

Geology 15 Activity 8 B

Name _____

Tsunami Times, Basin Depth, Wave Height

Using the equation for shallow water waves ($C = \sqrt{gd}$), calculate the following water wave speeds for the following depths. This yields the speed in m/sec. Multiply by 1.94 to get the speed in knots.

8,000m: _____ m/sec = _____ knots; 4,000m: _____ m/sec = _____ knots,

200m: _____ m/sec = _____ knots; 100m: _____ m/sec = _____ knots; 10m: _____ m/sec _____ knots

A magnitude 8.2 earthquake occurred of the southern coast of Peru (16.2° S, 73.4° W) on June 23, 2001 at 2033 GMT. The earthquake generated a tsunami that was recorded on tide gauges around the Pacific basin. Using six of these tidal records calculate the arrival time, travel speed, average depth of travel, wave height, and damage hindcast for each site.

Site: ARICA, CHILE [18.4667°S, 70.3333°W; distance from epicenter: 412 km]

Arrival After Quake = _____ (hours)

Avg. Travel Speed _____ (km/hr). Shallow-water Calculation, Avg Depth of Travel = _____ (m)

Wave Height (cm) = _____ Expect Damage? Why or why not?

SITE: ANTAFOGASTA, CHILE [23.65°S, 70.4°W; distance from epicenter: 856 km]

Arrival After Quake = _____ (hours)

Avg. Travel Speed _____ (km/hr). Shallow-water Calculation, Avg Depth of Travel = _____ (m)

Why was the speed faster to this location?

Wave Height (cm) = _____ Expect Damage? Why or why not?

SITE: CALLAO, PERU [12.05°S, 77.15°W; distance from epicenter: 609 km]

Arrival After Quake = _____ (hours)

Avg. Travel Speed _____ (km/hr). Shallow-water Calculation, Avg Depth of Travel = _____ (m)

Wave Height (cm) = _____ Expect Damage? Why or why not?

SITE: VALPARAISO, CHILE [33.0333°S, 71.6333°W; distance from epicenter: 1,886 km]

Arrival After Quake = _____ (hours)

Avg. Travel Speed _____ (km/hr). Shallow-water Calculation, Avg Depth of Travel = _____ (m)

Wave Height (cm) = _____ Expect Damage? Why or why not?

SITE: SANTA CRUZ, GALAPAGOS ISLANDS [00.75°S, 90.3167°W; distance from epicenter: 2,531 km]

Arrival After Quake = _____ (hours)

Avg. Travel Speed _____ (km/hr). Shallow-water Calculation, Avg Depth of Travel = _____ (m)

Wave Height (cm) = _____ Expect Damage? Why or why not?

SITE: SAND POINT, ALASKA [55.3366°N, 160.4933°E; distance from epicenter: 11,298 km]

Arrival After Quake = _____ (hours)

Avg. Travel Speed _____ (km/hr). Shallow-water Calculation, Avg Depth of Travel = _____ (m)

Wave Height (cm) = _____ Expect Damage? Why or why not?

Table 7-2. Recorded tide gauge heights.

Gauge Location	Distance (km)	Wave Height cm (peak - trough)	Initial Motion	Travel Time hr:min	*
Arica, Chile	415	257	rise	0:35	1
Callao, Peru	609	80	rise	1:34	1
Antofagasta, Chile	856	90	rise	1:02	1
Valparaiso, Chile	1,886	60	rise	2:27	1
Talcahuano, Chile	2,283	250	rise	3:41	1
Santa Cruz, Galapagos Is.	2,523	90	rise	3:59	1
Easter Is., Chile	3,905	35	?	5:41	2
Cabo San Lucas, Mexico	5,960	25	?	8:56	2
La Jolla, CA	7,170	10	?	11:19	2
Los Angeles, CA	7,304	10	?	11:36	2
San Francisco, CA	7,887	7	?	12:51	2
Crescent City, CA	8,280	40	?	13:13	2
Hilo, HI	9,770	70	rise	13:27	1
Chatham Is., NZ	9,781	55	?	14:05	2
Sitka, AK	9,929	5	?	16:02	2
Apia, Western Samoa	10,450	25	?	14:49	1
Kodiak, AK	10,890	8	?	16:59	2
Sand Point, AK	11,298	24	?	17:08	2
Nukualofa, Tonga	11,489	20	?	15:07	1
Midway Is., USA	12,188	15	?	16:27	2
Adak, AK	12,317	20	?	17:27	2
Kwajalein, Marshall Is.	13,347	10	?	18:00	2
Wake Is.	13,679	10	?	18:11	2
Omaezaki, Honshu, Japan	16,259	25	?	21:39	2
Naha, Okinawa, Japan	17,565	10	?	23:05	2

* 1.) travel time measured from recorded arrivals

2.) travel time estimated from algorithm; source:<http://wcatwc.gov/06-23-01.htm>