

# Combining estimated basin depth with an assumed $V_{S30}$

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USGS 2018 NSHM Update Workshop

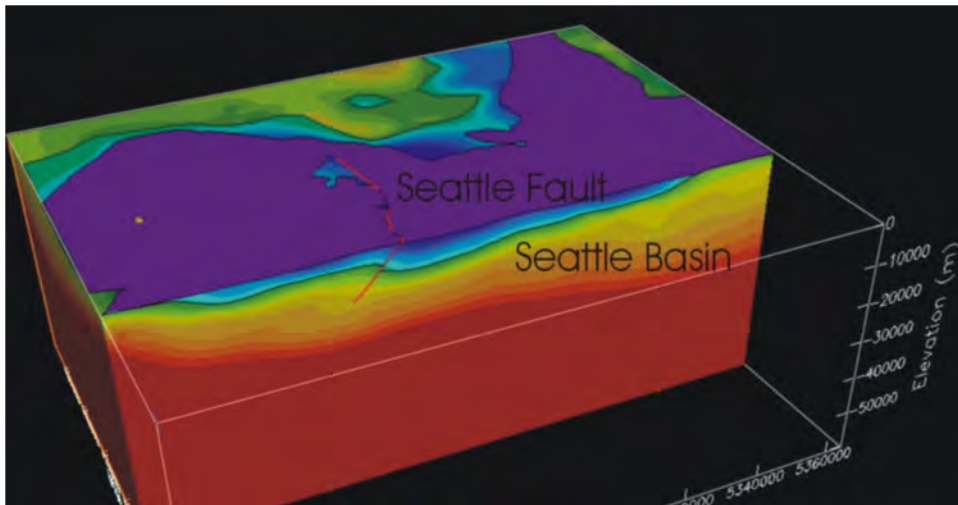
Thursday, March 8<sup>th</sup>, 2018

RMS Headquarters, Newark, CA

# Overview

- Constructing a uniform  $V_{S30}$  hazard map with variable basin depth
- Computing the hazard with an assumed  $V_{S30}$

Seattle 3D velocity model (VM):



Stephenson (USGS OFR 2007-1348)

$$Z | VM = N(\mu_{Z1}, \sigma_{Z1}^2) \quad \text{"prior"}$$

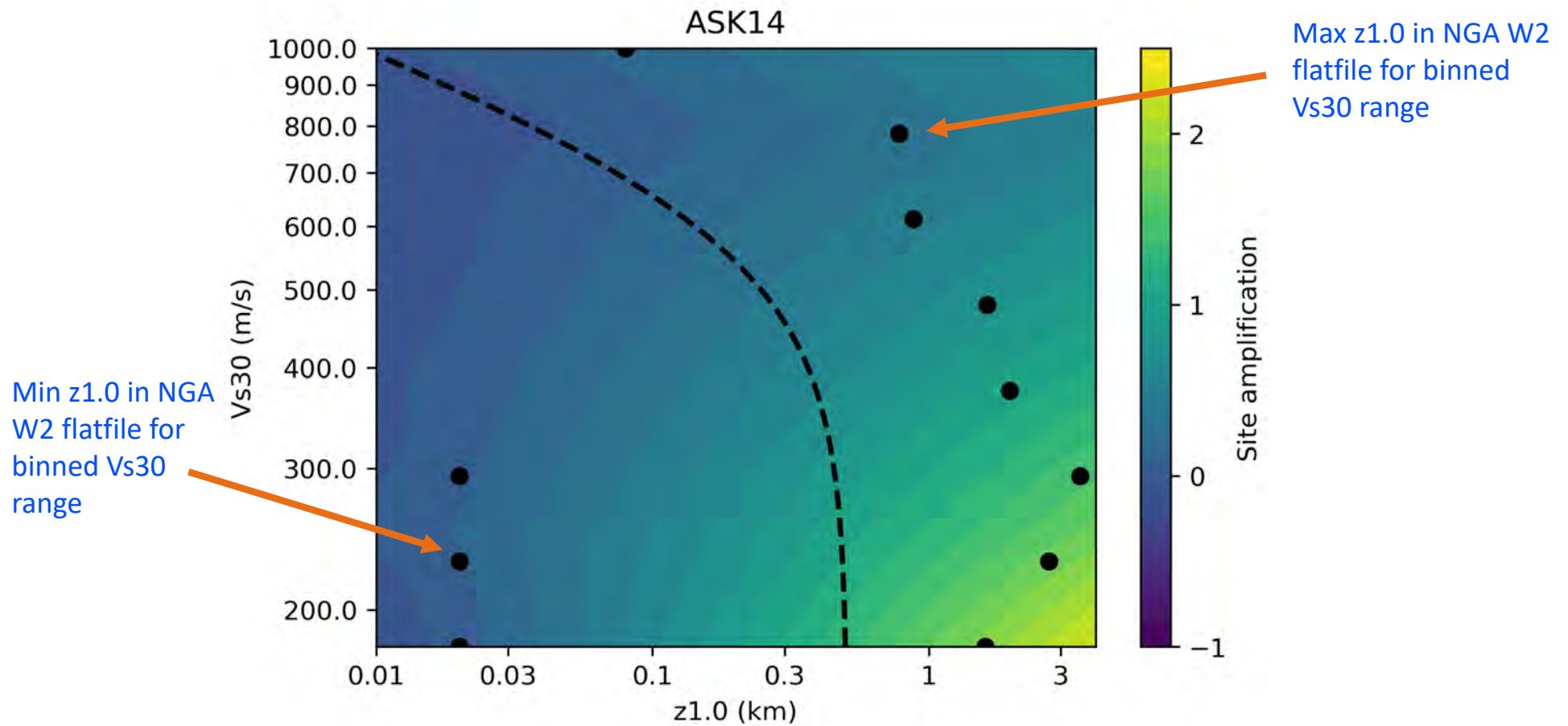
$$Z | V_{S30} = N(\mu_{Z2}, \sigma_{Z2}^2) \quad \text{"update"}$$

