Safecast: How disaster led to empowerment of crowdsourced citizen science for radiation measurement and communication after Fukushima

Azby Brown: Safecast; Kanazawa Institute of Technology
Future Design Institute

EGU General Assembly, Vienna, April 2016

14:46:24 JST - March 11, 2011

Greater Eastern Japan Earthquake and Tsunami

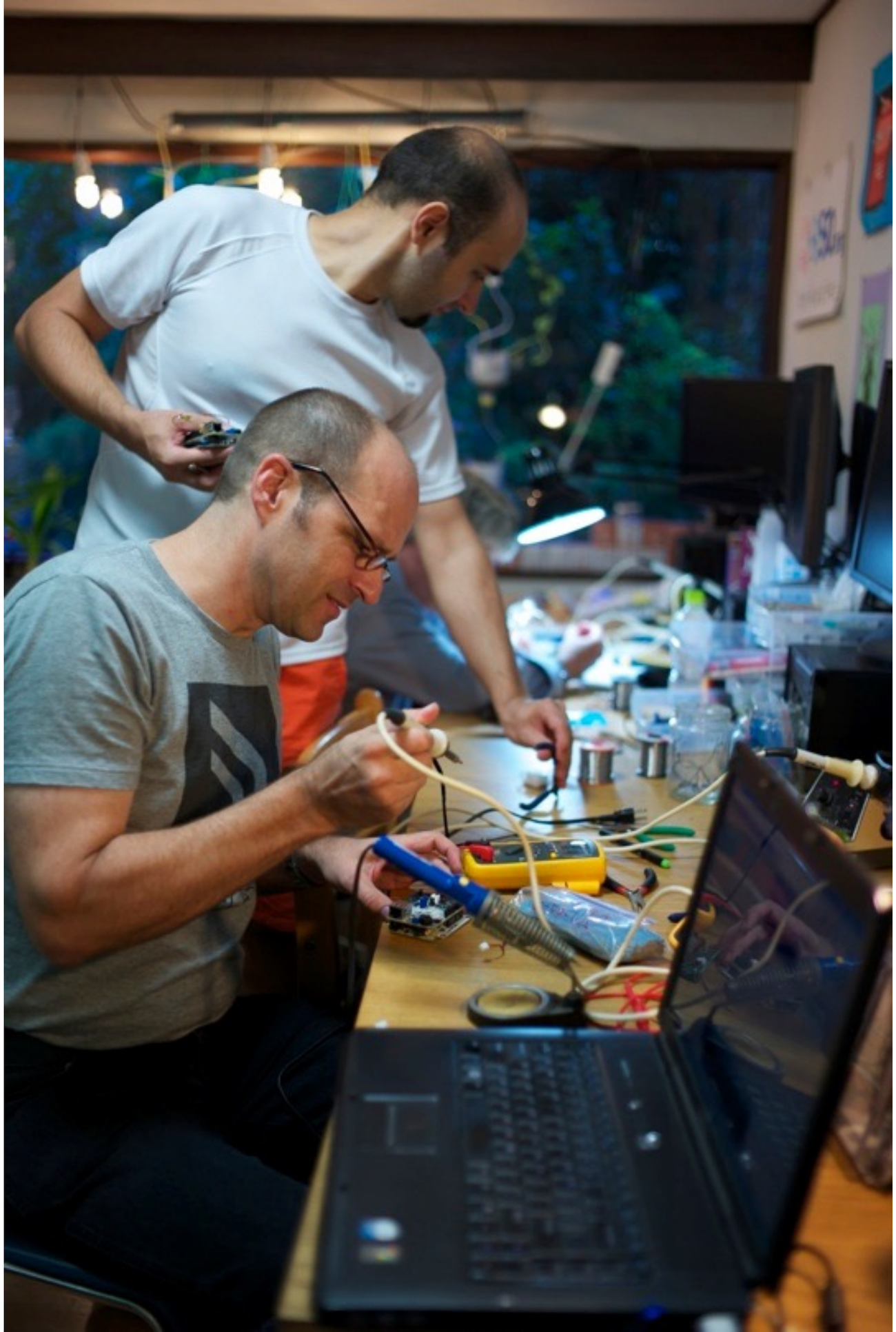
Fukushima Nuclear Powerplant Accident

From the point of view of average citizens:

- Fear, need to decide soon whether to flee
- Information vacuum
- Official sources deemed untrustworthy
- Social media paints more dire picture
- Even knowledgeable people can’t find enough reliable and useful data

Our Response:

- Develop devices
- Make a mapping system
- Build a community of motivated citizen-scientists who want to measure radiation.



Our first systems were bulky, but worked.

Deployment:

Automobile

Bicycle

Hand-carry

Aerial drone

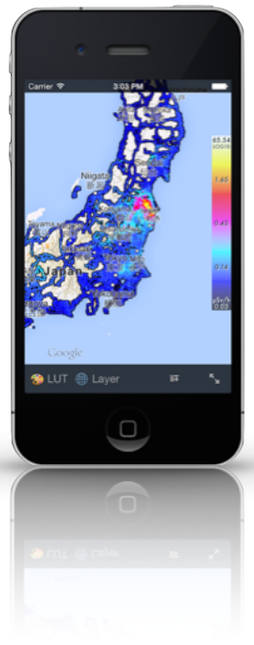
Current workhorse:

bGeigie Nano

- 7th-generation mobile detector
- Rugged
- Arduino-based
- GPS and data-logging
- LND 7317 2” pancake sensor
- OLED display
- Bluetooth and WiFi capable
- Open-source, open hardware, open data
- Designed to be sold as a kit, anyone can build it and upload data

~500 Devices worldwide

iOS



OS X

Web

Map system:

- Database updated daily, now approx 10GB
- Both server-fed webmaps and smart-client iOS and OSX apps
- API with query/filtering by time, location, device, etc.
- Approx 360 volunteers have uploaded data.
  But 90% is contributed by the most active 10%.
- Data and system are open-source (Creative Commons CC0 license). Anyone can download the data, and we encourage independent efforts based on our dataset.

safecast.org

Map

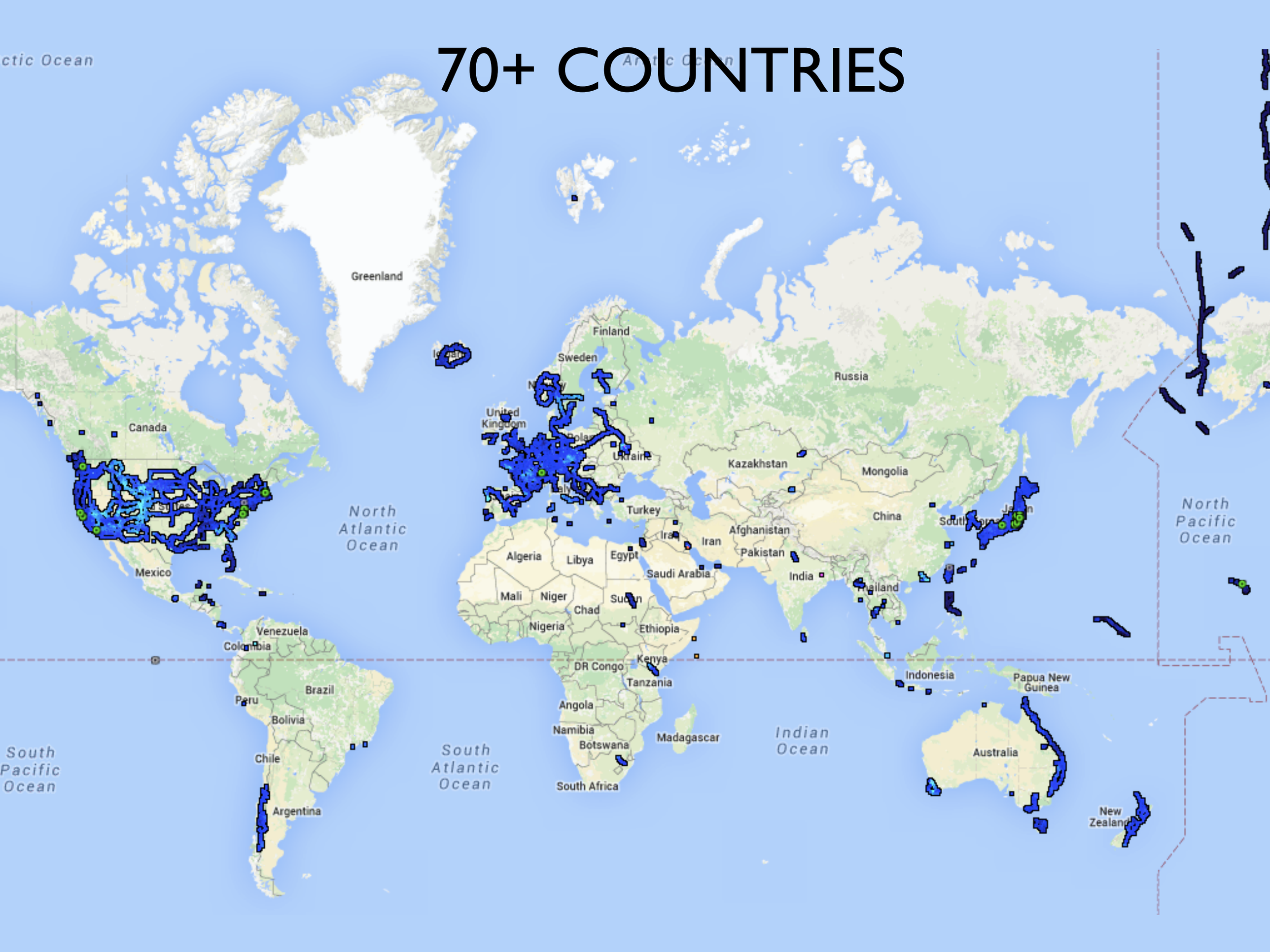
Vladivostok
Владивосток
Nakhodka
Находка
Sea of Japan
Niigata
新潟
Kanazawa
金沢
Fukuoka
福岡
Nagasaki
長崎
Miyazaki
宮崎
Mt. Dainichi
大日岳
Mount Nasu
那須岳

