

**VIETNAM INSTITUTE OF
METEOROLOGY, HYDROLOGY AND CLIMATE CHANGE**



WATER DISASTER MANAGEMENT AND CLIMATE CHANGE

DUONG HONG SON





CONTENT

- ✓ What is IMHEN?
- ✓ Water Disaster
- ✓ Climate Change
- ✓ Conclusion





IMHEN FOUNDATION

Total: 257

2014 Prof., Assoc. Prof.: 8 PhD: 26 MSc.: 44 BSc., Engineers: 150

2003 VietNam Institute of Meteorology, Hydrology and Environment (IMHEN)
Ministry of Natural Resources and Environment (MONRE)

1977 Vietnam Hydrometeorological Service of Viet Nam (HMS)
Institute of Meteorology and Hydrology (IMH)



Most Likely and Serious Impacts

- More than 3,000 km coast line
- Sea level rises as the key impact

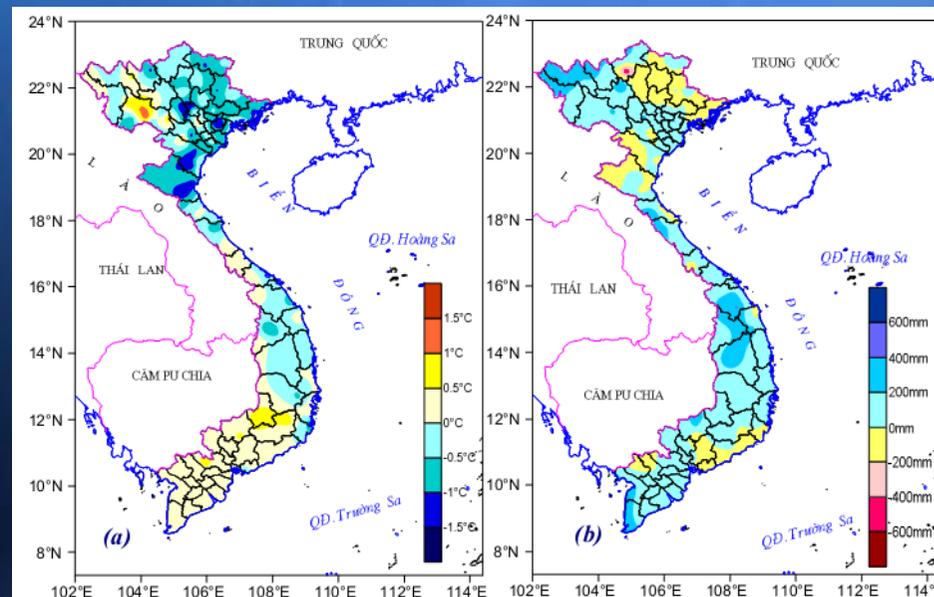


Water disaster management



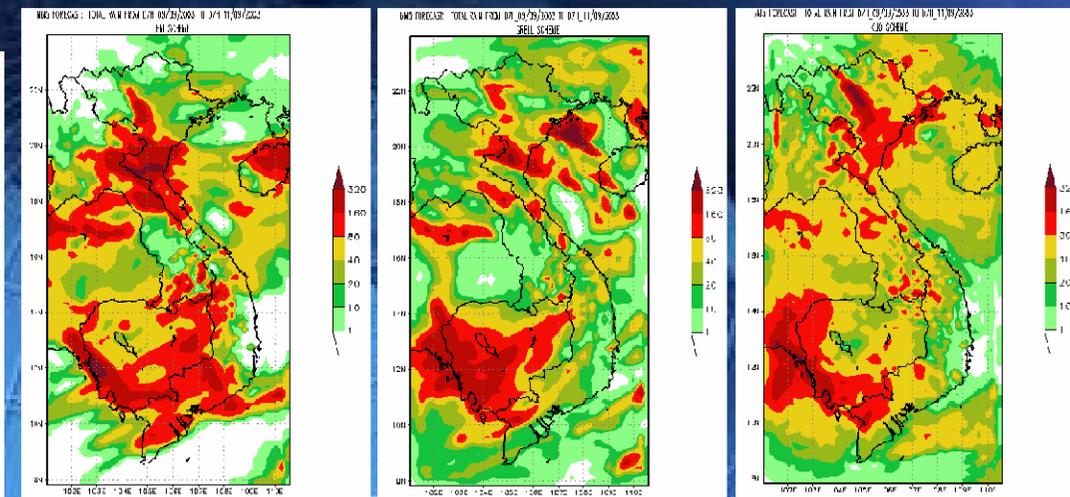
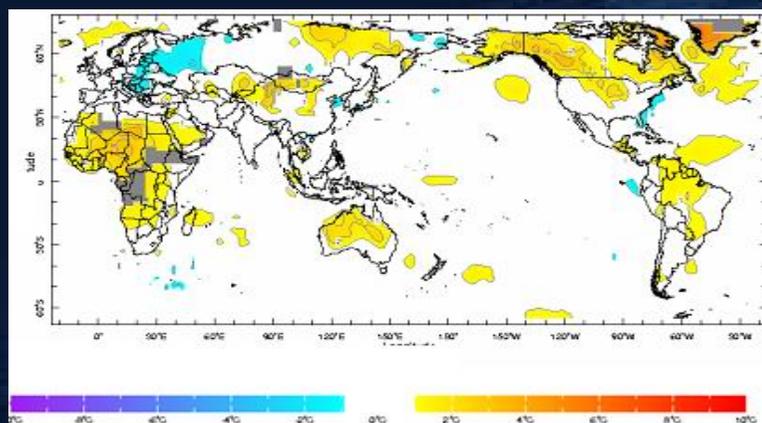
Three month seasonal Tem. and rainfall anomaly predictions

- Seasonal climate bulletin and outlook
- Climate extreme events
- Prevention and mitigation of desertification in the Central Viet Nam
- Drought forecast and warning

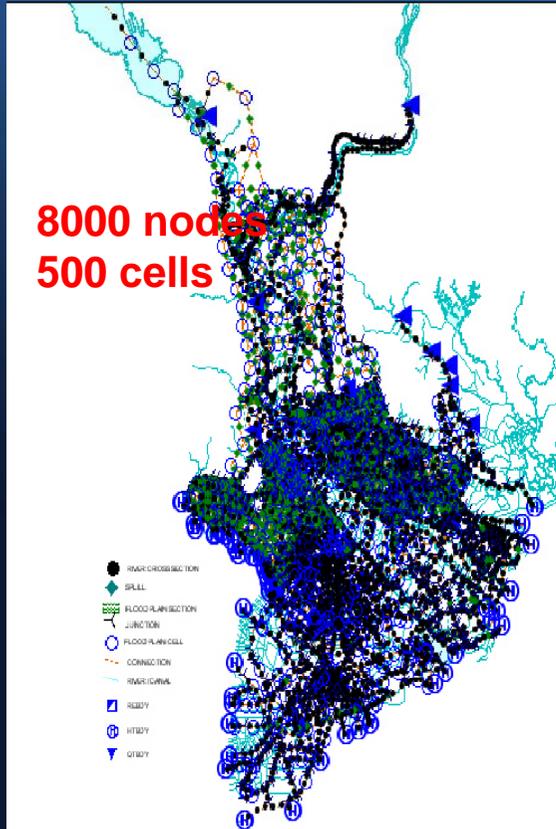


Rainfall forecasts

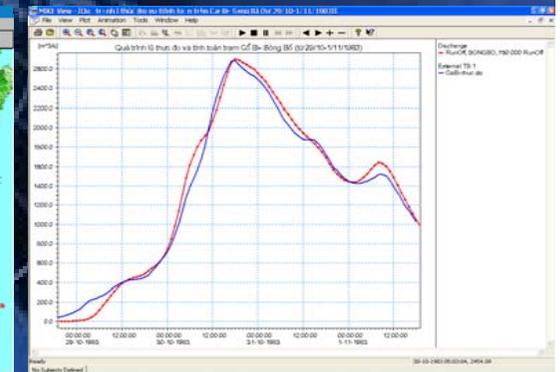
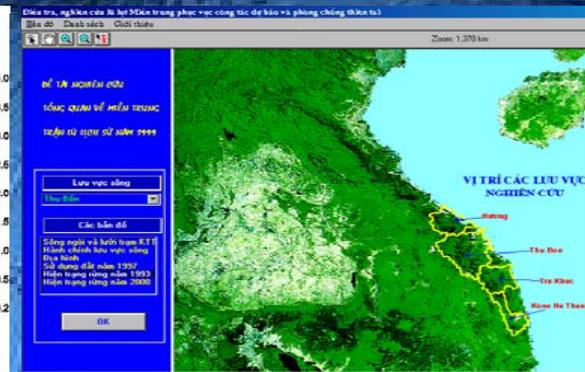
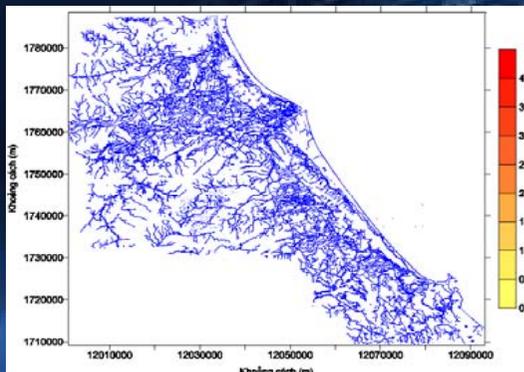
Three months Tem. anomaly prediction



