# Typesettng your M.Sc Dissertation using LaTeX

Hugh C. Pumphrey

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**Abstract**

Students taking the M.Sc degrees in Remote Sensing and Image Processing, Geosciences and Remote Sensing and Quantitative Earth Observation are required to write a dissertation as well as several short reports. The dissertation has to be in the format of an article in a suitable journal — section 8 of this document contains details on various suitable journals which may also be of interest to nonLaTeX users. Other reports may be in any suitable layout. This document provides some advice on using LaTeX to typeset these reports. It is also an example: you should read the source as well as the typset document in order to see how it was all done.

## Contents

# 1 Introduction

## 1.1 What is it?

LaTeX is a typesetting system. It takes your text, together with various interspersed instructions, and lays it out nicely on the page, inserting your figures in appropriate places. LaTeX will automatically number your sections and equations, generate cross-references to them and to your bibliography, and generally help you to do a good job.

## 1.2 What are the advantages and disadvantages?

You might want to consider using LaTeX for your dissertation and your other reports for the following reasons:

- The typeset text looks nicer than word-processor output.
- The table of contents, cross-references and bibliography can be generated automatically.
- Many journals provide LaTeX styles and templates, so that you can generate a report that looks like a journal paper without having to think about the formatting at all.
- LaTeX is available for FREE, for all popular operating systems (and most of the unpopular ones).

The principal disadvantages are:

- LaTeX is not WYSIWYG. You type your document into an ordinary text editor and typeset it in a separate step. Arguably, this helps one to separate layout (the computer's job) from content (your job).

- While it is easy to get LaTeX to typeset your document in its default style, it can be tiresome or obscure to get it to do anything different.
- The learning curve can be a little steep at first.

# 2 Getting started

## 2.1 Editing your document

You can edit your LaTeX document with any text editor. EMACS, vi, kate, gedit or even (ugh!) MicroSoft Notepad can be used. Save your document with a name that ends in `.tex` so that you and LaTeX know that it contains LaTeX source code. An absolute minimum LaTeX document is:

```
\documentclass{article}
\begin{document}
Here is some text for \LaTeX\ to typeset.
\end{document}
```

Note that things beginning with a `\` are instructions to the LaTeX program. Everything else is text to be typeset.

## 2.2 Typesetting your document

LaTeX traditionally takes your LaTeX source and converts it to a form called dvi (Device Independent). You can inspect the dvi file on the screen using a program called `xdvi`, but to print it, it has to be converted again into a format that your printer understands. Nowadays this means PostScript, but LaTeX dates back to the days when laser printers were not ubiquitous. To typeset your document and convert it to PostScript, assuming that it is in a file called `thesis.tex` in your current working directory, do this:

```
latex thesis && dvips thesis -o
```

This runs LaTeX on your input to produce a file called `thesis.dvi` and (if that was successful) converts it to PostScript with a program called `dvips`. You can look at the resulting PostScript file with `evince` or `gv` or send to the printer. If you want to convert your PostScript file to Adobe's Portable Document Format (PDF), you can do so with the command `ps2pdf`.

Recently, LaTeX has acquired an alternative command, which generates a PDF file without the intermediate steps. So you can typeset your document like this:

```
pdflatex thesis
```

to get a PDF file called `thesis.pdf`. You can look at the PDF with `xpdf`, `acroread` or `evince`.

## 2.3 Basics

Here are a few things that you need to know from the start.

- LaTeX ignores white space a lot of the time. You cannot insert space by putting spaces in the source code. Normally you don't need to, either; the whole point of LaTeX is to free you from having to think about that kind of thing.
- A completely blank line is used to start a new paragraph.
- A % can be used to put comments into your source code. These will not be typeset. Note that a blank line with a % at the start will not start a new paragraph: this can help to make your source file look tidier.
- You can use `~` and `\,` to make special spaces that will not appear as a line break. The `~` is an ordinary thickness space, useful for things like "Figure 27". You don't want a line break between "Figure" and "27". A thinner space is generated by `\,`; this is suitable for between a number and a unit, like this: 88.7 MHz.
- You can use `\emph{}` to *emphasise* text, `\textbf{}` to make **bold** text, `\textsf{}` to get sans serif, and `\texttt` for a `monospaced typewriter font`. Terry Pratchett fans will be delighted that they can use `\textsc{}` To Speak Like Death, in CAPS and small caps.

