ESS 595 B – Scientific Writing

Week 9 – Practice with Figures

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Concepts:
What separates a good figure from a bad figure?
Good Figures:

- Are easy to read and interpret
- Lead the viewer to the important information without distraction
- Are pleasing to the eye
- Have clear units and equations
- Bank slopes to 45°

Bad Figures:

- Are cluttered
- Obscure important information among irrelevant details
- Have discordant color schemes
- Intentionally obscure information

Minutes:
The class started off with a review of a few figures that the presenters highlighted as being either especially good or bad.

Good Figure 1: Antarctica/Greenland Rate of Change of Elevation

There was some debate on the aesthetics of the color bar. Some like it warm to cool, some hate green. The general consensus was that the colors were good in that they didn't offend the eye, but may not do the best of jobs in highlighting relevant information. It was noted that it would port poorly into black and white (eg: when printed by hapless students) since both ends of the spectrum were dark and the center was light.

There was some debate about using a mapping of the elevation change data, the point of the figure, onto a visually busy grayscale (topo) map of the two land-masses. Some were in favor of using a simple shoreline outline to help identify the land-masses, rather than the extra internal detail of the topographic underlay.

It is good that the figure showed both land-masses on the same scale.

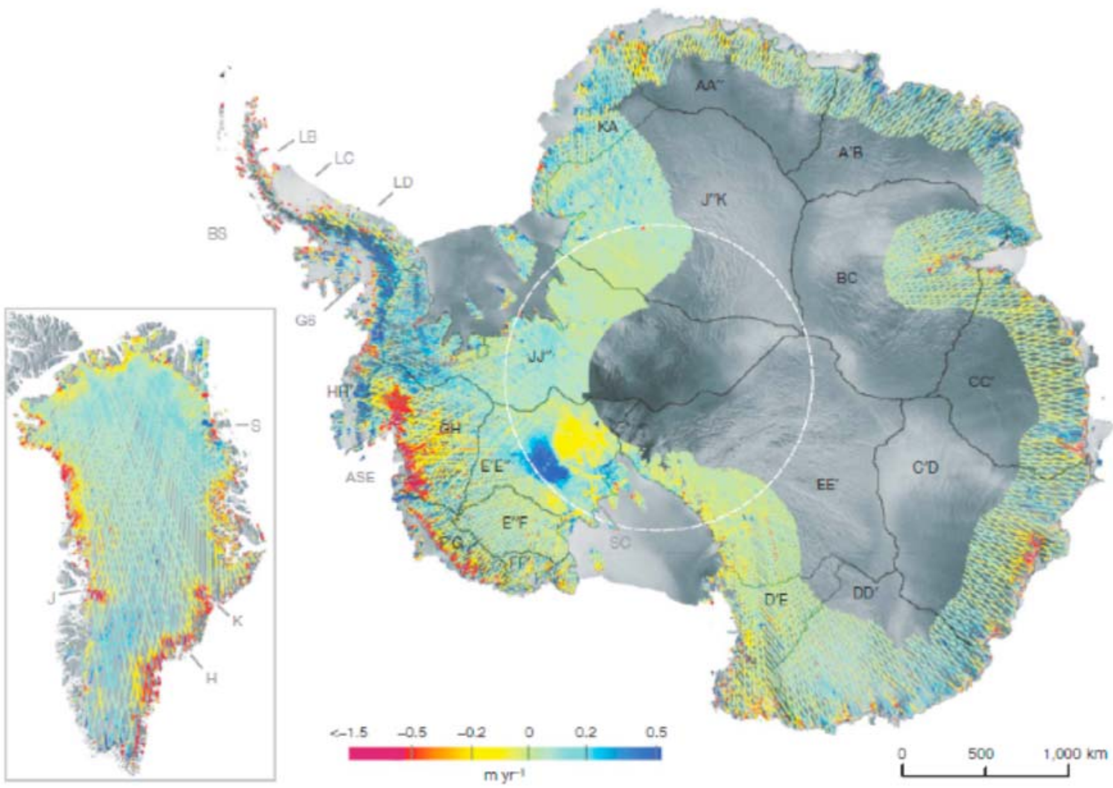

Figure 2 | Rate of change of surface elevation for Antarctica and Greenland. Change measurements are median filtered (10-km radius), spatially averaged (5-km radius) and gridded to 3 km, from intervals (Δt) of at least 365 d, over the period 2003–2007 (mean Δt is 728 d for Antarctica and 746 d for Greenland). East Antarctic data cropped to 2,500-m altitude. White dashed line (at 81.5° S) shows southern limit of radar altimetry measurements. Labels are for sites and drainage sectors (see text).

