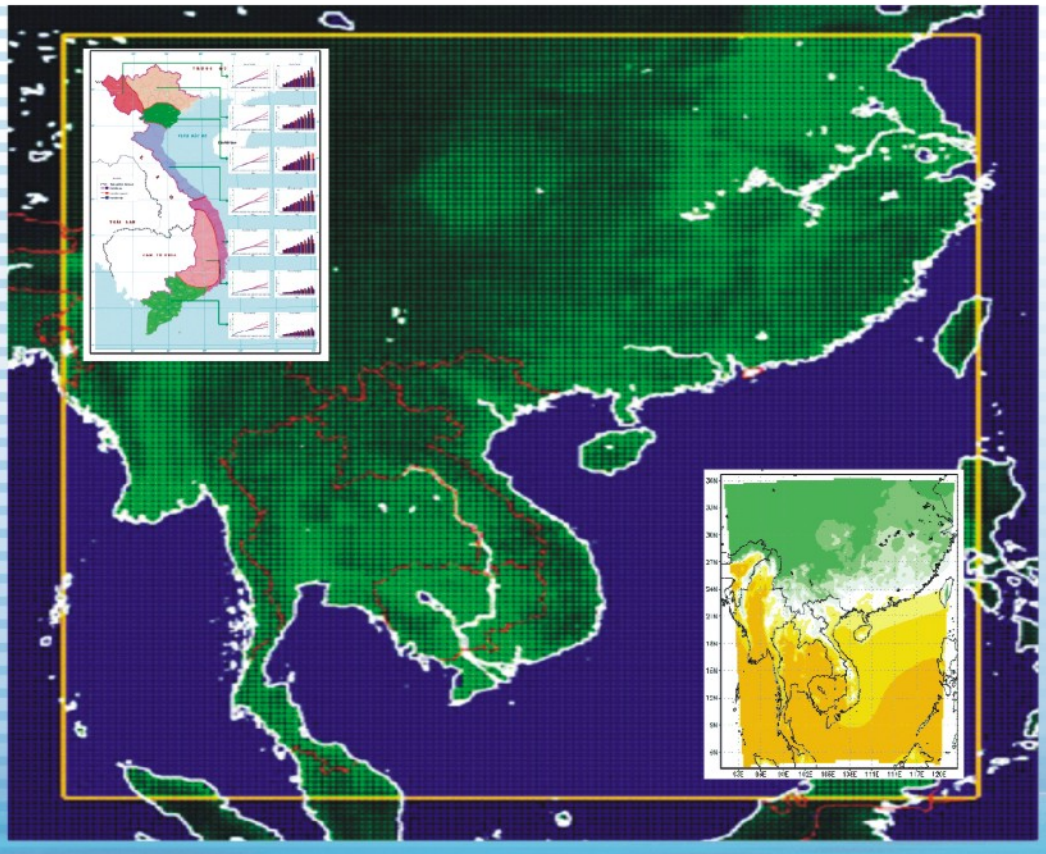
MINISTRY OF NATURAL RESOURCES
AND ENVIRONMENT

CLIMATE CHANGE, SEA LEVEL RISE SCENARIOS FOR VIETNAM



Hanoi, June - 2009

PREFACE

Climate change is one of the most significant challenges facing human beings in the 21st century. Climate change will seriously affect life, production and environment worldwide. Temperature rise and sea level rise may cause floods and salt water intrusion, thus harm agriculture and pose risks to industries and socio-economic systems in the future.

In Vietnam, over the past 50 years, average temperature has increased about 0.5 - 0.7°C, sea level has risen about 20cm. Climate change has made natural disasters, especially typhoons, floods, and droughts more severe.

Consequences of climate change in Vietnam are considered to be serious and present significant threats to hunger eradication and poverty reduction, the achievement of the Millennium Development Goals and the country's sustainable development.

Recognizing potential impacts of climate change, the Government of Vietnam has approved the National Target Program to Respond to Climate Change. One of the important activities of the Programs is to develop and update climate change scenarios. This is the basis for ministries, sectors and provinces/cities to assess climate change impacts, to develop and implement their respective responding action plans.

The Ministry of Natural Resources and Environment was assigned by the Government: *"To complete constructing climate change scenarios, especially sea level rise, for Vietnam by early 2009 based on existing studies in Vietnam and overseas,... By the end of 2010, to complete updating climate change scenarios, and by 2015 to continue updating climate change scenarios, especially sea level rise for periods up to 2100"*.

The Ministry of Natural Resources and Environment hereinafter respectfully introduces the scenarios of climate change, sea level rise for Vietnam. According to these scenarios, climate would significantly change over all regions of Vietnam. By the end of the 21st century, average temperature in Vietnam is expected to increase about 2.3°C; total annual rainfall and rainy season's rainfall would increase while dry season's rainfall would decrease; sea level is expected to rise about 75cm compared to the average for 1980-1999.

The Ministry of Natural Resources and Environment will continue to update climate change scenarios, especially sea level rise, in order to provide more sufficient information for ministries, sectors and provinces/cities to carry out their action plans and effectively implement the National Target Program to Respond to Climate Change.

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Minister of the Ministry of Natural Resources and Environment

I. INTRODUCTION

The purpose of developing the scenarios of climate change, sea level rise for Vietnam is to provide the basic information of the future trends of climate change and sea level in Vietnam, corresponding to different scenarios of global socio-economic development which cause different emission rates of green house gases. These scenarios of climate change, sea level rise are the preliminary basis for ministries, sectors and provinces/cities to assess possible climate change impacts on socio-economic sectors, to develop and implement their respective action plans for responding to and reducing potential impacts of future climate change.

According to the Inter-governmental Panel on Climate Change (IPCC), a climate change scenario is a plausible description of future climate, based on a set of climatic relations, being developed to be used in studies of the consequences of climate change induced by anthropogenic activities and often used as inputs for impact assessments. The IPCC's results are presented in the first assessment report in 1992 through the fourth assessment report in 2007.

At present, many regions and countries have developed climate change scenarios at regional, national, and climatic or smaller scales. Most climate change scenarios are constructed for the time frame of decades of the 21st century.

In Vietnam, there is a number of climate change scenarios developed and applied for different purposes of climate change related activities. However, in order to have more comprehensively scientific and practical based scenarios for the implementation of National Target Program to Respond to Climate Change (NTP), the Government has assigned Ministry of Natural Resources and Environment (MONRE) to be a coordinating agency for developing climate change scenarios, especially sea level rise for Vietnam.

The scenarios of climate change, sea level rise for Vietnam presented in this report were developed based on the available national and international studies, the comments and ideas of experts and managers of relevant ministries and sectors. These scenarios will be updated and improved on schedule at 2010 and 2015.

II. CURRENT STATUS OF CLIMATE CHANGE, SEA LEVEL RISE

Climate change manifested mainly by global warming and sea level rise, is caused substantially by human activities that emit excessive greenhouse gases into the atmosphere.

According to the IPCC Fourth Assessment Report in 2007, the global average temperature has risen about 0.74°C for the period of 1906 - 2005 and the warming trend over the last 50 years is nearly twice that for the previous 50 years (Figure 1). Temperature rise over the continents is higher than that over the oceans (*IPCC, 2007*).

In the past 100 years, rainfalls had increasing trends in the areas with latitude higher than 30°. On the other hand, rainfalls had decreasing trends in tropical areas since the mid 1970s (Figure 2). Heavy rainfall events seem to take place more frequently in many regions of the world (*IPCC, 2007*).

Global average sea level rose in the 20th century with an increasing rate (Figure 3). The two major causes of sea level rise are thermal expansion and ice melting.

The observed sea level data of 1961 - 2003 showed an increasing rate of the average global sea level of about 1.8±0.5mm/year, in which the thermal expansion contributed about 0.42±0.12mm/year and ice melting contributed about 0.70±0.50mm/year *(IPCC, 2007)*.

The satellite data from TOPEX/POSEIDON in the period of 1993 - 2003 showed an increasing rate of the average global sea level of about 3.1±0.7mm/year, considerably faster than that of 1961 - 2003 *(IPCC, 2007)*.

In Vietnam, results of analysis of observed data indicated changes of climate parameters and sea level with the following noticeable features:

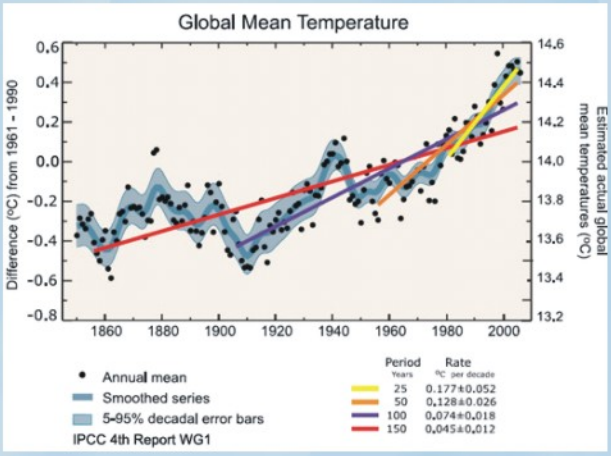


Figure 1. Anomalies of global annual mean temperatures. *Source: IPCC/2007*

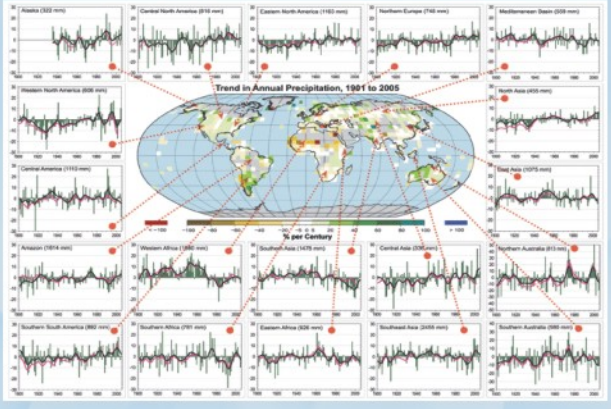


Figure 2. Changes in annual rainfall in different parts of the world. *Source: IPCC/2007*

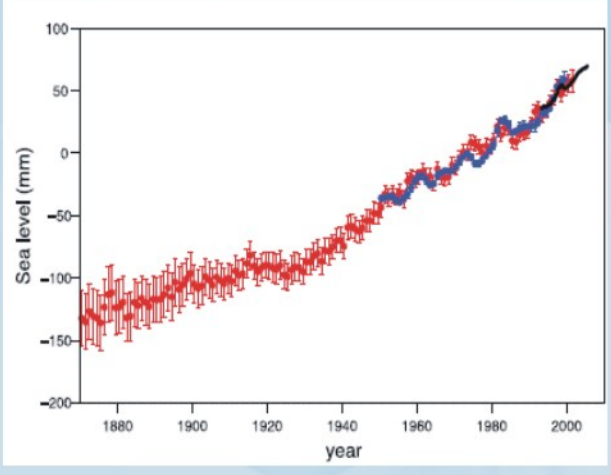


Figure 3. Changes in Global Average Sea Level. *Source: IPCC/2007*

- *Temperature:* During the last 50 years (1958 - 2007), the annual average temperature in Vietnam increased about 0.5 to 0.7°C. Winter temperatures increased faster than those of summer and temperatures in Northern climate zones increased

faster than those of Southern climate zones (Figure 4a). The annual average temperature for the last four decades (1961 to 2000) was higher than that of the three previous decades (1931 to 1960). Annual average temperatures for 1991 to 2000 in Ha Noi, Da Nang and Ho Chi Minh City were all higher than the average for 1931 - 1940 by 0.8; 0.4 and 0.6°C respectively. In 2007, the annual average temperatures at these three locations were all higher than the average for 1931 - 1940 by 0.8 - 1.3°C and similarly higher than the average for 1991 - 2000 by 0.4 - 0.5°C (*NTP, MONRE, 2008*).

- *Rainfall:* At every location, change of annual average rainfalls for the last 9 decades (1911 - 2000) was not distinct and not consistent with each other. There were ascending and also descending periods. The annual rainfall decreased over Northern climate zones while increased over Southern ones (Figure 4b). On average for the whole country, the rainfall over the past 50 years (1958 - 2007) decreased by about 2% (*NTP, MONRE, 2008*).

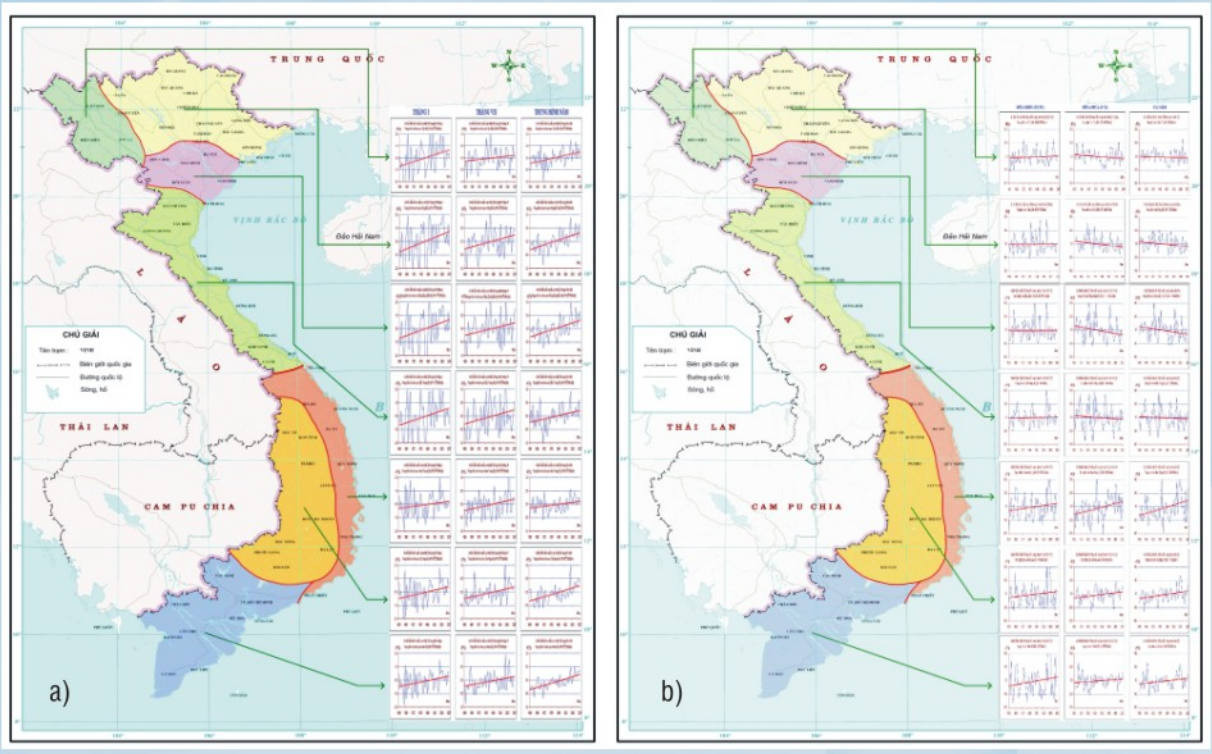


Figure 4. Trend of temperature (a) and rainfall (b) over Vietnam for the last 50 years

- *Cold fronts*: In the last two decades, the number of cold fronts affecting Vietnam was reduced remarkably. Anomalous events, however take place more frequently such as the most recent extremely and damaging cold surge lasting consecutively 38 days during January and February 2008 in Northern Vietnam (*NTP, MONRE, 2008*).

