

SUBJECT REVIEW

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TITLE

**GLOBAL CLIMATE CHANGE AND THE ANTARCTIC
TREATY SYSTEM SINCE 2000.**

Global climate change is increasingly being recognised as key issue in the 21st century - and one that is intimately entwined with the Antarctic. This paper reviews global climate change discussion and science inside the context of the Antarctic Treaty System (ATS), and particularly the Antarctic Treaty Consultative Meetings (ATCMs), since 2000.¹ It is hoped that this review may highlight several aspects: firstly, document the development of scientific evidence for global climate change; secondly, trace the broader acceptance of global climate change inside the ATS; and thirdly observe the ATS bodies and members in researching and managing climate change.

To achieve these goals, the analysis reviews papers submitted to the annual ATCMs either as working papers or information papers since the year 2000. This method provides a number of advantages: firstly, selecting papers from this source serves as a filter. It is expected that information provided to the ATCMs are of significantly scientifically robust and represent the best thinking on climate change at the time; secondly, there is significant scope within this forum for adequate criticism of the papers; and thirdly, the meetings occur annually which provides opportunity to track the progression of scientific understanding as well as the broader acceptance of climate change in the ATS. Additionally, to further develop the growth in scientific understanding of climate change, the paper draws on scientific papers that are referenced in ATCM documents.

The paper opens by briefly introducing the Antarctica Treaty System so as to provide context for the ATCMs. Having made this introduction, the paper recaps global climate change understanding at the turn of the millennium before tracing developments in scientific knowledge and understanding to the present. The paper concludes by presenting key areas of current research around the International Polar Year (IPY) and noting trends within the ATS over the period of analysis.

The Antarctica Treaty System

Since the entry into force of the Antarctic Treaty in June 1961, the signatories have been obligated to regularly meet “for the purpose of exchanging information, consulting together on matters of common interest pertaining to Antarctica, and formulating and considering and recommending to their Governments measures in furtherance of the principles and objectives of the Treaty” (Antarctic Treaty, 1959, Article IX). The signatories largely meet these objectives through the Antarctic Treaty Consultative Meetings (ATCM). ATCMs were held biennially from 1961, and then annually from 1994 and have become the central discussion and decision-making forum for the Antarctic Treaty system (ATS).

¹ ATCMs since 2000 are listed in Appendix Two. A full list is available in the ATS website. It is important to note that ATCM XXIV scheduled to be held in St. Petersburg in 2000 was delayed one year until 2001.

The Antarctic Treaty provides for two levels of membership. The original signatories to the Treaty and those demonstrating their interest in Antarctica by “conducting substantial research activity there” are awarded ‘Consultative’ status (Antarctic Treaty, 1959, Article IX). Consultative parties may vote at ATCMs and are able to submit both working and information papers (WP and IP, respectively) at the meetings. By contrast, ‘non-Consultative’ parties have no voting rights and may only submit information papers. Of the Treaty’s 45 state signatories, currently 28 hold Consultative status, including the original 12 signatories.²

ATCMs are also open to delegates of recognised bodies that have an interest in the Antarctic. The three Antarctic Treaty System bodies - the Secretariat for the Convention of the Conservation of Antarctic Marine Living Resources (CCAMLR), the Council of Managers of National Antarctic Programs (COMNAP), and the Scientific Committee on Antarctic Research (SCAR) - are reserved Delegate Observer status, while a selection of non-governmental and international bodies (such as the United Nation Environment Program, the International Association of Antarctic Tour Operators and the Antarctic and Southern Ocean Coalition) are provided Delegate Expert status.

It is important to note that, despite the variety of interests and expertise that are represented in the ATS, only Consultative parties have decision-making and agenda-setting (through the submission of working papers) competencies within the ATCMs.

