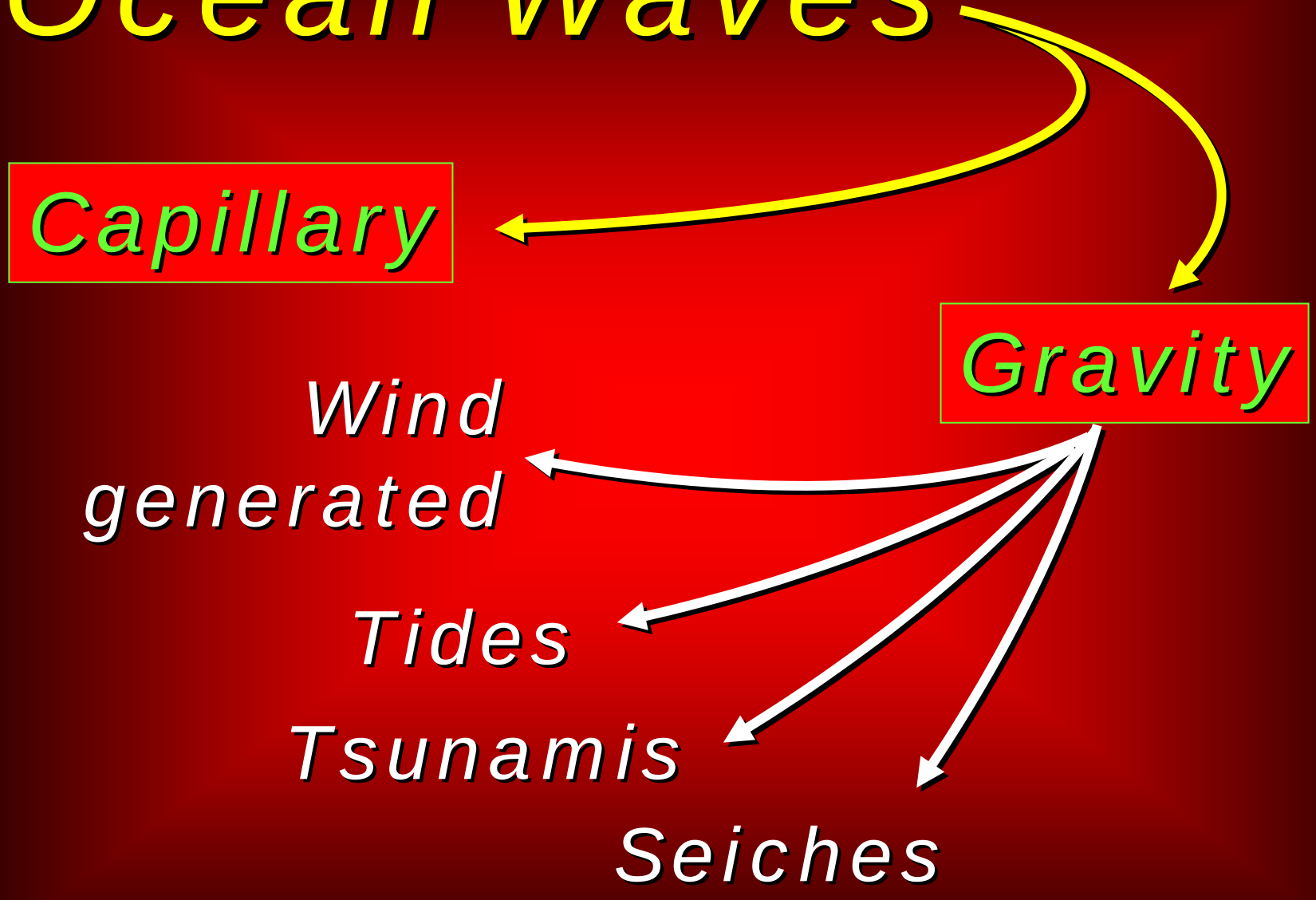
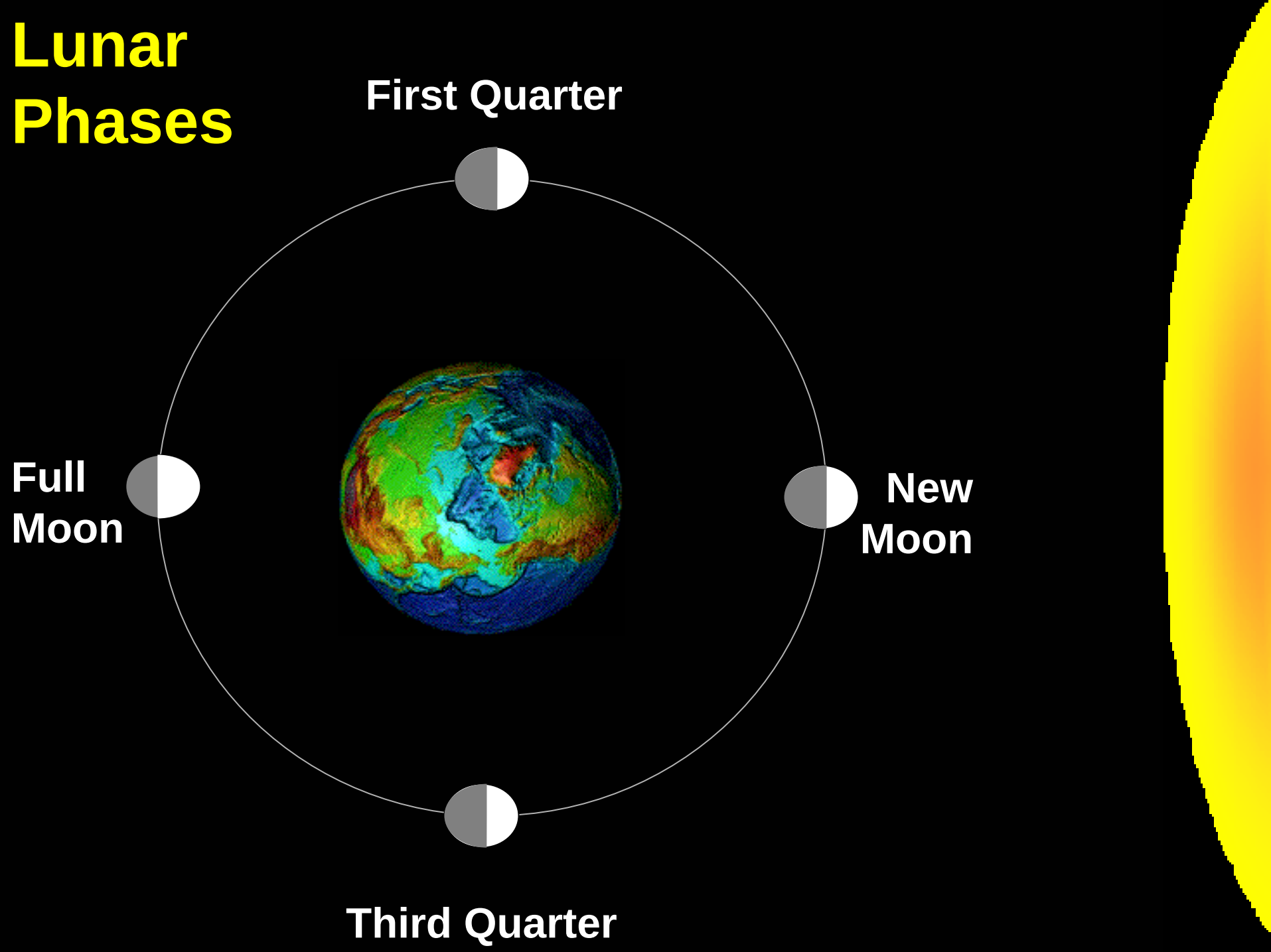
Ocean Waves

