Do Planets Cause Earthquakes?

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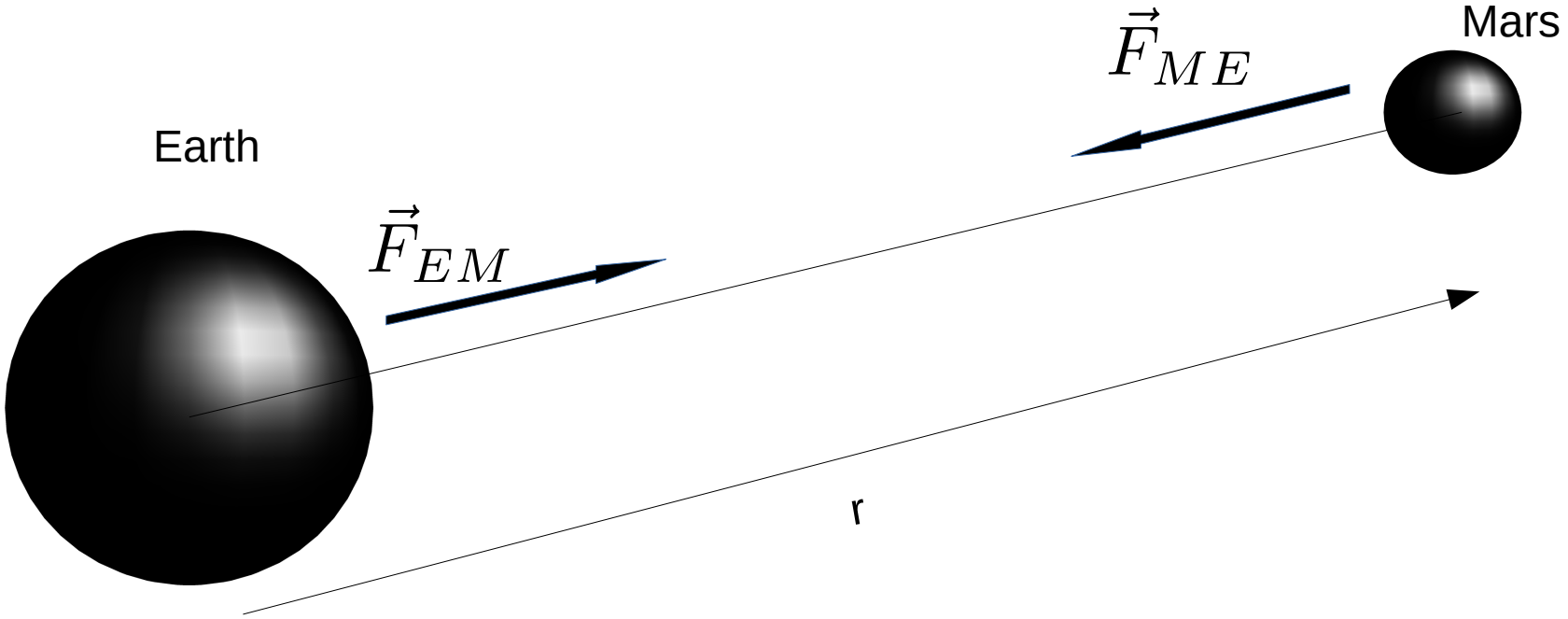
Gravitational Force

