Use of new digital technology to enhance community resilience to floods

Sue Tapsell, Simon McCarthy, Rosalind McDonagh, Vitaveska Lanfranchi, Uta Wehn de Montalvo

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Establishing a Citizens Observatory of Water

- EU FP7 project, 4 years (2012-2016), €5.4m
- 14 Partners: 4 academic institutions, 8 SMEs, 2 local authorities
- 3 case studies: Alto Adriatico (It), Delfland (NL), Doncaster (UK)
- Focus: floods, drought, water quality
The challenges

Traditional approaches to observing water cycle

- Density and resolution of collected data is too low to describe the status of the water cycle, particularly during critical events such as floods
- They promote a passive role for the community with regards to understanding the environment
- Citizens traditionally considered consumers of information services at end of information chain
- Need to determine what citizens need to know to act more effectively to enhance their decision-making and increase their resilience
Policy responses towards participation: stakeholders as environmental citizens

- General recognition that effectively managing our local environments is enhanced by engagement with and between relevant stakeholders, both professionals and citizens.

- Recent shift in emphasis in the scales at which governments believe that sustainable development, including flood risk management, can be promoted e.g. local and regional scales and an emphasis on individuals as agents for change.

- Result of the re-scaling of responses:
  - Policy imperative to encourage major shift from passive to active publics in the context of global environmental concerns.
  - Growing scholarly interest in “democratising expertise” through increased citizen engagement in science and technology development and policy making.
Citizen science and the potential of new technology to enhance community resilience

• One avenue of participation to address some of the challenges: involve citizens as scientists
• A number of factors now coming together to accelerate development of citizen science and evolve it in new directions
• Improved technical abilities to both monitor and communicate about our environment, such as digital technologies to improve data collection
• Social media is increasingly being adopted as a communication medium during disaster or crisis situations - both in alerting communities to particular threats as well as in crisis response and recovery
• Online social networking sites (SNS) enable collaborative information sharing through communication and help build resilient communities in areas exposed to risk
• Involvement can help enable ‘ownership’ by citizens
WeSenseIt project aims and objectives

- **Aim is to promote an environment that enables better water knowledge for use by policy makers, industry, citizens and research with a view to managing water resources effectively and efficiently via citizen involvement.**

Project objectives include:

- the creation of a Citizens’ Water Observatory platform which becomes a unique virtual place to gather and share data and information;
- that provides multimodal services for citizens, communities and authorities to obtain up-to-date situation awareness while respecting the different roles and information needs of users;
- supports the study of the impact of new communication models and polices on society.
Physical and Social Sensors: two layer approach

Hard layer – physical sensors:

• Static and portable devices sensing and transferring water information via mobile phones etc.

• Rainfall, temperature, water levels etc.

• Objective to have a large number of sensors providing spatial patterns and temporal evolution and real-time information for decision-making

• Sensors for: citizens, citizen scientists and professionals

• Low cost as a main objective for availability
Physical Sensors

WeSenseIt
Citizen Water Observatories

GPRS
IP

Mobile network & Internet
Soft layer – social sensors

• Harnessing citizens’ collective intelligence
  ➢ Direct messages to authorities (explicit social sensors)
    ▪ Creation of explicit two-way communication channel
      ▪ between citizens and authorities
      ▪ between citizens and citizens
  ➢ Mining social streams (implicit social sensors)
    ▪ Large scale mining of social media for situation awareness and disaster management

• Collective knowledge, social trends, social activity, behaviour
Overview

• How information in case studies is connected

Apps, Models & Decision support systems

WeSenseIt Platform

Social Sensors

Physical Sensors
Modelling (physical and social)

Decision-making processes will be supported via:

- Physical hydrological models and Agent Based Models enhanced or based on the citizen observations and use within the observatory

Models will help:

- Support authorities and empower citizens in making sense of, and planning reactions to, emergency situations
- Implement new approaches to participation in flood risk management planning, decision-making and governance
Governance research questions

Technological developments will be accompanied with analysis of local governance context

• What is the **governance context** within which the Citizen Observatories are being embedded?

• How do the **knowledge flows and exchanges** mediated by the citizen observatories **affect and change water/flood risk governance processes**?

• What **social innovation** is necessary for **realising the expected impact** of the citizen observatories in 'good governance' domains (e.g. participation, transparency, accountability and responsiveness)?
Two-way communication paradigm leading to...

- increasing public awareness of environmental issues
- support for environmental decisions....?
History of significant flood events

• Many notable floods with records dating back to the 16th Century

• Town of Doncaster has largest flood risk - currently 25,000 properties at risk from River Don flooding

• Additional risk from surface water flooding

• Significant flooding during the large-scale 2007 floods: c 80 million cubic metres of rain fell on South Yorkshire on 25 June 2007 - parts of town flooded twice in 10 days

• Flood risk has had a large economic, social, physical and psychological impact on citizens, especially following 2007
### Initial key stakeholders identified

<table>
<thead>
<tr>
<th>Community volunteer flood wardens</th>
<th>Toll Bar</th>
<th>Deprived/engaged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bentley</td>
<td>Mixed income/interested</td>
</tr>
<tr>
<td></td>
<td>Fishlake</td>
<td>Wealthy retired/engaged</td>
</tr>
</tbody>
</table>

### Council Professionals

- Bridge, asset and road engineers
- Surface water experts

### Environment Agency

- Emergency management
- Flood risk management
- Stakeholder engagement
- Modelling
Meeting stakeholders face to face

Mixture of qualitative and quantitative approaches:

• meetings with citizens/communities at their local meetings where possible

• meetings with professional users at emergency centre and DMBC venue

• mixture of presentations, discussion and questionnaires
Communities already engaged in gathering data by creating their own map and visualisation of the extent of flooding in 2007.
Site walks with three communities for citizens to determine sensor requirements and locations
Custom mobile App to engage citizens

Location-based discussion

Users can:

- submit requests for information
- report dangerous/worrying situations
- upload photos and videos
- run through official flood planning checklist
  - checklist is interactive
  - box ticks are recorded
- Authorities can know the distribution of user actions in a community
Combines existing technologies

- Crowdsourcing
- Volunteer Information
- Social Media Gathering and Analysis

- Will provide multimodal interaction
  - Desktop App + Mobile App

- To collect, share and access data

- Being piloted in all three study sites
Visualising data
Some tentative conclusions

- Good progress made on engaging citizens and determining their requirements - *the challenge* is to maintain engagement until end of project (and beyond?) and to widen stakeholder base

- Some early lessons are already being identified:
  - Two stage development approach. First with already engaged citizens and then the less engaged wider community with a fully functioning system.
  - Requirements requested by professionals was greater than project can provide – therefore need to match what is available to key decisions that need to be made in case study locations
  - Mismatch between what citizens (residents) and professionals thought was important and thus different triggers being used for decision-making
  - Signs of potential that topographically broader shared information might encourage shared action between disperate local communities
  - If planning to make use of social media need to have adequate resources to respond to information as well as receiving it
Thank you. Any questions, comments or suggestions welcome!