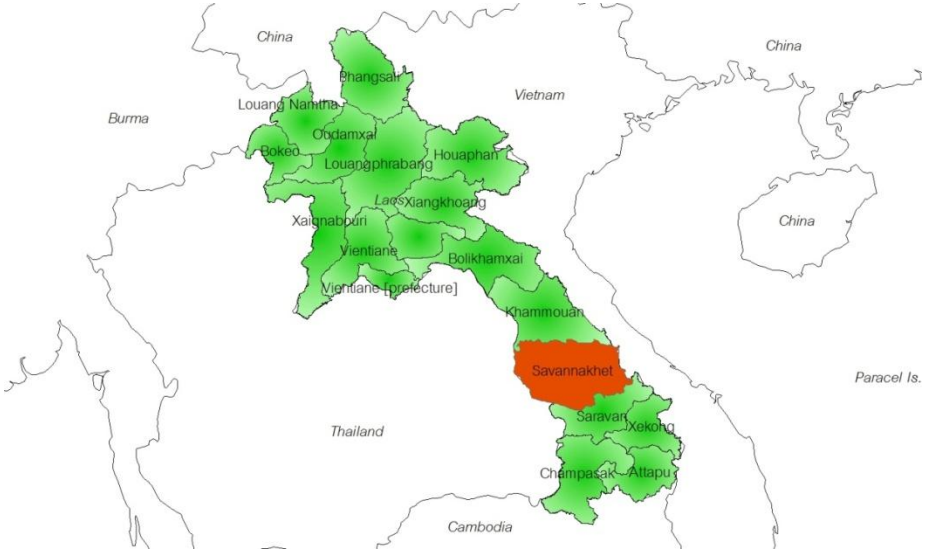
Rapid Assessment on Climate Change Risk
CCAI pilot site: Champhone, Savannakhet, Lao PDR



Session 7: Working with climate change data

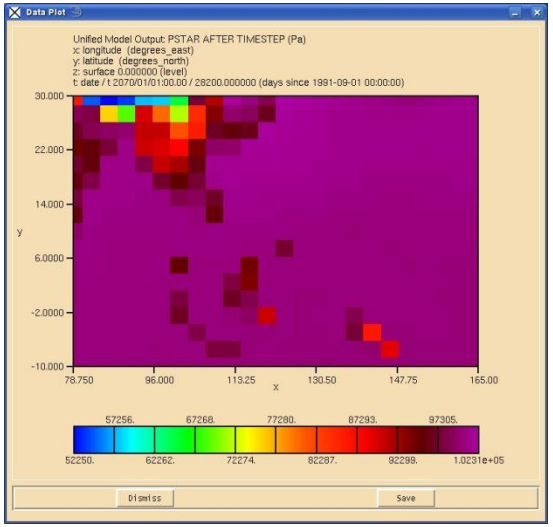
Southeast Asia START Regional Center

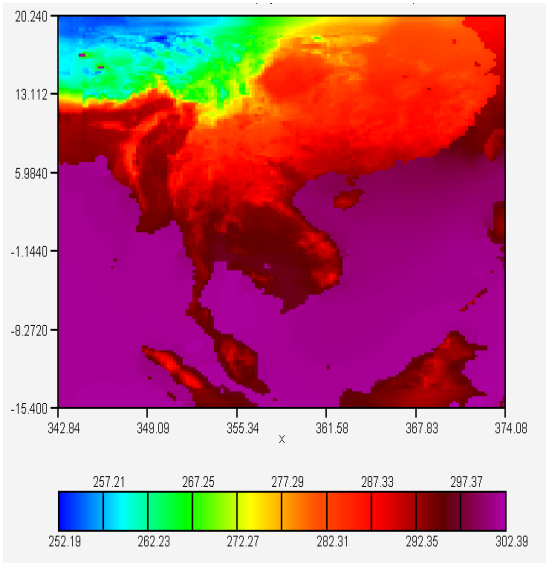
Working with climate change data

- Background
- Data structure of climate scenario
- Extracting climate change data for further analysis
- Examples from previous case studies: Analysis of climate change for risk assessment – Numerical analysis vs Spatial analysis

Working with climate change data

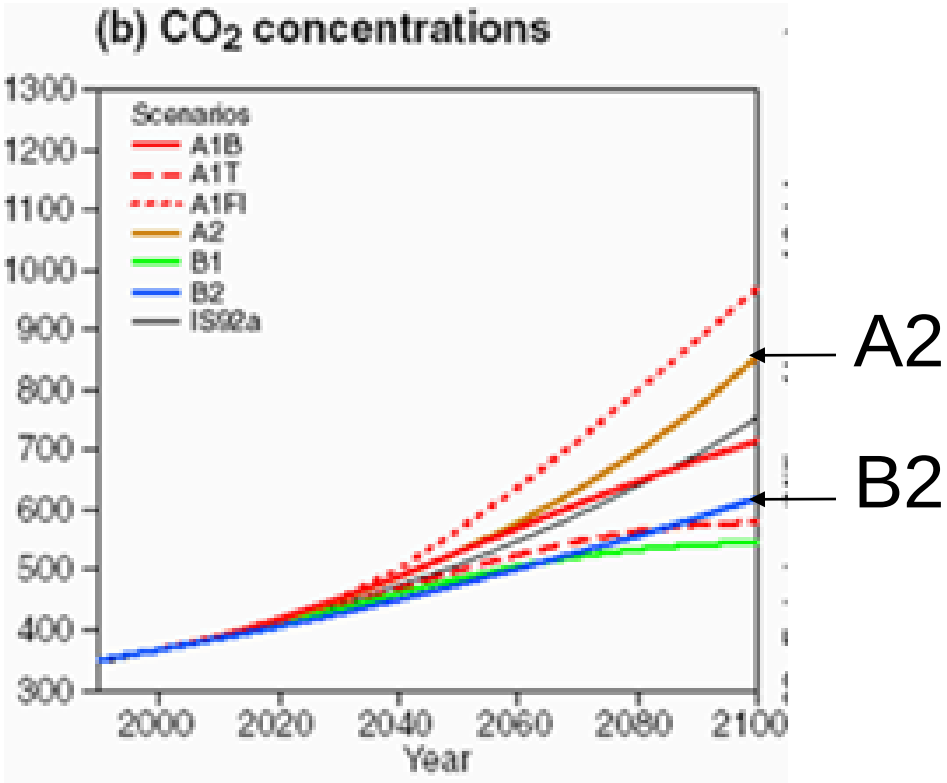
- Dynamic downscaling using ECHAM4 GCM A2 and B2
  (ECMWF Atmospheric General Circulation Model coupled with
  University of Hamburg Ocean Circulation Model)
- Global resolution: ~2.8°
- Regional resolution: .22º and rescale to 20x20km
- Temporal resolution: Daily
- Timeframe: 1960-2100
- Coverage
  - Lat. 0-35ºN
  - Lon. 90º-112ºE

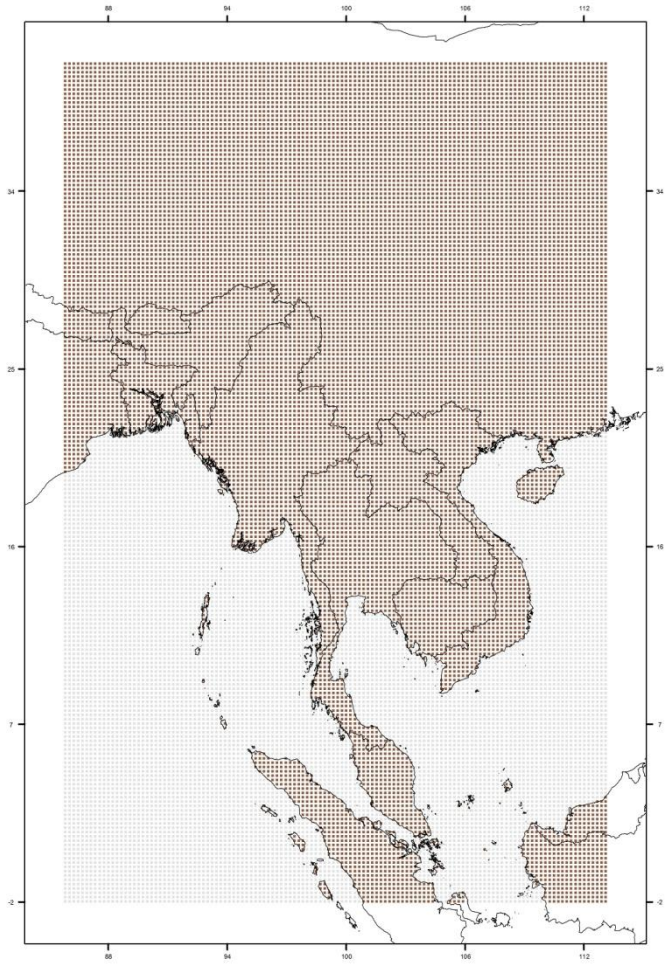




Working with climate change data

Domain coverage and GHG scenarios:

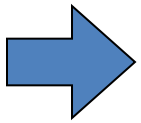




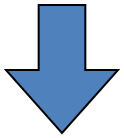
Working with climate change data

Example of data: Tmax

LAT	LON	D1	D2	D3	D4	D5	D6
18.4	103.6	22.97	23.04	24.38	25.53	25.06	25.57
18.4	103.8	23.33	23.48	24.68	25.85	25.34	25.73
18.2	103.6	23.26	23.43	24.87	25.97	25.41	25.97
18.2	103.8	23.17	23.31	24.58	25.79	25.24	25.60



D360

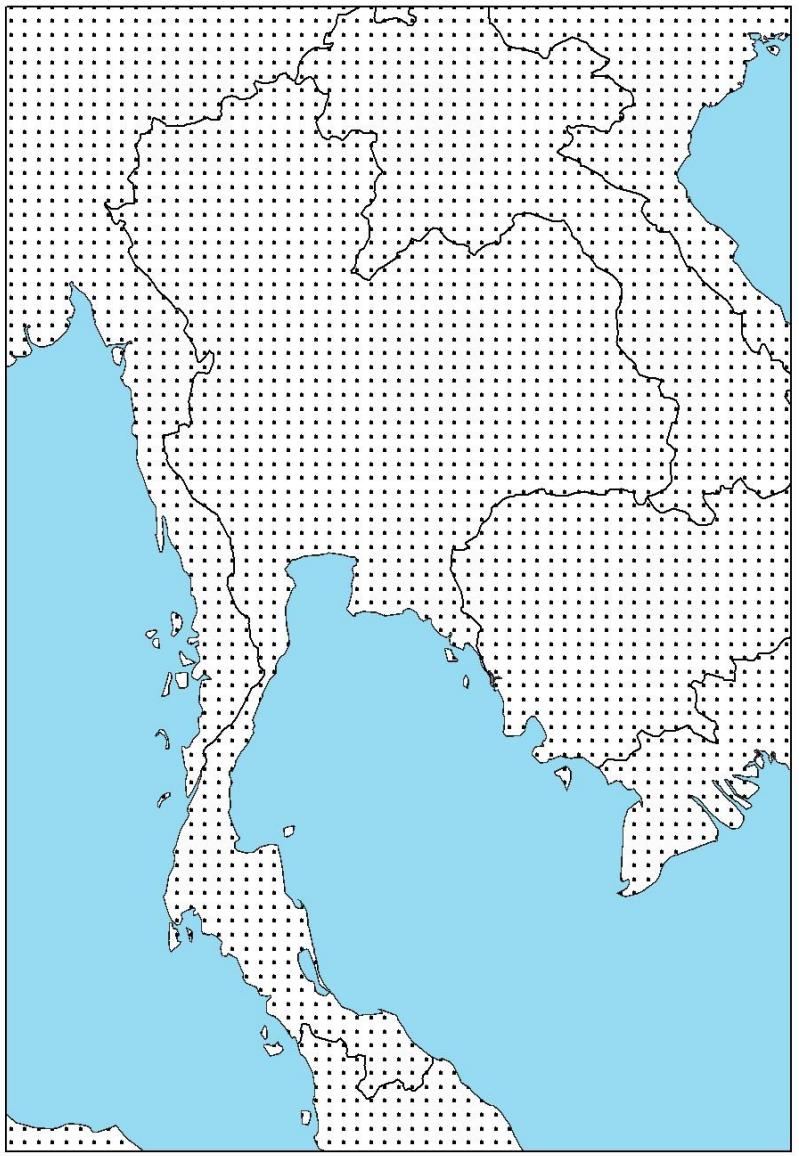


Working with climate change data

Data represents centroid of the grids

Data to be distributed to users in smaller domain of focus:

- Watershed
- Administrative boundary
- Freehand selection



Working with climate change data

Climate data for distribution

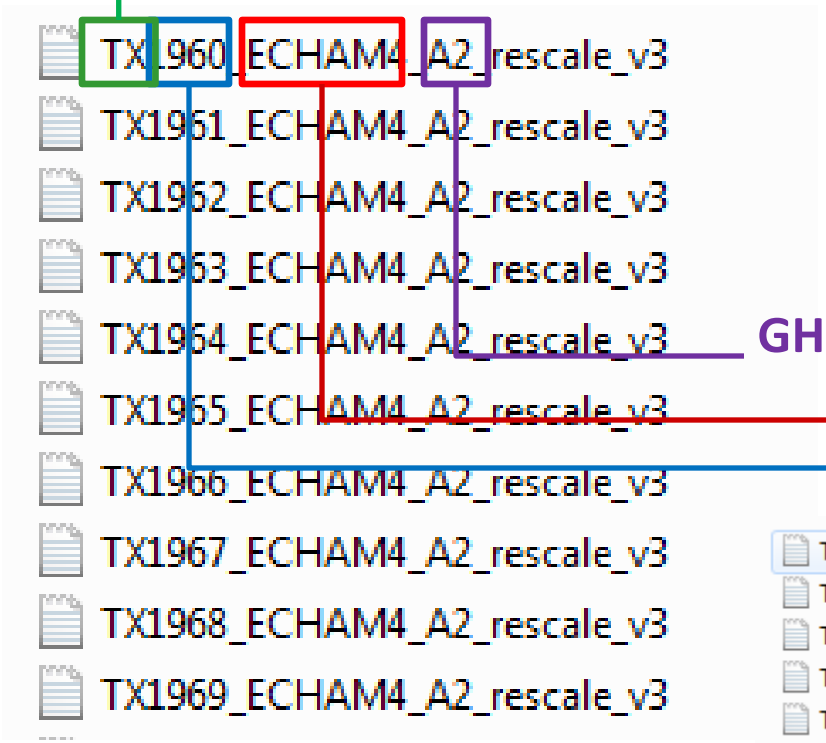
- Daily maximum temperature (º C)
- Daily minimum temperature (º C)
- Daily precipitation (mm)
- Solar radiation (watt/m^2)
- Wind speed (m / sec)
- Wind direction (degree from north)
- Relative humidity (in conversion process)

Available in text file format for ease of use

Each file = 1 variable / 1 year

Total data size (A2/B2) approx. 100GB

Working with climate change data



Variables

TX= Maximum temperature

TN= Minimum temperature

PC = Precipitation

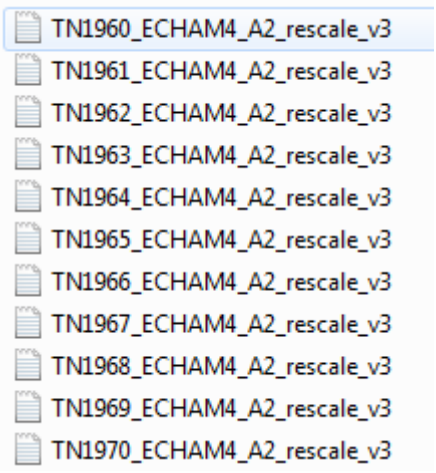
SL= Solar radiation

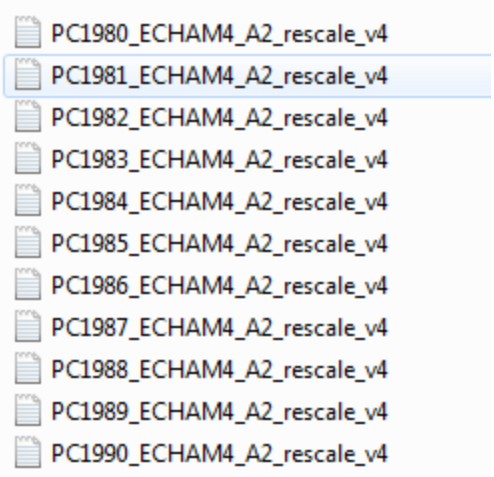
WD=Wind direction WS=Wind speed

GHG Scenarios

GCM data

Year





Data structure of climate scenario

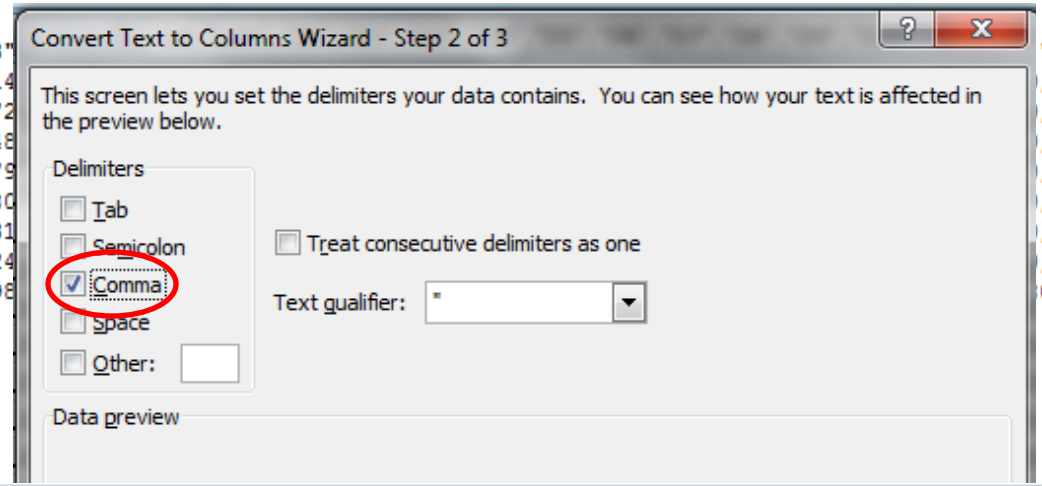
- Temporal resolution: Daily
- 360 days in each simulated year
- 30 days in each simulated month

"LAT"	"LON"	"D1"	"D2"	"D3"	"D4"	"D5"	"D6"	"D7"	"D8"	"D9"
38.2	98.6	-21.0140	-19.8140	-17.3610	-19.9930	-20.7420				
38.2	98.8	-20.7140	-19.6720	-17.1150	-19.7070	-20.3200				
38.2	99.0	-20.6810	-19.7480	-17.0590	-19.5990	-20.2500				
38.2	99.2	-20.9170	-19.9790	-17.2790	-19.7560	-20.5230				
38.2	99.4	-21.1850	-20.1800	-17.5910	-20.0130	-20.8860				
38.2	99.6	-20.4210	-19.7310	-16.9030	-19.3700	-20.3220				
38.2	99.8	-19.2230	-19.0240	-15.8510	-18.3730	-19.2840				
38.2	100.0	-17.9770	-17.9880	-14.7490	-17.3480	-18.1250				

