University of Potsdam

Cumulative Dissertation

This is the title of my dissertation

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by

MyName MyLastName

Supervisors:
Name LastName, Ph.D.
Prof. Dr. Name LastName

for the degree of
doctor rerum naturalium (Dr. rer. nat.)
in Geoecology
Institute of Environmental Science and Geography
Faculty of Science

April 2019

This is the title of my dissertation

by MyName MyLastName

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Publication-based dissertation submitted in fulfilment of the requirements for the degree of Doctor of Philosophy under the discipline of Geoecology in the Institute of Environmental Science and Geography Faculty of Science at the University of Potsdam.

Declaration of Authorship

I, MyName MyLastName, declare that this thesis titled, “This is the title of my dissertation ” and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at the University of Potsdam.
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- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Signature:

Date:

"Sometimes attaining the deepest familiarity with a question is our best substitute for actually having the answer."

Brian Greene

Abstract

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Zusammenfassung

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Acknowledgements

Words of gratitude.

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Chapter 1

Introduction

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How weather radars work

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$$P_r = \frac{z}{r^2}\left(\frac{P_t g^2 \theta \phi h}{\lambda^2}\right)\left(\frac{\pi^3}{1024 \ln(2)}\right)|K|^2 l \quad (1.1)$$

where the non-numeric parameters can be classified into three categories:

Derived quantities

P_r = power received by radar (watts)

r = range or distance to target (m)

z = radar reflectivity factor (mm^6/m^3)

Radar constants

P_t = power transmitted by radar (watts)

g = antenna gain

θ = horizontal beam width (radians)

ϕ = vertical beam width (radians)

h = pulse length (m)

λ = wavelength of radar pulse (m)

Assumed values

$|K|^2$ = dielectric constant for radar targets (usually set at 0.93 for liquid water)

l = loss factor for beam attenuation (assumed to be 1 for if attenuation is unknown)

The equation can be simplified by combining the numeric values, the assumed values, and the radar-specific variables into a single constant c_1, and solve for z, such that:

$$z = c_1 P_r r^2 \quad (1.2)$$

The constant c_1 depends on a specific radar and its configuration, such that the reflectivity factor z is calculated based on the two parameters measured by the radar: the amount of power return (P_r) and the range (r). This reflectivity factor is a function of the distribution of the rainfall drop sizes within a unit volume of air measured. The reflectivity factor is derived as:

$$z = \sum_{vol} D^6 = D_1^6 + D_2^6 + D_3^6 + \ldots + D_N^6 \quad (1.3)$$

where D is the drop diameter in mm.

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Figure 1.1: This is a figure taken from a different paper, so it needs to be cited. (Heistermann et al., 2014)

Research questions and structure

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RQ1: Research question 1

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RQ2: Research question 2

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RQ3: Research question 3

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Towards open science

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Contribution to Publications

The scientific papers that merge the core of the thesis is as follows:

Paper I / Chapter 2

Heistermann, Maik, Irene Crisologo, Catherine C. Abon, Bernard Alan Racoma, Stephan Jacobi, Nathaniel T. Servando, Carlos Primo C. David, and Axel Bronstert. 2013. "Brief Communication 'Using the New Philippine Radar Network to Reconstruct the Habagat of August 2012 Monsoon Event around Metropolitan Manila.'" Nat. Hazards Earth Syst. Sci. 13 (3): 653–57. https://doi.org/10.5194/nhess-13-653-2013.

MH conceptualized the study, together with IC and CCA; NTS and CPCD provided the radar data; MH wrote the software code, and MH and IC carried out the analysis. MH prepared the manuscript, with contributions from all co-authors.

Paper II / Chapter 3

Crisologo, Irene, Robert A. Warren, Kai Mühlbauer, and Maik Heistermann. 2018. "Enhancing the Consistency of Spaceborne and Ground-Based Radar Comparisons by Using Beam Blockage Fraction as a Quality Filter." Atmospheric Measurement Techniques 11 (9): 5223–36. https://doi.org/10.5194/amt-11-5223-2018.

IC and MH conceptualized the study. KM, MH, RW, and IC formulated the 3D-matching code based on previous work of RW. IC carried out the analyses; IC and MH the interpretation of results. IC and MH, with contributions from all authors, prepared the manuscript.

Paper III / Chapter 4

Crisologo, Irene and Maik Heistermann: Using ground radar overlaps to verify the retrieval of calibration bias estimates from spaceborne platforms, Atmos. Meas. Tech., submitted.

IC and MH conceptualized the study and formulated the code for 3D-matching of GRs. IC prepared the scripts for 3-way comparison and carried out the analysis. IC and MH interpreted the results and prepared the manuscript.

