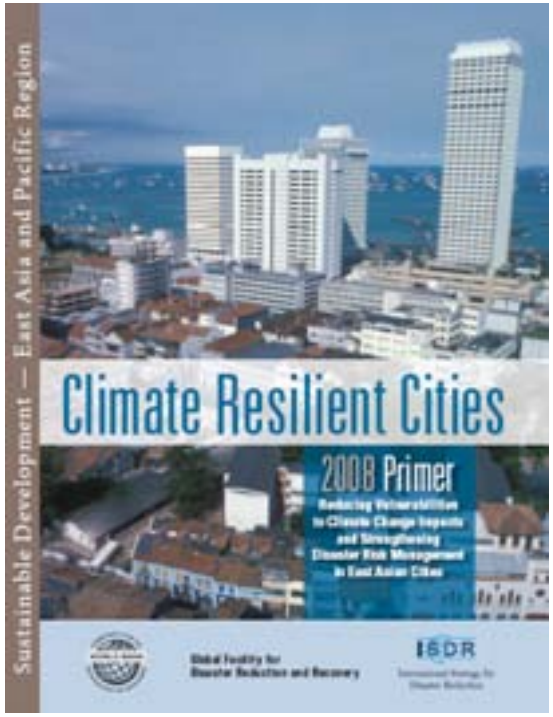
Green Cities Launch Event : A Primer on Climate Change Impacts and Disaster Risk Management in Urban Areas in East Asia



Session 5 – Guidance from the Primer: Understanding the Local Impact of Climate Change and Disasters

Downscaling Climate Change models to the city level: challenges and experience

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Global Facility for Disaster Reduction and Recovery

International Strategy for Disaster Reduction

Key Features

Session 5

- Introduce the CC Models and Scenarios and understand the Downscaling problem
- Present issues and good practices
- Showcase the Bangkok City Case Study (Climate Change Impact and Adaptation in Asian Coastal Cities): experiences and lessons learned

CC Models and Scenarios

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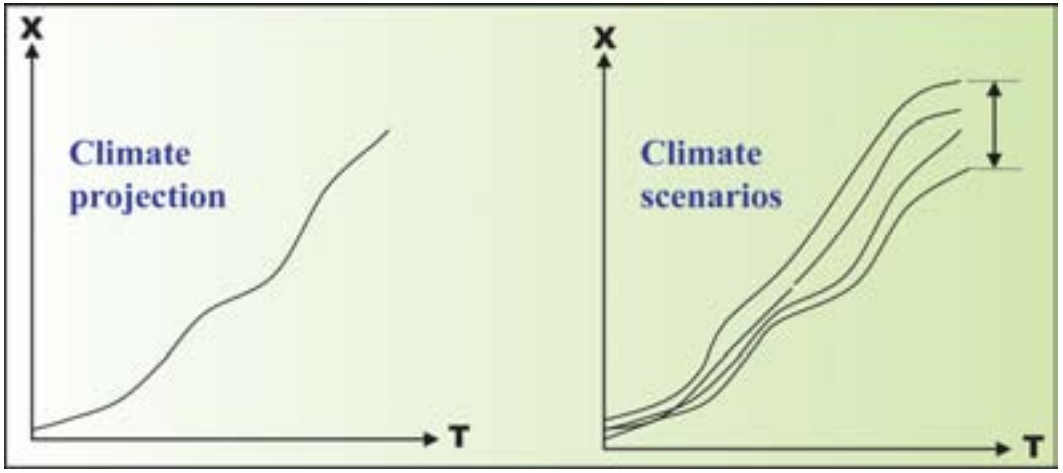
- IPCC Models present a set of emissions scenarios associated with future temperature and precipitation variability on a global scale
- A climate scenario is:"…. a plausible future climate that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change". (IPCC, 2001)



Downscaling CC Models

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- To achieve a higher resolution we need to downscale global predictions
- We can use several methodologies:
  - GCM General Circulation Models (AO-GCM, AR4)
    - Pros: easily accessible, numerous model runs, global in scale
    - Cons: coarse resolution (300km), daily extremes poorly represented
  - RCM: Nested Regional Climate Models
    - Pros: higher resolution (50km), daily extremes more realistic
    - Cons: time-consuming, not good for representing risk assessment
  - Statistical Models (SCI, PP, MOS)
    - Pros: site-specific, long and multiple daily sequences produced
    - Cons: requires a lot of historic data, based on empirical data not always available

