# **SAFECAST**:
# Tool for public information and engagement during and after nuclear emergencies

Azby Brown

RICOMET 2015
BRDO Castle, Slovenia
June 15, 2015

# March 11, 2011

From the point of view of average citizens:

After March 11, 2011:

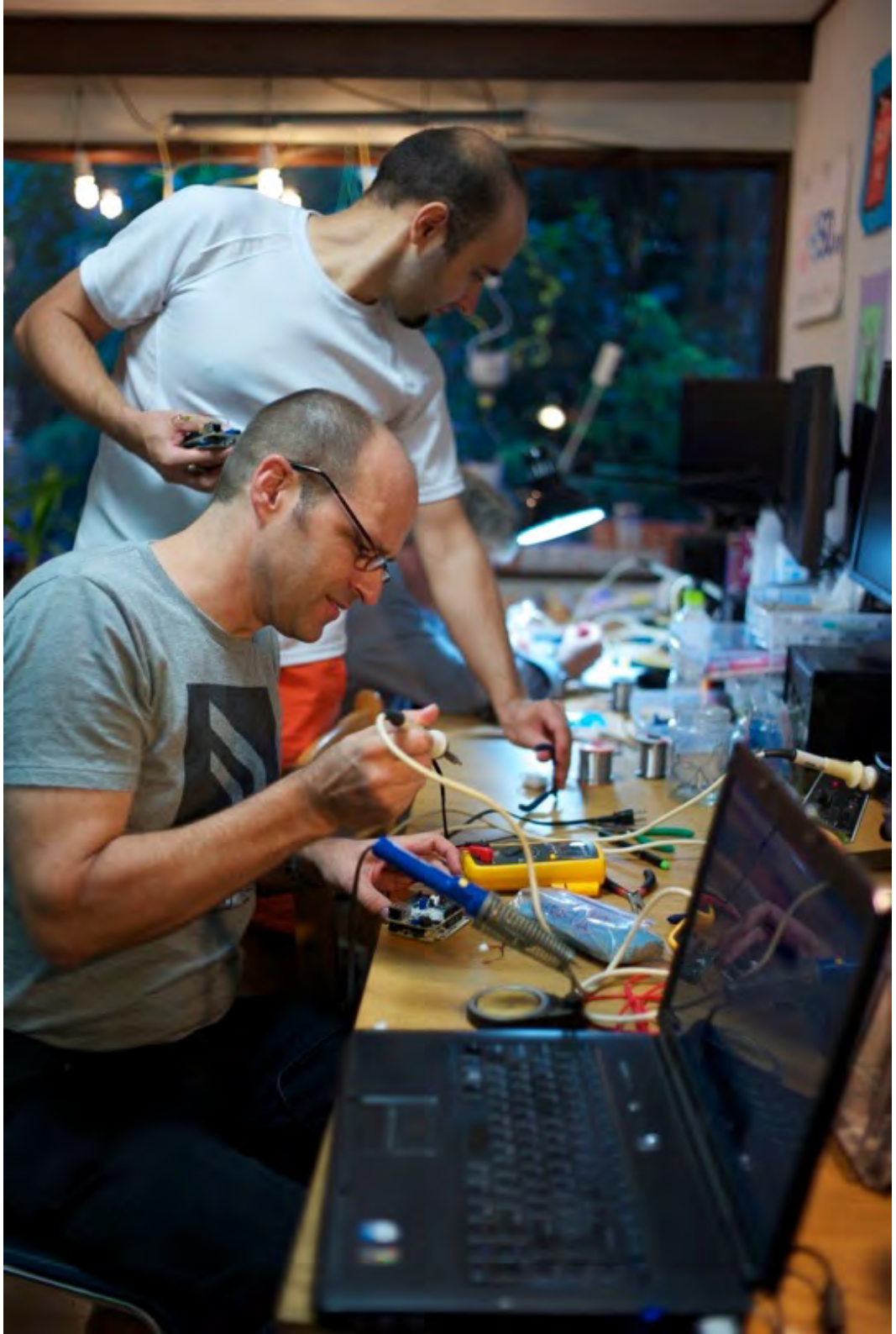
- Fear, need to decide soon whether to flee
- Information vacuum
- Official sources deemed untrustworthy
- Social media paints more dire picture
- Even knowledgeable people can’t find enough reliable and useful data

# In Response:

-We developed devices

-We made a mapping system

-We built a community of motivated citizen-scientists who want to measure radiation.



# Evolving according to needs:

*Early Phase: “Reality Check”*

*Transitional Phase: “Enablement”*

*Long-term: “Alternatives”*

# SAFECAST today:

- International, ad-hoc volunteer network
- Non-heirarchical (but with “centers of gravity”)
- Includes radiation experts, hardware designers, software designers, academics, tinkerers, hackers, entrepreneurs, housewives, drivers, students, etc.
- “Brain Trust” : Leaders in their fields
- We are neither pro- nor anti-nuclear.
  We are Pro-Data !

# Funding:

- Individual donations
- Crowdfunding:  Global Giving
- Kickstarter campaigns
- Support from private foundations
- In-kind support from manufacturers, etc.
- Most importantly, people donate their time

-Topic 1: The technical side

-Topic 2: The human side

Our first systems were bulky, but worked.

# 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

# Devices:

- Primarily mobile to maximize coverage
- New fixed sensor network to log changes over time
- Iterative design, “agile and lean” development
- Open-source, open hardware, open data
- 7+ generations of devices in 2 1/2 years
- GPS, data-logging, tied to our API
- Emphasize ease of use, consistency, ruggedness, speed of deployment, cost-effectiveness
- Industry-standard 2” pancake GM tube (LND 7317) in most devices

