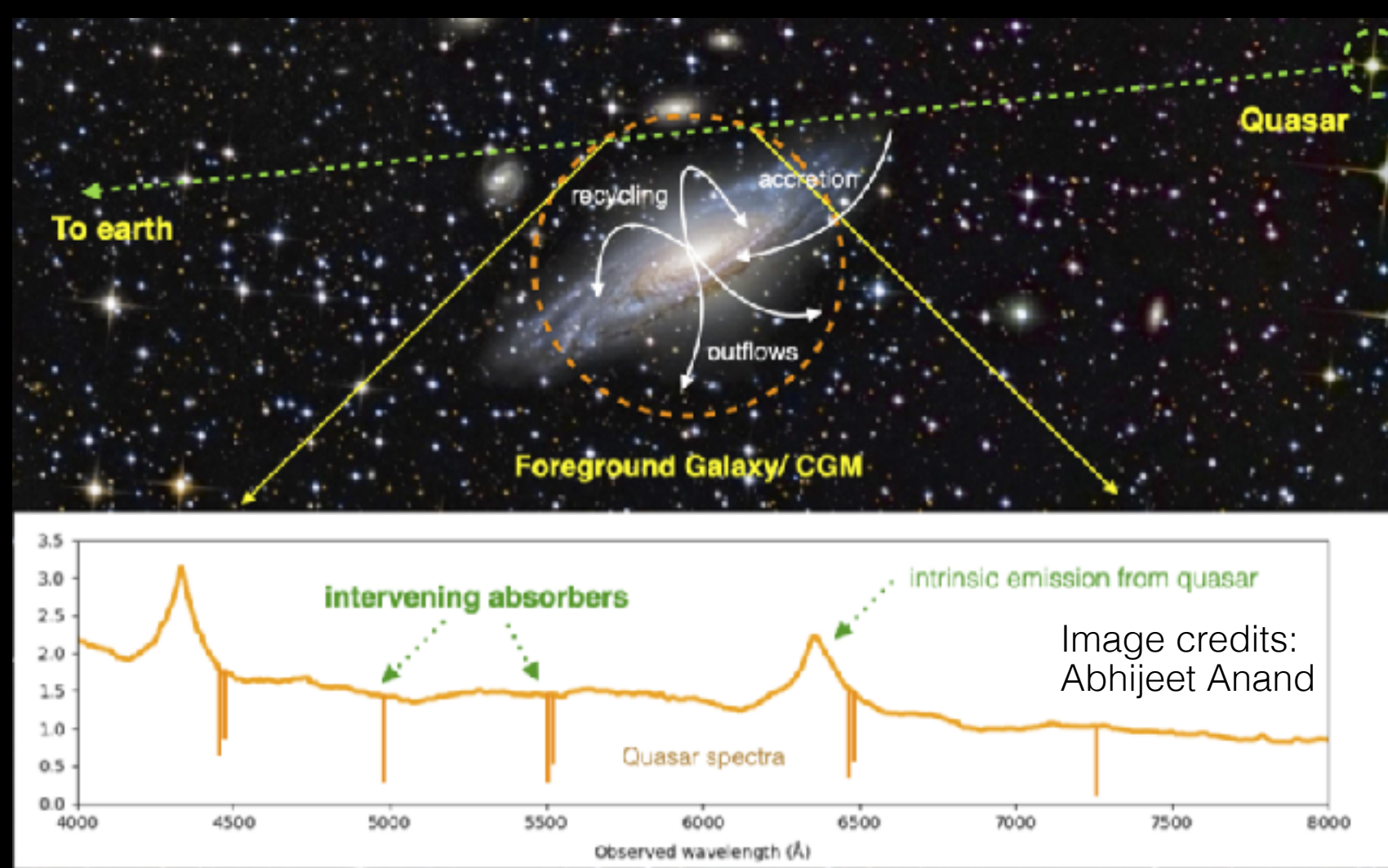
Simulating the multiphase CGM

Rajsekhar Mohapatra,
Alankar Dutta, Prateek