This presentation is my first step for the research about Global Warming

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My Interests:

- Global Warming not only for scientific changes but also for Social changes.
- Social changes in Asia.
- Economic prediction and population change.

It is necessary for me to read and put together IPCC third assessment report for understanding the summary of Global Warming. Especially, I need reading the report of Working Group 2 which shows impact, adaptation, and vulnerability by Global Warming. Hereinafter, I introduce a part of WG2 along my interests.

- IPCC Third Report is …This is the beginning.

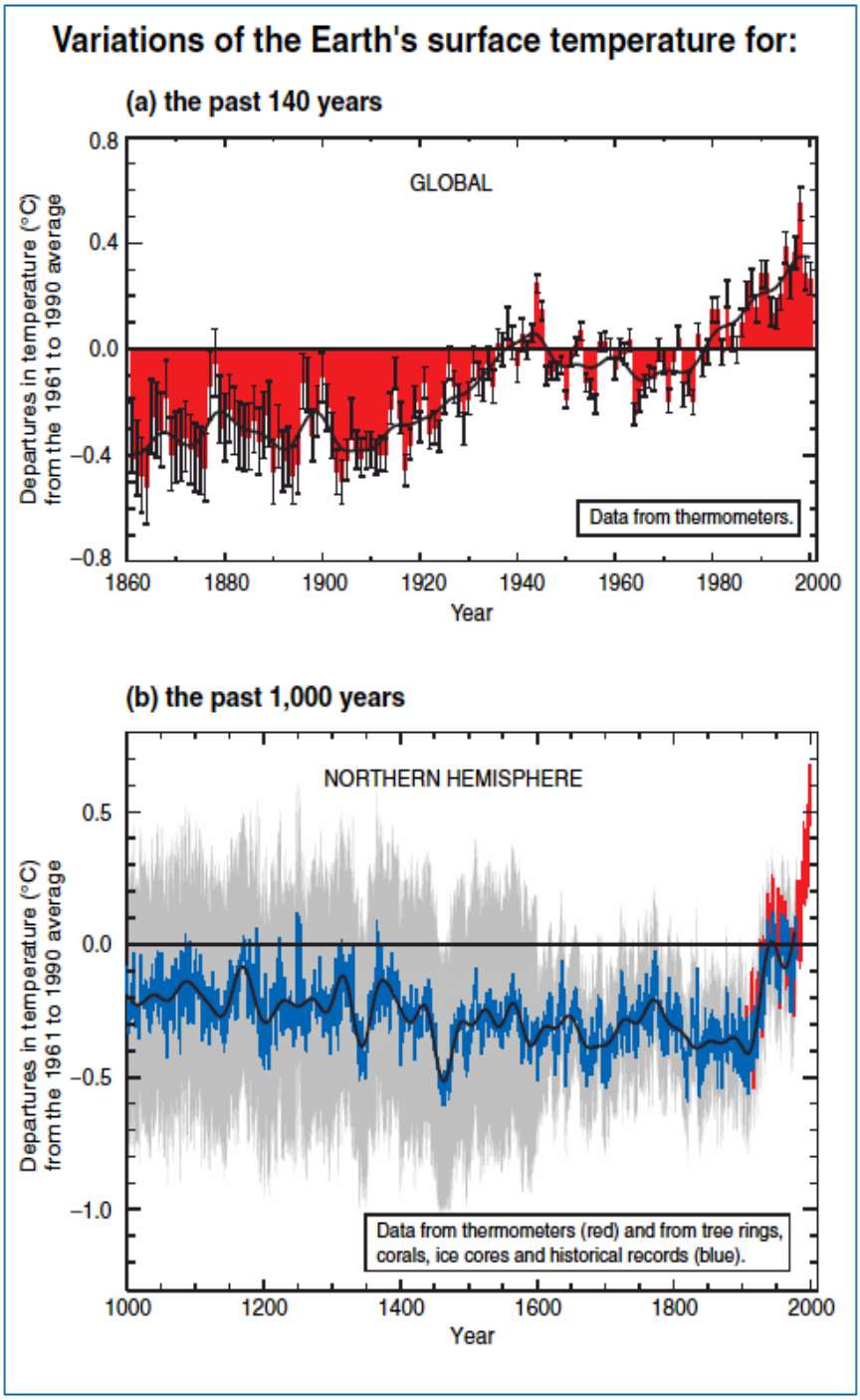


Figure 1: Variations of the Earth's surface temperature over the last 140 years and the last millennium.

(a) The Earth's surface temperature is shown year by year (red bars) and approximately decade by decade (black line, a filtered annual curve suppressing fluctuations below near decadal time-scales). There are uncertainties in the annual data (thin black whisker bars represent the 95% confidence range) due to data gaps, random instrumental errors and uncertainties, uncertainties in bias corrections in the ocean surface temperature data and also in adjustments for urbanisation over the land. Over both the last 140 years and 100 years, the best estimate is that the global average surface temperature has increased by 0.6 ± 0.2°C.

