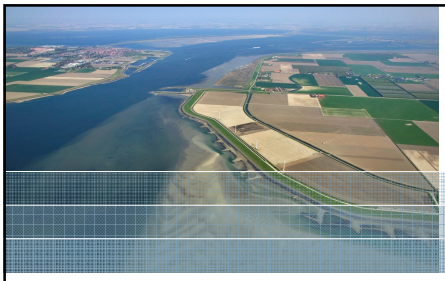

Exploratory modeling in support of robust policies for flood risk management

Martin Ebskamp, Jan Kwakkel, Marjolein Mens en Tineke Ruijgh

01-10-2010

Presentation outline

- Introduction
- Research Approach
- Case study + Modeling
- Results of the case study
- Added value of EMA
- Conclusions

Introduction (1)

Hall & Solomatine (2008)

- Preferred options for Flood Risk Management should be analyzed for robustness to deep uncertainty.
- Exploratory Modeling and Analysis is suggested to be a useful tool in this respect.

Introduction (2)

Deep Uncertainty:

1. Lack of agreement on relationships among variables
   - How does flooding of one dike ring affect the other?
2. Lack of knowledge on probability distributions of parameters
   - How much will sea level rise?
3. Lack of agreement on how to value system outcome
   - Economic optimization vs potential loss of life

Introduction (3)

Exploratory Modeling and Analysis:

In EMA thousands model runs are made for plausible situations and performance is analyzed across these situations.

In contrast to other methods, EMA:

- examines uncertainty in parameter values and model structure.
- does not predict the future, but explores it.

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Research approach (1)

Aim of the study:

- Investigate if EMA is promising for Flood Risk Management.

General approach:

- Choose a finished study in which deep uncertainty was important
- Apply EMA using the same data
- Compare the results and assess the added value of EMA

Today: Focus on EMA results and added value

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Research approach (2)

Policy questions in FRM:

1. What policy option is preferred?
2. What uncertain factors have a large effect on policy performance?
3. What would happen to policy performance if.....?
4. To what extent is the policy option robust?
5. How should we adapt to changing conditions?
6. Is the outcome of the study suitable for decision making in a multiple stakeholder arena?

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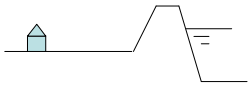
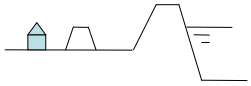
Case study

Flood risk management on the river Meuse



Do Nothing (0 €)

Probability reduction: 0%



Create Flooding area (100M€)

Probability reduction: 10%

Stronger Dikes (400M€)

Probability reduction: 30%

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Modeling

Cost-benefit analysis to assess performance of 14 policy options

2 Valuation methods used >> 2 model structures

- *Net Present Value*
- *First Year Rate of Return*

6 Uncertain, external factors considered

- Probability of flooding
- Damage of flooding
- Rate of climate change
- Economic growth
- Discount rate
- Investment Cost

→ Explore policy performance under wide range of uncertainty

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Results (1)

Valuation method A:

- One option ranks highest
- Uncertainty in 'Probability of flooding' is most important

Valuation method B:

- Ranking of options depends on parameter values
- Five options seem promising
- The model was used to reveal the parameter settings that favored each option most.

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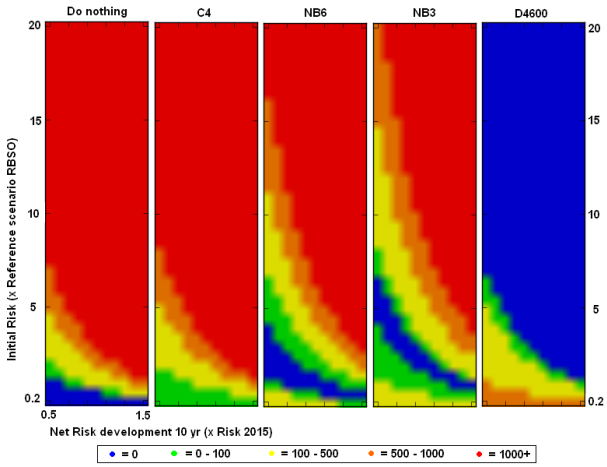
Results (2)



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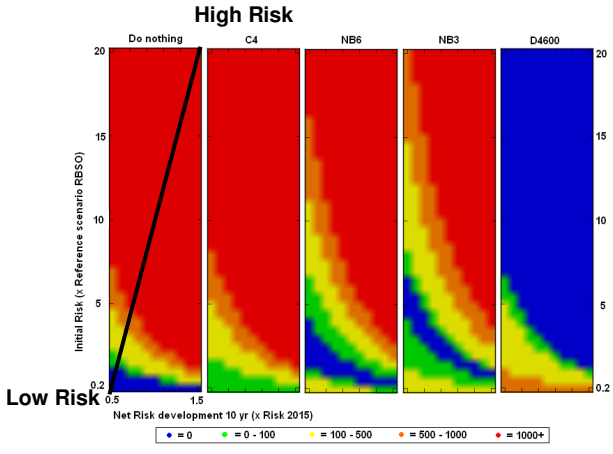
Results (3)



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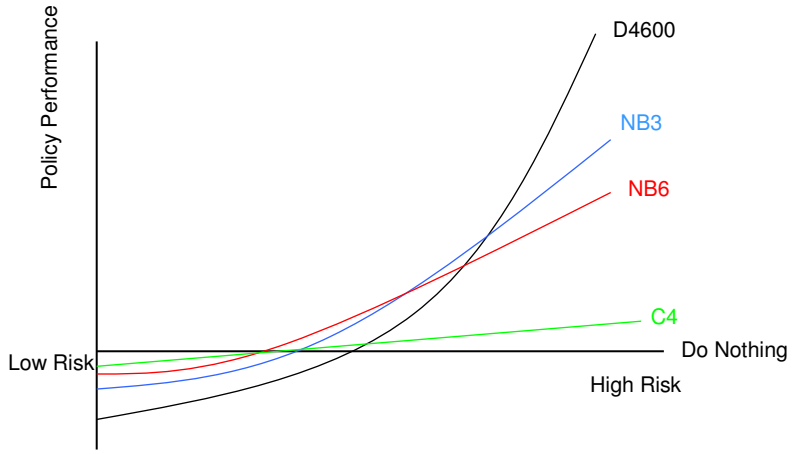
Results (4)



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Added value of EMA (1)

Policy questions in FRM:

1. What policy option is preferred?
   - Depends on…
2. What uncertain factors have a large effect on policy performance?
   - Initial probability of flooding and other parameters…
3. What would happen to policy performance if.....?
   - Visualization displays large variety of possible outcomes, more research is needed.

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Added value of EMA (2)

Policy questions in FRM:

4. To what extent is the policy option robust?
   - Insight in performance across wide uncertainty range
5. How should we adapt to changing conditions?
   - EMA does not show how, but under what conditions and how much. Important for planned adaptation.
6. Is the outcome of the study suitable for decision making in a multiple stakeholder arena?
   - Multiple performance indicators (& model structures) examined

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Conclusion

EMA is a promising method for FRM beacause it provides valuable information if there is:

1. Lack of agreement on relationships among variables
2. Lack of knowledge on probability distributions of parameters
3. Lack of agreement on how to value system outcome

→ Deep uncertainty

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