

Writing a scientific paper

Jonathan GULA
gula@univ-brest.fr

Lectures

Introduction:

- Brief History of Science and Scientific Writing

Scientific writing:

- Structure and content of a paper
- Writing and revising a scientific paper
- Writing a scientific report

Effective Scientific writing:

- How to write more effectively

The peer-review process

Activities

- Read and discuss scientific articles
- Write short articles / abstracts

Presentations and articles will be available at <http://stockage.univ-brest.fr/~gula/SE/>

#3

Structure and content of a paper

Scientific writing

1. Type of articles
2. Architecture of an article

Types of articles

Several types of journal articles:

- **Letters** (or *communications*) - short descriptions of important current research.
- **Articles** - complete descriptions of current original research findings.
- **Review articles** - put many different articles on a particular topic into a coherent narrative about the state of the art in that field.
- **Data papers** - describe datasets [*e.g. Scientific Data and Earth System Science Data*]

Types of articles

1. Letters (or *communications*) - short descriptions of important current research.

- Usually few pages and less than 5 figures [rules are journal-dependent]
- Ex: **Geophysical research letters**
 - Limitation = **12 Publication Units**
 - Total publishing units = # of words/500 + # of figures + # of tables
 - Word count includes abstract, text, and figure captions only.
 - Word count excludes titles, author lists and affiliations, tables, and references

<http://stockage.univ-brest.fr/~gula/SE/Cheltonetal07.pdf>

Types of articles

1. Letters (or *communications*) - short descriptions of important current research.

- Usually few pages and less than 5 figures [rules are journal-dependent]
- **Ex: Nature Geosciences:**

http://www.nature.com/ngeo/pdf/submission_guide_ngeo.pdf

Letters: a referenced <200 word introductory paragraph; main text of no more than 1,800 words and 4 display items (figures, tables). As a guideline, Letters allow up to 30 references. Section headings are not used.

<http://stockage.univ-brest.fr/~gula/SE/Donatoetal11.pdf>

Types of articles

2. Articles - complete descriptions of current original research findings.

- Can be much longer (up to 20 – 30 pages/figures)
- **Ex: AMS [Journal of Climate, Journal of Physical Oceanography, Journal of the Atmospheric Sciences]**
 - <https://www.ametsoc.org/ams/index.cfm/publications/authors/journal-and-bams-authors/formatting-and-manuscript-components/>
 - Length of **7500 words** or less not counting the abstract, figure caption list or references. If a submission exceeds the word limit the author must upload a cover letter with the manuscript presenting a justification for the length of the manuscript to request the Chief Editor's approval of the overage.

<http://stockage.univ-brest.fr/~gula/SE/Kanzovetal10.pdf>

Types of articles

3. Review articles - put many different articles on a particular topic into a coherent narrative about the state of the art in that field.

- Usually scientists are invited to write a review on a given topic by a journal.
- Some journals publish only reviews:
 - *Annual review of marine science*
 - *Review of Geophysics*

<http://stockage.univ-brest.fr/~gula/SE/McWilliams16.pdf>

<http://stockage.univ-brest.fr/~gula/SE/LeCunBengioHinton15.pdf>

Types of articles

3. Review articles - put many different articles on a particular topic into a coherent narrative about the state of the art in that field.

- *Review of Geophysics* : Reviews of Geophysics is an invitation-only journal. If you would like to submit a manuscript to be considered for publication, please send a brief proposal to reviewsgeophysics@agu.org. The proposal should include proposed paper title, list of potential authors, abstract, outline, and an analysis of recent similar review articles, and should explain how the journal's target audience might benefit from your article. RoG has a wide readership, and while reviews may be technical, they must be fundamentally accessible to geoscientists from all major disciplines. The Editorial Board will review your request and get back to you within about two weeks. If your proposal is accepted, the Editor in Chief will send you a formal invitation through GEMS. Concerning the timeline for manuscript submission, because our articles are longer than average journal articles, we will ask for submission within 3 months of the invitation to submit. AGU allows articles to be supplemented with dynamic content. There are no page limits or page charges.