Conditional bivariate normal equation:

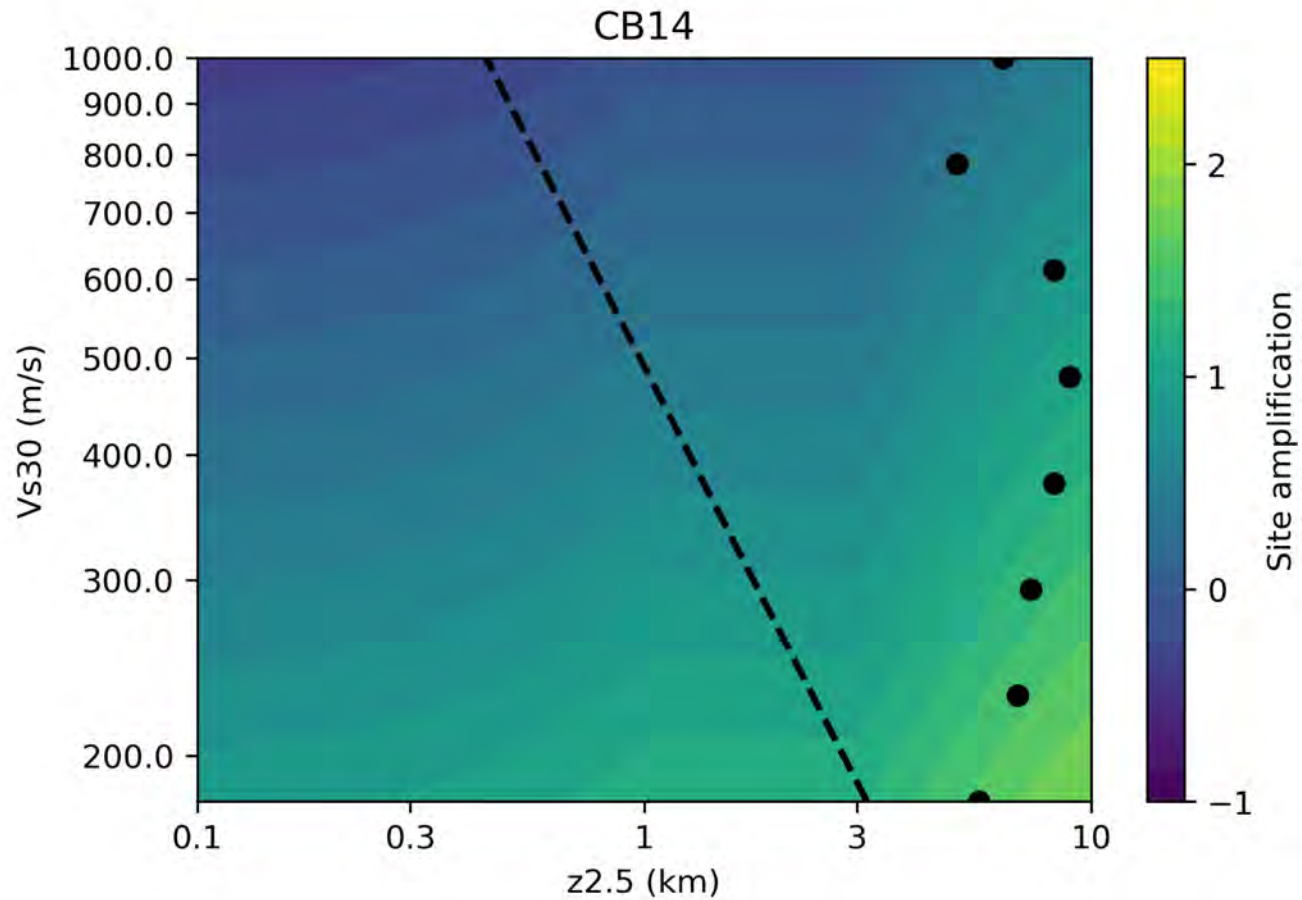
$$Z | VM, V_{S30} = \mu_{Z1} + \frac{\sigma_{Z1}^2}{\sigma_{Z1}^2 + \sigma_{Z2}^2} (\mu_{Z2} - \mu_{Z1})$$

