APPLICATE Early Career Event
ECMWF, Reading, 31 January 2019

How to enjoy writing your next scientific paper?

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APPLICATE.eu
Advanced prediction in polar regions and beyond

UCLouvain

EARTH & LIFE INSTITUTE

fnrs
FREEDOM TO RESEARCH

This is ***not*** a comprehensive course on scientific writing

This is rather a collection of personal advices based on my (short) experience

1. Why should I care?

Scientific writing is all about running the last mile of the marathon of your research

Ask a question

Read literature

Formulate hypothesis

Design experiment

Collect data

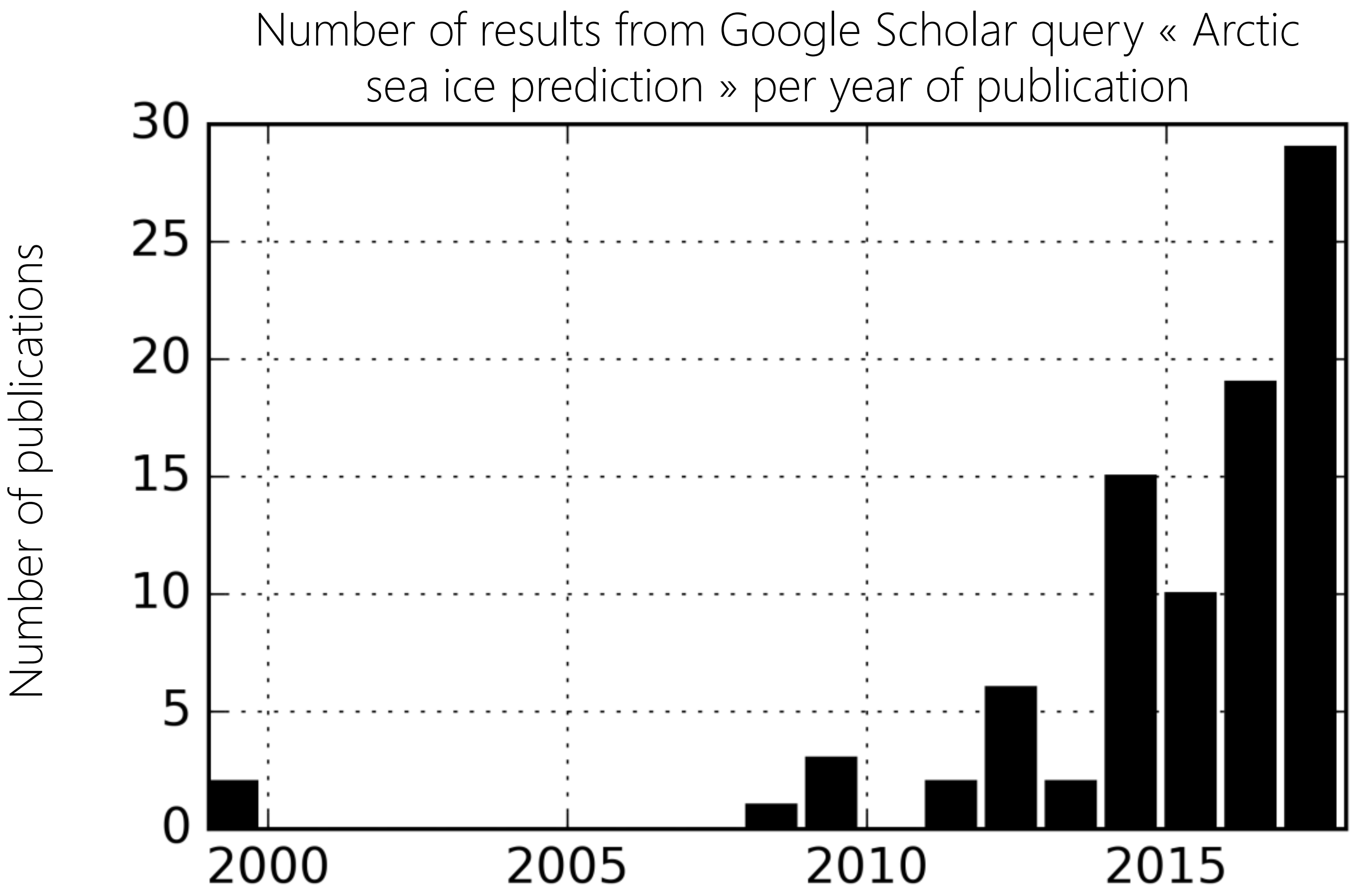
Analyze results

Exchange with peers

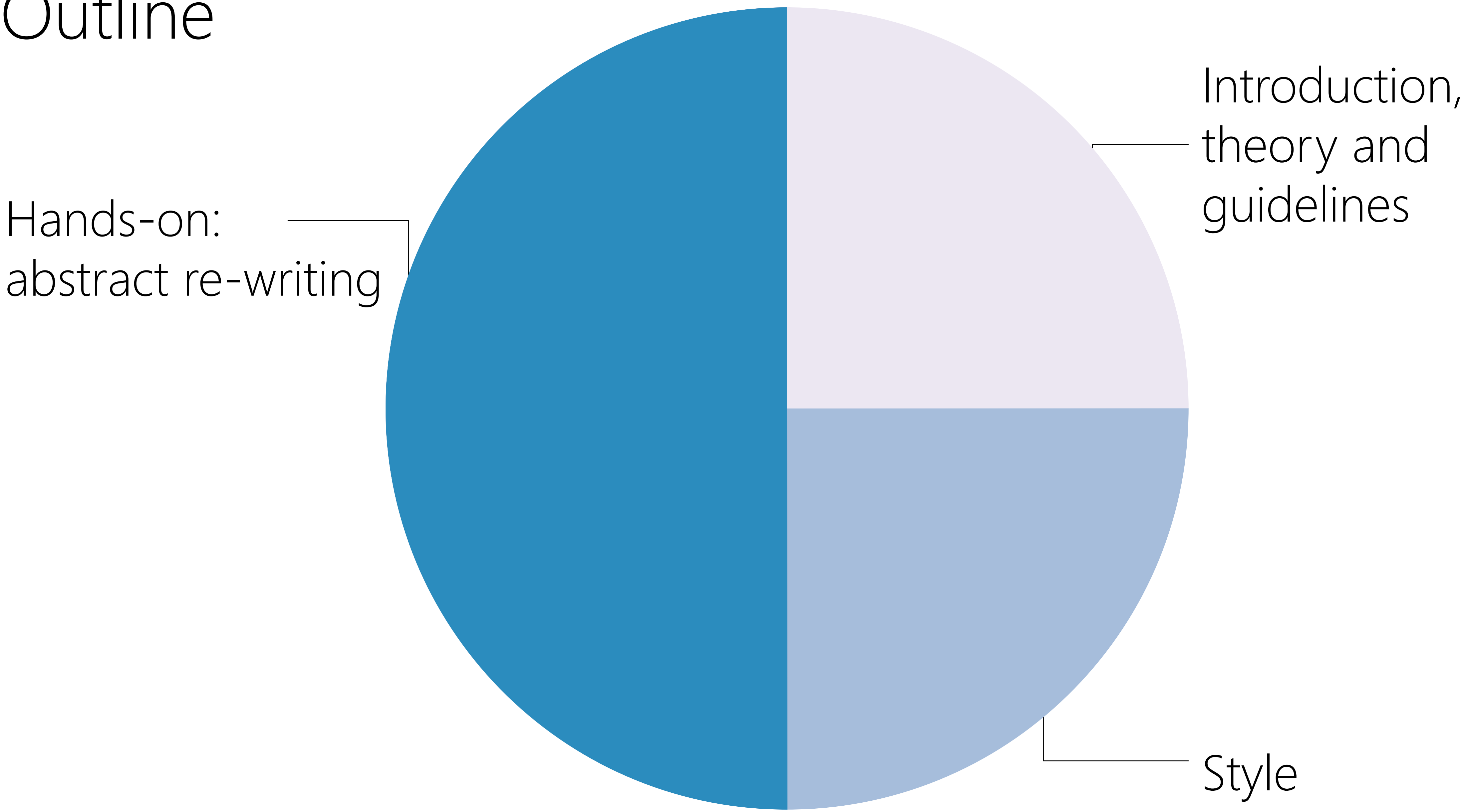
Write paper

The scientific process

