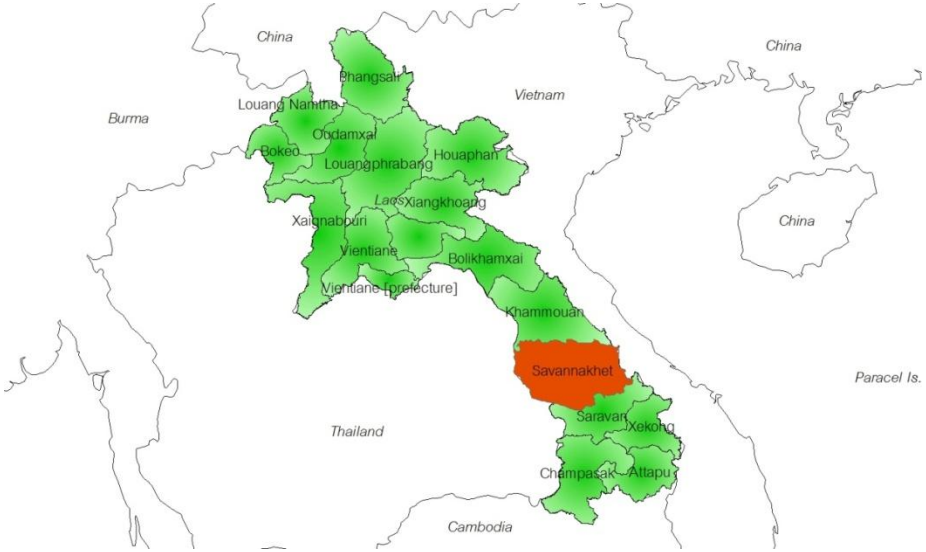
Rapid Assessment on Climate Change Risk
CCAI pilot site: Champhone, Savannakhet, Lao PDR



Session 3: Climate scenario and climate change risk assessment

Southeast Asia START Regional Center

Concerns on use of climate scenario data

Limitation of climate scenarios

Be Cautious:

A GCM is better than another for simulating past historical climate, it does not means that it is more reliable for future projections.

Arguably, the changes response to anthropogenic forcing may be decoupled to some degree from bias and systematic errors of the control climate simulation.

Models have sources of error: from aspects of simplification, structural design, representation of physics, to limited and inadequate science knowledge

Southeast Asia START Regional Center
IHDP · IGBP · WCRP

Concerns on use of climate scenario data

Limitation of climate scenarios

Aware the facts

Downscaling is NOT for reproducing the real world

- at seasonal and inter-annual scales should match relative magnitude of the temporal evolution of the forcing
- at daily time scales should match the statistics of the daily events (frequency of events, etc)

Downscaling is NOT able to correct errors in the predictors; but predictor errors (such as too many low pressure systems) should be propagated

Concerns on use of climate scenario data

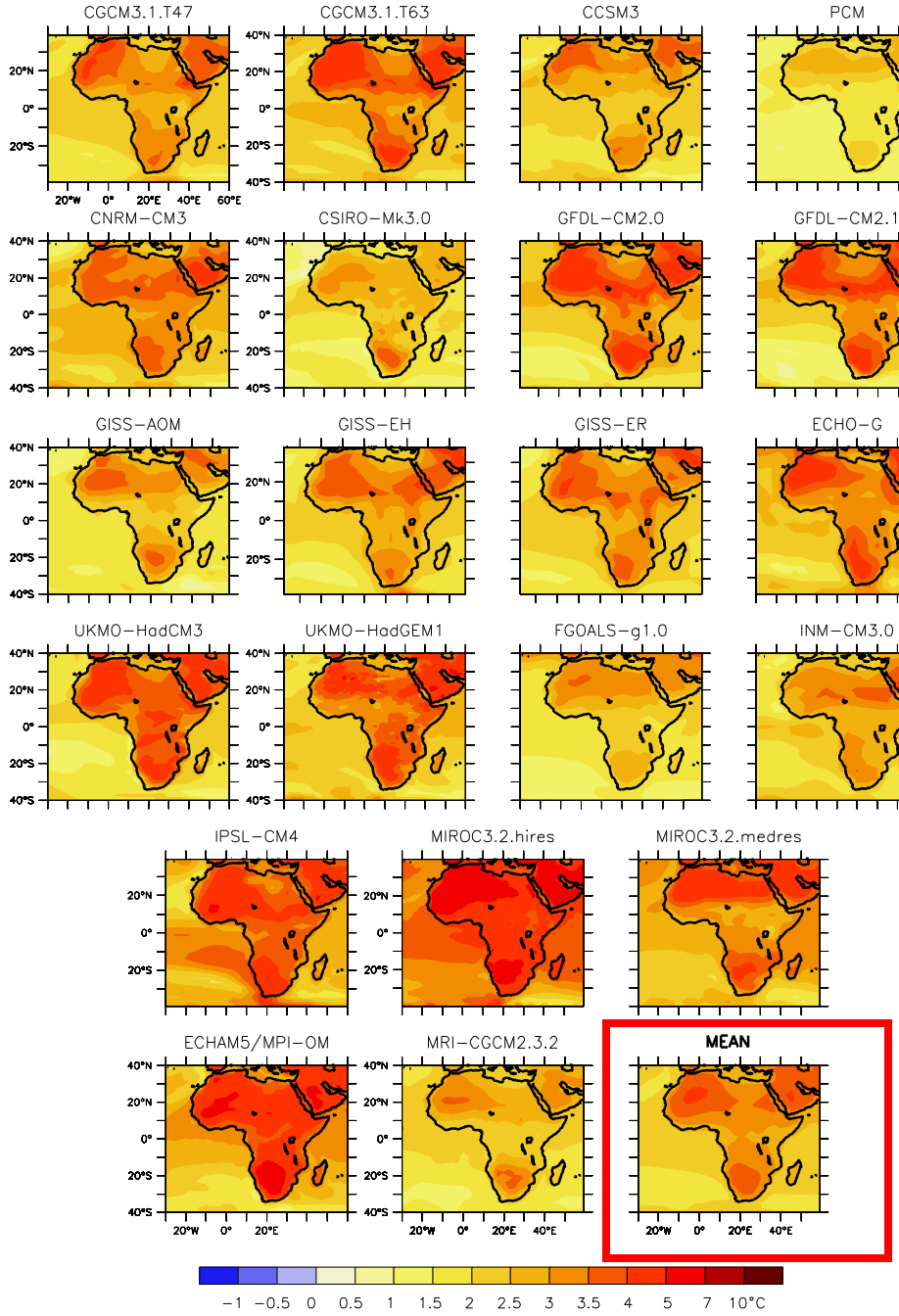
Limitation of climate scenarios

Uncertainty and probability

Data are not TRUTH! There will only be one time evolution into the future, but many possible evolutions

Uncertainty DOES NOT mean nothing can be stated robustly

Based on available evidence, assess whether projected direction of change is robust, then assess magnitude of change



Diversity of scenarios from different GCM is required to deal with uncertainty

Africa Change at the large scale

Change in annual mean temperature by 2100

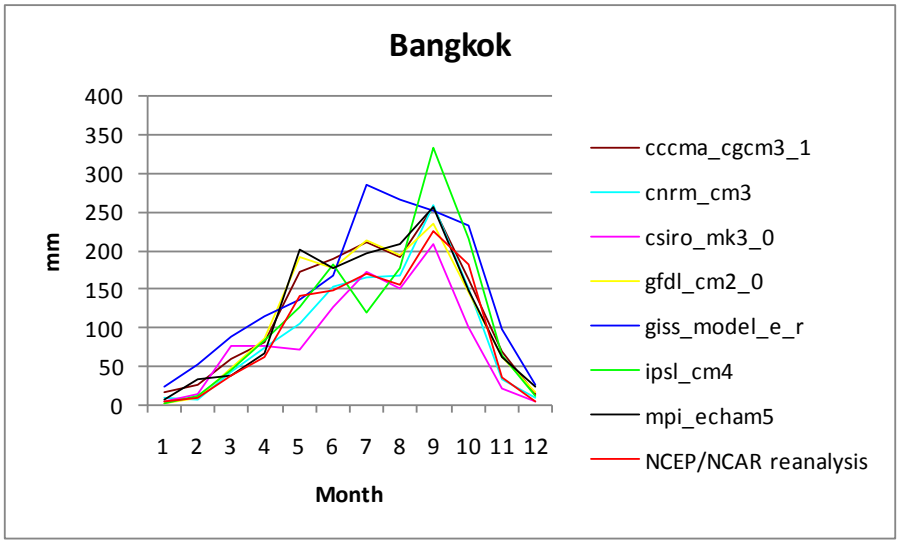
Caution: beware interpreting a point locations – know the skill resolution of your data

Courtesy of Isaac Held from PCMDI AR4 model archive

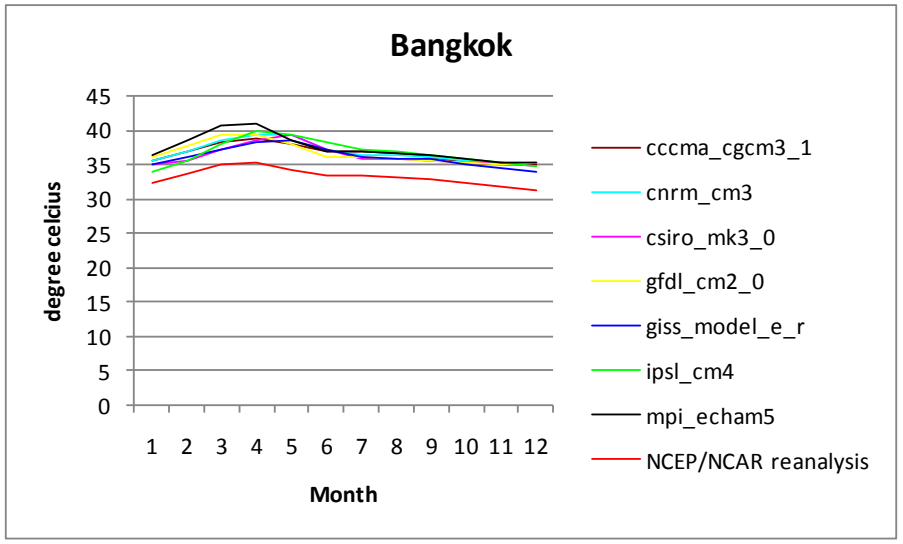
Concerns on use of climate scenario data

Dealing with Uncertainty of Climate Model

Different climate model may gives different result



Monthly average precipitation in the future



Monthly average maximum temperature in the future

Concerns on use of climate scenario data

Dealing with Uncertainty of Climate Model

Frequently asked question:

1. What climate model is best?
2. If we cannot be certain about result of climate models, how can we work on climate change?

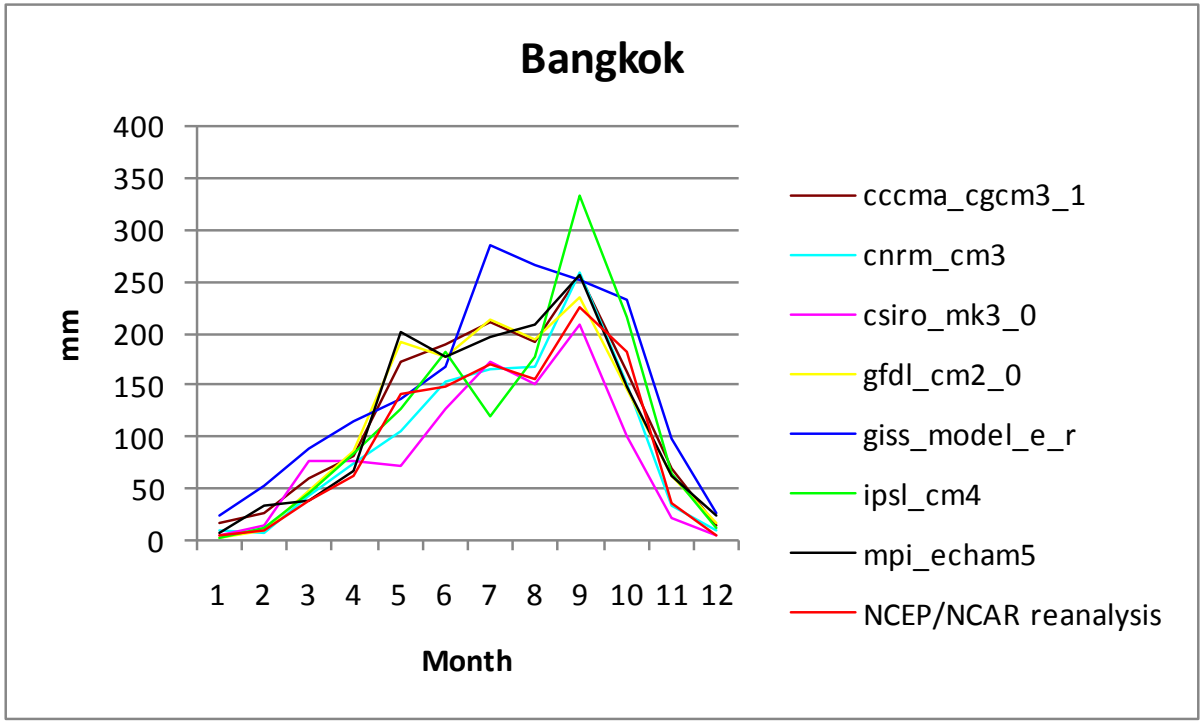
These questions are not relevant!

