



EGU 2011
Short Course

How to write (and publish) a scientific paper in hydrology

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meetingorganizer.copernicus.org/EGU2011/session/6622

Room 39

5 Apr, 2011 17:30–19:00

Target group of this presentation: Early stage researchers (doing their PhD)

→ Doing research in hydrology is an **art** (see Savenije, 2009)

→ But writing a paper is a **skill**
(i.e. simple but needs some practice)



Also see excellent talks from previous years:
Demetris Koutsoyiannis and Jeff McDonnell

hs.egu.eu

(I used some of their ideas)



My own experiences come from

- Paper writing
- Helping my PhD students & Post Docs to write their papers
- Reviewing papers
- Editor/Associate Editor of 10+ Hydrology Journals

Some background of myself

1985 Diploma in Civil Engineering at TU Wien

1990 Doctorate in Hydrology

1992-1994 Visiting fellow in Canberra, Australia

1997 Assoc. Prof. of Hydrology

2007 Chair of Hydrology and Water Resources Management



Important in my career: Professional friends with **shared vision**

Examples:

Rodger Grayson.

Shared vision: Dynamic spatial patterns



Siva Sivapalan

Shared vision: Scale as a framework



1. How to write a paper

Why would you like to write a paper?

- **Formal** goal: In fulfilment of doing a PhD. Note: A PhD thesis typically consists of 4 journal papers + introduction
- **Idealistic** goal: To contribute to the international body of knowledge, to assist others so they can build on your work
- **Career** goal: Get a job, succeed in academia, become influential, ..

My recommendation:

Tell the reader something that is **useful** to him/her

This will address all 3 goals.

Recommended approach: **Take the readers' perspective**

Who is the readership?

- Mostly: Hydrologists like yourself
- Or: Practitioners (require different message, style, ..)
- Or: General public (again, different message, style, ..)

Reader's perspective means:

- Make paper **useful** to the type of reader your are envisaging
Example: Focus on Take Home Message (THM, see later)

- Make the paper **clear** (and concise) for the type of reader your are envisaging

Example: Reader is likely familiar with hydrology (so no need to repeat hydrology 101 in the paper) but is not familiar with your data/method (do say exactly what you have been doing)

- Adjust the **style** to the readership

Example: Use technical language for fellow hydrologists, use every day language for general public

A stepwise guide to writing a paper

Step 1: Start with the “take home message” (THM)

Try to think what could be the things you have learned in your research that could be useful to hydrologists outside your group

This is an iterative process, as often you will have to do extra research to identify nice Take Home Messages.

Example (for a paper on regional flood frequency):

THM1: “Spatial distance is a better similarity measure than catchment attributes.”

THM2: “Auxiliary information improves spatial-distance based regionalisation.”

Do's and don'ts of THM

- Try to be quantitative

Example: “The normalised jack-knife validation error is 0.15 in 37 Austrian catchments for the period 1980-2010.”

- And again, try to be useful to others (by being quantitative and by generalisable messages)

Example: “In the wet catchments, regionalisation performance was significantly better than in the dry catchments (normalised errors of 0.12 and 0.23, respectively).”

- Avoid messages that are only relevant to yourself

Example: “The model provided an excellent fit to the data”

Note: You are happy that you made the model fit the data, but this is only relevant to others if it supports other model results.

Example: “The project was successful.”

Note: Rather present your results that imply you have done a good job, don't praise yourself.

Do's and don'ts of THM (cont'd)

- The THM should be “new”. Focus on the **new** thing (what sets it apart from the literature).

Example: “While most of previous regionalisation studies have used daily models, this papers analyses the model performance at an **hourly** time step.”

Special problem: Your research was part of an applied project and it is difficult for you to find what is new. Additional analyses are probably needed.

Example: Applying model for flood forecasting.

Additional analyses: Model performance as a function of catchment characteristics



Step 2: Formulate science question

This is simple once the THM is identified. For the above THM the science questions (SQs) are.

SQ1: Is spatial distance a better similarity measure than catchment attributes?

SQ2: What is the value of auxiliary information in flood regionalisation?

Note: The easiest way for a reviewer to kill your paper is to say there is no science question. So make it explicit (in the introduction, see later).

