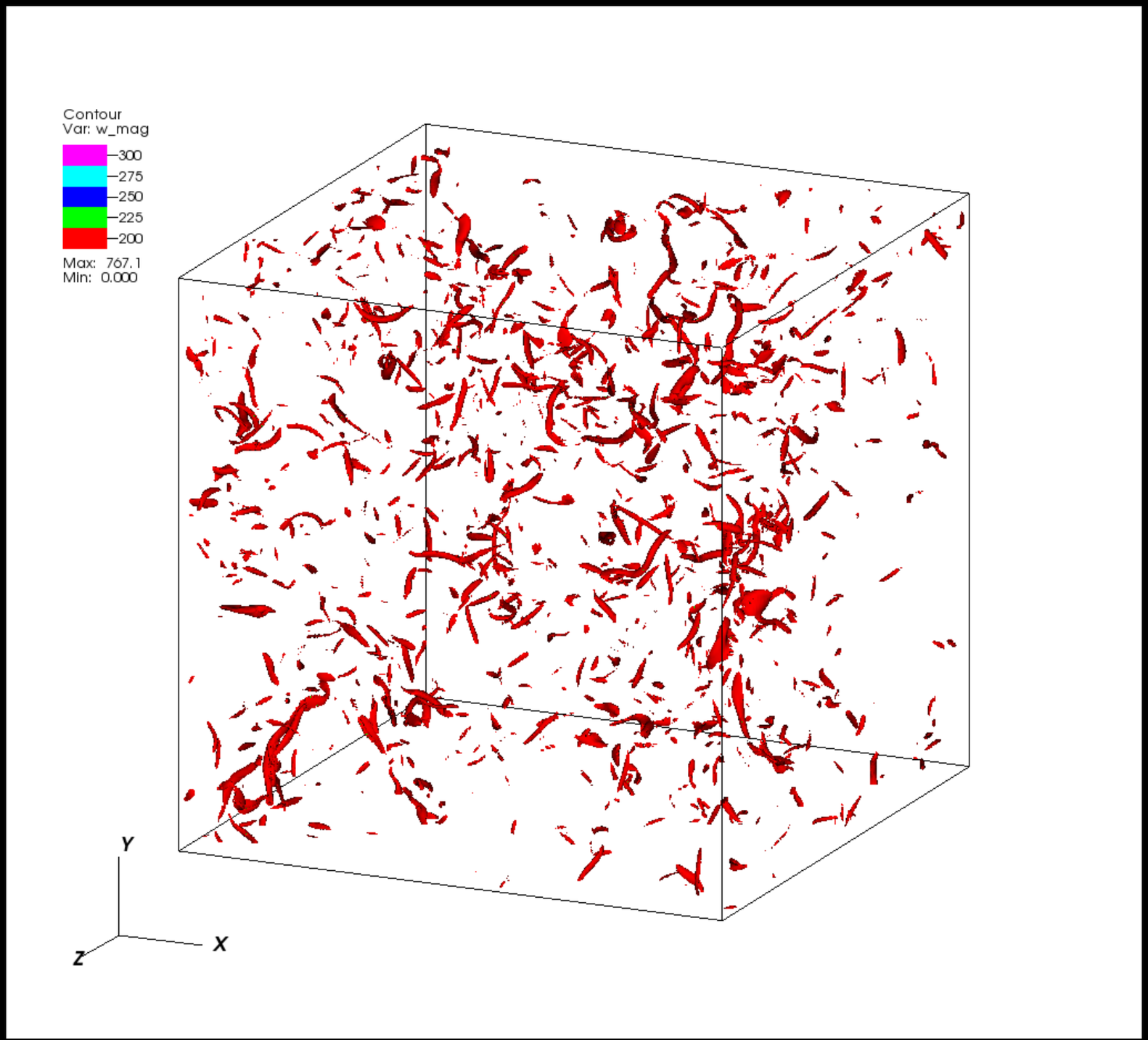
