

# Decision making under uncertainty in complex emergencies: what can volcanologists learn from other disciplines?

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# Anticipatory decision making under uncertainty in volcanic emergencies

- Effective mitigation of volcanic hazards generally requires anticipatory mitigation (in the sense defined by Day & Fearnley, 2015) on the basis of
  - Uncertain data on precursory phenomena from monitoring systems
  - Uncertain interpretation of this data in the light of hazard mapping and modelling, themselves uncertain
  - Uncertain understanding of the effectiveness of anticipatory mitigation measures such as evacuations
- Nevertheless, timely decision making enabling effective actions is required, before these actions are overtaken by rapidly evolving events
- Except in countries with extremely high levels of volcanic activity, these decisions will have to be taken by people with little or no prior professional experience of managing volcanic emergencies

# Two views of decision makers at Pinatubo, 1991

**The volcanologist (A. Lockhart, quoted in R. Thompson, *Volcano Cowboys*):**

“I was impressed with these [Air Force] guys. They were trained decision makers. It was not like working with elected officials elsewhere, and the first time you meet them you want to say, “I am the last guy you want to see walking through your door, because the s\*\*\* is about to happen, man, and you have no idea how bad it is going to be”. You feel sorry for these guys because you know you’re going to be their nightmare. But these [Air Force] guys, these guys were ready to deal with that”

**The emergency manager at Clark Air Force Base (Col. R. Anderegg, USAF): journal entry quoted in *Volcano Cowboys*.**

“I had no idea how to deal with this information on either a personal or professional level. What they [the volcanologists] had just said scared me, really scared me. Not so much for myself or any immediate danger. But how would we manage this thing? How would we make decisions?”

# So, how do military men and aviators take decisions in uncertain, complex emergencies?

- Note that Anderegg and his Air Force colleagues in the chain of command at Clark were both military men and aviators
- There are few studies of decision-making in volcanic emergencies, and almost none written by the management-level decision-makers themselves\*
  - The complexities and problems of the relationships between volcanologists and decision makers have been described in a number of case studies and general lessons have been drawn, but again there has been little in the way of detailed analysis of the *processes* involved
- So, what can we learn about decision-making under uncertainty in complex emergencies more generally, from people in military and aviation fields?
  - How do relationships between military men and intelligence or scientific personnel affect decision-making in military operations, and how do relationships between aviators and scientists / engineers / aviation doctors affect decision-making in aviation safety matters?

\* The only example known to me is Anderegg's memoir of Pinatubo, *The Ash Warriors*, and this has relatively little to say about the details of decision-making *processes* at the emergency management level