International Cooperation toward National Action Plan for Adaptation

1. **Framework of Adaptation Planning**
2. **Vulnerability Assessment for the Asia and Pacific Region**
3. **Conclusions**

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Conditions for Adaptation Planning

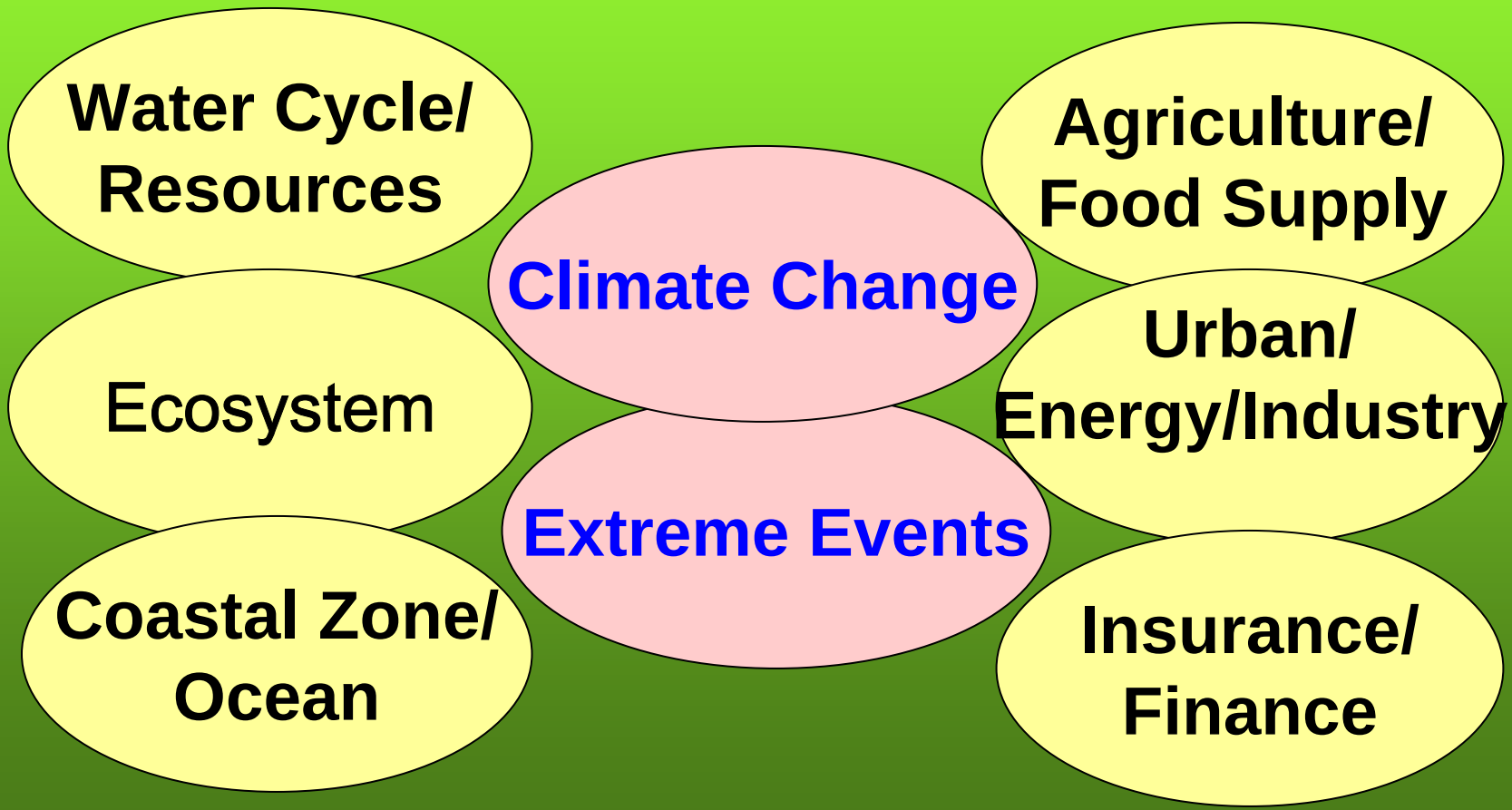
- Need to know the range and degree of the potential impacts, and vulnerable sectors and areas(hot spots)
- Need to know what are needed to increase preparedness against the impacts
- Need to know strategy and tactics for adaptation
- The adaptation plan should be incorporated in the mainstream policies such as disaster prevention, environmental management, agriculture, forestry, and fishery, urban infrastructures, and national development plan.
- Adaptation is a part of sustainable development plan in each country
- Adaptation should meet the social acceptance. Therefore, need to raise people's awareness on the vulnerability

Framework of Adaptation Planning

1. Vulnerability Assessment
   - Past works including IPCC TAR is an important contribution
   - So much information, mainly in a qualitative manner
   - Insufficient to use as a basis for the adaptation planning
2. Needs Assessment
   - Need to know what are needed for the vulnerable sectors and areas
3. Adaptation Assessment
   - Strategies and measures of adaptation
4. National Action Plan for Adaptation

- Need more studies to prepare the adaptation plan, and capacity building for these.

Impacts of Global Warming



Impacts on the Asia and Pacific Region

Assessment Method

Sea Level Scenarios

1. Present HWL
2. Present HWL+ Maximum Storm Surge (past 40 yrs)
3. HWL in 2100 (1m SLR)
4. HWL in 2100 + Maximum Storm Surge (past 40 yrs)

