WHAT IS CLIMATE CHANGE?
CONSTRUCTS OF A GLOBAL PROBLEM

Vanessa Schweizer, Centre for Knowledge Integration, University of Waterloo

I realized belatedly that my discipline, 'Knowledge Integration' may appear cryptic. I would like to begin my comments on what climate change is by telling you a bit more about what Knowledge Integration means at the University of Waterloo, as well as my own background in 'applied' Knowledge Integration.

My PhD is in Engineering and Public Policy from Carnegie Mellon University. The department is housed in the Carnegie Institute of Technology, which would be equivalent to the Faculty of Engineering at the University of Waterloo. Thus, our faculty and graduate student body did policy analysis, but we did it out of the engineering school. Thus we did a certain type of policy analysis – quantitative policy analysis – based on a risk and decision analytic view. Our ranks of faculty and graduate students were, and continue to be, dominated by physicists and engineers. This may provide a sense of why I identify with an 'applied research' orientation towards knowledge integration.

Regarding the Centre for Knowledge Integration at the University of Waterloo, we focus on interdisciplinary undergraduate education. We award Bachelors degrees in Knowledge Integration, where our focus is on developing literature, numerate, articulate, and collaborative students. One of the things we encourage our students to do is to think divergently and convergently. Thus my comments on the presentations we heard today begin by reminding everyone about the diverse perspectives we heard on what climate change is before identifying some points of convergence.

We first heard from the mathematician John Baez. He ran us through some impressive numbers regarding the extent of human impacts on the natural world. Ultimately, he concluded that climate change is one among many anthropogenic manifestations of the geologic epoch we are in, the Anthropocene. Next, we heard from geographer Jean Andrey. She similarly described climate change as one stressor on society among many. She also described ways in which climate change influences society at different spatial and temporal scales. In the temporal vein, we heard from philosopher Byron Williston that climate change is an inter-generational misalignment of incentives for use of the atmospheric commons. He explained that each present generation perceives benefits to venting its greenhouse gas emissions to the atmosphere, to the detriment of future generations.

We next heard a communications perspective from Chris Russill. He argued that climate change is a translation problem between the scientists who have studied it and the decision-makers who must respond to it. This viewpoint is similar to that presented by Mike Hulme, who characterized climate change as a meaning-making problem. I took the liberty of reinterpreting Dr. Hulme as a Science, Technology and

Society (STS) scholar, as his presentation showcased multiple interpretations, or meanings, of climate change – some of which are at serious odds with each other (Ban Ki-Moon's "defining challenge" is James Inhofe's "greatest hoax"). Political scientist Radoslav Dimitrov described climate change as a global human-security problem and summarized the unusual political landscape that surrounds it. In contrast to other global problems, where global powers like the US have played a central role, different political actors can exercise leadership, such as sub-national states (California) and provinces (British Columbia).

Finally, we heard an engineering perspective from Jatin Nathwani, that climate change is a large-scale technology management problem. This is because the energy technologies in question underpin our economic activities, and each has its own life cycle, which spans multiple decades. Professor Sarah Burch provided an educational perspective, also discussing climate change from the perspective of the large-scale. Through her experience teaching a MOOC (Massive Open Online Course) on climate literacy, she showed that the concept of global climate change can become more accessible to students through effective social media in the MOOC model. Her examples included assignments on discussion boards and self-made videos.

In spite of the diversity of these eight perspectives, five points of convergence can be found in the presentations.

- First, climate change is risky. By altering the probability distributions for temperatures and precipitation in climates that we have long taken for granted, the future climate may be quite unlike anything that we are familiar with – potentially in undesirable ways.
- Second, climate change is a market failure, where greenhouse gas emissions due to economic activities have continued unabated for centuries. Setting aside the point that such emissions were not recognized as pollution until relatively recently, this has occurred and continues because the 'social bad' of greenhouse gas pollution has no market signal, or a weak one. Thus the market, which can otherwise allocate market goods and resources quite efficiently, has no self-correcting mechanism for the overproduction of greenhouse gas.
- Third, climate change, and opportunities for political reaction as well as meaning-making, operate at multiple spatial scales.
- Fourth, climate change is only one of many influences and stressors on society.
- Finally, our presenters agree that climate change can have multiple meanings.

