General problem

Floods Jakarta 2013:
Direct damages USD3bn
Background

To contribute to scientific knowledge and the development of methods and tools to assess flood risk in Jakarta and Indonesia

JCAT: main goals

• To develop and improve methods and tools for assisting in decision-making on flood risk adaptation

• To contribute knowledge and capacity building

• To disseminate results to stakeholders in Jakarta, and more broadly to scientists and practitioners worldwide
**JCAT: main goals**

- To develop and improve methods and tools for assisting in decision-making on flood risk adaptation

1. Overview of tools

2. National scale flood risk assessment tool

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**Overview of tools**

a) Damagescanner-Jakarta

b) Economic assessment and optimisation tools

c) Coastal flood exposure tool

d) SDAS: erosion and sediment yield model

e) National scale flood risk assessment tool
Damagescanner-Jakarta

River flood risk assessment tool for Jakarta

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Economic assessment and optimisation tools

Assess costs and benefits of different adaptation options

Contact: pini.wijayanti@wur.nl
SDAS

Sediment and erosion models
Effects of policy measures
Long term changes in erosion

Contact: poerbandono@gd.itb.ac.id

National scale flood risk assessment tool
National scale flood risk assessment tool

Sanne Muis, Burak Güneralp, Brenden Jongman and Philip Ward

Future trends in flood risk in Indonesia
A probabilistic approach

General problem

Flood North Sumatra 2013: 18,000 people displaced
**Objectives**

- Develop national scale flood risk assessment tool for Indonesia
- Combine information from global models with more local knowledge
- Probabilistic estimates of risk

**Methods: General framework**

- **Flood Risk**
  - **Hazard**
    - Inundation depth
    - Inundation extent
  - **Exposure**
    - Urban area
    - Maximum damage
  - **Vulnerability**
    - Depth-damage curve
Methods: Hazard

Hazard
- Current conditions
- Climate change

River floods
- Modelled with GLOFRIS
  (Winsemius et al., 2013; Ward et al., 2013)
- RPs = 2, 5, 10, 25, 50, 100, 250, 500, 1000 yrs
- CC projections
  - ISIMIP: 5 GCMs and 4 RCPs

Coastal floods
- Based on DIVA database
  (Hinkel and Klein, 2009)
- RPs = 1, 10, 100, 1000 yrs
- CC scenarios
  - Three sea level rise scenarios based on IPCC AR5
    - Low (0.09m); medium (0.12m); high (0.17m)

Methods: Exposure

Exposure
- Urban area

- Probabilistic projections of urban expansion for the years 2015, 2020, 2025 and 2030 (ca. 2000 = baseline)
- Based on probabilistic population projections
- For each time-step 1000 iterations
  Seto et al. (2013)
Methods

Exposure
- Maximum damage

- Maximum damages
  - 6.7 million 2000USD/km² for Jakarta (Budiyono et al., 2014)
  - Scaled per province based on regional GDP per capita

Vulnerability
- Stage-damage curve

- Based on depth-damage functions
  - Jakarta (Budiyono et al., 2014)
  - From expert workshops
Results: Urban expansion (2000-2030)

Java → accounts 80% of national increase

Results: Response of river floods to climate change

• Change in 1/100 year flood volume under climate change

• Results based on 5 GCMs and 4 RCPs
Results: Future urban damages

When assuming urban expansion only: by 2030, there will be a factor increase in risk larger than of 8 and 6 for coastal and river flood risk, respectively.

Results: Current and future river flood risk
Results: Current and future coastal flood risk

Coastal flood risk - 2000

Results: Effect of urban planning

Reduction in coastal flood risk

Effective strategy even under low levels of enforcement
Results: Effect of flood protection

<table>
<thead>
<tr>
<th>Protection level</th>
<th>Reduction in EAD relative to no flood protection (%)</th>
<th>River floods</th>
<th>Coastal floods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/10</td>
<td></td>
<td>53 (±0.28)</td>
<td>63 (±0.10)</td>
</tr>
<tr>
<td>1/50</td>
<td></td>
<td>86 (±0.14)</td>
<td>91 (±0.07)</td>
</tr>
<tr>
<td>1/100</td>
<td></td>
<td>93 (±0.08)</td>
<td>95 (±0.06)</td>
</tr>
</tbody>
</table>

Effective adaptation measure even for relatively low protection standards

Conclusions

- **National scale flood risk assessment**
  - Rapid urban expansion
  - Particularly on Java island
  - Results in strong increases in flood risk
    - Prime driver: urban expansion: even without SLR enormous increases in expected damage
    - Impacts of climate change on flood risk still highly uncertain
    - Adaptation strategies can effectively reduce risk

- **Jakarta Climate Adaptation Tools**
  - Set of tools available for use in Jakarta
  - Interaction with users and stakeholders
Thank you!

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