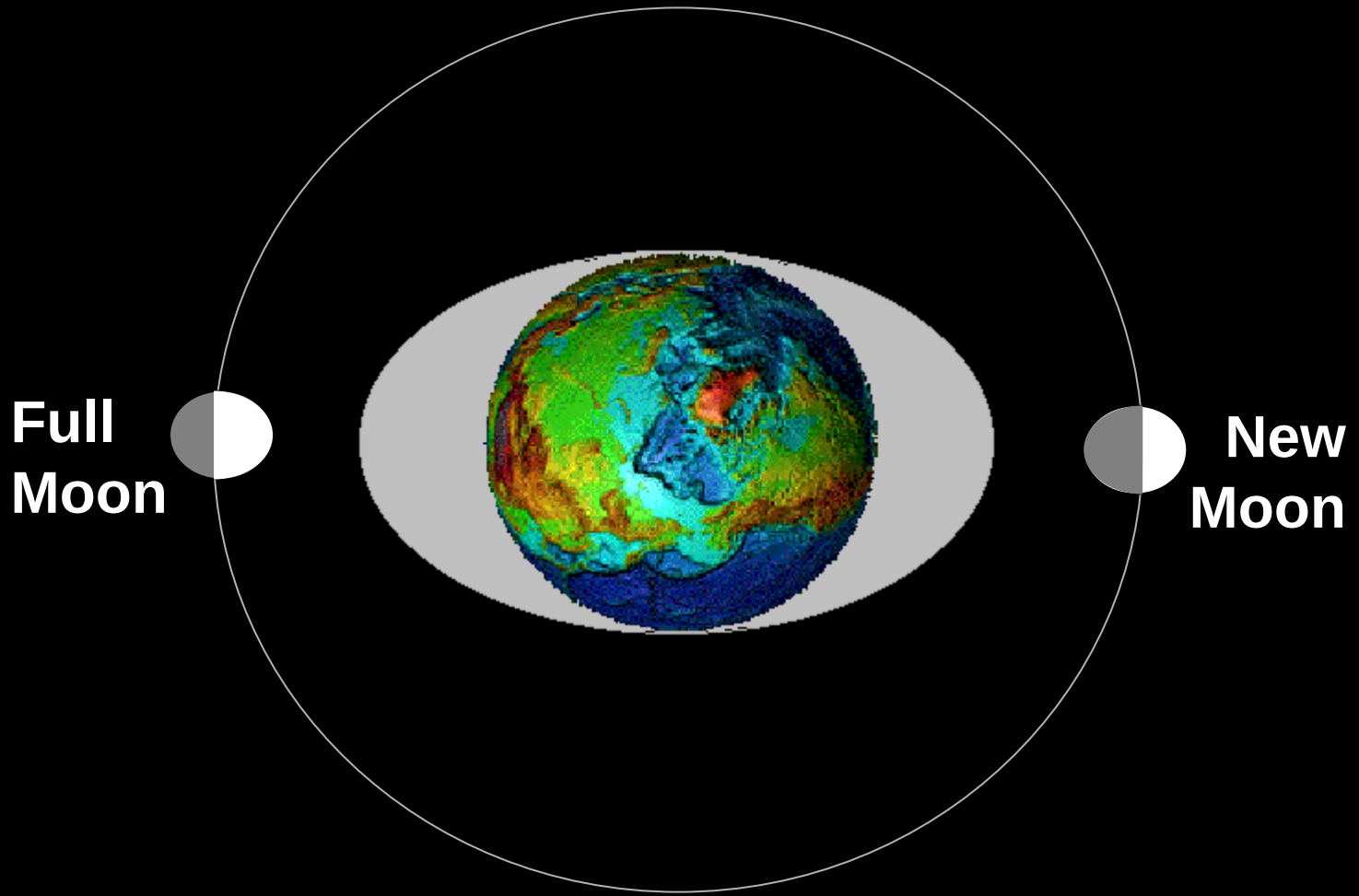


Tides

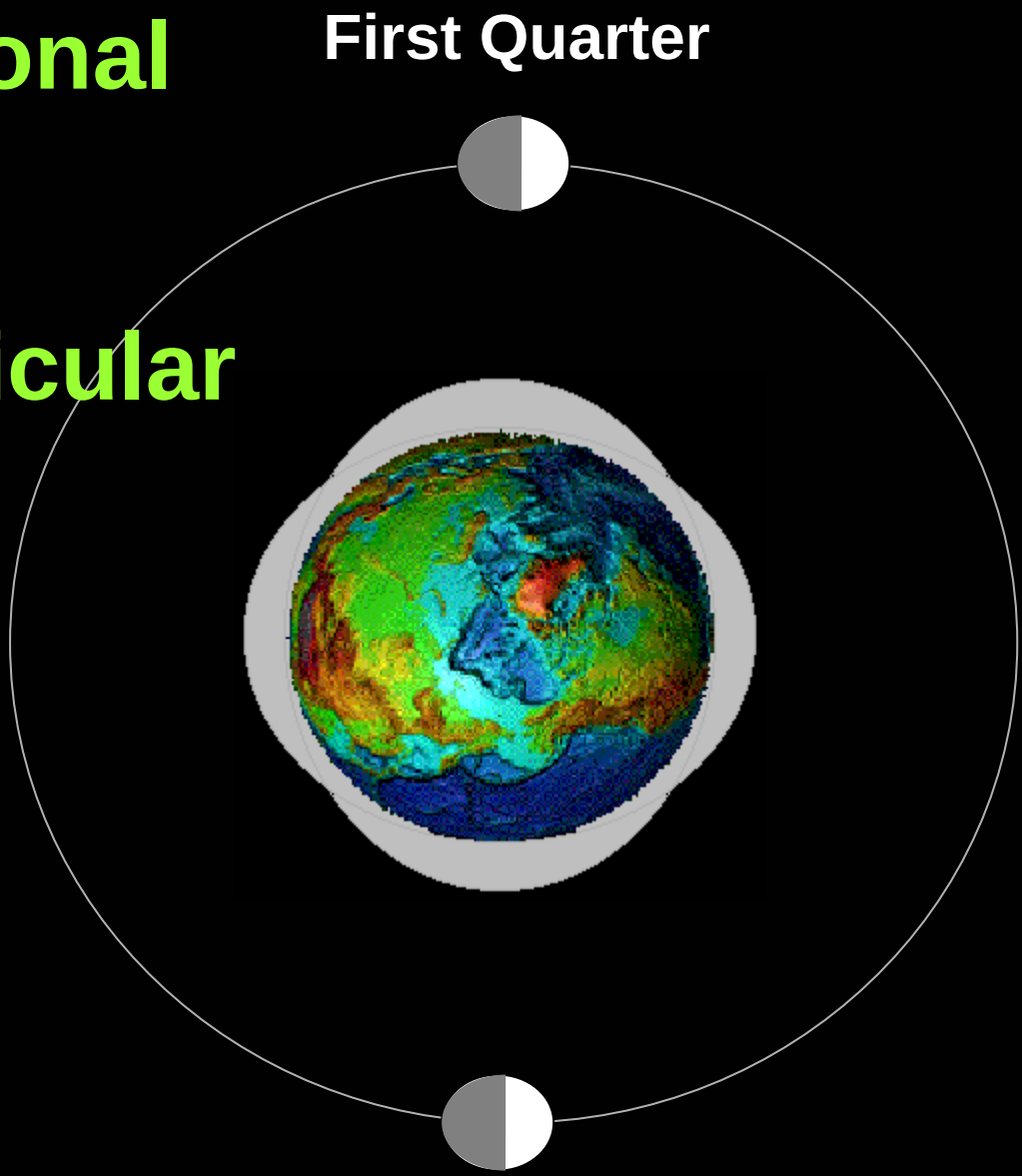
Lunar Phases



Spring Tides occur when the lunar and solar gravitational pulls add up

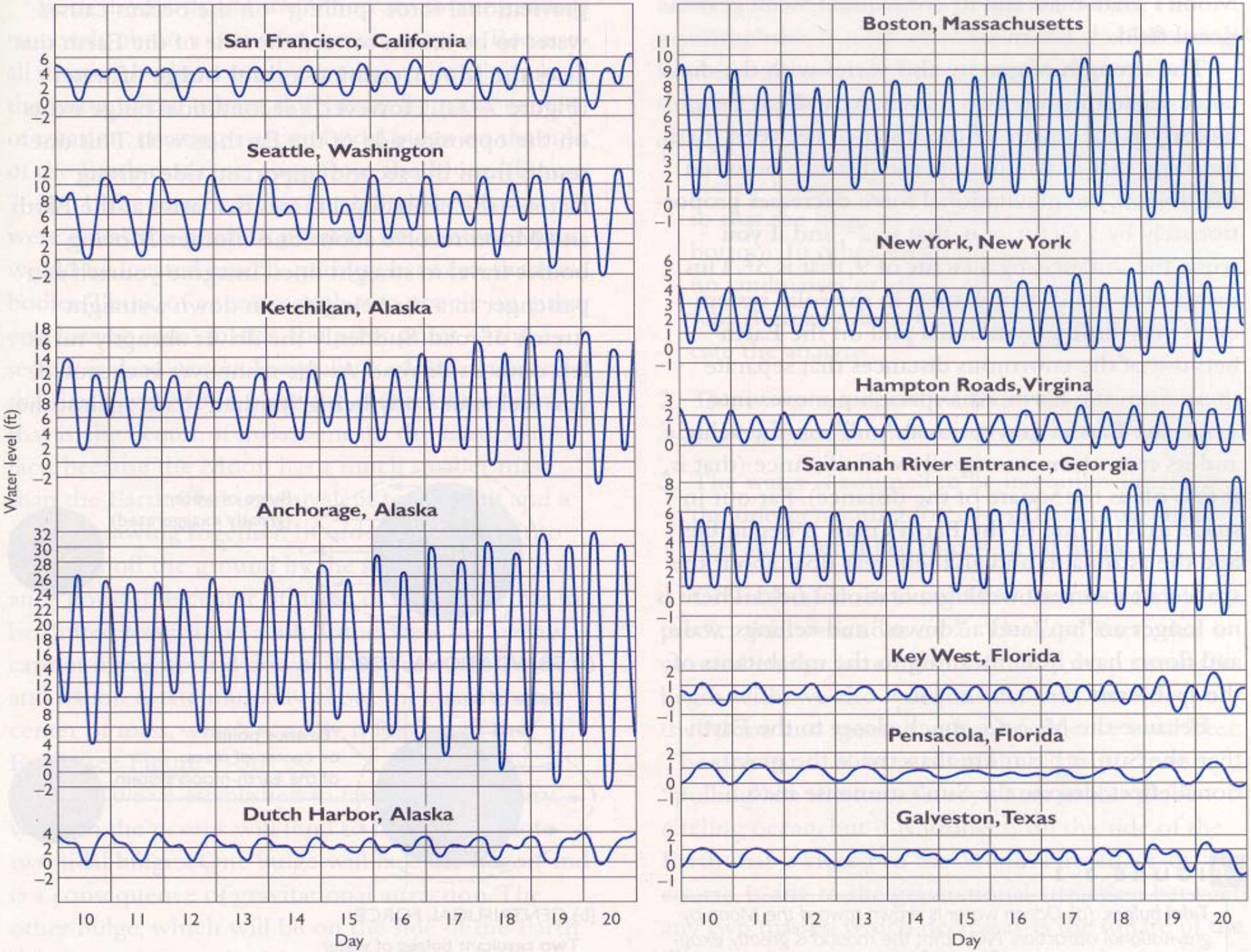


Neap Tides occur when lunar and solar gravitational pulls are mutually perpendicular