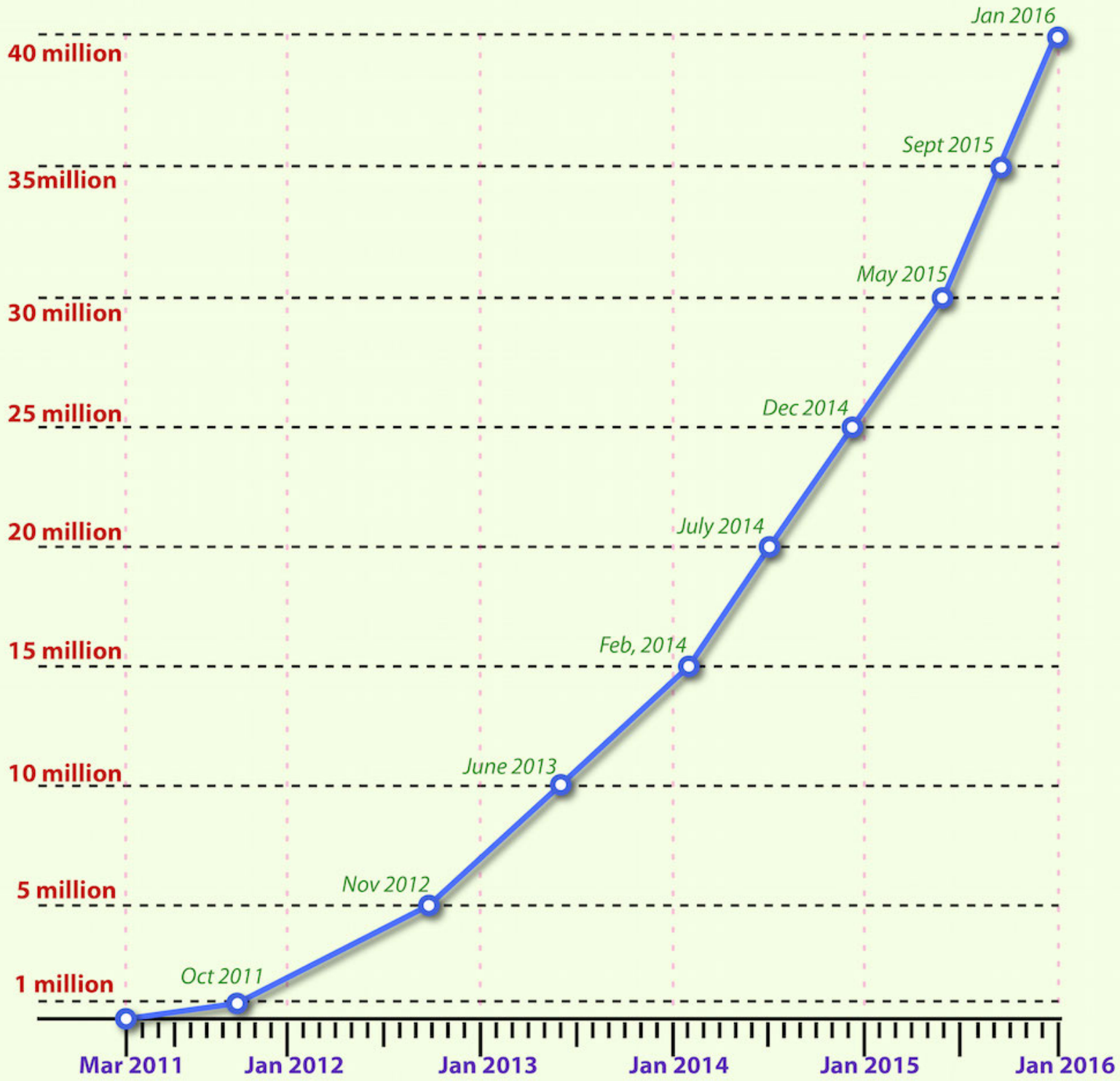
65.54
LOG10
10.09
3.99
2.13
1.31
0.87
0.60
0.43
0.31
0.23
0.16
0.12
0.08
0.05
μSv/h
0.03