Primary Impacts

Inundated Areas, and Flooded Areas by Storm surge

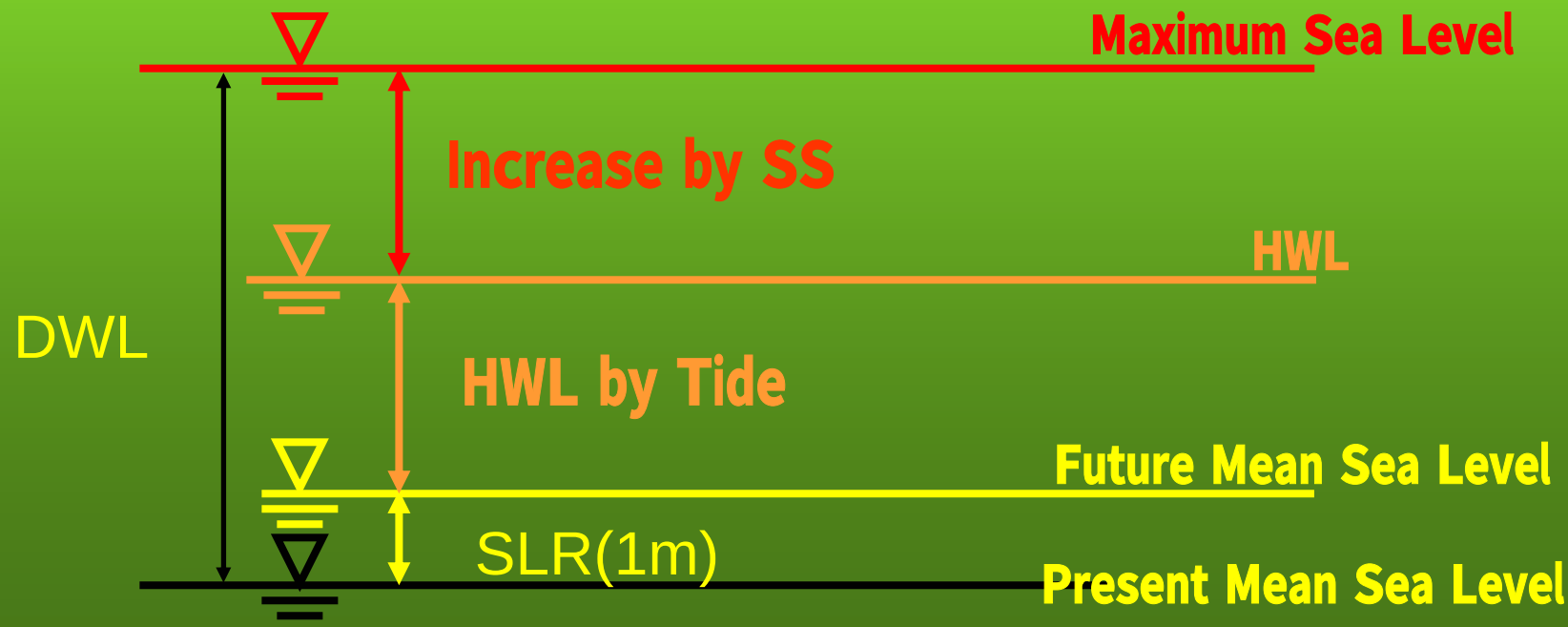
Secondary Impacts

Population, Natural Systems, and Infrastructures

Sea Level Scenarios

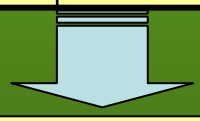
Design Water Level

DWL = SLR + HWL by Tide + Storm Surge



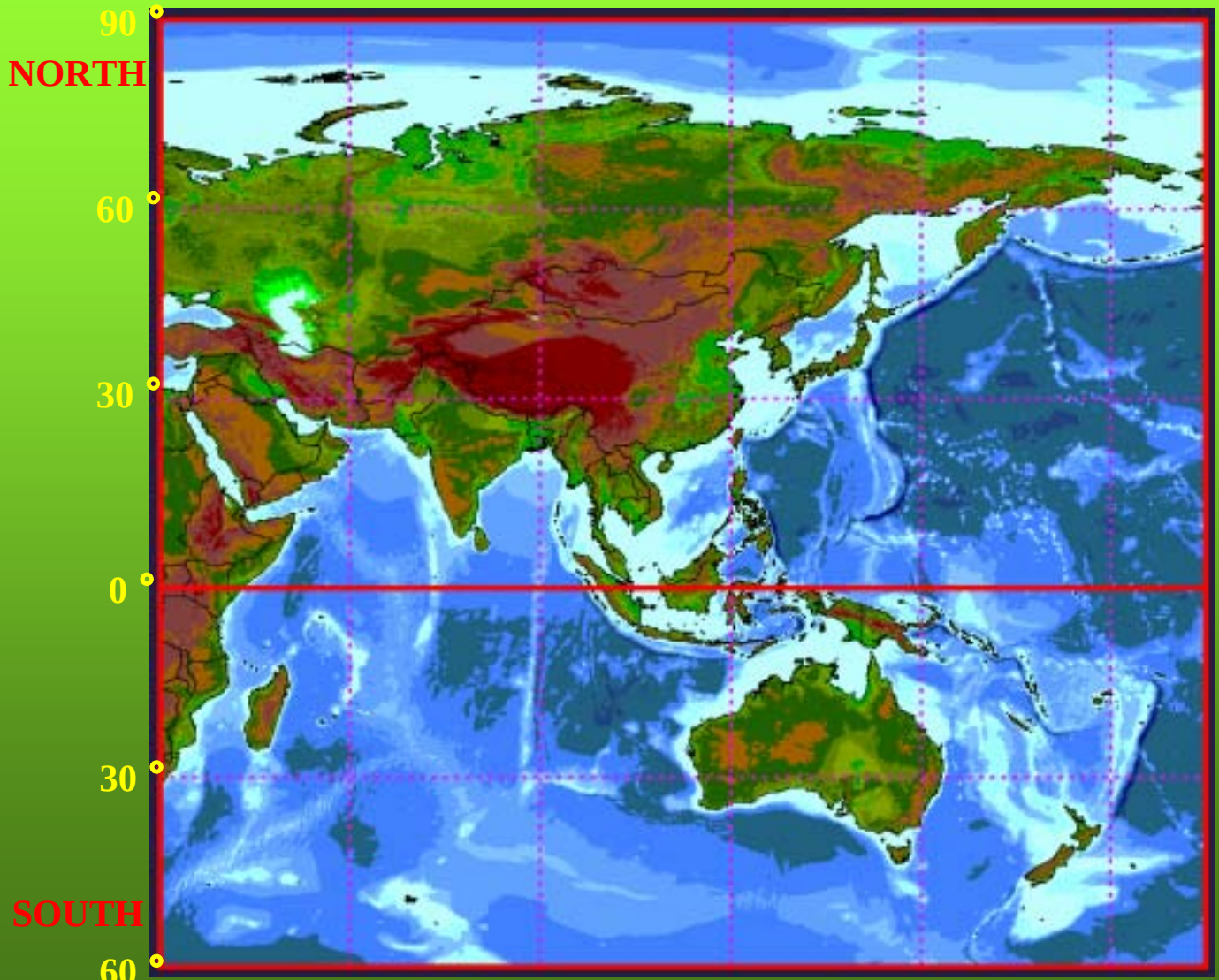
Global Database

SLR	IPCC estimation	IPCC SAR	1992	Global average
Topography	GTOPO30	EROS Data Center (US)	1993	0.5’
Water Depth	ETOPO5	Nat. Geographic Data Center (US)	1988	5’
Boundary	Nations World Political Bound.	Global GRASS Data	1982	4.8’
Tide	Tide Tables	Hydrographic Dep. Japan	1999	points
Cyclones	World-wide Tropical Data Set	US NOAA	1842～1989	points on tracks
Population	Gridded pop. of the World	CIESEN (US)	1994	5’
Future population	Long-term Prediction	World Bank	1996	Nation



Create a data set with a uniform 1’ grid

Topography of Target Area



Height (GTOPO30, [m])

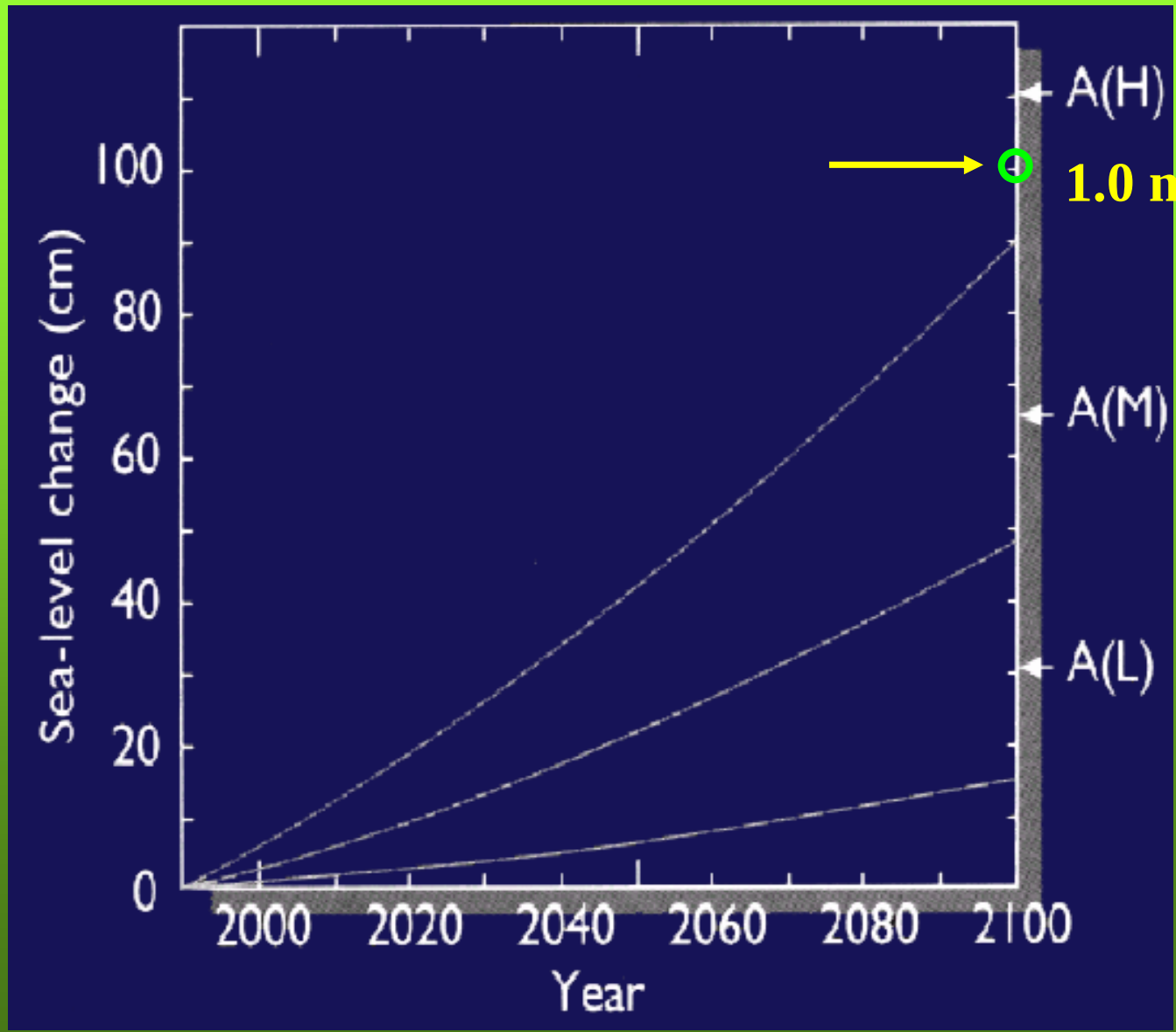
-27 –	0
0 –	20
20 –	50
50 –	100
100 –	200
200 –	500
500 –	1000
1000 –	2000
2000 –	5000
5000 –	7833

Depth (ETOPO5, [m])

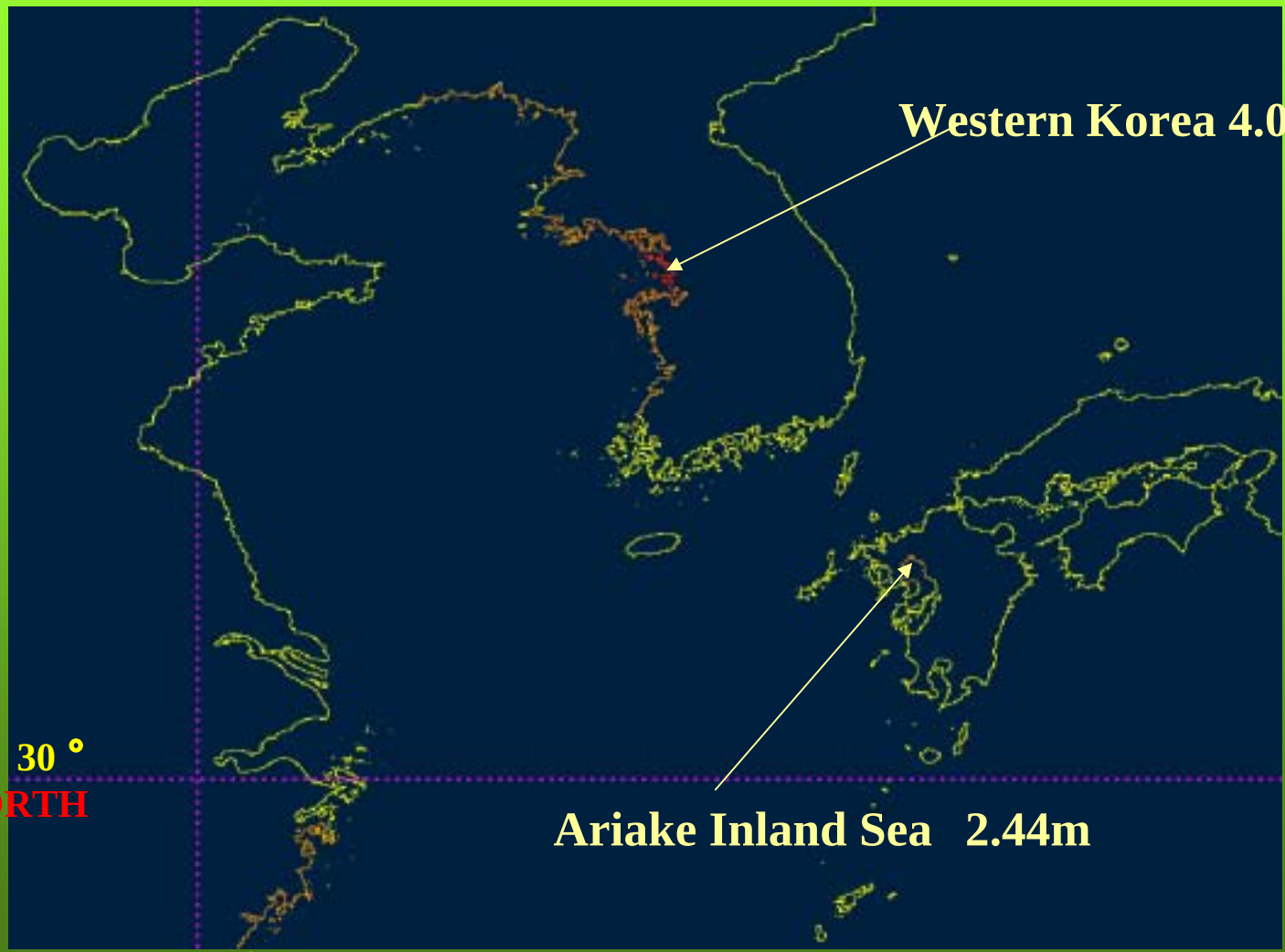
-10376 –	-9000
-9000 –	-8000
-8000 –	-7000
-7000 –	-6000
-6000 –	-5000
-5000 –	-4000
-4000 –	-3000
-3000 –	-2000
-2000 –	-1000
-1000 –	0

