Role of Citizen Monitoring in Post-Accident Recovery : Opportunities, Challenges and Lessons Learned from Fukushima

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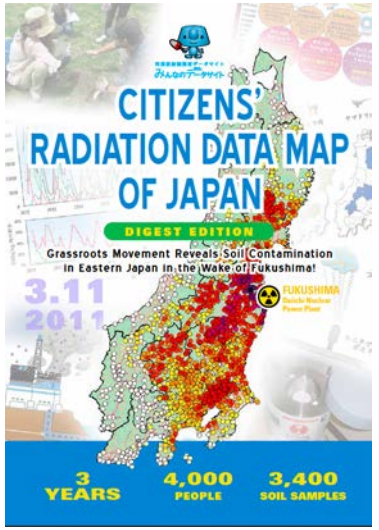
There were many public-involved radiation measurements after the Fukushima Accident

- There were hundreds of radiation monitoring p programs in which residents and citizens participated.
- Affected residents or citizens wanted to overcome their own anxiety about radiation and to come up with better ways to protect themselves.
- To make up for delays, inadequacies, and shortcomings in radiation measurements by national and local governments

Azby Brown et al 2016 J. Radiol. Prot. 36 S82



https://en.minnanods.net/mds/e-digest.html/

Various ways for citizens or affected residents to get involved in radiation measurements

Some Examples from Naito et al. (2020)

Community-Based Approach : Affected communities are actively engaged in planning, monitoring, and evaluating the radiological situation of the local environment with the help of experts.

Researcher (including academic institution)-Driven Approach: Radiation measurement activities driven by institutional and academic researchers.

Citizen Science Group Approach: Radiation measurement in the environment and communicated the results via the Internet by citizen science group members

Eight types of radiation measurement activities by citizens

Type	Contents
Ⅰ	Citizens' groups conducted detailed measurement of ambient doses in their residential areas
Ⅱ	NGOs and citizens‘ groups conduct radioactivity measurements in food and soil samples
Ⅲ	Establishing a comprehensive community support system that includes specialized measurements and health cares
Ⅳ	Presenting counter-evidence to the government based on a long-term and detailed understanding of the contamination situation in highly contaminated areas
Ⅴ	Developing cooperative relationships with local governments and establish their own protective measures
Ⅵ	Developing cooperative relationships with local governments and establish their own protective measures
Ⅶ	Sharing know-how on radiation protection through networking, with a focus on protection for children
Ⅷ	Consolidate data from many citizen measurements across Japan and ensure its accuracy. The data will be archived and visualized as a mapping of the whole of Japan

Ueda(2020). Significance of radiation measurement activities by citizens after the Fukushima nuclear accident. Journal of science and technology studies vol.18. (Japanese)

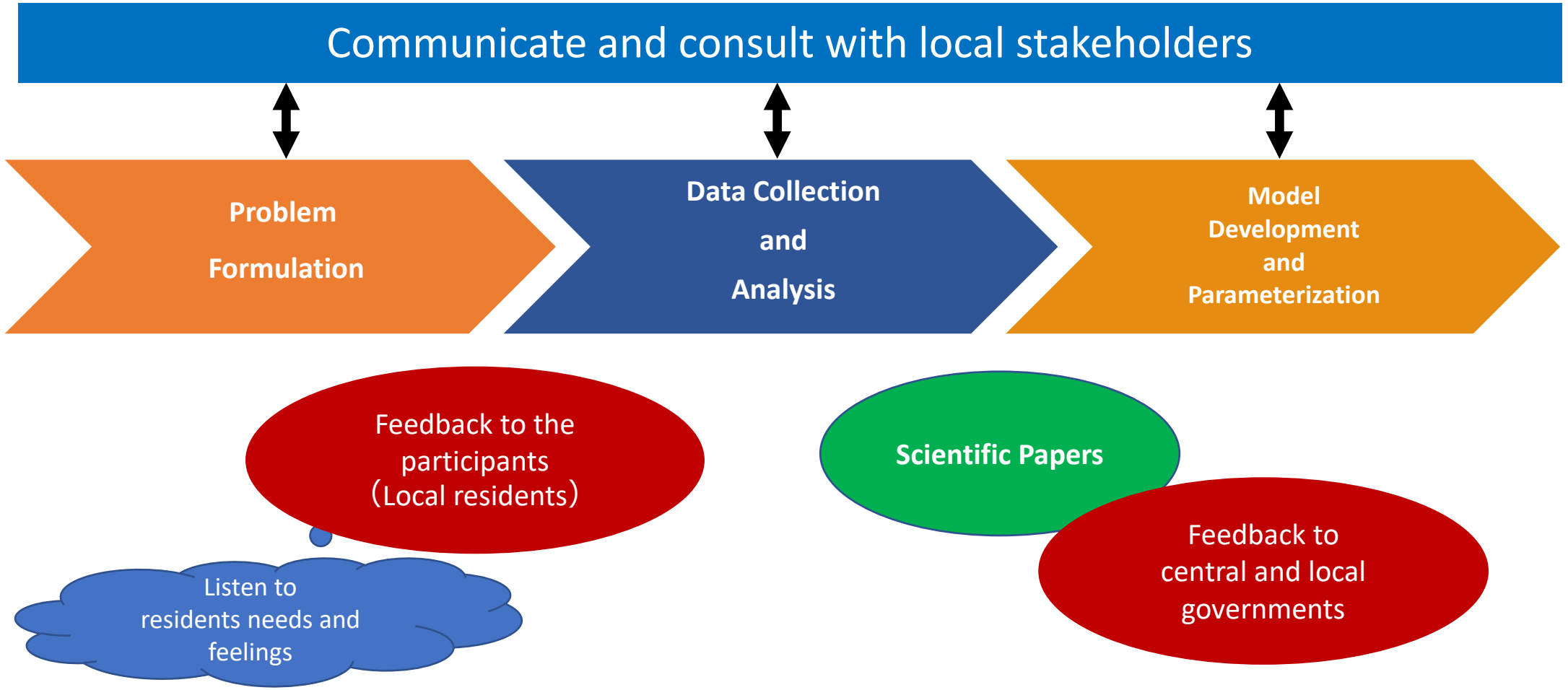
Our Study
A (Community-Based) Researcher-Driven Approach to Measure and Assess individual External Doses in Fukushima