Step 3: Write a preliminary title and select journal, select authors

Title:

- Should address the **science question**
- **Specific** titles should be preferred over general titles

Journal: See later (how to publish a paper)

Authorship:

- First author: **Who actually did the work**, usually the doctoral student
- Last author: Senior author, supervisor
- Who deserves to be a co-author? Those contributing to paper, including ideas (when in doubt be inclusive)

So this is what your document should now look like:

Flood Frequency regionalisation – spatial proximity vs. catchment attributes

Author 1, Author 2

To be submitted to *Hydrol. Earth. Sys. Science*

TAKE HOME MESSAGE:

- Spatial distance is a better similarity measure than catchment attributes
- Auxiliary information improves spatial distance based regionalisation
- Uncertainty due to short observation periods is important

Step 3: Write a preliminary abstract

Part 1: Context (no more than 1 sentence, can be omitted)

“Estimating flood frequencies is important for .. “

Part 2: Methods and data (i.e. what you did) (should be no more than 1/3 of abstract)

“We examine the predictive performance of various flood regionalisation methods for the ungauged catchment case, based on a jack-knifing comparison of locally estimated and regionalised flood quantiles for 575 Austrian catchments, 122 of which have a record length of 40 years or more.”

Part 3: Results (should be at least 1/3 of abstract), be quantitative

“The main result is that spatial proximity is a significantly better predictor of regional flood frequencies than are catchment attributes (normalised errors of 0.11 and 0.23, respectively). ... A stratified analysis suggests that in wet catchments all regionalisation methods perform better than they do in dry catchments.”

Note: The results include the THM. They are of most use to the reader, so should represent the main part of the abstract.

Part 4: Discussion/outlook (no more than 1 sentence, can be omitted)

“Implications for hydrological modelling are discussed” or
“Further work will focus on .. “

Step 4: Make an outline of the paper including the figures

Outline:

- Introduction
- Data
- Model (data and model can be combined into methods)
- Results
- Discussion
- Conclusions (last 2 can be combined)

Example: Draft paper by Magdalena Rogger



.. then assign the figures to the sections of the paper

(see her talk Wednesday 9:15 room 36)

12.211
ROGGER Step changes in the ff curve - process controls

Fig. 1



Obs. step changes

(intro)

Fig. 2



contaminants)

Fig. 3

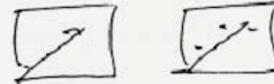
Photo / histological info

Fig. 4



caliber / valist

Fig. 5



scatter

Fig. 6



Fig. 7



Fig. 8



Fig. 9



Toy model

Fig. 10



schematic ff fitting

Step 5: Write Introduction

Part 1: **Context** (This is the “wall where to hang the picture” - the picture is your paper)

Example: “Analysing flood response is important from both practical and theoretical perspectives. From a practical ..”

Part 2: State the **issue** (this must relate to your THM!)

Example: “However, it is unclear what is the best method for estimating flood flow in ungauged catchments ..”

Part 3: State what others in the **literature** have found on this issue

Example: “Results of Pfaundler (2001) suggest that flood regionalisation errors using the ROI method are less than 0.20 for the 50 Swiss catchments he examined. However, this is at variance with Tasker”

Part 3 (cont'd):

Important!!!!: Do not write about your topic in general, but summarise findings in the literature **on the science question**.

There is little value in writing: “Tasker (1987), Pfaundler (2001), Stedinger (1995) applied regional flood estimation methods” because reader learns little from it.

Much better to write **what they found**. Summarise **their** Take Home Messages in the context of your science question.

This part should be organised by science questions (or sub-science questions – science questions split into parts) in a similar way as the discussion section (see later).

This part can be 2-3 pages.

Part 4: State the **purpose** of the paper

This is identical with the science question you identified earlier.

Example: “The aim of the paper is to assess the relative performance of methods based on spatial distance and methods based on catchment attributes”

Note: The easiest way for a reviewer to kill your paper is to say there is no science question. **So make it explicit.**

Start the sentence with

“The aim of this paper is ..“, “The objective of the paper is ..”

or something similar, so it is clear to the reader what you are trying to achieve in this paper.

