EXPLORING MUON RADIOGRAPHY AS AN ASSET IN THE CHARACTERISATION OF ACTIVITY AT DOME-FORMING VOLCANOES

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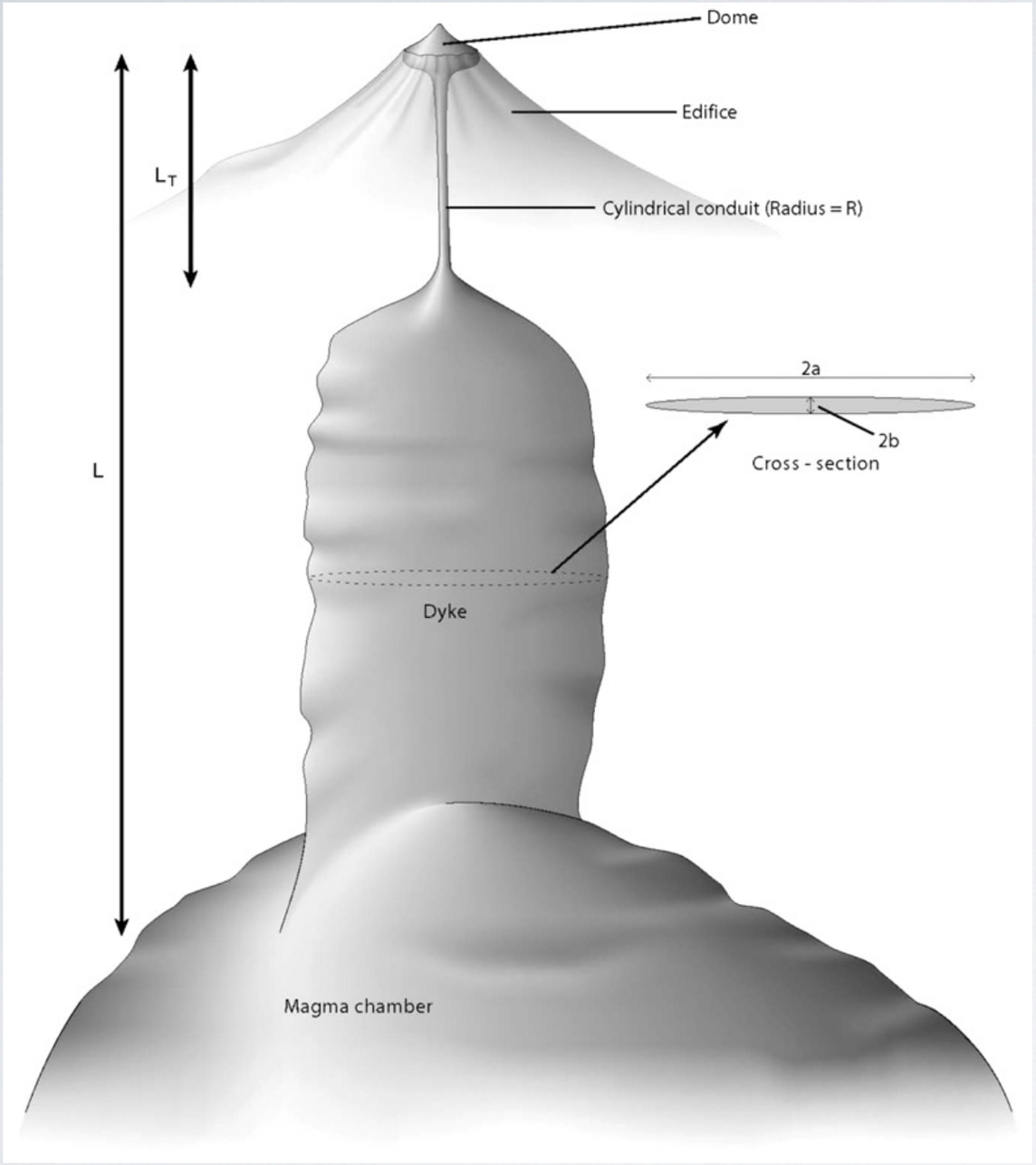
KEY QUESTIONS

Active dome formation:

Dome-scale density structure
Time-dependent density structure
Shallow plumbing system
Scale with porosity/permeability (fluid migration)
Effusive vs Explosive Activity

