

Institut für Meteorologie und Geophysik  
der Universität Wien

# **Titel der Arbeit welches auch mehrere Zeilen lang sein kann**

Bachelorarbeit im Sommersemester 2024  
von

**Vorname Nachname**

**Betreuer:**

Dr. Betreuer 1

Prof. Betreuerin 2

Meteorologie (Bachelor)

Wien, Abgabe Datum

## **Abstract**

The abstract should summarise the motivation for the work, the main findings, and their impacts in a broader context. A good guide for the structure of an abstract can be found here: <https://www.nature.com/documents/nature-summary-paragraph.pdf>. Keep the abstract as short as possible.

## **Acknowledgements**

Acknowledgements are commonly for professional help, data/code, funding and possibly a personal note. You do not have to acknowledge your supervisors.

Example:

I would like to thank GeoSphere Austria for providing the TAWES data, and Manfred Dorninger for his help in understanding the synoptic situation. Thanks to the community that maintains the MetPy python library which was used to make most of my plots. And lastly I want to express my appreciation for my fellow students Martin Meier and Martina Meyer who read the draft and provided valuable feedback.

## **Datenschutzerklärung**

Das Institut für Meteorologie und Geophysik der Universität Wien (IMGW) darf:

1. Meinen Namen und den Titel meiner Arbeit auf der Homepage veröffentlichen.
2. Die Arbeit länger als 2 Jahre aufbewahren.
3. Meinen Namen und den Titel meiner Arbeit an Meteorologische Gesellschaften und Forschungseinrichtungen weiterleiten.

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# 1 Introduction

The introduction provides an interesting entry point into the thesis and introduces the topic. It can begin with a motivation that goes beyond the specific topic and highlights the broader relevance of the work. It should cover the current state of research in the field(s) relevant to the topic of the thesis, citing key literature (Kapitein et al., 2005; Hersbach et al., 2020). Ultimately, it guides the reader towards the research question, which is usually presented at the end of the introduction. It normally does not have any subsections, and is normally about 2-3 pages long.

## 2 Methods

A description of all data and methods used in the thesis. Can include model description and setup, theory, experimental setup, measurement devices, campaign description, and so on. As short and concise as possible without omitting important details. It does not have to read exciting. Depending on the type of thesis this section can be quite short or the majority of the thesis. If you are using new data and methods it is important to distinguish them from previous work.

### 2.1 Theory

### 2.2 Data

### 2.3 Model setup

## 3 Results

This chapter is the main part of the thesis, it presents and describes the results of the work and their implications. The results are commonly spread over multiple subsections or sections. If results are based on figures, they should go beyond a simple description of the figure. Avoid sentences like: “Figure 1 shows a cold anomaly over Europe in blue colors.” This can already be seen in the figure, rather try to write something like: “The cold anomaly over Europe shown in Figure 1 provides evidence for.../is a result of.../develops due to...” (see also Section 5.4 on figures). Tables are less exciting than figure but can help to structure results, consider using them.

If there is previous work on the topic you can also compare and contextualise your results.

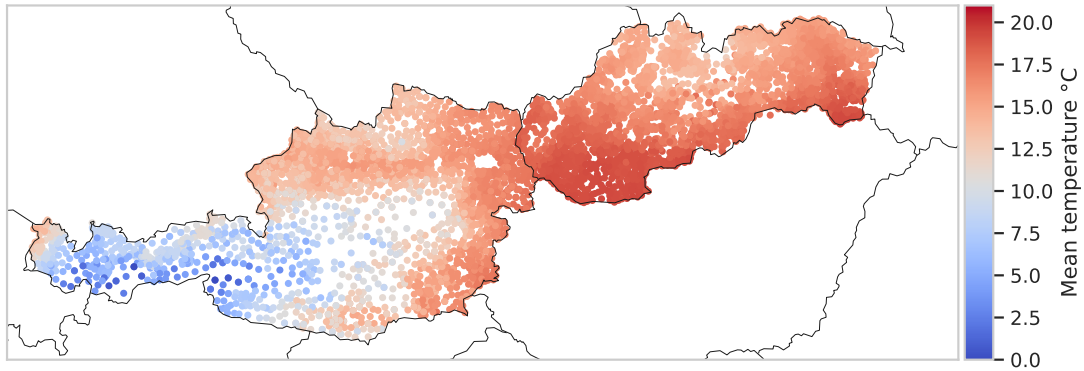


Figure 1: Shown here is the average temperature of drinks served in restaurants across Austria and Slovakia from 1505 to 1910. This is a pdf image, which is not only 5 times smaller than the image used in Figure 2, it can also be zoomed into without losing quality. A full description of the data is in Subsection 2.2. By adding [!b] behind the figure you could force it to be on the bottom of the page.

