Scientific writing - some tips and tricks

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Disclaimer: this is my personal opinion. No guarantee that other advisors agree

Before you start

- The **audience** to keep in mind while writing the thesis is your fellow HE MSc students. You need to make sure they can understand what you did.
- Read through some **thesis examples** in the TU Delft repository for inspiration

Content

- **Start to write a draft storyline with (planned) figures at an early stage**. In a good thesis / scientific paper, every figure has a purpose, and together they form the backbone of your story.
  - This storyline is not cast in stone. It will change, as research is not completely predictable: you may find that your ideas do not work out or that other directions / questions are more interesting. It will evolve, so no problem if you find it hard to write the first time, just practice and learn
  - The first version(s) of this draft storyline may just be a collection of figures, with some short sentences / keywords written down for each of them to indicate (i) what is shown, (ii) why this is of interest to your story, and (iii) next steps to explore.
  - If the storyline is OK, you will be able to logically connect the figures / paragraphs / chapters:
    "In Figure A, we see..... From this, it seems that process XX may play a role. To investigate this in more detail, we have analyzed YY in Figure B"

    If this is not the case, it should be easy to identify what is missing from the storyline and which analyses / figures are still needed, or whether your storyline needs to be adjusted.
  - Re-evaluate your storyline regularly. It will help avoid getting lost in details and on sidetracks. As a check, try to summarize the main results in three key sentences. Discuss the storyline and its adjustments with your daily advisor(s).
  - The above implies that you will need to select the figures that contribute to your story. Not all figures you make will end up in the report. You have to choose the relevant ones and have to be able to motivate your choices.
- The **chapters in your thesis are not necessarily ordered chronologically**, i.e. in the order you worked on the various subprojects. The optimal order is determined by the storyline.
- Many textbooks suggest to separate the **Summary / Conclusions** (where you provide the answers to the questions posed in the beginning) from the **Discussion** (things that need to be explored further, new and remaining questions). It is also very well possible to integrate these in one chapter, as they are of course strongly connected. The same holds for the **Introduction** and the **Research questions**.

Writing Style

- **Scientific writing is very different from writing a novel**: it has to be structured and highly predictable; no surprises for the reader. Provide plenty of "signposts" for the reader in which you explain your line of thoughts and connections between the different parts of the work. ("In the previous section, it was shown that..... In this Chapter, we will explore this further by .... "). What is obvious to you will not be obvious to a reader unfamiliar with your work.
- There are basically two options for the **structure of a paragraph** / section / chapter in scientific writing:
  1. Start each paragraph with a conclusive statement, and then substantiate how you arrived at this statement based on your analysis / figures.
     - Advantage: when you read the first line of each of paragraph the storyline should (re)appear - this is a thing you can easily check yourself
     - Disadvantage: conclusions may seem to appear out of thin air and take the reader by surprise
  2. Give each paragraph a clear "head" (announce what is coming) and "tail" (conclusive statement) and describe the analysis itself in between
     - Advantage: reader is guided through the text.
     - Disadvantage: may result in repetition and inconcise texts

  For chapters, method (2) usually works best, as a summary of a few sentences is very useful (provide a "take home message" for that chapter and connection to the next one). For shorter pieces of text both are fine, whatever you prefer
- **Be consistent** in your terminology. Once you define something, keep referring to that by that same name (this will feel very boring but is actually very helpful).
- **Be specific** in your writing: *"In simulation B, the speed of the current increases by 32%"* rather than *"In simulation B, the speed of the current changes"*. Guide the reader where to look when you refer to figures: *"The velocity at the surface is twice as large as at the bottom (blue line in Figure 4b)"* rather than just "*The velocity ..... bottom (Figure 4)*"
- **The tense you use (past tense / present tense) has a large influence on the message you (intentionally or unintentionally) convey**. An example:
  - *"Ocean eddies are important for the circulation in the Atlantic Ocean"*: present tense = nobody doubts this statement, and you consider it a known fact in your work
  - *"The vertical structure of ocean eddies has been measured in the Atlantic Ocean"*: past tense = this is not the end of the story - reader expects some remark will follow: *"The vertical structure of ocean eddies has been measured in the Atlantic Ocean, but not in the Pacific, ... but using the wrong instruments, ... "*.

