Data access overview:

Chapter 3: Please see the following pages of this document and DOIs 10.21420/XPT9-XG94 and 10.21420/MW46-NH92.

Chapter 4: Please see the following pages of this document and DOIs 10.21420/XPT9-XG94 and 10.21420/MW46-NH92.

Chapter 5: Please see DOI 10.1007/s00445-019-1320-y.

Chapter 6: Please see DOIs 10.21420/G20652 and 10.17608/k6.auckland.9962021.v1.

Chapter 7: Please see DOI 10.17608/k6.auckland.11406720.v1.

Chapter 3:

The social science data presented in this chapter was collected by Sophia Tsang and Jan Lindsay over the course of two trips to Hawaii, USA and one trip to Italy. The data from Hawaii has already been published in two GNS Science Reports:

Tsang, SWR, Lindsay, JM, Deligne, NI. 2019. Short-term Preparation for and Response to an Impending Lava Flow: Lessons from the June 27th Lava Flow (2014-2015), Hawai‘i, Hawaii, USA. Lower Hutt (NZ): GNS Science. 112 p. (GNS Science report; 2019/061). doi:10.21420/XPT9-XG94.

Tsang, SWR, Lindsay, JM, Deligne, NI. 2019. Response to and Short-term Recovery from a Lava Flow Inundation: Lessons from the May 2018 Eruption at Kīlauea Volcano, Hawaii, USA. Lower Hutt (NZ): GNS Science. xx p. (GNS Science report; 2019/075). doi:10.21420/MW46-NH92

Due to the requirements of our ethics approval protocols, the data cannot be made publically available to protect our participants’ privacy. Please see the associated data management plans (found in the folders corresponding to the two appendices above and this folder) for more information about how to request access to the data.

DATA MANAGEMENT PLAN

Project Title: Mitigating Lava Flows Impacts in Urban Environments

Description:

Several locations around the world have been historically threatened by lava flows. The likelihood that lava flows will enter urban locations grows each year as the populations on or near volcanoes grow. Lava flow invasion is economically costly, and few attempts at mitigating or redirecting lava flows have succeeded. Since the city of Auckland is located within the active Auckland Volcanic Field (AVF) that has produced lava flows in past eruptions, this project investigates the local lava flow hazard and possible mitigation measures. In order to optimise mitigation measures, this project interviews decision makers and their science advisors in Italy who have been tasked with mitigating the effect of lava flows on the built environment. Focus groups will also be conducted with local, Italian companies (i.e. electricity, water, wastewater, storm water, telecommunications companies and local transportation authorities). This information will help Auckland plan and prepare for a possible future eruption in the city.

Field of Research: Geology, Volcanology, Resilience

Data Management Plan Created: 17 October 2018
Last Updated: 17 July 2019

Project Start Date: 1 August 2016
Project End Date: 31 December 2019

Project Contributors:

PI: Giovanni Coco, School of Environment, University of Auckland, g.coco@auckland.ac.nz
CoI: Jan Lindsay, School of Environment, University of Auckland, j.lindsay@auckland.ac.nz
Data Contact: Sophia Tsang, School of Environment, University of Auckland, s.tsang@auckland.ac.nz

Related Policies:

This project complies with the University of Auckland's Researcher Code of Conduct and University of Auckland's Guiding Principles for Conducting Research with Human Participants.

Ethics Requirements:

This project requires ethics approval. It received approval from the University of Auckland's Human Participants Ethics Committee on 13 March 2018, reference number 020699.

Ethical Issues: The data in this project conforms to the requirements set out in our ethics application. Consent was gained from participants to store the data. Participants were informed that the data would result in publications and could be shared after it had been anonymised. All data containing information that could be used to identify participants must be securely destroyed on 13 March 2021; this includes consent forms, audio data, copies of transcripts before they were anonymised, and notes with names in them.