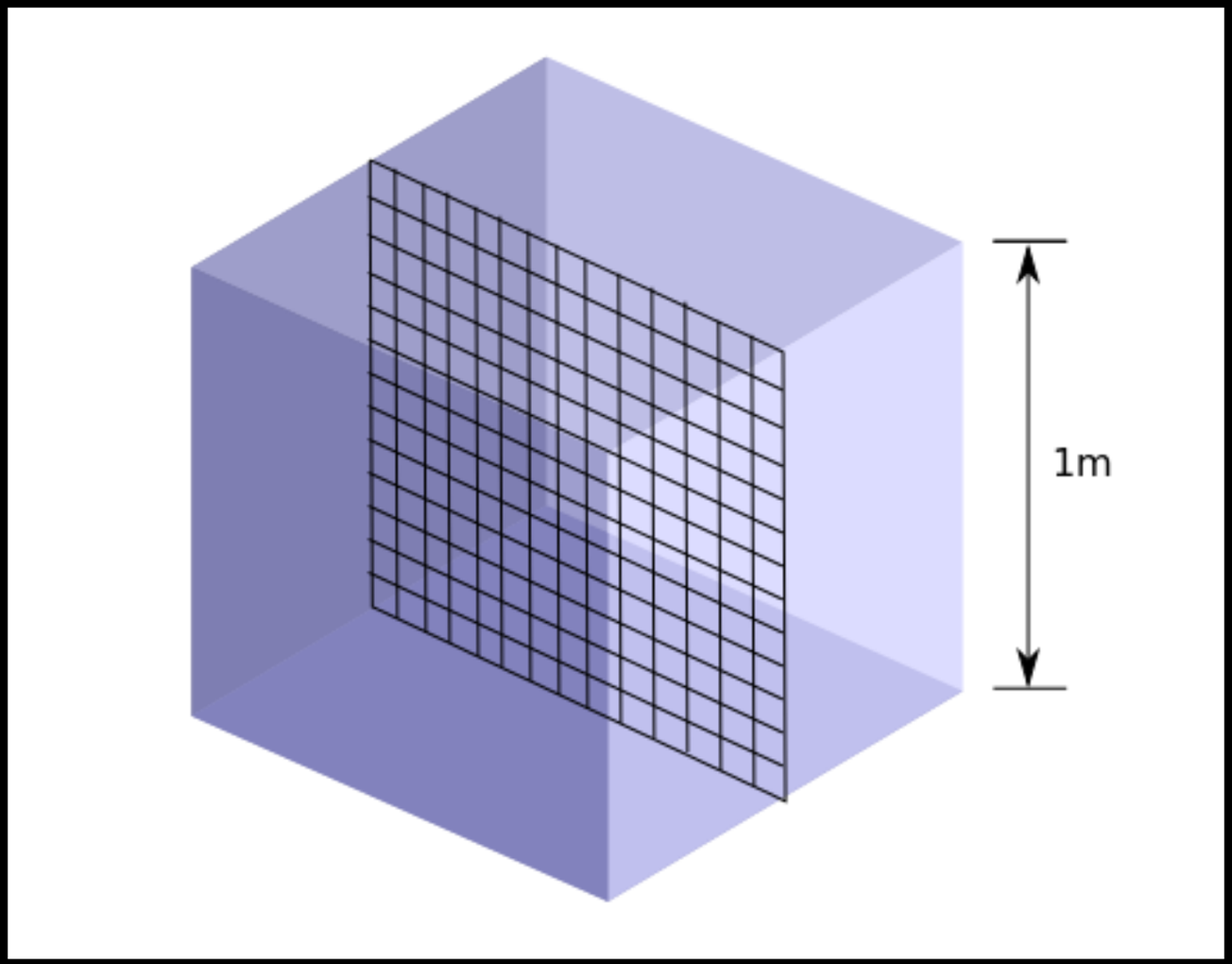
Multiprocessing with Python

