

CORRESPONDENCE:

Difficult but not impossible

To the Editor — Parmesan and colleagues¹ criticize a guidance paper that was produced following an Intergovernmental Panel on Climate Change (IPCC) expert meeting on detection and attribution². This paper includes methods that seek to establish links between observed changes and external drivers of climate change, including greenhouse gases. Parmesan and co-authors argue that attempting to attribute ecological impacts to rising greenhouse gases is 'misguided' and instead propose concentrating on assessing the interacting roles of climate and other environmental factors, regardless of their underlying causes.

The guidance paper — of which most of us are co-authors — does not advocate one particular type of research over another. Rather, it attempts to bring clarity and uniformity to the diverse set of methods associated with the detection and attribution of climate change and its impacts. We contend, however, that detection and attribution is both possible and advisable.

We agree that it is important to carefully account for confounding drivers of change, and this is indeed stressed in the guidance paper. It seems near-sighted, however, to

suggest that the difficulty of attributing a species' extinction to the human influence on climate makes any such attempt 'misguided' in principle. Parmesan and co-authors observe that it is difficult to attribute the extinction of a species known to have been caused by a single event to human-induced climate change with high confidence. It is incorrect, however, to suggest that this means it is 'inappropriate' even to try. If human influence on climate doubles or quadruples the probability of a given event occurring — as has been estimated in a few well-studied cases — then there is a clear sense in which its causal role can be quantified, albeit probabilistically³.

Attributing events to natural versus anthropogenic causes may not always be the most important research goal, particularly in the case of some conservation challenges. However, being able to identify changes that are due to greenhouse-gas forcing has important implications for what lies ahead. A change associated with greenhouse-gas forcing is likely to continue, while changes due to internal climate variability may be more likely to reverse. Quantifying the impacts of anthropogenic climate change in this way is also important in guiding

the allocation of resources available for adaptation. □

References

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Ove Hoegh-Guldberg^{1*}, Gabi Hegerl², Terry Root³, Francis Zwiers⁴, Peter Stott⁵, David Pierce⁶ and Myles Allen⁷.

¹Global Change Institute, University of Queensland, St Lucia, Queensland 4072, Australia, ²Grant Institute, The King's Buildings, West Mains Road, University of Edinburgh, Edinburgh EH9 3JW, UK, ³Woods Institute for the Environment, Stanford University, 473 Via Ortega, Stanford, California 94305, USA, ⁴University of Victoria, PO Box 1700 Sta CSC, Victoria, British Columbia V8W 2Y2, Canada, ⁵Met Office Hadley Centre, FitzRoy Road, Exeter EX1 3PB, UK, ⁶Climate Research Division, Mail Stop 0224, Scripps Institution of Oceanography, La Jolla, California 92092-0224, USA, ⁷School of Geography and the Environment, University of Oxford, Oxford OX1 3QY, UK.

*e-mail: oveh@uq.edu.au

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The current status of climate change research

To the Editor — A deeper understanding of current climate change and the mitigation of its potential future effects are among the greatest challenges facing modern science and society as a whole. In recognition of this, the past few years have seen a striking growth in funding and publication of climate change research, a trend that looks set to continue. Moreover, these trends have been matched by an increase in media coverage of climate change. Here we provide an overview of these trends.

US government and philanthropic foundation funding specifically for climate change research has increased to about \$3.5 billion per year^{1,2}, although numerous studies on the impacts of climate change are funded by other sources, see for example, ref. 3. The number of journals dedicated primarily or exclusively to climate change research doubled from 10 in 2006 to 20 in 2010, and at least two new titles have already been released this year (Fig. 1; Supplementary Table S1). This striking growth reflects an increasing

interest and investment in this field by the major scientific publishers.

We queried the Web of Science (WoS) database to selectively identify climate change publications (Supplementary Table S2) and retrieved a total of 110,139 records. Exponential growth is clearly evident over the past 19 years (Fig. 1). Our data indicate that the number of publications per year doubled from 1997 to 2004, and from 2005 to 2009. In fact, almost half of the 110,139 retrieved records were published between 2006 and 2009.