$$\vec{F}_{E,P} = G\frac{M_E M_P}{r^2}\hat{r}$$

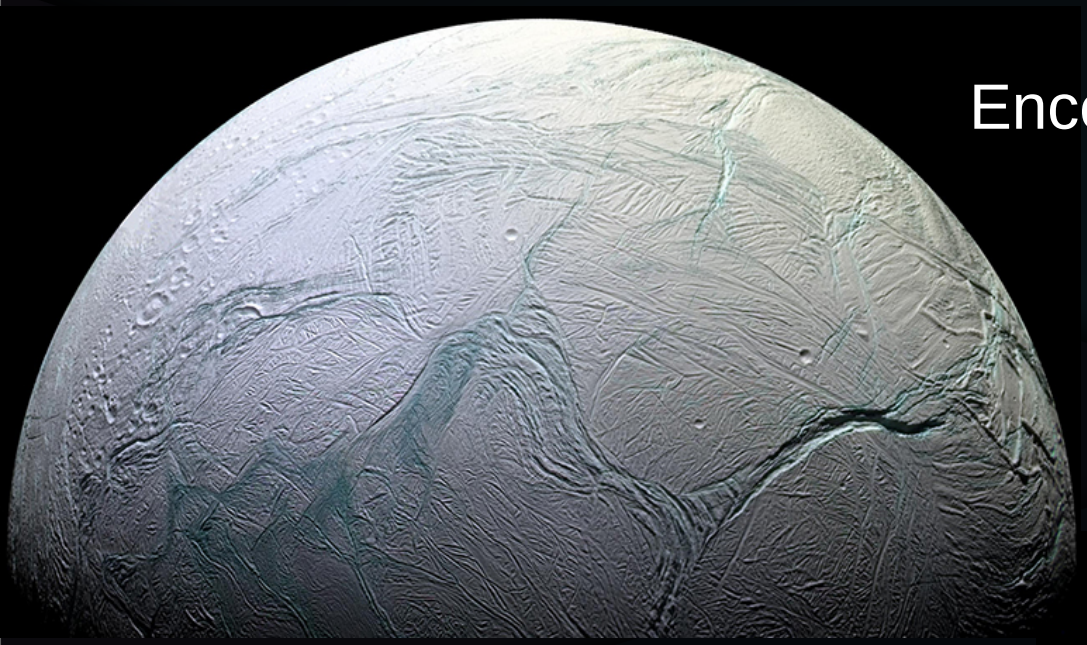


Tidal Forces