Data



Grid

- Grid - 64 x 64 x 64
- 3 variables at each point - U, V and W



Calculating Derivatives

- All variables defined with indices - U_{ijk}, V_{ijk}, W_{ijk}
- 0 <= i < 64
- 0 <= j < 64
- 0 <= k < 64

$$\frac{\partial u}{\partial x} = \frac{u_{i+1,j,k} - u_{i-1,j,k}}{2\Delta x} \qquad \frac{\partial v}{\partial y} = \frac{v_{i,j+1,k} - v_{i,j-1,k}}{2\Delta x}$$

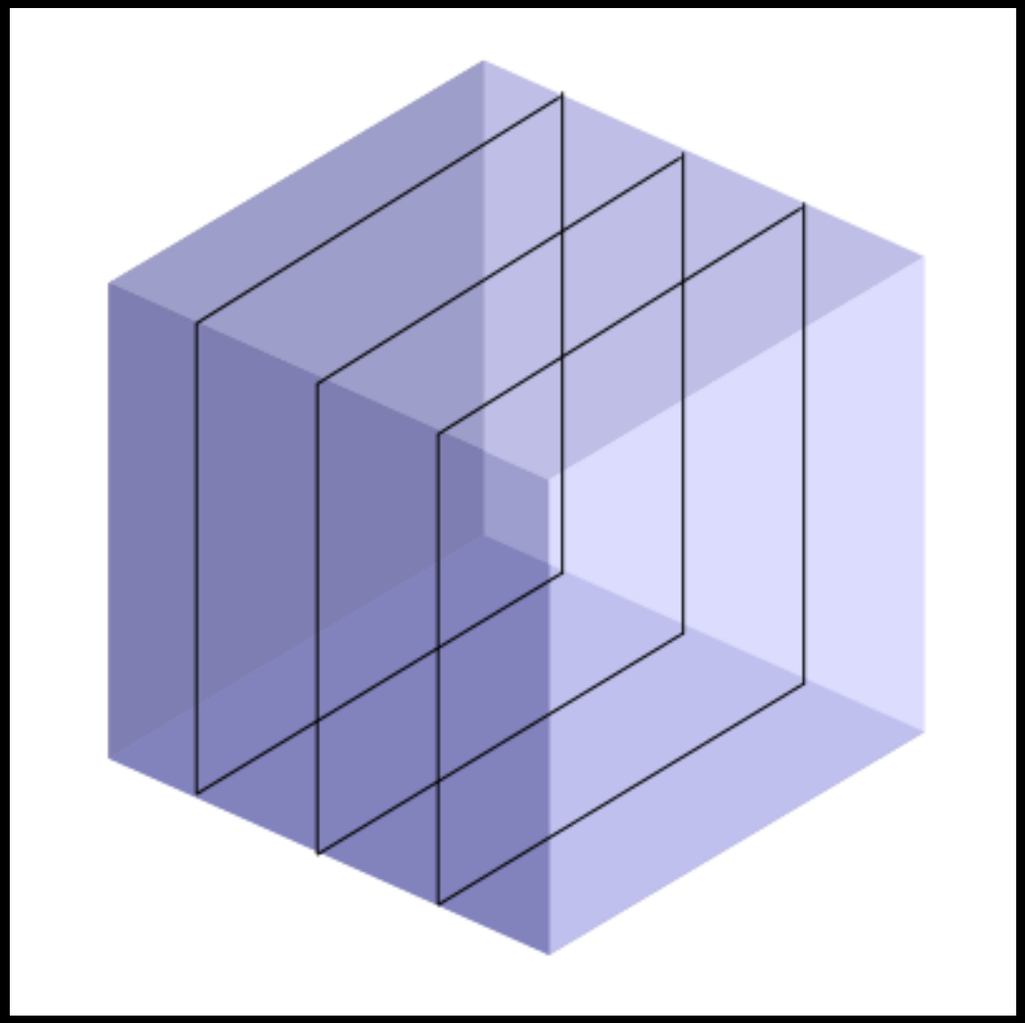
and so on..

Post-processing

- Calculate eigenvalues of strain-rate matrix

$$\begin{bmatrix} \frac{\partial u}{\partial x} & \frac{1}{2}\left(\frac{\partial u}{\partial y}+\frac{\partial v}{\partial x}\right) & \frac{1}{2}\left(\frac{\partial u}{\partial z}+\frac{\partial w}{\partial x}\right) \\ \frac{1}{2}\left(\frac{\partial v}{\partial x}+\frac{\partial u}{\partial y}\right) & \frac{\partial v}{\partial y} & \frac{1}{2}\left(\frac{\partial v}{\partial z}+\frac{\partial w}{\partial y}\right) \\ \frac{1}{2}\left(\frac{\partial w}{\partial x}+\frac{\partial u}{\partial z}\right) & \frac{1}{2}\left(\frac{\partial w}{\partial y}+\frac{\partial v}{\partial z}\right) & \frac{\partial w}{\partial z} \end{bmatrix}$$

Dividing Tasks



Divide the domain along one-direction for different processes

Multiprocessing Scaling

Cores	Time (s)
1	50.91
2	25.53
4	12.51
8	6.22
16	3.71

Multiprocessing Scaling