- *Typhoons:* In recent years, there were more typhoons with higher intensity affecting Viet Nam. Typhoon track has a tendency of moving southward and typhoon season tends to end later. There were more typhoons with abnormal movement - Figure 6 *(Vietnam Initial National Communication under the United Nations Framework Convention on Climate Change, MONRE, 2003).*

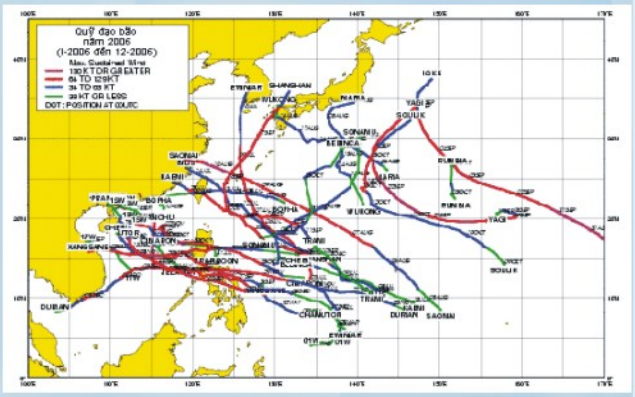


Figure 5. Typhoon tracks in the North Western Pacific Ocean & East Sea

- *Drizzles:* The average number of drizzle days in Hanoi gradually decreased since the decade of 1981 - 1990 and in the last 10 years, there was only half (15 days/year) of the long-term average number *(Nguyen Duc Ngu, Nguyen Trong Hieu, 2003).*

- *Sea level:* Data from tidal gauges along Vietnam coasts show that sea level rise was at the rate of about 3mm/year during the period of 1993 - 2008 which is comparable with the global tendency. In the past 50 years, sea level (Figure 6) at Hon Dau station rose about 20cm *(NTP, MONRE, 2008).*

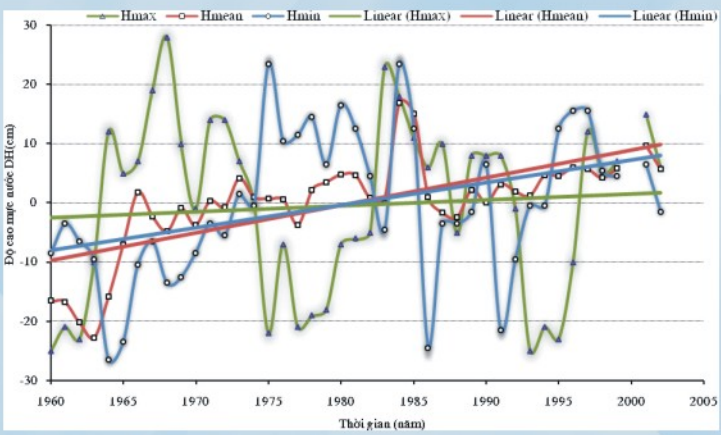


Figure 6. Changes in sea level at Hon Dau oceanographical station

III. BASIS FOR DEVELOPMENT OF CLIMATE CHANGE, SEA LEVEL RISE

In the IPCC's studies, the development of climate change scenarios for the 21st century is the key task conducted by Working Group 1. Scenarios are used by Working Group 2 for evaluating consequences of climate change on physical and socio-economic conditions, and used by Working Group 3 for setting up global alternative adaptation and mitigation strategies.

Current and future climate change depends primarily on greenhouse gas emission level, i.e. on socio-economic development. Therefore, climate change scenarios are developed based on global socio-economic development scenarios.

Humans have emitted excessive greenhouse gases to the atmosphere from their activities such as industry, agriculture, transportation, deforestation... Hence, the grounds for determining greenhouse gas emissions scenarios are: (1) Economic growth at a global scale; (2) Global population and consumption; (3) Life standards and behavior; (4) Energy sources and consumption; (5) Technology transfer; (6) Land use change;...

In the Special Report on Emissions Scenarios in 2000, IPCC introduced 40 scenarios, reflecting relatively diversified possibilities of greenhouse gas emissions in the 21st century. These emission scenarios are classified into 4 families namely A1, A2, B1, and B2 (Figure 7) with the main characteristics as follows:

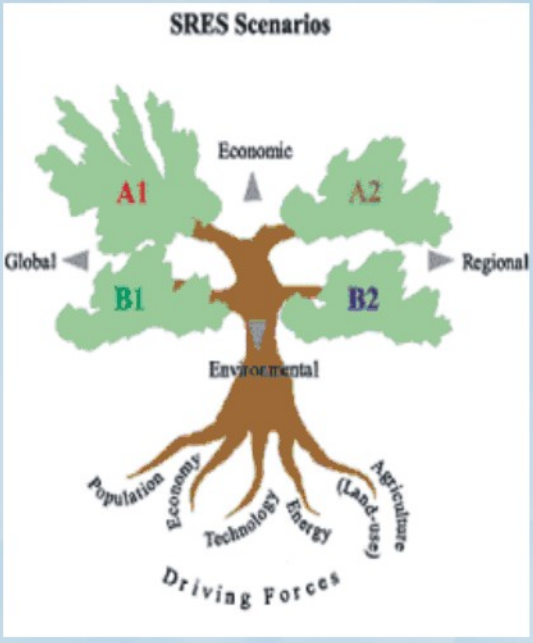


Figure 7. Conceptual diagram of 4 GHG emission scenario storylines. *Source: IPCC*

- A1 family: Rapid economic growth; A global population that peaks at nine billions in 2050 and declines thereafter; the rapid introduction of new and more efficient technologies; A convergence of world-income and way of life, a convergence among regions and increased cultural and social interactions. The A1 scenario family develops into three groups based on their technological emphasis:

+ A1FI: An emphasis on fossil-intensive (high emission scenario);

+ A1B: An emphasis on a balance across all energy sources (medium emission scenario);

+ A1T: An emphasis on non-fossil energy sources (low emission scenario).

- A2 family: A very heterogeneous world; self-reliance and preservation of nations; continuously increasing population in the 21st century; Regionally-oriented economic development; technological change and per capita economic growth are more fragmented and slow (high emission scenario, similar to A1FI).

- B1 family: Rapid economic growth as in A1, but with rapid changes toward a service and information economy; global population reaches the peak in 2050 and declines thereafter; Reductions in material intensity and the introduction of clean and resources efficient technologies; The emphasis on global solutions to economic, social and environmental sustainability (low emission scenario, similar to A1T).

- B2 family: Continuously increasing population, but at a rate lower than A2; The emphasis is on local rather than global solutions to economic, social and environmental sustainability; Intermediate levels of economic development; Less rapid and more diverse technological change than in B1 and A1 families (medium emission scenario, in the same group of A1B).

Emission scenarios recommended for use by IPCC are arranged from low to high, namely: B1, A1T (low emission scenarios), B2, A1B (medium emission scenarios), and A2, A1FI (high emission scenarios) (Figure 8). However, depending on practical requirements and computing capacity, IPCC recommends selecting suitable scenarios among these groups for climate change scenarios development.

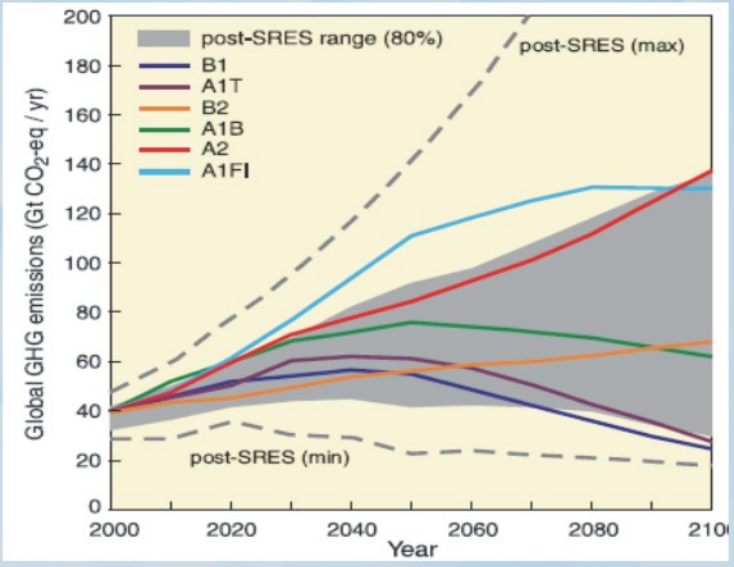


Figure 8. The corresponding number of CO2 emission in 21st century of scenario. *Source: IPCC*

Existing studies in Vietnam and overseas on climate change scenarios are analyzed and consulted for the development of climate change scenario for Vietnam. The details are as follows:

1) Studies Overseas:

- The second (1995), the third (2001), and the fourth (2007) IPCC Assessment Reports (Figure 9);

- Results from the global climate model (MRI-AGCM) with 20 km resolution from the Meteorological Research Institute of Japan Department of Meteorology (Figure 10: a product of MRI-AGCM model for temperature over Vietnam at the medium emission scenario);

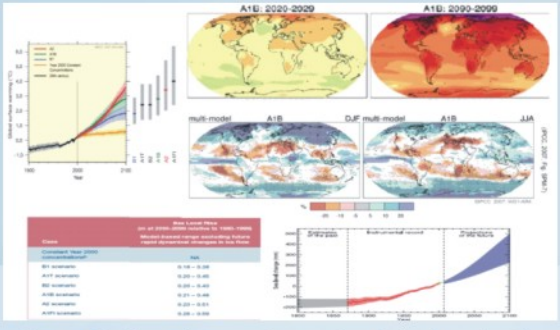


Figure 9. The climate change in global scale of AR4/IPCC

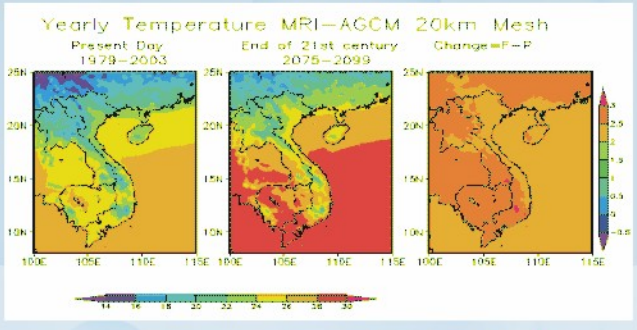


Figure 10. Simulated temperature from MRI-AGCM model for Vietnam domain

- Report of climate change scenarios for Vietnam by research group of the Oxford University, United Kingdom (Example of rainfall is in Figure 11);

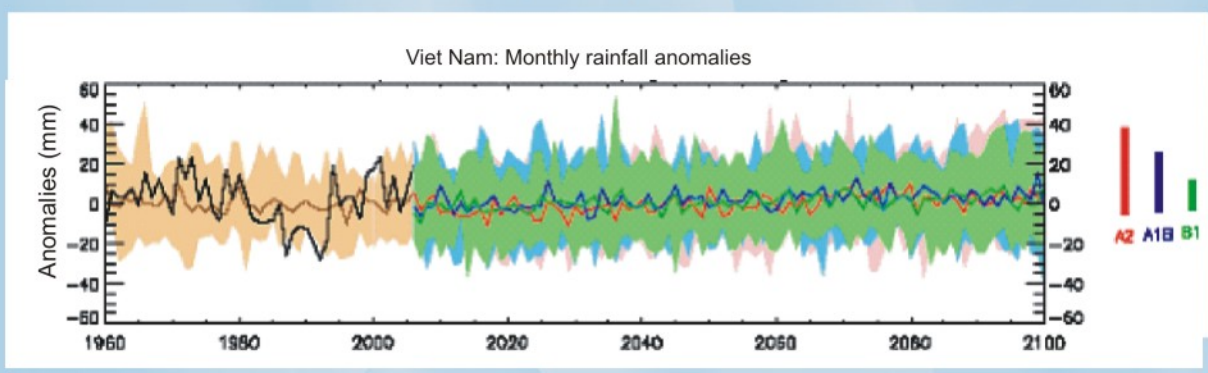


Figure 11. Rainfall anomalies for Vietnam
Source: Research group, Oxford University

- Data from TOPEX / POSEIDON and JASON1 satellites since 1993;

- Recent studies on global sea level rise: CSIRO Marine and Atmospheric Research (*www.cmar.csiro.au*); Proudman Oceanographic Laboratory - Natural Environment Research Council, United Kingdom (*http://www.pol.ac.uk/psmsl*), the gauge system of the global sea level (*http://www.gloss-sealevel.org)*; University of Hawaii Sea Level Center (*http://ilikai.soest.hawaii.edu/uhslc*);...

