HoChiMinh University of Transport

RIVER TRANSPORT IN MEKONG RIVER DELTA AND THE ADVERSE EFFECT OF CLIMATE CHANGE

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Contents

1- The Mekong and Mekong delta

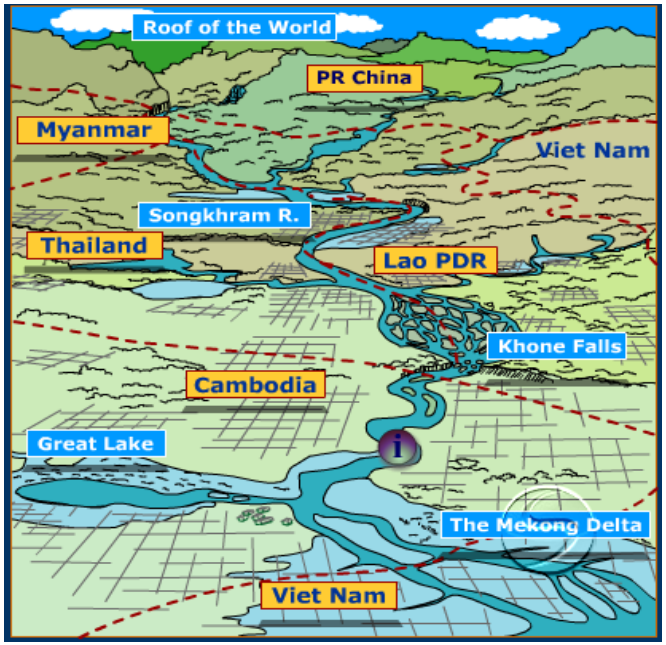
- The Mekong is the world's 12th-longest river and the 7th-longest in Asia. Its estimated length is 4,350 km (2,703 mi),and it drains an area of 795,000 km2 (307,000 sq mi), discharging 475 km3 (114 cu mi) of water annually. (*source: Mekong river commission, state of the Basin Report, 2010*")
- From the Tibetan Plateau this river runs through China's Yunnan province, Burma (Myanmar), Laos, Thailand, Cambodia and Vietnam.
- In 1995, Laos, Thailand, Cambodia and Vietnam established the River Commission's resources. In 1996 China and Burma (Myanmar) became "dialogue partners" of the MRC and the six countries now work together within a cooperative framework.

1- The Mekong and Mekong delta

Table 1: Basic data on country share of basin territory and water flows

	China	Myanmar	Lao PDR	Thailand	Cambodia	**Vietnam**	Total
Area in Basin (km,^{2})	165,000	24,000	202,000	184,000	155,000	**65,000**	795,000
catchments % of MRB	21	3	25	23	20	**8**	100
Flows % of MRB	16	2	35	18	18	**11**	100

1- The Mekong and Mekong delta



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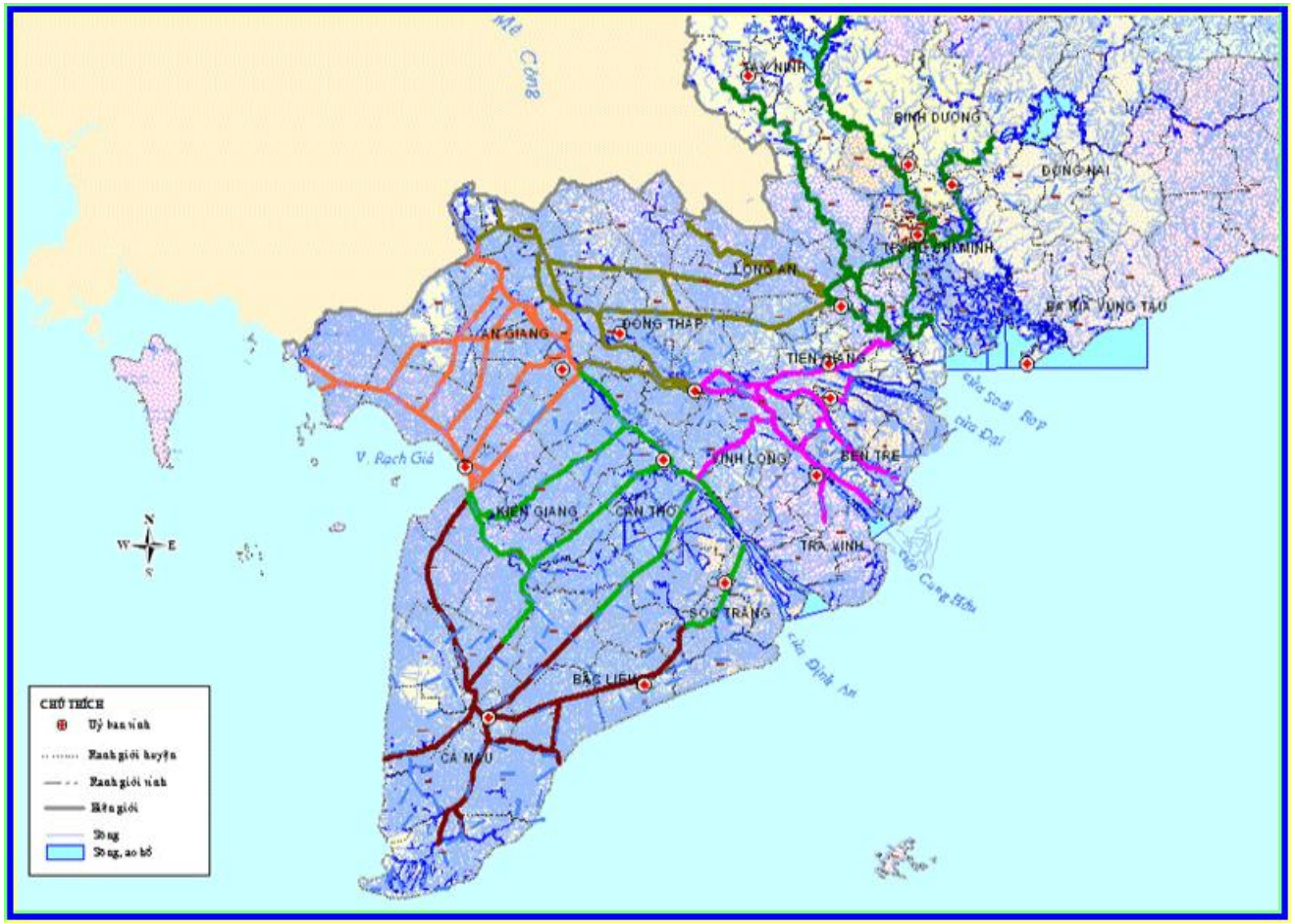


2- The current river transport in Mekong delta and tendency of development

Saigon Port

2- The current river transport in Mekong delta and tendency of development

Bridges on rivers

Small ports, markets

2- The current river transport in Mekong delta and tendency of development

River Transport volume of Vietnam B.03

Hạng mục	Unit				2010 and forecast for 2020	
			2005		2010	2020
Transport volume						
1. Good	10^6Ton		14		90	190-210
2. passenger	10^6 peoples		90		240	530-540

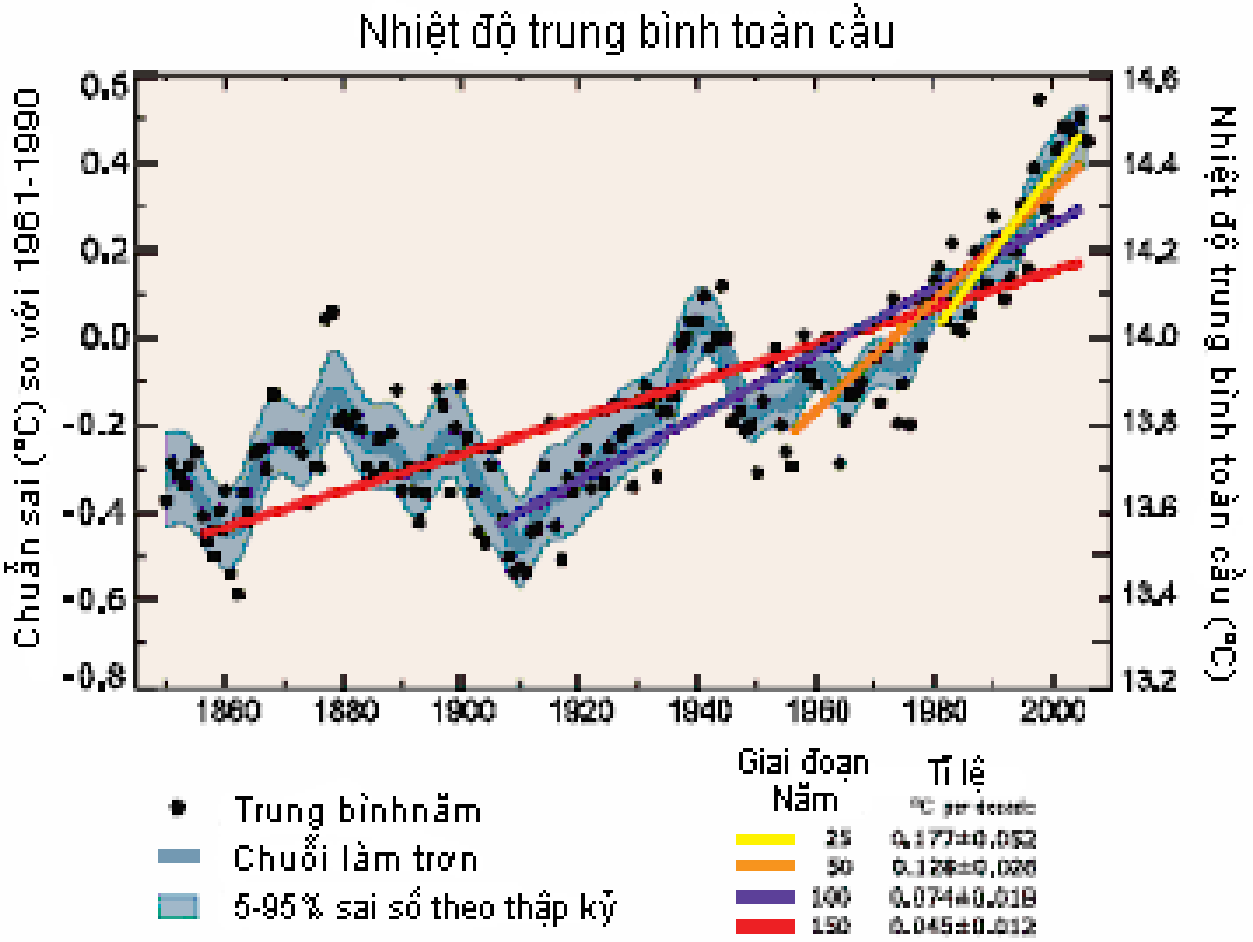
Source: "Toàn cảnh Giao thông VT Việt nam", tr.123-125