Map data ©2016 Google, SK planet, ZENRIN
100 km
Terms of Use

safecast.org/tilemap/

70+ COUNTRIES

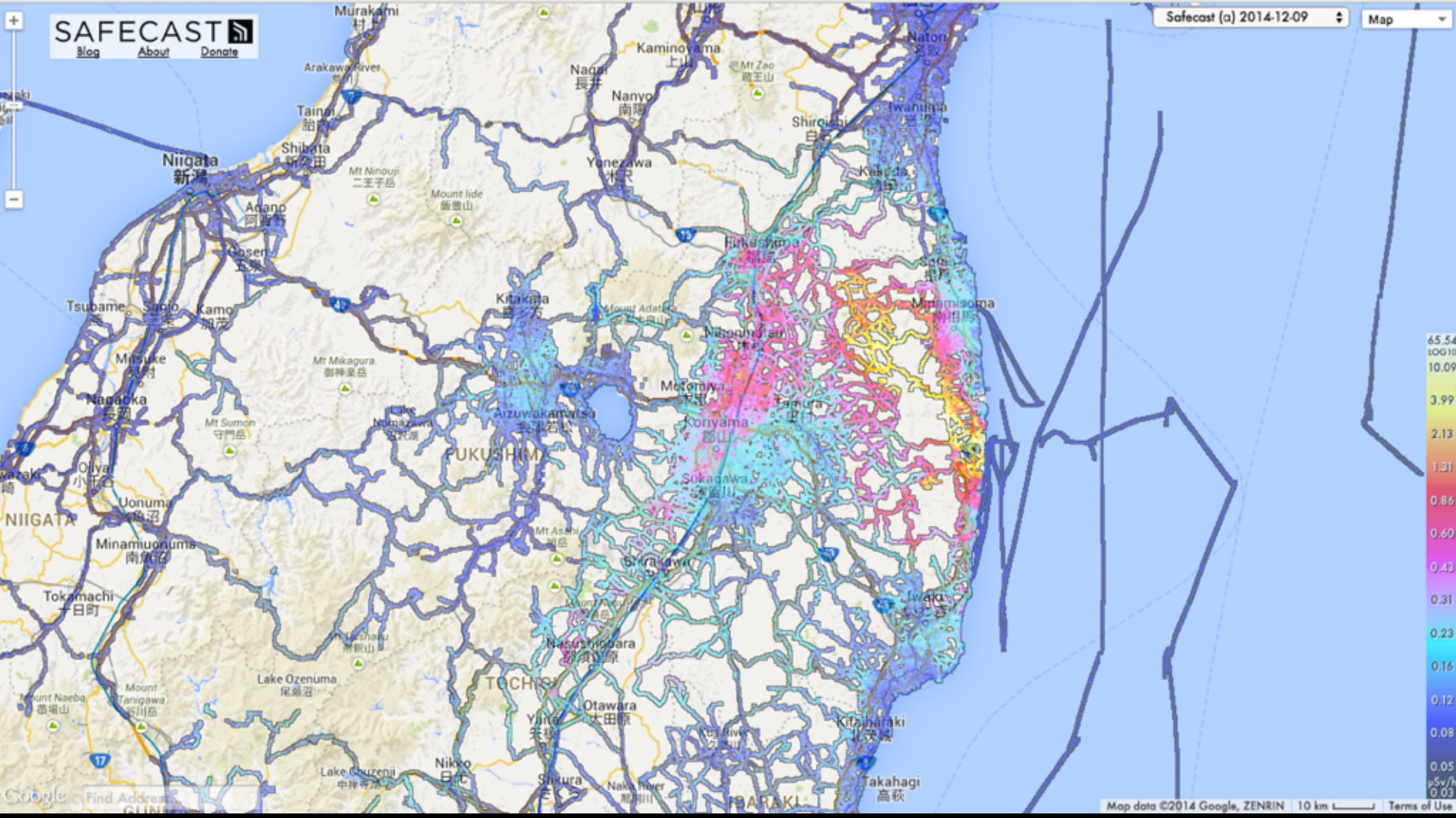




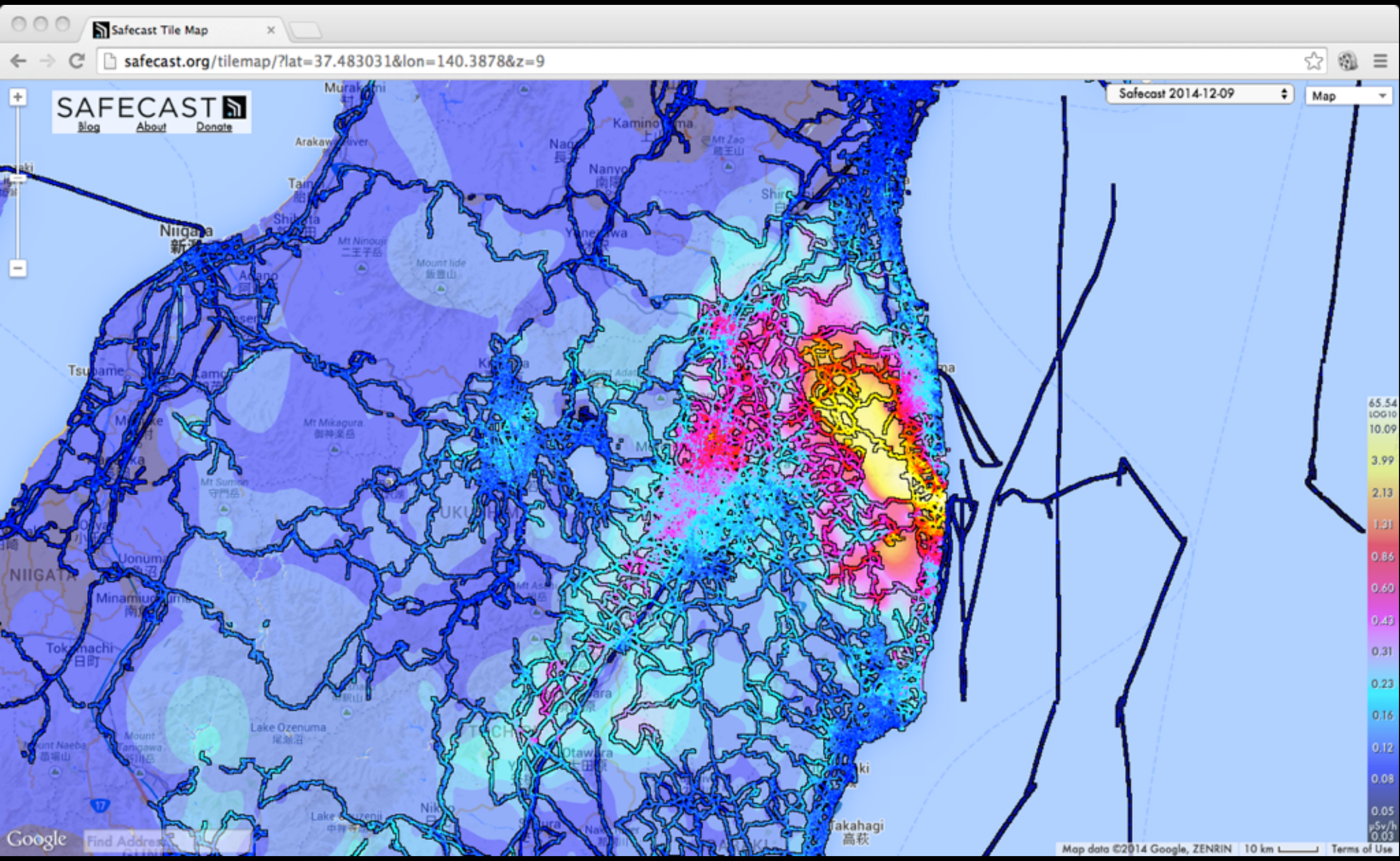
March 2016: Over 43 million data points

Safecast Tile Map

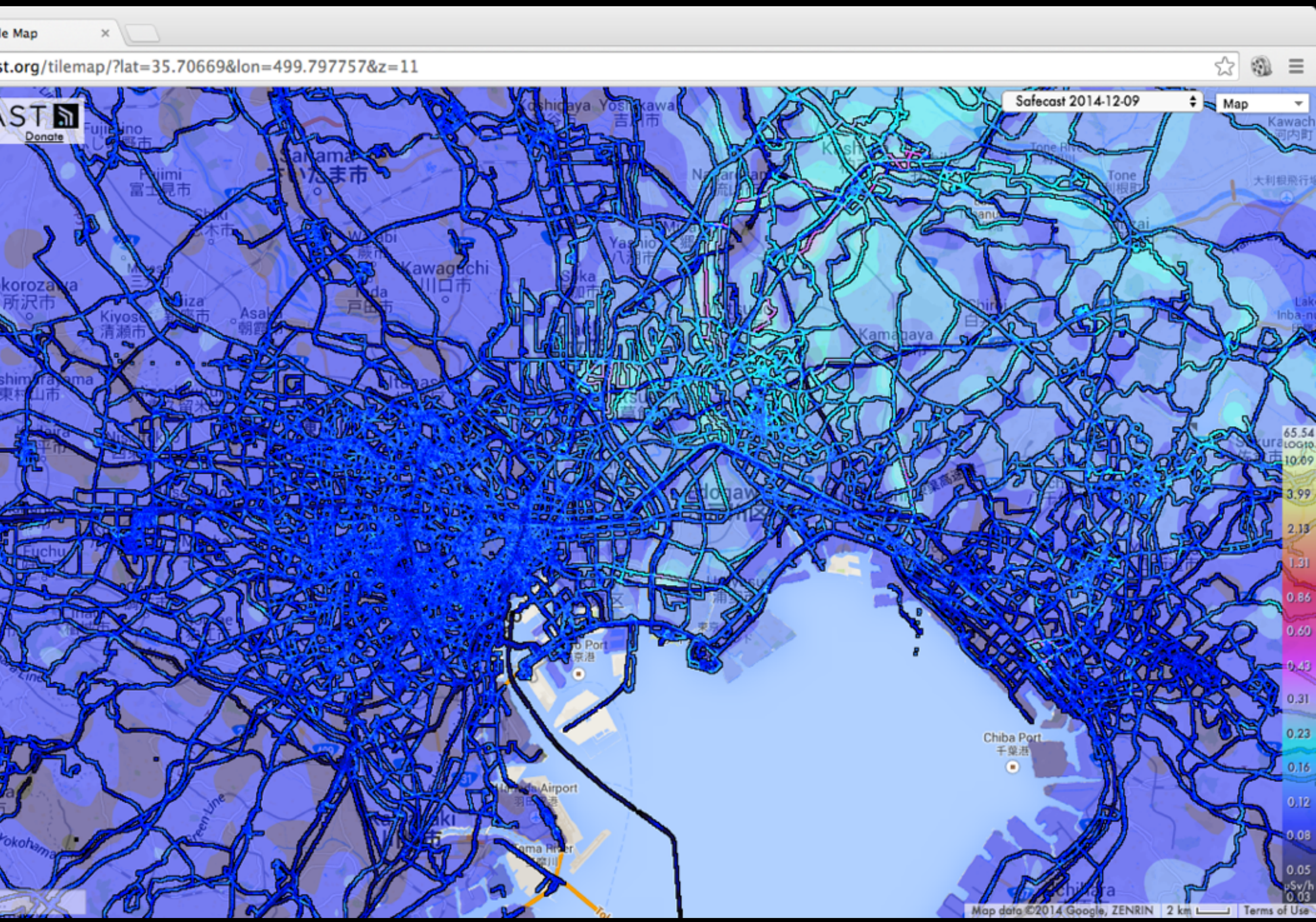
safecast.org/tilemap/?lat=37.483031&lon=140.3878&z=9&lidx=1



Visualization Controls



Interpolation



le Map
st.org/tilemap/?lat=35.70669&lon=499.797757&z=11
Safecast 2014-12-09
Map
Donate
Kawaguchi
Kamagaya
Chiba Port
千葉港
Map data ©2014 Google, ZENRIN
2 km
Terms of Use
65.54
10.09
3.99
2.13
1.31
0.86
0.60
0.43
0.31
0.23
0.16
0.12
0.08
0.05
0.03

Tokyo Area

le Map

st.org/tilemap/?lat=37.483031&lon=140.3878&z=9&lidx=3

AST Donate

NNSA Japan 2011-06-30

Map

Murakami 村上
Arakawa River 荒川
Tainai 胎内
Shibata 新発田
Niigata 新潟
Agano 阿賀野
Gosen 五泉
Kamo 加茂
Mt Ninouji 二王子岳
Mount Iide 飯豊山
Nagai 長井
Nanyo 南陽
Yonezawa 米沢
Kaminoyama 上山
Mt Zao 蔵王山
Shiroishi 白石
Natori 名取
Kitakata 喜多方
Mount Adatara 安達太良山
Aizuwakamatsu 会津若松
Lake Numazawa 沼沢湖
Mt Sumon 守門岳
Mt Mikagura 御神楽岳
FUKUSHIMA
Mt Asahi 旭岳
Mt Taishaku 帝釈山
Lake Ozenuma 尾瀬沼
Lake Chuzenji 中禅寺湖
Sakura さくら
Naka River 那珂川
Kuji River 久慈川
Takahagi 高萩
IBARAKI

65.54
LOG10
10.09
3.99
2.13
1.31
0.86
0.60
0.43
0.31
0.23
0.16
0.12
0.08
0.05
μSv/h
0.03

Map data ©2014 Google, ZENRIN | 10 km | Terms of Use

Open Dataset Layers: US DOE/NNSA

cast API

ttps://api.safecast.org/en-US/home

SAFECAST

ADMIN SUBMIT UPLOAD AZBY@ME.COM

- Dashboard
- Safecast Api
- Users
- Measurements
- bGeigie Imports
- Devices

The Safecast API

Query and add to the Safecast dataset with your own application.