Sharma, Eliot Quataert



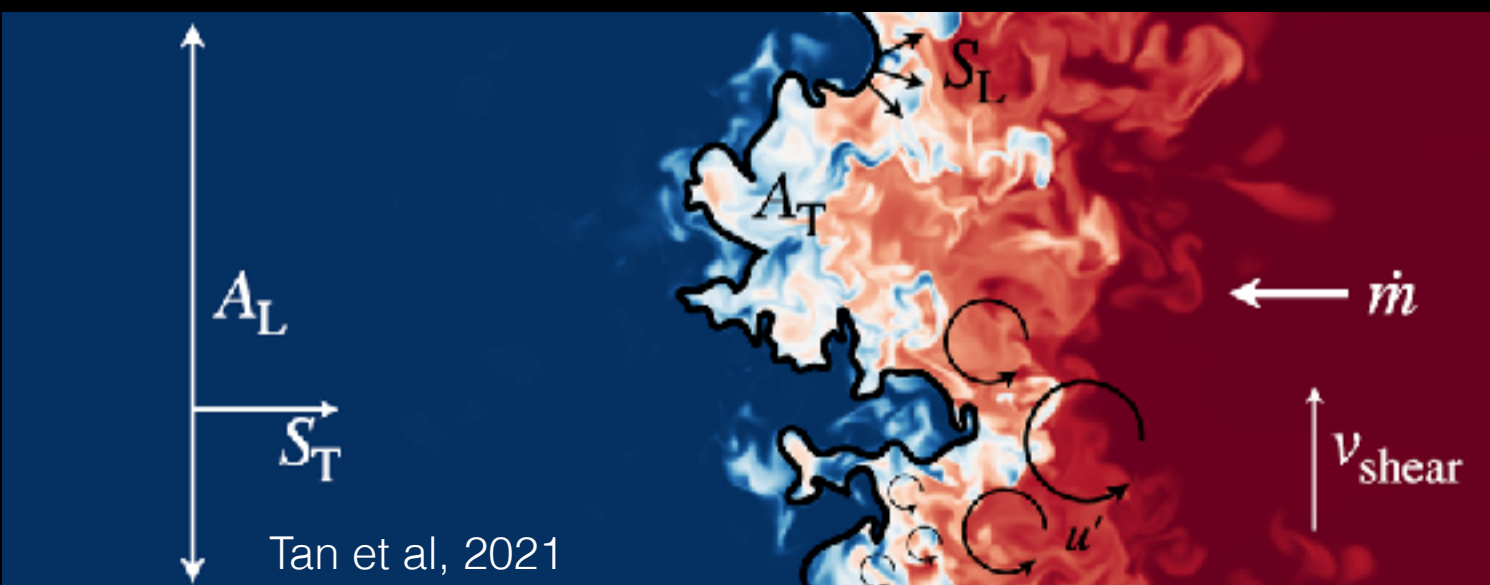
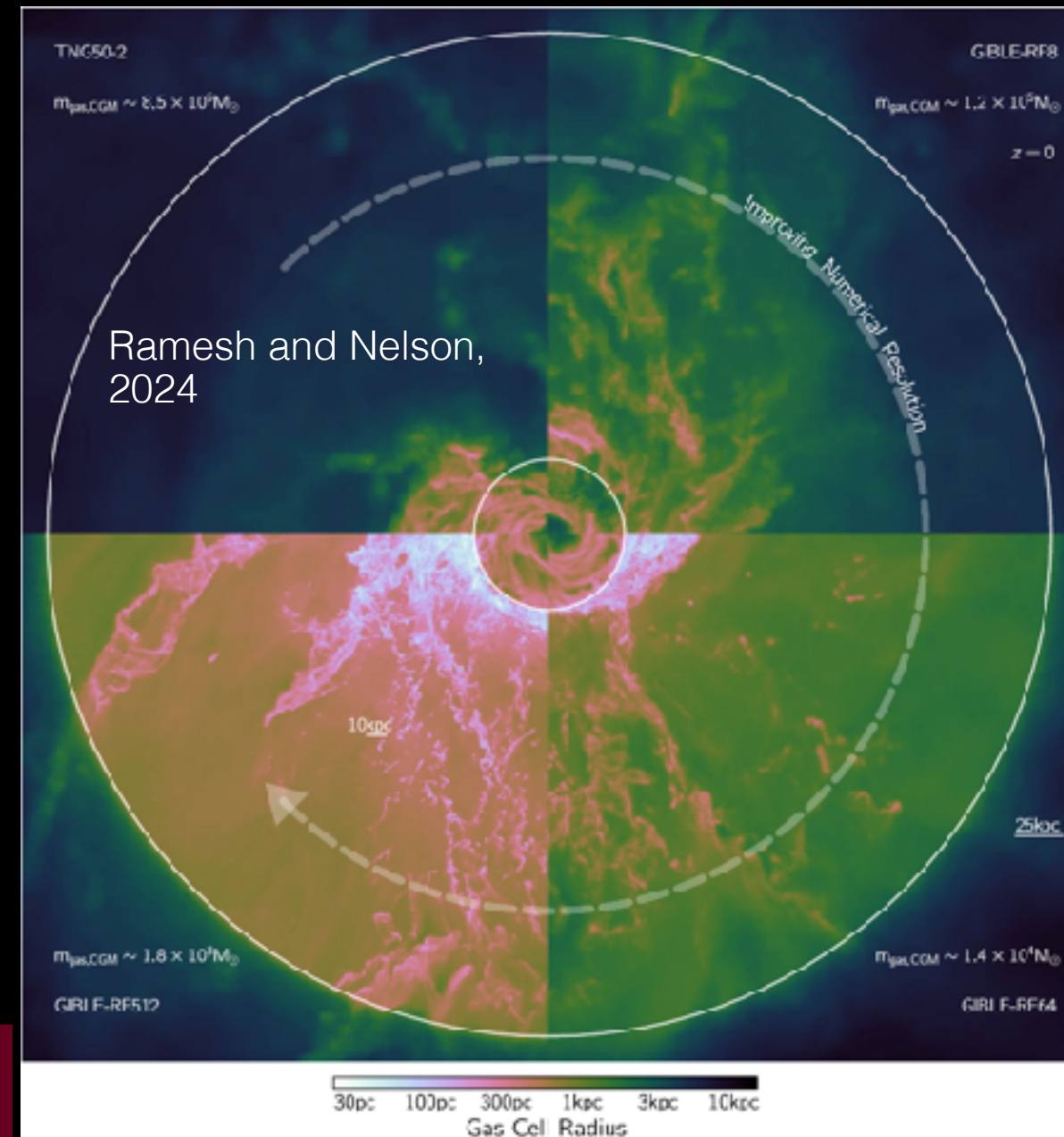
PRINCETON
UNIVERSITY