# 3 Sectioning

You can generate section, subsection, subsubsection headings using `\section` etc.

## 3.1 Numbering of your sections

The sections are numbered automatically.

### 3.1.1 Avoiding numbering

If you want a section without its number, put a star on the end of the command, like this:

#### Un numbered subsubsection

Generated with the `\subsubsection*{}` command.

# 4 Numbering and cross-referencing

So, you have written your dissertation, LaTeX has numbered all the sections and figures, and your text contains many cross-references to the sections. And now your supervisor has asked you to insert a new section after the introduction, containing a new figure. Will you have to re-do all your cross-references? Not if you took advantage of LaTeX's cross-reference system. This allows you to put `\label{mylabel}` in a section or figure caption, and then generate the number of that section or caption using `\ref{mylabel}`. For instance, in this document this section is section 4, including figures is in section 5 and typesetting instructions are in section 2.2. You will notice that if you add a new label, you need to run `latex` or `pdflatex` TWICE for the cross-references to work.

# 5 Including figures

Figures are inserted using the `\includegraphics` command. For this to work, you need to have used `\usepackage{graphicx}` near the start of the document. You can use `\includegraphics` anywhere you like.

The above figure has to appear exactly where I put it, between "...you like." and "The above figure...". This is not smart for anything except the smallest graphics, because it can lead to large spaces at the foot of a page. More usually, we put figures into a *float*, like Figure 1. LaTeX can not include all types of

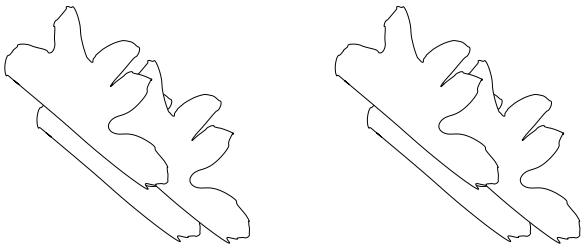

Figure 1: This picture is in a float, which means that LaTeX will put it in a suitable position, somewhere close to where you put it in your LaTeX source. The optional `[htbp]` argument gives you a little control over where it goes: you can put any combination of here, top, bottom, [whole] page and LaTeX will do its best give you the best of the options you permitted.

graphics, so you need to make your pictures in the correct format, or convert them to it.

- If you use `latex` and `dvips` then all of your figures must be *encapsulated PostScript.*
- If you use `pdflatex` then your figures may be any of
  - Portable Document Format (PDF)
  - JPEG image
  - PNG image

If you miss off the filetype extension, then LaTeX will look for a file with a suitable extension. So if you do

```
\includegraphics[width=4cm]{lara_croft}
```

then `latex` will look for a file called `lara_croft.eps`, but `pdflatex` will look for files called `lara_croft.pdf`, `lara_croft.jpg` and `lara_croft.png` (in I don't know what order).

# 6 Equations

LaTeX allows you to insert equations into your running text by putting `\(` and `\)` round it, so that `\(x^2 + y^2 = c^2\)` comes out as $x^2 + y^2 = c^2$. You can also use the $ sign, so `$x^2 + y^2 = c^2$` will do the same thing. But it is harder to distinguish the start and end of the formula. Some equations are too big for in-line formulæ to look good: for these it is better to set them as display equations using `\[` and `\]` like this:

$$A = \int_0^\infty \frac{x^2 \cos ax}{1 + x^3}\, dx$$

Numbered equations are done using `\begin{equation}` and `\end{equation}`, like in equation 1.

$$\sigma = \sqrt{\frac{1}{n}\sum_{j=0}^{n}(x_j - \bar{x})^2} \tag{1}$$

The markup language for equations takes a bit more learning than those for text. However, be assured that more or less everything can be done. And you have to worry a lot less about spacing in your formulae than you do in most other systems[1]. A good place to read up on math mode is *The not so Short Introduction to LaTeX 2ε* [1].

