Climate and Global Change—
A Southern Hemisphere Perspective*

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1. Introduction

Thank you, Mr. President. The title of my talk is, depending upon your perspective, either very narrowly constraining or so broad as to make it impossible to say anything of any depth or value in twenty minutes. It’s the sort of title that one might come up with in response to a five o’clock A.M. telephone call from the other side of the world from the president of the American Meteorological Society after spending half the night lying awake troubling about the future of international meteorology. In any event, against the backdrop of yesterday’s wide-ranging symposium on challenges in atmospheric and earth sciences, I probably should recast the subtitle as “A Highly Selective and Extremely Biased Southern Hemisphere Perspective.” But, be that as it may, I welcome the opportunity to take up a few of the challenging ideas that Rick Anthes and other speakers presented us with yesterday and to follow on with an overseas perspective from Tom Molone’s stirring address on “Meteorology at the Crossroads of Change.” Where I come from in the Southern Hemisphere, we sometimes feel a long way from the crossroads, but the issues of climate and global change are very much on our minds.

I will divide my talk into four parts. In the first part, I would like to range fairly widely across the contemporary climate and global change scene and offer a few observations that will reveal my biases. In the second part, I will try to identify, very briefly, what I see as the distinguishing features of the Southern Hemisphere perspective. Then in the third part, I will summarize the Australian experience as I have observed it, before finally honing in, in the final part of my talk, on what I see as the major issues now confronting us all.

2. Some observations

“It is a very remarkable thing that climatology faces such an important, possibly a dramatic, future when it is the oldest science we have.” These were the first words of Dr. C. H. B. (Bill) Priestley in his opening address to an international conference on climate change and variability in Melbourne in December 1975. He went on to speak of the dangers and the challenges facing the climate science community as we entered the era of bustle and turbulence, and I would have to say that I have observed much wreckage over the past seventeen years on the rocks Priestley charted back in 1975. To the extent that his opening words were a prediction, they were a remarkably accurate prediction. I doubt that many of us who had taken our basic meteorological education in the 40’s, 50’s, and 60’s really expected that, by the 80’s, climate would be center stage in world affairs.

One of our central problems in the meteorological community as we’ve struggled to deal with the issues of climate and global change over the past few decades has been an immense confusion over terminology. The one thing that we probably all have in common is that when we hear others speak of “climate,” “climate change,” “global change,” and “global climate change,” we’re never quite sure if those to whom we are listening are talking about the same things we take the words to mean. I would go so far as to suggest that perhaps we’ve done the world, as well as the meteorological profession, a considerable disservice through our ambiguity and imprecision in the use of words. We don’t even seem to be able to tell a consistent story on what is “climate,” “climate change,” “global change,” and “global climate change,” we’re never quite sure if those to whom we are listening are talking about the same things we take the words to mean. I would go so far as to suggest that perhaps we’ve done the world, as well as the meteorological profession, a considerable disservice through our ambiguity and imprecision in the use of words. We don’t even seem to be able to tell a consistent story on what is “climate,” “climate change,” “global change,” and “global climate change,” we’re never quite sure if those to whom we are listening are talking about the same things we take the words to mean.
have our own ways, often cast in the language of climate variability, of avoiding the question of “Is the climate changing?” In a sense, the diplomats have resolved a fundamental terminological issue on which we, as scientists, seemed unable to reach agreement. Article I of the Framework Convention on Climate Change tells us that, for the purposes of the convention, “Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods.” I suspect we’d be wise to learn to live with that definition so that we can converse in common language with at least one major element of the nonscientific climate community.

Having mentioned the Framework Convention on Climate Change, I would like to say a few words about the Intergovernmental Panel on Climate Change (IPCC) whose report is usually regarded as having triggered it. One cannot deny that the IPCC First Assessment Report was a remarkable achievement, but I suggest that the jury is still out on the IPCC as a science policy process. I doubt if we had any choice internationally but to set up something like the IPCC, and I believe the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) deserve much credit for moving for increased scientific effort on the climate issue by choosing to employ the standard language of “climate” in a fashion that is both rigorous and comprehensible to the public in language that the public can understand. I’ve looked long and hard and I can’t find anything anywhere that explains something as fundamental as the greenhouse effect in terms that are both rigorous and comprehensible to the person in the street. I sometimes wonder if such is possible?