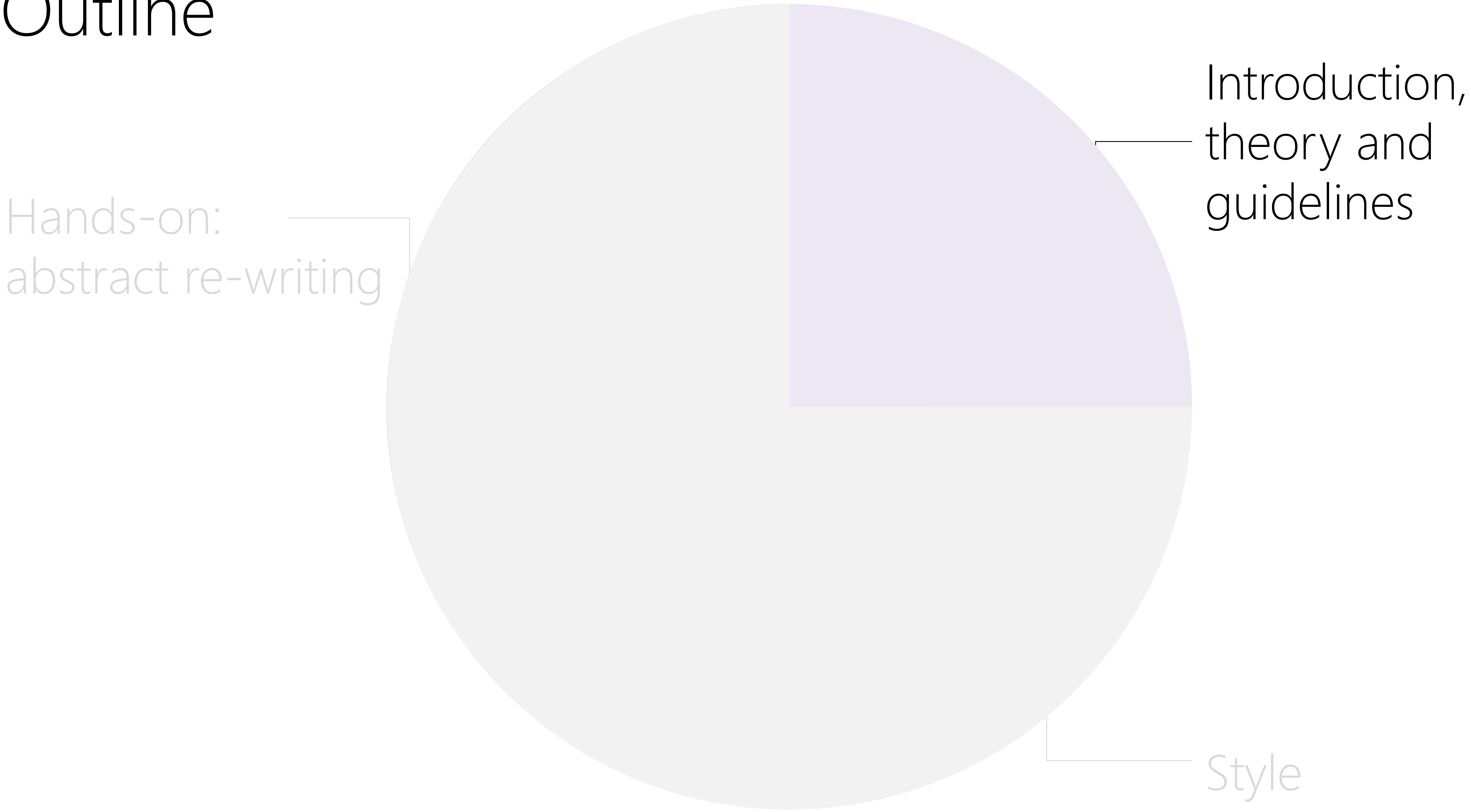
More papers are published every year, so your own papers need to stand out



Outline


Introduction, theory and guidelines
Hands-on: abstract re-writing
Style

Outline


Introduction, theory and guidelines
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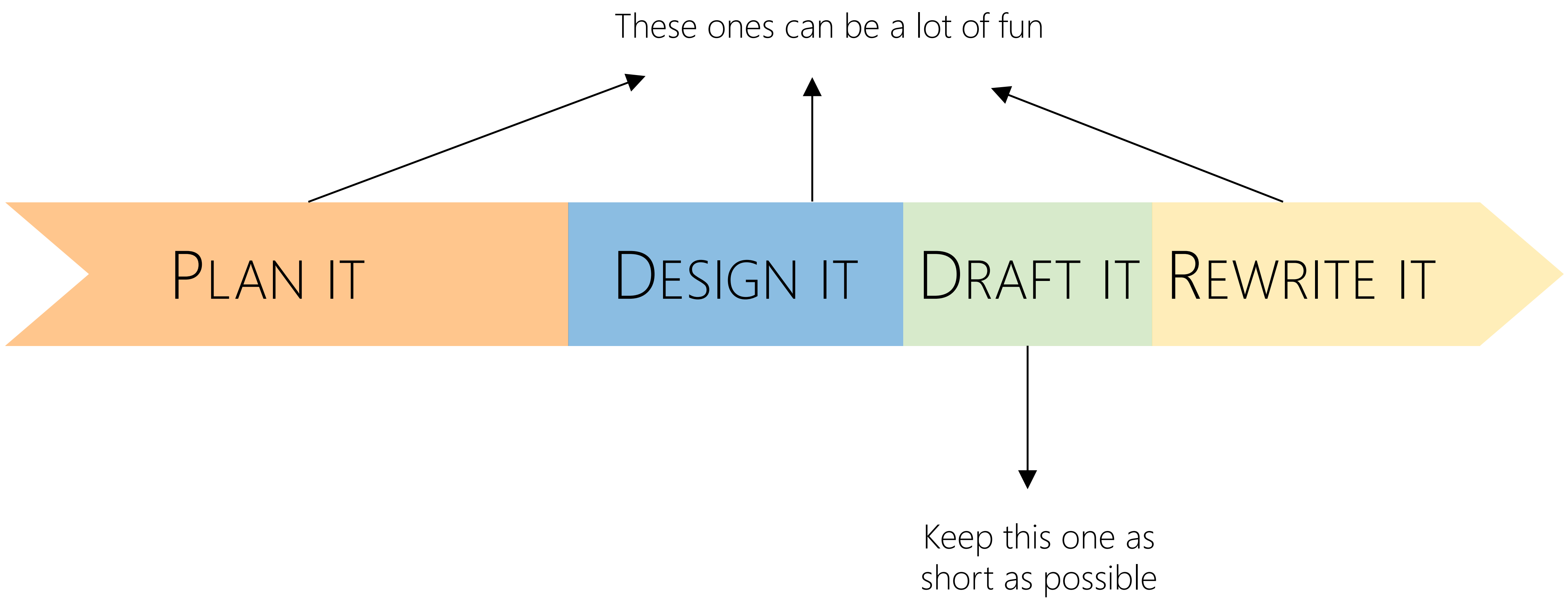
2. Introduction, theory and guidelines

The road to writing a scientific paper

The road to writing a scientific paper



The road to writing a scientific paper

Plan it

Design it

Draft it

Rewrite it

Step 1. Sit down with your co-authors and ask:

1. What is the one message, the one idea of the paper?
2. What audience are you be targeting? What journal?
3. What contents do you have to select to make your point?
4. What are the constraints?