2- The current river transport in Mekong delta and tendency of development

Ports capacity in Mekong Delta (current 2010 and plan 2020)

TT	Port name	Unit	Capacity		Port type
			2010	2020	
1	Vĩnh Long Port	10^3 Tone	700	950	Mix
2	Cao Lãnh Port	"	700	1.150	"
3	Long Xuyên Port	"	850	1.400	"
4	Cà Mâu Port	"	390	470	"
5	HCM city Port	"	1.500	2.400	"
6	Cần Thơ Port	"	1.200	1.700	"
7	HCM New Ports group	"	2.000	3.000	"

3 - Climate change and the adverse effects to the river transport in Mekong del ta



According to IPCC (2007): average temperature increase by 0,74^{o}C in 1906 – 2005

Last 50 years it increased double in compared with 1906-1955

3 - Climate change and the adverse effects to the river transport in Mekong del ta

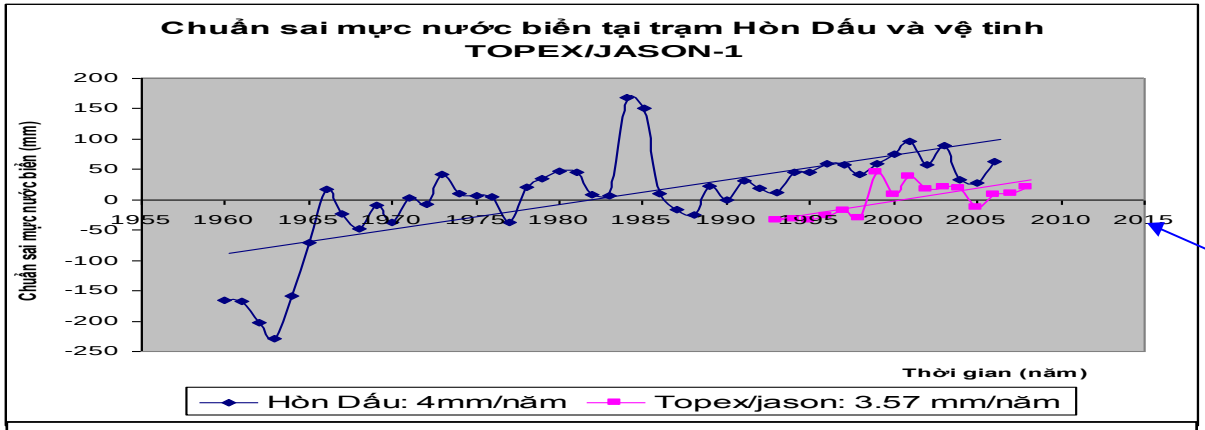
ViệtNam is 1 of 5 countries most effected by GCC and Mekong river Delta is on e of 3 river deltas which most effected

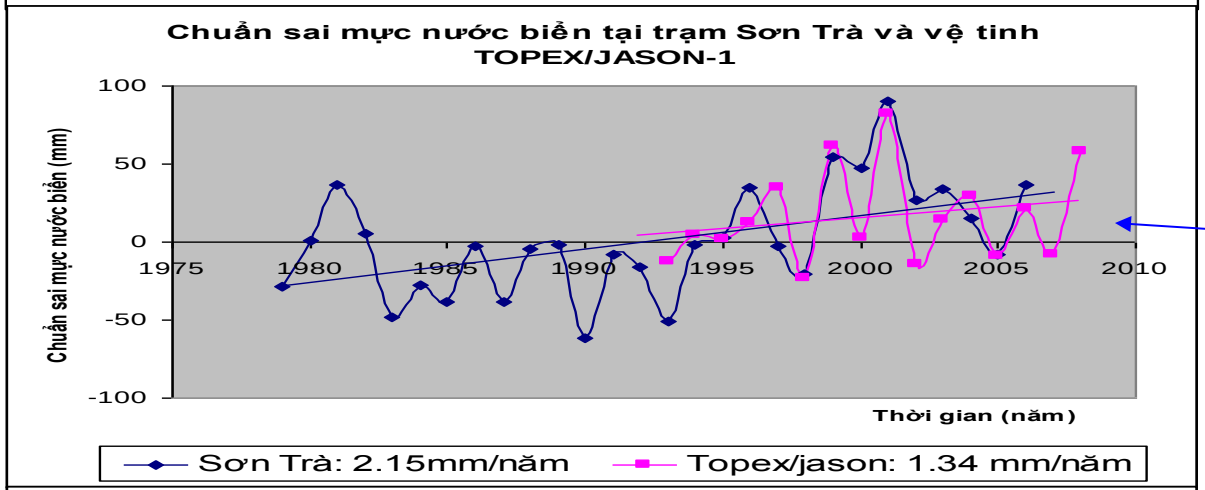
3 - Climate change and the adverse effects to the river transport in Mekong del ta

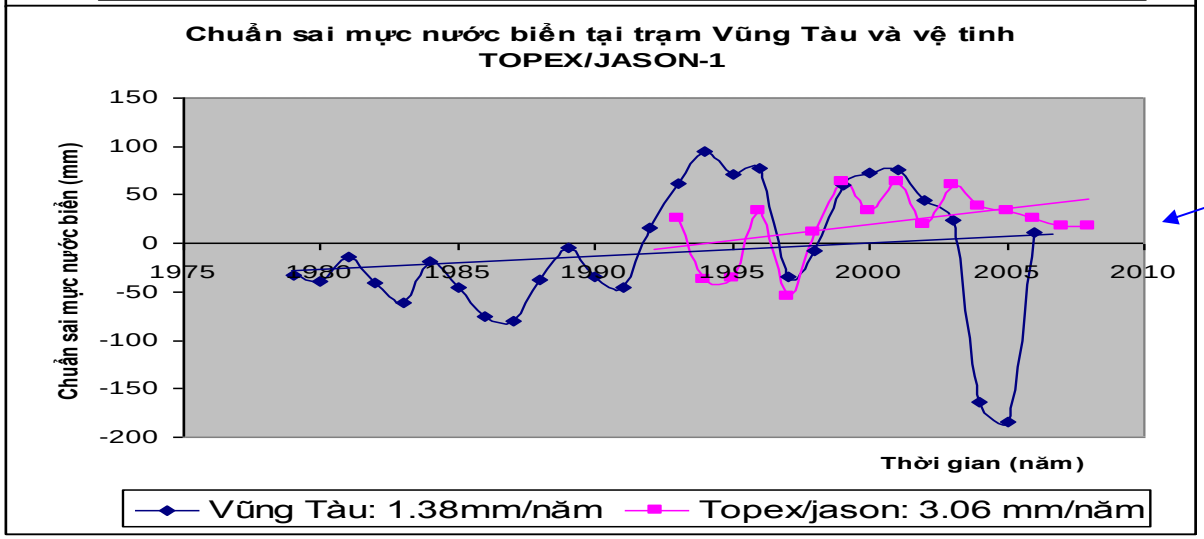
Flooded in HàTĩnh province , ViệtNam

3 - Climate change and the adverse effects to the river transport in Mekong del ta

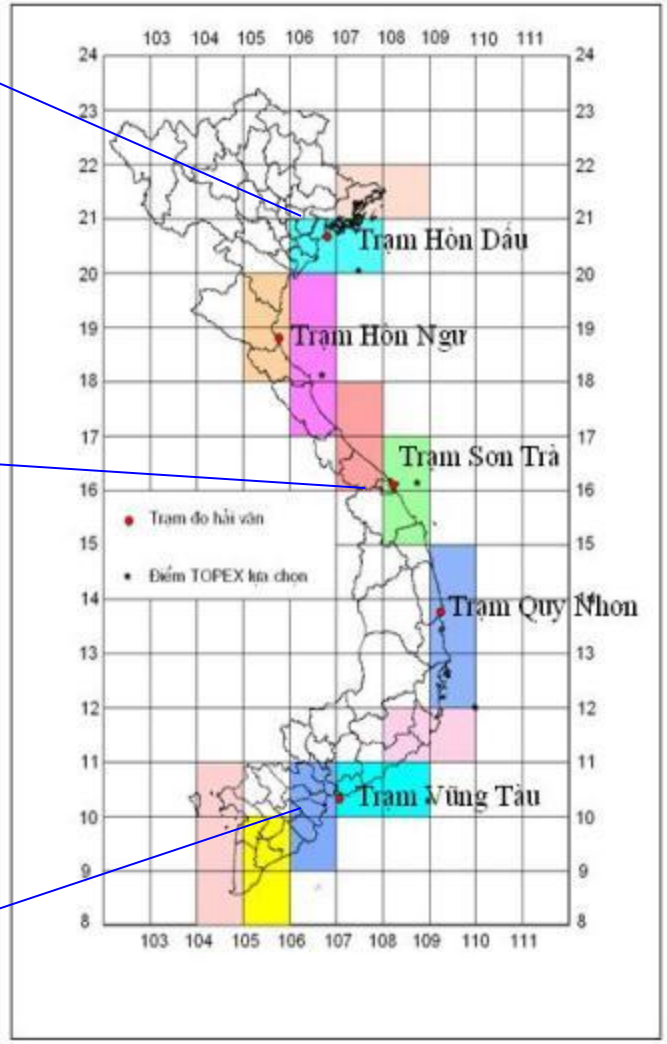
- Number of hot sunny days in 1991 - 2000 increasing, in Middle and South VN
- Rain in out of season, heavy rain is more often in region







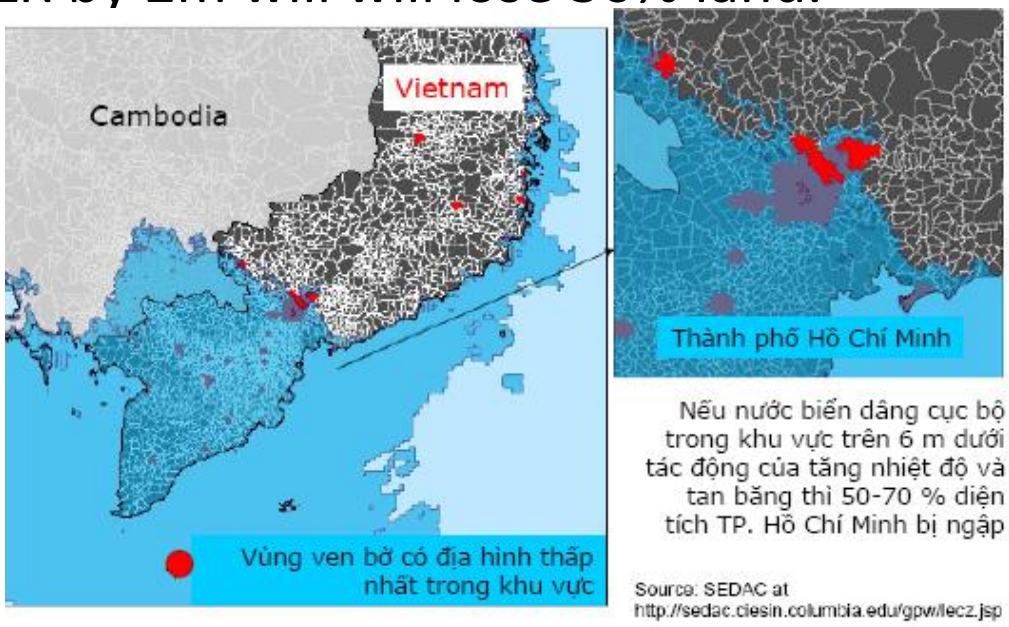
Data of satellite and in several observing station is differ



Average sea level rise in VN 3mm/year

Effect to coastal areas and river sides

- Mekong river, Hồng river and main rivers in Middle of VN
- If the water level rise by 6m most area of Mekong delta is flooded, 50-70% of HoChiMinh city is under the water level.
- Mekong river delta have 34.300 km2 area, if the SLR by 0.2-0.6m we will lose 5% land area, affect more than 10 million people, if SLR by 2m will will lose 50% land.