# Deployment:

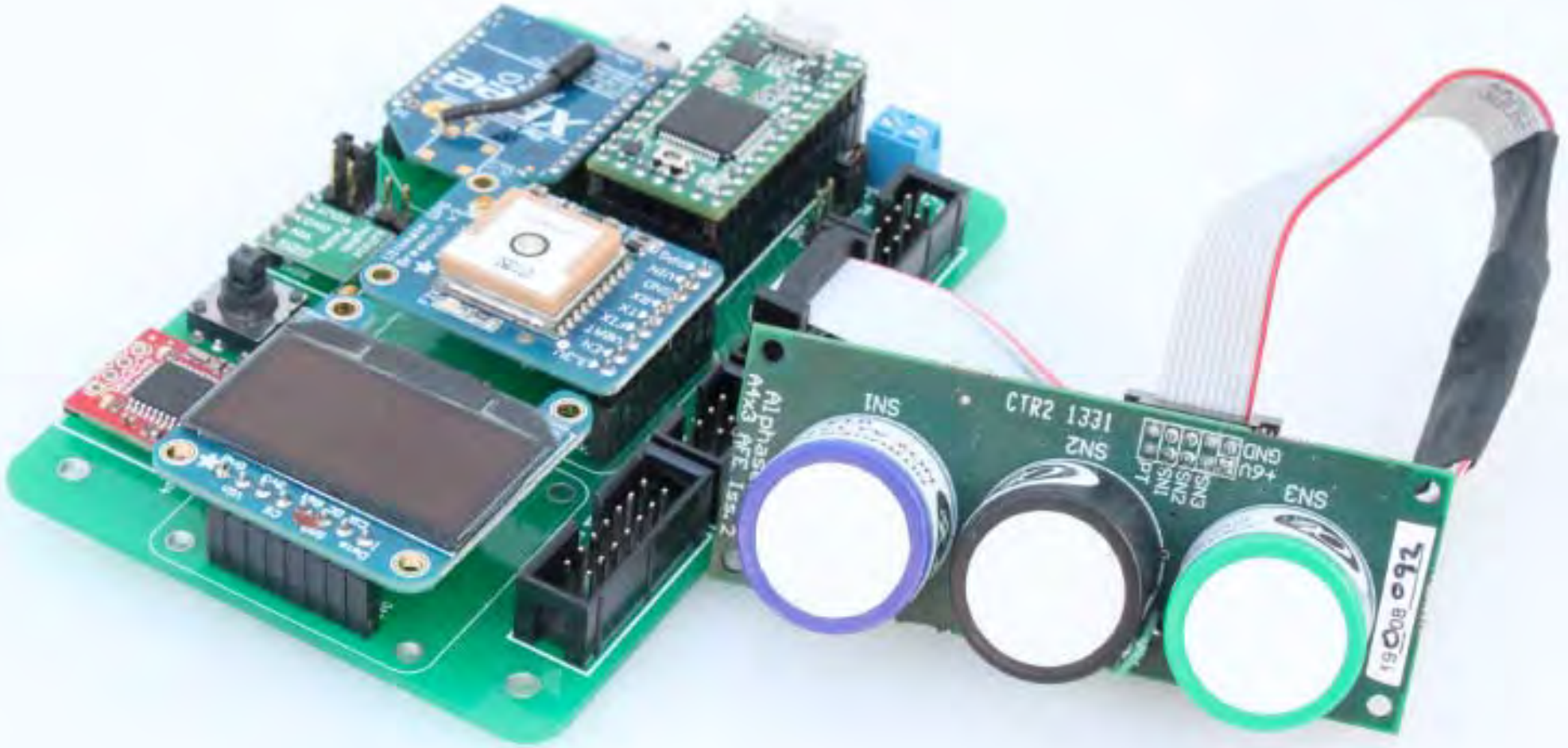
Automobile

Bicycle

Hand-carry

Aerial drone
(under development)

