Evidence based Policy: How might the IPCC's fifth assessment report alter the trajectory of climate negotiations?

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UNFCCC

The United Nations Framework Convention on Climate Change (or UNFCCC) is a global mechanism that aims to provide an intergovernmental platform to mitigate the effects of climate change globally. Membership is almost universal across the world with 194 countries listed as members of the UNFCCC.

The ultimate objective of the UNFCCC is to stabilise the level of greenhouse gas emissions in the Earth's atmosphere as to stop any major disruptions to the world's environments and ecosystems as a result of human induced interference with the climate system. It was established at the Rio Earth summit in 1992 in response to international concerns about climate change. Its establishment was a formal recognition that climate change was an issue that simply could not be resolved by individual nations; a coordinated response was required.

Member-states attend an annual 'Conference of Parties' (or COP) to assess the level of progress in mitigating the effects of climate change and establishing legally binding obligations for countries to reduce their emissions. In 2012, the main COP will be held in Qatar.

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Abstract

From 2013 through 2014, the Intergovernmental Panel for Climate Change (IPCC) will release its three part fifth Assessment Report (AR5) regarding the scientific evidence of climate change and strategies to mitigate and adapt to this change. The report will be released during the negotiations of the new global climate agreement under the Durban Platform for Enhanced Action, which is to be finalized in 2015 and put in force by 2020. Both scientists and policy makers are now calling for a more ambitious approach to the implementation of evidence-based policy. This paper argues that although the AR5 has greatly increased the certainty of evidence, which has increased policy relevance, it is unlikely to raise ambition based solely on its findings and inclusion within the periodic review. Its impact is also dependent on the geopolitical context it is released into, and whether sufficient preliminary action is taken before its release.

Introduction

The IPCC, which is the leading international body for climate change assessment – has, since 1990, presented scientific evidence showing that not only is climate change occurring, but that it is highly likely to be anthropogenic. Projections in its previous assessment reports show that current global efforts to mitigate this under the United Nations Framework Convention on Climate Change (UNFCCC) are insufficient to avoid dangerous anthropogenic climate change[1]. Reasons for this shortfall in greenhouse gas (GHG) emission reductions are not due to lack of participation or insufficient technology, but due to lack of political will[2].

In 2011, the seventeenth Conference of Parties (COP17) in Durban produced an agreement for a legally binding multilateral treaty to be agreed upon by 2015 and implemented by 2020. The timing of the release of the AR5, which will include potential impacts of climate change and response strategies, represents an opportunity to raise ambition for climate change mitigation efforts in the framing of the 2015 treaty. AR5 will coincide with the 2013-2015 Periodic Review of the UNFCCC, and will be used as the primary source of scientific evidence to assess whether a limit of a two degree temperature rise in global temperatures above pre-industrial levels is sufficient to avoid dangerous anthropogenic climate change. Both the periodic review and the AR5 may change the ambition of the next legally binding treaty.

This paper discusses the impact the AR5 may have on the trajectory of negotiations. Initially the AR5 and AR4 will be compared, in terms of extreme weather events, as well as differences in scenarios used and climate modeling. Also, the possible context of negotiations around the release of the AR5, as well as its recommendations on how it may increase ambition of mitigation targets will be discussed.

Climate modeling was chosen due to the significant advances in scenarios and Greenhouse Gas (GHG) Metrics, which have been identified by the IPCC to be major 'cross cutting

[1,2] Climate Action Tracker, Governments set world on more than 3°C warming, still playing with numbers, 4 September 2012, retrieved 8 September 2012,<http://climateactiontracker.org/assets/publications/press_releases/2012-09-04_Bangkok_2012_PR.pdf>.

methodologies' within the AR5[3]. The analysis and projection of extreme weather events – under the umbrella of Water and the Earth System: Changes, Impacts and Responses - was also stated to be a 'cross cutting theme'[4], an area which has also developed significantly since 2007 and is therefore worth exploring here. Both of these issues are of especial importance in regards to human response to climate change as the former relates to projections of global temperature increase, and the latter addresses the impacts of this increase.