Types of articles

4. Data papers - describe datasets [*e.g. Scientific Data and Earth System Science Data*]

- **Data Descriptors** submitted to *Scientific Data* should provide detailed descriptions of valuable research datasets, including the methods used to collect the data and technical analyses supporting the quality of the measurements. Data Descriptors focus on helping others reuse data, rather than testing hypotheses, or presenting new interpretations, methods or in-depth analyses. Relevant datasets must be deposited in an appropriate public repository prior to Data Descriptor submission, and the completeness of these datasets will be considered during editorial evaluation and peer-review. Datasets must be made publicly available without restriction in the event that the Data Descriptor is accepted for publication (excepting reasonable controls related to human privacy issues or public safety).

<http://stockage.univ-brest.fr/~gula/SE/Roquetetal14.pdf>

Types of articles

Others :

- **Article + comment + response**

<http://stockage.univ-brest.fr/~gula/SE/Steffenetal15.pdf>

- **News and views**

<http://stockage.univ-brest.fr/~gula/SE/Stewart17.pdf>

The architecture of a paper

Most journals are subdivided into the following sections:

-

The architecture of a paper

Most journals are subdivided into the following sections:

- Title
- Abstract (+ keywords)
- Introduction
- Methods
- Results
- Conclusion
- Acknowledgements
- References

The architecture of a paper

Most journals are subdivided into the following sections:

- Title
- Abstract (+ keywords) *What did I do in a nutshell?*
- Introduction *What is the problem?*
- Methods *How did I solve the problem?*
- Results *What did I find out?*
- Conclusion *What does it mean?*
- Acknowledgements *Who helped me out?*
- References *Whose work did I refer to?*

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- Introduction
- Methods
- Results
- Conclusion
- Acknowledgements
- References

Long articles

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

The architecture of a paper

Short articles (letters)

- **Title**
- Abstract (+ keywords)
- Introduction
- Methods
- Results
- Conclusion
- Acknowledgements
- References

Long articles

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Title

A good title is defined as the fewest possible words that **adequately describe** the contents of the paper.

- Waste words (studies on, investigations on, a, an, the etc) should not be used.
- Syntax (word order) must be very carefully considered
- It should contain the keywords that reflect the contents of the paper.
- It should be meaningful and not general
- It should be concise, specific and informative
- It should capture the fundamental nature of the experiments and **findings**

Use as broad a title as you can reasonably get away with. Do not limit your potential audience. Your title will be read by thousands, whereas few will read the entire paper.

Indexing and abstracting of the paper depends on the accuracy of the title. An improperly titled paper will get lost and will never be read.

Title

It should headline the main result of the paper (not the main effort):

- Prefer: ***“The wineglass effect shapes particle export to the deep ocean in mesoscale eddies”***
- To: ***“Study of the mechanisms controlling particle transport in mesoscale eddies”***

- Prefer: ***“Topographic inviscid dissipation of balanced flow”***
- To: ***“Instabilities of buoyancy-driven coastal currents and their nonlinear evolution in the two-layer rotating shallow-water model. Part 1. Passive lower layer”***

Title

- For example, in a paper reporting on an experiment involving dosing mice with the sex hormone estrogen and watching for a certain kind of courtship behavior, a poor title would be:

Mouse Behavior

- Why? It is very general, and could be referring to any of a number of mouse behaviors. A better title would be:

The Effects of Estrogen on the Nose-Twitch Courtship Behavior in Mice

- Why? Because the key words identify a specific behavior, a modifying agent, and the experimental organism. If possible, give the key result of the study in the title, as seen in the first example. Similarly, the above title could be restated as:

Estrogen Stimulates Intensity of Nose-Twitch Courtship Behavior in Mice

Title

Some Journals have specific rules for the title:

- Ex: ***Nature journals***

Titles should be 90 characters including spaces or less and avoid technical terms, abbreviations, punctuation and active verbs. We don't allow multi-part titles, i.e., two phrases separated by punctuation of some kind.

