Deltares

Risk-based Flood Forecasting

Manila Bay - Cyclone - Storm Surge – Impact Forecast

By Roman Schotten, Daniel Twigt,
Daniel Bachmann and Tom Bogaard

17. October 2018, JONSMOD, Florence

I. Introduction:

Chronic of Forecast

II. Methodology:

Risk-based Forecast system Manila

III. Results & Conclusion:

Understanding of Flood Forecast

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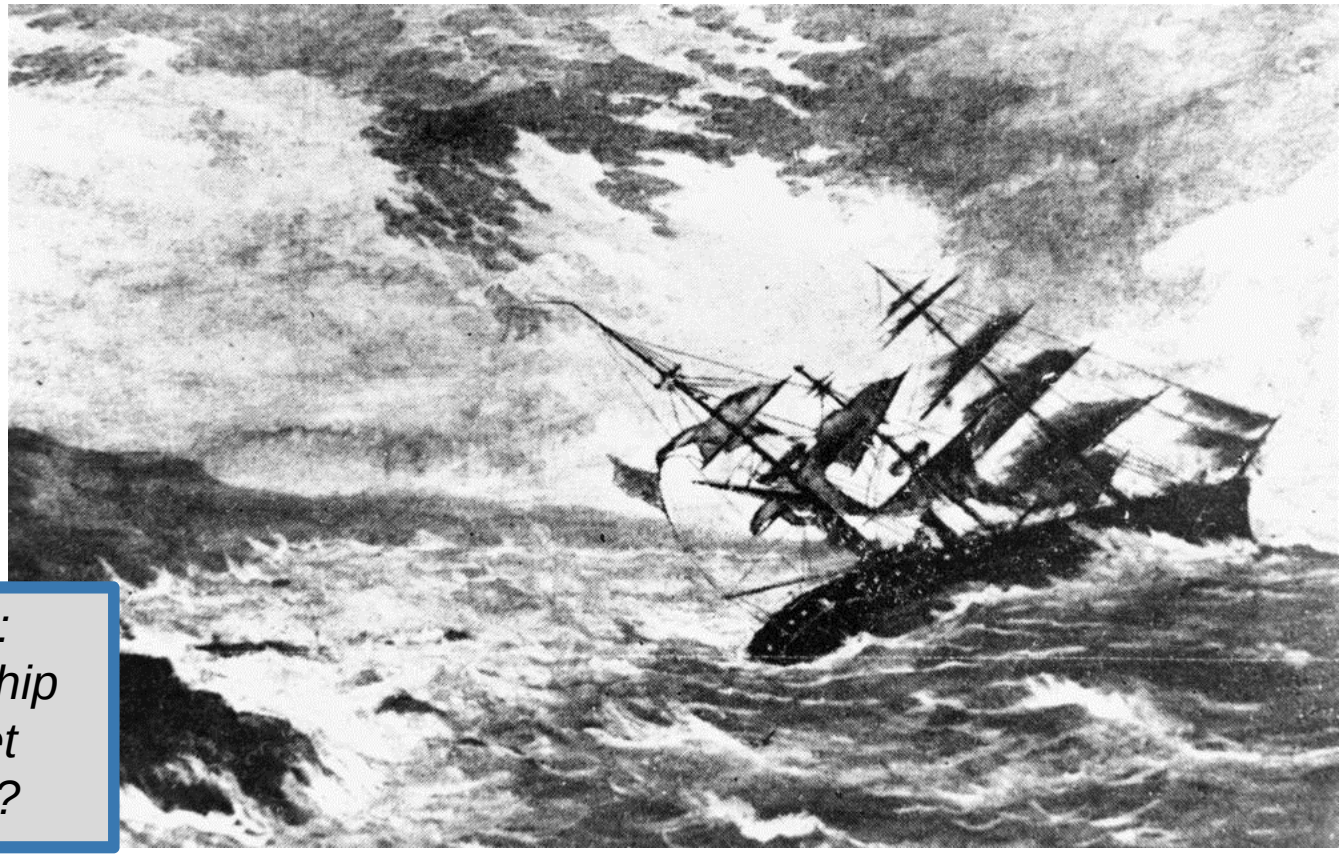

Question: Could my ship sink or get damaged?

Storm Occurrence

1850 1950 1990 2010 2020 2030

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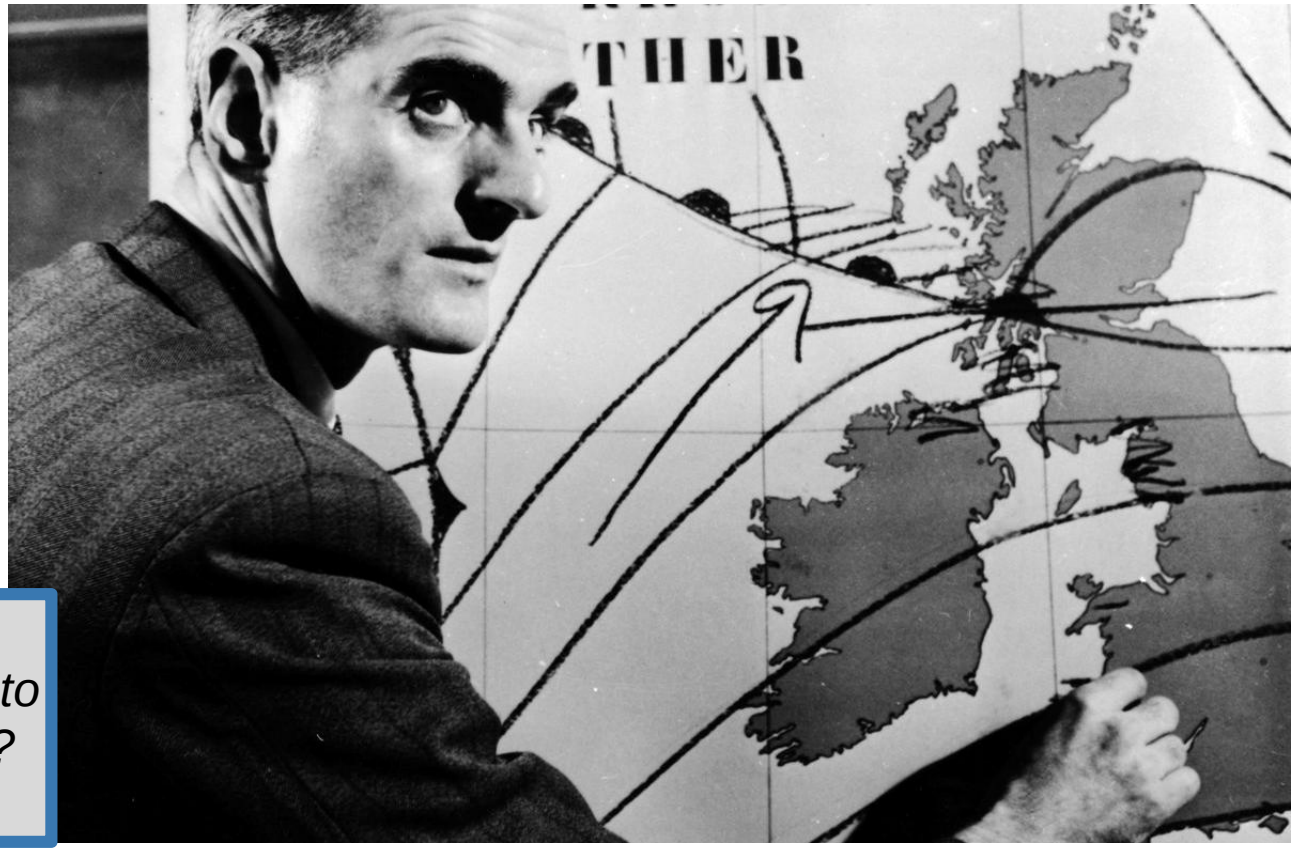