  See the leaflet "Using tenses in scientific writing" (University of Melbourne) for more examples and guidelines on which tense to use in specific chapters of scientific reports / papers.

Figures / Tables

- Captions need to be self-explanatory: the reader must be able to understand what is presented without consulting the main text

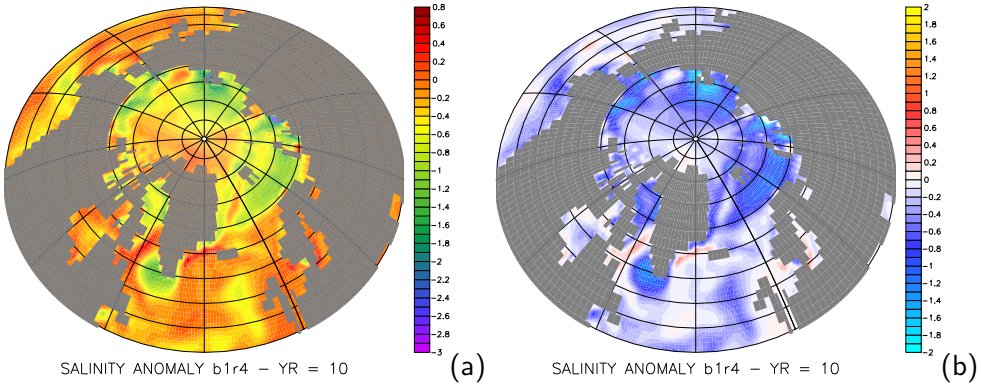

Figure 1: Sea Surface Salinity difference between a numerical simulation with increased precipitation over the Arctic Ocean and a numerical simulation of the present-day climate (in psu, figure is for year 10 of the simulation). In (a), a standard color map and non-symmetric range chosen by the plotting software is used. In (b), a red-white-blue color map is chosen, and a symmetric range set by the user. Note how in panel (b) the reader's attention is automatically drawn to the regions where large changes occur (i.e., Barents Sea and region southwest of Greenland). Also, it is immediately clear that the anomalies are predominantly negative

- Axis labels need to be large enough to read, adjust standard choices in Matlab / Python if needed
- Carefully choose your colors in line with the reader's expectations (e.g., never use red for cold, blue for warm)
- When you have multiple plots that need to be compared (e.g., currents in 2002 versus 2012), make sure the ranges plotted (axes and/or contour levels) are the same in each subpanel
- When you plot anomalies / differences, always use a colorbar range that is symmetric around zero, and a color map that is white in the middle. In this way, emphasis is on data points with a non-zero anomaly. See Figure 1 for an illustration.

Commons mistakes in English

- Use of capitals when referring to locations / directions:
  - general direction = no capital: "in the west / towards the east"
  - specific location = capitals: "In the North Atlantic "
  See for example https://www.quickanddirtytips.com/education/grammar/when-do-you-capitalize-directions
- references to figures, chapters with capitals: "in Figure 4, ...".
- As a non-native English speaker, language subtleties are sometimes hard to grasp. Also, we all tend to make the same mistakes. Examples of these common mistakes can be found in "The effective scientist" by C. Bradshaw (Chapter 2) and "How to write a lot" by P.J. Silvia. You can borrow these books from me.

Miscellaneous

- When you hand in a draft and you know things are still missing: that is OK (that is why it is called a draft version). Add a (colour-coded) remark to let me know that you know something needs to be added / adjusted ("here I will add a figure of the bathymetry")
- Reading guides are highly appreciated when you hand in a draft version: "Chapter XX has not been changed since the previous draft", "please focus on Section YY as I find that hard to write", etc. This allows for more effective feedback sessions
- When presenting your results in a meeting with your exam committee, make sure to discuss / remind them of the background and motivation for the research project before you go to the results. Do not count on the committee to recall where the discussions in the previous meeting ended. Also, when you decide to change course, explain why you did this and what the new plans are. That is, **always present the (updated) storyline**. Discuss (the plans for) your presentation with your daily advisor before the committee meeting - you only have a few of these meetings, and you want to use those wisely.