# SAFECAST Air



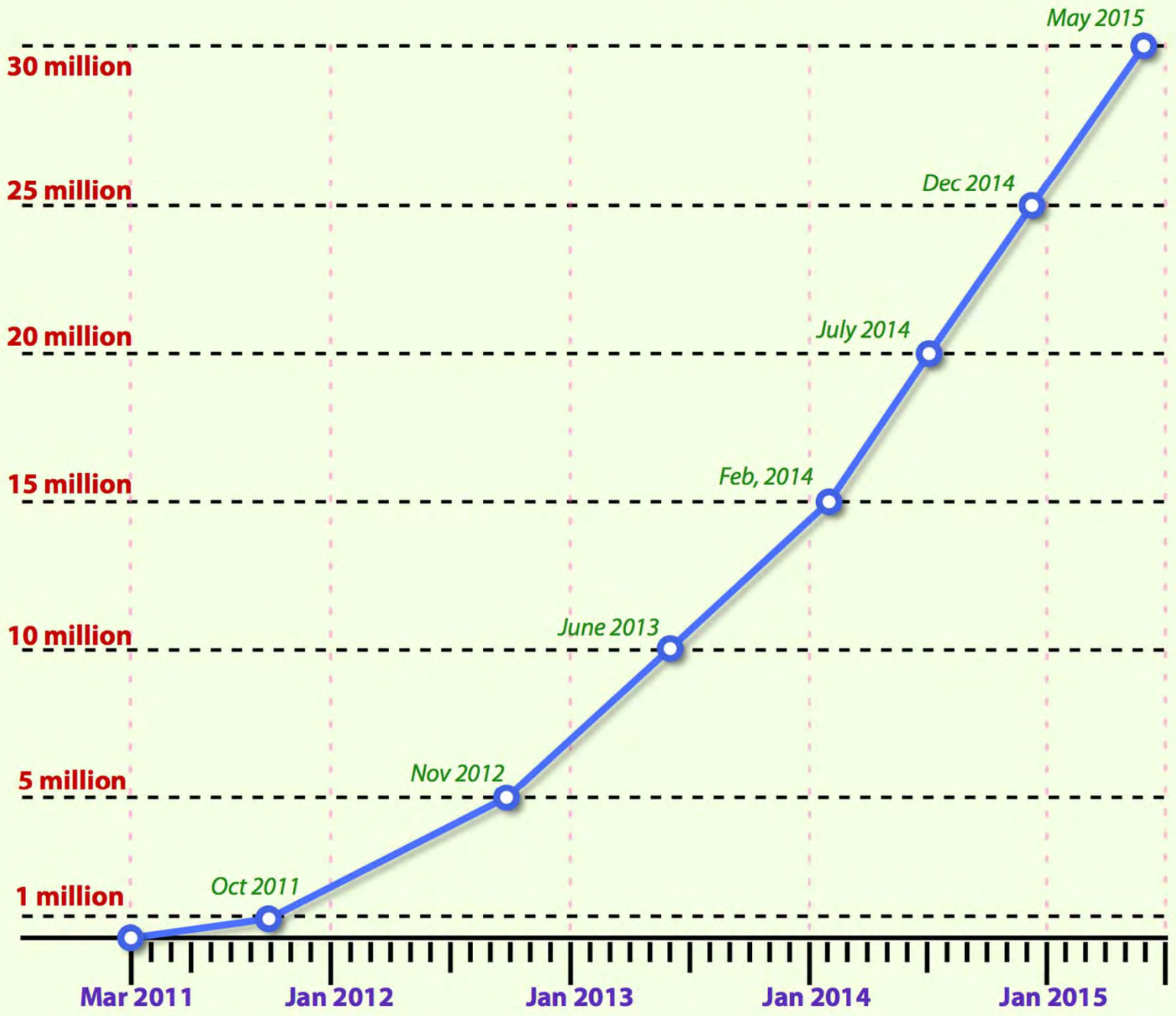

Prototype, 2015

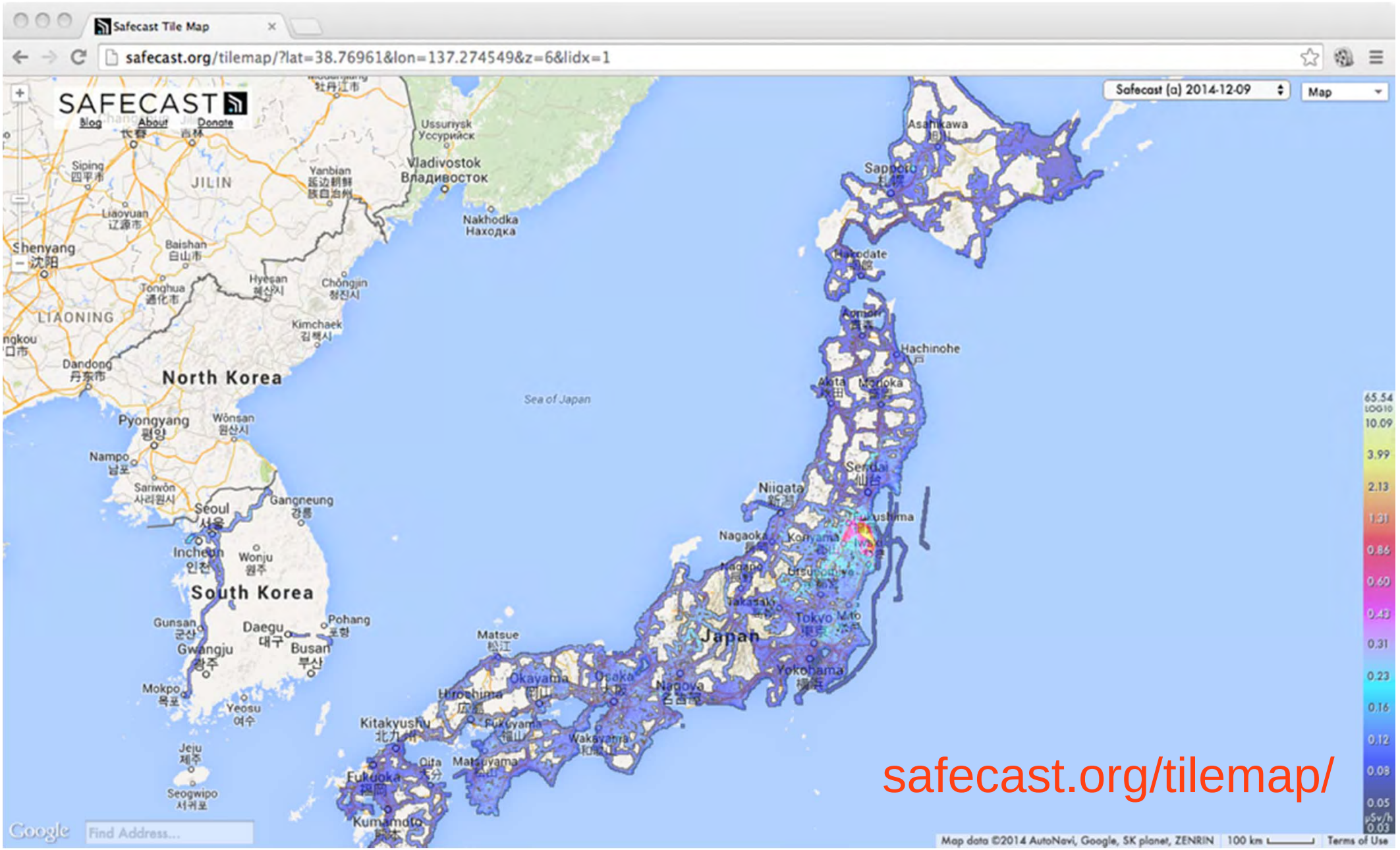
iOS OS X Web

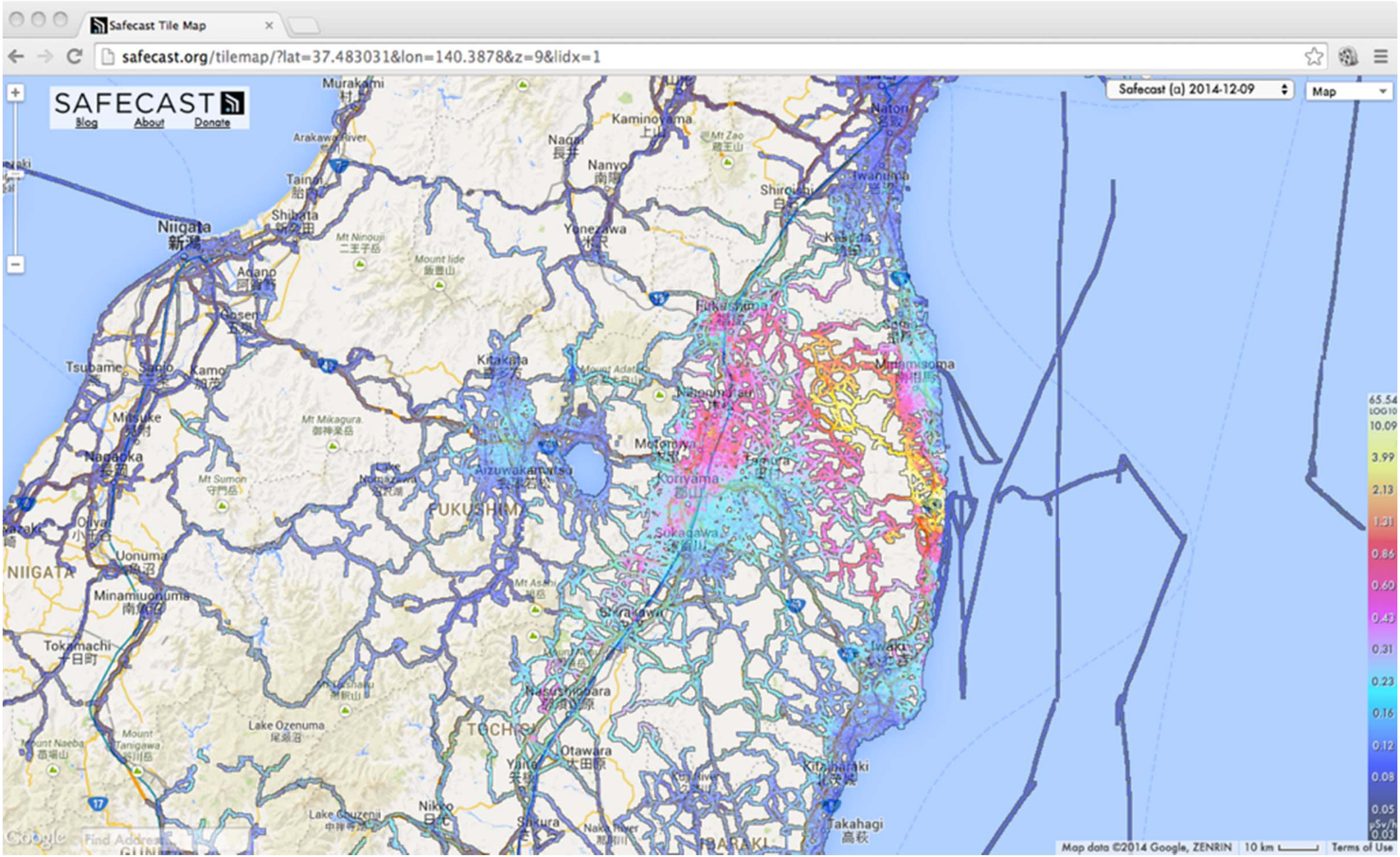
# Map system:

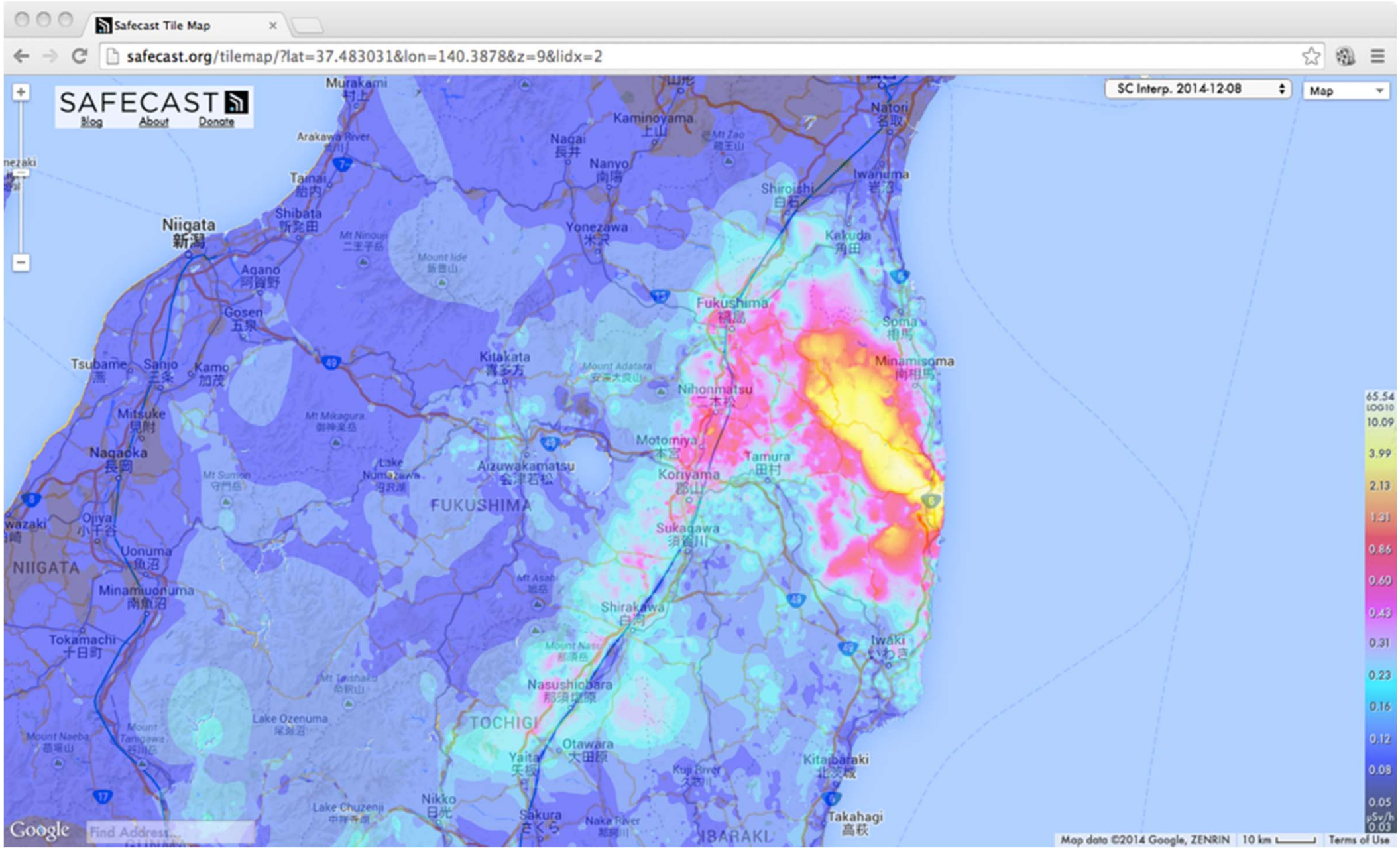
- Database updated daily, now approx 10GB
- Both server-fed webmaps and smart-client iOS and OSX apps
- API with query/filtering by time, location, device, etc.
- Approx 360 volunteers have uploaded data. But 90% is contributed by the most active 10%.
- Data and system are open-source (Creative Commons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