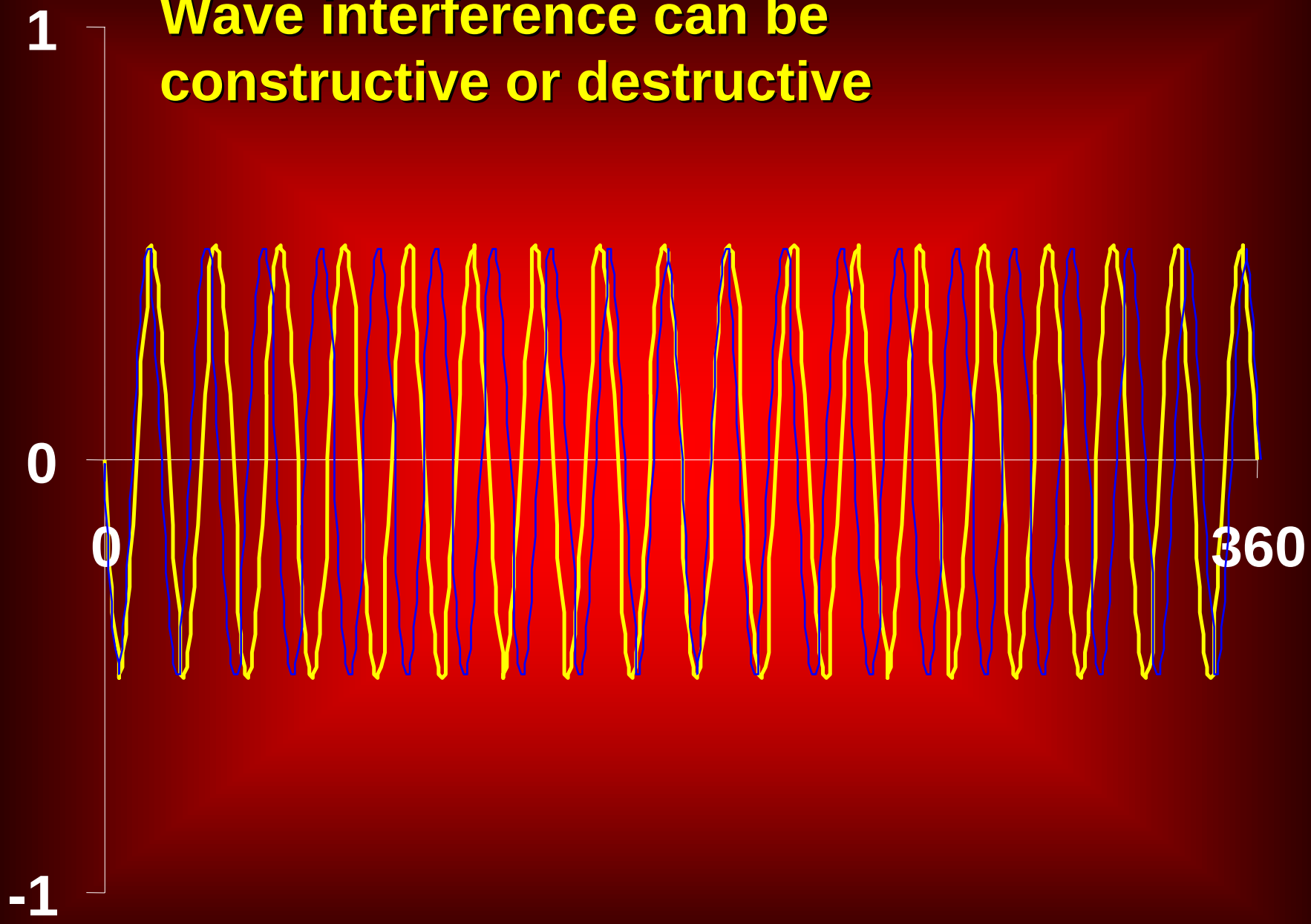


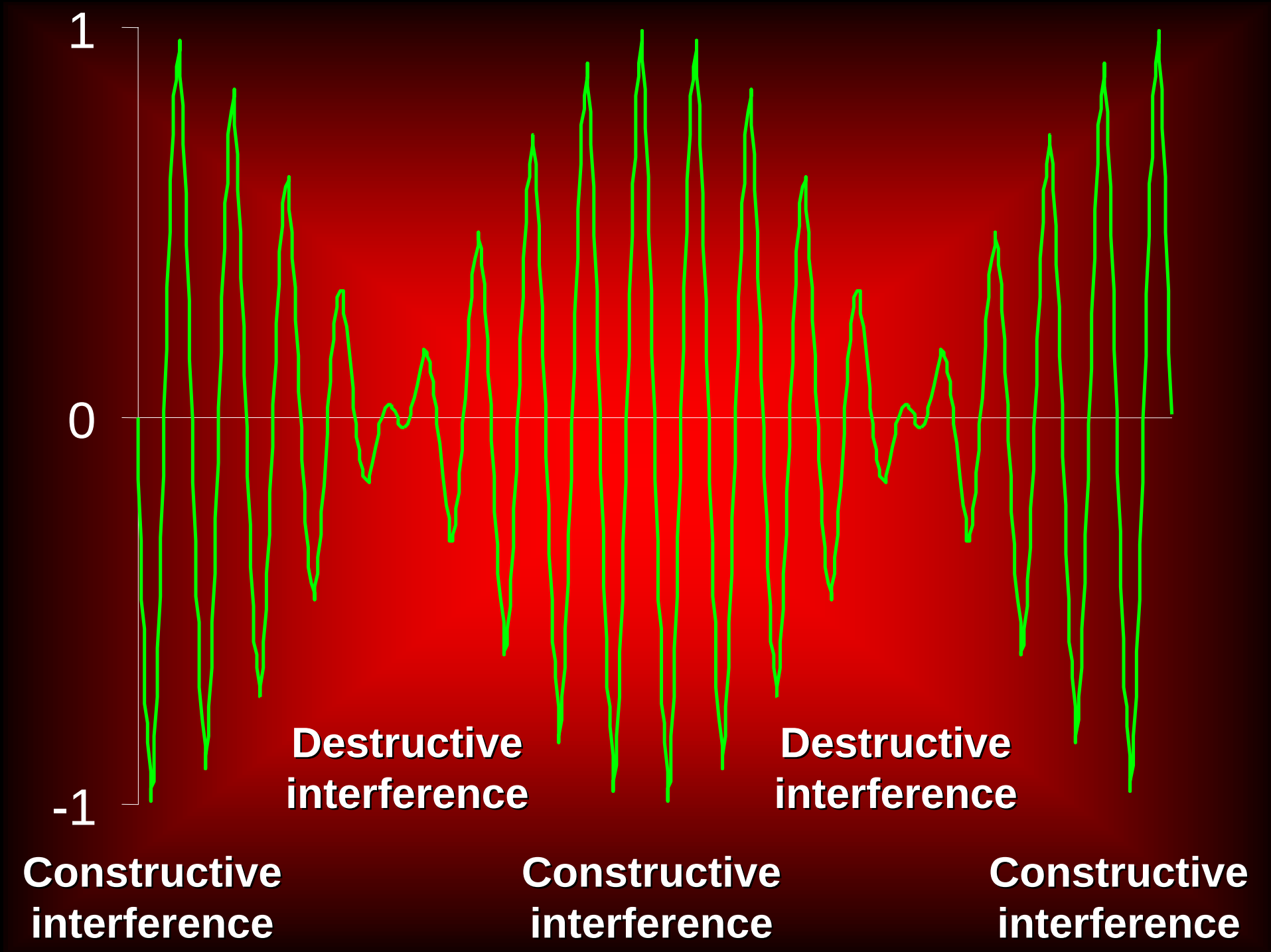
Tides can be

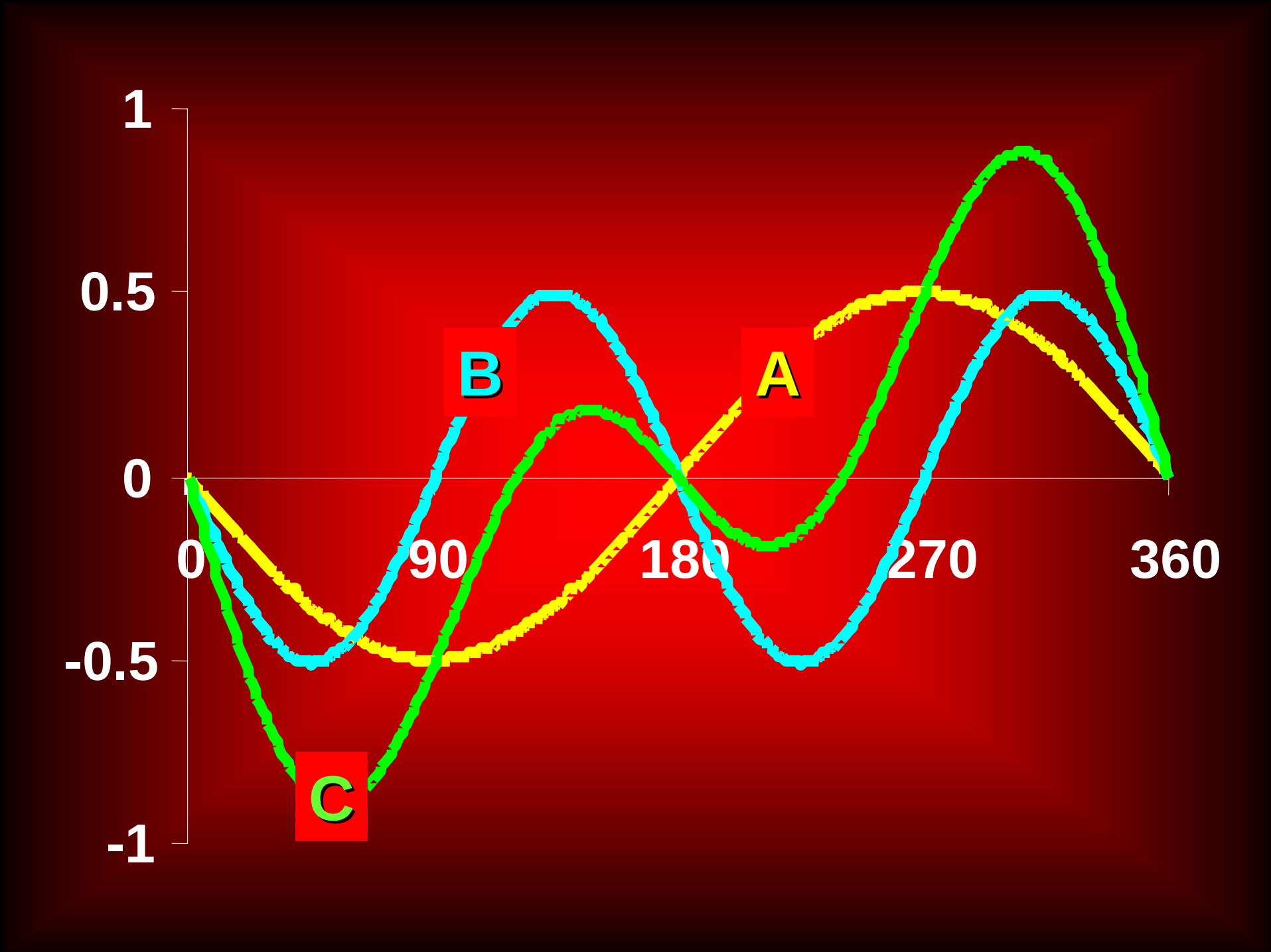
- *SPRING and NEAP, depending on the relative positions of Sun and Moon*
- *DIURNAL, SEMIDIURNAL or MIXED, depending on their daily cycles*

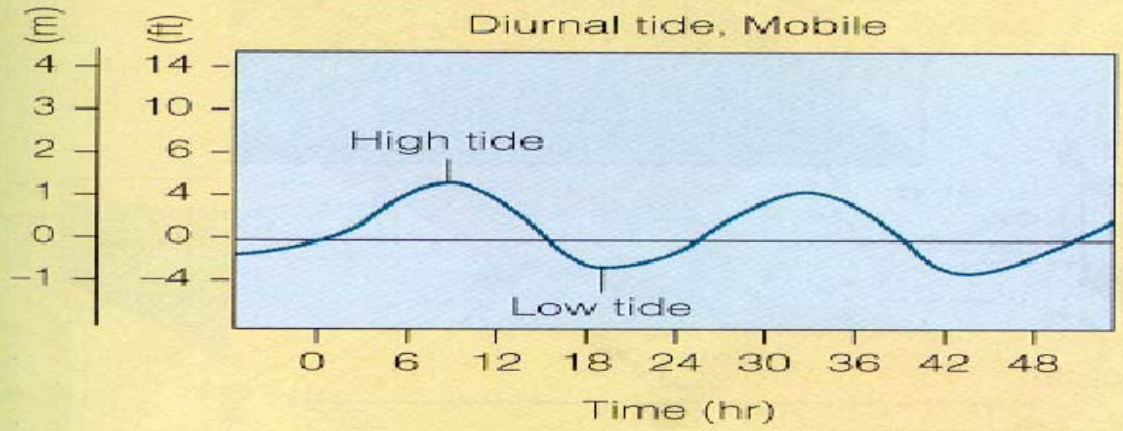

San Francisco, California
Seattle, Washington
Ketchikan, Alaska
Anchorage, Alaska
Dutch Harbor, Alaska
Boston, Massachusetts