Land：$65 \times 10^6 km^2$

SLR Scenario



Distribution of Tidal Amplitude - East Asia

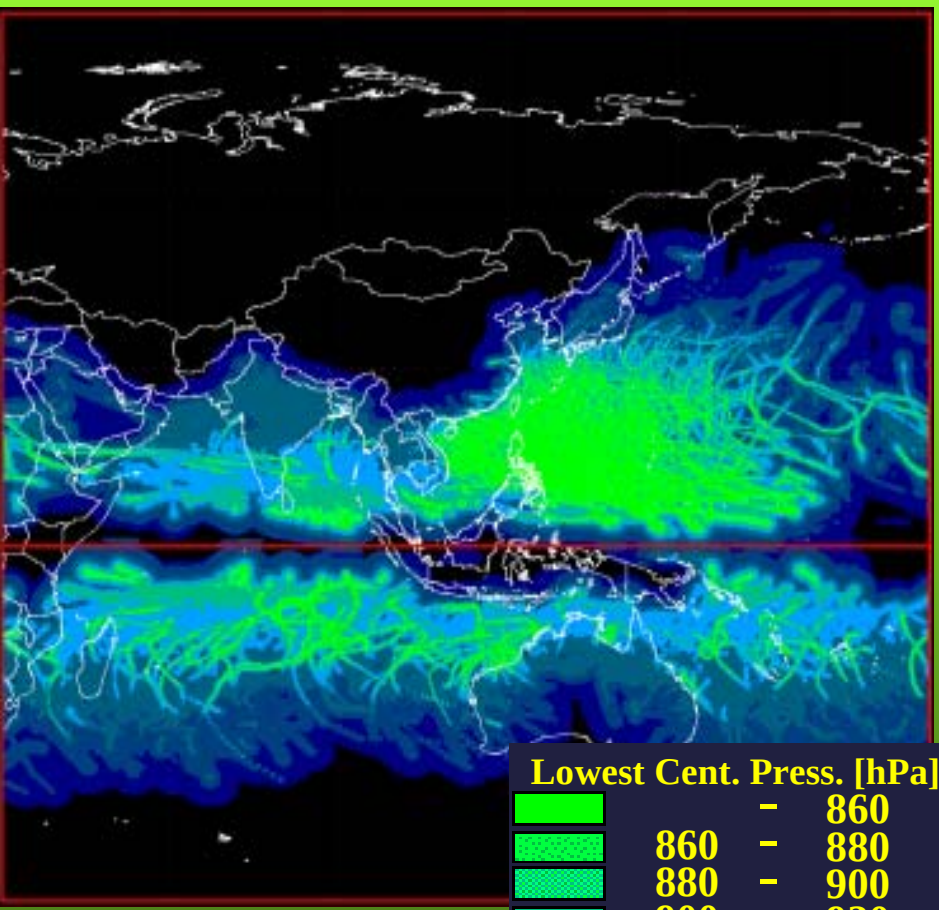


Amplitude (m)

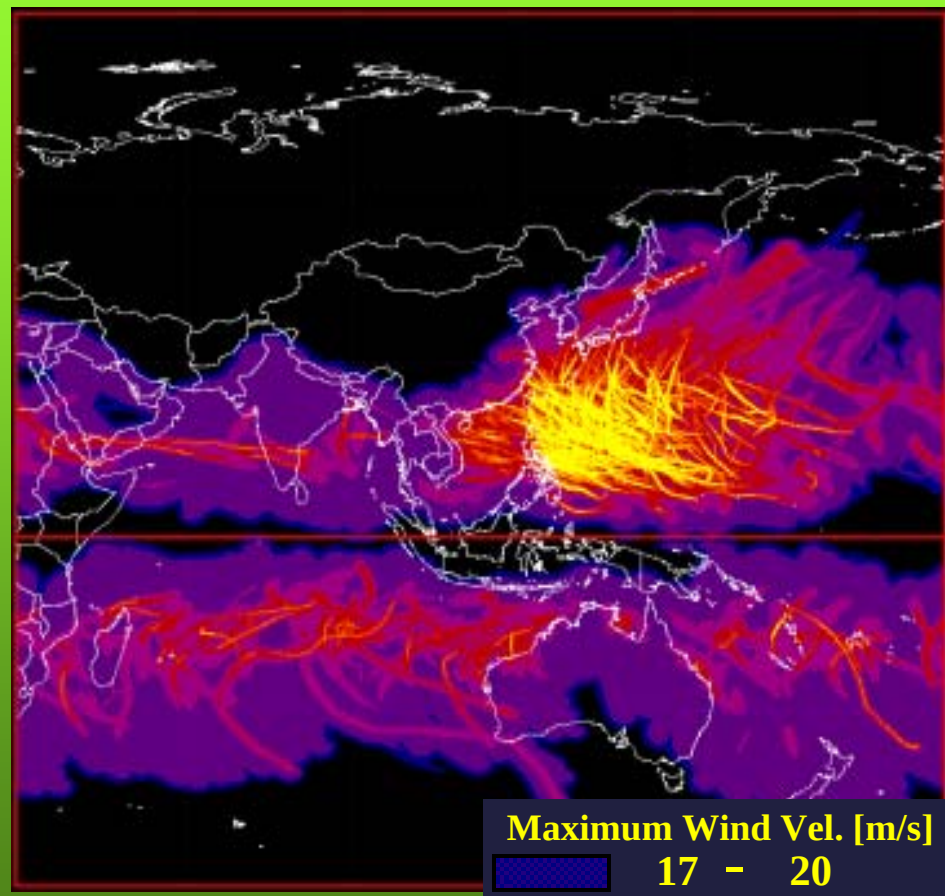
0 -	1.0
1.0 -	2.0
2.0 -	3.0
3.0 -	4.0
4.0 -	5.0
5.0 -	5.28

Estimated Typhoon Parameters(1949～1988)

Lowest Center Pressure



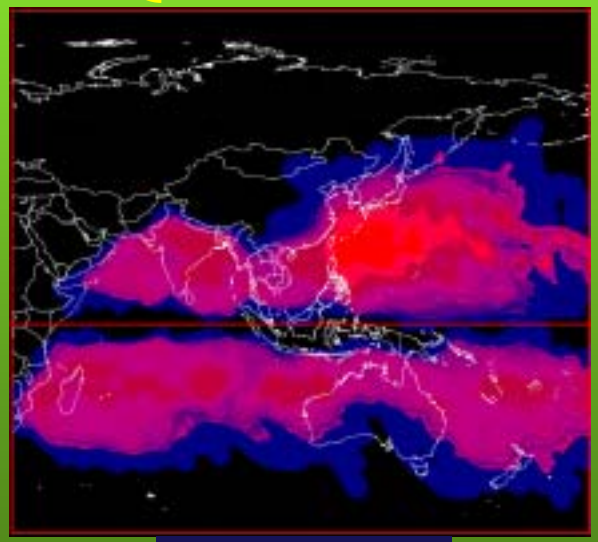
Maximum Wind Velocity



Characteristics of Typhoons (1949～1988)

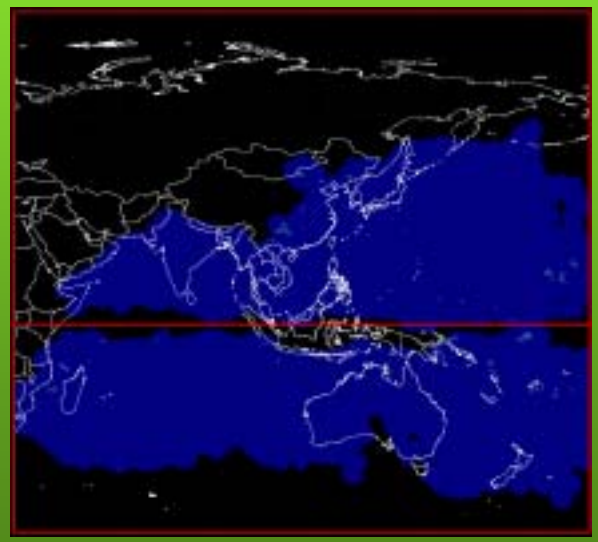
Cumulative Effect of Typhoon

$$\Sigma \left(\text{Average Wind Vel. (m/min)} \times \text{Retention Time (min/typhoon)} \times \text{Frequency (number/yr)} \right)$$



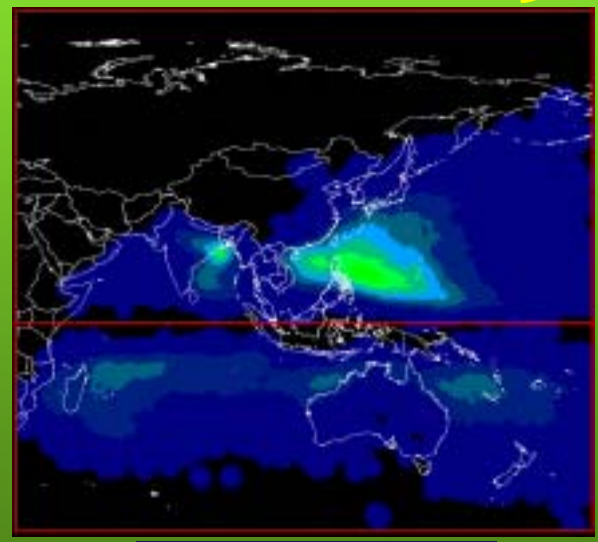
Average Vel. [m/s]

0.0 –	5.0
5.0 –	10.0
10.0 –	15.0
15.0 –	20.0
20.0 –	25.0
25.0 –	30.0
30.0 –	35.0
35.0 –	38.8



Retention Time [day]

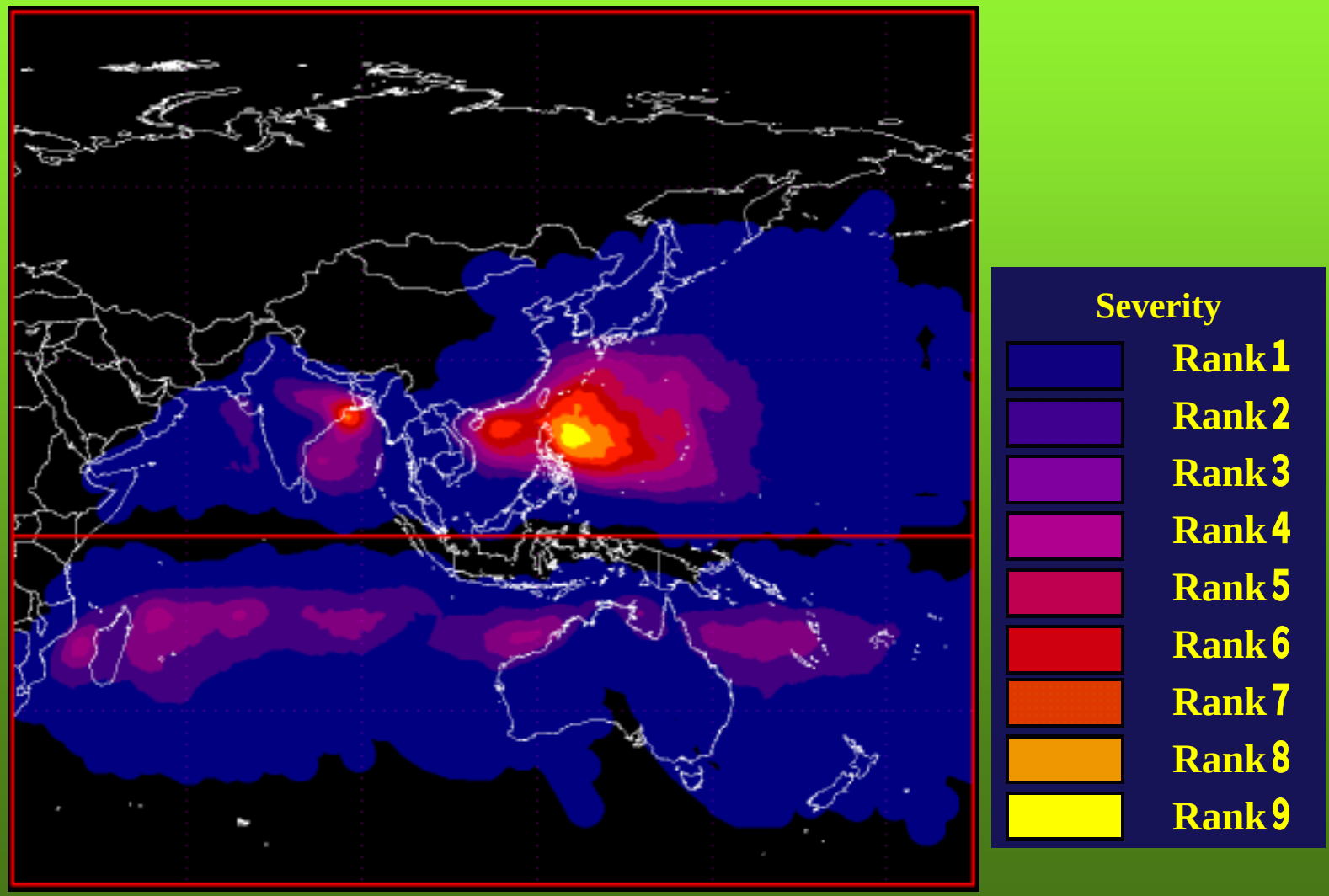
0.0 –	1.0
1.0 –	2.0
2.0 –	3.0
3.0 –	4.0
4.0 –	5.0
5.0 –	6.0
6.0 –	