(b) Additionally, the year by year (blue curve) and 50 year average (black curve) variations of the average surface temperature of the Northern Hemisphere for the past 1000 years have been reconstructed from "proxy" data calibrated against thermometer data (see list of the main proxy data in the diagram). The 95% confidence range in the annual data is represented by the grey region. These uncertainties increase in more distant times and are always much larger than in the instrumental record due to the use of relatively sparse proxy data. Nevertheless the rate and duration of warming of the 20th century has been much greater than in any of the previous nine centuries. Similarly, it is likely[7] that the 1990s have been the warmest decade and 1998 the warmest year of the millennium.

[Based upon (a) Chapter 2, Figure 2.7c and (b) Chapter 2, Figure 2.20]

We look back history of IPCC. Models have used in IPCC have been improved for many times. We will know how it has improved as we see the table 1 below. GCM has been AOGCM (atmosphere-ocean GCM) from AGCM (atmospheric GCM), and parameters have been more complex as the report step up higher. It's notable that SRES, which considers social changes in GHG emissions changes, was suggested on Third Assessment Report for the first time.

Table 1: Approximate chronology of IPCC process in relation to GCM simulations, their adoption in impact studies, and the development of IPCC emissions scenarios. Abbreviations follow: GHG = GreenHouse Gas; IS92 = IPCC emissions scenarios published in 1992; SRES = Special Report on Emissions Scenarios used in IPCC2001.

Date	IPCC Process	Working Group 1 GCM Simulations	Working Group 2 GCM-Based Scenarios used in Impact Studies	Working Group 3 Emissions scenarios
1988-1990	First Assessment Report, 1990	Equilibrium high-resolution AGCM	Equilibrium low-resolution 2× CO_2	Scenarios A-D (A=business-as-usual)
1993-1996	Second Assessment Report, 1996	Transient AOGCM GHG + aerosol (0.5 or 1% per year emissions)	Equilibrium low/high-resolution 2 ×CO_2	IS92
1999-2001	Third Assessment Report, 2001	Transient AOGCM CO_2-stabilization (SRES)	Transient warm-start; multi-century control and ensembles	SRES; stabilization

- What is the contribution of IPCC third report in detail?

