4/8/11: Discussion notes for Week 2

ARTICLE STRUCTURES (Cargill and O'Connor, 2009)

Conventional article structure: AIMRaD (see handout from Cargill and O'Connor, 2009)
Discuss different article structures while looking at handout.

ABSTRACTS AND TITLES: (see handouts from Harmon and Gross, 2010)

Discuss Abstracts while looking at reading from Harmon and Gross (2010).

The typical speciality journal requires an abstract that answers the following questions (see Harmon and Gross, 2010 for examples):
What was done?
How was it done?
What was discovered?

For journals with a broader audience, you often will add additional information and it will have a structure more like this (see Nature summary paragraph description handed out with homework assignment):
- Basic introduction (what is the topic of your paper?)
- Basic background (what is the paradigm or idea that your paper is testing)
- Basic statement of problem (what specific problem are you addressing)
- Your main result (what does your study show?) [note: the method you used could also be included if important]
- Your main discussion idea (what do your results mean?)
- Basic conclusion (how do your results help guide future research?)

Remember: A good abstract is one that can basically be understood without reading the rest of the paper.

Assignment for next week: Write a working, extended abstract of your paper. See assignment instructions handed out in class (and posted on-line).
OUTLINING: for those that are ready, let’s talk about outlining your results and discussion section. A strong outline is one that is detailed. It is important because once you have it, you only need to think about language and illustration (figures) during the writing process, and not organization. Thus, it will make the writing process easier, and will help you to maintain momentum and efficiency when you write. However, think of your outline as being flexible – it gives you a sensible structure and maps out the logical flow of your paper, but as you write you may find that it will change.

First, a few words about the RESULTS AND DISCUSSION section. We’ll talk more about this later, but here are some basic guidelines for those that are ready for outlining.

RESULTS AND DISCUSSION: There is no standard structure for the results and discussion section, but here are some tips about what goes in each section. [From Harmon and Gross, 2010]

Results:
1. Results are presented in tables, figures and accompanying text. Text is limited to the immediate inferences you can make from the data. It should explain the immediate meaning of the displayed data. For example, “global temperature increased from the 1850 to 2010”. The results are described, but the interpretation is left for the discussion section. For example, the discussion section would explain why the temperature increased.
2. The results section should show how the limitations of your methods qualify the factual status of your findings. For example, statistical tests and tests to understand patterns and statistical significance of your results should go into this section.

Tables and figures should visually make the main points. When you place them in order, they should form a data backbone of the story you want to tell, a backbone without missing vertebrae.

Discussion:
1. The discussion section presents arguments that turn the findings from results into evidence for new scientific claims (or to show how your bottom line, main message, is supported by evidence). This section should make the broadest claims that are legitimate, given the existing data. This section should include published studies that could make your argument clearer or stronger.
2. The discussion section should also limit and qualify your claims so that they are in conformity with the evidence. Your claims need to fine-tuned to be acceptable by the scientific community (i.e., you have to make sure not to make outrageous claims that aren’t backed up by evidence).
OUTLINING  RESULTS AND DISCUSSION SECTIONS (continued):

The outline should list:
- your main headings (“Results”, “Discussion”, etc)
- your subheadings
- notes about each section and sub-section, starting with the main point of each section with some sentences and phrases you may use.

A really good, detailed outline would include a list of ideas that you will present as part of making your point. For example, a very detailed outline would have notes that show the logical flow of each section.

Having trouble figuring out what figures to show? Having trouble figuring out how to describe your results? If so, then it will be hard to write you detailed outline right away. Here’s something that could help – a sort of exercise that might help you decide which data to show in your results, and how to discuss the data in your discussion.

First produce an outline that focuses on your main point(s). This initial exercise will mix results with discussion. It could have this type of basic structure:

1. Main point #1. This should be in the form of a few sentences. One sentence describes the feature of your data that you are focused on (this will end up in your results section). The next sentence states the main interpretation of that feature (this will be one of the main points you make in your discussion section).
   a. Sub-point #1a. an additional observation or idea, either from your own data or from a published study, that you will use to support your interpretation.
   b. Sub-point #1b. same as 1a
   c. ......
   d. ....

2. Main point #2. Same structure as #1

3. Main point #3. Same structure as #1 and #2.

You could have only one main point in your paper, but for more complex studies there could be more than one main point. Generally, a paper should only make 1, 2 or maybe 3 points. Exceptions are things like big surveys and review papers.

