



**PROJECT REPORT** for  
Bilateral Cooperative Program between  
**JAPAN** and **FINLAND**

# Assessment Tools for Solving Aquatic Problems



**Okayama University**  
Graduate School of Environmental and Life Science  
**Finnish Environment Institute**  
Freshwater Centre

•SUPPORTED BY **Japan Society for the Promotion of Science and Academy of Finland**  
•PROJECT PERIOD **July 2012 – June 2014**

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# Preface

Timo Huttula<sup>1</sup> and Hiroshi Suito<sup>2</sup>

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<sup>2</sup>Okayama University, Japan

This project started in July 2012 as a bilateral collaborative project based on an agreement between the Japan Society for the Promotion of Science (JSPS) and the Academy of Finland (AF). Mutual collaboration of the Graduate School of Environmental and Life Science, Okayama University (OU) and Finnish Environment Institute (Suomen Ympäristökeskus: SYKE) has a long history, which originated in 2004. Collaboration from that time until 2012 revealed many common aquatic problems that exist in our countries and demonstrated that we can support one another in terms of research technologies, data and strategies to address these difficulties. Therefore we agreed to respond to the call from JSPS and AF in 2012 for increased bilateral collaboration.

This project has already addressed various topics related to aquatic problems. Details of the working packages (WPs) of this project are presented in the following pages. This report has gathered the technical reports related to topics, some of which shall be submitted to peer-reviewed scientific journals in the near future.

This report also includes a list of activities and some relevant materials for lectures given by Prof. Timo Huttula at OU.



WP 1

Project coordination

# ***Assessment tools for solving aquatic problems related to the pollution from agriculture***

## **Project plan**

Timo Huttula and Hiroshi Suito



## **Project duration, funds and structure**

- Active in July 1, 2012 – June 30, 2014
- Funding
  - Finland 300 k€, Academy of Finland 80%
  - Japan 326 k€, JSPS 72 %
- **WP 1: Project coordination**
- **WP 2: Atmospheric modelling (coupling with lake model)**
- **WP 3: Flow and wave measurements and modelling**
  - **Task 1:** Wave measurements and modelling
  - **Task 2:** External and internal loading
  - **Task 3:** Seto Inland Sea flow modelling
  - **Task 4:** Data assimilation
- **WP 4: Statistical analysis for habitat modelling and relationship between land use and river water quality**
- **WP5. Dissemination of the project results**



## Goals

- Main goal: Is to improve our present aquatic models so that we are able to assess the effects of various pressures such as land use changes by intensified urbanisation and agriculture as well as climate change
- More specifically
  - Produce information to study the effects of the spatial variability of the wind field on the current field in a water body and to produce tools that can estimate this.
  - To study the effect of reeds on the wave-current interaction in a shallow part of the lake and to study how they effect the erosion of material from the bottom.
  - To study how the physical and biological variables interact to produce a habitat, and what are the main driving forces for the locations of different habitats.
  - To produce a tool to predict the currents in the Seto Inland Sea and for tsunami forecasting



## Better results together

- OU, Graduate school of Environmental Science,
  - a very interdisciplinary organisation
  - from civil engineering, agriculture, material science to medicine.
  - mathematical science connects these different scientific fields, and plays an important role.
- The Modelling and Assessment Unit of SYKE, Freshwater Centre
  - represents expertise on local and regional scale modelling of water basins
  - experience in small scale models of convective phenomena
  - expertise in measurements, both manual and automatic
  - The data available at SYKE is invaluable to the modelling endeavours of both groups



## Activities: data and measurements

- SYKE will coordinate data collection for all case study locations.
  - In Finland SYKE researchers will carry the main responsibility for data collection
  - In Japan the measurements will be made as a joint effort between SYKE and OU researchers
  - The measurements will be used to validate the developed models and to provide forcing information for the models
    - CTD
    - Water currents
    - Wave measurements



## Models

- SYKE
  - Coherens
  - ELMER
- OU
  - Atmospheric modelling software
  - Eelgrass modelling software
- The small scale models used to calculate the precise solution to a specific problem will take their boundary conditions from the large scale and regional scale models.
- This small scale solution will then be used to make a parameterization of the specific phenomenon that can then be used in the large and regional scale models





## Case studies

- In Finland
  - Lake Pyykösjärvi in Oulu (area 1,4 km<sup>2</sup>, mean depth 1,2 m, to improve lake water quality by leading river water to dilute the lake waters)
  - Lake Pyhäjärvi in Säkyä
- In Japan
  - Kojima Lake, (area 10.9 km<sup>2</sup>, mean depth 1.8 m, heavy agricultural loading)
  - Seto Inland Sea (area 20,000 km<sup>2</sup>, mean depth 31 m, electricity power generation by tidal flow and the tsunami prediction problem)