Even with these points of convergence, there are more questions about what climate change 'is'. I have three questions, the first of which strikes at the very heart of the question that brings us here today, "What is climate change?" The word, 'is', is the singular present tense of the verb, 'be'. 'Being' is often defined as existing or occurring. If we take these definitions to refer to things that are 'real', or out there in the world, my first question is, "What is 'real' about climate change?" I raise this

question because I would like to return to a point that came up during our first panel, where Jean Andrey acknowledged that there might be tension between scholars who study what can be observed about climate change and those who study what cannot. Here I am referring less to the divide between scholarship that focuses on observation versus that which focuses on theory. Instead, I am referring to the fact that much of what concerns us about climate change has less to do with what we have observed and more to do with the risk of what could happen in the future.

To put a finer point on this question – What is climate change, and what is 'real' about it? – let's have a look at a visual representation of the new framework for scenarios in climate change research (Figure 1). The framework summarized in Figure 1 is relevant to our discussions of what climate change is, as it separates familiar climate change projections, namely temperature change, from other things that will also change in the future. In Figure 1, the vertical axis [W/m^2] pertains to radiative forcing, which is a relevant parameter for climate modeling. Projections for temperature change are strongly determined by radiative forcing. In previous climate change research, radiative forcing was tightly coupled with particular socioeconomic assumptions. This made sense because future concentrations of greenhouse gases will depend on emissions due to economic activity. However, as Jean Andrey mentioned in her presentation, vulnerability to climate change is also a function of socioeconomic conditions. Thus the columns in Figure 1 depict alternative socioeconomic pathways (abbreviated SSP) that could exist in the context of any particular level of radiative forcing. In Figure 1, what is climate change? Is it simply the vertical axis, or are the risks of climate change embodied by the cells representing the intersection of any particular forcing level and set of socioeconomic conditions?