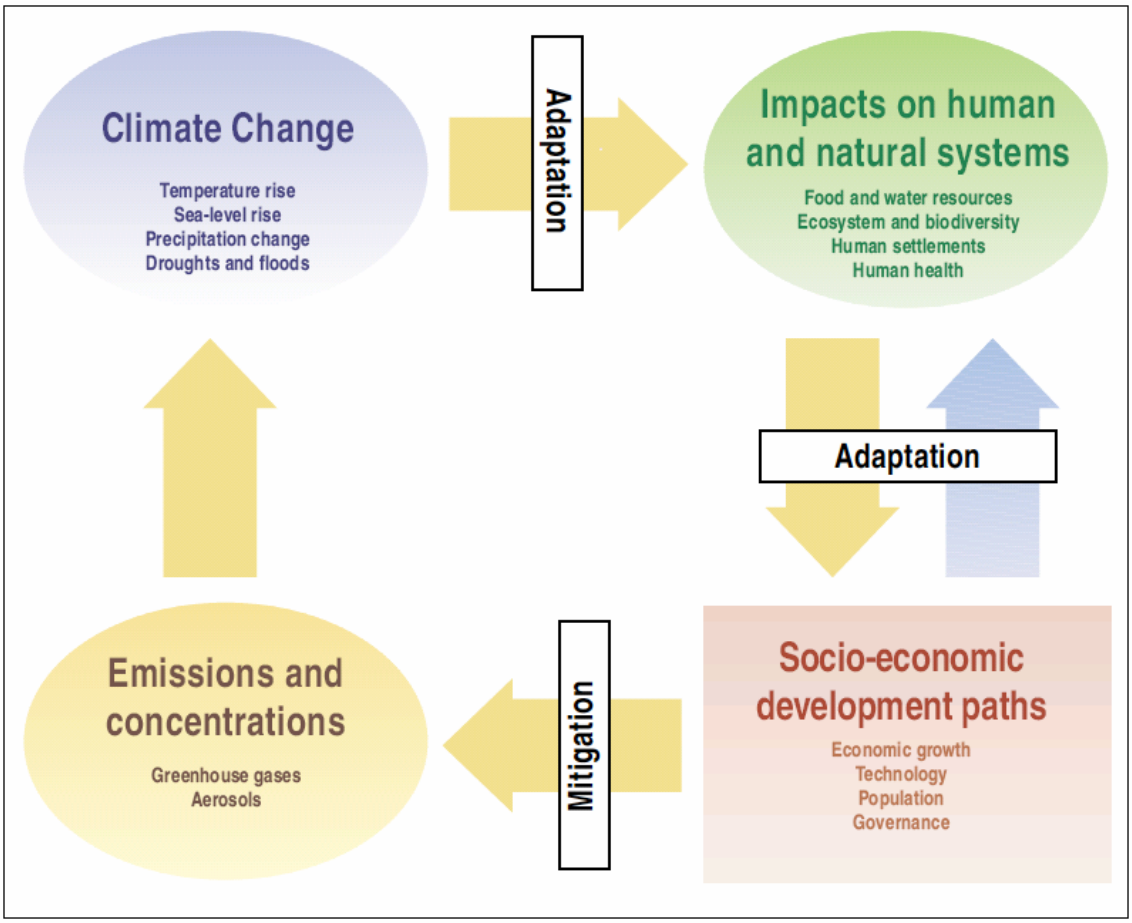


Figure 2: Climate change – an integrated framework. The figure is schematic and simplified representation of an integrated assessment framework for considering anthropogenic climate change. The yellow arrows show a clockwise cycle of cause and effect among the four phenomena shown in the figure, while the blue arrow indicates the societal response to climate change impacts.

- And then, what are scenarios?

The Emissions Scenarios of the Special Report on Emissions Scenarios (SRES)

A1. The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies).

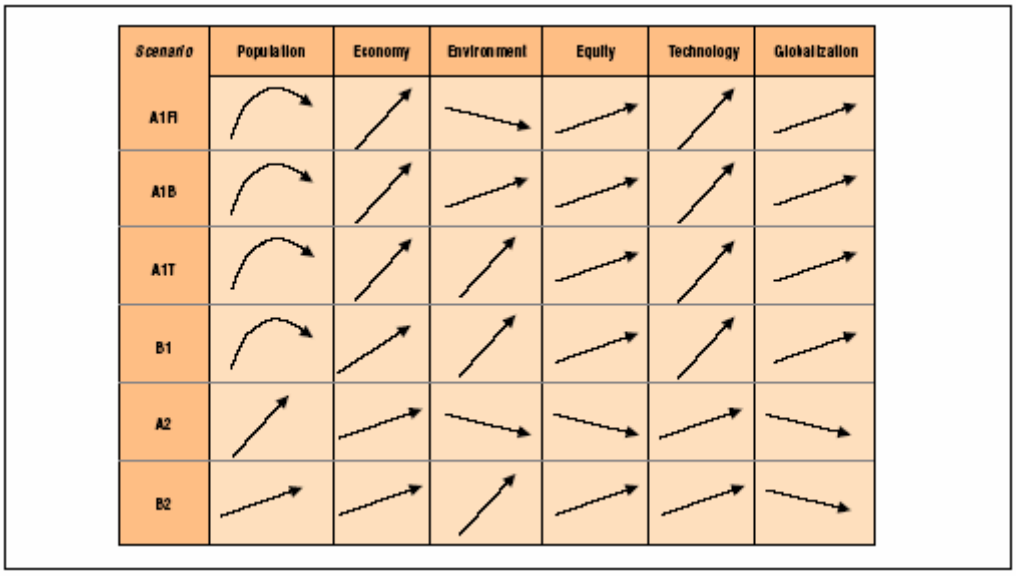
A2. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.