Studying the multiphase CGM



Simulating the multiphase CGM - challenges

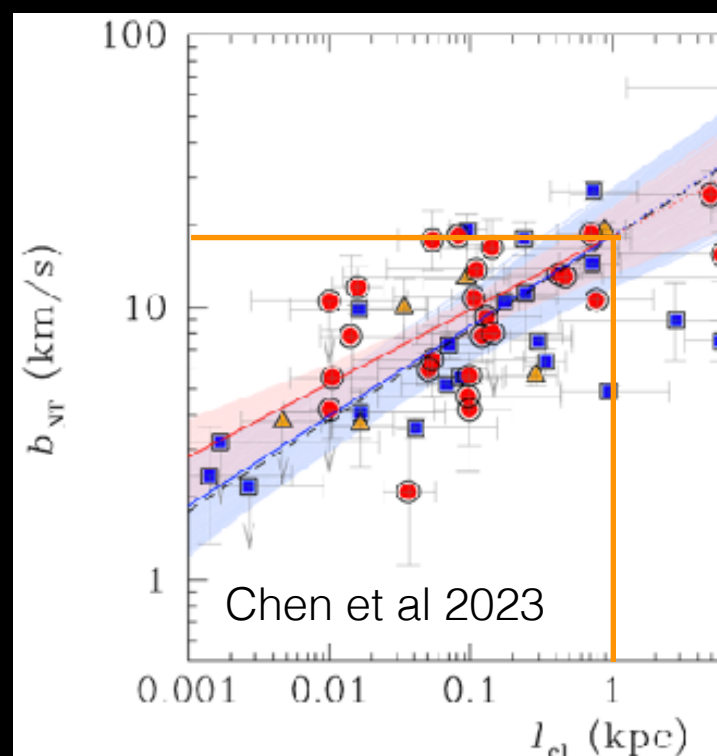
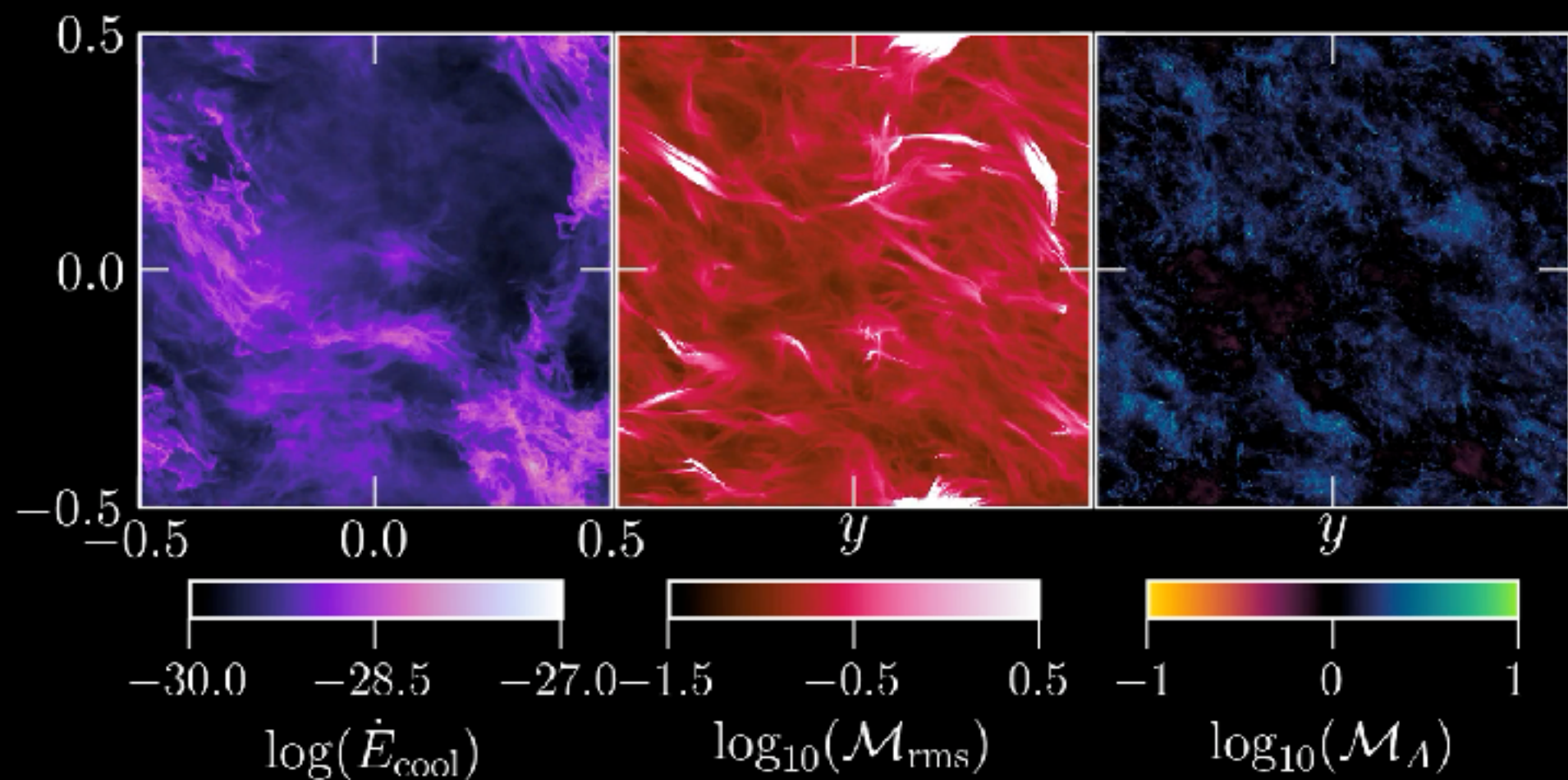
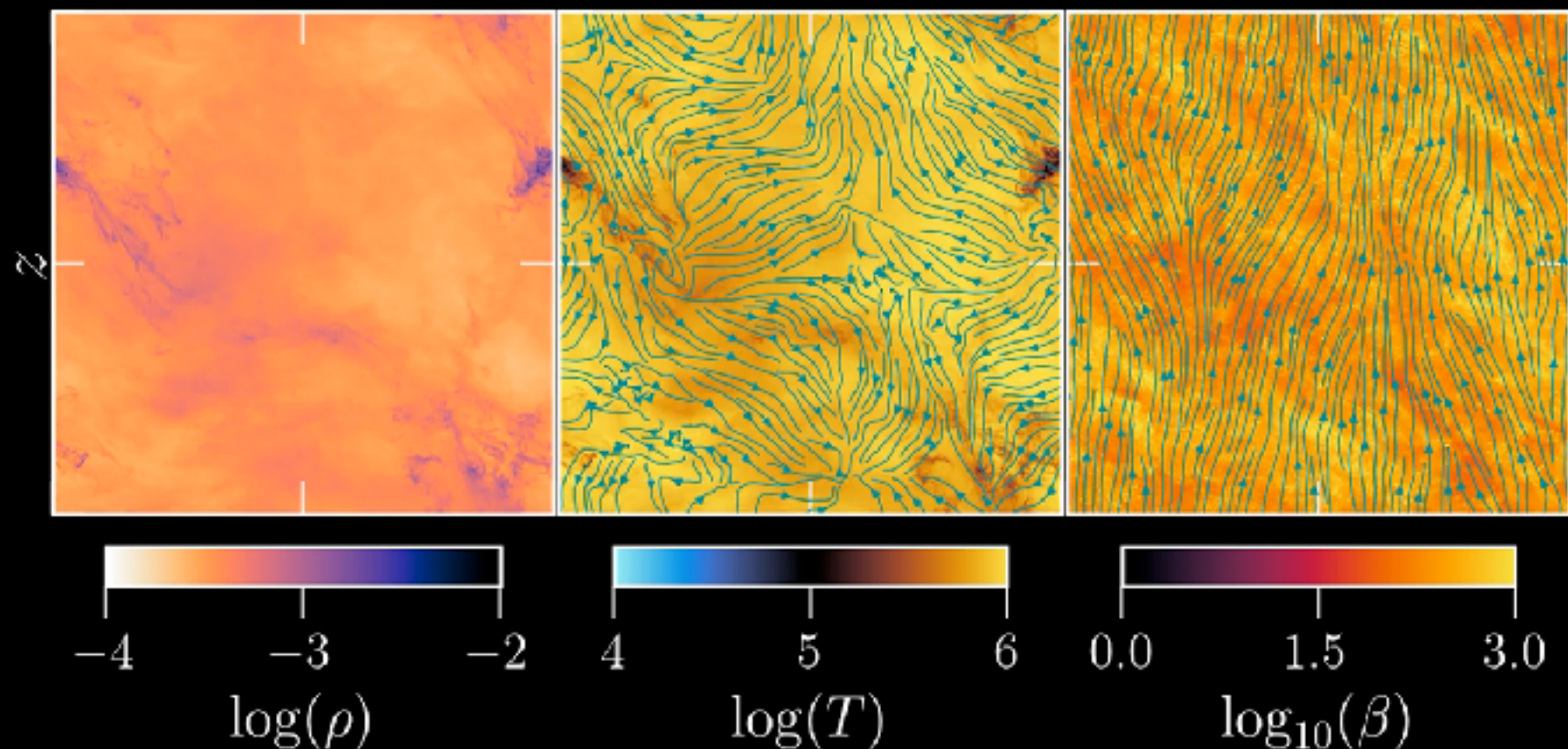
- Cosmological/galaxy-scale simulations - struggle to resolve cold gas
 - Cooling length $\ell_{\text{cool}} = c_s t_{\text{cool}}$ (can be sub-pc)
- Local simulations
 - Resolve small-scale interactions but often lack global context and statistics



