Title: Ideas and diversity in climate science – and a challenge to students

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Note to Editor,

I submit this item as a prospective EOS Forum piece. Its aim is to increase readership and interest among graduate students, and address an aspect of the climate science debate which I believe AGU has not fully addressed. The prizes I refer to are notional at this time – I will be happy to sponsor these personally as and when EOS runs with the idea. I will be happy to vary the amount as may be considered appropriate by AGU. While I have referred to Dessler and Curry as adjudicators for the suggested prizes, they would need to be consulted, and/or alternative nominations arranged, before (and if) this Forum piece proceeds to a final form.

Regards,

Michael Asten

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Submission to AGU as item for the EOS Forum

Ideas and diversity in climate science – and a challenge to students

Reports of the AGU Fall Meeting (EOS 4 Feb 2014) contained a strange gap when representing issues of climate change science – a disappointing amnesia regarding points two and three of our mission statement:

- Open exchange of ideas and information
- Diversity of backgrounds, scientific ideas and approaches

The review of Simon Lamb's film "On Thin Ice"
http://onlinelibrary.wiley.com/doi/10.1002/2014EO050013/pdf

noted that it brought tears to the eyes of one viewer, but after viewing the film online I reserve my tears for the fact that the AGU is able to endorse such a single-themed piece of descriptive science. The film's educational strength is the portrayal of scientists at work, but it fails to portray scientific method in considering those parts of the science which don't fit an

over-simplified scenario of CO2-driven anthropogenic global warming (AGW). The makers of the film could have consulted a range of AGU members who would have cogently explained that currently-available quantitative data sets demand a more multi-faceted approach.

The most glaring example of missing science was absence of mention of the feed-back loops of water vapour and cloud formation which amplify the warming associated with atmospheric CO2. The size of the amplification factor is the major influence and uncertainty in model-based predictions of global warming, and attempts to quantify it using satellite data, historical meteorological data and paleo-temperature data provide a remarkably wide spread of estimates; I suggest that the wide spread of estimates is telling us there is more to the science than the simplistic CO2-temperature relation which the film presents.

One of the strengths of the US political system is the use of congressional committees which provide opportunity for expert testimony from both sides of questions of importance. An excellent example is recent testimony at the US Senate Committee on Environment and Public Works on 16 Jan 2014. The panel of witnesses included two senior members of AGU, professors Andrew Dessler of Texas A&M and Judith Curry of the Georgia Institute of Technology.

Dessler presented a concise overview of AGW science, arguing for the standard model and how it stands the tests of comparison with observational data. I noticed one gem of optimism as he discussed discrepancies between models and some observational data, saying "I suspect future revisions [of the data] will bring it into ever-closer agreement with the models."

Curry argued that in her view "both the climate change problem and its solution have been vastly oversimplified", and reviewed global temperature, climate sensitivity and sea-level data from the IPCC AR5. She finds that the case for human factors dominating temperature change of the past 130 years is weaker than it was 10years ago, and evidence for the importance of natural variability on climate changes, is growing.

These pages are not the place to adjudicate these opposing arguments, but it surprises me that contrary to the intent of our mission statement, the two sides rarely appear in AGU commentaries. I have a particular concern that presentation of science in a monochromatic style risks being unchallenging to our student population. I have on two occasions in the past year attended conferences relating to climate science where my questions (from a perspective closer to Curry than Dessler) have prompted graduate geology students to talk to me about aspects of their data which don't fit the concept of recent unprecedented climate change. It is tragic when such students are discouraged by supervisors or departmental priorities from exploring such ideas – there are too many anecdotal examples of such discouragement to ignore. I urge interested students to analyse both Dessler and Curry as succinct statements on the complexities of the challenges ahead in climate science. I also say to such students that no Nobel prize winner in science ever received such recognition without breaking out of prior consensus understanding.

I myself had a career-changing experience while studying geosciences in 1969 as a sideline to taking a physics major. Plate tectonics was by then generally accepted, but staff could regale students with stories of the controversies of a past decade. After a lecture introducing continental drift, I happened on a letter in Nature by Sir Harold Jeffreys (one of the great geophysicists of the 20th century, and a father of modern seismology). Jeffreys ridiculed recent papers in Nature outlining the new tectonics, and pointed out that he had established that the earth behaved as a Lomnitz solid (having a characteristic of logarithmic flow), and the maths showed that convection could not occur in such a model. Ergo, continental drift cannot happen. With a vigorous undergraduate lack of discretion, I waved the copy of Nature at my professor after the following lecture and he spent 45 minutes explaining evidence for the differences between solid and fluid behaviour of the Earth over geologic time. He threw in for good measure Lord Kelvin's 1897 estimate of the Earth's maximum age (seven to seventy million years, based on heat flow observations and models, without consideration of then-undiscovered radioactivity). Kelvin thus appeared to prove geological estimates based on sedimentation rates and biological evolution to be wildly in error. With a twinkle in his eye, Prof Sam Carey sent me on my way with the advice, "Disbelieve if you can, my boy". The primacy of observational data over model prediction in the scientific method is the self-evident truth, although both are essential parts of the process of enquiry.

I have been a member of AGU since my student curiosity led me into my current career in 1973. I find Lamb's "Thin Ice", and Dessler's and Curry's testimony, valuable reference points for scientific debate. However I am disappointed that while the US Congress regularly calls for, listens to and records opposing scientific arguments, EOS does but rarely.

My challenge to the AGU – more particularly to graduate student members – is to peruse a pair of opposing testimonies such as Dessler and Curry, review your own data, and write a 300-word statement on an aspect of climate sensitivity, global temperature change, sea-level change and associated indications of anthropogenically driven or natural variation. If EOS Forum provides a page for the best ten statements, I'll put up two student prizes of $500 each, to be awarded on the recommendation of Prof Dessler and Prof Curry.

The testimony of Dessler and Curry is available at
http://www.epw.senate.gov/public/index.cfm?FuseAction=Hearings.Hearing&Hearing_id=e07101a7-0715-7690-b6e9-c39e56a3b468

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The Author (detail provided for the Editor, but not intended for publication)

Michael Asten is a Professor (Research), part-time, in the School of Geosciences, Monash University, Melbourne. He gained a PhD in geophysics from Macquarie University in 1977, worked in academia and the mineral exploration industry in Australia and overseas to1997, and joined Monash part time in 1997. He is

recipient/co-recipient of five innovation awards from the Australian Society of Exploration Geophysicists, CSIRO and BHP in the years to 1997. While at Monash he has been recipient of two Australian Research Council Linkage grants, two US Army SERDP grants and three US Geological Survey grants. He has current collaborative projects with Geoscience Australia, the US Geological Survey and the Middle East Technical University, Turkey. He is currently the Australian Geoscience Council representative on the Australian Academy of Sciences UNCOVER Executive Committee, a group providing guidance for development of next-generation technology in Australia for mineral exploration. He has served twice on Australian Research Council panels reviewing Key Centres. Prof. Asten has published as author or co-author 173 scientific papers (including 96 peer-reviewed to the ARC C1 and E1 standards). He has published on climate sensitivity as deduced from deep-ocean records of the Eocene period, and is a regular commentator on climate-change science with twenty OpEds and letters published in The Australian, The Age and various geoscience journals, since 2009.