Earth – No Moon

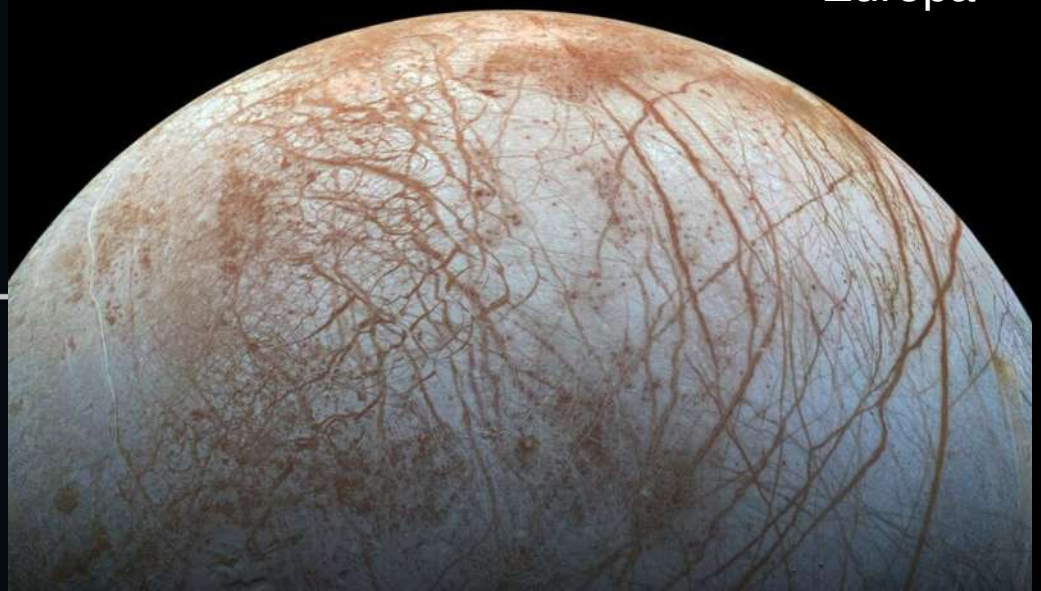
Earth – Moon System

Gravitational Effects