Global Climate Change at the Millennium

At the millennium, global climate change issues were occurring against broader backdrop of increased awareness surrounding large-scale environmental and social issues. In 1997, the majority of the members of the UN ratified the United Nations Framework Convention on Climate Change (UNFCCC) (1994) following an increased political understanding of the challenges and consequences of global climate change. The agreement was followed up in 1997 with the adoption of the Kyoto Protocol text which sought to reduce global emissions of gases affecting climate change (greenhouse gases) by five *per cent* on 1990 levels by 2012 (Kyoto Protocol, 1997).³

Global Climate Change Science at the Millennium

At the arrival of the millennium, there was significant scientific evidence that global temperatures were increasing as a result of greenhouse gas emissions. In its third report, the International Panel on Climate Change (IPCC) provided substantial evidence for global climate change concluding that the global average surface temperature had increased by

² Antarctica Treaty signatories and their status are listed in Appendix One.

³ Significant issues surround the effectiveness of the Kyoto Protocol following several key greenhouse gas emitters failure to ratify the agreement. Of the Antarctic Treaty signatories Australia and the United States have failed to ratify the agreement. This theme will be picked up later in the context of the ATCMs (UNFCCC, 2006).

approximately 0.6 °C over the 20th century and noted increases in temperature in the lower atmosphere, that significant snow and ice melt was occurring and that global sea levels had risen over the same period (IPCC, 2001). While significant gaps in knowledge remained, the fundamental basis and mechanisms for global warming processes, the scientific methods to measuring changes and the global ramifications of global warming had been established.

Despite these concerns and ongoing action in the international community, there was a distinct lack of business on the agenda relating to climate change at the first ATCM of the new millennium. With most of the business focused on the Antarctic operations of the signatories and issues relating to the implementation and requirement of the recently ratified Protocol (1998), the sole paper with a direct bearing on climate change was submitted by Russia and related to their ongoing drilling programme at Vostok. The paper summarised key developments in climate change knowledge following analysis of the Vostok ice core. The drilling project at Vostok had drilled through the ice sheet to a depth of over 3600m over successive austral summers between 1990 and 1998. The extracted ice core represented over 400,000 years of accumulation at the site and collaborative research teams in Russia, France and the USA analysing the samples had been able to establish cylindrical patterns of climate change. Over a period of 420,000 years, four distinct glacial-interglacial periods were identified with each cycle averaging approximately 100,000 years. This finding correlated well with findings from other scientific examinations of oceanic and continental records and it is accepted that these changes in temperature are caused by oscillations in the earth's orbit around the sun (Zachos *et al.*, 2001). The researchers also succeed in creating a historic record of atmospheric concentrations of CO₂ and CH₄ by measuring concentrations in successive levels of the core. It was found that historic periods of higher atmospheric temperatures coincided with higher concentrations of the gases (Russian Institute of GeoEcology, 2001). The strong correlation with existing research provided further weight for the relationship between CO₂ and CH₄ gases and atmospheric temperature with the researchers suggesting that "the greenhouse gases are important as amplifiers of the initial orbital forcing and may have significantly contributed to glacial-interglacial changes" (Petit *et al.*, 1999, p.429).

The findings also suggested significant cause for alarm: the CO₂ levels measured at present were the highest throughout the 420,000 record. This indicated that human activity had led to historically unprecedented levels of greenhouse gases and the potential for significantly warmer periods that had been experienced for over 100,000 years (a finding also shared by North Greenland Ice Core Project members (2004)).

The significance of the outcomes from the Vostok drilling programme further highlighted the importance of collaboration research projects on global climate change. In 2002, the Antarctic Climate Evolution (ACE) was established as a research group by SCAR. The group grew out of the ANTOSTRAT (Antarctic Offshore Stratigraphy) group, and was changed with

1) facilitating communication and collaboration between research scientists working on all aspects of Antarctic climate evolution; 2) providing advice to the research community of on areas of data that are required research; 3) provide technical assistance on both field work and modelling exercises; 4) promote data access and sharing within the scientific community; and 5) summarise and report on results to the broader scientific community.