Step 2. Go back to your desk, write down the answers

1. What is the one message, the one idea of the paper?
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3. What contents do you have to select to make your point?
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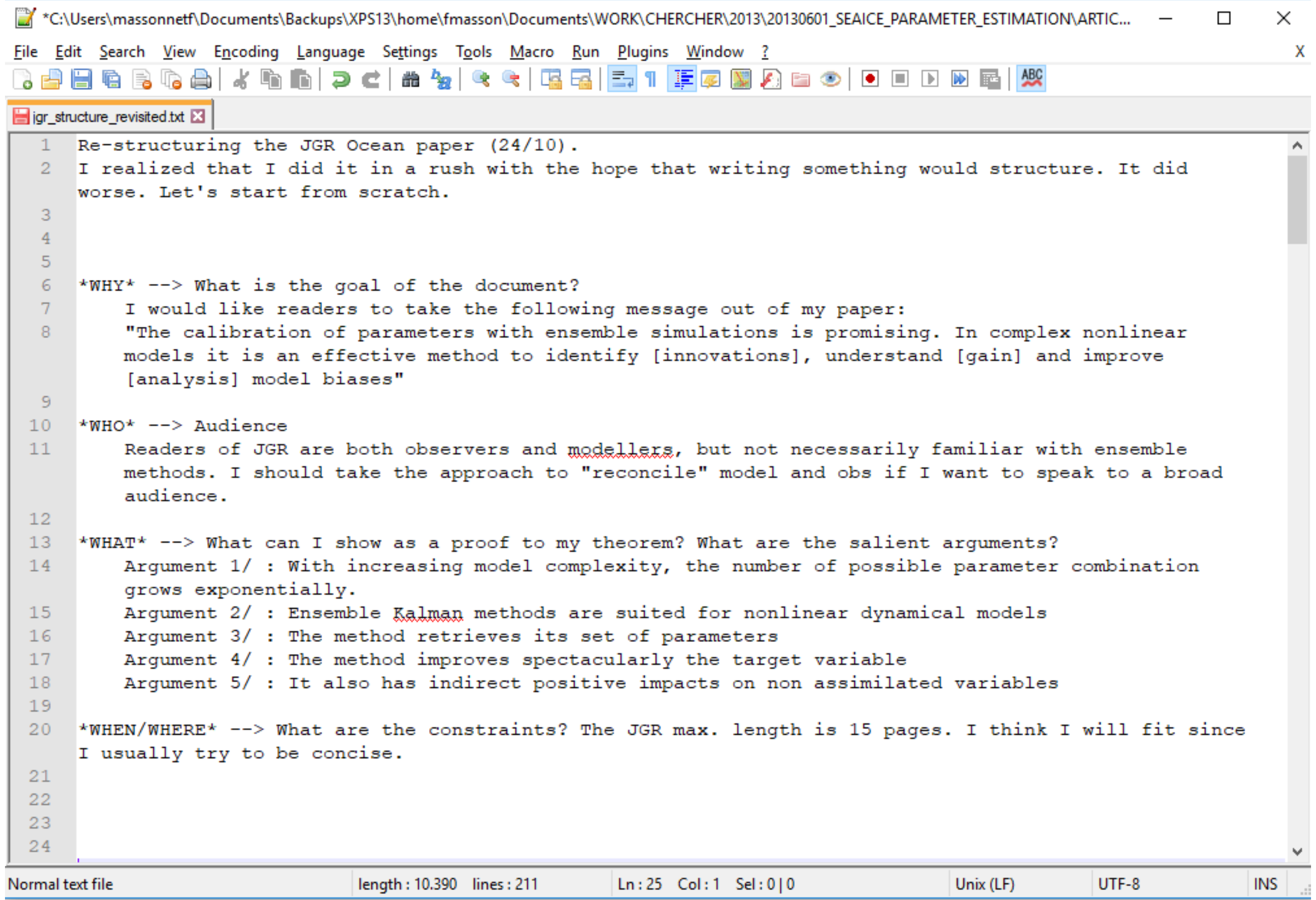

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jgr_structure_revisited.txt

```
Re-structuring the JGR Ocean paper (24/10).
I realized that I did it in a rush with the hope that writing something would structure. It did
worse. Let's start from scratch.



*WHY* --> What is the goal of the document?
    I would like readers to take the following message out of my paper:
    "The calibration of parameters with ensemble simulations is promising. In complex nonlinear
    models it is an effective method to identify [innovations], understand [gain] and improve
    [analysis] model biases"

*WHO* --> Audience
    Readers of JGR are both observers and modellers, but not necessarily familiar with ensemble
    methods. I should take the approach to "reconcile" model and obs if I want to speak to a broad
    audience.

*WHAT* --> What can I show as a proof to my theorem? What are the salient arguments?
    Argument 1/ : With increasing model complexity, the number of possible parameter combination
    grows exponentially.
    Argument 2/ : Ensemble Kalman methods are suited for nonlinear dynamical models
    Argument 3/ : The method retrieves its set of parameters
    Argument 4/ : The method improves spectacularly the target variable
    Argument 5/ : It also has indirect positive impacts on non assimilated variables

*WHEN/WHERE* --> What are the constraints? The JGR max. length is 15 pages. I think I will fit since
I usually try to be concise.
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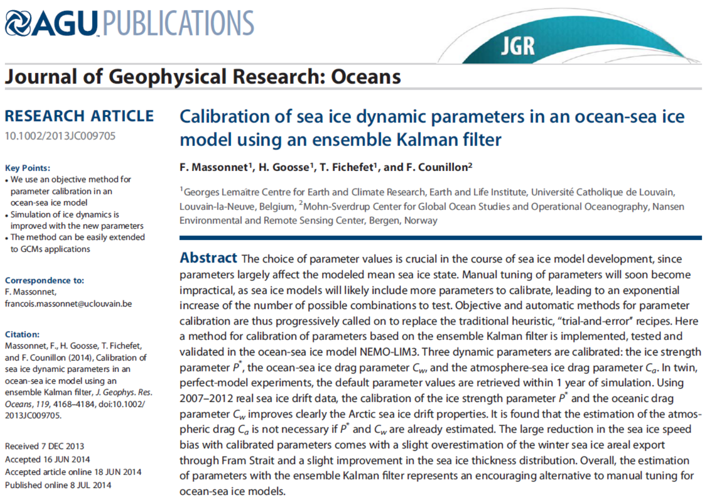

AGU PUBLICATIONS JGR

Journal of Geophysical Research: Oceans

RESEARCH ARTICLE

10.1002/2013JC009705

Calibration of sea ice dynamic parameters in an ocean-sea ice model using an ensemble Kalman filter

F. Massonnet[1], H. Goosse[1], T. Fichefet[1], and F. Counillon[2]

[1]Georges Lemaître Centre for Earth and Climate Research, Earth and Life Institute, Université Catholique de Louvain, Louvain-la-Neuve, Belgium, [2]Mohn-Sverdrup Center for Global Ocean Studies and Operational Oceanography, Nansen Environmental and Remote Sensing Center, Bergen, Norway

Key Points:
- We use an objective method for parameter calibration in an ocean-sea ice model
- Simulation of ice dynamics is improved with the new parameters
- The method can be easily extended to GCMs applications

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Citation:
Massonnet, F., H. Goosse, T. Fichefet, and F. Counillon (2014), Calibration of sea ice dynamic parameters in an ocean-sea ice model using an ensemble Kalman filter, *J. Geophys. Res. Oceans*, *119*, 4168–4184, doi:10.1002/2013JC009705.

Received 7 DEC 2013
Accepted 16 JUN 2014
Accepted article online 18 JUN 2014
Published online 8 JUL 2014

Abstract The choice of parameter values is crucial in the course of sea ice model development, since parameters largely affect the modeled mean sea ice state. Manual tuning of parameters will soon become impractical, as sea ice models will likely include more parameters to calibrate, leading to an exponential increase of the number of possible combinations to test. Objective and automatic methods for parameter calibration are thus progressively called on to replace the traditional heuristic, "trial-and-error" recipes. Here a method for calibration of parameters based on the ensemble Kalman filter is implemented, tested and validated in the ocean-sea ice model NEMO-LIM3. Three dynamic parameters are calibrated: the ice strength parameter P^*, the ocean-sea ice drag parameter C_w, and the atmosphere-sea ice drag parameter C_a. In twin, perfect-model experiments, the default parameter values are retrieved within 1 year of simulation. Using 2007–2012 real sea ice drift data, the calibration of the ice strength parameter P^* and the oceanic drag parameter C_w improves clearly the Arctic sea ice drift properties. It is found that the estimation of the atmospheric drag C_a is not necessary if P^* and C_w are already estimated. The large reduction in the sea ice speed bias with calibrated parameters comes with a slight overestimation of the winter sea ice areal export through Fram Strait and a slight improvement in the sea ice thickness distribution. Overall, the estimation of parameters with the ensemble Kalman filter represents an encouraging alternative to manual tuning for ocean-sea ice models.

The road to writing a scientific paper

PLAN IT | **DESIGN IT** | DRAFT IT | REWRITE IT

Step 3. Draft a full plan, up to the paragraph level

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jgr_structure_revisited.txt

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STRUCTURE OF THE DOCUMENT

1. Introduction [Foreword+Context+Need]
---------------------------------------
1§ Foreword
    Theorem: Climate model development faces a paradox / uncomfortable situation
        - Models get more and more complex, with more and more parameters (cite...)
        - The choice or parameters is still obscure (Mauritsen)
        - But these parameters define the model climate (Annan)
        - This is not going to get better (Sumata)

2§ Context: sea ice modelling
    Theorem: Sea ice modelling is a good illustration of such a problematic
        - It is a complex and non linear system
        - Sea ice is highly sensitive to its parameters in models (Kim)
        - Significant biases still exist in coupled and forced mode. In particular, drift is not well
        simulated but important.

3§ Need
    Theorem: We need robust and objective methods for parameter calibration at reasonable cost in
    complex models
        - This is not the case in the sea ice community. Only 3 studies optimize the stuff
        systematically
        - NEMO-LIM3 is a good test-case: it typically misses the high-frequency drift statistics.
        With 3 key parameters, each ~20 possibilities, it is not conceivable to run 8000 simulations
        to make the assessment.

4§ Structure of the paper

2. Methods [Task]
-----------------
```

