Avances en el conocimiento del CC desde el AR4

Ferran P. Vilar

X Seminario “Respuestas desde la comunicación y la educación frente al cambio climático”

Valsaín, 15/10/2013
MICHAEL CRICHTON

ESTAT DE POR

edicions 62
“No sabemos lo suficiente como para saber qué va a pasar con el cambio climático”

Daniel Cano
Presidente de Aemet

Me gustaría recomendar el uso sostenible de los recursos, pero eso es complicado.
The study of ignorance and its cultural production
The goal of incorporating agnotology as a teaching tool in the classroom is to study how and why there is ignorance about well-established facts about global warming, such as why public opinion sees disagreement among scientists when little or none exists. This can be approached through the explicit study of influential works of agogenesis, including op-ed articles by syndicated columnists, and the best-selling novel State of Fear, by Michael Crichton (2004), which includes many of the more commonly encountered arguments from the wider agenogenesis literature.
Fact recitation coupled with demonizing any position or person who disagrees with a singularly-derived conclusion has no place in education. Instead, all sides must be covered in highly debatable and important topics such as climate change, because authoritarian science never will have all the answers to such complex problems.”

doi:10.1007/s11191-013-9588-3 - Department of Geography, University of Delaware; Harvard-Smithsonian Center for Astrophysics
Promoting interdisciplinarity through climate change education

Aaron M. McCright\textsuperscript{1,2,*}, Brian W. O'Shea\textsuperscript{1,3}, Ryan D. Sweeder\textsuperscript{1}, Gerald R. Urquhart\textsuperscript{1,4} and Aklilu Zeleke\textsuperscript{1,5}

Climate change is a complex scientific and social problem. Effectively dealing with it presents an immense challenge, yet educating students about it offers educators in science, technology, engineering and mathematics (STEM) fruitful opportunities for promoting interdisciplinarity, retaining talented young people in STEM fields and enhancing multiple literacies of all students. We offer three illustrative examples of interdisciplinary climate change-related STEM education projects. Each of these models is designed deliberately for implementation in the first two years of collegiate-level STEM courses; thus, they may be employed in both four- and two-year institutions. The scientific community can use climate change education opportunities to help further transform STEM education in the US and increase production of high-quality STEM graduates.

We offer three illustrative examples of interdisciplinary climate change-related STEM education projects. Each of these models is designed deliberately for implementation in the first two years of collegiate-level STEM courses; thus, they may be employed in both four- and two-year institutions. The scientific community can use climate change education opportunities to help further transform STEM education in the US and increase production of high-quality STEM graduates.
IPCC WGI 2013 - Novedades

- Escenarios
- Lenguaje de incertidumbre
- Variables
  - Nivel del mar
  - Hielo Ártico
  - Forzamiento neg. aerosoles
- TCR, ESS
- Ciclo del agua
- Atribución variabilidad natural
- Geoingeniería
- Comunicación
  - 19 declaraciones
  - Viernes mañana
  - Movimiento browniano

No novedad:
Peor que el anterior
When Arrhenius published his theory of electrolytic dissociation, his ideas met with resistance for a time, though eventually, thanks in part to Ostwald, the theory was accepted and Arrhenius was given the Nobel prize for it.
James E. Hansen

“I believe there is a pressure on scientists to be conservative. Papers are accepted for publication more readily if they do not push too far and are larded with caveats … I could not see how to prove the existence of a ‘scientific reticence’ about ice sheets and sea level.

James Hansen (2007) - Scientific reticence and sea level rise - Environmental Research Letters 2 024002
doi:10.1088/1748-9326/2/2/024002

Ross Garnaut

"My own experience and observations of related phenomena suggest that the source of bias is scholarly reticence. It is not optimism that is unscholarly, but being too far away from the mainstream. That could potentially cut either way on climate change. However … There must be a possibility that has led to understatement of the risks."

Ross Garnaut (2011) - Garnaut Climate Change Review - Update 2011: Update Paper 5: The science of climate change - Australian Government - -

Carga electrón Millikan
The available evidence suggests that scientists have in fact been conservative in their projections of the impacts of climate change. In particular, we discuss recent studies showing that at least some of the key attributes of global warming from increased atmospheric greenhouse gases have been under-predicted, particularly in IPCC assessments of the physical science, by Working Group I. We also note the less frequent manifestation of over-prediction of key characteristics of climate in such assessments.
Do probabilistic expert elicitations capture scientists’ uncertainty about climate change?