Question:
Is it a good day to dry my laundry?
Will it rain?

Storm Occurrence

1850 1950 1990 2010 2020 2030

Wind and Precipitation

Deltares

Question: What can happen?

Storm Occurrence

Thresholds

1850 1950 1990 2010 2020 2030

Wind and Precipitation

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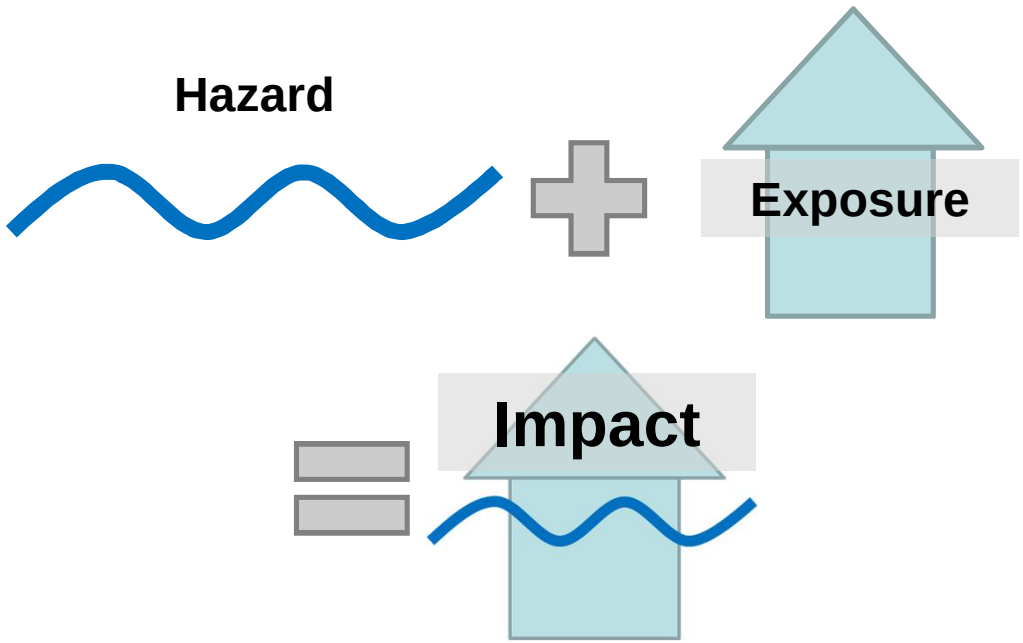

Question: What could happen to you?

Storm Occurrence

Thresholds

1850 1950 1990 2010 2020 2030

Wind and Precipitation

Impact Forecasting

Chronic of Forecast

Methodology

Results & Conclusion

Risk-based Flood Forecasting - Storm Surge Manila Bay

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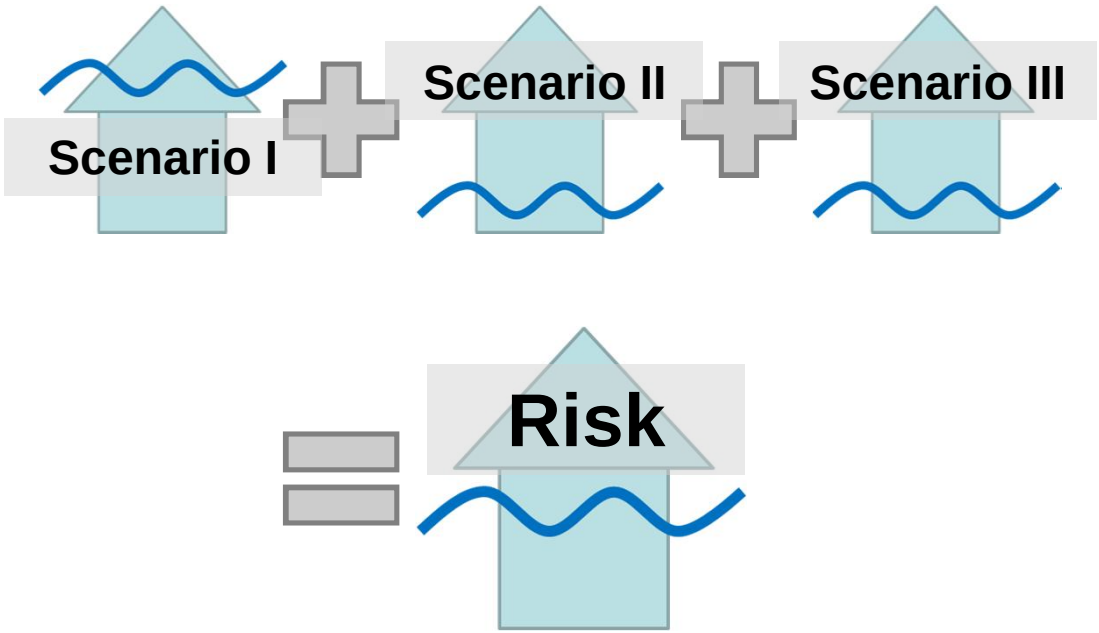

Question: What could probably happen to you?