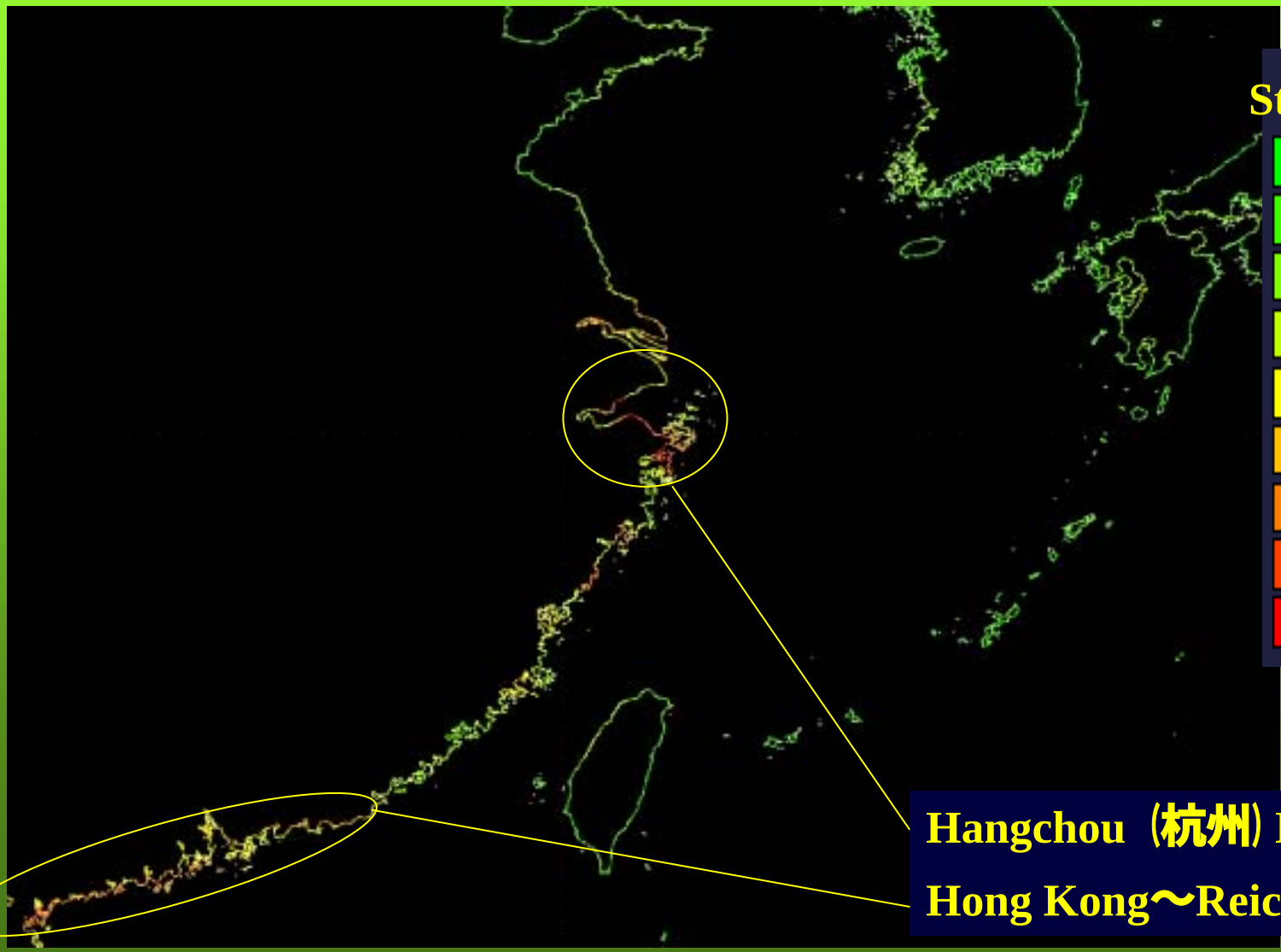
Frequency [num./yr]

–	1.0
1.0 –	2.0
2.0 –	3.0
3.0 –	4.0
4.0 –	5.0
5.0 –	6.0
6.0 –	6.8

Severity of Typhoon Effect (1949～1988) - Cumulative Effect



Maximum Storm Surge (Past 40 years)



Strom Surge ([m])

0 -	1.0
1.0 -	2.0
2.0 -	3.0
3.0 -	4.0
4.0 -	5.0
5.0 -	6.0
6.0 -	7.0
7.0 -	8.0
8.0 -	8.68