Emerging Climate Science

Climate Modeling and Radiative Forcing

Climate modeling and analysis of both anthropogenic and natural radiative forcing has undergone considerable change since the IPCC's fourth Assessment Report (AR4) in 2007. Radiative forcing is defined as the imbalance between incoming solar radiation and outgoing infrared radiation[5], measuring solar irradiance in Watts/m^2 (W/m^2). As such it predicts the degree of global warming or cooling. The AR4 presented impacts of projected global temperature increases using scenarios described in the IPCC's Special Report on Emissions Scenarios (SRES 2000)[6]. The various scenarios, which were alternative images of how the future of Greenhouse Gas (GHG) emissions may unfold, were dependent on the highly uncertain changes in technology, macroeconomics and population growth. However climate projections for the AR5 will replace the SRES scenarios with 2 new sets of scenarios to be used in a matrix; Representative Concentration Pathways (RCPs)[7] and Shared Socio-economic-ecological Pathways (SSPs)[8]. Since solar irradiance is influenced by GHGs, the 4 RCPs to be used within the AR5 (RCP2.6, 4.5, 6.0 and 8.0) correspond also to 4 GHG concentration trajectories (rather than the emissions trajectories used previously). They are modeled on the 4 radiative forcing values in the year 2100, for which they are named. The RCPs, developed to expedite the modeling process, hold a major conceptual advantage, as they consider radiative forcing irrespective of the contributing socio-economic factors[9], leading to decreased variables associated with projections. RCPs also include an additional scenario of strong, policy driven mitigation of climate change[10], RCP2.6, which will peak at 2020 with a radiative forcing of $3W/m^2$. Based on data compiled from literature sources and

[3,4] IPCC, 'Activities: Fifth Assessment Report', <http://www.ipcc.ch/activities/activities.shtml#.UHKKGPmzu0V>, (accessed 1st October 2012).
[5] Earth System research Laboratory, 'Radiative Forcing of Climate by non-CO2 Atmospheric Gases What is Radiative Forcing of Climate by Trace Gases?', <http://www.esrl.noaa.gov/research/themes/forcing/> accessed on 12 October 2012.
[6] IPCC Special Report on Emissions Scenarios (eds Nakicenovic, N. & Swart, R.) (Cambridge Univ. Press, 2000).
[7] J.P. Van Ypersele, 'Update on Scenario Development: from SRES to RCPs' *Vice-chair of the IPCC,* Cancún 2010.
[8] IPCC, 2012: Workshop Report of the Intergovernmental Panel on Climate Change Workshop on Socio-Economic Scenarios [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, V. Barros, C.B. Field, T. Zwickel, S. Schloemer, K. Ebi, M. Mastrandrea, K. Mach, C. von Stechow (eds.)]. IPCC Working Group III Technical Support Unit, Potsdam Institute for Climate Impact Research, Potsdam Germany, pp. 51
[9] WMO, 'Emission Scenarios', <http://www.wmo.int/pages/themes/climate/emission_scenarios.php>, accessed 5 October 2012.
[10] RH Moss et. al., 'The next generation of scenarios for climate change research and assessment', *Nature,* Vol. 463, 2010, p.747-756.

compiled into RCPs, they unavoidably contain some inconsistencies as they were produced by four different Integrated Assessment Models (IAMs). RCPs will be used in an integrative "parallel process" (rather than the traditional sequential approach), to assess impacts, adaptation, vulnerability and mitigation[11].

RCPs will be used in conjunction with the fifth phase of the Coupled Model Intercomparison Project (CMIP5) [12], the next generation in climate modelling. Relative to the CMIP3 used in the AR4, the CMIP5 incorporates more comprehensive models, allowing for a broader set of experiments, as well as enhanced documentation of experimental conditions[13]. Additionally, the CMIP5 will operate at a higher spatial resolution of both atmospheric and oceanic components, allowing the AR5 to provide "much greater regional detail on climate change impacts"[14].

The RCPs are also to be used in conjunction with the previously mentioned SSPs. The SSPs describe five scenarios of various adaptive and mitigation capacities ranging from "low adaptive-low mitigation" through to "high adaptive – high mitigation". These scenarios will provide socio-economic narratives for the RCPs, characterizing the specific mitigation and adaptive options needed to reach and respond to different radiative forcing levels[15]. This matrix including RCPs and SSPs will enable increased policy relevance without being policy prescriptive.