Change in thinking paradigm

Concerns on use of climate scenario data

Dealing with Uncertainty of Climate Model

- Work with multiple projections – use every climate projections as stress test to test resilience of any future plan

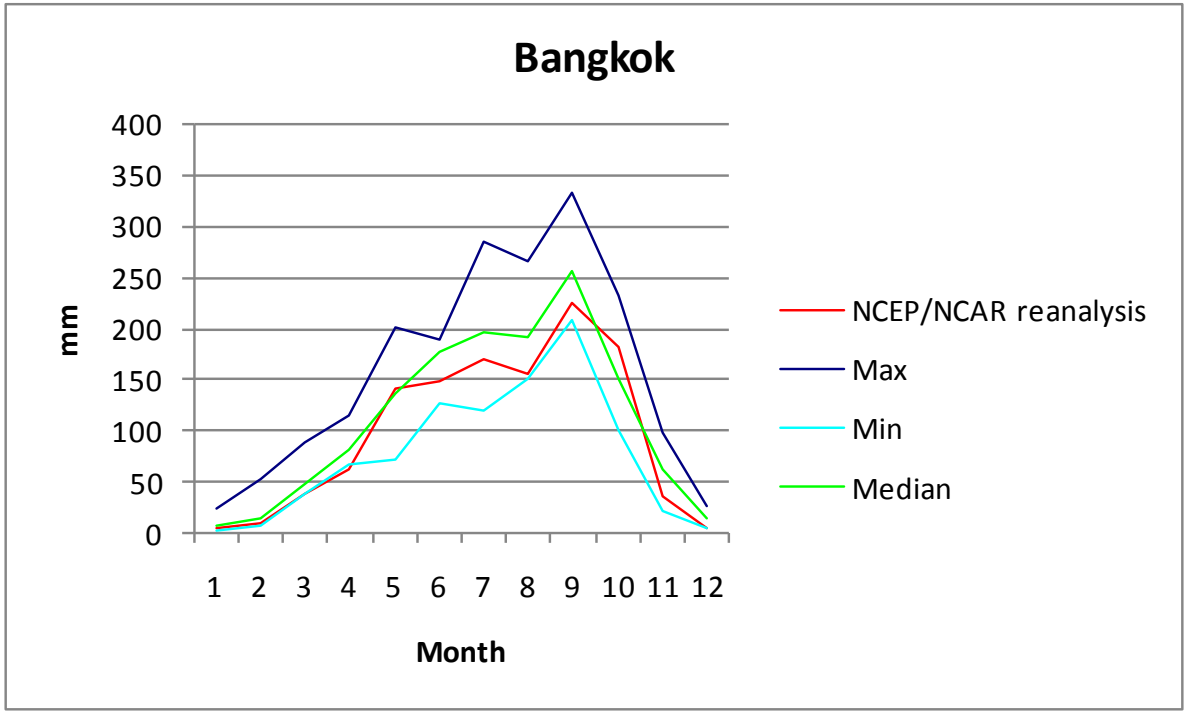


Monthly average precipitation in the future

Concerns on use of climate scenario data

Dealing with Uncertainty of Climate Model

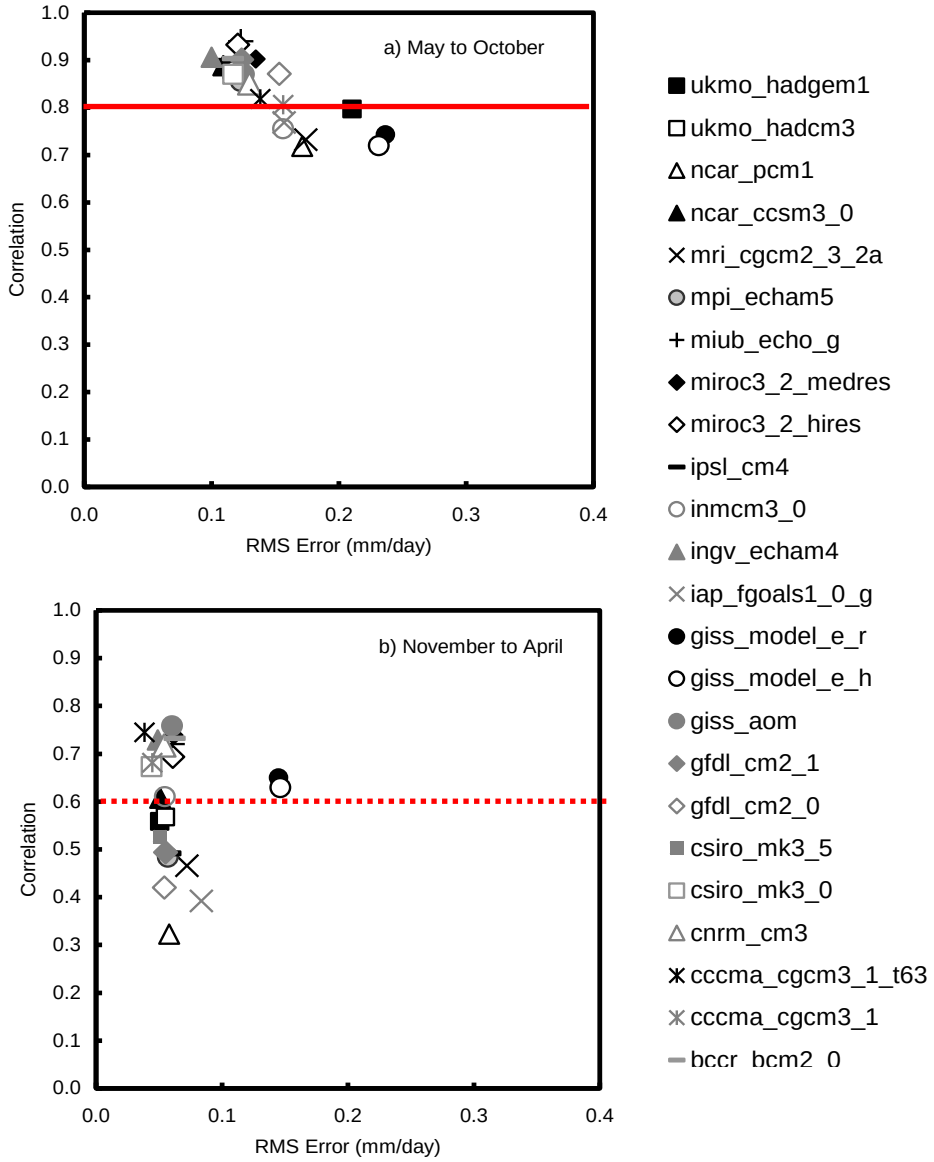
- Work with range of future change – worst case scenarios



Monthly precipitation

Concerns on use of climate scenario data

- Find consensus among results of climate models



Source: Dr.Judy Eastham – CSIRO Land and Water

Concerns on use of climate scenario data

Final tips about dealing with climate model uncertainty:

- Look at future in broad sense, no need to be very explicit about future change in risk assessment
- Use future climate scenario as guideline / indicator of direction of change
- Use future climate scenarios along with conventional projection method, keep in mind that future climate will not repeat the cycle as it has been – but we do not know it for certain.

Using climate scenario data for climate change impact assessment

Selecting indicators for climate change risk assessment

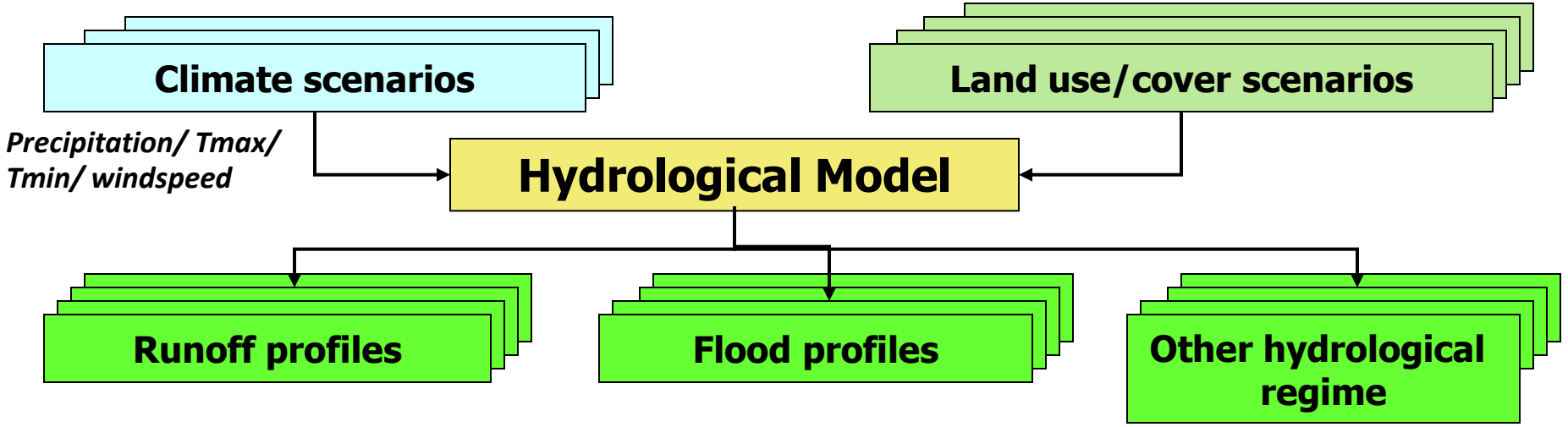
- What is key climate concerns in the study site?
- What climate risk and what could be consequences?
- Different sectors may have different concern

Using climate scenario data for climate change impact assessment

Using long term climate projection data in climate change impact assessment to support long term development planning:

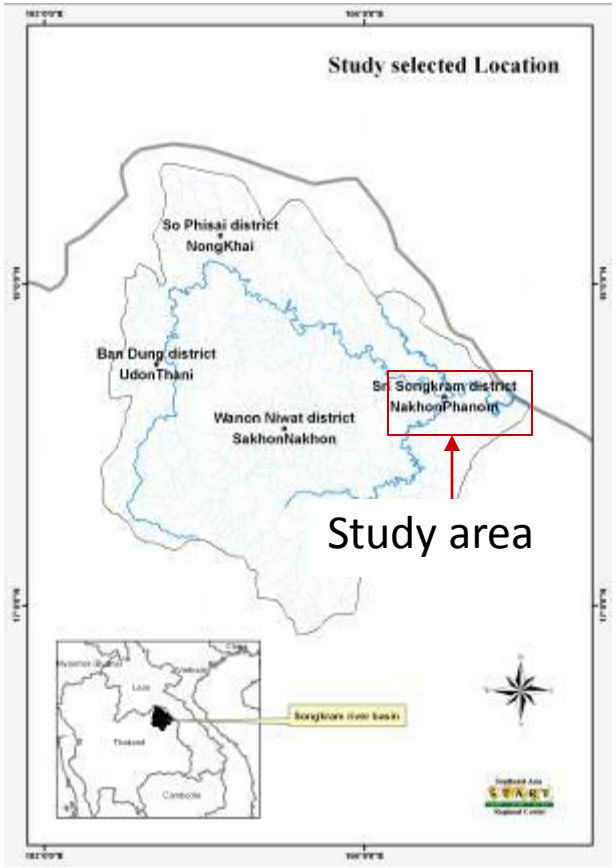
Using climate scenario data for climate change impact assessment

Using long term climate projection data in climate change impact assessment to support long term development planning: Case studies on hydrological analysis



Using climate scenario data for climate change impact assessment

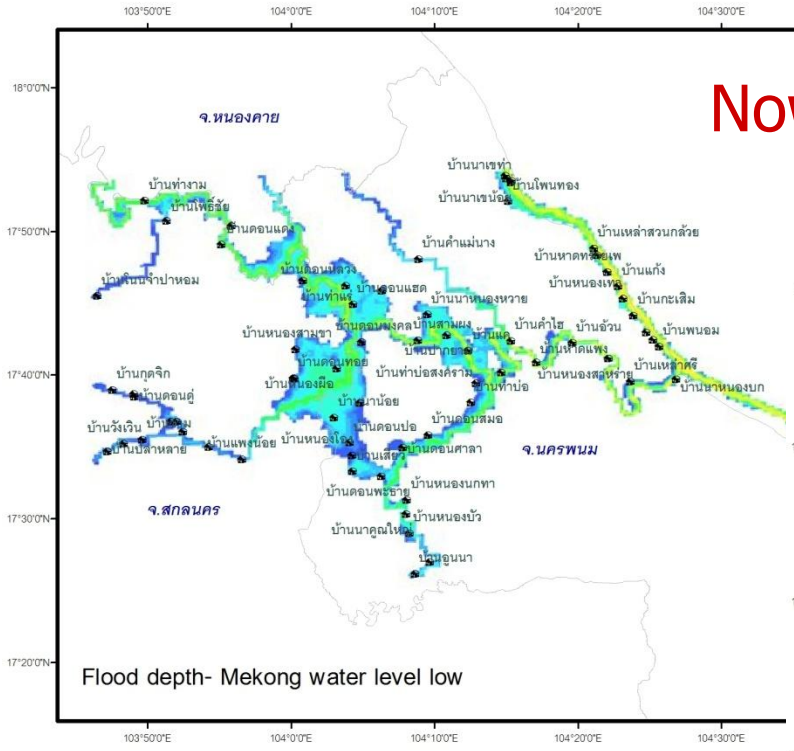
Case study in Lower Songkram River basin - Thailand