- **Understand the realistic individual external doses** of individuals in the affected areas (both non-evacuation and evacuation zones)

- Elucidate **the relationships between individual external doses with activity patterns and ambient doses** (based on airborne monitoring data and others)

- **Investigate the participants' responses** to their measured individual external dose and radiological conditions

Our D-shuttle Pragmatic Research has Dual Objectives

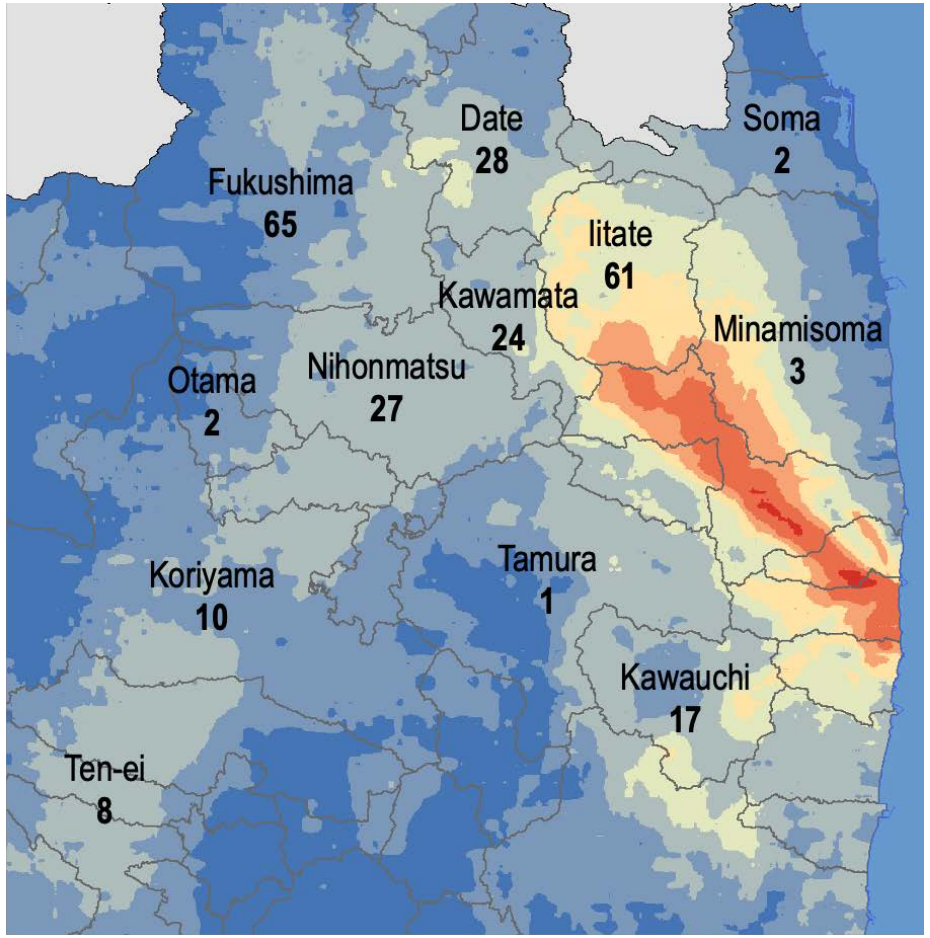


To aware of his/her own dose and to utilize for self-protection or making lifestyle choices

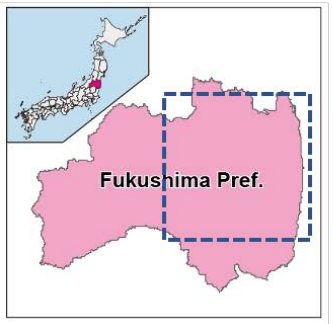
To obtain dose distribution of the population