Water disaster management



- Assessment of water balance and water resources for regions and river basins;
- Inland, urban, and watershed hydrology, river-estuary flows interaction;
- Flood/Flash flood/inundation warning, Flood risk and inundation mapping;
- Flood forecasting and management,



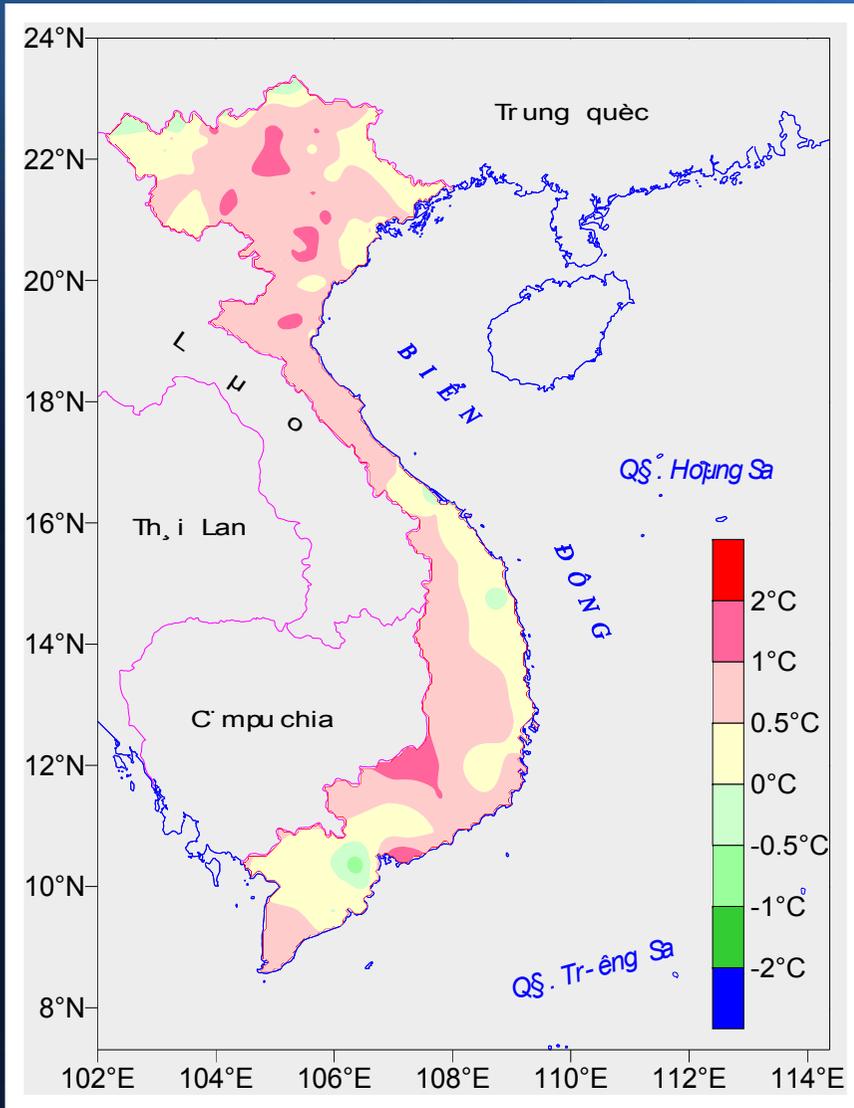
Water disaster management



- Constructing the flood alert level in the main rivers in Viet Nam.
- Applied Research: Mapping the flash flood risk in Northern mountains, drought map in the Central Highlands and South Central, frost map, salinity intrusion
- Research on air and water pollution and proposing the mitigation measures.



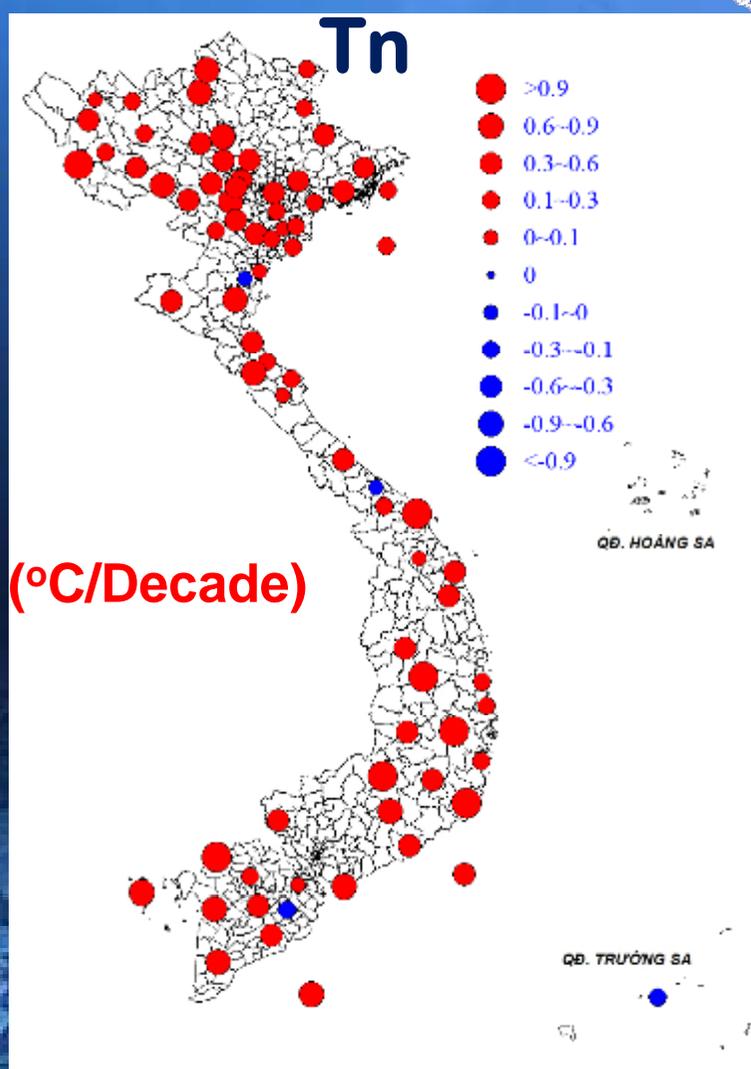
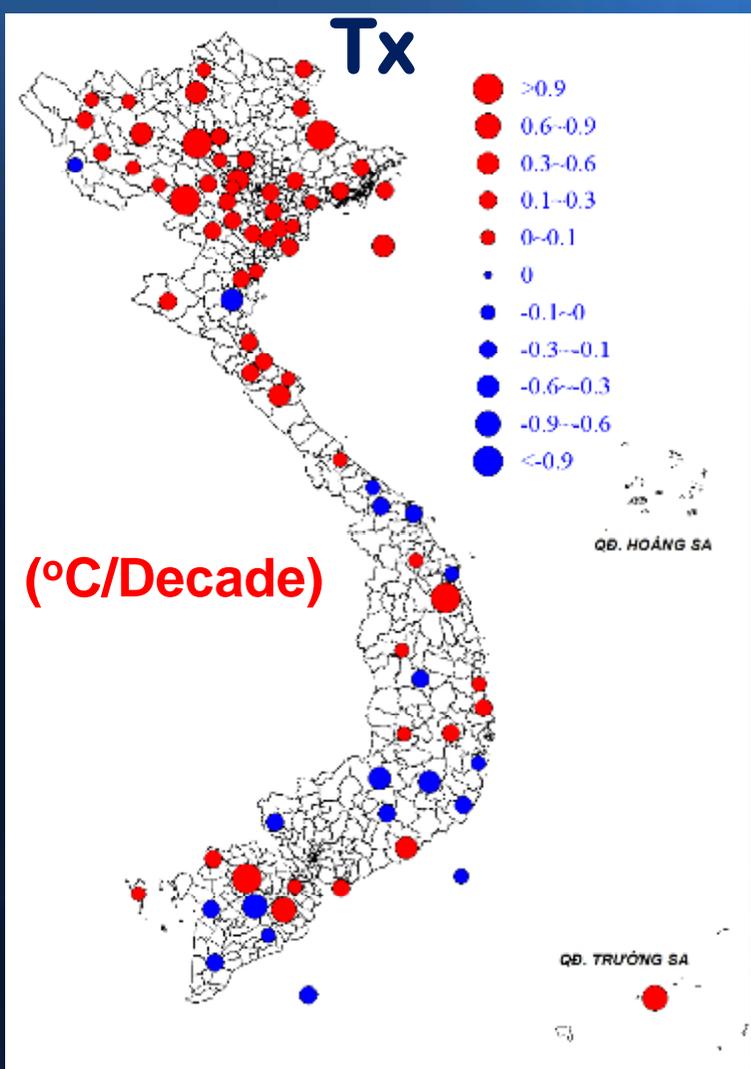
Mean Temperature