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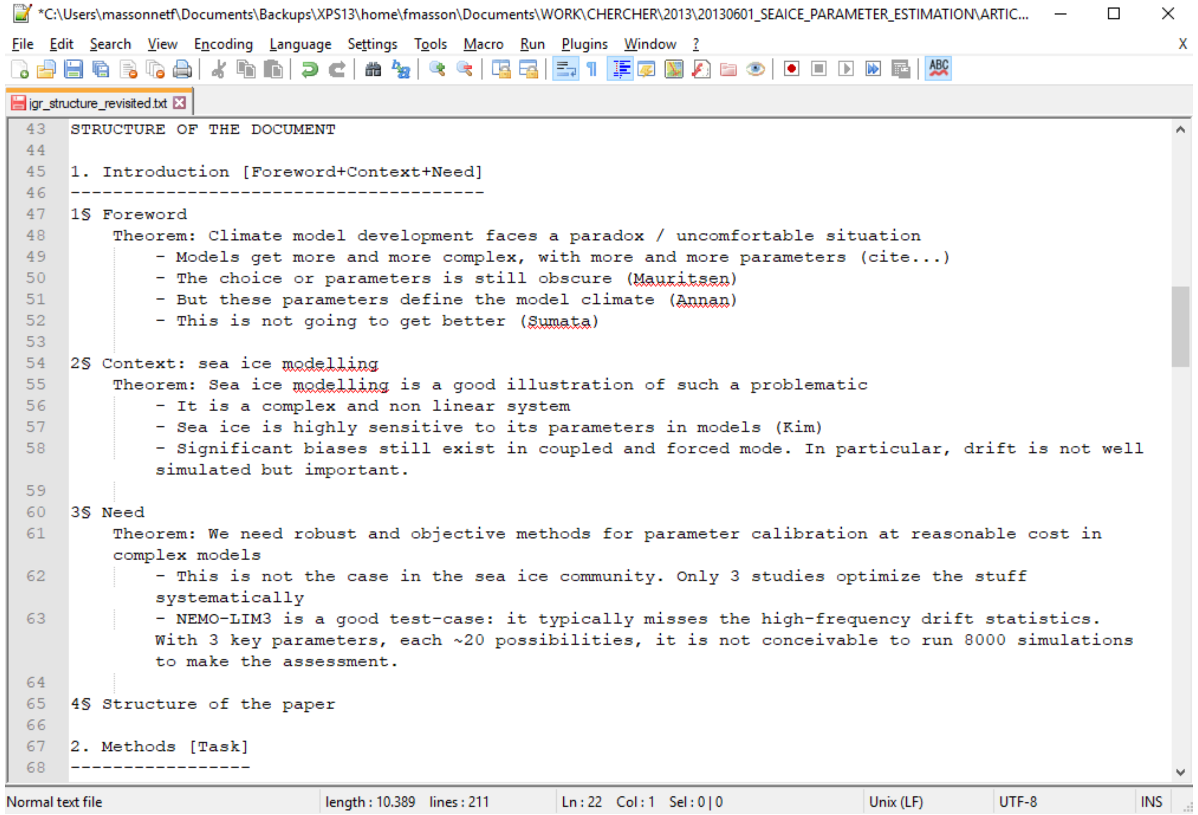
For each paragraph, formulate a « theorem », that is, a statement.

List cited literature

Then lay out as bullet points the arguments that support the statement

Each paragraph conveys a unique message

Step 3. Draft a full plan, up to the paragraph level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File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

