General description of the TAR by the WG1

by

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1. Introduction

The third assessment report (TAR) of the Intergovernmental Panel on Climate Change (IPCC) is now on the last stage of completion with the remaining part, the Synthesis Report, to be finalized at the coming session in September. Since its establishment in 1988, the IPCC has been actively issuing various reports covering scientific, technological, social and economic aspects of the climate change based upon all available updated research outcomes. These reports, including the First Assessment Report(FAR) in 1990 and the Second Assessment Report (SAR) in 1995, have contributed considerably to the decision making of the policy makers particularly through the United Nations Framework Convention on Climate Change and subsequent Conferences of the Parties (COPs). The Working Group I (WG I) of the IPCC already approved its Summary for Policy Makers (SPM) and also accepted its underlying report of the TAR at its 8th Session (Shanghai, January 2001). The General description of the WG I/TAR are briefly presented here with emphasis on its new and characteristic features.

2. Observed climate

Firstly, the TAR shows much more substantial analysis of the past climate for 1000 years making use of all available instrumental data and proxy data than the former assessment reports. Instrumental data are available for the past 140 years globally to show the most extensive surface temperature analysis of the whole 20th century. Furthermore, proxy data derived from tree rings, corals, ice cores and historical records have enabled detailed analysis of the surface temperature in the northern hemisphere up to the past 1000 years. Findings from these researches are as follows:

- The global-average surface temperature has increased over the 20th century by about 0.6°C. It is *very likely* that globally the 1990s was the warmest decade and 1998 the warmest year in the instrumental record since 1861.
- It is indicated that the increase in temperature in the 20th century is *likely* to have bee the largest of any century during the past 1000 years.
- Snow cover and ice extent have decreased in the 20th century.
- Global average sea level has risen and ocean heat content has increased.
- Emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that are expected to affect the climate.

3. Simulation Experiment of the 20th century

Secondly, TAR has shown for the first time remarkable research outcomes from simulation experiments of the 20th century in three cases with different external forcings: one with natural forcings of solar variation and volcanic activity, another with anthropogenic forcings of greenhouse gases and an estimate of sulphate aerosols, and the last one with both natural and anthropogenic forcings. The result of these experiments contributes much to the following assessments:

- The most of the warming observed over the last 50 years is attributable to human Activities.
- Confidence in the ability of models to project future climate has increased.

4. Projection of the climate change

Thirdly, results of projections of future climate up to the end of the 21st century from 1990, incorporating past as well as future emissions of greenhouse gases and aerosols according to the full range of 35 SRES scenarios are shown as follows based a number of climate models:

The globally averaged surface temperature is projected to increase by **1.4 to 5.8**°C, higher than that projected by the SAR (1.5 to 4.5°C with IS92 scenarios) due primarily to the lower projected sulphur dioxide emissions with negative radiative forcing; and

- Global mean sea level is projected to rise by **0.09 to 0.88 metres** mainly caused by thermal expansion and loss of mass from glaciers and ice caps, slightly lower than that projected by the SAR (0.13 to 0.94 with IS92 scenarios) primarily due to the use of improved models, which give a smaller contribution from glaciers and ice sheets.

Based upon global model simulations for a wide range of scenarios, following findings are among those obtained:

- Nearly all land areas will warm more rapidly than the global average, particularly those at northern high latitudes in the cold season.
- Global average water vapour concentration and precipitation are projected to increase.

Changes in extreme weather and climate events are projected with estimate of confidence globally. For example, higher maximum temperatures and more hot days over nearly all land areas *very likely (terms of confidence by 90-99 % chance).* Changes of monsoons, El-Nino events are also discussed. Some research results projecting well beyond 21st century are also shown.

5. Future actions required

One of the main objectives of the TAR was originally to project regional climate changes focusing on extreme weather, in particular. Some regional climate models are now being developed but their research outcomes have not been published in time for the TAR. Quality of regional climate models depends on that of global climate models, which still have various problems to be solved. The TAR indicates their details to address remaining gaps in information and understanding mainly in two areas:

・*Systematic observations and reconstructions:*

- Reverse the decline of observational networks in many pats of the world.
- Sustain and expand the observational foundation for climate studies by providing accurate, long-term, consistent data including implementation of strategy for integrated global observations.
- Enhance the development of reconstruction of past climate periods.
- Improve the observations of the spatial distribution of greenhouse gases and aerosols.

・*Modelling and process studies:*

- Improve understanding of the mechanisms and factors leading to changes in radiative forcing.
- Understand and characterize the important unresolved processes and feedbacks, both physical and biogeochemical, in the climate system.
- Improve the integrated hierarchy of global and regional climate models with a focus on the simulation of climate variability, climate changes and extreme events.
- Link more effectively models of the physical climate and the biogeochemical system, and in turn improve coupling with descriptions of human activities.