Using Suitability Analysis to Identify Potential Locations for Acoustic Flow Monitors on Cascade Volcanoes

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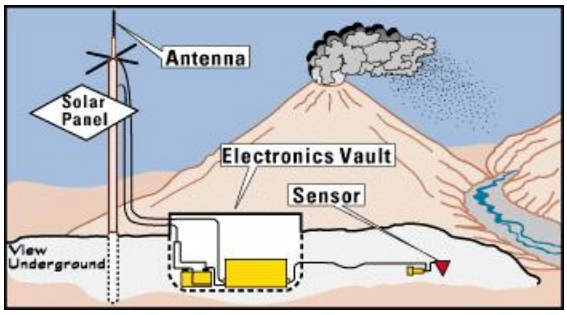
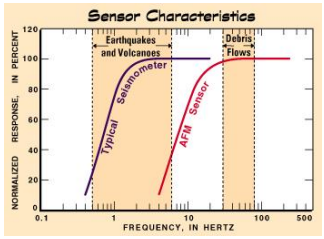
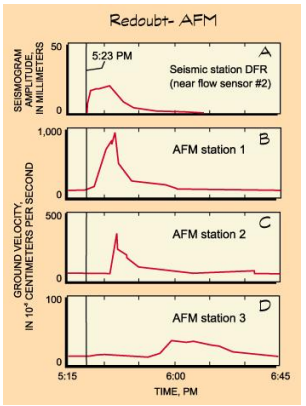
Lahars

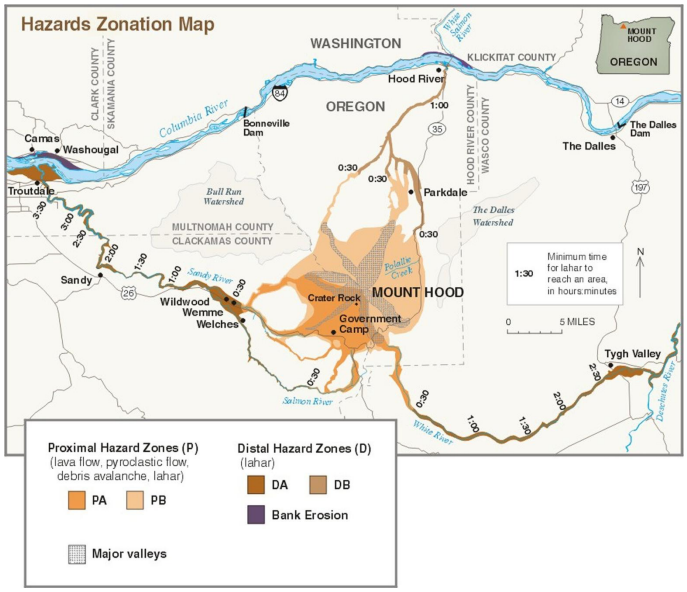
Acoustic Flow Monitor (AFM)