- IPCC summary on sea level rise scenarios for the 21st century, in Assessment Reports in 2001 and 2007;

- Reports on sea level rise from Tiempo Climate Cyber library, University of East Anglia (*http://www.cru.uea.ac.uk/tiempo*).

2) Studies in Viet Nam:

- Climate change scenario developed in 1994 in Report on climate change in Asia, a project funded by Asian Development Bank;

- Climate change scenario in Vietnam National Initial Communication to the United Nations Framework Convention on Climate Change (*IMHEN, 2003*);

- Climate change scenarios constructed by using the coupled method (MAGICC/ SCENGEN 4.1 software) and the statistical downscaling method for Vietnam domain and other smaller regions (*IMHEN, 2006*);

- Climate change scenarios developed for the draft of the Vietnam National Second Communication to the United Nations Framework Convention on Climate Change (*IMHEN, 2007*);

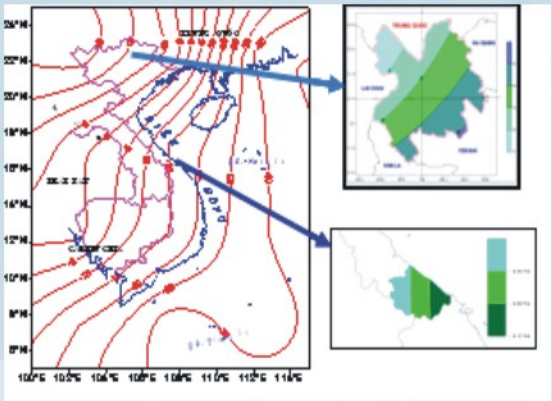


Figure 12. Climate change scenario for Vietnam and other small regions

- Climate change scenarios developed by using the MAGICC/SCENGEN 5.3 software and statistical downscaling method (*IMHEN, 2008*);

- Climate change scenarios for Vietnam domain developed by using dynamical method (*IMHEN, SEA START and Hadley Centers, 2008*);

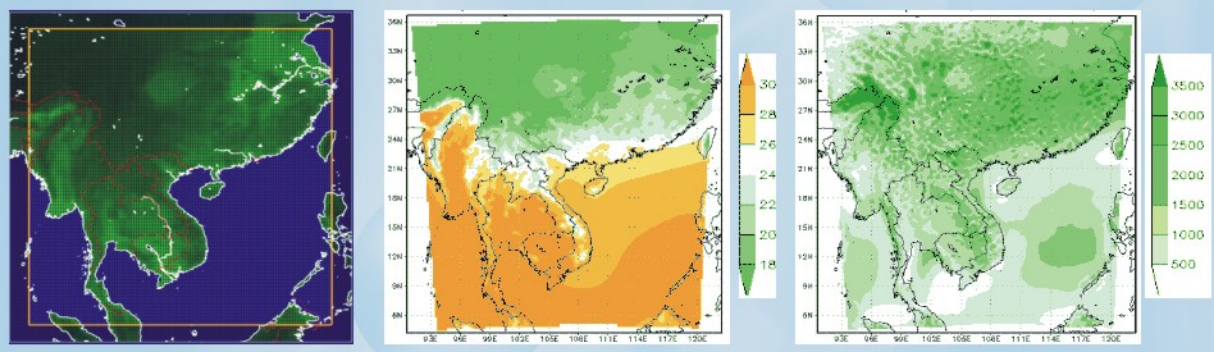


Figure 13. The calculated domain and the outputs of simulated annual average temperature (°C), annual rainfall (mm) from PRECIS model for Vietnam by the end of 21st century

- Tidal gauges data at Vietnam coastal stations;

- Vietnam studies on sea level rise such as East Sea Tides and Water Level Rise along Vietnam Coasts; Assessment of sea level rise-induced damages; ... carried out by the Marine Center (*General Department of Sea and Islands, MONRE*).

IV. CLIMATE CHANGE, SEA LEVEL RISE SCENARIOS FOR VIET NAM

Criteria for the selection of methods for climate change scenario development in Vietnam include: (1) Plausibility of global climate change scenarios; (2) Level of details of climate change scenarios; (3) Inheritability; (4) Up-to-date; (5) Local appropriateness; (6) Completeness of scenarios; and (7) Possibility of self updating.

Based on the analysis of the above mentioned criteria, the results of the calculations using MAGICC/SCENGEN 5.3 software and statistical downscaling method are selected for the development of climate change scenarios, sea level rise for Vietnam in the 21st century.

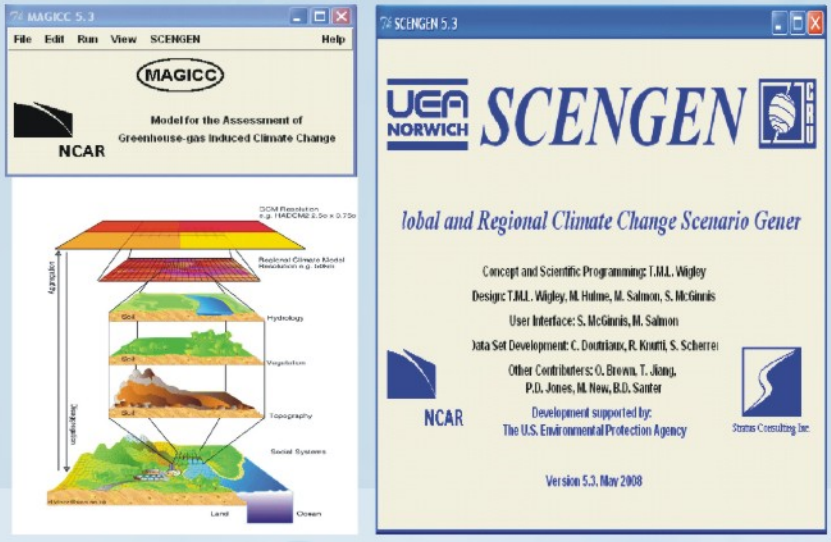


Figure 14. MAGICC/SCENGEN 5.3 Software and statistical downscaling method

1) Climate Change Scenarios

Greenhouse gas emissions scenarios selected for the development of climate change scenarios: Low emission scenario (B1), Intermediate emission scenario of the medium scenario group (B2), and intermediate scenario of the high scenario group (A2).

Climate change scenarios for temperature and rainfall are developed for seven climate zones in Vietnam: North West, North East, North Delta, North Central, South Central, Central Highlands, and South. The baseline period is 1980 - 1999 (the same as that used in the 4th IPCC Assessment Report).

Climate change scenarios for climate zones of Vietnam in the 21st century (Tables 1 - 6 and Appendices 1 - 11) can be summarized as follows:

a) Temperature

Temperatures in winter can increase faster than those in summer for all climate zones. Temperatures in Northern climate zones can increase faster than those in Southern climate zones.

- *In low emission scenario (B1):* By the end of the 21st century, annual mean temperatures in Northern climate zones would increase by 1.6 to 1.9°C relative to the baseline period (1980 - 1999). The increase in temperatures in Southern climate zones is expected to be less than that of Northern climate zones and is about 1.1 to 1.4°C (Table 1).

Table 1. Changes in Annual Mean Temperature (°C) relative to period from 1980 - 1999 Low emission scenario (B1)

Climatic Region	Decades in the 21 Century								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	0.5	0.7	1.0	1.2	1.4	1.6	1.6	1.7	1.7
North East	0.5	0.7	1.0	1.2	1.4	1.5	1.6	1.7	1.7
North Delta	0.5	0.7	0.9	1.2	1.4	1.5	1.5	1.6	1.6
North Central	0.6	0.8	1.1	1.4	1.6	1.7	1.8	1.9	1.9
South Central	0.4	0.6	0.7	0.9	1.0	1.2	1.2	1.2	1.2
Central Highlands	0.3	0.5	0.6	0.8	0.9	1.0	1.0	1.1	1.1
South	0.4	0.6	0.8	1.0	1.1	1.3	1.3	1.4	1.4

- *In medium emission scenario (B2):* By the end of the 21st century, annual mean temperatures would increase about 2.6°C in the North West, 2.5°C in the East West, 2.4°C in the North Delta, 2.8°C in the North Central, 1.9°C in the South Central, 1.6°C in

the Central Highlands, and 2.0°C in the South compared to the average of 1980 - 1999 (Table 2).

Table 2. Changes in Annual Mean Temperature (°C) relative to period of 1980 - 1999 Medium emission scenario (B2)

Climatic Region	Decades in the 21 Century								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	0.5	0.7	1.0	1.3	1.6	1.9	2.1	2.4	2.6
North East	0.5	0.7	1.0	1.2	1.6	1.8	2.1	2.3	2.5
North Delta	0.5	0.7	0.9	1.2	1.5	1.8	2.0	2.2	2.4
North Central	0.5	0.8	1.1	1.5	1.8	2.1	2.4	2.6	2.8
South Central	0.4	0.5	0.7	0.9	1.2	1.4	1.6	1.8	1.9
Central Highlands	0.3	0.5	0.6	0.8	1.0	1.2	1.4	1.5	1.6
South	0.4	0.6	0.8	1.0	1.3	1.6	1.8	1.9	2.0

- *In high emission scenario (A2):* By the end of the 21st century, annual mean temperatures in Northern climate zones would increase about 3.1 to 3.6°C relative to the average of 1980 - 1999, in which, North West: 3.3°C, North East: 3.2°C, North Delta:3.1°C, and North Central: 3.6°C. The change in temperatures in the Southern climate zones is 2.4°C in South Central, 2.1°C in the Central Highlands, and 2.6°C in the South (Table 3).

Table 3. Changes in Annual Mean Temperature (°C) relative to period of 1980 - 1999 High emission scenario (A2)

Climatic Region	Decades in the 21 Century								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	0.5	0.8	1.0	1.3	1.7	2.0	2.4	2.8	3.3
North East	0.5	0.7	1.0	1.3	1.6	1.9	2.3	2.7	3.2
North Delta	0.5	0.7	1.0	1.3	1.6	1.9	2.3	2.6	3.1
North Central	0.6	0.9	1.2	1.5	1.8	2.2	2.6	3.1	3.6
South Central	0.4	0.5	0.8	1.0	1.2	1.5	1.8	2.1	2.4
Central Highlands	0.3	0.5	0.7	0.8	1.0	1.3	1.5	1.8	2.1
South	0.4	0.6	0.8	1.0	1.3	1.6	1.9	2.3	2.6

b) Rainfall

Rainfall in dry season would decrease in most climate zones, especially in Southern climate zones. Rainfall in the rainy season and the total annual rainfall would increase in all climate zones.

- *In low emission scenario (B1):* By the end of the 21st century, annual rainfall would increase, relative to the period of 1980 - 1999, about 5% in the North West, North East, North Delta, and North Central zones, and about 1 - 2% in the South Central, Central Highlands and South zones (Table 4). Rainfall in the period of March

to May would decrease about 3 - 6% in Northern climate zones; rainfall in the middle of the dry season in Southern climate zones would decrease up to 7 - 10%, relative to the period of 1980 - 1999. Rainfall in the middle of the rainy season would increase 6 to 10% for the four Northern climate zones and the South Central, and it is about 1% in the Central Highlands and the South, relative to the period of 1980 - 1999 (Appendix 9).

Table 4. Changes in Annual Rainfall (%) relative to period of 1980 - 1999
Low emission scenario (B1)

Climatic Region	Decades in the 21 Century								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	1.4	2.1	3.0	3.6	4.1	4.4	4.6	4.8	4.8
North East	1.4	2.1	3.0	3.6	4.1	4.5	4.7	4.8	4.8
North Delta	1.6	2.3	3.2	3.9	4.5	4.8	5.1	5.2	5.2
North Central	1.5	2.2	3.1	3.8	4.3	4.7	4.9	5.0	5.0
South Central	0.7	1.0	1.3	1.6	1.8	2.0	2.1	2.2	2.2
Central Highlands	0.3	0.4	0.5	0.7	0.7	0.9	0.9	1.0	1.0
South	0.3	0.4	0.6	0.7	0.8	0.9	1.0	1.0	1.0

- *In medium emission scenario (B2):* By the end of the 21st century, annual rainfall would increase, relative to the period of 1980 - 1999, about 7 - 8% in the North West, North East, North Delta, and North Central zones, and about 2 - 3% in the South Central, Central Highlands and South zones (Figure 5). Rainfall in the period of March to May would decrease about 4 - 7% in the North West, North East, North Delta; and about 10% in the North Central. Rainfall in the middle of the dry season in the South would decrease up to 10 - 15%, relative to the period of 1980 - 1999. Rainfall in the middle of the rainy season would increase 10 to 15% for the four Northern climate zones and the South Central, and it is about 1% in the Central Highlands an the South (Appendix 10).

Table 5. Changes in Annual Rainfall (%) relative to period of 1980 - 1999
Medium emission scenario (B2)

Climatic Region	Decades in the 21 Century								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	1.4	2.1	3.0	3.8	4.6	5.4	6.1	6.7	7.4
North East	1.4	2.1	3.0	3.8	4.7	5.4	6.1	6.8	7.3
North Delta	1.6	2.3	3.2	4.1	5.0	5.9	6.6	7.3	7.9
North Central	1.5	2.2	3.1	4.0	4.9	5.7	6.4	7.1	7.7
South Central	0.7	1.0	1.3	1.7	2.1	2.4	2.7	3.0	3.2
Central Highlands	0.3	0.4	0.5	0.7	0.9	1.0	1.2	1.3	1.4
South	0.3	0.4	0.6	0.8	1.0	1.1	1.2	1.4	1.5

- *In high emission scenario (A2):* By the end of the 21st century, annual rainfall would increase, relative to the period of 1980 - 1999, about 9 - 10% in the North West and the North East; 10% in the North Delta and the North Central; 4 - 5% in the South Central, 2% in the Central Highlands and the South (Table 6). Rainfall in the period of March to May would decrease about 6 - 9% in the North West, North East and the North Delta, about 13% in the North Central; rainfall in the middle of the dry season in the South Central and Central Highlands and the South would decrease up to 13 - 22% relative to the period of 1980 - 1999. Rainfall in the middle of the rainy season would increase 12 to 19% for the four Northern climate zones and the South Central, and it is about 1 - 2% in the Central Highlands and the South (Appendix 11).