And, of course, our communication problems are not just with the public. I think that, in the late 1970s, the mainstream meteorological community was commendably responsible but perhaps not as successful as we might have been in communicating the urgency for increased scientific effort on the climate issue by choosing to employ the standard language of “climate” in arguing the case for national climate programs and the like. I see a sharp contrast with the journalistic appeal and emotive force of ICSU’s “global change” banner for the International Geosphere–Biosphere Programme.

It seems to me also that, having triggered the public and political concern with the greenhouse issue, the professional climate science community to a large extent let it get away from them. Many soon found themselves under enormous pressure to play a political role in a much larger show. With a few notable exceptions, by mid-1990 climate change as an issue in international public policy had become largely decoupled from the science that triggered it.
By way of a final introductory comment, I’d like to touch on the issue of controversy and return to Bill Priestley. In what I saw at the time as words of great wisdom, Priestley applauded vigorous debate within the scientific community on the climate issue but pleaded for balance in public utterances from the scientific community. He was especially concerned, at that time, about public overstatement of our confidence in the scientific evidence for an imminent ice age. I’m not sure whether his exhortation is realistic for the 1990s but I feel that, to a large extent, we let him down in the 1980s.

3. The Southern Hemisphere view

Almost by definition, it is difficult to isolate a distinctly Southern Hemisphere perspective on global change, but it is certainly true that we have some special problems of which we are rather more conscious because of our geography.

Clearly, one of these is the role of the Antarctic continent. Scientific issues relating to the part played by Antarctica in the global heat balance have a special significance for us, as does the problematic question as to whether global warming, if it occurs, will lead to buildup of the Antarctic ice cap or whether one of our great worries should be the threat of sea level rise as a result of melting of the Antarctic ice.

We also feel a special closeness, or at least a close proximity, to the so-called Antarctic ozone hole. The “hole in the ozone layer” is every bit as much a public and political issue as it is a scientific problem. Claims that the belt of depleted stratospheric ozone had already extended over the southern tip of Argentina brought a much heightened public awareness of the problem to all of us in the Southern Hemisphere, not just to those in South America.

The distinguishing feature of the Southern Hemisphere that has both meteorological and socioeconomic significance is, of course, that it is the ocean hemisphere. The heat transport mechanisms in the Southern Ocean have special scientific relevance both as a major determinant of present-day climatic patterns and as an influence on how these might change in the future. But probably even more significant is the socioeconomic dimension, the fact that in the southwest Pacific, in particular, we have a large number of small low-lying island states who feel especially vulnerable to fluctuations and trends in sea level and climate.

Although there are, of course, exceptions such as Australia and New Zealand, the so-called north—south political division of the world is broadly in keeping with its geography. We in the Southern Hemisphere have a preponderance of developing countries facing the exacerbating effect of meteorological influences such as floods, droughts, fire, and tropical cyclones on already fragile societies, economies, and ecosystems. There are many Southern Hemisphere countries for which desertification is one of the great looming threats to survival in the years ahead.

The international climate research effort of the last decade has shown that it is by no means an exclusively Southern Hemisphere influence, but any mention of a southern perspective on climate must take special note of the Southern Oscillation. There is an increasing level of confidence that modeling of the El Niño and Southern Oscillation phenomenon may be leading us much more quickly than many of us expected to a capability for useful seasonal to interannual climate prediction in South Africa, Australia, South America, and elsewhere in the Southern Hemisphere and the tropical belt.

4. The Australian experience

In the words of one of our best-loved nineteenth-century poets, Australia is indeed a land of “droughts and flooding rains.” Climate variability is always with us and the images of living with the vagaries of climate are burned deep into the Australian psyche.

As a child on a dairy farm in southeast Queensland, I grew up with stories of “the great drought” and popular speculation that “possum hunting in the 1800s had left the mistletoe to thrive; this had killed the trees and without the trees there was nothing to draw the rain” and that was why the great drought had been so bad. As a young meteorologist, I soon became aware of the Southern Oscillation. I also became involved with the Australian Bureau of Meteorology’s drought watch system and the extensive work that was done in Australia in the 50’s and 60’s to help use our understanding of the statistical characteristics of climate in agricultural and water resource planning and management.