- Spatial resolution: 0.2 degree (in latitude /longitude) approximately 20 x 20 km

Data structure of climate scenario

```
"LAT","LON","D1","D2","D3"
38.2,98.6,-21.0140,-19.814
38.2,98.8,-20.7140,-19.672
38.2,99.0,-20.6810,-19.748
38.2,99.2,-20.9170,-19.979
38.2,99.4,-21.1850,-20.180
38.2,99.6,-20.4210,-19.731
38.2,99.8,-19.2230,-19.024
38.2,100.0,-17.9770,-17.98
```



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	LAT	LON	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19
2	38.2	98.6	-21.01	-19.81	-17.36	-19.99	-20.74	-19.73	-20.29	-19.06	-17.5	-16.82	-17.72	-19.84	-20.35	-21.02	-19.73	-21.55	-21.88	-18.99	-15.03
3	38.2	98.8	-20.71	-19.67	-17.12	-19.71	-20.32	-19.47	-20.12	-18.77	-17.24	-16.45	-17.5	-19.63	-20.17	-20.74	-19.47	-21.34	-21.59	-19.08	-14.75
4	38.2	99	-20.68	-19.75	-17.06	-19.6	-20.25	-19.45	-20.15	-18.7	-17.28	-16.41	-17.53	-19.7	-20.28	-20.76	-19.39	-21.29	-21.57	-19.06	-14.78
5	38.2	99.2	-20.92	-19.98	-17.28	-19.76	-20.52	-19.75	-20.45	-18.98	-17.62	-16.72	-17.84	-20.05	-20.68	-21.07	-19.62	-21.55	-21.87	-19.28	-15.18
6	38.2	99.4	-21.19	-20.18	-17.59	-20.01	-20.89	-20.17	-20.85	-19.45	-18.03	-17.13	-18.2	-20.46	-21.15	-21.43	-19.99	-21.95	-22.27	-19.67	-15.67
7	38.2	99.6	-20.42	-19.73	-16.9	-19.37	-20.32	-19.67	-20.35	-18.99	-17.37	-16.54	-17.5	-19.82	-20.54	-20.81	-19.33	-21.36	-21.63	-18.86	-15.06
8	38.2	99.8	-19.22	-19.02	-15.85	-18.37	-19.28	-18.76	-19.4	-18.05	-16.26	-15.47	-16.33	-18.74	-19.51	-19.76	-18.29	-20.32	-20.57	-18.16	-14.08
9	38.2	100	-17.98	-17.99	-14.75	-17.35	-18.13	-17.72	-18.36	-17.27	-15.04	-14.3	-15.07	-17.58	-18.37	-18.6	-17.15	-19.18	-19.42	-17.9	-12.98
10	38.2	100.2	-16.02	-16.16	-12.97	-15.63	-16.23	-15.85	-16.16	-15.13	-12.72	-12.05	-12.78	-15.83	-16.68	-16.81	-15.37	-17.34	-17.51	-16.84	-11.17
11	38.2	100.4	-12.78	-13.3	-10.01	-12.64	-13.13	-12.59	-11.94	-10.29	-8.511	-7.958	-8.663	-13.09	-14.12	-13.97	-12.52	-14.31	-14.34	-13.74	-8.216

Extracting climate change data for further analysis

Selecting data from relevant grids(s) for further analysis

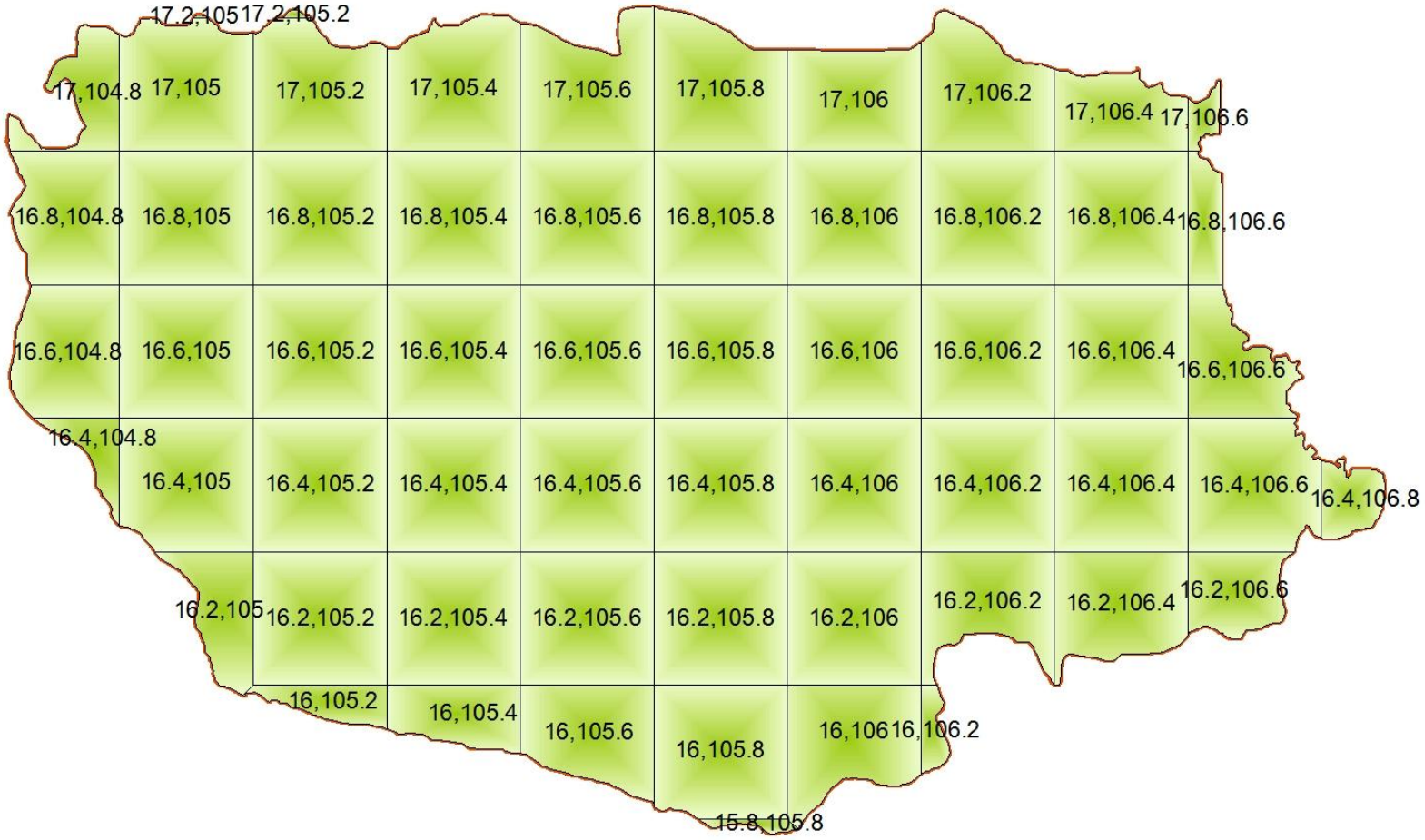
- Selecting data from multiple grids for area analysis
  (large area – using GIS tool to select data)

- Selecting data from selected grid(s) for analysis
  (small area – hand pick grid(s) to select data based on lat./lon. coordinate)

How to conduct climate change risk assessment with limited dataset

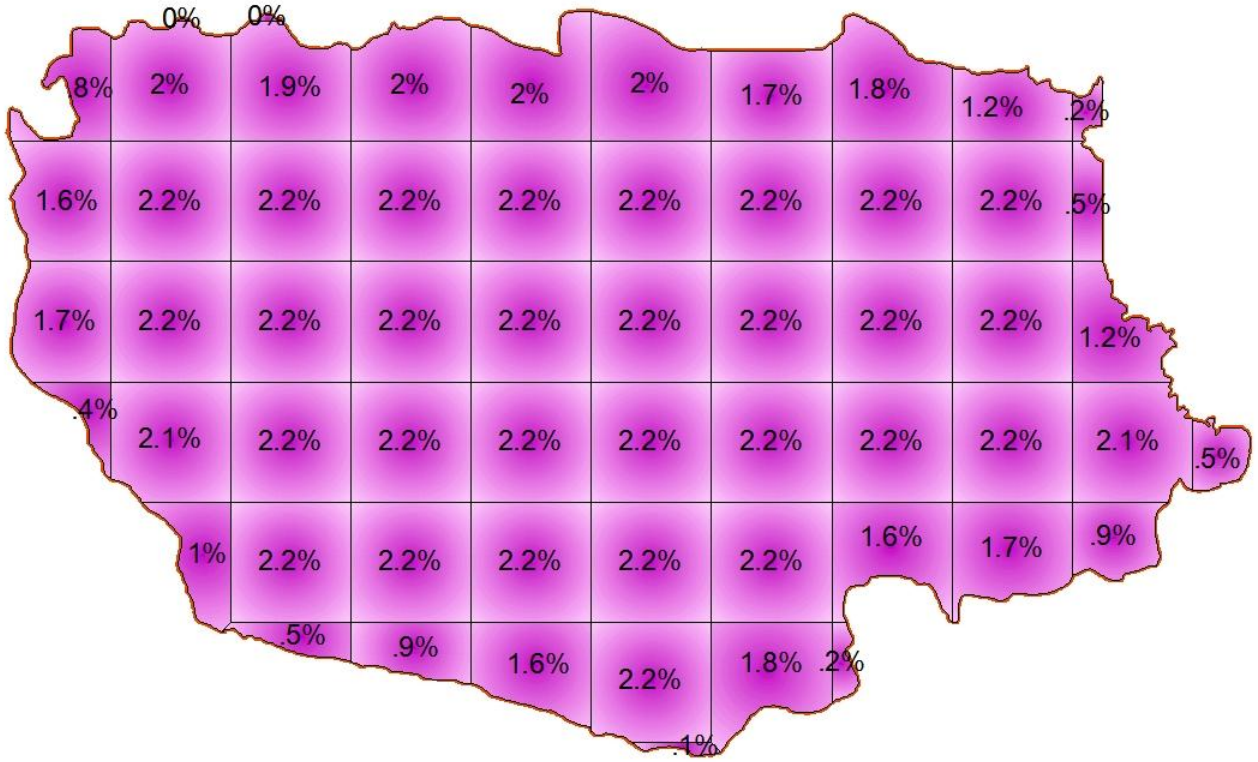
Extracting climate change data for further analysis

Grid data – Savannakhet province
Using GIS tool to select grids



Extracting climate change data for further analysis

Weighting data from partial grid



Whole Area

1.Calculate total area of study area

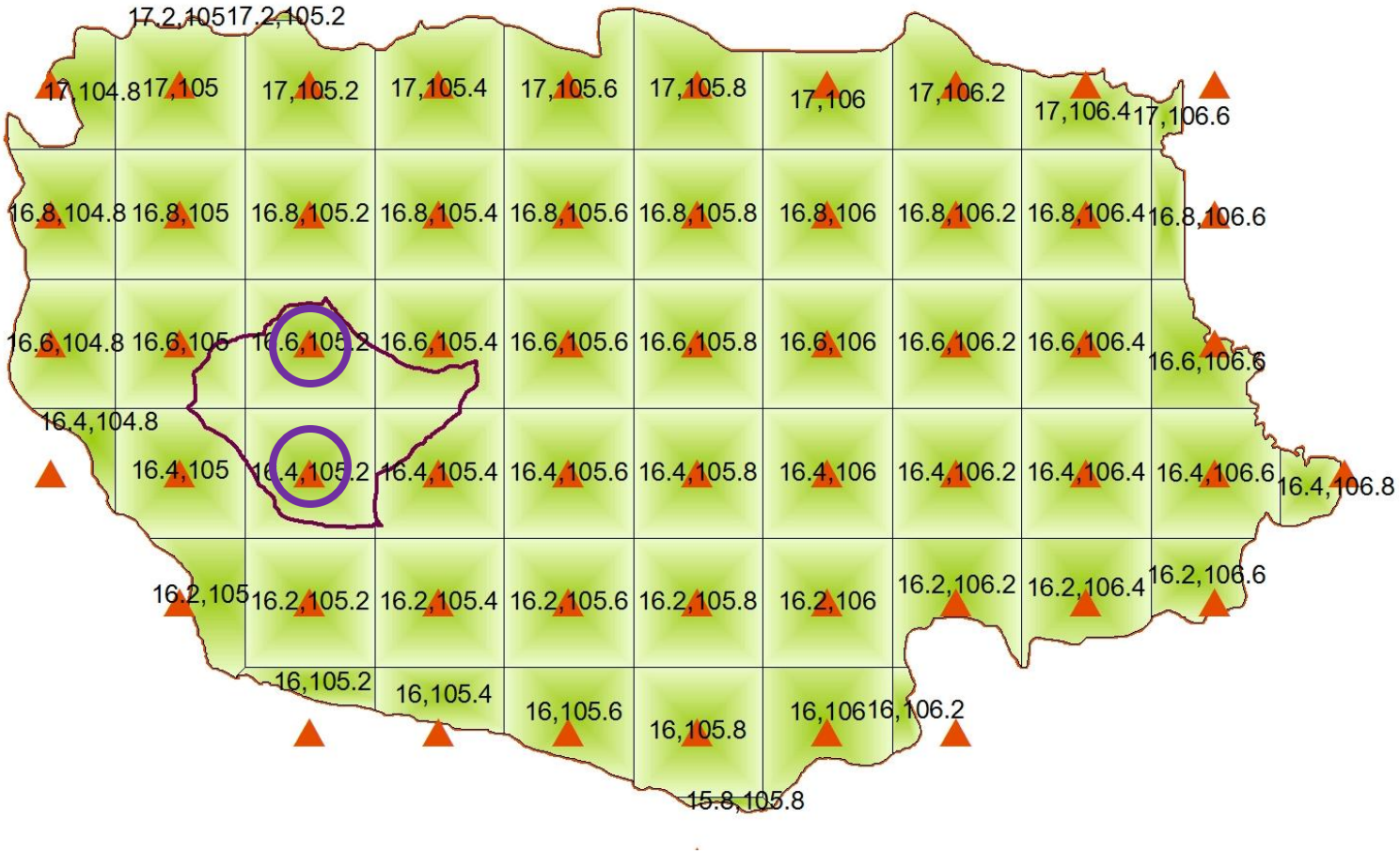
Total area: 21408 square kilometers.

2.Calculate area of each grid

3.Calculate percentage area of each grid

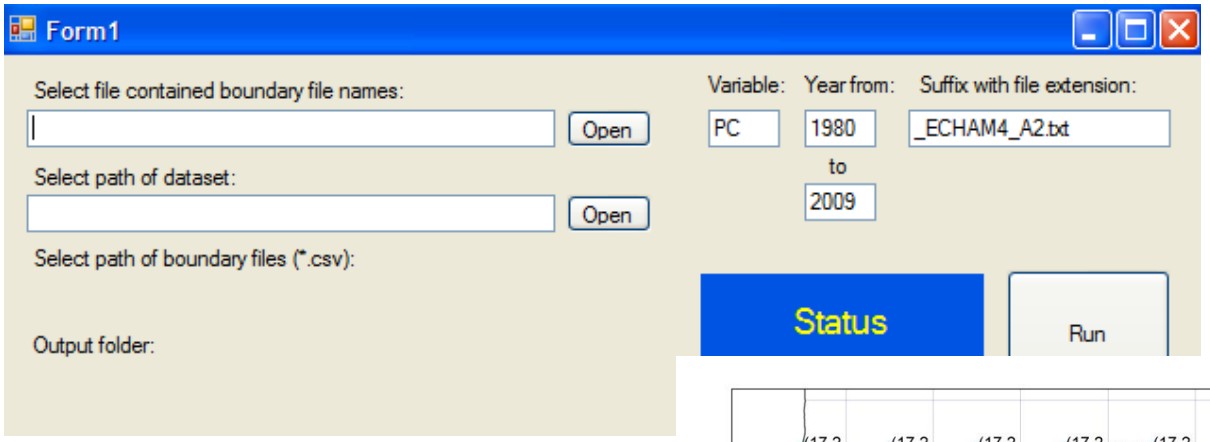
Extracting climate change data for further analysis

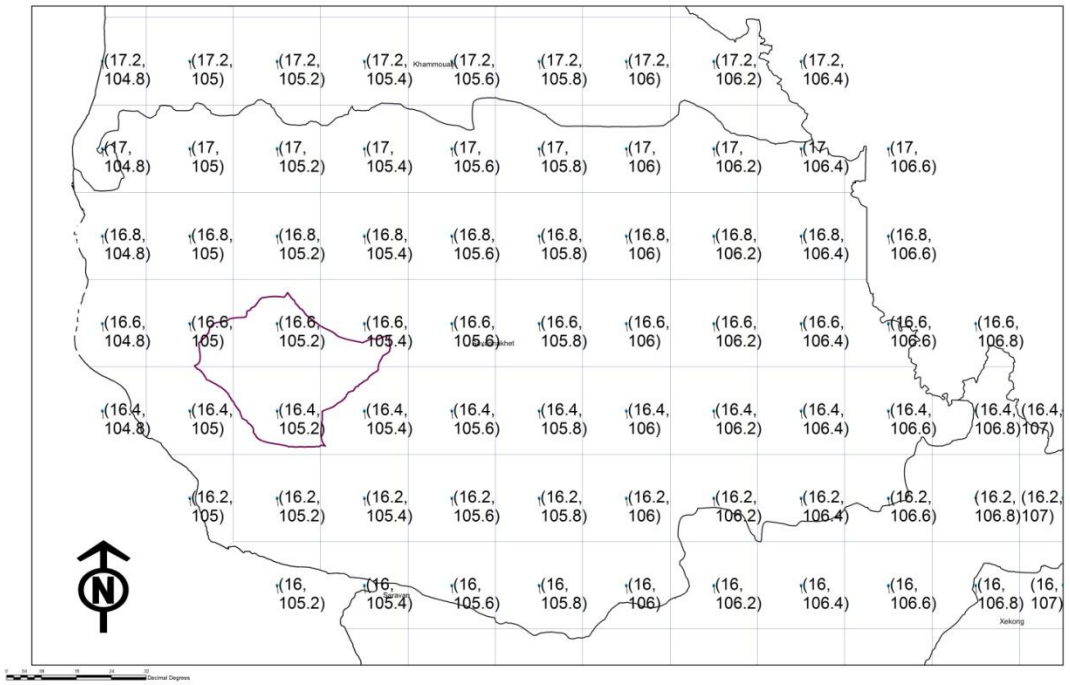
Selecting 1-2 grids to represent small area – Champone district



Extracting climate change data for further analysis

Selecting data from desired grid using data selection utility





Extracting climate change data for further analysis

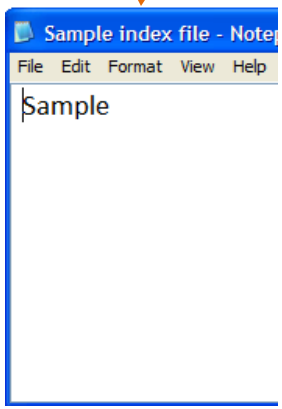
Selecting data from desired grid using data selection ut