Hangchou（杭州）Bay 7.1m

Hong Kong～Reichou 8.6m

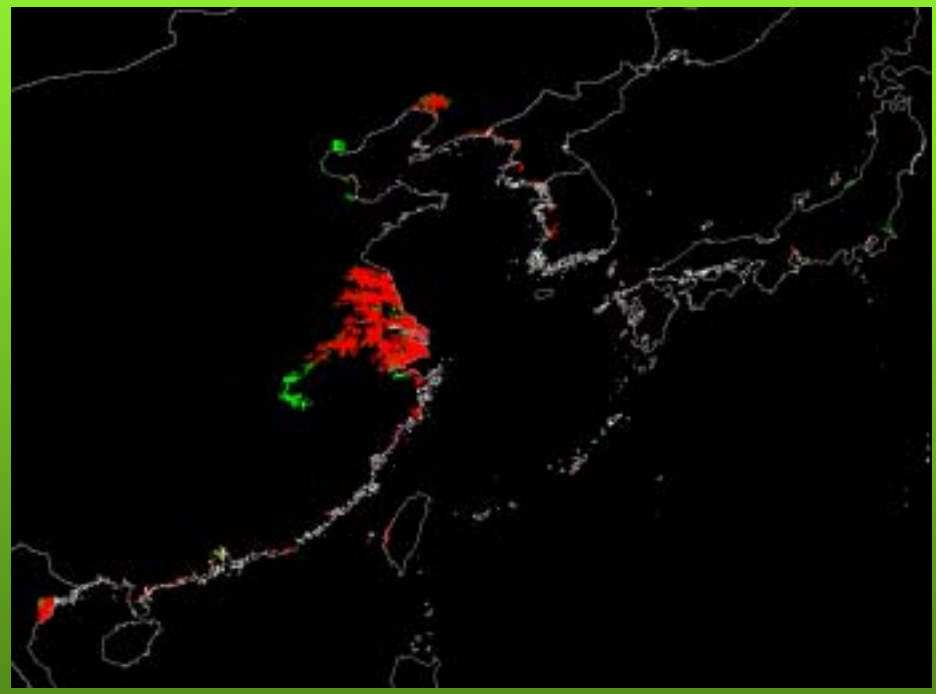
Inundated and Flooded Areas - East Asia

<Inundation>

Inundated by HWL

Inundated by HWL+1m SLR

<Flooding by Storm Surge >

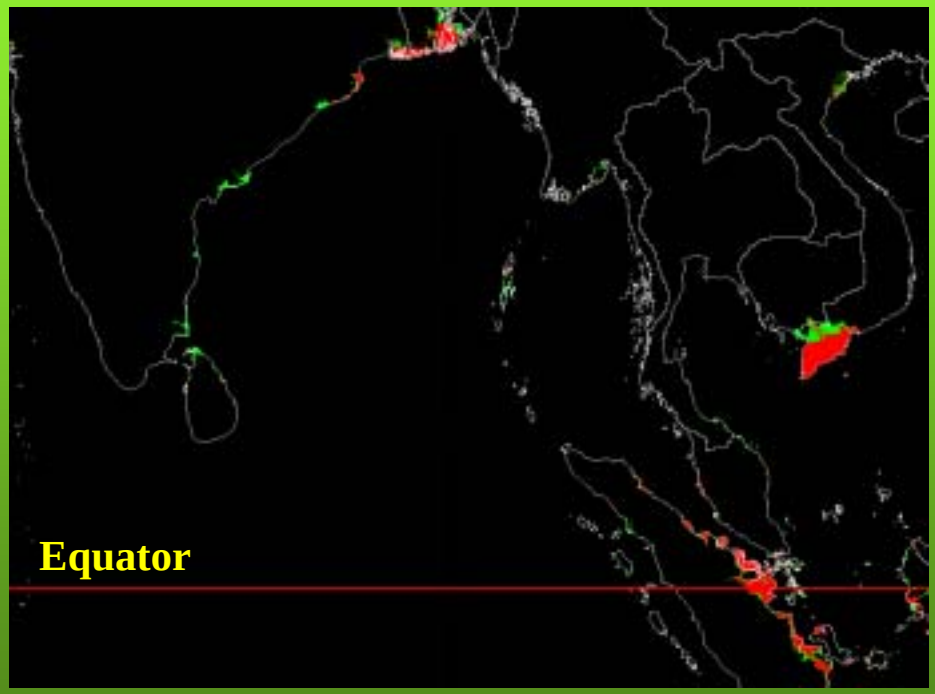


Flooded by HWL + SS

Flooded by HWL + SS + 1mSLR

Inundated and Flooded Areas - Southeast and South Asia

<Inundation>



Inundated by HWL

Inundated by HWL+1m SLR

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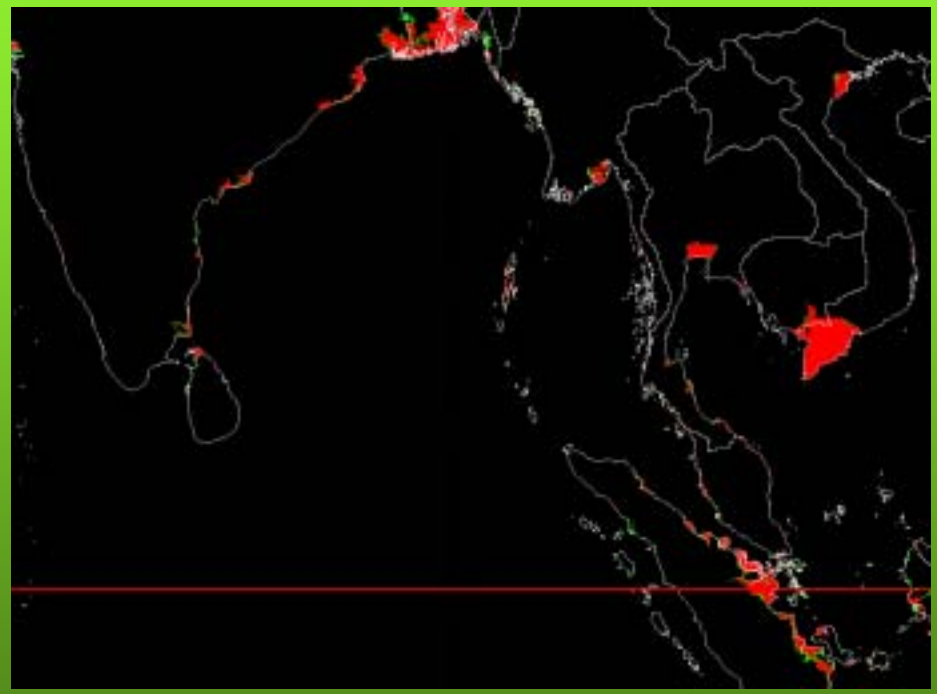
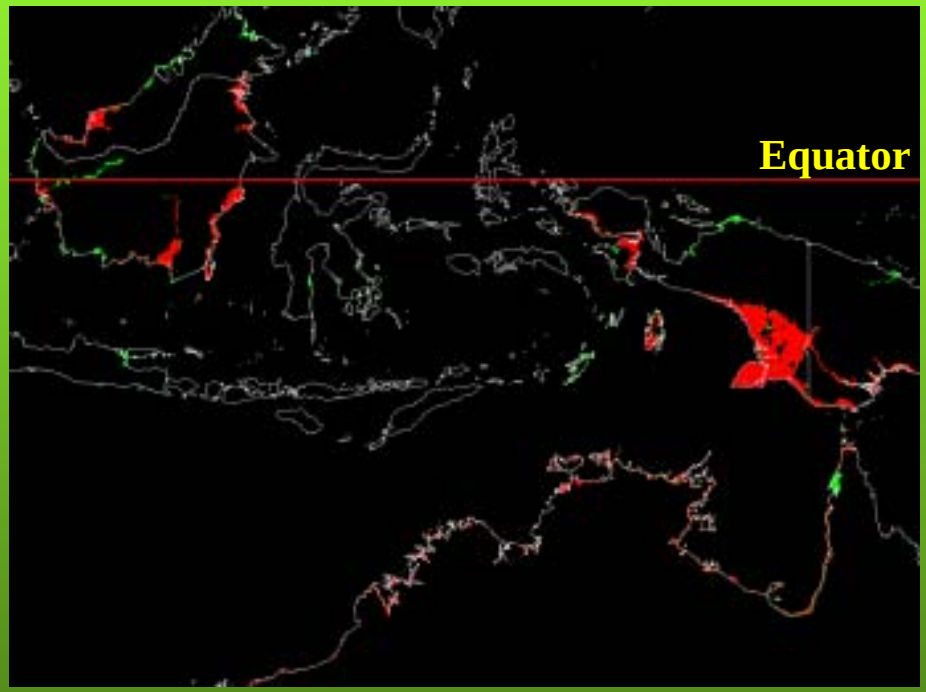


Flooded by HWL + SS

Flooded by HWL + SS + 1mSLR

Inundated and Flooded Areas - Kalimantan, New Guinea, North Australia

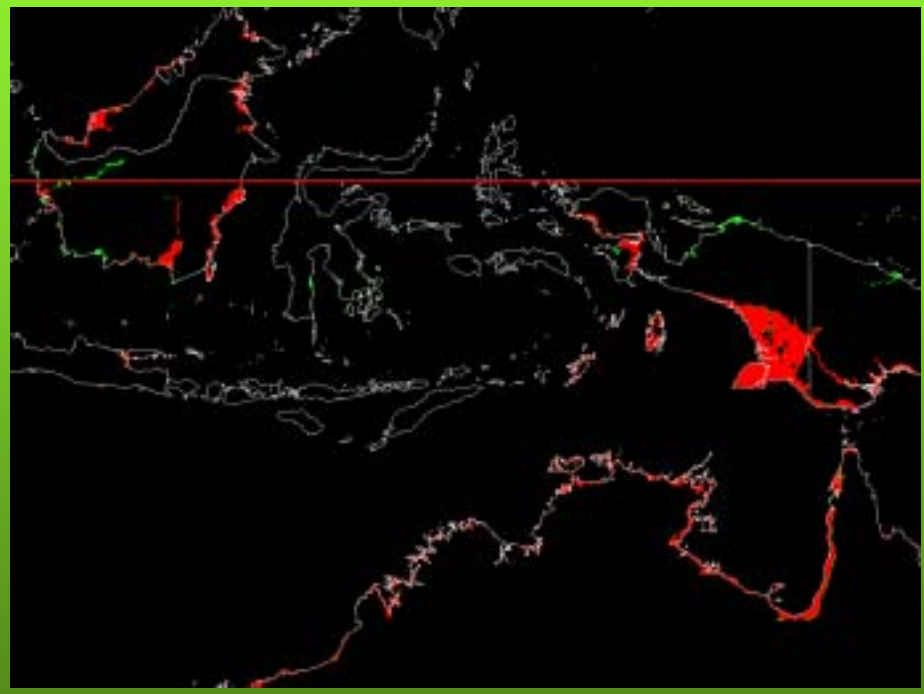
<Inundation>



Inundated by HWL

Inundated by HWL+1m SLR

<Flooding by Storm Surge>



Flooded by HWL + SS

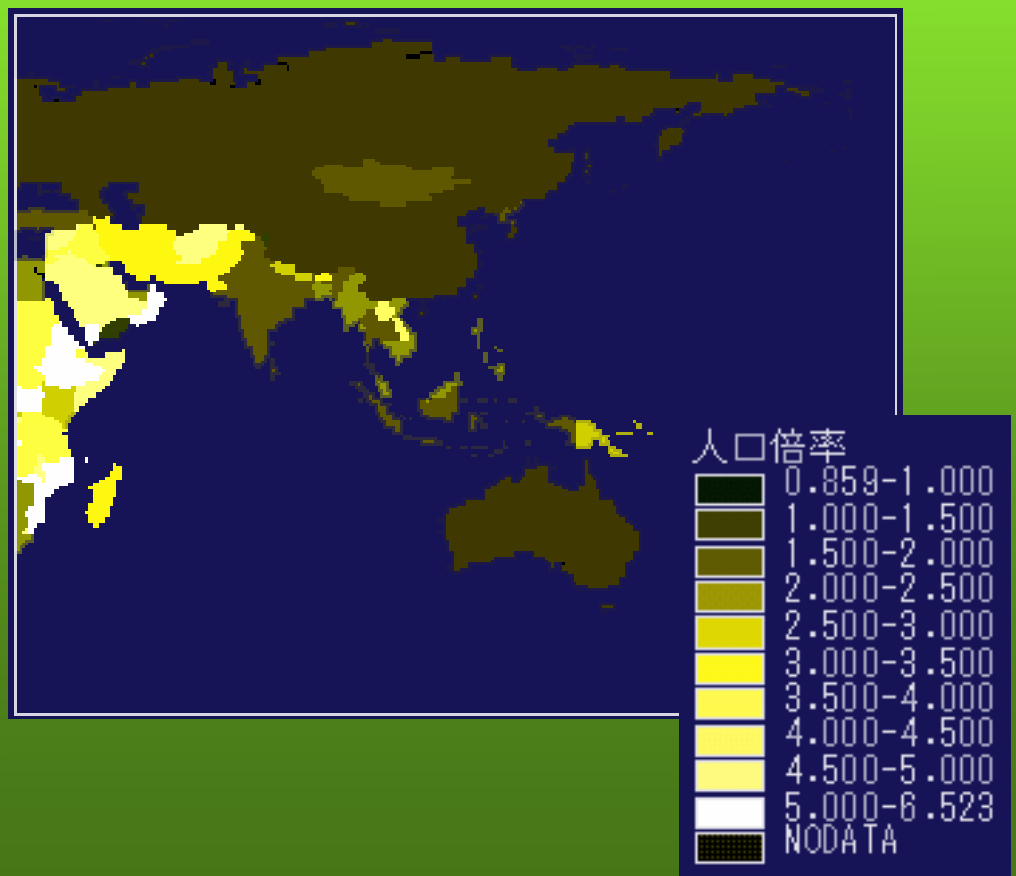
Flooded by HWL + SS + 1mSLR

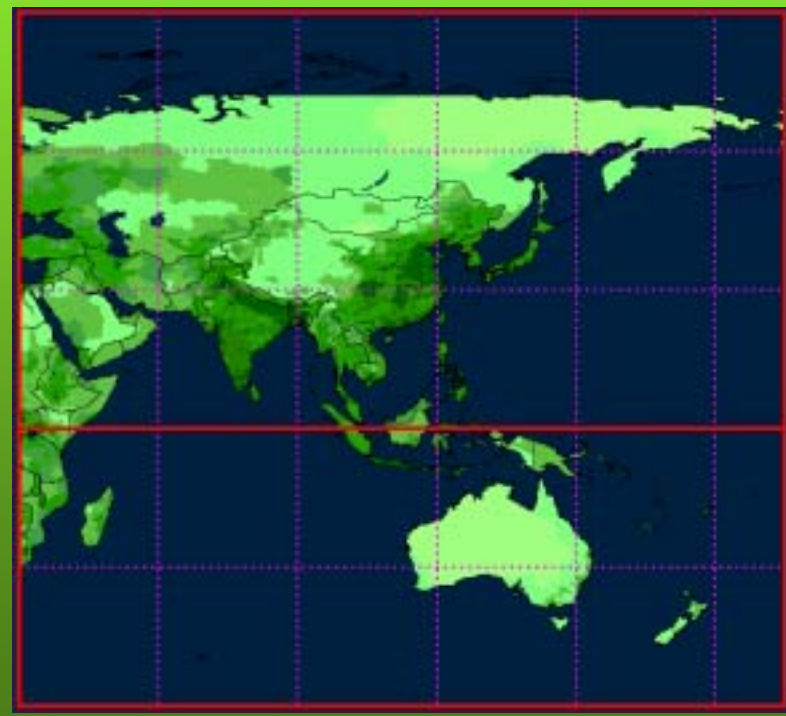
Estimate of Future Population

Rate of Population Growth (country-based, 2100／1994)