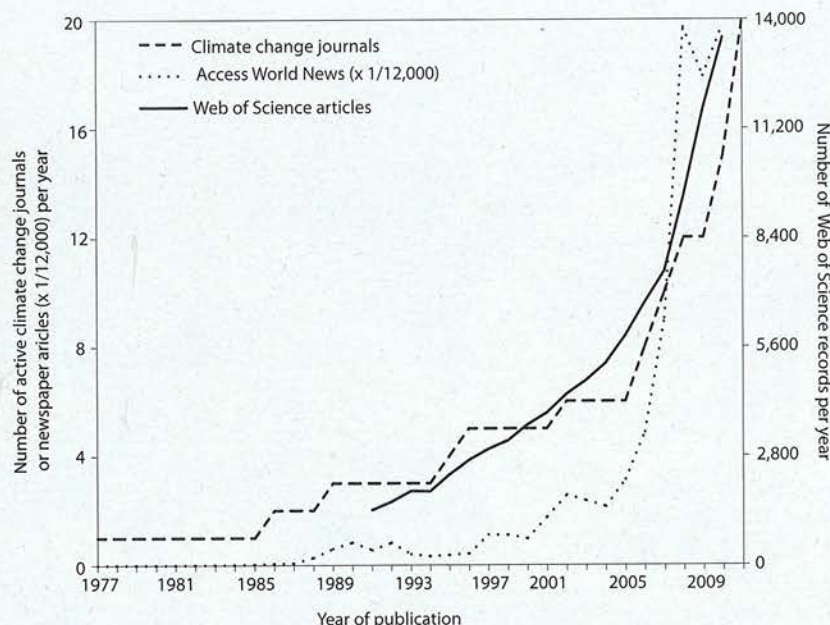


Figure 1 | Growing footprint of climate change in scientific research and the news media. This graph shows the number of journals exclusively dedicated to climate change actively published each year (dashed line); records retrieved by the search query from either Web of Science (solid line; exponential growth: $y = 242.95e^{0.1171x}$) or Access World News (dotted line; divided by 12,000). Note that Access World News database records for 2007 and 2009 numbered just under 240,000 for each year. Because Web of Science added abstracts in 1991, search results for previous years are artificially lower and are not shown here.

Stanhill⁴ projected that by the “middle of the twenty-first century” the cumulative climate change literature would reach “100,000 [articles], equal to that of a major scientific discipline”. It appears to have exceeded that level already.

The top 25 institutions publishing climate change research include 8 (32%) government agencies and 17 (68%) universities (Supplementary Table S3). Institutes in the US and the 27 European Union countries accounted for ~80% of the total climate change research literature (Supplementary Table S3). Many other countries yielded a significantly lower, but modestly growing, number of records (Supplementary Fig. S1).

Climate change is now being studied across a wide range of fields. Refining the query results by grouping WoS subject categories into the 10 largest broad categories (Supplementary Table S3) reveals that only about 5% (5,580/110,139) of the articles published so far are in the social sciences, 28% of which are from the journal *Energy Policy*. A previous study reported low numbers of climate change articles in the top journals from several social science fields⁵, and a recent examination of thousands of citations in the third assessment report from the Intergovernmental Panel on Climate Change (IPCC) found them

to be “strongly dominated by the natural sciences”⁶.

Of the current 253 WoS subject categories, 229 were represented in the climate change query results (data not shown). However, a recent survey of 6,417 references in the IPCC’s third assessment report found that interdisciplinarity, in the sense of individual studies examining issues across multiple disciplines, “is not a prominent feature” of current climate change research⁷; and the complex topic of climate change interdisciplinarity is now receiving increasing attention^{7,8}. To foster coordinated international efforts, instruments such as the Kyoto Protocol, Copenhagen Accord and IPCC were designed to unite scientists from numerous fields with policymakers and economists, to identify the myriad problems, implications and factors associated with understanding climate change and to design practical mitigation strategies.

The role of the general public in climate change mitigation will probably be significant; involving factors such as consumer choices and popular support for mechanisms like carbon-trading systems. The number of climate change-related newspaper articles (‘newsworthiness’) in the Access World News database was used here as a proxy for the level of public

interest/awareness of climate change issues. The terms of the search query, minus the journal titles (Supplementary Table S2, Query 5), yields over 1.3 million records, with the yearly distribution since 1977 shown in Fig. 1. The newsworthiness of climate change surged after 2003, reaching maximum levels of ~240,000 articles per year for 2007 and 2009.

The recent growth in funding levels, scientific research and media interest reflect increasing attention to climate change at all levels: public sentiment, and scientific and policy priorities. Further scientometric and bibliometric analyses of this field may suggest ways to improve collaboration networks and technology transfer among the many, diverse stakeholders. Unprecedented levels of collaboration will probably be required to find climate change solutions that are scientifically, socially and politically feasible.

References

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Author contributions

M.L.G. and M.Z. designed the study together. M.L.G. performed the database searches and compiled data for the list of climate change journals in the supplementary information. M.L.G. and M.Z. compiled (and excluded, when appropriate) the terms of the search strategy, discussed the analysis and results in the context of the global climate change issue, and wrote the manuscript.

Additional information

Supplementary information accompanies this paper on www.nature.com/natureclimatechange.

Michael L. Grieneisen¹ and Minghua Zhang^{1,2*}

¹Department of Land, Air and Water Quality, University of California – Davis, Davis, California 95616, USA, ²Wenzhou Medical College, Wenzhou, Zhejiang 325000, China. *e-mail: mhzhang@ucdavis.edu

Correction

In the print version of the Commentary ‘Time to try carbon labelling’ (M. P. Vandenbergh, T. Dietz & P. C. Stern, *Nature Clim. Change* **1**, 4–6; 2011), in the acknowledgement, the first name was spelt incorrectly; it should have read Lisa Kenney. This is correct in the HTML and PDF versions.