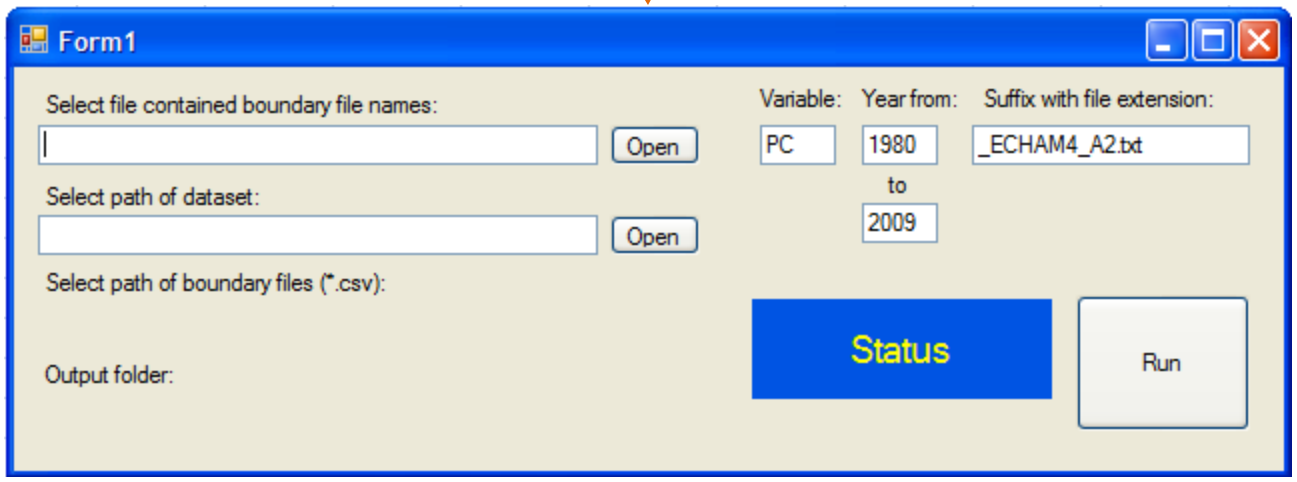
Grid Split
WindowsApplication1
SANGMANEE

Sample
Microsoft Office Excel Comma ...
2 KB

Sample index file
Text Document
1 KB

	A	B
1	16.6	102
2	16.6	102.2
3	16.6	102.4
4	16.6	102.6
5	16.6	102.8
6	16.6	103
7	16.6	103.2
8	16.6	103.4
9	16.6	103.6
10	16.6	103.8
11	16.8	101.8
12	16.8	102
13	16.8	102.2
14	16.8	102.4





Extracting climate change data for further analysis

- CC Distribution
  http://cc.start.or.th/

Extracting climate change data for further analysis

Climate Change Data Distribution System

ยินดีต้อนรับสู่ระบบบริการข้อมูลการคาดการณ์สภาพภูมิอากาศอนาคตสำหรับพื้นที่เอเชียตะวันออกเฉียงใต้ ระบบนี้เป็นความร่วมมือทางวิชาการระหว่างศูนย์เครือข่ายงานวิเคราะห์วิจัย และฝึกอบรมการเปลี่ยนแปลงของโลกแห่งภูมิภาคเอเชียตะวันออกเฉียงใต้และบริษัทอีเอสอาร์ไอ (ประเทศไทย) จำกัด โดยการสนับสนุน ของสำนักพัฒนาบัณฑิตศึกษาและวิจัย ด้านวิทยาศาสตร์และเทคโนโลยี (สบว.) ข้อมูลการคาดการณ์สภาพภูมิอากาศอนาคตที่เผยแพร่นี้เป็นผลจากโครงการพัฒนาขีดความสามารถในการวิจัยโดยการสนับสนุนของ Asia- Pacific Network for Global Change Research (APN) ภายใต้โครงการ CAPaBLE Project "Climate Change in Southeast Asia and Assessment on Impact, Vulnerability and Adaptation on Rice Production and Water Resource" และ โครงการวิจัย "การจำลองสภาพภูมิอากาศอนาคตสำหรับประเทศไทยและพื้นที่ข้างเคียง" ภายใต้ การสนับสนุนของสำนักงานกองทุนสนับสนุนการวิจัย (สกว.) และได้รับการสนับสนุนด้านเทคนิคจาก The Met Office Hadley Centre for Climate Prediction and Research แห่ง ประเทศอังกฤษ โดยการฝึกอบรม การจัดหา Software PRECIS regional climate model และข้อมูลที่จำเป็นในการดำเนินการ

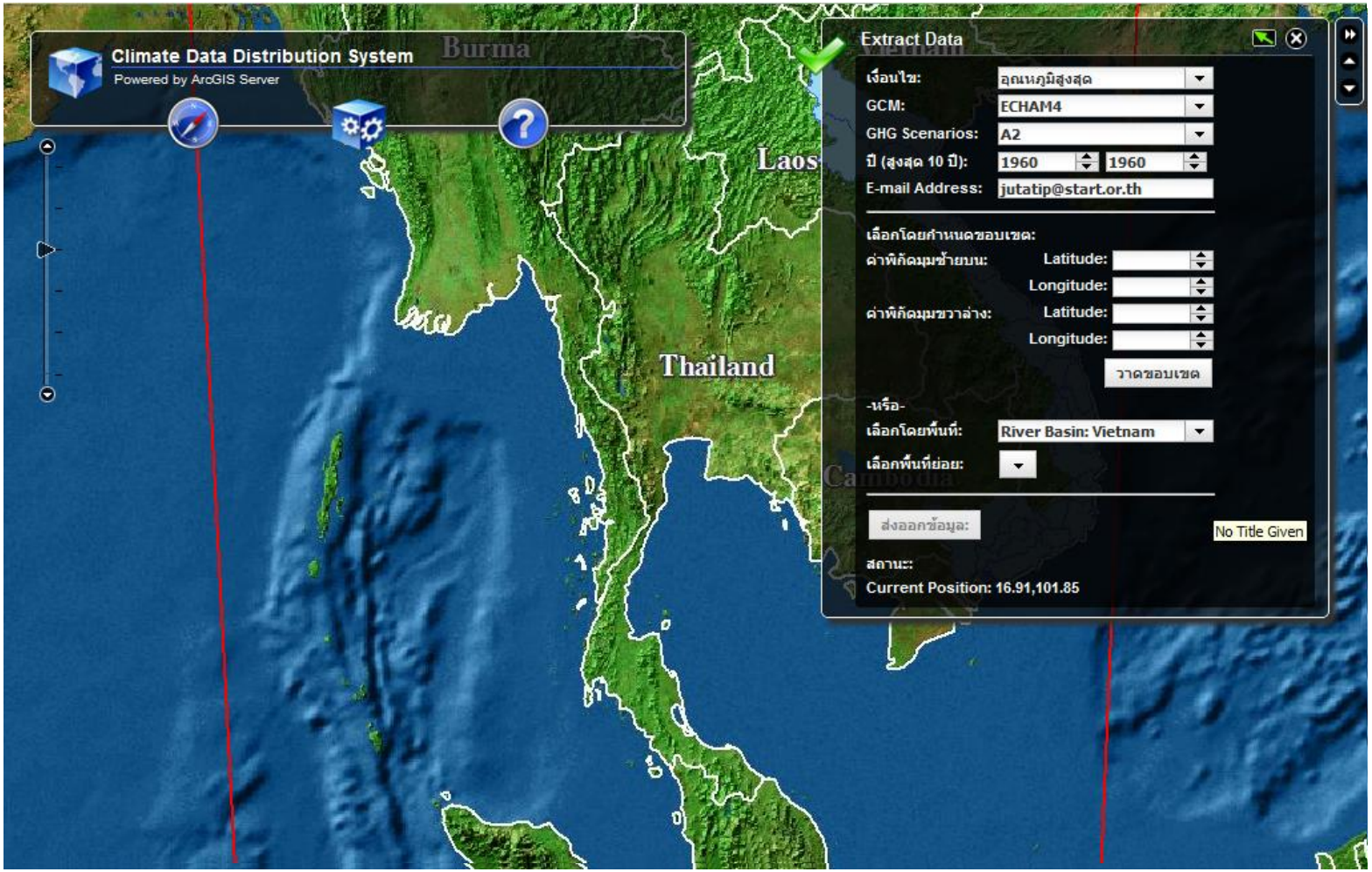
Welcome to climate change data distribution system. This website is collaboration between Southeast Asia START Regional Center and ESRI (Thailand), Co., Ltd., under support from S&T Postgraduate Education and Research Development Office (PERDO). The future climate projection data is result of capacity building program supported by Asia-Pacific Network for Global Change Research (APN) under CAPaBLE project "Climate Change in Southeast Asia and Assessment on Impact, Vulnerability and Adaptation on Rice Production and Water Resource" and research project "Simulation of Future Climate Scenario for Thailand and Surrounding Countries", which was supported by Thailand Research Fund (TRF). The Met Office Hadley Centre for Climate Prediction and Research of United Kingdom provides technical support on know-how transfer, including training and providing of regional climate model software, PRECIS, as well as GCM dataset for regional downscaling operation.

View Future Climate Display System | Data Distribution System English | ภาษาไทย

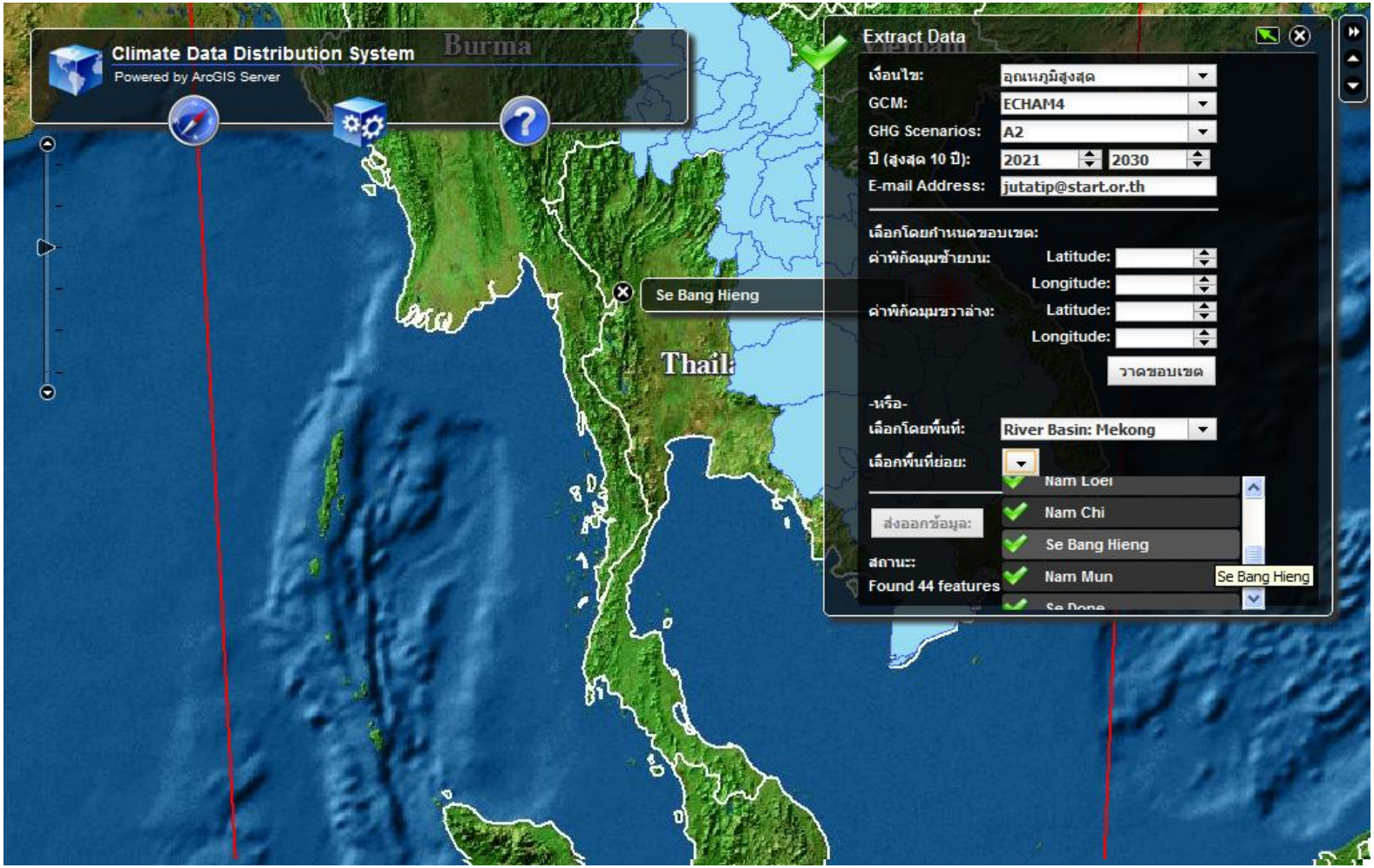
Extracting climate change data for further analysis

Domain coverage: Lat. 0 - 35ºN / Lon. 90ºE - 112ºE

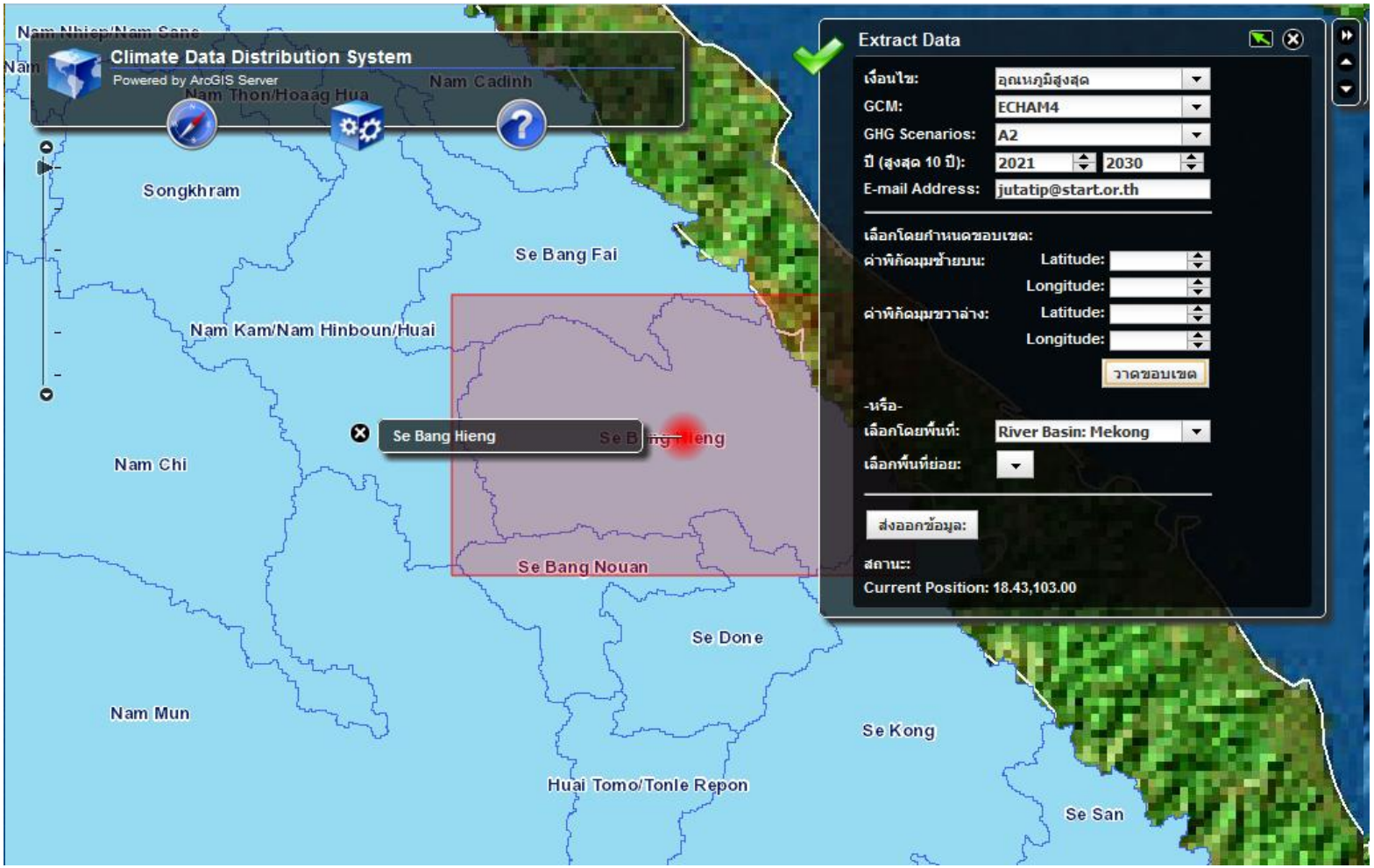
Extracting climate change data for further analysis



Extracting climate change data for further analysis



Extracting climate change data for further analysis



Southeast Asia START Regional Center
IHDP · IGBP · WCRP

Extracting climate change data for further analysis

Analysis of climate change for risk assessment

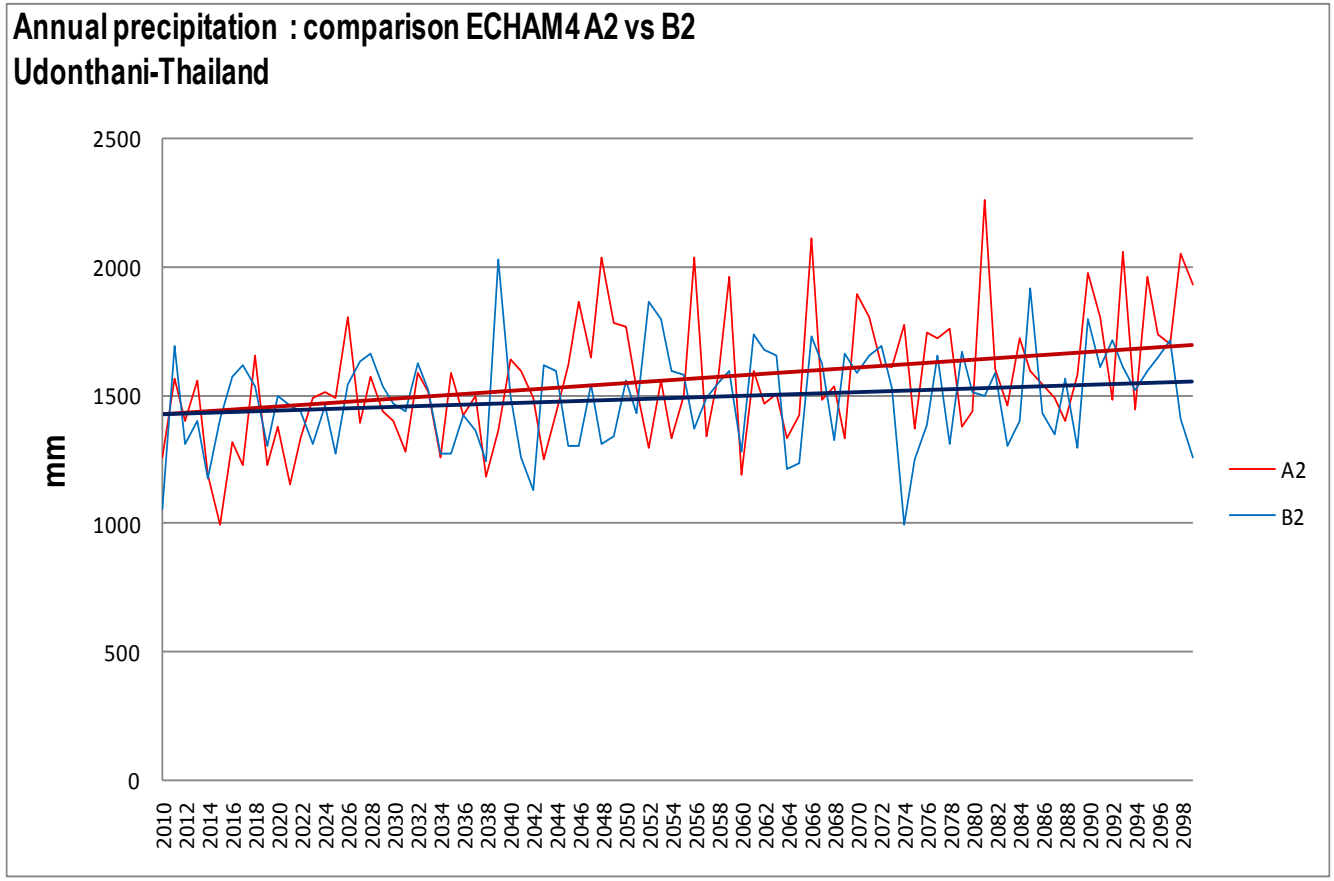
Using climate change data to analyze change in future trend

