Preface

The book *MATLAB and Design Recipes for Earth Sciences* is designed to help undergraduate and postgraduate students, doctoral students, post-doctoral researchers, and professionals find quick solutions for common problems when starting out on a new research project. A project usually starts with searching and reviewing the relevant literature and data, and then extracting relevant information as text, data or graphs from the literature, followed by searching, processing and visualizing the data, and finally, compiling and presenting the results as posters, abstracts and talks at conferences.

The course on which this book is based was first taught by M.H.T. as a bachelor's module for second-year students during the 2010/11 winter semester, three years after the introduction of bachelor's and master's programs at the University of Potsdam. The initial design of the bachelor's program included an introductory course on data analysis, scheduled for the second year, which was based on the sister book to this one: *MATLAB Recipes for Earth Sciences–3rd Edition* (Trauth 2010). This course was a complete failure, probably because the second-year bachelor students were not well enough prepared for an advanced course on data analysis, even after two semesters of mathematics during the first year. A few weeks later, the course for students at master's and doctoral levels on the same topic, which M.H.T. was invited to give at the University of Ghent in Belgium, was a great success. The difference between the undergraduate students in Potsdam and the graduate students in Belgium was, of course, the greater motivation that students already working on their own projects had to learn the statistical and numerical methods offered by MATLAB, in order to be able to analyze their data.

As a consequence, M.H.T. moved the course into the master's program and designed a completely new course on *How to Collect, Process and Present Geoscientific Information*, which was very well received by the second-year students, despite the very large number of participants. The course was not presented as a complete package, but evolved during the months of teaching, taking into consideration the suggestions made by students attending the course. During the course, and very much motivated by

its success, the idea for this new book quickly emerged and the first outline for the text was drafted in late December 2010. Most of the text was written immediately following completion of the first course and before the start of the second course in spring 2011. Fortunately, the graphic design specialist E.S., who is the owner of *blaetterwaldDesign*, joined the project to contribute to the design sections in the book as well as the book's layout, after having designed the layout of all three editions of the sister book, as well as many other books, for *Springer*. The publisher quickly agreed to assist in realizing the book and contracts were signed in summer 2011.

While undergraduates participating in a course on data analysis might wish to work their way through the entire book, more experienced readers might refer to only one particular method in the book, in order to solve a specific problem. The concept of the book and its contents are therefore outlined below, in order to make it easier for readers with a variety of different requirements to decide how they wish to approach the book.

- *Chapter 1* – This chapter is about initiating, planning and organizing a project. It introduces the Internet resources used in the following chapters to search for geoscientific information, as well as the software and online tools used to manage projects, to process data, to exchange information, and to present project results.

- *Chapters 2 and 3* – These chapters deal with searching and reviewing scientific literature and data on the Internet. Chapter 2 provides a comprehensive tutorial-style introduction to Internet literature resources. It also demonstrates how to extract information from the literature for use within the reader's own projects, and introduces software for managing large collections of electronic journal articles and books. Chapter 3 introduces the most popular data formats on the Internet, and methods to store and transfer such data. Data access and management is demonstrated by means of typical examples.

- *Chapters 4 to 7* – The first of these chapters starts with a tutorial-style introduction to MATLAB, designed for earth scientists (as in Chapter 2 of the sister book). Chapters 5 and 6 introduce advanced visualization techniques with MATLAB, for example, how to create sophisticated two- and three-dimensional graphs from data collected in Chapter 3. Chapter 7 is on processing and displaying images with MATLAB, including satellite images (as in Chapter 8 of the sister book).

- *Chapter 8* – The graphs created with MATLAB in the previous chapters are now handed over to the graphic design unit of the project. Even though the advanced plotting features of MATLAB presented in Chapters 5 and 6 are able to create sophisticated figures, all graphs will require further editing with vector and image processing software before they can be included, together with text and tables, in conference presentations and manuscripts.