Downscaling Issues

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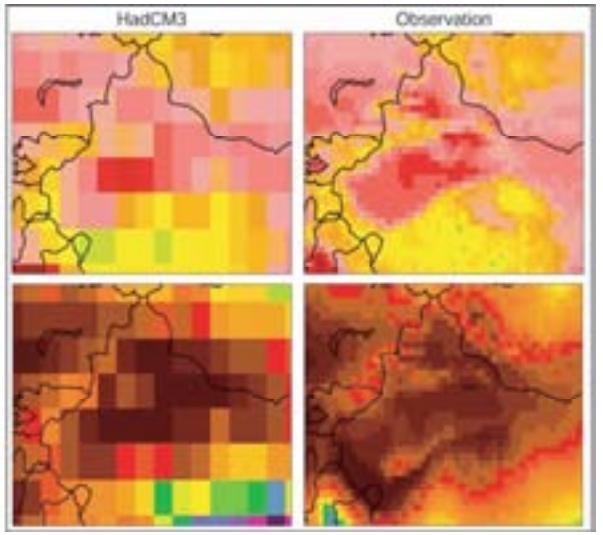
- Downscaling these models is not simple (you cannot just 'chop down the grid'):
  - No unified methodology exists: different climate models give different results



- Very commonly there is fragmented or no local data (especially in developing countries and / or in remote regions)
- The specificity of downscaling problem can hamper the comparability and interpretation of results

Downscaling Issues (II)

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- But the biggest problem is that c=scenario development is largely an exercise of handling uncertainty:
  - The accuracy of the model is limited by grid resolution and the quality of global predictions.
  - Natural weather variability adds uncertainty

		Sources of Uncertainties
Emissions	Scenarios from population, energy, economics models	• Specifying alternative emissions futures;
Concentrations CO_2, methane, sulphates, etc.	Carbon cycle and chemistry models	• Converting emissions to concentrations;
Global climate change Temperature, rainfall, sea level, etc.	Coupled global climate models	• Converting concentrations to radiative forcing;
Regional detail Mountain effects, islands, extreme weather, etc.	Regional climate models	• Modelling global climate response to a given forcing; • Regional climate responses

Downscaling - Good Practices

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- But there are some good practices that can help you go on the right path:
  - The use of coupled or different techniques may provide the most suitable approach
  - Since no method is perfect, sensitivity analysis and scenarios help you cope with uncertainty
  - Solid data and IT (DSS – Decision Support Systems and GIS - Geographic Information Systems) help
  - Understanding the local context leads to a better interpretation of the findings
  - Consistent approaches and common baselines will facilitate the comparability of results

Asian Coastal Cities Project

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- The project is a joint effort of ADB, JBIC and WB to study and be able to compare CC Impacts on several Asian megacities
- The project is currently ongoing in Metro Manila, Ho Chi Min City, Bangkok and Kolkata, and may be extended to other.
- Objectives (Tasks 1-4):
  1. Assess knowledge base (meteorological and urban)
  2. Model city-specific CC scenarios and their effects on geophysical systems (esp. hydrology)
  3. Evaluate impact assessment
  4. Identify and propose Adaptation options

Asian Coastal Cities Project

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- Implementation Agreements:
  - JBIC (in collaboration with UoT's IPCC experts) provides temperature and precipitation increases for every city
  - The local consultants assess and put together the city knowledge and building on it develop city-specific hydrology scenarios
- Challenges: common downscaling problems and city specific issues
  - Choice of models and agreement on their validity and accuracy
  - Data requirements and data availability
  - Comparability of approaches
  - Institutional and other practical problems

Bangkok City Case Study

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- The local team had a very solid proposal
  - Relevant and city-specific expertise
  - Excellent database and references
  - Sound Project Planning and Schedule
- Bangkok had well-known, city specific issues:
  - Sea level rise
  - Major flows/flooding from upstream catchments
  - Land subsidence
  - Coastal erosion in the Golf of Thailand
  - Rapid urbanization