igr_structure_revisited.txt

```
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Normal text file | length : 10.389 lines : 211 | Ln : 22 Col : 1 Sel : 0 | 0 | Unix (LF) | UTF-8 | INS

Producing that document is **key**. It will be your cheat-sheet when you will be writing a first draft and it **will save you a lot of time.**

Step 4. Choose yourself a title

Which version do you prefer? Why?

REVIEW

doi:10.1038/nature14956

Numerical weather prediction: recent advances and future directions

Peter Bauer[1], Alan Thorpe[1] & Gilbert Brunet[2]

REVIEW

doi:10.1038/nature14956

The quiet revolution of numerical weather prediction

Peter Bauer[1], Alan Thorpe[1] & Gilbert Brunet[2]

The road to writing a scientific paper

Plan it Design it **Draft it** Rewrite it

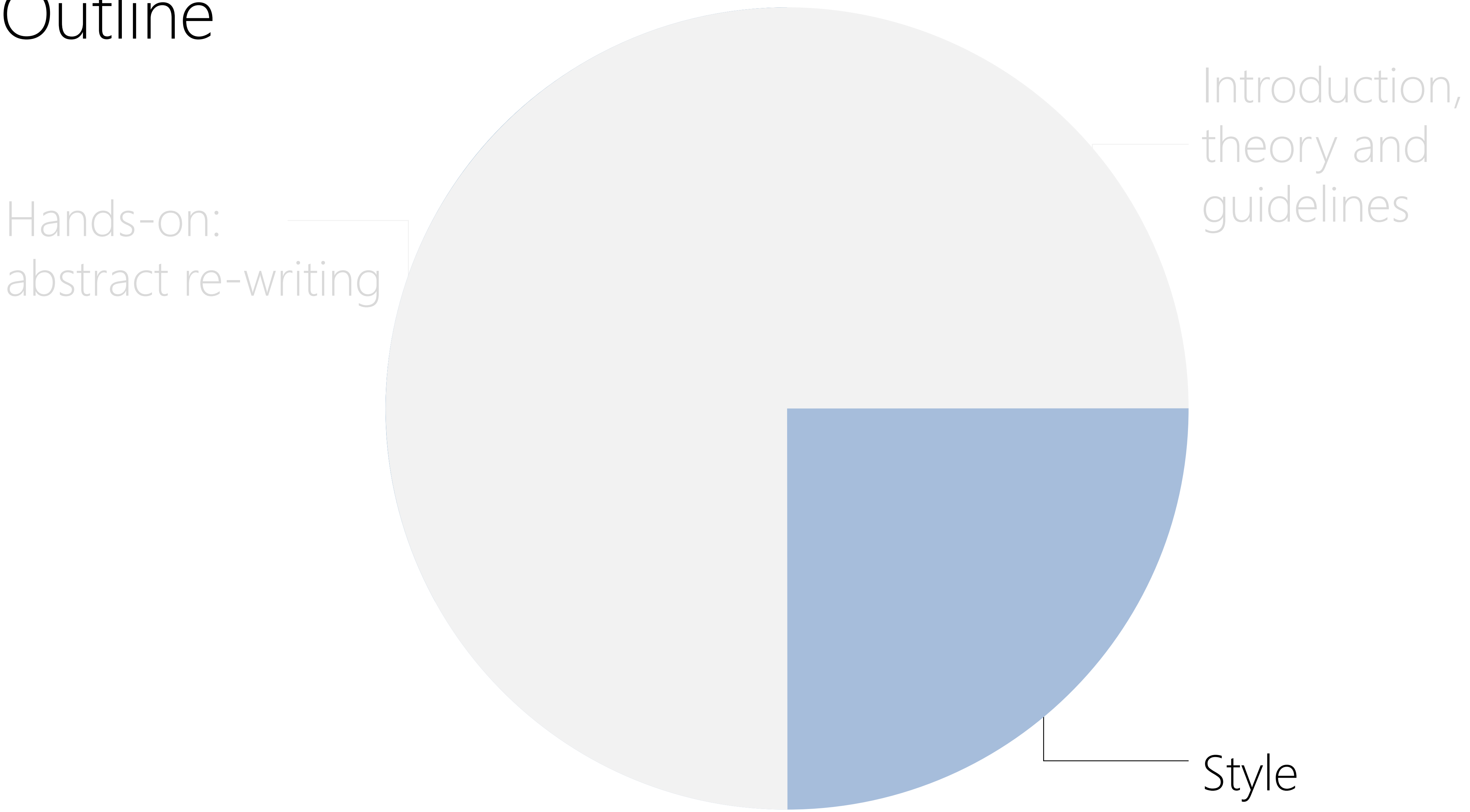
Step 5. Give your manuscript a first shot

- Don’t pay attention to style
- Make sure you follow your own plan
- Try to spend as little time as possible on writing

The road to writing a scientific paper

Plan it → Design it → Draft it → **Rewrite it**

Outline


Introduction,
theory and
guidelines
Hands-on:
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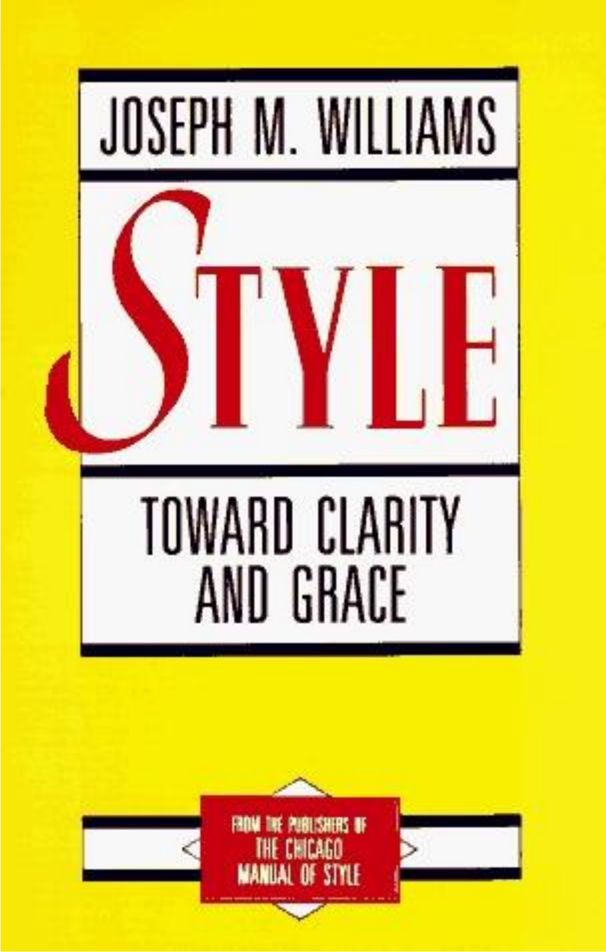
Style

3. Style


JOSEPH M. WILLIAMS
STYLE
TOWARD CLARITY AND GRACE
FROM THE PUBLISHERS OF THE CHICAGO MANUAL OF STYLE

Identify what you like in other authors' styles

coordinated experimentation by specifying identical sea-ice loss in different models. We call for a collaborative approach to future model experiments.

The atmospheric response to sea-ice loss may also depend on the background state. Sensitivity studies have identified appreciably different atmospheric responses depending on the prescribed SSTs[49], the phase of multi-decadal climate variability[50,51] and biases in the models' mean state[16]. However, McCusker and co-authors[24] found a robust atmospheric response to sea-ice loss across two different climate states, one representing a pre-industrial climate and the other a warmer climate with doubled atmospheric CO_2 concentration. Further work is required to understand why the response to sea-ice loss appears sensitive to certain mean state differences and not to others. We conjecture that the spatial pattern of the mean state differences might be critical.

Sensitivity of the large-scale atmospheric circulation response to both the location of sea-ice loss and the background state can partly be explained by wave–mean flow interaction. One

The idea conveyed by the paragraph is stated right away

The paragraph alternates long sentences to reflect more complex ideas…

… and shorter ones to reflect more simple ones.

From Screen et et al., Nature Geosci., 2018

Strive for brevity

« Sensitivity to disturbances resulting from a noisy environment has ben observed in quantum computers »

From Carolyn Newey's training on scientific writing, July 2015, Barcelona

Strive for brevity

« Sensitivity to disturbances resulting from a noisy environment ***has been observed*** in quantum computers »

From Carolyn Newey’s training on scientific writing, July 2015, Barcelona

Strive for brevity

« Sensitivity to disturbances resulting from a noisy environment has ben observed in quantum computers »

« Quantum computers are sensitive to noisy environments »

From Carolyn Newey’s training on scientific writing, July 2015, Barcelona

Strive for brevity

« It has been reported in several studies in the literature that several vaccine doses are required for the induction of long-term protection »

From Carolyn Newey’s training on scientific writing, July 2015, Barcelona

Strive for brevity

« It has been reported in several studies in the literature that several vaccine doses are required for the induction of long-term protection »

« According to several studies, vaccine doses are required for long-term protection»

From Carolyn Newey's training on scientific writing, July 2015, Barcelona

Strive for brevity

« In view of the fact that solar energy is not yet fully developed at the present time, we will have to continue utilizing fossil fuels well into the next century »

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Strive for brevity

« In view of the fact that solar energy is not yet fully developed at the present time, we will have to continue utilizing fossil fuels well into the next century »

« We will have to use fossil fuels as long as solar energy is not yet fully developed »

From Carolyn Newey's training on scientific writing, July 2015, Barcelona

Strive for parallel structures

« At weekends, I like hiking, the cinema, and to sit and do nothing »

From Carolyn Newey's training on scientific writing, July 2015, Barcelona

Strive for parallel structures

« At weekends, I like hiking, the cinema, and to sit and do nothing »

« At weekends, I like to hike, to go to the movies, and to sit and do nothing »

From Carolyn Newey's training on scientific writing, July 2015, Barcelona

Strive for parallel structures

« We used the Chi square test to compare clinical data between phenotypes and genotypes, while comparisons of the degree of fatty infiltration in each muscle were made with the Mann-Whitney test »

From Carolyn Newey’s training on scientific writing, July 2015, Barcelona

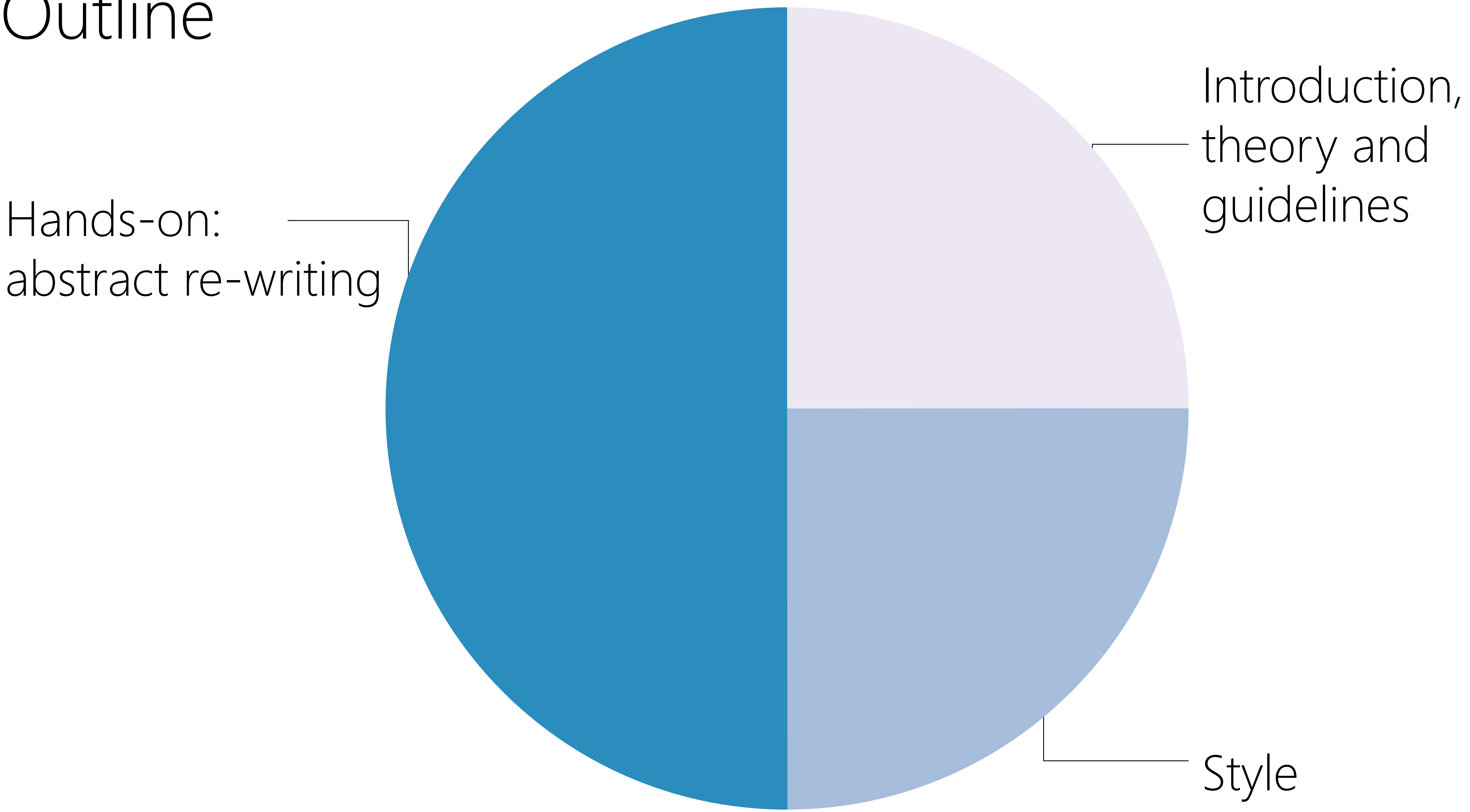
Strive for parallel structures

« We used the Chi square test to compare clinical data between phenotypes and genotypes, while comparisons of the degree of fatty infiltration in each muscle were made with the Mann-Whitney test »

« Phenotypes and genotypes were compared using a Chi square test while the degrees of fatty infiltration in each muscle were compared using a Mann-Whitney test»

From Carolyn Newey's training on scientific writing, July 2015, Barcelona

Outline


Introduction, theory and guidelines