Changes in scenarios and models make direct comparisons between findings in the AR4 and those that will be presented in the AR5 difficult. However research was conducted[16] to compare SRES scenarios with the RCP using a consistent model framework (used in AR4 projections), giving a preview of the results expected in the AR5. This showed that three of the four RCPs to be used in the AR5 (RCP 8.5, RCP6 and RCP 4.5) had similar increased temperatures to SREN scenarios (SRESA1F1, SRES B2 and SRES B1 respectively). However the so-called "strong mitigation" scenario RCP2.6, (also known as RCP3-PD) which requires CO_2 concentration-associated solar irradiance to peak at $3W/m^2$ by 2020 and decline later in the century (peak and decline "PD") was illustrated in other research[17, 18]. This was conducted through using various models to predict an overall temperature increase of 1.5^oC by 2100, which is still under that deemed by the UNFCCC as sufficient to avoid dangerous

[11, 18] M. Meinhshausen et. al., 'The RCP greenhouse gas concentrations and their extensions from 1765 to 2300', *Climatic Change,* vol. 109, no.1-2, 2011, p.213-241.
[12, 16] J. Rogelj, M. Meinshausen, R. Knutti, 'Global warming under old and new scenarios using IPCC climate sensitivity range estimates', *Nature Climate Change,* 2, 2012, p. 248–253
[13] K.E. Taylor, R.J. Stouffer, G.A. Meel, 'An Overview of CIMP5 and the Experiment Design', *American Meteorology Society,* 2011.
[14] IPCC, 'The IPCC's Fifth Assessment Report (AR5)', <http://www.ipcc.ch/pdf/ar5/ar5-leaflet.pdf>, accessed 7 October 2012.
[15] IPCC, 2012: Workshop Report of the Intergovernmental Panel on Climate Change Workshop on Socio-Economic Scenarios [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, V. Barros, C.B. Field, T. Zwickel, S. Schloemer, K. Ebi, M. Mastrandrea, K. Mach, C. von Stechow (eds.)]. IPCC Working Group III Technical Support Unit, Potsdam Institute for Climate Impact Research, Potsdam Germany, pp. 51
[17] J. Schewe, A. Levermann, M. Meinshausen, 'Climate change under a scenario near 1.5 °C of global warming: monsoon intensification, ocean warming and steric sea level rise', *Earth System Dynamics,* Vol. 2, 2011, p.25-35.
[19] UNFCCC, *Article 2: Objective*, 2012, retrieved 7 September 2012, <http://unfccc.int/essential_background/convention/background/items/1353.php>.
[20] S. Raper, 'Climate Modelling: IPCC gazes into the future', *Nature Climate Change,* Vol. 2, 2012, p.232-233.

anthropogenic climate change[19]. It is not unreasonable to expect similar findings being published in the AR5[20], despite the use of different models.

Further innovations since the AR4 include the new concept of Global Temperature-Change Potential (GTP), This metric was developed in response to the 2010 Cancún Agreements, which provided an internationally recognized 1.5-2^{o}C limit to warming above pre-industrial levels[21]. GTPs represent the temperature change at a given time due to an emission of a gas, relative to that for the same mass of emitted CO_2[22]. This will be used in addition to Global Warming Potential (GWP), however it does not measure temperature and does not highlight the need to limit cumulative CO_2 emissions. GTPs have been introduced as a means of descending the cause-effect chain to decrease ambiguity and increase relevance for guiding policy, as GWP are ill suited to this[23].

The AR5's findings and representation of results are likely to have some affect on the trajectory of the next commitment period. As mentioned above, the use of RCPs increases the robustness of projections, although most RCPs were shown to follow a similar radiative forcing path as SRES scenarios. Moreover, the addition of the RCP2.6 highlights the need for immediate and dramatic increase of ambition, as this pathway requires GHG emissions to peak at 2020. Modeling shows this pathway is likely to avoid dangerous climate change; making it directly relevant to the policy making of the next treaty as it shows the need for increased ambition without being policy prescriptive. The use of the updated CMIP5 model, which allows for increased certainty as well as increased spatial and temporal resolution, enables models to discern the effect of anthropogenic climate change at a regional level. This improvement gives research presented in the AR5 increased relevance to the national interest of each UNFCCC party. The inclusion of GTPs as a means of elucidating the cause-effect chain makes findings presented in the AR5 is of particular interest since it decreases the ambiguity of the affect of GHGs and aerosols and allows the effect of GHGs to be presented with greater clarity.