Antony Millner · Raphael Calel · David A. Stainforth · George MacKerron

“We expect these results to hold to a greater extent for less understood climate variables, calling into question the veracity of previous elicitations for these quantities. Our experimental design provides an instrument for detecting ambiguity, a valuable new source of information when linking climate science and climate policy which can help policy makers select decision tools appropriate to our true state of knowledge.”
This paper adds a new dimension to the role of scientific knowledge in policy by emphasizing the multivalent character of scientific consensus. We show how the maintained consensus about the quantitative estimate of a central scientific concept in the anthropogenic climate-change field — namely, climate sensitivity — operates as an `anchoring device' in `science for policy'. In international assessments of the climate issue, the consensus-estimate of 1.5°C to 4.5°C for climate sensitivity has remained unchanged for two decades. Nevertheless, during these years climate scientific knowledge and analysis have changed dramatically. We identify several ways in which the scientists achieved flexibility in maintaining the same numbers for climate sensitivity while accommodating changing scientific ideas.

We propose that the remarkable quantitative stability of the climate sensitivity range is in part the result of adding together a variety of different social worlds relating to climate change, by continuously translating and adapting the meaning of the `stable range'. But the emergent stability also reflects an implicit social contract among the various scientists and policy specialists involved, which allow `the same' concept to accommodate radically different local meanings. Thus the very multidimensionality of such scientific concepts is part of their technical imprecision (which is more than just analytical lack of resolution); it is also the source of their resilience and value in bridging (and perhaps reconciling) the differentiated social worlds typical of modern policy issues. The varying importance of particular dimensions of knowledge for different social groups may allow coexistence to be sustained amidst pluralism, and universality to coexist with cultural distinctiveness.

Anchoring Devices in Science for Policy: The Case of Consensus around Climate Sensitivity

Jeroen van der Sluijs, Josée van Eijnhoven, Simon Shackley and Brian Wynne

Experts started drafting assessment reports for policy-makers when research on anthropogenic climate change (and especially climate modeling) was still in an early stage of development. ‘Assessment’ is the analysis and review of information derived from research in order to help someone in a position of responsibility to evaluate possible actions, or to think about a problem. It does not necessarily mean doing new research. Assessment means assembling, summarizing, organizing, interpreting, and possibly reconciling pieces of existing knowledge, and communicating them so that they...
The ASC expectation, more specifically, is that the scientific outcome is likely to be precisely the opposite of the one that is most often feared — in the case of global climate disruptions, a bias toward underestimating rather than overestimating likely climate disruptions — precisely because so much of the prevailing pattern of scientific challenge has had the opposite focus and concern.”
¿ASC?

- Sólo modelos
- Lazos perdidos
- Pausa?
  - Año de comparación
- Poco Tipping Points
- ECS vs. nivel del mar
- Cambio de referencia
  - 1986-2005

- Adiós
  - Anomalía térmica medieval
  - Rayos cósmicos
- Corriente termohalina
- Nivel del mar
- CC comprometido >2100
- TP Groenlandia
- Atribución reforzada
Spencer R. Weart (2003) - The Discovery of Global Warming - Harvard University Press - Published online: 01/01/2003 - Director of the Center for History of Physics, American Institute of Physics - http://www.aip.org/history/climate/index.htm

Raymond T. Pierrehumbert (2011) - Infrared Radiation and Planetary Temperature - Physics Today January 2011:33-38 - Published online: 01/01/2011 - Louis Block Professor in Geographical Sciences, University of Chicago
Perturbación – Respuesta

- Perturbación
  - Gases y aerosoles añadidos

- Sistema Climático de la Tierra

- Respuesta
  - Temperatura media
  - Impactos
Realimentació

\[ S(s) = \varepsilon(s) \times G(s) \]

\[ \varepsilon(s) = E(s) - S(s) \times H(s) \]

\[ \varepsilon(s) = \frac{G(s)}{S(s)} \]

\[ S(s) = \frac{E(s)}{1 + G(s)H(s)} \]
Table: Projections of Global Mean Surface Temperature Change and Global Mean Sea Level Rise