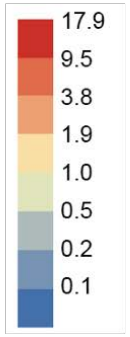
Study participants and area

Support of local residents is essential for the data collection stage



Ambient dose rate is based on 10th Airborne Monitoring Survey (2018.Nov.15)





2013: 50 (0)
2014: 96 (16)
2015: 76 (55)
2016: 15 (15)
2019: 17(17) (+ 279)
2020: 19(19)

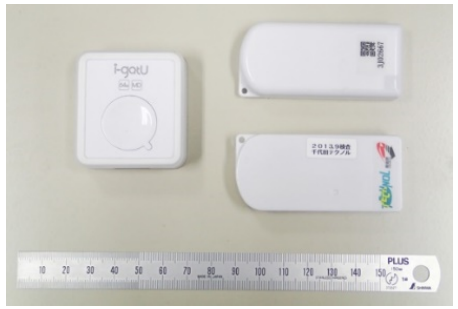
To date, approximately 300 Fukushima residents participated in our study

The study was approved by the Committee for Ergonomic Experiments in the AIST.
Written informed consents were obtained from all participants prior to conducting the study.

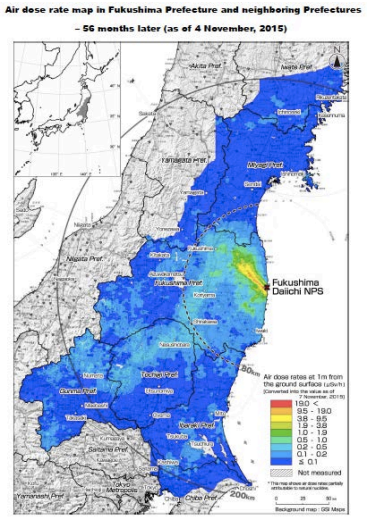
What kinds of data were collected ?

Data collection periods :

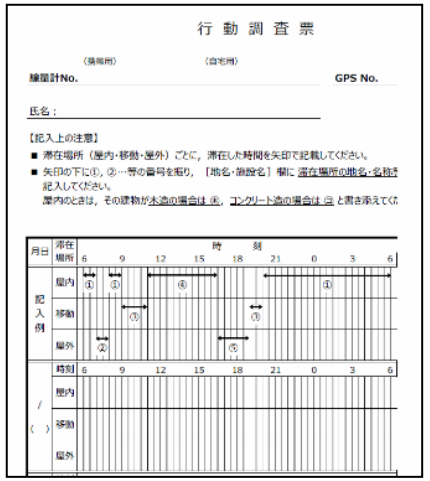
approximately 7 – 14 days (Sep. 2013 – Oct. 2020)



- Individual external dose
  → Personal Dosimeter(D-shuttle [hourly dose, μSv/h])



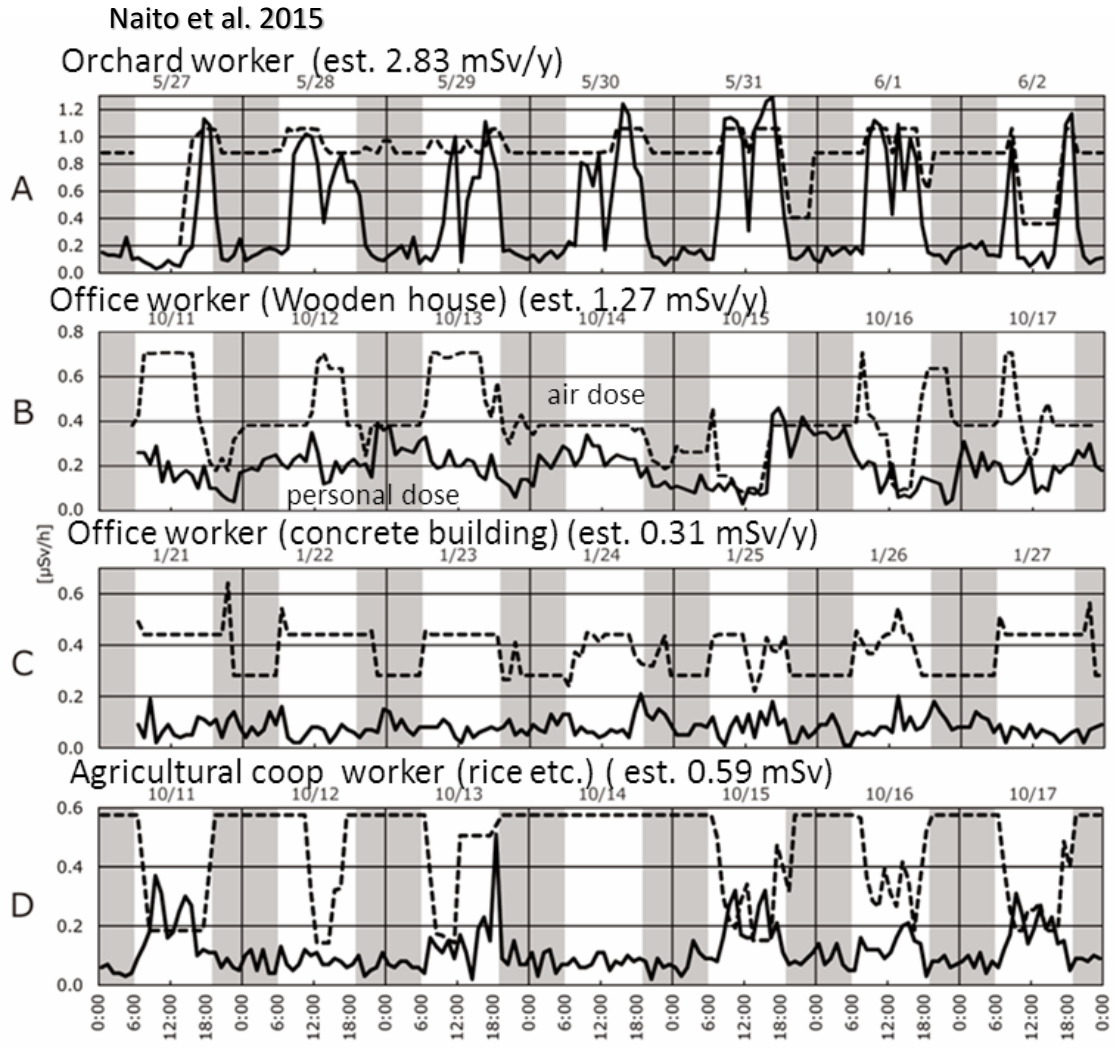
- Location and activity-patterns of individuals
  → GPS receiver and time-activity diary