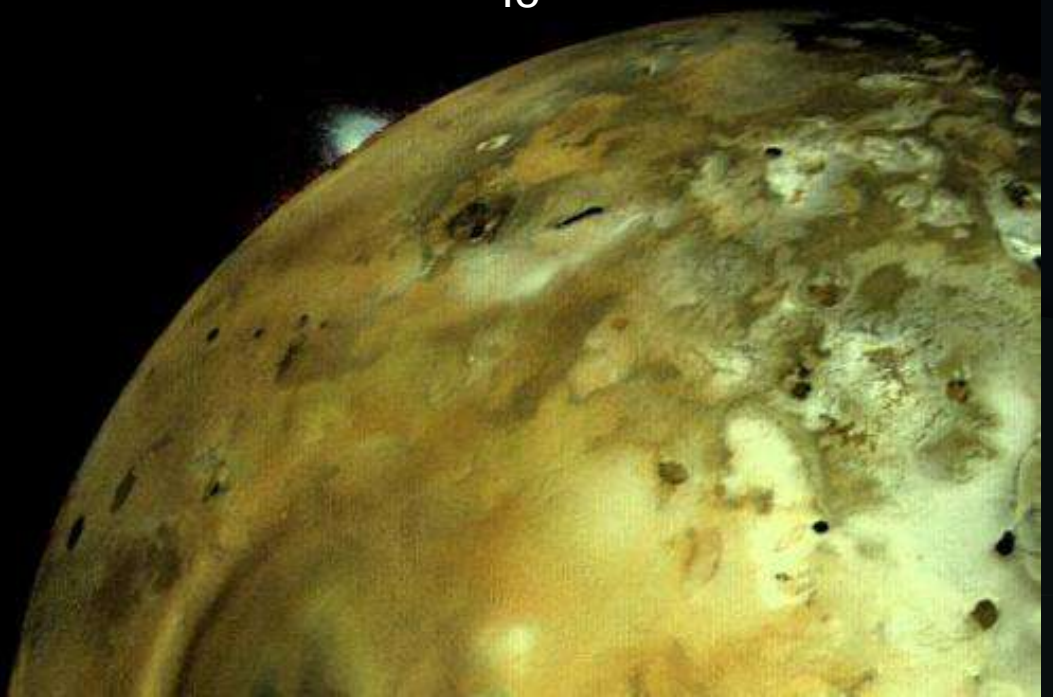


Enceladus

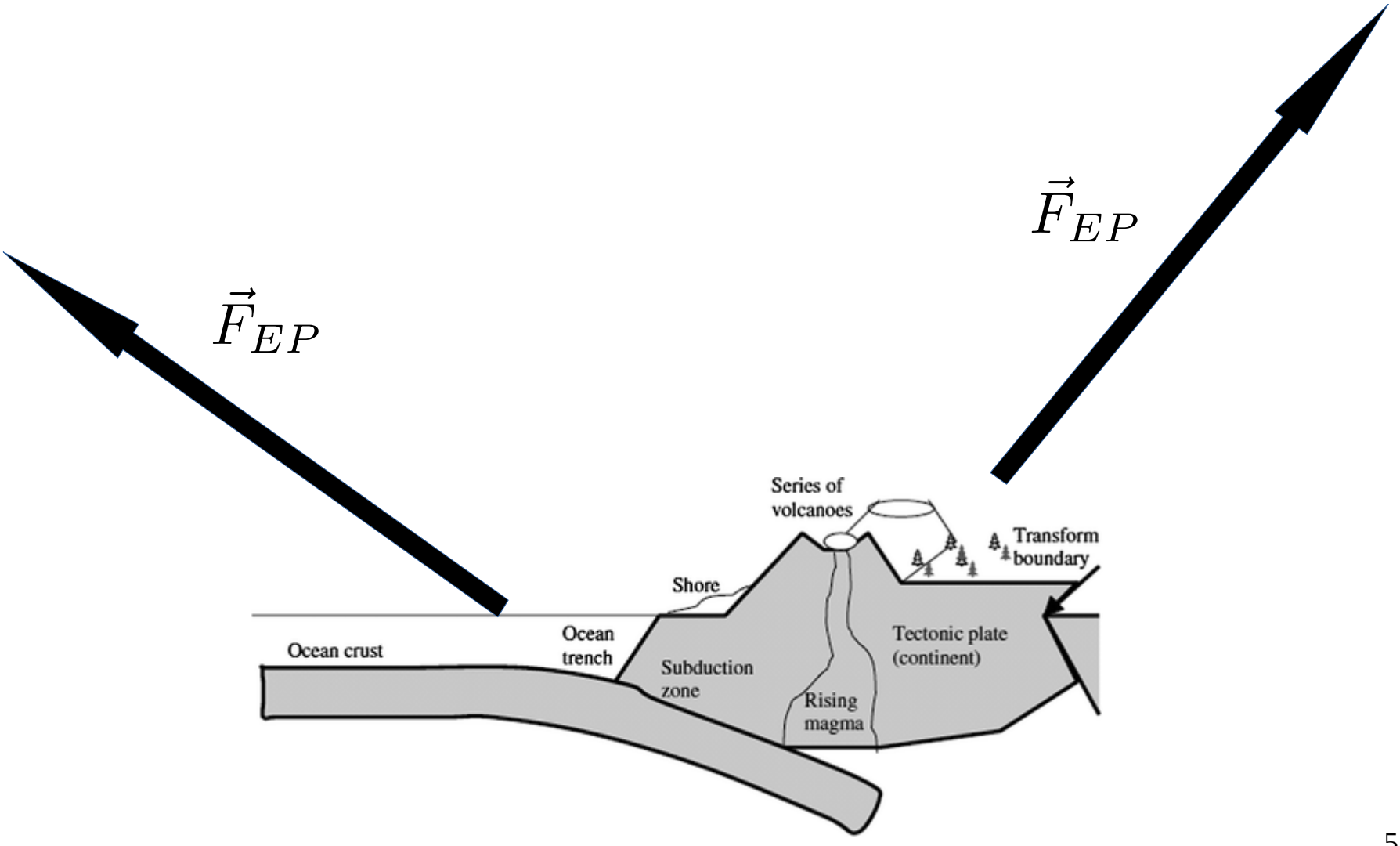