$$\sigma^2 | VM, V_{S30} = \frac{\sigma_{Z1}^2 \sigma_{Z2}^2}{\sigma_{Z1}^2 + \sigma_{Z2}^2}$$

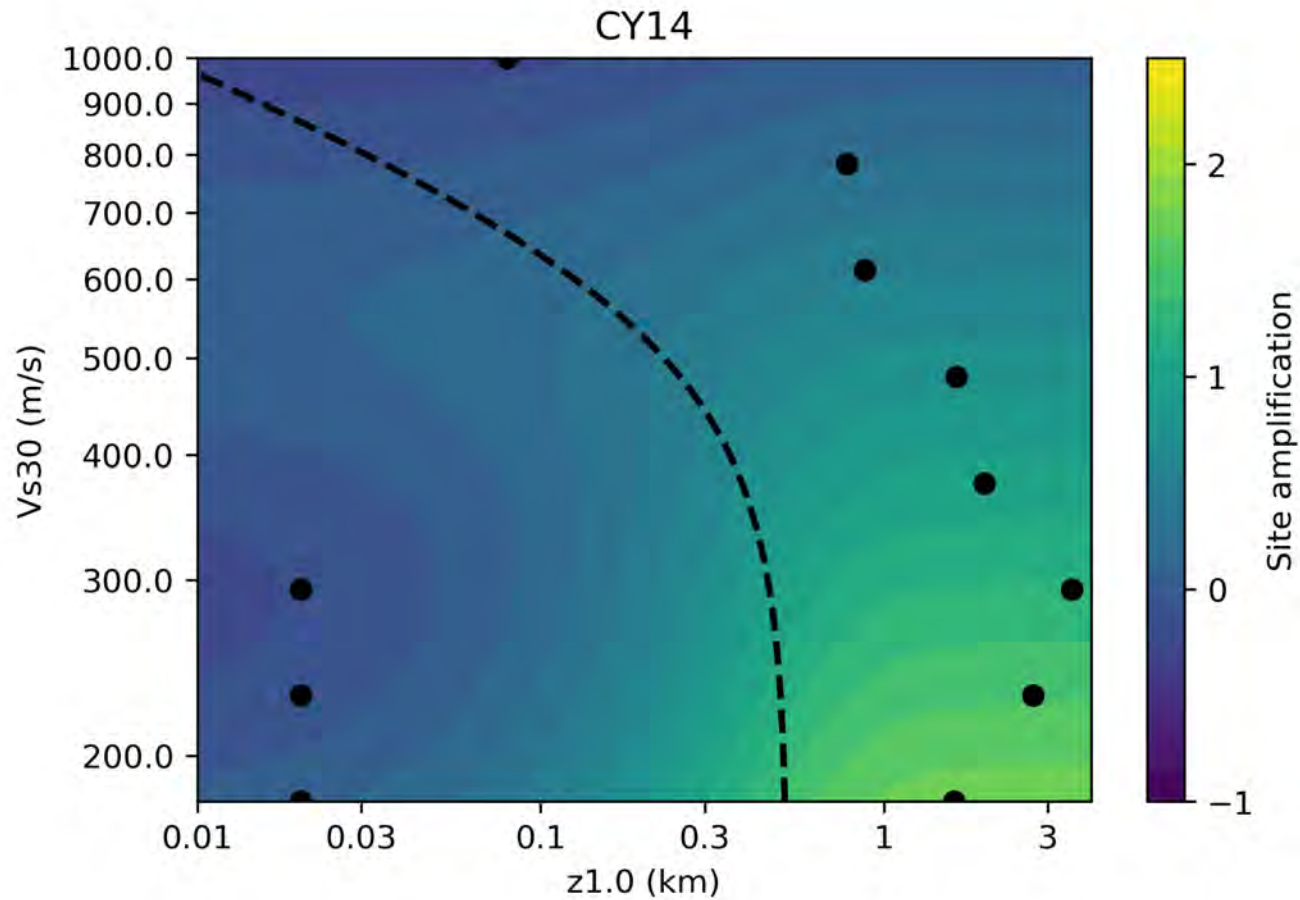
# Sensitivity of different GMMs to $Z_x$ (for $T=5$ s)