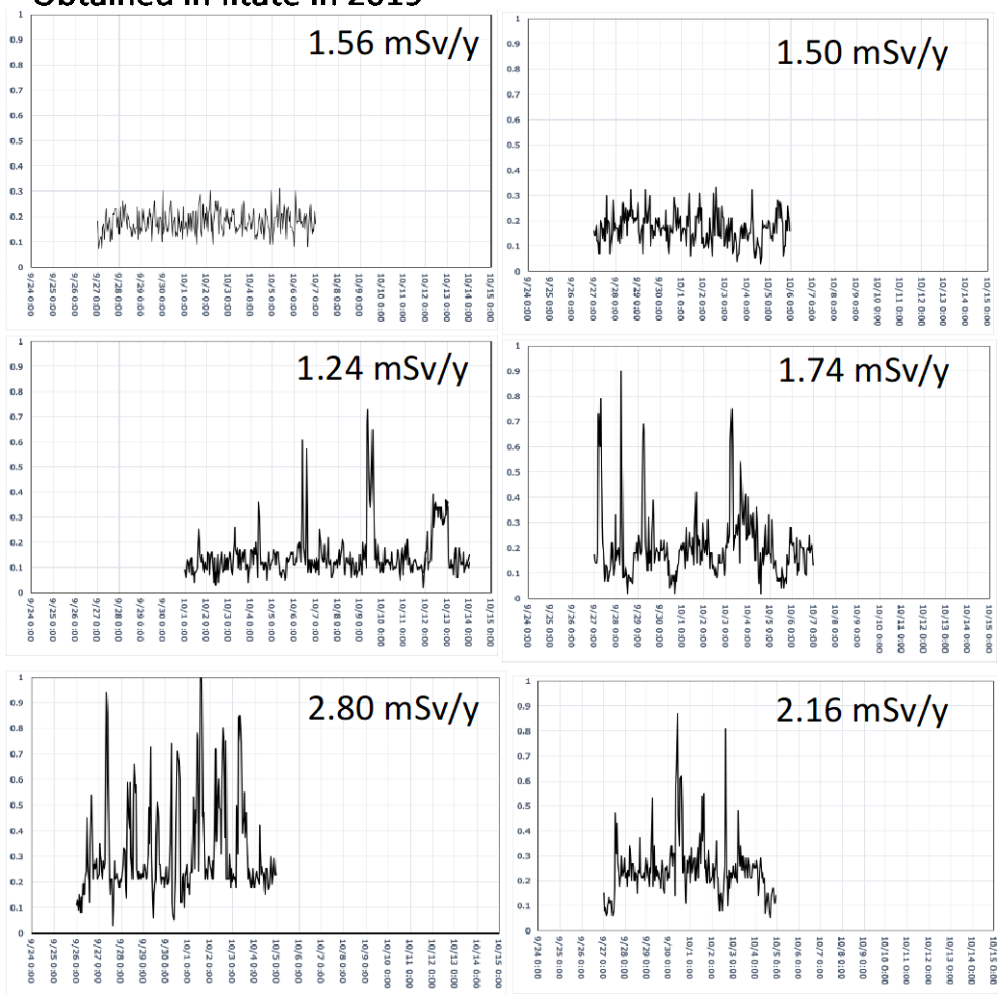
- Air dose rate
  → Airborne monitoring conducted by
  Nuclear Regulation Authority, Japan