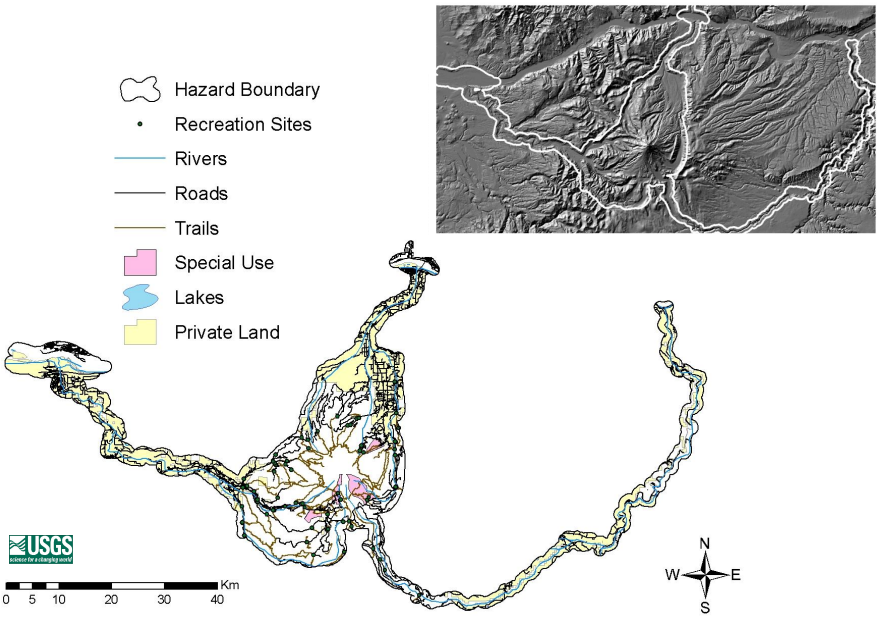




Research vs. Warning



Problem



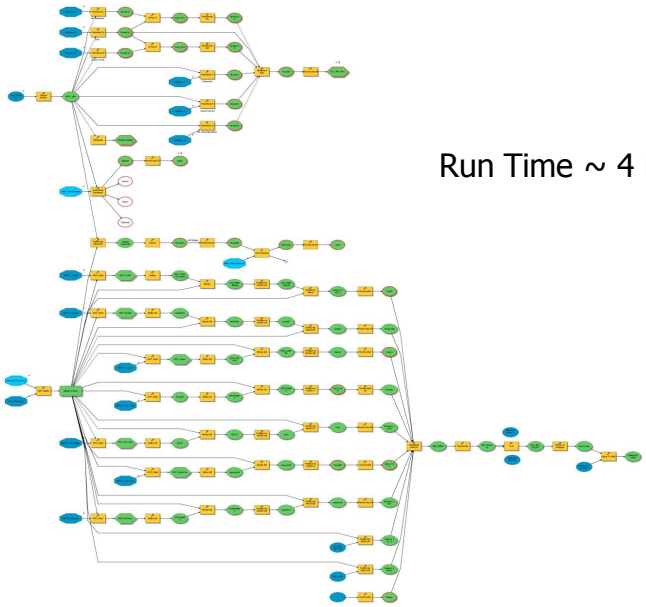
Criteria

- Instrument needs
  - Geophone
  - Power
  - Radio telemetry
- Other considerations
  - Slope
  - Land use
  - Land ownership
- Proximity
  - Access – temporal, trail, road, or helicopter LZ
  - Interference
  - Vandalism

Data Sources

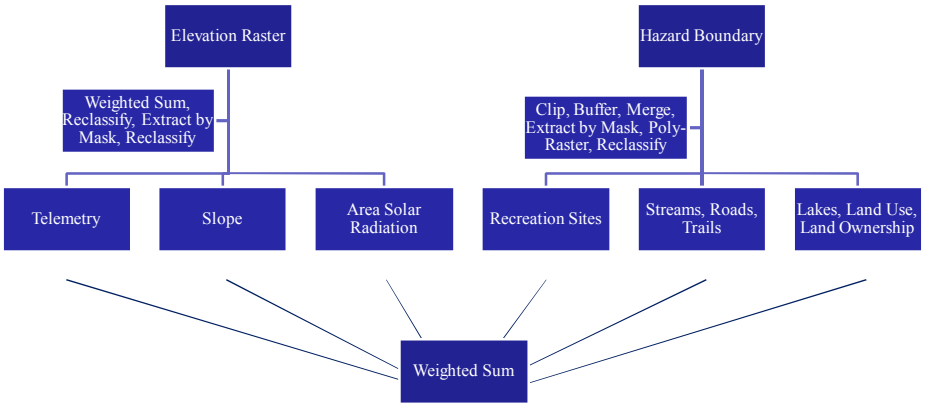
- USGS CVO internal GIS server
  - *Hazard data*
- USGS EROS and National Atlas (via Seamless Server)
  - *3m LiDAR, 10 & 30m NED*
  - *Roads*
- USGS NHD
  - *Streams*
- USDA - Mt. Hood National Forest
  - *Trails*
  - *Recreation sites*
  - *Land use & ownership*

Model



Run Time ~ 4 hrs.