Trend of mean annual temperature

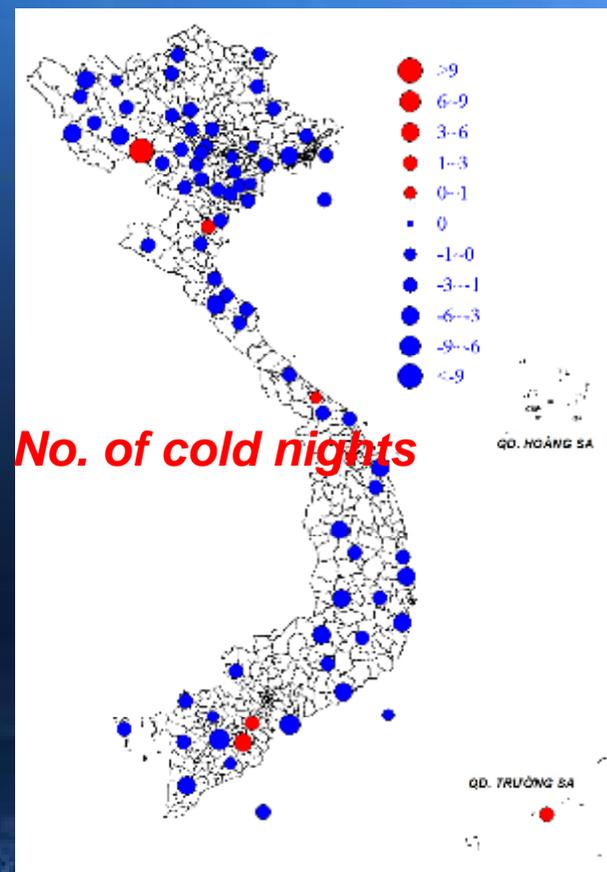
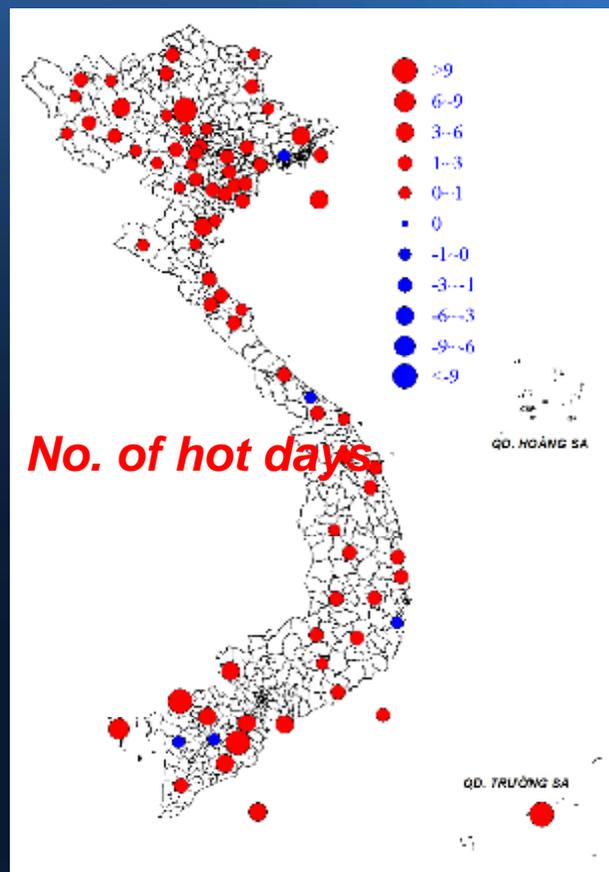
- ✓ Over the past 50 years, annual average temperature has increased 0.5°C.
- ✓ Winter temp increased faster than summer temp.
- ✓ Temp in the North increased faster than in the South.
- ✓ Temp inland increased faster than in coastal areas and islands.

Maximum and Minimum Daily Temperature



Min. temperature has increased more than Max. temperature, particularly over North West, South of North Central, South Central and Central Highlands

Change in No. of Hot Days and Cold Nights



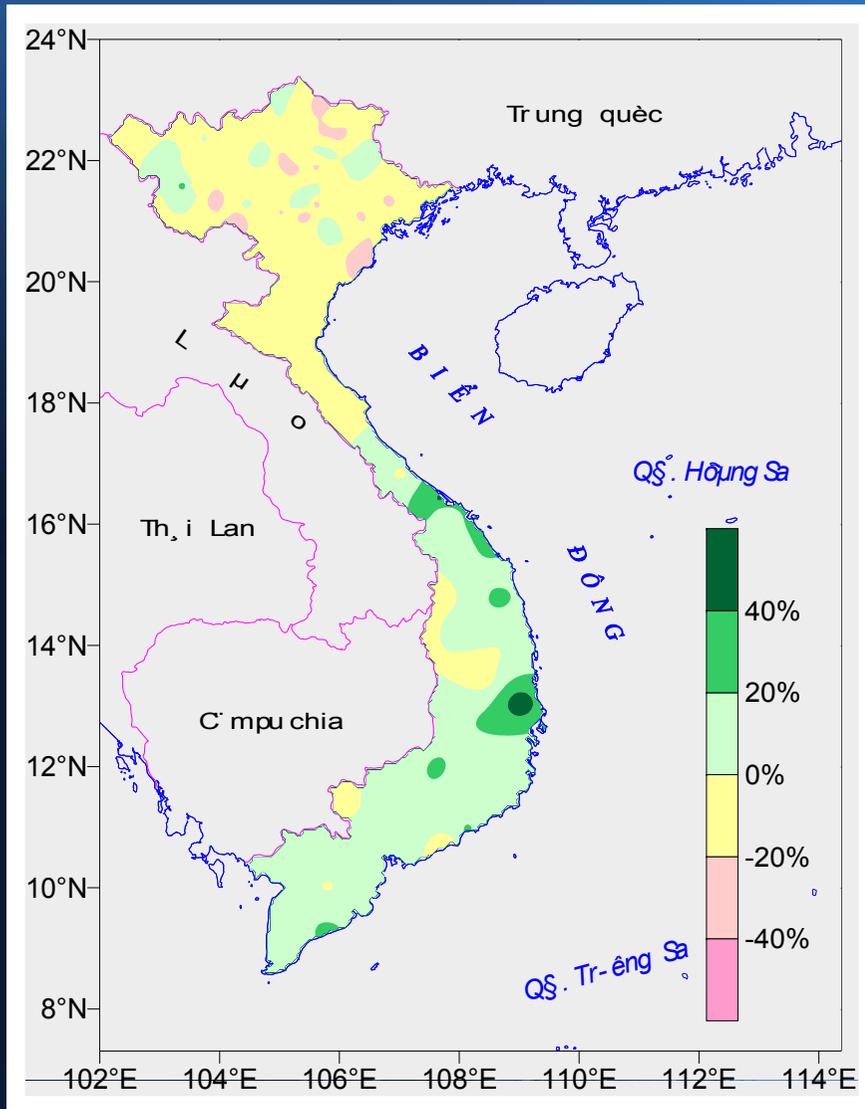
Hot day: Day with Max temp. higher than temp. of 90%

Cold night: Night with Min. temp. lower temp. of 10%

- No. of hot days increases significantly, about 34 day/decade.
- No. of cold night decreases about 11 day/decade (in the South)