Hands-on: abstract re-writing
Style

3. Hands-on: abstract re-writing

The Cryosphere, 5, 687–699, 2011
www.the-cryosphere.net/5/687/2011/
doi:10.5194/tc-5-687-2011

The Cryosphere

On the influence of model physics on simulations of Arctic and Antarctic sea ice

F. Massonnet, T. Fichefet, H. Goosse, M. Vancoppenolle, P. Mathiot, and C. König Beatty

Georges Lemaître Centre for Earth and Climate Research, Earth and Life Institute, Université Catholique de Louvain, Louvain-la-Neuve, Belgium

Received: 8 March 2011 – Published in The Cryosphere Discuss.: 15 April 2011
Revised: 3 August 2011 – Accepted: 20 August 2011 – Published: 2 September 2011

Abstract. Two hindcast (1983–2007) simulations are performed with the global, ocean-sea ice models NEMO-LIM2 and NEMO-LIM3 driven by atmospheric reanalyses and climatologies. The two simulations differ only in their sea ice component, while all other elements of experimental design (resolution, initial conditions, atmospheric forcing) are kept identical. The main differences in the sea ice models lie in the formulation of the subgrid-scale ice thickness distribution, of the thermodynamic processes, of the sea ice salinity and of the sea ice rheology. To assess the differences in model skill over the period of investigation, we develop a set of metrics for both hemispheres, comparing the main sea ice variables (concentration, thickness and drift) to available observations and focusing on both mean state and seasonal to interannual variability. Based upon these metrics, we discuss the physical processes potentially responsible for the differences in model skill. In particular, we suggest that (i) a detailed representation of the ice thickness distribution increases the seasonal to interannual variability of ice extent, with spectacular improvement for the simulation of the recent observed summer Arctic sea ice retreats, (ii) the elastic-viscous-plastic rheology enhances the response of ice to wind stress, compared to the classical viscous-plastic approach, (iii) the grid formulation and the air-sea ice drag coefficient affect the simulated ice export through Fram Strait and the ice accumulation along the Canadian Archipelago, and (iv) both models show less skill in the Southern Ocean, probably due to the low quality of the reanalyses in this region and to the absence of important small-scale oceanic processes at the models' resolution ($\sim 1°$).

1 Introduction

Current General Circulation Models (GCMs) show large intermodel spread in simulating future (decadal to centennial) characteristics of sea ice (Zhang and Walsh, 2005; Arzel et al., 2006). This disagreement appears for both sea ice extent and volume, with an even more striking scatter in the Southern Hemishpere (Flato, 2004; Lefebvre and Goosse, 2008). In addition, most of those GCMs present large discrepancies with respect to observations over the last decades, in terms of mean seasonal cycle as well as interannual variability, for both hemispheres (Parkinson et al., 2006; Arzel et al., 2006; Holland and Raphael, 2006; Connolley and Bracegirdle, 2007; Lefebvre and Goosse, 2008; Stroeve et al., 2007).

The sources of this spread are manifold. First, the ability of GCMs to reproduce the observed atmospheric state is not always satisfactory. Bitz et al. (2002) show that the biases in Arctic surface pressure and winds create anomalous ice exports and thickness patterns. Holland and Raphael (2006) come to similar conclusions for the Southern Hemisphere (SH). In the Northern Hemisphere (NH), errors in simulated air temperatures, precipitation rates, clouds and humidities are other well-known sources of spread in GCMs (Walsh et al., 2002). Second, the initial conditions, and in particular those of the Southern Ocean, are important for the multi-decadal evolution of sea ice (Goosse and Rensen, 2005) but are still uncertain. Third, the model equations are solved differently from one model to another, using different numerical methods and horizontal and/or vertical resolutions

Two hindcast (1983-2007) simulations are performed with the global, ocean-sea ice models NEMO-LIM2 and NEMO-LIM3 driven by atmospheric reanalyses and climatologies. The two simulations differ only in their sea ice component, while all other elements of experimental design (resolution, initial conditions, atmospheric forcing) are kept identical. The main differences in the sea ice models lie in the formulation of the subgrid-scale ice thickness distribution, of the thermodynamic processes, of the sea ice salinity and of the sea ice rheology. To assess the differences in model skill over the period of investigation, we develop a set of metrics for both hemispheres, comparing the main sea ice variables (concentration, thickness and drift) to available observations and focusing on both mean state and seasonal to interannual variability. Based upon these metrics, we discuss the physical processes potentially responsible for the differences in model skill. In particular, we suggest that (i) a detailed representation of the ice thickness distribution increases the seasonal to interannual variability of ice extent, with spectacular improvement for the simulation of the recent observed summer Arctic sea ice retreats, (ii) the elastic-viscous-plastic rheology enhances the response of ice to wind stress, compared to the classical viscous-plastic approach, (iii) the grid formulation and the air-sea ice drag coefficient affect the simulated ice export through Fram Strait and the ice accumulation along the Canadian Archipelago, and (iv) both models show less skill in the Southern Ocean, probably due to the low quality of the reanalyses in this region and to the absence of important small-scale oceanic processes at the models' resolution (~ 1°).

Why the hell did you do that??

Why does it matter to me?