The Antarctic and Global Climate Change

The Antarctic plays a central role in the global climate for a number of reasons. Firstly, as highlighted by the Vostok drilling programme, Antarctica is of immense value for researchers seeking historic data on climate change due to minimal human impact on the continent. As will be discussed further, this is allowing current research to map historic changes in climate over millions of years. Secondly, there has been fresh research emphasis on the role that the Antarctic plays in global climate system. For example the role the Antarctic ice shelves play in the thermohaline circulation in ocean systems (Clark *et al.*, 2002). As well as continued focus on these areas, the period 2002 - 2004 saw an increased focus on the effects of global warming on the broader ATS. A good example of this trend is the information paper submitted by South Africa at ATCM VII in Cape Town. The paper correlated research on seabird numbers of sub-Antarctic birds over a 20 year period and draws a direct correlation between changes in bird populations and climatic changes in the sub-Antarctic (Crawford, 2004).

In 2005 the British Antarctic Survey published results following a survey of glaciers on the Antarctic Peninsula. Of the Peninsula's 244 glaciers, 87 *per cent* had retreated since their earliest know position. The researchers also noted that the magnitude of glacial advancement in the non-retreating glaciers had been minimal and that no pattern existed between retreating and advancing glaciers on the Peninsula (Cook *et al.*, 2005, p. 541). In summary, their research argued that the results

indicate the existence of a clear transition between mean advance and mean retreat; a southerly migration of that transition at a time of ice-shelf retreat and progressive atmospheric warming; and a clear regime of retreat, which now exists across the Antarctic Peninsula (p. 543).

By contrast, researchers utilising satellite radar altimetry concluded that over the period 1992 - 2003, the East Antarctic ice sheet was increasing by 45 billion tonnes per annum (± 7 billion) due to increased precipitation on the Plateau (Davis *et al.*, 2005). The paper concludes that - consistent with IPCC projections (refer IPCC, 2001) - the increased accumulation on the Plateau, caused by global warming, was mitigating potential increases in sea-levels from melting in the West Antarctic ice sheet - at least for the time being.

An Increased Focus on Global Climate Change at ATCMs

ATCMs since 2005 have been marked by a greater explicit focus on climate change issues than their predecessors. There are several trends to note. The first trend is a renewed focus on climate change issues by the signatories. This has largely been driven by the British Government adopting an all of government approach to climate change issues. This has had the effect of providing the BAS with the rationale to lobby for climate change prevention and mitigation measures in the ATS. The result has been signatories submitting both working and information papers following developments in climate change modelling and further climate change research. Recent submissions have been made by Argentina, Australia, France, New Zealand, Sweden and the United Kingdom as well as SCAR. This aspect will be returned to in greater detail shortly.

A second key trend is the increased role played by non-governmental organisations (NGOs) in the ATCMs and the subsequent politicisation of the meetings. The Antarctic and Southern Ocean Coalition (ASOC) is a coalition of environmental NGOs from over 40 countries and attends ATCM meetings as an expert, non-consultative party. ASOC has become increasingly active in recent years in lobbying Antarctic Treaty members and submitting information papers to ATCMs. Both 2005 and 2006 papers submitted by ASOC (2005 & 2006) have been explicit in their call for Antarctic Treaty members to “take tangible steps both domestically and through international treaties to address the threats posed by the rapidly growing levels of CO₂ and other greenhouse gases globally” and have specifically drawn attention to Antarctic Treaty members who “have so far not joined the global consensus in favor of concerted actions to slow the growth of greenhouse gas emissions” (ASOC, 2006, p. 7). These events mark the first time that the ATCMs have been used to bring political pressure on parties.