Volcano hydrology
Edifice alteration
hydrothermal systems
Edifice stability



Hautmann et al., JGR 115, 2010

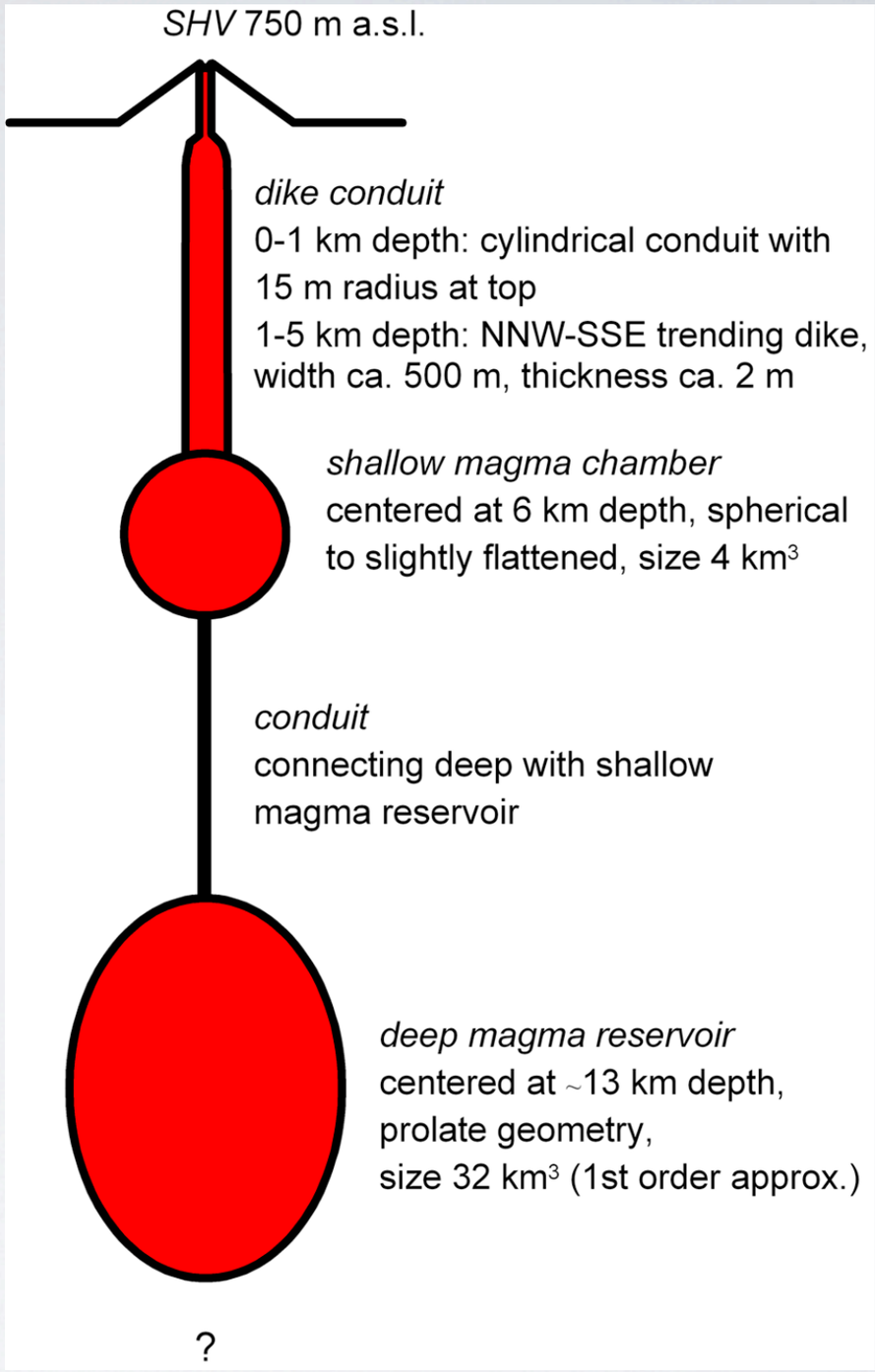
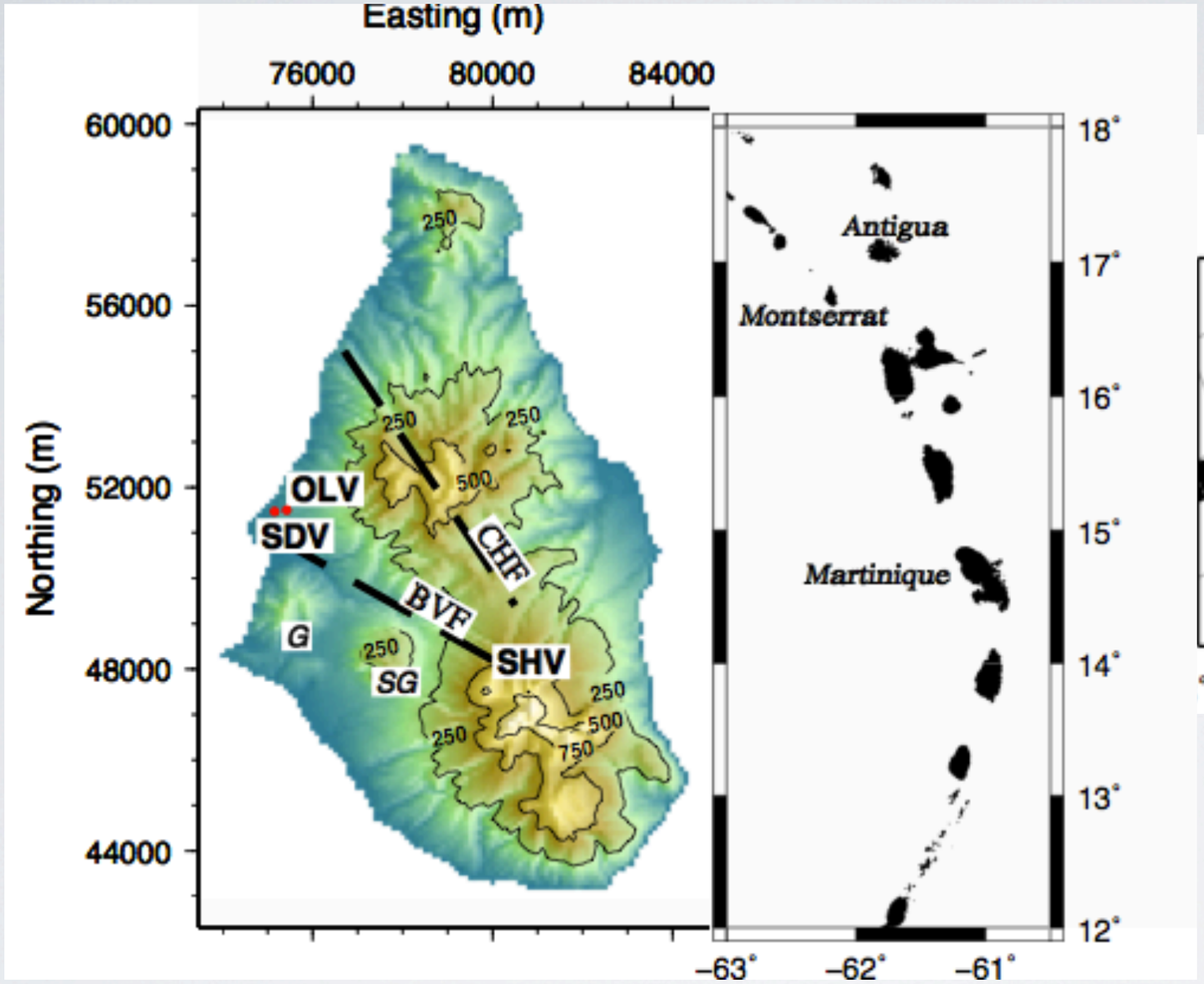
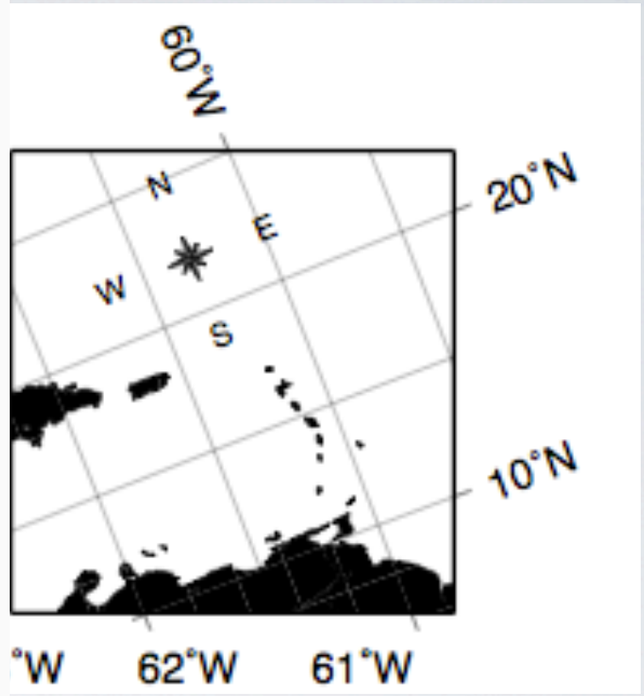