Once you have mapped out your main points (as above), you can cobble together the results section so that it contains all the results needed to back up
all the main points. You can cobble together the discussion section so that it contains each interpretation (these may be your sub-section of your discussion). Your sub-points could be organized to form the logical flow that you will present in each of your sub-sections.

Here’s an example, with portions that will end up in results in red, portions for the discussion in blue, and portions that could be moved into conclusions (which we will discuss later) in green.:

1. Main point #1. Global temperature over the last 150 years has been rising due to an increase in carbon dioxide concentrations in the atmosphere. Here are the things I want to discuss related to this main point:
   a. carbon is a known greenhouse gas. Provide citations and past studies that back this up.
   b. carbon dioxide has been rising over the last 150 years. Explain this and provide citation.
   c. carbon dioxide records are correlated to temperature records. This shows how you bring in published records to compare to your data to make a point.
   d. changes in solar radiation and aerosols are other possible forcings of temperature, but cannot explain the observed increase in temperature. Explain and provide references.
   e. if I account for all three forcings, I can explain most features of the temperature curve, but the greenhouse gas forcing is primarily responsible for the temperature increasing over the last 15 year.
   f. future studies should look at regional heterogeneities in temperature trends to further differentiate between different forcing factors.
   g. future climate models should be used to test the interpretations for the relative importance of the three forcings.

2. Main point #2. Year-to-year variability in global temperature over the last 150 years has been increasing, due to higher amplitude El Niño Southern Oscillations (ENSO)
   Here are the things I want to discuss related to this main point:
   a. published studies show that the ENSO index varies with higher amplitude now than it did 150 years ago. Provide citations to back this up.
   b. comparison of the variability in my global temperature record with that of ENSO shows coherency between the two records.
   c. if I remove tropical data from my data set, I see that only 25% of the variance in mid and high latitude temperatures is coherent with low latitude temperatures. By comparing data from different regions to the ENSO index, I can see that low latitude temperatures are strongly related to the ENSO index, whereas high latitudes temperature records
are not. Thus, while changes in ENSO strength may account for much of the year-to-year tropical temperature variability, it accounts for much less of the extratropical variability.

d. The causes of increasing ENSO amplitude with time are unknown, but maybe if increasing tropical mean temperatures fuels more vigorous atmospheric convection and Walker circulation, and strengthens the Bjerknes feedbacks known to impact ENSO. [this could end up in conclusions, but for now I’ll keep it in discussion].
e. The processes responsible for increased variability in extratropical regions are not currently understood, but changes in the behavior of the North Atlantic Oscillation, etc., need to be investigated.

Now that I know how I want to make my two main points (above), I can create my paper outline by grouping together the parts that go into the results, discussion and conclusions, and I can add more detail (in black):

**Results:**

Global temperature over the last 150 years has been rising (show Table 1 with station locations, and Figure 1 of map here, and Figure 2 with global temperature curve)
- explain how temperature data was compiled and how global average was calculated
- show analyses that the increase is statistically significant
- explain the main feature of the curve – that although there are some years/decades of cooling, the overall trend is warming

Year-to-year variability in global temperature over the last 150 years has been increasing
- show analyses, and explain, how interannual variability is statistically characterized (show Figure 3 and 4 here)

If I remove tropical data from my data set, I see that only 25% of the variance in mid and high latitude temperatures is coherent with low latitude temperatures.
- Show reanalysis of regional temperature trends that show the tropics have greater variability with time.
- Show analyses of coherency between regional trends, and statistical analyses. (show Figure 5 here)

**Discussion (I’ll have two subsections for my discussion):**

*Carbon dioxide forcing of global temperature*
Write intro paragraph explaining that the main point of this section
In 1-2 paragraphs each, explain each point:

a. carbon is a known greenhouse gas. Provide citations and past studies that back this up.
b. carbon dioxide has been rising over the last 150 years. Explain this and provide citation. (Show Figure 6 here).
c. carbon dioxide records are correlated to temperature records. This shows how you bring in published records to compare to your data to make a point.
d. changes in solar radiation and aerosols are other possible forcings of temperature, but cannot explain the observed increase in temperature. Explain and provide references.
e. if I account for all three forcings, I can explain most features of the temperature curve, but the greenhouse gas forcing is primarily responsible for the temperature increasing over the last 15 year.