Part 5 (usually omitted): Readers' guide

Perhaps summarise structure of paper to guide the reader but avoid writing a summary (including methods, findings) of the paper.

Example: “Section 2 presents the data used in the study, section 3 summarises the model ..”

Step 6: Write data section

Strike a balance of what would be of interest to the reader and what would not.

Avoid general statements (that can be found in a text book).

Example: “A raingauge consists of a cylindrical container ...”

But give the local details of your data, including study area, geographical location, number of stations, record length, experimental setup etc.

Example: “We used a Hellmann XX raingauge Type YY”

Step 7: Write model section

The same principles apply as for the data section, i.e. avoid general statements but give the details of what you actually did.

Reader will have knowledge of hydrology but is not familiar with the particularities of your study.

Again, say what **you** did.

Examples: Avoid: “can be calculated”, “may be analysed”

Rather say: “We calculated”, “In this study we analysed ... “

If the model description is long it can go into an appendix.

Step 8: Write results section

Summarise the findings of your research.

This sections contains most of the figures (with the results).

State the facts, no speculation is allowed here.

The results section follows the order of the figures.

Example: “Fig. 3 shows the error statistics of regionalising the 100 year floods using the ROI method. As can be seen from the figure, the errors tend to decrease with ..”

Step 9: Write discussion section

Here you **interpret** your findings in the light of the literature.

Need to **connect** partial findings of your paper to each other.

Also need to **connect** your findings to the literature.

Are your results consistent with the literature? Why? Why not?

Give the reasons. Just stating that they are different is not enough. You need to say why.

Example: “Unlike Pfaundler (2001) the results in this study indicate that the geostatistical method outperforms the ROI method. The difference in the two studies are likely **due** to .. “

Some speculation is allowed here, provided you are explicit about it.

Discussion section often organised differently from results section (but not always).

- Results section: organise by figures (the way you did the analysis)
- Discussion section: organise by sub-science questions.

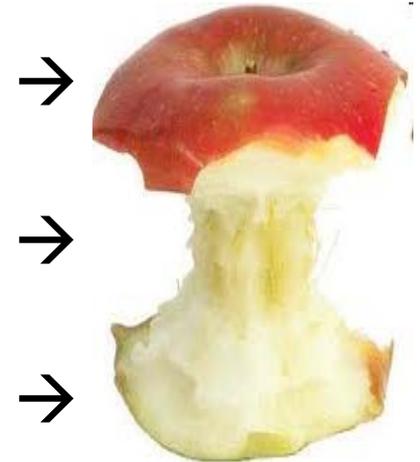
Example: “The results in this paper indicated that spatial distance is a better similarity measure than catchment attributes. ...” This relates to THM1.

Then in the next paragraph you can write:

“We also found that auxiliary information improves spatial distance based regionalisation. This would be expected as Merz et al. (2004) ...” This relates to THM2.

Paper is symmetric (apple core)

- Introduction: literature with interpretation
- Data/model and results: hard facts (what you did and what you found)
- Discussion: literature with interpretation and connected to your results



coreeducationllc.com

Note: As an indication of the symmetry, the introduction and discussion sections should relate to similar references.

- Introduction & discussion sections correspond
- Data/model & results sections correspond

Step 10: Write conclusions

These are the THMs.

You can add an outlook at the end of the paper (not more than 2-3 sentences).

Example: “Future work will focus on .. “

Most people state here what they are planning for their next paper.

Note: Papers that have been written with this framework in mind can be downloaded from: www.hydro.tuwien.ac.at/forschung/publikationen/download-journal-publications.html

Step 11: Go through the entire manuscript

... a couple of times until you are happy with it.

Step 12: Ask your co-authors/colleagues/supervisor to read through the manuscript

They will likely come back with questions (2 types):

(1) Clarification: They did not understand part of what you are writing.

Now the ball is in **your** court. **You** need to write the manuscript in the way they understand it. If they do not understand it, change the paper rather than argue with them.

(2) Methodological problems: Some discussion is needed, and possibly corrections/additional analyses.

Note: The same things apply to the review process.

Now the paper is ready for submission.

2. How to publish a paper

Why is publishing important for you?