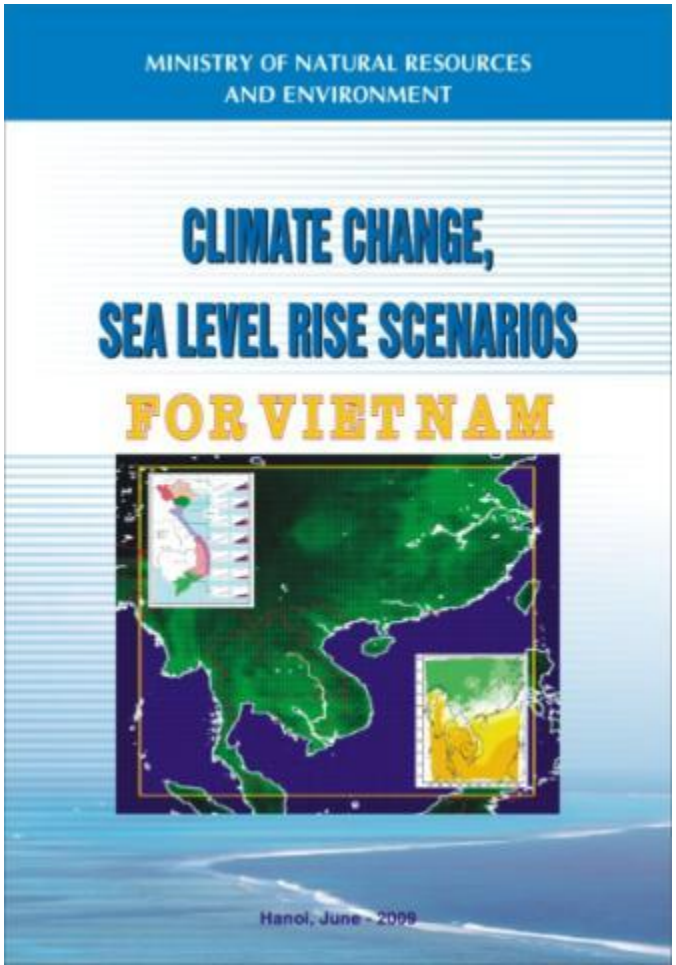
Source: First national report

4- Hydraulic model for river transport in Mekong delta

MODELING AND FORCAST OF WATER LEVEL ON MAIN RIVER IN MEKONG DELTA

- Investment in 7 main rivers in Mekong delta
- Forecast river water level based on sea water level (Ministry of Natural Resources and Environment-MONRE sea level rise scenario) in rain season and in dry season

Climate change, Sea Level rise Scenarios for Vietnam of MONRE



Main Contents of Climate change, Sea Level rise Scenarios of MONRE:

According to the world industry development situation, temperature, methodology and tendencies of development,

The sea level rise will modeled with 3 scenarios:

sea level rise

sea level rise

sea level rise

Time: (2010 -2100).

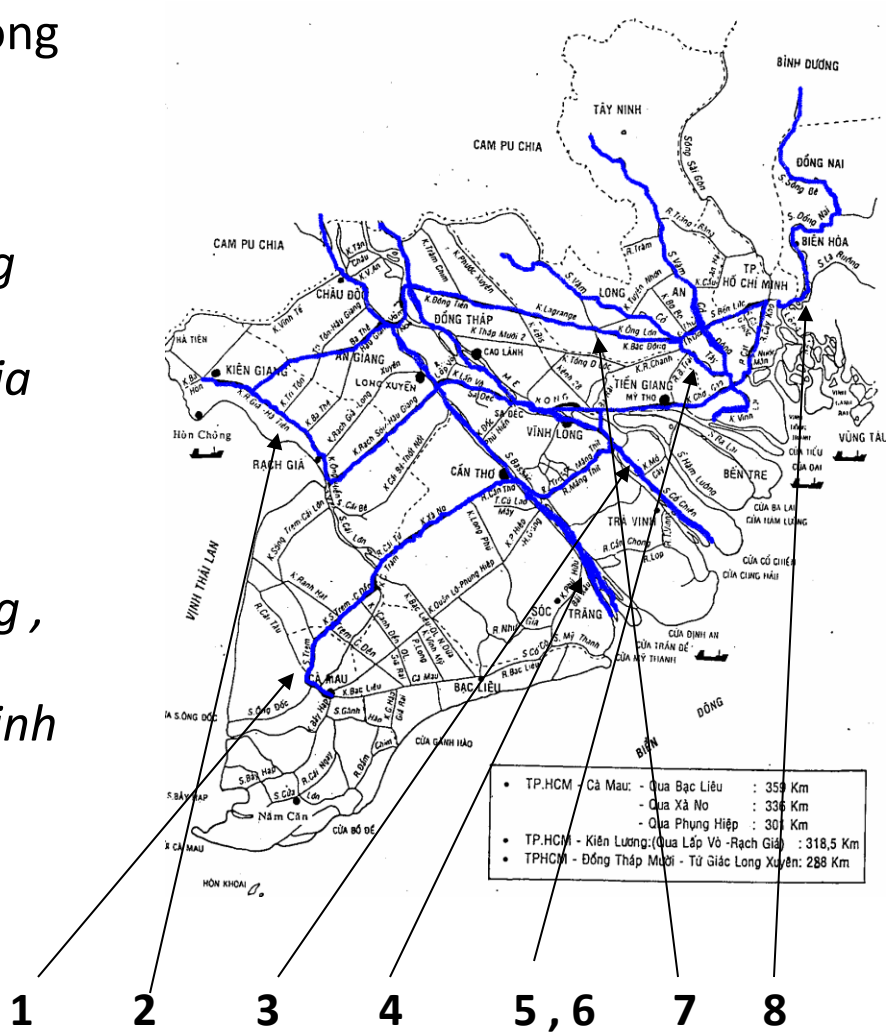
Scenarios

- Normal B2:
- In the middle century 21 the rise of sea level 25-30cm.
- In the end of century 21 the rise is 62-82cm compare with 2000.
- **For Mekong delta:**

Sea level rise scenarios	Century 21								
	2020	2030	2040	**2050**	2060	2070	2080	2090	**2100**
Low (B1)	7-10	10-15	14-21	**18-28**	22-36	26-45	30-54	33-63	**35-72**
Normal (B2)	9-10	13-15	19-22	**25-30**	32-39	39-49	47-59	55-70	**62-82**
High (A1FI)	9-10	14-15	20-23	**28-32**	38-57	48-57	60-72	72-88	**85-105**

The Main Rivers in Research

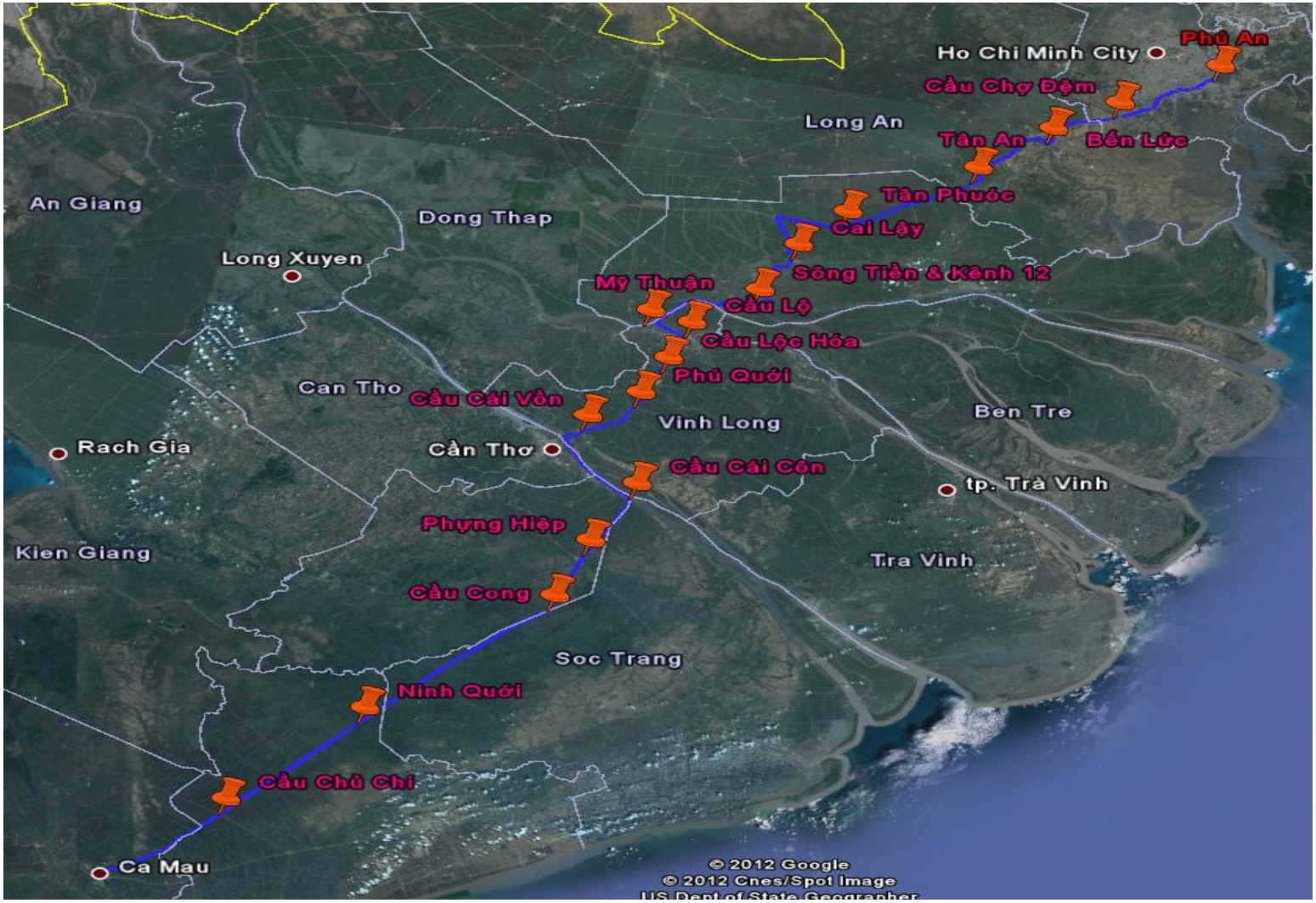
- The main water transport lines in Mekong Delta: (rivers and river valleys):
- *+ River 1: Hồ Chí Minh city - Cà Mau province*
- *+ River 2: Hồ Chí Minh city - Kiên Lương (Hà Tiên province)*
- *+ River 3: Tiền river: Cửa Tiểu- Cambodia border*
- *+ River 4: Hậu river: Cửa Định An- Cambodia border*
- *+ River 5,6: Vàm Cỏ rivers: Vàm Cỏ Đông , Vàm Cỏ Tây*
- *+ River 7: National waterway Hồ Chí Minh city - Hà Tiên through Đồng Tháp Mười*
- *+ River 8: Saigon-Bien Hoa - HieuLiem*



