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Introduction to LaTeX

For PhD-students of the GSGS

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University and City Library Cologne

Next steps

Our agenda today

- citations and references
- maths
- code
- index
- splitting large project into smaller files
- tables from data
- including an article as pdf
- hyperref & metadata for pdf

Citations and References

biblatex

Like with everything, there are many different ways to deal with citations and references.

We are using BibLaTeX

A neat introduction can be found in the Overleaf documentation

There is a cheat sheet on CTAN

Telling LaTeX to use BibLaTeX in preamble

```
% You can break lines to make options
% easier to read and change
% UzK Overleaf can't build with biber

\usepackage[
backend=bibtex8,    % usually biber
sorting=ydnt,
style=authoryear,
firstinits=true,
]{biblatex}

\addbibresource{exp.bib}  % Adding exp.bib
```

An entry in exp.bib

```
@article{greenwade93,
author  = "George D. Greenwade",
title   = "The {C}omprehensive {T}ex {A}rchive
{N}etwork ({CTAN})",
year    = "1993",
journal = "TUGBoat",
volume  = "14",
number  = "3",
pages   = "342--351"
}
```

Citing in the text

The entry can be cited with `\cite{greenwade93}`. The result could look like the next sentence. CTAN is decribed in Greenwade 1993

References

Greenwade, G. D. (1993). **"The Comprehensive Tex Archive Network (CTAN)".** In: *TUGBoat* 14.3, pp. 342–351.

Now: Hands-on!

Add some references to your document!

Math

Math

LaTeXcomes with probably the best features to typeset mathematical equations.
The Overleaf Documentation has some nice intro to writing mathematical expressions.
There are two easy methods to include expressions in a text.
You can use `\(\pi \approx 3.14\)` which prints as $\pi \approx 3.14$ in the text or `\[\pi \approx 3.14\]` which prints as

$$\pi \approx 3.14$$

in an extra line.

A more complex example

```
\begin{equation}
e^x = 1 + x + \frac{x^2}{2} +
\frac{x^3}{6} + \cdots
= \sum_{n\geq 0} \frac{x^n}{n!}
\end{equation}
```

$$e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \cdots = \sum_{n\geq 0} \frac{x^n}{n!} \tag{1}$$

Now: Hands-on!

Add some mathematical expressions to your document!

Further reading: Overleaf Documentation

Code

Showing Code with verb

Text in a verbatim block:

```
This text demonstrates the use of verb to show
code in your document:
\verb|\verb||| uses itself to show its use.
```

Output in use:
This text demonstrates the use of verb to show code in your document: `\verb||` uses itself to show its use.

Showing Code with lstlisting

In LaTeX:

```
\begin{lstlisting}[language=python]
import os
filelist=os.listdir() print(filelist)
\end{lstlisting}
```

Output:

```
import os

filelist=os.listdir()
print(filelist)
```

Now: Hands-on!

Add some code to your document!

Further reading: Overleaf documentation

Making an index

Making an index

Preamble:

```
\usepackage{imakeidx}
\makeindex
```

Text:

A demo text to show how indexes`\index{index}` are made.

```
\printindex
```

Now: Hands-on!

Add an index to your document!

Splitting large projects into smaller files

Splitting large projects into smaller files

It is pretty straight forward to include files into the main document.

You can use `\input{path/to/your/file.tex}` which won't put the content on a new page.

You can use `\import{path/to/your/file.tex}` which will put the content on a new page.

It is **important** that file.tex has no preamble or `\begin{document}` or `\end{document}` statements.

Now: Hands-on!

Add chapters/appendix.tex to your document!

Further reading: Overleaf Documentation

Tables from data

Tables from data

One great advantage of writing with LaTeXis that you do not have to copy and paste everything by hand. You can import files and data. In case of tables, a lot of data handling libraries, like *knitr* in *R* or *pandas* in *python* have functions to generate LaTeXCodes for tables that you can write to a file and import like we have seen before.
LaTeXhas its own functions to import e.g. *CSV* files. We will look at an example with *pgfplotstable*.

Tables from data

Code:

```
\pgfplotstabletypeset[
col sep = comma,
every head row/.style=
{before row=\toprule,after row=\midrule},
every last row/.style={after row=\bottomrule},
display columns/.style={string type,column name={}}
]{demo.csv}
```

Result:

A	B	C
1	2	3
4	5	6

Now: Hands-on!