Extreme Weather Events

A direct impact of any magnitude of global warming will be an increase in the intensity, frequency and duration of extreme weather events[24], including tropical storms, heat waves, floods and droughts[25]. An extreme weather event is defined in the IPCC's Special Report for

[21] UNFCCC, *The Cancun Agreements*, <http://cancun.unfccc.int/>
2011, retrieved 7 September 2012
[22] K.P. Shine, J.S. Fuglestvedt, K. Hailemariam, N.Stuber, 'Alternatives to the Global Warming Potential for Comparing Climate Impacts of Emissions of Greenhouse Gases', *Climatic Change,* Vol. 68, No. 3, 2005, p.281-302.
[23] S.M. Smith et. al., 'Equivalence of greenhouse-gas emissions for peak temperature limits', *Nature Climate Change,* Vol. 2, 2012, p.535-538.
[24,26] IPCC 'Summary for Policymakers. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation' [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea,, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 2012.
[25] IPCC 'Climate Change 2007: Synthesis Report.' Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)]. IPCC, Geneva, Switzerland, 104 pp., 2007.

Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) as a climate event with a 1-5% chance of occurring over a given time frame[26].

The robust findings of the IPCC presented in the 2007 AR4 were that increases in extreme precipitation and heat waves are *very likely* (>90% certainty) and that increases in drought-affected areas and tropical cyclones are *likely* (>66% certainty) under a range of SRES scenarios. These increased extreme weather events will impact on all sectors of society and the environment in both the near and long term[27]. A report by the independent organization DARA, which monitors and evaluates climate change, disaster management and humanitarian aid, stated that storms are becoming more extreme due to increased rainfall and wind speeds, as well as a pole ward shift in tropical storm tracks[28]. However in the AR4 the key uncertainty addressed was the difficulty of analyzing and monitoring extreme climate events. Greater spatial and temporal resolution of such events is required for increased certainty of projections[29].

Since the AR4 new methodologies such as downscaling[30, 31] (taking information known at a large scale to make projections at a regional scale[32]) have been adopted for projections of future frequencies of tropical cyclones. New research highlights the significance of Sea Surface Temperatures (SSTs) in the frequency and magnitude of tropical cyclones, and notes a strong correlation to GHG concentration[33]. The application of statistical downscaling to SSTs was conducted in conjunction with CMIP5 and will be included within the AR5 report[34]. The research [35] involved predicting Northern Atlantic (NA) tropical storms (TS) under different RCPs, however results showed that different scenarios had little affect on the total number of tropical storms, and that from 2006-2050 the average trends were for an additional two TS per century, with weaker trends over the latter half of the century. It was concluded that these projected increases in tropical storms were due not to increases in GHG, but to the model's response to non-greenhouse gases (such as ozone and aerosols), showing that GHGs have little effect.

Since the AR4 there has been no change in the IPCC's analysis of the effect of anthropogenic climate change. In particular, it was stated in both the AR4 (2007) and SREX (2012) that since

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[27,29] IPCC 'Climate Change 2007: Synthesis Report.' Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)]. IPCC, Geneva, Switzerland, 104 pp., 2007.
DARA, 'A Guide to the Cold Calculus of a Hot Planet', *Climate Vulnerability Monitor,* 2012
[28,38] DARA, 'A Guide to the Cold Calculus of a Hot Planet', *Climate Vulnerability Monitor,* 2012.
[30] Knutson, TR, JL McBride, J Chan, K Emanuel, G Holland, C Landsea, I Held, JP Kossin, AK Srivastava, M Sugi 'Tropical cyclones and climate change', Nature Geoscience, Vol. 3, 2010, pp.157–163.
[31]Emanuel, K., Sundararajan, R. & Williams, J. Hurricanes and global warming: results from downscaling IPCC AR4
[32]Geographic Information System, 'Climate Change Scenarios: What is downscaling?', <http://gisclimatechange.ucar.edu/question/63>, accessed 12 October 2012.
[33] Hawkins, E, PL Vidale, 'Meteorology: counting the storms', Nature Climate Change, July 2012, Vol. 2, pp.574-575.
[34,35] Villarini, G, GA Vecchi, 'Twenty-first-century projections of North Atlantic tropical storms from CMIP5 models', Nature Climate Change, May 2012, Vol. 2, pp604-607.
[36] DARA, *Report: Climate crisis already causing unprecedented damage to the world economy; human impact on large scale,* Climate vulnerability monitor, 2012.
[37] M. Marshall, 'Climate change already harming the global economy', *New Scientist,* Vol. 215, No.2884, 2012, p.5