Effect on Infrastructure for River Transport

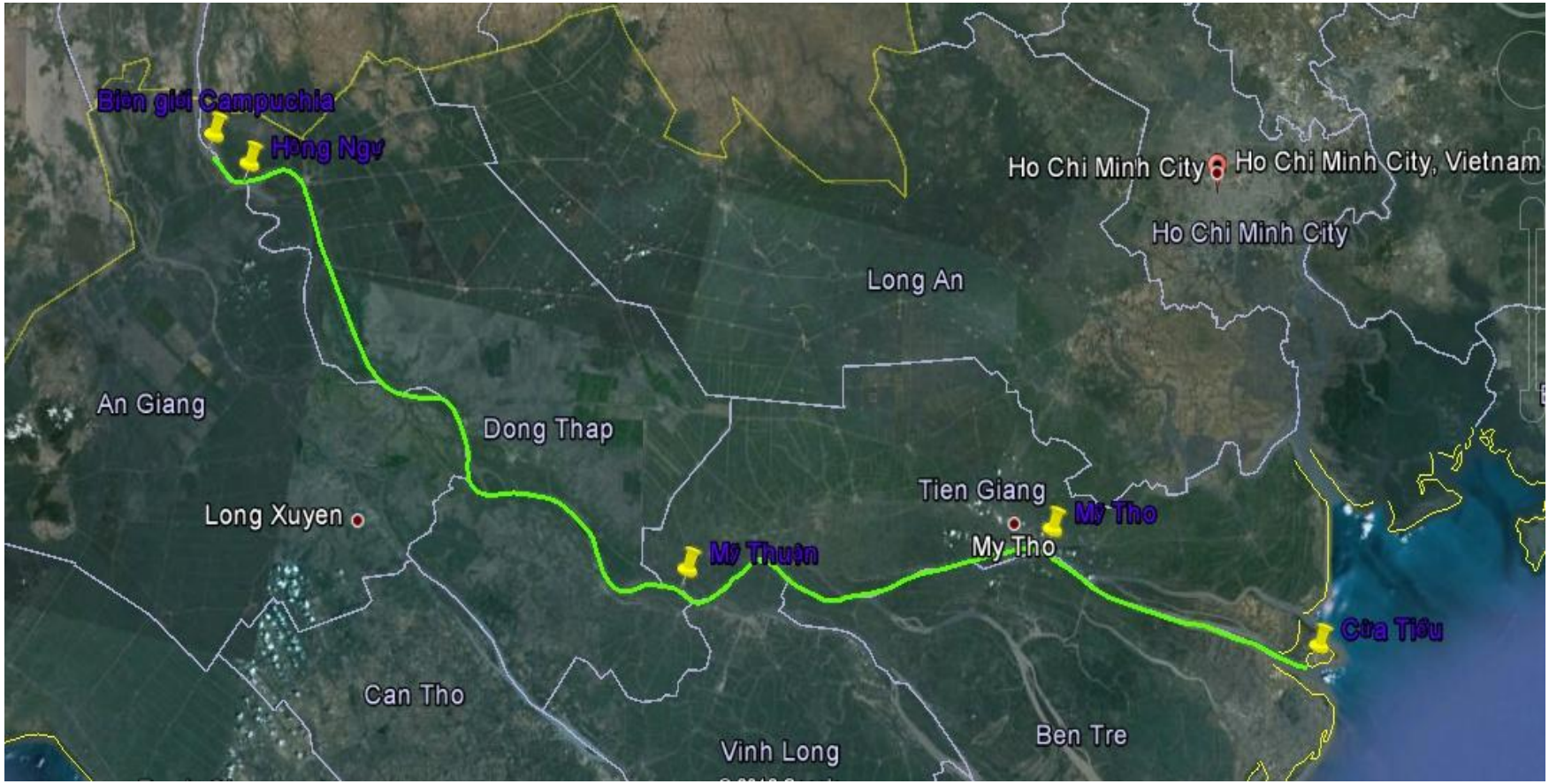
- Bridges
- Ports
- Break waters
- Dykes
- Embankments
- Dams
- Infrastructure of valleys, irrigation canals

River 1: HCM city- Cà Mau route



River 2: HCM city - Kiên Lương route

River 3: Tiền river



River 4: Hậu river

River 5, 6: Vàm Cỏ East & West river

River 7: HCM city - Hà Tiên route

TUYẾN 8: TP HCM - Biên Hòa - Hiếu Liêm

Water level calculation

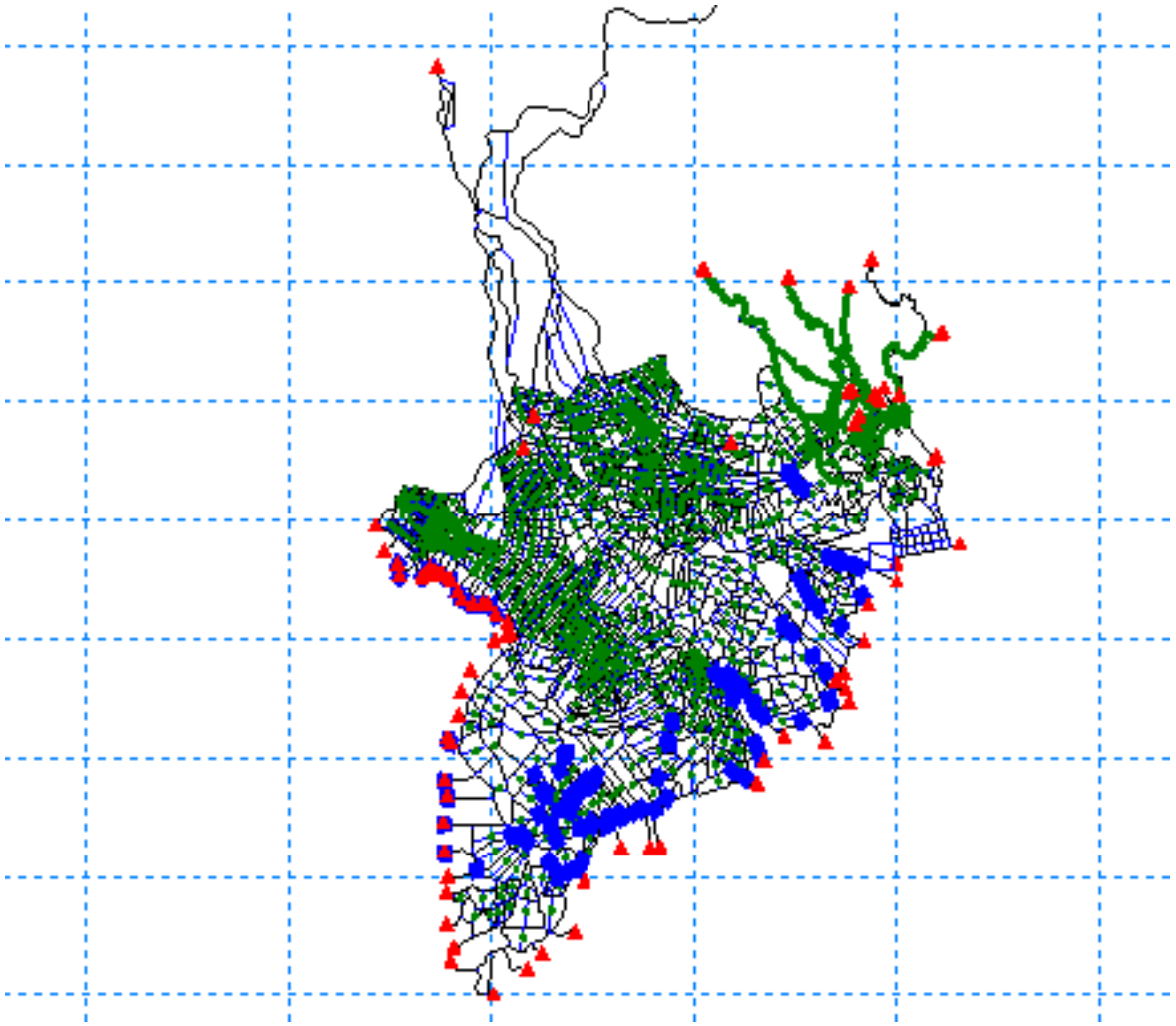
Software:

- MIKE 11 (1D)
- MIKE 21 (2D)