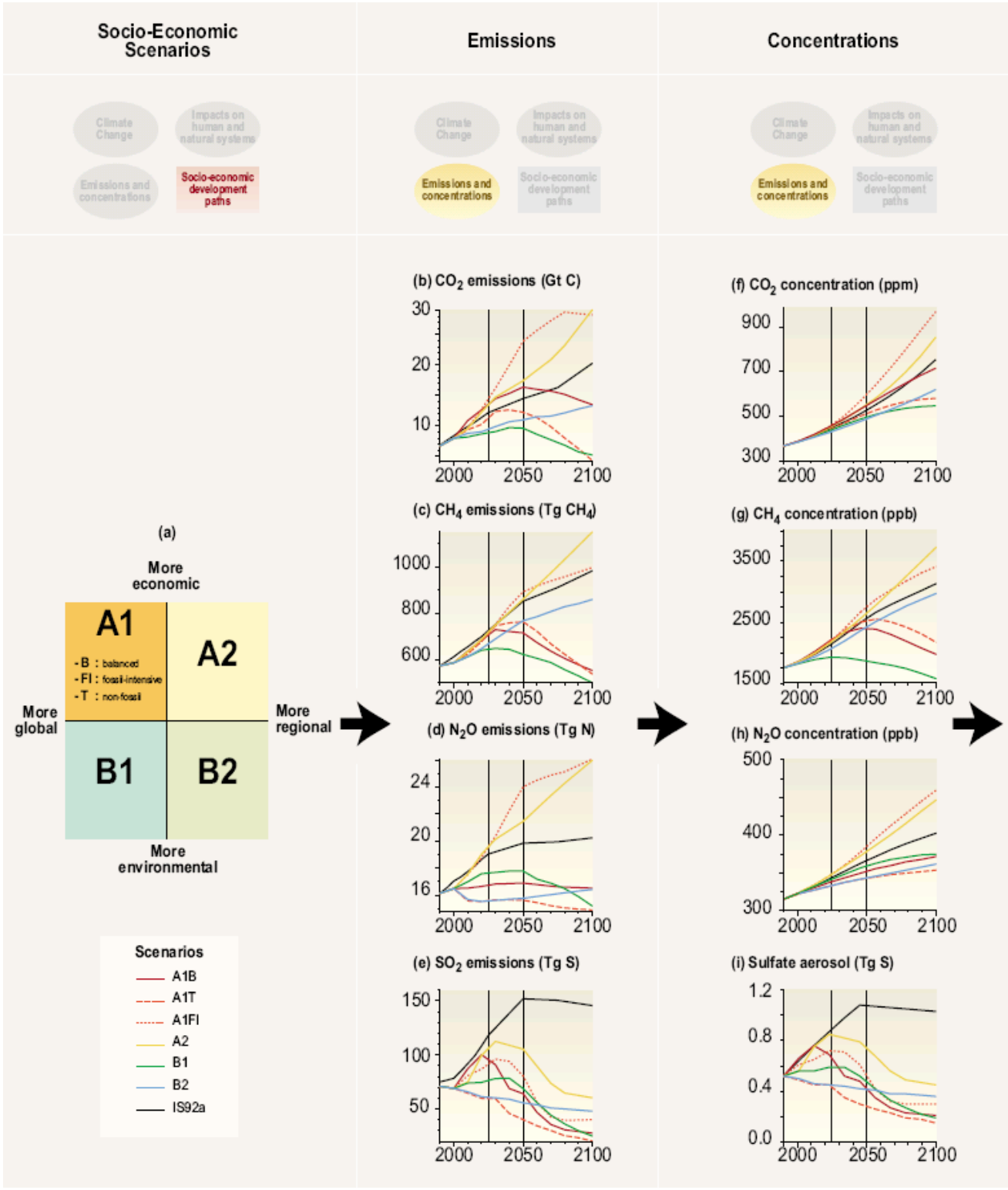
B1. The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

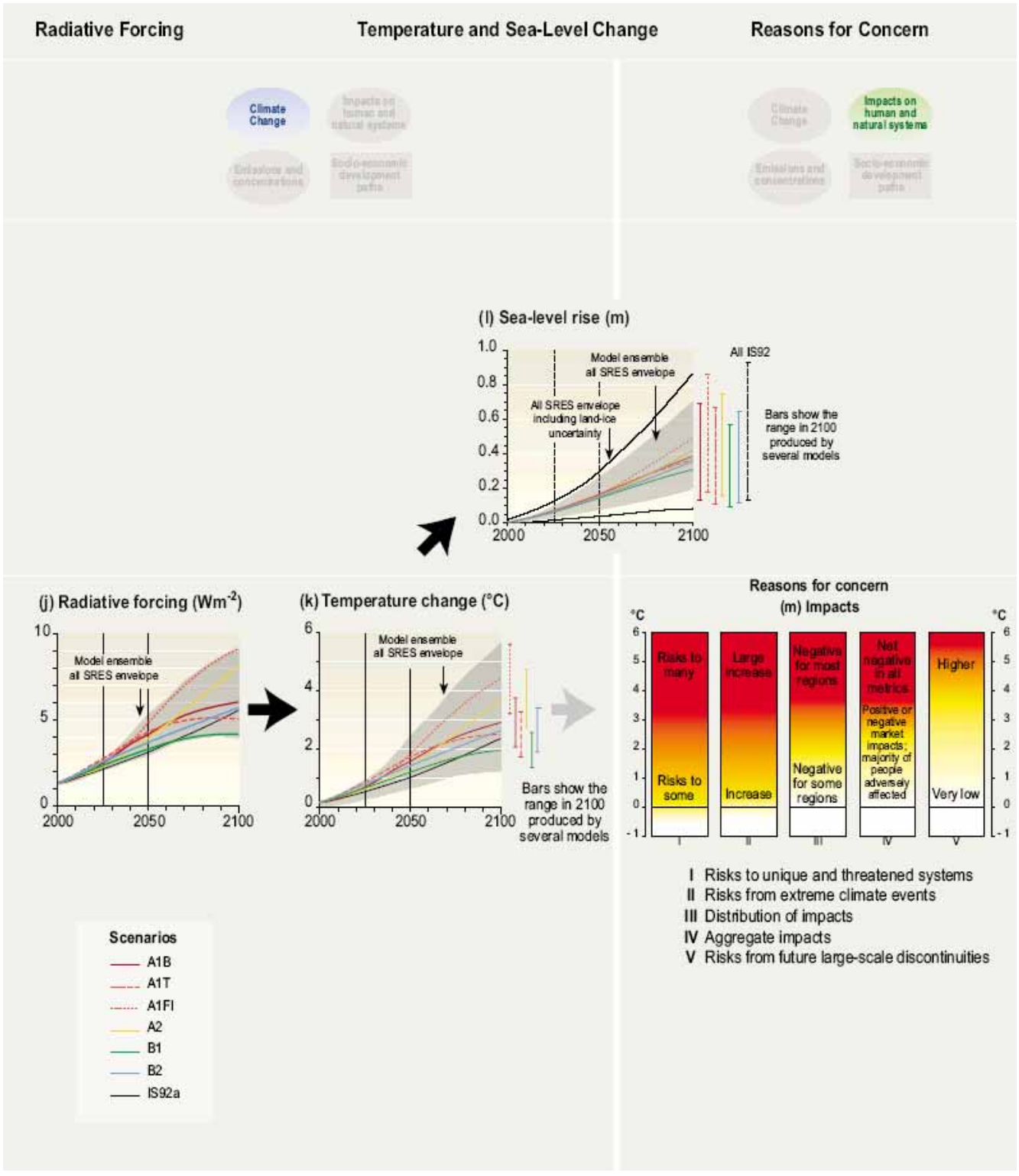
B2. The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.

