

Introduction to Lava Flows using VICTOR

Running MOLASSES and Mr Lava Loba on VICTOR with
insights from the 2022 Mauna Loa Eruption



source: [USGS](#)

Overview of the Lab

- Part 1: Familiarizing yourself with the eruption area
- Part 2: Getting Started on VICTOR
- Part 3: Running the Model: MOLASSES
- Part 4: Recording MOLASSES Outputs
- Part 5: Analyze your MOLASSES Outputs
- Part 6: Running the Model: MrLavaLoba
- Part 7: Recording MrLavaLoba Outputs
- Part 8: Analyze your MrLavaLoba Outputs
- Part 9: Share and Discuss

Lava Flows

MOLASSES and Mr Lava Loba on VICTOR

Objectives:

1. **Identify** and **navigate** key aspects of the VICTOR interface.
2. **Analyze** real-world data from the 2022 eruptions of Mauna Loa and **conduct** a parameter sweep using VICTOR.
3. **Compare** and **contrast** outputs from two VICTOR models.

Introduction and Background:

In this assignment, you will use two numerical flow models – MOLASSES and MrLavaLoba to simulate the 2022 eruption of Mauna Loa volcano in Hawai'i. You will examine the effect of input parameters on model predictions and use the models to forecast the impact of the flow on infrastructure.



source: USGS

you will need...

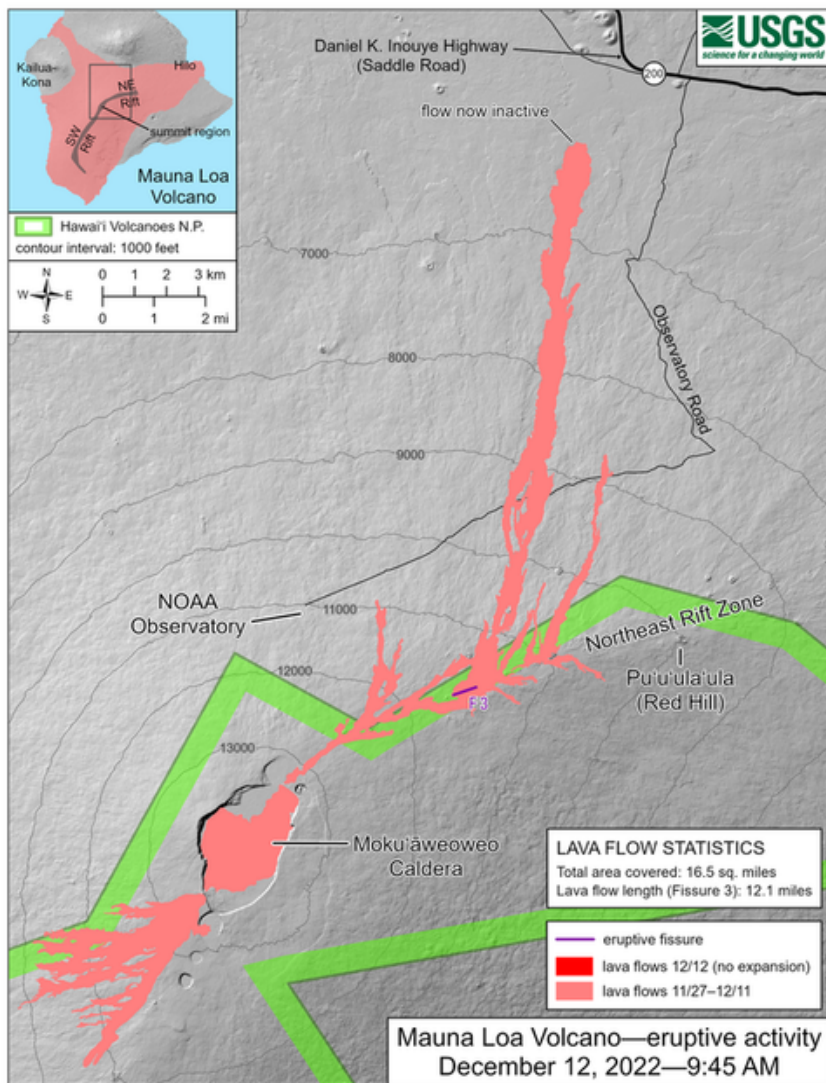
Preparation and Materials:

- Access to the Internet.
- To be registered on VICTOR.
 - If you have not completed this step yet, navigate to victorproject.org and fill out the form under 'sign up' in the menu.
 - ✱ The VICTOR team needs to manually confirm all registrations, so this may take up to 48 hours.
- To sign up for the VICTOR forum: forum.victorproject.org/signup
 - <https://forum.victorproject.org/signup>
 - Use this as a resource to ask for help or search for previously asked questions from other users.
- Optional tasks:
 - Background reading or review:
 - Molasses background: tinyurl.com/nzcjkh25
 - Mr Lava Loba paper: tinyurl.com/bdzknppz
 - Watch the MOLASSES and Lava2D VICTOR tutorials on YouTube. www.youtube.com/@volcanocyber

Tasks and Procedures

Part One

Familiarizing yourself with the eruption area:



Use the map to complete this section. The vent is marked in purple and labeled 'F3.'

Use the map scale, and measure and record the distance to the highway (labeled saddle road) from the vent.

Tasks and Procedures [IN CLASS]

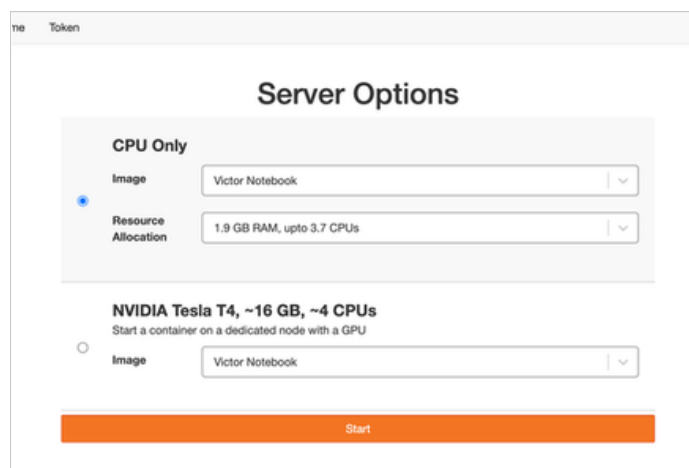
Part Two:

Getting Started on VICTOR:

1. Log in to VICTOR at hub.victorproject.org
2. "Server Options"
 - Ensure Victor Notebook is selected
 - Under resource allocation, select

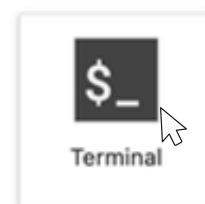
7.4 GB RAM, upto 3.7 CPUs

- Clicking **Start** will bring you to The Launcher.



3. The Launcher and VICTOR Setup command

- From the Launcher, open a new terminal by clicking the **terminal icon** at the bottom left of your launcher.
- In the new terminal, type `victor setup` and press enter.
- Identify **MOLASSES** in the list that appears
- Type its corresponding number and press enter.



```

Terminal 2
(notebook) jovyan@jupyter-ameliamullins:~$ victor setup
Hello, and welcome to the VICTOR platform.
We have a huge variety of models and tools for use.
This program is meant to make it simple to set up workflows and associated files.
To set up, please choose the number next to the model listed below.
1: alphaMELTS
2: CONFLOW
3: DISGAS
4: HAZMAP
5: HYSPLIT
6: IMEX (Lava)
7: IMEX_Sflow2D_V2
8: LaharZ
9: LAVA2D
10: MR LAVA LOBA
11: MOLASSES
12: PYFLOWGO/DOWNFLOWGO
13: Scoops3D
14: SULFUR_X
15: TEPHRA2
16: TITAN2D
17: TWODEE
Model: █
  