New York, New York
Hampton Roads, Virgina
Savannah River Entrance, Georgia
Key West, Florida
Pensacola, Florida
Galveston, Texas
Water level (ft)
Day
Day

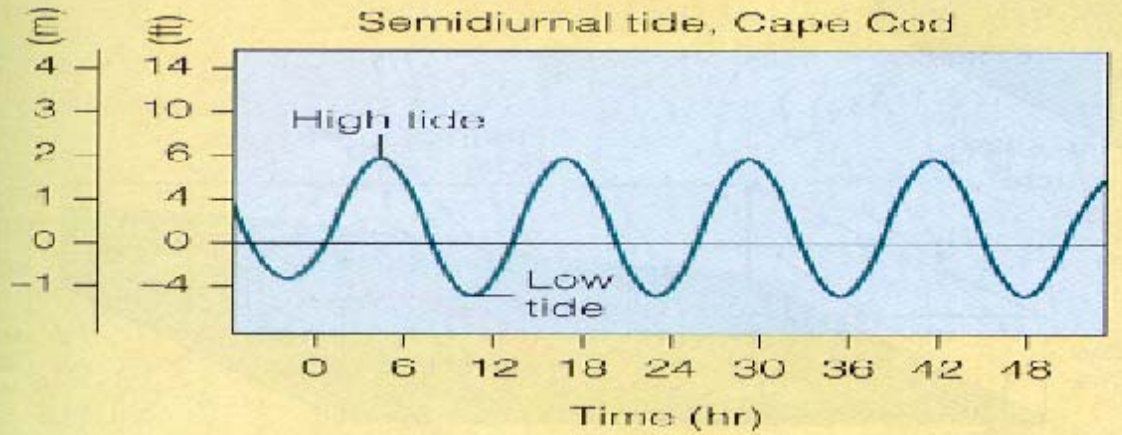
Wave interference can be constructive or destructive

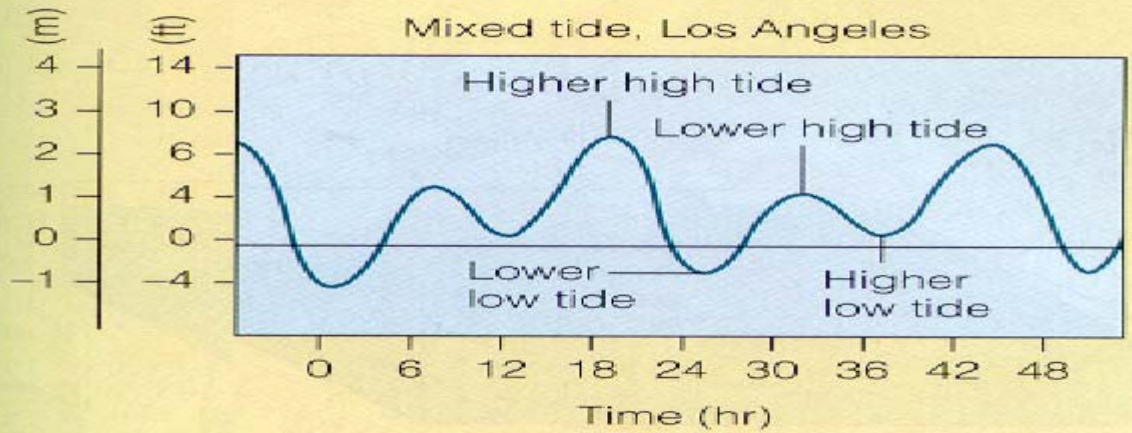



1
0
-1
Destructive interference
Destructive interference
Constructive interference
Constructive interference
Constructive interference