Data Organisation:

Consent forms (paper forms) were collected from participants and their superiors, if applicable. Audio data (M4As) was collected when permitted by the participant(s). Notes (paper notes) were also taken during interviews and focus groups. All of the above data is stored on an encrypted hard drive that is backed up to the University of Auckland servers daily or in a locked cabinet; it will all be destroyed securely on 13 March 2021.

The audio data was used to create transcripts (DOCXs). Participants were then given the opportunity to edit their transcripts. The edited transcripts were then anonymised (DOCXs). The anonymised transcripts are named with a random number; only one version of the transcripts will be generated. All of the transcripts are stored on an encrypted hard drive that is backed up to the University of Auckland servers daily.

File management is described in the metadata that accompanies the data.

Data Reuse:

Researchers may contact the data contact listed above to request access to the anonymised data only. Data reuse will always be restricted.

Metadata:

A metadata text file accompanies the data to explain software requirements and folder and file structures.

Temporal Extent of Data:

Data was collected between 20 August 2018 and 20 September 2018.

The copyright & other IP is held by: Sophia Tsang, PhD Candidate at The University of Auckland

Preamble

In this paper, we discuss the need to thoroughly and systematically document effusive eruptions in order to extract lessons learned and to be able to rigorously examine if past eruptions can be used to create lava flow hazard and impact models. While compiling data for this paper, we encountered information that could be useful to such future studies. In many cases, this data did not have a place in the paper. Rather, we provide it here to be useful for future studies without distracting from the main text.

We hope that Section 3.4.4 emphasises that there are many lava flow attributes that could be collected and that some lava flow attributes are more routinely collected than others. For example, eruption effusion rates are relatively commonly collected and published in many of the eruption narratives. Other measurements, such as temporal temperature series, are not as common. This document focuses on data that is not commonly collected. Additionally, this document primarily serves as a way of directing the reader to other studies that focus on less commonly discussed aspects of the case studies.

Etna detailed data

During the 1971 eruption, twelve hours after the lava flow front reached the volcanic observatory, the steel door could be seen budging outward due to the pressure exerted by the lava flow (Huntingdon 1972). The forest fires burned blue due to the presence of volcanic gases (Huntingdon 1972).

During the 1991-1993 eruption, the US military were asked to provide helicopters to drop objects into a skylight of the lava tube to try to block the cross-section of the flow; some objects survived the heat better than others (Barberi et al. 1993). Similarly, diversion channels were constructed to stall the advancement of the flow while a redirection channel could be built (Barberi et al. 1993). The redirection channel took 4.5 months to build. When explosives in the lava tube wall between the molten flow and the redirection channel were detonated, approximately one third of the flow was redirected. A second set of explosions were attempted; this time the rest of the lava flow was diverted into the artificial channel (Barberi et al. 1993).

Kīlauea detailed data

Similar to Etna, the presence of a volcano observatory located on Kīlauea has resulted in a large body of knowledge about the volcano. Hon et al. (1993), Keszthelyi (1995), Keszthelyi and Delinger (1996), and Keszthelyi et al. (2003) have published short-duration temperature data. Brantley et al. (2019) describes that the advancement rate of the June 27th Lava Flow in 2014-2015 was not continuous. During the 2007 and 2014-2015 eruptions, lines of steepest descent were used (Brantley et al. 2019), rather than modelling, because there were not pāhoehoe lava flow models (Kauahikaua 2007).

MaunaLoa detailed data

During the 1950 flow, temperature measurements taken at the vent averaged to 1070°C while the flow had cooled to 940°C 0.8 km downslope. The flow measurement was assumed to be an underestimate due to the crust of the flow (MacDonald 1954). In less than two weeks, the temperatures measured through cracks in the flow's crust averaged 695°C (MacDonald 1954). Combined with measurements from the 1949 eruption, this led scientists to believe MaunaLoa lava flows stop advancing when their temperature drops below 700 to 780°C (MacDonald 1954). The flow front advancement rate combined with the distance from the 1950 vent and the time at which ocean entries formed reveal that the flow fronts did not stall in their advancement on MaunaLoa's steep slopes. Additionally, dead fish were found in the ocean up to half a mile from the ocean entry, which indicates how far away the lava at the ocean entry was heating the water.