Examples of individual external dose profiles obtained with D-shuttle by local residents

Naito et al. 2015



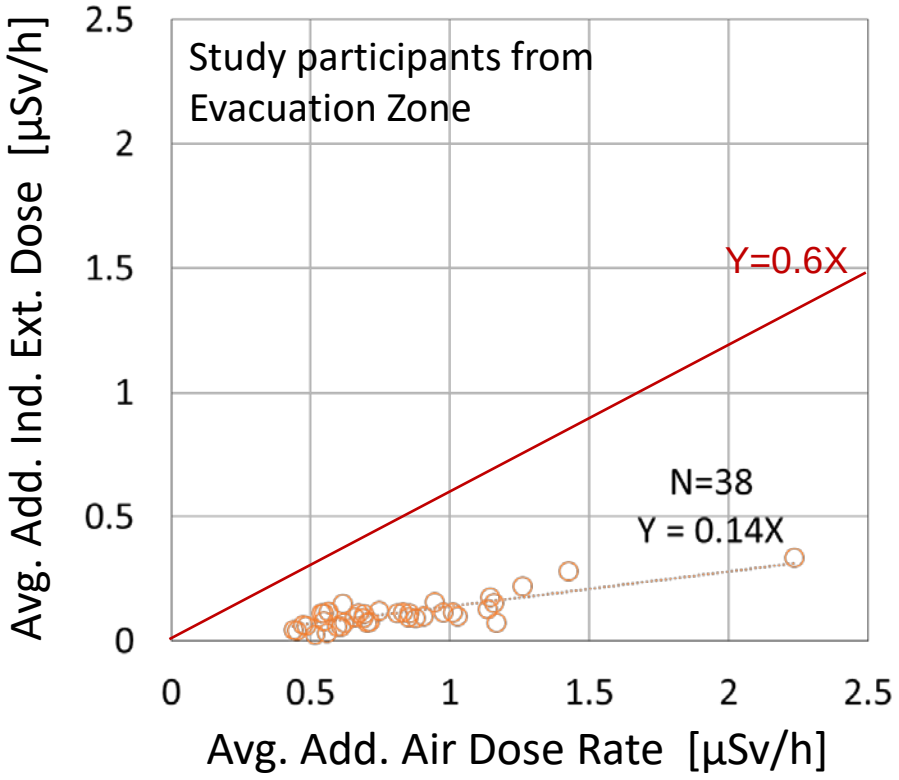
Obtained in Iitate in 2019



Personal dosimeter such as D-shuttle provides easy-to-understand information for residents to know the radiation situation in their daily life.

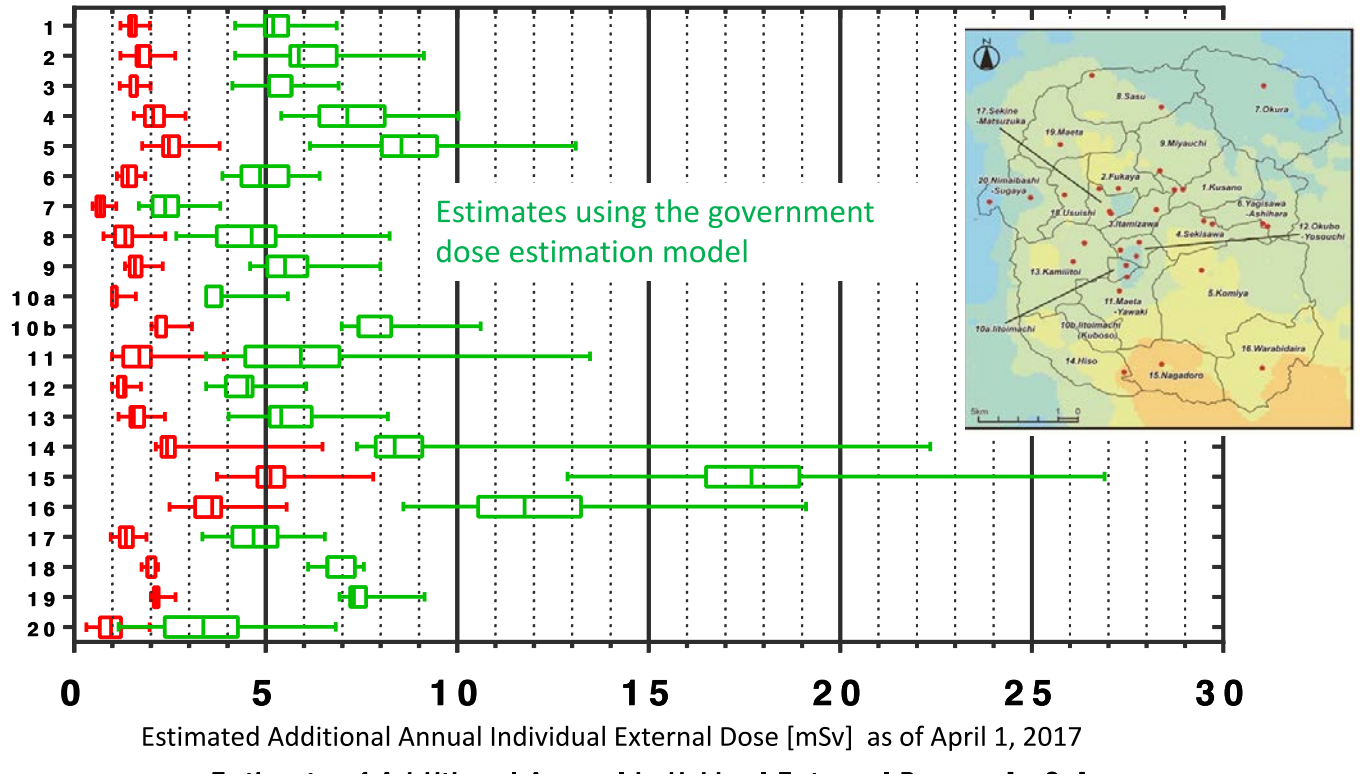
The estimates of individual external doses based on the result from our measurements were well below the estimates calculated by the gov. model