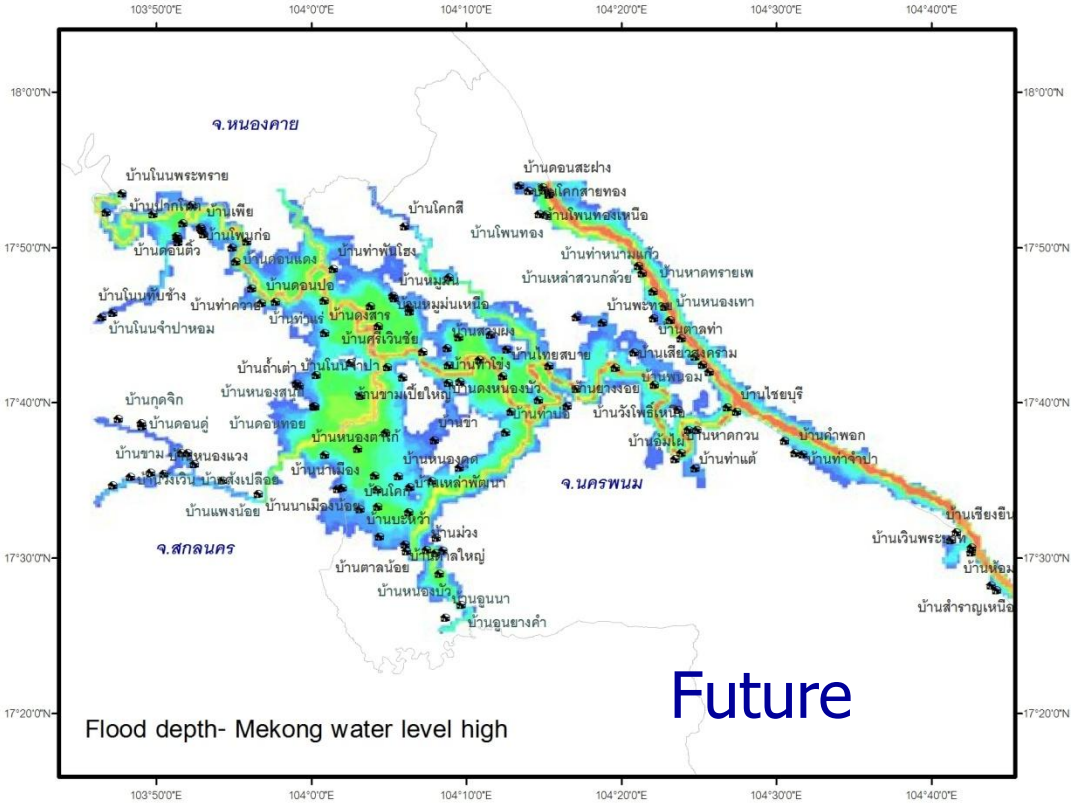
Using climate scenario data for climate change impact assessment

Change in flood boundary in lower Songkram River basin

Now



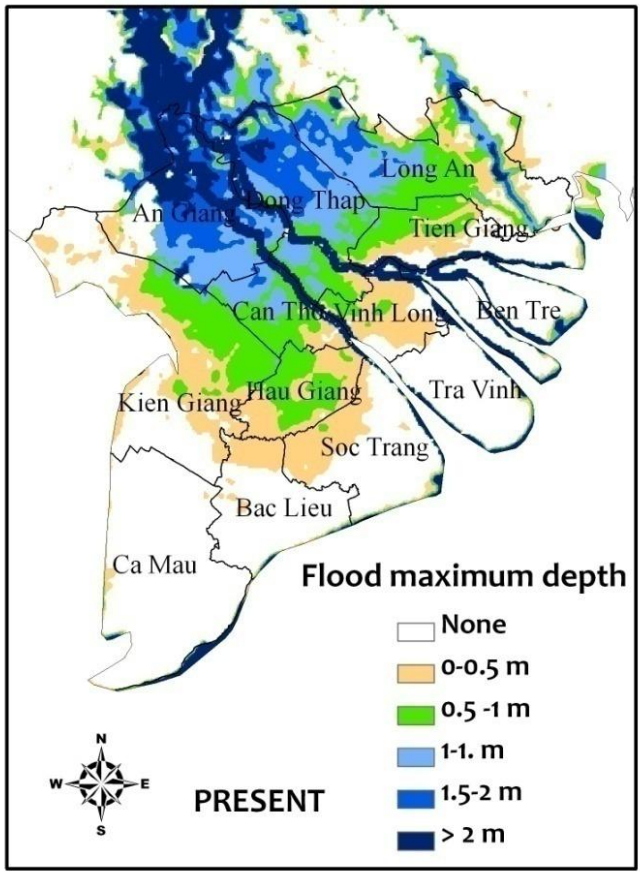
Future

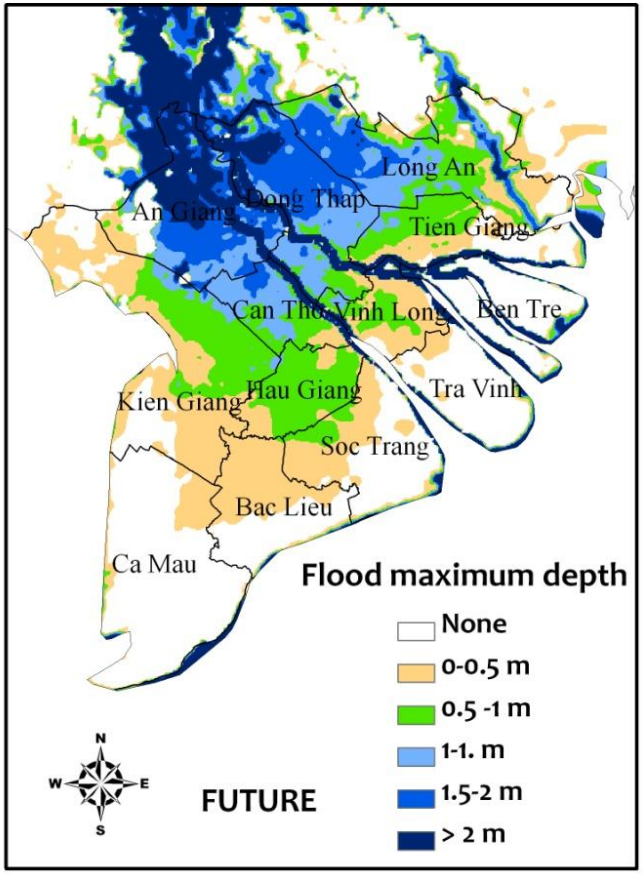


Source: WUP-Fin Group, MRCS

Using climate scenario data for climate change impact assessment

Change in future flood risk in Mekong River delta

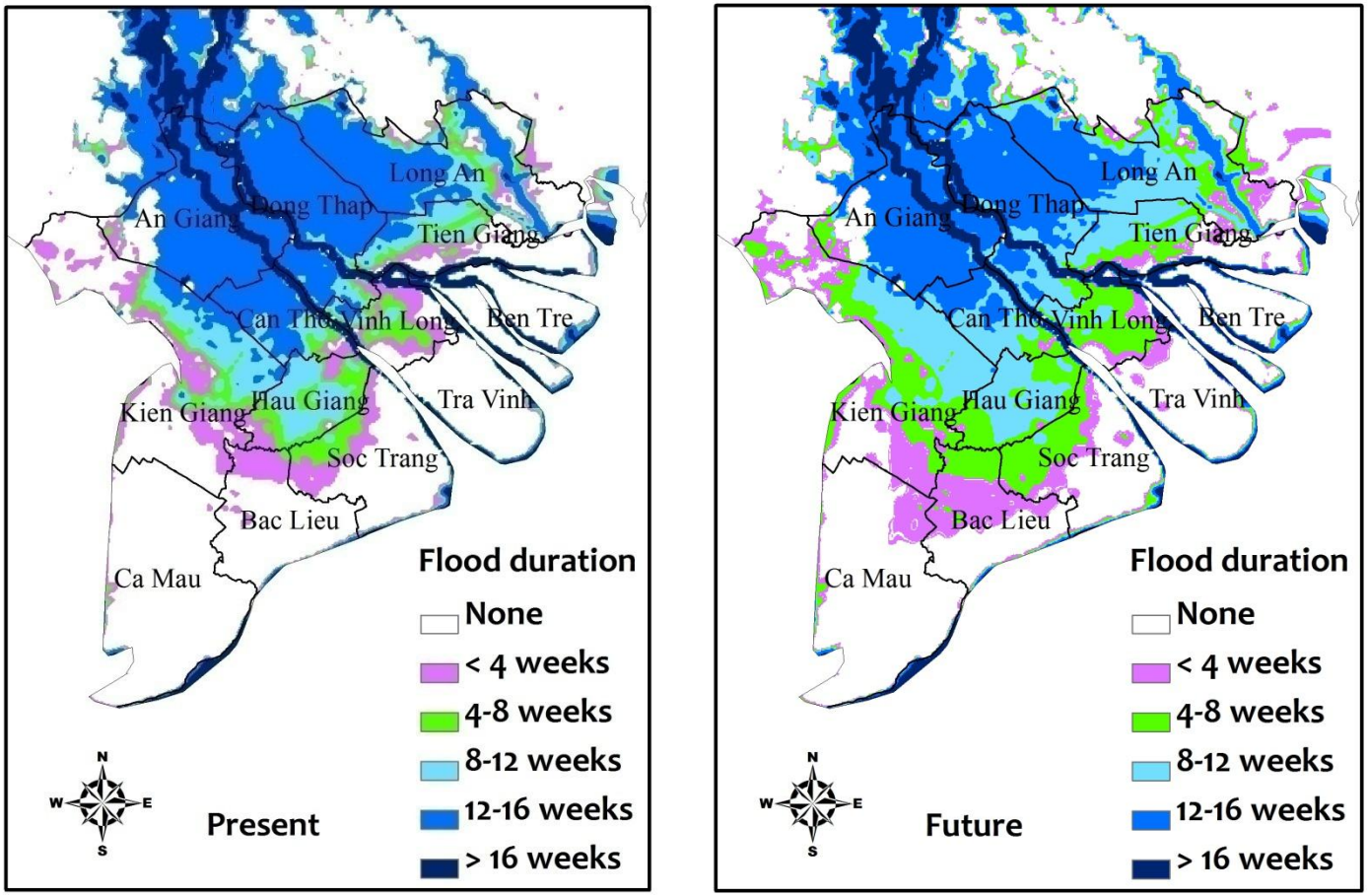




Flood boundary may expand in the future.

Using climate scenario data for climate change impact assessment

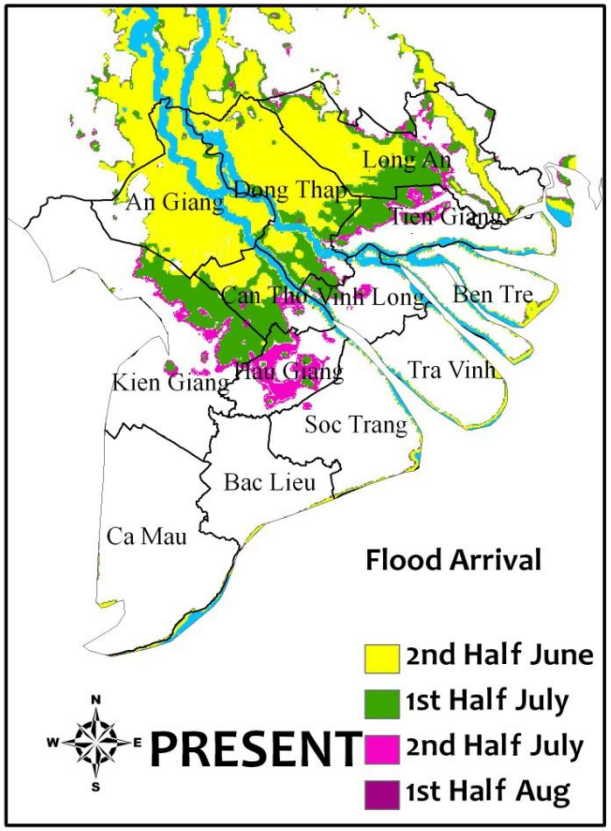
Change in future flood risk in Mekong River delta

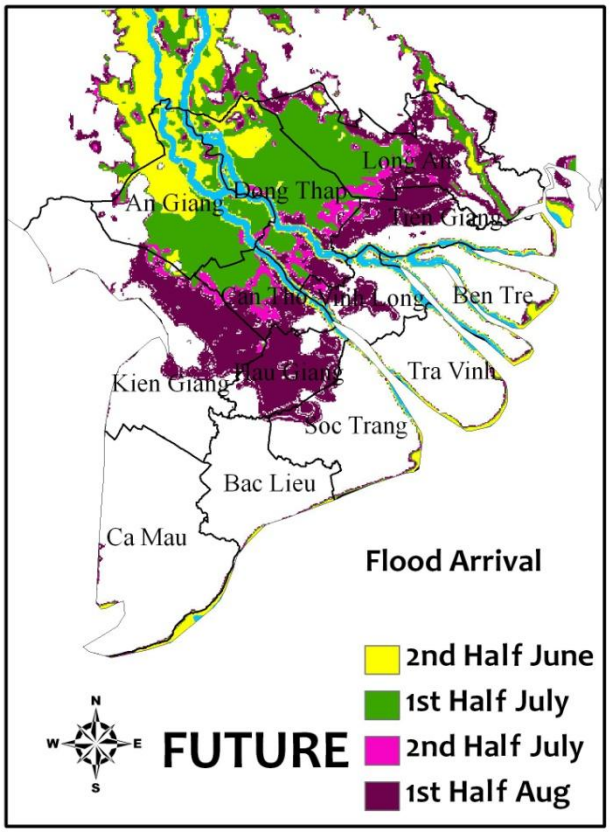


But duration of flood may be shorter in the future.