$t = 60.0 \text{ Myr}$

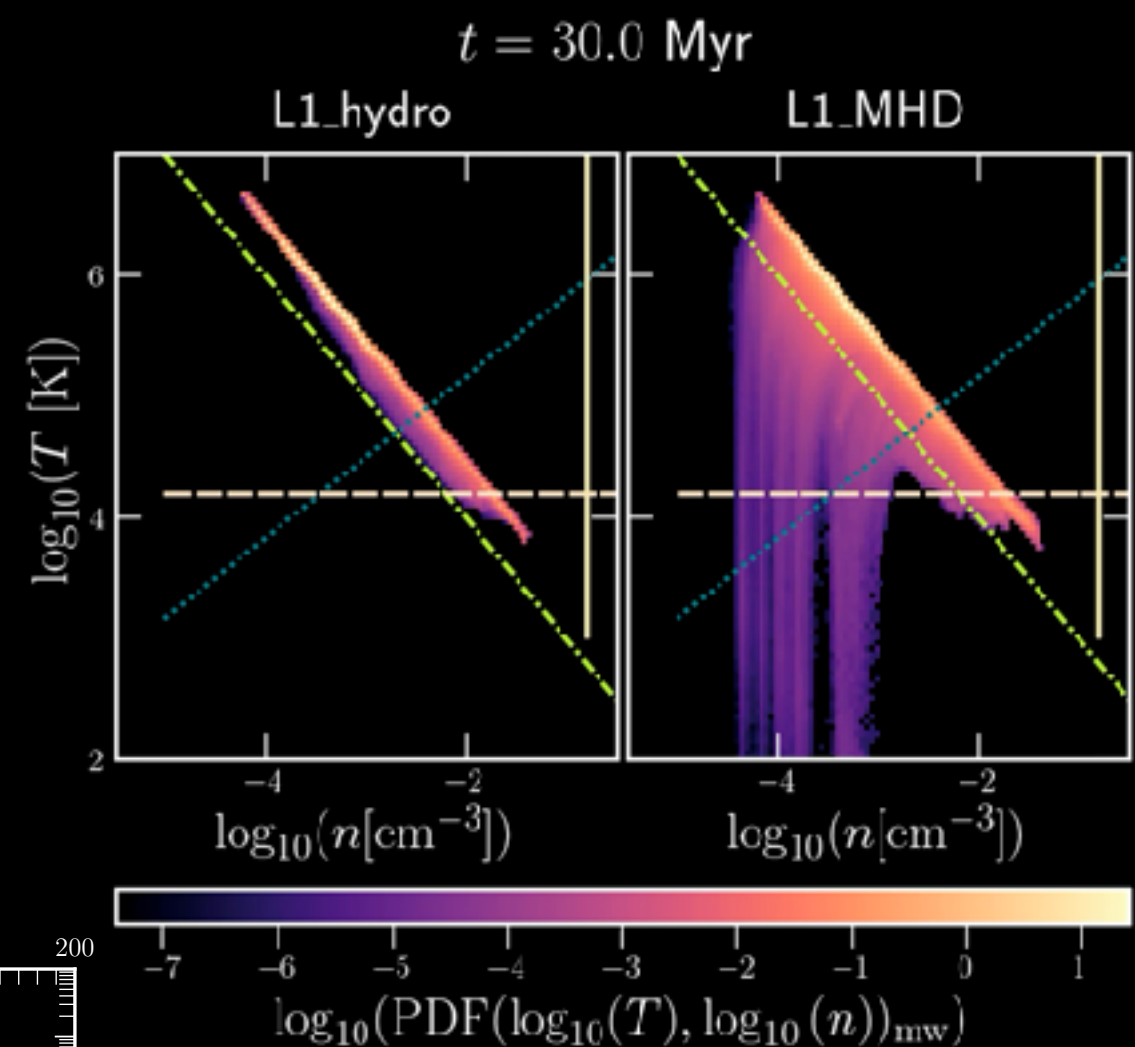
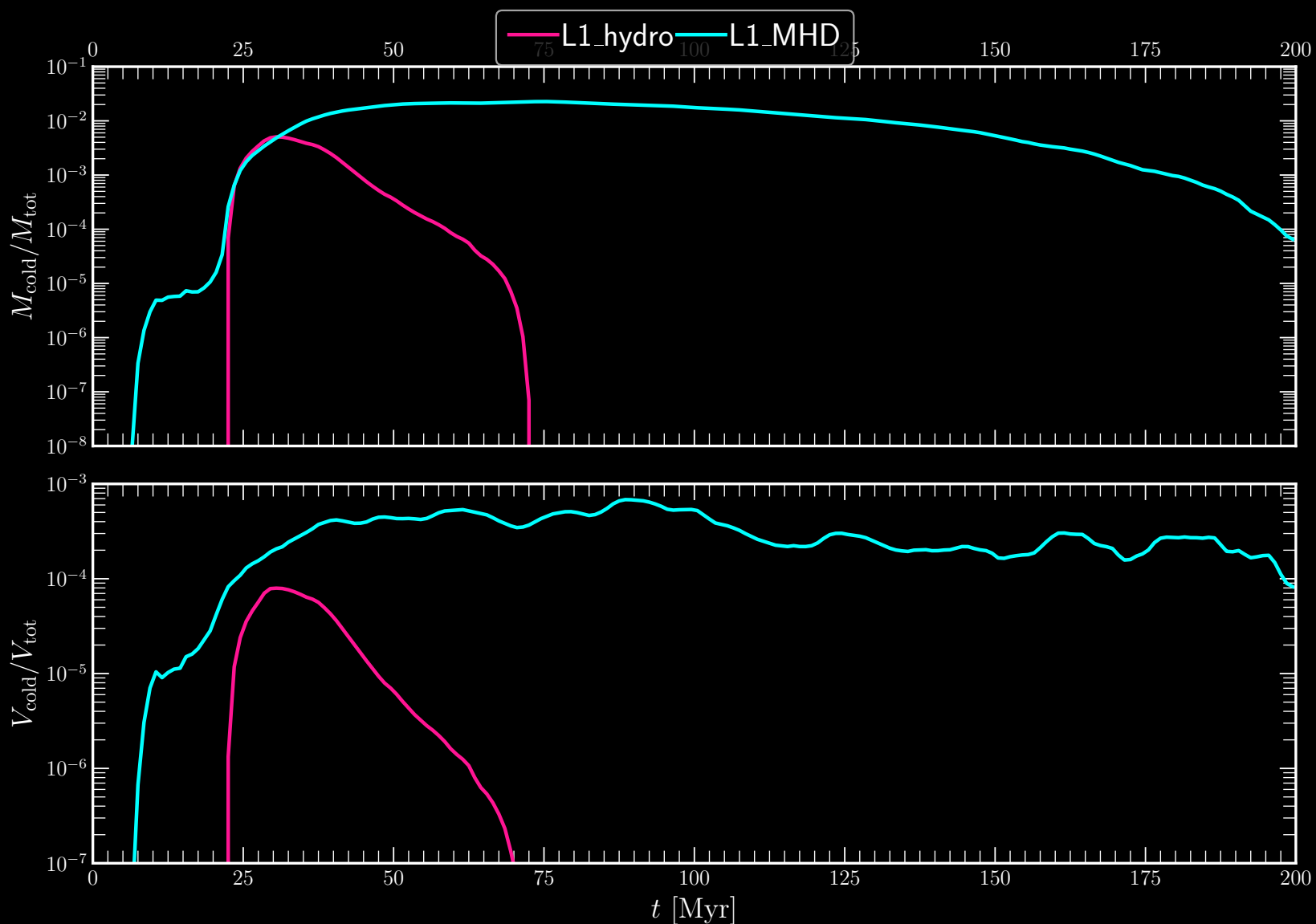
Meso-scale MHD turbulent boxes