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scenario</th>
<th>2046–2065</th>
<th>2081–2100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>mean</td>
<td>likely range</td>
</tr>
<tr>
<td>Global Mean Surface Temperature</td>
<td>RCP2.6</td>
<td>1.0</td>
<td>0.4 to 1.6</td>
</tr>
<tr>
<td>Change (°C)</td>
<td>RCP4.5</td>
<td>1.4</td>
<td>0.9 to 2.0</td>
</tr>
<tr>
<td></td>
<td>RCP6.0</td>
<td>1.3</td>
<td>0.8 to 1.8</td>
</tr>
<tr>
<td></td>
<td>RCP8.5</td>
<td>2.0</td>
<td>1.4 to 2.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.24</td>
<td>0.17 to 0.32</td>
</tr>
<tr>
<td>Global Mean Sea Level Rise (m)</td>
<td>RCP2.6</td>
<td>0.26</td>
<td>0.19 to 0.33</td>
</tr>
<tr>
<td></td>
<td>RCP4.5</td>
<td>0.25</td>
<td>0.18 to 0.32</td>
</tr>
<tr>
<td></td>
<td>RCP6.0</td>
<td>0.30</td>
<td>0.22 to 0.38</td>
</tr>
</tbody>
</table>
Escala de tiempo de los lazos

Lazos rápidos

• Radiativos
  – Vapor de agua
  – Albedo hielo marino
  – Nubosidad

• Biológicos
  – Ciclo del carbono (parcial)

Lazos lentos

• Radiativos
  – Aerosoles
  – Albedos terrestres
  – Hidratos de metano

• Biológicos
  – Fracción aérea
  – Permafrost + tundra
  – Otros suelos
  – Fuego
“Periods of extreme drought in particular reduce the amount of carbon absorbed by forests, meadows and agricultural land significantly. “We have found that it is not extremes of heat that cause the most problems for the carbon balance, but drought,” explains [lead author] Markus Reichstein.... Drought can not only cause immediate damage to trees; it can also make them less resistant to pests and fire. It is also the case that a forest recovers much more slowly from fire or storm damage than other ecosystems do.”
"None of the climate projections in the IPCC Fourth Assessment Report include the permafrost carbon feedback (IPCC 2007). Participating modeling teams have completed their climate projections in support of the Fifth Assessment Report, but these projections do not include the permafrost carbon feedback. Consequently, the IPCC Fifth Assessment Report, due for release in stages between September 2013 and October 2014, will not include the potential effects of the permafrost carbon feedback on global climate."
"Biological systems constitute a critical, but sometimes overlooked, component of the climate system because they influence key physical characteristics of the land surface and atmosphere ... Unfortunately, it's difficult to include these feedbacks accurately in climate projections because future responses of vegetation are hard to constrain using past observations and field experiments."

Global warming amplified by reduced sulphur fluxes as a result of ocean acidification

Katharina D. Six, Silvia Kloster, Tatiana Ilyina, Stephen D. Archer, Kai Zhang & Ernst Maier-Reimer

Climate change and decreasing seawater pH (ocean acidification) have widely been considered as uncoupled consequences of the anthropogenic CO₂ perturbation. Recently, experiments in seawater enclosures (mesocosms) showed that concentrations of dimethylsulphide (DMS), a biogenic sulphur compound, were markedly lower in a low-pH environment. Marine DMS emissions are the largest natural source of atmospheric sulphur and changes in their strength have the potential to alter the Earth’s radiation budget. Here we establish observational-based relationships between pH changes and DMS concentrations to estimate changes in future DMS emissions with the reduced DMS emissions induce a significant additional radiative forcing, of which 83% is attributed to the impact of ocean acidification, tantamount to an equilibrium temperature response between 0.23 and 0.48 K. Our results indicate that ocean acidification has the potential to exacerbate anthropogenic warming through a mechanism that is not considered at present in projections of future climate change.
# Previsión temperatura

<table>
<thead>
<tr>
<th></th>
<th>Δ 2081-2100 (°C)</th>
<th>Σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCC WGI 2013 RCP8.5</td>
<td>3,7</td>
<td></td>
</tr>
<tr>
<td>DMS</td>
<td>0,7</td>
<td>4,4</td>
</tr>
<tr>
<td>Permafrost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Otros lentos</td>
<td></td>
<td>5,4</td>
</tr>
<tr>
<td>Cambio referencia</td>
<td>0,6</td>
<td>6,0</td>
</tr>
</tbody>
</table>
The world: 4°C warmer

Ice melt will result in rising sea levels.