Using climate scenario data for climate change impact assessment

Change in future flood risk in Mekong River delta

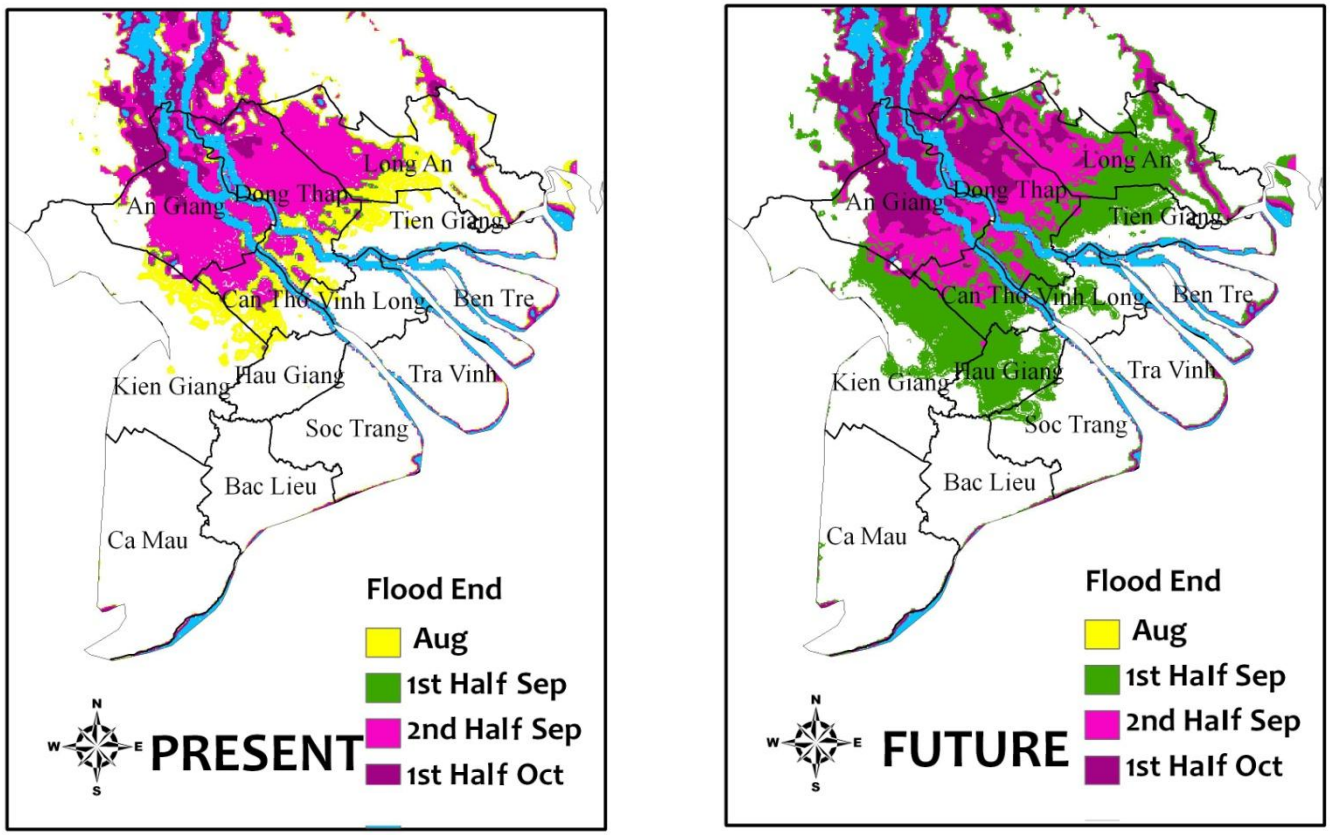




Serious flood – 50cm (river overflow) may arrive 2 weeks late in future.

Using climate scenario data for climate change impact assessment

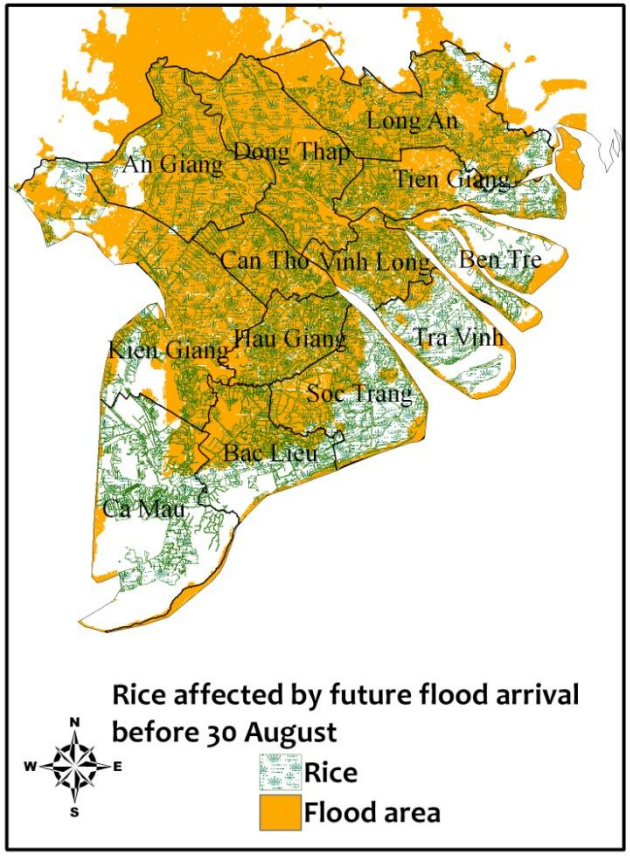
Change in future flood risk in Mekong River delta

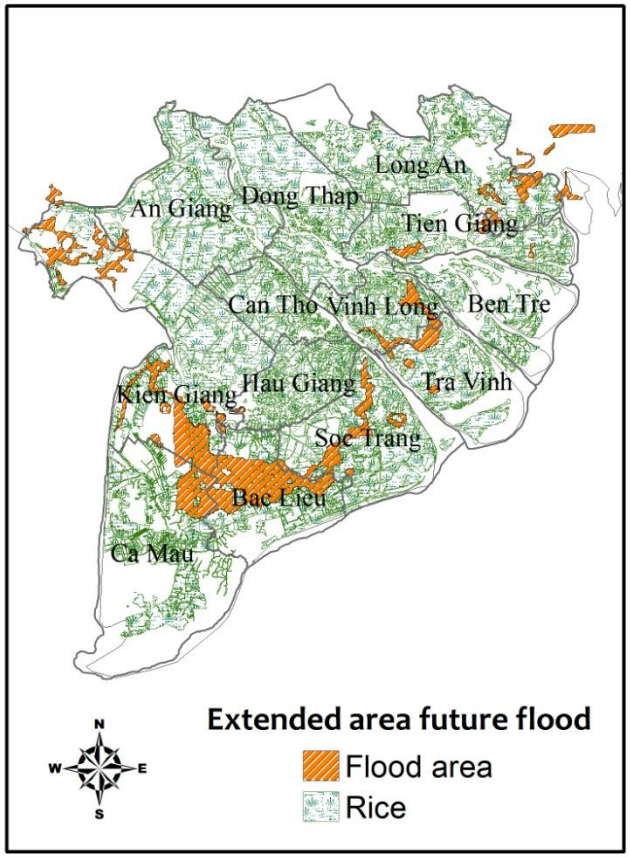


Serious flood (50cm) may end 2 weeks late in future

Using climate scenario data for climate change impact assessment

Change in future flood risk in Mekong River delta

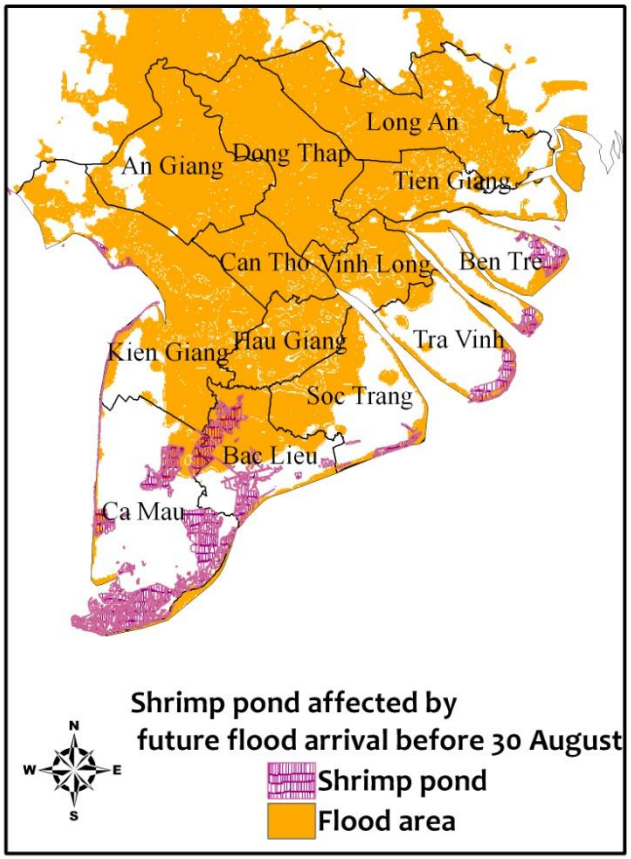


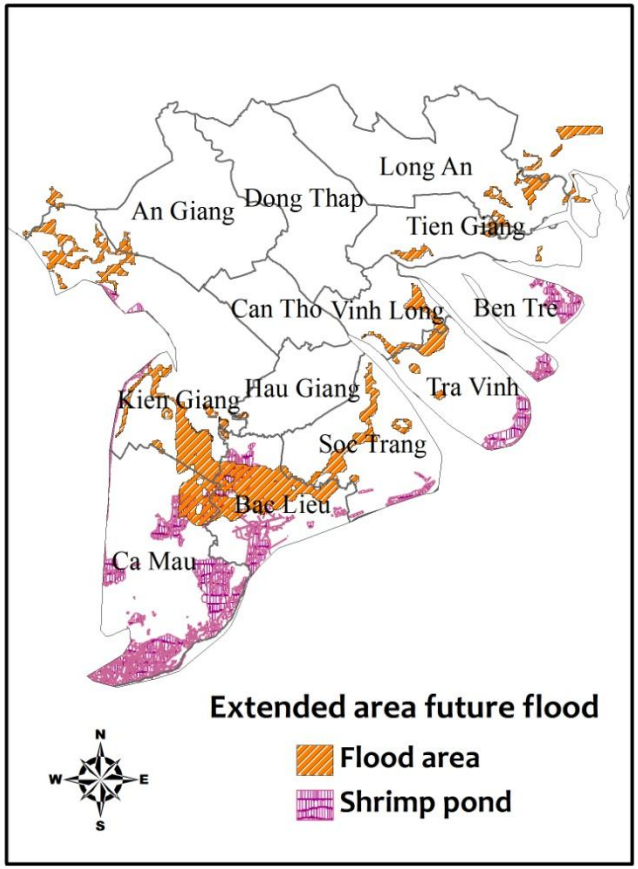


Serious flood (50cm) may start before end-August and affect the Summer-Autumn rice crop