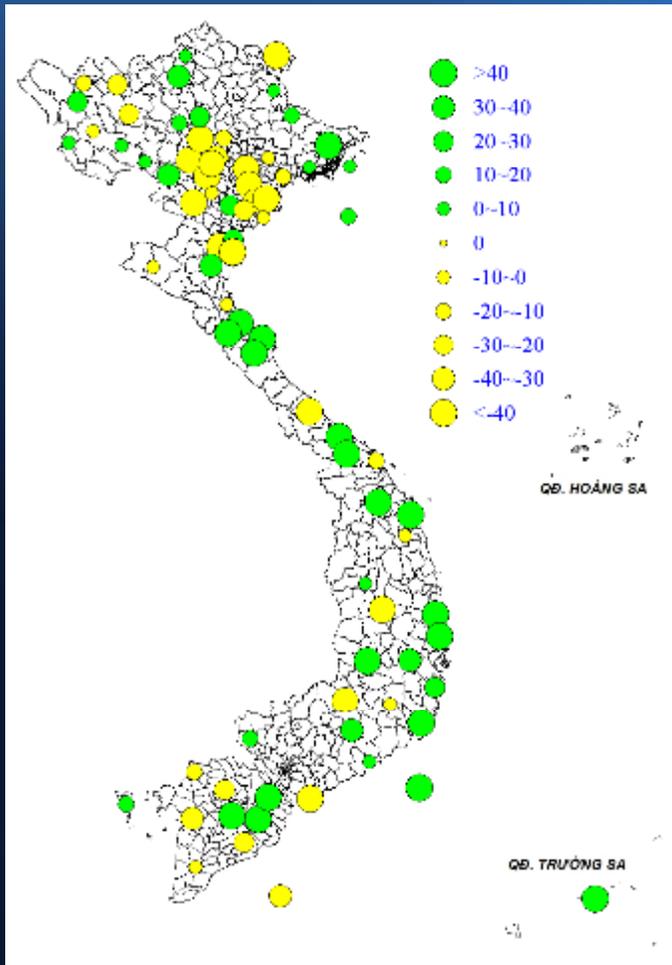
Rainfall



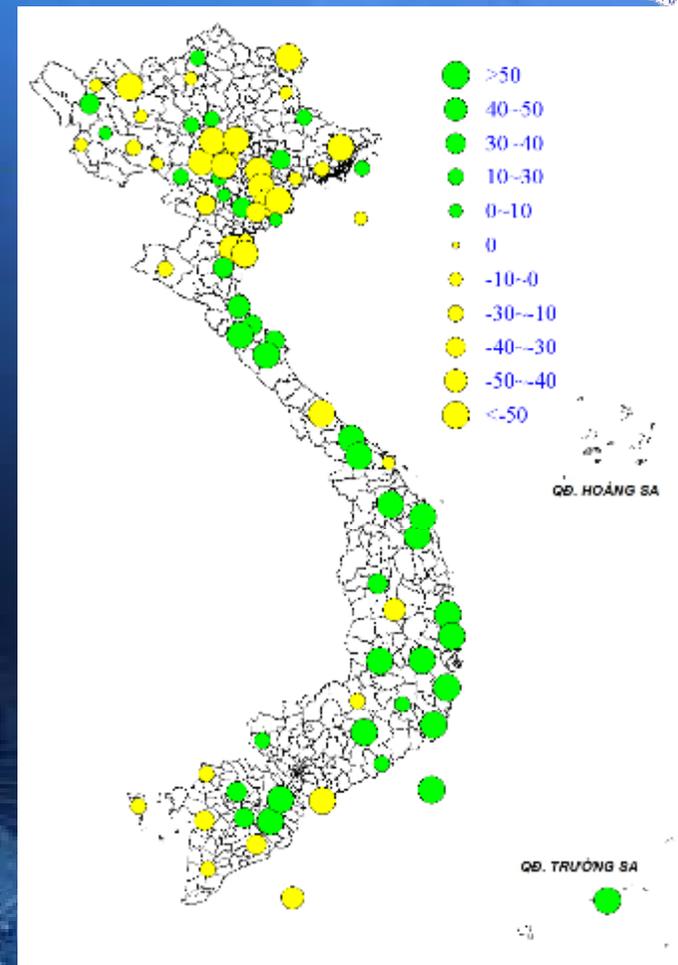
- Annual mean: Decreases in the North; Increases in the South,
- Dry season: Slight change in the North, but increases strongly in the South;
- Rainy season: Decreases 5-10% in the North, increases 5-20% in the South;
- Rainfall in rainy season in Central VN increases stronger than others, up to 20%/50 years;

%) over 50 past years

Extreme Rainfall



Annual maximum 1-day rainfall (mm)

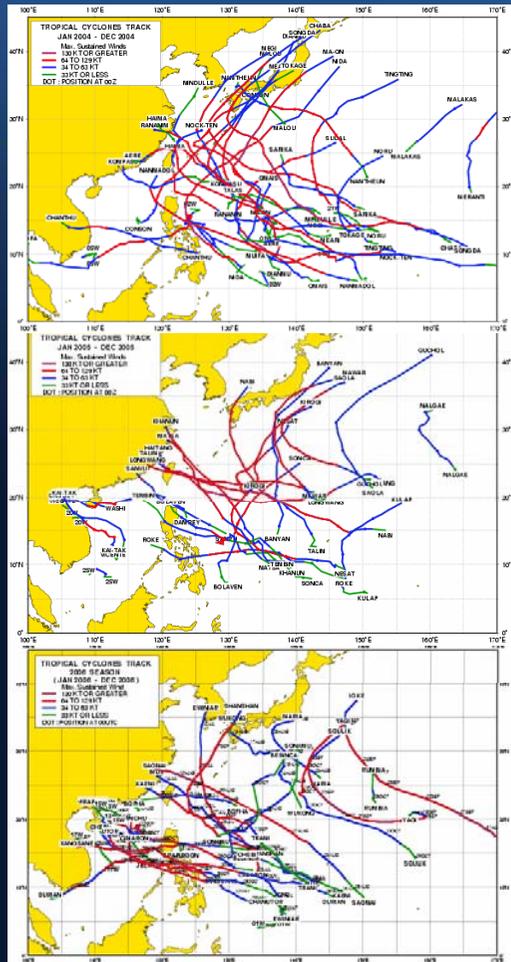


Annual maximum consecutive 5-day rainfall (mm)

- Significant **decrease** in **Northern Delta**, up to 11%/decade
- Significant **increase** in **South Central and Central Highlands**

Tropical Storms

- Frequency: no clear change;
- Frequency of very strong typhoon (> level 12) increased;
- Typhoon track has a tendency of moving southward;
- Typhoon season tends to end later;
- More typhoons with abnormal movement.



Hình 1.11. Bản đồ tần suất XTND hoạt động (a), hình thành (b) ở Biển Đông và ảnh hưởng đến đất liền Việt Nam (c) (Nguồn: IMHEN/2010)



Droughts

- ❖ Droughts occur more frequently, especially with extreme levels.
- ❖ More severe in dry season (2005, 2010-2011, 2013), water levels in rivers, reservoirs reached the minimum levels.



Kông Chro, Gia Lai, 2013 (<http://laodong.com.vn>)

Floods

- ❖ **Red River:** Annual flow has decreased in recent years, but strong floods occur frequently upstreams.
- ❖ **Mekong River:** Sequence of strong floods in 2000, 2001 and 2011, with water level at Tan Chau over 4,5m – increase of hydrological extremes.
- ❖ **Rivers in Central Viet Nam:** Very fast floods with severe damage



Flash Floods



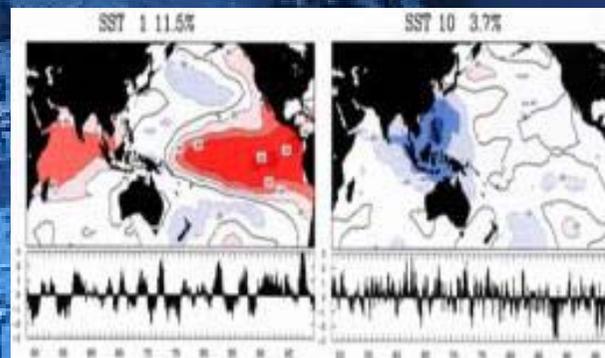
Number of flash floods increased

- 1970 - 1980 : 7 events
- 1981 - 1990 : 8 Events
- 1991 - 2000 : 101 event
- 2001 - 2013 : 182 event

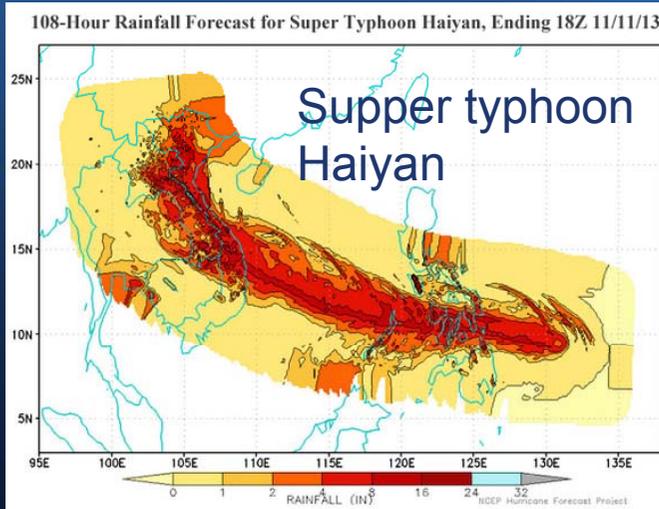


Others Climate Extremes

- Drizzling rain decreased;
- Cold fronts decreased;
- Cold days, damaging cold days decrease, but **extremes cold spells appeared** (2008, 2013, 2014);
- Heat wave increases in central and southern areas;
- Off-season extreme rainfall occure more reqlently;
- ENSO has stronger effects.