1950 it is *very likely* that there has been an overall increase in the number of unusually warm days and nights. Emerging research has shown that this has had a large negative impact on human productivity, a harmful affect not covered by the AR4. A report released by DARA stated that in 2010 climate change shaved 1.6% off the global gross domestic product (GDP) [36]. Taking this into account, emissions cuts were proposed as a cheaper alternative, costing only 0.5% of global GDP, as opposed to 3.2% - the predicted costs of climate change in 2030[37] under 'business as usual' (very similar to the RCP8.5) projection. This is continued further, with DARA stating that costs due to climate change could exceed 10% by the end of the century[38]. It is to be hoped that these findings may also be presented in the AR5, as a major change stated by the IPCC in their coming report is 'greater emphasis on assessing the socio-economic factors of climate change'[39].

Since AR4, further study has been conducted with increased emphasis on how increased extreme weather events become disasters, defined as when society and/or ecosystems cannot cope with extreme weather events effectively[40]. In 2012 the IPCC released the SREX, which examined how exposure (the presence of people or assets in places that could be adversely affected) and vulnerability (the predisposition to be adversely affected) can be reduced through adaptation strategies to minimize losses.

These findings are also likely to increase the ambition of parties under the UNFCCC, especially in those countries that will be most affected. If considered in the AR5 findings, the finding that potentially holds the greatest impact to raising mitigation ambition is that claimed by DARA (discussed above) that due to decreased productivity and increased extreme weather events, it is more economic to put in place stringent mitigation and adaptation strategies. These strategies presented in the AR5 will expand on what has already been stipulated in the SREX and Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN). The only negative impact on ambition may be the new findings that Northern Atlantic tropical storms are increased through changes in aerosol-associated radiative forcing rather than increases in GHG concentration. Superficially, the fact that there are apparently fewer cyclones in recent years may elicit complacency; however it is now understood that there is a slight increase in the frequency of higher intensity cyclones. The significance of this elucidated by DARA, who reported that in the US, 85% of all cyclone damage is caused by the most extreme storms.

Possible impacts of the AR5 on ambition

Historical analysis on how Assessment reports have affected policy outcomes

To predict how the AR5 will affect climate negotiations, the impact of previous assessment reports by the IPCC must first be considered. Historically, it can be shown that all assessment reports have had an impact on the outcome of climate negotiations. The conclusions of the First Assessment Report (FAR) completed in 1990 were that unmitigated GHG emissions

[39] IPCC, 'Activities: Fifth Assessment Report', <http://www.ipcc.ch/activities/activities.shtml#.UHKKGPmzu0V>, (accessed 1st October 2012).
[40] *IPCC Climate Change 2007: The Physical Science Basis* (eds Solomon, S. *et al*.) (Cambridge Univ. Press, 2007).

were certain to cause global warming[41], and that 'anthropogenic climate change would persist for many centuries'[42]. This finding enabled the FAR to play a decisive role in establishing the Intergovernmental Negotiation Committee for the UNFCCC, serving as the basis for negotiations[43].

The Second Assessment Report (SAR) was received by the COP2 in Geneva, where a decision was reached to develop a legally binding treaty to reduce carbon emissions, as urged by the US (under the Clinton administration)[44]. The SAR stated that many regions would suffer increased floods, droughts and fires[45] and provided key input into starting negotiations that would eventually lead to the Kyoto Protocol. The 2001 Third Assessment Report (TAR) was also influential in the finalization of the Kyoto Protocol, presenting conclusions that 'new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities'[46], as well as raising the possibility of abrupt shocks to the Earth's system, such as the slowing of ocean circulation. The Kyoto Protocol was finally agreed upon, however in 2001 the US, under the Bush administration[47] rejected the Protocol, which even though it meant that there were no reductions of emissions by the US, in fact galvanised most other countries into action, lead by the European Union. However even though the TAR was partly responsible for the creation of this legally binding treaty, the ambition of the Kyoto protocol was minimal, with 5% reductions from 1990 levels.