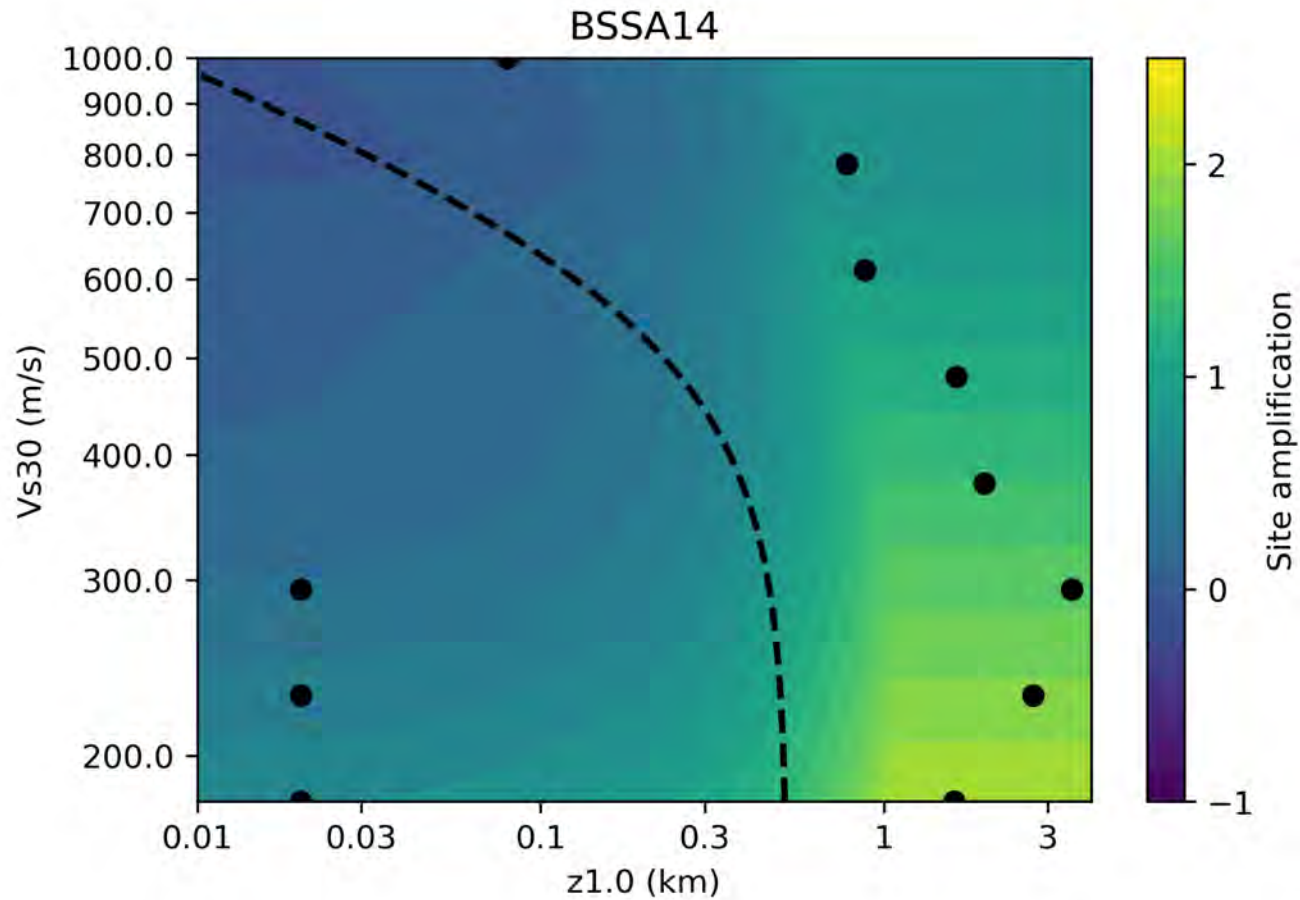
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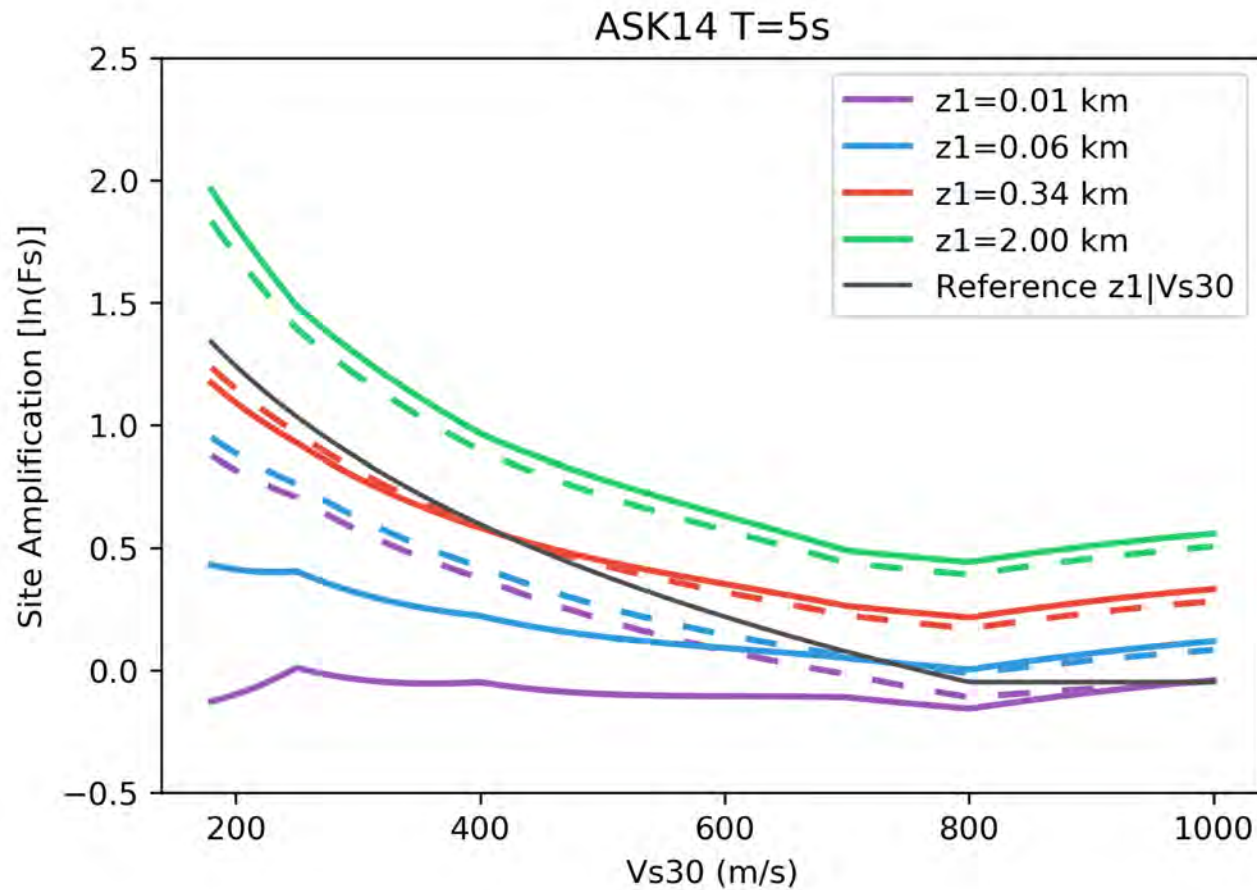
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# Effect of Conditioning on Vs30



- Dashed lines are the amplifications after conditioning the basin depth on the assumed Vs30 value
- Intersection of the dashed lines with the solid line is at the default Vs30 associated with the given basin depth.

# Summary

- For a given  $V_{s30}$ , the possible range of depth parameters is large
- Only very extreme cases are “impossible”
- Conditioning on a  $V_{s30}$  value moderates basin term effect
- As uncertainty in the basin depth increases, the conditioned value approaches the default
- This provides an approach for acknowledging and handling variable uncertainty in the basin depth estimates