**Interannual variability related to ENSO**

Write intro paragraph explaining that the main point of this section

In 1-2 paragraphs each, explain each point:

a. published studies show that the ENSO index varies with higher amplitude now than it did 150 years ago. Provide citations to back this up.
b. comparison of the variability in my global temperature record with that of ENSO shows coherency between the two records.
c. By comparing data from different regions to the ENSO index, I can see that low latitude temperatures are strongly related to the ENSO index, whereas high latitudes temperature records are not. Thus, while changes in ENSO strength may account for much of the year-to-year tropical temperature variability, it accounts for much less of the extratropical variability.
d. The causes of increasing ENSO amplitude with time are unknown, but maybe if increasing tropical mean temperatures fuels more vigorous atmospheric convection and Walker circulation, and strengthens the Bjerknes feedbacks known to impact ENSO. [this could end up in conclusions, but for now I’ll keep it in discussion].

**Conclusions (I’ll organize this later, but here are some thoughts of what should go into here):**

a. future climate models should be used to test the interpretations for the relative importance of the three forcings.
b. future studies should look at regional heterogeneities in temperature trends to further differentiate between different forcing factors.
c. The processes responsible for increased variability in extratropical regions are not currently understood, but changes in the behavior of the North Atlantic Oscillation, etc., need to be investigated.

Later in the class we’ll talk about the content of the Methods, Introduction and Conclusions, and about how to outline those parts of the paper. [If you’re ready for the next step, you could use your outline and start writing your results section].
Working with advisor(s) and co-authors:

Discussion points:
What is the role of the advisor?
Usually is the primary collaborator. Usually has a lot invested in the research and feels some degree of ownership of it.
What are the challenges of this and how do you deal with them?
What are the benefits of this and how do you take advantage of them?
- This can ensure that you get access to them. This means you can get significant intellectual guidance, and mentoring, when needed.
- If access is difficult, how do you get it?

What are the criteria for being a co-author?
- Different people have different ideas for this. But, discussion about this should happen before the study even begins rather than later, particularly with respect to who is going to be the lead author.
- Typically, the person that did the most work and wrote the paper is 1st author.
- Some people think that anyone that contributes data or analyses of some sort, funding, intellectual input, work towards drafting text and/or figures, should be co-author. Some people think you need to contribute two or more of these things to be co-author.
- More controversial: Some people think anyone that steps into their lab and makes measurements, or anyone that provides advice on analytical techniques, deserves co-authorship. Even if they didn’t generate any of the data themselves, or provide any intellectual input.

What is the role of the co-authors during the writing stage?
- ‘Use’ your co-authors wisely. Check with them about how they want to be involved.
- Advisors might want to only see a complete draft – but you need to ‘use’ them more than this. Bring them a figure to talk about. Meet with them to discuss your findings and interpretations. See if they are willing to provide feedback on an outline, or extended abstract. Since they will ultimately critique the complete draft, you will save yourself a lot of time if you get input from them so that the draft is not a surprise. **Avoid having to rewrite major portions of the paper by making sure you advisor is onboard with the main storyline and interpretation ahead of time.**
- Co-authors might not have time to provide detailed comments. Check with co-authors ahead of time about what they want, and don’t burn them out by asking them to do too much. This will delay completion of the paper. If they are super busy, send them a 2nd or 3rd draft and ask them for specific feedback: ‘Do you agree with the main interpretation, and is it
clearly expressed?’ or ‘Please focus on sections X and Y, or on these specific aspects of the paper, if you don’t have time to provide feedback on the entire paper.’ Don’t ask them to do busy work – you need their intellectual input more than anything.
- Always provide deadlines if they can’t commit to giving you feedback by a certain date – ‘Your comments would be most helpful before XXX date, but you will have the opportunity to provide input after I get the reviews back, in case you don’t have time now.’ Make requests of them in a way that ensures that silence from them does not slow you down.

How do you deal with differences of opinion?
- With advisors, this can be difficult. You first need to make sure that you are not being unreasonable or stubborn. If you are convinced of this, then you may need to stand up for yourself. Discussion.
- With co-authors, you can usually be selective about what feedback you think will improve your paper. You want to include as much as you can, but typically you know the data better than they do and can judge what to include. If you decide NOT to include a major suggestion, it is best to let them know why to see if more discussion is needed.