Climate in 2013



TET holiday in the North Vietnam

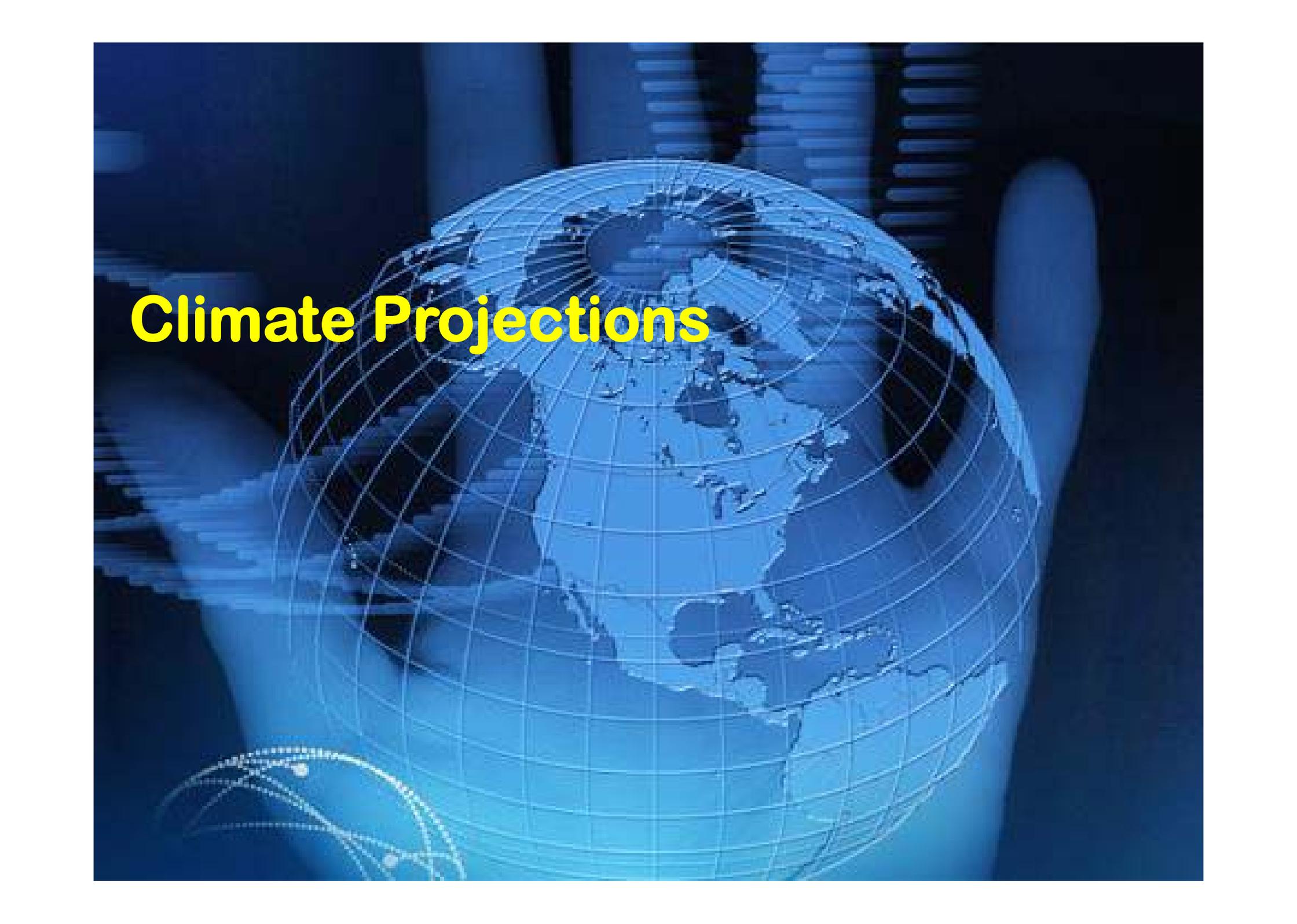
Cold winter season with temp about -40°C in EU, USA



Heatwave in Australia with temp about near 46 °C



Climate Projections

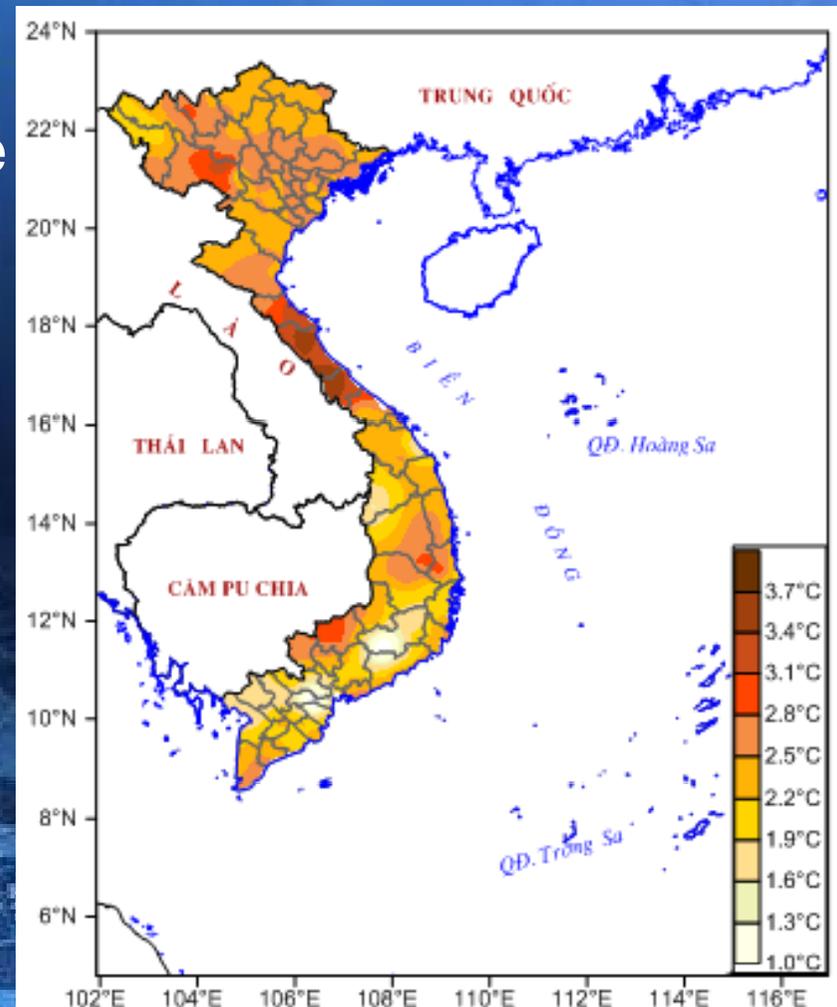
The image features a central globe with a white grid overlay, representing latitude and longitude. The globe is rendered in a light blue color. The background is a dark blue, almost black, space filled with vertical lines and horizontal streaks, suggesting a digital or server environment. In the bottom left corner, there are some faint, glowing white lines and dots, possibly representing data or network connections. The overall aesthetic is futuristic and technological.

Changes in temperature

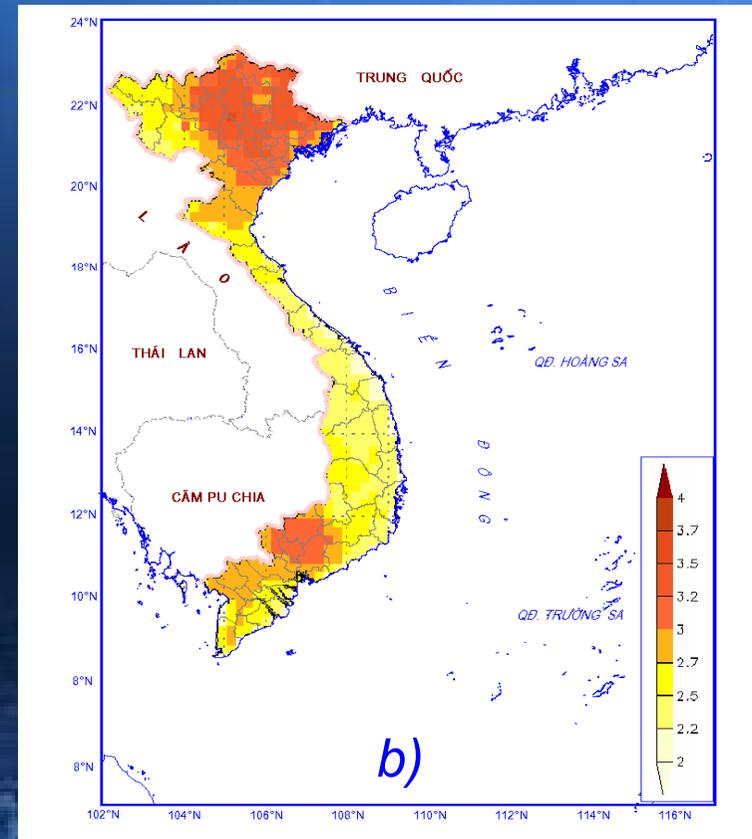
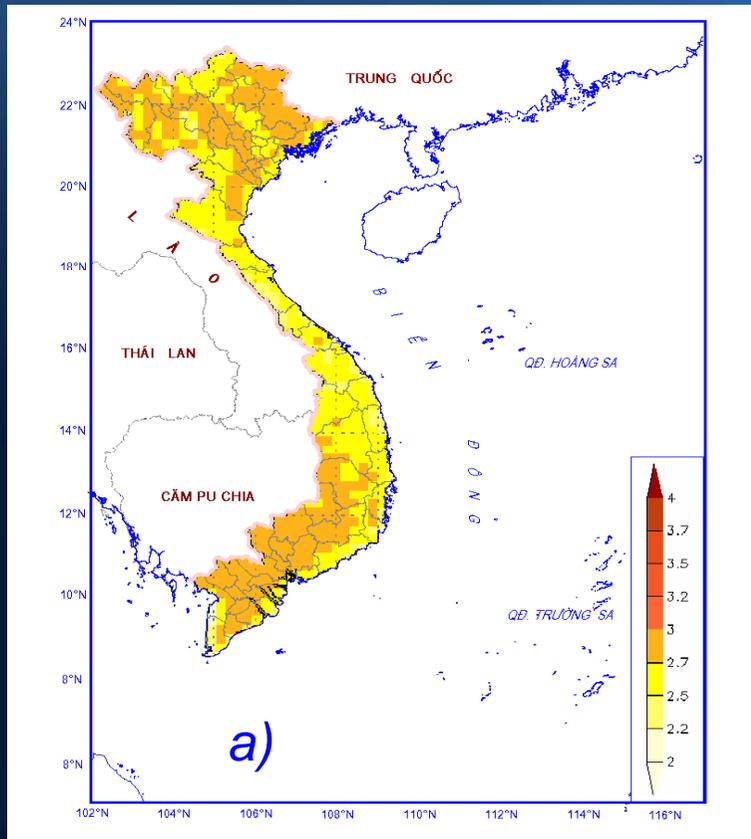


At the end of 21 century by medium emission scenario:

Annual mean temperatures increase by 2-3°C; Hà Tĩnh - Quảng Trị: higher rate.