API Endpoint

https://api.safecast.org/en-US

GET https://api.safecast.org/.json JSON HTML

Available Resources

Users	Add and view user accounts
Measurements	Add and view measurements
bGeigie Imports	Add and view bGeigie Imports
Devices	Add and view Devices

Users

Get a list of Safecast users	GET /users.json
Add a new user	POST /users.json
View a user	GET /users/334.json

Measurements

Get a list of Measurements	GET /measurements.json
Add a new measurement	POST /measurements.json
View a measurement	GET /measurements/22684490.json

api.safecast.org

SAFECAST

ADMIN SUBMIT UPLOAD AZBY@ME.COM

- Dashboard
- Safecast Api
- Users
- Measurements
- bGeigie Imports
- Devices

Bgeigie Import #019-1112.LOG Processed

Download Original File

If you don't see the map, please manually reload the page.

1. Uploaded | 2. Processed | 3. Metadata Added | 4. Submitted | 5. Approved | 6. Live

Metadata | Process Log | Edit Details

Uploaded By
KM.AIZU
Filename
019-1112.LOG
Number Of Lines
6079
Number Of Measurements
6079

Metadata

Title	Route6 2014/11/12
Description	Route 6 Return difficult district
Credits	Aizu radioactivity information center
Height	1.3m
Orientation	Facing Left
Cities	Koriyama,Hirata,Ono,Iwaki,Hirono, Naraha,Tomioka,Okuma,Futaba,Namie Minamisoma,Iitate,Kawamata,Fukushimaa, Nihonmatsu,Motomiya,Inawashiro,Aizuwakamatsu

API walks users through the upload process

Delete this Import

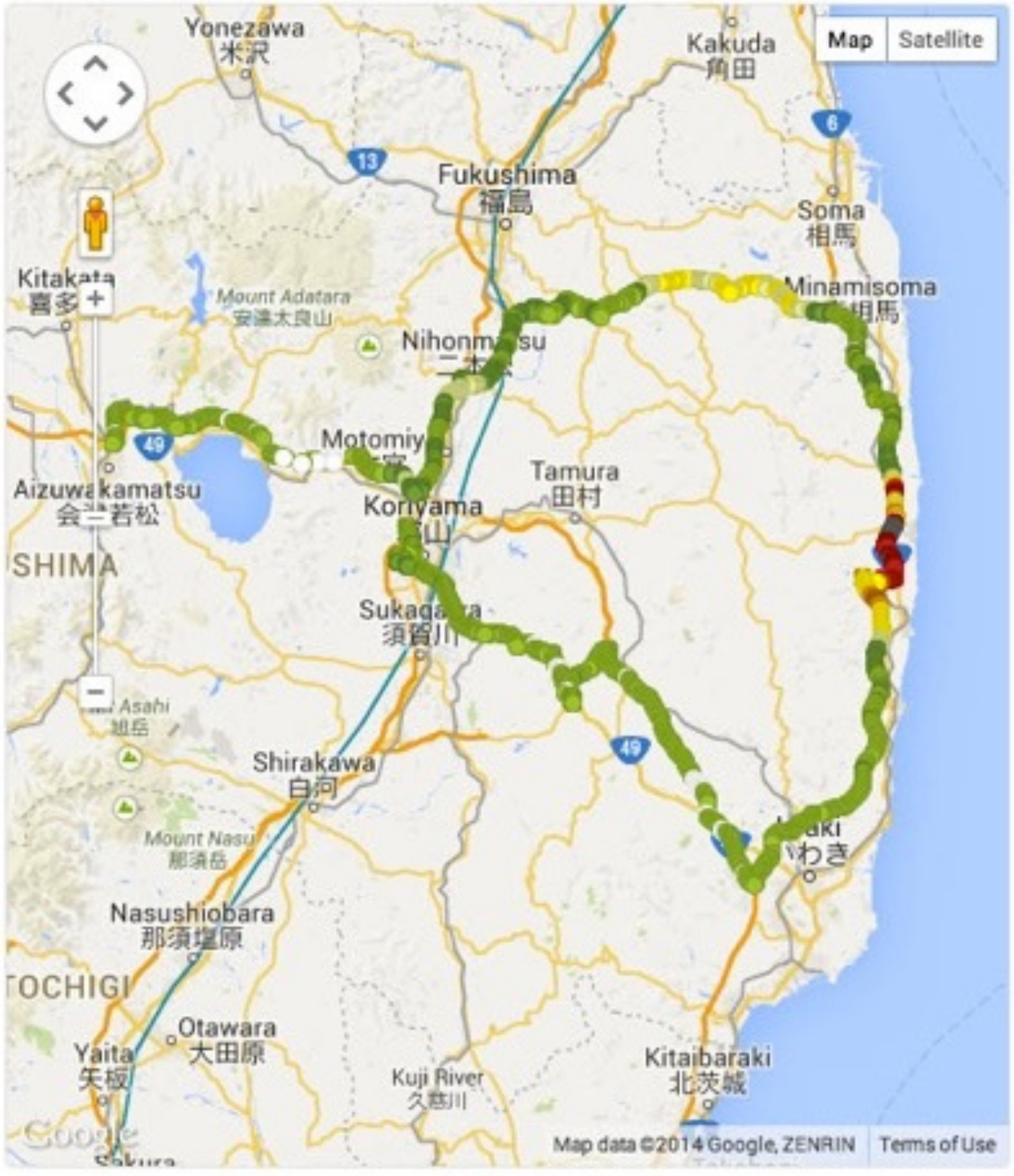
MEASUREMENT

Captured At	2014-11-12T10:27:28Z
Latitude	37.4701
Longitude	140.3621
CPM	72

Delete this Import

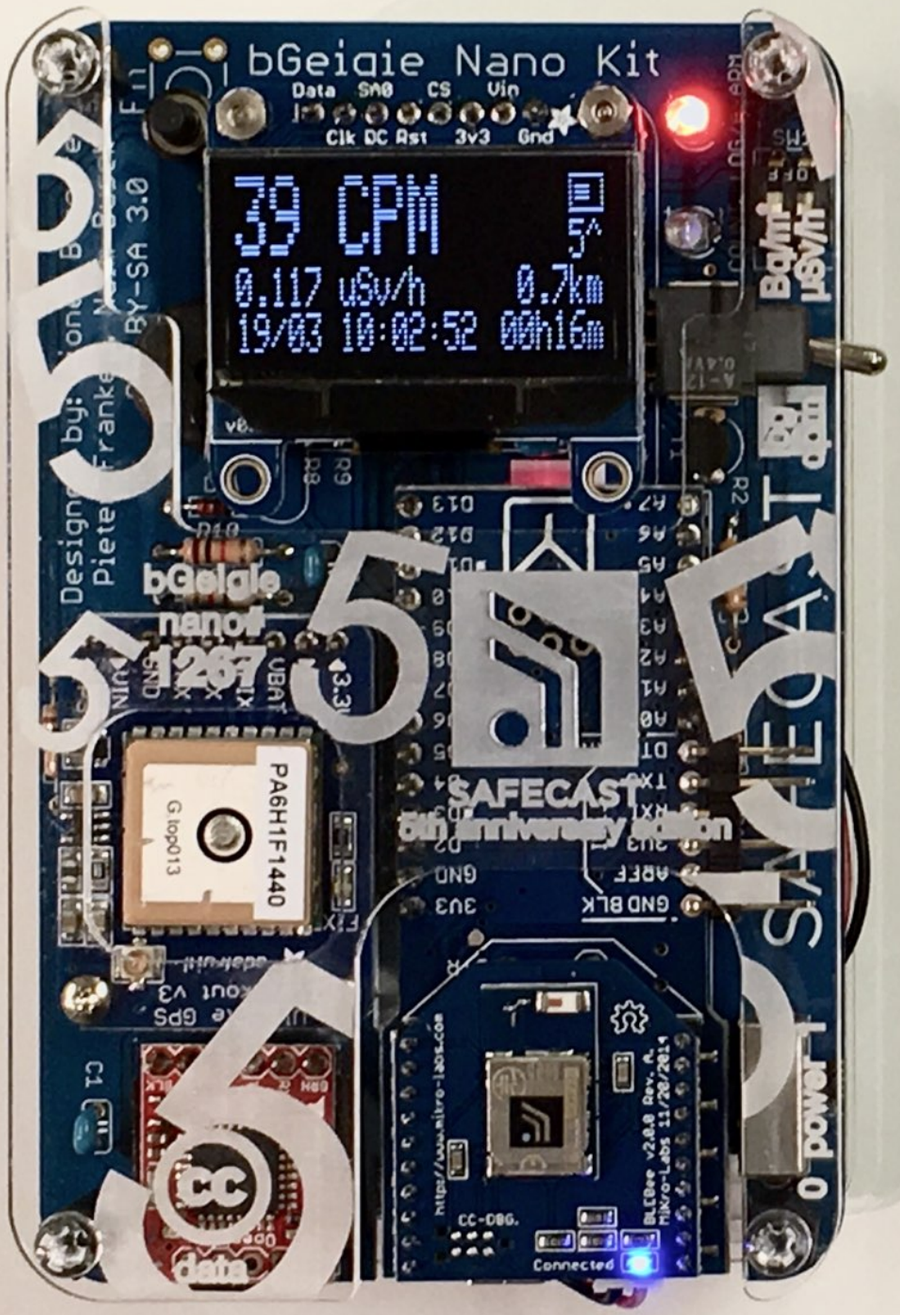
MEASUREMENT

Captured At	
2014-11-12T10:27:28Z	
Latitude	37.4701
Longitude	140.3621
CPM	72
µsv	0.22

