Scientific Assessment on Climate Change in the Mekong Region: Issues and Challenges

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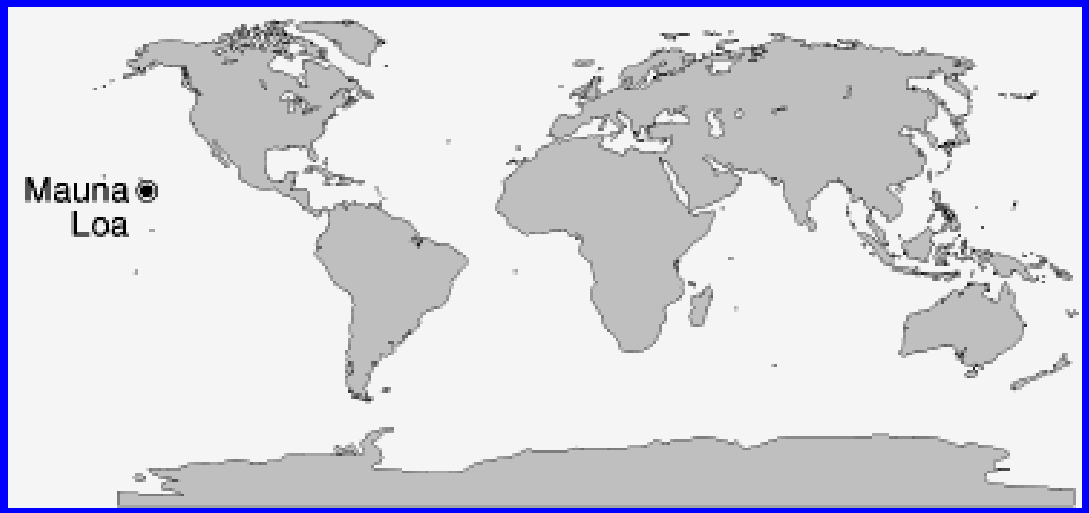
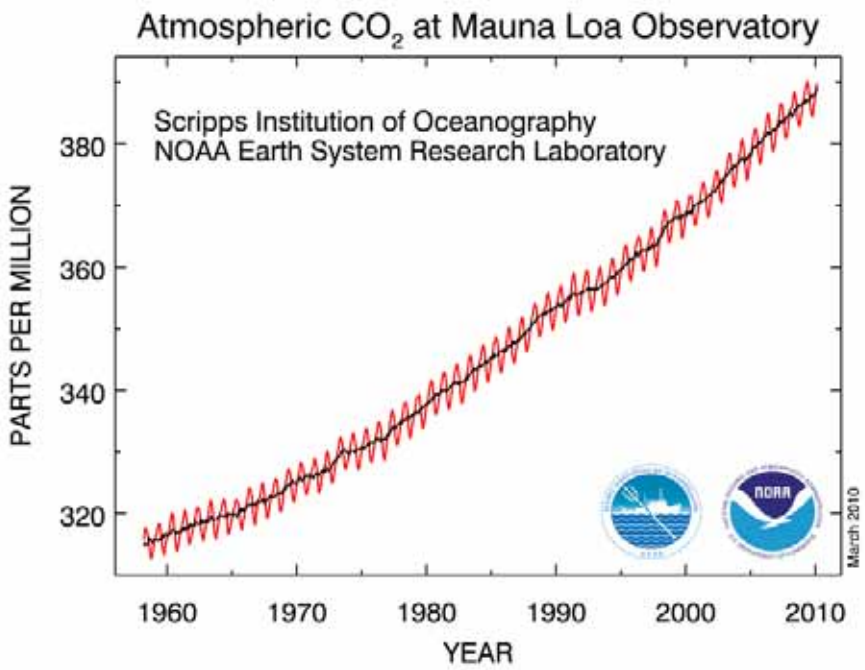
Mekong Environment and Climate Symposium
26-27 April 2010
Ho Chi Minh City
Viet Nam

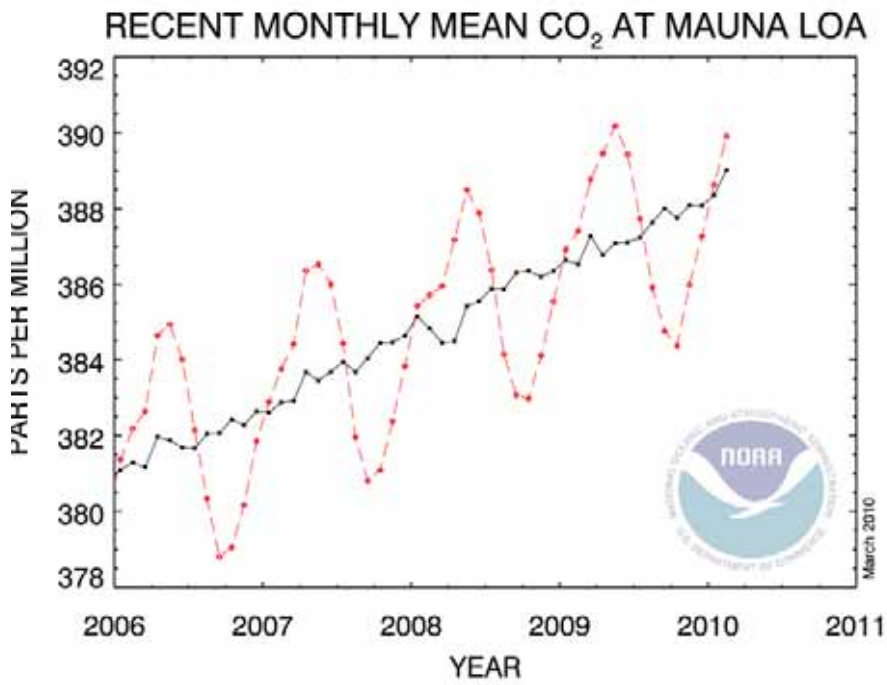


Records at Mauna Loa, Hawaii, shows an increase in the mean annual CO_2 concentrations from 315.98± 0.12 ppm of dry air in 1959 to 385.57 ± 0.12 ppm in 2008, to 387.35 ± 0.12 ppm in 2009.

Atmospheric mixing ratio of CO_2 : 275-285 ppm in the pre-industrial era (AD 1000–1750)

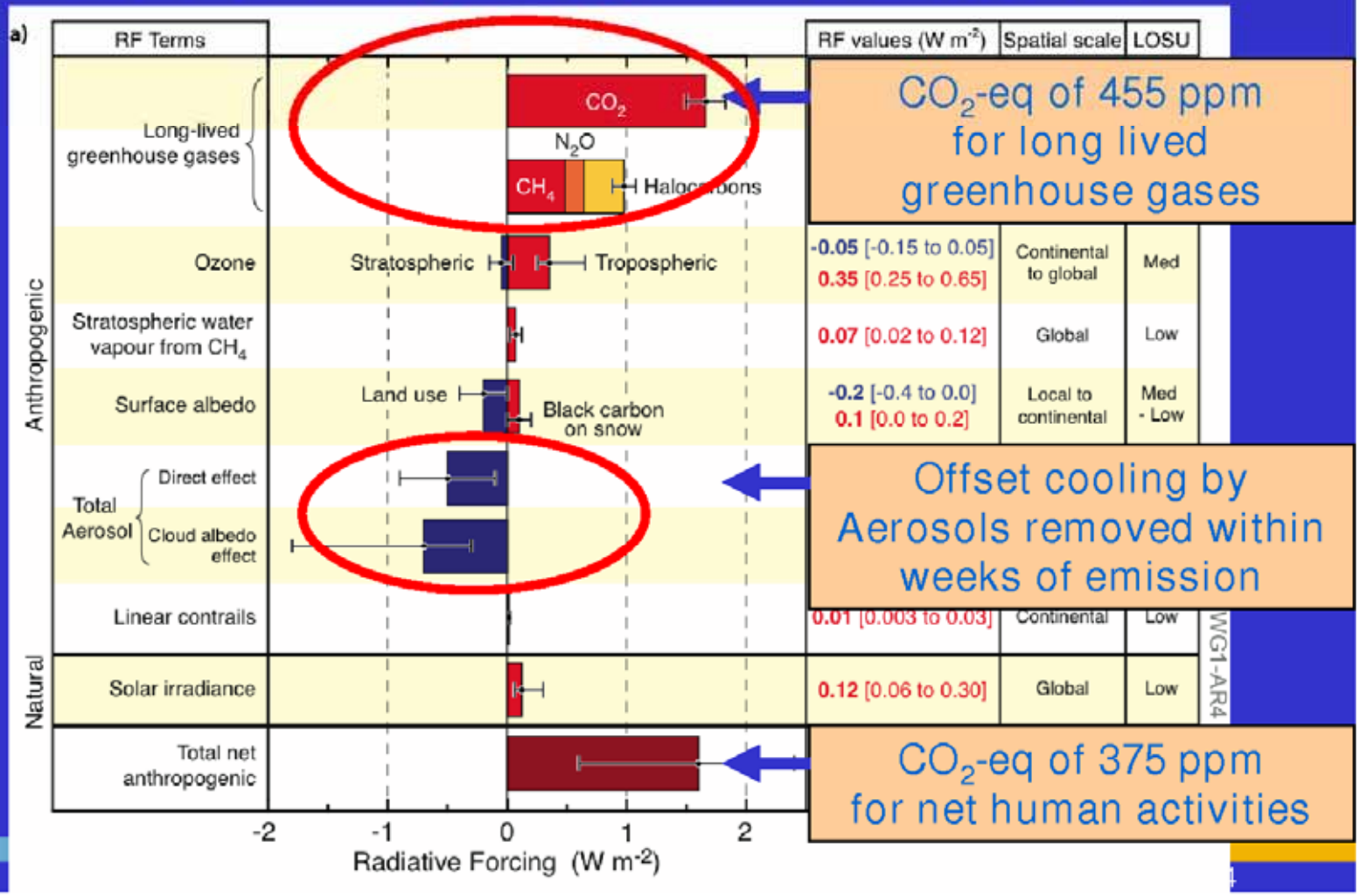
http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html