Analysis of climate change for risk assessment

CHANGE IN ANNUAL PRECIPITATION

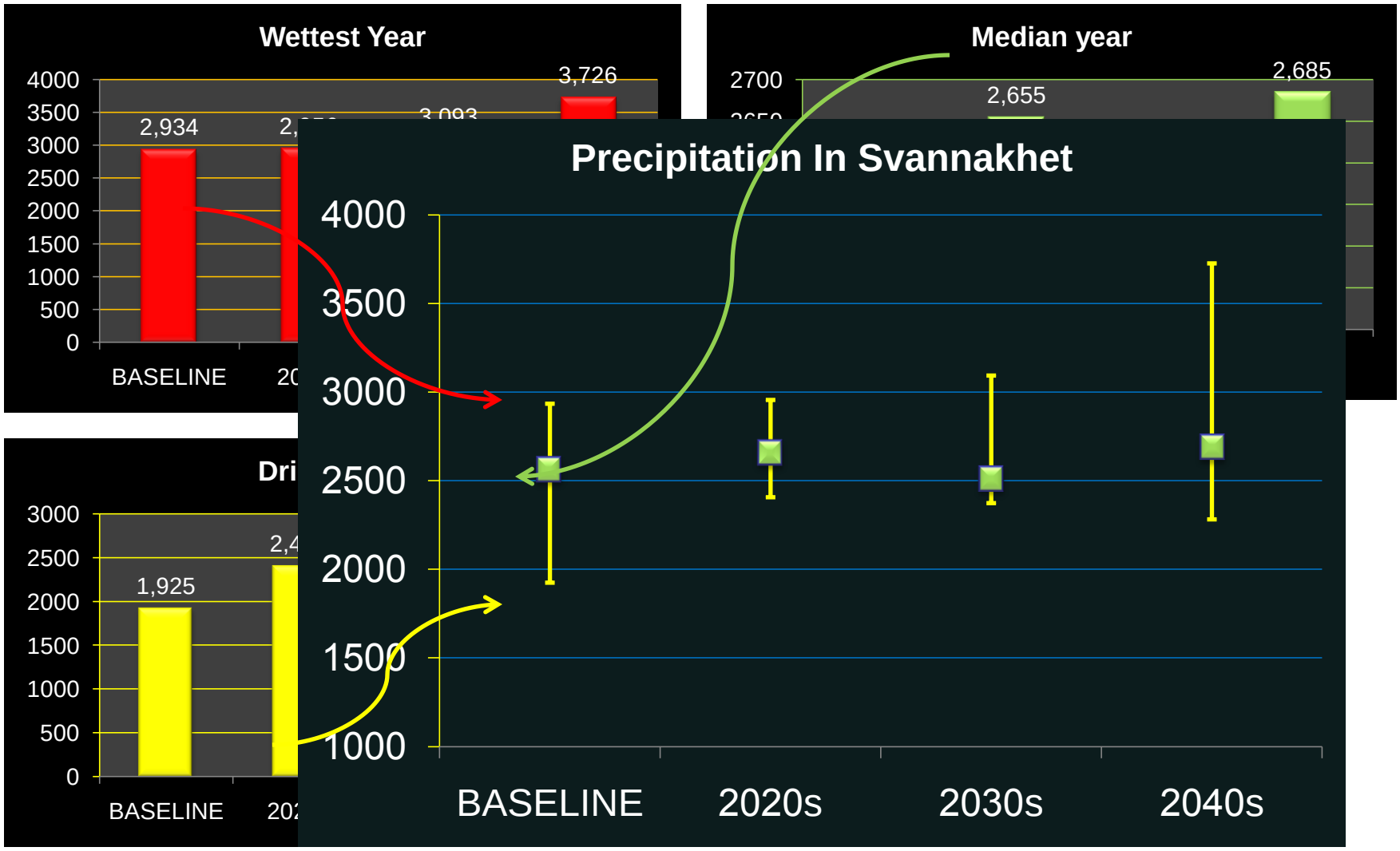
Year	A2	B2
2010	2560	3616
2011	2967	3246
2012	1588	2353
2013	3155	2253
2014	1976	2853
2015	3379	2872
2016	2027	3973
2017	2210	2367
2018	2525	2721
2019	2104	2465
2020	2316	2583

2090	2013	3104
2091	2400	2530
2092	1328	2627
2093	2397	1870
2094	2793	1952
2095	3594	2765
2096	2940	2342
2097	1989	3377
2098	2539	2856
2099	2142	2428



Analysis of climate change for risk assessment

CHANGE IN ANNUAL PRECIPITATION – EXTREME YEAR VS MEDIAN YEAR



Analysis of climate change for risk assessment

CHANGE IN FREQUENCY OF HEAVY RAINFALL YEAR OVER THE DECADE

1995	2391
1996	2879
1997	2934
1998	2653
1999	2563
2000	2680
2001	2178
2002	1925
2003	2011
2004	2498
Average	2471

Svannakhet	2040s
1	3726
2	2447
3	2522
4	2282
5	2518
6	2535
7	3286
8	2685
9	3401
10	2783

6 → 8

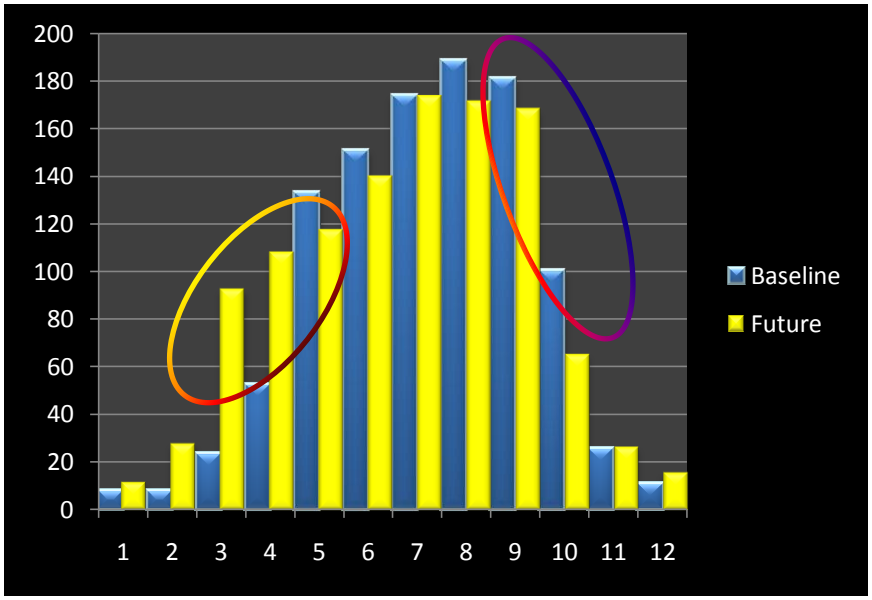
Analysis of climate change for risk assessment

CHANGE IN FREQUENCY OF HEAVY RAINFALL YEAR OVER THE DECADE

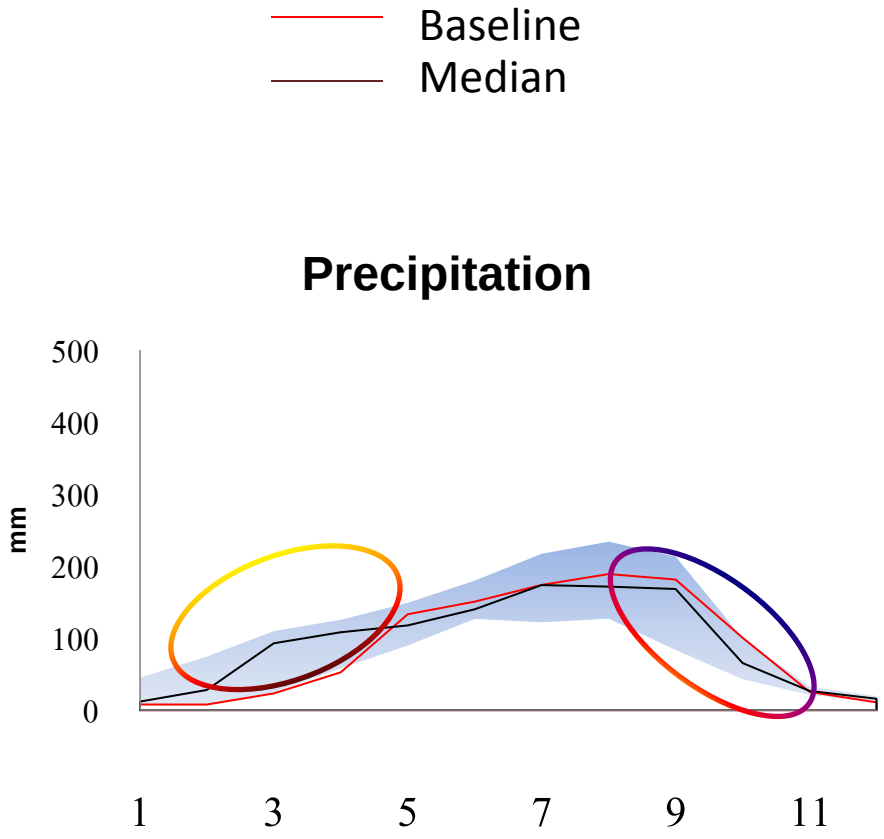
Time	Number of years which annual rainfall higher than average annual rainfall in Baseline period
Baseline	6
2020s	8
2030s	6
2040s	8

Analysis of climate change for risk assessment

SHIFT AND CHANGE IN RAINFALL DISTRIBUTION PATTERN/RAINY SEASON



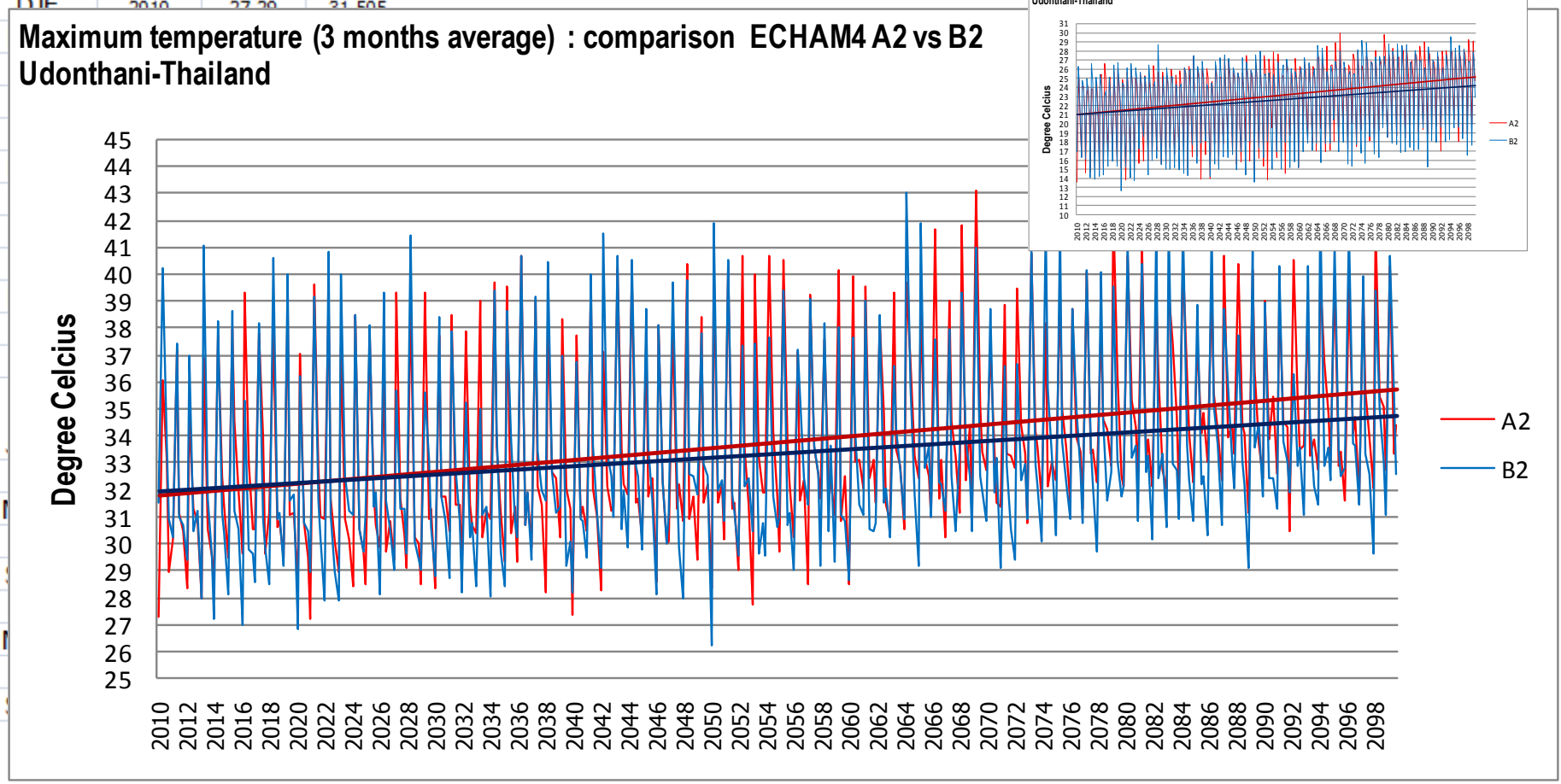
Shift of rainy season



Analysis of climate change for risk assessment

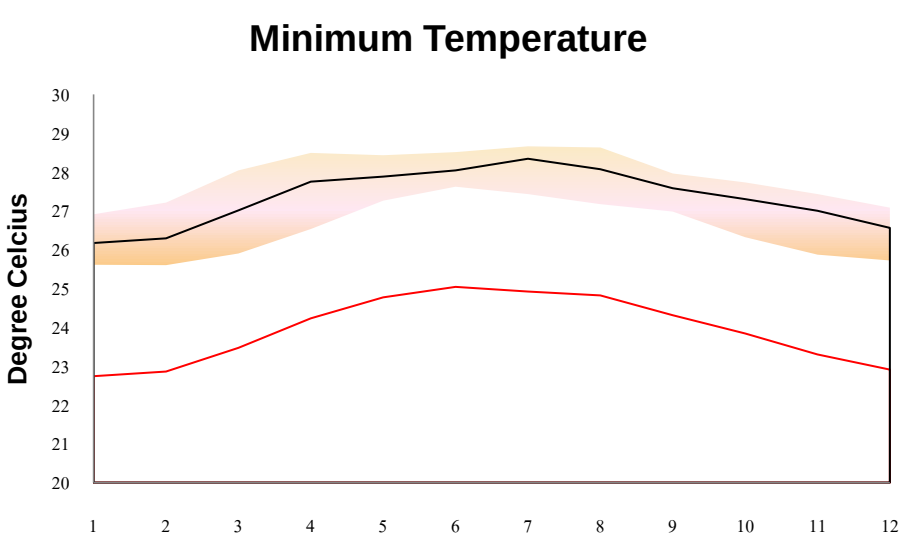
CHANGE IN TREND OF TEMPERATURE:
3-MONTH AVERAGE MAXIMUM TEMPERATURE

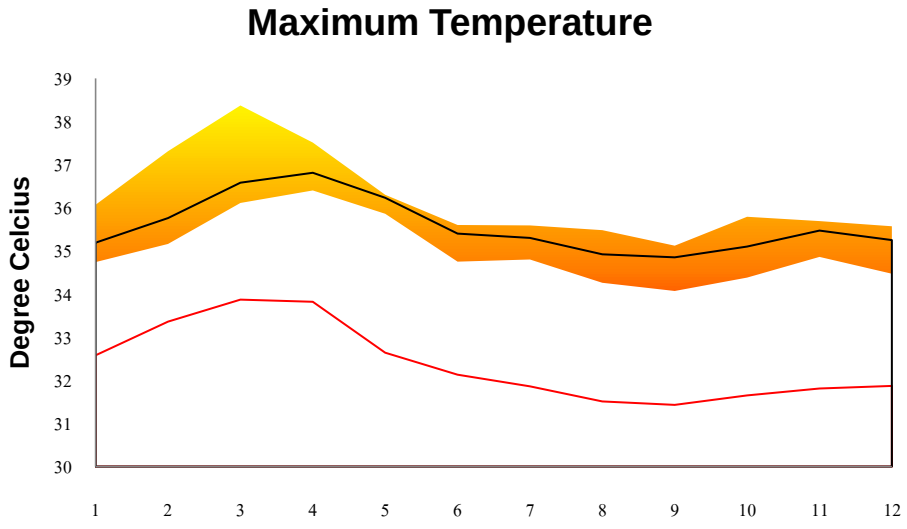
	Year	A2	B2
DJF	2010	27.29	31.505



Analysis of climate change for risk assessment

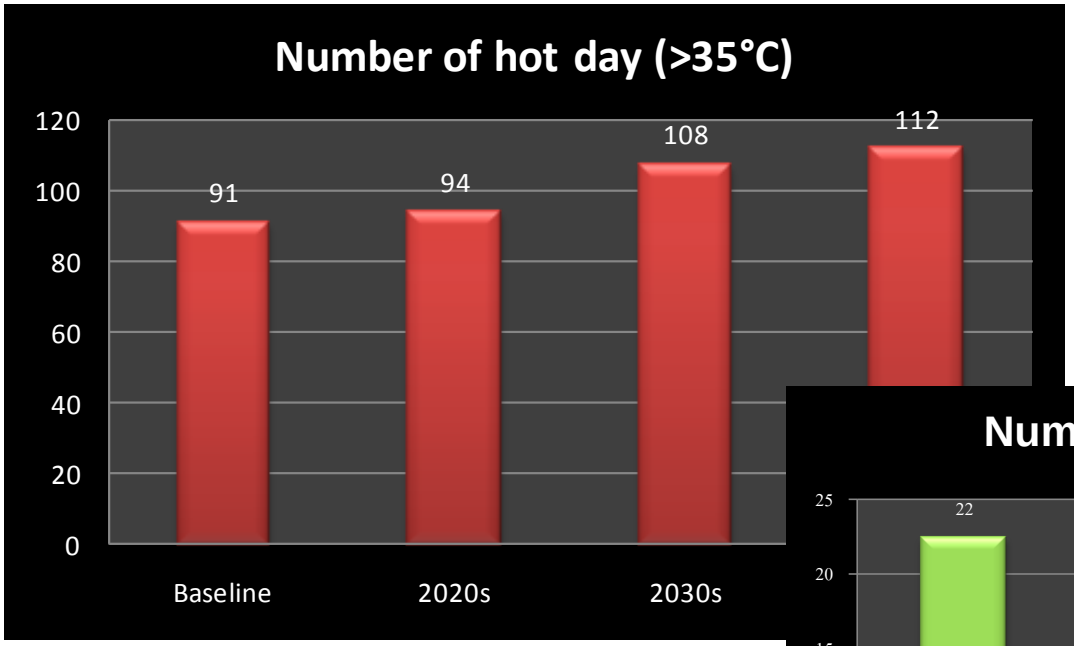
CHANGE IN TEMPERATURE – NIGHT-TIME & DAYTIME