Add a table with data from a CSV file to your document!

Further reading: Manual

Including an article as pdf

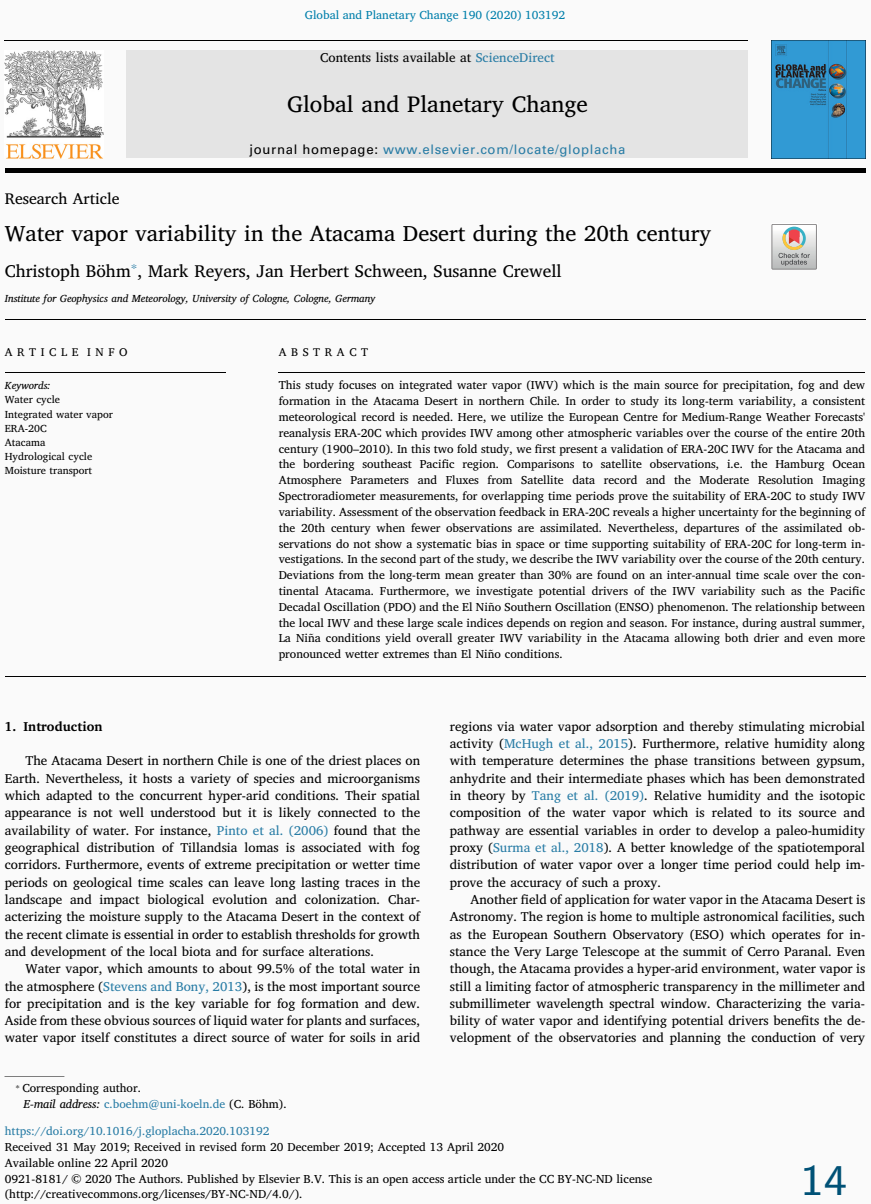
Including an PDF of your article in a document

The *pdfpapers* package enables you to include pdfs in your document.
In the preamble:

```
\usepackage{pdfpages}
```

In the location, where you like to include the (part) of the pdf:

```
\includepdf[pages={1}]{exp.pdf}
```