- Size 1 kpc
- Resolution 1024^3
($\Delta x \sim 1 \text{ pc}$)
- $v_\ell = 20 \text{ km/s}$,
- $n_{\text{hot}} = 3 \times 10^{-4} / \text{cm}^3$,
- $T = 10^6 \text{ K}$



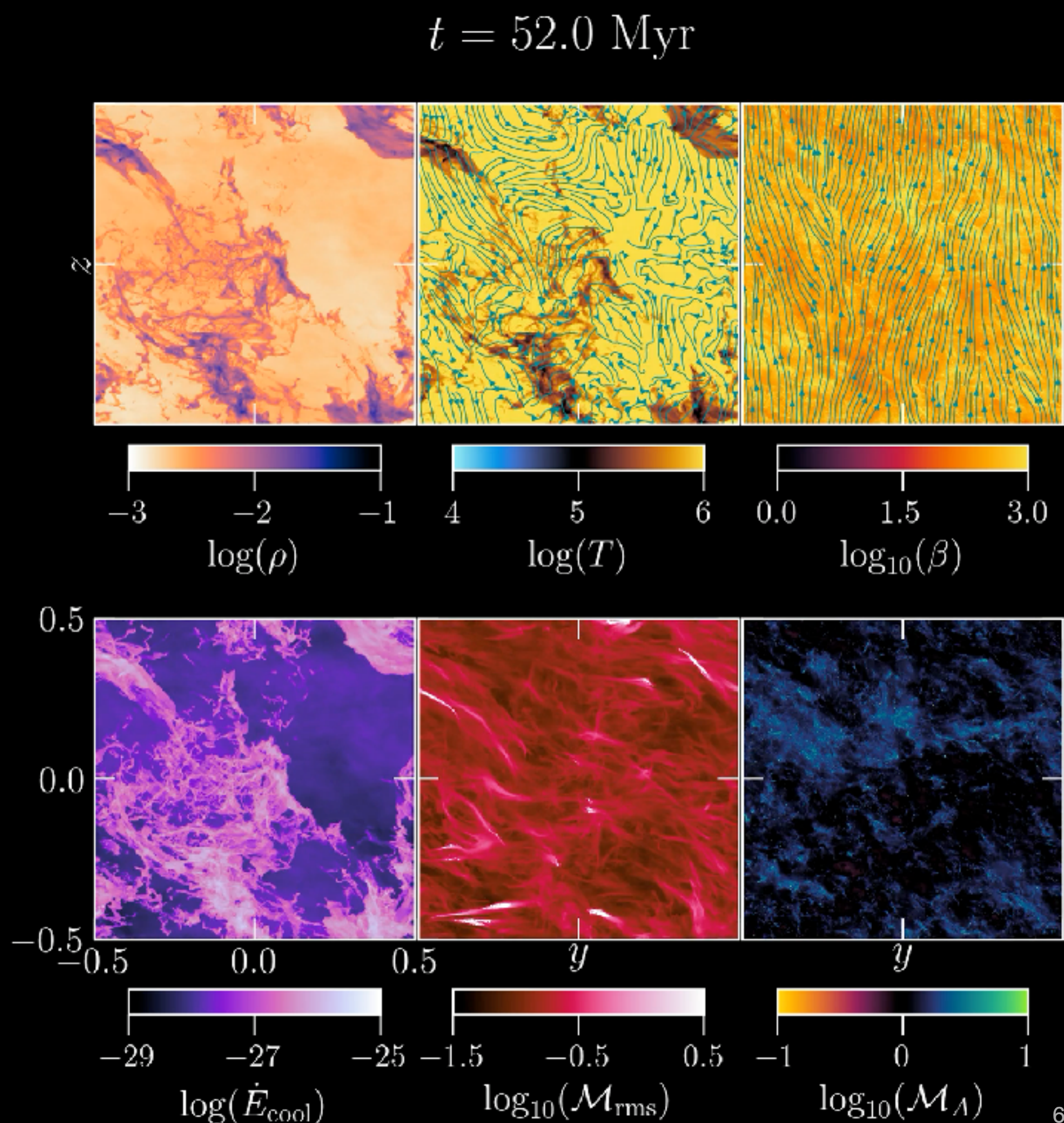
Key results

- Hydro runs - cold gas disappears < 100 Myr
- MHD runs - cold gas survives, with mass and volume fraction 10^{-4} , density similar to that of hot gas