## List of activities

| Year | Month                     | Country | Place                                     | Type of activity                                   | Participants (Japanese)  | Participants (Finnish)  |
|------|---------------------------|---------|---|--|--|---|
| 2012 | July                      | Finland | Turku<br>Eura<br>Vaasa<br>Oulu            | Field trip   | Hiroshi Suito<br>Toshitsugu Moroizumi<br>Akiko Mano<br>Mika Kobayashi  | Timo Huttula<br>Janne Ropponen  |
| 2012 | August                    | Finland | Jyväskylä                                 | Project meeting                                    | Hiroshi Suito<br>Kenji Okubo<br>Shin-ichi Nishimura<br>Shinji Hiejima<br>Kazunori Fujisawa<br>Makiko Oda<br>Akiko Mano<br>Mika Kobayashi       | Timo Huttula<br>Olli Malve<br>Janne Ropponen<br>Ninni Liukko<br>Saija Koljonen<br>Niina Kotamäki<br>Hanna Arola<br>and others     |
| 2012 | November<br>(~Feb. 2013)  | Finland | Jyväskylä                                 | Research<br>discssion                              | Akiko Mano   | Timo Huttula<br>Janne Ropponen  |
| 2012 | December                  | Japan   | Okayama<br>Hiroshima<br>Imabari<br>Naruto | Project meeting<br>and field trips                 | Hiroshi Suito<br>Kenji Okubo<br>Shin-ichi Nishimura<br>Akiko Mano<br>Takashi Nakazawa<br>Mika Kobayashi<br>Shinya Morifuji                     | Timo Huttula<br>Jari Koskiaho<br>Janne Ropponen<br>Ninni Liukko   |
| 2012 | December<br>(~Feb. 2013)  | Finland | Jyväskylä                                 | Research<br>discssion                              | Mika Kobayashi   | Timo Huttula<br>Janne Ropponen<br>Ninni Liukko  |
| 2013 | March                     | Finland | Jyväskylä                                 | Research<br>discssion                              | Makiko Oda   | Saija Koljonen<br>Matti Leppänen  |
| 2013 | September                 | Finland | Helsinki                                  | Project meeting                                    | Hiroshi Suito<br>Kenji Okubo<br>Shin-ichi Nishimura<br>Toshitsugu Moroizumi<br>Makiko Oda<br>Akiko Mano<br>Takashi Nakazawa<br>Shinya Morifuji | Timo Huttula<br>Olli Malve<br>Sirkka Tattari<br>Jari Koskiaho<br>Janne Ropponen<br>Saija Koljonen<br>Niina Kotamäki<br>and others |
| 2013 | September<br>(~Nov. 2013) | Finland | Helsinki                                  | Research<br>discssion                              | Akiko Mano   | Olli Malve<br>and others  |
| 2013 | September                 | Finland | Säkylä<br>Eura                            | Field trip   | Hiroshi Suito<br>Kenji Okubo<br>Akiko Mano<br>Takashi Nakazawa<br>Shinya Morifuji  | Timo Huttula<br>Jari Koskiaho<br>Janne Ropponen   |
| 2013 | December                  | Japan   | Okayama                                   | Research<br>meeting and<br>field trip              | Hiroshi Suito<br>Kenji Okubo<br>Shin-ichi Nishimura<br>Toshitsugu Moroizumi<br>Makiko Oda,   | Jari Koskiaho<br>Sirkka Tattari   |
| 2014 | March                     | Finland | Jyväskylä                                 | Research<br>discssion                              | Hiroshi Suito  | Timo Huttula<br>Janne Ropponen  |
| 2014 | March                     | Finland | Jyväskylä                                 | Research<br>discssion                              | Makiko Oda   | Saija Koljonen<br>and others  |
| 2014 | May                       | Japan   | Okayama<br>Katata<br>Kyoto                | Research<br>meeting,<br>lectures and<br>field trip | Hiroshi Suito<br>Kenji Okubo<br>Shin-ichi Nishimura<br>Toshitsugu Moroizumi<br>Hidenori Morita<br>Makiko Oda<br>Shinya Morifuji                | Timo Huttula  |

## List of participants

### Participants by SYKE:

Timo Huttula  
Kirsti Krogerus  
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Saija Koljonen  
Niina Kotamäki  
Ninni Liukko  
Janne Ropponen  
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Kai Rasmus  
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### Participants by OU:

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Kenji Okubo  
Shin-ichi Nishimura  
Toshitsugu Moroizumi  
Hidenori Morita  
Shinji Hiejima  
Takayuki Shuku  
Mika Kobayashi  
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### Affiliated participants:

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(Kyoto University)  
Makiko Oda  
(National Defense Medical College)  
Akiko Mano  
(Ochanomizu University)  
Takashi Nakazawa  
(Tohoku University)