```

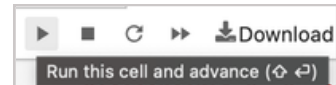
- On the left of your screen, a folder called **Molasses** will appear.
- Open the folder by double clicking it and find the Jupyter Notebook for **molasses.ipynb**

Tasks and Procedures [IN CLASS]

Part Three:

Running the Model: Molasses

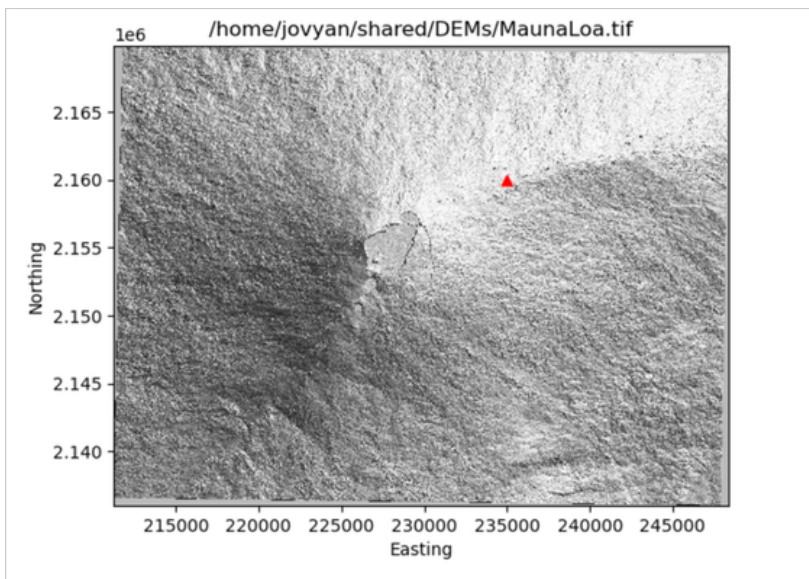
- From the folder tree on the left of your screen, open the **Molasses** folder, and double click the  **molasses.ipynb** notebook to open it.
- Run the notebook without changes. Press the **play button** at the top of your notebook to run each cell.
- Using the table on page 5, record the volume for this run.
- Once the cell called **Let's confirm your DEM works!** is finished, you will see a visual output similar the this:



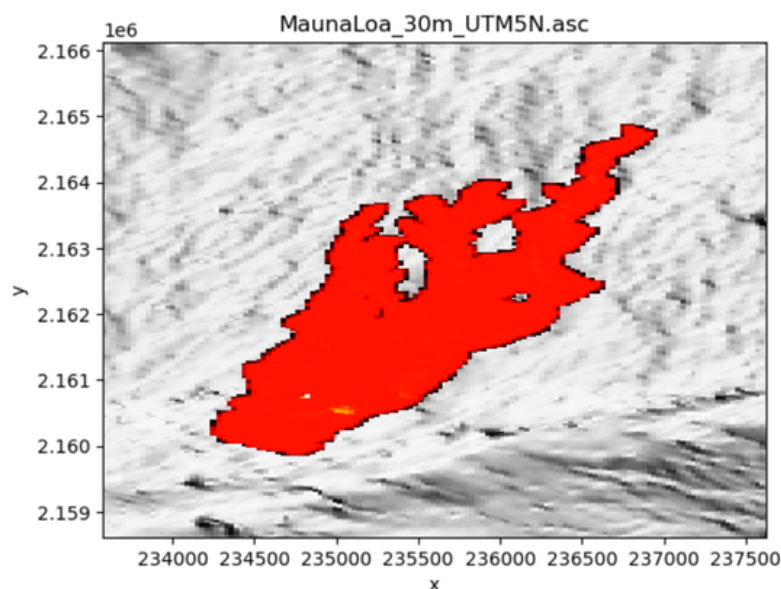
Run each cell by clicking the play button at the top of the notebook or press Shift + Enter



If the cell number is replaced with an asterisk, the cell is still running!



- Finish running the model without changes. Below is what your visual output will look like. Save the visual output as a .png for model comparison later.