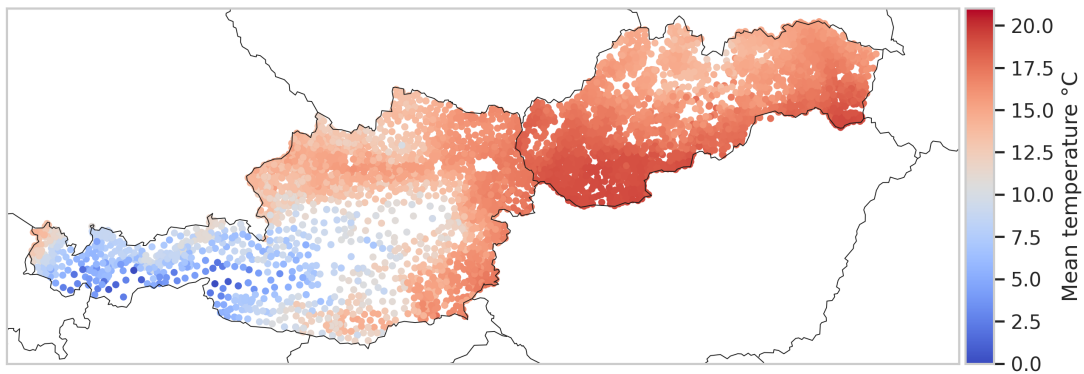


Figure 2: Shown here is the average temperature of drinks served in restaurants across Austria and Slovakia from 1505 to 1910. This is a high resolution png image (exported with dpi=300), which is five times larger than the pdf image in Figure 1, and less precise when you zoom in.

### **3.1 Simple test case**

### **3.2 Difficult test case**

## **4 Conclusions**

Is commonly one section without subsections, but can be split into any combination of summary, conclusions, discussion, and outlook. The name is then sometimes changed to “Summary and Conclusions” or “Conclusions and Discussions” or any other combination, depending on the focus. Here, the conclusions that can be drawn from the results are presented and contextualised. You can also provide your own interpretation, but always make a clear distinction between conclusions objectively based on the results and subjective opinions.

The conclusions chapter often opens with a short summary of the results, written in the past tense. This summary should be broadly understandable to someone who has only read the introduction. It should contain no or few acronyms and only make limited use of references to other parts of the thesis.

Questions that remained open and could not be answered in the thesis can also be discussed here, as well as the implications resulting from this thesis’s results. Suggestions for further studies or how the results might be applied in the future can be given in a short outlook, but the focus of the conclusions should remain on the completed work. The conclusions are also commonly 1-3 pages long.

## References

- Hans Hersbach, Bill Bell, Paul Berrisford, Shoji Hirahara, András Horányi, Joaquín Muñoz-Sabater, Julien Nicolas, Carole Peubey, Raluca Radu, Dinand Schepers, Adrian Simmons, Cornel Soci, Saleh Abdalla, Xavier Abellan, Gianpaolo Balsamo, Peter Bechtold, Gionata Biavati, Jean Bidlot, Massimo Bonavita, Giovanna De Chiara, Per Dahlgren, Dick Dee, Michail Diamantakis, Rossana Dragani, Johannes Flemming, Richard Forbes, Manuel Fuentes, Alan Geer, Leo Haimberger, Sean Healy, Robin J. Hogan, Elías Hólm, Marta Janisková, Sarah Keeley, Patrick Laloyaux, Philippe Lopez, Cristina Lupu, Gabor Radnoti, Patricia de Rosnay, Iryna Rozum, Freja Vamborg, Sebastien Villaume, and Jean-Noël Thépaut. The era5 global reanalysis. *Quarterly Journal of the Royal Meteorological Society*, 146(730):1999–2049, 2020. doi: <https://doi.org/10.1002/qj.3803>. URL <https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/qj.3803>.
- Lukas C. Kapitein, Erwin J. G. Peterman, Benjamin H. Kwok, Jeffrey H. Kim, Tarun M. Kapoor, and Christoph F. Schmidt. The bipolar mitotic kinesin Eg5 moves on both microtubules that it crosslinks. *Nature*, 435(7038):114–118, 2005. doi: 10.1038/nature03503.



