Briefing Sheet: Volcano Team
Instructions

The information and tools you will need:

- 2 Seismic Events Data Sheets: Both RF and VT
- Graph paper
- Practice data
- Calculator

Steps:

1. Download and Read the Real-Time Data

During Mission day, the LEO satellite will be relaying real-time data from ground-based sensors on the island. This data may be downloaded by using the URL given to you by Mission Control. We have also included some sample real-time data here for your practice.

EXAMPLE: Real-Time Data 09/04/1996

GMT	RF	VT
00:00	16	12

In this example, the data is from Sept. 4, at midnight, Greenwich Mean Time (GMT). (GMT is the same as "Universal Coordinated Time" or "Zulu" time). The first data report reads, "Seismic Activity data for September 4th at zero hundred hours: Hourly Rockfall Events total 16, and Hourly Volcanic Tremors total 12."

2. Record the data

Record the data in Column B on each of the Seismic Events Data Sheets.

In the example at the top of Seismic Events Data Sheet, you can see we've recorded the data in Column BC.

3. Calculate the cumulative events for 24 hours

Add the current Hourly Events (Column B) to the previous Column C*. Record the total in the Cumulative Events column (Column C).

*Note: For the first reading assume the previous Column C figure is zero. In the example at the top of Seismic Events Data Sheet, you can see we've calculated the first four cumulative totals.

4. Use the Cumulative Hourly Events to calculate the Projected Daily Events Total

To establish a Projected Daily RF Event Total, multiply the Cumulative Hourly RF Totals (Column C) by the factor in the "Multiply By" column (Column D). Round-off your results to the nearest whole number.

5. Calculate Projected Total Seismic Activity

Total seismic activity is the sum of the estimates of Projected Daily RF Events (Column E) and Projected Daily VT Events (Column E, other sheet). The data tells us if and when the seismic activity shows a sharp increase.

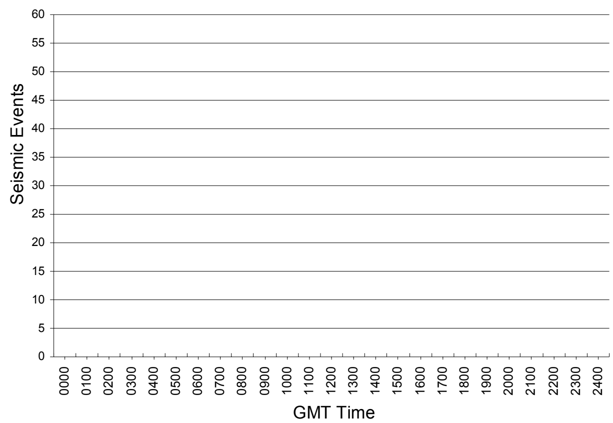
6. Graph seismic activity

Create a graph of the total projected activity to find if there has been a sharp increase at any one time interval. Note: A large increase in the number of VTs between one reading and the next is an important indicator of pyroclastic or lava flows to follow

You may choose to make one to three graphs:

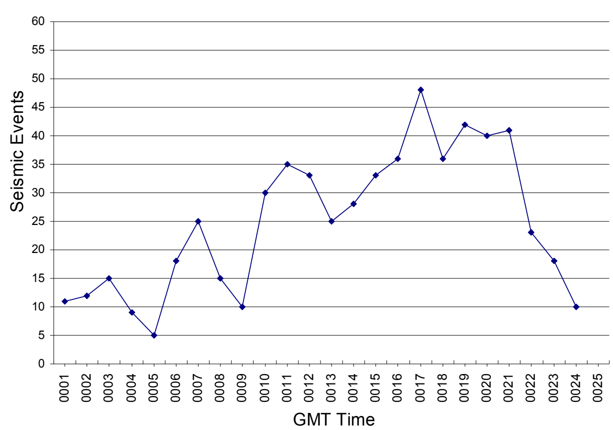
- Graph of **Hourly RF Events** (scale of 0-60) as a function of GMT time (Column B)
- Graph of **Hourly VT Events** (scale of 0-60) as a function of GMT time (Column B)
- Graph of **Total Seismic Activity** (scale of 0-2000) as a function of GMT time (Column F)

Along the X Axis (horizontal), make 24 evenly spaced marks. Label each mark according to GMT 00:00 (Midnight) through 23:00 (11 pm).



Along the Y axis, start at 0 and label each mark by 5s up to 60 (or start at 0 and label by 100s up to 2000, depending on which graph you choose to make).

Plot each point from Column B or F on the line graph. Connect the data points to create a line graph that represents the Projected Seismic Events.



Predicting Eruptions

Volcanologists use different tools and techniques to analyze and interpret data. One kind of data is numbers. VT and RF numbers represent the amount of seismic activity. Another kind of data is visual observations. An observation can be just as important as the numbers for predicting volcanic eruptions. For instance, if lava flows are observed as especially "bubbly", then a scientist can infer that the lava contains a high level of dissolved gases and can be explosive.

To be able to predict volcanic activity during the mission, you will want to use all the data. Others may have different predictions. To determine which prediction is most scientific, you must use your best communication skills to point out the relationship between the data and the prediction.

No one can predict exactly when a volcano might explode. There are, however, common clues to look for to let people know that the danger is increasing:

- **Land deformation**. Near the volcanic vent, as magma pushes up from below, the land on top of and surrounding the vent may start to deform, and grow larger. In many cases this deformation creates a dome of volcanic debris. As the dome grows in size, it becomes more unstable, and ultimately it will collapse and produce pyroclastic flows or lava flows. Increasing dome size indicates a growing danger.

- **Ash Clouds**. Large ash clouds are evidence of increasing volcanic activity. On the island of Montserrat scientists have found that during dangerous times, ash clouds occur in a cycle of 4 to 30 hours apart. What causes an ash cloud? In an active volcano, the vent may become plugged by rocky materials. This plug causes the pressure from the rising magma to build until eventually the plug is blasted apart in a flurry of explosive activity. The released pressure creates an ash cloud, shooting volcanic debris high into the air. Once an ash cloud is produced, the vent may become plugged again and the cycle may repeat. If a plugged volcano does not release its pressure, then scientists become concerned that a massive explosion is imminent. As long as the ash clouds keep appearing regularly, then there is less concern.

- **Tremors**. Flowing magma, trying to make room for itself, causes tremors on the surface. Tremors are measured both for their magnitude and the length of time between vibrations, or rate. On the island of Montserrat, scientists study two kinds of seismic data: Volcanic Tremors (VTs) and Rockfall (RF). The number of tremors or falling rocks which exceed a predetermined critical value are counted by the seismometer (see illustration). The more of these "events" the greater the level of the seismic activity. The rate of tremors is determined by charting the number of events per hour. An increase in the number of events can be an indication of possible eruption.