

# A Case for Open Access: Accelerating Discovery in Climate Science

by Dan Fatton

“Comprehensive scientific assessments of our current and potential future climates clearly indicate that climate change is real, largely attributable to emissions from human activities, and potentially a very serious problem.” This is taken from a public policy statement originally written in 2004 by the American Chemical Society.<sup>1</sup>

Eighteen scientific societies signed on to a similar American Association for the Advancement of Science statement affirming the consensus scientific view on climate change in 2009.<sup>2</sup> According to the California Governor’s Office of Planning and Research,<sup>3</sup> at least 200 worldwide scientific organizations now formally hold the position that climate change has been caused by human action.

The International Panel on Climate Change (IPCC) was set up in 1988 to assess global warming and its impacts. Recently, the panel released a major report, capping its latest assessment, a mega-review of 30,000 climate change studies that establishes with 95% certainty that nearly all warming seen since the 1950s is due to human activity. More than 700 of the world’s top climate scientists and 1,729 expert reviewers from more than 70 countries participated in the report preparation process.

The latest report reinforces with medium to high confidence levels some of the basic science concerning climate change:

- Each of the last three decades has been successively warmer at the earth’s surface than any preceding decade since 1850. The period from 1983 to 2012 was very likely the warmest 30-year period of the last 800 years in the northern hemisphere (high confidence), and likely the warmest 30-year period of the last 1,400 years (medium confidence).
- Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010 (high confidence), while only about 1% of that energy is stored in the atmosphere.
- Glaciers have lost mass and contributed to sea-level rise throughout the 20<sup>th</sup> century. The rate of ice mass loss from the Greenland ice sheet has very likely substantially increased over the period 1992 to 2011, resulting in a larger mass loss over 2002 to 2011 than over 1992 to 2002.
- Over the period 1901 to 2010, the global mean sea level rose by  $0.19 \pm 0.02$  m. The rate of sea-level rise since the mid-19<sup>th</sup> century has been larger than the mean rate during the previous two millennia (high confidence).
- Atmospheric concentrations of greenhouse gases (GHG) are at levels that are unprecedented in at least 800,000 years. Concentrations of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O have all shown large increases since 1750 (40%, 150%, and 20%, respectively).
- Total annual anthropogenic GHG emissions have continued to increase from 1970 to 2010 with larger absolute increases between 2000 and 2010 (high confidence).

To summarize the latest report, “It is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together.”<sup>4</sup>

More troubling than the confirmation of this science, which many have long considered settled, are the projections for future impacts and the truly daunting emission reductions that are projected to be necessary to avoid disruptive, and potentially catastrophic, changes in the future.

As the latest IPCC report notes in the *Extreme Events* section, “Impacts from recent climate-related extremes, such as heat waves, droughts, floods, cyclones, and wildfires, reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability (very high confidence). Impacts of such climate-related extremes include alteration of ecosystems, disruption of food production and water supply, damage to infrastructure and settlements, human morbidity and mortality, and consequences for mental health and human well-being.”<sup>5</sup>

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The disproportionate impacts of climate change are also underscored, “Climate-related hazards exacerbate other stressors, often with negative outcomes for livelihoods, especially for people living in poverty (high confidence). Climate-related hazards affect poor people’s lives directly through impacts on livelihoods, reductions in crop yields, or the destruction of homes, and indirectly through, for example, increased food prices and food insecurity.”<sup>6</sup>

This September, I joined more than 400,000 others for the Peoples Climate March in New York City. I was encouraged by the “We Have the Solutions” contingent of the march, which included several groups of scientists. Many of us have been demanding action on climate change from our leaders, including those that attend the Climate Summit negotiations. For me, the latest IPCC report simply reinforces what I’ve already understood: we must do more to limit greenhouse gas emissions if we want any chance of keeping global temperature change below 2°C relative to pre-industrial levels.

The report also reinforces that the conversion to a clean energy economy is already feasible, both economically and technologically. Countries like Germany have been demonstrating the possibilities of renewable energy, despite having sunshine profiles similar to that of Alaska. Of course, the *Energiewende* transition has not been without growing pains, and most would agree we must address the underlying energy storage issues to fully realize the potential of renewable energy sources like sun, wind, and water. Thankfully, we know the scientists of ECS are working on exciting research to improve our understanding and technological capabilities in batteries, photovoltaics, nanotechnology, and fuel cells, among other cutting-edge fields.

In 2013, the ECS board of directors made a bold, strategic decision to pursue open access. The push for transformation is being driven by a desire to disseminate scientific research and make it more widely accessible, to spread theoretical and practical knowledge that will advance scientific understanding. In March, after launching author choice open access, ECS published its first open access paper in the *Journal of The Electrochemistry*. Since then, there has been a strong demand for open access publication, with more than 214 papers published as open access as of October. Yet, to be truly open access and to create the most freedom possible for research that may affect the sustainability of our planet, we want to remove all financial

barriers in ECS publications. Making the scientific research and data in ECS journals accessible to anyone with an internet connection will only inspire more discoveries, as well as more research and more innovation.

In my view, the bold pledge to move toward open access at ECS has serious implications for action on climate change. If we can make the scientific research results and latest findings published in ECS publications more widely accessible, we may speed up the scientific discovery process. Perhaps a young scientist in the developing world will unlock the key to some perplexing energy storage dilemma once we've made the latest findings more freely available in an ECS journal. Many of us believe we can accelerate the pace of innovation, and help solve critical challenges by opening access to scientific research. The urgency of the climate change crisis underscores the importance of this approach. You can support these efforts directly by donating to the ECS Publications Endowment. ■

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