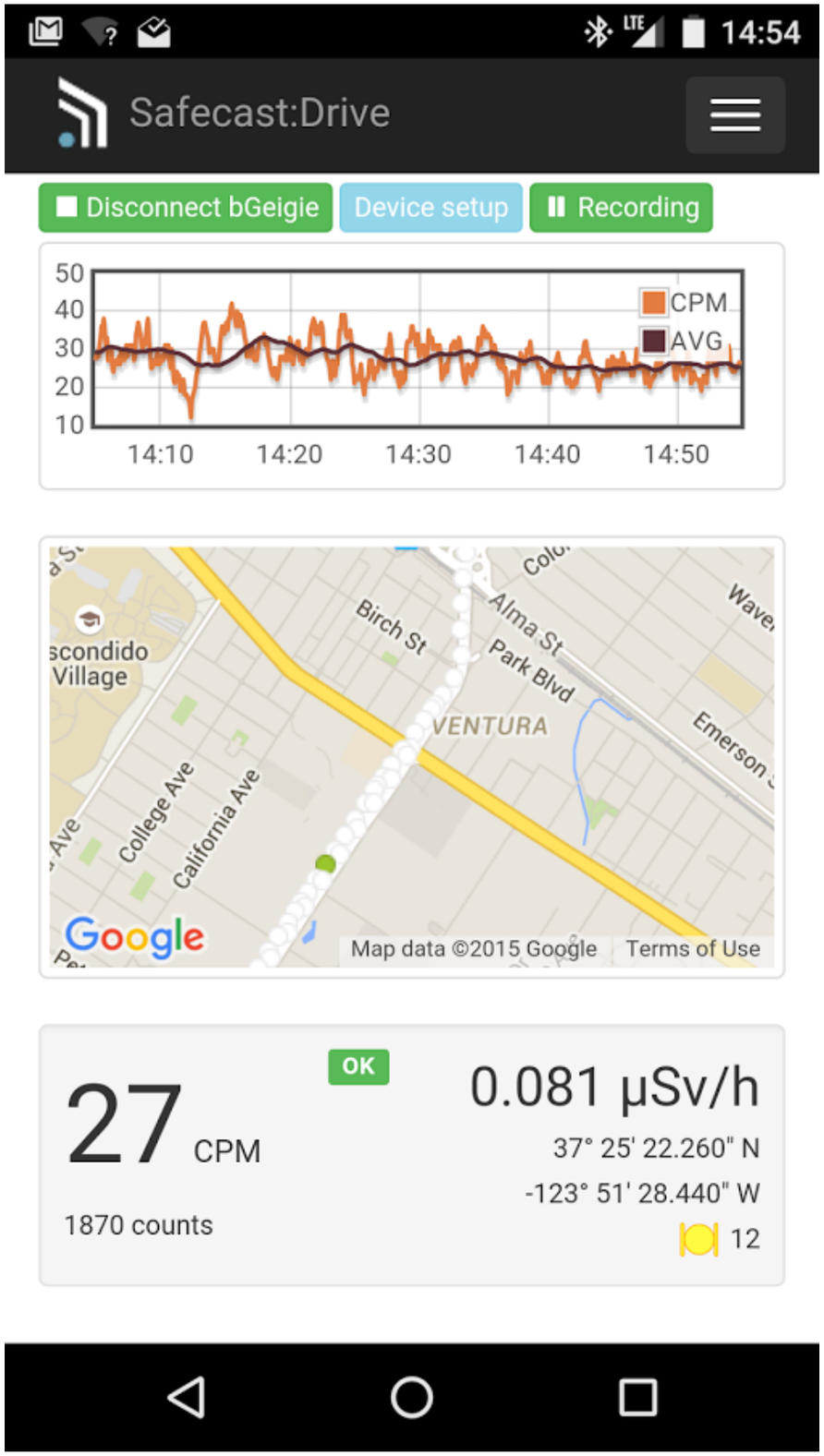


API allows each data point to be checked before approval

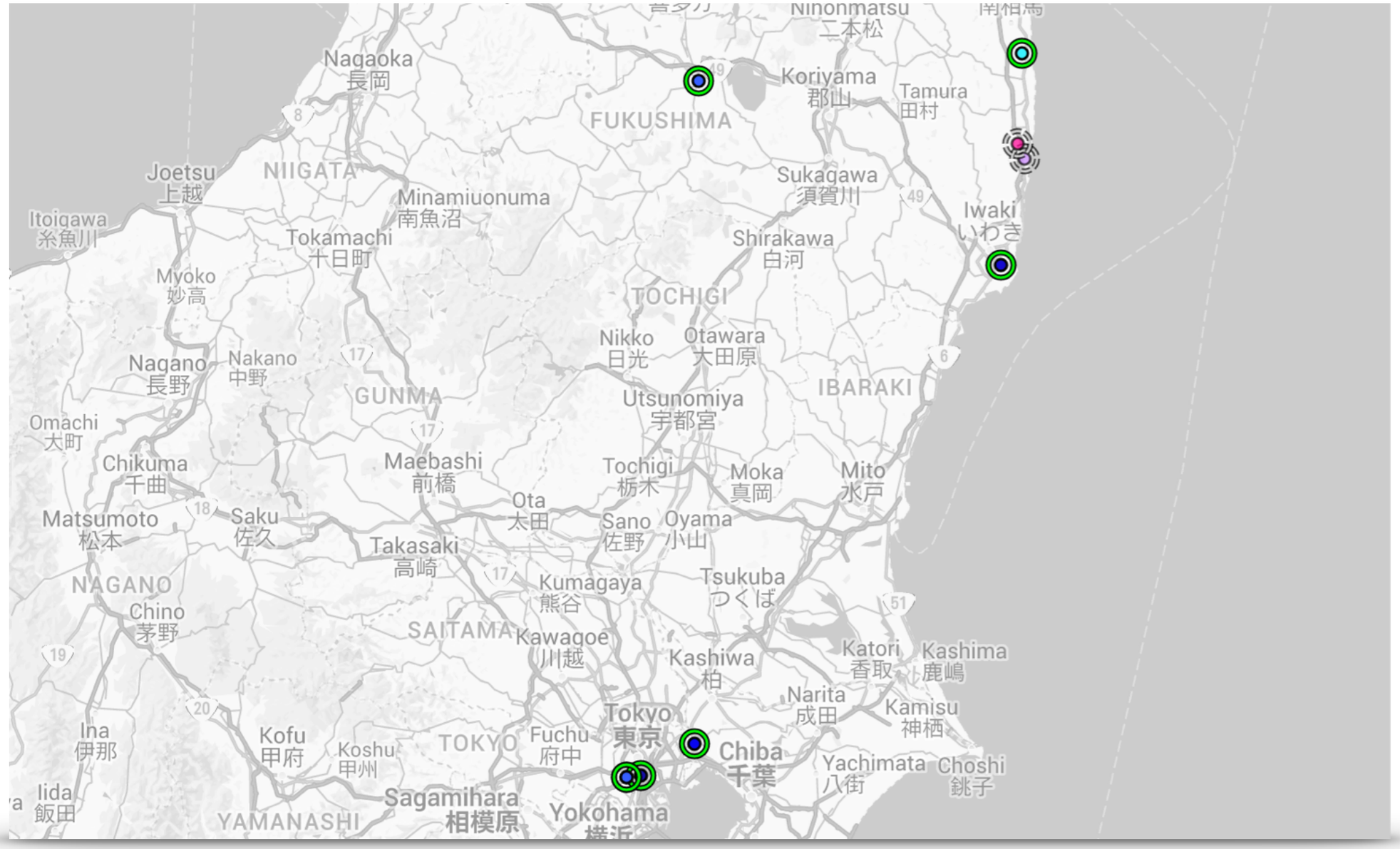
Because sometimes there's no substitute for human judgement, we think it's important to keep humans in the loop!