Figure 10. Sketch of the proposed structure of the magmatic system beneath Soufrière Hills Volcano.

A WORKING MODEL

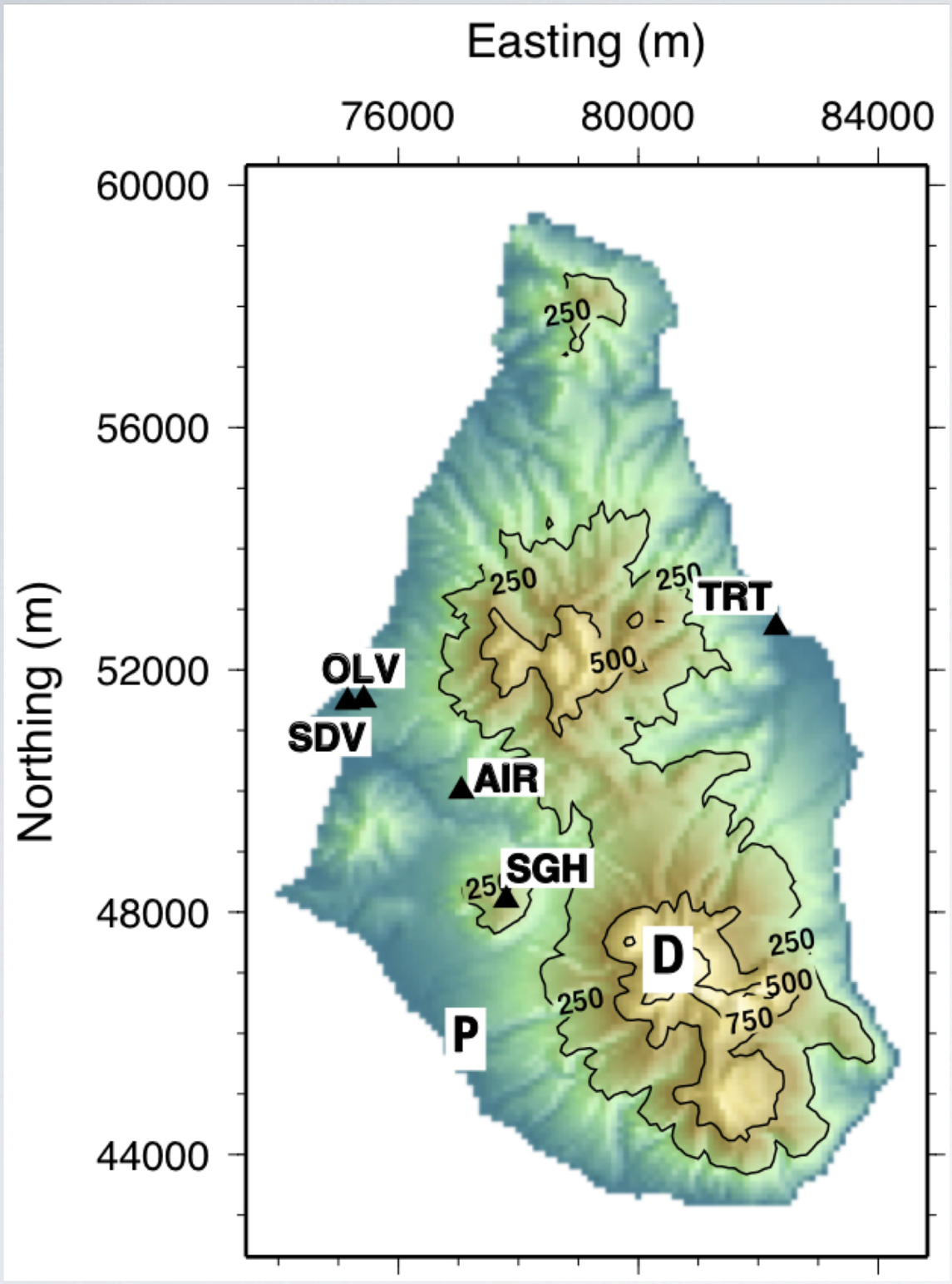
SOUFRIERE HILLS VOLCANO





MONTSERRAT, BWI

DOME GROWTH AND DESTRUCTION SINCE 1996



AIR (barometer, strainmeter)

TRT (barometer, strainmeter)

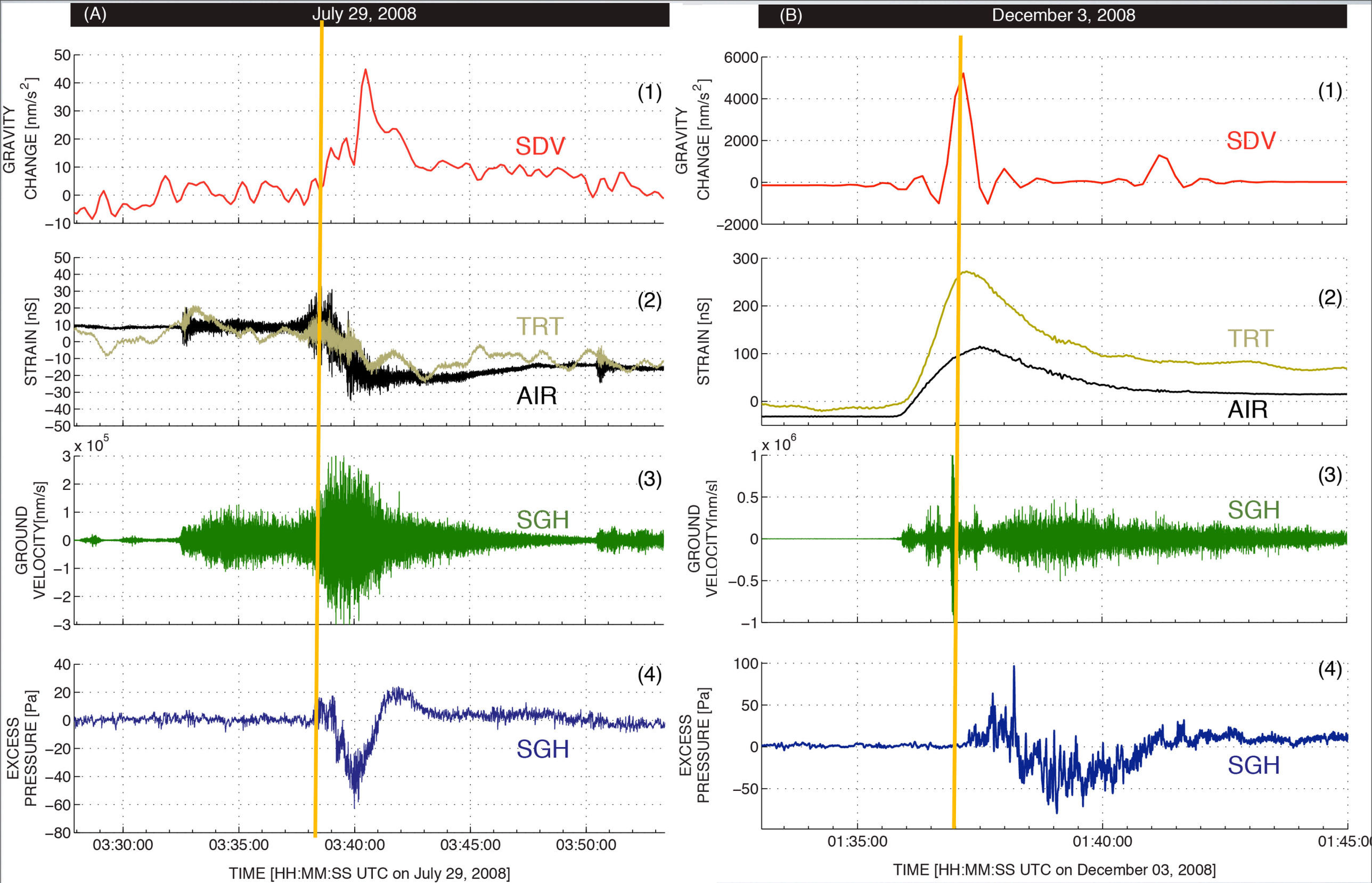
SDV (barometer, gravimeter, cGPS)