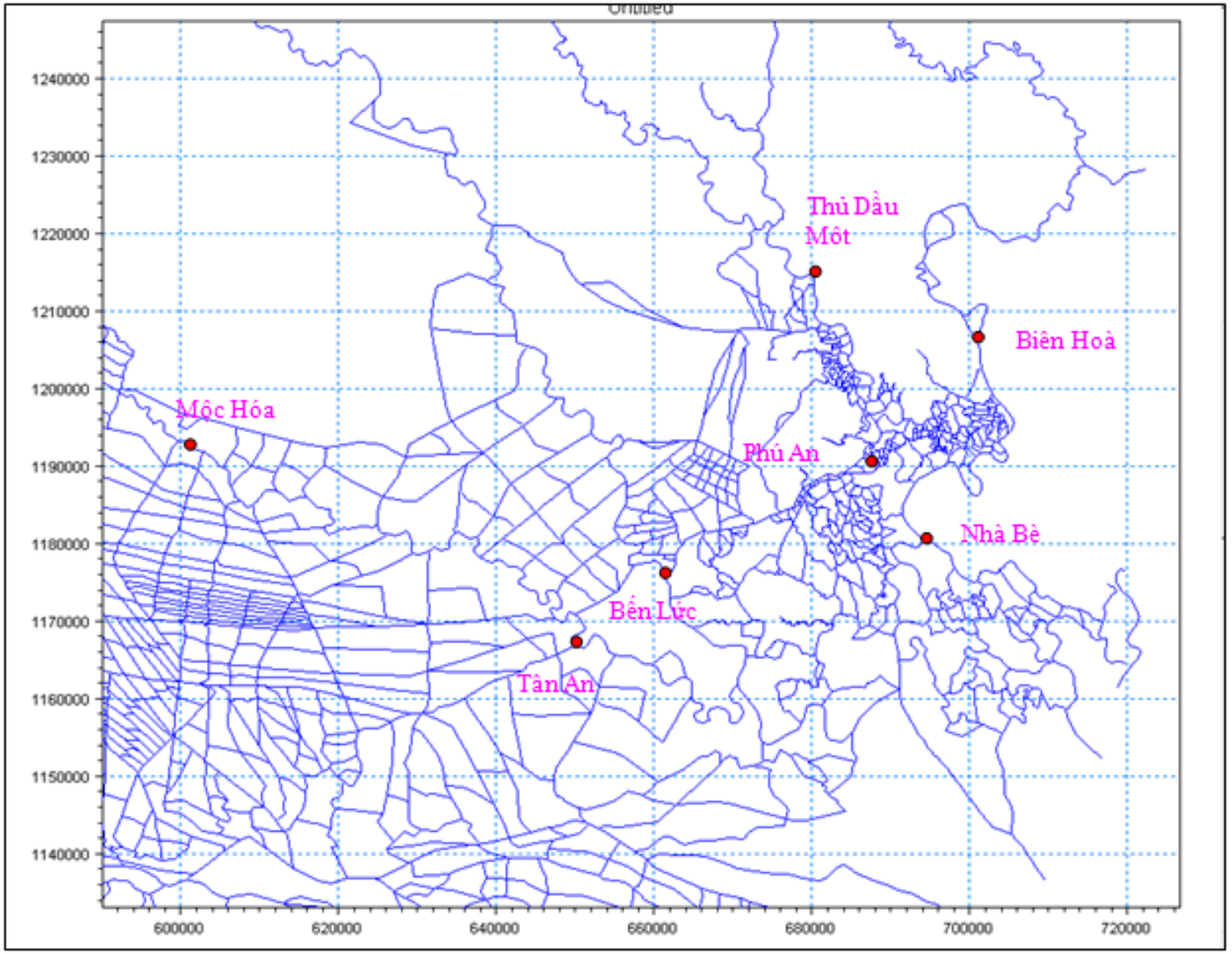
Steps:

- Information gathering
- Model establish
- Model calibration
- River water level calculation fore 3 scenarios