A third trend is the increased level of education on climate change issues being offered at ATCMs. SCAR utilised the ATCM XXIX to present a lecture on climate change science by Valerie Masson-Delmotte from the Laboratoire de Modélisation du Climat et de l'Environnement. Her presentation was attended by delegates and was made available as an information paper (IP 76). The presentation provided a synopsis of climate change science to date in the context of the Antarctic, and noted areas for future research (Masson-Delmotte, 2006). The New Zealand delegation also submitted an information paper on Climate Change and Governance (IP 47) following a conference in Wellington, New Zealand earlier in the year of the same name. The paper notes that “It was evident that most climate scientists were now in broad agreement that the Earth has been warming at an unprecedented rate historically, that most of this warming was due to greenhouse gas emissions... [and that] Uncertainties remained over... how much the Earth was likely to warm up and over what time span” (Barrett, 2006, p. 3)

At the same meeting SCAR submitted an information paper announcing plans for an Antarctic Climate Assessment which will provide guidance for policy-makers within the

Antarctic Treaty system (SCAR, 2006).⁴ The paper notes that while there is significant evidence for global warming, the correlation between CO₂ levels and temperature need to be further studied to imply causality as the initial feedback loops at the start of the warming cycle are extremely complex (pp. 3 & 4). The paper notes that:

The difficulty in evaluating the causes of climate change with absolute confidence lies primarily in the fact that the signal (0.1°C per decade) is tiny compared with the noise of seasonal and inter-annual variability. The difficulty is further complicated by the dearth of past climatic data, and the lack of knowledge of past variability in solar output.

It should also be noted that most of the current debate about climate change centers on future predictions and not on observed trends. The validity and accuracy of the current generation of models of the non-linear climate system lie at the core of current controversy regarding future change. Such models need to be tested more rigorously in the Antarctic context, where at present they perform rather poorly.

(SCAR, 2006, IP 89, p. 4)

The broad agreement noted in these papers on climate change has led to increased scientific activity on its consequences. These research efforts have led to the formation of two SCAR research programmes in 2005-06. The Antarctica in the Global Climate System (AGCS) is a 10 year programme charged with investigating the nature of the atmospheric and oceanic linkages between the climate of the Antarctic and the rest of the Earth system, and the mechanisms involved in such processes. The second committee is the Evolution and Biodiversity in the Antarctic group and will “explore (1) the evolutionary history of Antarctic biota, (2) how biological diversity in the Antarctic influences ecosystem function, and (3) how the biota will respond to environmental change” (EBA, 2006). Both are good examples of the increasing scientific focus on Antarctica’s present role in the global environment and how collaborative research projects are being managed in the context of the Antarctic Treaty system.

Additional drilling projects have also been carried out to gain a fuller picture of historic climate change in the Antarctic. At the present, drilling projects have been completed at Vostock (3623m, 400,000 years); EPICA Dome C (3270m, 800,000 years); EPICA Kohnen Station (2774m, 500,000 years) and Dome F (3029m, 1 million years) (Masson-Delmotte, 2006). To help coordinate efforts, the International Partnership for Ice Core Science (IPICS) has been established.

International Polar Year and Current Research Initiatives

To commemorate 50 years since the International Geophysical Year (IGY), an International Polar Year (IPY) has been planned to again focus scientific endeavour on the Polar regions.

⁴ An Arctic Climate Impact Assessment had been concluded in early 2005.

Global climate change and the global repercussions of Polar warming are key themes developed in the research activities to be undertaken with the International Council of Science IPY Planning Group noting the need to “quantify, and understand, past and present environmental and social change in the polar regions, and to improve projections of future change” (ISCU, 2004, p. 12). Two key current for understanding past and recent changes in climate change are the ITASE and ANDRILL projects.

The International trans-Antarctic Scientific Expedition (ITASE) is an ongoing research project drawing together 20 countries draw together under a SCAR initiative on data gathered surface and near-surface records of ice sheets. The collaborative effort allows samples to be taken from across the Antarctic continent with the same methodology and for the data to be commonly collated. It is hope that the data will determine the spatial and environmental variability in Antarctic over the past 200 years, and will provide information on climate change since the end of the last Little Ice Age. Results from this project are feed directly into SCAR’s research committees and presented to the Antarctic Treaty parties (ITASE, 2006).