×

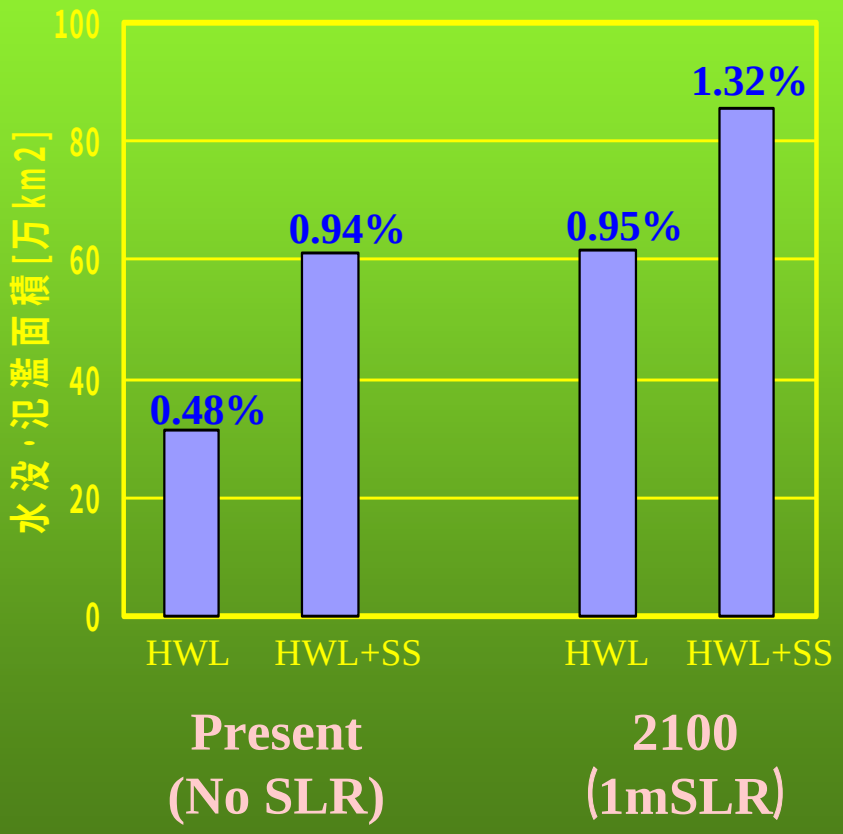
Population Distribution in 1994



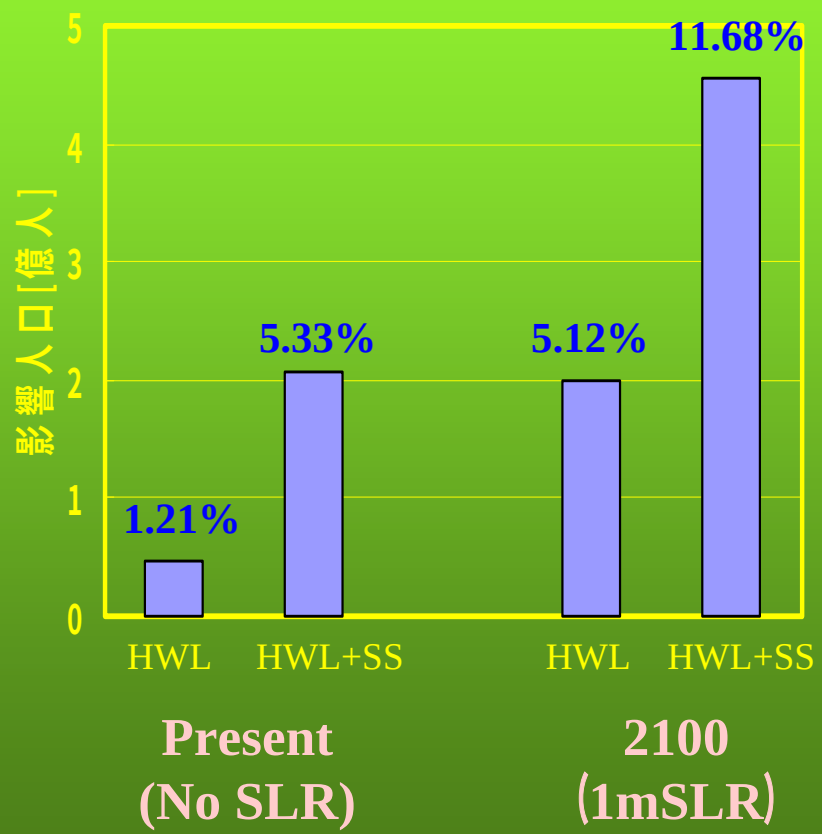


Affected Areas and Pupolation

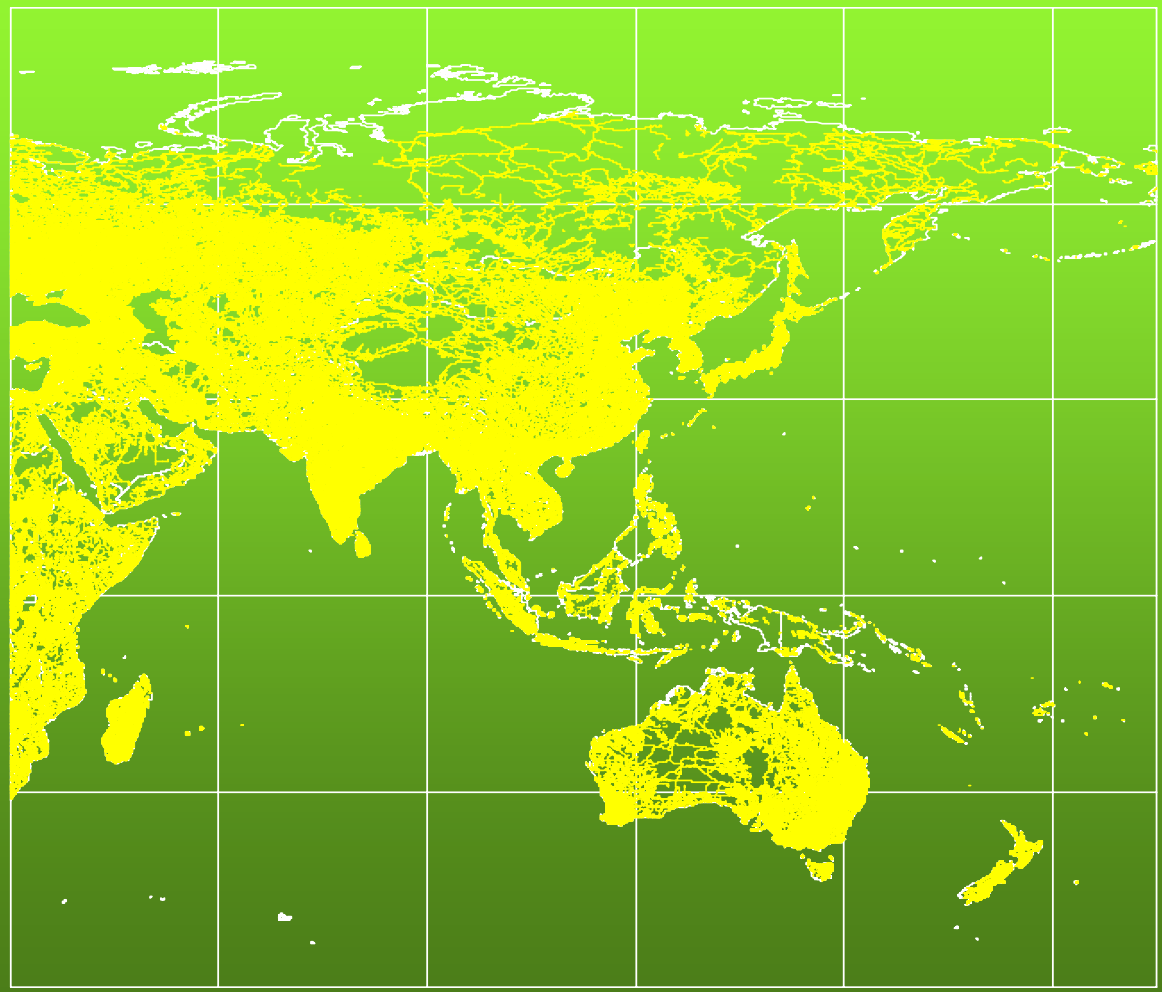
Inundated and Flooded Areas



Affected Population

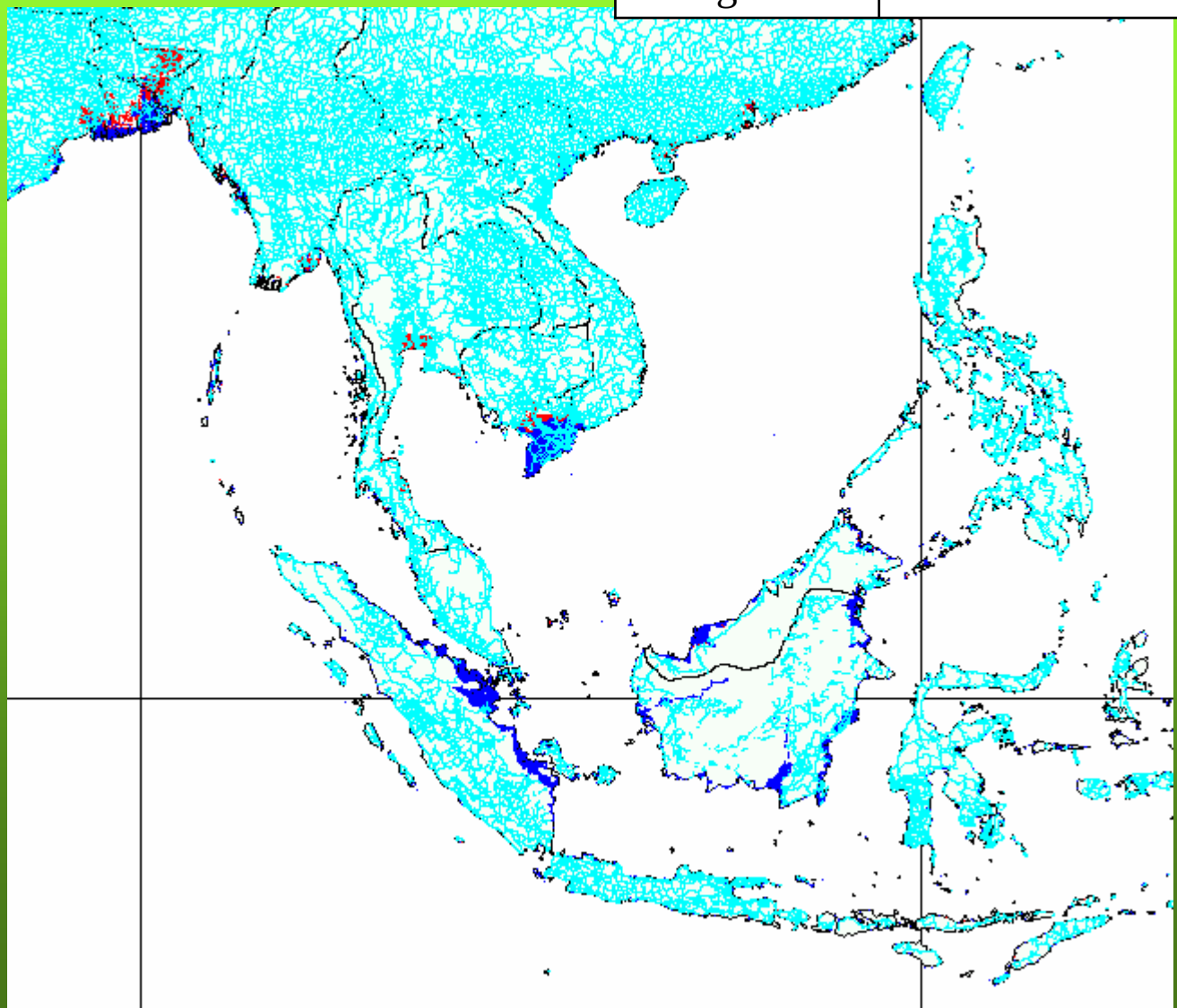


Distribution of Roads

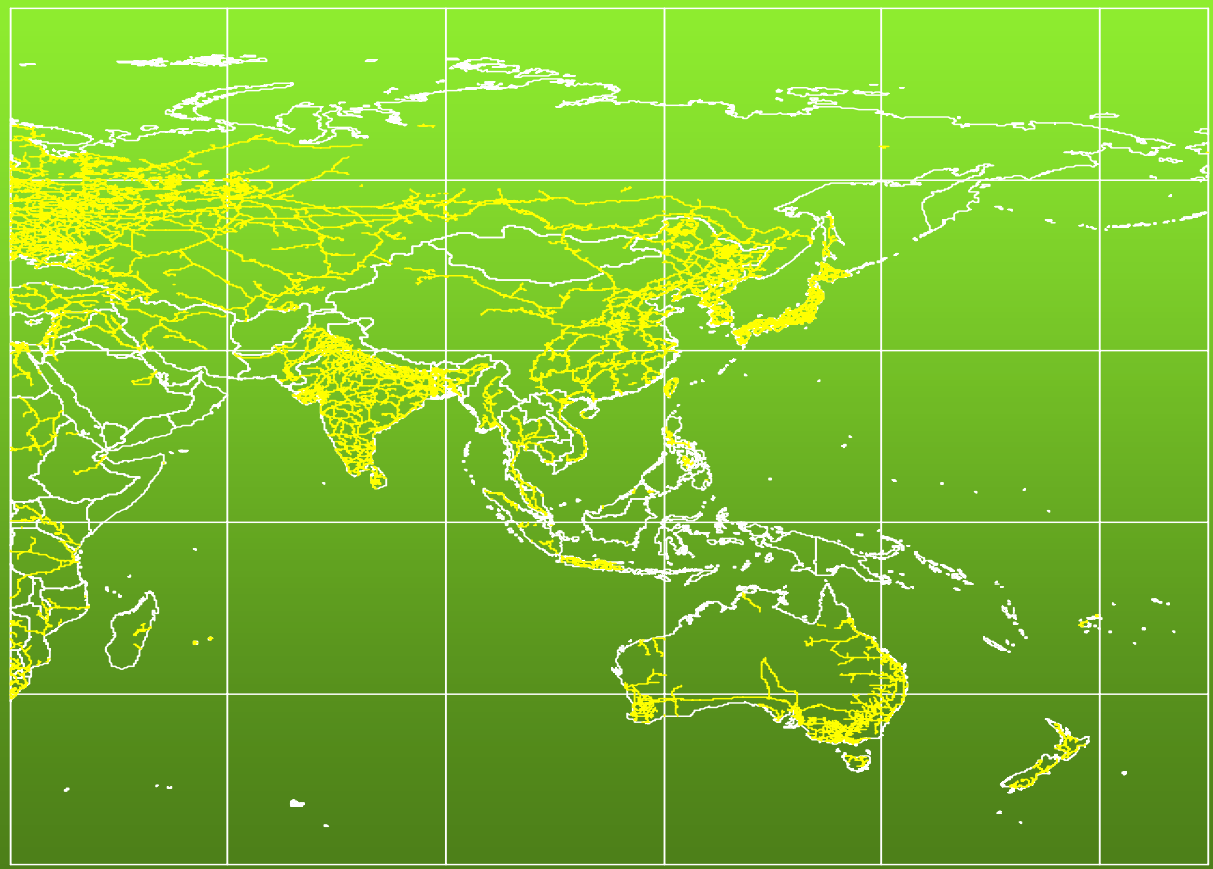


Roads

	Inundation	Flooding
Singapore	57.6%	57.6%
Brunei	38.8%	43.6%
Bangladesh	7.4%	26.3%