BLUETOOTH - ENABLED



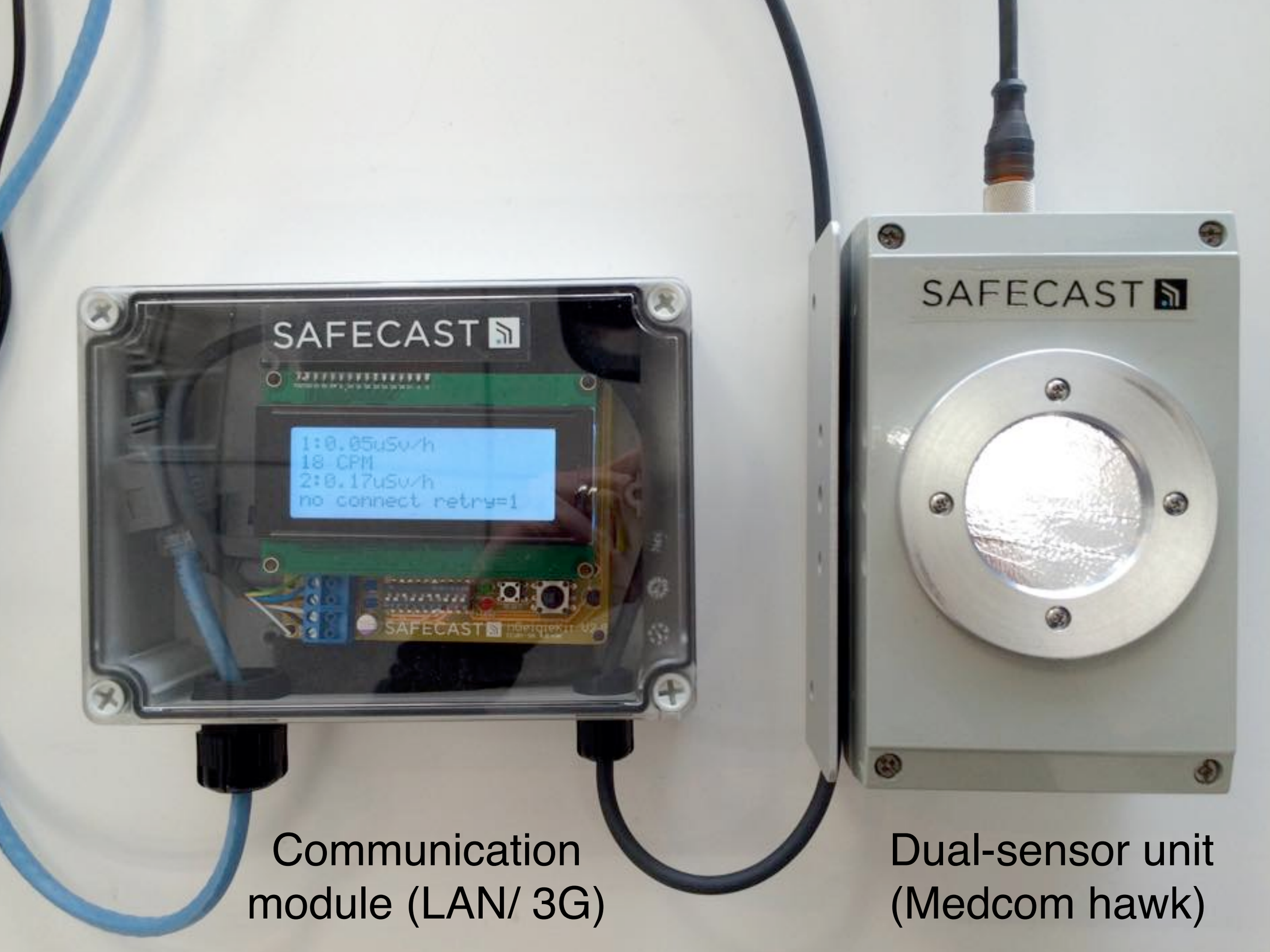
SAFECAST DRIVE APP - ANDROID



Realtime Sensors

pointcast.safecast.org

Wi-Fi
Odaka
Worker's
Base
小高ワーカーズベース



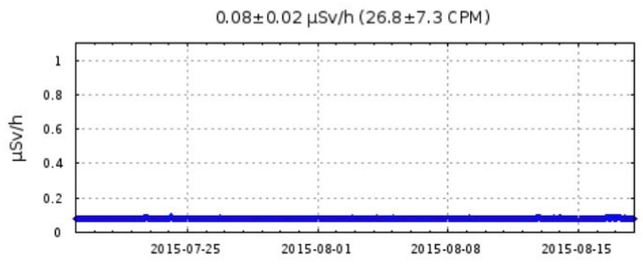
Communication module (LAN/ 3G)

Dual-sensor unit (Medcom hawk)

Japan, Tokyo, Minato-ku, Roppongi District (sensor 100022)

Online

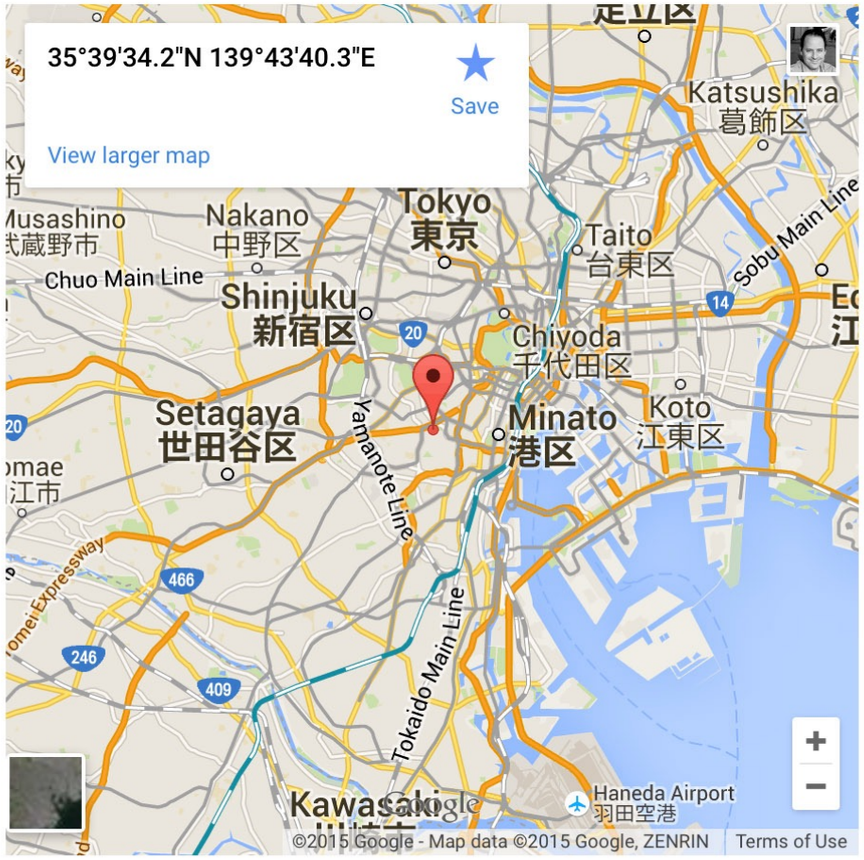
4 mins ago	4 weeks ago
24 *cpm*	43 *cpm*
0.072 *µSv/h*	0.129 *µSv/h*



More sensor data

Tube:LND7317

Share



Comments

- Ross on USA, California, Bodega Head
- Kent Noonan on USA, California, Bodega Head
- robouden on Japan, Nara, Mitsue-Mura, Safecast Nara
- Marco Kaltofen on Japan, Fukushima , Matsukawa, Seirinji
- Safecast on Japan, Tokyo, Shibuya, Safecast Office
- Rob Oudendijk on Japan, Tokyo, Shibuya, Safecast Office
- Jam on Taiwan, Taipei, Fabcafe
- robouden on Taiwan, Taipei, Fabcafe
- robouden on Taiwan, Taipei, Fabcafe
- Tim Wong on Taiwan, Taipei, Fabcafe

Leave a Reply

Name (required)

Email (will not be published) (required)