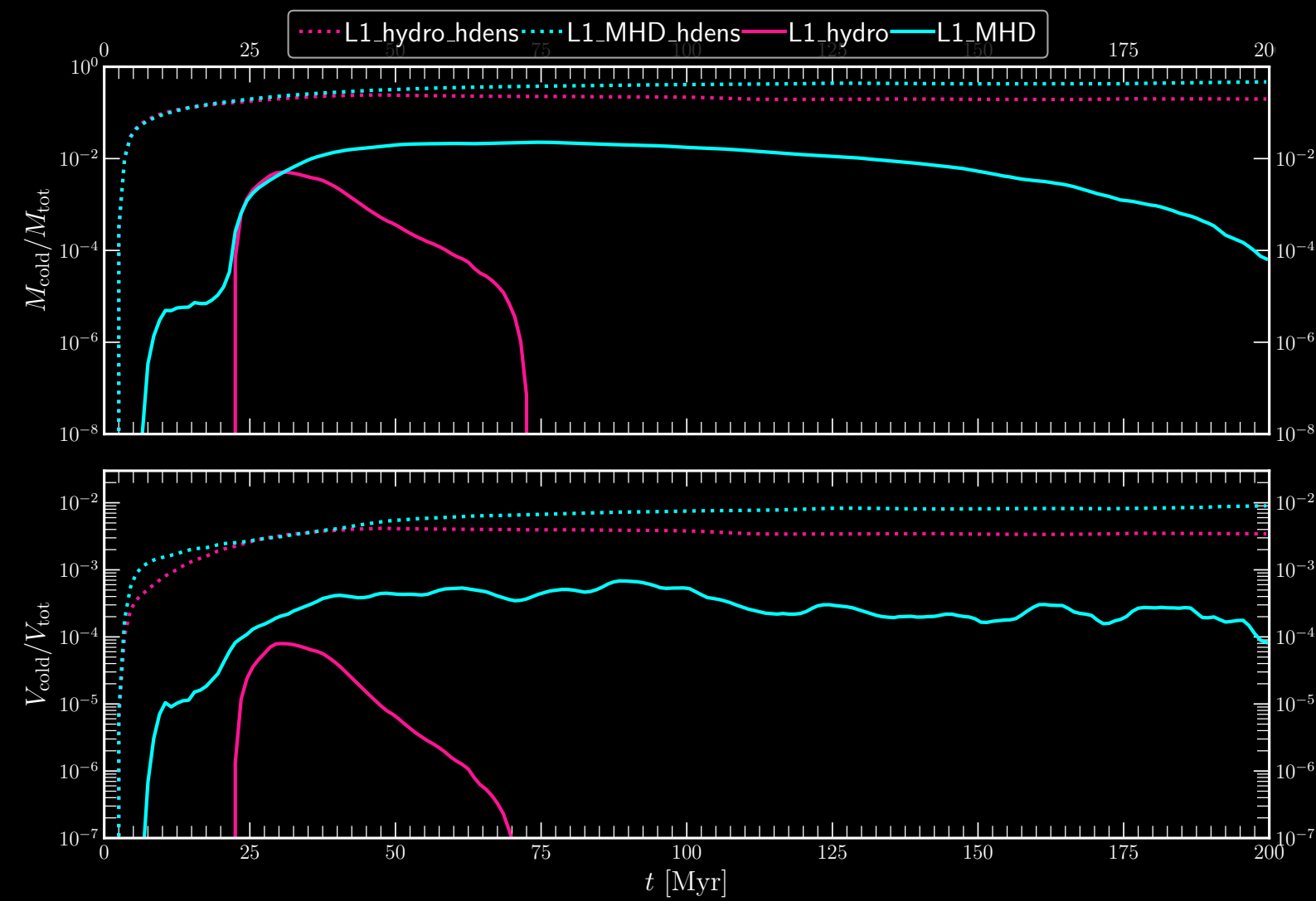
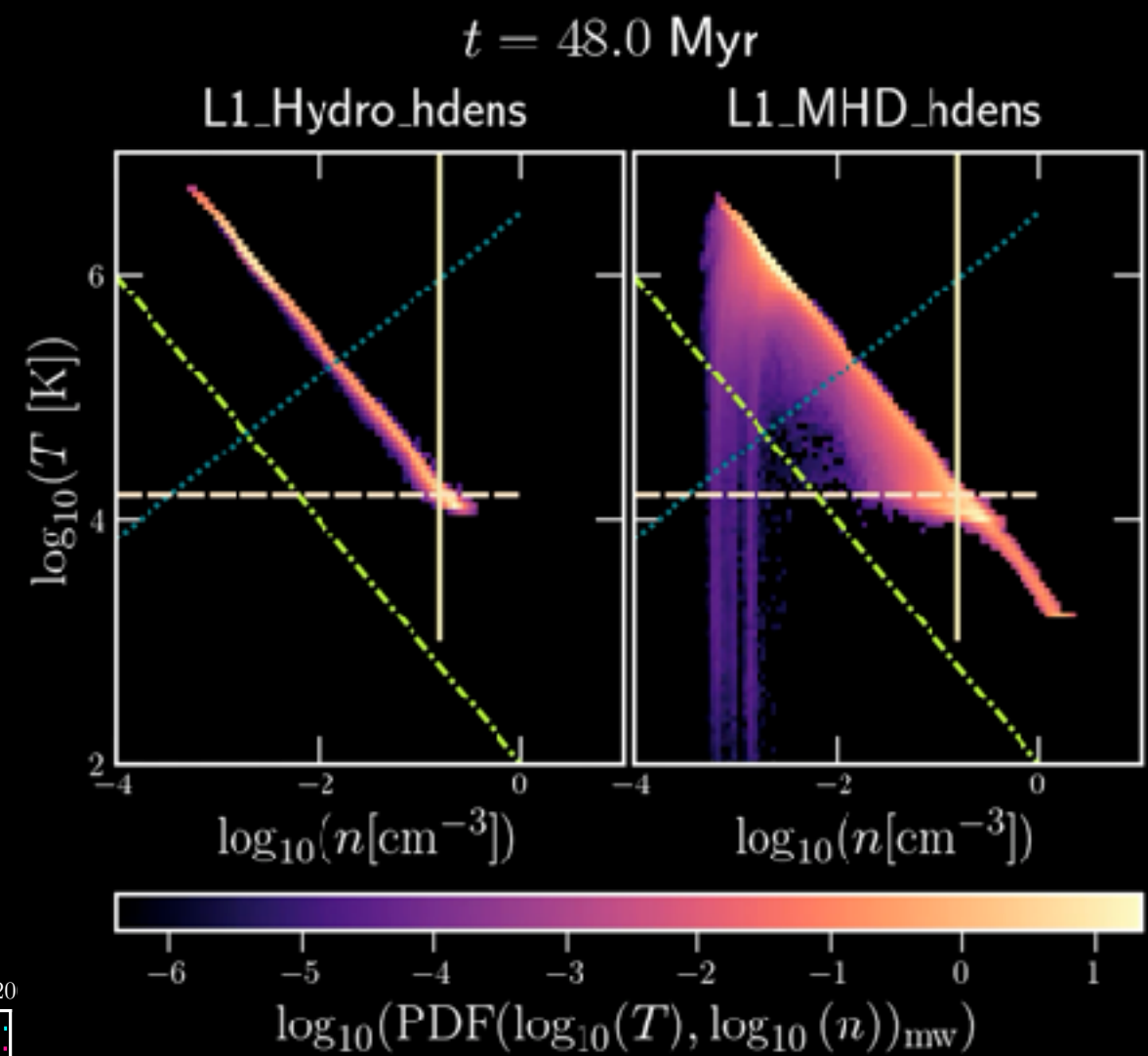
Higher-density runs