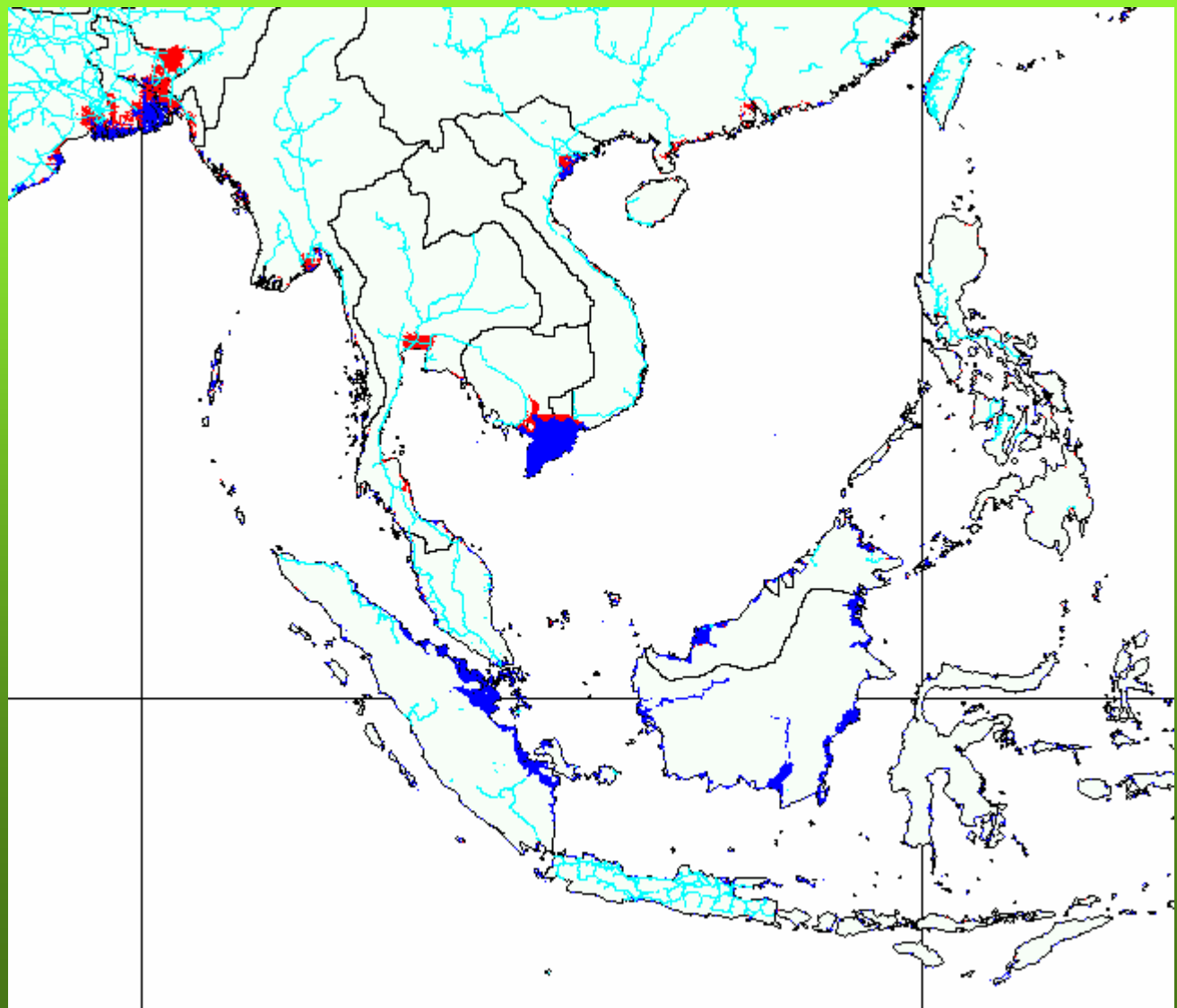


Distribution of Railways

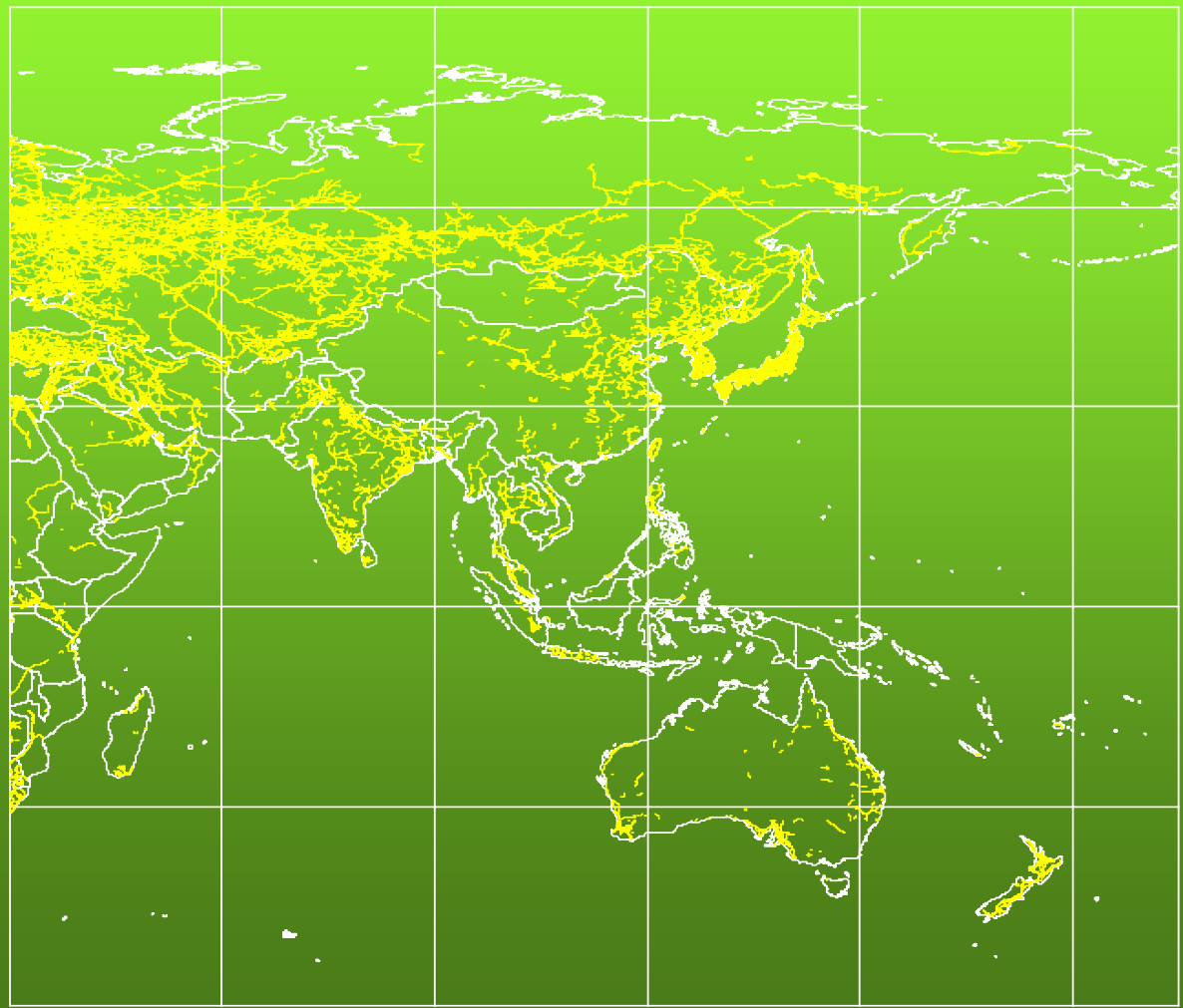


Railways

	Inundation	Flooding
Singapore	100%	100%
Brunei	50.0%	62.5%
Bangladesh	1.3%	22.4%

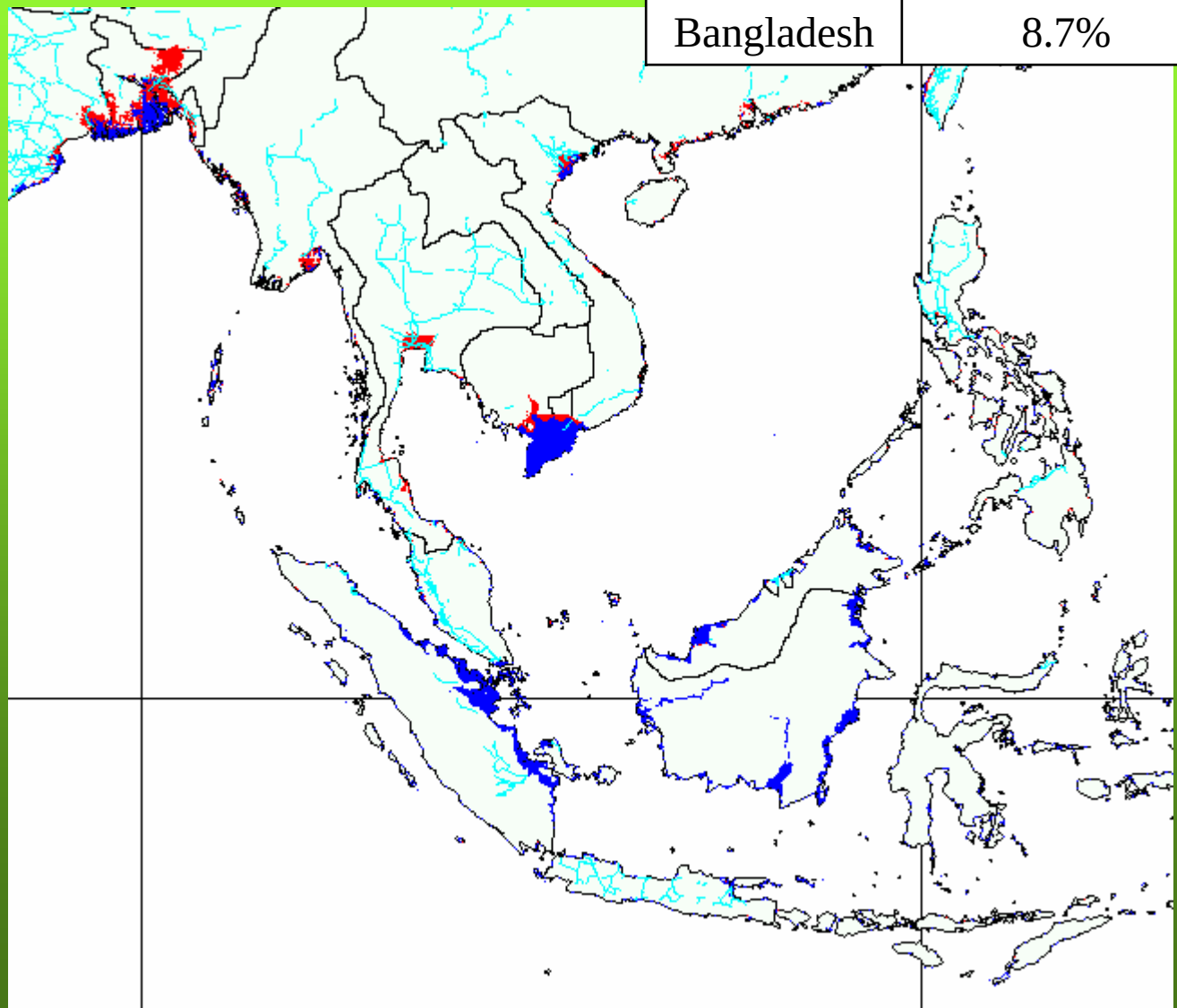


Distribution of Utilities



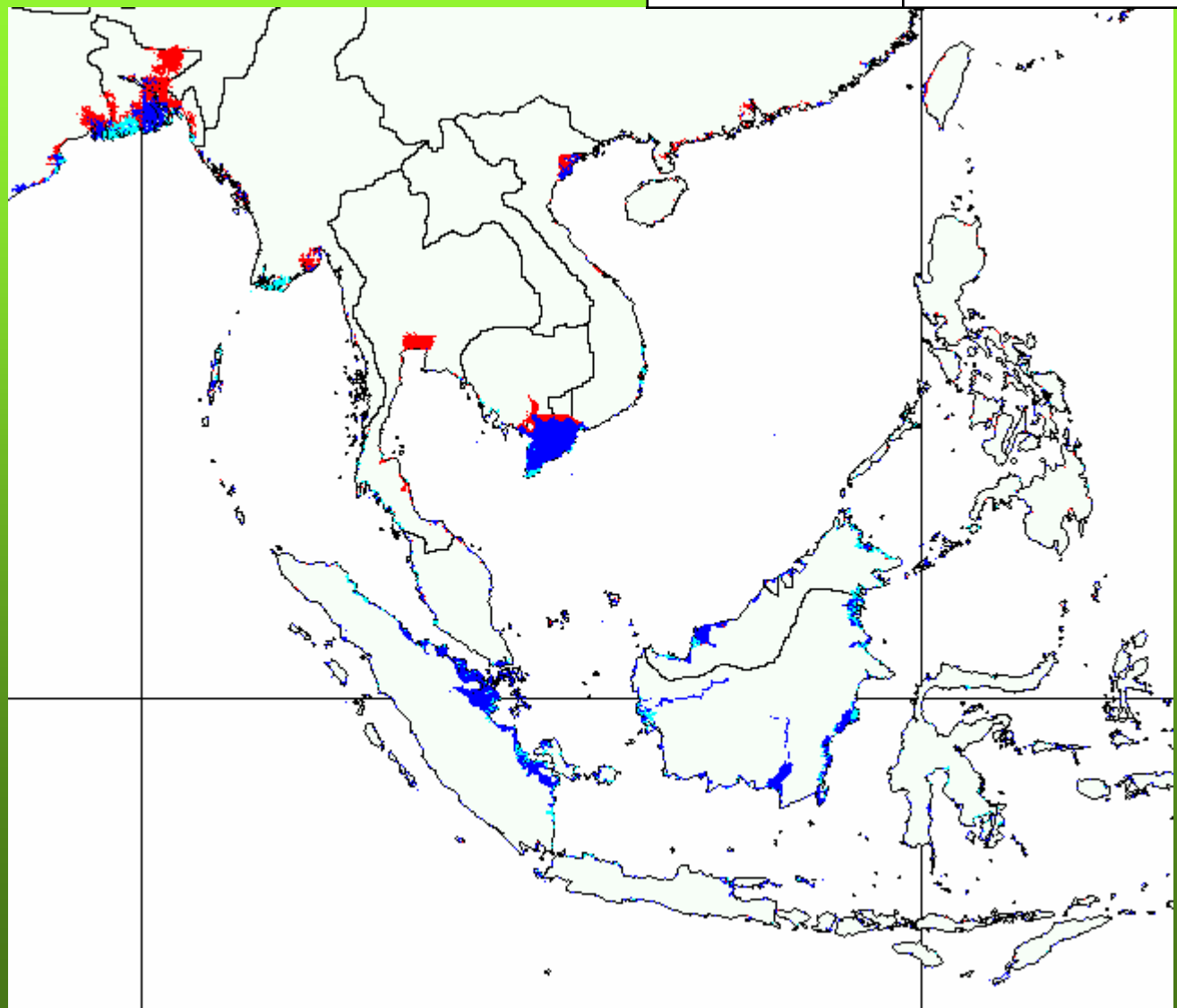
Utilities

	Inundation	Flooding
Vietnam	5.9%	12.2%
Brunei	57.3%	62.5%
Malaysia	4.8%	6.2%
Bangladesh	8.7%	62.5%



Mangrove

	Inundation	Flooding
Vietnam	87.0%	87.7%
Indonesia	74.3%	75.4%
Bangladesh	42.8%	68.1%



Response Strategies

1. Protection
2. Accommodation
3. Planned Retreat

Some Thresholds of Impacts

Ecosystem	Plants in high mountain Mangrove	Apparent effects for 2℃ increase Cannot survive for 45cm SLR
Agriculture	Rice	Heat effect by over 35 ℃ during flowering
Marine Ecosystem	Coral	Bleaching by 1-2 ℃ increase in water temperature
Coastal Zone	Sandy beach Port and coastal structure	Erosion of 57% beaches by 30cm SLR 100 billion US$ of costs for 1mSLR
Human Health	Elder people	Increase of mortality rate for 33-35 ℃ of daily high temp.
Economy	Nations	Negative effects for 2-3 ℃ increase

Conclusions

We need to strengthen international cooperation in the following fields to promote developing National Action Plan for Adaptation.

1. Vulnerability Assessment
2. Needs Assessment
3. Adaptation Assessment
4. National Action Plan for Adaptation

Collaborative Studies in the South Pacific

1991-1997 Assessment of Impact and Vulnerability Coastal Zone Management
- Tonga, Fiji, Samoa, Tuvalu

#A New Stage from VA to Response

1999-2000 Needs Assessment to countries and stakeholders

2001-2002 Editing the Resource Book as a guiding material for NAPS