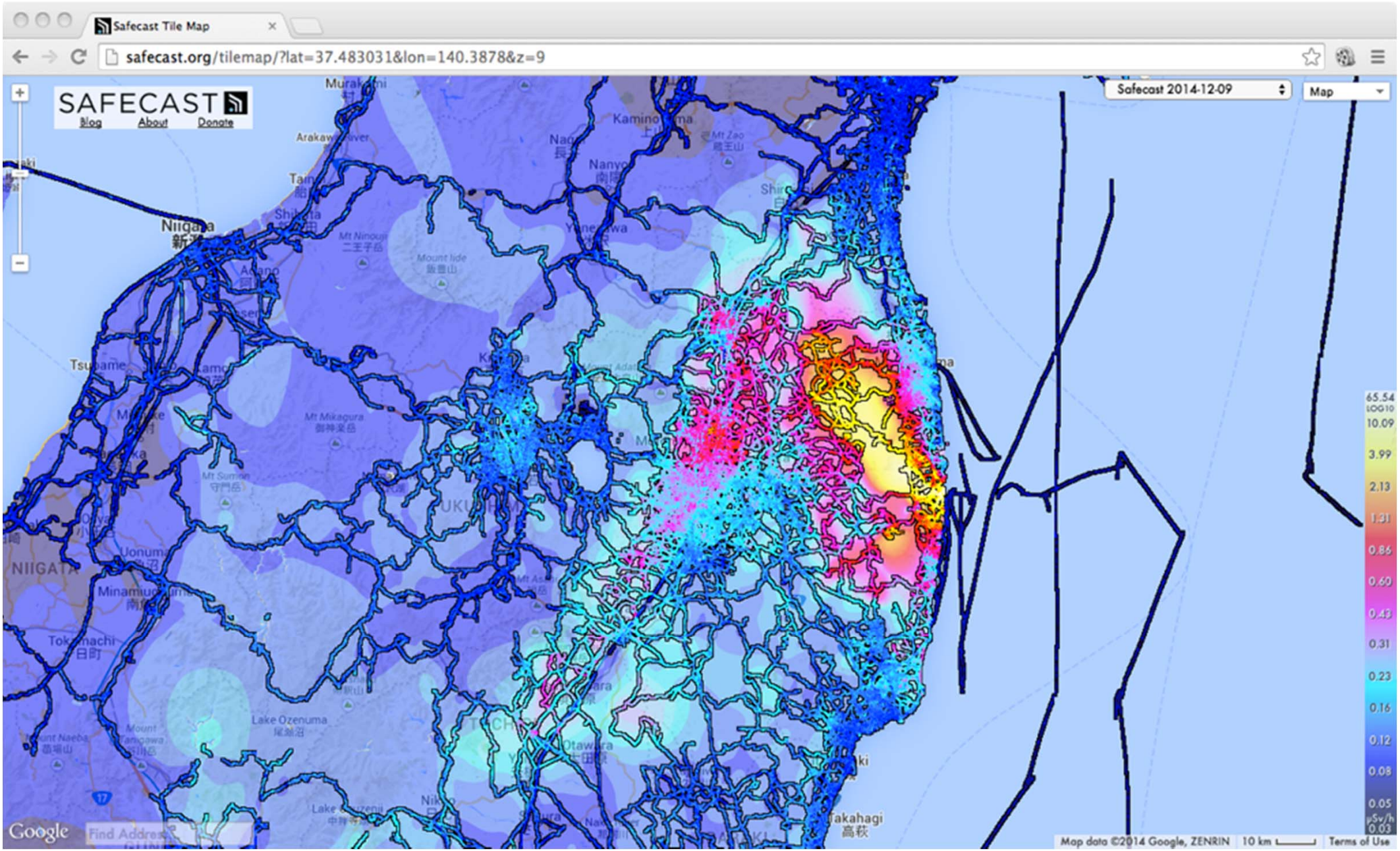
# Growth of SAFECAST dataset

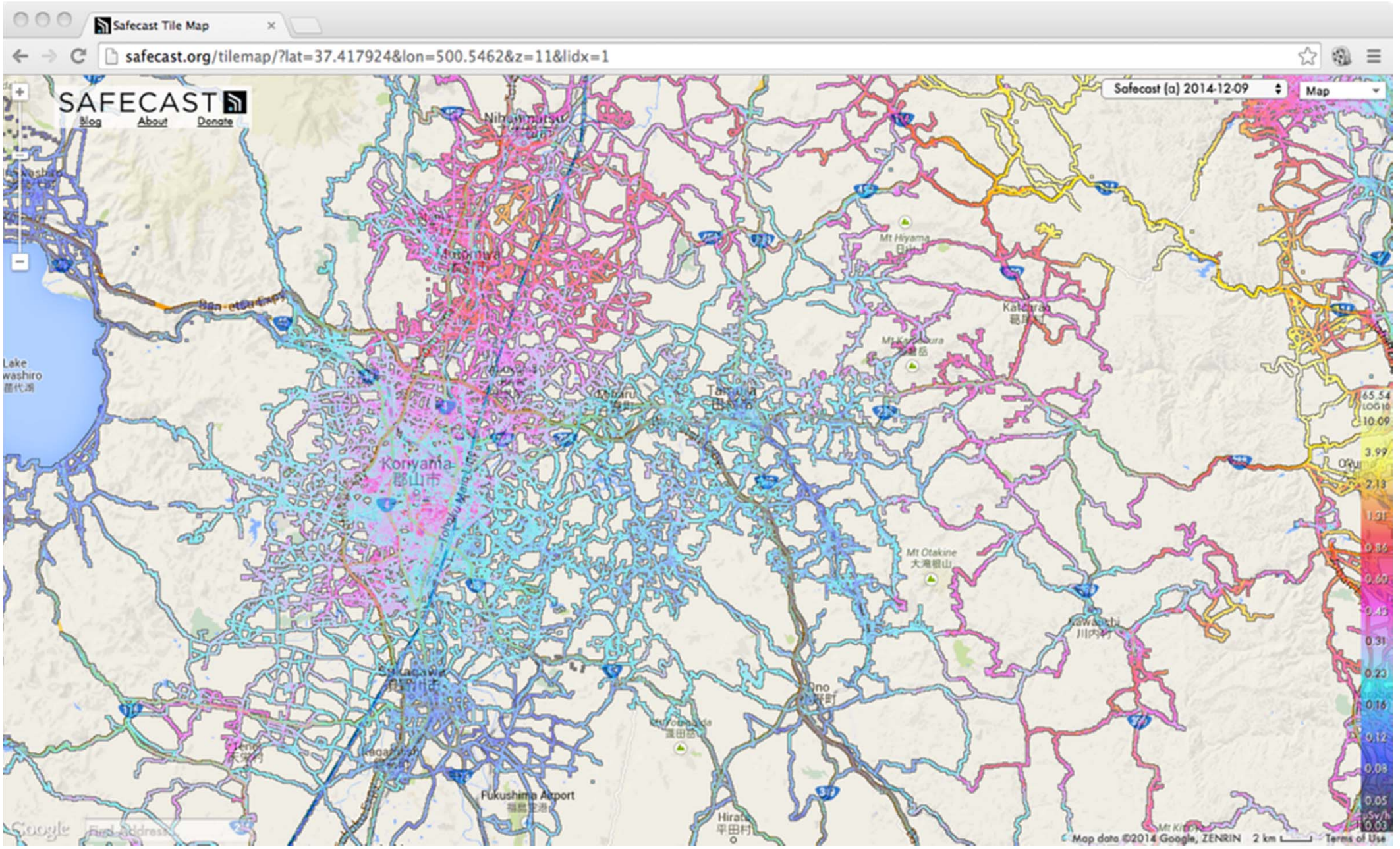


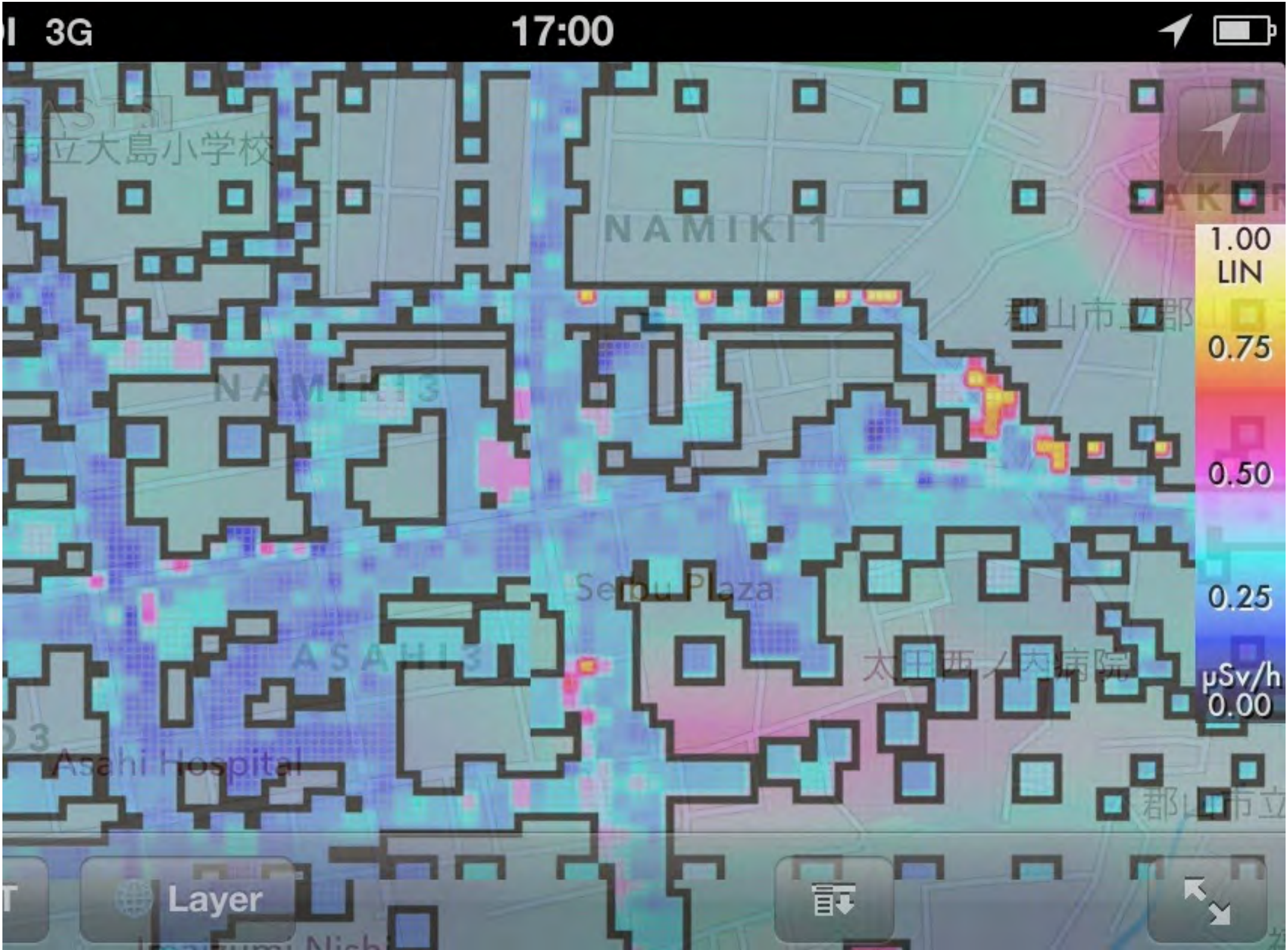

Safecast Tile Map
safecast.org/tilemap/?lat=38.76961&lon=137.274549&z=6&lidx=1
SAFECAST
Blog
About
Donate
Safecast (a) 2014-12-09
Map
North Korea
South Korea
Japan
Sea of Japan
Pyongyang
Seoul
Tokyo
Sapporo
Vladivostok
Nakhodka
Niigata
Nagoya
Osaka
Hiroshima
Fukuoka
Kumamoto
Yokohama
65.54
10.09
3.99
2.13
1.31
0.86
0.60
0.43
0.31
0.23
0.16
0.12
0.08
0.05
0.03
μSv/h
Google
Find Address...
Map data ©2014 AutoNavi, Google, SK planet, ZENRIN
100 km
Terms of Use
safecast.org/tilemap/