The architecture of a paper

Short articles (letters)

- Title
- **Abstract** (+ keywords)
- Introduction
- Methods
- Results
- Conclusion
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Abstract

The abstract – like the conclusion – is the most difficult and touchy/tricky part of the paper.

It is the first and often the only part of the manuscript read.

A hasty reader will browse

- *the abstract*
- *elements of material and methods*
- *some figures*
- *and he/she will jump to the summary/conclusions*

Abstract

Give it time and attention ! An external reader must understand

- where you go
 - why you go there
 - what you did
 - why it is interesting and novel
-
- THEREFORE, THE ABSTRACT IS THE LAST PART YOU WRITE IN YOUR PAPER.

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- Introduction
- Methods
- Results
- Conclusion
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Keywords

The keyword list provides the opportunity to add keywords, used by the indexing and abstracting services, in addition to those already present in the title. Judicious use of keywords may increase the ease with which interested parties can locate your article.

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- **Introduction**
- Methods
- Results
- Conclusion
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Introduction

- **Context:** provide some context to orient readers who are less familiar with your topic and to establish the importance of your work.
- **Need:** state the need for your work, as an opposition between what the scientific community currently has and what it wants.
- **Task:** what you have done to address the need
- **Object of the document:** preview the remainder of the paper to mentally prepare readers for its structure

➤ See “An effective introduction...”

Introduction

Context (Background):

- Start broad and progressively narrow down to the issue addressed in the paper.
- Write the context in a way that appeals to a broad range of readers and leads into the need.
- Provide only what will help readers better understand the need and, especially, its importance. (*Do not include context for the sake of including context*)

Introduction

Need (knowledge gap + question):

- State the actual situation (**what we have** -> state of the art) and the desired situation (**what we want**)
 - *If you must explain recent literature in more than two or three paragraphs — consider moving the details to a section titled State of the art (or something similar) after the Introduction.*
- Provide a compelling **motivation for the work** presented in your paper.
 - *The fact that a phenomenon has never been studied before is not, in and of itself, a reason to study that phenomenon.*

Introduction

Task (your approach):

- Clarifies your contribution as a scientist.
 - ***Here we quantify*** the sea-ice freshwater flux using a state-of-the-art data assimilation that incorporates millions of ocean and ice observations.
 - ***Here, we examine*** the atmospheric conditions associated with over 600,000 individual eddies in the Southern Ocean, using satellite data.
 - ***Here we present*** statistics of vorticity, divergence, and strain rate of submesoscale turbulence obtained via synchronous velocity measurements by a pair of vessels running on parallel tracks.

Introduction

Object of the document:

- Prepares readers for the structure of the paper:
- Short papers/letters examples [Task + Object may be merged]
 - ***The present study revisits the emission of gravity waves in a dipole, using long-term simulation to identify the backreaction of the waves on the dipole.***
 - ***The objective of this study is to investigate these characteristics from the higher resolution SSH fields afforded by the merged T/P and ERS-1 and ERS-2 satellite datasets.***