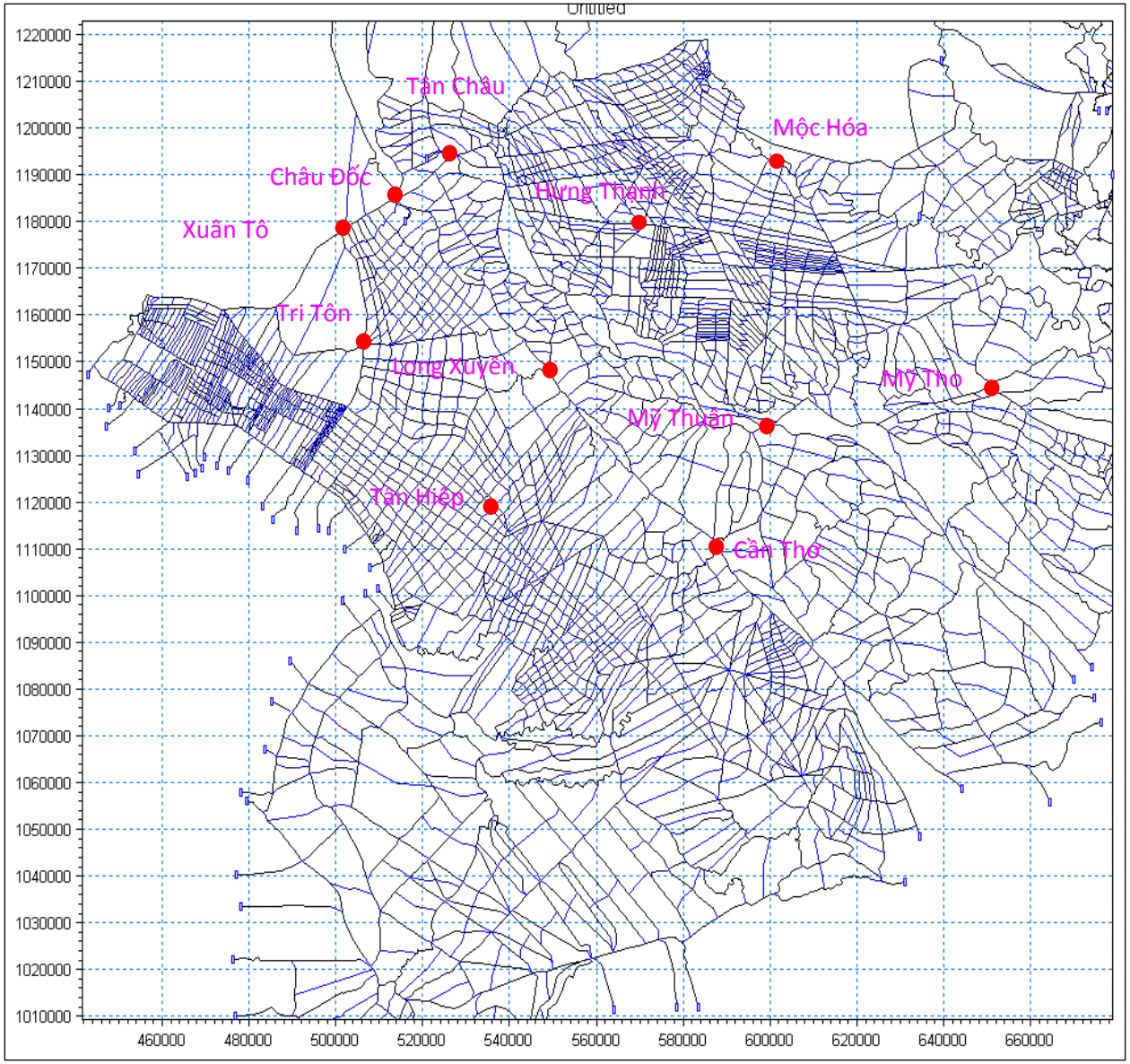
Model establish



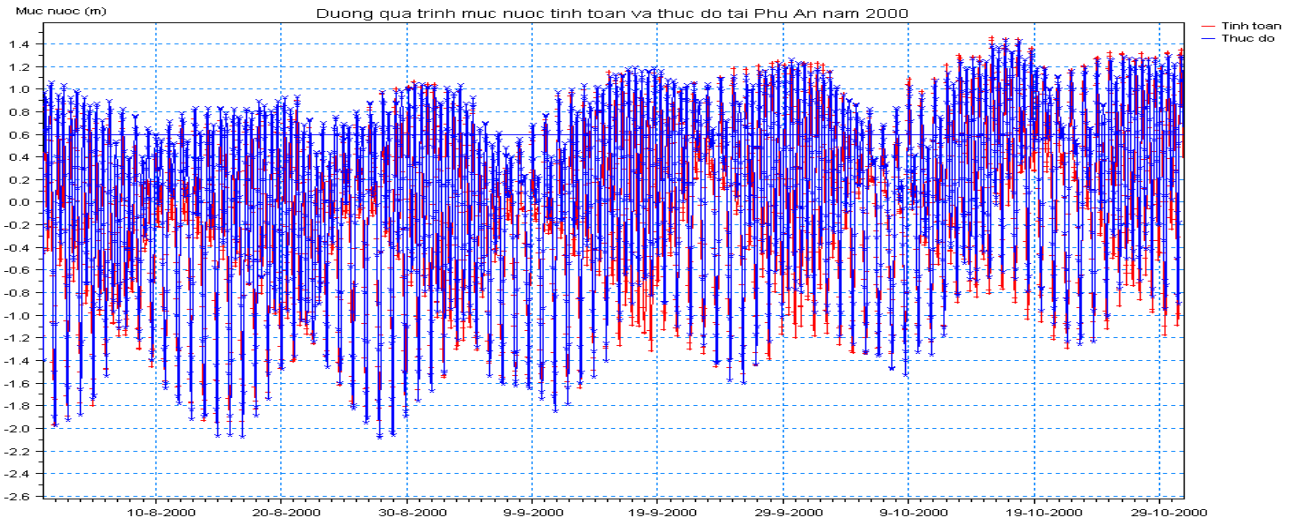
Station for Calibration

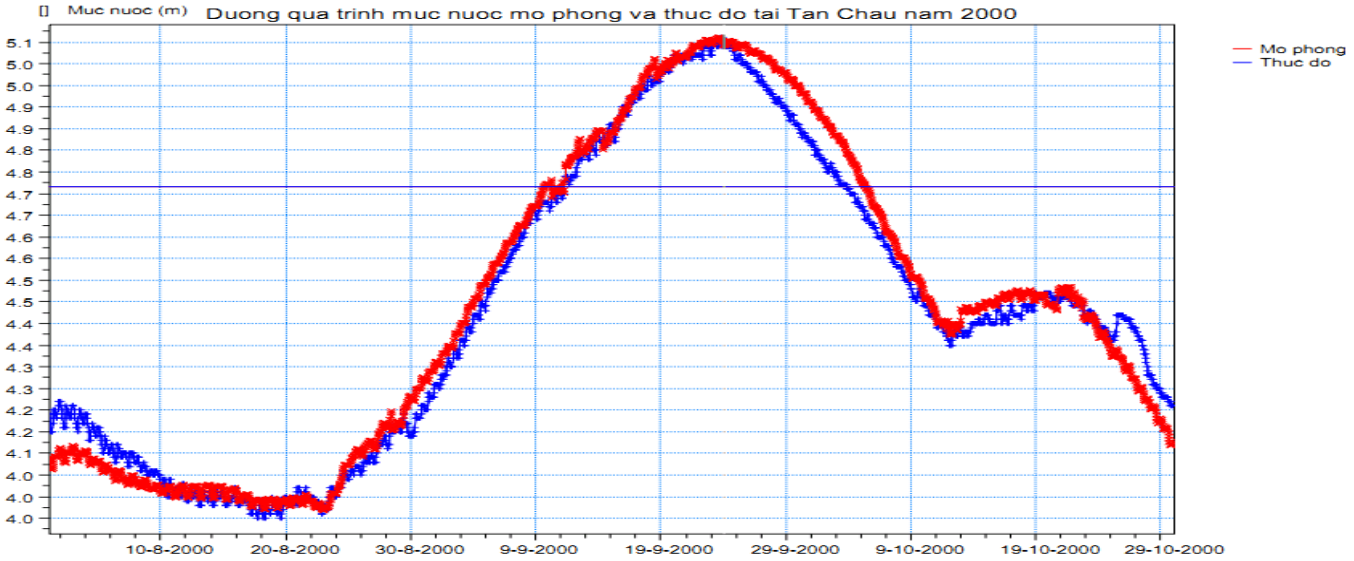


Calibration

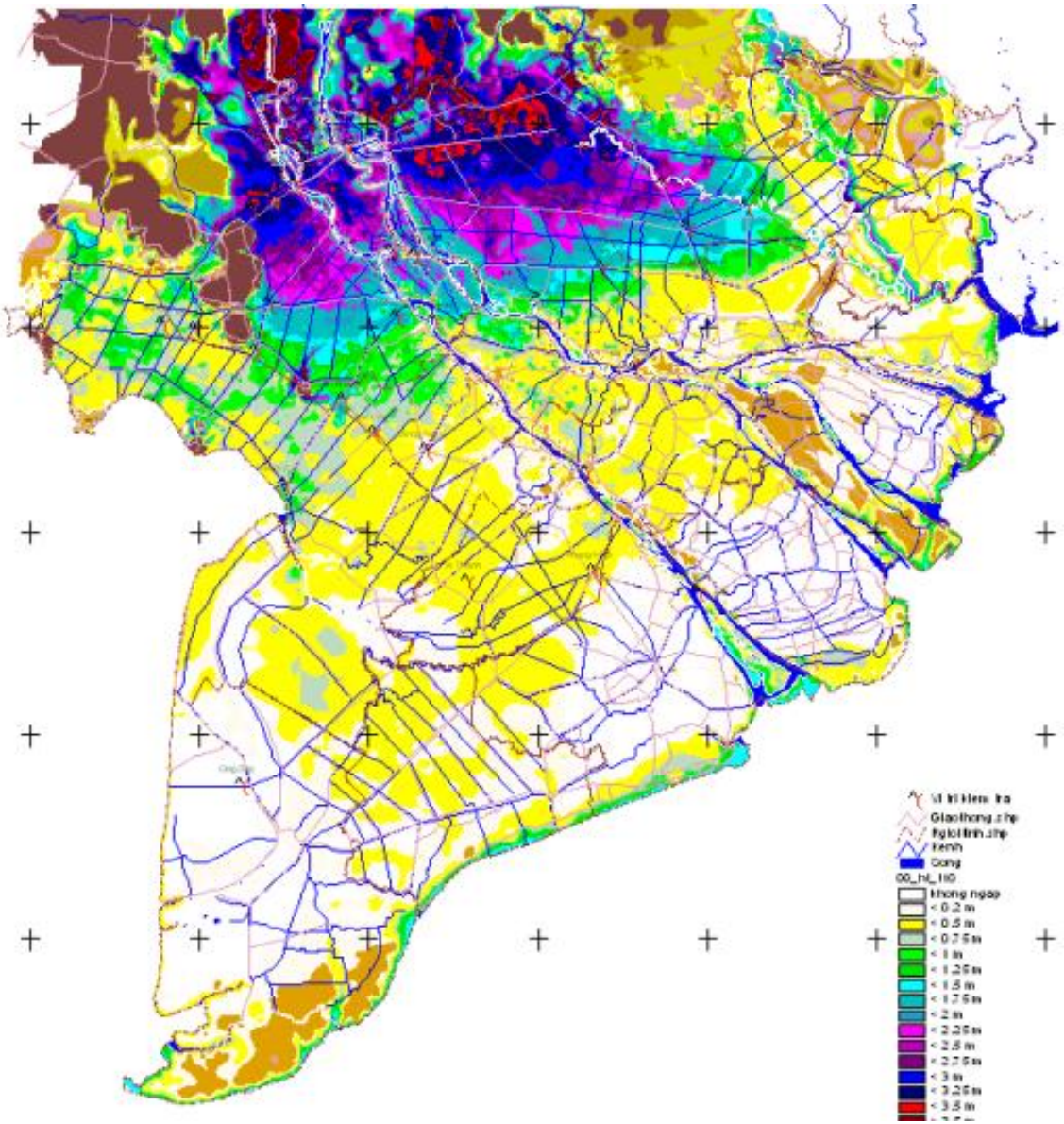


Calibration results





Flood map


Giaothong.shp
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Song
Khong ngap
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< 1 m
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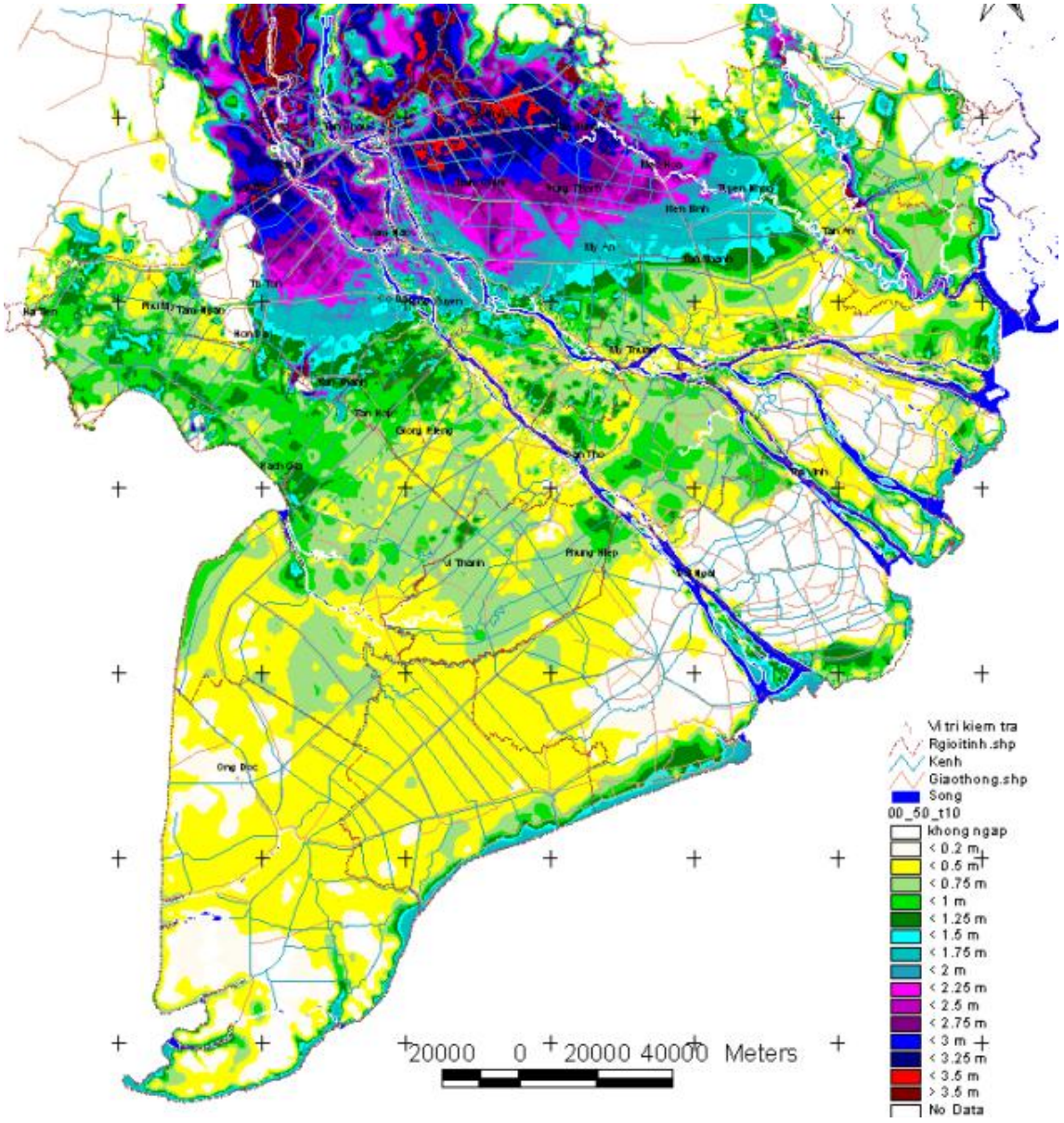
< 3.5 m

Flood map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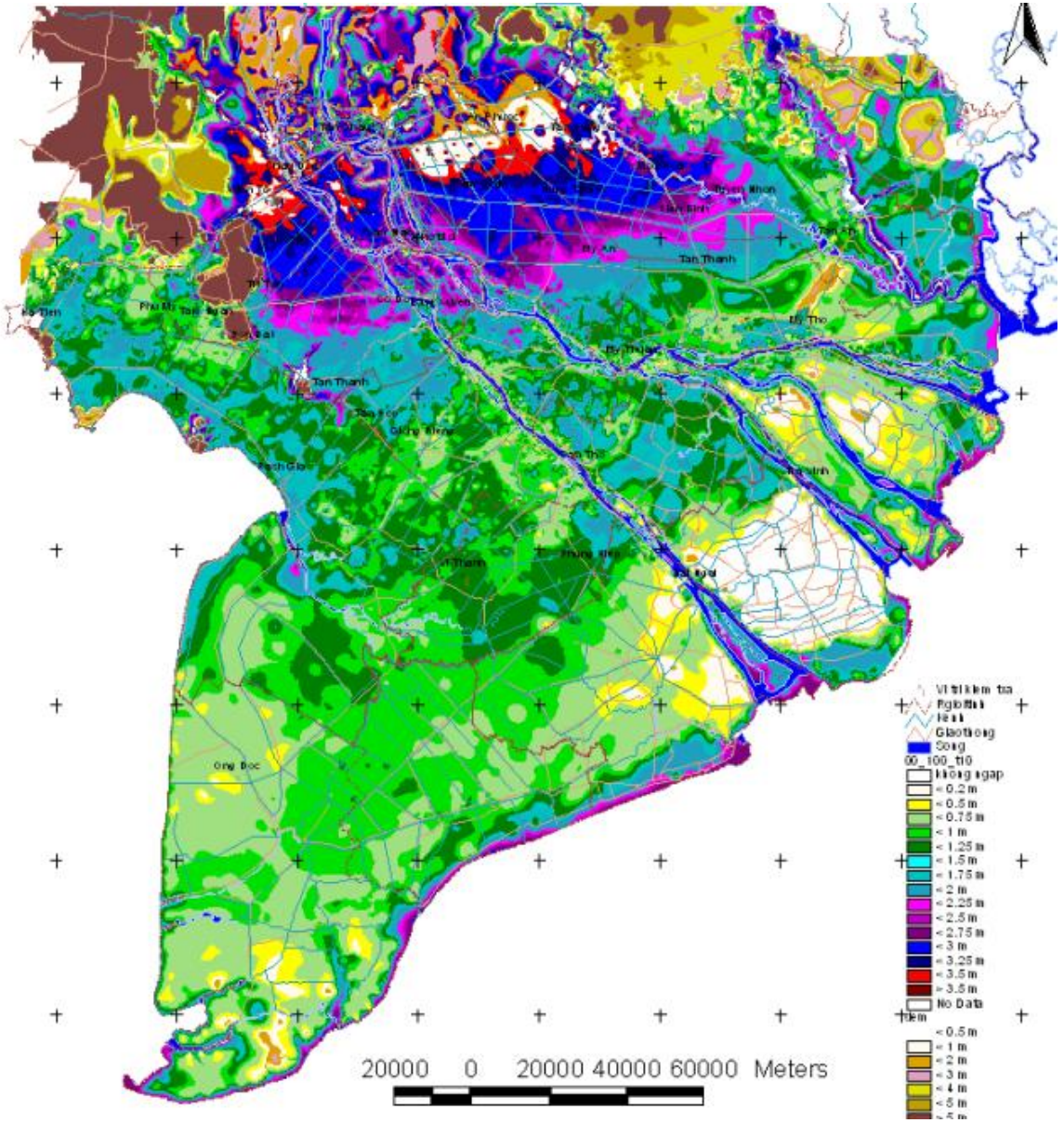
< 3.5 m
> 3.5 m
No Data
20000 0 20000 40000 Meters