Table 6. Changes in Annual Rainfall (%) relative to period of 1980 - 1999
High emission scenario (A2)

Climatic Region	Decades in the 21 Century								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	1.6	2.1	2.8	3.7	4.5	5.6	6.8	8.0	9.3
North East	1.7	2.2	2.8	2.8	4.6	5.7	6.8	8.0	9.3
North Delta	1.6	2.3	3.0	3.8	5.0	6.1	7.4	8.7	10.1
North Central	1.8	2.3	3.0	3.7	4.8	5.9	7.1	8.4	9.7
South Central	0.7	1.0	1.2	1.7	2.1	2.5	3.0	3.6	4.1
Central Highlands	0.3	0.4	0.5	0.7	0.9	1.1	1.3	1.5	1.8
South	0.3	0.4	0.6	0.7	1.0	1.2	1.4	1.6	1.9

2) Sea Level Rise Scenarios

The Fourth Assessment Report of IPCC estimated that sea level may rise about 26 - 59cm by 2100, not excluding a possible higher rate.

Studies show that IPCC projection on temperature rise is in good agreement with observed data. However, IPCC projection on sea level rise is underestimated compared to measured data at gauging stations and satellite data. The main reason for the underestimation is that IPCC calculation models do not fully take into account melting processes.

Recent studies showed that sea level may rise by 50 - 140cm by 2100.

Sea level rise scenarios for Viet Nam were computed on the basis of the lowest (B1), the medium (B2), and the highest (A1FI) emission scenarios.

The results show that, by mid 21st century, sea level may rise by 28 to 33cm, and by 2100 sea level may rise about 65 to 100cm relative to the baseline period of 1980 - 1999 (Table 7).

Table 7. Sea Level Rise (cm) relative to period of 1980 - 1999

Scenarios	Decades in the 21 Century								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
Low emission scenario (B1)	11	17	23	**28**	35	42	50	57	**65**
Medium emission scenario (B2)	12	17	23	**30**	37	46	54	64	**75**
High emission scenario (A1FI)	12	17	24	**33**	44	57	71	86	**100**

Based on sea level scenarios, inundation maps were constructed initially for Ho Chi Minh City areas and Mekong River Delta, overlaying topographic maps scale 1/2000 and 1/5000 for Ho Chi Minh City, and scale 1/5000 together with high digital resolution of 5x5m for Mekong River Delta *(MONRE, 2009)*.

The average sea levels of the areas were calculated based on observed data at Vung Tau station (1979 - 2007). Other factors such as effects of waves, tides, storm surge and flood, and other dynamic mechanisms were not yet considered.

The inundation maps based on the scenarios of sea level rise for Ho Chi Minh City and Mekong River Delta are presented in Appendices 12 - 17.

3) Proposed climate change and sea level rise scenarios for Vietnam

Climate change, sea level rise scenarios for Vietnam are developed based on different emission scenarios, namely, low (B1), medium (B2) and high (A2, A1FI).

The low emission scenarios (B1) describes the convergent world with relative development toward the lowest green house gas emissions, low population growth, rapid change in economic structure toward a service and information economy, international agreements in GHG reduction are strictly and fully performed over the whole globe. However, with a current heterogeneous world economy, diverse understanding and views on climate change between developed and developing countries, there are difficulties in international negotiations in stabilizing GHG concentration for keeping temperature rise under 2°C, it is unlikely that the low emission scenario (B1) is possible in the 21st century.

The high scenarios (A2, A1FI) describe a very heterogeneous world in a global scale, with high population growth, less rapid and more diverse technological change (A2) or fossil-extensive (A1FI). These are the worst scenarios that we expect. With the development of new and climate friendly technology, efforts in international

negotiations in greenhouse gas mitigation, the world's campaign in "combating climate change", it is hoped that the high emission scenarios will not happen.

Moreover, there are uncertainties in construction of socio-economic development scenarios, followed by greenhouse gas emissions in the future. Apparently, when there are uncertainties, climate change and sea level rise scenarios which lie in the upper or lower limits would have a lower level of confidence than that of the medium one (B2).

Due to the above reasons, the medium emission scenario (B2) is recommended to be used currently for climate change and sea level rise scenarios for Vietnam.

V. CONCLUSIONS

1) Climate change, sea level rise scenarios for Vietnam in the 21st century are developed based on different emission scenarios, namely, low (B1), medium (B2) and high (A2, A1FI).

2) Due to the complexity of climate change and the limited understanding of climate change, both in Vietnam and in the world, together with the psychological, social, economic factors, uncertainties of green house gas emissions scenarios, uncertainties of model-estimated scenarios results,... ***the most harmonious scenario is the medium scenario which is recommended for ministries, sectors and provinces/cities to use as an initial basis in climate change and sea level rise impact assessments and in the development of action plans to respond to climate change.***

3) By the end of 21st century, temperatures in Vietnam would rise 2.3°C relative to the average of 1980 - 1999. The increase in temperature would be in the range of 1.6°C to 2.8°C in different climate zones. Temperatures in Northern and Northern Central climate zones of Vietnam would increase faster than those in Southern zones. In each climate zone, winter temperatures would increase faster than summer ones.

4) Both annual rainfall and rainy season's rainfall would increase, while dry season's rainfall tends to decrease, especially in Southern climate zones. For the whole country, annual rainfall by the end of the 21st century would increase by 5% compared to that of the period 1980-1999. In Northern climate zones, rainfall increasing rate would be more than that of Southern ones.

5) By mid of the 21st century sea level is expected to increase about 30cm and sea level would rise about 75cm by the end of 21st century compared to the period of 1980-1999.

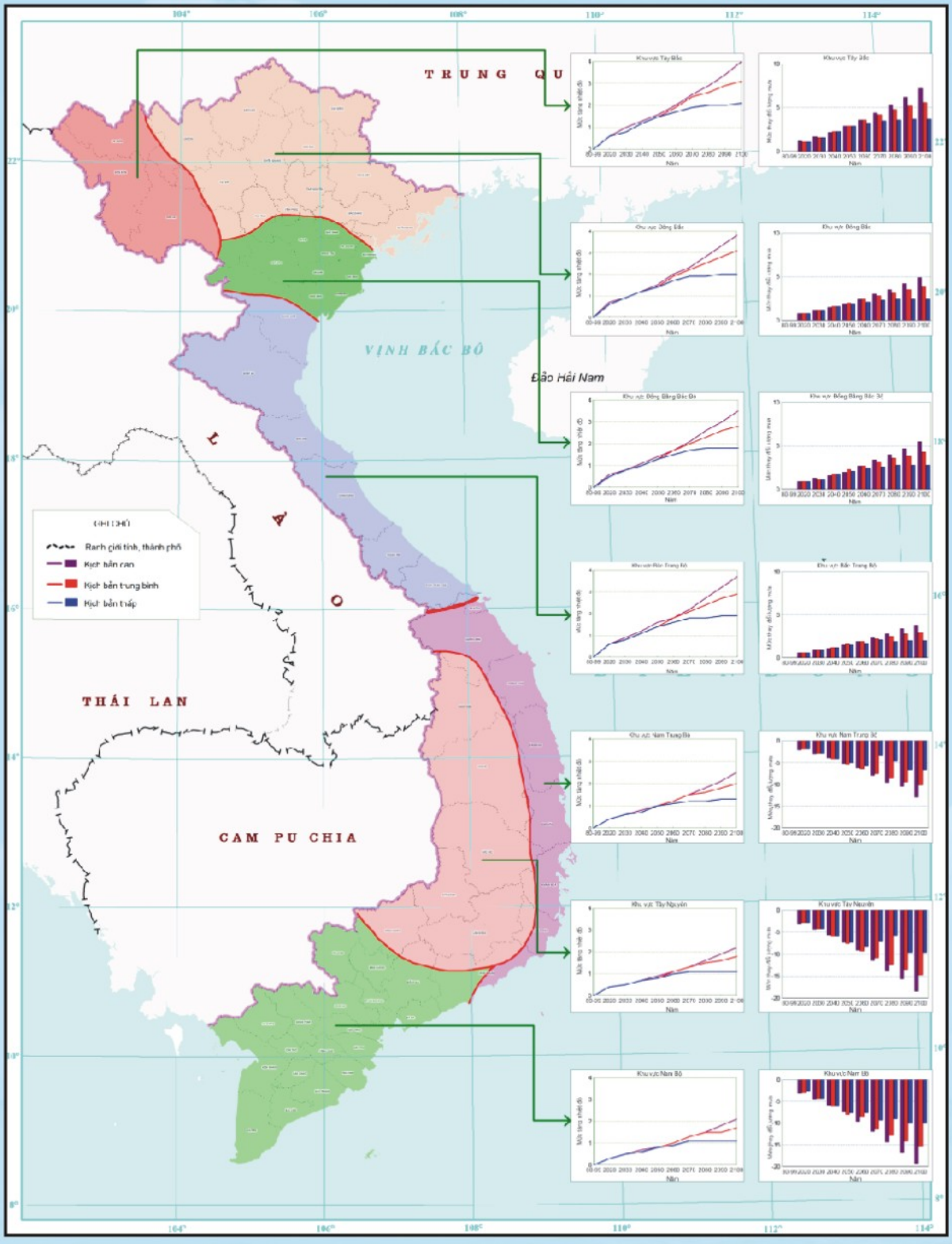
There are high uncertainties contained in the above results. The possible reasons are: (i) Low confidence level of emission scenarios; (ii) Certain errors of models in simulating for a long period; (iii) Certain errors in the statistical downscaling method based on the global and regional data; (iv) Large differences of climatic factors by locations.

In order to overcome the above mentioned uncertainties, IPCC recommended applying tolerance for climate change scenarios. For example, a tolerance for temperature by the end of the 21st century is 0.4 - 0.6^{o}C, for annual rainfall it is 1 - 2% and about 5% for monthly rainfall. Moreover, climate change scenarios need to be regularly updated in data, knowledge, models, and computation methods.

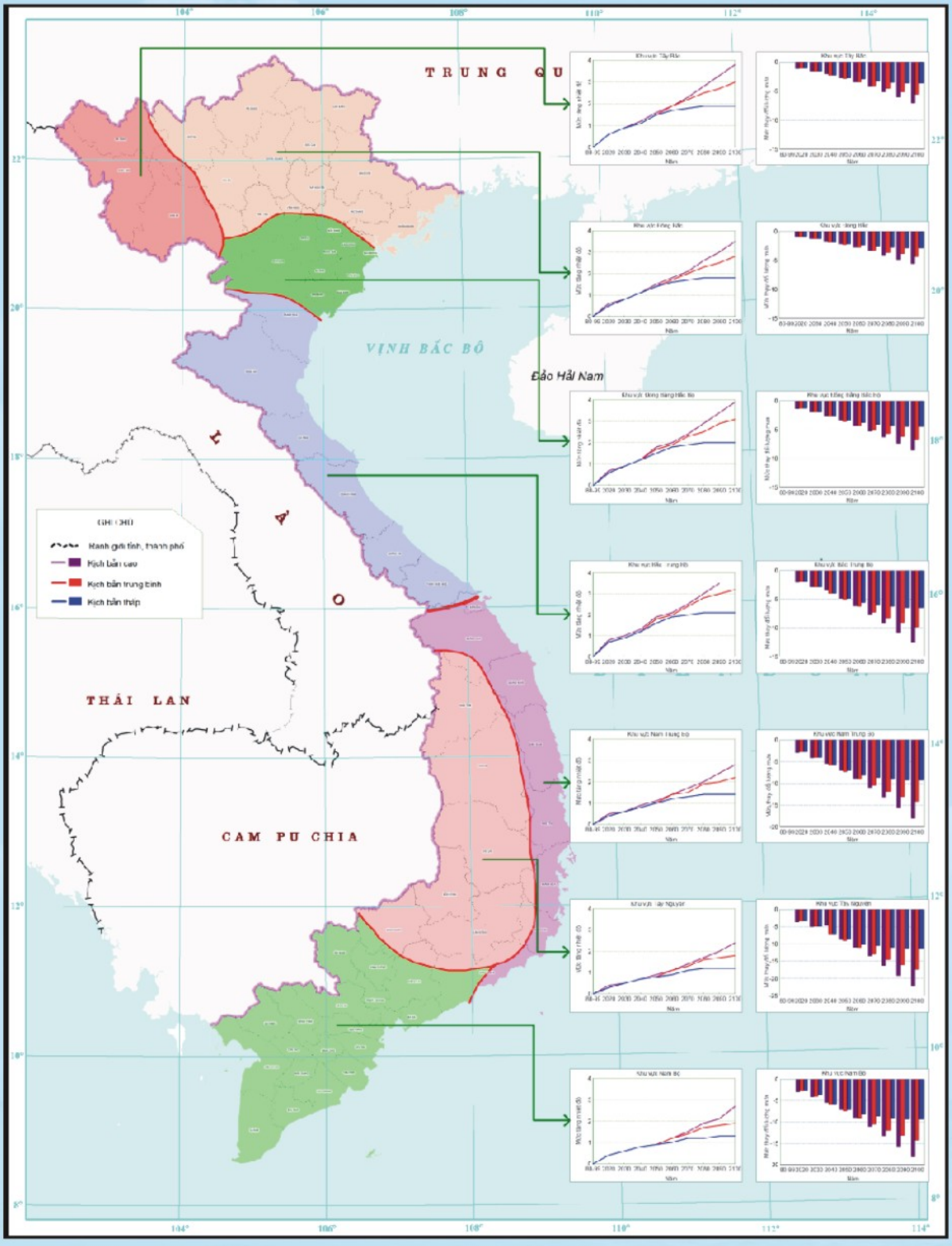
Climate change scenarios, especially sea level rise for Vietnam will be updated as specifically scheduled in the National Target Program to Respond to Climate Change as follows:

- By the end of 2010, update climate change scenarios, especially sea level rise, for the period of 2010 - 2100. The scenarios must have a solid scientific and practical basis;

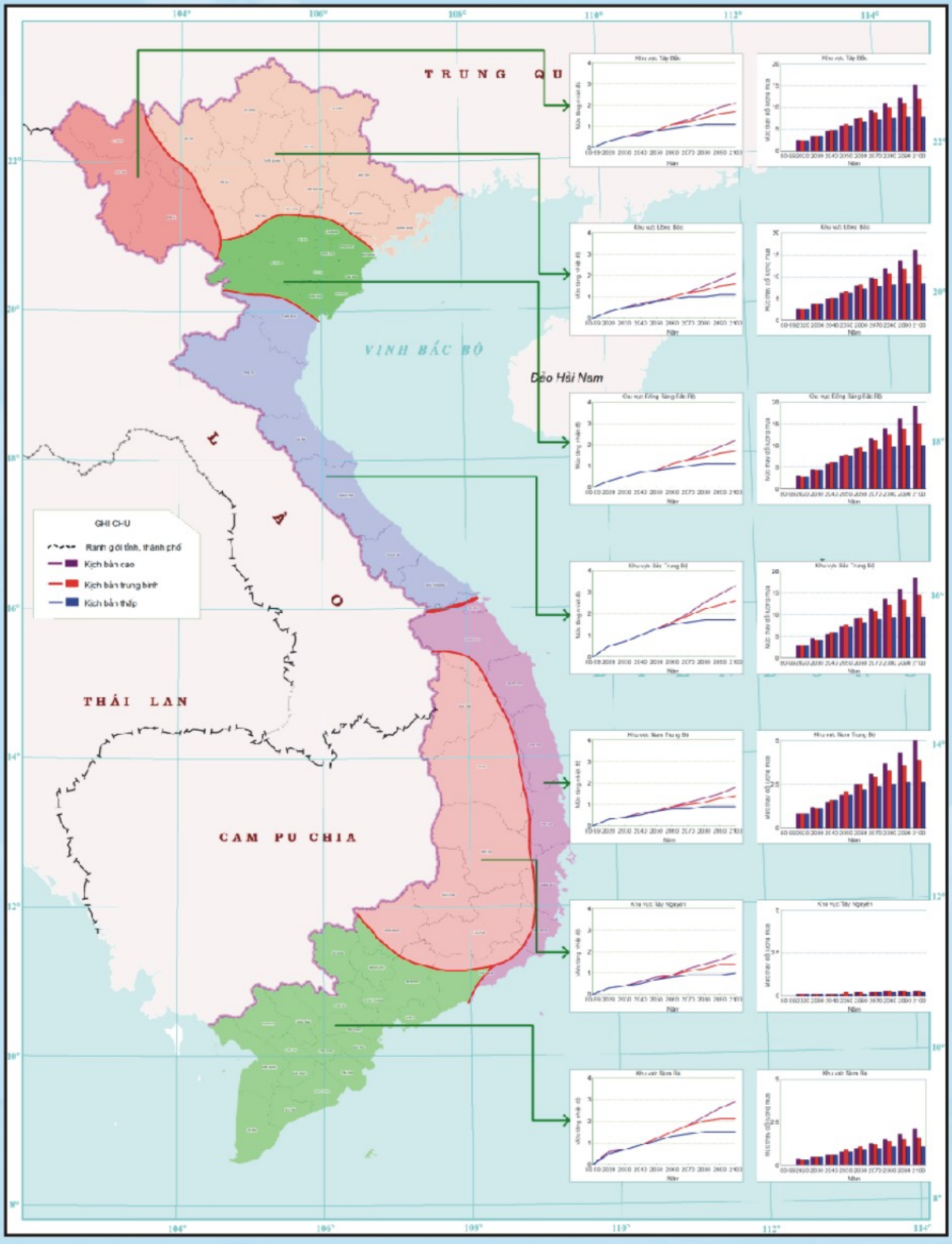
- By 2015, update climate change scenarios, especially sea level rise for Vietnam.



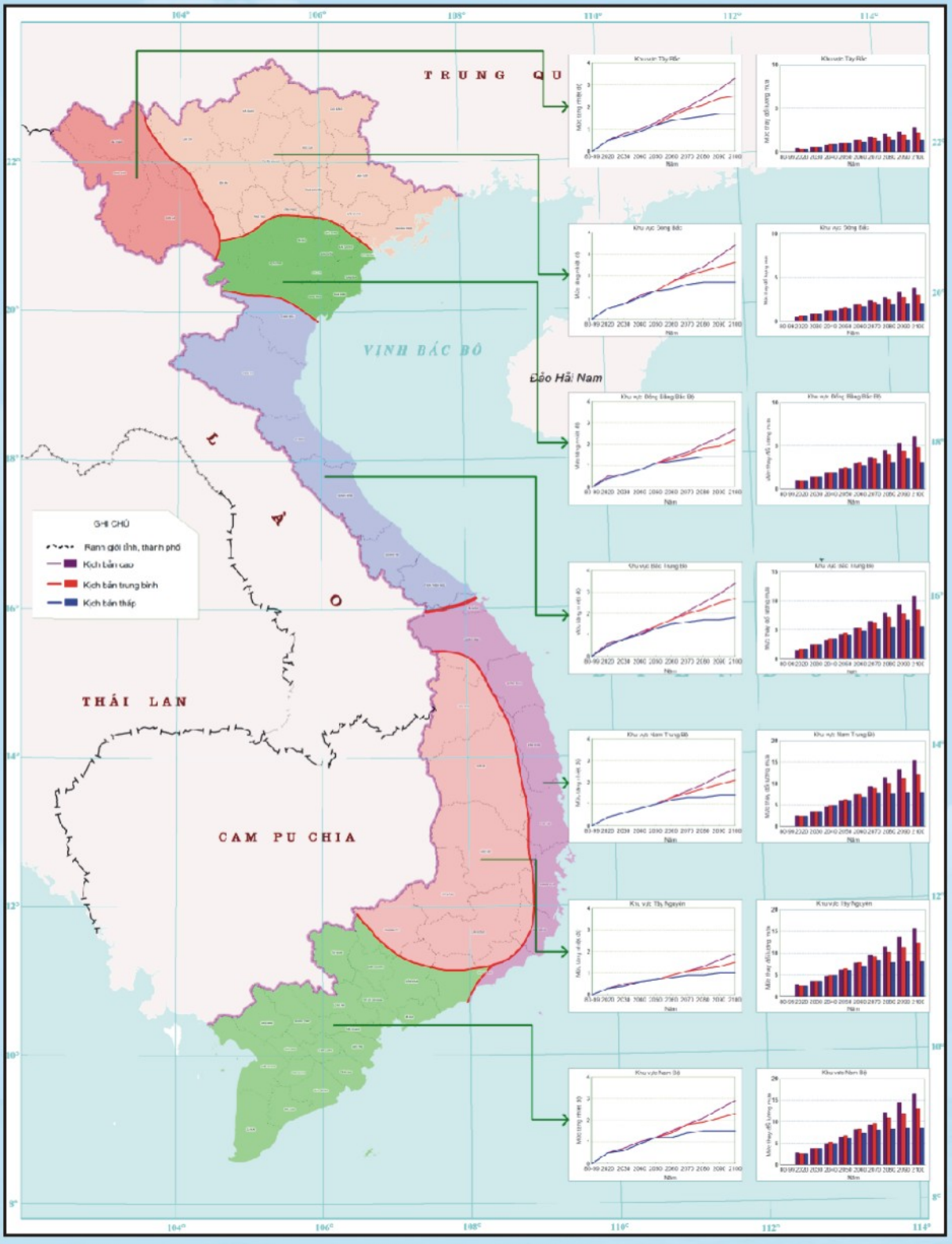
Appendix 1. Change in annual temperature (°C) and rainfall (%) over Vietnam climate zones in months of Dec - Feb relative to the average for 1980-1999, according to low (B1), medium (B2) and high (A2) emission scenarios



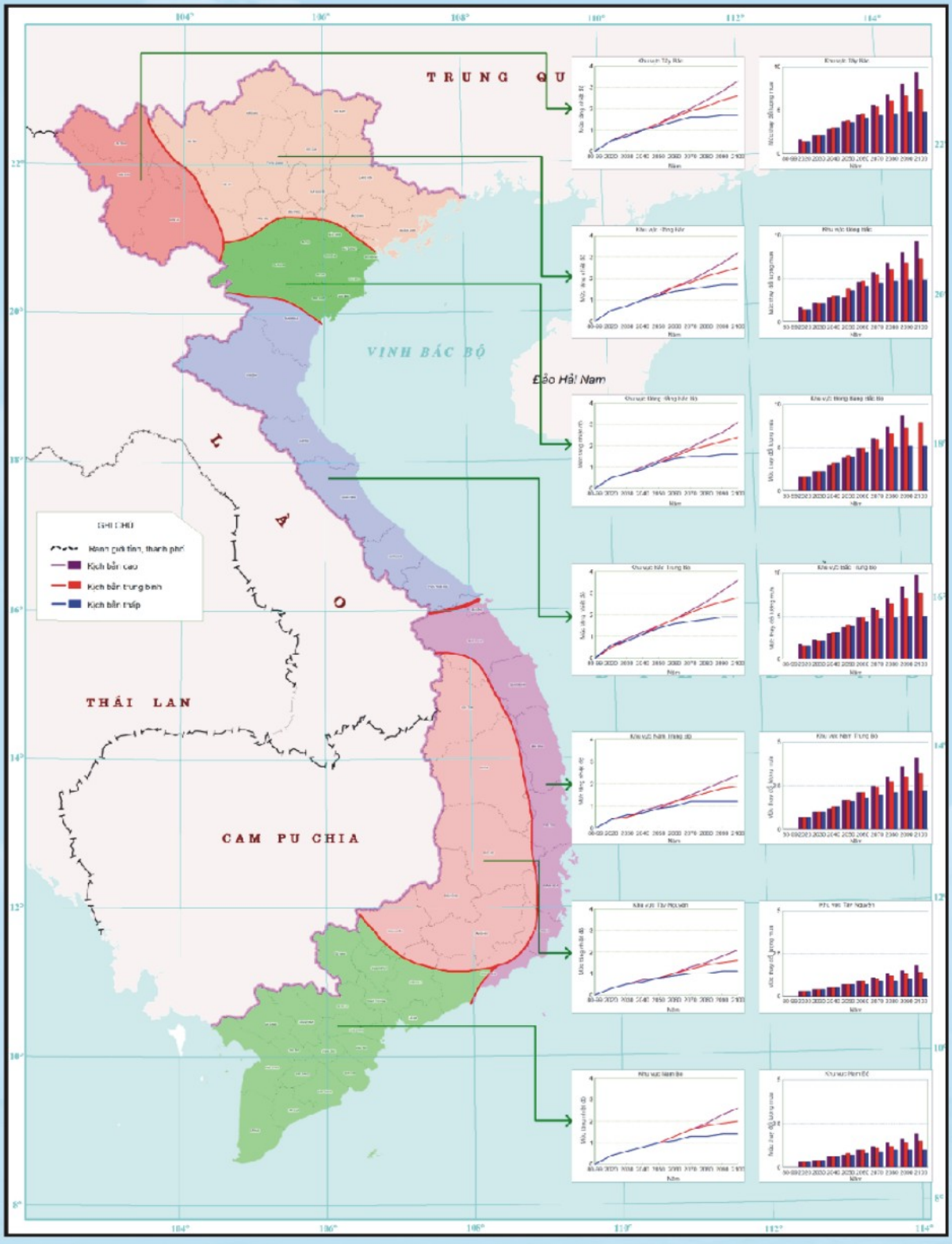
Appendix 2. Change in annual temperature (°C) and rainfall (%) over Vietnam climate zones in months of Mar - May relative to the average for 1980-1999, according to low (B1), medium (B2) and high (A2) emission scenarios



Appendix 3. Change in annual temperature (°C) and rainfall (%) over Vietnam climate zones in months of Jun - Aug relative to the average for 1980-1999, according to low (B1), medium (B2) and high (A2) emission scenarios



Appendix 4. Change in annual temperature (°C) and rainfall (%) over Vietnam climate zones in months of Sep - Nov relative to the average for 1980-1999, according to low (B1), medium (B2) and high (A2) emission scenarios



Appendix 5. Change in mean annual temperature (°C) and annual rainfall (%) of Vietnam climate zones relative to the average for 1980-1999, according to low (B1), medium (B2) and high (A2) emission scenarios

Appendix 6. Mean temperature change (°C) in Vietnam climate zones relative to the average for 1980-1999, low emission scenario (B1)