[1] You can insert space if you want to, of course

# 7 References

You can make a bibliography section by hand, but it is better to get a program called BibTeX to make it for you. Enter the information about all the papers you need to reference in a separate file called a BibTeX database, giving each reference a *key*. You should find an example in the file `myrefs.bib` in this directory. To use it, you need the lines

```
\bibliographystyle{unsrt}
\bibliography{myrefs}
```

at the end of your document. You can then reference a paper using `\cite{mykey}`. For example, Smith [2] is merely dull, but Bush et al.[3] is actively wrong. Note that for your dissertation, your chosen journal will probably provide a bibliography style to be used instead of `unsrt`. When you introduce or change some references, you need to run LaTeX, BibTeX and then LaTeX *twice* before the references get properly inserted into your typeset document. Like this:

```
pdflatex thesis_in_latex
bibtex thesis_in_latex
pdflatex thesis_in_latex && pdflatex thesis_in_latex
```

Entering the information about the papers you need to reference into your BibTeX database is a tiresome task, although you only have to do it once for each paper. Some text editors (e.g. GNU Emacs) know about BibTeX and can provide you with some assistance. Alternatively, you can use a specialist BibTeX database editor. The most detailed one I have seen is called `JabRef`. You can obtain this from `http://jabref.sourceforge.net/` and it should also be available on the School of GeoSciences' Linux computers. It is written in java, so you should be able to run it on almost any machine.[2]

Even better than using a specialist BibTeX editor is to use an on-line research tool which will spit out references in BibTeX format, or a format which can be converted automatically into BibTeX format. Google Scholar[3] will export BibTeX entries directly: Hit the `scholar preferences` link and choose BibTeX in the "Bibliography Manager" section. ISI web of science[4] will only save your references in a clumsy-looking plain text format, but `JabRef` can import this format and convert it to BibTeX entries. `JabRef` will also get references for you directly from the IEEE web site and a few others.

# 8 Journal-specific advice

In the old days, journals expected you to send your paper as double-spaced typescript. Their professional typesetters would produce the final copy. However, for many years now, many journals have expected you to do your own

[2] On a Linux machine, download the file `JabRef-2.3.jar` and type `java -jar /jabref/JabRef-2.3.jar` — you don't need any special privileges to try this out.

[3] `http://scholar.google.co.uk`

[4] `http://wok.mimas.ac.uk`

typesetting. Usually they will provide templates and styles in LaTeX and/or MS Word. Some prefer LaTeX and provide support for MS Word grudgingly, others do the reverse. Please pick a journal that requires or allows you to typeset your own final copy, so that you can present us with something that looks like a finished, published journal article. You are advised to avoid journals that still do their own typesetting and page layout as you will be on your own in your attempts to produce a document that looks like a published article.

Warning: although LaTeX provides both the `latex && dvips` processing route (requiring your figures to be .eps) and the `pdflatex` route (requiring your figures to be pdf, png or jpg), some journals can only work with one or the other of these processing routes.

## 8.1 IEEE Journal of GeoSciences and Remote Sensing

The IEEE provide truly excellent LaTeX templates. The package contains a LaTeX class file called `IEEEtran.bst` and a BibTeX style file called `IEEEtran.bst`. You can download the files from
`http://www.ieee.org/web/publications/authors/transjnl/index.html`
— they are available bundled as either zip or gzipped tar archives. Unpack the files into the directory in which you are preparing your paper. There is also a HOWTO document and a skeleton paper which you can start with, inserting your own content. IEEE papers can be prepared using `pdflatex` and PDF figures or using `latex && dvips -o` with encapsulated PostScript figures.

For those who prefer Word to LaTeX the IEEE journals also provide a detailed Word template.

## 8.2 Atmospheric Chemistry and Physics

This journal actually charges LESS for LaTeX users than for other forms of electronic submission. Instructions and preparation materials are available at
`http://www.atmospheric-chemistry-and-physics.net/submission/index.html`
ACP papers can be prepared using `pdflatex` and PDF figures or using `latex && dvips -o` with encapsulated PostScript figures. ACP papers are reviewed in an unusual way: They first appear in Atmospheric Chemistry and Physics Discussions, where anyone can comment on them. Only later will they appear in ACP itself. Please prepare your paper for ACP, not ACPD. And please put the figures near the text that refers to them, NOT all at the end as you have to do for ACPD. BibTeX is supported for doing your bibliography.