Bangkok Study: Project Planning

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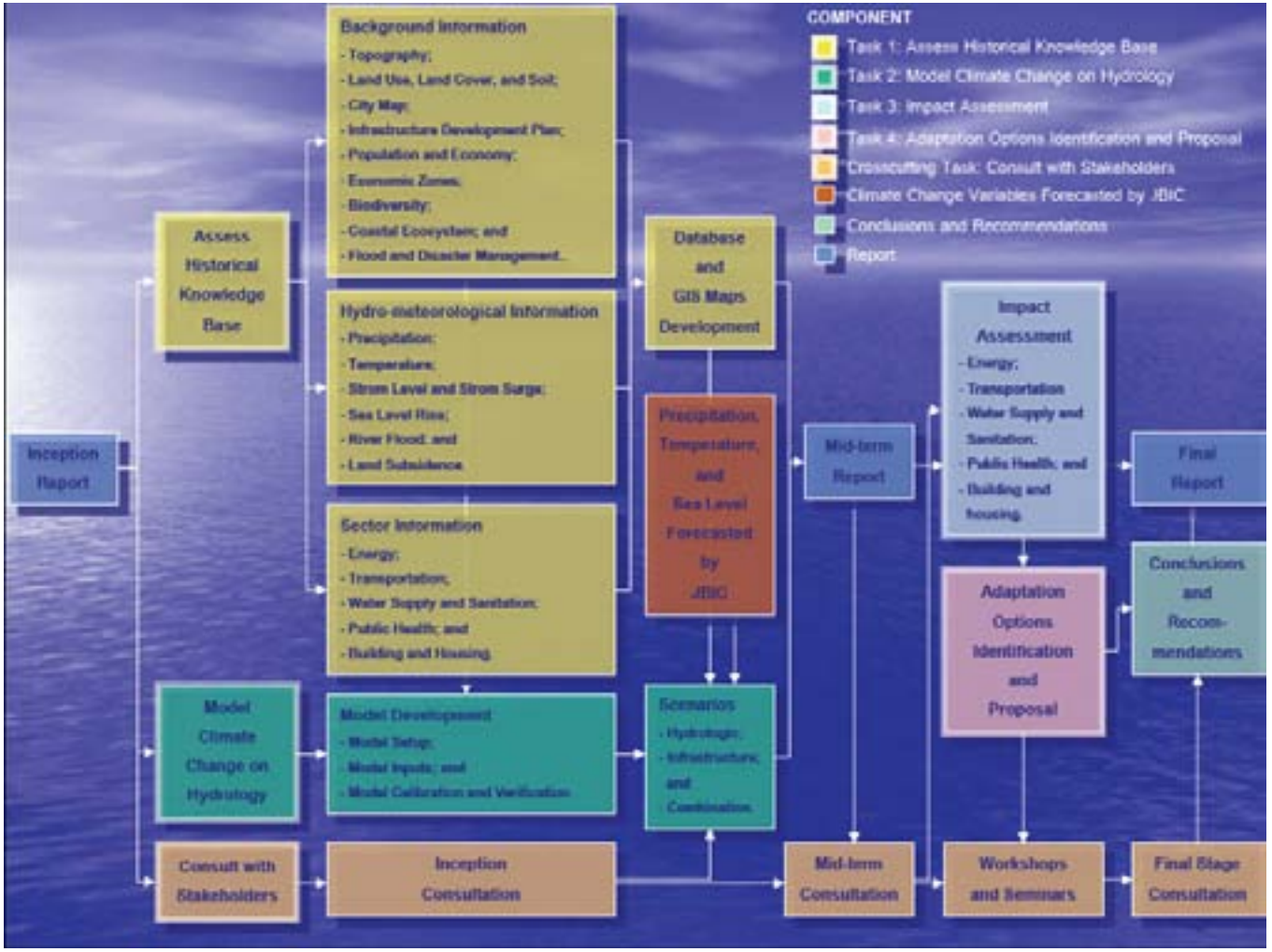

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Bangkok City Case Study: Challenges

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- JBIC provided the local team with input:
  - Precipitation scenarios for Bangkok, 2050
    - ΔTlocal [K] = 1.9 (A1FI) / 1.2 (B1)
    - ΔPmean [%]= 3 (A1FI) / 2 (B1)
    - ΔPextreme [%]= 15 (A1FI) / 9.8 (B1)
  - Similar forecasts for 2030, 2020
- However, inevitable challenges appeared:
  - Given the city's hydrology, the modeling had to consider the whole Chao Praya River watershed, not only the city system
  - JBIC city predictions could not be applied as easily as per Manila (the different hydrology implied a different scale, questioning the validity of JBIC assumptions)