Storm Occurrence

Thresholds

Risk - based Forecasting

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Risk-based Flood Forecasting - Storm Surge Manila Bay

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Question: What should you do?

Storm Occurrence

Thresholds

Risk - based Forecasting

1850 1950 1990 2010 2020 2030

Wind and Precipitation

Impact Forecasting

Decision-based Forecasting

Chronic of Forecast

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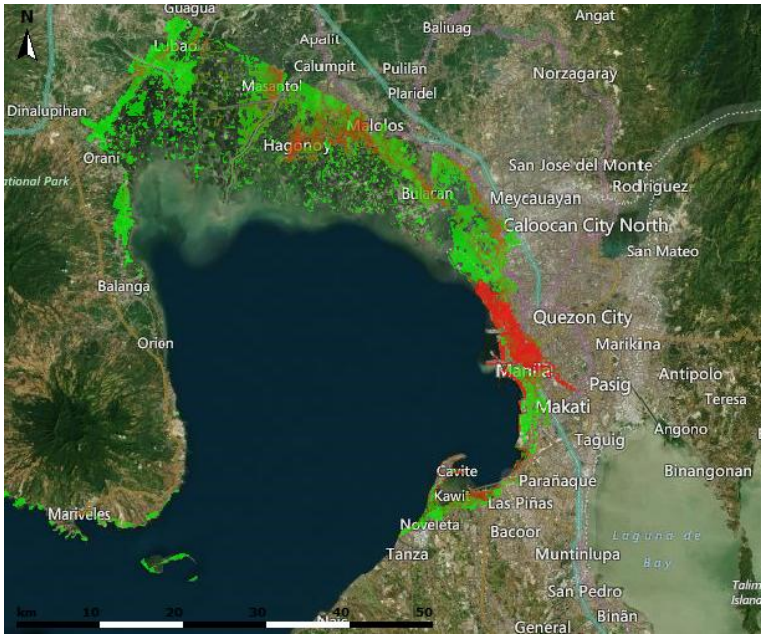
Today:
Test Case for flooding due to storm surge in Manila Bay, Philippines



Storm Occurrence

Thresholds

Risk - based Forecasting

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Wind and Precipitation

Impact Forecasting

Decision-based Forecasting

Chronic of Forecast

Methodology

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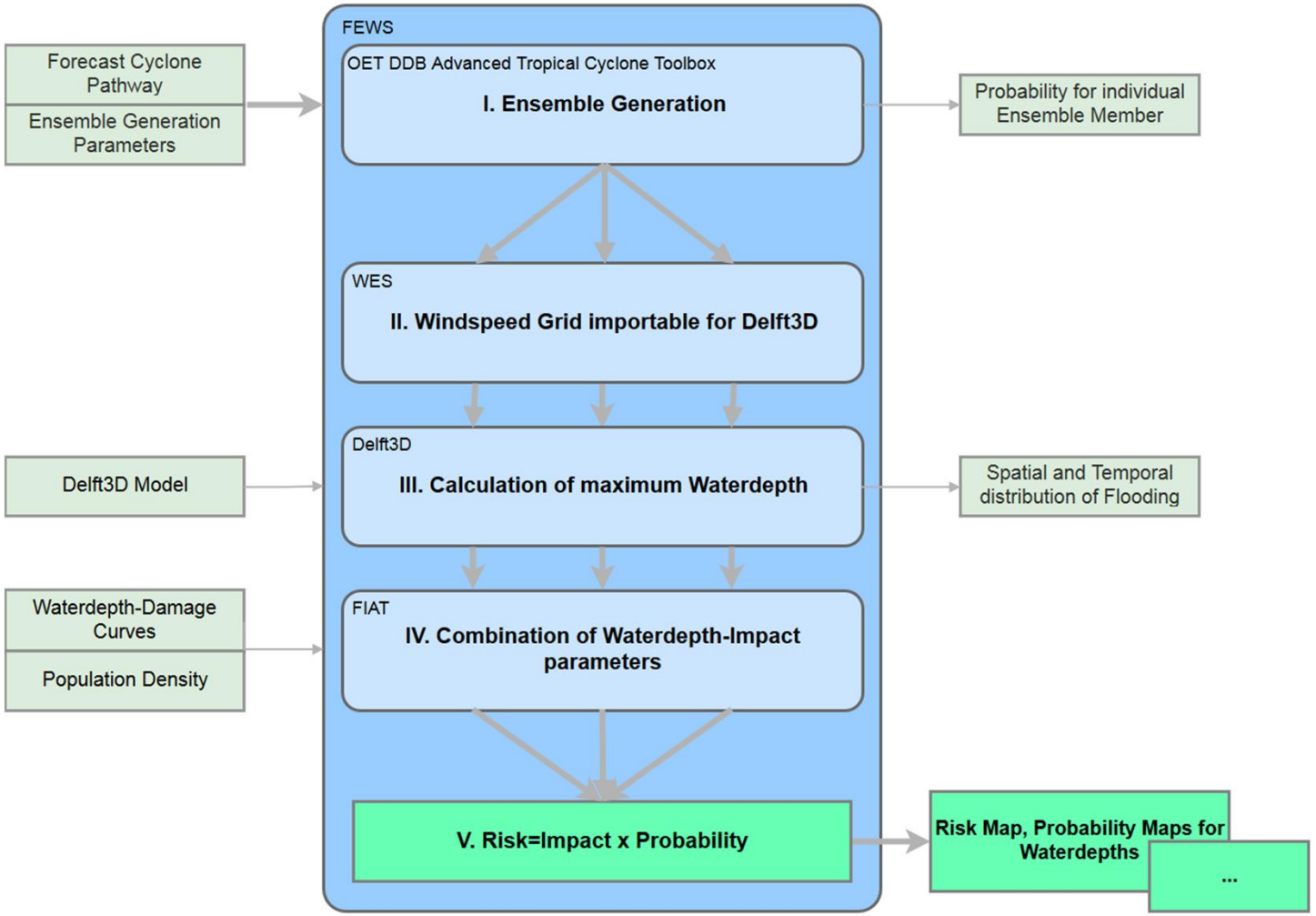
Forecast Cyclone Pathway
Ensemble Generation Parameters
FEWS
OET DDB Advanced Tropical Cyclone Toolbox
I. Ensemble Generation
Probability for individual Ensemble Member
WES
II. Windspeed Grid importable for Delft3D
Delft3D Model
Delft3D
III. Calculation of maximum Waterdepth
Spatial and Temporal distribution of Flooding
Waterdepth-Damage Curves
Population Density
FIAT
IV. Combination of Waterdepth-Impact parameters
V. Risk=Impact x Probability
Risk Map, Probability Maps for Waterdepths
...