Radiative forcing: CO_2 equivalents

Used to compare different drivers of climate change



CO_2-eq of 455 ppm for long lived greenhouse gases

Offset cooling by Aerosols removed within weeks of emission

CO_2-eq of 375 ppm for net human activities

Pathways towards stabilization

Characteristics of stabilization scenarios

Category	CO_2 concentration at stabilization (2005 = 379 ppm) [b]	CO_2-equivalent Concentration at stabilization including GHGs and aerosols (2005 = 375 ppm) [b]	Peaking year for CO_2 emissions [a, c]	Change in global CO_2 emissions in 2050 (% of 2000 emissions) [a, c]	Global average temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity [d], [e]	**Global average sea level rise above pre-industrial at equilibrium from thermal expansion only [f]**	Number of assessed scenarios
	ppm	ppm	Year	Percent	°C	metres	
I	350 – 400	445 – 490	2000 – 2015	-85 to -50	2.0 – 2.4	**0.4 – 1.4**	6
II	400 – 440	490 – 535	2000 – 2020	-60 to -30	2.4 – 2.8	**0.5 – 1.7**	18
III	440 – 485	535 – 590	2010 – 2030	-30 to +5	2.8 – 3.2	**0.6 – 1.9**	21
IV	485 – 570	590 – 710	2020 – 2060	+10 to +60	3.2 – 4.0	**0.6 – 2.4**	118
V	570 – 660	710 – 855	2050 – 2080	+25 to +85	4.0 – 4.9	**0.8 – 2.9**	9
VI	660 – 790	855 – 1130	2060 – 2090	+90 to +140	4.9 – 6.1	**1.0 – 3.7**	5

EU target 2°C, approx. 450 ppm CO_2-eq

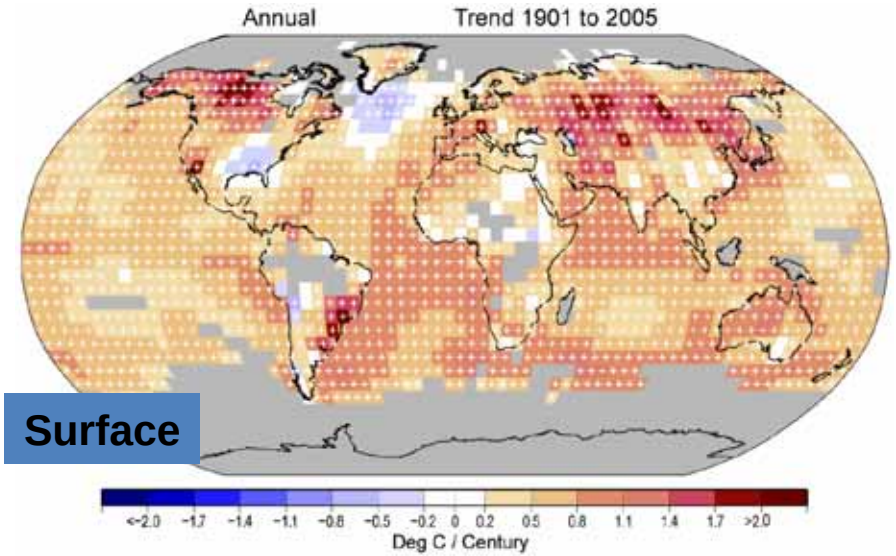
- Sea level rise under warming is inevitable
- Long time scales of thermal expansion & ice sheet response to warming imply that stabilisation of GHG concentrations at or above present levels will not stabilise sea level for many centuries

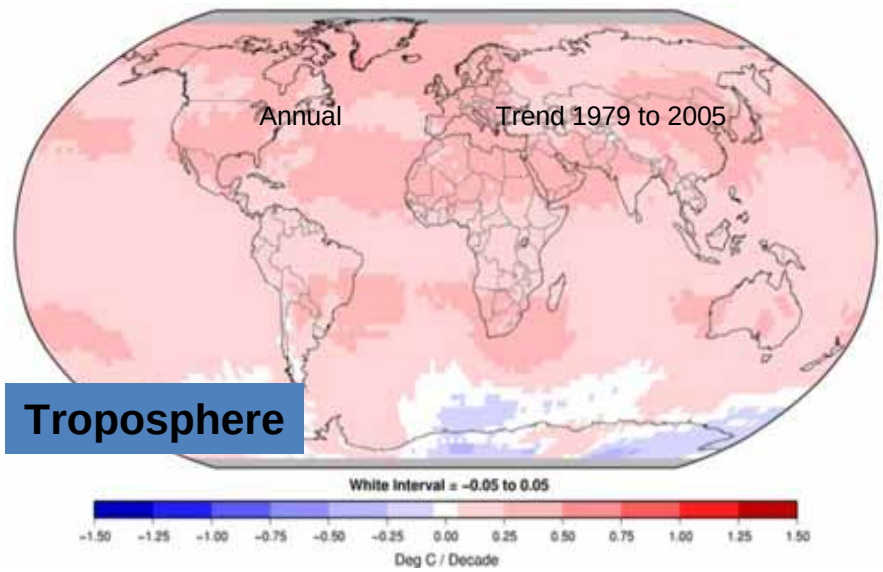
◆Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels. Annex 1 Parties would require to reduce emissions in a range of 25-40% below 1990 level by 2020

350 parts per million is what many scientists, climate experts, and progressive national governments are now saying is the safe upper limit for CO_2 in our atmosphere.
It is based on the study of Dr. James Hansen of NASA, who first publicly testified before the U.S. Congress in June of 1988 that global warming was real.