- In academia you are mainly judged by the quality and quantity of your journal papers

Note: Do not bother with conference proceedings.

Main bibliometric criteria:

- Number of papers (not very useful, but often used)
- Quality of the journals you are publishing (ISI Impact factor)
- Number of citations you get for your papers

→ Choice of journal?

→ How to get cited?

Top hydrology journals (by ISI impact factor)

<i>Journal</i>	<i>Impact factor</i>
Hydrol Earth Syst Sc	2.46
Water Resour Res	2.45
J Hydrol	2.43
Adv Water Resour	2.35
J Contam Hydrol	2.01
Vadose Zone J	1.99
Hydrol Process	1.87
Ground Water	1.83
Hydrolog Sci J	1.42
Hydrol Res	0.65



Note: These are all very good journals.

Note: Impact factor is a measure of how often papers in that journal are cited.

Choice of journal

Other considerations than ISI impact factor often more important for journal choice

Examples of how I am choosing journals:

Hydrol Earth Syst Sc	→ fast, transparent reviews
Water Resour Res	→ methods
J Hydrol	→ case studies
Adv Water Resour	→ methods
Hydrol Process	→ field studies
Hydrolog Sci J	→ developing countries
Hydrol Res	→ cold regions

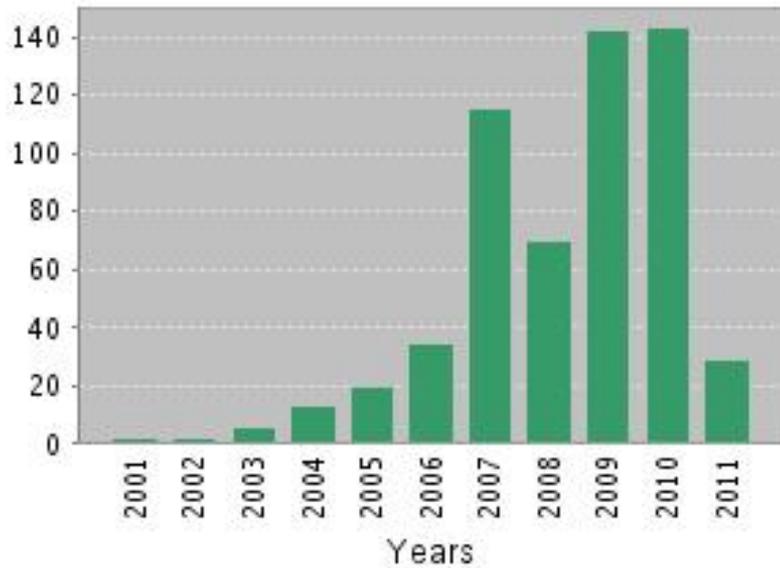
How to get cited?

- Tell reader something that is **useful** to him/her (see THM)
Example: New method that is likely to be used such as van Genuchten infiltration equation
- Chose **topic** that is of much interest (if you can)
Example: Estimating runoff model parameters in ungauged catchment related to GIS (browse Scopus or ISI Web for citations).
- Chose appealing **title**: Science question is often good title
Example: Is spatial distance a better similarity measure than catchment attributes?
- Perhaps consider to write a **review paper**. These are very well cited but a lot of work.

Example: Citations of publications of two newly appointed hydrology professors in Europe