The Australian meteorological community moved swiftly in the 1960s on two issues of immense significance to the future handling of the issues of climate and global change. The first was to establish a specialist numerical modeling center to take up the challenge posed by the international focus on both the first (weather) and second (climate) objectives of the Global Atmospheric Research Program (GARP). The second was to lay the scientific foundation through both CSIRO (Commonwealth Scientific and Industrial Research Organisation) and the Bureau of Meteorology for the establishment of what, in the 1970s, became the Cape Grim Baseline Air Pollution Station
in Tasmania. The proposals struck few responsive chords in government at the time, but eventually persistence paid off. These two developments enabled us to establish a very sound scientific base for meeting the political demands of a decade and a half later.

The year 1975, as well as witnessing the first major international scientific conference in Australia on climate variability and change, saw the first direct political concern with the issue. On 9 January 1975, just as the U.S. National Academy of Sciences was finalizing its “program for action” for understanding climate change, the commonwealth minister for science wrote to the president of the Australian Academy of Science: “I am writing on this occasion to enquire if the Academy could assist the Government by examining, and reporting on, claims recently made in the media, and apparently also by competent scientists, that the earth’s climate is changing and that a new ice age could be on the way.”

The academy’s response was unequivocal. It dismissed the speculation on an imminent ice age and focused on the need to better understand, and eventually develop the capability to predict, the natural variability of Australia’s climate and to pursue further the scientific issues associated with possible human influences on climate. Its specific recommendations were as follows.

1) The bank of Australian meteorological data should be maintained, improved by quality control, and subjected to more detailed systematic analysis.

2) Studies on climate–crop relationships in Australia should be expanded, making use of meteorological data relevant to the agroecological effects of weather and climate.

3) Australian palaeoclimatic studies, including glaciological investigations in Antarctica, should be supported since they are now beginning to provide a reliable record of past climates.

4) Australia should support increased physical oceanographic research in the seas surrounding it, in order to improve understanding of the mechanisms controlling both weather and climate in the Southern Hemisphere.

5) Australia should make a contribution to the Global Atmospheric Research Program and to atmospheric monitoring commensurate with its unique location in a relatively “empty” part of the Southern Hemisphere.

By the late 1970s, the Australian meteorological community was proceeding vigorously, albeit with very limited resources, with scientific work on both fronts. I should perhaps mention in particular the work of Graeme Pearman and Brain Tucker of CSIRO in raising awareness in the broader Australian scientific circles of the potential significance of the CO$_2$–climate connection.

We didn’t take advantage in the way that we might have in Australia of the vehicle provided by the establishment, by the 1979 World Meteorological Congress, of the World Climate Programme. We did not establish a formal national climate program such as had already happened in the United States and we were not successful, in a time of severe recession, in getting climate issues high on the agenda of an incoming government whose ascent to power had coincided with the breaking of the 1982–83 drought. What we did do was set up a joint Academy of Science–Bureau of Meteorology “Australian Committee for the World Climate Research Programme,” which provided a useful focus for Australian climate research issues for most of the 1980s.

The early 1980s saw a period of substantial rationalization of government atmospheric research in Australia, but the essential basic work in atmospheric chemistry and numerical modeling continued. In 1985, in an effort to sharpen the focus on the practical application of climate science and services, the Australian Bureau of Meteorology regrouped a number of its activities to establish the Australian National Climate Centre, essentially a data collection, data service, and climate monitoring and analysis operation. It now issues a regular climate monitoring bulletin for the Southern Hemisphere and seasonal outlooks for most of Australia.

The establishment of the International Geosphere–Biosphere Programme (IGBP) by ICSU in September 1986 produced a more immediate response in Australia than had the World Climate Programme seven years earlier. The Academy of Science sought and received from the then Department of Science, specific funding to support the operation of a national committee for the IGBP, and the organization of a global change symposium in Canberra in February 1988. This symposium set in motion a series of government-funded national workshops (by then with funding from the Department of the Arts, Sport, the Environment, Tourism and Territories) aimed at identifying the essential features of a national research program on global change. In the early stages, at least, there was a lot of uncertainty as to the extent to which “global change” should be interpreted as including or excluding climate change.