http://www.350.org/understanding-350

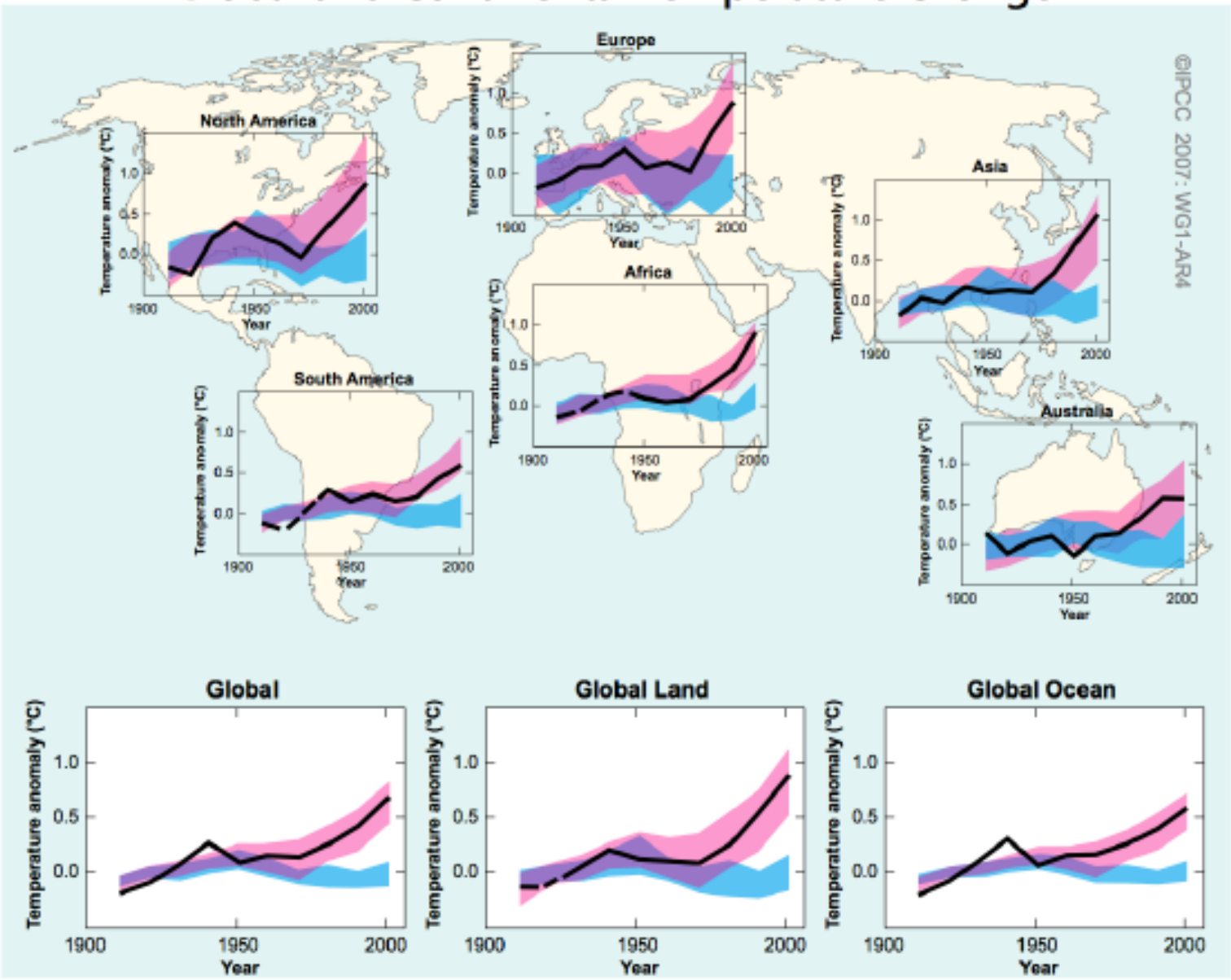
Observed Widespread Warming





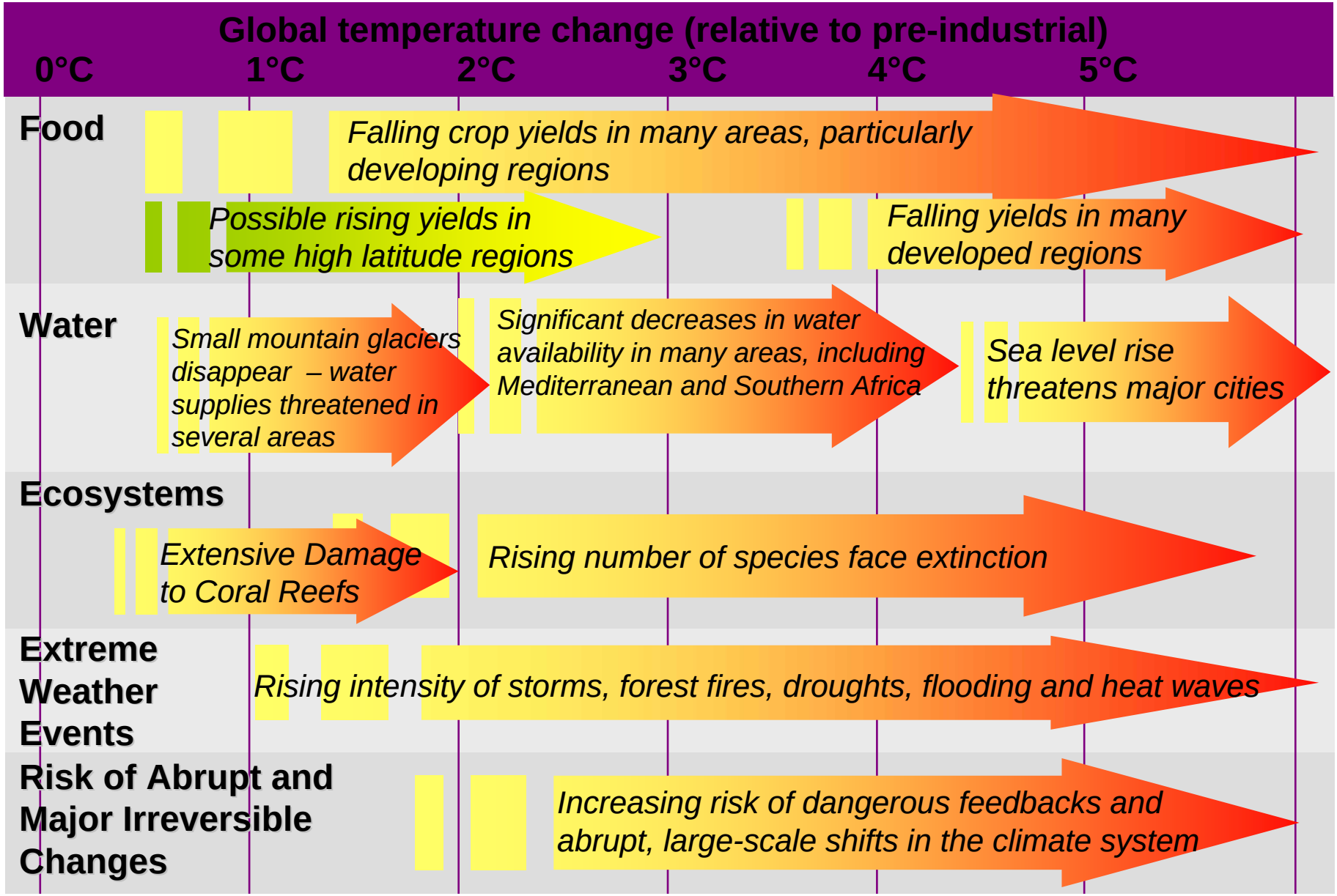
- The global average air temperature has warmed 0.74 [0.56 to 0.92]°C during 1906-2005
- It is projected to increase (best estimate) from 1.8°C (*likely* range 1.1°C - 2.9°C), to and 4.0°C (*likely* range 2.4°C - 6.4°C) by 2100.
- If GHG were kept at current levels, a committed 0.6°C of further warming would be expected by 2100.
- More warming would accompany more emission
- The last two decades being the warmest of the last century
- At least in the Northern Hemisphere, the 20th Century was the warmest in the last 1000 years
- Extremely unlikely without external forcing
- Very unlikely due to known natural causes alone

Global and Continental Temperature Change

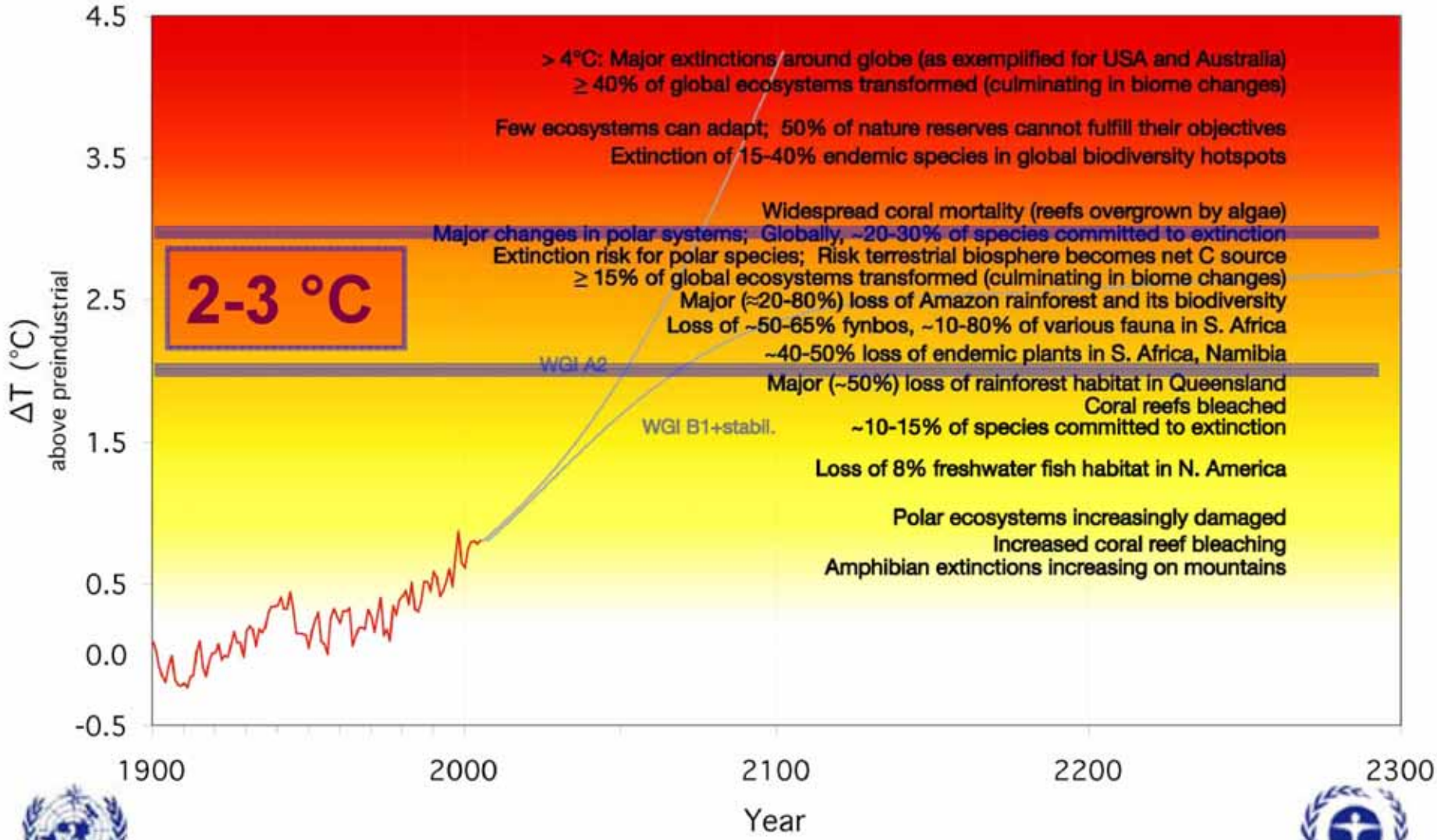


Strong regional variations

Projected impacts of climate change (Stern, 2007)



Summary - Ecosystem impacts



WMO

UNEP

20% - 30% of higher plants and animals at high risk of extinction

if ΔT 1.5°C - 2.5°C over present

WMO

UNEP

What is *dangerous* climate change?

- A warming of 2°C above pre-industrial temperatures (1.3°C above present levels) is frequently cited as the limit beyond which the world will face "dangerous" climate change. It had generally been assumed that this would occur if greenhouse gas concentrations rose above 550 ppm CO_2-eqv by volume.
- In January 2007, the European Commission issued a communication stating that "*the European Union's objective is to limit global average temperature increase to less than 2°C compared to pre-industrial levels*".
- AOSIS proposes that global average surface temperature increases to be limited to well below 1.5° C above pre-industrial levels