Good Figure 2: Retreat of an Antarctic Ice-sheet

A simple figure that was easy to identify, and to determine the key points. Also contained some extra, and potentially important information without being overly complicated (measured vs. extrapolated boundaries of the ice-sheet).

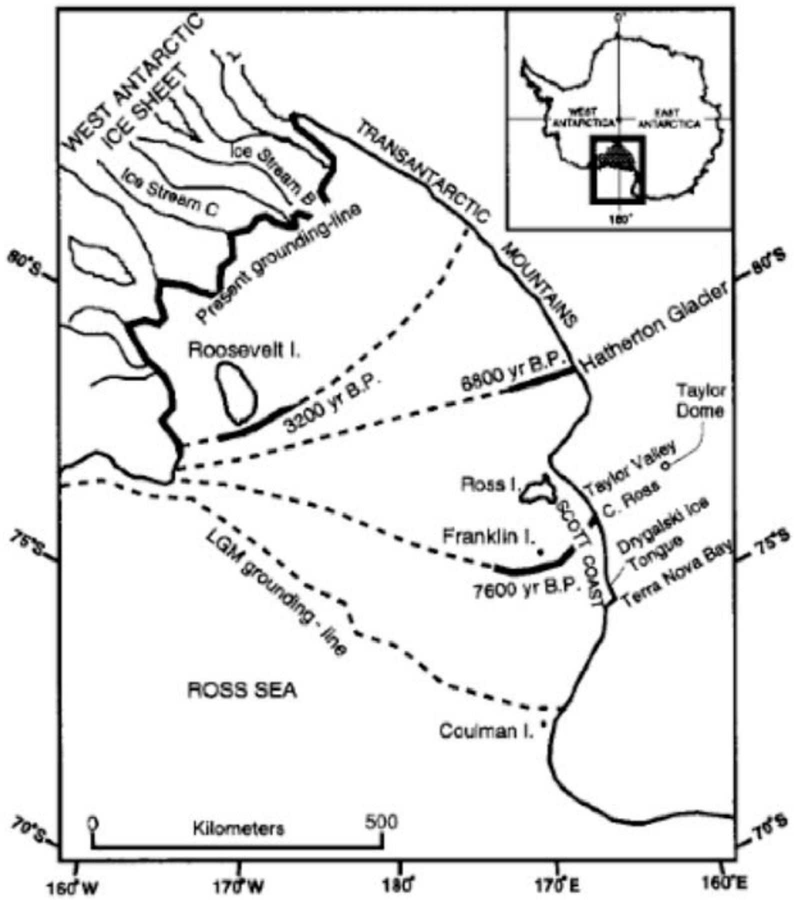

Fig. 1. Map showing dated locations used to resolve Holocene grounding-line retreat to its present position in the Ross Sea Embayment. Although the detailed structure of past grounding-line positions is unknown, dotted lines show the simplest grounding-line pattern consistent with the dates in the text.

Bad Figure: Andrill Core

Very busy figure that related several (~8?) datasets from a single core. It was agreed that the figure did a good job of relating many, disparate datasets, but that for interpreting each of the datasets by itself, it was virtually useless. It was suggested that this figure may work better in supplementary material where a user can view it to help in synthesizing the information, but should not be used as a principal figure when initially presenting the information.