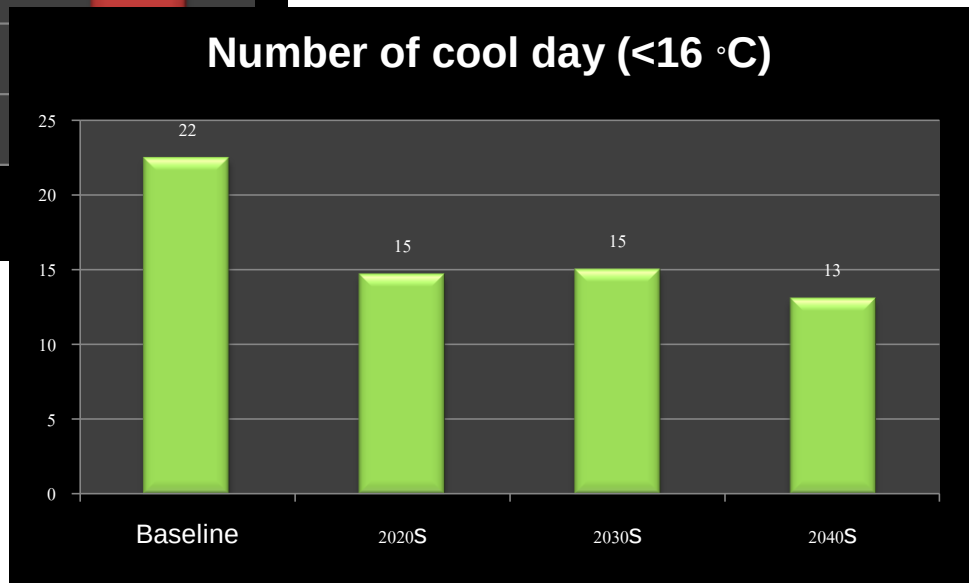




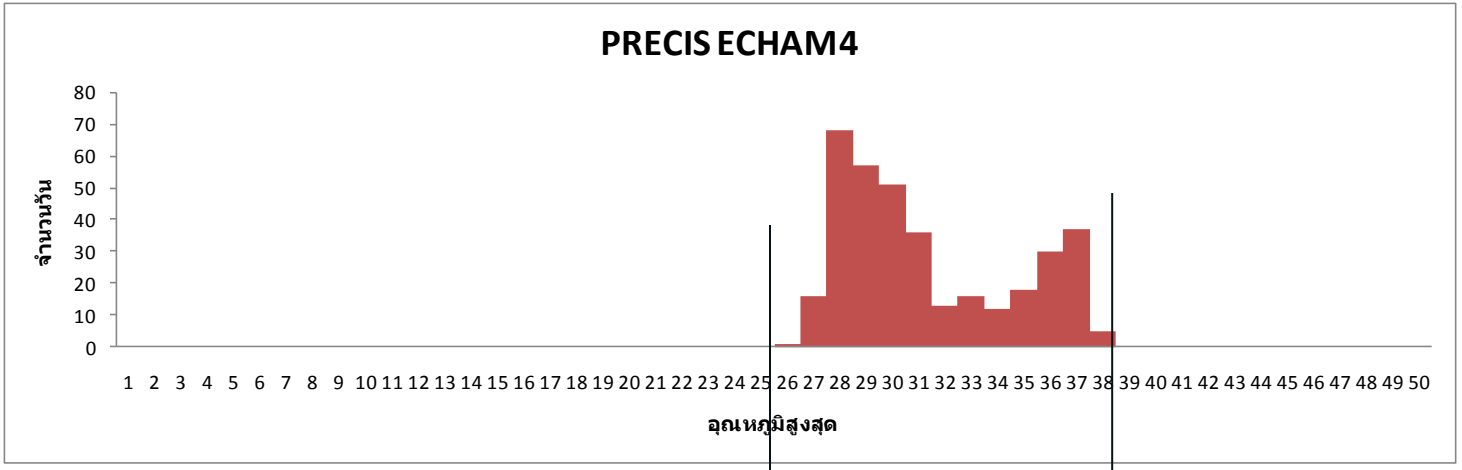
Analysis of climate change for risk assessment