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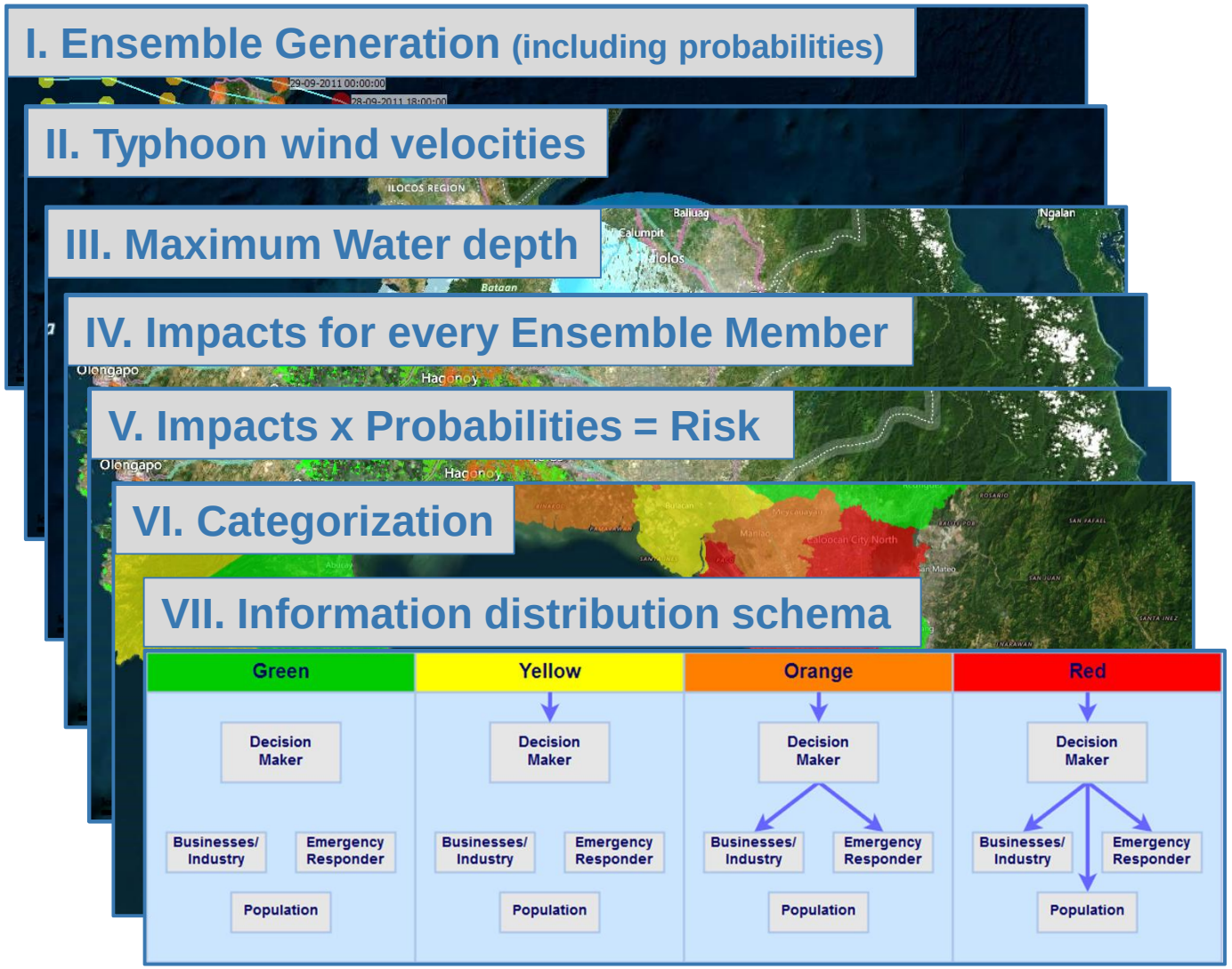
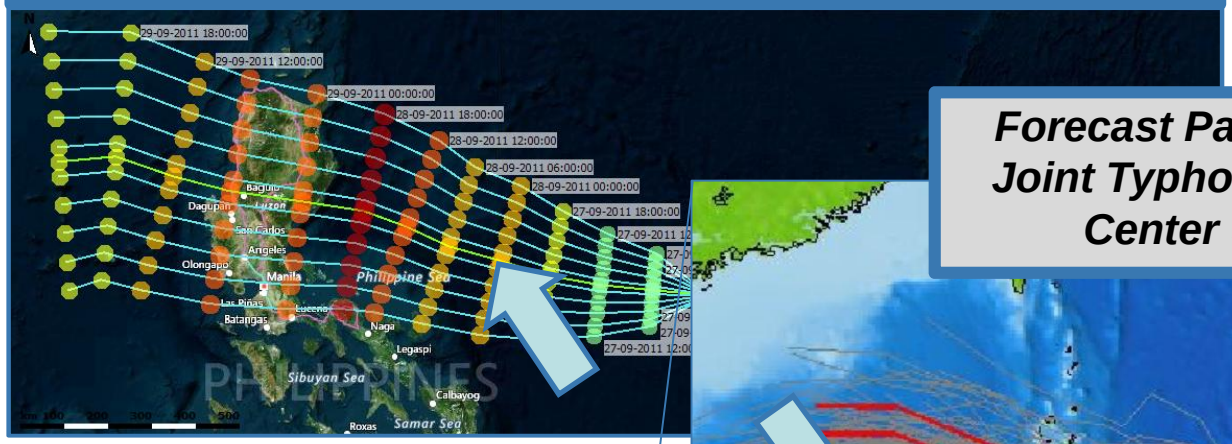
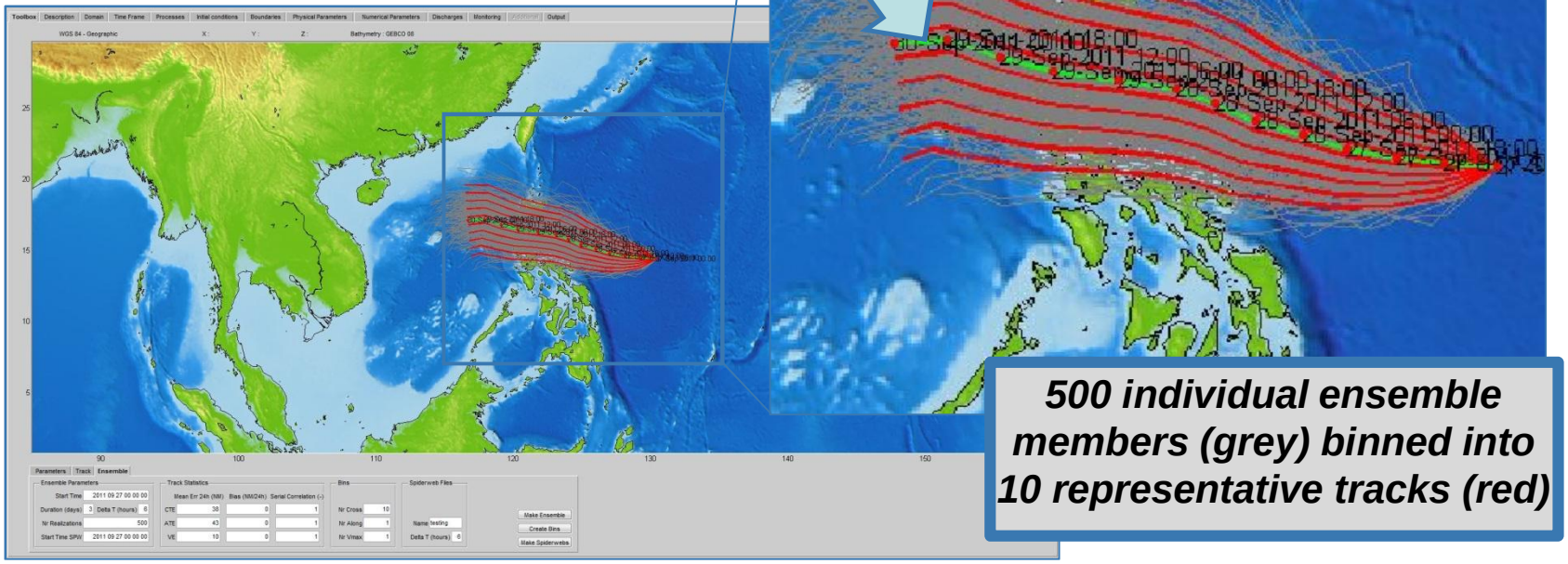


