Why write scientific papers ?

Scientists are motivated by two things:

(1) to understand the world,

(2) to get credit for it

- **A scientific career is all about expansion of human knowledge**
- **In the academic and public sectors, scientific papers ARE the**
- **means for this expansion.**
- **Quantity doesn't matter beyond an expected number – quality is what matters (what we used to say …)**
- **What determines the perceived quality of a scientific paper? (now routinely - perhaps unfortunately – measured by the citation index)**
  - **Originality and importance of ideas**
  - **Effectiveness of communication**
  - **Usefulness as a source of information**

"The paper is not a description of the work, it IS the work"

Never sign a paper that you have not fully read

Few will read your papers from beginning to end

- **Think of how scientists (e.g., you!) read papers !**
- **Title and abstract are for search engines ... Most readers will not go beyond the abstract.**
- **Figures+captions and Tables+footnotes must be self-contained ... a lot of readers go through those w/out reading the text. Some may look for quick explanation in text, so discussion of figures/tables in text should jump at reader (start paragraphs with "Figure X shows...")**
- **Make your figures attractive for use in presentations, both by you and others. If you wouldn't use a figure in a presentation, then fix or delete the figure!**
- **Many readers are interested in your paper mainly because they want some specific numbers, or a synthesis or references to previous work; oblige them by being scholarly.**
- **The take-home messages of the paper should be "in your face",I.e., in abstract, in intro, in conclusions, to make sure the "diagonal reader" gets the message.**

Introduction

- **Write it first – do it early, revisit often ; use it to think about what your paper is about, to test your knowledge of the literature**

Classical approach:

- **Begin with a mini-review and finish the intro by saying what your paper is about**

Modern approach:

- **First paragraph : state the problem– don't encumber with too many refs**
- **At end of first paragraph or beginning of second : tell us in one sentence what your paper is about**
- **Second and following paragraphs : now, give the background information, what people have done before, the limitations, etc. (copious referencing)**
- **Last paragraph: few precise questions that will be adressed, then delineate the paper**

Methods section following the Intro

- **Write it soon - the writing process make you check whether they really are mature**
- **If working with a complicated model or using a messy data set. Focus your methods section solely on what is important for your paper. Reference accurately other papers for other information.**
- **Read papers from your group. No point in reinventing the wheel.**
- **Provide useful numbers for readers to use (budgets, etc.)**
- **Make sure all math is clean**
- **Use a table if too many variables or processes**
- **Use “information flow diagram” to describe complex procedures**

Results sections

- Use section headers descriptive of the science: “Model comparison to observations”, “Results and discussion” are generally not good.
- If not clear from the header, start the section with a brief statement of what it’s about
- Start by presenting result (Figure X shows...) and then discuss what they mean including comparisons to prior work
- Logical, linear flow of thought – you’ve thought a lot about your results and what they mean, share this progression with reader
- One theme per paragraph – first sentence lays out the theme, last sentence provides link to next paragraph. Few paragraphs need to be longer than 1⁄2 page – longer than 1 page is sure sign of confused thinking.
- Don’t wring your hands about lack of confidence in your results. The reader expects you to focus on what you can say with confidence.
- Avoid useless statements e.g. « model agrees with data «
- Avoid optimistic statements, « highly correlated « (R2 = 0.45)
- Avoid arrogant statements « our results are superior to … »
- Avoid promising things in a follow up study

Results sections (for modelers)

"Nobody believes a modeling paper except the author, everybody believes an observational paper – except the author"

- **Comparisons with observations should have a clear purpose in terms of learning about the system studied. Tell what features you're looking for**

- **No one cares that the model "does a good job", "is in reasonable agreement", etc. What are you actually testing in the model? What increased confidence in terms of processes (e.g. soil water uptake, convection) are you getting from the comparison? Can you usefully make the comparison quantitative?**

Discussion section

- Usually difficult to write (and often not read by scientists)
- Should not be a mere repeat of results section
- Focus on interesting things
- Show your command of litterature, including competitors
  - What is different and similar between your results and other studies
  - If possible, why are they different ? (often not possible for models)
  - Do not consider that models are reality, remain critical about model performances, e.g. error compensations
  - Identify sources of uncertainties (in data, in forcing, in models) and try if possible to compare their contributions
  - Propose solutions to reduce critical uncertainties
- Can use discussion to formulate a new hypothesis

Abstract and Conclusions

…can wait to be written until rest of paper is mature

- Abstract is the most important part of the paper – many readers will read just that. Focus on what is new - essential ideas, essential numbers. One fact/idea per sentence. Everything that you would like the casual reader to remember should be there.
- The Conclusions section gives the take-home messages of your paper in a way that's not as severely limited in space as the Abstract. Readers who want to go beyond the Abstract may read your paper diagonally and then zoom in on the Conclusions. Here's an easy recipe for writing an effective Conclusions section:
  - First paragraph: quick summary of what you did and why you did it.
  - Successive paragraphs: one paragraph per section, following the flow of the paper and extracting the take-home messages.

Avoid "soft text" in abstract – give numbers to be remembere

A few words about references…

- Showing command of the literature is extremely important. You need to describe the foundation on which your contribution to human knowledge is based. Thorough referencing is the scholarly and ethical thing to do, it's also useful to readers and it makes your paper more accessible by search engines!
- So be serious about literature search and reading papers – comb the literature using search engines.
- Never cite a paper for which you haven't read at least the relevant part.
- Cite papers in a context that makes it clear what the paper did – otherwise the reference is useless. If you're not clear on what the paper you're citing actualy did, go back and (re-)read the paper – it's the intellectually honest thing to do and you may learn something.
- Don't cite textbooks – they may be difficult for reader to access, information may be buried.
- There's nothing wrong with citing yourself extensively – in fact that's normal since that's the work you typically build on, and that's part of advertising. But don't ignore what others have done!
- References should be helpful to the reader, not of historical interest (unless you're writing a review)

- **Read draft from the perspective of a critical reader. Are you satisfied?**
- **Be as short as possible. “Every word must hurt”**
- **Use short words (e.g.“use” vs. “utiilize”) and strong effective words with precise meaning.**
- **Try to use short sentences. Using active present form.**
- **Remove value judgments: “Surprising”, “interesting”, “unfortunately”, have little place place in a scientific paper (a Chinese and French classic)**
- **Beware of words with different scientific vs. lay meanings, such as “significant”, “uncertain”**
- **Be consistent in notation and terminology. “methane” or “CH4“?**
- **Communication is better if you write as you would speak. Which means for “ozone”, but “CO”, “SO2 “, but “sulfate”, etc.**
- **Avoid complex naming of model experiments. Which means « SIM-1 » better than « REF_NOCO2CLIMLUC_betax2 »**
- **Use figures, don’t surf on them in one sentence**
- **Do not give key information in supplementary**
- **Do not « hide » approach in a method while be pompous in the text**