Introduction to Science Communication: from paper to press release (or blog post)

Bárbara Ferreira

EGU Media and Communications Manager

Science Communication Workshop (#EGUscicomm), EGU General Assembly

Vienna, Austria | Thursday, 1 May 2014

Contact: media@egu.eu

Variability of black-hole accretion discs: a theoretical study

[redacted]

(Submitted on 11 Oct 2010)

This thesis investigates phenomena occurring in black-hole accretion discs which are likely to induce high-frequency quasi-periodic variability. Two classes of pseudo-relativistic theoretical models are studied. The first is based on the stability of transonic accretion flows and its connection to a disc instability that takes the form of propagating waves (viscous overstability). The second class of models looks at accretion-disc oscillations which are trapped due to the non-monotonic variation of the epicyclic frequency in relativistic flows. In particular, it focuses on inertial waves trapped below the maximum of the epicyclic frequency which are excited in deformed, warped or eccentric, discs. The influence of a transonic background on the propagation of these inertial modes is also investigated.

Comments:	PhD thesis, 199 pages, 32 figures. For higher quality images, please contact the author
Subjects:	**Solar and Stellar Astrophysics (astro-ph.SR)**; Astrophysics of Galaxies (astro-ph.GA)
Cite as:	**arXiv:1010.2259 [astro-ph.SR]**
	(or **arXiv:1010.2259v1 [astro-ph.SR]** for this version)

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Know your audience!

When you communicate science, no one else is more important than your audience. You might feel like talking or writing about your research but they don't have to listen or read what you are trying to communicate. Make an effort to keep them engaged with each sentence you say or write.

European Geosciences Union

Nat. Hazards Earth Syst. Sci., 13, 1285–1292, 2013
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Natural Hazards and Earth System Sciences
Open Access

Instant tsunami early warning based on real-time GPS – Tohoku 2011 case study

A. Hoe

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Scientists

Received: 20 November 2012 – Published in Nat. Hazards Earth Syst. Sci. Discuss.: –
Revised: 29 March 2013 – Accepted: 18 April 2013 – Published: 17 May 2013

Abstract. Taking the 2011 Tohoku earthquake as an example, we demonstrate the ability of real-time GPS to provide qualified tsunami early warning within minutes. While in earlier studies we demonstrated the power of the so-called GPS shield concept based on synthetic data, we here present a complete processing chain starting from actual GPS raw data and fully simulate the situation as it would be in a warning center. The procedure includes processing of GPS observations with predicted high precision orbits, inversion for slip and computation of the tsunami propagation and coastal warning levels. We show that in case of the Tohoku earthquake, it would be feasible to provide accurate tsunami warning as soon as 3 min after the beginning of the earthquake.

1 Introduction

1.1 The Tohoku earthquake and tsunami

The magnitude $M_W = 9.0$ Tohoku earthquake on 11 March 2011, with epicenter at 142.9° E 38.1° N (JMA) was the largest event ever instrumentally observed in Japan, and the fourth-largest world wide. In the last century, 22 earthquakes with magnitude between 7.5 and 8.3 occurred an hour, demonstrated run-ups exceeding 40 m (Mori et al., 2012) and locally inundated up to 5 km inland (Fujii et al., 2011). It caused more than 15 000 fatalities and massive devastation, including damage of the Fukushima nuclear power plant.

Due to numerous and various sensor networks deployed in Japan and in the Pacific, this event is now the most extensively recorded megathrust event ever. Coseismic deformation was recorded by the GEONET GPS array (GSI, 2011) and deduced by sea floor geodesy (Sato et al., 2011). Source parameters were the scope of many investigations including inversion of ocean data, seismic waveforms, as well as joint inversions (Romano et al., 2012; Yokota et al., 2011). Most studies reveal a compact slip distribution (Pollitz et al., 2011), very high maximum slip and average slip about twice as high as for the $M_W = 9.3$ Sumatra earthquake (Tajima et al., 2013).