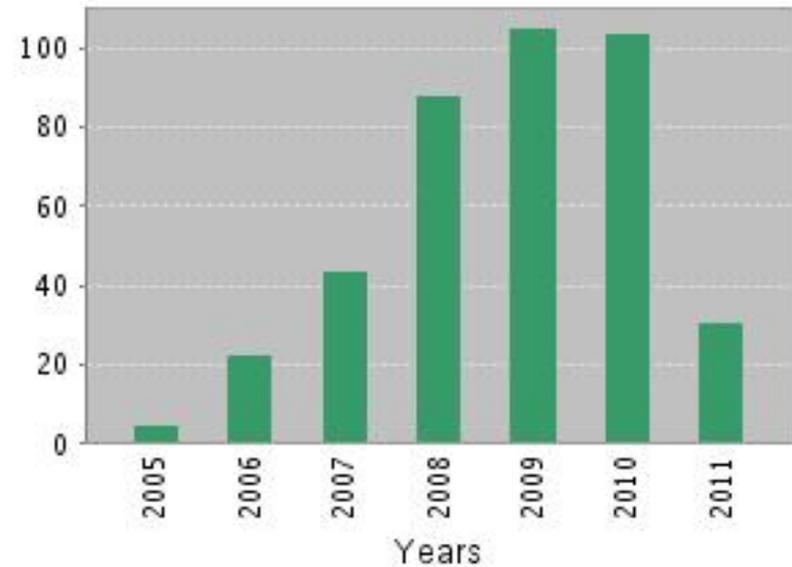
Professor X

Citations in Each Year



Professor Y

Citations in Each Year



The editorial/review process

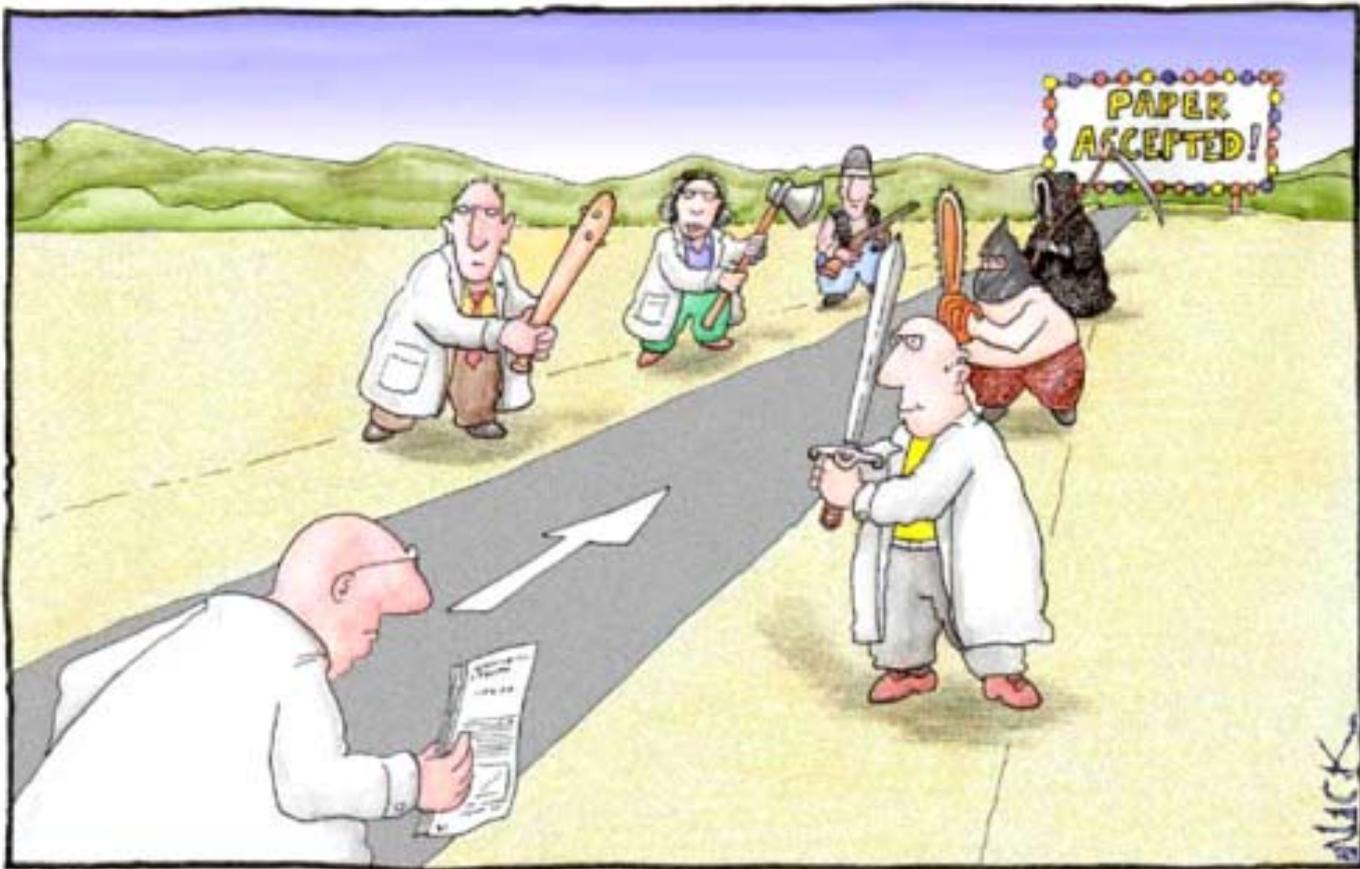
- (1) Submit paper to journal
- (2) Paper is sent out by editor to 2-3 reviewers
- (3) Editor gets back to you with the (anonymous) review comments
- (4a) Respond to review comments and revise paper
- (4b) Paper was rejected
- (5a) Paper will possibly be re-reviewed with re-revision
- (6a) Paper accepted
- (7a) Type setting, you need to check proofs
- (8a) Paper published in journal