Chapter 2

Full version of chapter title

This chapter is published as:

Heistermann, M., I. Crisologo, C. C. Abon, B. A. Racoma, S. Jacobi, N. T. Servando, C. P. C. David, and A. Bronstert. 2013. “Brief Communication ‘Using the New Philippine Radar Network to Reconstruct the Habagat of August 2012 Monsoon Event around Metropolitan Manila.’” Nat. Hazards Earth Syst. Sci. 13 (3): 653–57. https://doi.org/10.5194/nhess-13-653-2013.

Abstract

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2.1 Introduction

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Figure 2.1: Photo by Claudio Testa on Unsplash

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2.2 Section

2.2.1 Subsection

Use section or subsection label for reference within text 2.2.1.

Sub sub subsection

Many many layers of sections. Soooo many layers. I think they lose numbering at this level though.

For tables following the column width, see latex code below.

Table 2.1: Caption of table. This is a column-width table.

	Subic Radar
Polarization	Single-Pol
Position (lat/lon)	14.82°N 120.36 °E
Altitude	532 m.a.s.l.
Maximum Range	120 km (150 km)
Azimuth resolution	1 °
Beam width	0.95 °
Gate length	500 m (250 m)
Number of elevation angles	14 (3)
Elevation angles	0.5, 1.5, 2.4, 3.4, 4.3, 5.3, 6.2, 7.5, 8.7, 10, 12, 14, 16.7, 19.5 (°) (0.0, 1.0, 2.0)
Volume cycle interval	9 minutes
Data available since	April 2012
Peak power	850 kW
Wavelength	10.7 cm

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Figure 2.2: Photo by Fabian Irsara on Unsplash

Supplemental material to the manuscript

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Table 2.2: Caption of table. This is a full-width table.

	Subic Radar	Tagaytay Radar
Bandwidth	S-Band	C-Band
Polarization	Single-pol	Dual-pol
Position (lat/lon)	14.822°N 120.363°E	14.123°N 120.974°E
Altitude	532 m a.s.l.	752 m a.s.l.
Maximum Range	120 km	
Azimuth Resolution	1 °	
Gate length	500 m	
Number of elevation angles	14	
Elevation angles	0.5°, 1.5°, 2.4°, 3.4°, 4.3°, 5.3°, 6.2°, 7.5°, 8.7°, 10°, 12°, 14°, 16.7°, 19.5°	
Volume cycle interval	8 minutes	15 minutes
Start of operation	2012	2012

Chapter 3

Full version of chapter title

This chapter is published as:

Citation

Abstract

Abstract

3.1 Introduction

Introduction

3.2 Section

3.2.1 Subsection

Use section or subsection label for reference within text 3.2.1.

Chapter 4

Full version of chapter title

This chapter is published as:

Citation

Abstract

Abstract

4.1 Introduction

IntroductionIntroduction Introduction Introduction-Introduction Introduction Introduction Introduction Introduction.

4.2 Section

4.2.1 Subsection

Use section or subsection label for reference within text 4.2.1.

Chapter 5

Discussion, Limitations, Outlook

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Limitations of the study

Limitations of the study.

Outlook

Outlook of the study.

Chapter 6

Summary and Conclusion

The Conclusion section is an essential (and required) part of a paper: it represents what remains after the dust of the discussion has settled. No new ideas can be introduced in the Conclusions.

Chapter 7

Additional Publications

I also contributed to the following publications during the course of the doctoral research, aside from the manuscripts listed in Chapter 1.

Bronstert, Axel, Ankit Agarwal, Berry Boessenkool, **Irene Crisologo**, Madlen Fischer, Maik Heistermann, Lisei Köhn-Reich, et al. 2018. "Forensic Hydro-Meteorological Analysis of an Extreme Flash Flood: The 2016-05-29 Event in Braunsbach, SW Germany." Science of The Total Environment 630 (July): 977–91. https://doi.org/10.1016/j.scitotenv.2018.02.241.

Ozturk, Ugur, Dadiyorto Wendi, **Irene Crisologo**, Adrian Riemer, Ankit Agarwal, Kristin Vogel, José Andrés López-Tarazón, and Oliver Korup. 2018. "Rare Flash Floods and Debris Flows in Southern Germany." Science of The Total Environment 626 (June): 941–52. https://doi.org/10.1016/j.scitotenv.2018.01.172.

Bibliography

Heistermann, M., Collis, S., Dixon, M. J., Giangrande, S., Helmus, J. J., Kelley, B., Koistinen, J., Michelson, D. B., Peura, M., Pfaff, T., and Wolff, D. B. (2014). The Emergence of Open-Source Software for the Weather Radar Community. *Bulletin of the American Meteorological Society*, 96(1):117–128. Software.

Heistermann, M., Jacobi, S., and Pfaff, T. (2013). Technical Note: An open source library for processing weather radar data (wradlib). *Hydrology and Earth System Sciences*, 17(2):863–871. Software.