1.2 GPS in tsunami early warning

Near-field tsunami early warning systems (TEWS) for coastal regions exposed to subduction earthquakes should be able to provide a warning as early as 5 to 10 min after an earthquake. Working within this time limit, traditional seismic methods tend to underestimate the total moment magni-

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Natural Hazards

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European Geosciences Union

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Press Release: GPS solution provides three-minute tsunami alerts

17 May 2013

Researchers have shown that, by using global positioning systems (GPS) to measure ground deformation caused by a large underwater earthquake, they can provide accurate warning of the resulting tsunami in just a few minutes after the earthquake onset. For the devastating Japan 2011 event, the team reveals that the analysis of the GPS data and issue of a detailed tsunami alert would have taken no more than three minutes. The results ar… …m Sciences, an open access journal of the European…

Journalists, wider audience

Most tsun… …4 and Japan in 2011, occur following underwate… …tonic plate slips under another causing a large earthquak… …affects coastal regions. There, researchers can meas… …and use this to determine tsunami information.

"High-pre… …ble reconstruction of the earthquake source, described… …ulate the uplift of the sea floor, which in turn is used as i… …d maximum wave heights at the coast," says lead-autho… …Geosciences (GFZ).

In the new Natural Hazards and Earth System Sciences paper, the researchers use the Japan 2011 tsunami, which hit the country's northeast coast in less than half an hour and caused significant damage, as a case study. They show that their method could have provided detailed tsunami alert as soon as three minutes after the beginning of the earthquake that generated it.

"Japan has a very dense network of GPS stations, but these were not being used for tsunami early warning as of 2011. Certainly this is going to change soon," states Hoechner.

The scientists used raw data from the Japanese GPS Earth Observation Network (GEONET) recorded a day before to a day after the 2011 earthquake. To shorten the time needed to provide a tsunami alert, they only used data from 50 GPS stations on the northeast coast of Japan, out of about 1200 GEONET stations available in the country.

At present, tsunami warning is based on seismological methods. However, within the time limit of 5 to 10 minutes, these traditional techniques tend to underestimate the earthquake magnitude of large events. Furthermore, they provide only limited information on the geometry of the tsunami source (see note). Both factors can lead to underprediction of wave heights and tsunami coastal impact. Hoechner and his team say their method does not suffer from the same problems and can provide fast, detailed and accurate tsunami alerts.

The next step is to see how the GPS solution works in practice in Japan or other areas prone to devastating tsunamis. As part of the GFZ-lead German Indonesian Tsunami Early Warning System project, several GPS stations were installed in Indonesia after the 2004 earthquake and tsunami near Sumatra, and are already providing valuable information for the warning system.

"The station density is not yet high enough for an independent tsunami early warning in Indonesia, since it is a requirement for this method that the stations be placed densely close to the area of possible earthquake sources, but more stations are being added," says Hoechner.

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Journalists, wider audience

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17 May 2013 Last updated at 13:51 GMT

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GPS data could improve tsunami early warnings

By Rebecca Morelle
Science reporter, BBC World Service

General public, very broad audience

The researchers say that GPS technology could provide vital extra minutes before a tsunami strikes

Scientists say they have found a way to provide faster and more accurate early warning systems for tsunamis.

A German team says GPS satellite-based positioning could offer detailed information about the events within minutes of an earthquake occurring.

They believe the technology could have improved alerts issued when the devastating tsunami hit Japan in 2011.

The study **is published in Natural Hazards and Earth Systems Sciences**.

When an underwater earthquake happens, with the power to generate a tsunami, every second counts.

The shifting tectonic plates can generate giant walls of water that can travel towards land in minutes, giving little time to put evacuation plans into action.

Related Stories

- GPS network is quick quake sensor
- Could GPS be used to predict earthquakes?
- Instruments saw Japan quake lurch

European Geosciences Union

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Natural Hazards and Earth System Sciences
Open Access

Instant tsunami early warning based on real-time GPS – Tohoku 2011 case study

A. Hoechner, M. Ge, A. Y. Babeyko, and S. V. Sobolev

GFZ German Research Centre for Geosciences, Potsdam, Germany

Correspondence to: A. Hoechner (

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Revised: 29 March 2013 – Accept

