

STATEMENT BY PROFESSOR G.O.P. OBASI, SECRETARY GENERAL  
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AT THE SMALL STATES CONFERENCE ON SEA LEVEL RISE  
(Maldives, 14-18 November 1989)



SMALL STATES  
CONFERENCE ON  
SEA LEVEL RISE  
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MR. CHAIRMAN  
YOUR EXCELLENCIES  
DISTINGUISHED DELEGATES  
LADIES & GENTLEMAN

On behalf of the World Meteorological Organization, may I first congratulate the organizers of this conference on "Small States and Sea Level Rise", and the initiative taken by the Maldives to convene such an important event. The global changes that are occurring will clearly affect some countries more than others, and the low-lying small states are particularly vulnerable.

It is probably worthwhile to examine briefly what we know, what we suspect but cannot state with scientific certainty, and how we arrived at our present understanding and knowledge. The first thing that is evident is that atmospheric concentrations of greenhouse gases are increasing, especially carbon dioxide ( $\text{CO}_2$ ), methane ( $\text{CH}_4$ ), CFCs, nitrous oxides and low level ozone. These are measured at stations world-wide within WMO's Global Atmosphere Watch (GAW). For  $\text{CO}_2$ , for example, while emissions are primarily from the industrialized North, the atmosphere is very well mixed and concentrations world-wide have increased from 315 parts per million by volume (ppmv) in the mid 1950's when continuous measurements began, to 350 ppmv in 1988. Measurements of other greenhouse gases have shown similar trends. It has long been recognized that some constituents of the atmosphere act in a manner similar to the glass in a greenhouse, allowing solar radiation to penetrate, but trapping some of the energy emitted back to space from earth. Without this natural effect, the planet would be about  $30^\circ\text{C}$  colder than it now is. But human actions leading to increasing  $\text{CO}_2$  and other greenhouse gases have been slowly but increasingly augmenting the greenhouse effect.

The  $0.5^\circ\text{C}$  warming of the earth's mean surface temperature observed over the past century by climatological observation networks co-ordinated by WMO, is reasonably consistent with the observed changes in greenhouse gases and with meteorological theory. Projections for the next 50 years are for additional significant warming of  $1.0 - 4.0^\circ\text{C}$ , a more rapid warming than man has hitherto experienced.

At the same time sea level has been rising. The best estimate is that mean sea level rose 10-15 cm over the past 100 years, due to the thermal expansion of the ocean waters, and the melting of mountain glacier ice. Neither the observed warming nor the sea level rise can be conclusively attributed to increased greenhouse effect, but the connection is strongly suggestive.

To what extent will sea level rises continue? You have several experts on the topic at this conference. I will simply note that the continued warming predicted would result in further expansion of sea water, and further melting of glaciers and polar ice. However, increased snowfall near the Poles, especially in the Antarctic, will offset the effect to some extent. The best guesses today are for a further gradual increase of 30 cm or so by the middle of the next century, with continuing increases thereafter if greenhouse gas concentrations are not stabilized.

I should emphasize that these figures for future warming and sea level rise are indeed best guesses of the scientific community. Many uncertainties remain, and expanded research on climate and climate change becomes ever more urgent as the countries of the world approach major decisions on adaptation or preventive strategies.

The major research programme in this field is the World Climate Research Programme (WCRP), co-ordinated jointly by WMO and the International Council of Scientific Unions, and part of the overall World Climate Programme initiated by WMO in 1979. The WCRP has two main objectives:

- (1) To determine the predictability, and the methods of predicting the climate for months or seasons in advance.
- (2) To determine human influences on climate, especially due to greenhouse gas increases.

The WCRP has a number of major projects addressed to these two goals. An important one in this region and to many Small States is the Tropical Oceans Global Atmosphere project or "TOGA" for short.

The primary scientific objective of TOGA is to develop the capability to predict the changes in the ocean-atmosphere system on time-scales of months to years. Air-sea interactions in the tropics have a significant effect on short-term climate variations throughout much of the world. By far the strongest effect is the El Niño/Southern Oscillation or ENSO phenomenon. Major departures from normal of ocean temperatures in the tropical Pacific ocean are linked with highly anomalous weather circulation patterns over the Indian and Pacific Oceans. TOGA has so far focussed on the ENSO phenomenon including investigations of related climatic variations such as excessive rainfall in the Indian monsoon, typhoon development, and drought in Australia. This is not to ignore the importance of connections between ENSO and climate variability outside the ENSO region, for example, in Africa or in temperate zones. However, these connections are less well-established and the oceanic signal in the Atlantic and Indian Oceans is far weaker than that in the Pacific.