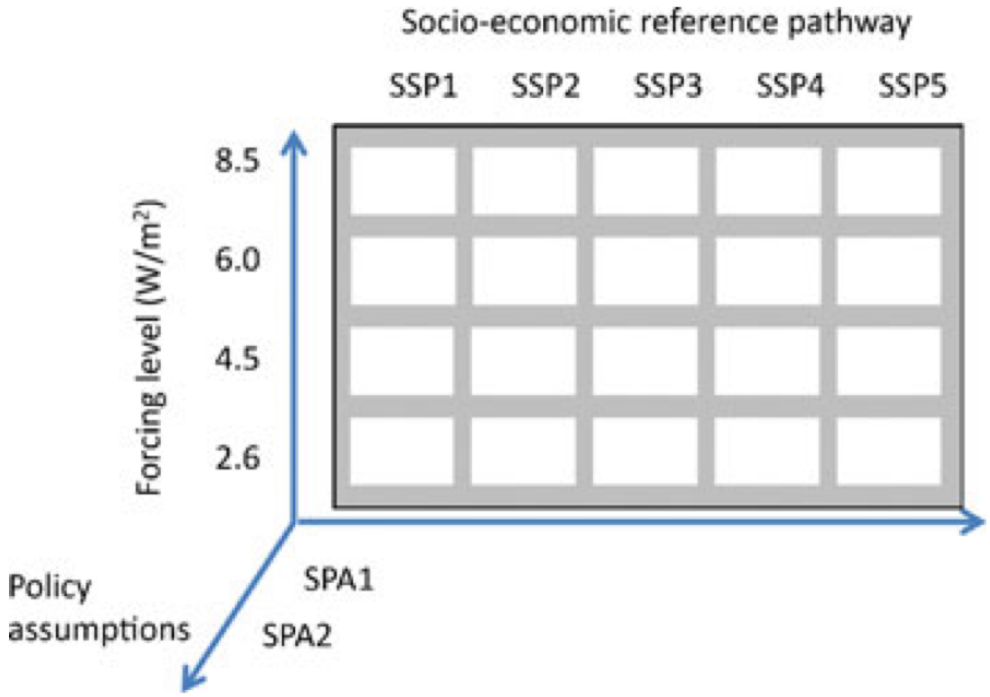

Figure 1. The new scenario matrix architecture described by van Vuuren et al (2013). Forcing level refers to global radiative forcing, while "SSP" is an abbreviation for Shared Socioeconomic Pathway. "SPA" is an abbreviation for Shared Policy Assumption.

Another layer of complexity for Figure 1 is the orthogonal axis for policy assumptions (abbreviated SPA). These refer to global climate policy assumptions, such as whether major emitters agree to limit their emissions by 2020, or if there is a delay, such as a political condition where the EU limits its emissions now while the US does not do so until 2035. Such conditions can affect what forcing levels will be more likely and could have implications for socioeconomic conditions (SSPs) as well. As Radoslav Dimitrov noted in his remarks, negotiators at COP meetings do not think of climate change as an environmental issue. Instead, they are negotiating socioeconomic futures – the SSP columns and SPA axis of Figure 1.

Bearing in mind that Figure 1 represents a future space, that is, a whole dimension of climate change that cannot be observed, it may be little wonder why climate change has multiple meanings. Much of what concerns us about climate change is in this future space, and naturally, what we believe lies ahead of us, or should lie ahead of us, is contested.

My second question is around an assumption that many speakers expressed about the diversity of meanings of climate change. Presenters tended to characterize the diversity of meanings as problematic. However, why should this be so? Instead, it could be argued that the diversity of meanings is a good thing, as multiple meanings provide multiple ways to be concerned about climate change and to address it.

Perhaps the problematic aspects of this diversity belie a different problem: In spite of the recognized value of pluralism, we still have trouble working with it. This observation is very close to Mike Hulme's work on why we disagree about climate change and his comments today on climate change as synecdoche.

My final question returns to a point made by John Baez, that climate change is not the type of problem routinely solved by existing human institutions. John Baez, Byron Williston, and Jatin Nathwani each made the case that climate change reflects an urgent need to update our economies. Baez highlighted that the throughput model for economic growth cannot be sustained indefinitely, while Williston pointed out that our steep discounting of future costs, which is so prevalent in economic thinking, can lead to suboptimal behavior and outcomes. Nathwani discussed the vast undertaking that is required to retool the energy systems that underlie our economy. However, presenters also discussed other time-honored institutions that may be in need of updating.

In his workshop paper, Radoslav Dimitrov mentioned other sub-national political actors that are foisting climate policies onto themselves in light of weak national leadership. Other scientists, such as Cynthia Rosenzweig at NASA GISS, have identified cities as more relevant political actors than nations for responding to climate change (UCCRN 2013). Perhaps these political trends signify a sea change for political science, where the most relevant political institutions in the future will be those that are closer to communities affected by policies.

Sarah Burch also provided a compelling example of what universities could be in the future. Rather than existing primarily (or solely) as physical, bounded learning communities, universities could also provide virtual, unbounded communities. The question of the university's institutional role in climate change is an important one, as academia is an important incubator of ideas and instrumental for developing the human capital on which the economy, and ultimately society, depends. Given the scale and urgency of climate change, it may be worthwhile for those of us in academia to consider where we fit into the picture.

References

UCCRN (2013) Urban Climate Change Research Network. http://uccrn.org. Accessed 30 October 2013.

van Vuuren DP, Kriegler E, O'Neill BC et al. (2013) A new scenario framework for Climate Change Research: scenario matrix architecture. *Climatic Change* doi:10.1007/s10584-013-0906-1.