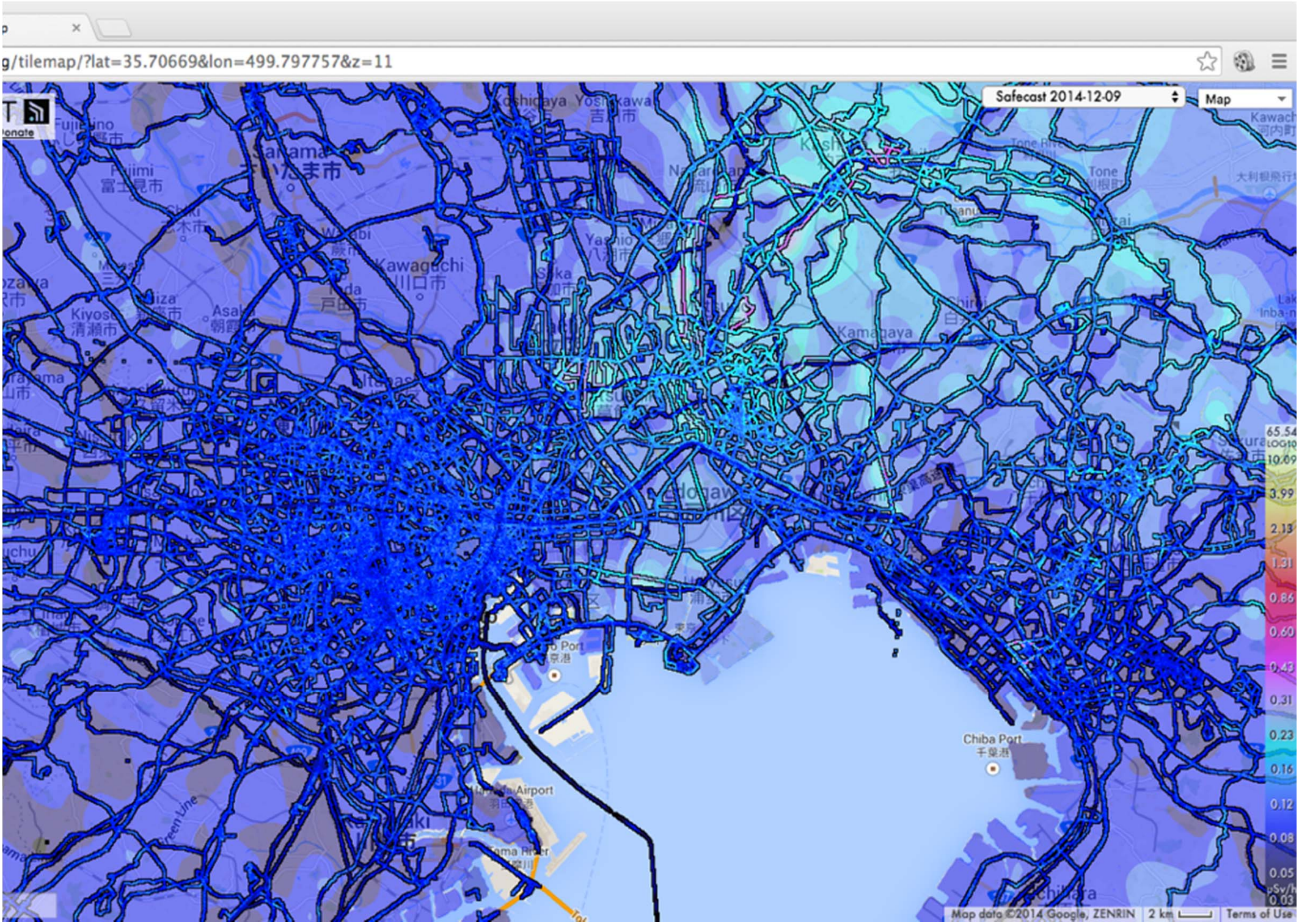

Safecast Tile Map
safecast.org/tilemap/?lat=37.483031&lon=140.3878&z=9&lidx=1
SAFECAST
Blog
About
Donate
Safecast (a) 2014-12-09
Map
Murakami
Arakawa River
Tainai
Shibata
Niigata
新潟
Agano
Gosen
Tsubame
Sanjo
Kamo
Mitsuke
Nagaoka
Oiya
Uonuma
NIIGATA
Minamiuonuma
Tokamachi
Mt Ninouji
Mount Iide
Mt Mikagura
Mt Sumon
Lake Nomazawa
Lake Ozenuma
Mount Naeba
Mount Tanigawa
Lake Chuzenji
Nikko
Kitakata
Aizuwakamatsu
FUKUSHIMA
Nagai
Nanyo
Kaminoyama
Yonezawa
Mt Zao
Shiroishi
Natori
Iwanuma
Kakuda
Fukushima
Soma
Minamisoma
Nihonmatsu
Motomiya
Koriyama
Tamura
Sukagawa
Shirakawa
Iwaki
Nasushiobara
TOCHIGI
Otawara
Yaita
Sakura
Kitaibaraki
Takahagi
IBARAKI
Map data ©2014 Google, ZENRIN
10 km
Terms of Use
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
0.03
μSv/h