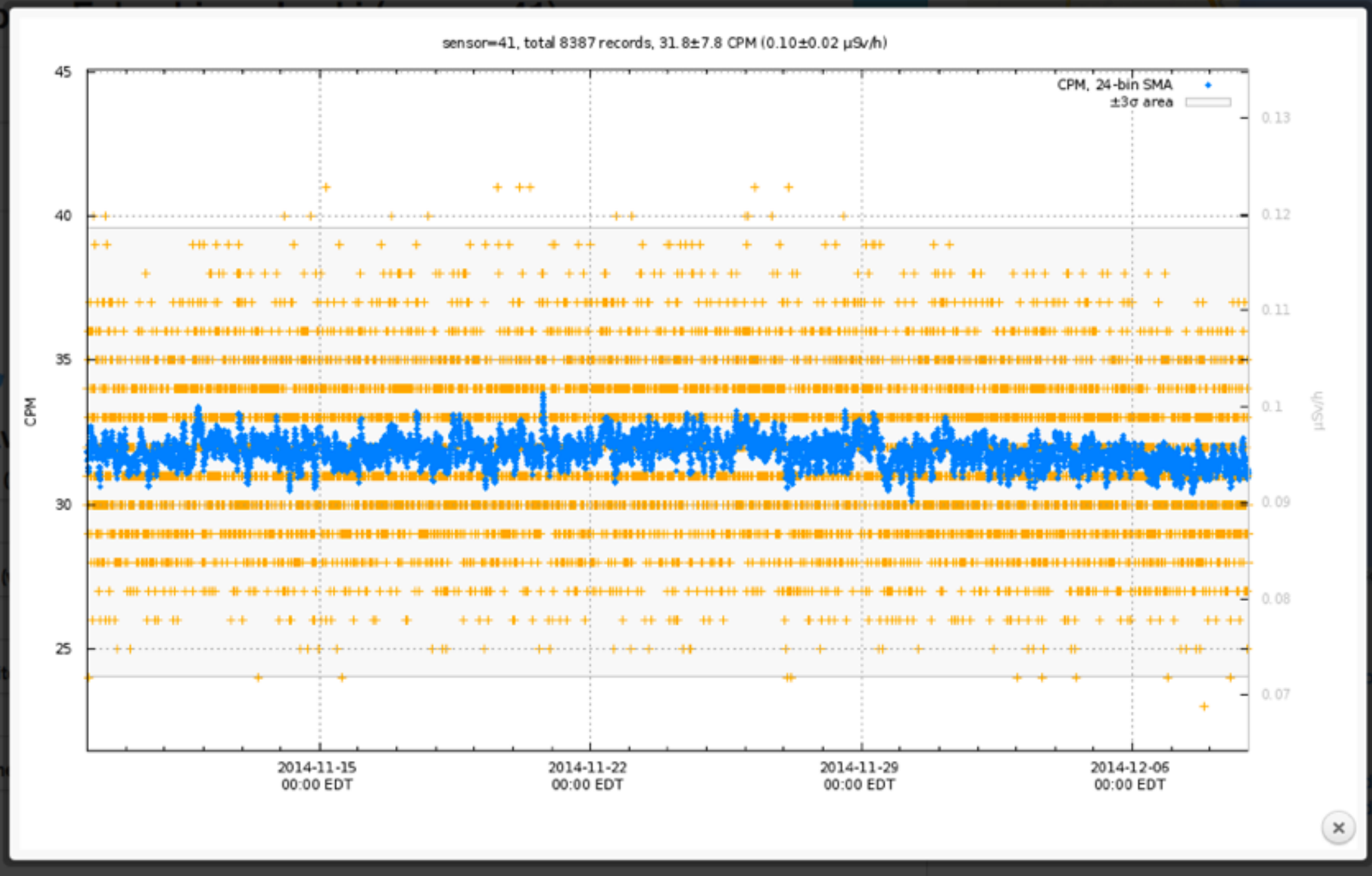
Website

Comment

Pointcast unit webpage allows feedback and queries

Bgeigie Import #17323 \\ | Safecast Tile Map | Japan, Fukushima, IwakiSA

realtime.safecast.org/sensor/41



Detailed view of time series

Community

Ad-hoc network

More

More

More

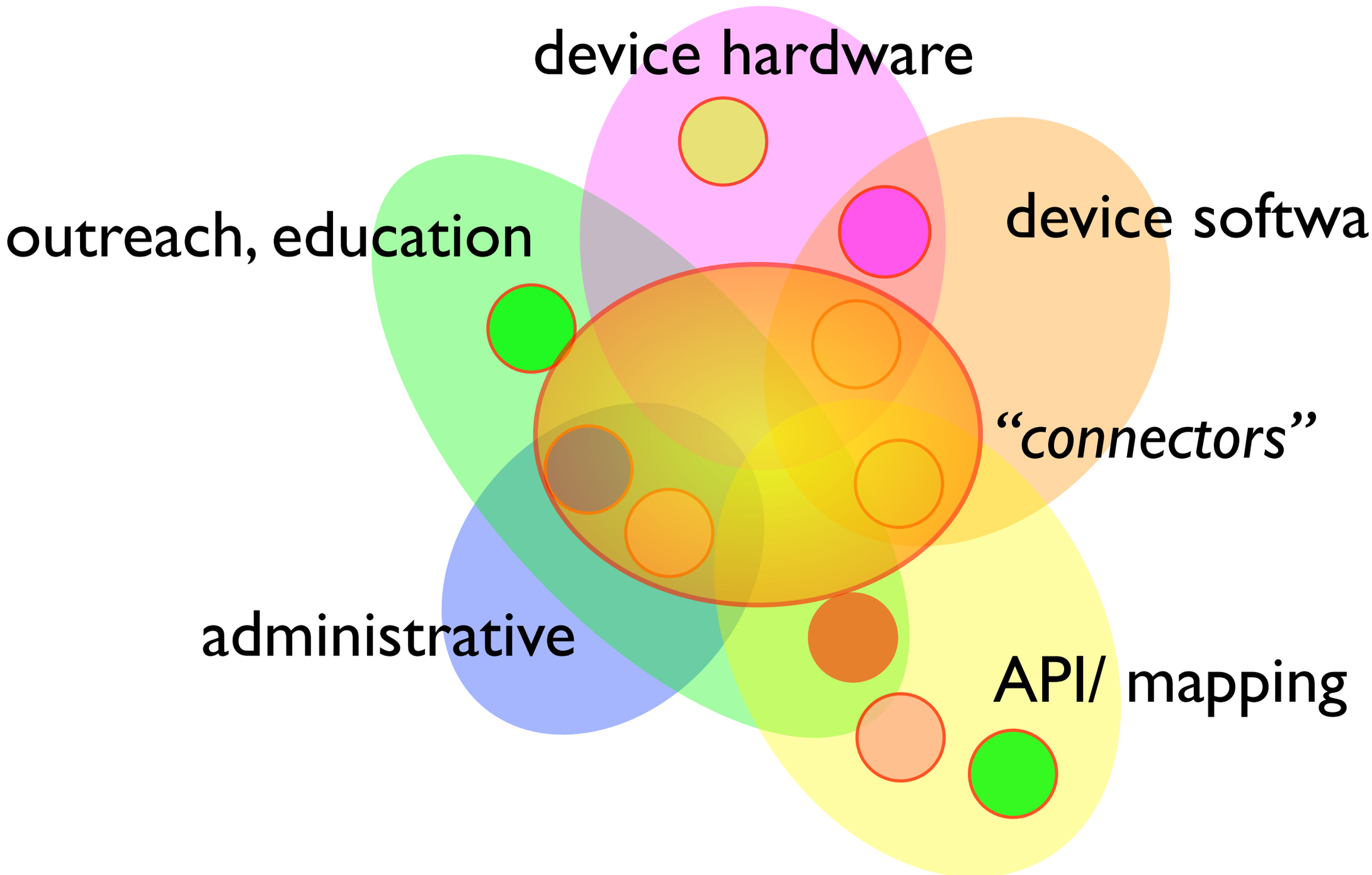
More

More

More

More

Our Teams



Lots of multitasking, multi-competence

Building Community

We want to encourage people to get involved.
This requires skills in education and media.

- Strong social-media presence —
  blog, discussion, Facebook, Twitter, etc
- Device-building workshops
- Talks and presentations
- Media interviews

SAFECAST

ABOUT - | MAPS | DATA - | FAQ | DONATE | HOW TO HELP | MAILING LIST

English
日本語

‹ Development: Real-Time Interpolation | Safecast OS X | Updated Safecast Webmap! | Safecasting DC | Safecasting Iraq: Open ›

ABOUT SAFECAST

Safecast is a global project to empower people with data, primarily by mapping radiation levels and building a sensor network, enabling

Learn More

OUR PROJECTS

Safecast is a global sensor network for collecting and sharing radiation measurements to empower people with data about their environments.

Learn More

DONATE

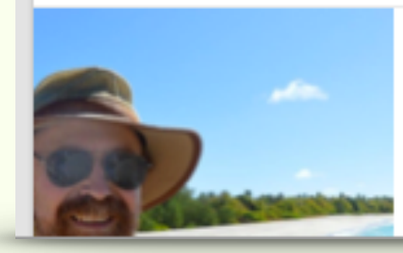
Safecast is made possible entirely thanks to tax deductible donations from people like you. We are a registered US 501(c) 3 non profit

Learn More

(日本語) BGEIGIE NANOの使用説明ーYOUTUBE動画

Sorry, this entry is only available in 日本語.