Risk-based Flood Forecasting - Storm Surge Manila Bay

Ensemble Generation (including probabilities)



Forecast Pathway from Joint Typhoon Warning Center (green)



500 individual ensemble members (grey) binned into 10 representative tracks (red)

(Advanced Tropcial Cyclone Toolbox, DDB)

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Forecaster's Compass

Probabilistic Forecast:

Number of simulations: 10
Grid resolution: 100m x 10[illegible]m
Runtime per track: ~ 20 mi[illegible]

Good Decision Making

Modelers frequent feedback needed for the application in forecasting!

High Modell Refinement

High Number of Simulations

Deterministic Forecast:

Number of simulations: 1
Grid resolution: ~15m x 15m
Runtime per track: ~ 4 h

Database Option:

Number of simulations: flexible
Grid resolution: flexible
Runtime per track: flexible

Long Modell Runtimes

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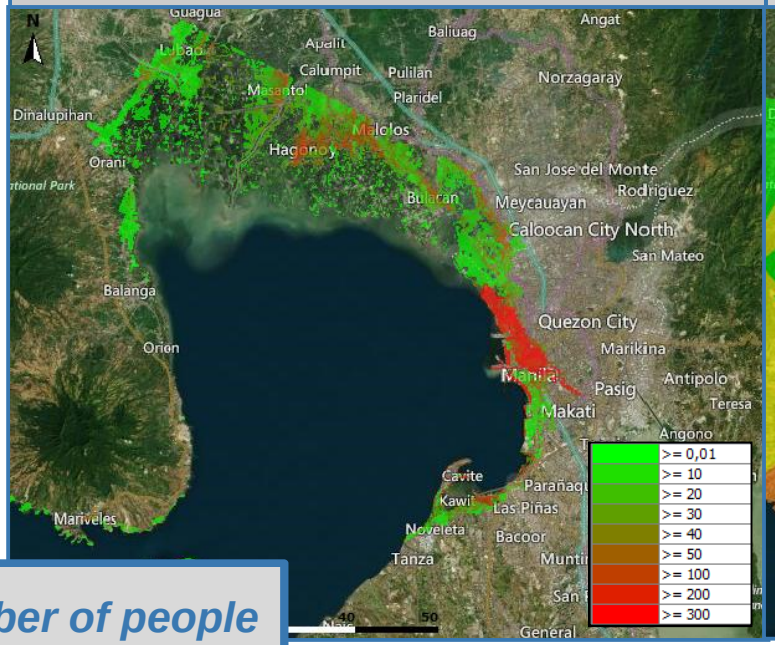
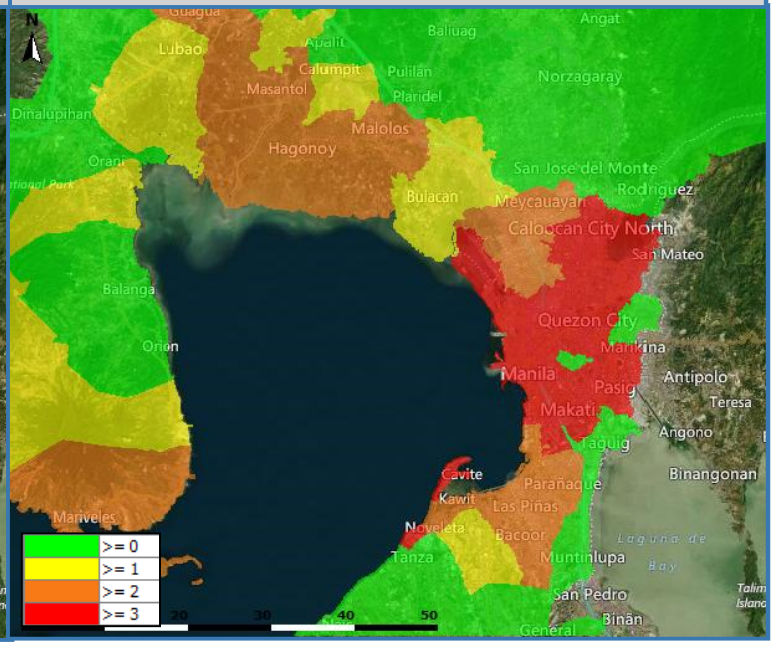
Understanding of Flood Forecast