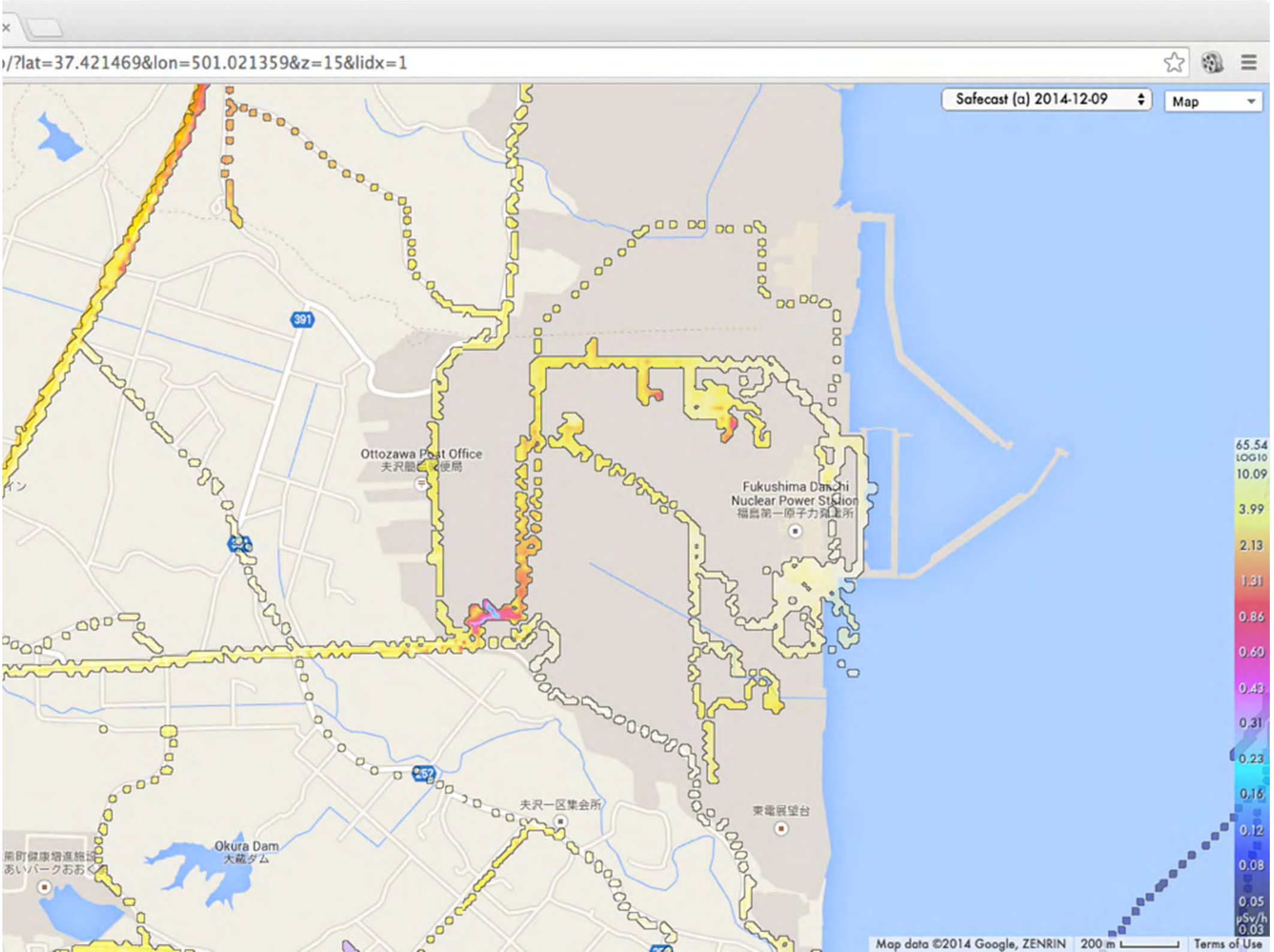

Safecast Tile Map
safecast.org/tilemap/?lat=37.483031&lon=140.3878&z=9&idx=2
SAFECAST
Blog
About
Donate
SC Interp. 2014-12-08
Map
Murakami
Kaminoyama
Natori
Nagai
Nanyo
Iwanuma
Shiroishi
Tainai
Shibata
Niigata
新潟
Yonezawa
Kakuda
Agano
Fukushima
Soma
Gosen
Kitakata
Minamisoma
Tsubame
Sanjo
Kamo
Nihonmatsu
Mitsuke
Motomiya
Nagaoka
Tamura
Aizuwakamatsu
Koriyama
FUKUSHIMA
Ojiya
Sukagawa
Uonuma
NIIGATA
Shirakawa
Minamiuonuma
Iwaki
Tokamachi
Nasushiobara
TOCHIGI
Otawara
Yaita
Kitaibaraki
Takahagi
Nikko
Sakura
IBARAKI
Google
Find Address...
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

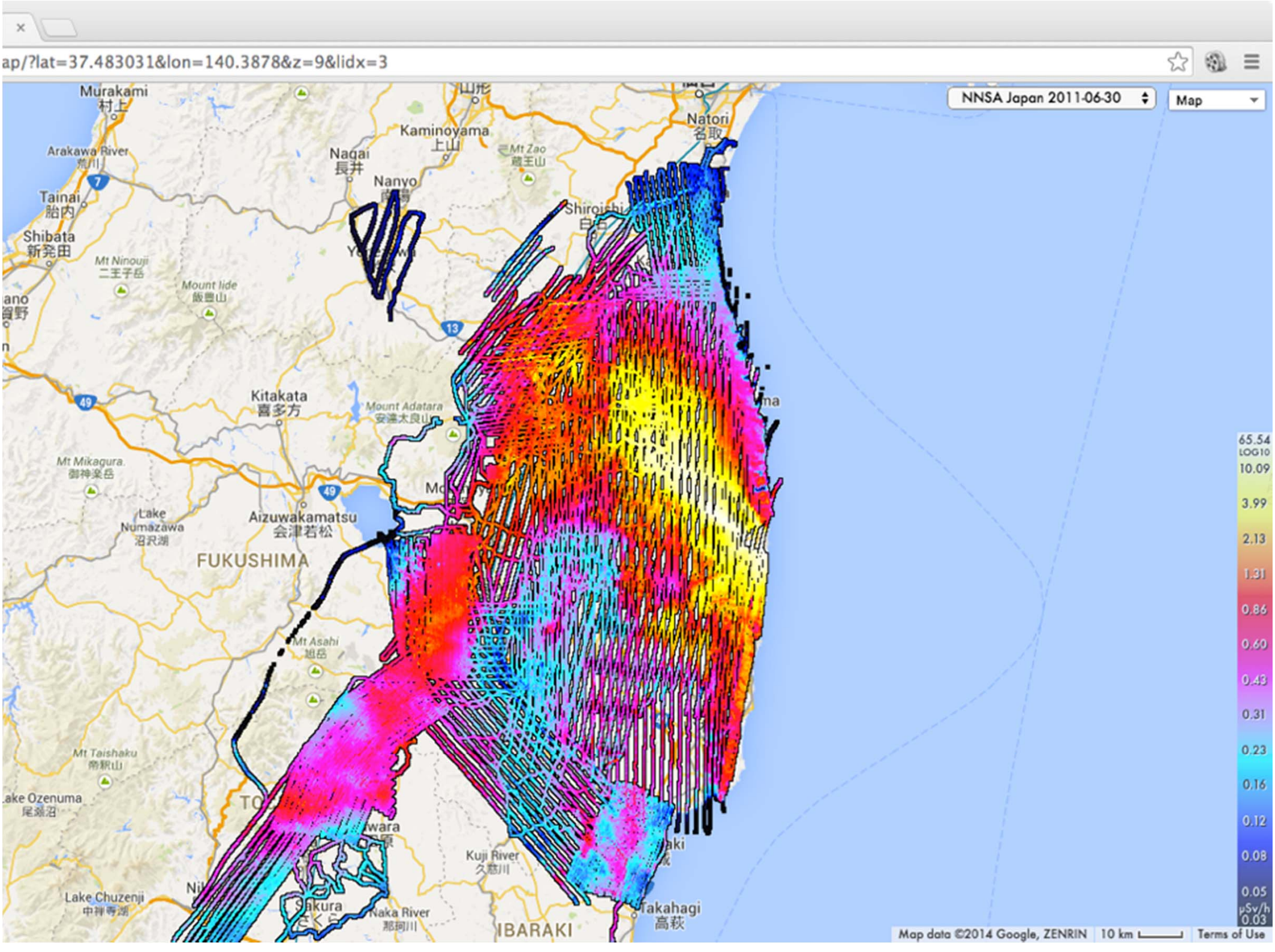

Safecast Tile Map
safecast.org/tilemap/?lat=37.483031&lon=140.3878&z=9
SAFECAST
Blog
About
Donate
Safecast 2014-12-09
Map
65.54
LOG10
10.09
3.99
2.13
1.31
0.86
0.60
0.43
0.31
0.23
0.16
0.12
0.08
0.05
μSv/h
0.03
Google
Find Address
Map data ©2014 Google, ZENRIN
10 km
Terms of Use