Scientists

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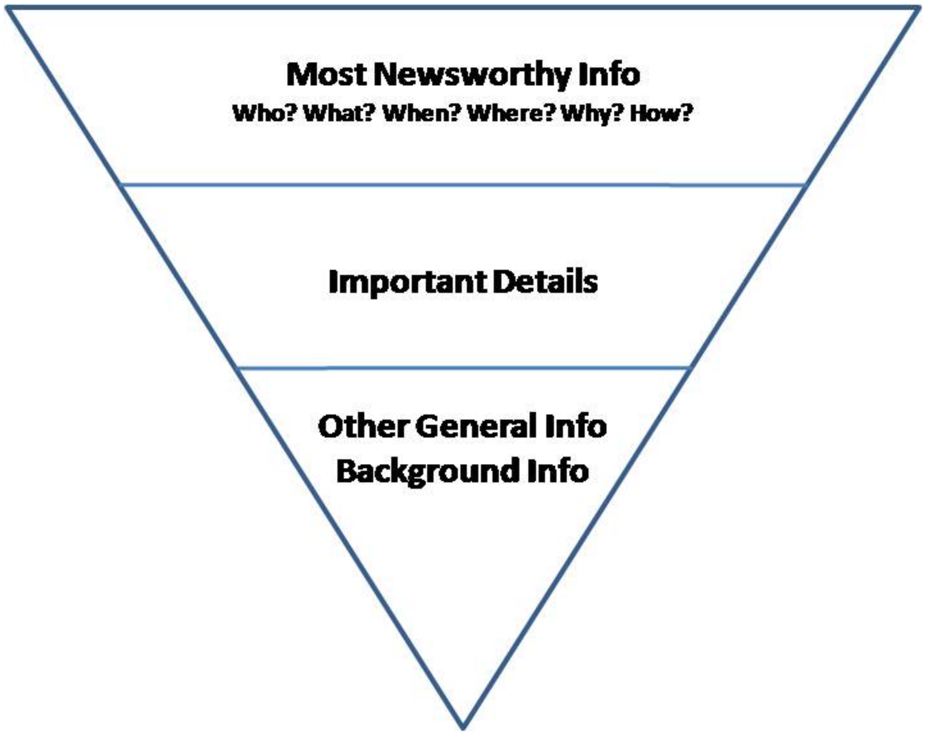
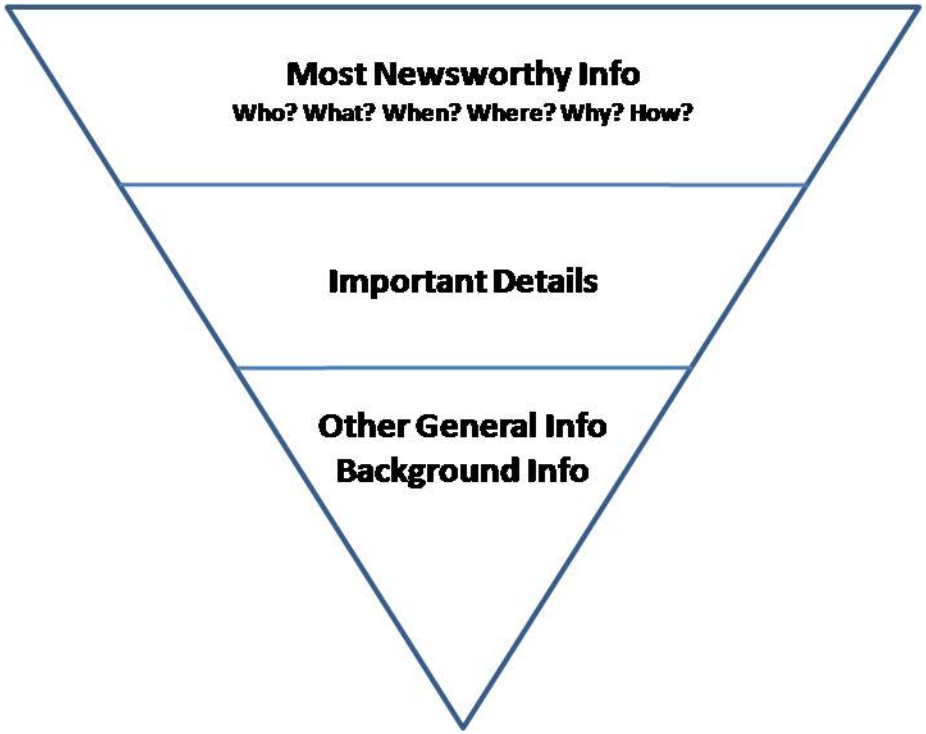
- Edit, proof

The structure: inverted pyramid



- Remember: keep the reader engaged

The structure: inverted pyramid



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- State the main points and conclusions first (but don't overstate them)