Simplified Model



Limitations & Assumptions

- Data accuracy and resolution:
  - Dynamic systems (rivers in crumbly rock)
  - Inability to properly model potential helicopter landing zone and slope
  - Radio telemetry takes some data prep prior to modeling with additional assumptions

Surveyed Weight

Weight	Criteria	Distance
20	Stream proximity	< 300 m
20	Radio telemetry	
15	Road proximity	< 500 m
10	High solar radiation	
10	Trail proximity	< 500 m
10	Not on private land	
5	Low slope angle	
5	Not within ski resort	
5	Not near rec site	> 150 m

Weight	Telemetry	
30	CVO Office	Obs 1
20	Mt. Hood Meadows	Obs 4
20	Timberline Lodge	Obs 6
15	CVO + Mt. Defiance	Obs 1+3
10	Cloud Cap Inn	Obs 5
5	CVO + Devils Peak	Obs 1+2

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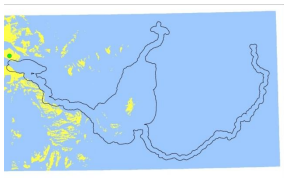
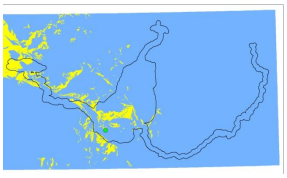
Radio Telemetry: Antenna locations