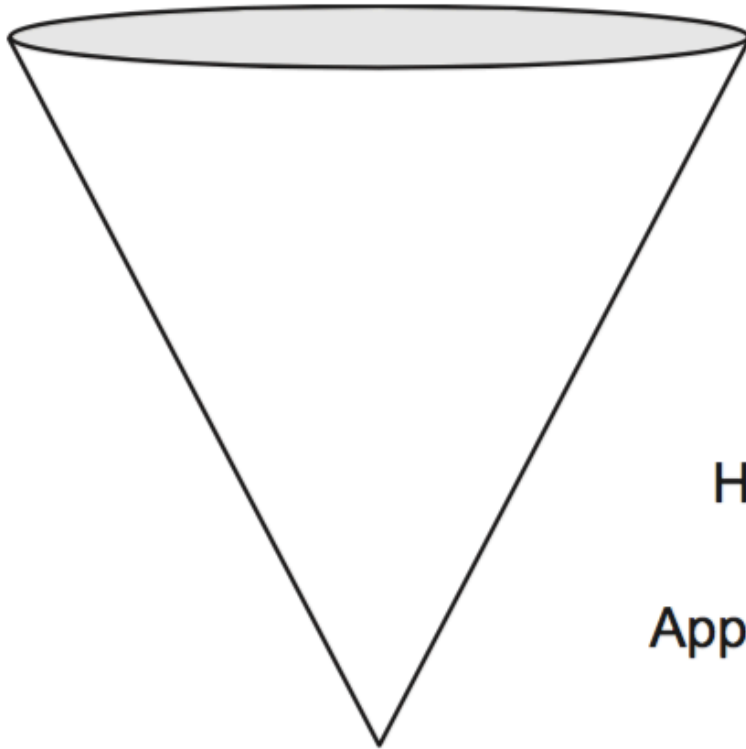
Introduction

Object of the document:

- Long papers (full outline):
 - *In the next section, it will be shown, that, in fact, the bottom pressure torque is of exactly the right size to balance the meridional flow required in a western boundary current. **Section 3 then discusses** diagnostics from a fully nonlinear, global, 1/4deg resolution numerical model: the Ocean Circulation and Climate Advanced Modelling project (OCCAM) model. These diagnostics confirm the predictions of section 2. **Finally, section 4 summarizes** the main results and remaining open questions.*

Introduction

- **The Cone:**



Background, known information

Knowledge gap, unknown information

Hypothesis, question, purpose statement

Approach, plan of attack, proposed solution

Introduction

- Ex: <http://stockage.univ-brest.fr/~gula/SE/Donatoetal11.pdf>

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- Introduction
- **Methods**
- Results
- Conclusion
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Material, methods, theory, etc.

One of the characteristics of a scientific article is that the results must be reproducible. Therefore all elements necessary to reach the results must be presented first.

- ***How you collected and processed the data, calculated the errors***
- ***What is your numerical model and the values of the parameters***
- ***Which theory you use***

Very technical details (parts of proofs, specific numerical schemes, specific data processing algorithm) must be put in appendix.

Material, methods, theory, etc.

The Material and methods section does not need to be boring

- Explain the choices you made in your experimental setup and how they are justified.
- Emphasize what is special, unexpected, or different in your approach.
- Mention these things early in your paragraph. Do not make readers guess: Make sure the paragraph's first sentence gives them a clear idea of what the entire paragraph is about.
- If you can, consider using a table or a schematic diagram rather than a paragraph of text.

➤ See “A paragraph of methods ...”

Material, methods, theory, etc.

Some journals (multidisciplinary like Nature) put the Methods section at the end of the article.

Ex: <http://stockage.univ-brest.fr/~gula/SE/Preinetal16.pdf>

Ex: <http://stockage.univ-brest.fr/~gula/SE/Donatoetal11.pdf>

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- Introduction
- Methods
- **Results**
- Conclusion
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Results

- The function of the Results section is to objectively **present your key results** in an orderly and logical sequence using both text and illustrative materials.
- The Results section should be **organized around Figures and Tables** that should be sequenced to present your key findings in a logical order.
- *Authors usually write the text of the results section based upon the sequence of Tables and Figures.*

Results

- The text should guide the reader through your results stressing the key results which provide the answers to the question(s) investigated.
- You must refer to each Table and/or Figure individually and in sequence, and **clearly indicate for the reader the key results that each conveys**. *[Do not reiterate each value from a Figure or Table - only the key result or trends that each conveys.]*
- *A good strategy is to note, on a draft of each Table or Figure, the one or two key results you want to address in the text portion of the Results.*

Results

- Order your main results according either to their importance or to their succession (they may be inductive) ; but do not force your readers to go through everything you went through in chronological order.
- Present a **broad approach of your results and of your major ideas from the start** – *you know where you go but your reader does not* - but do not give details from the start ; the reader will feel more at ease if he/she knows where you are going
- You also have to **ensure logical and smooth transitions between ideas** (sections and paragraphs)

Results

Remember to prepare your readers for the structure ahead at all levels.

Prepare your readers for an upcoming division into subsections by introducing a global paragraph between the heading of a section and the heading of its first subsection.