Using climate scenarios for risk climate change risk assessment

Change in future flood risk in Mekong River delta

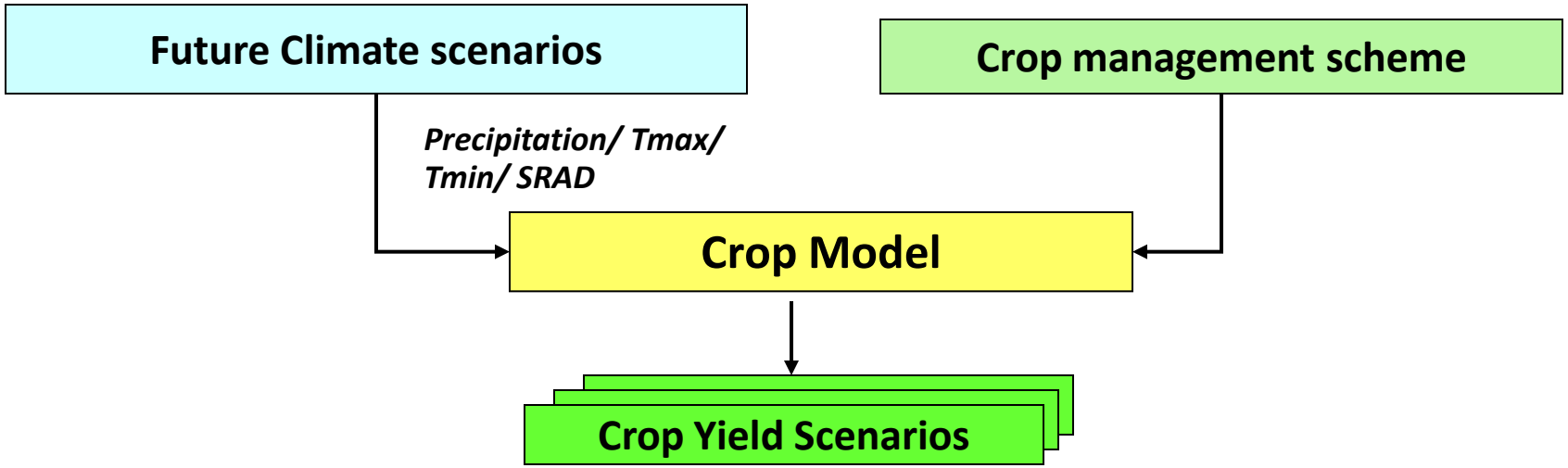




Extended flood area and affect some shrimp ponds.

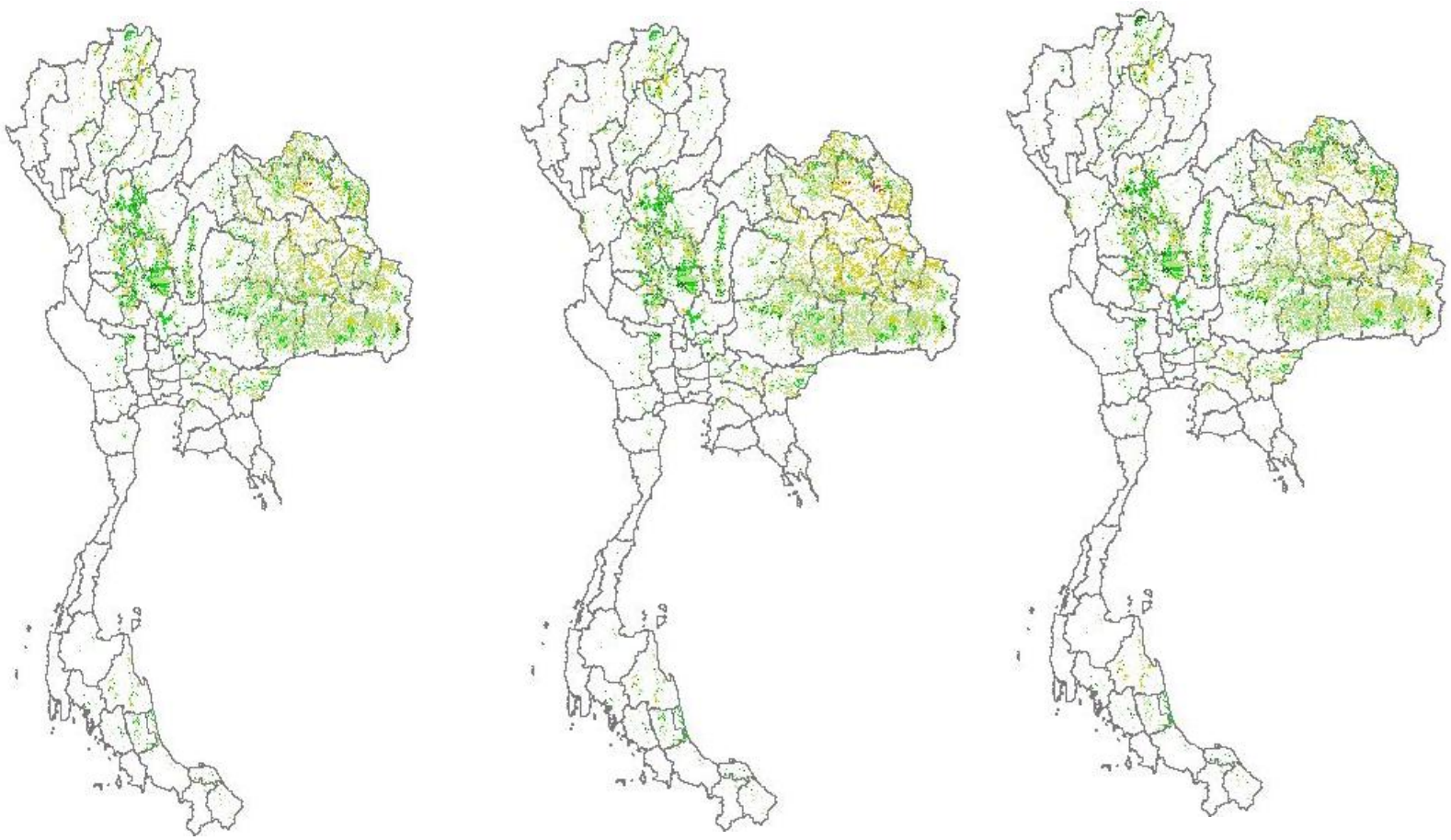
Using climate scenario data for climate change impact assessment

How does future climate pattern alter rice productivity?



Rice productivity: kg/ha

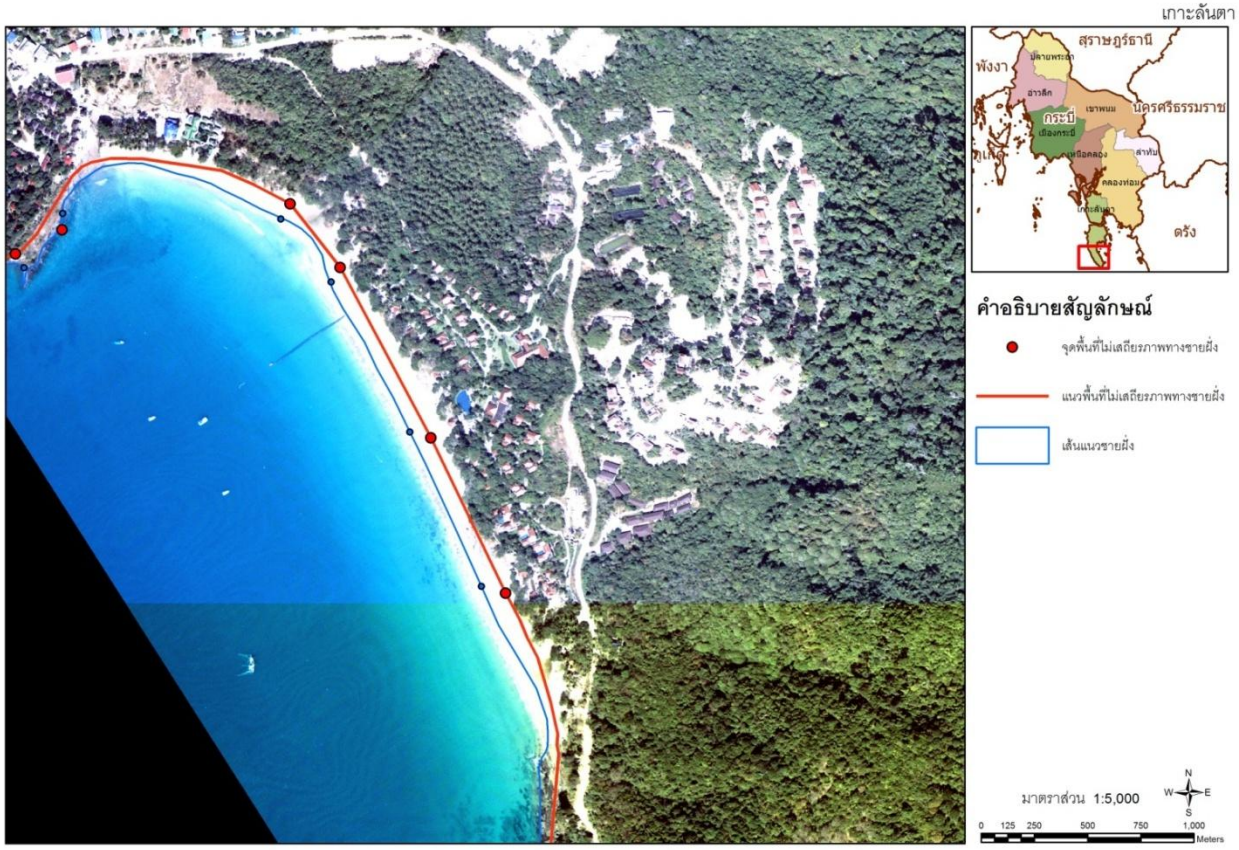
Using climate scenario data for climate change impact assessment



