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Science, policy and place in volcanic disasters: Insights from Montserrat☆

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ABSTRACT

This paper presents the results of empirical research on Montserrat, in the British West Indies, undertaken in 2008–2010. It highlights the challenges of managing a crisis that evolved from acute to chronic over a period of fifteen years. In particular, the paper considers the evolution of science and policy over a period of fifteen years in its social and cultural context. It discusses the relationship between different types of evolving knowledges, and the interaction between them. Finally, a reflexive model is introduced to draw attention to some of the challenges of managing the science–policy interface under high uncertainty and high stakes.

1. Introduction

During the past 40 years, scientists have been involved in advising governments about volcanic eruptions around the world, often at short notice and in very difficult circumstances (e.g. Tazieff, 1977; Voight, 1990; Newhall and Punongbayan, 1996; Aspinall et al., 2002; Donovan and Oppenheimer, 2012). The importance of volcano monitoring and volcano observatories has also been increasingly recognised (e.g. Tilling, 2008). Nevertheless, the recent court case in L'Aquila has demonstrated the potential legal implications of providing advice under circumstances where the science is highly uncertain: in November 2012, six Italian scientists and a local official were convicted of manslaughter by an Italian court. There were accusations of complicity with political attempts to maintain public calm by underplaying the risk, but there were also questions about the limits of earthquake science and whether or not a low probability of an event suggests that it will not occur (e.g. Marzocchi, 2012). Critically, this incidence has highlighted the issue of risk communication between scientists and governments, as well as with the affected population. This is a question that has also dominated many interdisciplinary research agendas – although the focus has generally been on communication with the public (e.g. Haynes et al., 2008; Bird et al., 2009, 2010; Gaillard, 2008). There is a favoured separation between risk assessment – conducted by scientists – and risk management, which is the purview of governments (e.g. Marzocchi et al., 2012). Fig. 1 presents a simplified conceptual representation of this process, taking as its basis a typical "linear model" approach to science and policy (e.g. Beck, 2011).

There are a number of issues that complicate the schematic in Fig. 1 – including the social context and ramifications of scientific advice, and the potentially very high levels of scientific uncertainty involved. In addition, the role of volcano observatories and advisory groups in many governmental structures

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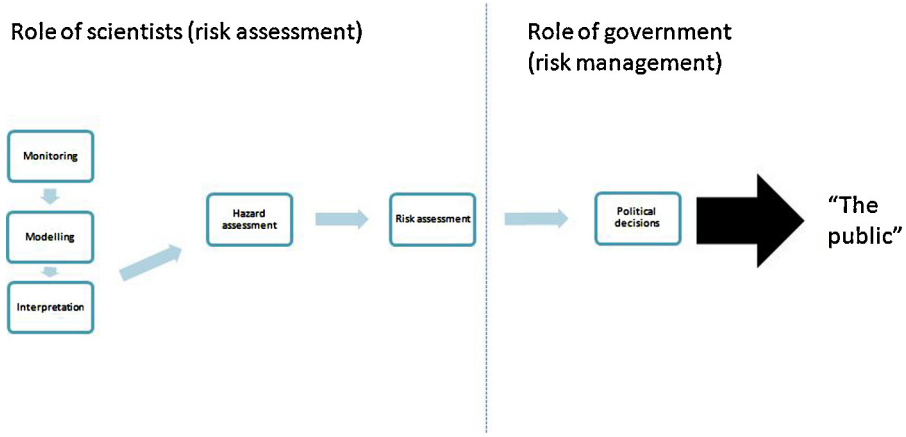

Fig. 1 – Traditional linear approach to science and policy on volcanoes.

requires them to undertake outreach, write public reports and participate in setting alert levels and hazard zonation. All of these activities are critical in volcano observatories, yet all of them involve an interaction of sorts with the public. Scientists may not be anonymous in their community – and the high stakes of evacuation politics render them vulnerable (e.g. Aspinall and Sparks, 2004; Donovan et al., 2012a). Indeed, risk communication studies have shown very convincingly that scientists are often well trusted and are the preferred source for public education about active volcanoes (Haynes et al., 2008; Bird et al., 2010). There is a moral imperative, then, even where legal ones are not in place, for scientists to get involved in risk communication with the public – and it may very well be part of their job to do so. The cost of this may be that when false alarms occur, or a situation akin to L'Aquila develops, scientists are put in difficult, potentially unjust and very stressful positions. It is critical, therefore, that lessons are learned from past crises, so that the risk communication as well as the act of risk assessment itself are undertaken with security and a full awareness of the political, legal and public contexts.

The weaknesses of the linear model have been described by a number of authors (e.g. Fischer, 2000; Pielke, 2004), particularly in relation to the politicisation of science by scientists and the technical-rational view of scientific knowledge. The latter is significantly undermined by uncertainty and also by the complexities of interaction between knowledge and power (Rayner, 2003; Owens, 2005; Beck, 2011). There are uncomfortable challenges when the linear model is applied in democratic contexts, where participatory and deliberative methods may be needed (e.g. Eden, 1998; Fischer, 2000, 2010; Brown, 2009; Jasanoff, 2005; Hajer and Kesselring, 1999; Owens, 2000; Gaillard and Mercer, 2013). In spite of this criticism, the linear model as an ideal does persist (Owens, 2005; Marzocchi et al., 2012). In analysing the science–policy interface in a volcanic disaster, however, we suggest that not only is the linear model inaccurate in the ways suggested by other authors, it is also not consistent with the experiences of scientists and cultures under scientific and social uncertainty. Indeed, volcanic crises involve the combination, over time, of: shifting political and cultural landscapes as institutions and populations are restructured, moved around and re-identify themselves in the context of the eruptions (Skelton, 2000); developing scientific knowledge (and non-knowledge due to uncertainty) as scientists gather information and data about the volcano; and high stakes. This creates a complex environment in which reflexivity and transparency are critical in opening up the advisory and policy process (Stirling, 2008). In this article, we explore these ideas in the context of the eruptions on Montserrat, British West Indies.

The eruptions of the Soufriere Hills Volcano on Montserrat in the British West Indies began in July 1995. Lava extrusion ceased in March 1998, but recommenced in November 1999 and continued episodically until February 2010 (see Supplementary Table 1). There were no previous eruptions on record, and the capital city, where many of the 13,000 people lived, was located on the flanks of the volcano. During 1995–1998, two thirds of the population left. This was a time of significant political, social and economic upheaval during which there was heavy dependence on scientific advice. We refer to this period as the "acute phase" of the eruption. The period from 1998 to 2010 is referred to as the "chronic phase". During this period, the exclusion zone (approximately two thirds of the island) became well-established, but there were periodic evacuations of areas on its margins. In 1995, the Montserrat Volcano Observatory (MVO) was set up to monitor the volcano. From 1997, regular risk assessments were carried out by a group of international scientists, who were formalised into a Scientific Advisory Committee (SAC) in 2003 (see Supplementary Fig. 1).

This paper will first describe the methods used in data collection and analysis. It then analyses the dialogue between science and policy through the eruption, broadly chronologically. Initially we discuss the acute phase, during which knowledge relationships were built between scientists, officials and the public. We then discuss some of the longer-term issues that arose over the acute and chronic phases. Finally, we examine the implications of a chronic eruption for land-use challenges and also a long-lasting dialogue between science and policy. In each of these time periods, we discuss the complexity introduced by particular social, cultural and political challenges. A detailed timeline and information about the eruptions and the political context are provided as supplementary data to this paper (see also Clay et al., 1999; Pattullo, 2000; Aspinall et al., 2002; Donovan et al., 2013). The paper argues that while linear approaches to science and