SGH (seismometer, barometer)

OLV (cGPS)

July 29 and Dec 3, 2008, VE at Soufriere Hills Volcano, Montserrat

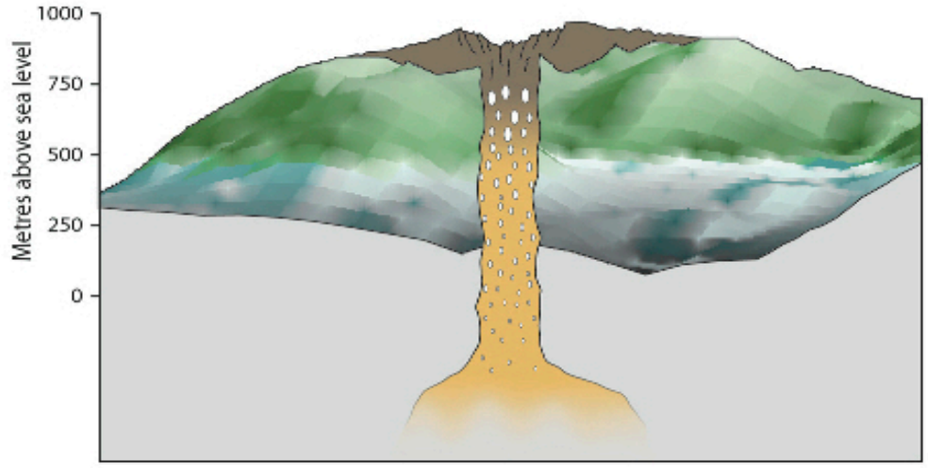
(Gottsmann et al., 2011 EPSL)



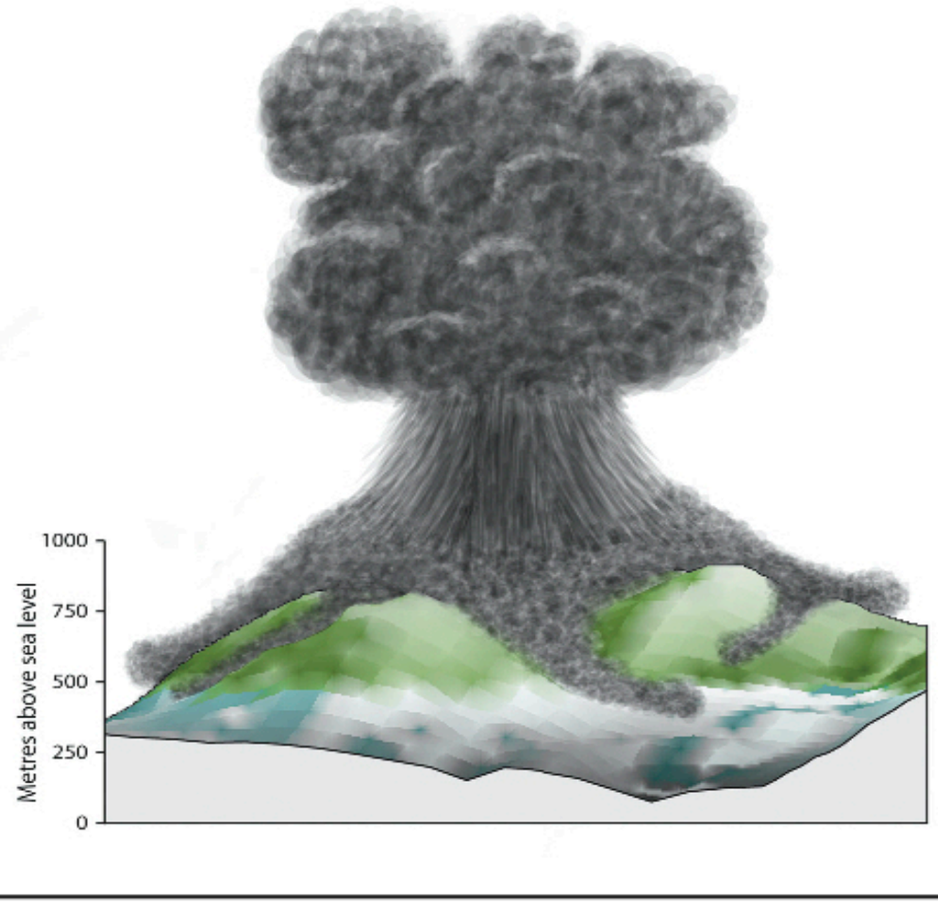
Vulcanian explosions
July vs December 2008