Rain-fed rice yield during 1990s vs 2030s vs 2050s

Using climate scenario data for climate change impact assessment

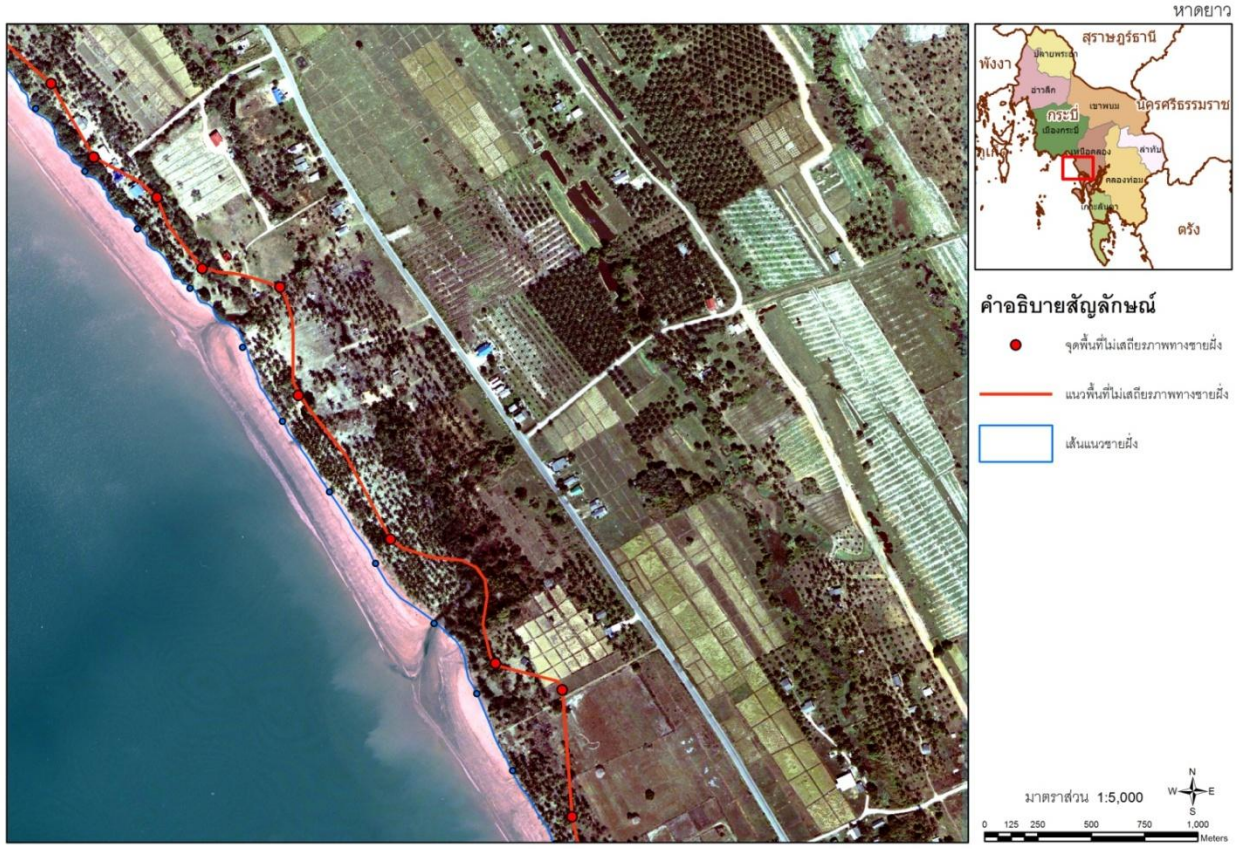
Coastal zone impact and risk assessment



Impact of sea level change on shoreline stability

Using climate scenario data for climate change impact assessment

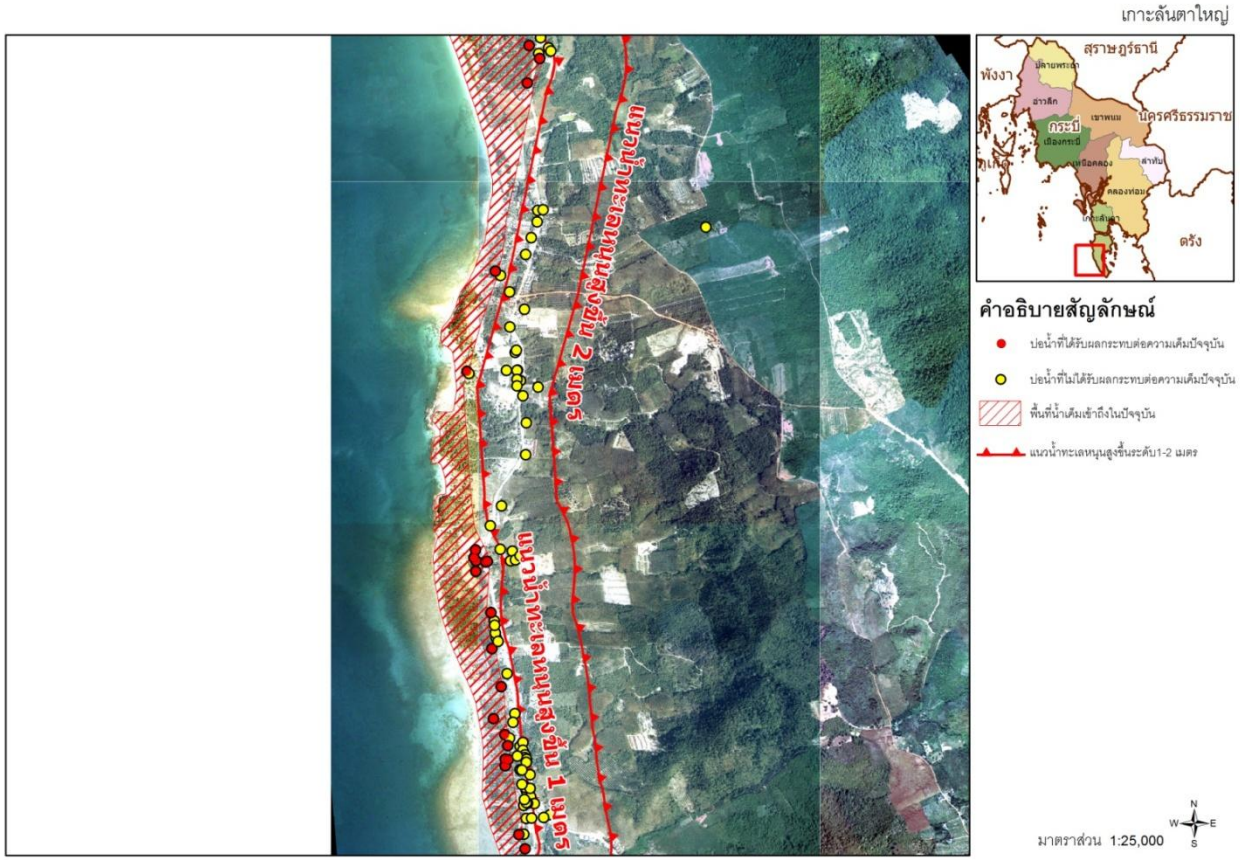
Coastal zone impact and risk assessment



Impact of sea level change on shoreline stability

Using climate scenario data for climate change impact assessment

Coastal zone impact and risk assessment



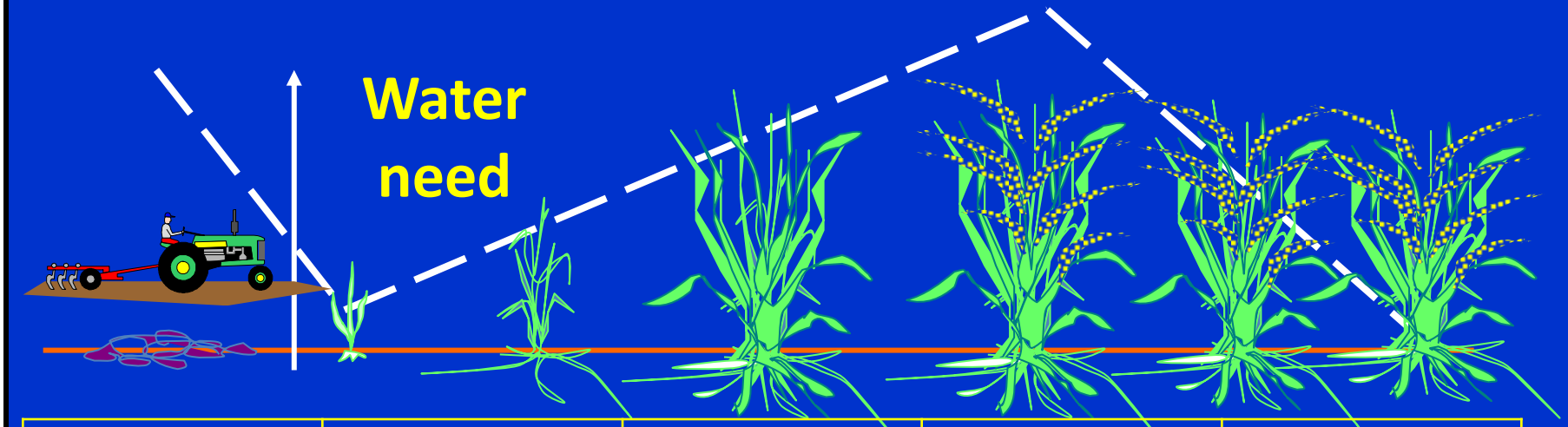
Impact of sea level change on aquifer contamination

Using climate scenarios for risk climate change risk assessment

Making information out of data

Needs to understand context of the specific sector

- Case study in the Mekong River Delta – Rice yield will be affected if:
  - Drought in early Summer – Autumn rice crop (15/5 – 15/6)
    - Total rainfall in 5 days is less than 100 mm.
    - Total rainfall in 5 consecutive days after sowing/transplanting day is less than 50 mm.
  - High temperature in early Summer – Autumn rice crop (1/5 – 30/5) :
    - High temperature in 5 continuous days after sowing/transplanting day is higher 40℃.
  - Dry spell in flowering period of Summer – Autumn rice crop (20/7 – 10/8):
    - Total rainfall in 7 continuous days is less than 150 mm.

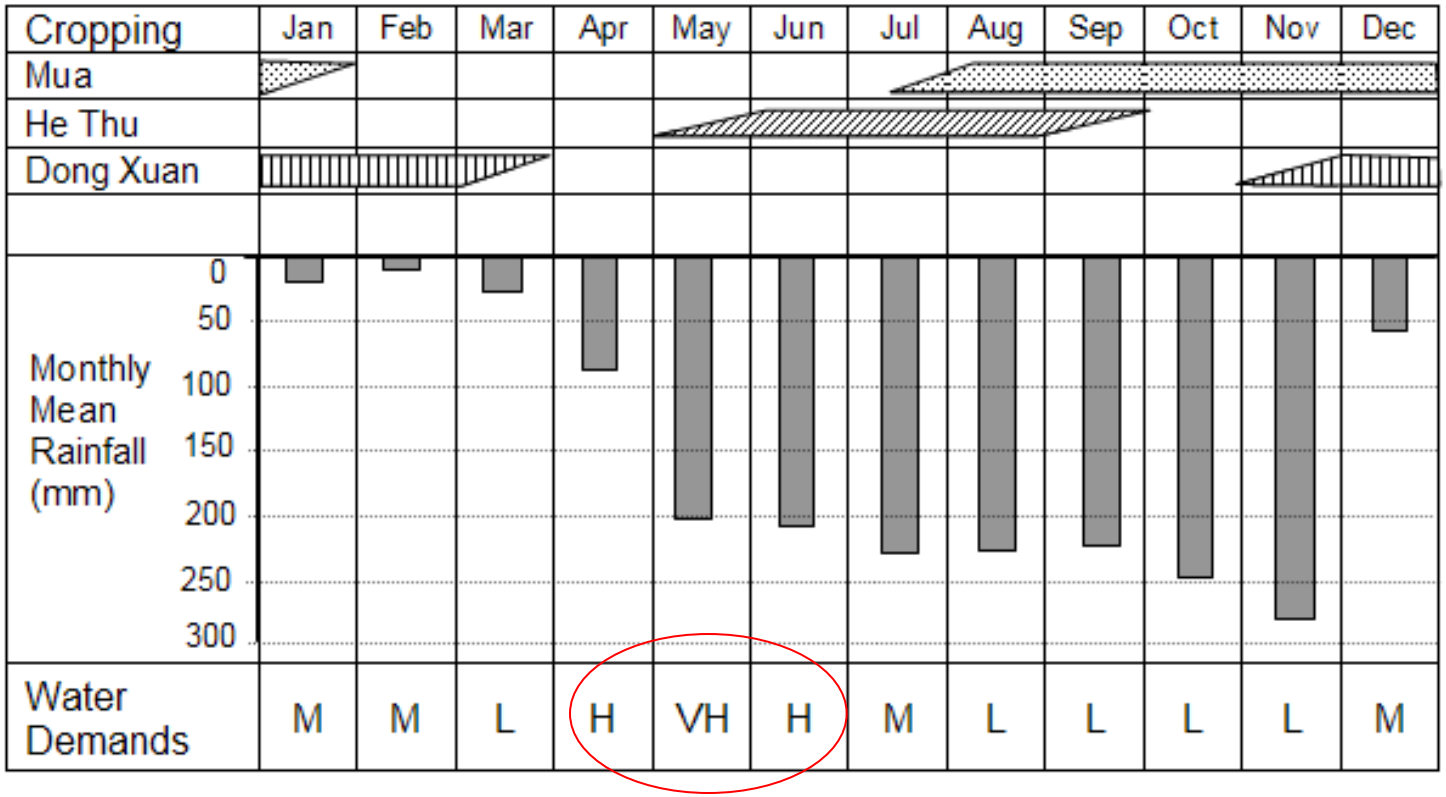


April	May	June	July	August

Plough	Sow/ Transplant	Budding	Max. bud	Flowering	Green grain	Ripening
Max. water	Medium water	Increasing water		High water	Decreasing water	
10 - 20 cm	5- 10 cm	2 – 10 cm		10 cm	5 – 0 cm	

Using climate scenarios for risk climate change risk assessment

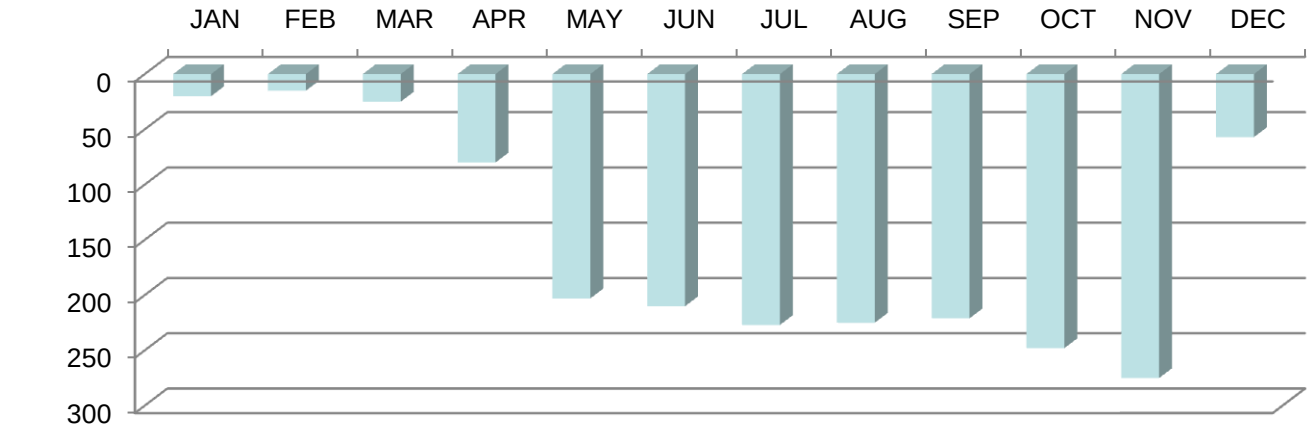
Making information out of data



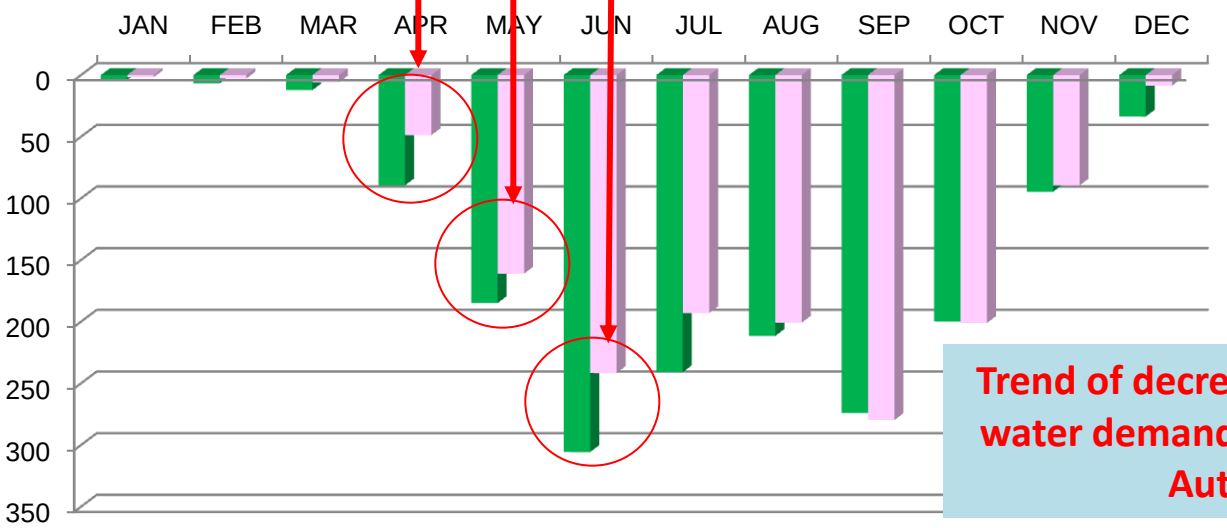
Cropping calendar, monthly rainfall and water demands in the MD