To save your visual output: Press and hold **shift**, then **right-click on the image**, then select 'save image as' to save the visual output as a .png to your device



Tasks and Procedures [IN CLASS]

Part Three:

Running the Model: Molasses (continued)

- **Next**, you will run the model again while **changing the volume to 2x the original**.
- Run the rest of the model as is, without changes.
- Using your visual output from this second run, record the input volume and flow length associated with 2x the volume in the table below.

Key Parameters

Here, please input your preferred residual thickness, total volume, and pulse volume, along with the DEM filepath and events in UTM coordinates

```
#Input residual thickness (meters)
residual = 20







```

[Changing volume parameter]

- Run the model a third time, **using 5x the original volume**. Repeat the above steps, and complete the table below with the input volume and flow length from your third output.

Part Four:

Recording Molasses Outputs

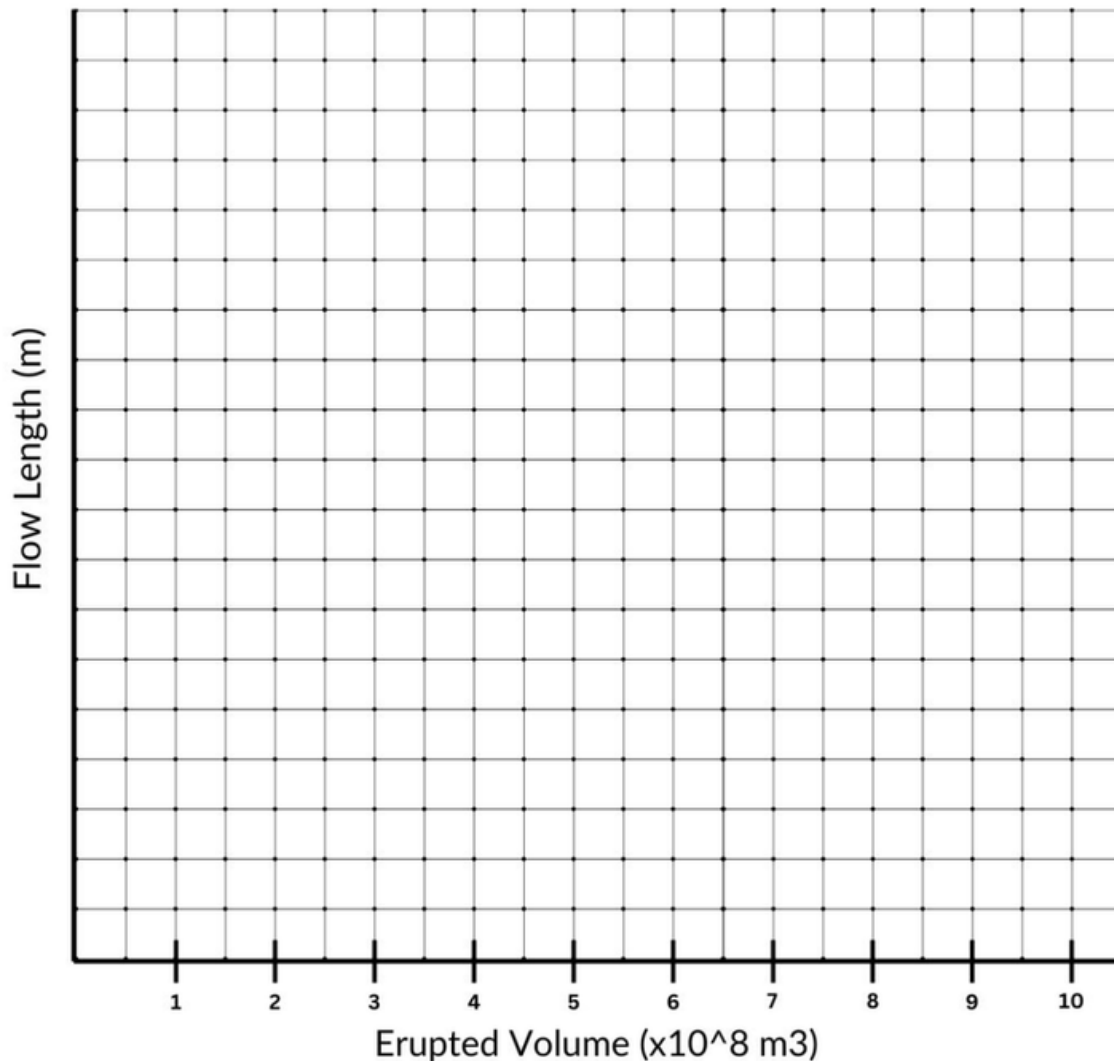
Volume	Flow length (m)	Remaining distance to highway (m)
1e8		