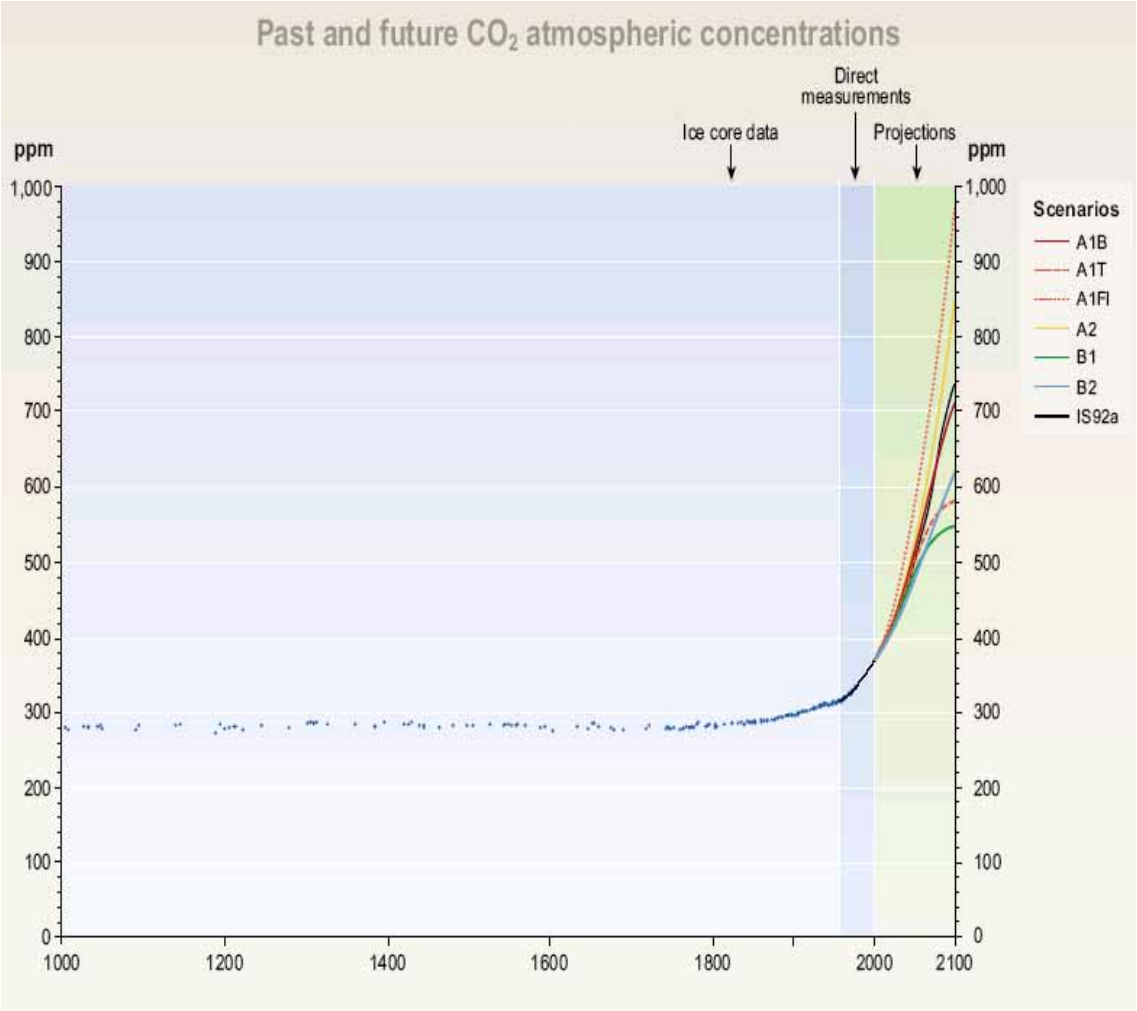
An illustrative scenario was chosen for each of the six scenario groups A1B, A1FI, A1T, A2, B1 and B2. All should be considered equally sound.