Concurrent with this activity on global change, a number of institutions led by the CSIRO Division of Atmospheric Research sponsored a series of workshops on greenhouse issues. Under the influence of these and overseas stimuli such as the 1988 Toronto Conference, the level of public and political concern with greenhouse gradually rose to the point where, in
April 1989, the commonwealth government provided specific additional funding for greenhouse research of the order of $5M per year and established the National Greenhouse Advisory Committee as a source of scientific advice to government. This enabled research organizations, such as the Bureau of Meteorology Research Centre and the CSIRO Division of Atmospheric Research, to move quickly to build on their earlier modeling work to pursue the specific requirements of greenhouse simulation.

Already in 1990 the Australian government had, on the basis of the IPCC First Assessment Report and other influences and after substantial commonwealth–state consultation, adopted an interim planning target and strategy for greenhouse gas reduction. It also set in motion a series of activities to produce a more comprehensive national strategy, which was eventually released in December 1992.

Through 1991, the Academy of Science’s National Committee for the IGBP and its National Committee for Climate and Atmospheric Sciences (which took over from the earlier Australian committee for the WCRP and now looks after Australian links with the World Climate Research Programme) worked together to produce an integrated global change research strategy for Australia 1992–96. This, in turn, was brought together during 1992 with a series of longstanding proposals before government for the establishment of a comprehensive National Climate Program to produce the concept of an integrated national climate and global change program. This has not, at this stage, been approved or funded by the Australian government.

5. The issues confronting us

Each of us has our own experience in and interpretation of the evolution of the climate and global change issues over the past few decades and our own views on the way ahead. Mine are probably colored by my background in the government system in general and the World Meteorological Organization in particular.

The Rio Declaration, Agenda 21, and the Framework Convention on Climate Change represent collectively a major milestone on a road that began with the United Nations Conference on the Human Environment in Stockholm in 1972. I believe we are at both a crossroads and a major watershed as we contemplate where to go from here. For what they’re worth, I would like to conclude this talk with some personal views on the major issues that confront us and the way ahead.

First, I believe we must get the right balance in the emphasis and effort we devote to the issues associated with understanding, predicting, and responding to natural climate variability and human-induced climate change. I believe that we have too readily overlooked the reality that, for the foreseeable future, the impacts of climate on society will continue to be those of the major severe weather phenomena that make up the extremes of climate—the floods, droughts, cyclones, bushfires, and severe storms. We must worry about the long-term issues associated with enhanced greenhouse warming, but let us not, at least in the meteorological community, lose sight of the fundamental characteristics of climate.

Second, I see both a compelling need for and a most welcome and rapidly accelerating trend toward closer links between the meteorological and oceanographic communities. I am delighted at the growing partnership and solid practical cooperation and mutual support developing between the World Meteorological Organization and the Intergovernmental Oceanographic Commission of UNESCO. In Australia, our professional society that replaced the former Australian branch of the Royal Meteorological Society is, I am pleased to say, the Australian Meteorological and Oceanographic Society (AMOS). To further underscore the point, we (AMOS and AMS) will be the joint sponsors of the Fourth International Conference on Southern Hemisphere Meteorology and Oceanography in Hobart, Tasmania, Australia, from 29 March to 2 April this year. I am pleased to see such a heavy emphasis on the oceans in the program for the Hobart conference and I look forward to seeing many of you there.

Third, we must address the challenge, in both scientific and institutional terms, of managing wisely the interface between “global change” and “climate,” where “climate” embraces both climate variability and climate change. My impression is that, at the international level, great progress has been made in harmonizing and mutually reinforcing the work going on under the World Climate Programme, the IGBP, and other related governmental and nongovernmental programs, but I sense that this constitutes a formidable challenge still in many countries. We have to do it because we must use the limited available resources to best effect and because we must, I believe, give governments not a range of different and conflicting pieces of advice, but the best integrated scientific advice we can.

Fourth, we must recognize that the issues of climate and global change are at least as much social and economic as they are scientific. The 1990 White House Conference on Global Change was a first brave attempt to build bridges between the scientific and economic disciplines involved in global change research and, in Australia, we worked through a two-year process of development of what is known as a...
national strategy for ecologically sustainable development (ESD) that brought many of those issues to the surface. Writ large, the issues involved in ESD will be central to the work of the Sustainable Development Commission of the United Nations and to the successful implementation of UNCED Agenda 21 on the international scene.