VH: very high; H: High; M: Medium; L: Low

Using climate scenarios for risk climate change risk assessment



Water Demands	M	M	L	H	VH	H	M	L	L	L	L	M



Preferred rainfall distribution condition

Rainfall distribution

Present vs Future

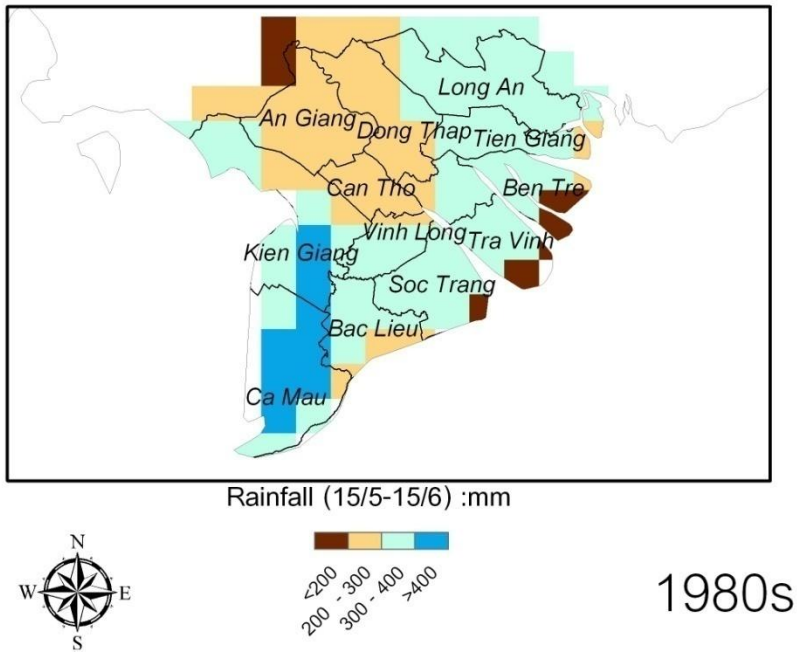
PRESENT

FUTURE

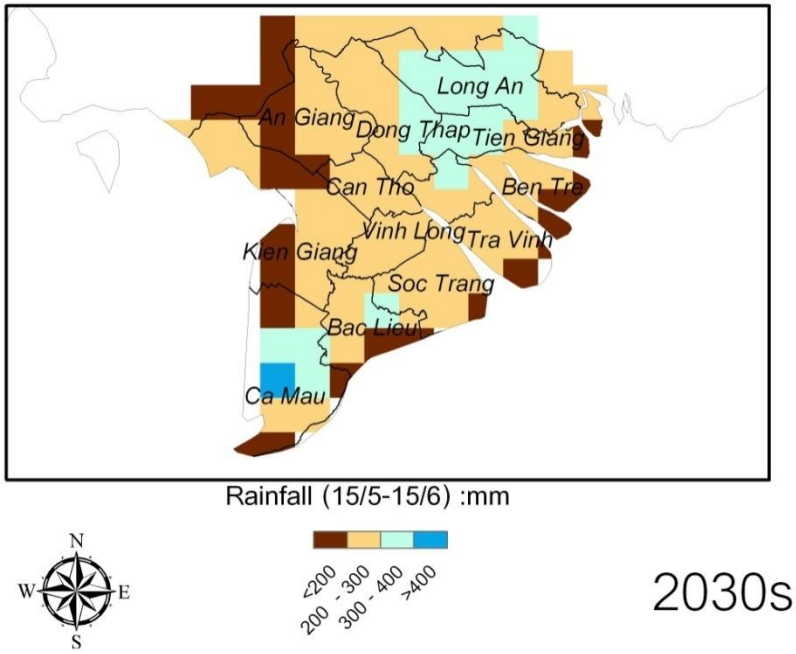
Trend of decreasing rainfall during high water demand period: early Summer – Autumn rice crop

VH: very high; H: High; M: Medium; L: Low

Using climate scenarios for risk climate change risk assessment



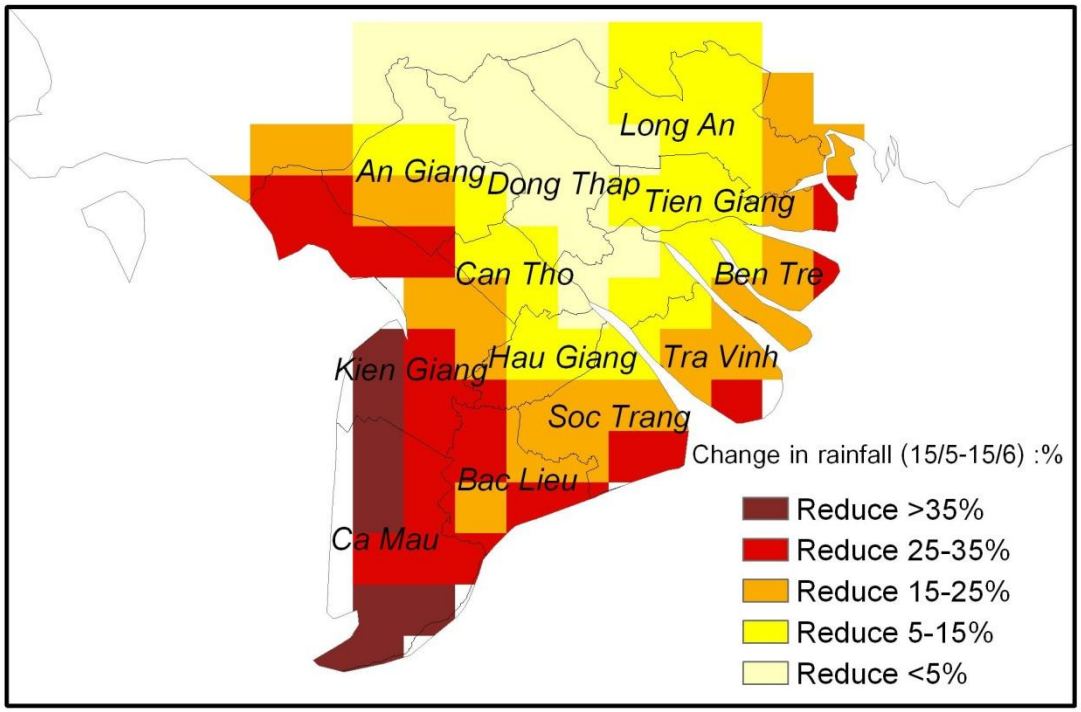
1980s



2030s

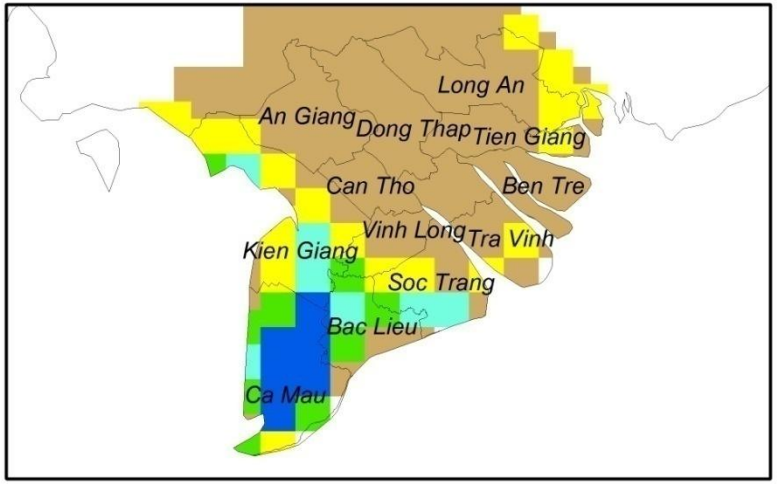
Total rainfall in early Summer – Autumn rice crop (mid-May to mid-June) will decrease

Using climate scenarios for risk climate change risk assessment



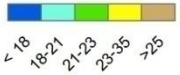
Total rainfall in early Summer – Autumn rice crop will reduce !!!

Using climate scenarios for risk climate change risk assessment

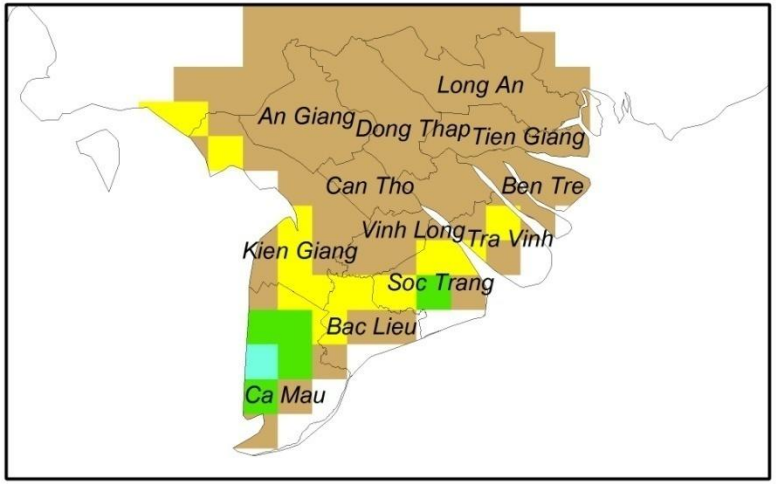


Number of drought event in early Summer – Autumn rice crop :15/5 – 15/6

(Total rainfall in 5 days is less than 100 mm)

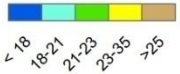


1980s

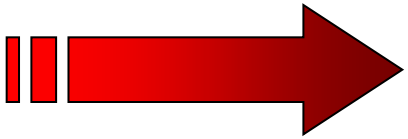


Number of drought event in early Summer – Autumn rice crop :15/5 – 15/6

(Total rainfall in 5 days is less than 100 mm)



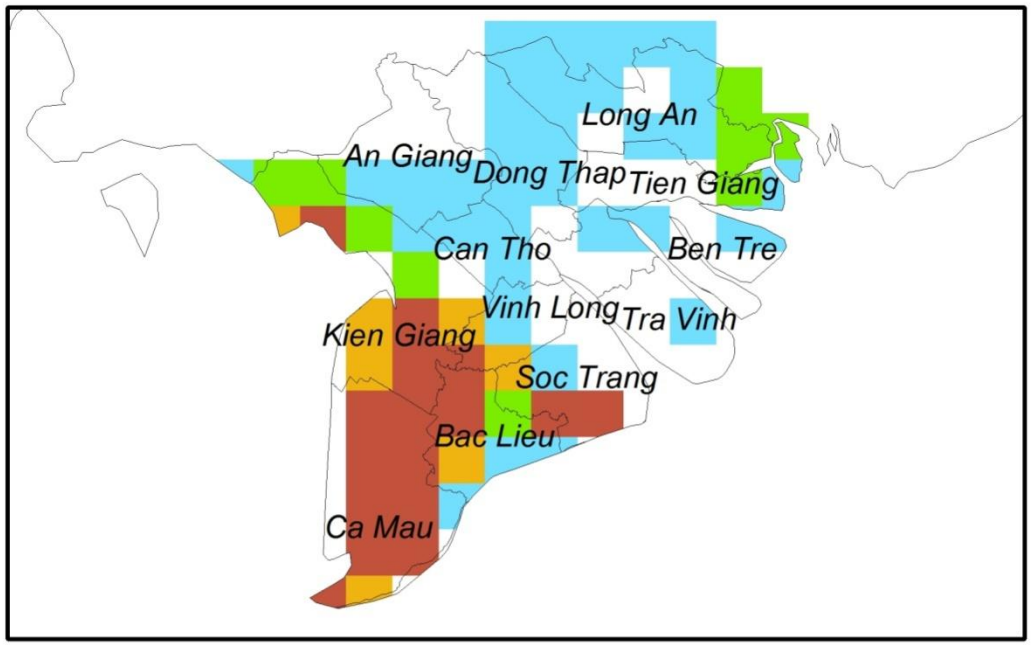
2030s



Higher risk of drought event in early Summer – Autumn rice crop !!!