The ANDRILL (Antarctic Geological Drilling) started in the 2006/07 austral summer, with the commencement of two drill cores on the Ross Ice Shelf. The project is a collaborative effort between the German, Italian, New Zealand, United Kingdom and United States Antarctic programmes. The research teams are aiming to extract cores from the underlying sediment deposits to a depth of approximately 1,200 metres below the seabed. It is hoped that cores gathered from the McMurdo Sound area will provided a record of major glacial and interglacial periods of the past 40 million years will sufficient accuracy as to be able to determine the glacial fluctuations caused by the orbital cycles. This will provide researchers with information on how the Antarctic region has responded to previous periods of global warmth and provide indicators on how the region may respond and potential repercussions (ANDRILL Science Management Office, 2006).

Conclusions

Since 2000 there has been dramatic increases in scientific understanding, modelling and research on global climate change. The ATS has served as a forum for discussion and collaboration between national research groups undertaking climate change projects in the Antarctic. Climate change science is presently focused on three areas related to the Antarctic. Firstly, the extraction of samples from the Antarctic to construct historic pictures of global climate change and its process, such as the projects undertaken at Vostok and presently by ANDRILL. Secondly, there is research being conducted on the role of the Antarctic in the global climate system. And thirdly, research is underway to ascertain the potential effects of global climate change on Antarctic flora and fauna.

These research activities have brought about a greater focus on climate change issues within the broader ATS, with an Antarctic Treaty body, SCAR, being utilised to

coordinate Antarctic-based climate change research projects and feed information on climate change into the ATCMs.

The final trend since 2000 has been the increased politicisation of the ATCMs as a forum to tackle global climate change. It remains to be seen what effects this may have on the operation of consensus of the system. Finally, it is important to note, the link between scientific knowledge and global measures to prevent or mitigate global climate is political action; and as this paper shows in the context of the ATS, the two do not always operate in concert.

APPENDICES

APPENDIX ONE

Antarctic Treaty Signatories and Status

CONSULTATIVE AND NON-CONSULTATIVE PARTIES

#	State	Date	Status
1	United Kingdom	31 May 1960	OS/CP
2	South Africa	21 June 1960	OS/CP
3	Belgium	26 July 1960	OS/CP
4	Japan	4 August 1960	OS/CP
5	United States of America	18 August 1960	OS/CP
6	Norway	24 August 1960	OS/CP
7	France	16 September 1960	OS/CP
8	New Zealand	1 November 1960	OS/CP
9	Russia ¹	2 November 1960	OS/CP
10	Poland	8 June 1961	AS/CP
11	Argentina	23 June 1961	OS/CP
12	Australia	23 June 1961	OS/CP
13	Chile	23 June 1961	OS/CP
14	Czech Republic ²	14 June 1962	AS
15	Slovak Republic ²	14 June 1962	AS
16	Denmark	20 May 1965	AS
17	Netherlands	30 March 1967	AS/CP
18	Romania	15 September 1971	AS
	German Democratic Republic ³	19 November 1974	AS/CP
19	Brazil	16 May 1975	AS/CP
20	Bulgaria	11 September 1978	AS/CP
21	Germany, Federal Republic of	5 February 1979	AS/CP
22	Uruguay	11 January 1980	AS/CP
23	Papua New Guinea ⁴	16 March 1981	AS
24	Italy	18 March 1981	AS/CP
25	Peru	10 April 1981	AS/CP
26	Spain	31 March 1982	AS/CP
27	China, People's Republic of	8 June 1983	AS/CP
28	India	19 August 1983	AS/CP
29	Hungary	27 January 1984	AS
30	Sweden	24 April 1984	AS/CP
31	Finland	15 May 1984	AS/CP
32	Cuba	16 August 1984	AS
33	Korea, Republic of	28 November 1986	AS/CP
34	Greece	8 January 1987	AS
35	Korea, Democratic People's Republic of	21 January 1987	AS
36	Austria	25 August 1987	AS