CHANGE IN LENGTH OF SUMMER /WINTER - SAVANNAKHET

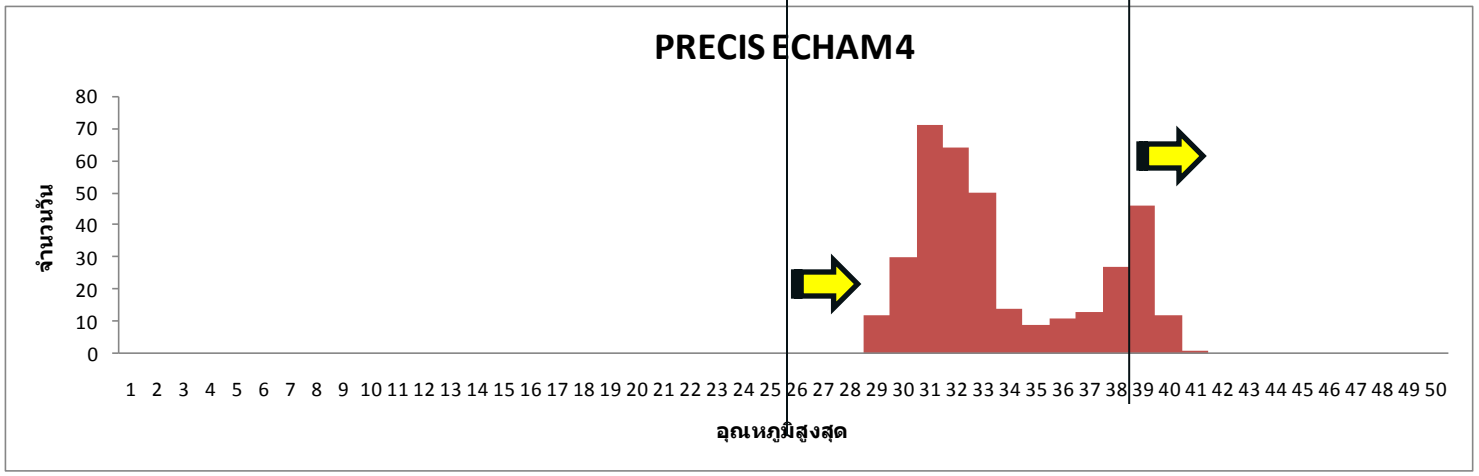




Analysis of climate change for risk assessment

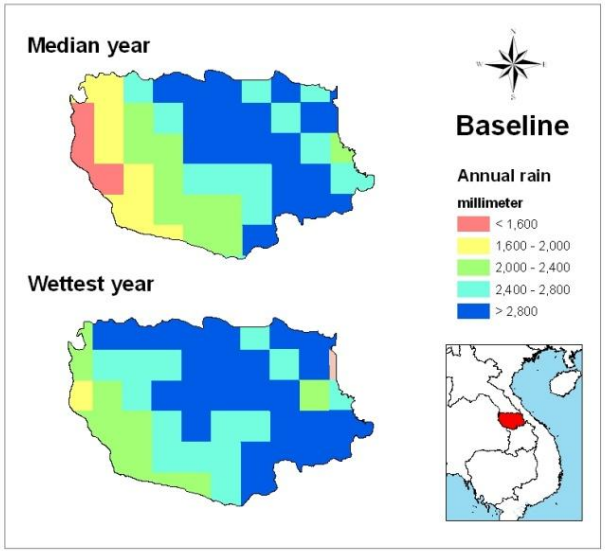


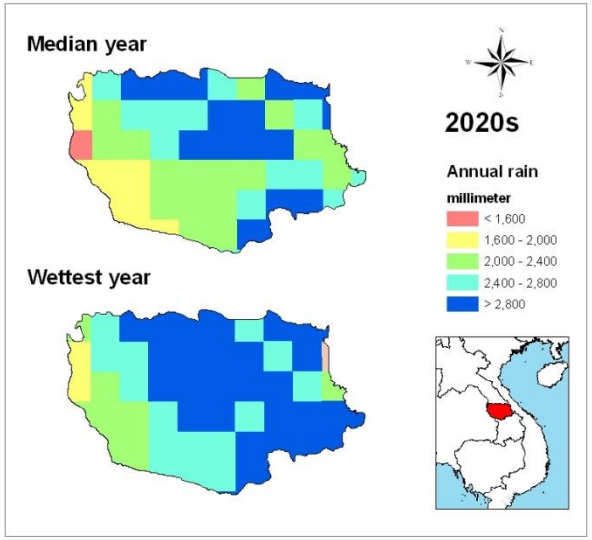
1961-2000

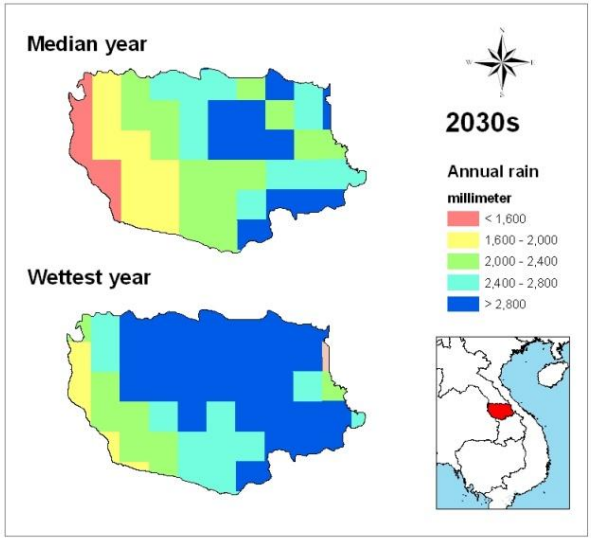


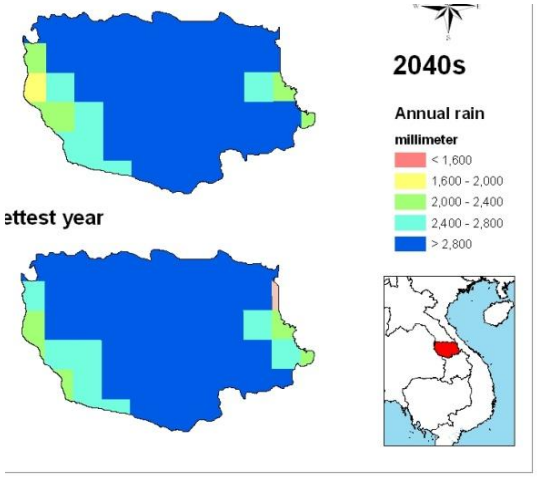
2045-2064

Climate change risk map from previous case study

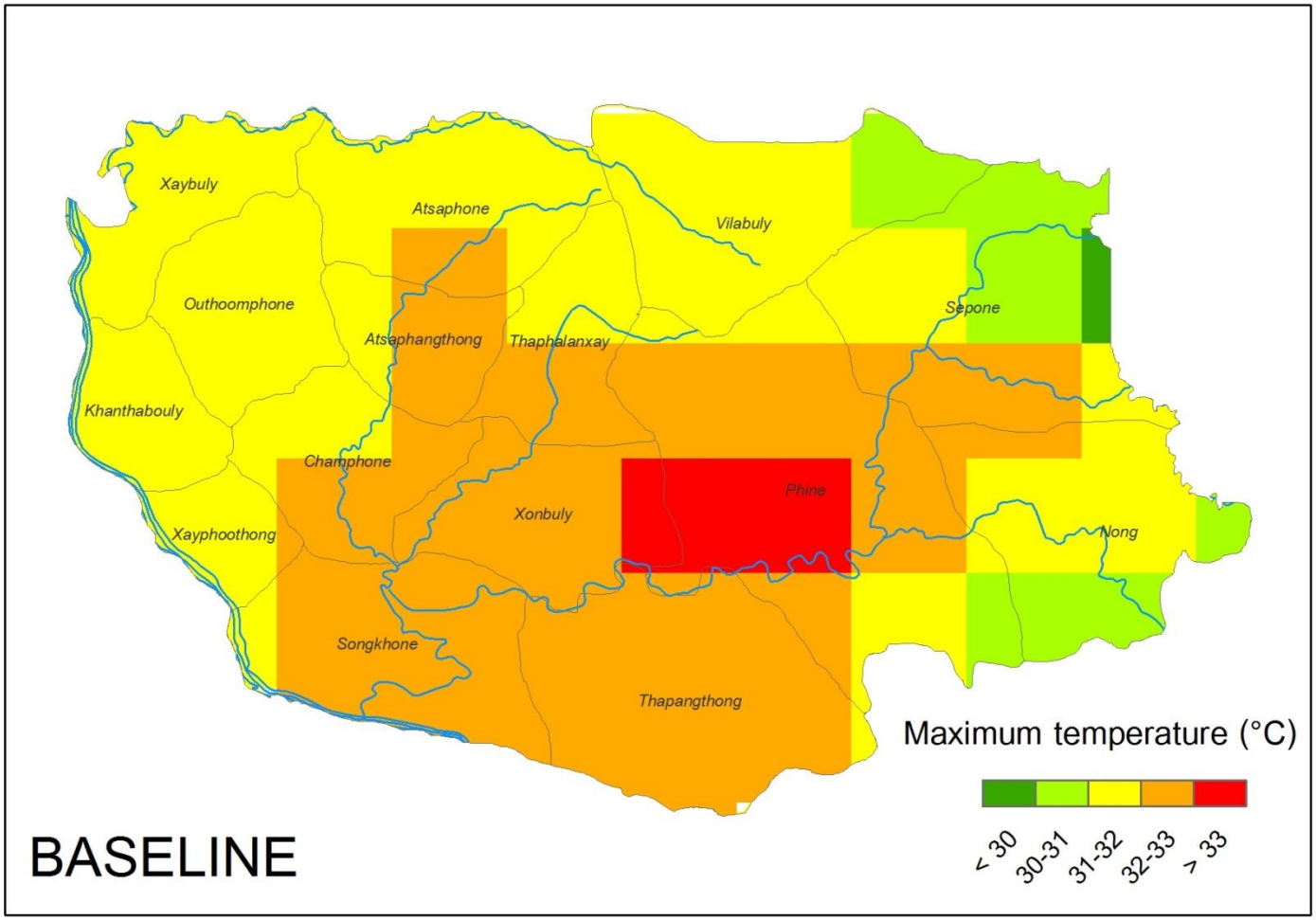




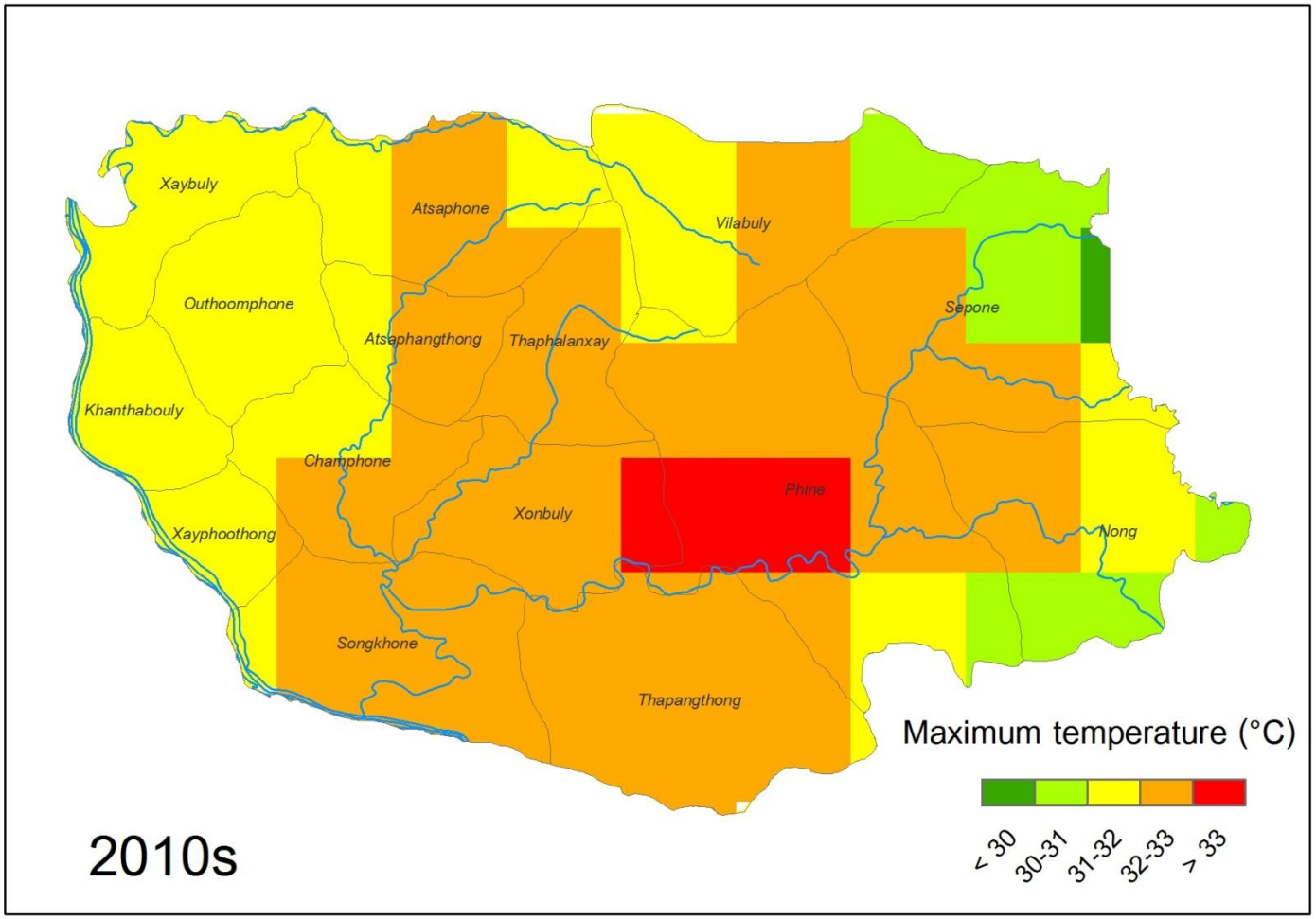




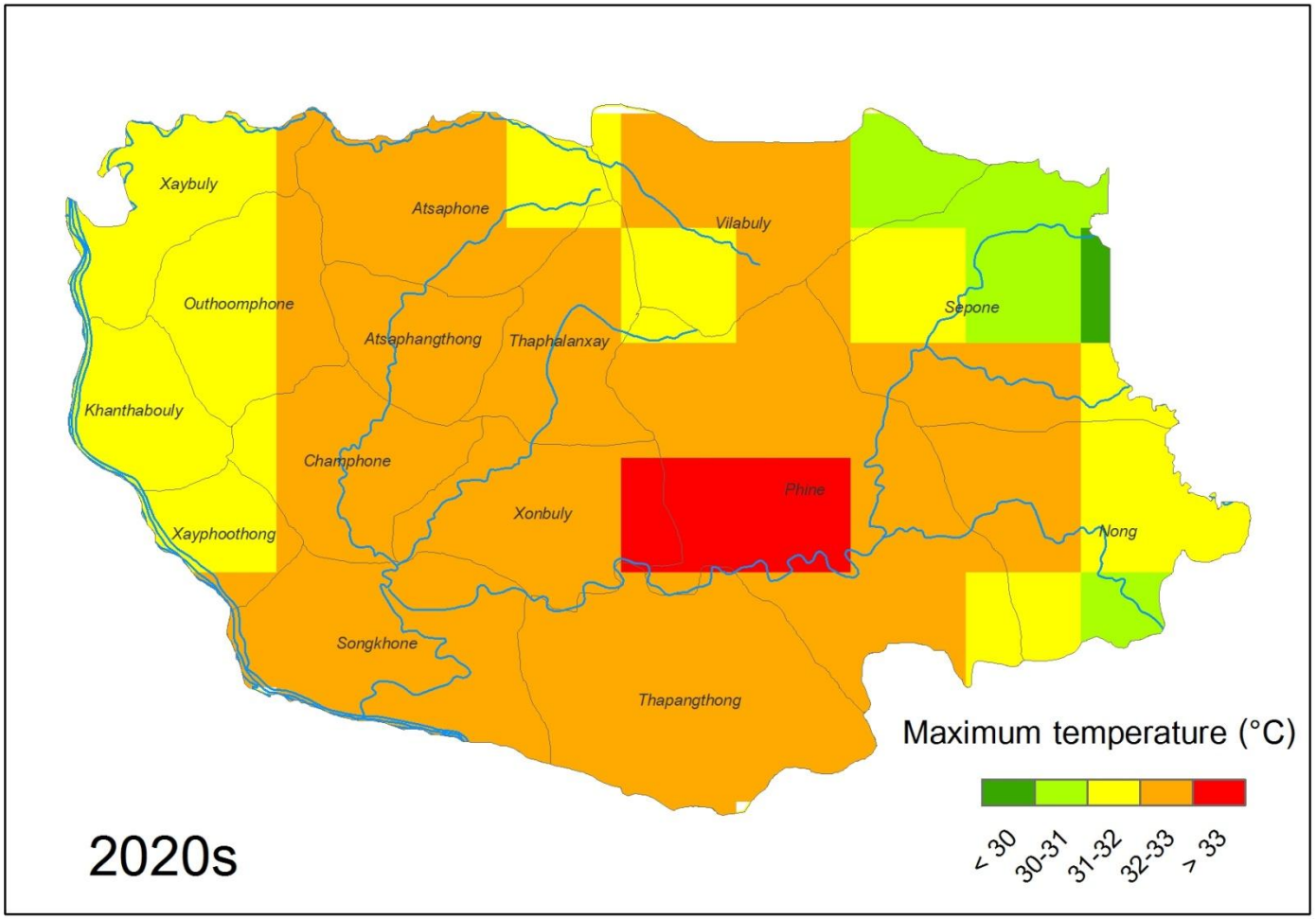
Examples from previous case studies: Climate change risk assessment – Numerical analysis vs Spatial analysis



Examples from previous case studies: Climate change risk assessment – Numerical analysis vs Spatial analysis

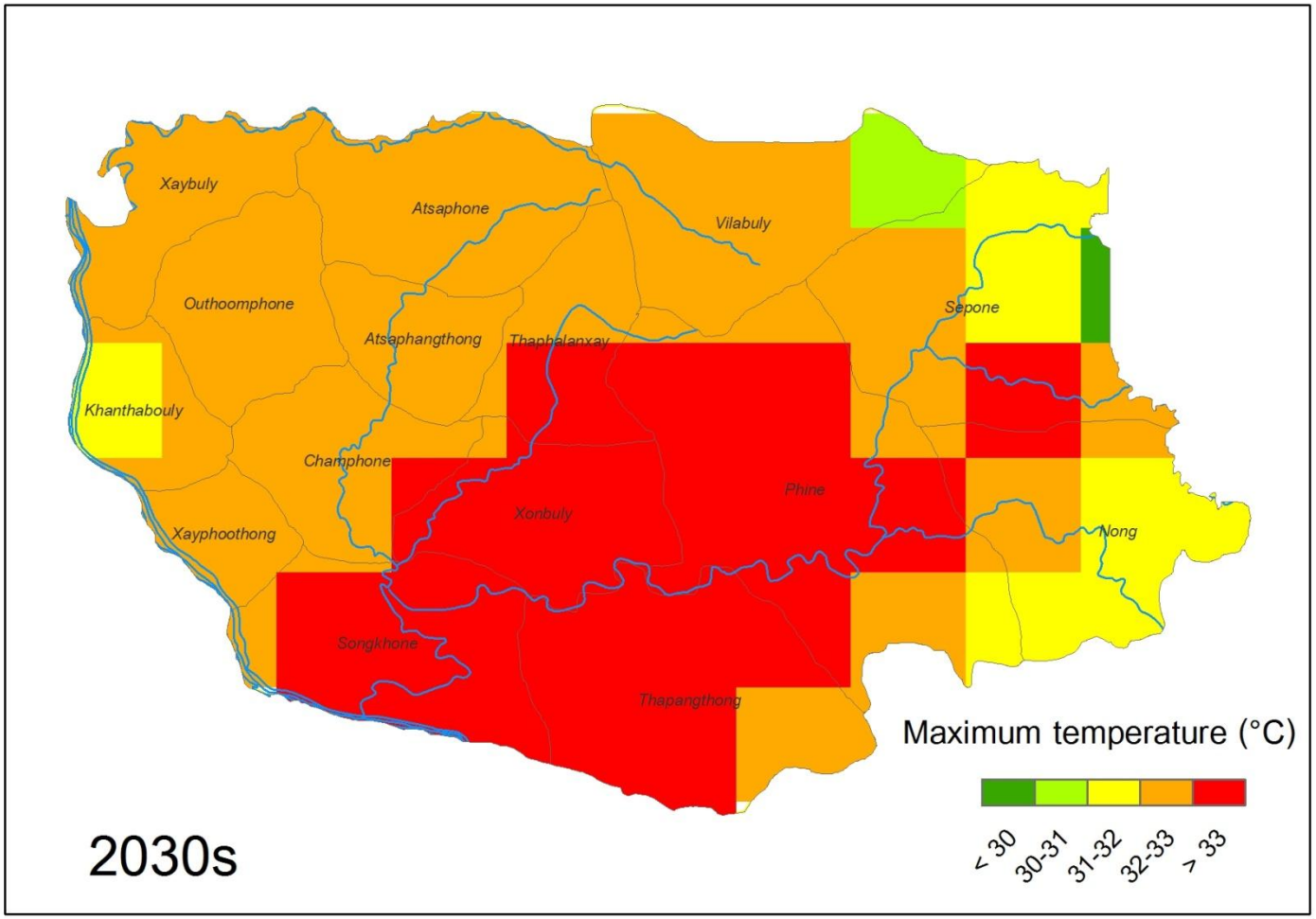


Examples from previous case studies: Climate change risk assessment – Numerical analysis vs Spatial analysis



Southeast Asia START Regional Center
IHDP · IGBP · WCRP

Examples from previous case studies: Climate change risk assessment – Numerical analysis vs Spatial analysis



Southeast Asia START Regional Center
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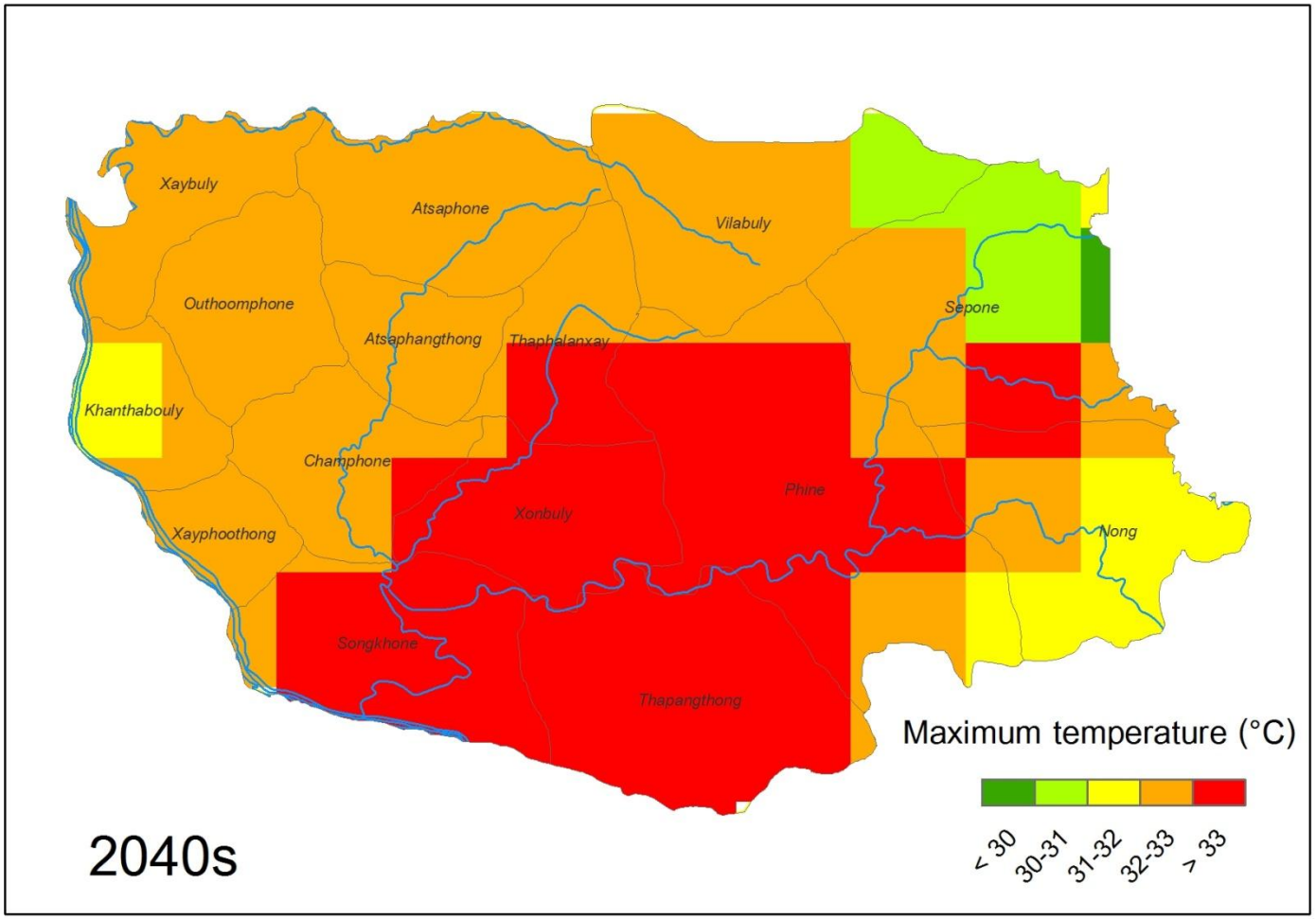
Examples from previous case studies: Climate change risk assessment – Numerical analysis vs Spatial analysis