The SRES scenarios do not include additional climate initiatives, which means that no scenarios are included that explicitly assume implementation of the United Nations Framework Convention on Climate Change or the emissions targets of the Kyoto Protocol.

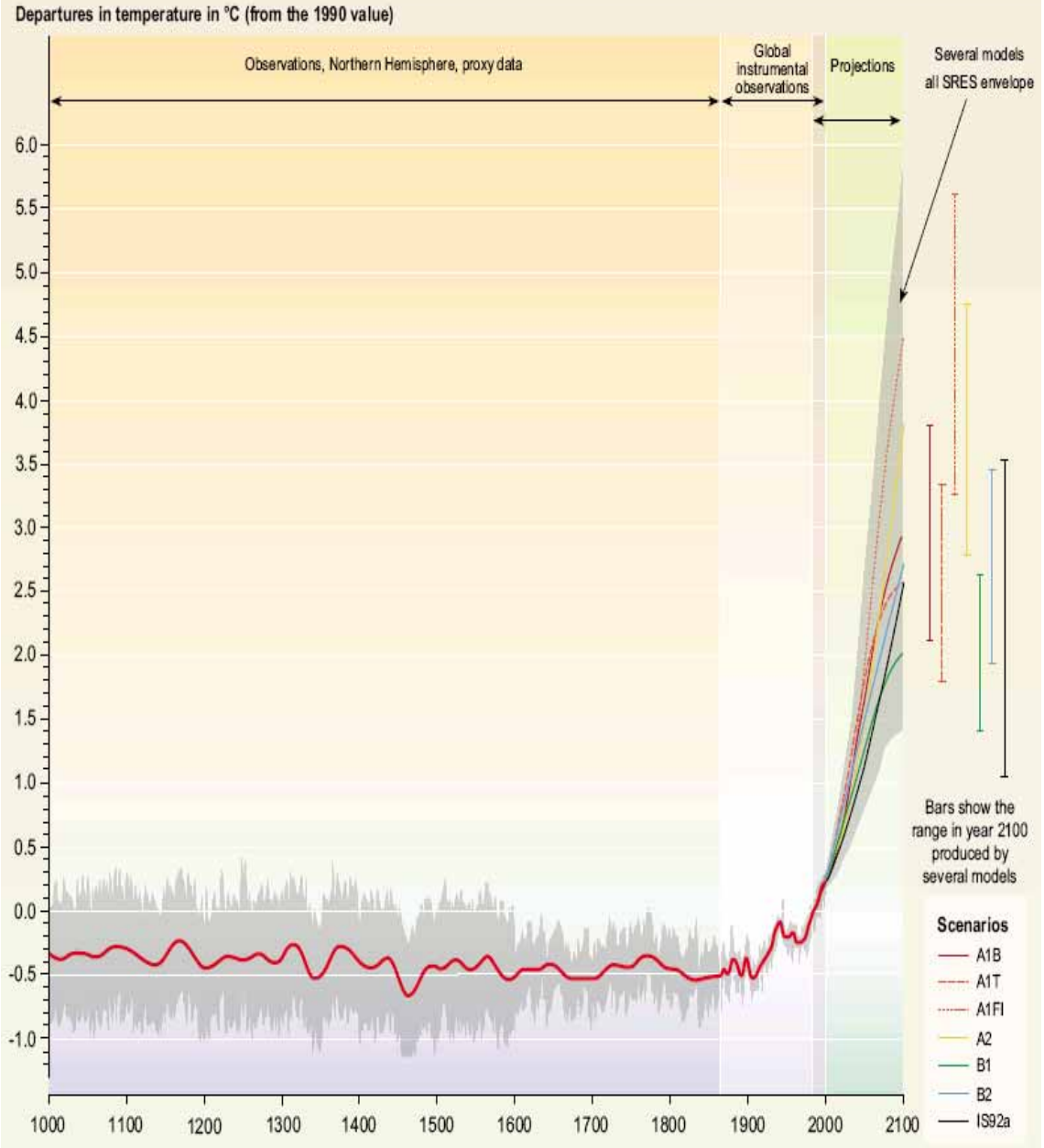



Socio-Economic Scenarios
Emissions
Concentrations
Climate Change
Impacts on human and natural systems
Emissions and concentrations
Socio-economic development paths
(a)
More economic
More global
More regional
More environmental
A1
- B : balanced
- FI : fossil-intensive
- T : non-fossil
A2
B1
B2
Scenarios
A1B
A1T
A1FI
A2
B1
B2
IS92a
(b) CO2 emissions (Gt C)
(c) CH4 emissions (Tg CH4)
(d) N2O emissions (Tg N)
(e) SO2 emissions (Tg S)
(f) CO2 concentration (ppm)
(g) CH4 concentration (ppb)
(h) N2O concentration (ppb)
(i) Sulfate aerosol (Tg S)
2000
2050
2100


Radiative Forcing
Temperature and Sea-Level Change
Reasons for Concern
Climate Change
Impacts on human and natural systems
Emissions and concentrations
Socio-economic development paths
(l) Sea-level rise (m)
1.0
0.8
0.6
0.4
0.2
0.0
2000
2050
2100
Model ensemble all SRES envelope
All SRES envelope including land-ice uncertainty
