Thermal Biology in Yellowstone National Park

Earth Science

**Predicting Riverside's next eruption
Geysers of Yellowstone National Park - Students Lab**

6-8

PROBLEM QUESTION:

What variables do you think would be needed in order to predict a geyser eruption?

HYPOTHESIS:

????

BACKGROUND CONTENT:

Old Faithful is one of the world's most popular geysers. Located in Yellowstone National Park, it was given its name by the Washburn Expedition in 1870. Classified as a cone-type geyser, it has intervals, which is the time between eruptions, that range from 35 to 120 minutes. The duration, the length of time that the geyser is erupting, ranges from 1 ½ to nearly 5 minutes, with an eruption height of 90 to 184 feet. Another less famous, however, just as predictable geyser is Riverside geyser located on the edge of the Firehole River less than a mile away from Old Faithful geyser. Riverside is also a cone geyser. This geyser has intervals of 5 ½ to 7 hours with the duration of the eruption lasting ½ hour. The geyser erupts 75 feet in the air over the river. The eruption process is highly complex, but basically a subterranean "plumbing system" contains water that is heated by magma that is near the earth's surface. This magma is within a mile of the surface in Yellowstone. The heated water reaches temperatures above boiling due to the pressure of the water in the plumbing system. At some point, the super-heated water bursts into steam setting off a chain-reaction in which other water molecules convert to steam. The volume of steam is 1500 times greater than that of water and the resulting increase in volume pushes water out of an opening in the earth's surface, causing a geyser eruption. The eruption continues as long as there is ample water in the plumbing system. When the amount of water is reduced and the pressure in the system is decreased, the eruption ceases, allowing the system to recharge for another eruption. Some geysers have a more stable plumbing system and water supply causing them to be "predicable." Such is the case with Riverside and Old Faithful.

MATERIALS AND SUPPLIES:

1. Data set of Riverside eruptions.

The data set includes the actual date and time of eruptions and the duration. The duration and interval is already calculated for you. The data table begins with an eruption in 2006 and then the 2007 data begins, that is why there is a 0:00:00 interval for the

first interval in the data set, do not use the first line of data. The data table for 2007 looks like the following:

DATE	TIME	DURATION	DATE	TIME	INTERVAL
12/31/06	17:13:00	2:05:00	12/31/06	19:18:00	0:00:00
12/31/06	23:53:00	2:01:00	12/31/06	01:54:00	6:36:00
01/01/07	06:30:00	1:22:00	01/01/07	07:52:00	5:58:00

We will only be working with the duration and the interval data.

2. Graph paper or graphing software or graphing calculator.
3. Generate a scatter plot of the two variables, placing the duration of the geyser eruption on the X axis and the interval between geyser eruptions on the Y axis.

RIVERSIDE GEYSER ERUPTIONS AND OVERFLOWS FOR THE FIRST 25 ERUPTIONS OF 2007					
Overflow			Eruptions		
Date	Time	Duration	Date	Time	Interval
12/31/2006	23:53:00	2:01:00	1/1/2007	1:54:00	6:36:00
1/1/2007	6:30:00	1:22:00	1/1/2007	7:52:00	5:58:00
1/1/2007	12:18:00	2:03:00	1/1/2007	14:21:00	6:29:00
1/1/2007	19:00:00	2:04:00	1/1/2007	21:04:00	6:43:00
1/2/2007	1:38:00	2:03:00	1/2/2007	3:41:00	6:37:00
1/2/2007	8:13:00	2:06:00	1/2/2007	10:19:00	6:38:00
1/2/2007	14:45:00	1:58:00	1/2/2007	16:43:00	6:24:00
1/2/2007	21:10:00	1:56:00	1/2/2007	23:06:00	6:23:00
1/3/2007	3:35:00	1:54:00	1/3/2007	5:29:00	6:23:00
1/3/2007	10:01:00	1:57:00	1/3/2007	11:58:00	6:29:00
1/3/2007	16:31:00	1:56:00	1/3/2007	18:27:00	6:29:00
1/3/2007	22:55:00	1:54:00	1/4/2007	0:49:00	6:22:00
1/4/2007	5:22:00	1:53:00	1/4/2007	7:15:00	6:26:00
1/4/2007	11:51:00	1:52:00	1/4/2007	13:43:00	6:28:00
1/4/2007	18:19:00	1:59:00	1/4/2007	20:18:00	6:35:00
1/5/2007	0:50:00	2:01:00	1/5/2007	2:51:00	6:33:00
1/5/2007	7:24:00	2:05:00	1/5/2007	9:29:00	6:38:00
1/5/2007	14:02:00	2:06:00	1/5/2007	16:08:00	6:39:00
1/5/2007	20:39:00	2:05:00	1/5/2007	22:44:00	6:36:00
1/6/2007	3:14:00	1:55:00	1/6/2007	5:09:00	6:25:00
1/6/2007	9:41:00	1:56:00	1/6/2007	11:37:00	6:28:00
1/6/2007	16:13:00	2:04:00	1/6/2007	18:17:00	6:40:00
1/6/2007	22:55:00	2:07:00	1/7/2007	1:02:00	6:45:00
1/7/2007	5:36:00	1:21:00	1/7/2007	6:57:00	5:55:00
1/7/2007	11:20:00	2:04:00	1/7/2007	13:24:00	6:27:00

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QUESTIONS:

1. Does the graph show a linear relationship?

2. Is there a particular grouping of data points?

3. What do you notice about the groupings?

4. What do the groups tell you?

5. Can you determine an average duration of eruption time for each of the groupings? Can you determine the average interval between eruptions for each of the groupings?

6. Using the graphic information can you predict the next eruption time?

7. What are the chances of the next eruption being a short geyser eruption?

RESOURCES:

Geyser Observation and Study Association
http://www.geyserstudy.org/default.htm

Old Faithful Webcam
http://www.nps.gov/archive/yell/oldfaithfulcam.htm

Short videos on geysers, videos 17,17a, 17b, 17c
(1-2 minutes each)
http://www.nps.gov/archive/yell/insideyellowstone/videolist.htm