Analysis of climate change for risk assessment

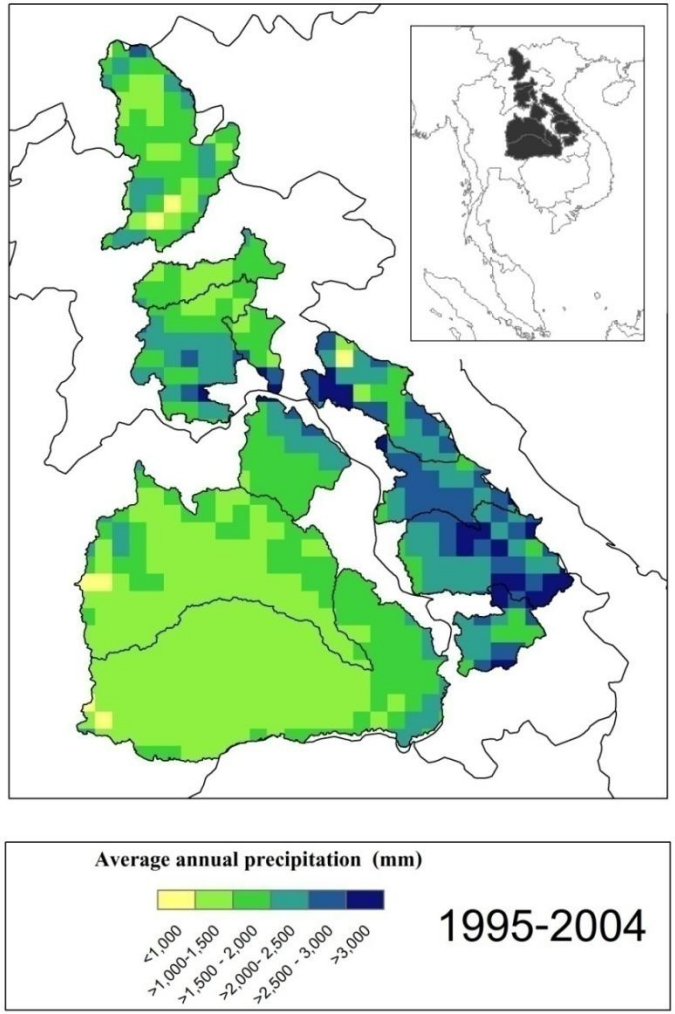
Spatial Analysis

Annual Precipitation

Analysis of climate change for risk assessment

Spatial Analysis

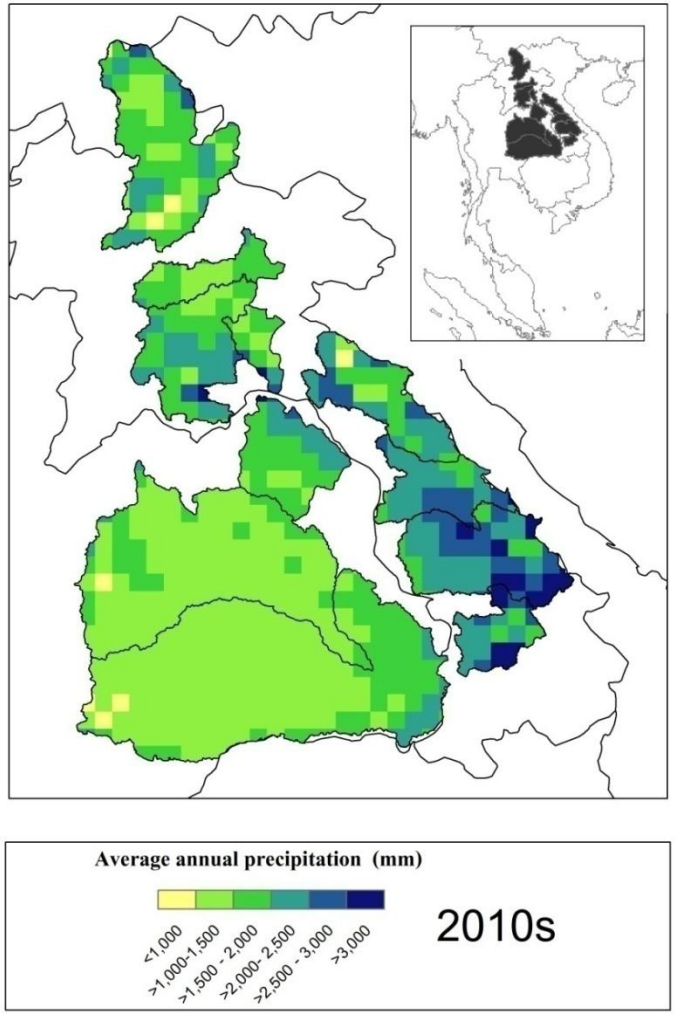
Annual Precipitation



Analysis of climate change for risk assessment

Spatial Analysis

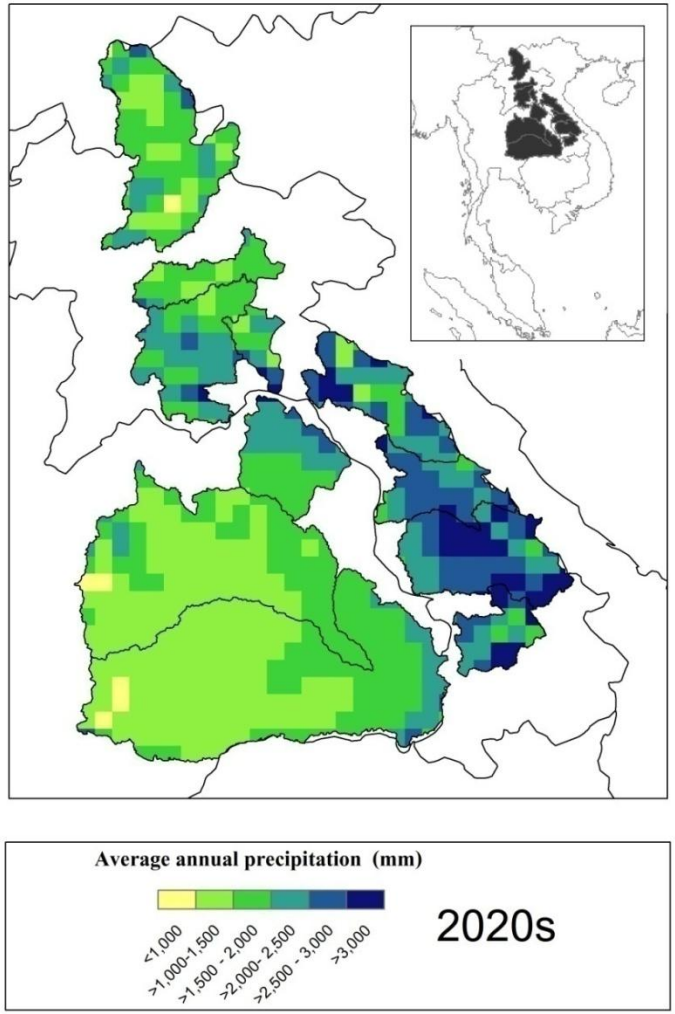
Annual Precipitation



Analysis of climate change for risk assessment

Spatial Analysis

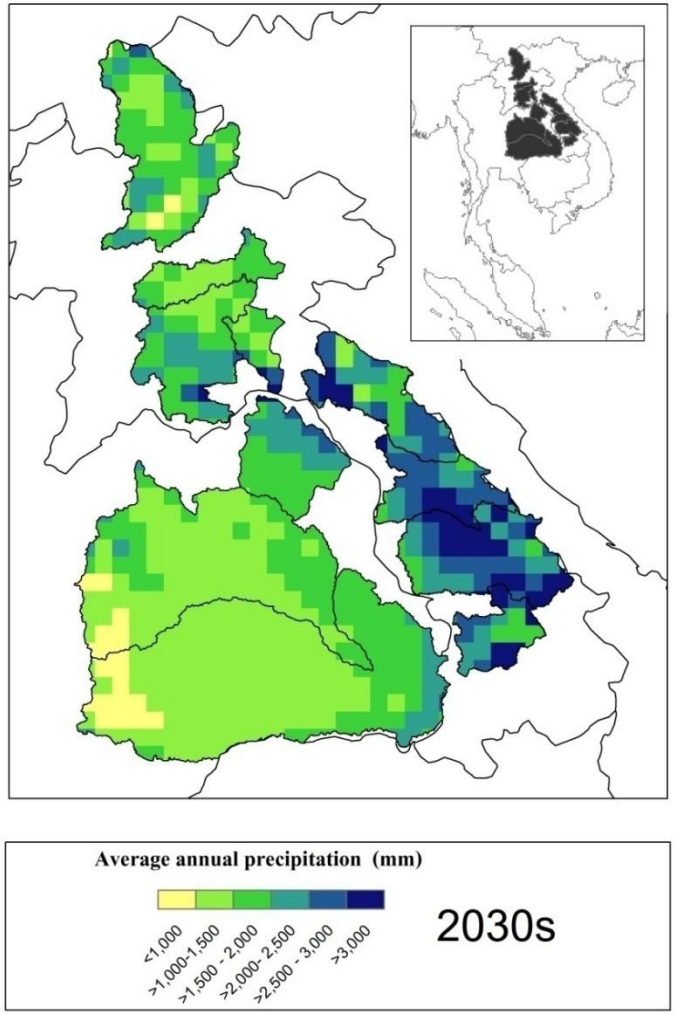
Annual Precipitation



Analysis of climate change for risk assessment

Spatial Analysis

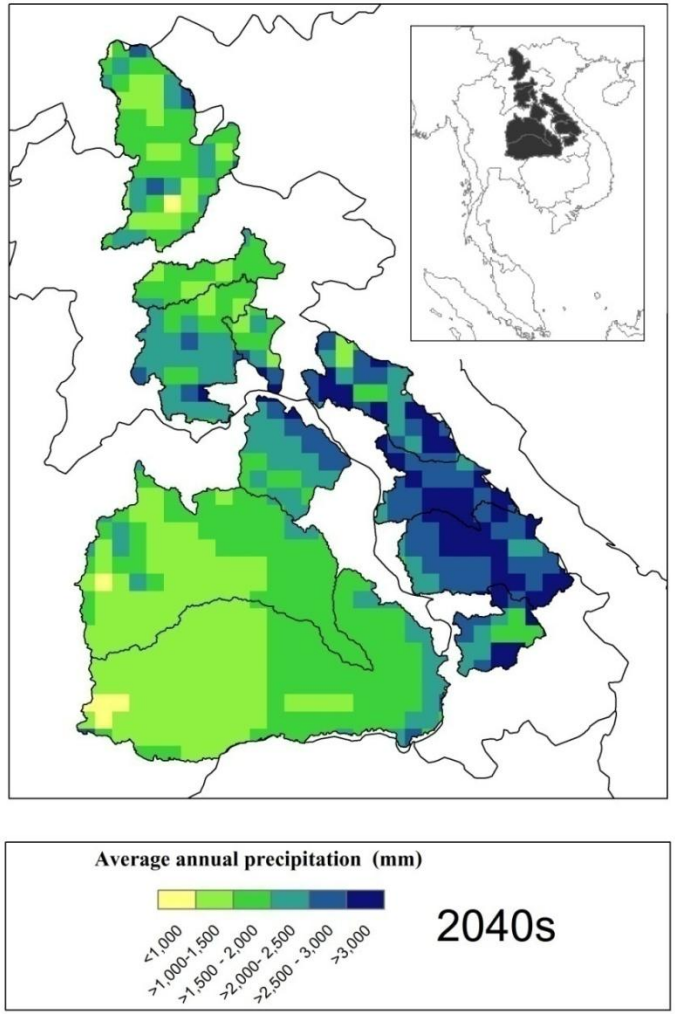
Annual Precipitation



Analysis of climate change for risk assessment

Spatial Analysis

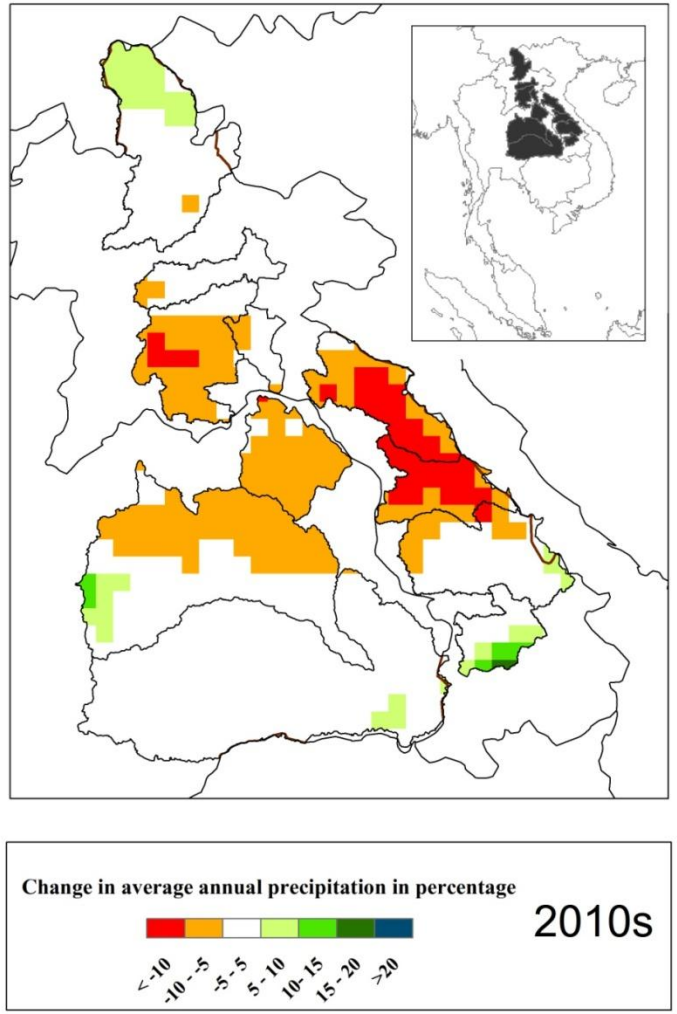
Annual Precipitation



Analysis of climate change for risk assessment

Spatial Analysis

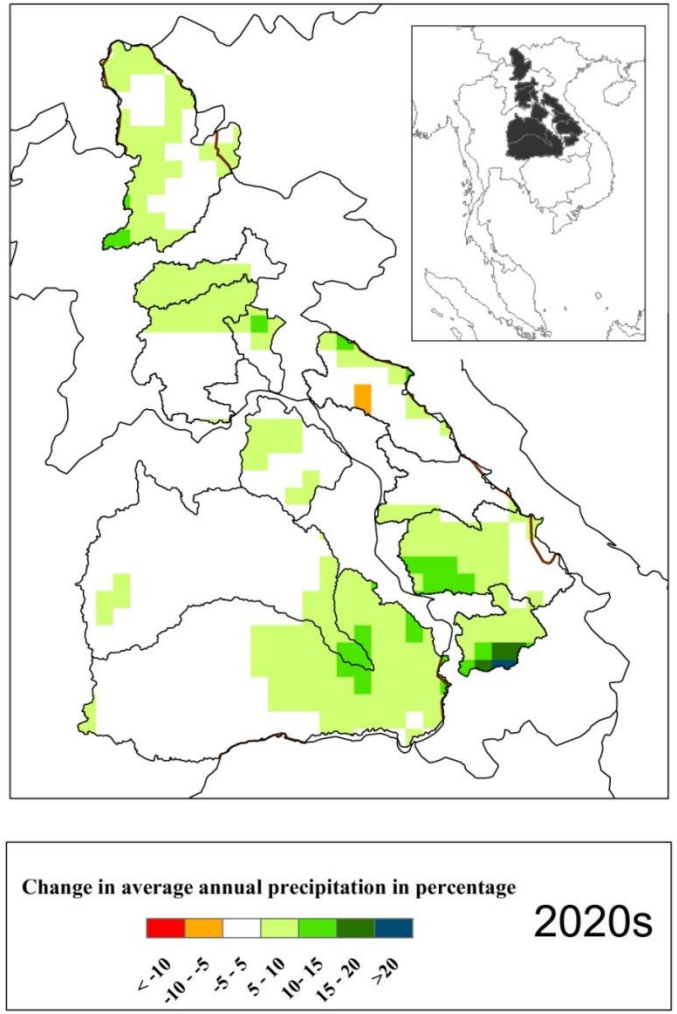
Change in Average Annual Precipitation



Analysis of climate change for risk assessment

Spatial Analysis

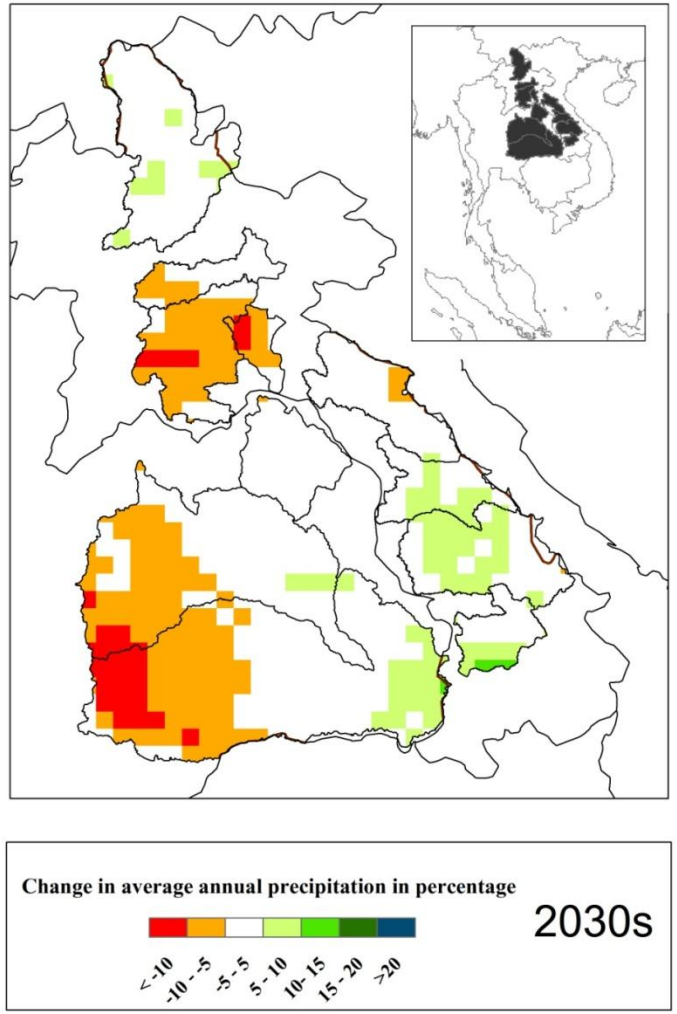
Change in Average Annual Precipitation



Analysis of climate change for risk assessment

Spatial Analysis

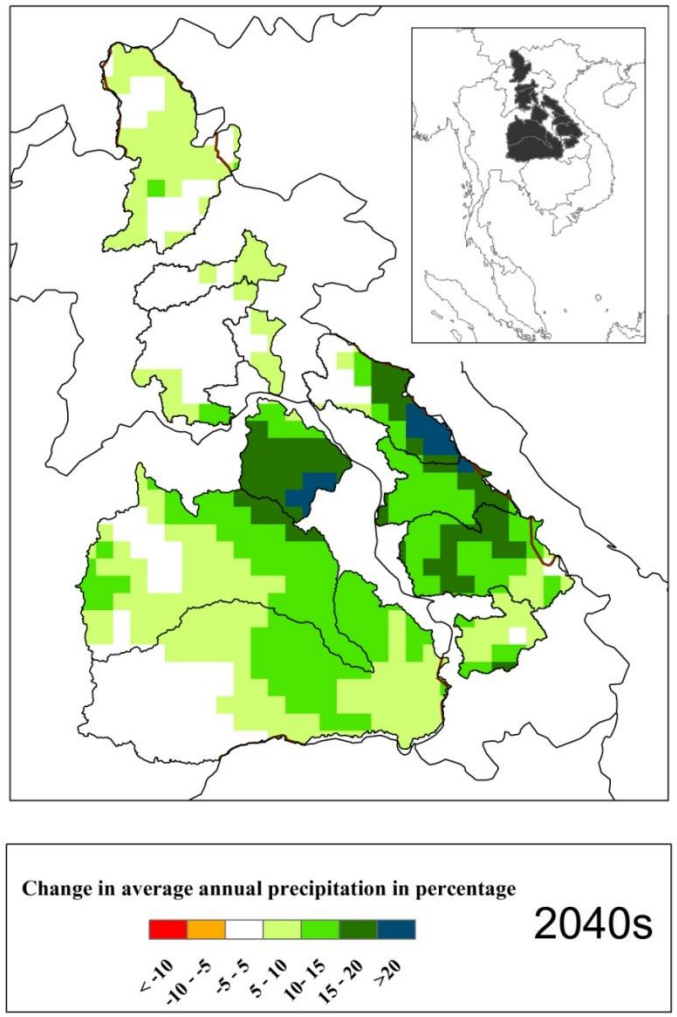
Change in Average Annual Precipitation



Analysis of climate change for risk assessment

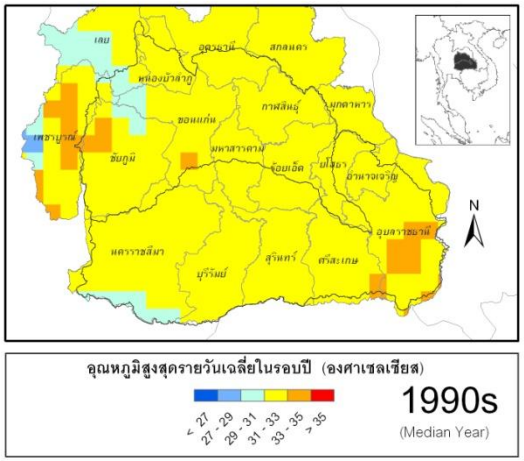
Spatial Analysis

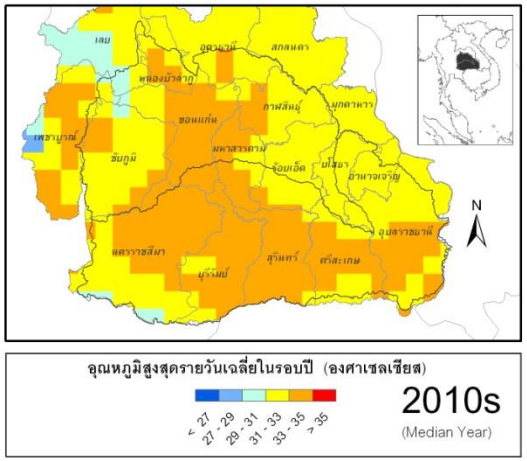
Change in Average Annual Precipitation

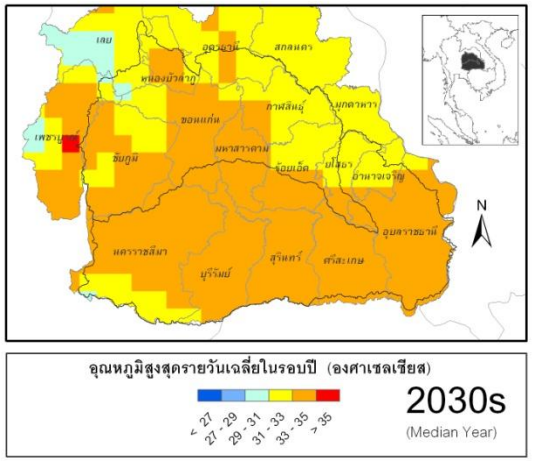


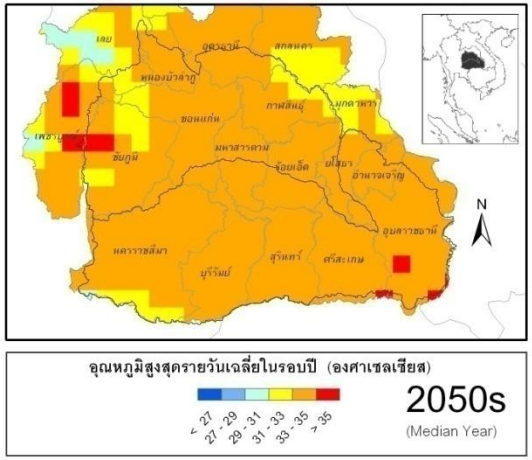
Analysis of climate change for risk assessment