Change in Max/Min Temperature (compared to 1980-1999)



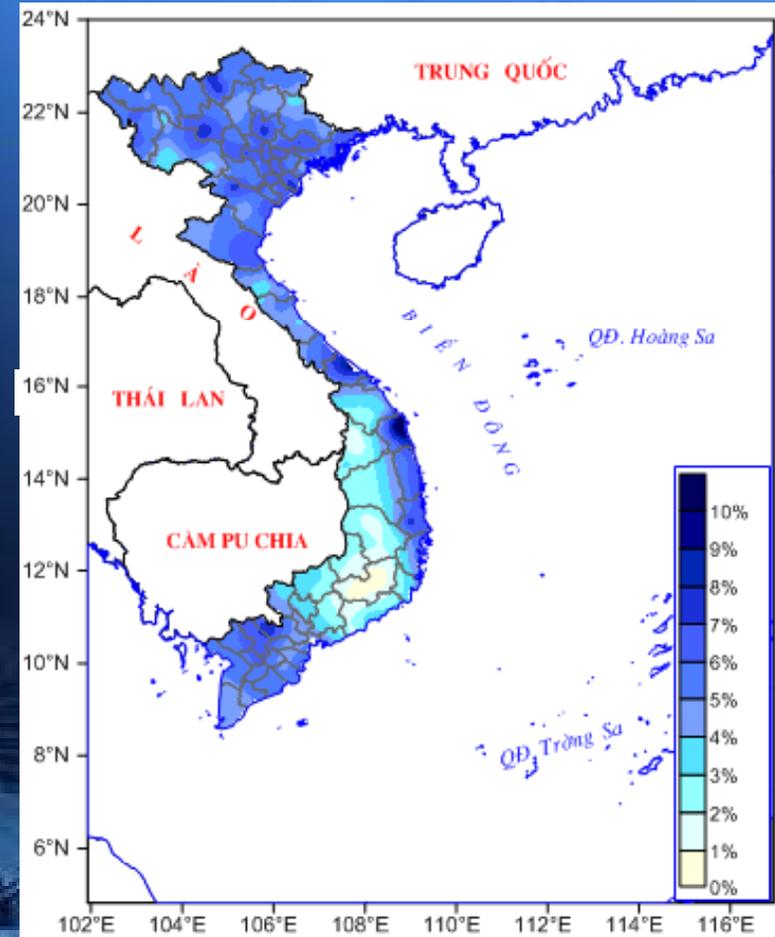
(a) Max. Temperature T_x , and (b) Min. Temperature T_m under B2 scenarios

- T_x is projected to increase about 2.0-3.2°C;
- T_m is projected to increase about 2.2-3.9°C.

Projected Change in Rainfall

At the end of 21 century by medium emission scenario:

- Annual rainfall increases by 2-7%, Central Highlands and South Central:
- Overall seasonal trends: decrease in dry season and increase in wet season.
- Maximum daily rainfall increases in the North Delta, North Central but decreases in South Central and Central Highlands.

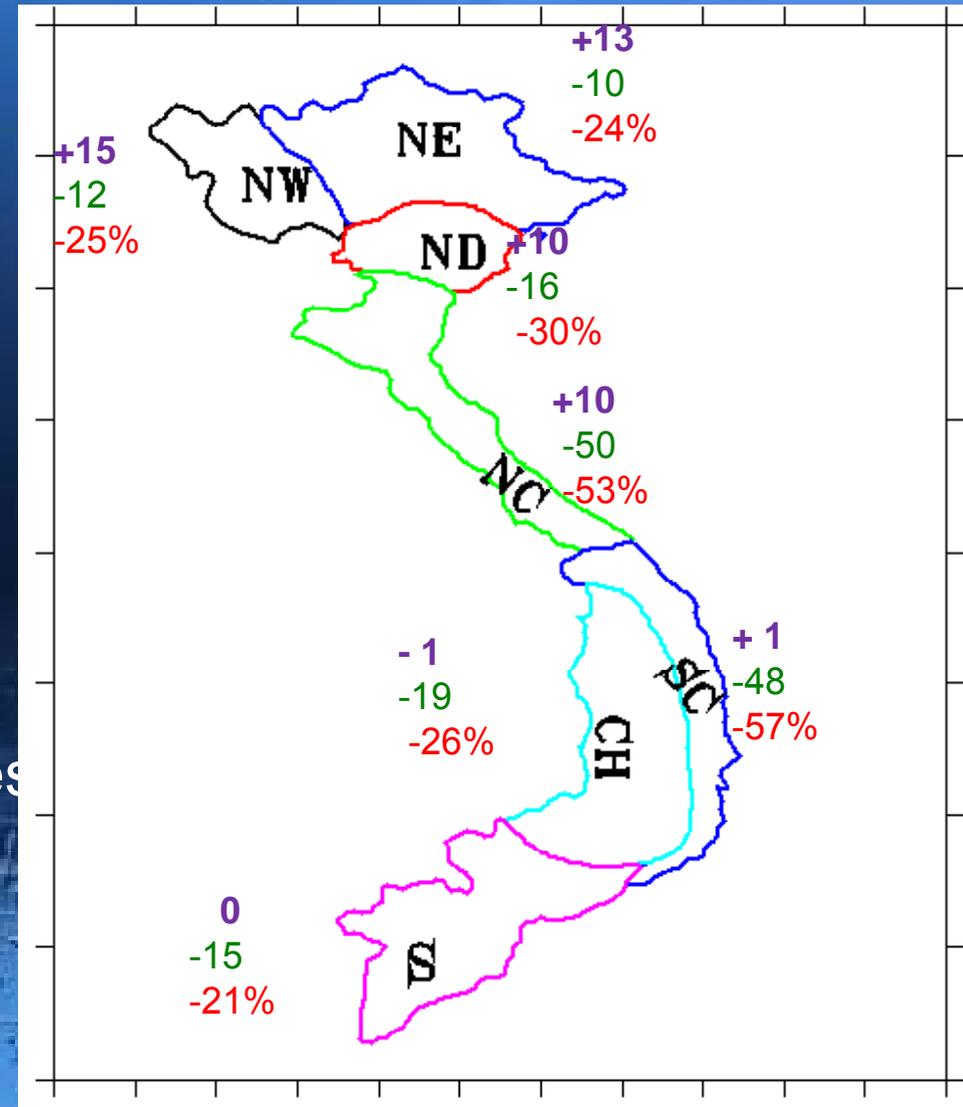




Summer Monsoon

Change by end of century

1. Onset date (days) unchanged in the South, about 12 days later in the north
2. Duration (days) becomes shorter from 10 days to 3 weeks and up to 1.5 months for North Central and South Central.
3. Rainfall intensity (%) decreases by more than 50% for North Central and South Central.

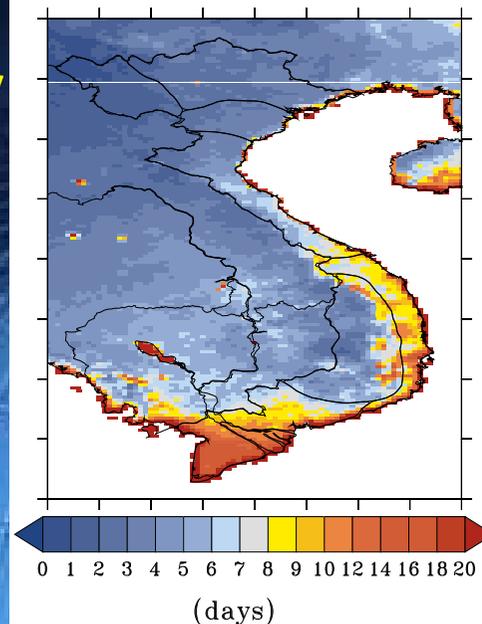
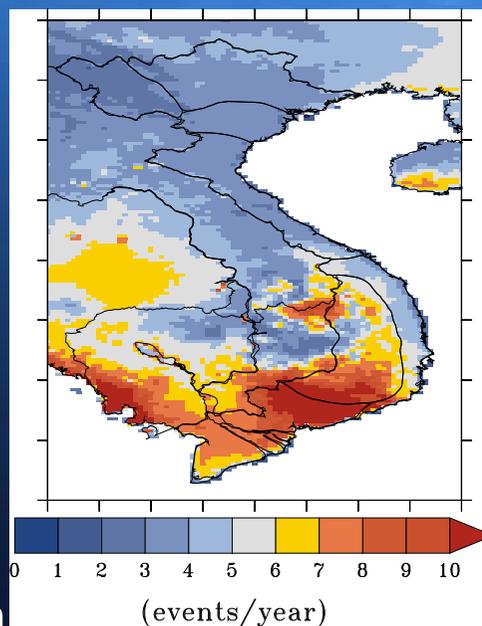




Changes in Heat Wave

Heatwave = at least 5 consecutive days with extreme Temperatures (95th percentile daily maximum)

1. Increase in **frequency** and **duration** over whole Vietnam
2. Largest increase in **frequency** in Central Highlands and South
3. Largest increase in **duration** in South and South Central