A

1


Metres above sea level
1000
750
500
250
0

2


Metres above sea level
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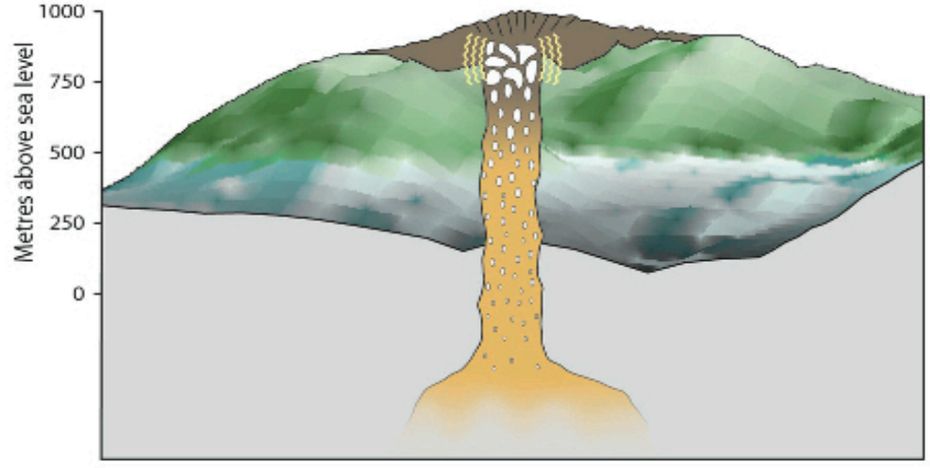
750
500
250
0

B

1


Metres above sea level
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750
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250
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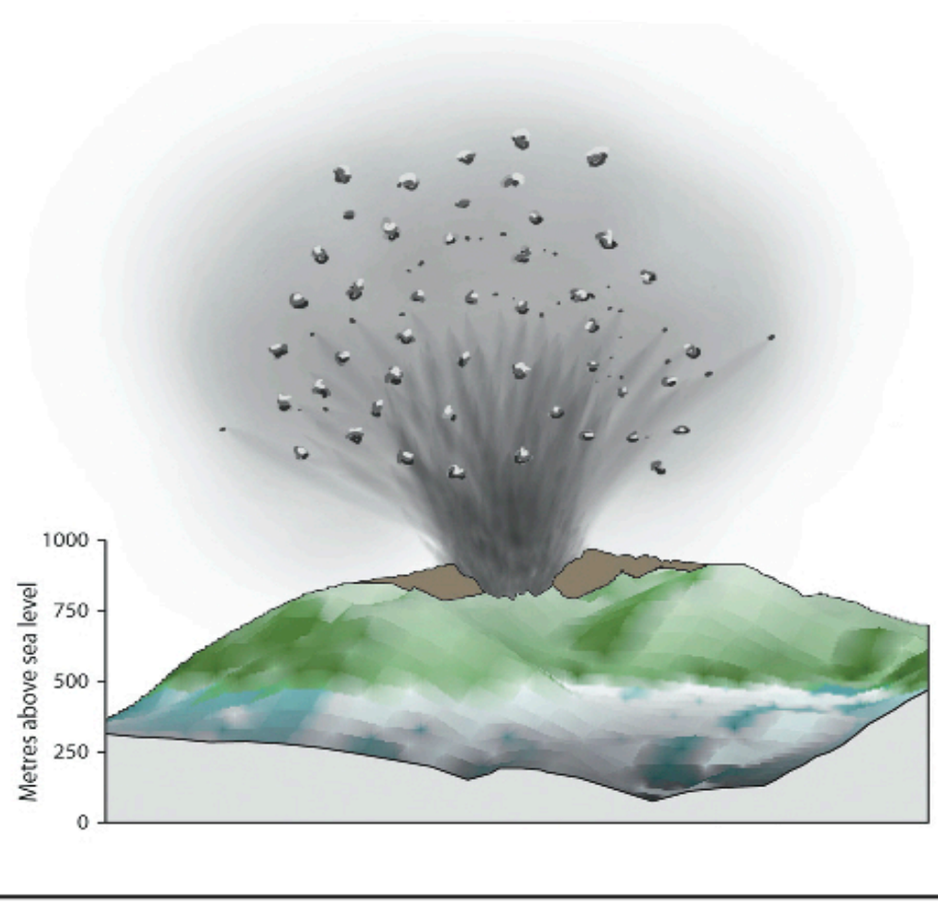
2


