Introduction to LATEX Winter School Modelling Hub 2021

Victoria University of Wellington



What is LATEX?

- Is a typesetting language.
- When using LaTEX, you write a plain text file which describes the document's structure and presentation. LaTEX converts this source text into a typeset document.

For example:

The IPCC assess the science related to \textit{climate change}.



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 EndNote.

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- To write huge documents (master, PhD thesis) you can have a file per chapter and join them together with just one click!
- In some journals, you might pay less to publish if your manuscript is done in LATEX instead of Word (e.g. half the price per page in LATEX than it is in Word).

How does it work?

```
\documentclass{article} % style of the document
\begin{document} %command to start the doc
Hello World % your content goes here
\end{document}
```

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Some tips:

- Commands start with \
- Every doc starts with \documentclass
- The sign % starts a comment
- Special characters: %, \$, &, #, _, {, }, \ Need to be written as: \%, \\$, \&, \#, _, \{, \}, \textbackslash

Preamble of the document

• The part of your .tex before the \begin{document} command is called the **preamble**.

The following command:

```
\documentclass[12pt, letterpaper]{article}
```

- Defines the type of document.
- Inside the squared brackets you can define the font size (12pt). The default is 10pt.
- You can also define the paper size (letterpaper). Other values can be A4 and legalpaper. Default is A4.
- If you want to use the default parameters, you can ignore the squared brackets.

Preamble of the document

Document types available in the \documentclass command:

Document type	Description		
article	For short documents and journal articles		
report	For longer documents and dissertations		
book	Useful to write books		
letter	For letters		
slides	For slides, rarely used		
beamer	Slides in the Beamer class format		
The decrease the self-of-left the master community could			

The document type 'article' is the most commonly used!

More examples of commands and their outputs

```
\begin{itemize}
\item Clouds
\item Ocean
\item Volcanoes
\end{itemize}
```

- Clouds
- Ocean
- Volcanoes

More examples of commands and their outputs

```
\begin{equation}
\alpha + \beta + 1
\end{equation}
```

$$\alpha + \beta + 1 \tag{1}$$

More examples of commands and their outputs

```
\begin{figure}
\includegraphics[width=50mm]{figures/cat.jpeg}
\end{figure}
```



What about errors?

- LATEX will stop compiling if there is an error.
- For example, if you misspell a command or forget a bracket, LATEX will stop with a message error showing the line and explaining the error (most of the times!).
- 3 Advice? Fix errors as soon as they arise.

Exercise 1: Overleaf

- Open the exercise in Overleaf (Exercise1.tex).
- Compile and fix the errors.
- Hint: Watch out for characters with special meanings ...

Exercise 1

Female academics earn 400,000 less than men over life-time. And of professors, only 28% were female in 2019/20.

Packages

- Packages are libraries of extra commands and environments.
- We need to load the packages in the *preamble* as: \usepackage{} . The name of the package goes inside the curly brackets.
- There are two categories of packages:
 - Packages that allow you to change the layout or structure of your document. For example, multicol.
 - Packages that allow you include new or enhanced content within your document. For example, amsmath.

Packages

Example for multicol :

```
\documentclass{article}
\usepackage{multicol} % preamble
\begin{document}
\begin{multicols}{2}
% Anything you write here will be in two columns
\end{multicols}
\end{document}
```

Packages

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\documentclass{article}
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\begin{document}
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% Anything you write here will be in two columns
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\end{document}
  Example: amsmath for maths!
\documentclass{article}
\usepackage{amsmath} % preamble
\begin{document}
% write your equations here!
\end{document}
```

More packages

- beamer for presentations
- tikz for amazing graphics
- spreadtab to create spreadsheets
- listings as a source code printer for LATEX
- cwpuzzle for crossword puzzles (not that I have used it before!)

Environments

- The dollar sign (\$) is special, because we can use it to mark math in the text.
- If you want to write a small equation in the text, always use dollar signs in pairs:

```
Let y=mx+b be \cdot ldots
```

```
Let y = mx + b be . . .
```

 However, if your equation is big and scary, use the equation environment as:

```
\begin{equation}
% equation goes here
\end{equation}
```

Exercise 2: Overleaf

- Open the exercise in Overleaf (Exercise2.tex).
- Write the following equation.
- Hint: A fraction is written as \frac{num}{den} and a partial derivative is \partial.

Exercise 2

The momentum equation for vertical velocity is:

$$\frac{\partial w}{\partial t} + u \frac{\partial w}{\partial x} + v \frac{\partial w}{\partial y} + w \frac{\partial w}{\partial z} = -\frac{1}{\rho} \frac{\partial p}{\partial z} + 2\Omega u \cos(\gamma) - g$$
 (2)



Exercise 2: Overleaf

Greek letters

αA	\alpha A	νN	\nu N
βB	\beta B	$\xi\Xi$	\xi\Xi
$\gamma\Gamma$	\gamma \Gamma	oO	0 0
$\delta\Delta$	\delta \Delta	$\pi\Pi$	\pi \Pi
$\epsilon \varepsilon E$	\epsilon \varepsilon E	$ ho \varrho P$	\rho\varrho P
ζZ	\zeta Z	$\sigma\Sigma$	\sigma \Sigma
ηH	\eta H	au T	\tau T
$\theta\vartheta\Theta$	\theta \vartheta \Theta	$v\Upsilon$	\upsilon \Upsilon
ιI	\iota I	$\phi \varphi \Phi$	\phi \varphi \Phi
κK	\kappa K	χX	\chi X
$\lambda\Lambda$	\lambda \Lambda	$\psi\Psi$	\psi \Psi
μM	\mu M	$\omega\Omega$	\omega \Omega

Graphics

- Use the graphicx package, which provides the \includegraphics[keys=value, ...]{file-name} command.
- The graphicx package supports different formats: JPEG, PNG, PDF.
- Note that the optional parameter accepts a comma separated list of keys and associated values.
- Some of the most important keys include: width, height, angle, scale.

```
\begin{figure}
\includegraphics[width=0.5\textwidth]{image.png}
\caption{Caption of the figure goes here.}
\end{figure}
```

The command width = 0.5 makes the image take up 50% of the width of the surrounding text (\textwidth).

- Tables can be tricky, but do not worry as everything comes with some practice.
- You need to add the package: tabularx

```
\begin{tabular}{lrr}
Item & Qty & Unit \$ \\
Widget & 1 & 199.99 \\
Gadget & 2 & 399.99 \\
Cable & 3 & 19.99 \\
\end{tabular}
```

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```
Item Qty Unit $
Widget 1 199.99
Gadget 2 399.99
Cable 3 19.99
```

You can add horizontal lines with \hline

```
\begin{tabular}{| l | r | r |} \hline
Item & Qty & Unit \$ \\ hline
Widget & 1 & 199.99 \\ hline
Gadget & 2 & 399.99 \\ hline
Cable & 3 & 19.99 \\ hline
\end{tabular}
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```

Item	Qty	Unit \$
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Gadget	2	399.99
Cable	3	19.99

Structured documents

- \title and \author go in the preamble.
- We can use \maketitle to create the title.

```
\documentclass{article}
\title{The title}
\author{Author}
\date{\today}
\begin{document}
\maketitle
\begin{abstract}
Abstract goes here!
\end{abstract}
```

Structured documents

The title

Author

August 17, 2021

Abstract

Abstract goes here!

Sections

- You can use the \section and \subsection commands (or \subsubsection? depending on how brave you are!).
- When you write \section* or \subsection* it means that it will not be numerated.

```
\documentclass{article}
\begin{document}
\section{Introduction}
I always struggle with intros \ldots
\section{Methods}
Whatever methods you used \ldots
\subsection{Fieldwork and laboratory sampling}
\section{Results}
My correlations are $r^2=0.01$ \ldots
\section{Conclusion}
\end{document}
```

Sections

1 Introduction

I always struggle with intros . . .

2 Methods

Whatever methods you used ...

2.1 Fieldwork and laboratory sampling

3 Results

My correlations are $r^2 = 0.01 \dots$

4 Conclusion

Exercise 3: Overleaf

- Open the exercise in Overleaf (Exercise3.tex).
- Make the script look like Exercise3.pdf
- Hint: You can avoid enumerating equations by typing \begin{equation*}.

To write papers or a thesis!

Introducing the command: \include{file}.

- The \include command is used for selective inclusion of files. The file argument is the first name of a file: file.tex.
- Note that when you name the file inside the curly brackets, you do not need to add the extension.

To write papers or a thesis!

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Now, follow these instructions:

- In Overleaf, find the folder THESIS and the file called main.tex, open it, and compile it.
- ② Check the new packages and commands.
- Learn how to collate different chapters of your thesis with one click (just sections here for the purpose of this exercise).

Font sizes in LATEX

Command	Output
\tiny	Lorem ipsum
\scriptsize	Lorem ipsum
\footnotesize	Lorem ipsum
\small	Lorem ipsum
\normalsize	Lorem ipsum
\large	Lorem ipsum
\Large	Lorem ipsum
\LARGE	Lorem ipsum
\huge	Lorem ipsum

Last but not least: referencing

Firstly, you need to learn that in LATEX there are different types of documents.

- The file .tex is the input file.
- For referencing you will need another file with extension '.bib'.
- A .bib file will contain the bibliographic information of your document.

BibTeX: the .bib file

• Your references in a .bib file in 'bibtex' database format would look like:

```
@Article{Jacobson1999Towards,
author = {Van Jacobson},
title = {Towards the Analysis of Massive Multiplayer Online
Role-Playing Games},
journal = {Journal of Ubiquitous Information},
Month = jun,
Year = 1999,
Volume = 6,
Pages = \{75--83\}
@InProceedings{Golledge2021Methodology,
author = {Nicholas Golledge and Liz Keller and
Stefan Jendersie},
title = {A Methodology for the Study of
climate models},
booktitle = {Proceedings of Climate},
Month = jun,
Year = 2021
```

BibTeX: the *key*

Each entry in the .bib file has a *key* that you can use to reference it in the document. For example, Jacobson1999Towards is the *key* for this article:

```
@Article{Jacobson1999Towards,
author = {Van Jacobson},
...
```

• You would usually write a key using the name, year, and title of the reference.

BibTeX: how to reference

- Define \usepackage{natbib} in the preamble. This will allow you to use the commands \citet and \citep. Can you guess what is the difference between each command?
- You will need to use the command \bibliography and specify a \bibliographystyle.