Greenland
Global rise:
will be meting rapidly

Scandinavia/UK/Northern Russia/Greenland
Compact high-rise cities would provide shelter for much of the world's highly populous

Siberia
Melt ice will provide water for urban areas

Southern Europe
Desertification is seen as a major threat to the continent, with large areas of the

Southern China
Dried rivers and arid plains have occurred due to climate change.

Canada
Rising temperatures will lead to flatter landscapes and increased forest fires.

South-west US
Desertification is seen as a major threat to the continent, with large areas of the

Peru
Desertification will render this area dry and uninhabitable.

Western Antarctica
Sea levels will rise due to melting ice sheets.

Patagonia
Guidelines for new areas will be implemented.

Food growing zones/Compact high-rise cities

Uninhabitable due to floods, drought or extreme weather

Solar power

Solar energy

Wind energy

New Zealand
Uninhabitable due to floods, drought or extreme weather.

Australia
In the far north and Tasmania, compact high-rise cities will provide shelter for much of

Gaia Vince (2009) - How to survive the coming century - New Scientist, Marzo 2009 -
Las sucesivas ediciones de este informe han demostrado que el objetivo climático de limitar el calentamiento global a 2 °C se hace más difícil y costoso de conseguir cada año que pasa.

Even with the current mitigation commitments and pledges fully implemented, there is roughly a 20 percent likelihood of exceeding 4°C by 2100. If they are not met, a warming of 4°C could occur as early as the 2060s.
<table>
<thead>
<tr>
<th>Fuente</th>
<th>mm/año</th>
<th>Gt/año</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groenlandia</td>
<td>0,33</td>
<td>215</td>
</tr>
<tr>
<td>Antártida</td>
<td>0,27</td>
<td>147</td>
</tr>
<tr>
<td>Glaciares</td>
<td>0,76</td>
<td>275</td>
</tr>
<tr>
<td>Almacenamiento</td>
<td>0,38</td>
<td></td>
</tr>
<tr>
<td>Dilatación</td>
<td>1,10</td>
<td></td>
</tr>
</tbody>
</table>
¿Solución?

Kevin Anderson and Alice Bows (2011) - Beyond ‘dangerous’ climate change: emission scenarios for a new world - Philosophical Transactions of the Royal Society of London A 369:20-44 doi:10.1098/rsta.2010.0290 - Tyndall Centre for Climate Change Research + School of Mechanical, Aerospace and Civil Engineering + School of Environmental Sciences and School of Development, University of East Anglia; Sustainable Consumption Institute, School of Earth, Atmospheric and Environmental Sciences, University of Manchester
"Similar reproche merecen los que deforman o exageran las conclusiones de la ciencia del clima, con alarmas que obvian cautelas y pasan por alto incertidumbres. Lo más recomendable, por tanto, es la atenta lectura de los informes del IPCC, donde se emplea un lenguaje escrupuloso que pretende reflejar lo que se sabe y lo que aún no se conoce bien."
¡CSIC!

Comunicado AEC ante las declaraciones del Presidente de AEMET

La Junta Directiva de la Asociación Española de Climatología (AEC) quiere con este comunicado expresar su posición científica en relación a una entrevista al Presidente de AEMET (Agencia Estatal de Meteorología) publicada el día 25 de noviembre de 2012 por EUROPA PRESS en la sección de Política Social, donde Daniel Cano opina, entre otras cosas, que “no se sabe lo suficiente como para asegurar las cosas que se están asegurando en relación al fenómeno del cambio climático”.

El mencionado comunicado puede descargarse en este archivo pdf COMUNICADO AEC. También puede consultarse a través de nuestro facebook ASOCIACIÓN ESPAÑOLA DE CLIMATOLOGÍA.

La AEC ha abierto un periodo de firmas para que aquellas personas que estén interesadas en apoyar los argumentos expresados en el comunicado puedan hacerlo. Para ello tienen que enviar un correo electrónico con su nombre y dos apellidos a la siguiente dirección: info@aeclim.org , indicando en el asunto “firma la carta AEC”. 

¡CSIC!
Figure 1.1. The four organs of mass communication. To reach the broadest audience, you need to move the process out of the head (1) and into the heart (2) with humor and intuition, and, ideally, if you're sexy enough, lower organs (3) with sex appeal. Photo courtesy of © Miriam Sygma/Corbis.
Gracias una vez más.