Note: Entire process may take 0.5 – 2 years

How to deal with reviews

Decision of Editor is usually either:

- Minor changes (requiring text changes)
- Major changes (requiring additional analyses)
- Reject



How to deal with reviews (cont'd)

Possible concerns of reviewers:

- (1) Clarification, language
- (2) Methodological problems
- (3) Science question / relevance is unclear

(Strong) recommendation: **You** need to write manuscript in the way reviewers understand it. If they do not understand it, change the paper rather than argue with them.

Note: There are exceptions of poor reviews. Also, reviews are often not well correlated.

How to deal with reviews (cont'd)

Recommendation: Take the reviewers' concerns seriously.

Their task is (a) **screening** and (b) **improving** your paper.

Papers can always be improved!

Prepare a detailed list of how you respond to **each** review comment (and send it to Editor along with revision).

Example (reviewer comments in *italics*, response in plain font):

“However, it seems unclear how the split sample test was performed given that only 3 yrs of data were available”.

“This issue was indeed unclear in the original paper. We have clarified it by stating that the split sample test was performed on data from neighbouring catchments.”

How to deal with reviews (cont'd)

If you disagree with a review comment you may say so and not change this aspect of your paper but explain why. Do not argue but state your view.

Example (reviewer comments in *italics*, response in plain font):

“L as used on p. 12 of the manuscript is not a formal likelihood function. The paper is therefore flawed”.

“We believe L is indeed a formal likelihood function. This is **because** ... We have therefore chosen not to change this aspect of the paper.”

The editor will tend to side with the reviewers, so explain it well. Also do not disagree with too many items of the reviewers (<20%), as you will lose credibility.

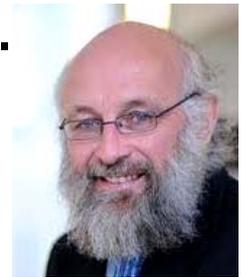
How to deal with rejections



How to deal with rejections

- (1) Redo the analysis in a way suggested by the reviewers, more data, changed methodology, ...
- (2) Possibly combine 2 pieces of research to make a more substantial contribution.
- (3) Chose a different journal. **Caveat:** Do not submit the paper to a different journal unchanged!
 - Chances are it goes to the same reviewers
 - Take advantage of what the reviewers told you
- (4) Try something else if you are not convinced about paper
- (5) Don't give up if your are convinced though!! Some of the most influential papers have been rejected at first.

Example: Beven (1989)



Once your paper gets accepted

Share your happiness with your colleagues and friends



forgottenclassicsofyesteryear.blogspot.com

... and think about your next paper

Final suggestions

- (1) **Go for it!** Journal papers will be extremely important for you if you intend to pursue an academic career.
- (2) Take the **readers' perspective**. Tell the reader something that is **useful** to him/her.
- (3) Know the **literature!** .. to the point where you have read everything related to your sub-topic.
- (4) **Take reviewers seriously** but do not get disappointed if they disagree with you (part of the quality assurance).
- (5) Most universities have **writing clinics / courses** to help with style/language – make use of them.
- (6) Paper writing is a **skill**, so it is simple but needs some practice.