Flood map


Tan Thanh
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< 3 m
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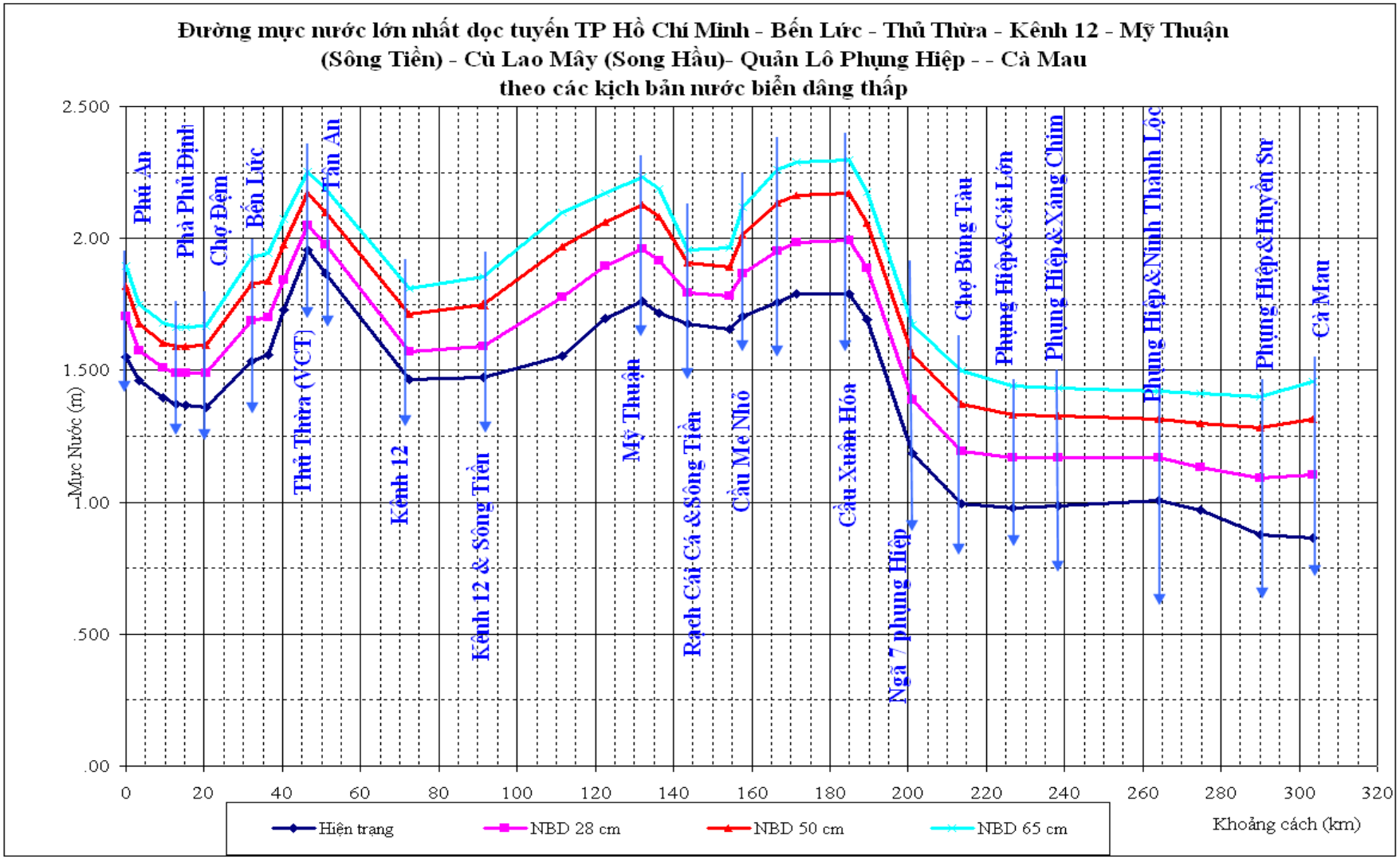
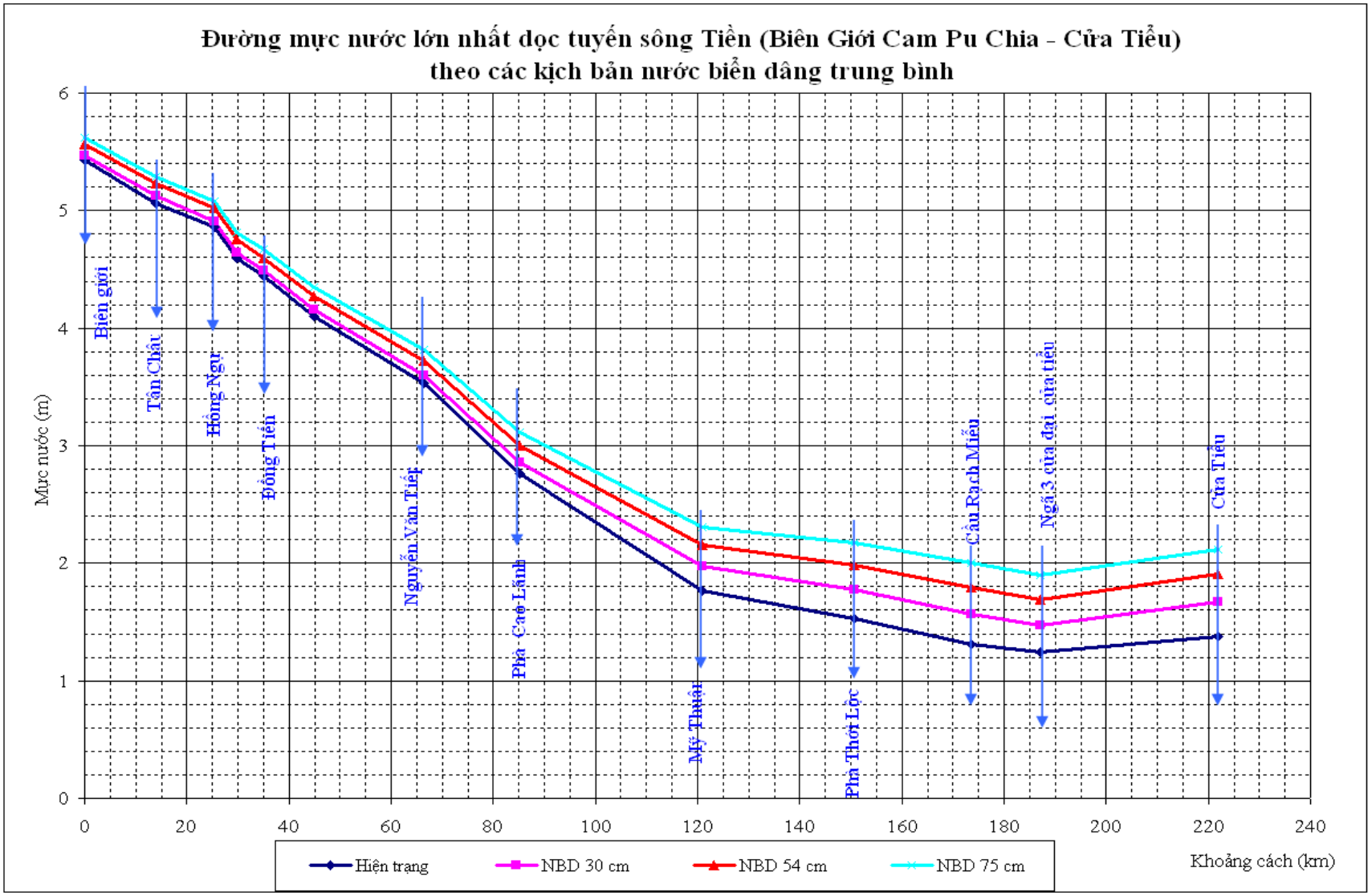
< 3.5 m
No Data
< 0.5 m
< 1 m
< 2 m
< 3 m
< 4 m
< 5 m