You can submit to ACP using Word. But the journal then does all the typesetting itself. They provide no way to typeset final copy for yourself using word, so please only chose ACP for your dissertation if you intend to use LaTeX.

## 8.3 Journal of Geophysical Research

AGU provide LaTeX templates
(`http://www.agu.org/pubs/au_contrib_rev.html`), but they are really not

very good. An updated version (2006) was made available and then withdrawn, with the rotten 2001 version being put back in place. Since then, another new version has appeared. This does allow two-column output (which is good) but various other features of it are less than satisfactory, so I can't recommend it wholeheartedly.

AGU permit final copy to be submitted as a Word document, but they either do not provide Word templates or I can not find them. So producing final copy may be a frustrating experience — you will be relying on your own Word skills.

### 8.4 Journal of Applied Meteorology

Provide LaTeX and word templates, but only for typed, double-spaced manuscript, not for the final copy. You should therefore avoid this journal (and possibly other AMS journals) for your dissertation.

### 8.5 Quarterly Journal of the Royal Met. Soc.

LaTeX templates are provided (`http://www3.interscience.wiley.com/journal/113388514/home`) and appear to work properly. Your figures have to be in encapsulated postscript. The bibliography has to be done by hand rather than by using BibTeX. However the referencing is done by name, so at least you don't have to re-do the references when you insert a new reference. The journal accepts Word files, but does not provide any help in producing final copy — they still do some of the typesetting themselves.

### 8.6 Remote Sensing of the Environment

No Word or LaTeX templates available — you are on your own for producing something that resembles a finished article.

### 8.7 International Journal of Remote Sensing

Provides both Word and LaTeX templates for final copy, from `http://www.tandf.co.uk/journals/authors/tresauth.asp`.

### 8.8 Earth and Planetary Science Letters

No Word templates provided. It is suggested (but not required) that submitted articles use the generic LaTeX packages for Elsevier journals — this can be found at `http://www.elsevier.com/wps/find/authorsview.authors/elsart`

## 9 Getting more help

There is a great deal of information on LaTeX on the web. Be careful: some of it is rather out of date, even though LaTeX itself has changed little since the

release of LaTeX $2_\varepsilon$ in 1994. Some useful documents are:

- The not so Short Introduction to LaTeX $2_\varepsilon$ [1]
- LaTeX: from quick and dirty to style and finesse. An on-line guide to be found at `http://www.sci.usq.edu.au/staff/robertsa/LaTeX/latexintro.html`

# A Appendix: Dangerous knowledge

## A.1 Colour

LaTeX dates back to a time when colour printing was the preserve of professional printers. It is unlikely that you would need colour for reports. But in case you really do, there is an add-on package for it. You need

```
\usepackage{color}
```

at the start of your document.

By putting `\color{red}` you can turn all subsequent text red. If you only want a word or two in a different colour, use `\textcolour{blue}{my blue text}` to get my blue text. If you want your red text to end, you would need to set it back to black with `\color{black}`.

Note that LaTeX often gets confused as to the point where the colour changes. You may need to enclose the coloured area in braces { } to ensure that the colour does not leak out.

Primary colours are pre-defined. If you want more, you can define them like this:

```
\definecolor{purple}{rgb}{0.9,0.1,0.7}
```

Having done so, you can then use it just as we used `red` above, to get text in purple.

## A.2 Fonts and sizes

Try to avoid controlling font size by hand. LaTeX's default style, or the style provided by your chosen journal will be pre-set to use sensible font sizes for most things. If you insist, LaTeXcomes with several pre-defined sizes: tiny, scriptsize, footnotesize small normalsize large Large LARGE huge and Huge.

# References


[1] Tobias Oetiker, Hubert Partl, Irene Hyna, and Elisabeth Schlegl. A not very short introduction to LaTeX2e. Technical report.

[2] John Smith, Fred Jones, and Eric Dull. An uninteresting study of the giant land snail. *J. Dull Biology*, 127(6):888–897, April 1997.

[3] George W. Bush, Dick Cheney, and Shelly Oilman. Global warming? It's a big con. *J. Climate*, 77(4):236–534, May 2005.