(Chance of dry spell – 5-day total rainfall is less than 100 mm. may increase)

Using climate scenarios for risk climate change risk assessment



Change in number of drought event in early Summer – Autumn rice crop :15/5 – 15/6

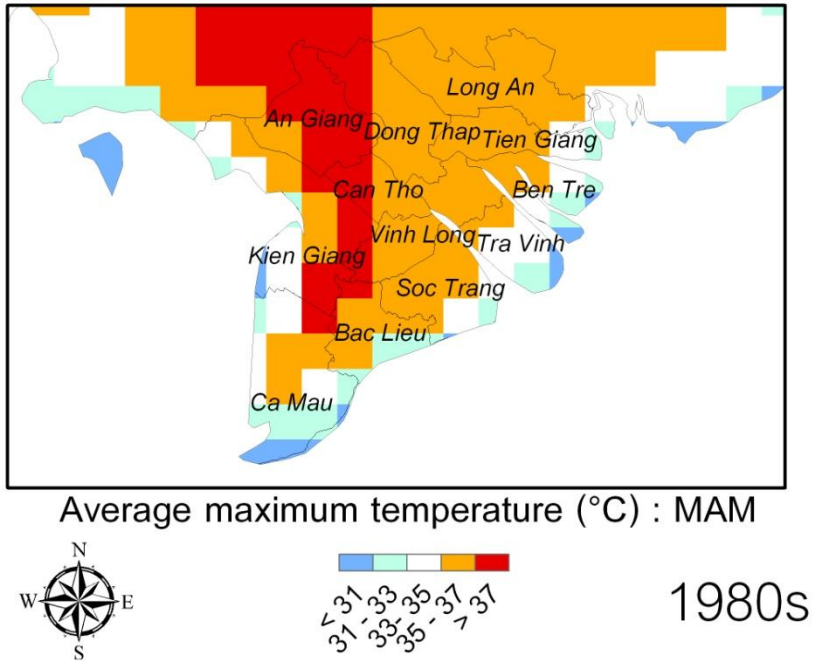
(Total rainfall in 5 days is less than 100 mm)

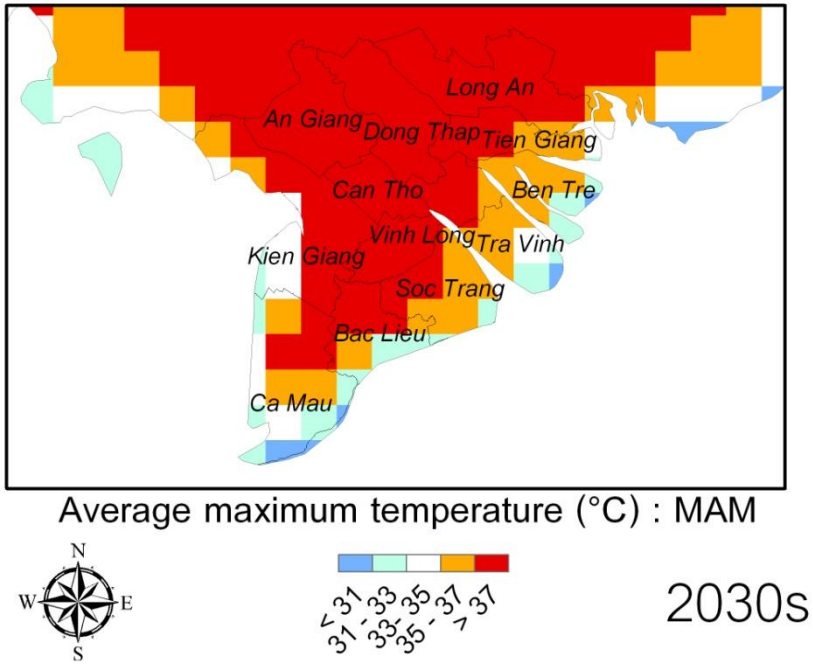
2030s

Number of drought event in early Summer – Autumn rice crop will increase !!!

Using climate scenarios for risk climate change risk assessment

Average max. temperature in March – April – May

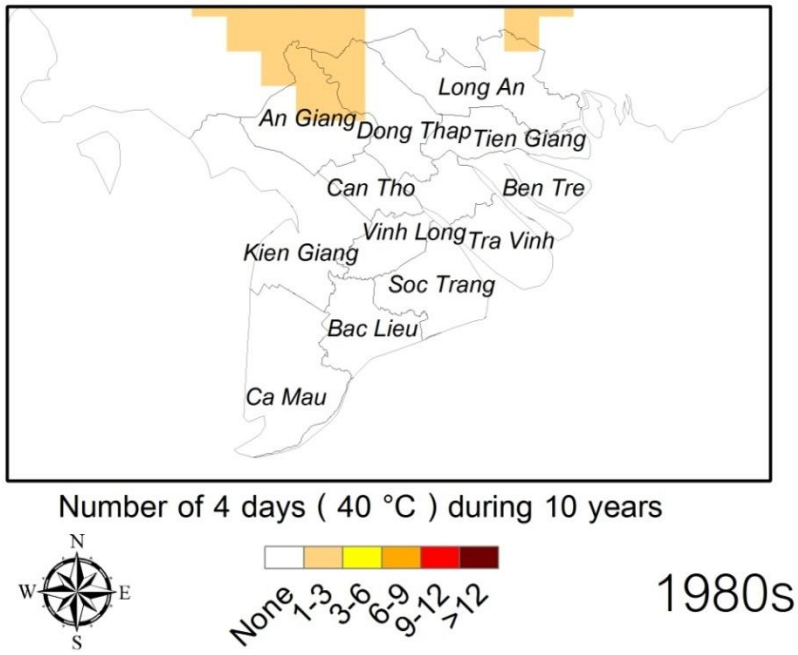


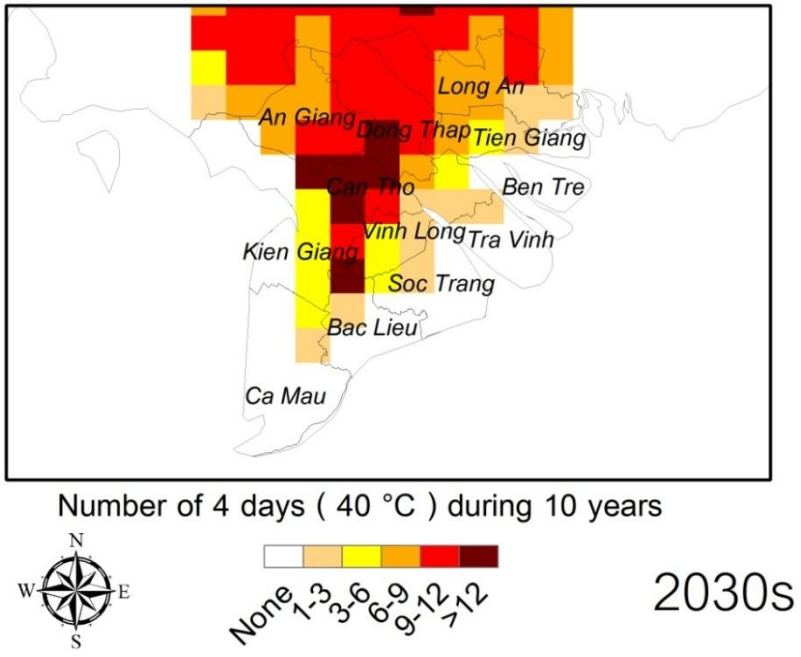


Higher risk of heat effect on rice in early crop season !!!

Max. temperature will increase

Using climate scenarios for risk climate change risk assessment

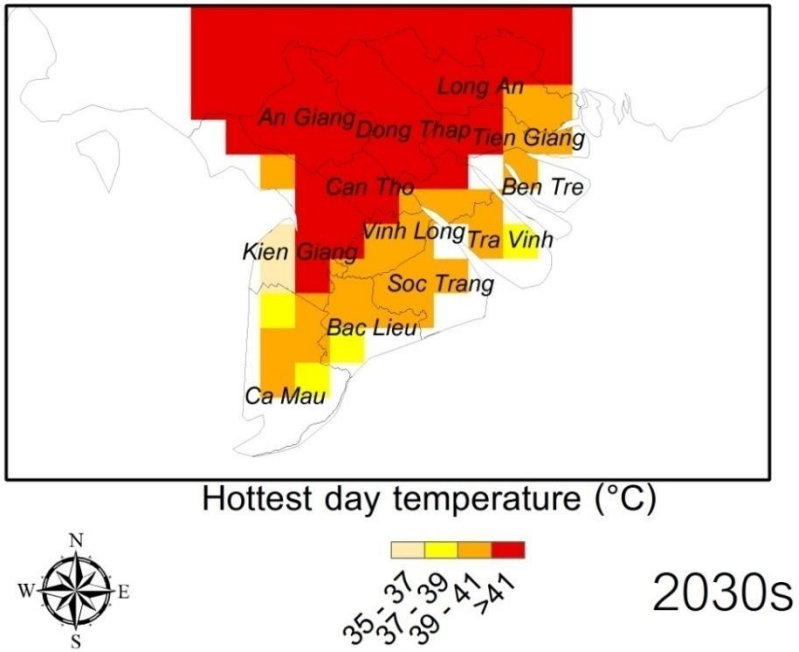




Higher risk of heat effect on rice in early crop season !!!

Number of hot period (4-hot-days > 40°C) in early Summer – Autumn rice crop (mid-May to mid-June) will increase !!!

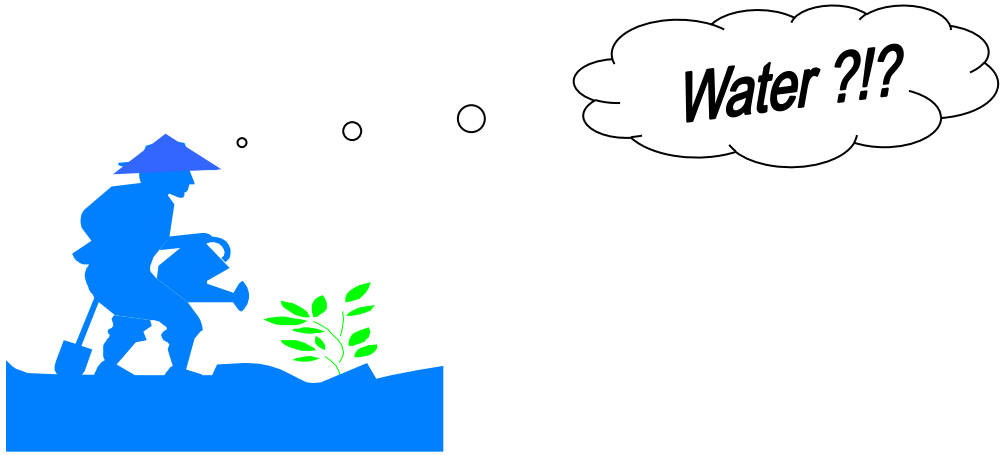
Using climate scenarios for risk climate change risk assessment



Higher risk of heat effect on rice during crop season !!!

Extreme max. temperature areas will increase !!!

Using climate scenarios for risk climate change risk assessment



Higher risk in shortage of water at beginning of Summer – Autumn rice crop

In general, compared 1980s, the rainy season in 2030s:

+ starts late about 2 weeks (15/4 – 30/5)

+ total yearly rainfall amount reduces about 20%

+ in the future the farmers have to pay more for pumping water

Using climate scenarios for risk climate change risk assessment

Selecting indicators for climate change risk assessment

Table 1 | A summary showing simplified, estimated impacts of hydropower development and climate change on selected hydrological indicators in the Tonle Sap area. Impact timescale refers to the time horizon within which the impacts are expected to start to occur*

Hydrological variable	Impact: development	Impact: climate	Certainty of climate impact
Average water level (Feb–Jul)	↑	↑	Very likely increases
Average water level (Aug–Jan)	↓	↑	Likely increases
Annual cumulative flooded area	↓	↑	Very likely increases
Maximum water level	↓	↑	Likely increases
Maximum flooded area	↓	↑	Likely increases
Flood start date	→	←	Very likely occurs earlier
Flood peak date	–	→ / ←	Occurs possibly later in average years and earlier in driest years
Flood end date	←	→	Likely occurs later
Flood duration	↓	↑	Likely increases
IMPACT TIMESCALE	Short–medium (~5–30 years)	Medium–long (~20–100 years)	

Thank you