Comparison Risk Map & Categorization Map

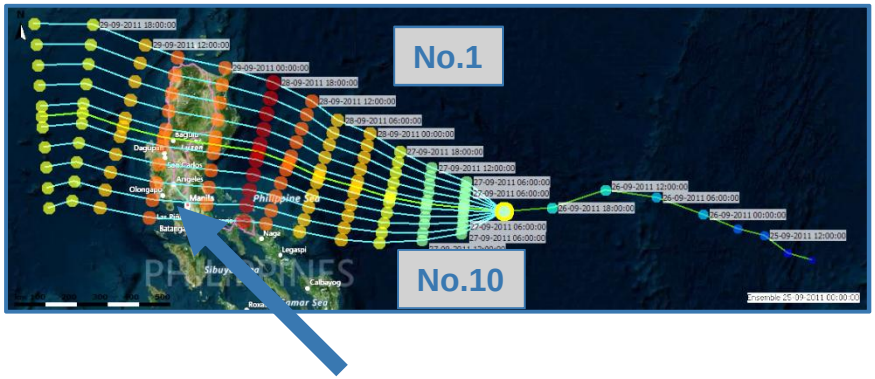
V. Σ (Probability x Impact) = Risk



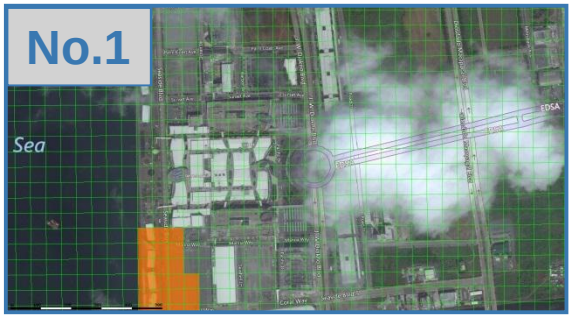
VI. Categorization



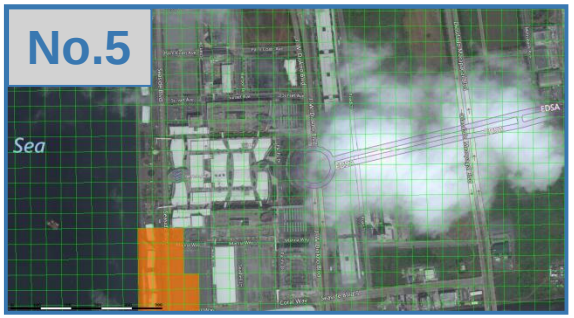
Number of people affected of a water level higher than 0,2 m per km²



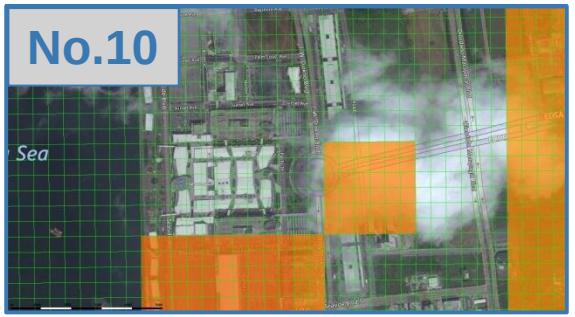
Immobile Damages:



Metro Manila, Mall of Asia, Immobile damages, Ensemble No.1, 00:00 27.09.2011 GMT 00:00 27.09.2011



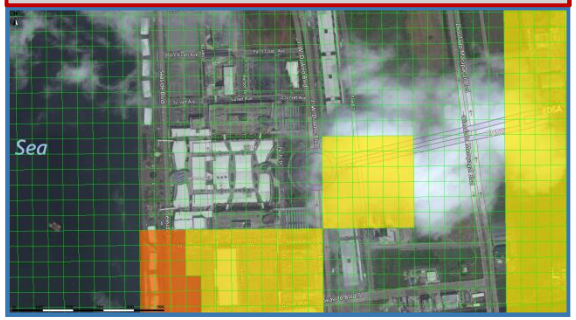
Metro Manila, Mall of Asia, Immobile damages, Ensemble No. 5 , 00:00 27.09.2011 GMT 00:00 27.09.2011



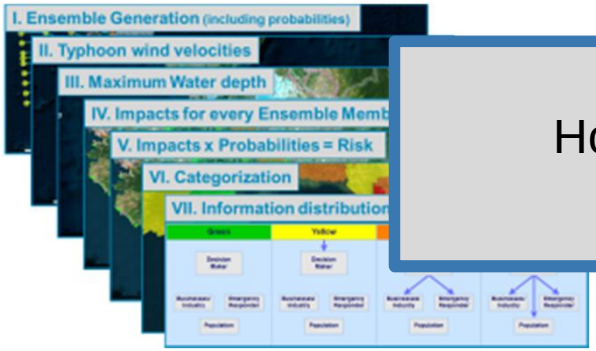
Metro Manila, Mall of Asia, Immobile damages, Ensemble No.10, 00:00 27.09.2011 GMT 00:00 27.09.2011

What is the benefit of the risk dimension?