Europa



Io



Forces and Subduction Zones



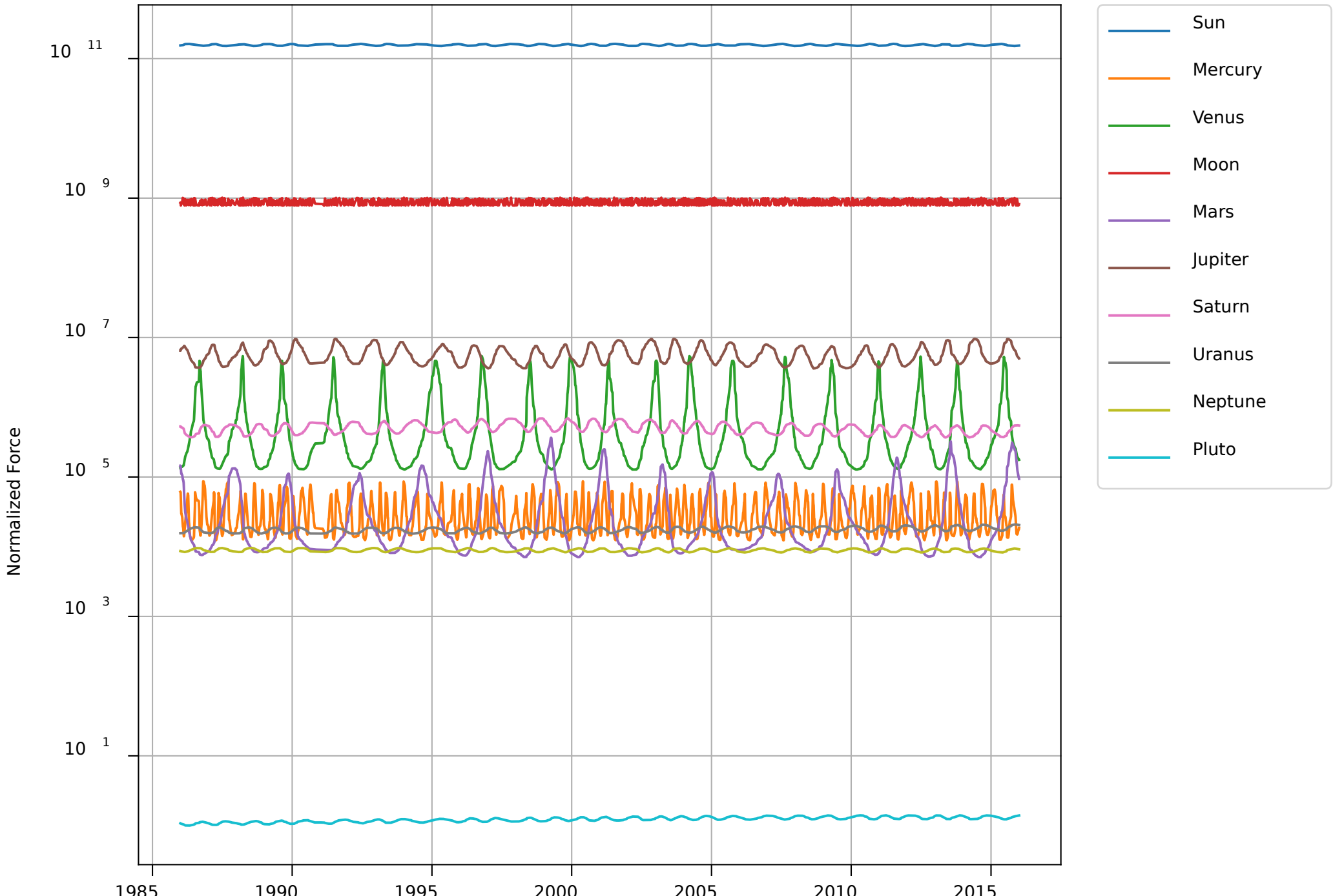
Data