Climate zones	Month periods	Decades in the 21 Century								
		2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	Dec-Feb	0.6	0.8	1.2	1.5	1.7	1.9	2.0	2.0	2.1
	Mar-May	0.6	0.9	1.1	1.5	1.7	1.8	1.9	1.9	1.9
	Jun-Aug	0.3	0.5	0.6	0.8	0.9	1.0	1.1	1.1	1.1
	Sep-Nov	0.5	0.7	0.9	1.2	1.4	1.5	1.6	1.7	1.7
North East	Dec-Feb	0.6	0.9	1.2	1.4	1.7	1.9	1.9	2.0	2.0
	Mar-May	0.5	0.8	1.1	1.4	1.6	1.7	1.8	1.8	1.8
	Jun-Aug	0.3	0.5	0.6	0.8	0.9	1.0	1.0	1.1	1.1
	Sep-Nov	0.5	0.7	1.0	1.3	1.4	1.6	1.7	1.7	1.7
North Delta	Dec-Feb	0.5	0.8	1.0	1.3	1.5	1.7	1.8	1.8	1.8
	Mar-May	0.6	0.9	1.2	1.5	1.8	1.9	2.0	2.0	2.0
	Jun-Aug	0.3	0.5	0.7	0.8	0.9	1.0	1.1	1.1	1.1
	Sep-Nov	0.4	0.6	0.8	1.1	1.2	1.3	1.4	1.4	1.4
North Central	Dec-Feb	0.6	0.8	1.1	1.4	1.6	1.8	1.8	1.9	1.9
	Mar-May	0.7	0.9	1.2	1.6	1.9	2.0	2.1	2.1	2.1
	Jun-Aug	0.5	0.7	1.0	1.3	1.5	1.6	1.7	1.7	1.7
	Sep-Nov	0.5	0.8	1.0	1.3	1.5	1.6	1.7	1.7	1.8
South Central	Dec-Feb	0.4	0.6	0.7	1.0	1.1	1.2	1.2	1.3	1.3
	Mar-May	0.4	0.6	0.8	1.0	1.2	1.3	1.4	1.4	1.4
	Jun-Aug	0.3	0.4	0.5	0.7	0.8	0.8	0.9	0.9	0.9
	Sep-Nov	0.4	0.6	0.8	1.0	1.2	1.3	1.3	1.4	1.4
Central Highlands	Dec-Feb	0.4	0.5	0.7	0.8	1.0	1.1	1.1	1.1	1.1
	Mar-May	0.3	0.5	0.7	0.8	0.9	1.1	1.2	1.2	1.2
	Jun-Aug	0.3	0.4	0.5	0.7	0.8	0.9	0.9	0.9	1.0
	Sep-Nov	0.3	0.4	0.6	0.7	0.8	0.9	0.9	1.0	1.0
South	Dec-Feb	0.3	0.5	0.6	0.8	0.9	1.1	1.1	1.1	1.1
	Mar-May	0.4	0.6	0.8	0.9	1.0	1.2	1.2	1.3	1.3
	Jun-Aug	0.5	0.7	0.9	1.1	1.3	1.4	1.5	1.5	1.5
	Sep-Nov	0.5	0.6	0.9	1.2	1.2	1.4	1.5	1.5	1.5

Appendix 7. Mean temperature change (°C) in Vietnam climate zones relative to the average for 1980-1999, meddium emission scenario (B2)

Climate zones	Month periods	Decades in the 21 Century								
		2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	Dec-Feb	0.6	0.8	1.2	1.5	1.9	2.4	2.6	2.9	3.1
	Mar-May	0.6	0.9	1.1	1.5	1.9	2.2	2.5	2.7	3.0
	Jun-Aug	0.3	0.5	0.6	0.8	1.1	1.2	1.4	1.6	1.7
	Sep-Nov	0.5	0.7	0.9	1.2	1.6	1.9	2.1	2.4	2.5
North East	Dec-Feb	0.6	0.9	1.2	1.4	1.9	2.2	2.5	2.8	3.1
	Mar-May	0.5	0.8	1.1	1.4	1.7	2.0	2.3	2.5	2.8
	Jun-Aug	0.3	0.5	0.6	0.8	1.0	1.2	1.3	1.5	1.6
	Sep-Nov	0.5	0.7	1.0	1.3	1.7	2.0	2.2	2.4	2.6
North Delta	Dec-Feb	0.5	0.8	1.0	1.3	1.7	2.0	2.3	2.6	2.8
	Mar-May	0.6	0.9	1.2	1.7	1.9	2.3	2.5	2.9	3.1
	Jun-Aug	0.3	0.5	0.7	0.8	1.1	1.3	1.4	1.6	1.7
	Sep-Nov	0.4	0.6	0.8	1.1	1.3	1.5	1.8	1.9	2.2
North Central	Dec-Feb	0.6	0.8	1.1	1.4	1.8	2.1	2.4	2.7	2.9
	Mar-May	0.7	0.9	1.2	1.8	2.0	2.4	2.8	3.0	3.2
	Jun-Aug	0.5	0.7	1.0	1.3	1.6	1.9	2.2	2.4	2.6
	Sep-Nov	0.5	0.8	1.0	1.4	1.7	2.0	2.2	2.5	2.7
South Central	Dec-Feb	0.4	0.6	0.7	1.0	1.2	1.5	1.6	1.8	2.0
	Mar-May	0.4	0.6	0.8	1.0	1.4	1.5	1.9	2.0	2.2
	Jun-Aug	0.3	0.4	0.5	0.7	0.9	1.0	1.1	1.3	1.4
	Sep-Nov	0.4	0.6	0.8	1.0	1.3	1.5	1.7	1.9	2.1
Central Highlands	Dec-Feb	0.4	0.5	0.7	0.8	1.1	1.3	1.5	1.6	1.8
	Mar-May	0.3	0.5	0.7	0.8	1.1	1.3	1.6	1.7	1.8
	Jun-Aug	0.3	0.4	0.5	0.7	0.9	1.1	1.2	1.4	1.4
	Sep-Nov	0.3	0.4	0.6	0.7	0.9	1.1	1.2	1.3	1.5
South	Dec-Feb	0.3	0.5	0.6	0.8	1.0	1.3	1.5	1.5	1.7
	Mar-May	0.4	0.6	0.8	0.9	1.2	1.4	1.7	1.8	1.9
	Jun-Aug	0.5	0.7	0.9	1.2	1.5	1.8	2.0	2.1	2.1
	Sep-Nov	0.5	0.6	0.9	1.2	1.4	1.8	1.9	2.1	2.3

Appendix 8. Mean temperature change (°C) in Vietnam climate zones relative to the average for 1980-1999, high emission scenario (A2)

Climate zones	Month periods	Decades in the 21 Century								
		2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	Dec-Feb	0.6	1.0	1.3	1.6	2.0	2.5	2.9	3.4	4.0
	Mar-May	0.6	0.9	1.2	1.6	1.9	2.3	2.8	3.3	3.8
	Jun-Aug	0.3	0.5	0.7	0.8	1.1	1.3	1.6	1.9	2.1
	Sep-Nov	0.5	0.8	1.0	1.3	1.7	2.0	2.4	2.8	3.3
North East	Dec-Feb	0.7	0.9	1.2	1.5	2.0	2.3	2.8	3.3	3.8
	Mar-May	0.6	0.8	1.1	1.5	1.8	2.1	2.6	3.0	3.5
	Jun-Aug	0.3	0.5	0.7	0.8	1.0	1.2	1.5	1.8	2.1
	Sep-Nov	0.5	0.7	1.1	1.3	1.7	2.1	2.4	2.9	3.4
North Delta	Dec-Feb	0.6	0.8	1.1	1.4	1.7	2.1	2.6	3.0	3.5
	Mar-May	0.7	0.9	1.2	1.8	2.0	2.4	2.9	3.4	3.9
	Jun-Aug	0.3	0.5	0.7	0.8	1.1	1.3	1.6	1.9	2.2
	Sep-Nov	0.5	0.6	0.8	1.1	1.4	1.6	2.0	2.3	2.7
North Central	Dec-Feb	0.6	0.9	1.2	1.6	1.8	2.2	2.7	3.2	3.7
	Mar-May	0.8	1.0	1.3	1.9	2.1	2.5	3.0	3.5	4.1
	Jun-Aug	0.5	0.7	1.0	1.3	1.6	2.0	2.5	2.9	3.3
	Sep-Nov	0.6	0.8	1.1	1.4	1.7	2.1	2.5	2.9	3.4
South Central	Dec-Feb	0.4	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.5
	Mar-May	0.4	0.5	0.7	0.9	1.1	1.3	1.6	1.9	2.2
	Jun-Aug	0.5	0.6	0.9	1.1	1.4	1.7	2.0	2.4	2.8
	Sep-Nov	0.3	0.4	0.6	0.7	0.9	1.1	1.3	1.5	1.8
Central Highlands	Dec-Feb	0.4	0.6	0.8	1.0	1.3	1.6	1.9	2.3	2.6
	Mar-May	0.4	0.5	0.7	0.9	1.1	1.4	1.7	2.0	2.4
	Jun-Aug	0.3	0.4	0.6	0.8	0.9	1.2	1.4	1.6	1.9
	Sep-Nov	0.3	0.5	0.6	0.7	0.9	1.1	1.3	1.6	1.9
South	Dec-Feb	0.3	0.5	0.7	0.8	1.0	1.3	1.5	1.8	2.1
	Mar-May	0.4	0.6	0.8	0.9	1.2	1.5	1.9	2.1	2.7
	Jun-Aug	0.6	0.7	0.9	1.2	1.5	1.8	2.2	2.6	2.9
	Sep-Nov	0.5	0.7	1.0	1.2	1.5	1.8	2.1	2.5	2.9

Appendix 9. Rainfall change (%) in Vietnam climate zones relative to the period of 1980-1999, low scenario (B1)

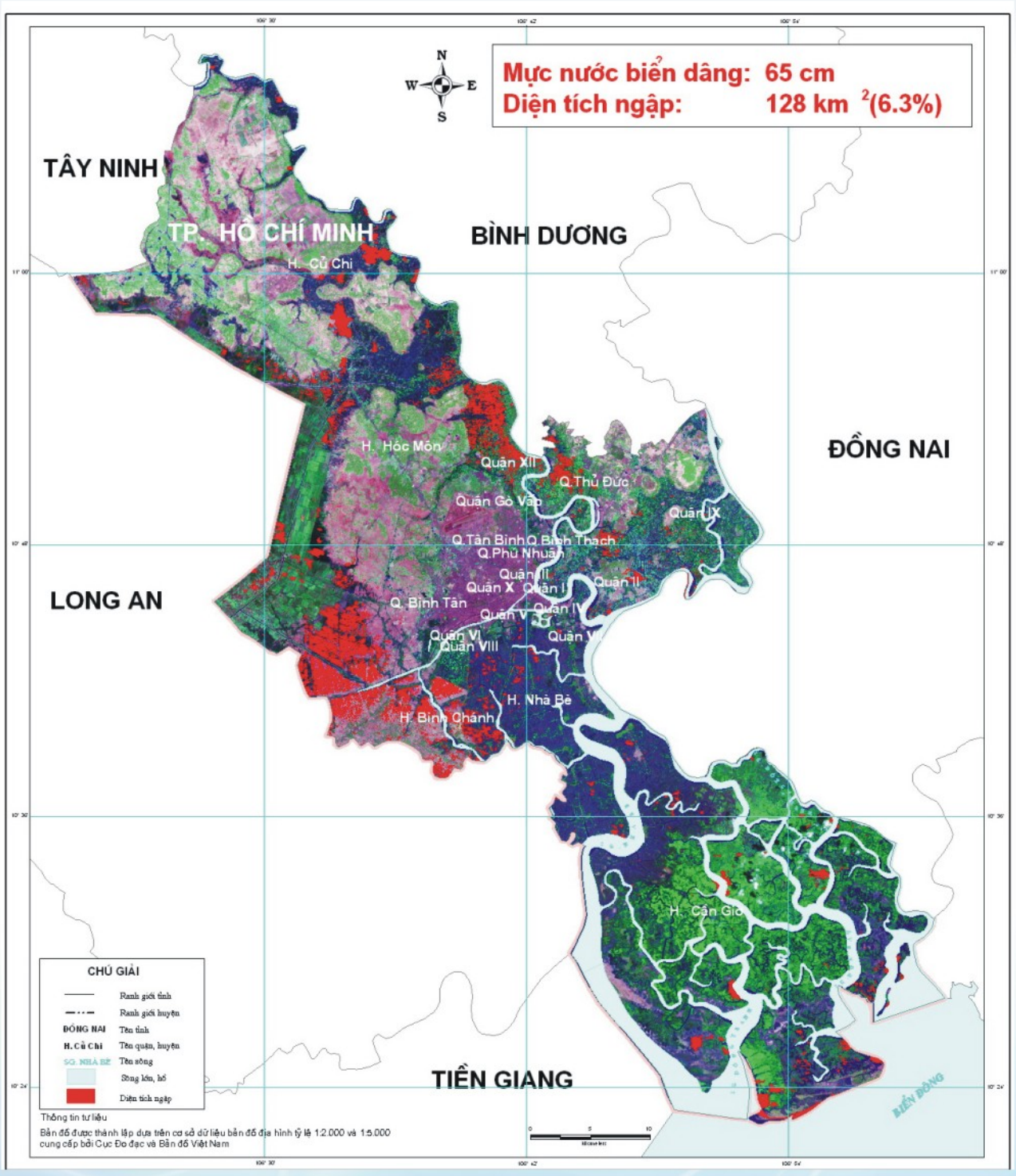
Climate zones	Month periods	Decades in the 21 Century								
		2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	Dec-Feb	1.1	1.6	2.3	2.9	3.2	3.5	3.6	3.7	3.7
	Mar-May	-1.1	-1.6	-2.3	-2.8	-3.0	-3.4	-3.6	-3.7	-3.7
	Jun-Aug	2.4	3.5	4.8	5.9	6.7	7.3	7.6	7.8	7.8
	Sep-Nov	0.4	0.6	0.9	1.1	1.2	1.3	1.4	1.4	1.4
North East	Dec-Feb	0.8	1.1	1.6	1.9	2.1	2.3	2.5	2.5	2.5
	Mar-May	-0.9	-1.3	-1.8	-2.2	-2.4	-2.7	-2.8	-2.9	-2.9
	Jun-Aug	2.5	3.7	5.1	6.3	7.1	7.8	8.1	8.3	8.3
	Sep-Nov	0.6	0.9	1.2	1.5	1.7	1.9	1.9	2.0	2.0
North Delta	Dec-Feb	0.9	1.2	1.8	2.1	2.4	2.6	2.8	2.8	2.8
	Mar-May	-1.3	-2.0	-2.7	-3.4	-3.8	-4.1	-4.3	-4.5	-4.5
	Jun-Aug	2.9	4.4	6.1	7.5	8.5	9.2	9.7	9.9	9.9
	Sep-Nov	0.9	1.4	1.9	2.4	2.7	2.9	3.1	3.5	3.1
North Central	Dec-Feb	0.6	0.9	1.2	1.5	1.7	2.1	1.9	2.0	2.0
	Mar-May	-1.9	-2.9	-4.0	-4.9	-5.6	-6.0	-6.3	-6.5	-6.5
	Jun-Aug	2.9	4.2	5.9	7.2	8.2	8.9	9.4	9.5	9.5
	Sep-Nov	1.7	2.5	3.5	4.2	4.8	5.2	5.5	6.7	5.6
South Central	Dec-Feb	-2.0	-2.9	-4.2	-5.1	-5.8	-3.5	-4.8	-6.7	-6.7
	Mar-May	-2.8	-4.1	-5.7	-7.1	-8.2	-8.7	-9.1	-9.3	-9.3
	Jun-Aug	0.8	1.1	1.6	1.9	2.2	2.4	2.5	2.6	2.6
	Sep-Nov	2.4	3.5	4.9	6.0	6.8	7.8	7.7	7.9	7.9
Central Highlands	Dec-Feb	-2.9	-4.3	-6.0	-7.4	-8.3	-7.1	-5.8	-9.7	-9.7
	Mar-May	-3.4	-5.0	-7.1	--8.7	-10.1	10.6	-11.1	-11.4	11.4
	Jun-Aug	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
	Sep-Nov	2.5	3.6	5.0	6.1	7.0	8.4	7.9	8.1	8.1
South	Dec-Feb	-2.7	-4.4	-6.2	-7.7	-7.7	-9.4	--9.1	-10.1	10.1
	Mar-May	-2.6	-3.6	-5.8	-7.2	-8.1	-8.7	-9.2	-9.4	-9.4
	Jun-Aug	0.3	0.5	0.6	0.8	0.9	1.0	1.1	1.1	1.1
	Sep-Nov	2.6	3.8	5.0	6.3	7.3	8.1	8.3	8.5	8.5