All state-of-the-art general circulation models include a sea ice component and are therefore able to propose historical reconstructions and future projections of Arctic and Antarctic sea ice. However, the spread in such simulations remains large.

Foreword: Setting the scene: what are the general themes of the paper?

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Context: why is the scientific question is relevant *now*?

All state-of-the-art general circulation models include a sea ice component and are therefore able to propose historical reconstructions and future projections of Arctic and Antarctic sea ice. However, the spread in such simulations remains large. In the context of rapid climate changes happening at high latitudes

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Foreword: Setting the scene: what are the general themes of the paper?
Context: why is the scientific question is relevant *now*?
Need: What was missing before the paper was published?

All state-of-the-art general circulation models include a sea ice component and are therefore able to propose historical reconstructions and future projections of Arctic and Antarctic sea ice. However, the spread in such simulations remains large. In the context of rapid climate changes happening at high latitudes, it appears urgent to identify the origin of these uncertainties and to eventually reduce them.

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Context: why is the scientific question is relevant *now*?
Need: What was missing before the paper was published?

Task: what did we do to address the need?

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Object: what does the manuscript cover?

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Context: why is the scientific question is relevant *now*?

Need: What was missing before the paper was published?

Task: what did we do to address the need?

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Findings: what did the work reveal?

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The Cryosphere

On the influence of model physics on simulations of Arctic and Antarctic sea ice

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Abstract. Two hindcast (1983–2007) simulations are performed with the global, ocean-sea ice models NEMO-LIM2 and NEMO-LIM3 driven by atmospheric reanalyses and climatologies. The two simulations differ only in their sea ice component, while all other elements of experimental design (resolution, initial conditions, atmospheric forcing) are kept identical. The main differences in the sea ice models lie in the formulation of the subgrid-scale ice thickness distribution, of the thermodynamic processes, of the sea ice salinity and of the sea ice rheology. To assess the differences in model skill over the period of investigation, we develop a set of metrics for both hemispheres, comparing the main sea ice variables (concentration, thickness and drift) to available observations and focusing on both mean state and seasonal to interannual variability. Based upon these metrics, we discuss the physical processes potentially responsible for the differences in model skill. In particular, we suggest that (i) a detailed representation of the ice thickness distribution increases the seasonal to interannual variability of ice extent, with spectacular improvement for the simulation of the recent observed summer Arctic sea ice retreats, (ii) the elastic-viscous-plastic rheology enhances the response of ice to wind stress, compared to the classical viscous-plastic approach, (iii) the grid formulation and the air-sea ice drag coefficient affect the simulated ice export through Fram Strait and the ice accumulation along the Canadian Archipelago, and (iv) both models show less skill in the Southern Ocean, probably due to the low quality of the reanalyses in this region and to the absence of important small-scale oceanic processes at the models' resolution (~1°).

1 Introduction

Current General Circulation Models (GCMs) show large intermodel spread in simulating future (decadal to centennial) characteristics of sea ice (Zhang and Walsh, 2005; Arzel et al., 2006). This disagreement appears for both sea ice extent and volume, with an even more striking scatter in the Southern Hemishpere (Flato, 2004; Lefebvre and Goosse, 2008). In addition, most of those GCMs present large discrepancies with respect to observations over the last decades, in terms of mean seasonal cycle as well as interannual variability, for both hemispheres (Parkinson et al., 2006; Arzel et al., 2006; Holland and Raphael, 2006; Connolley and Bracegirdle, 2007; Lefebvre and Goosse, 2008; Stroeve et al., 2007).

The sources of this spread are manifold. First, the ability of GCMs to reproduce the observed atmospheric state is not always satisfactory. Bitz et al. (2002) show that the biases in Arctic surface pressure and winds create anomalous ice exports and thickness patterns. Holland and Raphael (2006) come to similar conclusions for the Southern Hemisphere (SH). In the Northern Hemisphere (NH), errors in simulated air temperatures, precipitation rates, clouds and humidities are other well-known sources of spread in GCMs (Walsh et al., 2002). Second, the initial conditions, and in particular those of the Southern Ocean, are important for the multi-decadal evolution of sea ice (Goosse and Rensen, 2005) but are still uncertain. Third, the model equations are solved differently from one model to another, using different numerical methods and horizontal and/or vertical resolutions

New abstract