An explicit preview would be phrased much like the object of the document: "This section first . . . , then . . . , and finally . . . "

Results

One SECTION per major idea

- Eddy Characteristics
- Propagation Directions and Speeds
- Nonlinearity

<http://stockage.univ-brest.fr/~gula/SE/Cheltonetal07.pdf>

One PARAGRAPH per step in the proof of the major idea

One argument per SENTENCE – short sentences if possible ;
sentence more than 3 lines long require much more attention from
the reader, and start to be confusing.

Results

Ex: <http://stockage.univ-brest.fr/~gula/SE/Donatoetal11.pdf>

Results

- State the message of each paragraph upfront: Convey in the first sentence what you want readers to remember from the paragraph as a whole = **topic sentence**
- Then develop your message in the remainder of the paragraph, including only that information you think you need to convince your audience.

Results

- Write paragraphs with a single subject and a topic sentence that conveys that subject.

“Asking someone to read a paragraph in a scientific paper that does not have a topic sentence is like asking a weary hiker to start up a steep, rugged trail without a destination in mind. The reader is likely to stop halfway, exhausted and wondering why he ever started.” [<http://www.iro.umontreal.ca/~bastin/Ressources/WritingSuggestions.pdf>]

- When you're finished with a paragraph, ask yourself whether all of the sentences of the paragraph contribute to its subject. Sentences that don't belong should be moved to another paragraph or removed. All of the sentences of a paragraph should contribute to its subject.
- if you begin writing a paragraph without a reasonably clear notion of its subject, stop writing and think harder: fuzzy thinking will likely lead to an ill-focused paragraph.

Results

- Ex: <http://stockage.univ-brest.fr/~gula/SE/Donatoetal11.pdf>

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- Introduction
- Methods
- **Results**
- Conclusion
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Discussion

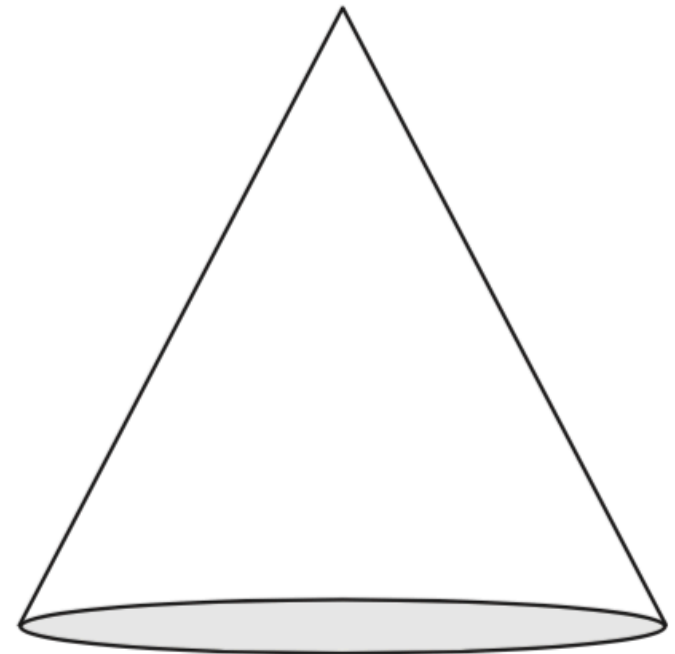
- The function of the Discussion is to interpret your results in light of what was already known about the subject of the investigation, and to explain our new understanding of the problem after taking your results into consideration.
- The Discussion will always connect to the Introduction by way of the question(s) or hypotheses you posed and the literature you cited, but it does not simply repeat or rearrange the Introduction. Instead, it tells **how your study has moved us forward from the place you left us at the end of the Introduction.**

Discussion

- Try to present the principles, relationships, and generalizations shown by the Results
- Show how your results and interpretations agree or contrast with previously published work
- Point out any exceptions or any lack of correlation and define unsettled points

Discussion

- Answer the question asked in the introduction
- Support your conclusion using your data and others' data
- Defend your conclusions (anticipate criticisms)
- Give the big-picture take home messages



Discussion

- Results and discussion can be well separated:

Ex: <http://stockage.univ-brest.fr/~gula/SE/Kanzovetal10.pdf>

Ex: <http://stockage.univ-brest.fr/~gula/SE/Brydenetal05.pdf>

- Or mixed together

Ex: <http://stockage.univ-brest.fr/~gula/SE//Cheltonetal07.pdf>

➤ See “A paragraph of results ...”