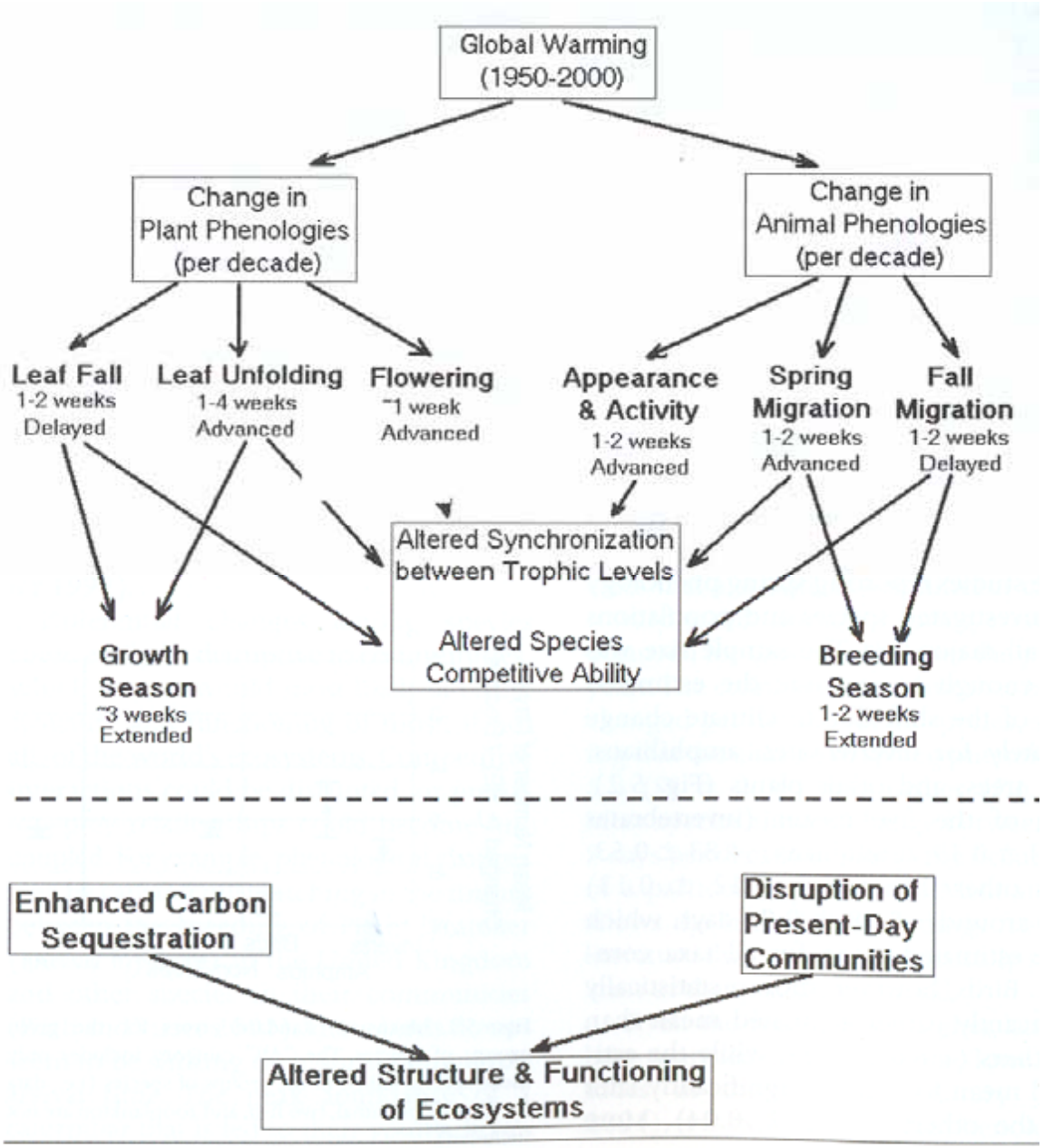
Copenhagen Accord

- Copenhagen Accord also proposes this *2°C* temperature limit
- Many developing countries, including Cambodia, Lao PDR and Viet Nam, have associated with the Copenhagen Accord, implying that they have agreed with this *2°C* temperature limit.

Copenhagen Accord

- Is this *2°C* temperature limit appropriate for the ecosystems of the Mekong Region?
- What are the implications of this *2°C* temperature limit to the ecosystems of the Mekong Region?
- What is the scientific basis for this *2°C* temperature limit in the Mekong Region?
- Was it a political or scientific decision?

Implications for phenological changes in plants/animals with 2 ^{o}C temperature increase? How does it affect the life cycles of the existing species?



The anomalous warming of the last few decades has already had significant effects on the life cycles of many species (Penuelas & Filella, *Science*, 2001)

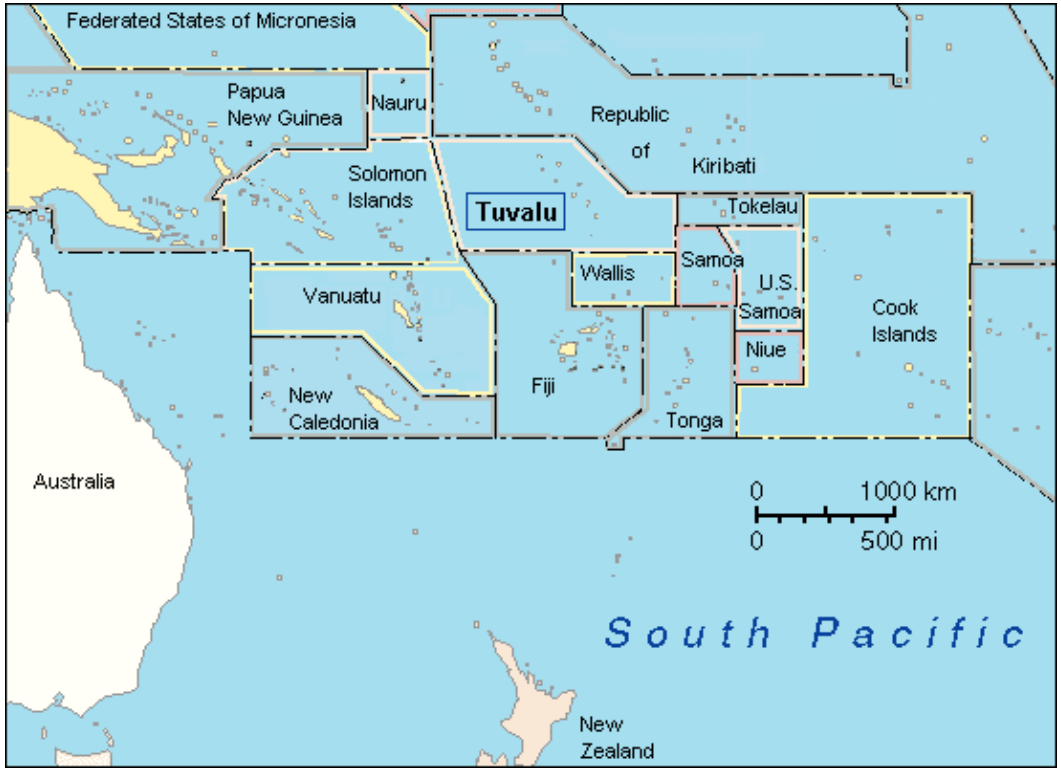
(This slide was kindly provided by Dr Dietrich Schmidt-Vogt formerly of AIT)

This brings us to the question:

- How will the global scientific assessment differ from the regional and national scientific assessments?

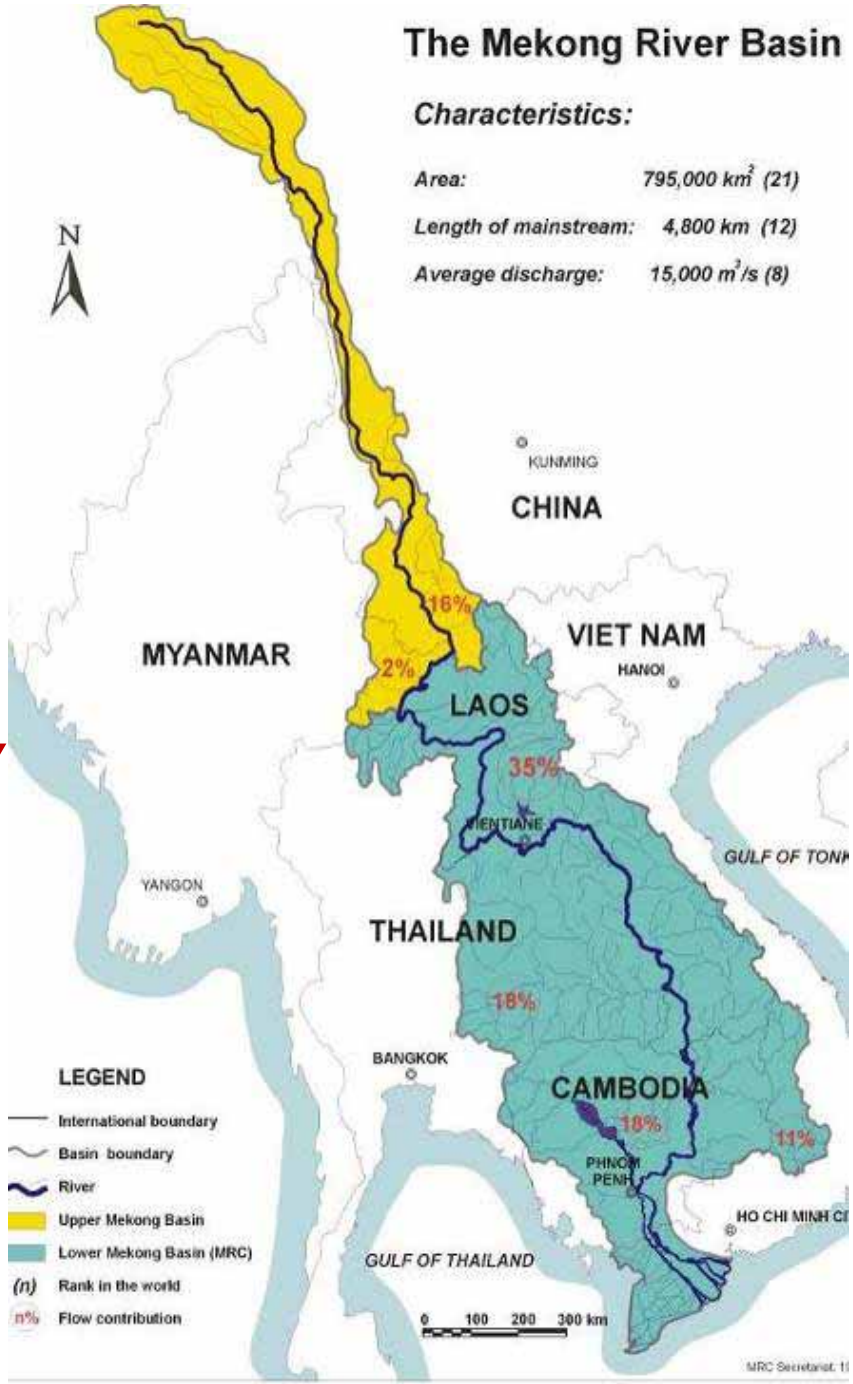
Scientific assessment is country and regional specific!