Appendix 10. Rainfall change (%) in Vietnam climate zones relative to the period of 1980-1999, medium scenario (B2)

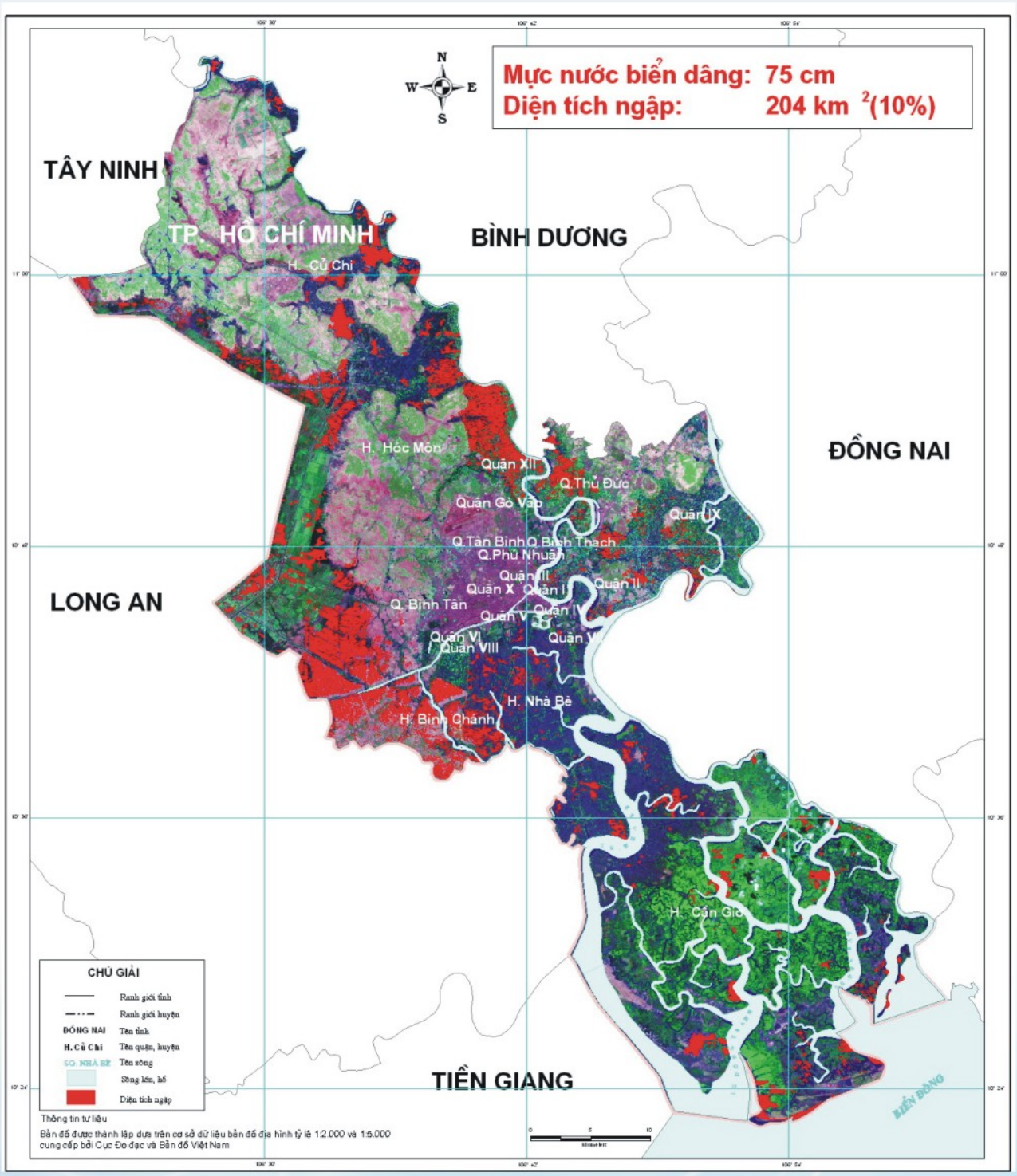
Climate zones	Month periods	Decades in the 21 Century								
		2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	Dec-Feb	1.1	1.6	2.3	2.9	3.6	4.2	4.8	5.2	5.6
	Mar-May	-1.1	-1.6	-2.3	-2.9	-3.5	-4.1	-4.6	-5.2	-5.6
	Jun-Aug	2.4	3.5	4.8	6.2	7.6	8.8	10.0	11.0	11.9
	Sep-Nov	0.4	0.6	0.9	1.1	1.4	1.6	1.8	2.0	2.2
North East	Dec-Feb	0.8	1.1	1.6	2.0	2.4	2.8	3.2	3.5	3.8
	Mar-May	-0.9	-1.3	-1.8	-2.3	-2.8	-3.3	-3.7	-3.9	-4.4
	Jun-Aug	2.5	3.7	5.1	6.6	8.1	9.4	10.6	11.7	12.7
	Sep-Nov	0.6	0.9	1.2	1.6	1.9	2.2	2.5	2.8	3.0
North Delta	Dec-Feb	0.9	1.2	1.8	2.3	2.7	3.2	3.6	3.9	4.3
	Mar-May	-1.3	-2.0	-2.7	-3.6	-4.3	-5.0	-5.7	-6.2	-6.8
	Jun-Aug	2.9	4.4	6.1	7.9	9.6	11.1	12.6	13.9	15.1
	Sep-Nov	0.9	1.4	1.9	2.5	3.1	3.5	4.0	4.4	4.8
North Central	Dec-Feb	0.6	0.9	1.2	1.6	1.9	2.2	2.5	2.8	3.0
	Mar-May	-1.9	-2.9	-4.0	-5.2	-6.3	-7.3	-8.3	-9.1	-9.9
	Jun-Aug	2.9	4.2	5.9	7.6	9.3	10.8	12.2	13.4	14.6
	Sep-Nov	1.7	2.5	3.5	4.5	5.4	6.3	7.1	7.8	8.5
South Central	Dec-Feb	-2.0	-2.9	-4.2	-5.4	-6.5	-7.6	-8.6	-9.5	-10.2
	Mar-May	-2.8	-4.1	-5.7	-7.4	-9.0	-10.5	-11.9	-13.1	-14.2
	Jun-Aug	0.8	1.1	1.6	2.1	2.5	2.9	3.3	3.6	3.9
	Sep-Nov	2.4	3.5	4.9	6.3	7.6	9.0	10.1	11.1	12.1
Central Highlands	Dec-Feb	-2.9	-4.3	-6.0	-7.7	-9.4	-10.9	-12.4	-13.6	-14.8
	Mar-May	-3.4	-5.0	-7.1	-9.1	-11.1	-12.9	-14.6	-16.1	-17.4
	Jun-Aug	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3
	Sep-Nov	2.5	3.6	5.0	6.5	7.9	9.2	10.3	11.4	12.4
South	Dec-Feb	-3.0	-4.4	-6.2	-8.1	-8.7	-11.4	-12.8	-14.2	-15.4
	Mar-May	-2.8	-4.1	-5.8	-7.5	-9.1	-10.6	-12.0	-13.2	-14.3
	Jun-Aug	0.3	0.5	0.6	0.9	1.1	1.2	1.4	1.5	1.6
	Sep-Nov	2.6	3.8	5.3	6.8	8.3	9.6	10.9	11.9	13.0

Appendix 11. Rainfall change (%) in Vietnam climate zones relative to the period of 1980-1999, high scenario (A2)

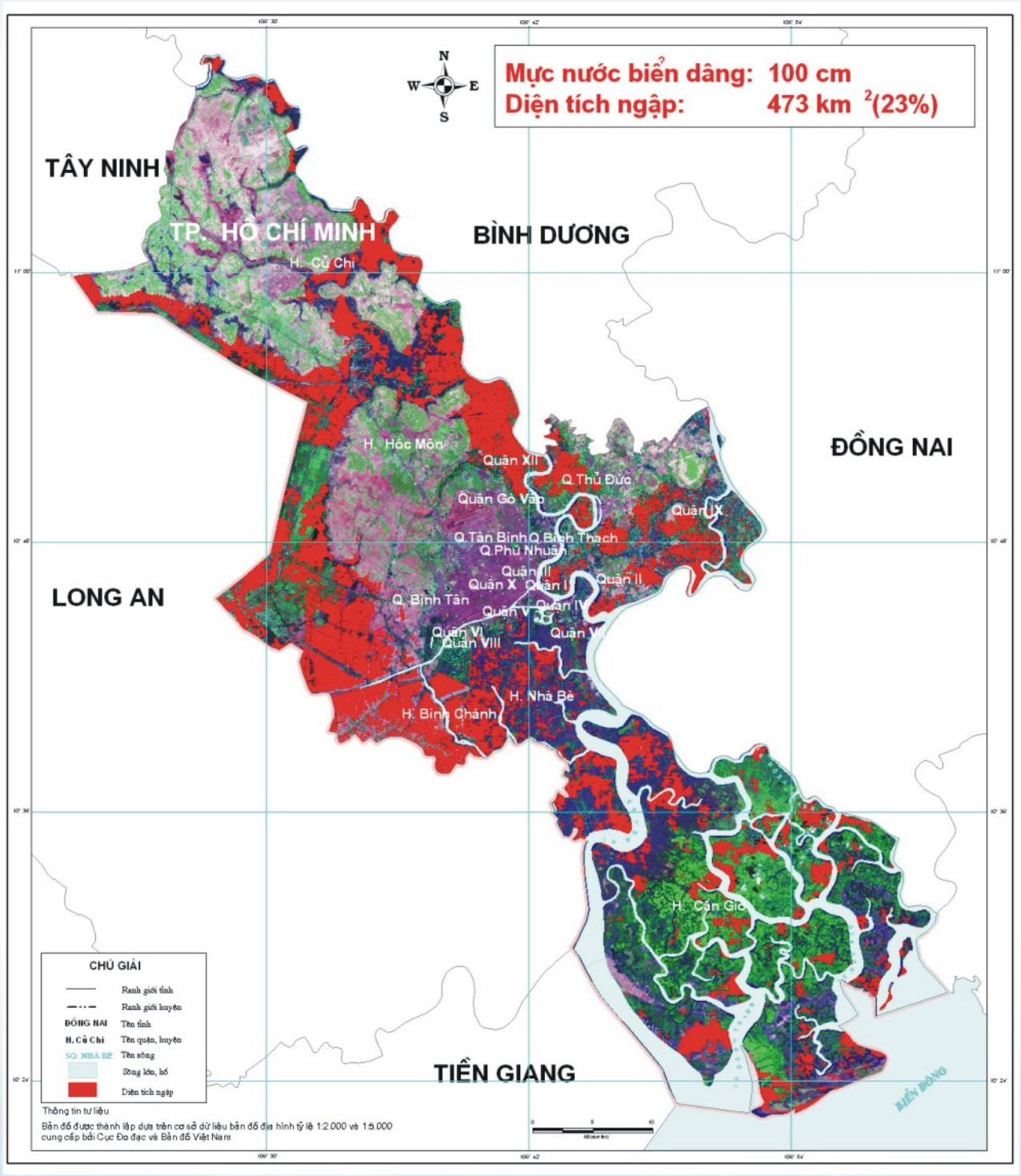
Climate zones	Month periods	Decades in the 21 Century								
		2020	2030	2040	2050	2060	2070	2080	2090	2100
North West	Dec-Feb	1.2	1.7	2.2	2.9	3.6	4.4	5.3	6.2	7.2
	Mar-May	-1.2	-1.6	-2.1	-2.8	-3.5	-4.3	-5.2	-6.1	-7.1
	Jun-Aug	2.5	3.5	4.6	5.9	7.5	9.3	11.0	12.2	15.1
	Sep-Nov	0.5	0.6	0.8	1.1	1.4	1.7	2.1	2.4	2.8
North East	Dec-Feb	0.8	1.1	1.5	1.9	2.4	3.0	3.5	4.2	4.9
	Mar-May	-0.9	-1.3	-1.7	-2.2	-2.8	-3.4	-4.1	-4.9	-5.6
	Jun-Aug	2.7	3.7	4.9	6.3	7.9	9.8	11.8	13.7	16.1
	Sep-Nov	0.5	0.9	1.2	1.5	1.9	2.4	2.8	3.3	3.8
North Delta	Dec-Feb	0.9	1.3	1.6	2.0	2.7	3.4	4.0	4.7	5.5
	Mar-May	-1.4	-2.0	-2.6	-3.4	-4.3	-5.3	-6.3	-7.4	-8.6
	Jun-Aug	3.1	4.5	5.8	7.5	9.4	11.7	14.0	16.3	19.1
	Sep-Nov	1.0	1.4	1.9	2.4	3.0	3.6	4.5	5.3	6.1
North Central	Dec-Feb	0.6	0.9	1.1	1.5	1.9	2.4	2.8	3.4	3.8
	Mar-May	-2.1	-2.9	-3.5	-4.9	-6.2	-7.7	-9.2	-10.9	-12.6
	Jun-Aug	3.0	4.6	5.6	7.3	9.1	11.3	13.6	15.9	18.5
	Sep-Nov	1.5	2.5	3.3	4.3	5.4	6.5	7.9	9.4	10.8
South Central	Dec-Feb	-2.2	-3.0	-4.0	-5.3	-6.3	-8.0	-9.6	-10.5	-13.0
	Mar-May	-3.0	-4.2	-5.5	-7.1	-8.9	-11.0	-13.2	-15.6	-18.1
	Jun-Aug	0.8	1.2	1.5	1.9	2.5	3.1	3.7	4.3	5.0
	Sep-Nov	2.5	3.5	4.6	6.1	7.6	9.3	11.3	13.3	15.3
Central Highlands	Dec-Feb	-3.1	-4.4	-5.7	-7.4	-9.2	-11.5	-13.8	-15.7	-18.5
	Mar-May	-3.7	-5.1	-4.5	-8.8	-11.0	-13.5	-16.3	-19.2	-22.2
	Jun-Aug	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3
	Sep-Nov	2.8	3.6	4.8	6.2	7.8	9.5	11.5	13.6	18.5
South	Dec-Feb	-3.3	-4.5	-5.9	-7.4	-9.7	-12.0	-14.4	-16.9	-19.6
	Mar-May	-3.0	-4.2	-5.5	-7.2	-9.0	-11.1	-13.3	-15.7	-18.2
	Jun-Aug	0.4	0.5	0.6	0.8	1.0	1.3	1.5	1.8	2.1
	Sep-Nov	2.8	3.8	5.0	6.5	8.2	9.3	12.1	14.3	16.5