Nyiragongo detailed data

Recent laboratory work by Morrison et al. (2020) has allowed for updated viscosities of the 1997 and 2002 lavas.

Piton de la Fournaise detailed data

During the 1986 eruption, the flow was 1160°C although the location of the measurement site with respect to distance down the flow from the vent, across the flow's cross-section, or depth in the flow was not recorded (Global Volcanism Program 2019g). Due to a content analysis of a local newspaper's reporting on the 2002 eruption and evacuation of the town of Le Tremblet by Harris and Villeneuve (2018a, 2018b), there are many resident opinions available.

Fogo detailed data

Although many of these eruptions were not extensively studied, international geologists have occasionally be asked to help respond. Thus, there are several field report comparisons between Fogo and Hawaiian eruptions. For example, the viscosity of a lava flow from Fogo's 1995 eruption was reported as higher than that commonly found at Kīlauea Volcano (Global Volcanism Program 2019b). In the same report, the lava flow's temperature was recorded as 1026˚C (Global Volcanism Program 2019b). Later, the flow temperature was measured again when a single house in Portela burned at its former site (Global Volcanism Program 2019b). By the third week of the eruption, the pāhoehoe lava flow temperatures were reported to be steady at 1065°C (Global Volcanism Program 2019b). During this eruption, the flow front was observed to be approximately 45° as the flow advanced through the towns (Global Volcanism Program 2019b).

Mt Cameroon detailed data

During the 1982 eruption, two velocity measurements were reported. Two metres from the vent, the lava was moving at 2 m/s while the flow front (1 km away) was advancing at 1-4 m/s (Global Volcanism Program 2019a). At the flow front, the ‘a’ā lava flow front was 2 m wide (Global Volcanism Program 2019a), and its temperature ranged between 1045 and 1070°C (Fitton et al. 1983). In the 1999 eruption, the lava flow temperature was, again, measured. Similar to the velocities measured in the 1982 eruption, the measurements indicate the importance of noting the distance from the vent when measuring temperatures. The flow measured 972°C at a location 300 m from the vent (Global Volcanism Program 2019a) while the temperature at the flow front varied between 950 and 1000°C (Suh et al. 2003).