All IS92
Bars show the range in 2100 produced by several models
(j) Radiative forcing (Wm-2)
10
5
0
Model ensemble all SRES envelope
(k) Temperature change (°C)
6
4
2
0
Bars show the range in 2100 produced by several models
Reasons for concern
(m) Impacts
°C
Risks to many
Risks to some
Large increase
Increase
Negative for most regions
Negative for some regions
Net negative in all metrics
Positive or negative market impacts; majority of people adversely affected
Higher
Very low
I
II
III
IV
V
Scenarios
A1B
A1T
A1FI
A2
B1
B2
IS92a
I Risks to unique and threatened systems
II Risks from extreme climate events
III Distribution of impacts
IV Aggregate impacts
V Risks from future large-scale discontinuities


Past and future CO_2 atmospheric concentrations
Direct measurements
Ice core data
Projections
ppm
ppm
1,000
900
800
700
600
500
400
300
200
100
0
1000
1200
1400
1600
1800
2000
2100
Scenarios
A1B
A1T
A1FI
A2
B1
B2
IS92a

Variations of the Earth's surface temperature: years 1000 to 2100



- The importance of Asian economy

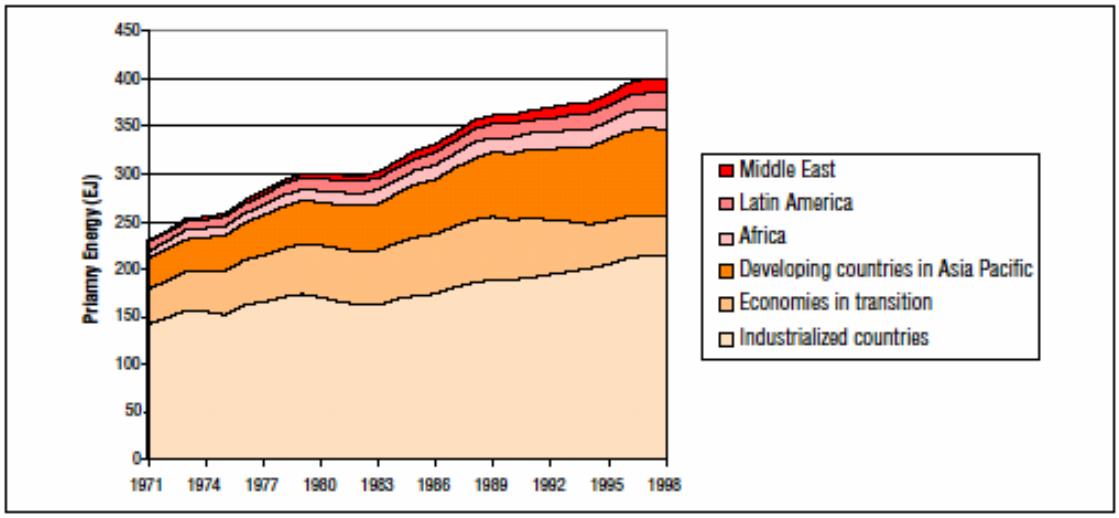


Figure 3: World primary energy has been used by various regions from 1971 to 1998.