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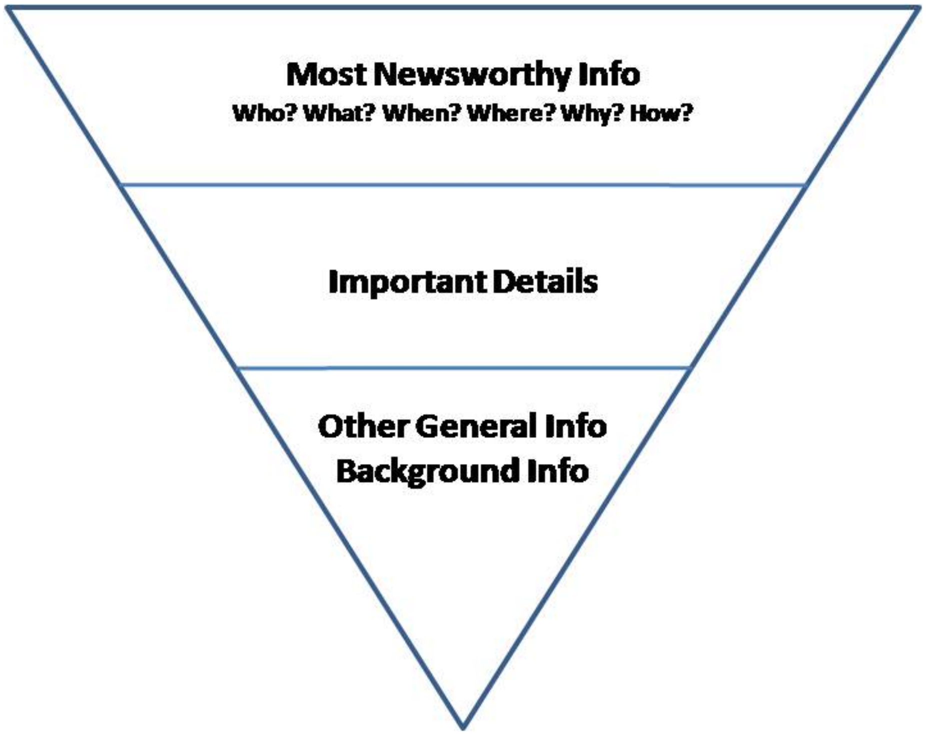

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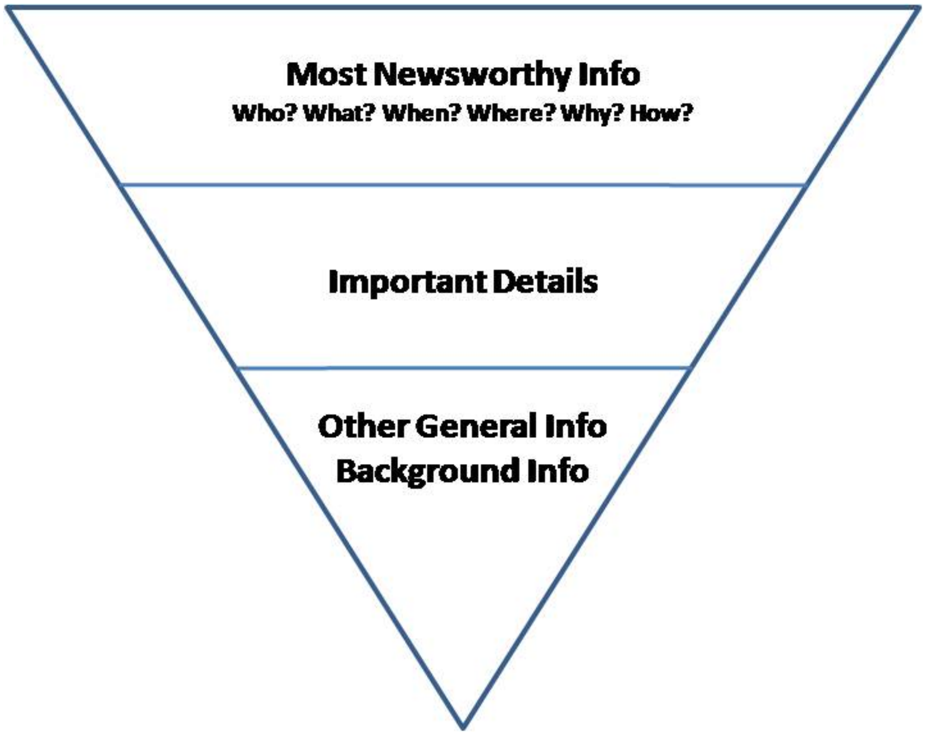

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- Write first about what's new and exciting about the research: why is it important? What are the implications?
- Explanations and background follow

Five Ws (and one H)

Who (did the work)?

