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Amy Laura Parker

InSAR Observations of Ground Deformation

Application to the Cascades Volcanic Arc

Doctoral Thesis accepted by
University of Bristol, UK

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I dedicate this thesis to my Nana who, in our last conversation, told me to write down what I knew in a book one day. Well Nana, consider it done.

Supervisor's Foreword

Over two hundred volcanoes are known to be deforming, yet the processes responsible are unclear in many cases. Measurements of ground deformation from satellite radar have the potential to play a key role in understanding volcanic and magmatic processes throughout the eruption cycle.

In her thesis, Amy Parker approaches this problem in the context of the Cascades Volcanic Arc. The thesis starts with a technical review of the influence of atmospheric uncertainties on satellite maps of volcano deformation, and the use of regional-scale weather models to assess this a priori. Next, it presents detailed geodetic studies of two case studies: Medicine Lake Volcano and Lassen Volcanic Centre. Both systems are subsiding, but with contrasting characteristics. The observations are used to constrain a thermal model of cooling intrusions, a new approach to combining geophysical and petrologic observations. The novelty and range of topics covered in this thesis mean that it is a key work in volcanic and magmatic studies, which lays the foundations for future studies both in the Cascades and elsewhere.

The thesis acts as an introduction to volcano geodesy in general, and to the understanding of magmatic processes leading to deformation on decadal timescales. It combines novel methods of measuring and modelling deformation with new case studies of specific examples. The four chapters together present timely research into magmatic processes occurring on decadal timescales.

Bristol, UK
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Dr. Juliet Biggs

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Parker, A. L., J. Biggs, and Z. Lu (2014), Investigating long-term subsidence at Medicine Lake Volcano, CA, using multitemporal InSAR, *Geophysical Journal International*, 199(2), 844–859, doi: [10.1093/gji/ggu304](https://doi.org/10.1093/gji/ggu304).

Parker, A. L., J. Biggs, R. J. Walters, S. K. Ebmeier, T. J. Wright, N. A. Teanby, and Z. Lu (2015), Systematic assessment of atmospheric uncertainties for InSAR data at volcanic arcs using large-scale atmospheric models: application to the Cascade volcanoes, *Remote Sensing of Environment*, 170, 102–114, doi:[10.1016/j.rse.2015.09.003](https://doi.org/10.1016/j.rse.2015.09.003).

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My Ph.D. has allowed me to begin to travel the world, and for that I am extremely thankful. I began this journey with a love of the United States, and two summers spent in Washington/Oregon only enriched this. Kristin, Vance, Quinn and Zia invited me into their home, and evenings spent looking out over the vines to Mount St. Helens will always be a fond memory. Scott, Dani, Bill and Cathy also allowed me to see more sides of this fantastic country. In my third year I participated in fieldwork in Ethiopia, which I found to be a vibrant, beautiful and humbling place. The experience I have gained in Bristol has given me the confidence and opportunity to continue travelling, and I now move on to Australia, where I will continue my research.

My family has been, and always will be, the foundation behind anything I do. I thank them for being proud of me and for sharing my sense of achievement in completing this thesis. I also thank Hugo, whose dreams are as big as mine, and whose patience and optimism helped to keep me smiling to the very end. You put the wind in my hair and the seasalt on my skin, and without you I imagine this would all be ending very differently.

Contents

1	Introduction	1
1.1	Motivation	1
1.2	InSAR	2
1.3	InSAR Observations of Ground Deformation at Volcanoes	8
1.4	The Cascades Volcanic Arc	9
1.4.1	Tectonic Setting	10
1.4.2	Magma Production and Storage	10
1.4.3	Monitoring	11
1.5	Thesis Structure	14
	References	17
2	Investigating Long-Term Subsidence at Medicine Lake Volcano, CA, Using Multi Temporal InSAR	25
2.1	Introduction	26
2.1.1	Tectonic and Geological Setting	28
2.1.2	Previous Studies of Ground Deformation at Medicine Lake Volcano	28
2.2	InSAR Data and Interferogram Formation	29
2.2.1	Coherence	30
2.2.2	Sources of Noise	30
2.3	InSAR Methods	35
2.3.1	Stacking	35
2.3.2	Poly-Interferogram Rate and Time-Series Estimator (π -RATE)	37
2.3.3	Persistent Scatterer InSAR (PSInSAR)	38
2.4	Results of Multi Temporal InSAR Analysis Techniques	38
2.4.1	Stacking	39
2.4.2	π -RATE	39
2.4.3	PSInSAR	40
2.4.4	Comparison to Past Geodetic Studies	42
2.4.5	Horizontal and Vertical Displacements	43

