Why HPC?

- Predict the weather of USA and Canada
- For the next 2 days
- 20 *km* altitude

$$20M\ km^2$$

$$2.0\times10^7\,km^2\times20km\times10^3\,cubes\ \ per\ km^3=4\times10^{11}\ \text{grid points}$$

$$4\times10^{13}\text{calculations}\times48\text{hours}\approx2\times10^{15}\text{calculations}$$

$$\text{at }10^9\text{ calculations per seconds}$$

$$2\times10^{15}\text{calculations}/10^9\text{calculations per seconds}=2\times10^6\text{second}$$

$$\approx23\text{ days}$$

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$$4\times10^{13}\text{calculations}\times48\text{hours}\approx2\times10^{15}\text{calculations}$$

$$\text{at}\ 10^{12}\text{calculations per seconds}$$

$$2\times10^{15}\text{calculations}/10^{12}\text{calculations per seconds}\approx\text{half hour}$$

Why HPC?

- Predict the weather of USA and Canada
- For the next 2 days
- 20 *km* altitude

$$5.0\times10^{8}\,km^{2}\times20km\times10^{3}\,cubes\ \ per\ km^{3}=1\times10^{13}\ \text{grid points}$$

$$1\times10^{15}\,\text{calculations}\times48\,\text{hours}\approx4.8\times10^{16}\,\text{calculations}$$

$$\text{at}\ 10^{12}\,\text{calculations per seconds}$$

$$4.8\times10^{16}\,\text{calculations}/10^{12}\,\text{calculations per seconds}\approx13\,\text{hours}$$

Why Parallel?

```
for (I = 0; i < TRILLION; i++)
   z[i] = x[i] + y[i];
```

This is at least 3×10^{12} trips

Assume trips at the speed of light

$$r = \frac{3\times10^{8}\,meter/\sec\times1\sec}{3\times10^{12}\,meters} = 10^{-4}\,meters$$

$$\frac{x\times10^{-4}}{x\times10^{6}} \approx x\times10^{-10}\,meters$$