1
0.5
0
-0.5
-1
0
90
180
270
360
A
B
C







Tides can be

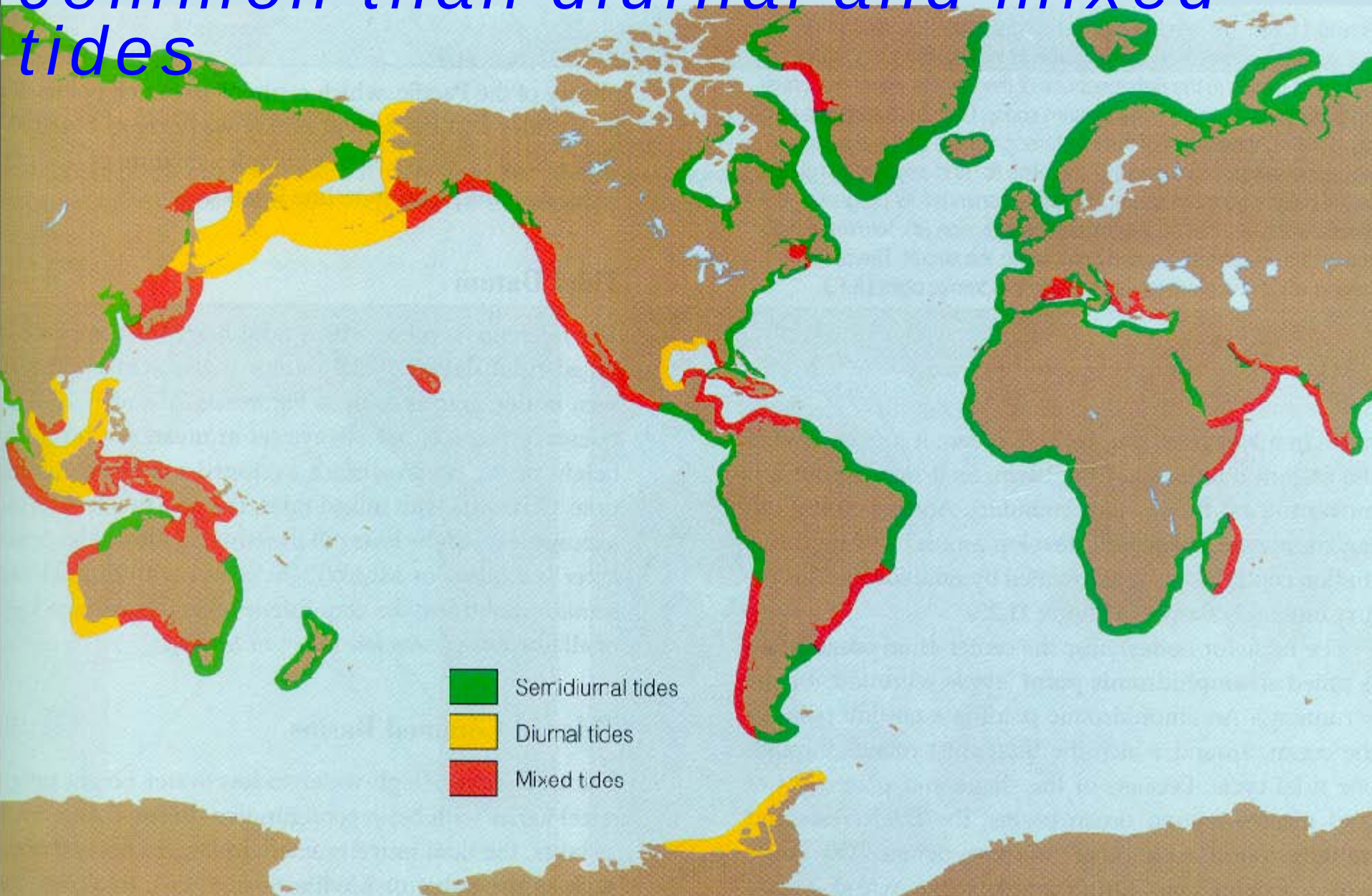
1. Diurnal: or once daily

2. Semidiurnal or twice daily

and

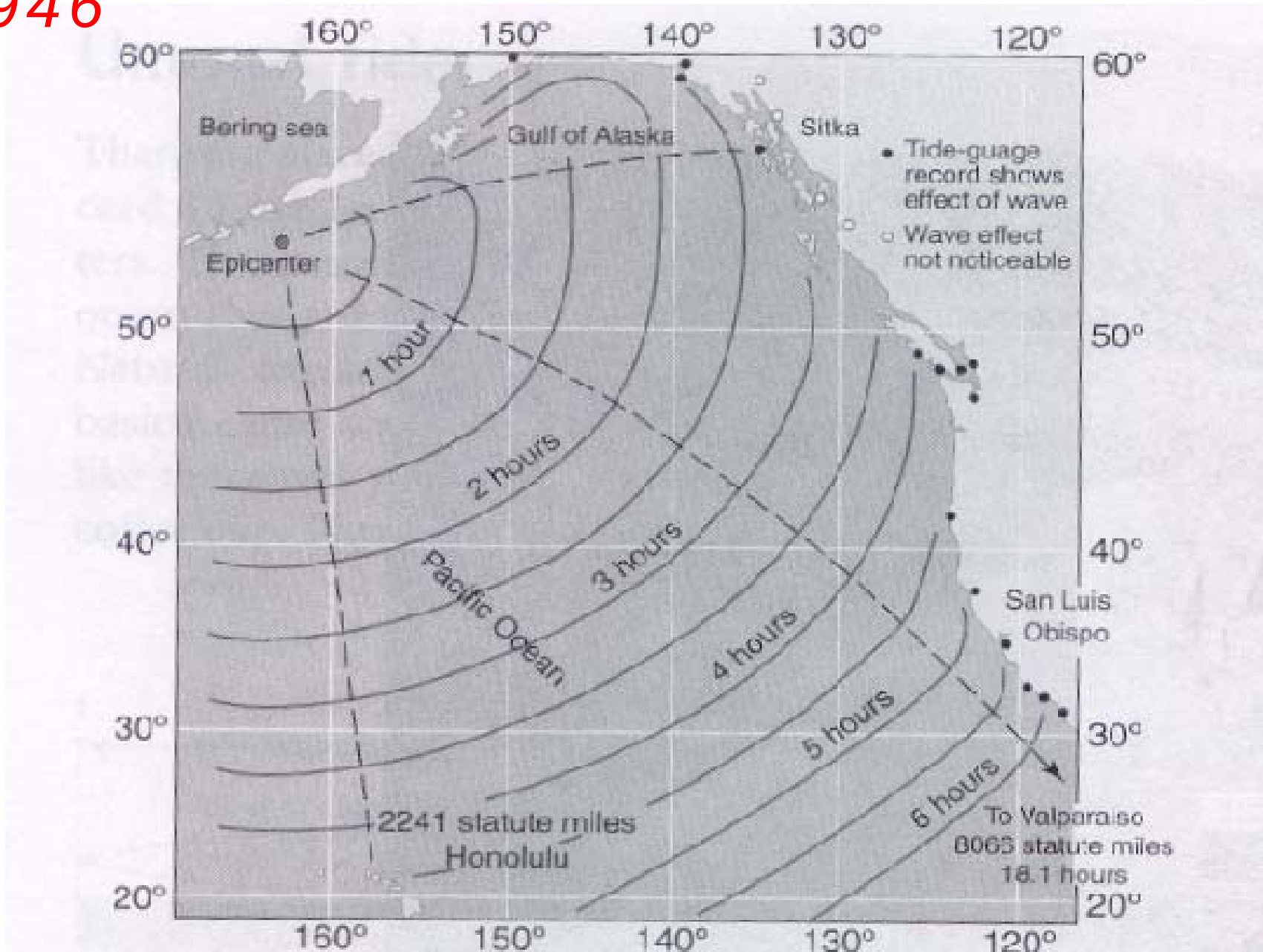
3. Mixed

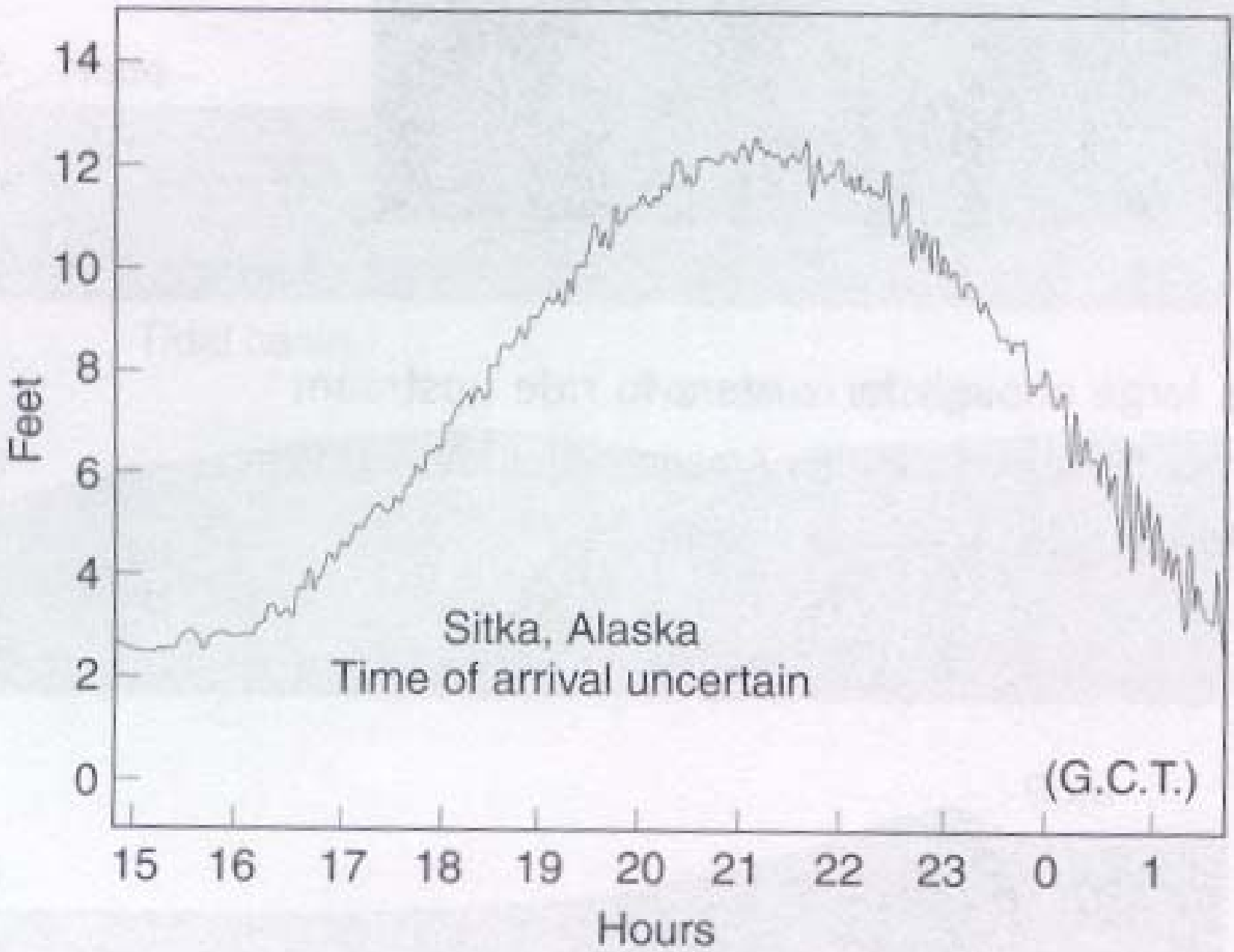
Semidiurnal tides are more common than diurnal and mixed tides