General circulation models are primary tools for studying past and future sea ice changes. However, sea ice reconstructions and projections are marred by large uncertainties, the origins of which remain elusive. Reducing these uncertainties is a prerequisite to gain a better understanding of rapid high-latitude climate changes. Here, we explore model physics as a possible source of uncertainty on the simulated mean sea ice state and its variability. We run two retrospective (1983-2007) simulations with the global ocean—sea ice model NEMO-LIM. The simulations differ only by the sea ice model used; all other elements of experimental design (resolution, initial conditions, atmosphere) are kept identical. We assess the performance of the two simulations by introducing a new set of performance metrics. Metrics are quantitative estimates on the adequacy between main simulated sea ice variables (concentration, thickness, drift) and corresponding observational references. In the Arctic Ocean, we find that more advanced physics has an important impact on the sea ice cover, notably on the simulation of summer Arctic trends. By contrast, we find the influence of physics to be insignificant in the Southern Ocean, where the two model versions also have less skill than in the Arctic Ocean. We attribute these differences to the prevailing role of ocean processes in the Southern Ocean, and to the lower quality of atmospheric reanalyses than over the Arctic Ocean. These findings imply that model error is a non-negligible source of uncertainty in sea ice simulations and that efforts to develop sea ice models should be continued. The performance metrics developed in this work also open new avenues for a more systematic assessment of sea ice in climate models.

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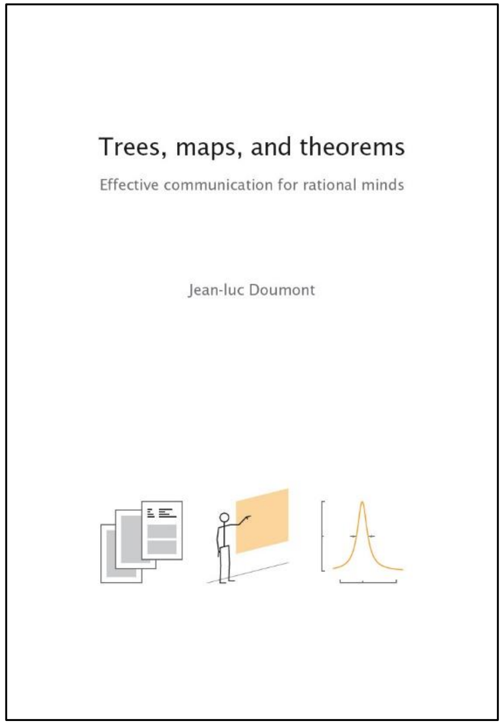

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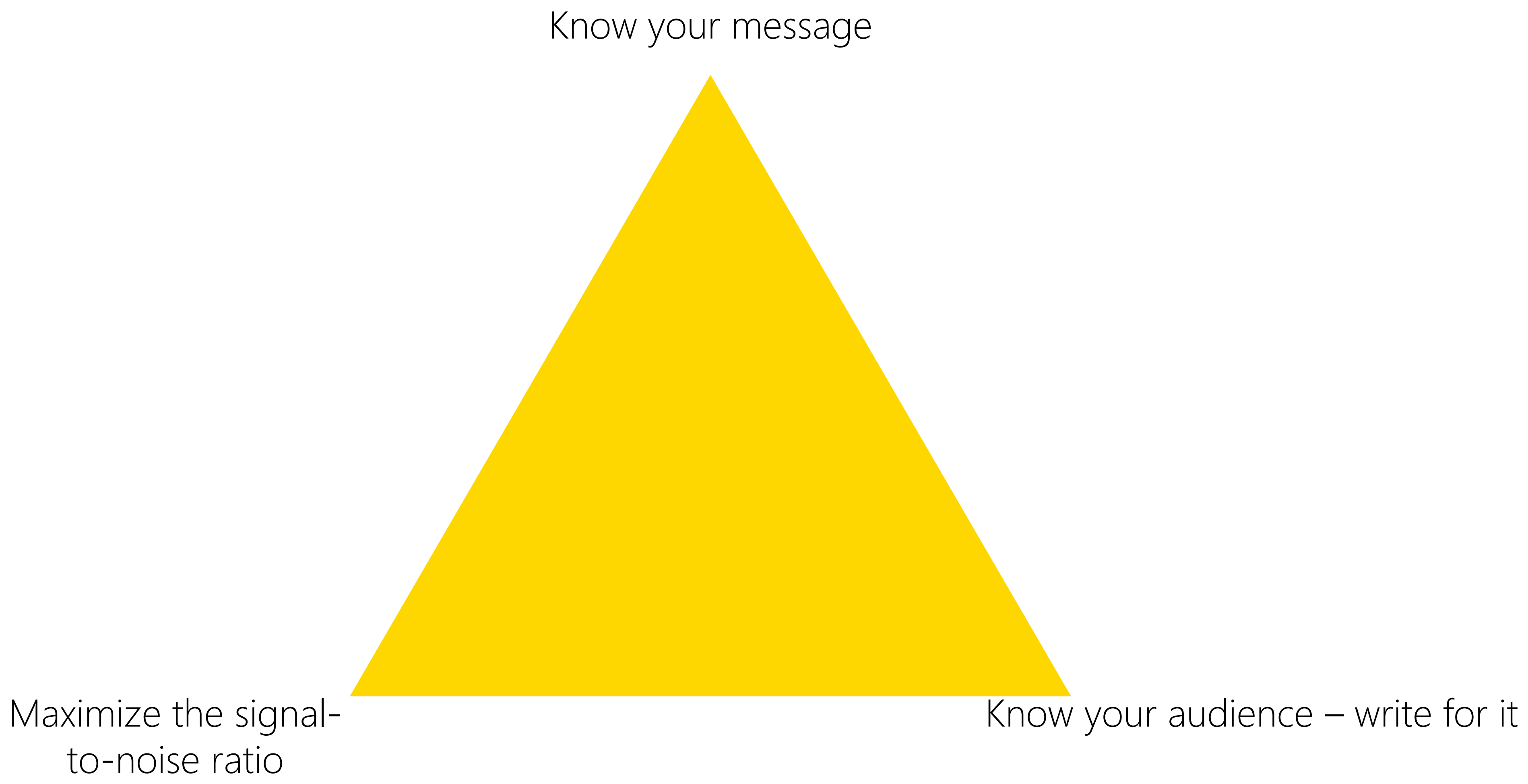

Retrospective self-assessment of my very first abstract (EGU General Assembly 2010)

Geophysical Research Abstracts
Vol. 12, EGU2010-6312, 2010
EGU General Assembly 2010

Comparative study of Arctic sea ice response from NEMO-LIM3 to two different atmospheric forcings

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Sea ice plays a key role within the climate system as it is, e.g., an efficient barrier to transfers of heat, mass and momentum between atmosphere and ocean. In order to simulate the observed sea ice state, global Ocean General Circulation Models (OGCMs) must benefit from good quality atmospheric forcings. NEMO-LIM3 is one of those OGCMs. This model results from the coupling of the sea ice model LIM3 with the ocean model OPA. So far, the NCEP/NCAR reanalysis dataset (2-m atmospheric temperatures and 10-m wind speeds) has been used jointly with monthly climatologies of relative humidity, cloudiness and precipitation to set up and calibrate NEMO-LIM3. Clear biases in model outputs have been tentatively attributed to this forcing. Here, we investigate the consequences of using the ERA-40-based DFS4 forcing on an ORCA1 configuration (1° resolution), with focus on the Arctic sea ice. Using an adequate metric, we measure the discrepancies between the simulations resulting from the respective forcings. A particular attention is paid to the sea ice features along Siberia at the beginning of the 80s, as previous NEMO-LIM3 runs with the NCEP/NCAR forcing exhibit a significant overestimation of ice extent in this area during this time period.

https://meetingorganizer.copernicus.org/EGU2010/EGU2010-6312.pdf

The title is about what we did, but not about what be found

60% of the text is used to describe the context

The remaining 40% is used to explain what we did

0% of the text is used to explain why this matters.

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Journal of Geophysical Research: Oceans

RESEARCH ARTICLE

10.1002/2013JC009705

Key Points:

- We use an objective method for parameter calibration in an ocean-sea ice model
- Simulation of ice dynamics is improved with the new parameters
- The method can be easily extended to GCMs applications

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Calibration of sea ice dynamic parameters in an ocean-sea ice model using an ensemble Kalman filter

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Abstract The choice of parameter values is crucial in the course of sea ice model development, since parameters largely affect the modeled mean sea ice state. Manual tuning of parameters will soon become impractical, as sea ice models will likely include more parameters to calibrate, leading to an exponential increase of the number of possible combinations to test. Objective and automatic methods for parameter calibration are thus progressively called on to replace the traditional heuristic, "trial-and-error" recipes. Here a method for calibration of parameters based on the ensemble Kalman filter is implemented, tested and validated in the ocean-sea ice model NEMO-LIM3. Three dynamic parameters are calibrated: the ice strength parameter P^*, the ocean-sea ice drag parameter C_w, and the atmosphere-sea ice drag parameter C_a. In twin, perfect-model experiments, the default parameter values are retrieved within 1 year of simulation. Using 2007–2012 real sea ice drift data, the calibration of the ice strength parameter P^* and the oceanic drag parameter C_w improves clearly the Arctic sea ice drift properties. It is found that the estimation of the atmospheric drag C_a is not necessary if P^* and C_w are already estimated. The large reduction in the sea ice speed bias with calibrated parameters comes with a slight overestimation of the winter sea ice areal export through Fram Strait and a slight improvement in the sea ice thickness distribution. Overall, the estimation of parameters with the ensemble Kalman filter represents an encouraging alternative to manual tuning for ocean-sea ice models.

Communication is a two-way process: if authors do not know themselves what they want to write, readers cannot second-guess