- *Chapters 9 to 11* – These chapters are about creating conference presentations such as talks and posters, and various types of manuscripts for publication. They cover the preparation of colorful flyers and brochures relating to projects, as well as theses or project reports with relatively modest designs, and also deal with assembling books and their layout design. Both Chapters 9 and 10 close with some remarks on practicing for conference presentations, and their final delivery.

The book contains *MATLAB* scripts, or *M-files* for visualizing typical earth science data sets (http://mathworks.com). The MATLAB codes can be easily adapted to the reader's data and projects. M.H.T. developed these recipes using MATLAB Version 7 (R2011b), but most of them will also work with earlier software releases. Furthermore, the book relies on numerous other software products, first and foremost the *Adobe Creative Suite* (http://adobe.com), which is used to edit all the graphs created with MATLAB. Although most examples are also explained with open-source alternatives, the use of the Adobe Creative Suite produces consistently high quality results for all graphics to be included in project presentations. The book provides brief introductions to the use of these graphics editors by means of step-by-step tutorials, supplemented by screenshots documenting the workflows that are provided as supplementary electronic material to this book. We are planning to make all vector materials available online as soon as an appropriate digital rights management is provided by the publisher.

We hope that our readers will appreciate our efforts to introduce open-source software tools in addition to the commercial products that the authors of this book use during their daily work. During the course at the University of Potsdam, students asked about free alternatives to *MATLAB*, such as *Python*, *R* and *Octave*. Some students also liked to use *LaTeX* for typesetting, and *GMT* for creating *xy* and *xyz* plots. Students' financial resources are often limited and many therefore use open-source software on their computers. For professionals, however, time is by far the more important limiting factor. When trying to meet a strict deadline for the sub-

mission of a research proposal or report, one quickly learns to appreciate complete and concise software manuals and the short response time of the software vendor's support line.

In putting together this book we have benefited from the comments offered by many people, in particular Nina Bösche, Verena Förster, Oliver Korup, Oliver Oswald, and Marius Walter. It is expected that this book will be constantly changing and evolving over time, as has been the case through the various editions of its sister book. Please send us your comments and criticisms on the text, suggestions for correction and expansion of the text, and comments on any experiences that you may have had with similar courses or books.

Please visit the webpages of M.H.T. (http://www.geo.uni-potsdam.de/palaeoklimadynamik.html) and E.S. (http://blaetterwald-design.de) from time to time, in order to check for updates and errata files for this book.

We are much obliged to Ed Manning for professional proofreading of the text. We would like to thank Christian Witschel, Chris Bendall and their team at *Springer*, and also Andreas Bohlen, Brunhilde Schulz and their team at *UP Transfer GmbH* for their support. M.H.T. acknowledges the *Book Program* and the *Academic Support* at *The MathWorks Inc.*, as well as Claudia Olrogge, Kremena Radeva, and Annegret Schumann at *The MathWorks GmbH Deutschland*. E.S. thanks *Adobe Systems Inc.* for their support and the permission to include screenshots of Adobe software in the book. M.H.T. would also like to thank *NASA/ GSFC/METI/ERSDAC/ JAROS* and the *U.S./Japan ASTER Science Team*, and their team leader Mike Abrams, for permission to include their ASTER images in the book.

Potsdam/Landau, June 2012

Martin Trauth
Earth Scientist, University of Potsdam

apl. Prof. Dr. Martin H. Trauth
Institute of Earth and Environmental Science
University of Potsdam
Karl-Liebknecht-Strasse 24–25
D-14476 Potsdam
Germany

Elisabeth Sillmann
Designer (AGD), blaetterwaldDesign.de

Dipl-Ing. (FH) Elisabeth Sillmann
blaetterwaldDesign
Büro für Medien und Gestaltung
Emich-von-Leiningen-Strasse 38
D-76829 Landau in der Pfalz
Germany

http://www.springer.com/978-3-642-32543-4

MATLAB® and Design Recipes for Earth Sciences
How to Collect, Process and Present Geoscientific Information
H. Trauth, M.; Sillmann, E.
2013, XII, 292 p. With online files/update., Hardcover
ISBN: 978-3-642-32543-4