- For example, Niue (is situated on a high cliff) *vs* Tuvalu (highest point 5 m above sea level)



Mekong Region Scientific Assessment for Better Policy Decisions and Action Plans

- Need regular and comprehensive scientific, technical and socio-economic assessments, including an integrated *Impact, Vulnerability and Adaptation Assessment*, so that realistic national and regional policies and comprehensive national and regional *Climate Change Action Plans* can be based on and developed



Mekong Panel on Climate Change (MPCC)

- The Climate Change Adaptation Initiative (CCAI) of the MRC is proposing to establish a MPCC based on the model of IPCC:

(1) To assess on peer-reviewed and published scientific, technical and socio-economic literature relating to climate change in the Mekong Region in a comprehensive, objective, open and transparent manner (similar to IPCC?);

(2) To facilitate and promote national and regional research on all aspects relating to climate change and assist researchers in publishing their findings in international peer-reviewed journals;

(3) Provide input to the IPCC Fifth Assessment Reports which will be completed in 2013/2014.

Nobel Peace Prize Winners 2007:
Al Gore and IPCC

WMO UNEP

IPCC Plenary

IPCC Bureau

IPCC Secretariat

Working Group 1 The Scientific Basis	Working Group 2 Impacts Vulnerability Adaptation	Working Group 3 Mitigation	Task Force on National Greenhouse Gas Inventories
TSU	TSU	TSU	TSU

Authors - Contributors - Reviewers - Review Editors - Experts

Memberships of MPCC

- The TOR is still being developed
- Criteria for selection are being established
- Memberships should be predominantly from the Mekong region (e.g., National and regional research institutes; Academy of Sciences and Technologies; national communication and NAPA projects members; etc.)
- Participation of scientists from China and Myanmar in MPCC are essential for the scientific assessment of the whole Mekong Region
- International experts who have extensive expertise and experience in the Mekong region may be invited as members or peer reviewers of the Assessment Reports of the Working Groups, which may be published every three or four years

National Panel on Climate Change?

- A Vietnam Panel on Climate Change (VPCC) has been advocated since late 2008, and it is being considered by the National Target Programme on Climate Change of Viet Nam

How about:

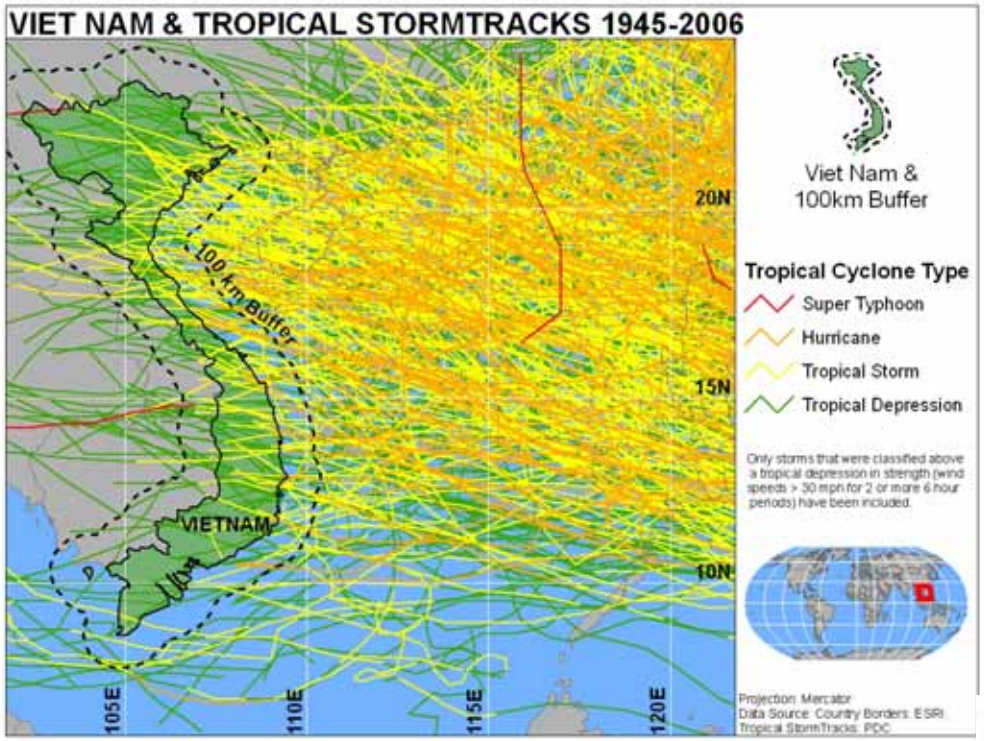
- Thailand Panel on Climate Change (TPCC)?
- Cambodia Panel on Climate Change (CPCC)?
- Laos Panel on Climate Change (LPCC)?
- Members of National Panel on CC may serve as members of MPCC

Some major issues for MPCC assessment

- Existing and projected climate change (e.g., temperature increase, spatial and temporal changes in rainfall patterns) in 20, 50 and 100 years and associated environmental, social and economic costs in the Mekong Region;
- Ecological consequences of climate change in the Mekong Region in 20, 50 and 100 years (e.g., phenological changes in plants and animals – the effects on the life cycles of the existing species);
- Vulnerability of water resources due to melting of glaciers in Qinghai-Tibet plateau and existing water resources management practices in 20, 50 and 100 years and associated impacts on natural (e.g., ecosystems) and human environment (e.g., settlements; agriculture; rice production; socio-economic development);

Some major issues for MPCC assessment

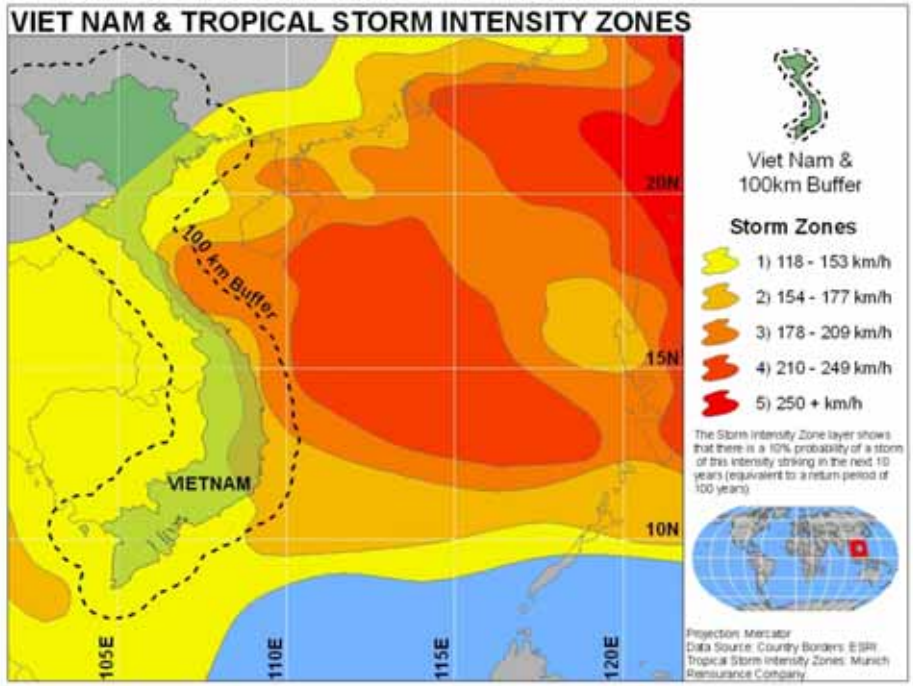
- Existing and future frequency of occurrences, intensity and duration of tropical cyclones that hit the region, such as Typhoon Ketsana that hit Viet Nam, Cambodia and Lao PDR on 30 September 2009;
- The relationship between El Niño and drought in the Mekong region;
- The relationship between La Niña and the frequency of occurrences, intensity and duration of tropical cyclones/typhoons in the Mekong region;
- Integrated assessment of climate change impacts based on observation and modelling;
- Sea-level rise and associated impacts;
- Cost-effective mitigation (including REDD) and adaptation measures;
- Synergies between adaptation and disaster risk reduction



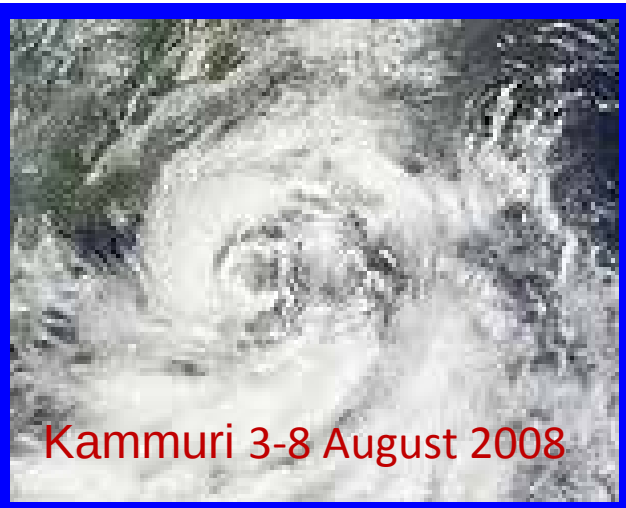
- Typhoon trajectory moves southward?
- Typhoon season shifts to later months of the year?
- Influence of ENSO?

- Higher or lower frequency of occurrence?
- More typhoons with higher intensity?