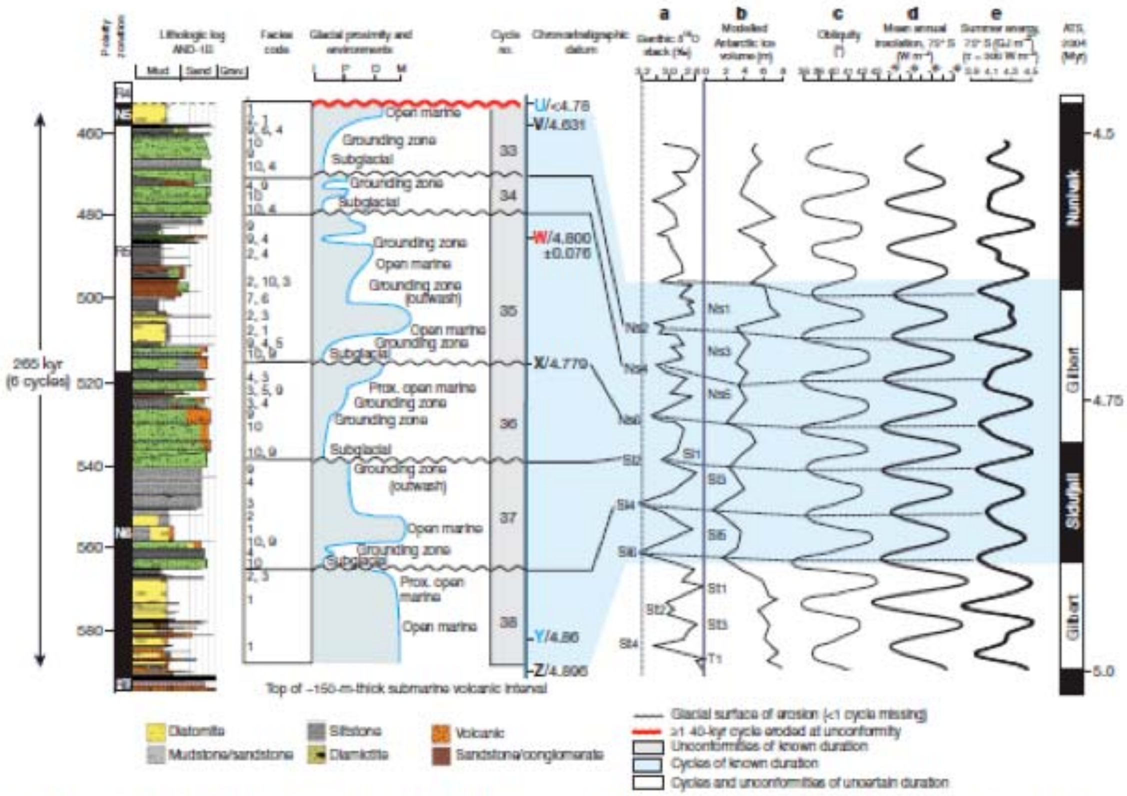

Figure 3 | Detailed analysis of early-Pliocene sedimentary cycles in the AND-1B core showing lithofacies interpretations of glacimarine environments. The glacial proximity curve tracks the relative position of the grounding line through ice-contact (I), ice-proximal (P), ice-distal (D) and marine (M) environments and provides a proxy for ice-sheet extent. Cycle duration is constrained by chronostratigraphic datums coded A–Z. The chronostratigraphy allows a one-to-one correlation of the cycles with obliquity-paced time series of the benthic $\delta^{18}O$ record[24] (**a**), modelled Antarctic ice volume[7] (expressed in metres of equivalent sea level, **b**), obliquity (**c**), mean annual insolation at 75° S (**d**), and summer energy at 75° S for inferred melt threshold (τ) of 300 W m^{-2} (**e**; see Supplementary Information for further explanation of summer energy). Dashed vertical lines represent present-day ice volume/sea level. (See Methods and Supplementary Table 2 for explanation of facies codes.)

Good Figure 3: δ^{18}O Over Time in Relation to the Presence of Ice

Shows a clear average-trend in time along with the individual data points, and relates it to a vertical line that separates the presence of ice from its absence.

Problems: it reverses the dependent and independent axis convention. This is likely due to "time" being calculated from "ice core depth" which is conventionally shown in the vertical axis, since we all naturally think of depth as vertical; δ^{18}O values read from high to low values left to right, against our usual expectation that low numbers should be on the left and high numbers on the right. The likely rational is that δ^{18}O is a proxy for temperature in this plot, with colder temperatures on the left and warmer on the right (as is implied at the bottom with 'ice' on the left and 'no ice' on the right).