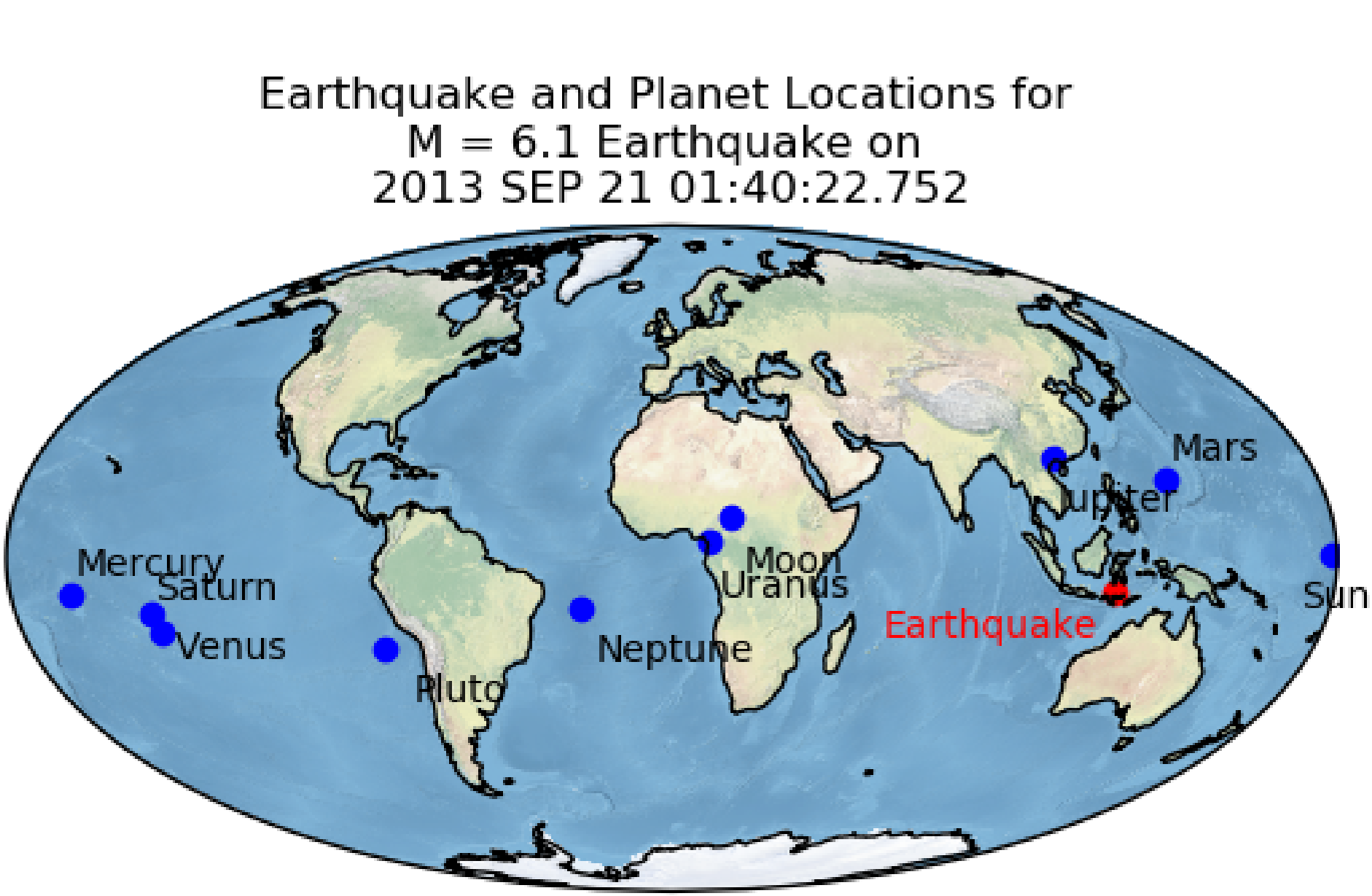
Kaggle: Earthquakes (1986 - 2016)
Magnitude, Latitude, Longitude