Discussion

- Ex: <http://stockage.univ-brest.fr/~gula/SE/Donatoetal11.pdf>

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- Introduction
- Methods
- Results
- **Conclusion**
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Conclusion

- State the **most important outcome** of your work.
- Show whether, or to what extent, you have succeeded in addressing the **need/questions stated in the *Introduction***.
- **Do not repeat material** from the *Introduction* (*a lot of people jump from introduction to conclusion and will notice that*)
- Do not simply summarize the points already made in the body but interpret your findings at a higher level of abstraction. Focus on **what your findings mean**.

Conclusion

- **Do not be afraid to write a short *Conclusion* section:** If you can conclude in just a few sentences given the rich discussion in the body of the paper, then do so. (*In other words, don't try to make the Conclusion longer under the false belief that a longer Conclusion will seem more impressive.*)
 - *Ex: <http://stockage.univ-brest.fr/~gula/Ondes/MowbrayRarity67.pdf>*
 - Consider including **perspectives**:
 - How could you go further ? What else should be done?
 - “One remaining question is . . .”
- See “*An effective conclusion...*”

Conclusion

- **Ex:** <http://stockage.univ-brest.fr/~gula/SE/Donatoetal11.pdf>

The architecture of a paper

Short articles (letters)

- Title
- Abstract (+ keywords)
- Introduction
- Methods
- Results
- Conclusion
- **Acknowledgements**
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Acknowledgements

Do not forget people who helped you nor institutes which funded your study – research is rarely a lonely work.

Plus acknowledge data providers:

- *The altimeter products were produced by Ssalto/Duacs and distributed by Aviso, with support from Cnes (<http://www.aviso.altimetry.fr/duacs/>)*

Computational resources :

- *Computational resources were provided by the Pôle de Calcul Intensif pour la Mer at Ifremer, Brest, France*

Appendices

Everything that is necessary but that would render the paper fuzzy and distract the reader from the main storyline.

References

- Referencing is a standardized way of acknowledging the sources of information and ideas that you have used in your document. A list of ALL the references used in the text must be written.
- Reference format varies widely (depending on the journal)
 - Harvard format (the name and year system) is the most widely used:

The role of bottom topography in ocean circulation is a strange subject. On the one hand, since the work of Stommel (1948) and Munk (1950), it has been assumed to play a rather minor role in the subtropical gyre circulation. On the other hand, in the Southern Ocean

Citation order system (Vancouver format)

The ocean circulation is forced at a global scale by winds and fluxes of heat and fresh water. Kinetic energy is dissipated at much smaller scales in the turbulent boundary layers and in the ocean interior^{1,2}, where turbulent mixing controls the transport and storage of tracers such as heat and carbon dioxide^{3,4}. The

REFERENCES

- Stommel, H., 1948: The westward intensification of wind-driven ocean currents. *Trans. Amer. Geophys. Union*, **29**, 202–206.
- —, 1957: A survey of ocean current theory. *Deep-Sea Res.*, **4**, 149–184.
- —, and A. B. Arons, 1972: On the abyssal circulation of the world ocean—V. The influence of bottom slope on the broadening of inertial boundary currents. *Deep-Sea Res.*, **19**, 707–718.

References

1. Wunsch, C. & Ferrari, R. Vertical mixing, energy, and the general circulation of the oceans. *Ann. Rev. Fluid Mech.* **36**, 281–314 (2004).
2. Hughes, G. O., Hogg, A. & Griffiths, R. W. Available potential energy and irreversible mixing in the meridional overturning circulation. *J. Phys. Oceanogr.* **39**, 3130–3146 (2009).