(Source of figures: Chris Chiesa, PDC, Hawaii, USA)



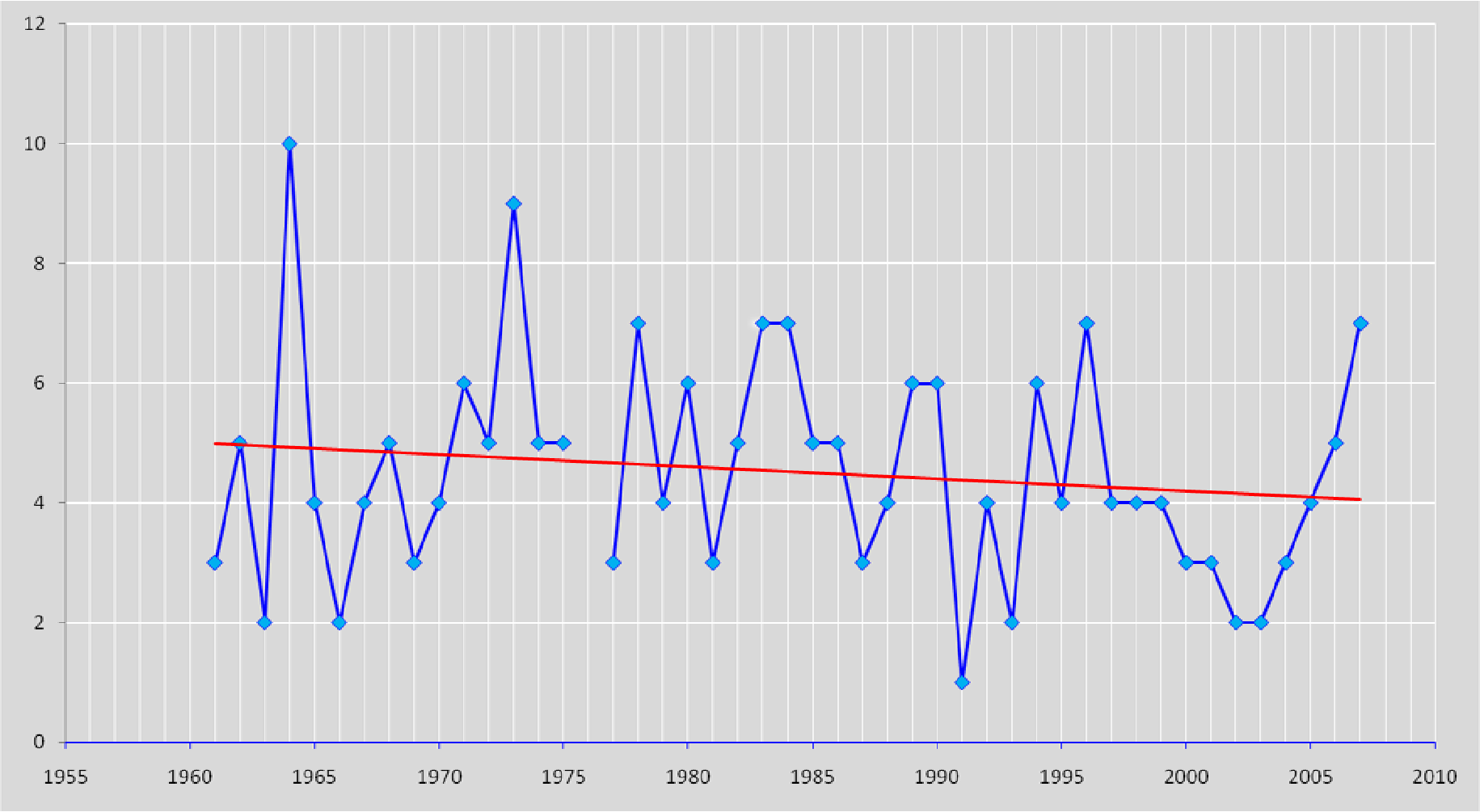
Tropical Cyclones



- are *likely* to become more intense on the whole under a warmer climate as a result of higher sea surface temperatures (but great uncertainty in changes in frequency, and changes to storm tracks)
- The uncertainty in potential changes in tropical cyclones also contributes to uncertainties in future wet season rainfall

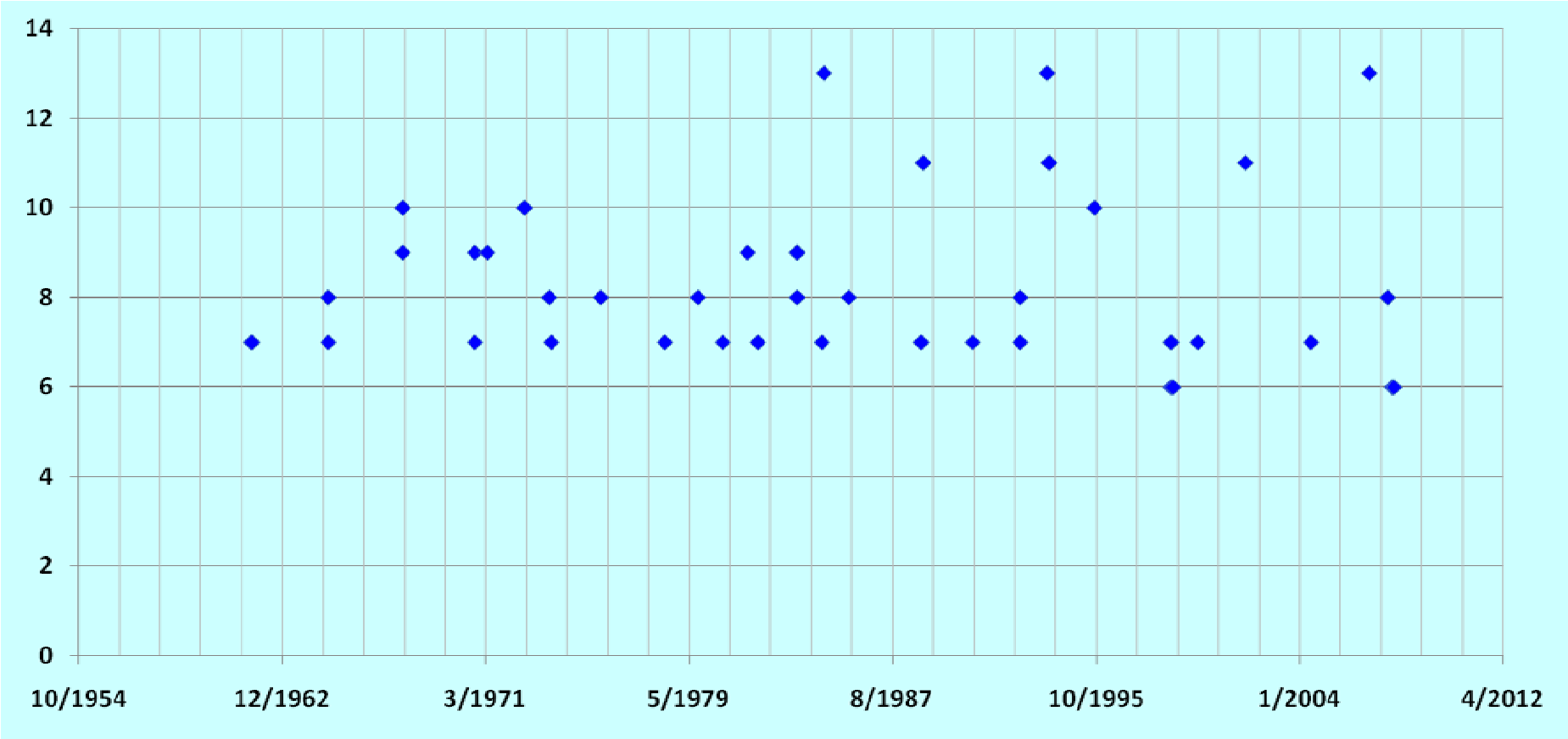
(Source: UNDP/Oxford University Climate Change Country Profiles, 2008)

Frequency of occurrence of typhoons in Viet Nam from June 1961- November 2007



Intensity of tropical cyclones that hit Viet Nam (June 1961- November 2007)

LONGTITUDE 109°



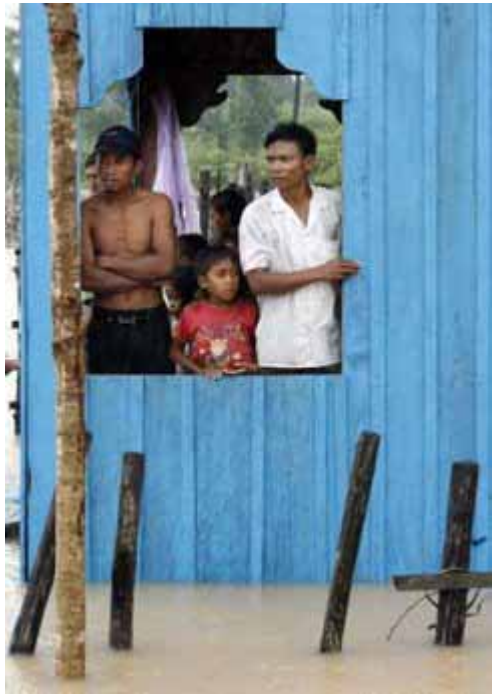
Typhoon Ketsana hit the Philippines, Vietnam, Cambodia and Lao PDR in late September/early October 2009

Central Vietnam, 30 September 2009

(Damage across 14 provinces has risen to US$785 million, killed 163 people and left 17 missing when it struck on 29 September 29, with an estimated 3 million people affected)