Risk Map

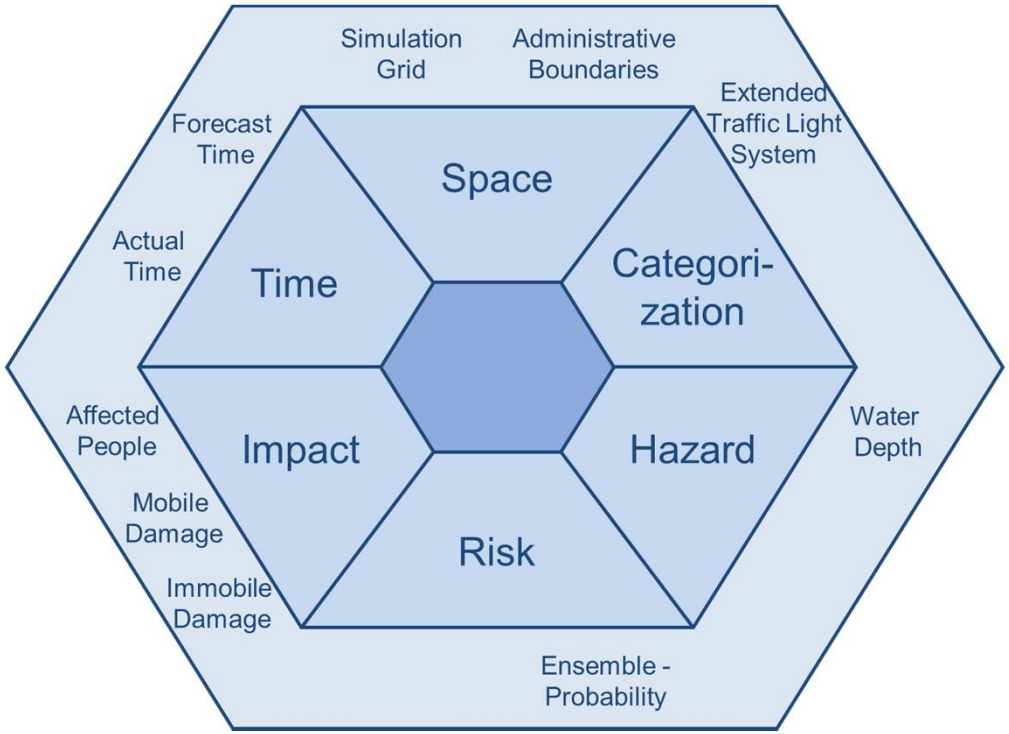


Metro Manila, Mall of Asia, Risk of Immobile damages, 00:00 27.09.2011 GMT 00:00 27.09.2011

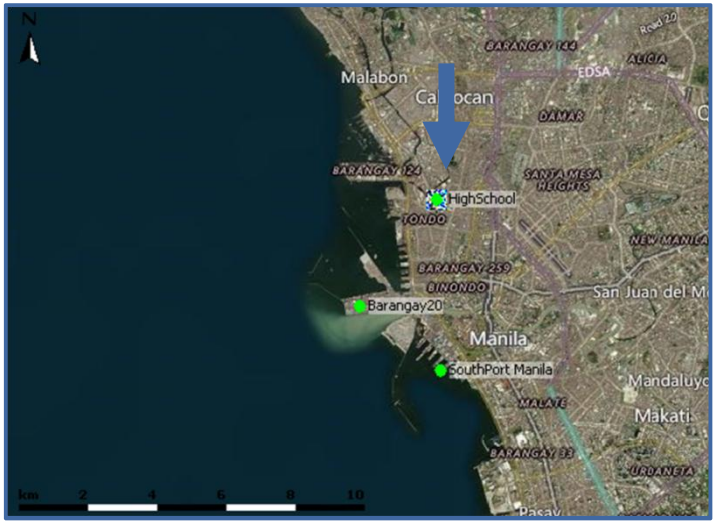


Problem:
How to display the results of the multidimensional system?

Dimension Board:
Method to display and simplify the output of RBF



Headmaster



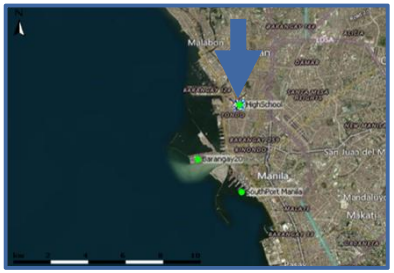
Scenario:
The headmaster of school in Manila hears about a Typhoon warning. The school frequently faces problems with flooding.

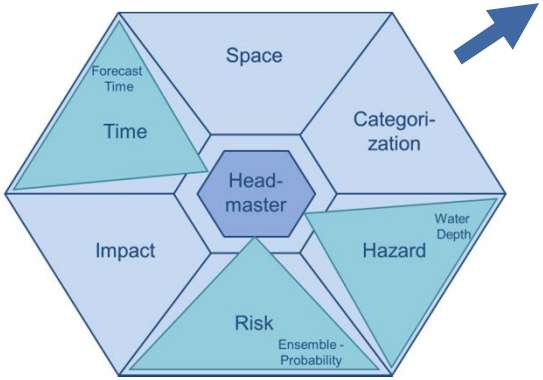
The Headmaster

"What is the worst case for my school in the upcoming three days?"
"How bad is it?"

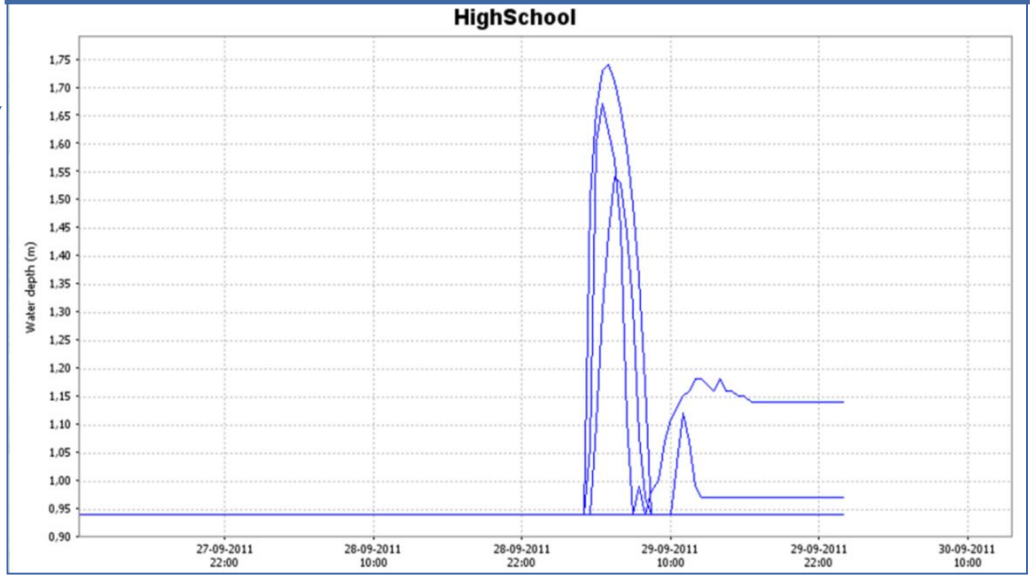
Headmaster

"What is the worst case for my school in the upcoming three days?"
"How bad is it?"