Relationship between individual external dose and airborne based ambient dose



Assuming people stay 16 hours indoors and 8 hours outdoors

Naito et al. (2017)

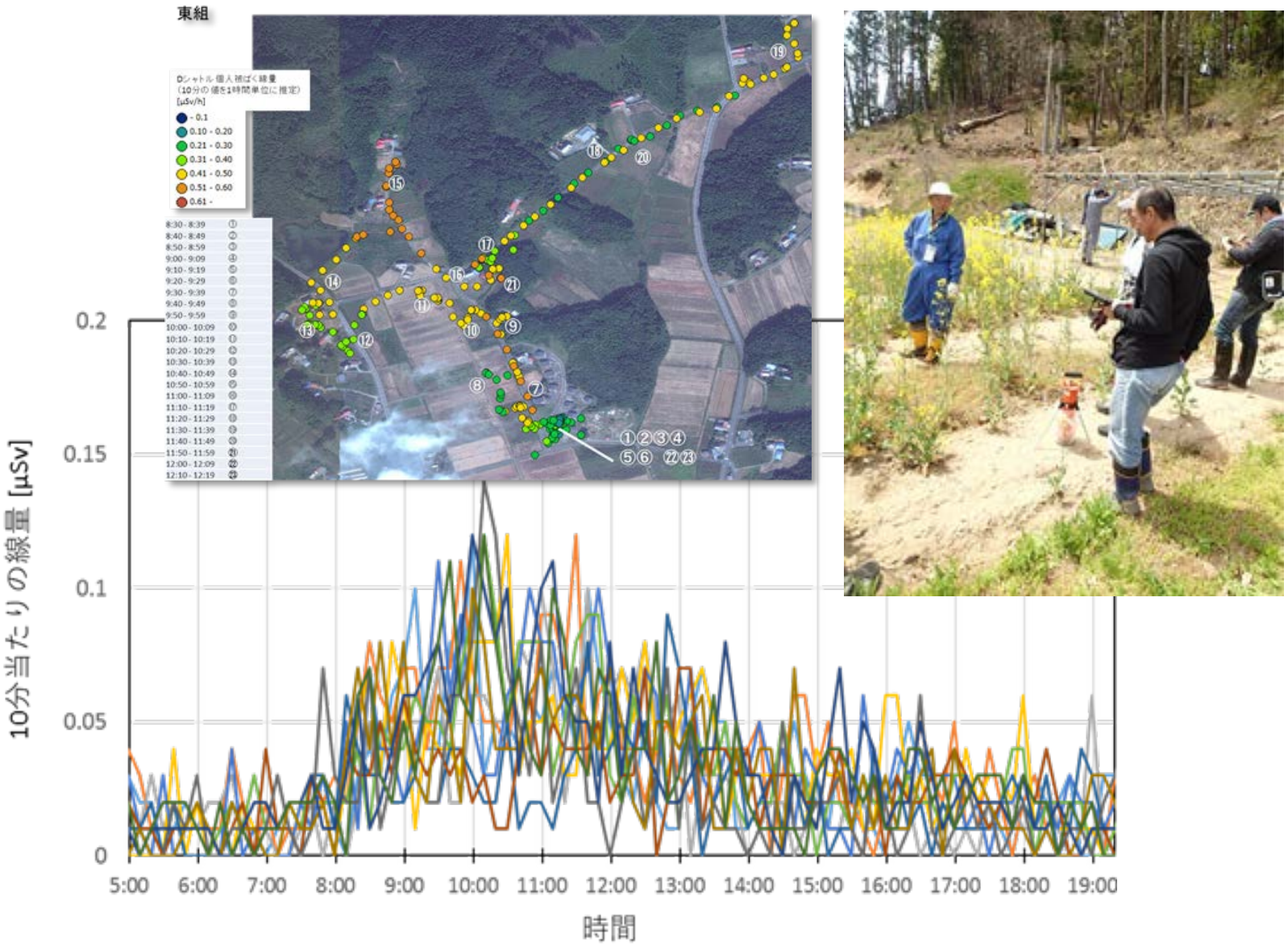


Individual external dose << Corresponding airborne-based ambient dose

Naito and Uesaka. 2018. Annals of ICRP

Based on data in Naito et al. 2016. PloS one 11 e0158879 and Naito et al. 2017. J. Radiol. Prot. 37 606–22

Local Residents and Institutional Researchers Collaborate on Radiation Measurement Event