Number of Heatwaves

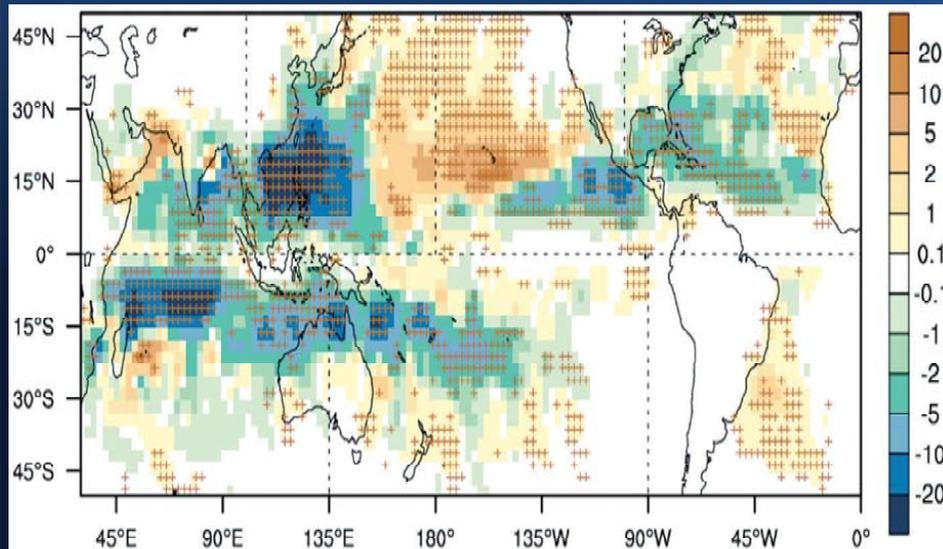


Length of Heatwaves



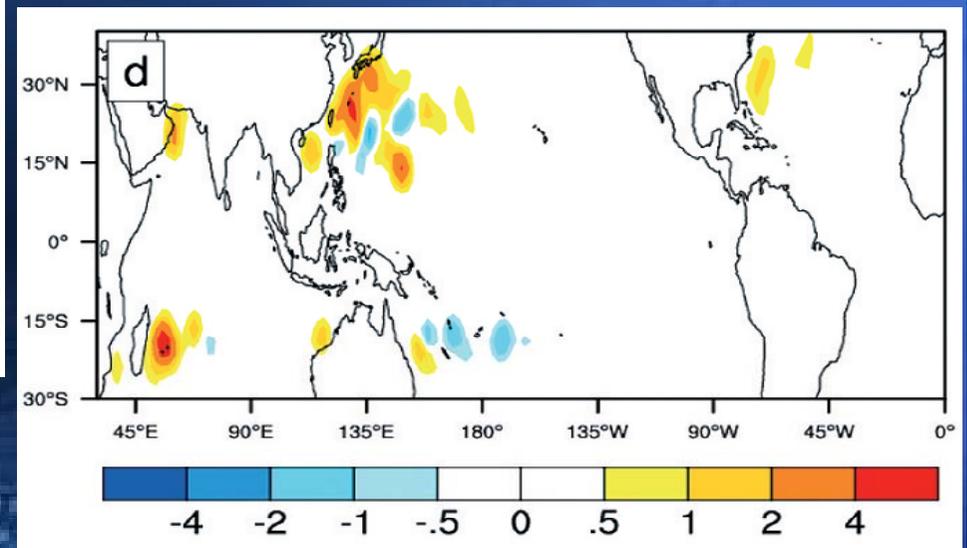
Change in Typhoons

No. of tropical cyclones decreases



Change in TC frequency by the end of century (TC/25 years)

Strong tropical cyclones increases



Change in strong TC ($V_{max} > 70 \text{ m s}^{-1}$) by end of the century



CC Scenarios

Temperature

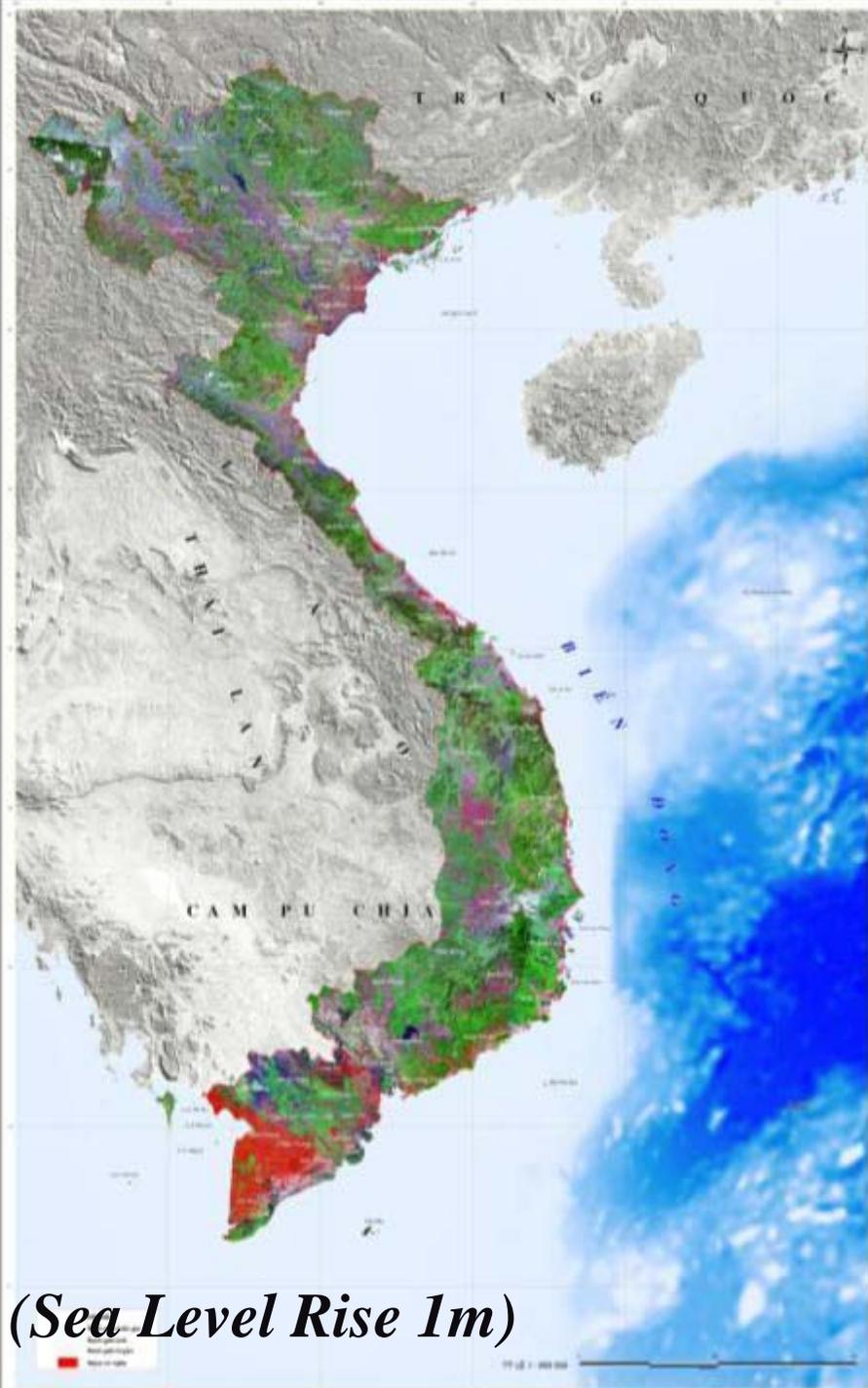
- Low scenario (B1): 1,6 - 2,2°C
- Medium scenario (B2): 2 - 3°C
- High scenario (A1FI): 2,5 - 3,7°C

Sea Level Rise

- Low scenario (B1): 49-64cm
- Medium scenario (B2): 57-73cm
- High scenario (A1FI): 78-95cm