The release of the 2007 Fourth Assessment Report (AR4) coincided with the documentary based on Al Gore's book 'An Inconvenient Truth'. The IPCC and Gore shared a Nobel Peace Prize for their work as it led to a much greater public awareness of climate change[48]. The AR4 also addressed in greater detail the relationship between mitigation and adaptation, and through this increased international pressure was brought to bear on the US, leading them to re-join negotiations and become part of the Bali Action Plan[49]. However a major drawback from the inclusion of the US in negotiations was the agreement to sideline specific emission targets proposed by the IPCC, which were for 25-40% reductions from 1990 levels by 2020[50]. This was replaced with a footnote, merely recognizing 'the urgency to address climate change as indicated in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change'[51]. Nonetheless the AR4 findings were instrumental in a dramatic

[41,44, 45] Nature Climate Change, 'International Climate Policy', <http://www.nature.com/climate/timeline/icp/index.html> accessed 13 October 2012.
[42,43] IPCCFacts.org, 'IPCC History', <http://www.ipccfacts.org/history.html>, accessed 13 October 2012.

[44, 45] Nature Climate Change, 'International Climate Policy', <http://www.nature.com/climate/timeline/icp/index.html> accessed 13 October 2012.

[46] IPCC, '2001: Climate Change 2001: Synthesis Report.' A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Integovernmental Panel on Climate Change [Watson, R.T. and the Core Writing Team (eds.)]. Cambridge University Press, Cambridge,United Kingdom, and New York, NY, USA, 398 pp.
[47] D. Bodansky, 'The International Climate regime', *Advances in the Economics of Environmental Resources,* Vol. 5, 2005, p.147-180.
[48] The Nobel Peace Prize 2007". Nobelprize.org, <http://www.nobelprize.org/nobel_prizes/peace/laureates/2007/>, accessed 13 October 2012.
[49] UNFCCC, 'Bali action Plan' *Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007 Part Two: Action taken by the Conference of the Parties at its thirteenth session.*
[50, 52] Nature Climate Change, 'International Climate Policy', <http://www.nature.com/climate/timeline/icp/index.html> accessed 13 October 2012.
[51] O. Heffernan, 'Was the science sidelined in Bali? (updated)', *Nature Climate Change: Climate Feedback* [web Blog], 17 December 2007 <

increase in ambition within the European Union, which subsequently pledged a 20% cut in 1990 GHG emissions by 2020[52]. Overall, it can be shown that Assessment Reports by the IPCC significantly influence the outcome of negotiations,[53] and it is expected that this will increasingly be the case for the AR5. However there remains a clear need to achieve an ambitious, binding multilateral target. Under the auspices of the IPCC, climate science has clearly informed debate and should inform policy, but the geopolitical obstacles to closing the ambition gap remain formidable and are beyond the scope and the role of science to control, as long as scientists are not sufficiently represented in government worldwide.
This historical analysis highlights that the AR5 will be influential in the development of this upcoming treaty, but is unlikely to increase efforts to mitigate climate change enough to close the ambition gap.

Prediction of AR5's affect on Trajectory

The AR5 will be critical for influencing the trajectory of the next legally binding treaty, as negotiations began this year with the objective of finalizing the treaty by 2015 so that it can be put into force by 2020[54]. This legally binding treaty promised by the Durban Platform will be fully inclusive, but also multilateral, acknowledging the need to support developing countries in mitigating and adapting to climate change. The proposed inclusivity of the next commitment period has been welcomed by the US, whose resistance to ratification of the Kyoto Protocol was predicated on the fact that rising economic powers including China, Brazil and India faced no constraints on emissions[55]. This may increase their willingness to co-operate with an increase in ambition, as specified in the AR5. However increased resistance may come from developing economic powers mentioned above due to issues of equity and justice, on the basis that developed countries are historically responsible for the problem, they should therefore be held accountable[56]. Nevertheless, at COP17 in Durban, China agreed to 'consider a legally binding treaty'[57]. However India reasonably pointed out that 'that the fight to reduce emissions effectively in an unequal world will be even more difficult in the years to come'[58]. In an effort to increase equity within the policy process, 30% of the authors for the AR5 will come from developing countries[59], whose input will go some way into increasing the knowledge base and minimizing the north south divide.