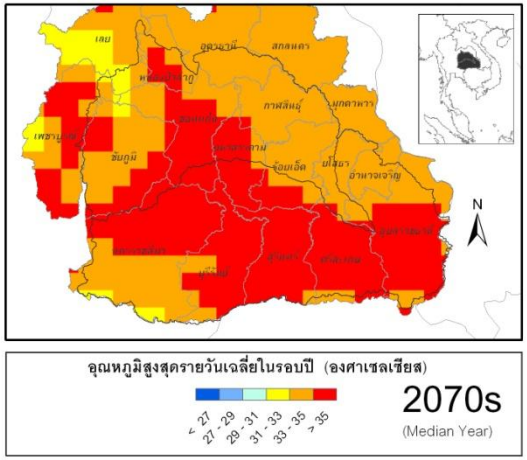
Climate Change in Chi-Mun

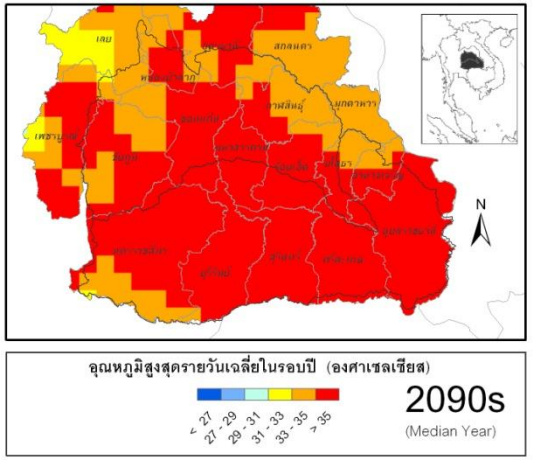








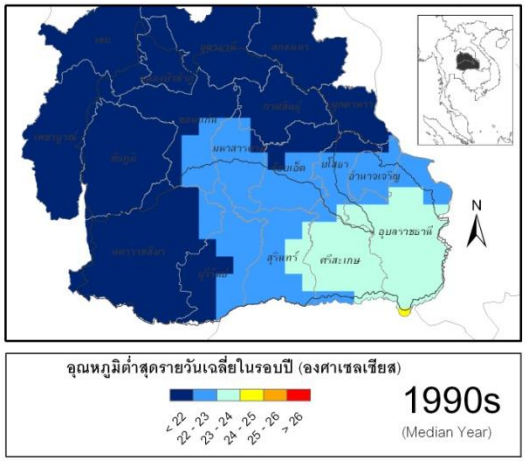


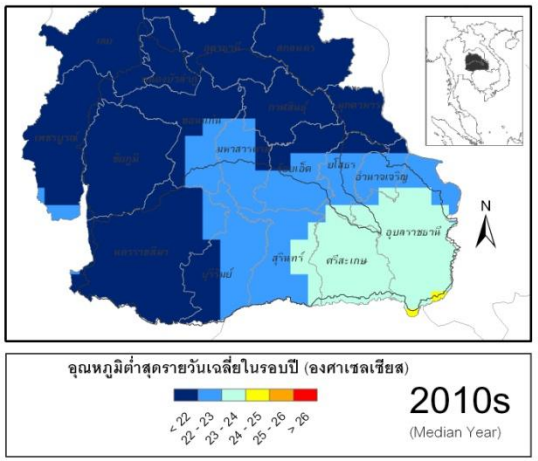


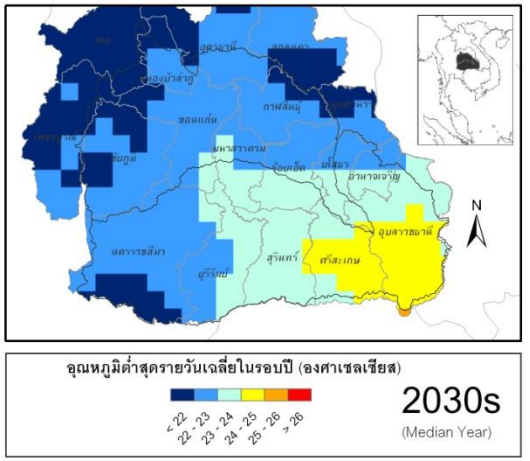
Maximum temperature

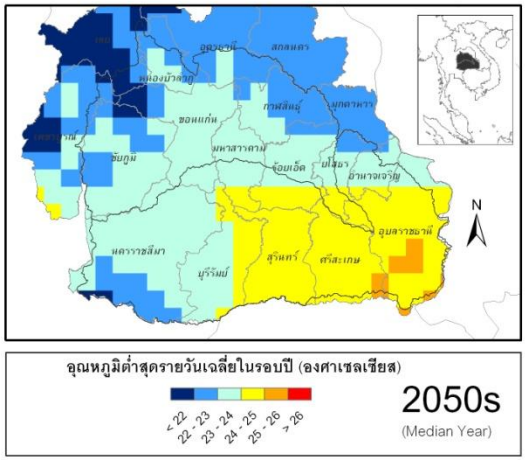
Analysis of climate change for risk assessment

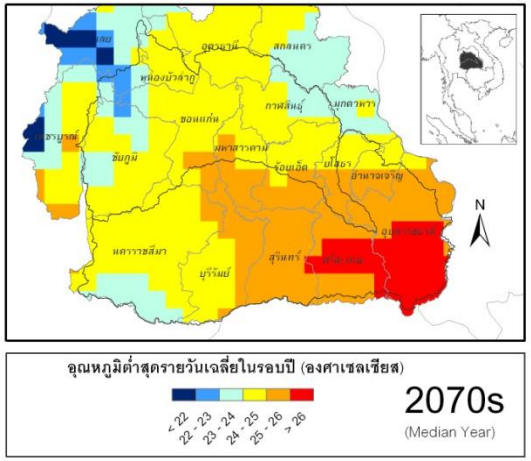
Climate Change in Chi-Mun

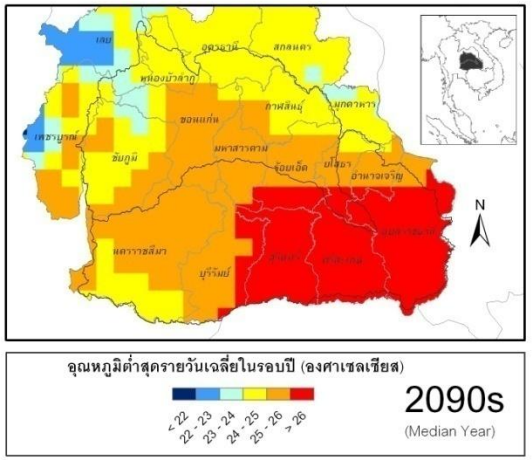








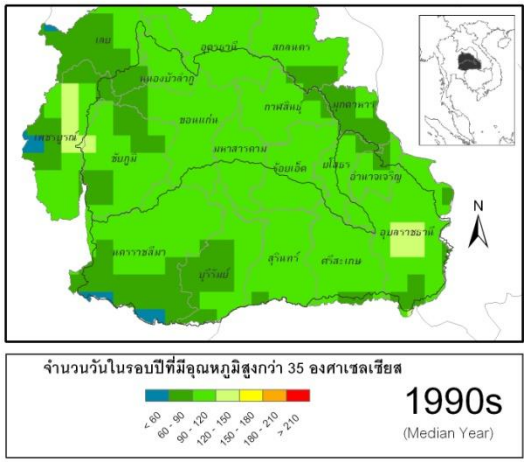


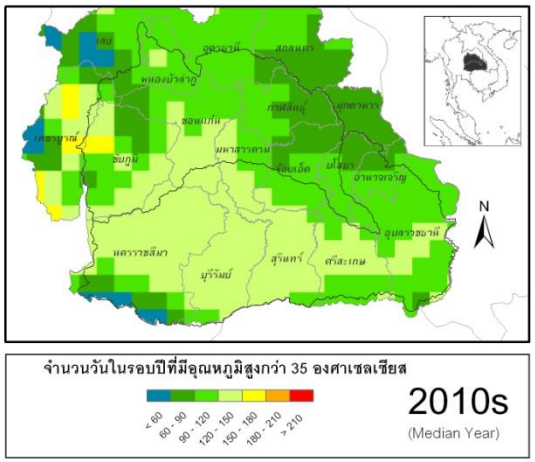


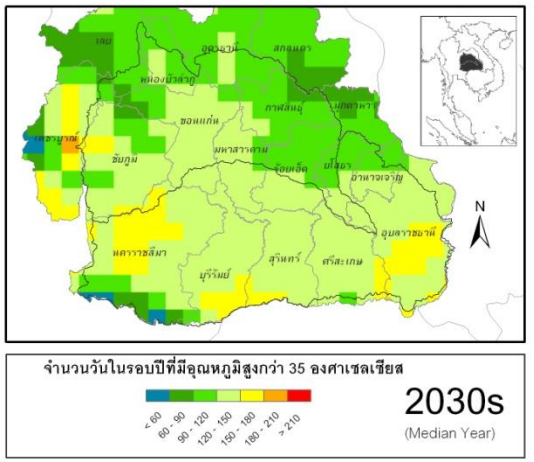
Minimum temperature

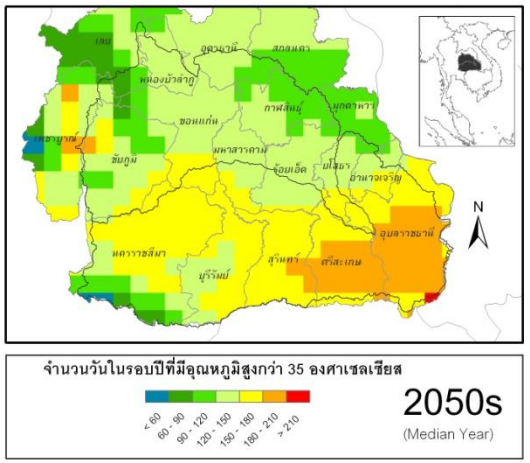
Analysis of climate change for risk assessment

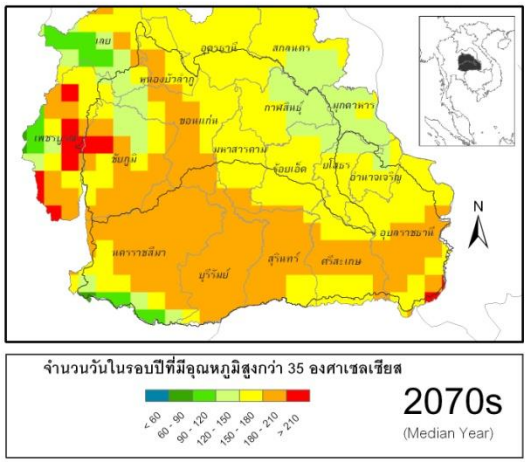
Climate Change in Chi-Mun

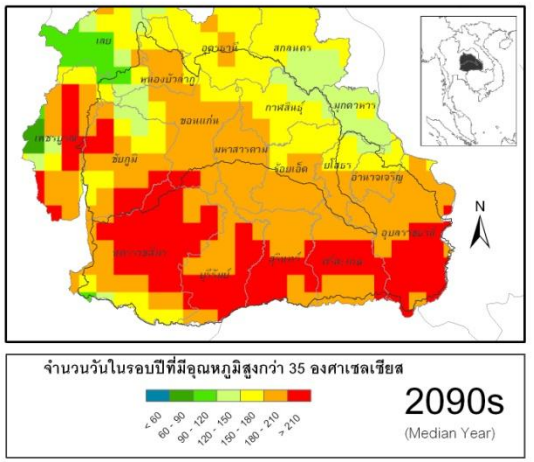








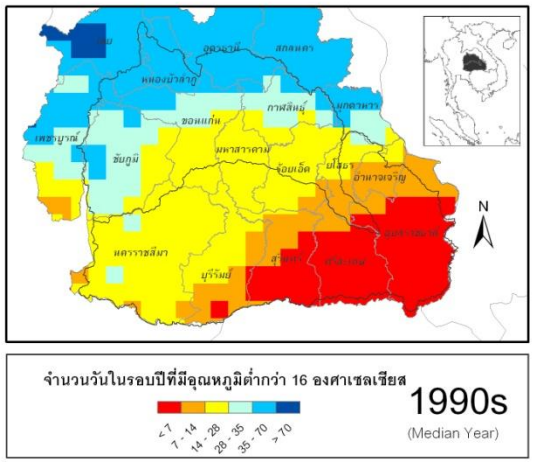


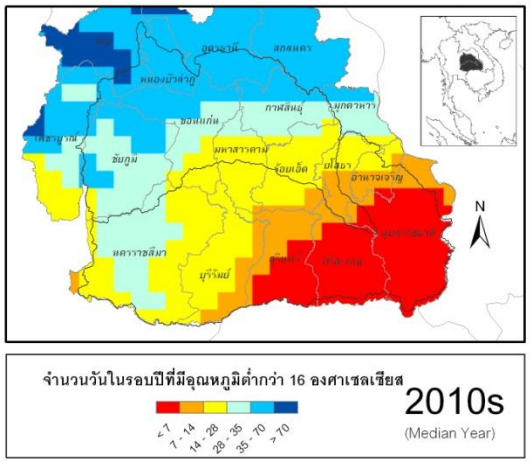


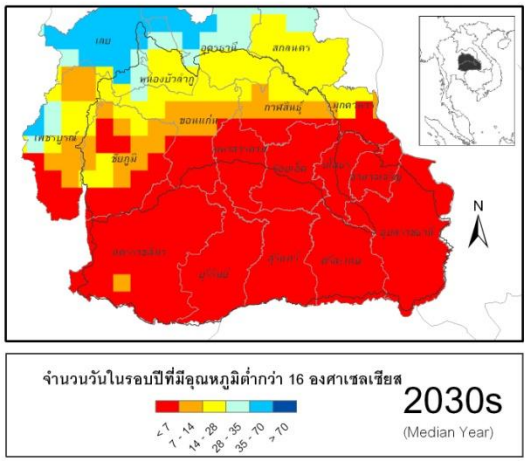
Change in number of hot days

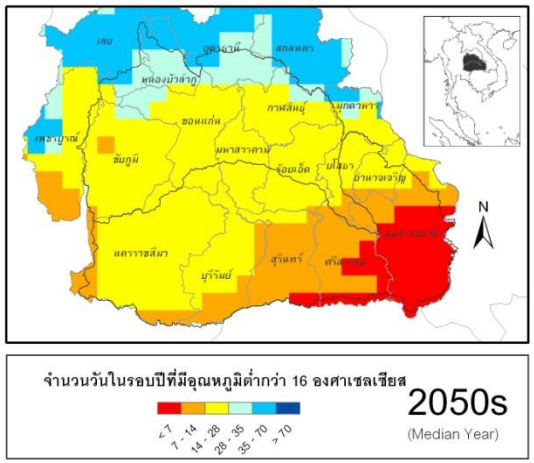
Examples from previous case studies: Climate change risk assessment – Numerical analysis vs Spatial analysis

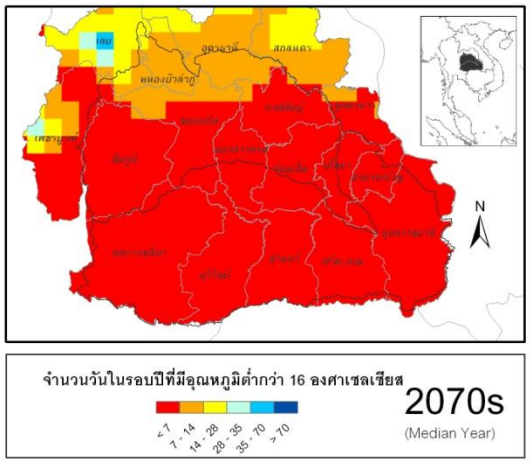
Climate Change in Chi-Mun

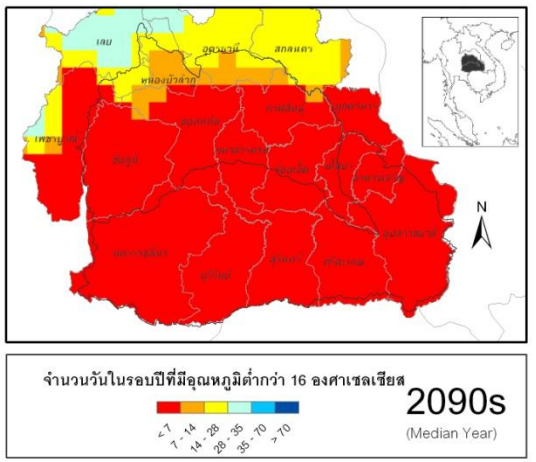








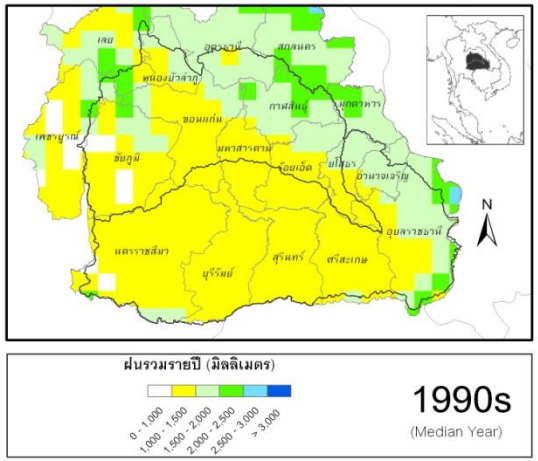


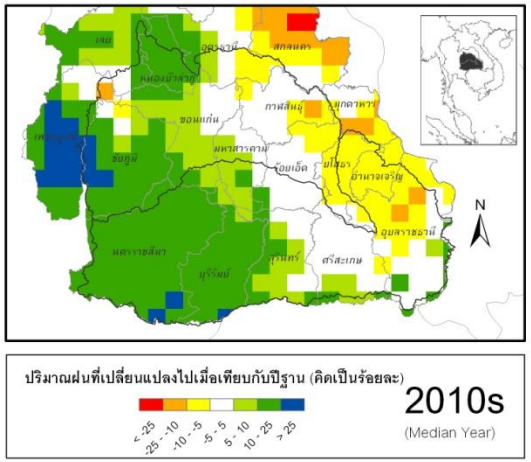


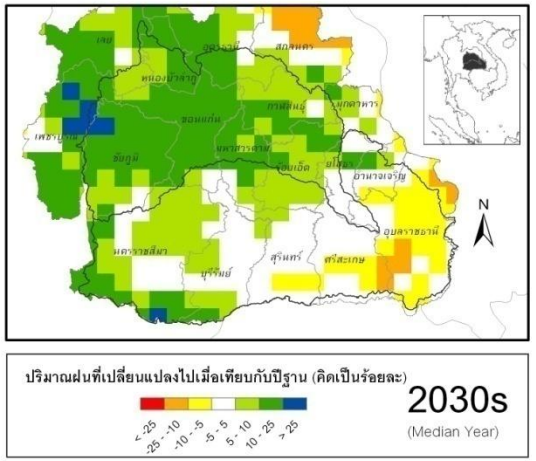
Change in number of cool days

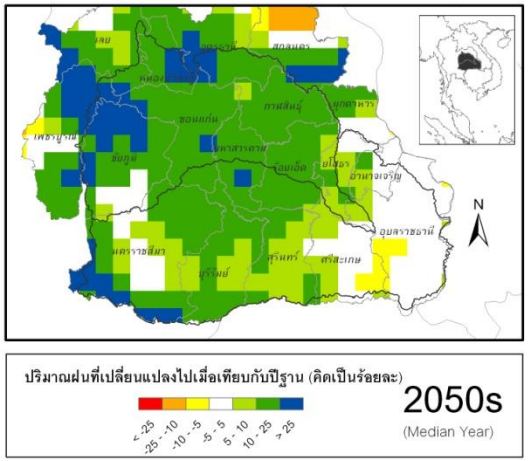
Analysis of climate change for risk assessment

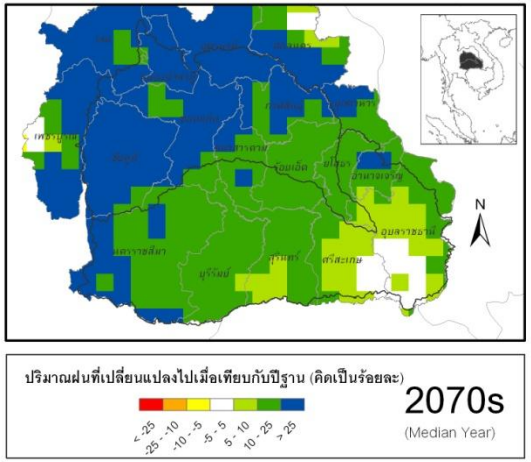
Climate Change in Chi-Mun

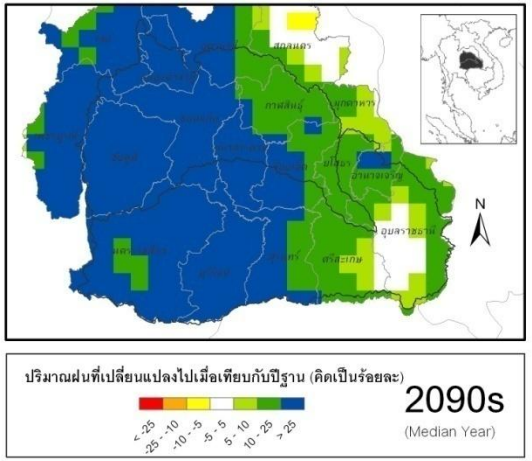












Change in annual rainfall

Thank you