After the first five years of TOGA, experimental forecasts of tropical Pacific sea surface temperature anomalies up to 15 months ahead are now being published regularly by several investigators. This is evidence of the encouraging progress made by TOGA so far and gives grounds for cautious optimism that the TOGA objectives can be met if this research is given sufficiently high priority by all nations, big and small.

TOGA has two main components: (1) measurements, and (2) mathematical modelling of the ocean-atmosphere system. One element of the measurements component of particular importance to this Conference is the TOGA sea-level network and the associated TOGA Sea-level Data Centre at the University of Hawaii. In the tropical Pacific nearly every island to which regular transportation is available has been instrumented with a tide-gauge, and the TOGA network has now grown to 81 stations out of the target of 90 that are listed in the TOGA Implementation Plan.

Very high quality sea-level data summaries developed at the TOGA Sea-level Centre are important tools in TOGA research. But they have an importance far beyond TOGA as a vital contribution to the Global Observation of Sea-Level Service (GLOSS) organised by Intergovernmental Oceanographic Commission (of Unesco). GLOSS data are of fundamental importance to the task

of detecting the global rise in sea-level. Although sea level data from satellites are valuable, especially over data sparse regions, satellite data by themselves will not provide the precise assessment of the absolute trend in sea level that is needed. There are, therefore, two reasons for small island states in the Indian and South Pacific to support the TOGA sea-level network. First, this network contributes to TOGA research which ultimately will lead to seasonal climate forecasts of major economic benefit. Secondly, maintenance of this network is essential to assess and counter the impact of a rise in sea-level resulting from global warming.

As far as atmospheric observations are concerned, TOGA relies heavily on WMO's World Weather Watch, augmented by a small but vitally important number of additional upper-wind observation stations at locations very close to the equator. It is impossible to overstate the importance to the World Climate Research Programme in general and to TOGA in particular of maintaining the World Weather Watch upper-air network in the tropical regions. Any reduction in this network has an adverse impact on all global climate research activities.

I should mention here as an example of what can be achieved, the experience of the Maldives. From the very outset one of the highest priority requirements for TOGA has been an upper-wind station on Gan Island in the Maldives. I am delighted to report that this requirement has very recently been met as a result of international collaboration co-ordinated by the International TOGA Project Office at WMO Headquarters in Geneva. The UK has donated a radar and associated equipment, and has funded the purchase of a satellite transmitter. Canada has donated a hydrogen generator. The Meteorological Service of the Maldives has provided all the various local facilities and, most important of all, the personnel to operate the station and the management to oversee its operation. Thanks to this co-operation, high quality upper wind data from an otherwise data sparse region are now available daily for vital climate research and for operational weather forecasting. The Maldives also maintains one of the tide-gauges in the TOGA Indian Ocean network, an excellent example for all Small Nations.

Finally, allow me to say a few words about tropical cyclones and storm surges, and their prediction and warnings. In an average year about 80 tropical cyclones form over the tropical ocean regions and affect some 50 countries, including most of the Small States represented at this Conference. It is not necessary for me to detail the damage done by the winds, the torrential rains and the waves and storm surges which accompany such tropical cyclones, be they called hurricanes, or typhoons, or cyclones, or other names in your regions. Some research workers have concluded that with warmer ocean surface water temperatures, tropical cyclones may well become more severe in the future and this would create even more difficult problems for the Small States in cyclone-prone regions.

However, under the International Decade for Natural Disaster Reduction (IDNDR), which is being launched by the United Nations General Assembly for the 1990's, a strong and concerted effort will be made to improve prediction, warnings, and preparedness systems for tropical cyclones. WMO with its five regional organizations of Member countries for tropical cyclone warnings, will play a central role in the Decade activities.

There are a number of actions that your countries can take in the face of probable rises in sea level of the magnitude anticipated. For example, the report, including the specific consultant's studies, of the Expert Group of the Commonwealth has documented a number of practical suggestions for Small States. The WMO/UNEP Intergovernmental Panel on Climate Change will be reporting in September 1990, and will be advising on strategies to limit in future the increases in greenhouse gases, and to adapt to warming and sea level rise. Immediately after this report, in November of 1990, WMO will be convening in Geneva the Second World Climate Conference. At that time all nations will be invited to discuss and consider the findings and recommendations of the IPCC. We hope that by then a sufficient consensus will have developed to begin negotiation of a global convention on climate change.

WMO pledges its full support to work through its 160 Member countries to provide the firm scientific foundation so necessary for adoption of sound responses.

Your Conference here has brought home forcefully to the world that sea level rise and climate change will seriously affect Small States, as well as large. We all have a stake in ensuring that the world community responds to your concerns.

Support of the Small States will be essential in many ways to move vigorously on the climate issue.

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