- 10 times larger density - much more cold gas forms and survives till 200 Myr

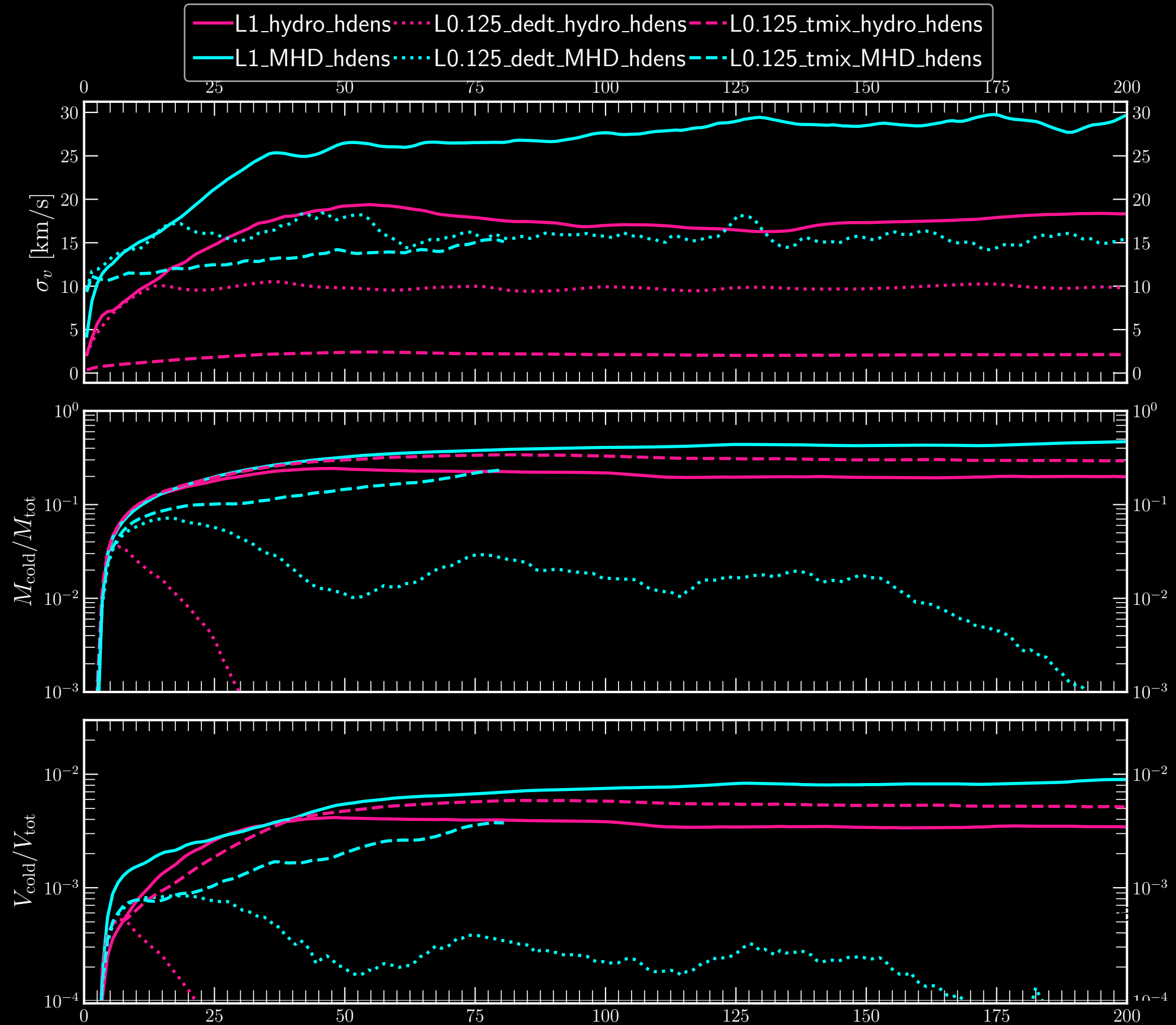


Higher-density runs

- Cold gas -> Around 50% of mass, $\lesssim 1\%$ of volume



Effect of reducing the box size



Concluding remarks

- Typical outer CGM parameters
($n = 3 \times 10^{-4}/\text{cm}^3$, $T = 10^6$ K, $v_{1 \text{ kpc}} = 20\text{km/s}$) -
 - $t_{\text{cool}}/t_{\text{mix}} \gg 1$
 - Cold gas fails to survive for > 100 Myr due to turbulent mixing
 - Magnetized, “fluffy” cold gas may survive
 - Mass and volume fraction $\simeq 10^{-4}$
- Denser CGM
 - Cold gas survives for longer, upto 50% of CGM mass in cold phase, $\lesssim 1\%$ in volume
- Effect of decreasing domain size
 - Keeping $t_{\text{cool}}/t_{\text{mix}}$ fixed gives consistent results with larger scale simulations