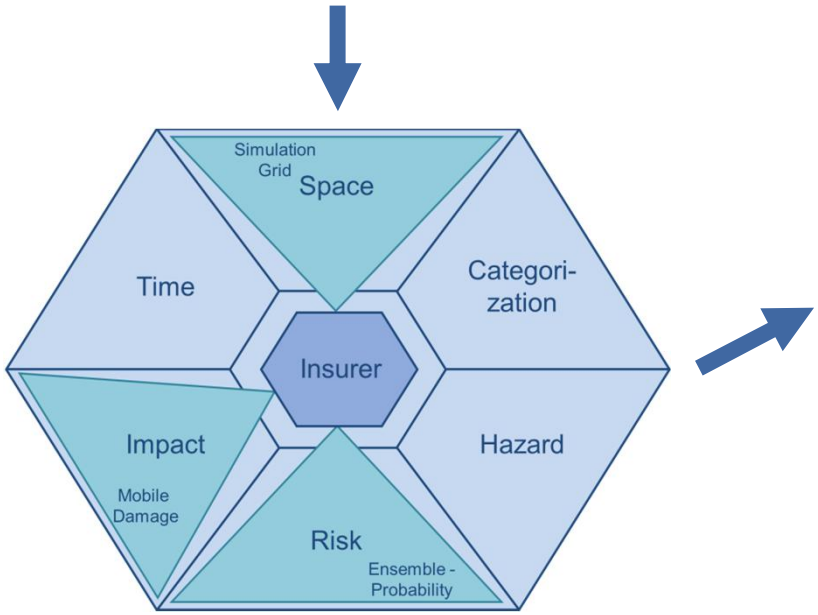
System output:
Water Level from ensemble members



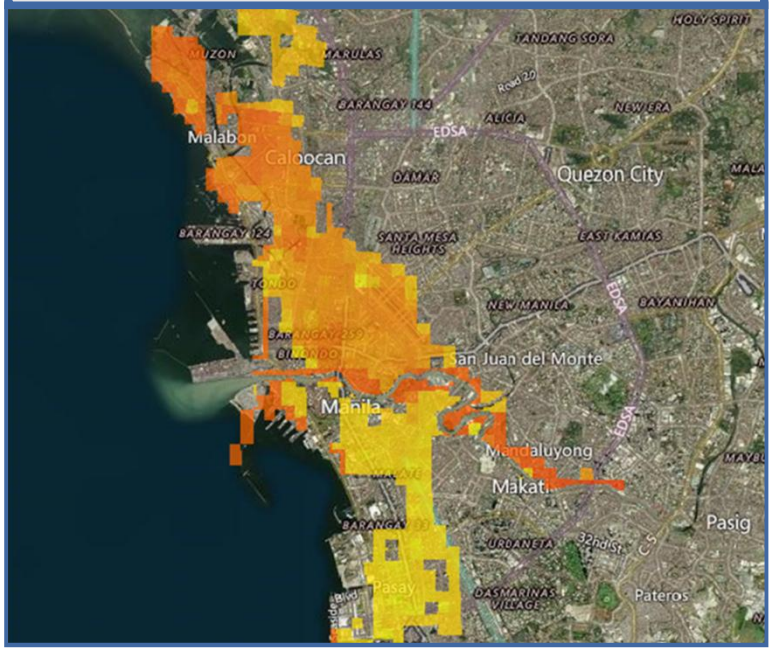
Water depth for every ensemble member, with peaks for ensemble member 8,9, 10 at 29.09.2011 06:00:00 GMT.

Insurer

"What probable damage is expected for different areas?"



System Output:
Mobile damage risk sum



Manila Bay, Spatial distribution of the damage risk sum

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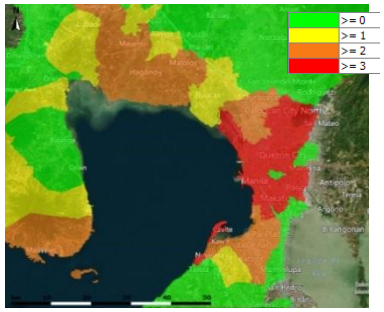
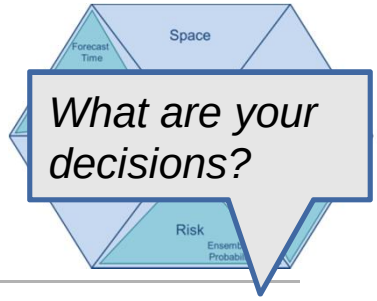
1. **Supporting** decision makers with a **new dimension** in forecast mode:
   risk = impact x probability



2. The application of a model in forecast mode requires good **interaction** of **modelers** and **forecasters**.

3. Everybody can be a decision maker and dependent on different type of information from the same source.



Thank you for your interest!

What should happen with this system?

Outlook

510 AN INITIATIVE OF THE NETHERLANDS RED CROSS

Deltares Enabling Delta Life

MSc project

Combination of humanitarian impact data and operational hazard forecast

Deltares

Deltares is an independent institute for applied research in the field of water and subsurface with several areas of expertise. In the fields of numerical simulation applications are pushed forward to operationally forecast water scarcity, impurifications or floodings (e.g. GLOSSIS). To further develop these applications Deltares collaborates with numerous institutions to actively steer these systems. One direction points towards the support of humanitarian aid work and civil protection.

View on part on the grid of the Operational Global Flood Forecast System (www.globalfloodforecast.com)

Screenshot from the Philippines in 510's dashboard. (www.dashboard.510.global)

510 Global

Is an initiative of the Netherlands red cross, which aims to shape the future of humanitarian aid by converting data into understanding, and put it in the hands of humanitarian relief workers, decision makers and people affected, so that they can better prepare for and cope with disasters and crises

MSc project description.

Deltares capacity to build-up model based forecast information and 510 Globals