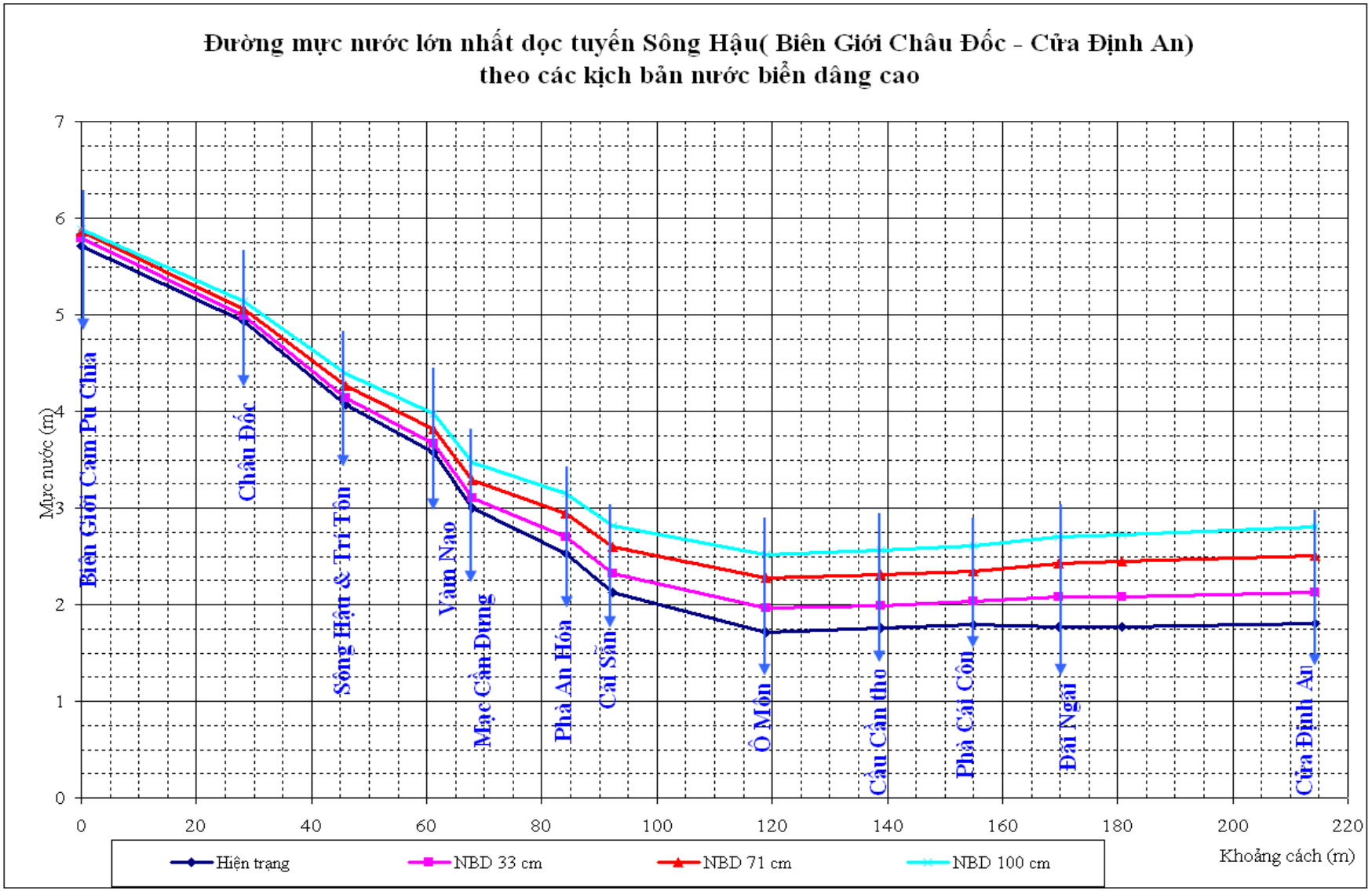
Water level on the river 1



Water level on the river 3



Water level on the river 4



5- GIS application

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- Software Client/Server, ArcGIS 9.x of ESRI company
- **Database** GIS with layer:
  + Admistration & topography
  + Infrastructure of river transport system
  + Affected infrastructure (bridges, ports, embankments, dams)
  + Water level

GIS FUNCTIONS:

- *System management function: allow the user to use the program with multi-users*
- *Information management functions: management the information such as administration, topography, river system, hydrology, water level, infrastructure such as bridges, ports, dams…*
- *Information Searching function*
- *Analysis function*

Result of forecast for infrastructure in River 1

- Bridge: 100% bridges not affected
- Clearance: among 17 bridge 11 not satisfied with 7.0m high of clearance
- Ports: 109 ports are affected

Result of forecast for infrastructure in River 2

- Bridges: 100% Bridges are good again river water level rise

- Clearance: High 7,0m: 11 of 13 bridges good

- Port: 227 affected

Result of forecast for infrastructure in River 3

- Bridges: All not affected
- Bridge Clearance: Not affected
- Ports: 17% - 39% affected

Result of forecast for infrastructure in River 4

- Bridge: All bridge not affected
- Bridge Clearance: all enough clearance
- Ports: 10% of 32 ports are affected.

Result of forecast for infrastructure in River 5

- Bridges: All bridge is not affected
- Clearance: All 5 bridges is good
- Ports: All ports is not affected

Result of forecast for infrastructure in River 6

- Ports: About 13% is affected
- Clearance: All bridge are not affected
- Ports: 7% - 22% of 66 are affected

Result of forecast for infrastructure in River 7

- Bridge: 26% - 28% will be affected by 2100

- Bridge clearance: 98 bridges on the route, only 6% satisfy with the planning transport river class

- Ports: About 16% - 31% ports will be affected.

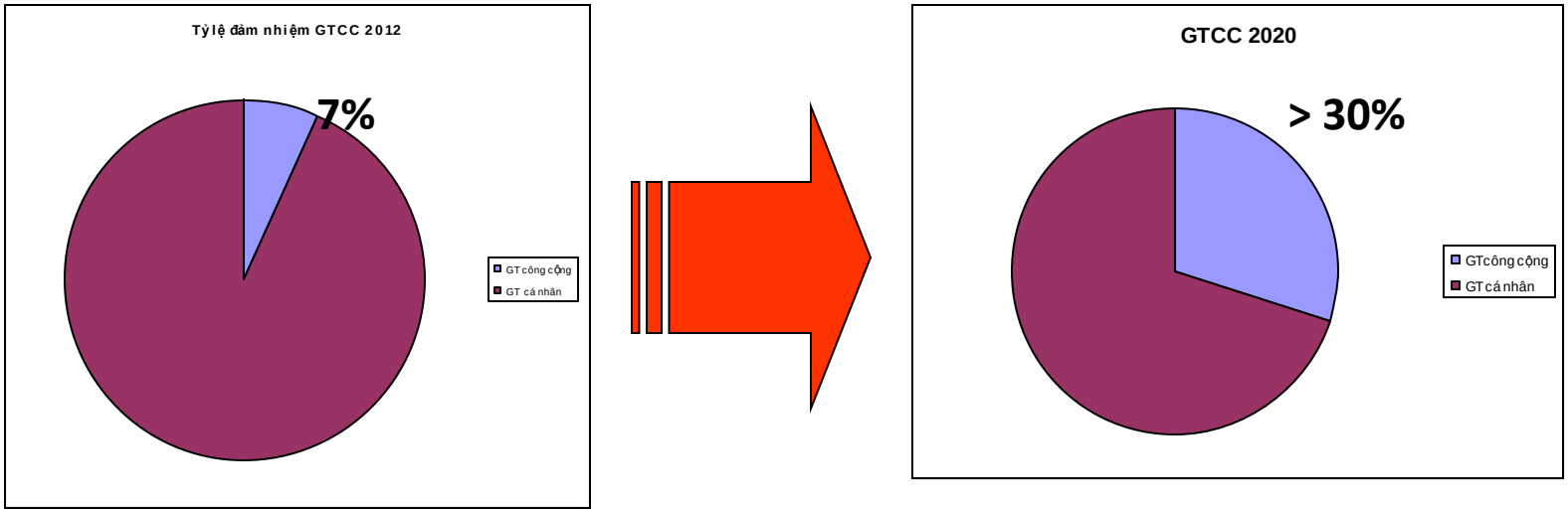
Result of forecast for infrastructure in River 8

- Bridges: 100% not affected
- Bridge Clearance: Dong Nai Bridge was effected, not enough clearance.
- Ports: not affected

Promotion of public transport of HoChiMinh city and other cities in Mekong delta

Encouraging Public Transport Usage

Current 2012 → **Target 2020**

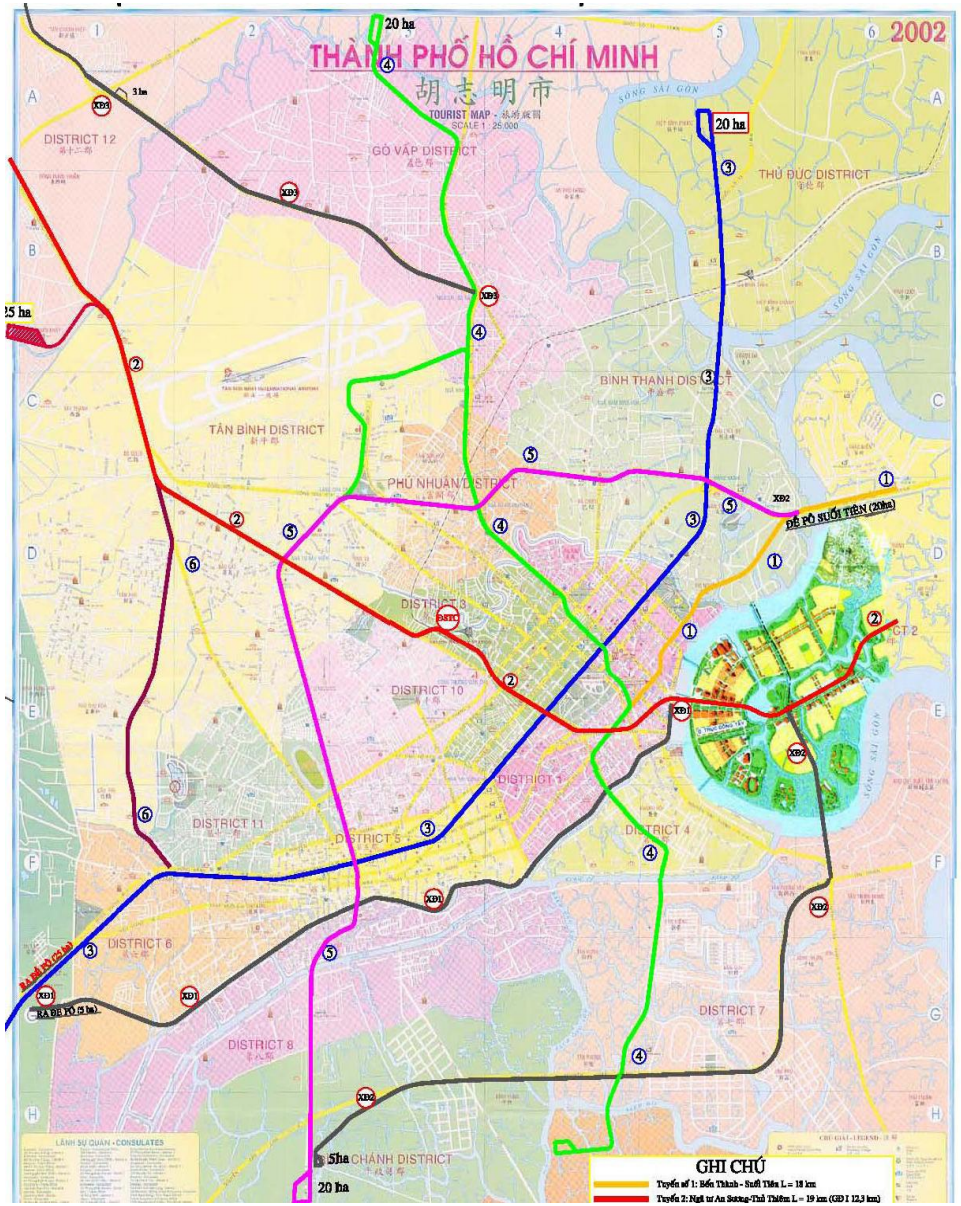


Private Transport

Public Transport

6.Conclussion

1) Vietnam have an CO2 emission amount of about 151 millions tone in 2005 and will be rise to 224 millions tone in 2020 (25% of them come from transport sector- road transport more than 20% and river transport about 2-3%), so public transport is the good choice not only from the point of view of traffic jam reduction but also from the point of energy, CO2 emission.
2) Global Climate Change have many advice impacts to river transport in Mekong delta
3) The result of modeling and calculating for water level of the river and affected infrastructure will help to planning both public river transport and infrastructure for railways, for roads, for planning of public transports



Thank you for your attention!