What (have they done)?

How (did/do they do it)?

"Researchers have shown that, by using global positioning systems (GPS) to measure ground deformation caused by a large underwater earthquake, they can provide accurate warning of the resulting tsunami in just a few minutes after the earthquake onset. For the devastating Japan 2011 event, the team reveals that the analysis of the GPS data and issue of a detailed tsunami alert would have taken no more than three minutes. The results are published on *17 May* in Natural Hazards and Earth System Sciences, an open access journal of the European Geosciences Union (EGU)."

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Where (did they do/publish/present the work)?

When *(did they do/publish/present the work)?*

Why (is it interesting/news)?

A couple of extras: title & why should the reader care?

- Your title needs to lure in the reader to your story: make it snappy, make it catchy! (You can come up with it after you write your first paragraph, or even the entire text.)

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    - DO: “Famous paintings help study the Earth’s past atmosphere”

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    - DON’T: “Paintings by great masters uncover that the perception of red-to-green ratios by the brains of the colourists incorporates important environmental information on aerosols and their effects in the atmosphere”

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- If you think the reader may be asking why they should care about the research after the first paragraph, tell them why in the second (example)

“How far into the past can ice-core records go? Scientists have now identified regions in Antarctica they say could store information about Earth’s climate and greenhouse gases extending as far back as 1.5 million years, almost twice as old as the oldest ice core drilled to date. The results are published today in Climate of the Past, an open access journal of the European Geosciences Union (EGU).

By studying the past climate, scientists can understand better how temperature responds to changes in greenhouse-gas concentrations in the atmosphere. This, in turn, allows them to make better predictions about how climate will change in the future.

“Ice cores contain little air bubbles and, thus, represent the only direct archive of the composition of the past atmosphere,” says Hubertus Fischer, an experimental climate physics professor at the University of Bern in Switzerland and lead author of the study.”

Source: EGU Press Release – The oldest ice core: Finding a 1.5 million-year record of Earth’s climate

The main text: rules for good (science) writing

- Assume the audience knows nothing about your research, but don’t assume they are stupid and won’t understand it

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- Write clearly, avoid acronyms (but NASA, BBC are ok) and technical terms; if you need to use jargon, explain what it means

Terms that have different meanings for scientists and the public

Scientific term	Public meaning	Better choice
enhance	improve	intensify, increase
aerosol	spray can	tiny atmospheric particle
positive trend	good trend	upward trend
positive feedback	good response, praise	vicious cycle, self-reinforcing cycle
theory	hunch, speculation	scientific understanding
uncertainty	ignorance	range
error	mistake, wrong, incorrect	difference from exact true number
bias	distortion, political motive	offset from an observation
sign	indication, astrological sign	plus or minus sign
values	ethics, monetary value	numbers, quantity
manipulation	illicit tampering	scientific data processing
scheme	devious plot	systematic plan
anomaly	abnormal occurrence	change from long-term average

Source: Somerville, R. and Hassol, S.: Communicating the science of climate change, Physics Today, 2011

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- Short, simple and concise style; be conversational: "Don't be effulgent or felicitous, be bright and happy instead!"
- Roughly: one idea per sentence and one concept per paragraph

"The researchers defined a parameter to measure how far apart a future ecosystem under climate change would be from the present state. The parameter encompasses changes in variables such as the vegetation structure (from trees to grass, for example), the carbon stored in the soils and vegetation, and freshwater availability. "Our indicator of ecosystem change is able to measure the combined effect of changes in many ecosystem processes, instead of looking only at a single process," says Ostberg."

Source: EGU Press Release – Terrestrial ecosystems at risk of major shifts as temperatures increase

The main text: rules for good (science) writing

- Assume the audience knows nothing about your research, but don't assume they are stupid and won't understand it
- Write clearly, avoid acronyms (but NASA, BBC are ok) and technical terms; if you need to use jargon, explain what it means
- Short, simple and concise style; be conversational: "Don't be effulgent or felicitous, be bright and happy instead!"
- Roughly: one idea per sentence and one concept per paragraph
- Everyday examples may help get your message across; give the reader something to relate to

“Drivers on a rainy day regulate the speed of their windshield wipers according to rain intensity: faster in heavy rain and slower in light rain. This simple observation has inspired researchers from the University of Hanover in Germany to come up with ‘RainCars’, an initiative that aims to use GPS-equipped moving cars as devices to measure rainfall.”