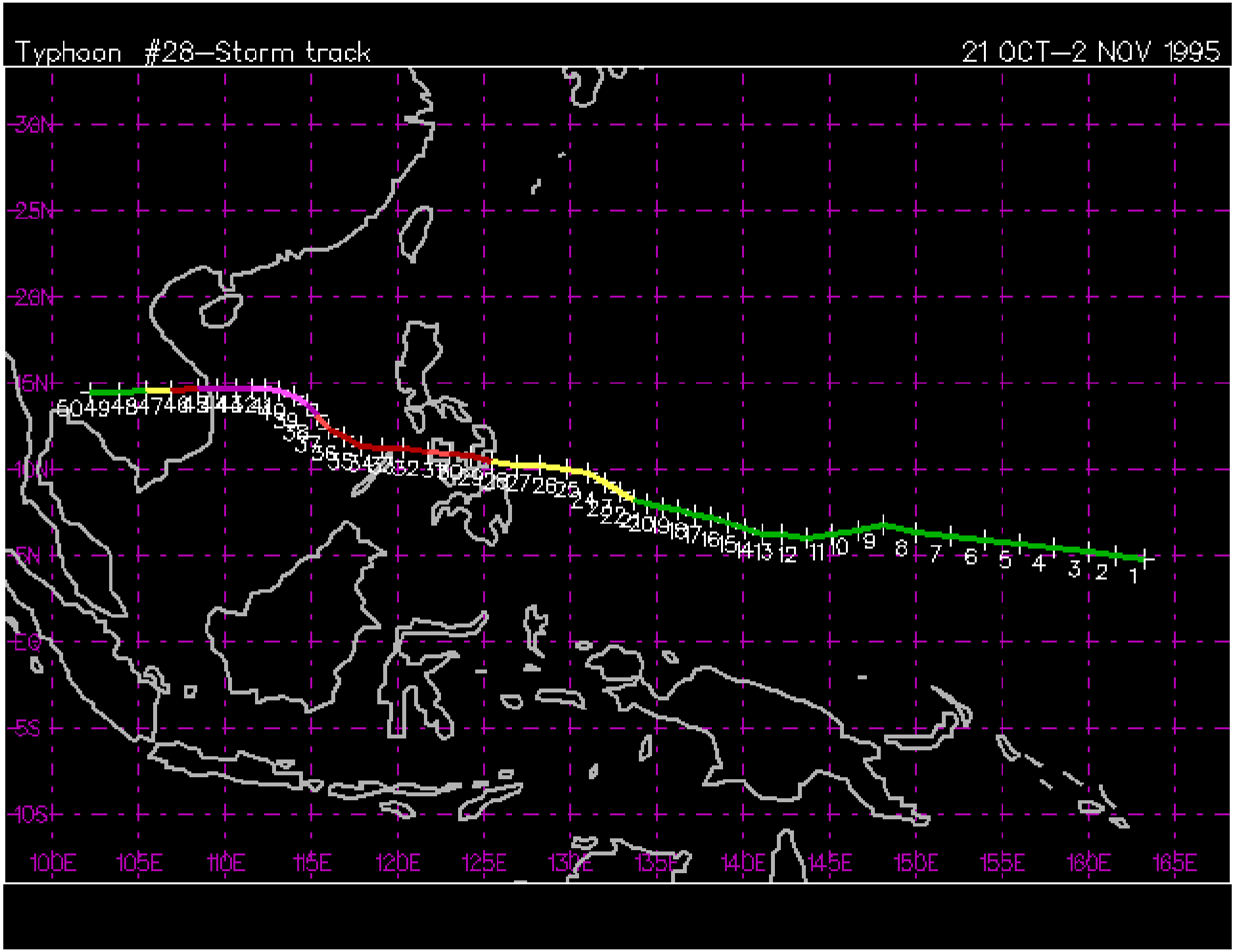
Kampong Thom Province, Cambodia, 30 September 2009

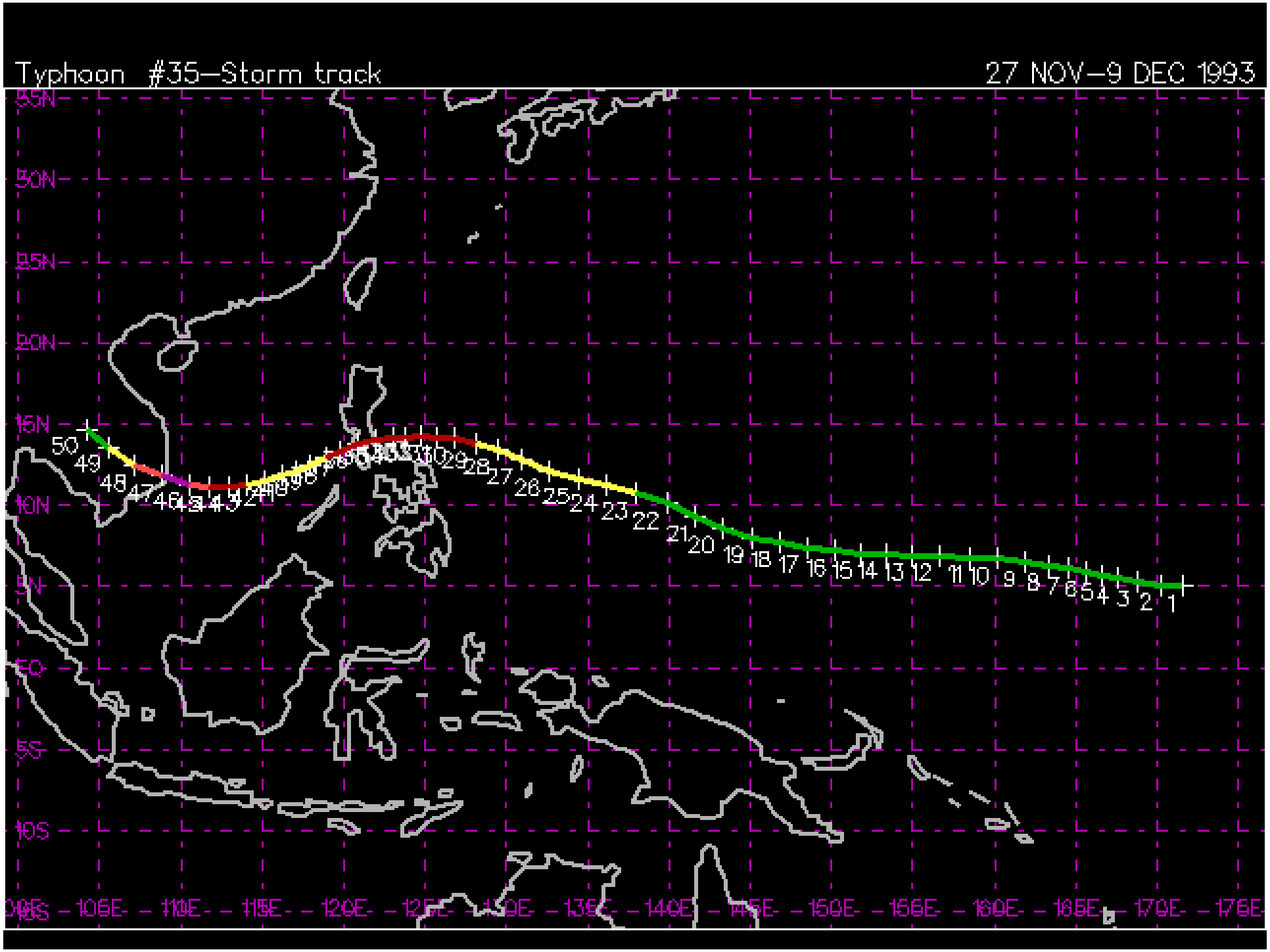
Number of death reported on 3 October: at least 17



Ketsana hit Lao PDR

Savannakhet, Saravan, Attapeu, and Xekong provinces (the latter two were the worst affected, with at least 24 death, thousands of people homeless, and 854 billion kip in damages)


Typhoon #28—Storm track
21 OCT—2 NOV 1995
30N
25N
20N
15N
10N
5N
EQ
5S
10S
100E
105E
110E
115E
120E
125E
130E
135E
140E
145E
150E
155E
160E
165E


Typhoon #35—Storm track
27 NOV—9 DEC 1993
55N
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
105E
110E
115E
120E
125E
130E
135E
140E
145E
150E
155E
160E
165E
170E
175E

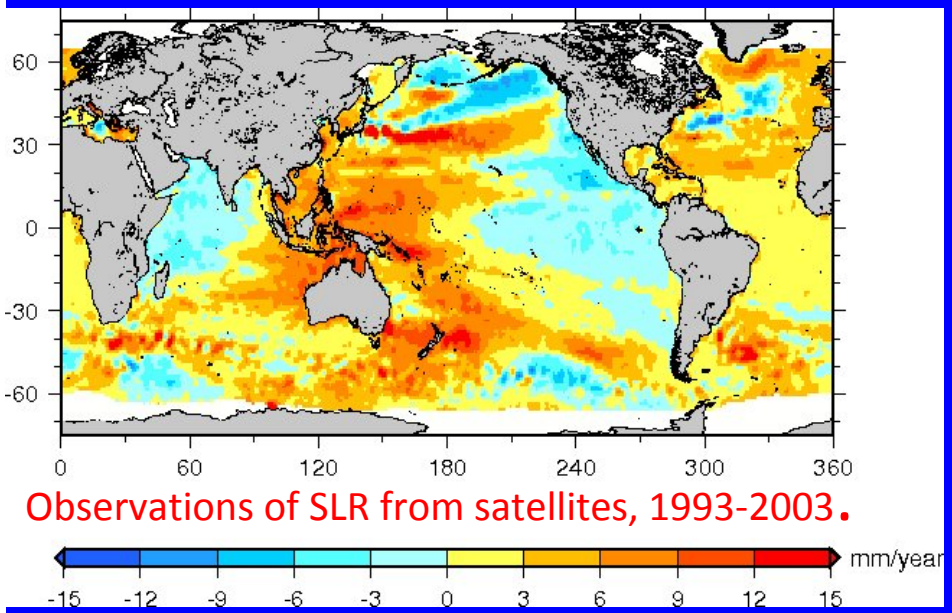
El Niño Southern Oscillation (ENSO) events lead to severe floods and droughts (e.g., western Pacific) in tropical and sub-tropical regions, including Mekong region.