```
\documentclass{article}
\usepackage{natbib}
\begin{document}
\citet{Jacobson1999Towards}
show that \ldots. Clearly,
the study of climate requires modelling
\citep{Golledge2010Methodology}.
\bibliography{bib-example}
% if 'bib-example' is the name of
% your bib file (note: do not put the extension .bib here)
\bibliographystyle{plainnat}
% try changing to abbrvnat
\end{document}
```

BibTeX: how to reference

Jacobson [1999] show that Clearly, the study of climate requires modelling [Golledge et al., 2021].

References

Nicholas Golledge, Liz Keller, and Stefan Jendersie. A methodology for the study of climate models. In *Proceedings of Climate*, June 2021.

Van Jacobson. Towards the analysis of massive multiplayer online role-playing games. Journal of Ubiquitous Information, 6:75–83, June 1999.

You guessed right (maybe?): \citet cites as Author (year), while \citep cites as (Author, year).

Bibliography style

There are many styles you can choose for your bibliography:

\bibliographystyle{plain} \bibliography{references.bib}

Style	Sort	Labels	Notes
plain	by author	numeric, like [1]	
plainnat	by author	numeric or author-year	\usepackage{natbib}
abbrv	by author	numeric	abbreviates authors and journals
abbrvnat	by author	numeric or author-year	\usepackage{natbib}
alpha	by author	alphanumeric, like [SJL05]	
unsrt	as cited	numeric	
unsrtnat	as cited	numeric or author-year	\usepackage{natbib}
apalike	by author	author-year, like [Smith 2005]	\usepackage{apalike}
custom-bib	asks questions to generate custom bibliography style		

However, most journals or schools have their own style and it will come in a file '.bst'.

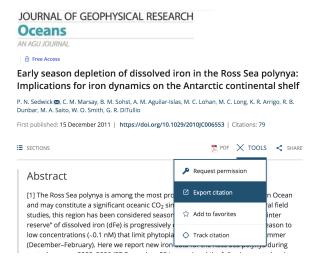
How do journals work?

Note that most journal's LATEX template will also come with a '.sty' file, which is the own style of the journal to define the layout of the paper. For example:

```
\documentclass{copernicus} %there will be a file called copernicus.sty
\usepackage{natbib}
\begin{document}
%Your paper goes here
\bibliographystyle{copernicus} % a file called copernicus.bst
\bibliography{paper} %a file called paper.bib that you will create
\end{document}
```

Create your .bib file

Step 1: download your citation





Create your .bib file

• Step 2: choose the bibtex style

Down	 Cianal	

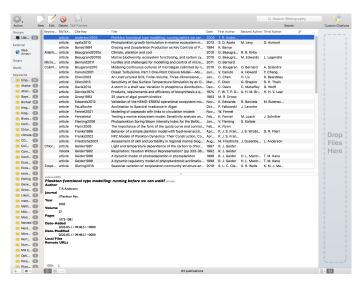
If you have the appropriate software installed, you can download article citation data to the citation manager of your choice. Simply select your manager software from the list below and click on download.

Format
O Plain Text
RIS (ProCite, Reference Manager)
○ EndNote
○ Medlars
RefWorks
Type of import
Direct import
○ Indirect import

DOWNLOAD

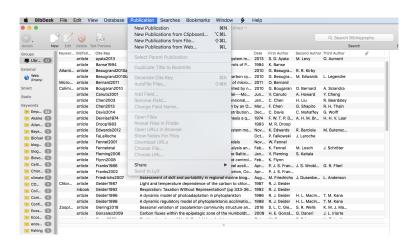
Create your .bib file

 Step 3: personal choice, but I use BibDesk, an application that comes with TexShop (LTEX for Mac users).



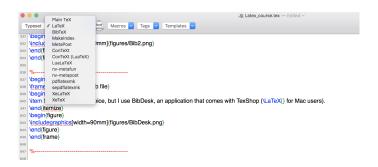
Create your .bib file with BibDesk

- $\textbf{ Open the exported Bibtex citation and go to the tab 'Publication'} \rightarrow 'New publication from file'.$
- Edit the cite-key to one of your choice.



Create your .bib file with BibDesk

- Save document as '.bib' and call it in your main.tex with \bibliography and \bibliographystyle. Which you already learned how to do!
- To compile: latex, bibtex, latex, latex. Yes, latex twice!
- Your references from .bib will only appear when you call them in the text (using \citep, \citet).



Homework: how to import your references in Unix or Windows?



