Code Comparison Project – two-layer setup 3D simulation (ransX resolution study 64cubed vs. 128cubed vs. 256cubed)

64x64x64   128x128x128   256x256x256

```
In [2]: run ransX.py
#-------------------------------------------#
('Datafile with space-time averages: ', 'DATA/TSERIES/tseries_ccptwo_64c_liger_fixedmu0pt3_1500secs.npy')
('Central time (in s): ', 1018.2)
('Averaging windows (in s): ', 1500.0)
('Time range (in s from-to): ', 0.0, 1999.0)
---------------
Resolution: 64 64 64
Radial size of computational domain (in cm): 4.06e+08 1.19e+09
Radial size of convection zone (in cm): 4.06e+08 1.18e+09
Extent of convection zone (in Hp): 3.601990
Averaging time window (in s): 1500.000000
RMS velocities in convection zone (in cm/s): 1.83e+07
Convective turnover timescale (in s) 8.48e+01
P_turb o P_gas 1.68e-03
Mach number Max 4.04e-02
Mach number Mean 3.00e-02
Dissipation length scale (in cm): 1.08e+09
Total nuclear luminosity (in erg/s): 4.52e+45
Rate of TKE dissipation (in erg/s): 1.79e+45
Dissipation timescale for TKE (in s): 29.541770
Reynolds number: 245
```
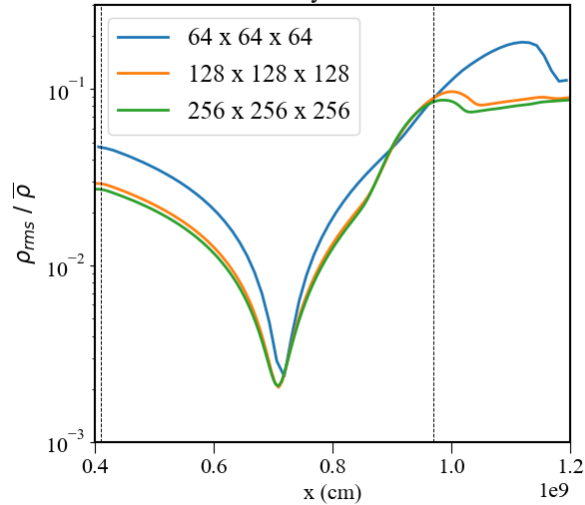
```
In [1]: run ransX.py
#-------------------------------------------#
('Datafile with space-time averages: ', 'DATA/TSERIES/tseries_ccptwo_128c_liger_fixedmu0pt3_1500secs.npy')
('Central time (in s): ', 1017.7)
('Averaging windows (in s): ', 1500.0)
('Time range (in s from-to): ', 0.0, 1999.0)
---------------
Resolution: 128 128 128
Radial size of computational domain (in cm): 4.03e+08 1.20e+09
Radial size of convection zone (in cm): 4.16e+08 9.59e+08
Extent of convection zone (in Hp): 2.736897
Averaging time window (in s): 1500.000000
RMS velocities in convection zone (in cm/s): 1.73e+07
Convective turnover timescale (in s) 6.28e+01
P_turb o P_gas 1.38e-03
Mach number Max 3.43e-02
Mach number Mean 2.82e-02
Dissipation length scale (in cm): 1.37e+09
Total nuclear luminosity (in erg/s): 4.50e+45
Rate of TKE dissipation (in erg/s): 1.07e+45
Dissipation timescale for TKE (in s): 39.547968
Reynolds number: 385
```
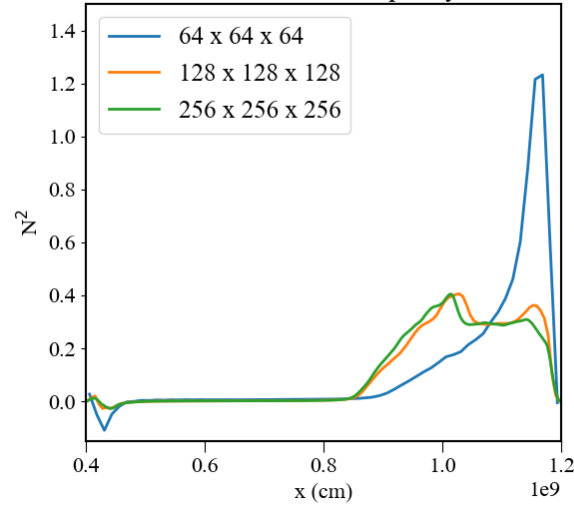
```
In [3]: run ransX.py
#-------------------------------------------#
('Datafile with space-time averages: ', 'DATA/TSERIES/tseries_ccptwo_256c_cosma_1500secs.npy')
('Central time (in s): ', 1017.1)
('Averaging windows (in s): ', 1500.0)
('Time range (in s from-to): ', 0.0, 1999.0)
---------------
Resolution: 256 256 256
Radial size of computational domain (in cm): 4.02e+08 1.20e+09
Radial size of convection zone (in cm): 4.11e+08 9.70e+08
Extent of convection zone (in Hp): 2.850421
Averaging time window (in s): 1500.000000
RMS velocities in convection zone (in cm/s): 1.73e+07
Convective turnover timescale (in s) 6.45e+01
P_turb o P_gas 1.32e-03
Mach number Max 3.43e-02
Mach number Mean 2.74e-02
Dissipation length scale (in cm): 1.49e+09
Total nuclear luminosity (in erg/s): 4.51e+45
Rate of TKE dissipation (in erg/s): 1.02e+45
Dissipation timescale for TKE (in s): 42.955814
Reynolds number: 1008
```


Relative Density RMS fluctuations — $\rho_{rms} / \overline{\rho}$ vs x (cm); 64 x 64 x 64, 128 x 128 x 128, 256 x 256 x 256

Brunt-Vaisalla frequency — N^2 vs x (cm); 64 x 64 x 64, 128 x 128 x 128, 256 x 256 x 256

Buoyancy — $buoyancy$ vs x (cm); 64 x 64 x 64, 128 x 128 x 128, 256 x 256 x 256