Volcano	Eruption	Preparedness		Response						Recovery		
		Preparatory narrative	Lava flow hazard modelling	Eruption narrative	Lava flow attributes	Detailed, physical impact data	Response approach	Communication approach	Evacuation data	Recovery narrative	Community reactions	Applications of learning
Etna	1971	n/a	n/a	Huntington (1972), Walker (1973)	n/a	Huntington (1972) Guest et al. (1980)	n/a	n/a	n/a	n/a	n/a	n/a
	1981	Science News (1981 March 28)	n/a	Coltelli et al. (2012)	n/a	n/a	DeVries (1981)	Science News (1981 March 28)	n/a	Tsang and Lindsay (*in prep*)	n/a	Maugeri and Romano (1981)
	1983	Frazzetta and Romano (1984)	Rongo et al. (2016)	Frazzetta and Romano (1984)	n/a	n/a	Schnanche (1983), Abersten (1984), Carapezza (2017)	Schnanche (1983), Carapezza (2017)	n/a	n/a	n/a	Abersten (1984), Colombrita (1984)
	1991-1993	Barberi et al. (1993)	Dobran and Macedonio (1992), Barberi et al. (1993), Wadge et al. (1994)	Barberi et al. (1993)	Barberi et al. (1993)	n/a	Bompard and Philips (1992 April), Barberi et al. (1993)	Bompard and Philips (1992 April)	Tomarchio (n.d.)	n/a	Tomarchio (n.d.)	Barberi et al. (1993)
	2001	Barberi et al. (2003)	Favalli et al. (2005), Coltelli et al. (2007), Scifoni et al. (2010), Rongo et al. (2016)	Barberi et al. (2003)	n/a	n/a	Reuters (2001 July 31), Barberi et al. (2003), Barberi and Carapezza (2004)	News Service Reports (2001 July 29), Reuters (2001 July 31)	n/a	n/a	n/a	n/a
	2002-2003	Bonaccorso et al. (2016)	Bonaccorso et al. (2016)	Andronico et al. (2005), Bonaccorso et al. (2016)	n/a	n/a	Villa (2002), Bonaccorso et al. (2016)	Villa (2002)	n/a	Bonaccorso et al. (2016)	n/a	n/a
Kilauea	1955	n/a	n/a	HVO (2018)	n/a	n/a	HVO (2018)	n/a	HVO (2018)	HVO (2018)	HVO (2018)	HVO (2018)
	1960	n/a	n/a	Macdonald (1962)	n/a	n/a	Macdonald (1962)	n/a	Macdonald (1962)	Cooper and Daws (1985)	Macdonald (1962)	Macdonald (1962)
	1983-2018	Hawaiian Electric Light Company (2014a, 2014b)	Kauahikaua (2007), Brantley et al. (2019)	Orr et al. (2015), Poland et al. (2015), Brantley et al. (2019)	Poland et al. (2015)	n/a	Hawaiian Electric Light Company (2014a, 2014b), Brantley et al. (2019)	Hawaiian Electric Light Company (2014a, 2014b), Brantley et al. (2019)	Brantley et al. (2019)	Mcmullen (2015)	Ballauer et al. (2015), Ching et al. (*submitted*)	Poland et al. (2015), Patrick et al. (2017), Brantley et al. (2019)
	2018	Neal et al. (2019)	Dietterich et al. (2018)	Neal et al. (2019)	n/a	See note in paper.	Neal et al. (2019)	Neal et al. (2019)	Neal et al. (2019)	Neal et al. (2019)	Hawaii Tracker (https://www.facebook.com/groups/hawaiitracker/)	Neal et al. (2019), Black (2019)
Mauna Loa	1950	n/a	n/a	Finch and Macdonald (1953), HVO (2016)	Finch and Macdonald (1953), Macdonald (1954)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1984	Lockwood et al. (1985)	n/a	Lockwood et al. (1985)	n/a	n/a	Lockwood et al. (1985)	n/a	n/a	n/a	n/a	Kauahikaua and Tilling (2014)
Vestmannaeyjar	1973	Thorarinsson et al. (1973), McPhee (1989)	n/a	Thorarinsson et al. (1973), Williams and Moore (1983), McPhee (1989)	Thorarinsson et al. (1973), Williams and Moore (1983)	n/a	Williams and Moore (1983), McPhee (1989)	McPhee (1989)	Williams and Moore (1983), McPhee (1989)	Williams and Moore (1983)	McPhee (1989)	n/a
Nyiragongo	1977	n/a	n/a	Tazieff (1977)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	New Scientist (2002), Finkel (2011)
	2002	Komorowski et al. (2002), New Scientist (2002), Finkel (2011)	Favalli et al. (2006, 2009), Chirico et al. (2009)	Komorowski et al. (2002), Giordano et al. (2007)	n/a	n/a	n/a	Lacey (2002 January 21, 2002 January 23), Finkel (2011)	UN Integrated Regional Information Networks (2002 January 21)	Comtex (2002 February 26, 2003 February 4), UN Integrated Regional Information Networks (2002 January 21, 2002 February 11)	Agencia (2002 January 21), UN Integrated Regional Information Networks (2002 January 21)	n/a