Tasks and Procedures [IN CLASS]

Part Four:

Recording Molasses Outputs: (continued)

- Use the graph below to record and visualize your outputs:



Part Five:

Analyze Your Outputs (Molasses):

- Based on these three measurements, make a guess: what volume will be required for the flow to reach the highway according to MOLASSES?

- Run MOLASSES with this volume and test your hypothesis. Were you correct?

- At a constant eruption rate of 20 m3/second, how many days will it take to reach that volume?

Tasks and Procedures [AT HOME]

Part Six:

Running the Model: Mr Lava Loba

- Repeat the `victor setup` command steps you did for MOLASSES in class.
- For support, navigate to <https://victor.ldeo.columbia.edu/content/training-and-tutorials> and expand the “VICTOR setup command” section in under “Getting Started with VICTOR.”
- From the folder tree on the left of your screen, open the `mr_lava_loba` folder, and double click the `mrlavaloba.ipynb` notebook to open it.
- Run the notebook after **reviewing the following parameter specifications**. [recall: press the play button at the top of your notebook to run each cell]
 - When you get to the cell titled: **Enter the bounds you would like to crop the flow**, ensure each direction has a value of at least 8000 (example inputs shown below).

Enter the bounds you would like to crop the flow

Only change these if you have a very large/small flow, or a very high resolution DEM.

```
east_to_vent = 15000.0
west_to_vent = 5000.0
south_to_vent = 5000.0
north_to_vent = 15000.0
```

- Similar to running Molasses, you will test the model with three different input volumes. The **original volume without change** (`total_volume = 36000`), **2x the original volume**, and **5x the original volume**. Use the table in part five to record these volumes.
- After the parameters are set properly, run the model. This should take a few minutes. A progress bar will be displayed. When the model is done it will save output files.
- Finally, you will see a parameter titled `run_num` and it will be set to `"0"`
- The Run Number specifies which simulation run the output will display. The model automatically saves output files in a numbered sequence, allowing you to refer to these files to track progress and select the correct run for your visualization.
 - Finding your Run Number: Refer to the folder tree on the left of your screen when you reach this parameter. You will see where the model has saved your output file(s). The numbers after the file name will represent the run number. The example to the right shows the folder tree from the user's initial run to their third run.
- This will help you determine the `run_num` input for this parameter.