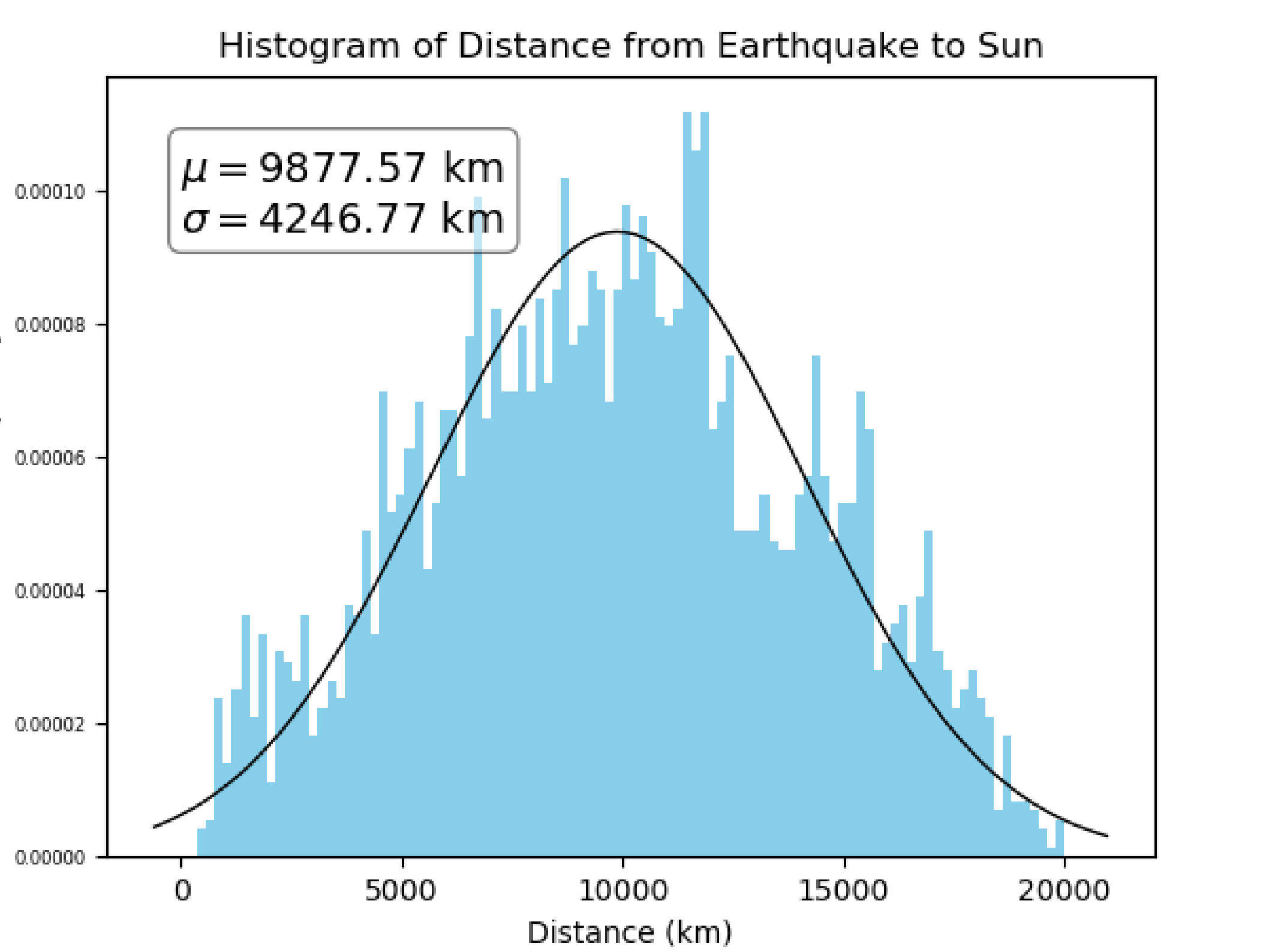
Navigation and Ancillary Information Facility(NAIF) : Ephemerides