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http://blogs.nature.com/climatefeedback/2007/12/was_the_science_sidelined_in_b_1.html>, accessed 14 October 2012.

[53] J. Goodwin, 'The authority of the IPCC First Assessment Report and the manufacture of consensus', *National Communication Association,* Chicago, Iowa State university 2009.

[54] J. Morgan, E. Cameron, 'Reflections on COP in Durban', *WRI Insights,* <http://insights.wri.org/news/2011/12/reflections-cop-17-durban>, 2011.

[55,57,58] C. Death, 'A predictable disaster for the climate – but who else won and lost in Durban at COP17?', *Environmental Politics*, Aberystwyth University 2012.

[56] B.C. Parks, J.T. Roberts, 'Inequality and the global climate regime: breaking the north-south impasse', *Cambridge Review of International Affairs*, 21:4,2009, 621-648.

[59] IPCC, *831 Experts Selected for the Fifth Assessment Report,* Press release June 2010, < http://www.ipcc.ch/pdf/press-releases/pr-23june2010.pdf>, (accessed 19 October 2012).

[60] UNFCCC, 'Science and the Climate Change Process', *UNFCCC E-Newsletter,* <http://unfccc.int/press/news_room/newsletter/in_focus/items/6856txt.php>, May 2012.

The AR5 can further increase its impact on negotiations through its central role in the UNFCCC's Periodic Review[60]. This review is an assessment on both whether implementing a 2°C limit to global temperature - as agreed to in Cancún - is adequate to achieve the ultimate goal of the UNFCCC (avoiding dangerous anthropogenic climate change); and the overall progress made to achieve this goal. The UNFCCC regards assessment reports by the IPCC as the most trusted policy relevant scientific information, and will therefore be primarily using the AR5 as its scientific evidence, as well as including its possible solutions in its periodic review spanning 2013-2015[61].

The UNFCCC has stated that for a transformation into a sustainable future, it is crucial there is a mutual understanding between science and policy[62]. The dialogue between science and policy will be conducted through the Subsidiary Body for Scientific and Technological Advice (SBSTA). Steps have already been taken to ensure this outcome, with the UN Secretary General's Global Sustainability Panel releasing a report 'Resilient People, Resilient Planet – A Future Worth Choosing' highlighting the need for an enhanced science-policy framework[63]. The Secretary General has also stated in his 'five-year action agenda' that action will be taken to ensure that by 2015 a comprehensive climate change agreement inclusive of all UNFCCC Parties[64], advocating the need for evidence based policy making. This consensus among policy makers demonstrates that future treaties are more likely to be based on scientific evidence, of which will come from the AR5, and being coupled with the periodic review, will further enable the AR5 to possibly increase ambition of parties and therefore effective and equitable climate policy[65].

Conversely, even though policy makers are calling for evidence based policy and current negotiations are heading towards a fully inclusive international treaty, it is unlikely that there will be a dramatic increase of ambition by 2015, regardless of the AR5. This is mainly due to ambition of targets being dependent by political and economic stance of individual nations, rather than scientific evidence. Although previous Assessment Reports have at times raised ambition to mitigate climate change, in the 22 year history of the UNFCCC, there has not been a single agreement by parties that has fully included that ambition dictated by the IPCC. A major impediment to any global increase in ambition is the Global Financial Crisis (GFC) with Parties – in particular the US – sidelining any mitigation of climate change in order to reaffirm their fragile economies[66]. A lack of action by the US and other parties is in turn likely to de-rail any commitment China and other developing countries had

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[61,62] UNFCCC, 'Science and the Climate Change Process', *UNFCCC E-Newsletter,* <http://unfccc.int/press/news_room/newsletter/in_focus/items/6856txt.php>, May 2012.