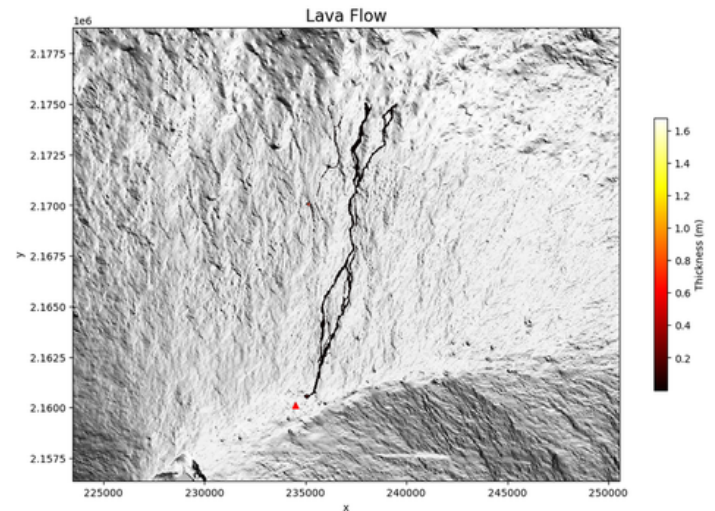
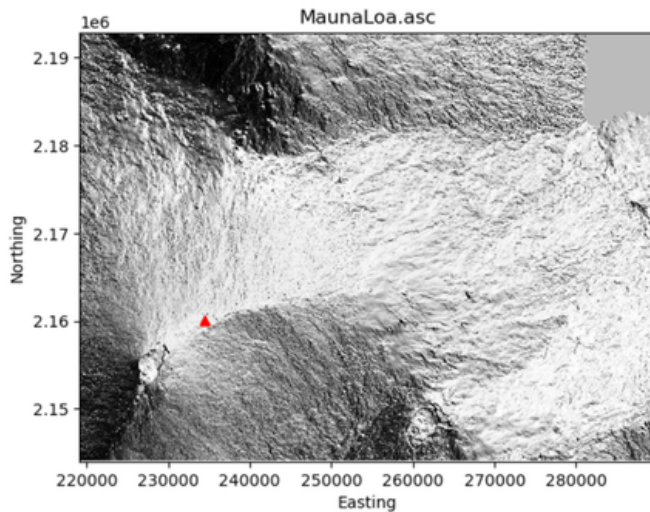
/ mr_lava_loba /		☆
Name		Modified
hawaii_000_advanced_inp.bak		5 days ago
hawaii_000_avg_thick.txt		5 days ago
hawaii_000_DEM.asc		5 days ago
hawaii_000_inp.bak		5 days ago
hawaii_000_thickness_full.asc		5 days ago
hawaii_000_thickness_masked...		5 days ago
hawaii_001_advanced_inp.bak		5 days ago
hawaii_001_avg_thick.txt		5 days ago
hawaii_001_DEM.asc		5 days ago
hawaii_001_inp.bak		5 days ago
hawaii_001_thickness_full.asc		5 days ago
hawaii_001_thickness_masked...		5 days ago
hawaii_002_advanced_inp.bak		5 days ago
hawaii_002_avg_thick.txt		5 days ago
hawaii_002_DEM.asc		5 days ago
hawaii_002_inp.bak		5 days ago
hawaii_002_thickness_full.asc		5 days ago
hawaii_002_thickness_masked...		5 days ago
hawaii_003_advanced_inp.bak		5 days ago
hawaii_003_avg_thick.txt		5 days ago
hawaii_003_DEM.asc		5 days ago
hawaii_003_inp.bak		5 days ago

Tasks and Procedures [AT HOME]

Part Six:

Running the Model: Mr Lava Loba (Continued)

- Below are two examples of visual outputs you will see once you confirm the DEM (left) and after you finish running the model (right). Save the visual output to compare with your molasses output.



- Use the table in 'Part 5: Recording Mr Lava Loba outputs' to record the volume, flow length, and distance remaining to the highway using your output.

Part Seven:

Recording Mr Lava Loba Outputs

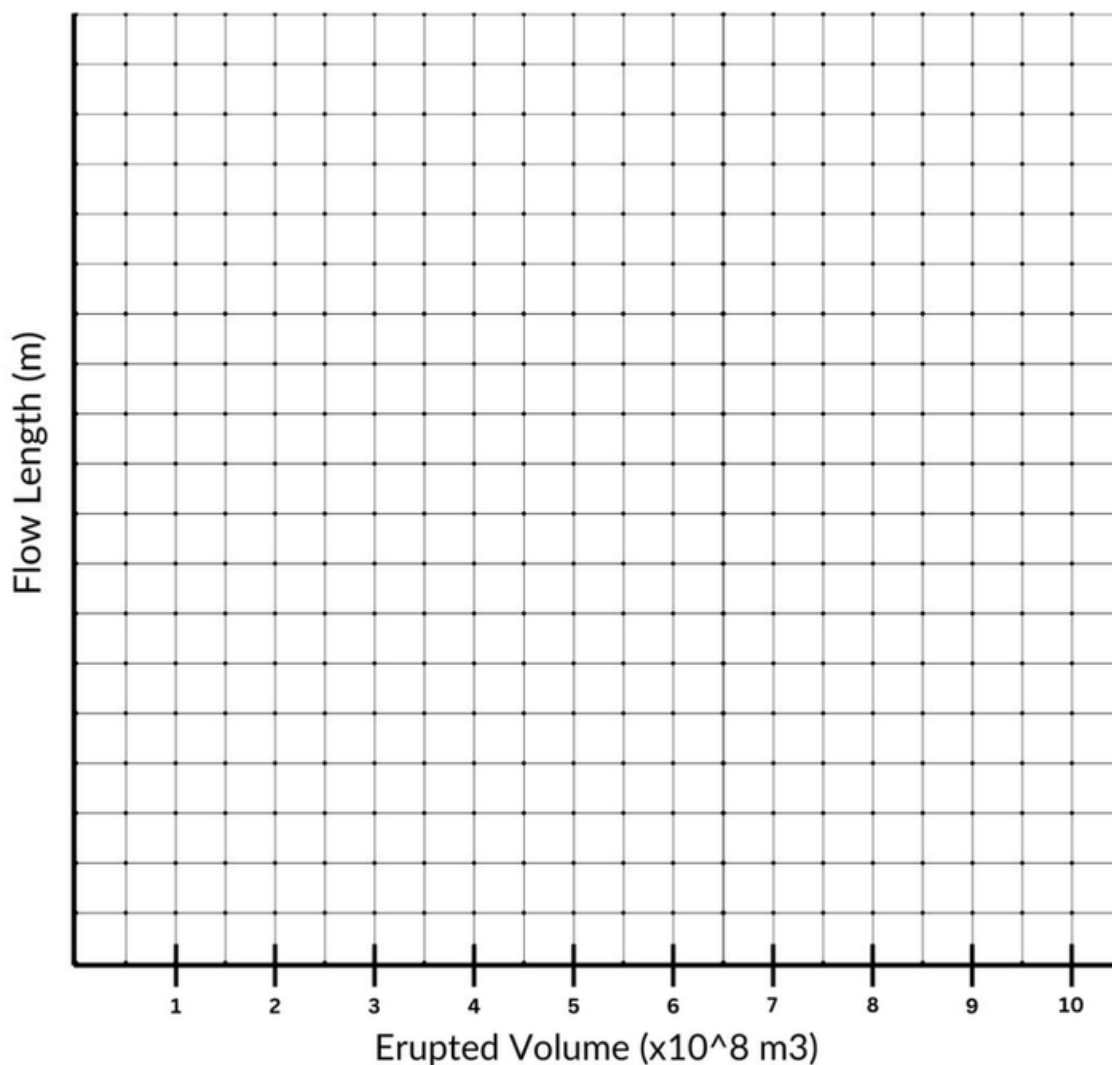
Volume	Flow length (m)	Remaining distance to highway (m)
36000		

Tasks and Procedures [AT HOME]

Part Seven:

Recording MrLavaLoba Outputs: (continued)

- Use the graph below to record and visualize your outputs:



Part Eight

Analyze Your Outputs (MrLavaLoba):

- Based on these three measurements, make a guess: what volume will be required for the flow to reach the highway according to MrLavaLoba?

- Run MrLavaLoba with this volume and test your hypothesis. Were you correct?

- At a constant eruption rate of 20 m³/second, how many days will it take to reach that volume?

Tasks and Procedures [AT HOME]

Part Nine:

Share and Discuss

- Follow this link to find VICTOR's Lava Flow Padlet: tinyurl.com/phvyrf2d
- You will see visual outputs share from previous classes that completed this lab.
- Share you saved visual outputs from MrLavaLoba and MOLASSES on a new note.
- In your post, **briefly assess discuss the differences in the models and compare and constrast your experience using both models.**
- Compare the USGS map provided on page 2 to your models' outputs. **Reflect on and discuss how accurate the models' outputs were compared to what really happened.** Include your thoughts in your post on Padlet.

Check your work!

Did you complete all 9 parts?

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