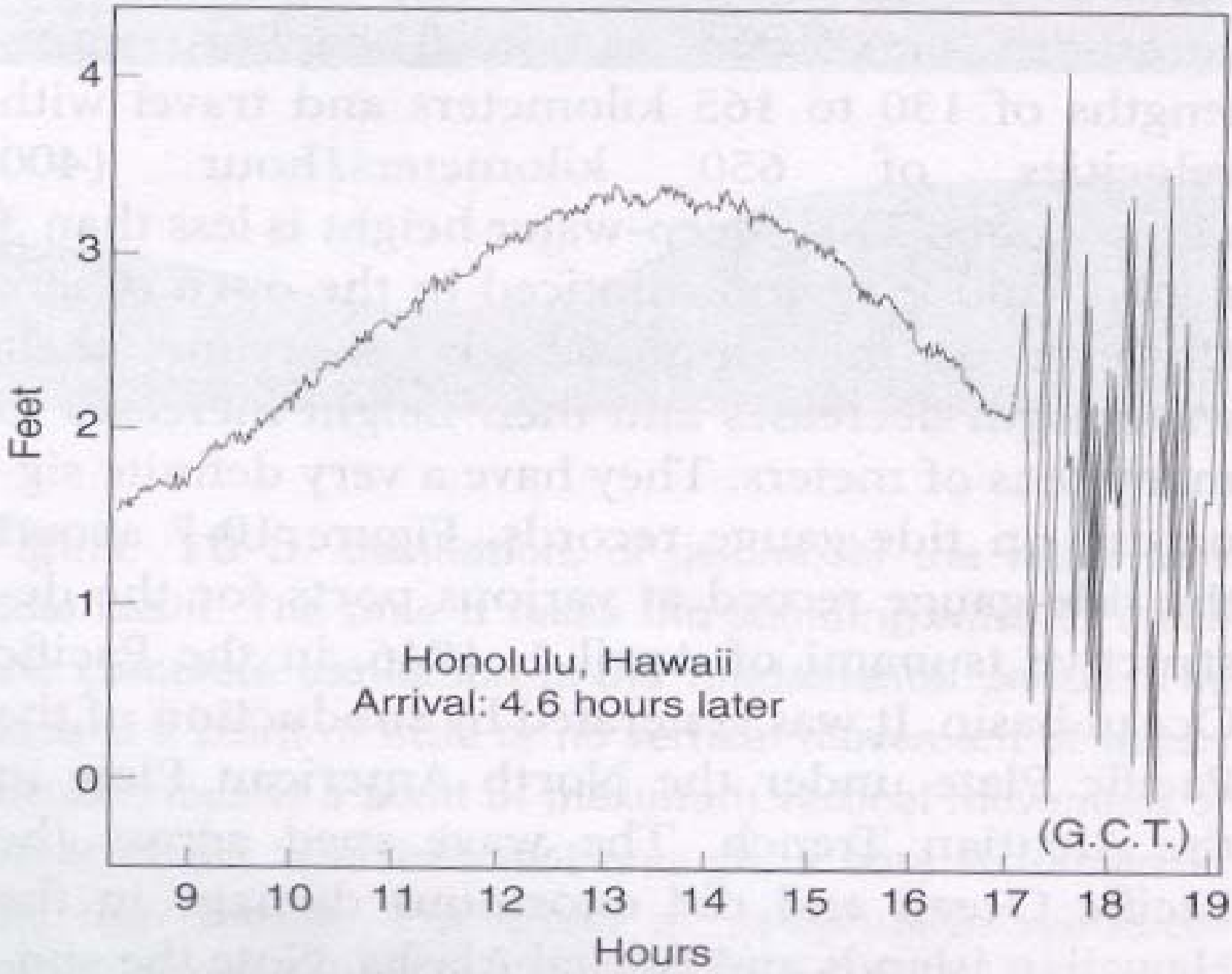


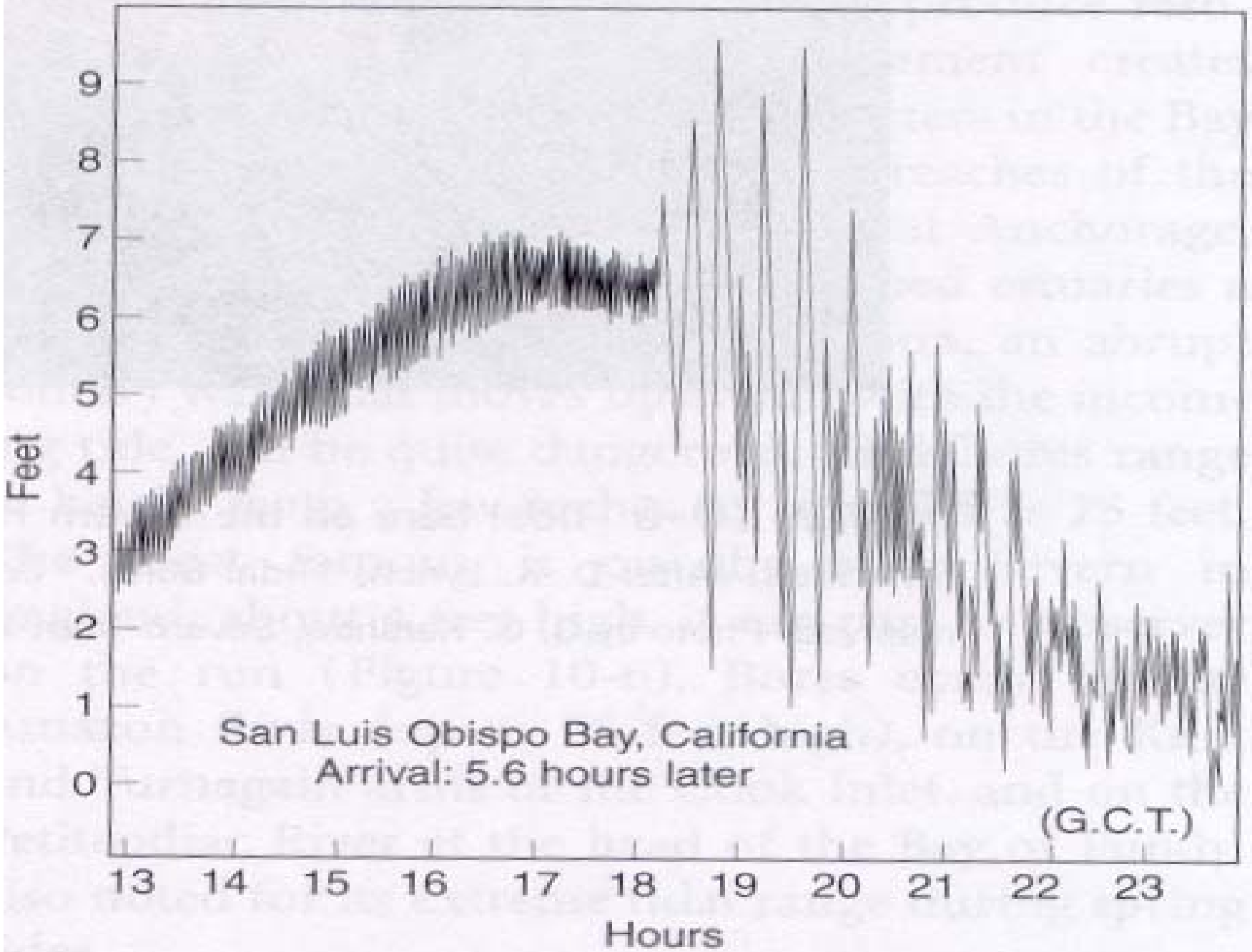
Tsunamis

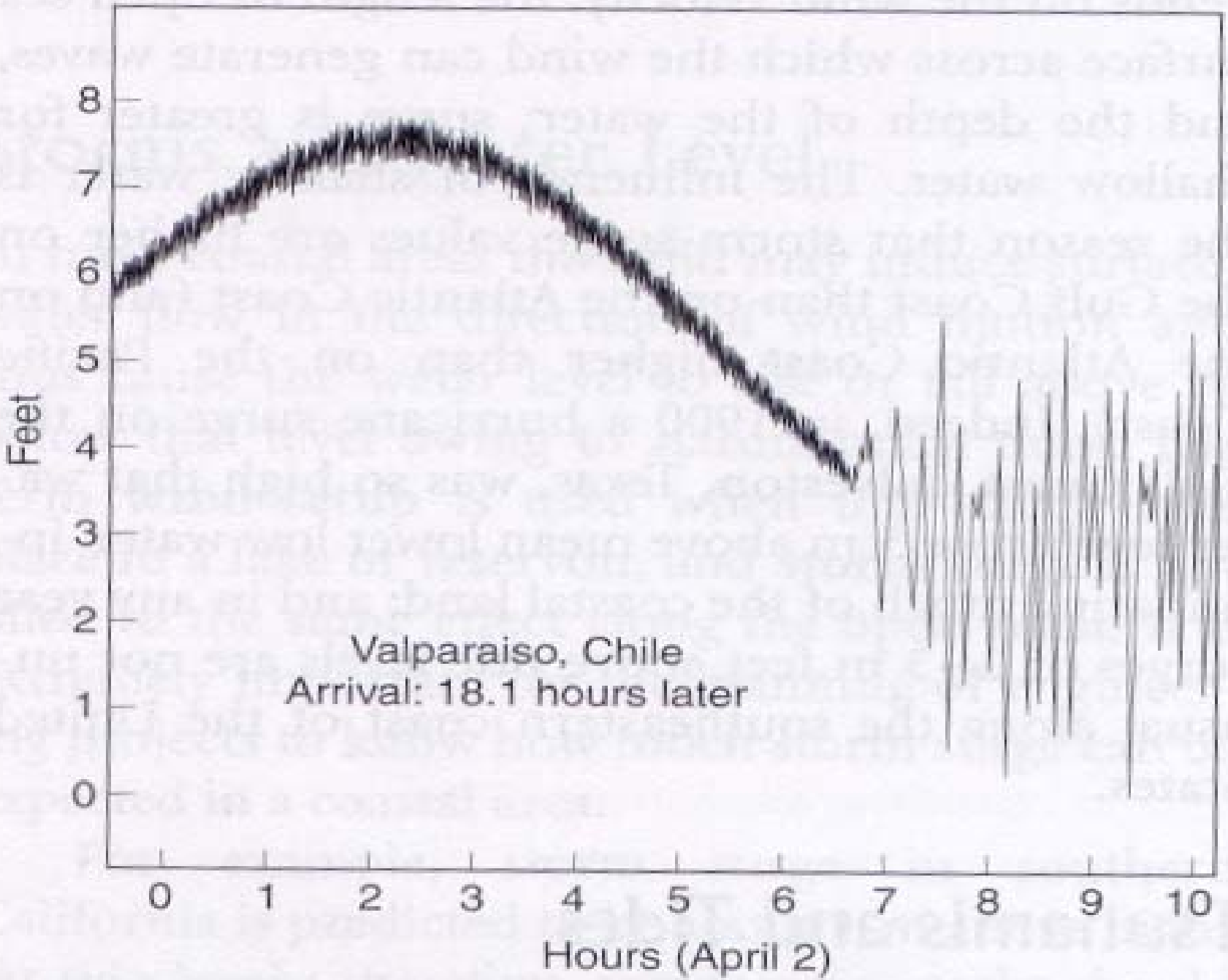
The travel-path of the tsunami of April 1, 1946