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29 (1): 46-56, Sep 2017

調査報告

住民と大学・研究機関との連携による 放射線計測と試験栽培

―― 福島県飯舘村大久保外内地区 ――

福島大学うつくしまふくしま未来支援センター　石井秀樹
福島大学経済経営学類　服部正幸
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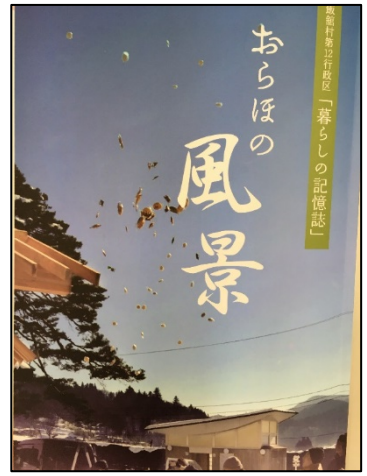
新潟大学農学部　野中昌法
福島大学経済経営学類　守友裕一

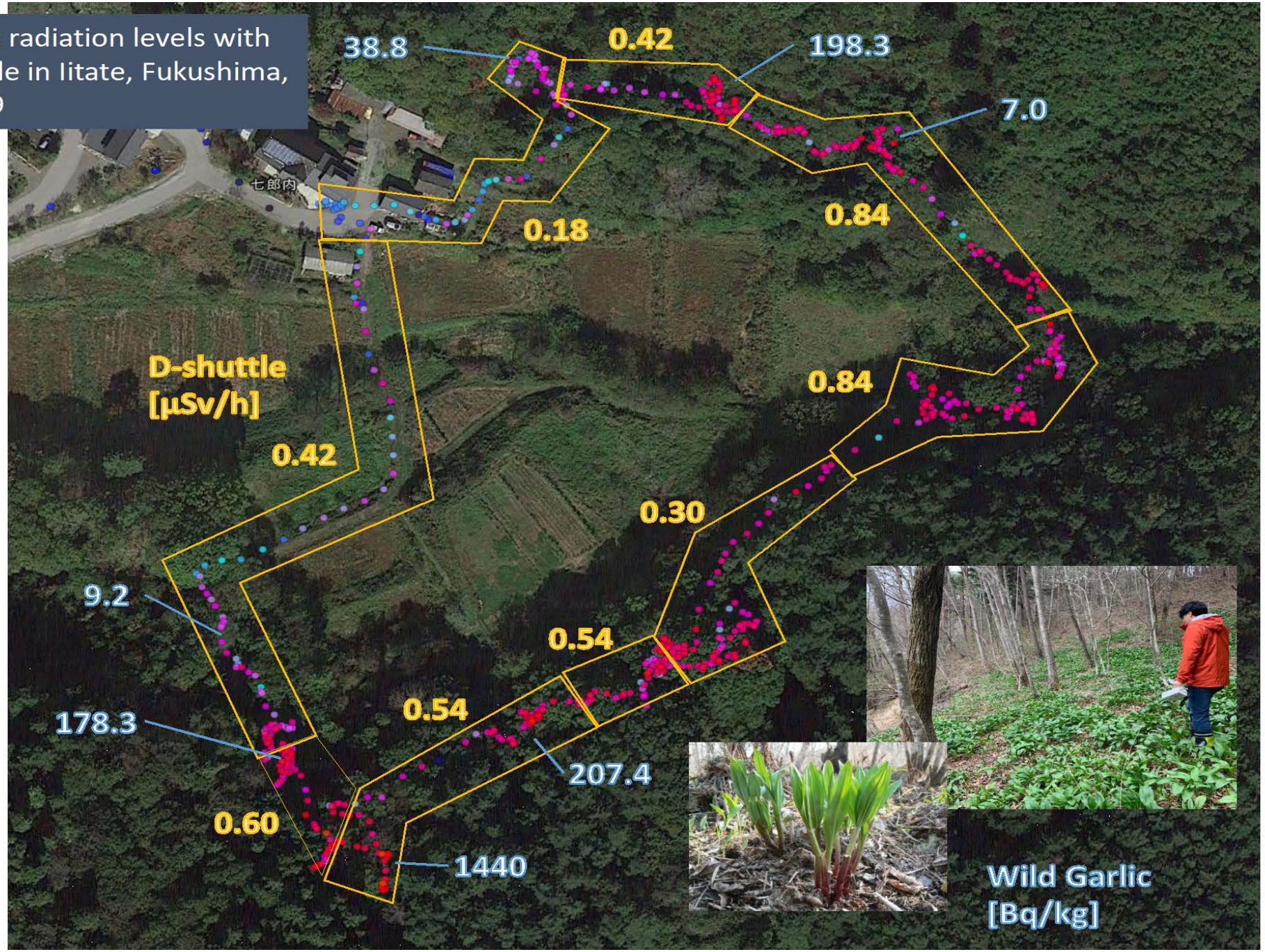
Radiation measurement and experimental cultivation conducted by cooperation between residents and universities / research institutes