Piton de la Fournaise	1977-1978	n/a	n/a	Global Volcanism Program (2019g)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	Lenat (2016), Staudacher et al. (2016)
	1986	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	n/a
	1998	Staudacher et al. (2016)	n/a	Staudacher et al. (2016)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	n/a
	2001	Staudacher et al. (2016)	n/a	Staudacher et al. (2016)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	n/a
	2002-01	Staudacher et al. (2016)	n/a	Staudacher et al. (2016)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a
	2002-11	Staudacher et al. (2016)	n/a	Staudacher et al. (2016)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	n/a
	2004-05	Staudacher et al. (2016)	n/a	Staudacher et al. (2016)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	n/a
	2004-12	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	n/a
	2005	Staudacher et al. (2016)	n/a	Staudacher et al. (2016)	n/a	n/a	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	n/a
	2007	Staudacher et al. (2016)	n/a	Staudacher et al. (2016)	n/a	n/a	Harris and Villeneuve (2018a, 2018b)	Harris and Villeneuve (2018a, 2018b)	Harris and Villeneuve (2018a)	Harris and Villeneuve (2018a)	n/a	n/a
	2018	Global Volcanism Program (2019g)	n/a	Global Volcanism Program (2019g)	n/a	n/a	Global Volcanism Program (2019g)	Global Volcanism Program (2019g)	Global Volcanism Program (2019g)	n/a	n/a	n/a
Karthala	1977	n/a	n/a	Krafft (1983)	n/a	n/a	n/a	n/a	Krafft (1983)	n/a	n/a	n/a
Fogo	1951	n/a	n/a	Global Volcanism Program (2019b)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1995	n/a	n/a	Smithsonian Institution's Global Volcanism Network (1995)	Smithsonian Institution's Global Volcanism Network (1995)	n/a	Smithsonian Institution's Global Volcanism Network (1995), Komorowski et al. (2018)	n/a	Smithsonian Institution's Global Volcanism Network (1995), Komorowski et al. (2018)	Komorowski et al. (2018)	n/a	n/a
	2014	n/a	n/a	Worsley (2015), Jenkins et al. (2017)	Worsley (2015), Jenkins et al. (2017)	Jenkins et al. (2017)	Economist Intelligence Unit (2014 November 28), United Nations Office for Disaster Risk Reduction- Regional Office for Africa (2014 December 12), Worsley (2015), Jenkins et al. (2017)	n/a	United Nations Office for Disaster Risk Reduction- Regional Office for Africa (2014 December 12), Worsley (2015), Jenkins et al. (2017), Komorowski et al. (2018)	Economist Intelligence Unit (2014 November 28), Ministry of Foreign Affairs of Japan (2014 December 19), Al Bawaba (2015 February 4), Komorowski et al. (2018)	n/a	n/a
Izu-Oshima	1986	n/a	Ishihara et al. (1989)	Sawada and Aramaki (1989), Ishihara et al. (1989), Global Volcanism Program (2019c)	n/a	n/a	Watts (1986 November 22)	Watts (1986 November 22)	Watts (1986 November 22), Global Volcanism Program (2019c)	n/a	n/a	n/a
Miyakejima	1962	n/a	n/a	Cappello et al. (2015), Global Volcanism Program (2019e)	n/a	n/a	n/a	n/a	Cappello et al. (2015), Global Volcanism Program (2019e)	n/a	n/a	n/a
	1983	n/a	n/a	Aramaki et al. (1986), Sawada (1986), Global Volcanism Program (2019e)	n/a	Global Volcanism Program (2019e)	Aramaki et al. (1986), Sawada (1986)	n/a	Aramaki et al. (1986), Sawada (1986)	Global Volcanism Program (2019e)	n/a	n/a
Mt Cameroon	1959	n/a	n/a	Njome et al. (2008)	Njome et al. (2008)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1982	n/a	n/a	Fitton et al. (1983), Global Volcanism Program (2019a)	Jennings (1959), Fitton et al. (1983), Global Volcanism Program (2019a)	n/a	n/a	n/a	n/a	n/a	n/a	Ateba et al (2009)
	1999	Deruelle et al. (2000), Suh et al. (2003)	n/a	Deruelle et al. (2000), Suh et al. (2003)	Deruelle et al. (2000), Suh et al. (2003)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2000	Suh et al. (2003)	n/a	Suh et al. (2003)	Suh et al. (2003)	n/a	n/a	n/a	Global Volcanism Program (2019a)	n/a	n/a	n/a
La Palma	1971	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	38	22	8	37	11	4	26	12	25	12	8	11