Source: EGU Press Release – Using moving cars to measure rainfall

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- If you can, use quotes! Less likely to be wrong, makes the text lively, sometimes you get really good, exciting and clear sentences – and even extra information – from the researchers you interview

“ This speedup of Jakobshavn Isbræ means that the glacier is adding more and more ice to the ocean, contributing to sea-level rise. **“We know that from 2000 to 2010 this glacier alone increased sea level by about 1 mm. With the additional speed it likely will contribute a bit more than this over the next decade,”** explains Joughin. ”

Source: EGU Press Release – Greenland’s fastest glacier reaches record speeds

“ **“Nature speaks to the hearts and souls of great artists,”** says lead-author Christos Zerefos, a professor of atmospheric physics at the Academy of Athens in Greece. ”

Source: EGU Press Release – Famous paintings help study the Earth’s past atmosphere

The main text: rules for good (science) writing, cont’d

- Prefer the active voice to the passive: the active voice is almost always clearer, more concise and easier to understand – it is also more direct and less obscure

"Nature journals prefer authors to write in the active voice ("we performed the experiment...") as experience has shown that readers find concepts and results to be conveyed more clearly if written directly."

Source: Nature’s Author Resources: How to write a paper

The main text: rules for good (science) writing, cont'd

- Prefer the active voice to the passive: the active voice is almost always clearer, more concise and easier to understand – it is also more direct and less obscure
- Prefer short sentences to long ones (otherwise the reader might get lost before he/she gets to the end of the sentence!). But don't forget to vary the length of your sentences to give rhythm to the text

“This sentence has five words. Here are five more words. Five-word sentences are fine. But several together become monotonous. Listen to what is happening. The writing is getting boring. The sound of it drones. It's like a stuck record. The ear demands some variety. Now listen. I vary the sentence length, and I create music. Music. The writing sings. It has a pleasant rhythm, a lilt, a harmony. I use short sentences. And I use sentences of medium length. And sometimes when I am certain the reader is rested, I will engage him with a sentence of considerable length, a sentence that burns with energy and builds with all the impetus of a crescendo, the roll of the drums, the crash of the cymbals – sounds that say listen to this, it is important.”

Source: G. Provost: 100 Ways To Improve Your Writing, Signet, 1985

The main text: rules for good (science) writing, cont'd

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- Human element: people and things people can relate too (controversy, anecdotes, etc.)

“In November 2006, **Craig McClain** sailed into the Pacific Ocean, threw 36 logs overboard, and created several new worlds.”

Source: Ed Yong: The Marine Creatures That Only Live on Land Plants, Not Exactly Rocket Science, 2014

“It started when a honeybee flew up **Michael Smith**’s shorts and stung him in the testicles.”

Source: Ed Yong: The Worst Places To Get Stung By A Bee: Nostril, Lip, Penis, Not Exactly Rocket Science, 2014

The main text: rules for good (science) writing, cont'd

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- Sometimes, you can break these rules

How to become a better science writer? Read!

- **A manifesto for the simple scribe – my 25 commandments for journalists, by Tim Radford: http://bit.ly/1g6I7nE**
- Guardian series on the secrets of good science writing: http://www.theguardian.com/science/series/secrets-science-writing
- Science communication resources from the American Association for the Advancement of Science (AAAS): http://www.aaas.org/page/communicating-science-resources
- EGU Young Scientists website, science communication resources: http://bit.ly/1i19RwK
- Read a lot of great science writing: BBC Science & Environment section, NYTimes Science section, Carl Zimmer, Ed Yong, Alex Witze (and the EGU blogs!)

But really… how to?

Medium interview with Carl Zimmer, January 2014:

“ **If somebody asked you for tips on becoming a better writer, what’s the one thing you’d tell them?** ”

But really… how to?

Medium interview with Carl Zimmer, January 2014:

“**If somebody asked you for tips on becoming a better writer, what’s the one thing you’d tell them?**

Write.”

Would you like to communicate science at the EGU?

Job opportunity! http://www.egu.eu/news/105/job-opportunity-at-the-egu-executive-office-communications-officer/