Posted on Saturday January 24th, 2015 07:16 PM Comment

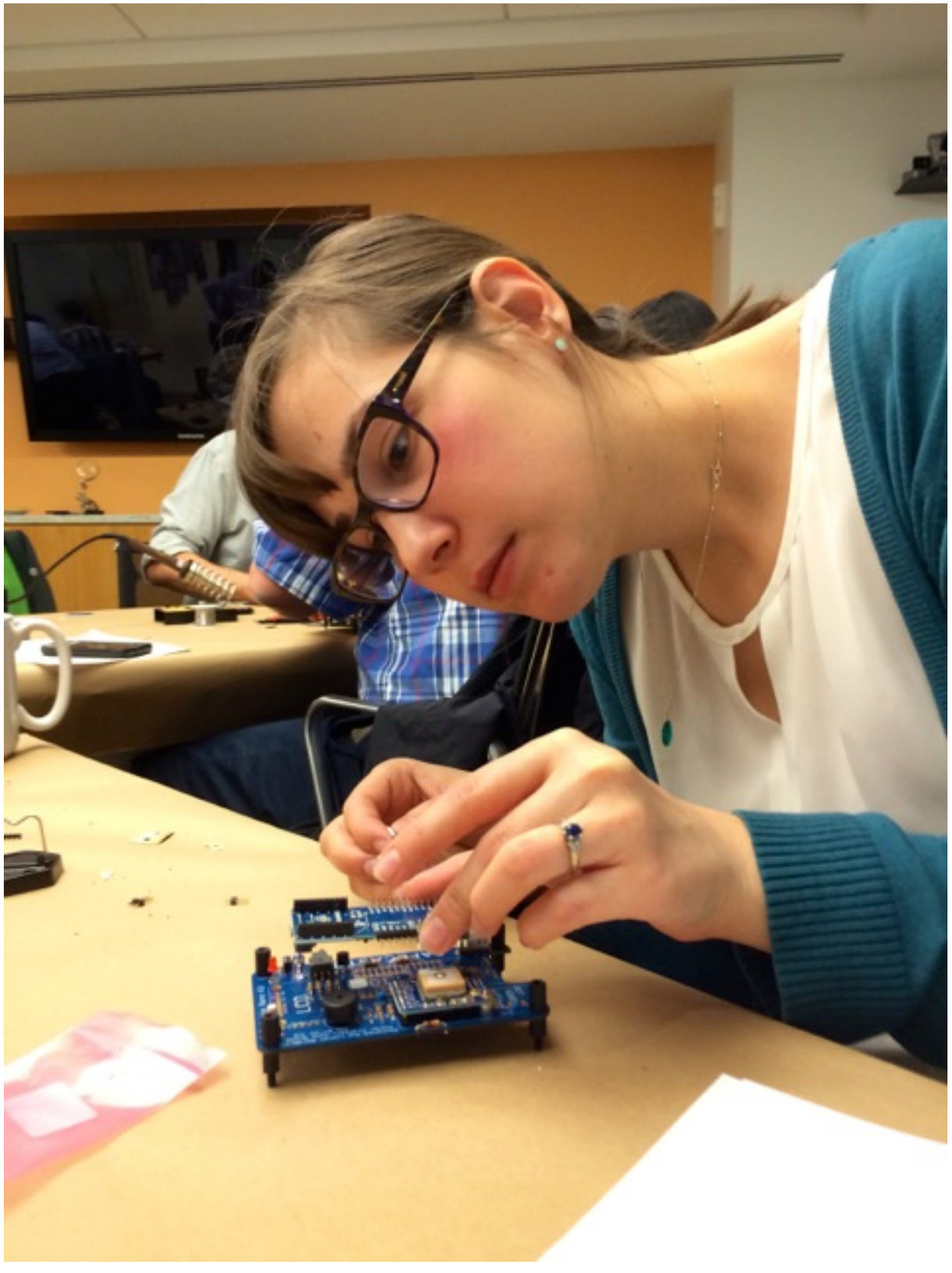


HELLO BIKINI !

Above: Dr. Buesseler on the beach at Bikini. We recently got some unique uploads from Bikini and Enewetak Atolls, courtesy of Dr. Ken Buesseler, of

Search Here Go

safecast.org



Recent workshops in:

Tokyo

Fukushima

Kobe

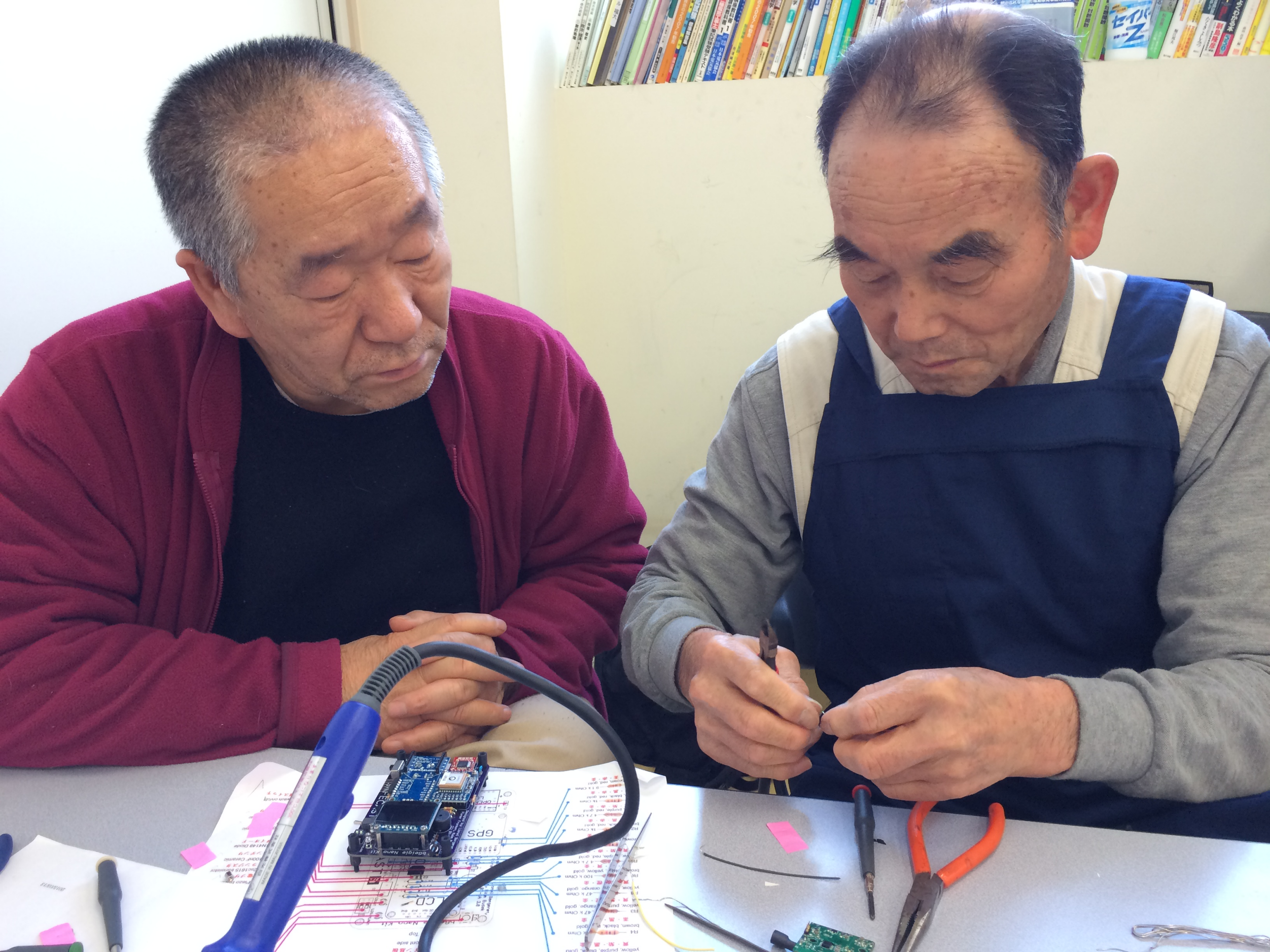
Washington, DC

Strasbourg

Taipei

Hong Kong

Geiger-counter building workshop with students in Koriyama
(They then become volunteers, contribute radiation readings,
and teach others)



CITIZEN SCIENCE:

- Where does the Safecast project lie within the spectrum of citizen science?
- ‘Crowd science’, ‘networked science’, ‘massively collaborative science’ ?
- Defined differently in different contexts
- Qualitative definitions and evaluative principles?
- Objective criteria for what constitutes ‘success’ ?

‘With appropriate protocols, training, and oversight, volunteers can collect data of quality equal to those collected by experts’

(Bonney, 2014)

CROWDSOURCING:

- Meaning of crowdsourcing has evolved
- Safecast's primary goal is to assemble database of observations
- Based on open-source hardware and software
- The achievement of specific social outcomes, such as promotion of openness, is a major motivation from the start
- Ad-hoc voluntary structure which embodies the emerging open collaborative culture

INFORMATION COMMONS:

- Decisions often reached through informal discussion
- Fluid decision making procedures
- Data-organization choices often impromptu, driven by affordances of open digital platforms
- Informal or semiformal hierarchies of authority, vs professional accreditation
- Norms that facilitate trust

OPENNESS and TRANSPARENCY:

- Have been key components of the Safecast project from the start.
- Use of open-source hardware and software is considered essential.
- All designs are publicly available for scrutiny.
- Any outside observer can independently evaluate the group's tools and methodology.
- Open-data publication principles go hand-in-hand with this approach.

WHAT IS SUCCESS?

- Key Metrics: Database size, how many users, how many detectors, etc..
- Intangibles: Perceived shifts in attitudes in society, a growing sense of community
- Increased interest in the capabilities of citizen scientists worldwide

For Safecast as a project, the intangibles are arguably as important as the metrics.

‘...Safecast is as crisp an example as we have for how mutualism can serve as a successful workaround for failure (whether for lack of capacity or, more likely, for lack of political will) of a public body.’

(Benkler, 2013)

SUMMARY:

Though groups like Safecast can help fill crucial gaps, ultimately the timely provision of data that citizens need to make informed decisions about their livelihoods and well-being is the government's responsibility.

The rise of citizen science should be seen as a very positive development, one of the few bright spots that have emerged following the Fukushima disaster.

SUMMARY:

The technical capabilities occasioned by the open-source and digital fabrication movements are poised to put increasingly sophisticated scientific and communication tools in the hands of average citizens worldwide.

This will continue to require social and regulatory accommodation and adjustment as governments and other established stakeholders grow to understand the implications of the changing information landscape and, hopefully, are motivated to reach mutually beneficial relationships with citizen scientists like those at Safecast.

“Emancipatory Catastrophism”

(Ulrich Beck)

www.safecast.org

end