Risk and Vulnerability Analysis in the Gulf of Finland

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Intro

- Aalto University School of Technology and Science (FIN)
  - Geoinformatics, cartography etc.
- ENSIETA, École Nationale Supérieure D'Ingénieurs (FRA)
  - Hydrography, oceanography etc.
- Raphaël Legouge
  - Internship
- Dr Rangsima Sunila
  - Spatial Data Modelling Using Fuzzy and Geostatistical Applications
- Professor Kirsi Virrantaus
  - Institute of Geoinformation and Positioning Technology
- MSc Hannes Seppänen
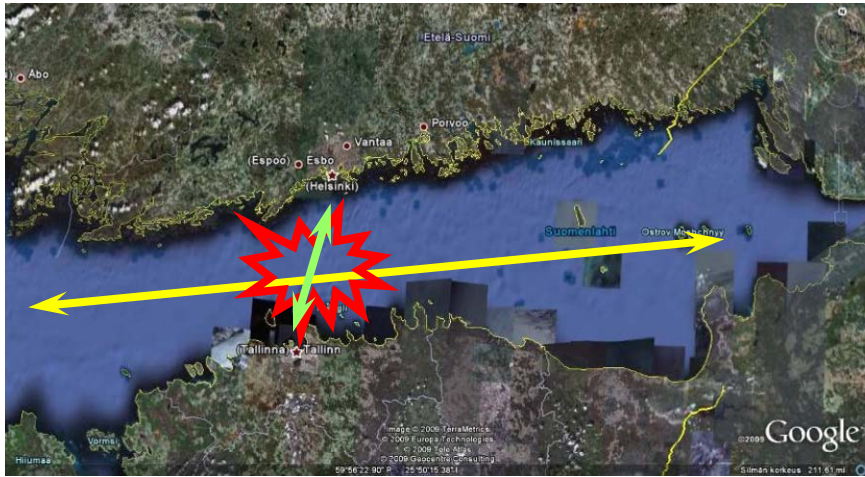 - Researcher, situation picture and situation awareness related research

Intro

- Crisis management, emergency response, comprehensive emergency management
- Situation Picture
  - What is happening now, real-time overview
- Risk
  - Probability of occurrence, Impact severity
  - Risk = Probability x Cost
- Vulnerability
  - Weakness in the system
  - Not based on probability or statistics
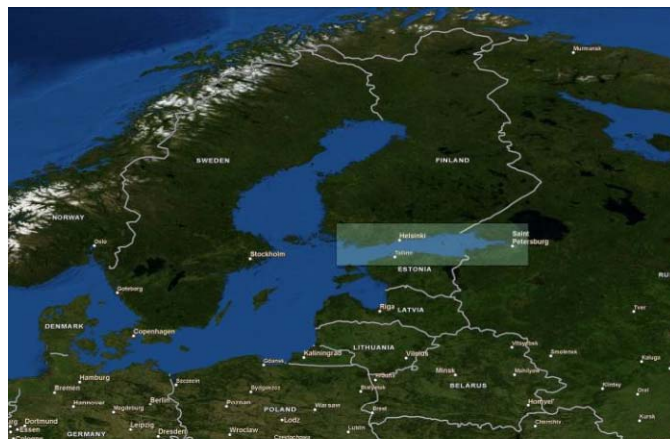
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Study area

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The Main Problem

Situation Picture

Project

- EfficienSea
  - Efficient, safe and sustainable traffic at Baltic Sea region
- Finnish Transport Agency
- Finnish Coast Guards
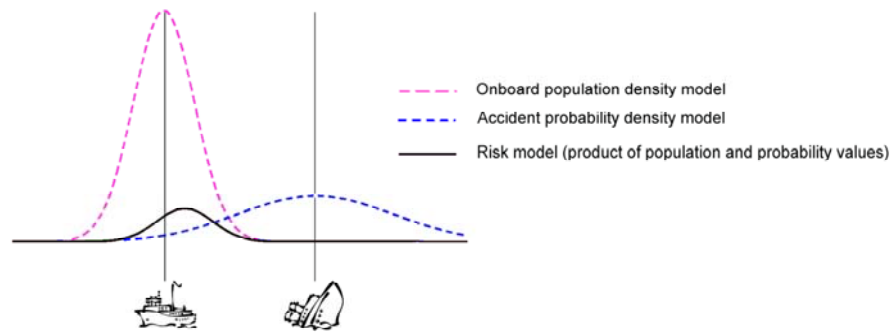 - Organize SAR

Data

- AIS (Automatic Identification System)
  - Time, ship position, speed, course, draught, type, status
- Accident history
  - No data available, no systematic collection at the moment
  - The data based on study performed by Kujala et al.[1]
- Rescue unit data
  - From AIS and GPS

1) Kujala, P., Hänninen, M., Arola, T., Ylitalo, J., 2009. Analysis of the marine traffic safety in the Gulf of Finland, Helsinki University of Technology, Department of Applied Mechanics, Marine Technology.
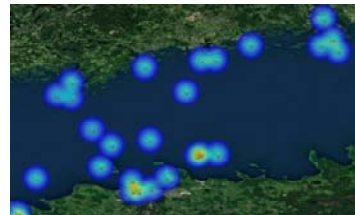
Risk analysis

- Risk = p(accident history) x c(population onboard)

Onboard population density model
Accident probability density model
Risk model (product of population and probability values)

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Risk analysis

Population density model

Accident probability density model

Risk analysis result

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Vulnerability analysis
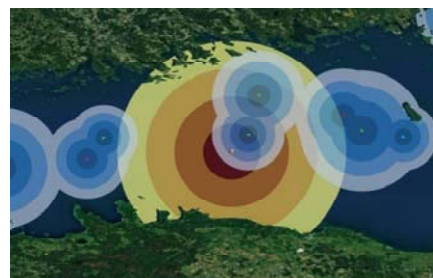
- Buffer calculation according to speed over ground data
- Vulnerable if isolated
- 15min, 30min, 45min and 60min zones

A.I.S. Data → Get Current S.O.G. → Draw Accessibility Buffers → Vulnerability Model

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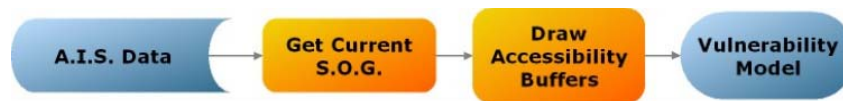
Vulnerability analysis

Accessible areas by ships with AIS   SAR vessel coverage

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Further study issues

- Risk analysis
  - How winter conditions and weather affects
  - Less weight for ships that run on daily basis
  - Accident probability model assumes that future accident locations are related to previous accidents
  - Accident knowledge approach
- Vulnerability analysis
  - Ships with no AIS -> Radar data
  - Settings such as speed
  - Buffering ignores islands etc.
  - Legal regulations

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Thank you

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