2.5	Modelling: Estimates of Source Geometry and Volume Change	45
2.5.1	Selection of InSAR Data for Use in Modelling.	47
2.5.2	Point Source	47
2.5.3	Sills.	47
2.6	Discussion	50
2.6.1	Causes of Subsidence	51
2.7	Conclusions	52
	Appendix	53
	References.	54
3	Systematic Assessment of Atmospheric Uncertainties for InSAR Data at Volcanic Arcs Using Large-Scale Atmospheric Models: Application to the Cascade Volcanoes.	59
3.1	Introduction	59
3.1.1	The Cascades Volcanic Arc	60
3.2	Atmospheric Noise in InSAR Studies at Volcanoes	61
3.2.1	Causes and Effects	61
3.2.2	Atmospheric Corrections for Volcano InSAR Studies.	63
3.3	Methods	65
3.3.1	InSAR.	65
3.3.2	Atmospheric Models	66
3.4	Case Study Volcanoes	68
3.4.1	Comparison Between ERA-I and NARR	68
3.4.2	Correcting Stratified and Turbulent Atmospheric Delays Using NARR.	69
3.5	Arc-Wide Assessment of Atmospheric Uncertainties	72
3.5.1	Method	72
3.5.2	Elevation-Delay Gradients.	74
3.5.3	Temporal Atmospheric Variability	74
3.6	Discussion	75
3.6.1	Detection Thresholds for InSAR Studies at the Cascade Volcanoes	78
3.6.2	Applicability to Regional Volcano InSAR Studies	81
3.7	Conclusions	82
	Appendix	83
	References.	86
4	Time Constraints on Magma Intrusion from Thermal Models of Long-Term Subsidence: Medicine Lake Volcano, CA	91
4.1	Introduction	91
4.2	Model Setup.	94
4.3	Results	97
4.3.1	Evolving Crystal Assemblage	98
4.3.2	Parameter Space Exploration.	100

- 4.4 Application to Medicine Lake Volcano 105
 - 4.4.1 Model Constraints 107
 - 4.4.2 Comparison to the Geodetic Record 108
 - 4.4.3 Constraints upon Magma Intrusion at Medicine Lake Volcano 108
- 4.5 Additional Factors 111
 - 4.5.1 Incremental Magma Intrusion 111
 - 4.5.2 Convection 113
 - 4.5.3 Gas Loss 113
- 4.6 Discussion 115
 - 4.6.1 Further Applications 116
- 4.7 Conclusions 117
- References. 118
- 5 Constraining Mechanisms of Volcanic Subsidence at Lassen Volcanic Center, CA, Using InSAR. 125**
 - 5.1 Introduction 125
 - 5.1.1 Tectonic and Geological Setting 126
 - 5.1.2 Hydrothermal and Seismic Activity. 127
 - 5.2 Methods 129
 - 5.2.1 InSAR Data and Processing 129
 - 5.2.2 Stacking 130
 - 5.2.3 Source Modelling 131
 - 5.2.4 Time-Series 132
 - 5.3 Results 134
 - 5.3.1 Stacking 134
 - 5.3.2 Source Modelling 135
 - 5.3.3 Time-Series of Source Volume Change 137
 - 5.3.4 Comparison with Past Geodetic Measurements 140
 - 5.4 Discussion 140
 - 5.4.1 Comparison with Medicine Lake Volcano 140
 - 5.4.2 Causes of Subsidence at LaVC 141
 - 5.5 Conclusions 144
 - Appendix 144
 - References. 145
- 6 Summary and Outlook 151**
 - 6.1 Application of InSAR Data in the Cascades Volcanic Arc 151
 - 6.2 Volcano Deformation in the Southern Cascades 154
 - 6.3 Long-Term Volcanic Subsidence 155
 - 6.4 Future Role of InSAR in Volcanology 156
 - References. 157
- Curriculum Vitae 161**

Author Contributions

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