- Model simulations show wide disagreements in projected changes in the amplitude of future El Niño events.
- ENSO influences the monsoon variability in South East Asia, a relationship which is also poorly understood, contributing to uncertainty in climate projections for this region.

(Source: UNDP/Oxford University Climate Change Country Profiles, 2008)

- In El Niño years, the southern part of East Asia (southern China, Philippines, Vietnam, etc.) is less likely to be affected by intense typhoons but the reverse happens in La Niña years (**Johnny C. L. Chan)**.

Sea-Level Rise (SLR)



Observations of SLR from satellites, 1993-2003.

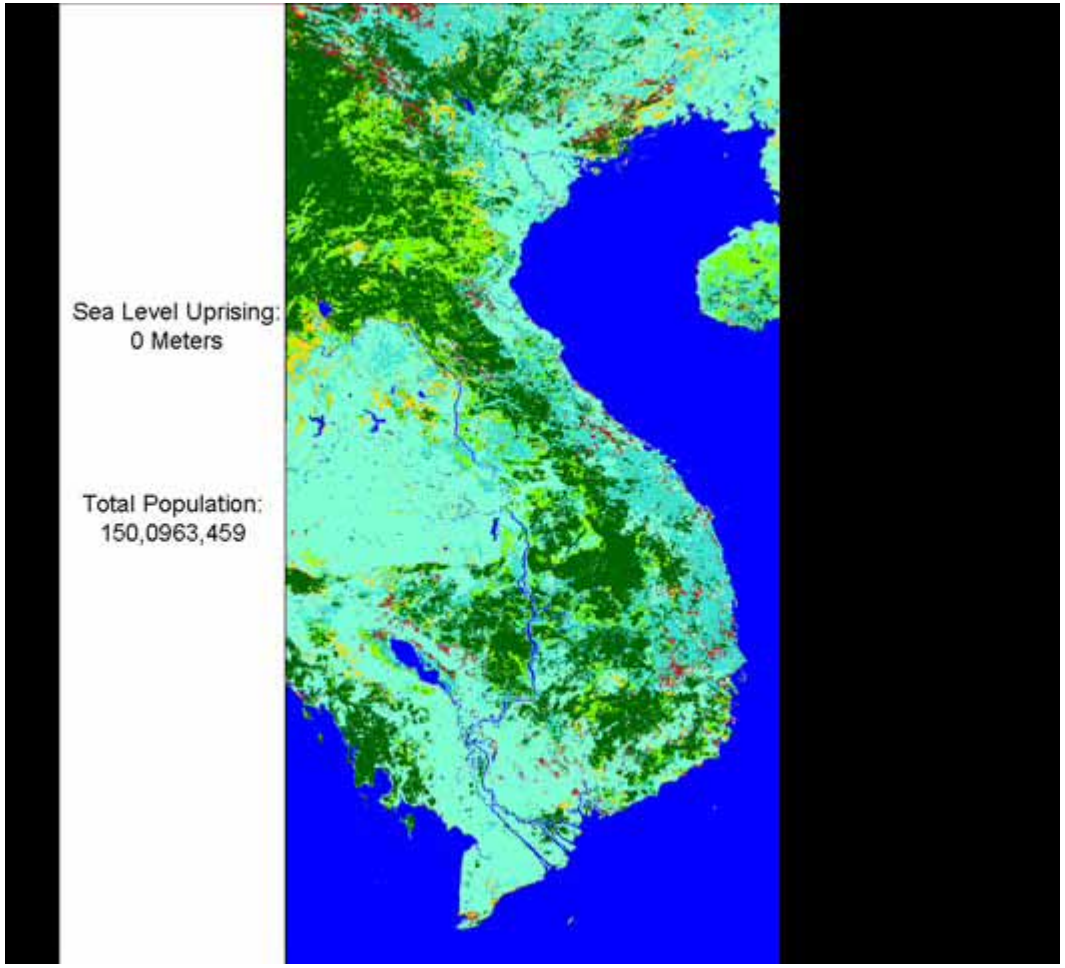
The global average SLR for the 20th century was about 0.17 [0.12-0.22] m, <u>mostly from expansion of the warmer ocean, and with contributions from glacier melt (Alaska, Patagonia, Europe….)</u>.

Future changes <u>just from these processes</u> could be up to 0.5 m by 2100, and up to 1 m within about 2-3 centuries, depending on the concentration of GHGs.

Recent study indicates that glaciers in Greenland and the West Antarctic are sliding into the ocean significantly faster than was previously predicted, and these could result in SLR of over 1.5 m by 2100.

Sea-Level Rise Animation – Mekong Delta

Inundation of much of the Red River and Mekong Deltas would seriously threaten rice production and food security



Sea level in this region is projected by climate models to rise by the following levels by the 2090s, relative to 1980 - 1999 sea level:

0.18 to 0.43m under SRES B1;
0.21 to 0.52m under SRES A1B;
0.23 to 0.56m under SRES A2

(Source: UNDP/Oxford University Climate Change Country Profiles, 2008)

Other study projects a 1-m SLR 2100 in Viet Nam

(Source of this animation: http://cegis.usgs.gov/sea_level_rise.html)

Vulnerability and Risk Assessment

Hazard x Vulnerability = Risk

(natural or human-induced)

(social, economic, environmental & even political factors)

Climatology,
Probabilities,
Forecasts

Population growth and shifts
Urbanization
Technology (EWS; Water conservation technologies)
Land use practices
Env. degradation
Water use trends
Govt policies
Env. Awareness
Capacity (technical & institutional)
Poverty

Uncertainties and Adaptation to Changing Ecosystems

1. Given the inherent uncertainties in climate models projections, how do the Mekong region countries use the modelled outputs for their longer-term adaptation planning?
1. The MRC member countries depend on their ecosystems for environmental, social and economic services:

   (a) How are the countries going to adapt in the changing ecosystems, including agricultural ecosystems?

   (b) How much is known about the adaptation of the countries' ecosystems, including agricultural ecosystems, to climate change?

- Implications for food security?

More research is needed!

Some Challenges

- Coordination of national and regional scientists
- Collaboration between MRC scientists and their counterparts in China and Myanmar
- Research and systematic monitoring
- Facilitation of national scientists to publish their research findings in the international peer-reviewed journals
- Capacity development for national scientists in research and international publications
- Sustainable financial support from national governments and donors
- How the policy makers will use the MPCC assessment reports?
- Outreach activities based on MPCC assessment reports
- Linkages to IPCC?

Conclusions

- Scientific assessment is the basis for good policy development
- National scientists from the MRC member countries need to be mobilized to undertake extensive and comprehensive scientific assessments in climate change in the Mekong River Basin for better policy decision-making;
- A Mekong Panel on Climate Change (MPCC) is being established by the Climate Change Adaptation Initiative (CCAI) of the MRC, and this MPCC will provide regular and comprehensive scientific assessments on climate change in the Mekong Region;
- Scientists from China and Myanmar should be part of the MPCC scientific assessment teams so that the whole Mekong Region is treated as an entity

Conclusions

- The MPCC will facilitate the publication of national and regional research in international peer-reviewed journals; which will form the basis for scientific assessment;
- Capacity development for national scientists in research and international publications will be needed for long-term planning;
- Sustainable financial support from national governments and donors for the operation of MPCC is needed;
- The assessment reports of MPCC will serve as input for future IPCC assessment reports.

A few examples of the adaptation and mitigation measures in the Mekong Region and other parts of the world

How did people adapt to extreme weather events? (Source: Dr Kien Tran Mai)

Indigenous technology in disaster mitigation community-based initiatives in Phu Vang District, Thua Thien-Hue Province, Viet Nam

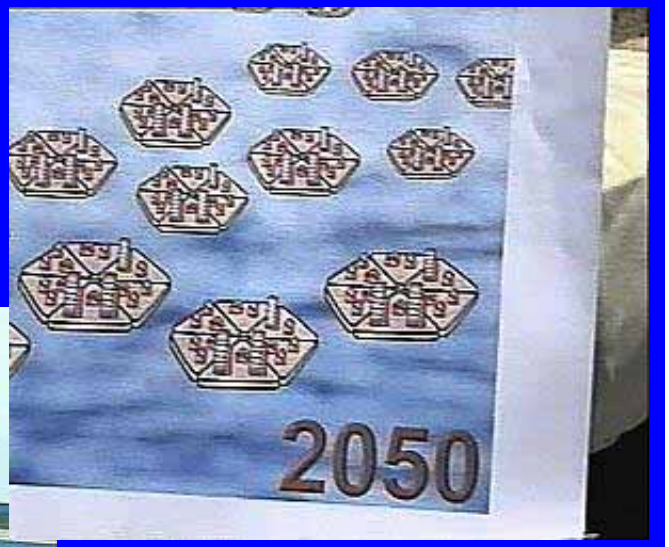
Rescue boats built using traditional craftsmanship

Flood shelter designed using indigenous knowledge

Lighthouse with pylons fitted with lights and sirens for early warning

Floating Houses in the Netherlands

- The Dutch people have designed houses that can float on the water to mitigate sea-level rise under climate change



Floating village in Chong Kneas, Tonle Sap Lake, Cambodia

Kid in a tub, Tonle Sap Lake, Cambodia

Floating gardens, Inle Lake, Myanmar

Hanoi, Viet Nam, currently has
1.5 million motorbikes! Eco-efficient transport but not so safe!!

Eco-efficient practice in India

Bagan, Myanmar: Eco-efficient public transport

Innovative mitigation practice in Africa

(Source: Chow Kok Kee)

Fossil-fuel free school bus in New Delhi, India

(Source: Chow Kok Kee)

Innovative mitigation practice In India

www.ebaumsworld.com/pictures/vie...1044894/

A different world in transportation

Brisbane, Australia

Honolulu Airport taxi, Hawaii

Thanks for your kind attention!