ADVANCING A **NEXUS APPROACH** TO THE SUSTAINABLE MANAGEMENT OF **WATER, SOIL AND WASTE**

INTERNATIONAL KICK-OFF WORKSHOP

11-12 NOVEMBER 2013
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Global Change and Water –
How far can the Nexus Approach help to meet
Future Challenges?

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1. Do current management approaches adequately address implications of climate change, e.g. frequency, intensity and duration of floods and droughts? -> No

2. Will new or improved technologies (and which) be required or at least be helpful to foster integrated management approaches?

3. Data scarcity: how far can remote sensing and satellite data replace or complement data from monitoring programmes? Do we need new approaches in handling data scarcity (e.g. specific modelling tools)?

4. Overall: is there a need for more research on the nexus?
Global Temperature (°C)

IPCC Projections

N.H. Temperature (°C)

Lower Risk for Instabilities

(NEAA, 2009)
Evidence of climate change

(Source: Battisti and Naylor (2009), Science, 323.)
Global Changes – Connected by Water

- Population (amount, density, structure, …)
- Climate (temperature, precipitation, radiation …)
- Land use, land cover
  - De-forestation / re-forestation
  - Increase of (irrigated) agriculture
  - Biofuel production
  - Urbanisation
  - Etc.
- Change of energy production
- Hydraulic works
- Technological development
- Water use in space and time
- Economic development
- Change of diet (*more meat* => *more water*)
- Nutrient fluxes to water bodies
- Pollution (new substances etc.)
- etc. etc. etc.

*… and many interdependencies/feedbacks!*
Demographics – a huge challenge...
By 2030 about 60% of the world’s population is expected to live in urban areas.

Share of population residing in urban areas, 2005 and 2030 (percent)

- World
- Africa
- Asia
- Europe
- Latin America and the Caribbean
- Northern America
- Oceania

Note: Regions are official UN regions.
Facts about Mekong River Basin

*Prediction of two climate related variables (precipitation and SLR) vs. planned reservoir storage development in the Mekong Basin*

(TKK & SEA START RC, 2009)
Expected Annual Maximum Daily Rainfall in X year return period

10% increase of rain intensity ≒ 3 times more frequent storms in this case

(CCSR/NIES K-1 Simulation Grid point near Tokyo)

Slide from Taikan Oki (2013)
Future change in flood frequency and low flow
(Median of 11 GCMs under the extreme future scenario, RCP 8.5 difference between 2071-2100 and 1971-2000)

Frequency of Flood
return period of 20C 100-yr flood

Low flow amount
change in Q95 discharge (%)
Stefan’s Questions

1. Do current management approaches adequately address implications of climate change, e.g. frequency, intensity and duration of floods and droughts?

2. Will new or improved technologies (and which) be required or at least be helpful to foster integrated management approaches?  
   -> probably

3. Data scarcity: how far can remote sensing and satellite data replace or complement data from monitoring programmes? Do we need new approaches in handling data scarcity (e.g. specific modelling tools)?

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Example: Uncertainty in flood modelling

Main sources of uncertainty:
- input data
- calibration data
- model parameters
- model structure

Uncertain predictions:
- Design floods
- forecasting
- inundated areas
- Risk maps/risk assessment
- Etc.
We begin to understand the connections, but...

Figure 3.1. Impact of human activities on freshwater resources and their management, with climate change being only one of multiple pressures (modified after Oki, 2005).

Source: Kundzewicz et al. (2007); chapter in IPCC (2007)
Towards integrated models, but still along way to integrated management ...
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3. Data scarcity: how far can remote sensing and satellite data replace or complement data from monitoring programmes? Do we need new approaches in handling data scarcity (e.g. specific modelling tools)? **-> only complement**

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But, isn’t there a ‘flood of data’? 

Globally and freely available space-borne data (e.g. SRTM, ENVISAT, SAR images etc.)

**Space-borne data**

**Airborne laser altimetry** (LiDAR): High resolution topography (1m DTM; 10 cm accuracy)  
Model output: GCMs, regional models etc.  

(Castellarin & Di Baldassarre, 2009)
WMO Stations

(courtesy Van der Giesen and Hut, 2013)
WMO Stations

5,000

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WMO Stations

5,000

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Density of gauging station network – ‘ground truthing’?!

(Bloeschl et al. 2013)
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-> of course!