ISHII Hideki, HATTORI Masayuki, TANAHASHI Tomoharu, KOMATSU Tomomi, GOTO Jun, NAITO Wataru, UESAKA Genki, HARADA Naoki, NONAKA Masanori, MORITOMO Yuichi



Local Community Booklet

Measuring radiation levels with local people in Iitate, Fukushima, May, 2019



Role of Citizen Monitoring in Post-Accident Recovery

Opportunities:

- **Enabled monitoring in areas that cannot be covered by the authorities**
- **Played a role in verifying the reliability of measurement data released by the authorities**
- **Understanding realistic radiological situation in the context of everyday life**
- **Answering actual concerns from the affected residents for everyday life**
- **Self-protection and lessening the anxiety against radiation**
- **Estimation of more realistic future radiation exposure**

Role of Citizen Monitoring in Post-Accident Recovery

Challenges:

- Radiation measurement by residents or citizens can be a solution to a problem (e.g., relieving anxiety), but it can also be limited to the discovery of a problem (e.g., discovery of a high dose level or the generation of anxiety). Providing specific solutions to reduce radiation exposure based on measurements may be difficult.

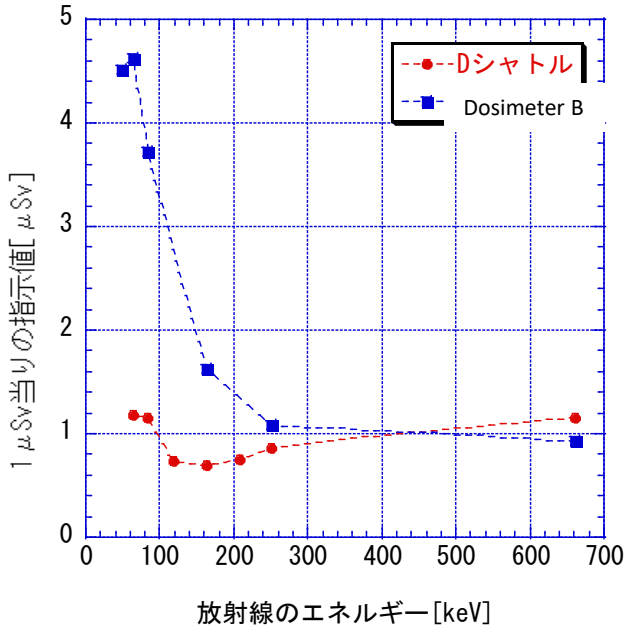
- Sharing data on social networks may cause incommensurate reactions

- Lack of coordination with government radiation protection measures

- Data quality
  (People can buy low quality detectors and carry out measurements)

- Ethical Issues

  - Participant autonomy and privacy
  - Intellectual property and data ownership



Not just measuring, it is necessary to

- To pay attention to the possibility that the measurements results may negatively impact both the local residents and society
- Properly and promptly communicate the result of the measurement or assessment to the stakeholders (ideally by trained specialists)
- Share the purposes of measurements and develop plans for communicating and responding to anticipated or unanticipated results among stakeholders before conducting measurement
- If needed, provide (maybe implement) risk reduction options (the support of authorities may be needed)
- Utilize the monitoring data to better understand realistic radiation exposure of the population with care of personal information

Summary

- Many and various forms of public-involved radiation measurement activities have emerged after the Fukushima accident.

- It played an important role in complementing radiation measurements taken by the government and played a versatile role in post accident recovery for residents and authorities in the affected areas understanding realistic radiological situation in the context of everyday life.

- The use of personal dosimeter such as D-shuttle by the affected people could be a double-edged sword. Public-involved radiation measurement can be a solution to a problem (e.g., relieving anxiety), but it can also be limited to the discovery of a problem (e.g., discovery of a high dose level or the generation of anxiety).

- In light of the ICT era, it is necessary to establish systems and protocols that make use of radiation data measured by citizens in nuclear disasters and radiation protection.

Acknowledgements – Thanks -

- Local residents who participated in our study
- Local officials from Iitate village and Kawamata town