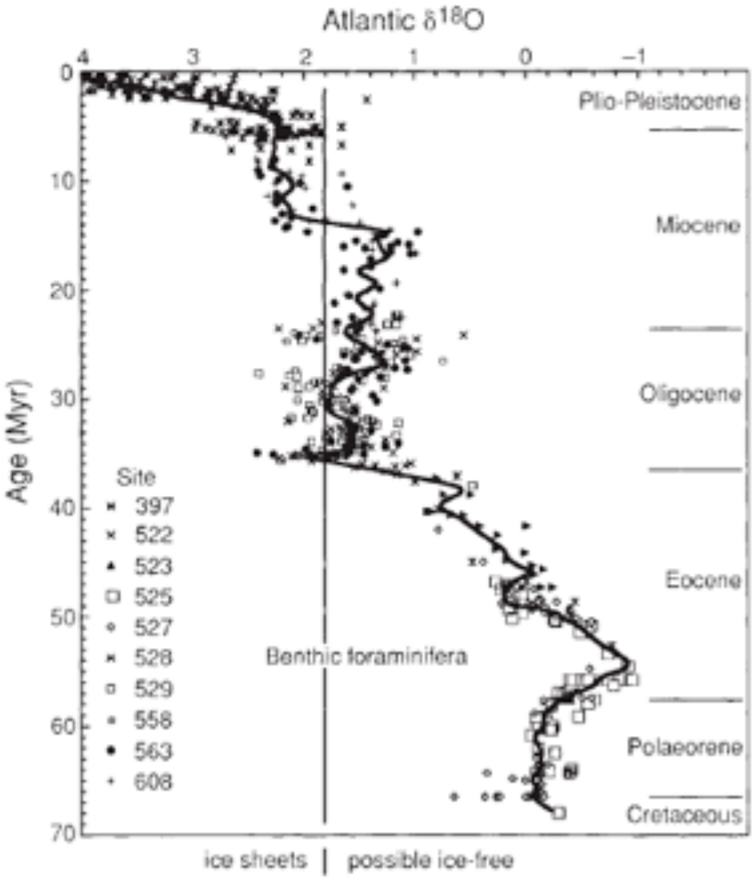

FIG. 1 Compilation of benthic δ^{18}O measurements from Deep Sea Drilling Program sites spanning the past 70 Myr. The long-term increase in δ^{18}O values reflects cooling of the deep ocean and growth of ice sheets at high latitudes (after ref. 14). $\delta^{18}O = [(^{18}O/^{16}O)_{sample}/(^{18}O/^{16}O)_{standard} - 1]$, where standard is PDB.

We then moved on to group work, where we critiqued one anothers' figures, attempting to determine the main points as we saw them *vs*. what the author had intended. Hilarity ensued.

Wrapping things up, we looked at a number of figures to talk about some specific topics, primarily common pitfalls.

The first was a plot that had a hidden factor of 10^{-5} at the top of the axis. This left the reader with the mistaken impression that ice particles near melting in slush could be as cold as -30°C, rather than near 0°C. A suggestion for improvement was to either use a metric prefix (eg: m or μ here) or to include the factor of 10 in the units (eg: 10^{-5} °C).

The second was a plot where the numbers along the x-axis were shown as 1.0, 2.0, 3.0, etc… When reading rapidly, this was easily mistaken for 10, 20, 30, etc… The recommendation was to remove meaningless sig-figs in the axis labels, making the axis labels 1, 2, 3, etc…

The third was a plot looking at a model and observed albedo of ice as a function of wavelength. The problem was that for the implicit emphasis on the energy of the light being reflected, the most important part of the figure was contained in about 10% of the width on the left, and visual emphasis was placed on a large portion of the spectrum that was not as relevant, and in fact was not as well modeled. The solution was to convert the wavelength into a log scale, this exaggerating the relevant portion of the plot and condensing the less relevant portion.

A fourth example was looking at particulate systematics in air, where the data were fit to a number of straight lines in a log-log plot. Because the lines were close to vertical, it was difficult to see changes in slope, so the suggestion was to stretch the horizontal axis, thereby banking the slopes closer to 45°.

The fifth example was an intentionally misleading plot. In the plot, several inputs at very different percentages were shown in the same font size with a large pictorial background. The percent of smog generated by autos was de-emphasized with a smaller font size and smog picture despite having a percentage number on a similar scale to the larger listings above.