## 5 Appendix

### 5.1 How to cite

Please cite using the author-year style only and link citations to their respective entry in the references chapter. If the citation is part of the sentence only the year should be in parentheses. For example: The abstract guide above is based on a paper by Kapitein et al. (2005). If you are giving more general information, you can also place a citation at the end of a sentence or paragraph. It is then often not necessary to cite the same study in consecutive sentences. For example: The abstract guide above is based on a paper from a different field. Its not necessary to cite it in the sentence before this one as this and the next sentence are still about the same topic. The abstract is used because it is a good example for other fields (Kapitein et al., 2005).

If you cite multiple papers the most common way is to order them by year, such as (Kapitein et al., 2005; Hersbach et al., 2020).

When working with  $\text{\LaTeX}$  you should make use of bibtex and .bib files (see, for example, here: [https://www.overleaf.com/learn/latex/Bibliography\\_management\\_with\\_bibtex](https://www.overleaf.com/learn/latex/Bibliography_management_with_bibtex)). To create an in-sentence citation you can use `\citet`, for a citation in parenthesis at the end of the sentence `\citep`.

### 5.2 Equations

To get math symbols you can use the dollar sign \$, for example  $\Delta T$ .

You can get an equation with a number you can reference using a label like this:

$$\frac{\partial T}{\partial t} = \frac{dT}{dt} - \vec{v} \cdot \nabla T \quad (1)$$

To get an equation without a number you could do this:

$$\frac{\partial T}{\partial t} = \frac{dT}{dt} - \vec{v} \cdot \nabla T$$

### 5.3 References

By attaching labels to sections, figures, and equations using `\label`, you can than reference these in the text using `\ref`. Examples are shown throughout the template, but here another example: Equation 1 in Section 5.2. The great advantage of using labels instead of setting them by hand is that the numbering automatically adapts when the number and order of figures/equations/tables/section changes. Clicking on them in the PDF also takes you directly there. Regarding capitalization, when referring to a specific figure, such as Figure 2, figure is capitalized. Same for tables and sections and so on. Sections can also be called chapters.

### 5.4 Figures

It is worth thinking about how to best visualise a given result and invest some time to polish the figures at the end. Figures are often the first thing scientists look at, and poorly made plots will immediately leave a poor impression.

Here are some points to consider:

- What is the best way to visualise a result? (lineplot, barplot, boxplot, map with shading, etc.)
- Is all the information needed to interpret the figure included? (title, axis labels, units, legend, etc.)
- Could the figure be misleading to a reader? (e.g.: multiple sub-figures beside each other showing similar metrics should use the same colorbar range, except for rare exceptions; blue is often associated with negative temperature anomalies but positive precipitation anomalies)
- For figures using shading, the use of discrete color levels is often preferable to a continuous color gradient as, values and colors are easier to match.
- Does the figure have a precise figure caption (introducing any acronyms or technical terms used in the figure even when they have already been introduced in the text; do not describe results in the figure caption!)
- Does the figure use colorblind and perceptually uniform colormaps where possible? (see, e.g., here: [https://seaborn.pydata.org/tutorial/color\\_palettes.html](https://seaborn.pydata.org/tutorial/color_palettes.html))
- Is the font size of the labels and other text in the figure large enough? (ideally, it should have a similar font size to the rest of the text)
- Is the resolution high enough (and not so high that file size becomes a problem)?
- Ideally figures should be vector graphics such as the PDF shown in Figure 1, and not raster images as the one used in Figure 2.