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Research Article

Water vapor variability in the Atacama Desert during the 20th century

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ABSTRACT

This study focuses on integrated water vapor (IWV) which is the main source for precipitation, fog and dew formation in the Atacama Desert in northern Chile. In order to study its long-term variability, a consistent meteorological record is needed. Here, we utilize the European Centre for Medium-Range Weather Forecasts' reanalysis ERA-20C which provides IWV among other atmospheric variables over the course of the entire 20th century (1900–2010). In this two fold study, we first present a validation of ERA-20C IWV for the Atacama and the bordering southeast Pacific region. Comparisons to satellite observations, i.e. the Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite data record and the Moderate Resolution Imaging Spectroradiometer measurements, for overlapping time periods prove the suitability of ERA-20C to study IWV variability. Assessment of the observation feedback in ERA-20C reveals a higher uncertainty for the beginning of the 20th century when fewer observations are assimilated. Nevertheless, departures of the assimilated observations do not show a systematic bias in space or time supporting suitability of ERA-20C for long-term investigations. In the second part of the study, we describe the IWV variability over the course of the 20th century. Deviations from the long-term mean greater than 30% are found on an inter-annual time scale over the continental Atacama. Furthermore, we investigate potential drivers of the IWV variability such as the Pacific Decadal Oscillation (PDO) and the El Niño Southern Oscillation (ENSO) phenomenon. The relationship between the local IWV and these large scale indices depends on region and season. For instance, during austral summer, La Niña conditions yield overall greater IWV variability in the Atacama allowing both drier and even more pronounced wetter extremes than El Niño conditions.

1. Introduction

The Atacama Desert in northern Chile is one of the driest places on Earth. Nevertheless, it hosts a variety of species and microorganisms which adapted to the concurrent hyper-arid conditions. Their spatial appearance is not well understood but it is likely connected to the availability of water. For instance, Pinto et al. (2006) found that the geographical distribution of Tillandsia lomas is associated with fog corridors. Furthermore, events of extreme precipitation or wetter time periods on geological time scales can leave long lasting traces in the landscape and impact biological evolution and colonization. Characterizing the moisture supply to the Atacama Desert in the context of the recent climate is essential in order to establish thresholds for growth and development of the local biota and for surface alterations.

Water vapor, which amounts to about 99.5% of the total water in the atmosphere (Stevens and Bony, 2013), is the most important source for precipitation and is the key variable for fog formation and dew. Aside from these obvious sources of liquid water for plants and surfaces, water vapor itself constitutes a direct source of water for soils in arid regions via water vapor adsorption and thereby stimulating microbial activity (McHugh et al., 2015). Furthermore, relative humidity along with temperature determines the phase transitions between gypsum, anhydrite and their intermediate phases which has been demonstrated in theory by Tang et al. (2019). Relative humidity and the isotopic composition of the water vapor which is related to its source and pathway are essential variables in order to develop a paleo-humidity proxy (Surma et al., 2018). A better knowledge of the spatiotemporal distribution of water vapor over a longer time period could help improve the accuracy of such a proxy.

Another field of application for water vapor in the Atacama Desert is Astronomy. The region is home to multiple astronomical facilities, such as the European Southern Observatory (ESO) which operates for instance the Very Large Telescope at the summit of Cerro Paranal. Even though, the Atacama provides a hyper-arid environment, water vapor is still a limiting factor of atmospheric transparency in the millimeter and submillimeter wavelength spectral window. Characterizing the variability of water vapor and identifying potential drivers benefits the development of the observatories and planning the conduction of very

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Now: Hands-on!

Add (a few pages of) a pdf to your document!

PDF metadata with hyperref

PDF metadata with hyperref

The *hyperref* package is widely used in LaTeXProjects and is included in the preamble with `\include{hyperref}`. The package already sets you up to include metadata for your pdf. Just include `\hypersetup{}` in the preamble.

Example for the metadata of this slides:

```
\hypersetup{
pdftitle    = {Next_Steps_In_LaTex},
pdfsubject  = {Slide for the GSGS LaTeX Course 2024},
pdfauthor   = {Gabriele Schwiertz \& Denis Arnold},
pdfkeywords = {LaTeX,Slides, GSGS, USB} ,
pdfcreator  = {pdflatex},
pdfproducer = {LaTeX with hyperref}
}
```

Now: Hands-on!

Add some metadata to your document!

Now: Break!!

Thank youand have fun experimenting!