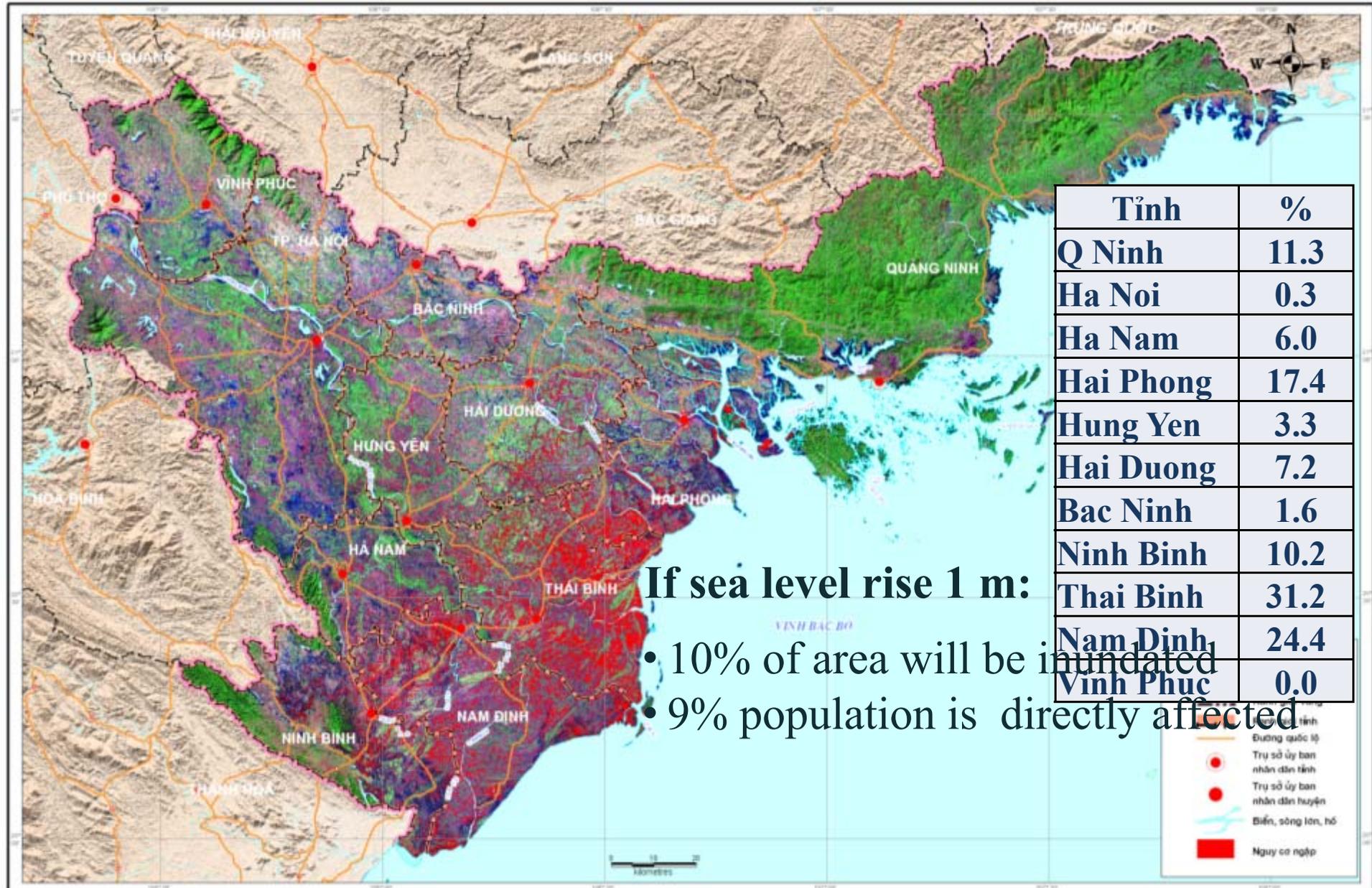
If sea level rise 1 m:

- 39% of Mekong Delta, 10% of Red River Delta, 2,5% of coastal area of the Central, 20% of HCM city will be inundated
- 35% population of Mekong Delta, 9% population of Red River delta, 9% population of the Central, 7% population of HCM City are directly affected.



(Sea Level Rise 1m)

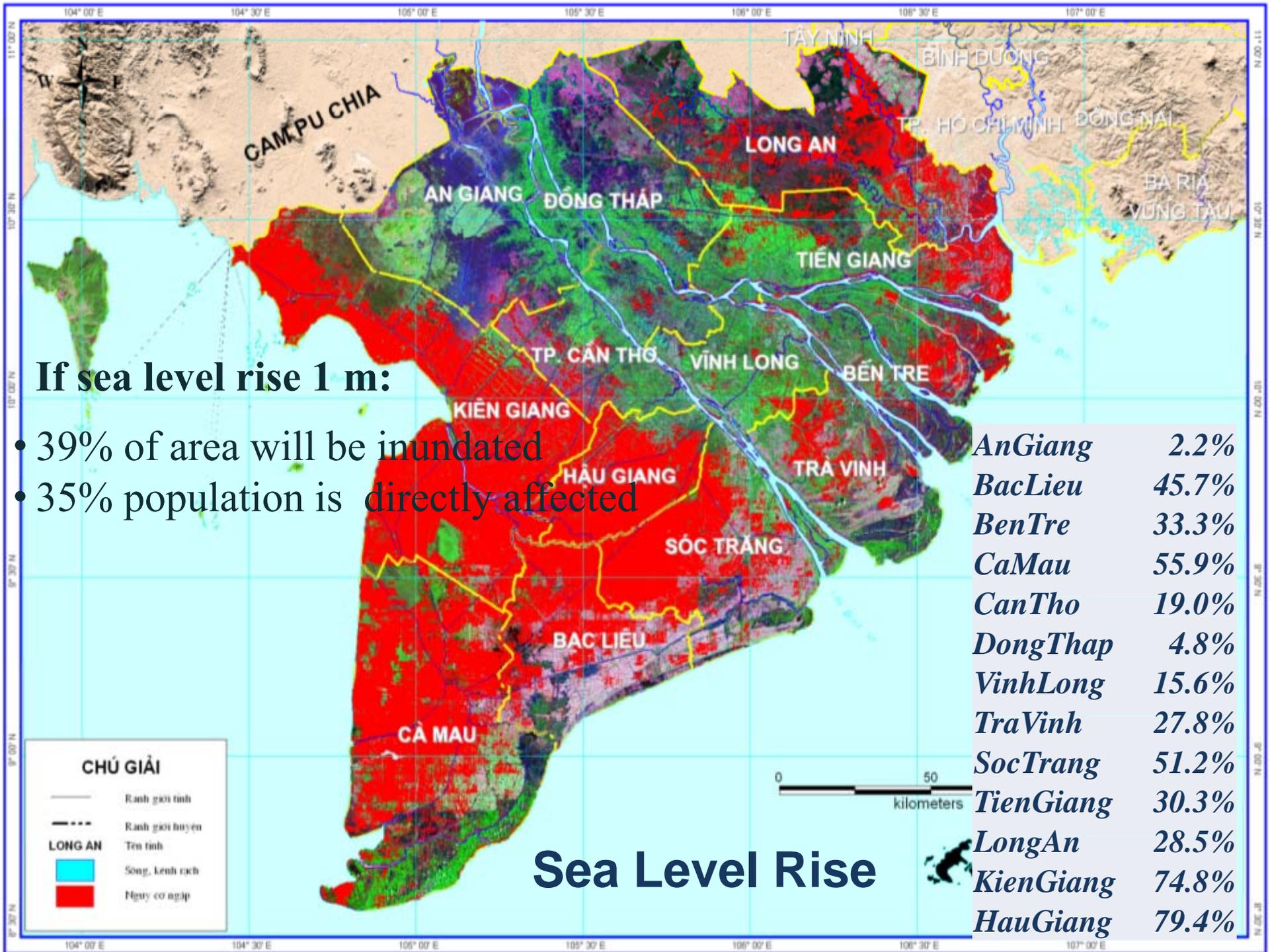
Red River Delta



Tỉnh	%
Q Ninh	11.3
Ha Noi	0.3
Ha Nam	6.0
Hai Phong	17.4
Hung Yen	3.3
Hai Duong	7.2
Bac Ninh	1.6
Ninh Binh	10.2
Thai Binh	31.2
Nam Dinh	24.4
Vinh Phuc	0.0

If sea level rise 1 m:

- 10% of area will be inundated
- 9% population is directly affected



If sea level rise 1 m:

- 39% of area will be inundated
- 35% population is directly affected

Climate Change SEA WATER LEVEL RISE SCENARIOS AND POSSIBLE DISASTER RISK REDUCTION IN VN



Funding: DANIDA, Implementing: IMHEN

IMPACT OF CC ON WATER RESOURCES AND ADAPTATION MEASURES,

Funding: DANIDA,
Implementing: IMHEN

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

Sea Level Rise Impacts

Backgrounds

cities such as Ho Chi Minh, Da Nang, Vinh, Phu Thiet, Vinh Tan. The most fertile agricultural lands, with about 70% of the population, are located on the low-lying Red River and the Mekong River Deltas.

Vietnam has more than 3200km shore line with two fertile deltas of Red River Delta and Mekong River Delta. There are 24 coastal provinces, including large

Objectives:

- Assess the knowledge on the SLR in Vietnam
- Study SLR adaptation measures for the local and most vulnerable communities
- Prepare to the Vietnam government the appropriate feasible utilization of the resources of the coastal areas.

Vulnerability Studies

Study the SLR scenarios for the 21st century. The study area is divided into 10 zones based on the elevation and the distance from the coast. The study area is divided into 10 zones based on the elevation and the distance from the coast.

Next Steps:

- Feasibility studies
- Economic
- Socio-Economic
- Environmental and Management
- Cost-Benefit Analysis of adaptation measures
- Risk Analysis and Management
- Prepare Adaptation Measures to the Government

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT
VIET NAM INSTITUTE OF METEOROLOGY, HYDROLOGY
AND ENVIRONMENT (IMHEN)

Project "Climate Change Impacts on Water Resources and Adaptation Measures"

Study Area: Vietnam

Legend:

- Temperature
- Precipitation
- Sea Level Rise
- Water Conservation
- Afforestation
- Water Management
- Water Conservation
- Afforestation
- Water Management



Concluding Remarks

- Climate change has contributed to the increase of climate related disasters (storms, floods/inundations, flash floods, droughts,...) which are more changeable in magnitude and difficult to predict.
- Projected Average temperature increases: 2-3°C (2.5 - 3.7°C).
- Projected Sea level rise: 57-73cm (78-95cm).
- Increase in demand for climate and climate change information.
- Translating climate and climate change information into actions appropriate for sectors/locations is an urgent need.





**Thank you
for your attention!**