37	Ecuador	15 September 1987	AS/CP
38	Canada	4 May 1988	AS
39	Colombia	31 January 1989	AS
40	Switzerland	15 November 1990	AS
41	Guatemala	31 July 1991	AS
42	Ukraine	28 October 1992	AS/CP
43	Turkey	25 January 1996	AS
44	Venezuela	24 May 1999	AS
45	Estonia	17 May 2001	AS

DELEGATES OBSERVERS

CCAMLR	Dr. Denzil G.M. Miller Mrs. Edith Fanta
COMNAP	Mr. Antoine Guichard Dr. Gerard Jugie
SCAR	Dr. Colin P. Summerhayes Dr. Marzena Kaczmarek

DELEGATES EXPERTS

ASOC	Mr. Jim Barnes
IAATO	Mrs. Denise Landau Dr. Kim Crosbie
IHO	Mr. Hugo Gorziglia
IMO	International Maritime Organization
IOC	Mr. Patricio Bernal
IUCN	Ms. Maj de Poorter Mr. Alan Hemmings
PATA	PATA Pacific Asia Travel Association
UNEP	Mr. Christian Lambrechts
WMO	Dr. Alexandre Karpov
WTO	WTO World Tourism Organization

References

- OS = Original Signatory
- CP = Consultative party
- AS = Acceding State

Notes

- 1 Known as the Soviet Union until December 1990.
- 2 Succeeded to the Treaty as part of Czechoslovakia which separated into two republics on 1 January 1993.
- 3 Became united with Federal Republic of Germany on 3 October 1990 (now known as Germany).
- 4 Succeeded to the Treaty after independence from Australia.

(Taken from ATS, 2006)

APPENDIX TWO

Antarctic Treaty Consultative Meetings (ATCM) since 2000.

2001*	XXIV ATCM	St. Petersburg, Russia
2002	XXV ATCM	Warsaw, Poland
2003	XXVI ATCM	Madrid, Spain
2004	XXVII ATCM	Cape Town, South Africa
2005	XXVIII ATCM	Stockholm, Sweden
2006	XXIX ATCM	Edinburgh, United Kingdom

**The XXIV ATCM in St. Petersburg was delayed from 2000 following organisational delays for the event. Consequently, the 2001 ATCM was the first meeting of the new millennium.*

APPENDIX THREE

URLs for Antarctica Treaty bodies researching Climate Change and key, related Climate Change Bodies

ANDRILL

www.andrill.org

Antarctica in the Global Climate System (AGCS), SCAR Scientific Research Programme
http://www.antarctica.ac.uk/met/SCAR_ssg_ps/AGCS.htm

Antarctic and Southern Ocean Coalition
www.asoc.org

Antarctic Climate Evolution (ACE), SCAR Scientific Research Programme
www.ace.scar.org

Antarctica Treaty Secretariat
www.ats.aq

Evolution and Biodiversity in the Antarctic (EBA), SCAR Scientific Research Programme
www.nioo.knaw.nl/projects/scarlsssg/eba/

Intergovernment Panel on Climate Change
www.ipcc.ch

International Polar Year (IPY)
www.ipy.org

International Council for Science
www.icsu.org

International Partnership for Ice Core Science (IPICS)
www.nicl-smo.unh.edu/IPICS/

International Trans-Antarctic Science Expedition (ITASE)
www2.umaine.edu/itase/index.html

Scientific Committee on Antarctic Research (SCAR)
www.scar.org

United Nations Framework Convention on Climate Change (UNFCCC)
www.unfccc.int

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