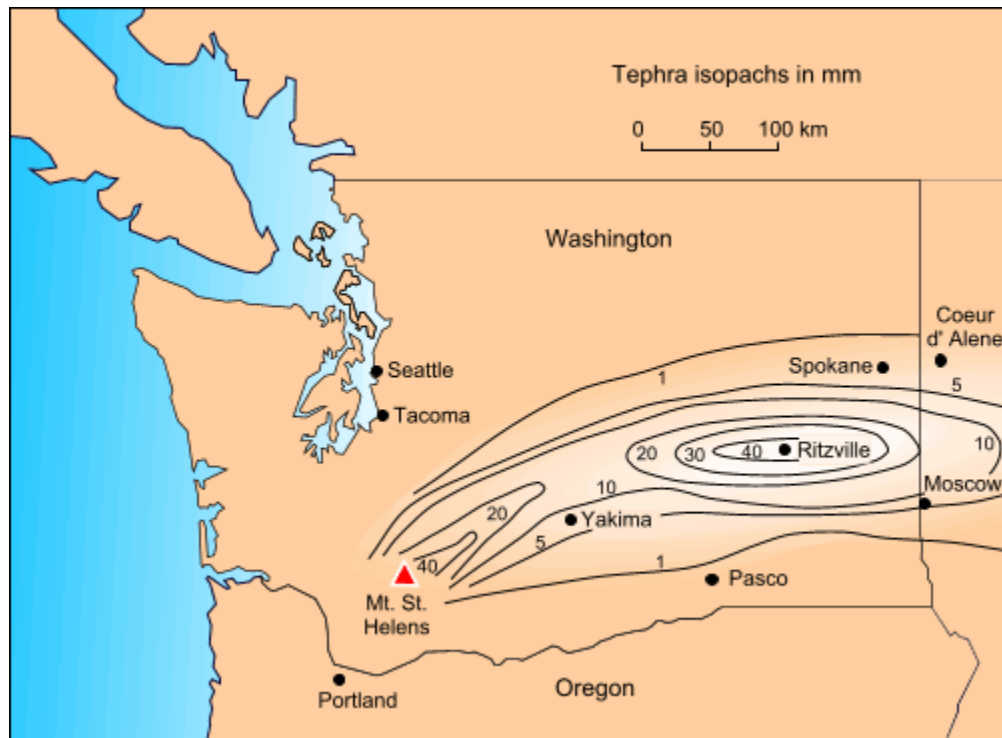


Assignment: Ash dispersal from explosive eruptions

In class, you saw a demonstration of the model TEPHRA2. The model calculates the mass loading (kg/m^2) by ash from an eruption given the properties of the eruption (e.g., plume mass and height) and the wind conditions.

Part 1– Mt St Helens:

Below is a map showing the thickness of ash deposited after the 1980 eruption of Mt St Helens in Washington. The contours, called “isopachs,” represent areas with equal deposit thickness



Source: Sarna-Wojcicki et al. (1981).

Investigate:

Based on the map, what was the dominant wind direction during the eruption?

Think:

What is the difference in units between the map you saw in class, which showed deposit mass loading (in kg/m^2), and the map in this figure? How would a scientist convert from isopachs to mass loading?

Calculate:

How thick is the layer of ash in Spokane, WA? _____

How thick is the layer of ash in Ritzville, WA? _____

How heavy is the load on roofs in these two places given ash density of 700 kg/m^3 ?

Spokane: _____

Ritzville: _____

Hypothesize:

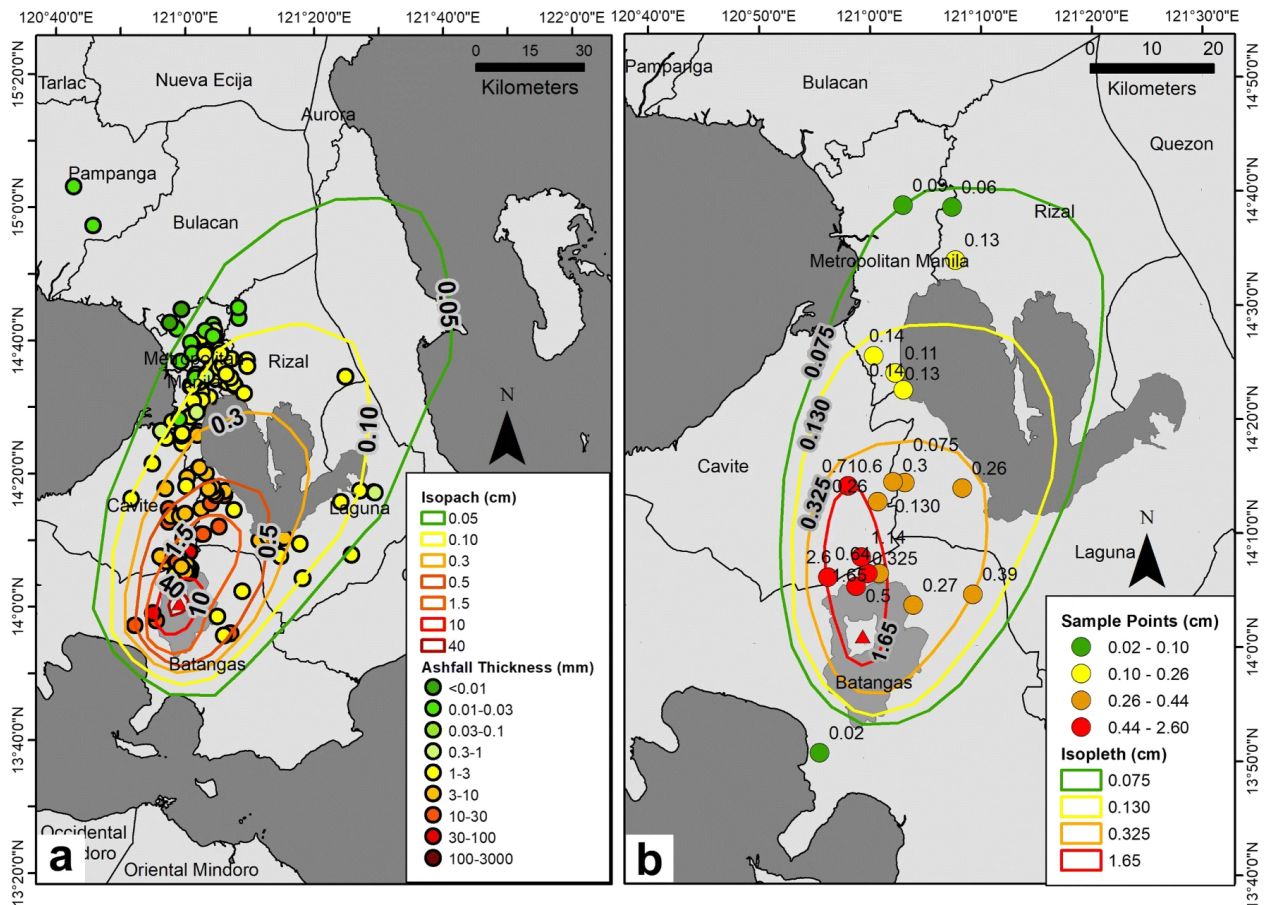
If Mt St Helen erupted today in a similar way to how it did in 1980, and the wind was blowing from the south to the north, which towns and cities would be impacted?

Draw a map of the isopachs that would result from this scenario.

[Turn the page for Parts 2 and 3]

Part 2 – Taal volcano:

The figure below shows isopachs (left) and isopach contours for the 2020 eruption of Taal volcano in the Philippines. The volcano is marked with a red triangle.



Source: M. I. R. Balangue-Tarriela et al., 2022.

Discuss:

Isopleth maps show areas of similar grain sizes. Think of two reasons why it is important to analyze the grain size of ash deposits.

1. ____
2. ____

What was the dominant size of grains close to the volcano? ____

What was the dominant grain size in Manila, the capital city? ____

Discuss:

Is grain size increasing or decreasing with distance? Why?

Part3 – Tephra2:

Below are maps with output from Tephra2 models for the Taal 2020 eruption. The blue star at Longitude=121°E shows Manila.

1. Discuss how eruption parameters of plume height and eruption mass impacted the deposits.
2. For each map, convert the deposit mass loading reported in the map for Manila to deposit thickness in mm using a density of 700 kg/m³.
3. Compare the model outputs with the actual field observations shown above. Are there noticeable differences between the models and the field observations? Which eruption conditions match the observations the best?