Hydrology

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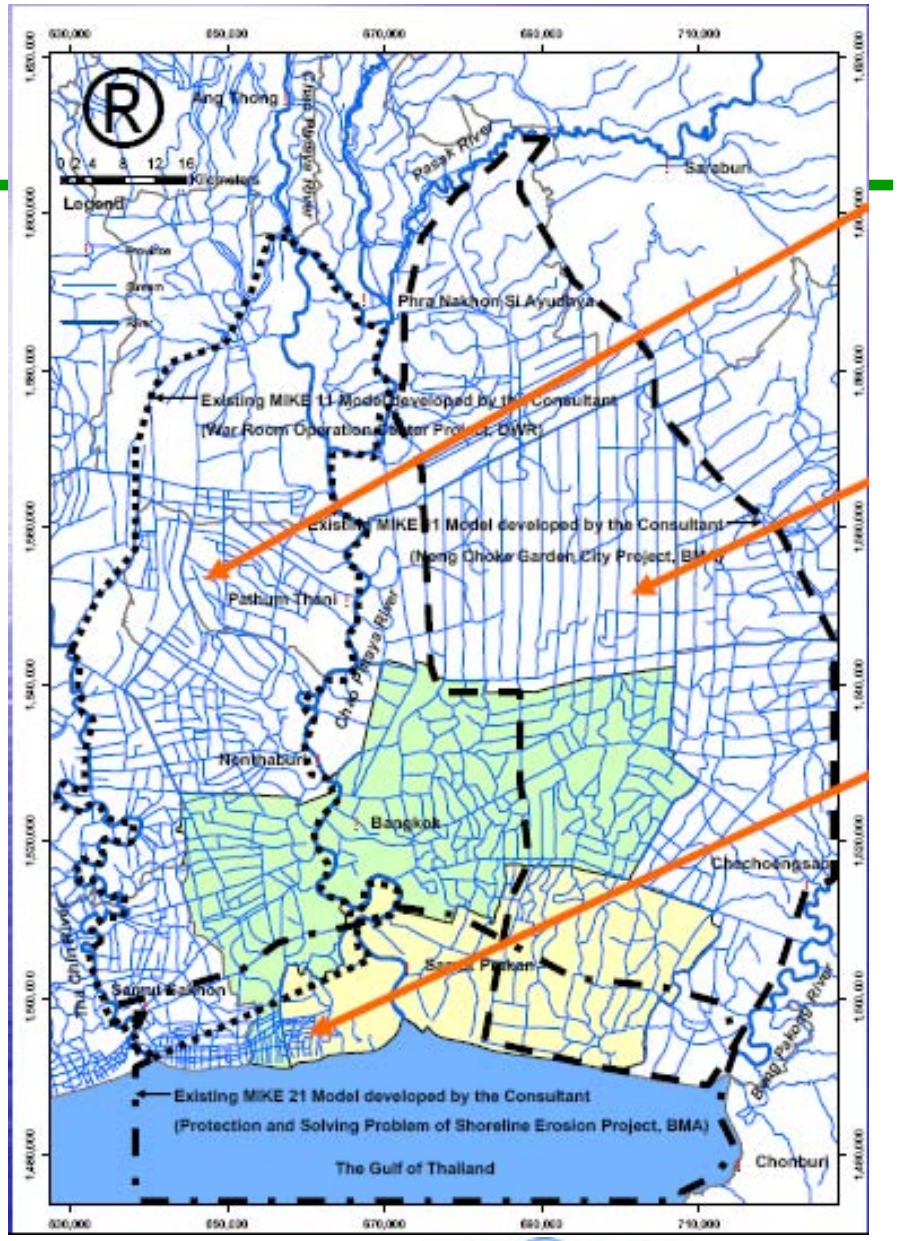
- The consultants developed a complex hydrology model to be validated by JBIC
- JBIC experts had to reevaluate their forecasts for the whole Chao Praya basin
- With a lot of fruitful discussion and a small delay, the modeling and estimates were finally agreed and we are now back in track



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Bangkok Study: Lessons Learned

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- Every city has its own city-specific issues (this not only true for model downscaling, but for all adaptation thinking)
- There is a gap between the climate model and the effective impact assessment (knowing temperature and precipitation increase doesn't necessarily mean knowing flooding increase)
- Extreme events are more important than average events (increase in variability more important than mean increase)
- It's very difficult to predict at the same time increases in magnitude and in frequency of events
- A certain degree of flexibility is required but a rigorous approach is essential to produce comparable results

Downscaling Climate Change Models

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Thank you!

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