References

In Harvard format:

- Citation in the text is followed by the author's last name and year of publication between parentheses.
 - If they were two authors then both last names are written.
 - If more than two then the only first author's name is written followed by the abbreviation *et al*

boundary current. More recently, Warren et al. (1996) advanced this viewpoint, while condemning consideration of the balance between wind stress and bottom form stress as “obscurantist” [see comments by Hughes (1997), Olbers (1998), and replies by Warren et al. (1997, 1998)]. It is not our purpose in this paper to

- If a single statement requires more than one citation then the references are arranged chronologically from oldest to more recent
- If more than one reference share the same year then they are arranged alphabetically within the year.

References

- Citations should be inserted right after a fact is introduced in a sentence. Thus, a citation might occur in the middle of a sentence:
 - *Because of the high reported incidence of infections following hip replacement (1), we added a 2-week course of ampicillin and sulfadrexin.*
- Make sure to insert the appropriate citation after the corresponding fact. Do not pool all the citations at the end of a sentence.
 - Although carcinoembryonic antigen is a good prognostic marker for colon cancer, it can also be found in cancer of the pancreas, breast, ovary, or lung (1– 8).
 - Although carcinoembryonic antigen is a good prognostic marker for colon cancer (1– 3), *it can also be found in cancer of the pancreas (4), breast (5,6), ovary (7), or lung (8).*

References

- Citations should be inserted right after a fact is introduced in a sentence. Thus, a citation might occur in the middle of a sentence:
 - *Because of the high reported incidence of infections following hip replacement (1), we added a 2-week course of ampicillin and sulfadrexin.*
- Make sure to insert the appropriate citation after the corresponding fact. Do not pool all the citations at the end of a sentence.
 - ~~Although carcinoembryonic antigen is a good prognostic marker for colon cancer, it can also be found in cancer of the pancreas, breast, ovary, or lung (1– 8).~~
 - Although carcinoembryonic antigen is a good prognostic marker for colon cancer (1– 3), *it can also be found in cancer of the pancreas (4), breast (5,6), ovary (7), or lung (8).*

References

- most journals do not allow authors to cite submitted papers or unpublished results.
- personal communications are permitted by most journals but only if you cannot do otherwise

The architecture of a paper

Short articles (letters)

- Title
- **Abstract** (+ keywords)
- Introduction
- Methods
- Results
- Conclusion
- Acknowledgements
- References

Long articles (letters)

- Section 1 of findings, or results
- Section 2 of findings, or discussion
- ...
- Summary, discussion (if none before)

Abstract

An effective abstract helps readers achieve two purposes:

- decide whether they want to read the full paper
- prepare themselves for the details presented in that paper

The abstract should present what the readers are primarily interested in:

- **motivation** for the work presented -> *Introduction*
- **outcome** of this work -> *Conclusion*

Abstract

- **Context**
 - **Need**
 - **Task + Object of the document**

 - **Findings:** the *what*
 - **Conclusion:** the *so what* - that is, the interpretation of your findings
 - **(Perspectives)**
- See “*An effective abstract*”

Abstract

The abstract parallels the structure of the introduction and conclusion in a **shorter and less specialized** way.

Any scientist reading it should be able to understand why the work was carried out and why it is important (context and need), what the authors did (task) and what the paper reports about this work (object of the document), what the authors found (findings), what these findings mean (the conclusion), and possibly what the next steps are (perspectives).

Enough key information (e.g., summary results, observations, trends, etc.) must be included to make the Abstract useful to someone who may reference your work.

Abstract

An effective abstract stands on its own :

- avoid referring to figures or the bibliography in the abstract.
- introduce any acronyms the first time you use them in the abstract (if needed), and do so again in the full paper

Also avoid:

- lengthy background information,
- elliptical (i.e., ending with ...) or incomplete sentences,
- any sort of illustration, figure, or table, or references to them.

Abstract

Journal often have specific rules for the abstract:

- Ex: ***AMS journals***

A concise (≤ 250 words) abstract is required at the beginning of each article and, at the discretion of the chief editors, at the beginning of appropriate shorter contributions. Authors should summarize their conclusions and methods in the abstract. First-person construction (e.g., I/my/we/our) and reference citations are not permitted.