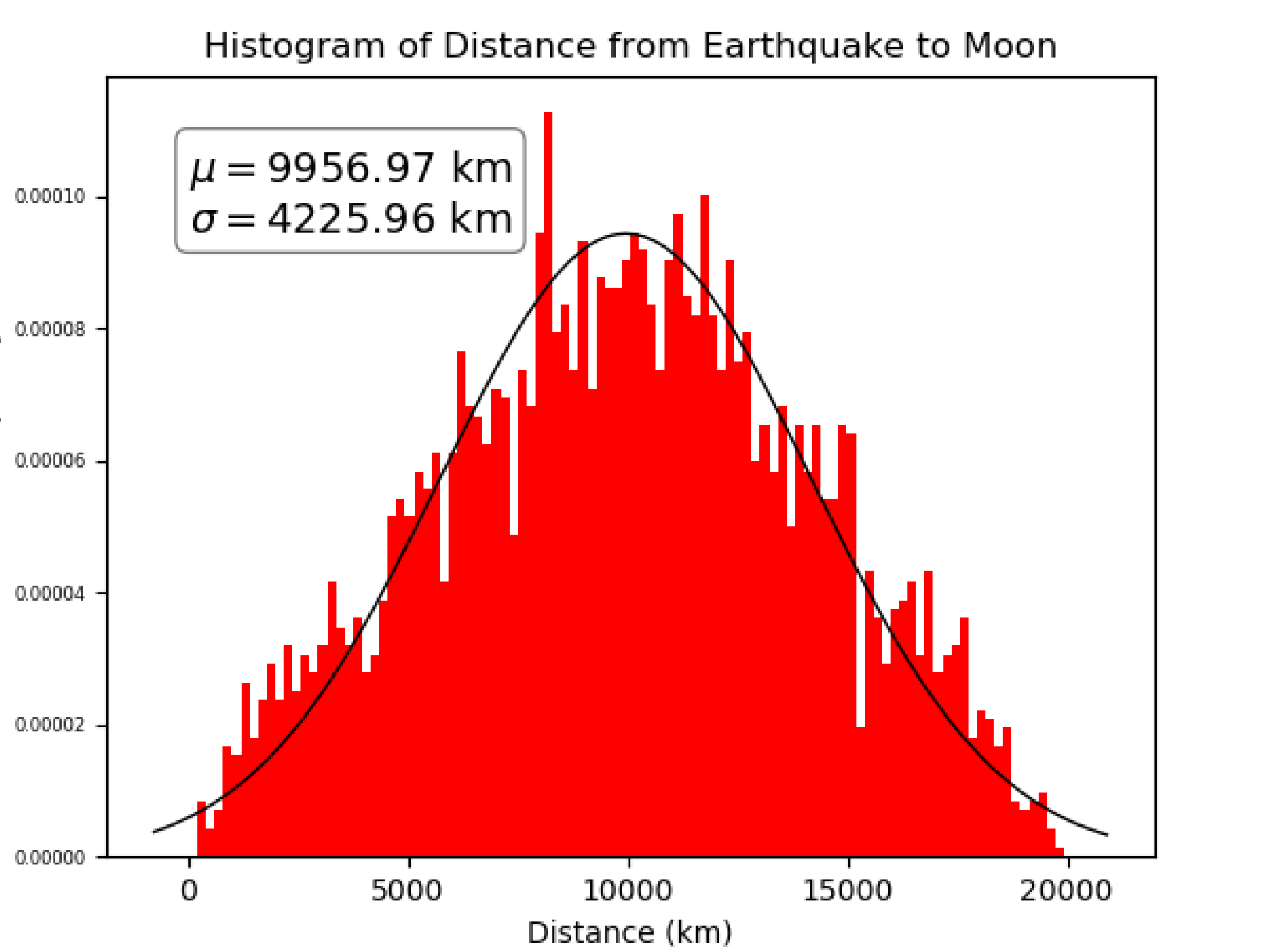
Considerations :
Fracking
Uncertainties
Trust

Plot of Normalized Force Versus Time




Earthquake and Planet Locations for
M = 6.1 Earthquake on
2013 SEP 21 01:40:22.752
Mercury
Saturn
Venus
Pluto
Neptune
Moon
Uranus
Earthquake
Jupiter
Mars
Sun


Histogram of Distance from Earthquake to Sun
$\mu = 9877.57$ km
$\sigma = 4246.77$ km
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
0
5000
10000
15000
20000
Distance (km)


Histogram of Distance from Earthquake to Moon
$\mu = 9956.97$ km
$\sigma = 4225.96$ km
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
0
5000
10000
15000
20000
Distance (km)

Statistics of Inference

Let μ be the mean distance between earthquake and planetary vector location

If earthquakes are caused by planetary gravitational forces then the distance between earthquake and planetary vector location should be small or zero.

$$H_0 : \mu = 0$$

If earthquakes are not related to planetary gravitational forces then the distance between earthquake and planetary vector location is greater than zero.

$$H_a : \mu > 0$$

Statistics of Inference

$$\mu_{Sun} = 9878 \text{ km} \quad \sigma_{Sun} = 4247 \text{ km}$$

$$\text{P} - \text{value} = 0$$

$$\mu_{Moon} = 9956 \text{ km} \quad \sigma_{Moon} = 4225 \text{ km}$$

$$P - value = 0$$

Conclusion:

Earthquakes are unlikely to be caused by Gravitational Changes Due to Planetary motion