Metres above sea level
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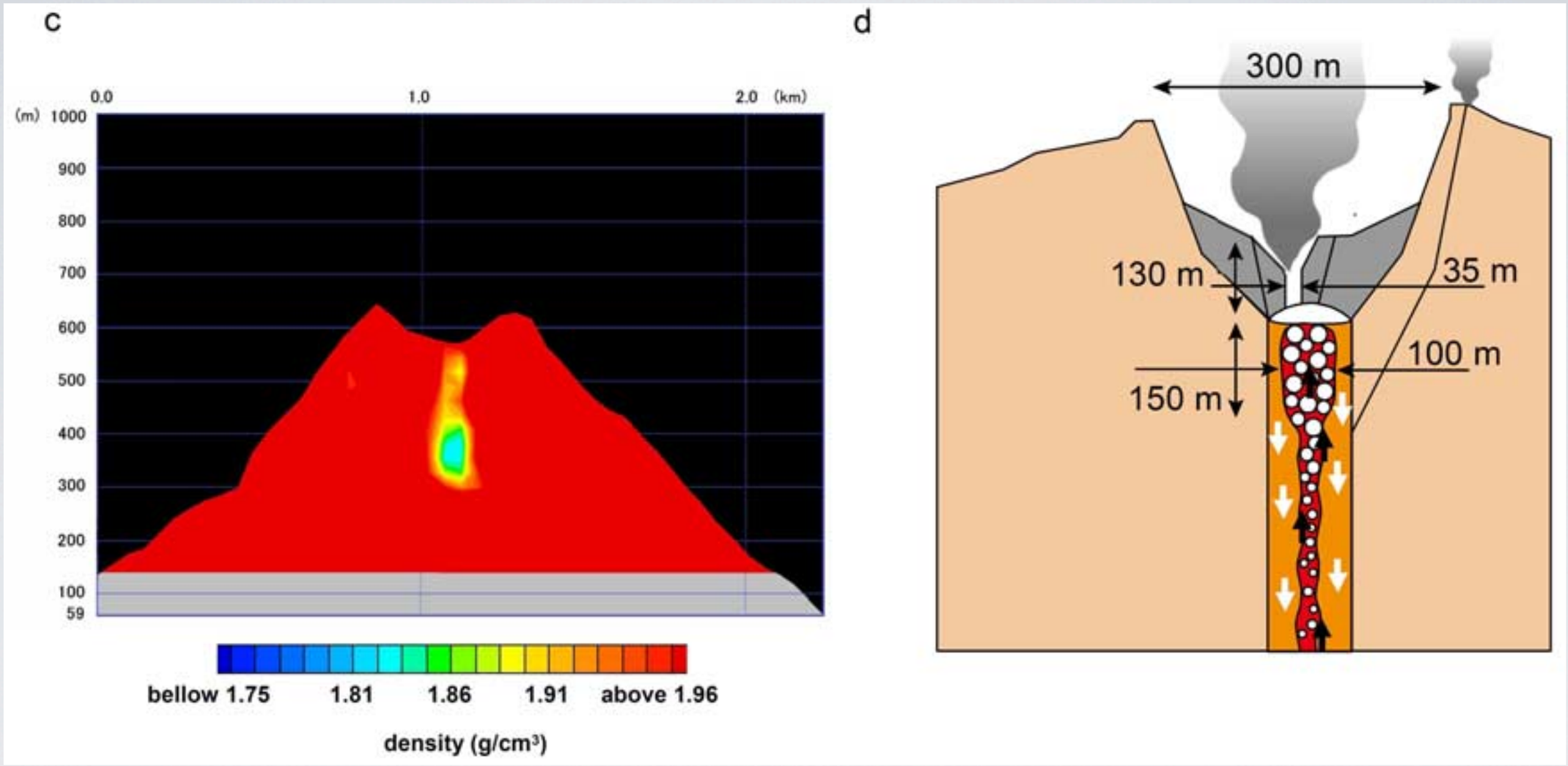
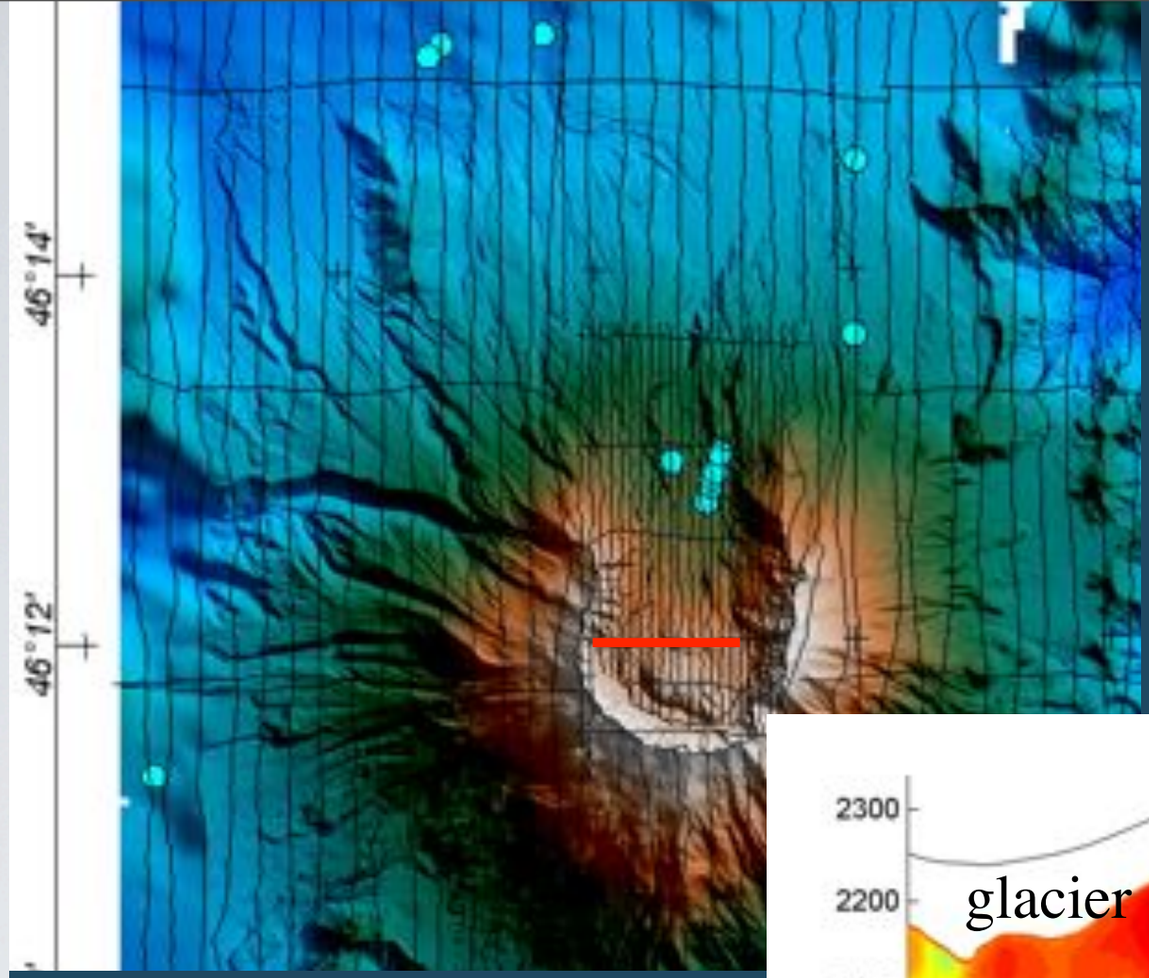
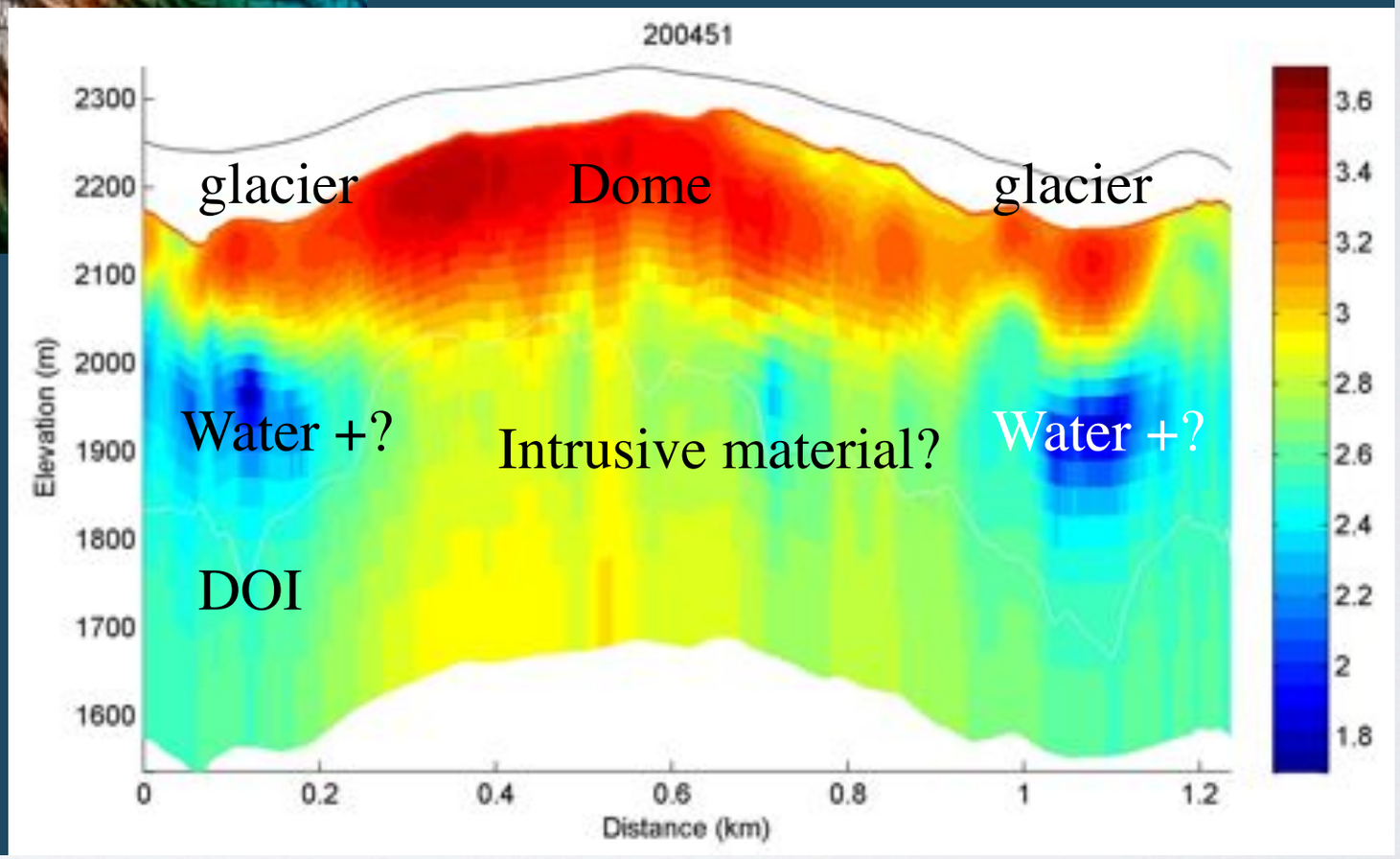


SATSUMA-IWOJIMA

Tanaka et al., 2009 GRL



Cross sections from Mt. St. Helens resistivity models



Resistivity model for Mt St. Helens (courtesy of C. Flinn, USGS)

LAHARS

Flank instability/collapse

HOW TO MAKE MUON RADIOGRAPHY AN ASSET

- complimentary to other geophysical/geochemical timeseries
- tool for pre-eruptive hazard assessment
- static to dynamic (< 1 image per day) imaging
- calibration of imaged rock density
- are % contrasts sufficient?
- tool for non-eruptive hazard assessment (lahars, flank collapse)