COMMENTS ON PROBABILISTIC VOLCANIC HAZARD ASSESSMENT

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Probabilistic Volcanic Hazard Assessment

- Geological Perspectives
- Basic Elements
- Examples of Volcanic Hazard Forecasting
- Methods Used
- Issues Relevant to Yucca Mountain
- Comments on Work Presented Here
PVHA - Geological Perspectives

Volcanic Forecasting

Key Questions:

What? type of event

When? repose frequency, next expected event

Where? at an existing volcano or a new location

Size? magnitude

Anticipated effects? vulnerability
PVHA - Geological Perspectives

Conceptual Models

Mass eruption rate (energy release rate)

Survivor function = probability that a repose has ended up to a specified time

Age-specific eruption rate

Spatial event predictors
BASIC ELEMENTS OF GOOD PVHA

- Define the problem and test the instrument
- Set limits of acceptability
- Identify key processes, parameters, & uncertainties
- Include all possibilities in model
- Arrange according to interdependencies
- Perform Sensitivity studies on parameters

Determine interactive effects of all elements on model
ADVANTAGE OF LOGIC TREES

- Applies to a wide range of problems
- Analyzes sources of uncertainty
- Accomodates interpretations with uncertainties
- Can use probabilities from expert judgement
- Can incorporate extreme interpretations
- Feedback etween nodes is possible
survivor function

\[ F(x) = \text{prob } (X > x) = \int_x^\infty f(u) \, du \]

age-specific eruption rate

\[ \phi(x) = \lim_{\Delta x \to 0^+} \frac{\text{prob } (x < X < x + \Delta x \mid x < X)}{\Delta x} \]

\[ \phi(x) = \frac{f(x)}{F(x)} = \frac{F'(x)}{F(x)} = -\frac{d}{dx} [\ln F(x)] \]
Oshima Volcano

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Scandone, 1981
LONG-TERM VOLCANIC HAZARD ASSESSMENT

Scandone (1979)  Mexico

Very active volcanoes

Popocatepetl  \(2.4 \times 10^{-2}\) yr\(^{-1}\)

Colima  \(5.0 \times 10^{-2}\) yr\(^{-1}\)

Volcanic fields and regions

Mexican volcanic belt  \(7.0 \times 10^{-2}\) yr\(^{-1}\)

Chichinautzin  \(236/7000,000\)  \(3.1 \times 10^{-4}\) yr\(^{-1}\)

Tlapacaya  \(12/23,000\)  \(5.3 \times 10^{-4}\) yr\(^{-1}\)
YUCCA MOUNTAIN ISSUES

Geologic Questions to be Answered

1. Vulnerability problem:
   - What is the minimum sized volcanic event that would present unacceptable safety hazards?
   - What is the temporal probability of such an event or a larger one in the relevant volcanic system?
   - What is the probability of such an event being close enough to effect the repository?
YUCCA MOUNTAIN ISSUES

Geologic Questions to be Answered

2. Problem resolution

- Put the volcanism problem into a "global" framework. For example: Compare local forecast with that of larger regions (entire Great Basin and larger volcanic fields).

- Give relatively more weight to qualitative scientific issues. For example: in determination of expected mass eruption rate for volcanoes near Yucca Mountain.

- Use expert judgment to evaluate conceptual issues. For example: the relative probability of various spatial models, or the likelihood of a new volcanic center.