[63] The United Nations Secretary-General's High-Level Panel on Global Sustainability, 'Resilient People, Resilient Planet – A Future Worth Choosing', Overview, New York: United Nations, 2012.
[64] United Nations, 'The Secretary-General's Five Year Action Plan Agenda', January 2012, <http://www.un.org/sg/priorities/sg_agenda_2012.pdf>.
[65] E. Cameron, 'COP17 And The Periodic Review: Putting Ambition Back At The Heart Of The UNFCCC', *WRI Insights,* < http://insights.wri.org/node/195>, 2011.

[66] I, Reed, 'The Effect of the Global Financial Crisis on Climate Change', *New Anthropocene, 2012, < http://newanthropocene.wordpress.com/2012/04/13/the-effect-of-the-global-financial-crisis-on-climate-change/>, (accessed 31 October 2012).*
[67] Department of Climate Change and Efficiency, 'Options and ways for increasing ambition' Australian Government submission under the Durban Platform for Enhanced Action, May 2012, <http://www.climatechange.gov.au/government/initiatives/unfccc/submissions/20120504-options.aspx>.

to mitigation, undermining the international co-operation achieved at Durban. Similarly, the transparency of compliance and carbon accounting methodology is of central importance if meaningful progress is to be made. If the AR5 is released into a political environment with little international co-operation, inadequate treatment of North-South equity issues and poor commitment, its impact on the trajectory of the next treaty is likely to be minimal.

Recommendations

If the AR5 is to increase ambition a number of preliminary steps must be taken to ensure parties are able to fully act on the findings. These steps are to be mostly mediated by the Ad Hoc Working Group on the Durban Platform for Enhanced Action (commonly called ADP).

- Firstly, negotiations leading up to 2015 should focus on raising the domestic actions of all parties. Due to the vast range of national circumstances, increasing and enabling national action can be done through making a fully inclusive multilateral treaty dividing countries into Annex's in terms of ability to mitigate climate change[67]. Furthermore, the Green Climate Fund[68] will be used to finance actions taken by developing countries to reduce emissions. Increased financing by developed countries before the release of the AR5 will enable increased action for the coming treaty. Annex 1 Countries should also acknowledge and act on their past emissions, resulting in a more equitable global effort to mitigate climate change and possibly increasing the ambition of developing countries.

- Secondly, clarification of these pledges as soon as possible is also necessary in terms of each Parties responsibility to reduce emissions, as this will accelerate negotiations for the new legally binding treaty.

- Also, annual considerations of ambition before the release of the AR5 is vital, and could be run in conjunction with COPs starting with COP18 in Doha[69]. This gives Parties a chance to consider their current pledge, and in light of emerging science or increased global action, to voluntarily increase their pledge. To encourage parties to increase ambition through this, increases in pledges should be showcased to other parties and increased transparency through further use of the Durban measurement, reporting and verification (MRV), to give parties confidence they are not acting alone[70].

Once the AR5 is released, if these mechanisms are to be put into place, they would enable the AR5 to have maximum impact on the trajectory of climate negotiations, ensuring evidence-based policy making.

[68] Green Climate Fund, *Mandate and Governance,* 2012, < http://gcfund.net/about-the-fund/mandate-and-governance.html>, (accessed 19 October 2012).
[69, 70] Department of Climate Change and Efficiency, 'Options and ways for increasing ambition' Australian Government submission under the Durban Platform for Enhanced Action, May 2012, <http://www.climatechange.gov.au/government/initiatives/unfccc/submissions/20120504-options.aspx>.

Conclusion

The Fifth Assessment Report released by the IPCC is likely to include similar findings to the AR4 in relation to the impacts of climate change. However findings will be displayed with greater certainty and with greatly increased relevance to policy making. The AR5 may not be expected to heavily impact on climate negotiations based solely on emerging findings. However the AR5 will be used as the primary source of scientific evidence for the UNFCCC's periodic review, and will be released during the negotiations of the next legally binding treaty that is to be completed by 2015. As policy makers are currently urging for evidence based policy, the AR5 might be empowered to substantially change the trajectory of negotiations and possibly increase ambition of parties to mitigate climate change. Not only will the AR5 findings shift the trajectory of negotiations, it is hoped that the certainty of its findings will be used to underscore policymaking in the near future. However the impact of the AR5 is largely dependent on the geopolitical context it is released into, and without much preliminary work to ensure an equitable, coordinated global effort to mitigate climate change, the AR5 may have muted impact on the trajectory of the next commitment period.

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