Fifth, I believe we have a formidable task ahead as a scientific community in underpinning the Framework Convention on Climate Change when it comes into force. The relevant U.N. and other bodies are there—WMO, IOC, ICSU, the IPCC, and so on—but their input and influence will be only as good as the science that supports them and the willingness of the scientific community to learn to speak and contribute, at least partly, in their language. I said earlier that I felt the professional scientific community had, to some extent, opted out when greenhouse became political and when their intellectual input was most needed. This was especially evident in the relatively small representation of the professional meteorological community in national delegations to the Intergovernmental Negotiating Committee and, indeed, also at UNCED in Rio de Janeiro. Distasteful though some of it may be at times, I believe we have an obligation to hang in there and contribute actively to what will now go on under the convention.

Sixth, I think one of the most important but most complex challenges now facing the international meteorological and oceanographic communities will be to implement successfully the concept of the Global Climate Observing System (GCOS) as it emerged from the 1990 Second World Climate Conference. The technological challenges will indeed be formidable, as will those in getting the different scientific communities (atmosphere, ocean, land surface, hydrology, ecology) with their different perspectives and traditions to work together. Another challenge will be that of forging the right relationships between those who will contribute to GCOS from under research funding umbrellas and those who are from the operational side. But I see as the most challenging task of all that of reestablishing or, hopefully, reinforcing the convention of free and unrestricted exchange of data that has been fundamental to the operation of international meteorology for more than a century. It is, at present, under unprecedented threat, but I believe it is as fundamental to GCOS as it has always been to the World Weather Watch and that we will all be the losers if we allow it to fall apart.

Seventh and finally, I see a major challenge in building the right international institutions and relationships for the changing times. At the broadest level, we now have bodies such as the U.N. Commission for Sustainable Development. I have already referred to the strengthening WMO–IOC partnership, and I should mention the progress that’s being made through, for example, the preparations for the forthcoming WMO–UNESCO–IOC–UNEP–ICSU–UNDP–FAO-sponsored meeting in Geneva in April on the future of the World Climate Programme. But there will be difficult decisions along the way, including that facing WMO as to the extent to which it sticks to its largely nonpolitical core role in mainstream meteorology versus the extent to which, in a post-Rio world, it sees the need to become a key player in the much more interdiscipli

6. Conclusions

Some might see it as a little naive to use the Club of Rome as the authority for my final words on climate and global change. But I was immensely taken by some of the ideas, if not the precise language, of “The First Global Revolution,” which was issued as a 1991 report by the Council of the Club of Rome. In looking to the way in which science and technology might best contribute to addressing the daunting challenges facing mankind on the threshold of the new millennium, it wisely refrained from detailed proposals but suggested three broad lines of approach needed to progress beyond the pursuit of knowledge to the achievement of wisdom. Its three priorities are:

- fundamental research concerning the human individual, his nature, motivations, potentialities, and limitations—essentially research into the nature of wisdom and its generation;
- research on the operation of the natural system of the planet;
- research leading to technological innovations.

It is the second of these, coupled hopefully with the products of the first, that I believe we in the meteorological community must see as both our opportunity and our obligation. The scientific problems of the atmosphere are central to most of the great issues of global change. We will have to learn how to interact widely across the other disciplines without losing depth in our own. And, I hope, we will all remember that when we address global problems, there’s a whole hemisphere down there south of the equator. It has its own problems and its own challenges, and its inhabitants get very confused when they hear about international meetings scheduled for the summer that actually take place in July!

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This landmark volume, the work of more than 200 contributors, brings alive the remarkable achievements of the past four and one-half decades of radar meteorology. Organized into three segments, the book covers the history, current status, and expected developments in the technological, scientific, and operational subject areas. This is much more than a narrow treatise on radar meteorology. Although the technological chapters deal explicitly with various aspects of the instruments, remaining chapters discuss a broad spectrum of scientific and operational problems such as cloud microphysics and dynamics to synoptic meteorology, nowcasting, severe-storm detection and warning, and hazards to aviation such as low-level wind shear. Radar in Meteorology represents an unprecedented compendium of knowledge in the field.