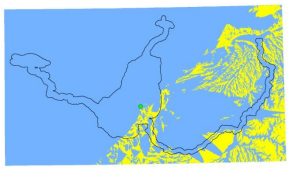


CVO office 18m tower

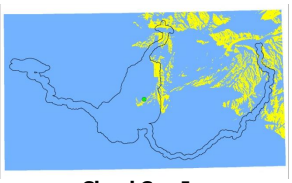


Devil's Peak - Unknown

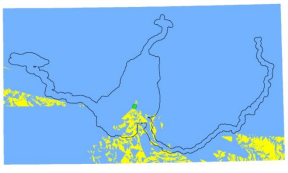
Mt. Defiance – 18m tower



Mt. Hood Meadows Vista Lift



Cloud Cap Inn



Timberline Palmer Lift

Antenna Hazard Boundary Not Visible Visible

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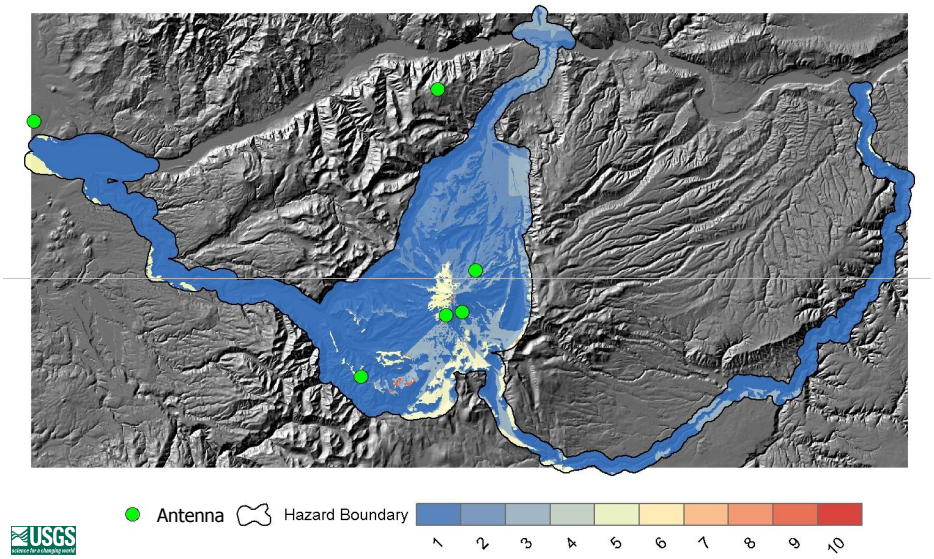
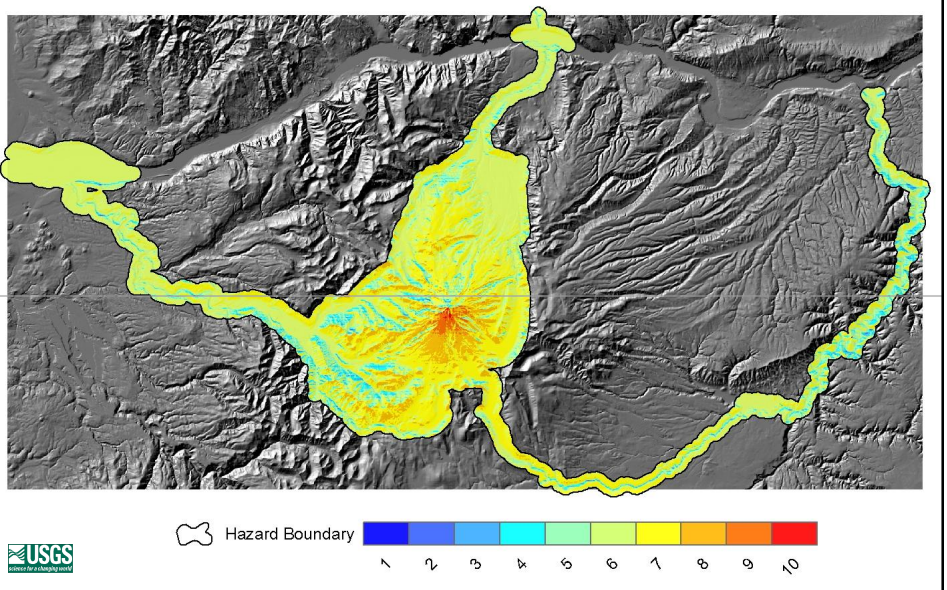
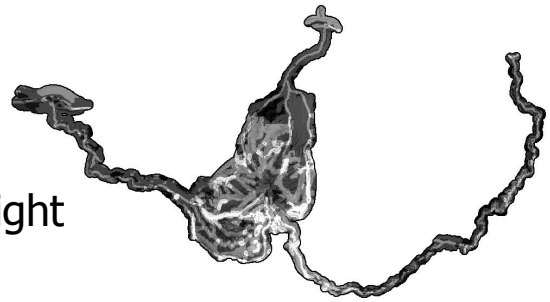
Radio Telemetry: Reclassed Weighted Sum



Solar Radiation: Reclassed

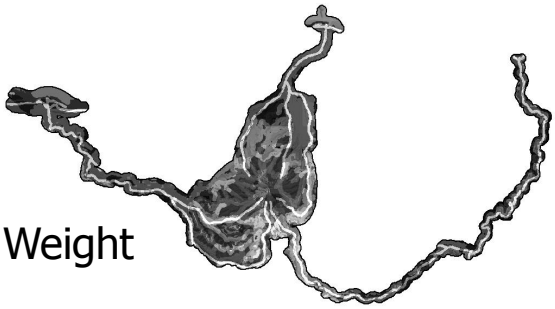


Results:



Equal Weight

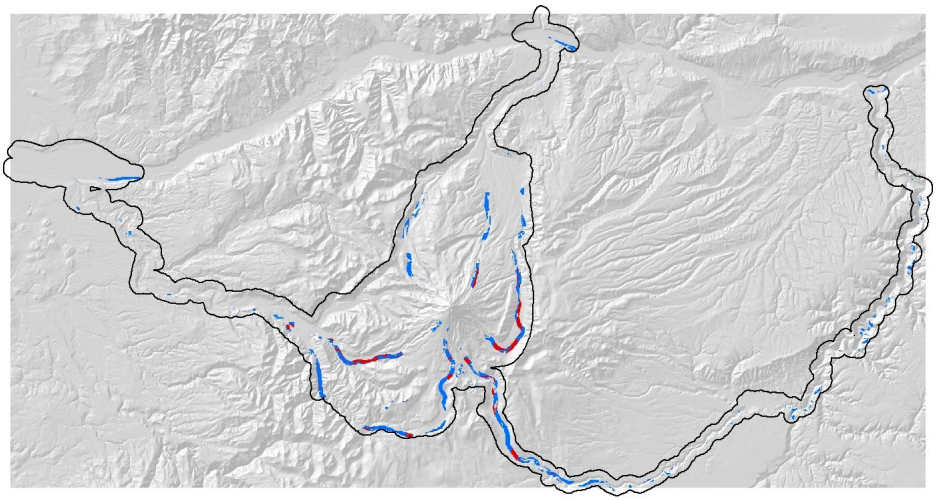
vs.



Surveyed Weight

USGS

Results: Most Suitable



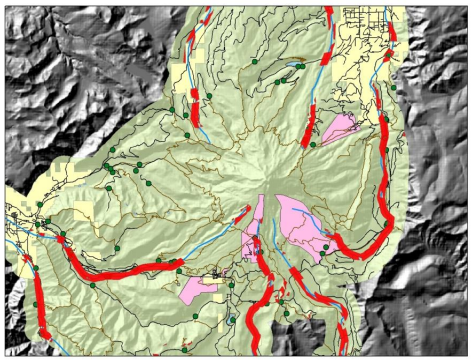
Hazard Boundary Equal Survey

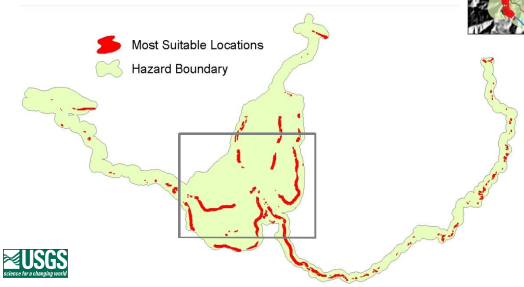
USGS

Final Results

- 274 separate polygons
- Total area of 65 km^2

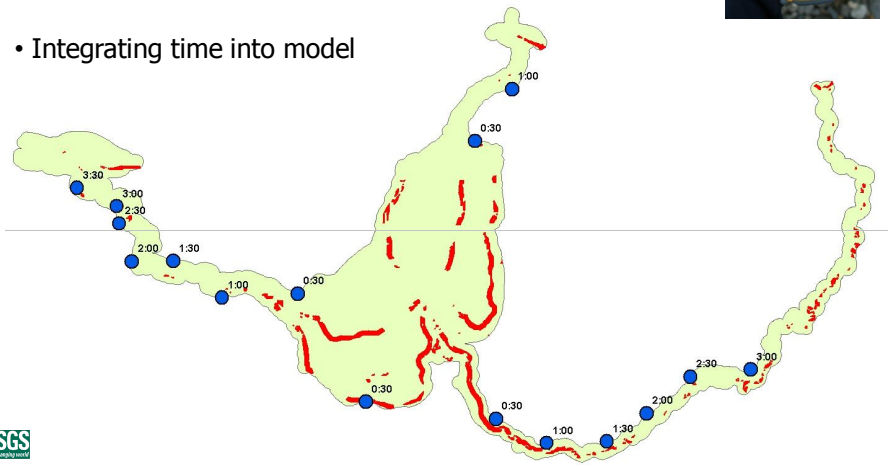
  (4.1% of the hazard area)





Next?

- More runs with different datasets and weights
- Field verification
- Integrating time into model



For more info…

www.volcanoes.usgs.gov
/activity/methods/hydrologic/lahardetection.php

Data references

www.seamless.usgs.gov, www.nhd.usgs.gov,
www.eros.usgs.gov

Questions?