Abstract

Journals often have specific rules for the abstract:

- Ex: ***Nature journals***

Articles should have an abstract of approximately 190 words, unreferenced; it contains a brief account of the background and rationale of the work, followed by a statement of the main conclusions introduced by the phrase "Here we show" or some equivalent.

Others

Some journals ask for specific things like:

- **Key points (AGU journals):** Key Points convey the main points and conclusions of the article. Up to three key point statements are allowed, and each must be 140 characters or less with no punctuation. All characters in key points must be from the main ASCII table, not the extended ASCII table. At least one key point is required per article.

RESEARCH LETTER

10.1002/2016GL071702

Key Points:

- The physics of eddy saturation is explained from first principles
- Enhanced bottom drag increases eddy energy dissipation and hence circumpolar volume transport
- Eddy energy dissipation may have an important impact on ocean heat content and atmospheric CO₂

Others

Some journals ask for specific things like:

- **Author Contributions** (Nature, Science): Each author's contribution to the work should be described briefly, on a separate line, in the Author Contributions section.

Author contributions

D.C.D. co-designed the study, collected field data, performed data analyses, and led the writing of the paper. J.B.K. conceived and co-designed the study, and contributed to data collection and writing. D.M. co-conceived the study, arranged for and contributed to data collection, and contributed to writing. S.K. contributed to data collection, data analysis, and writing. M.S. collected field data and contributed to writing. M.K. co-conceived the study and contributed to writing.

Others

Some journals ask for specific things like:

- **Data availability** (AGU journals, Nature):

Please provide a Data Availability statement in the Methods section under “Data Availability”; detailed guidance can be found in our data availability and data citations policy. Certain data types must be deposited in an appropriate public structured data depository (details are available [here](#)) and the accession number(s) provided in the manuscript. Full access is required at publication. Should full access to data be required for peer review, authors must provide it.

We encourage provision of other source data in unstructured public depositories such as Dryad or figshare, or as supplementary information. To maximize data reuse, we encourage publication of detailed descriptions of datasets in *Scientific Data*.

Others

Some journals ask for specific things like:

- **Code availability** (AGU journals, Geosci. Model Dev., etc.):
GMD code and data policy

All papers must include a section at the end of the paper entitled "Code and/or data availability":

Preferably, this section should contain the instructions for obtaining the model code and/or data, either from the supplement or from an archive with a digital object identifier (DOI). Suitable repositories can be found at the [Registry of Research Data Repositories](#), e.g. [ZENODO](#) for model code. After the paper is accepted, a link to the GMD paper should be added to the metadata of the archive.

6 Code availability

The source code of MOPS coupled to TMM, as well as the optimization framework, are available as the Supplement. The most recent TMM source code, forcing, etc., are available at <https://github.com/samarkhatiwala/tmm>.

Others

- **Check the journal's website to find out about all requirements.**

See for example Nature Communications Manuscript Checklist.

The architecture of a paper

- means of **efficiently communicating scientific findings** to the broad community of scientists in a uniform manner.
- allows the paper to be read **at several different levels**. Whatever level a person reads your paper, they will likely get the key results and conclusions.
 - *For example, many people skim Titles to find out what information is available on a subject. Others may read only titles and Abstracts. Those wanting to go deeper may look at the Tables and Figures in the Results, and so on.*
- *Read:*

<http://www.sciencemag.org/careers/2016/03/how-seriously-read-scientific-paper>



Homework

Presentations and articles will be available at <http://stockage.univ-brest.fr/~gula/SE/>

For next lecture (Sep. 23rd):

- Read: **Cheltonetal07.pdf**
 - *We will discuss it collectively*
- Read the report ...



Homework

Presentations and articles will be available at <http://stockage.univ-brest.fr/~gula/SE/>

For next lecture (Sep. 24th):

- Read: **MossRacusinetal12.pdf**
- Pick a report for next week

For next lecture (Sep. 24th):

- Read: **MossRacusinetal12.pdf**
-