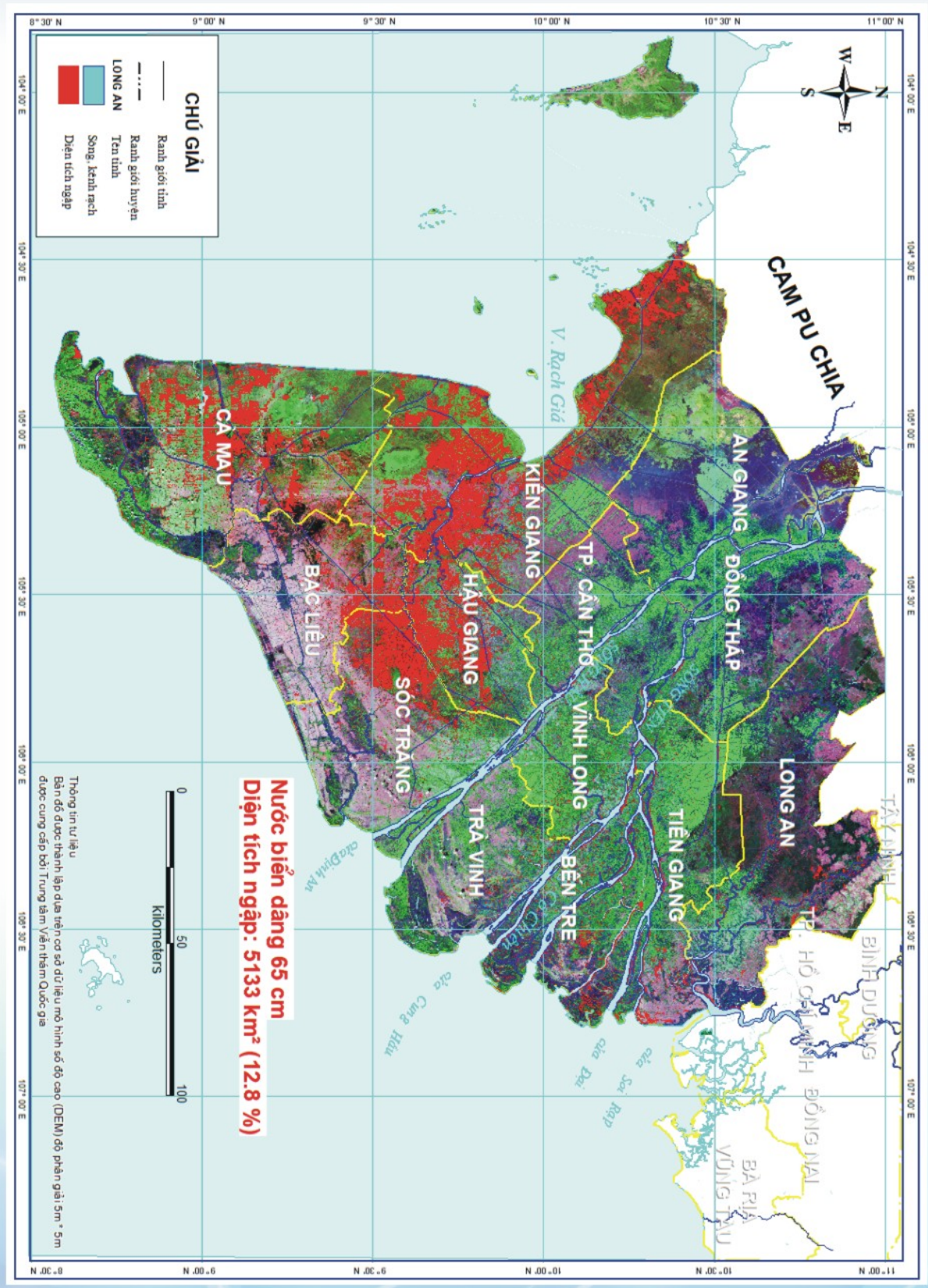
Appendix 12. Inundation map of Ho Chi Minh city at 65cm sea level rise scenario



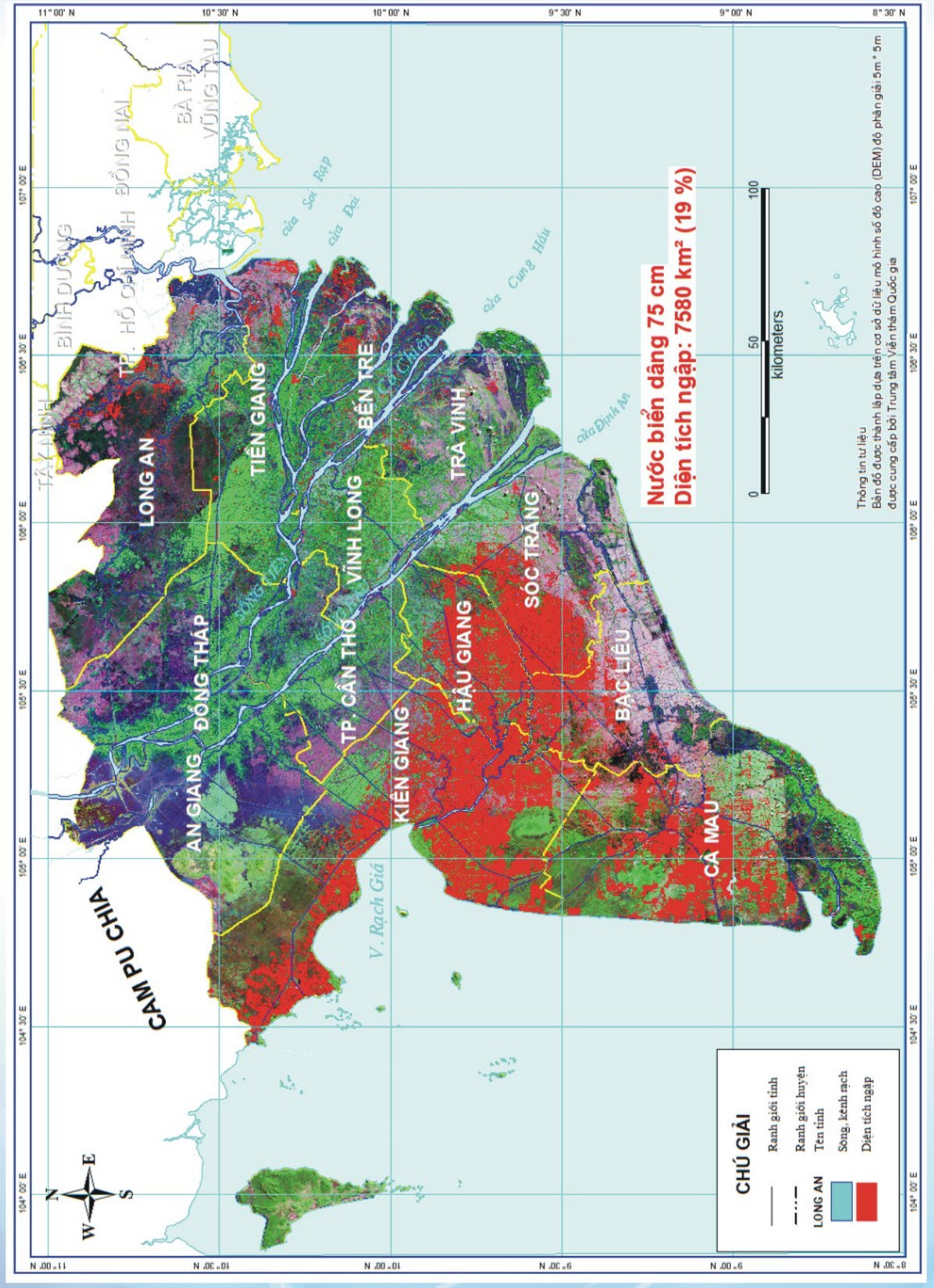
Appendix 13. Inundation map of Ho Chi Minh city at 75cm sea level rise scenario



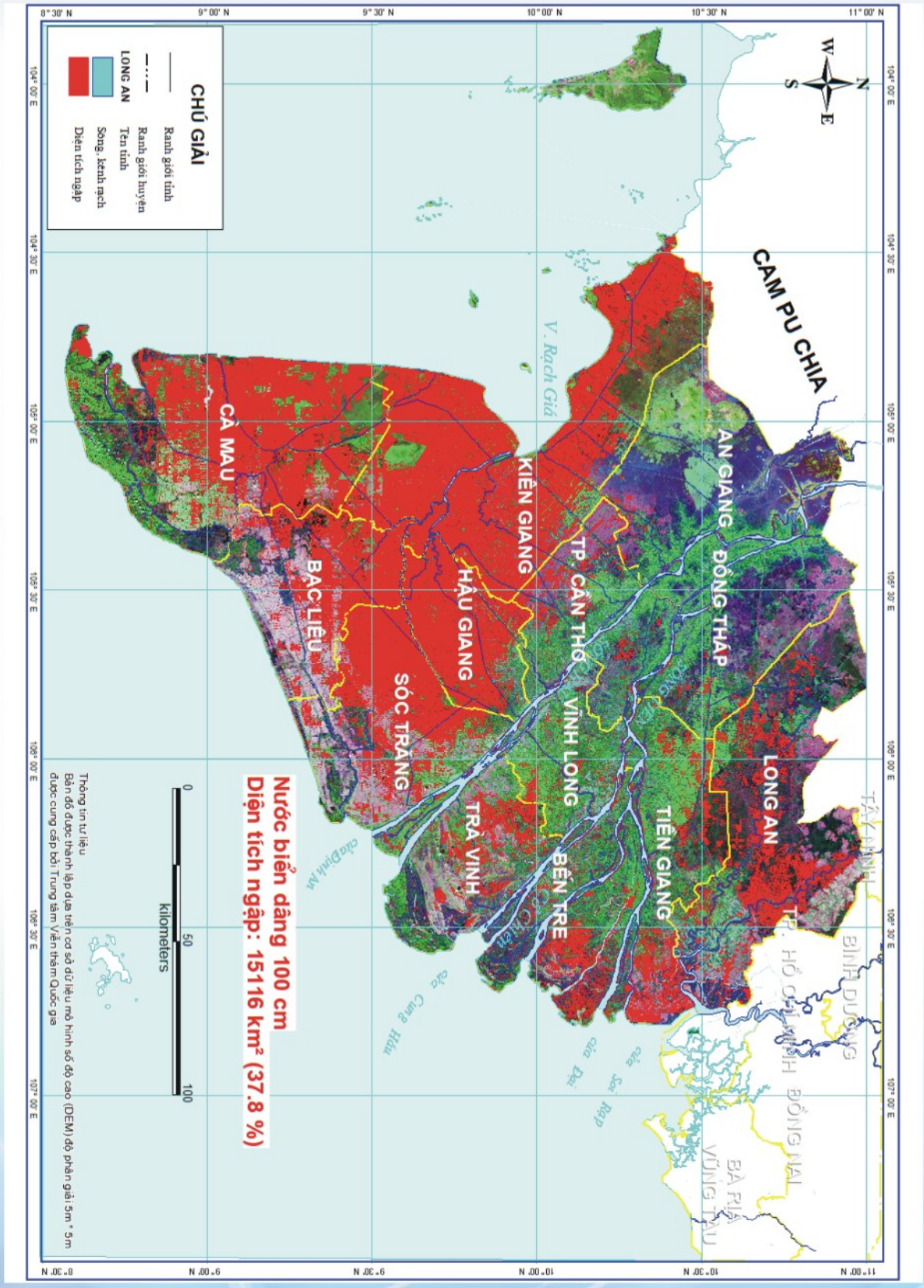
Appendix 14. Inundation map of Ho Chi Minh city at 100cm sea level rise scenario



Appendix 15. Inundation map of Mekong River Delta at 65cm sea level rise scenario



Appendix 16. Inundation map of Mekong River Delta at 75cm sea level rise scenario



Appendix 17. Inundation map of Mekong River Delta at 100cm sea level rise scenario