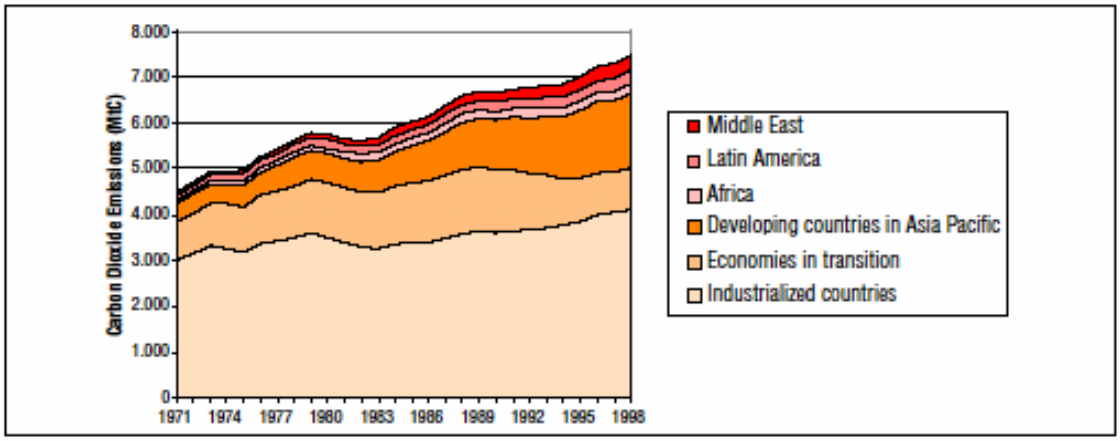


Figure 4: World CO_2 emissions by various regions from 1971 to 1998.

- **Various impacts on Asia by global warming**

It is important to know how Asia region will be influenced by global warming for the sake of understanding how forecast of global warming will be changed by the population change and the economic development in Asia, because the population and the economic change in Asia will strongly depend on impact by global warming.

Table 2: Sensitivity of representative Asian regions to climate change

Change in Climatic Elements and Sea-Level Rise	Vulnerable Region	Primary Change	Impacts	
			Primary	Secondary
0.5–2°C (10- to 45-cm sea-level rise)	Bangladesh Sundarbans	– Inundation of about 15% (~750 km²) – Increase in salinity	– Loss of plant species – Loss of wildlife	– Economic loss – Exacerbated insecurity and loss of employment
4°C (+10% rainfall)	Siberian permafrosts	– Reduction in continuous permafrost – Shift in southern limit of Siberian permafrost by ~100–200 km northward	– Change in rock strength – Change in bearing capacity – Change in compressibility of frozen rocks – Thermal erosion	– Effects on construction industries – Effects on mining industry – Effects on agricultural development
>3°C (>+20% rainfall)	Water resources in Kazakhstan	– Change in runoff	– Increase in winter floods – Decrease in summer flows	– Risk to life and property – Summer water stress
~2°C (-5 to 10% rainfall; 45-cm sea-level rise)	Bangladesh lowlands	– About 23–29% increase in extent of inundation	– Change in flood depth category – Change in monsoon rice cropping pattern	– Risk to life and property – Increased health problems – Reduction in rice yield

Table 3: Potential land loss and population exposed in Asian countries for selected magnitudes of sea-level rise.

Country	Sea-Level Rise (cm)	Potential Land Loss (km²)	(%)	Population Exposed (millions)	(%)
Bangladesh	45	15,668	10.9	5.5	5.0
	100	29,846	20.7	14.8	13.5
India	100	5,763	0.4	7.1	0.8
Indonesia	60	34,000	1.9	2.0	1.1
Japan	50	1,412	0.4	2.9	2.3
Malaysia	100	7,000	2.1	>0.05	>0.3
Pakistan	20	1,700	0.2	n.a.	n.a.
Vietnam	100	40,000	12.1	17.1	23.1

n.a. = not available.

Forward study

- To read and understand outlines of various integrated models
- To decide the model
- To find a remarkable parameter in models

I have to read many articles so that I do above.

- **Socio-economic development** explored in the SRES has given rise to emissions of greenhouse gases, aerosols, and carbon dioxide. The greenhouse gas emissions accumulate in the atmosphere, changing concentrations and disturbing the natural balances. Aerosols also give rise to air pollution that damage human and the natural systems. The enhanced greenhouse effect will cause **climate changes** with associated **impacts on the natural and human systems**. These changes will have effects on socio-economic development paths. The development paths also have direct effects on the natural systems such as changes in land use leading to deforestation. It's shown by the anti-clockwise arrow from the development box. A major contribution of the TAR is to explicitly consider the right bottom box by examining the relationships between greenhouse gas emissions and development paths.

First, most of countries in Asia socioeconomically depend on natural resources, which are water, forests, pastures, and fisheries. If global warming will make an affect on natural resources, many countries will receive a heavy blow.

Secondly, crop productions and culture fisheries will be threatened by high temperature, water stress, sea level rise, and the increase of flood.

Thirdly, severe lack of water will be concerned, because river flow will be changed by climate change.

Lastly, Delta region and lowland will be flooded by sea level rise.