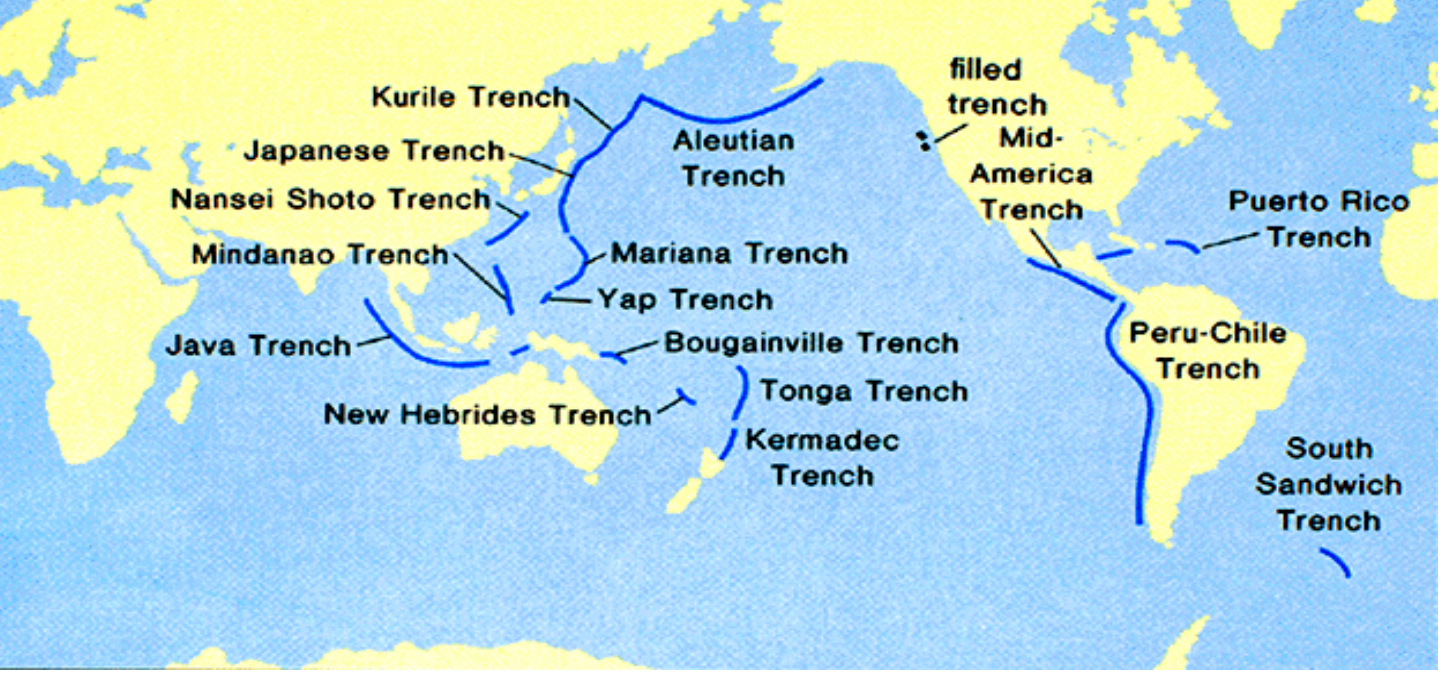


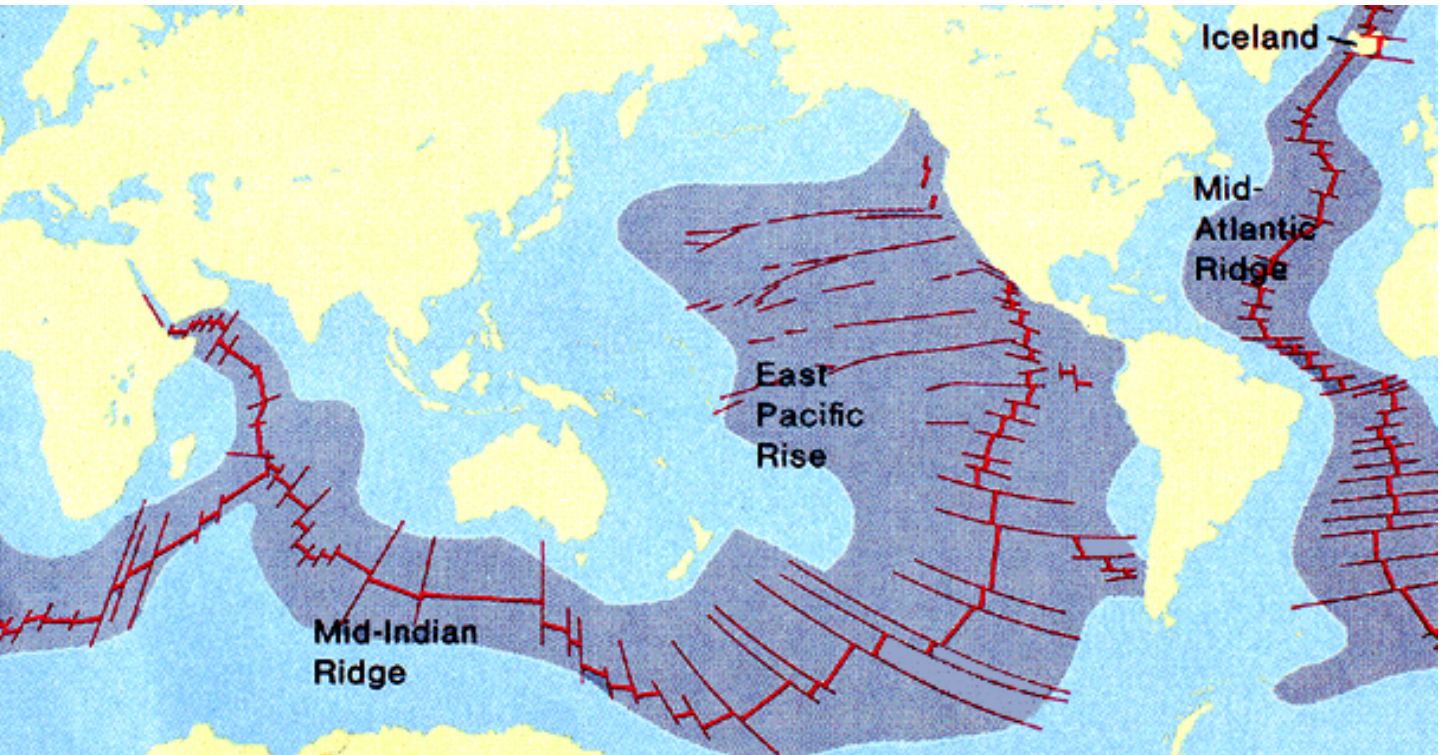

14
12
10
8
6
4
2
0
Feet
Sitka, Alaska
Time of arrival uncertain
(G.C.T.)
15
16
17
18
19
20
21
22
23
0
1
Hours


Feet
4
3
2
1
0
Honolulu, Hawaii
Arrival: 4.6 hours later
(G.C.T.)
9
10
11
12
13
14
15
16
17
18
19
Hours


Feet
9
8
7
6
5
4
3
2
1
0
San Luis Obispo Bay, California
Arrival: 5.6 hours later
(G.C.T.)
13
14
15
16
17
18
19
20
21
22
23
Hours

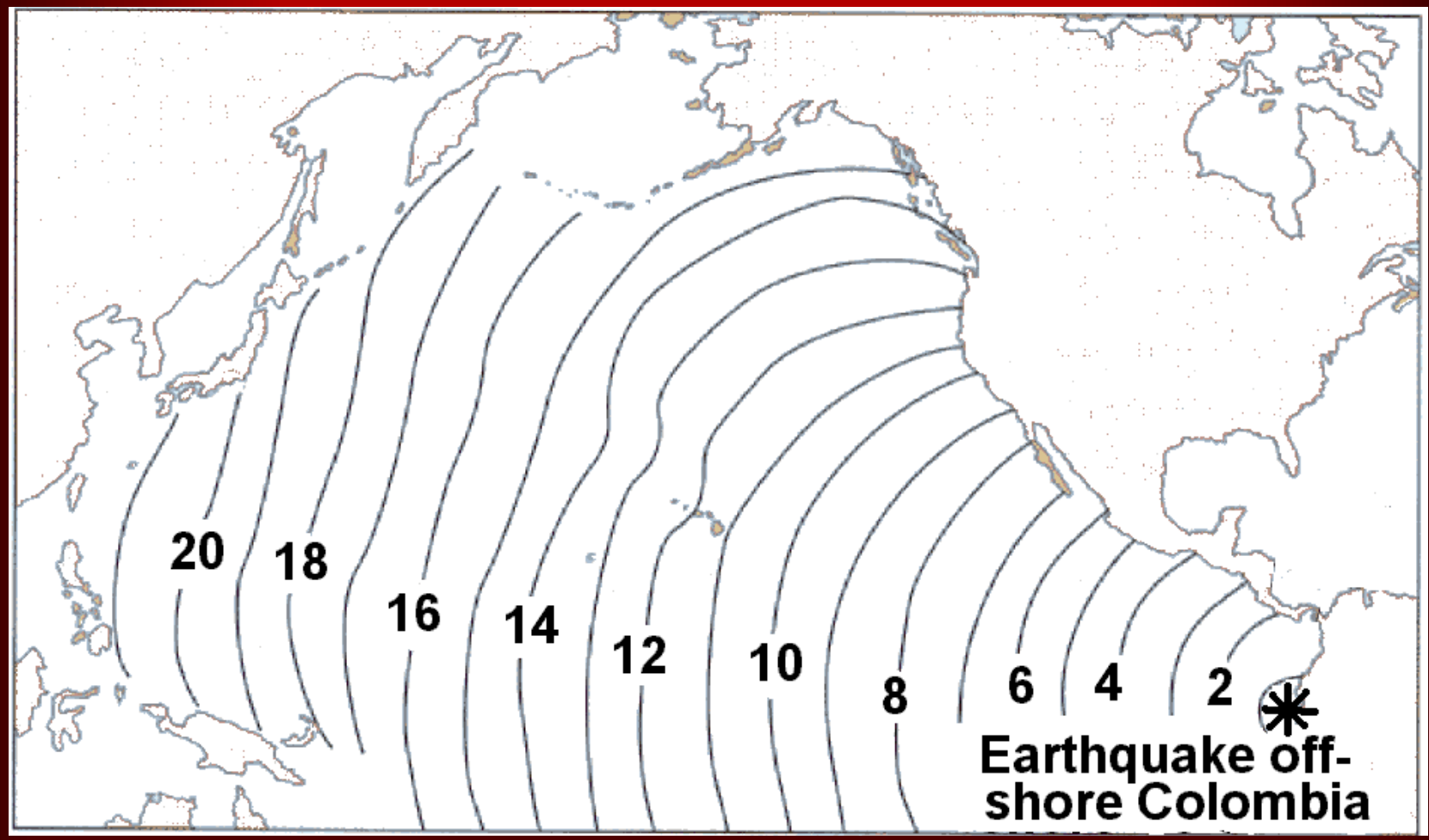

Feet
8
7
6
5
4
3
2
1
0
Valparaiso, Chile
Arrival: 18.1 hours later
0
1
2
3
4
5
6
7
8
9
10
Hours (April 2)





Active ocean-continent margins should expect tsunamis more frequently than the passive ones

The map below shows the position of the leading wave of a tsunami generated by a 1979 earthquake offshore Colombia, South America*. These contours are for the tsunami arrival times in hours.



*K. Ida & T. Iwasaki (Ed.): Tsunamis: Their Science and Engineering (D. Reidel, Boston MA, 1983)

Consider an earthquake with its epicenter at Honolulu, Hawaii. The corresponding tsunami travel times (in hours) from Hawaii are given in this map of the Pacific Ocean.