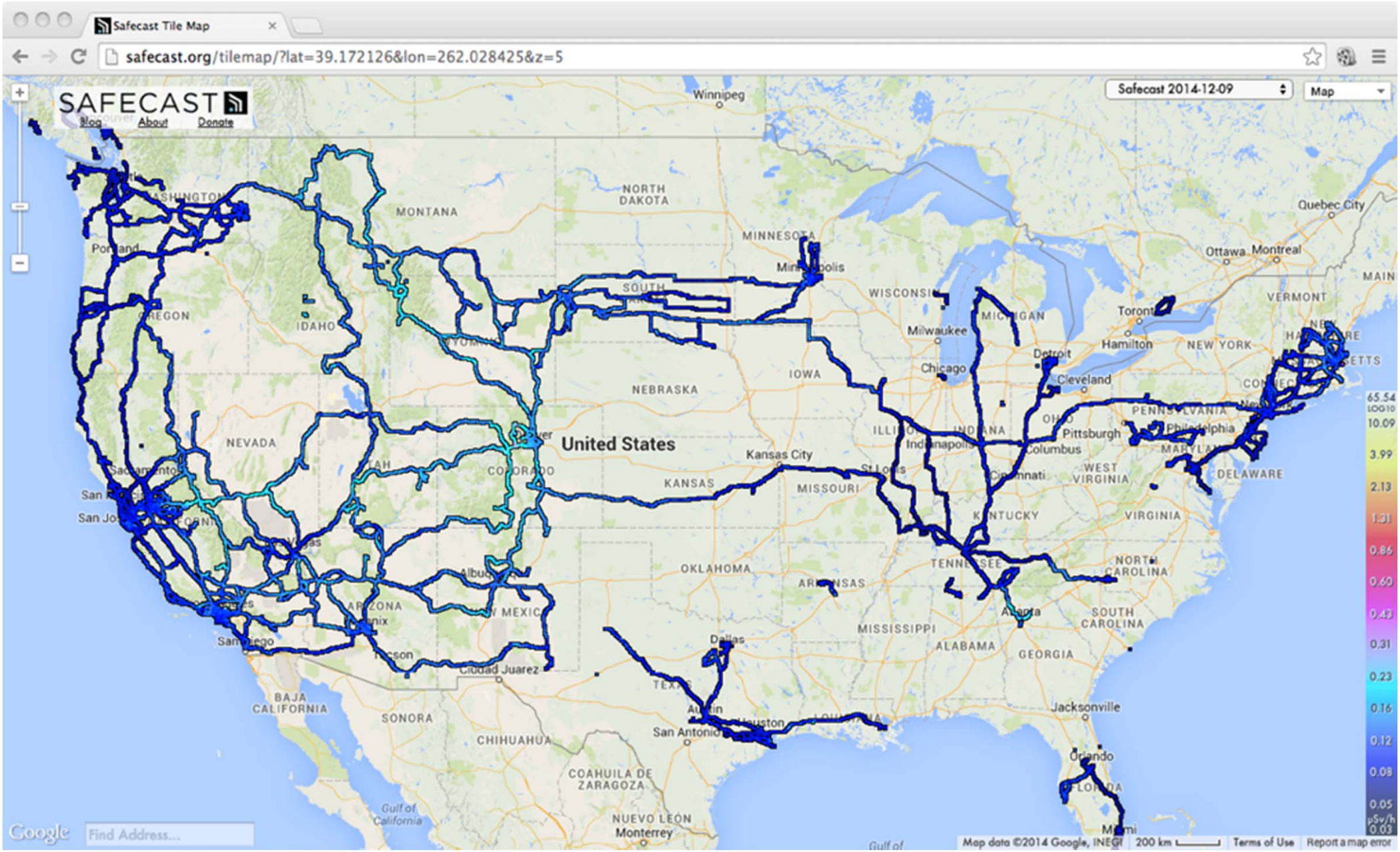

Safecast Tile Map
safecast.org/tilemap/?lat=37.417924&lon=500.5462&z=11&lidx=1
SAFECAST
Blog
About
Donate
Safecast (a) 2014-12-09
Map
Koriyama
郡山市
Mt Hiyama
Mt Otakine
大滝根山
Fukushima Airport
Hirata
平田村
Map data ©2014 Google, ZENRIN
2 km
Terms of Use

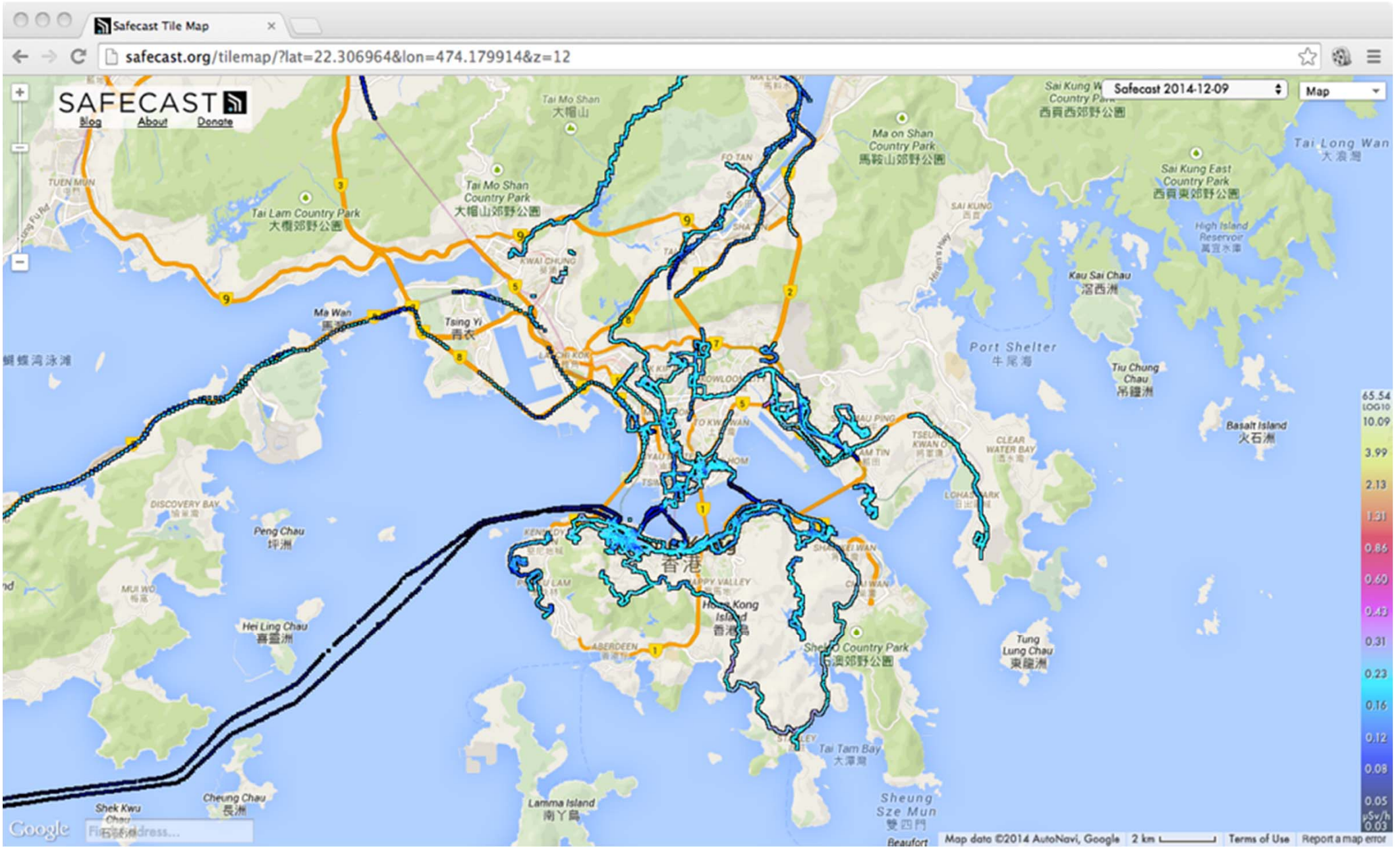

3G
17:00
1.00
LIN
0.75
0.50
0.25
μSv/h
0.00
NAMIKI1
NAMIKI3
ASAHI3
Seibu Plaza
Asahi Hospital
Layer

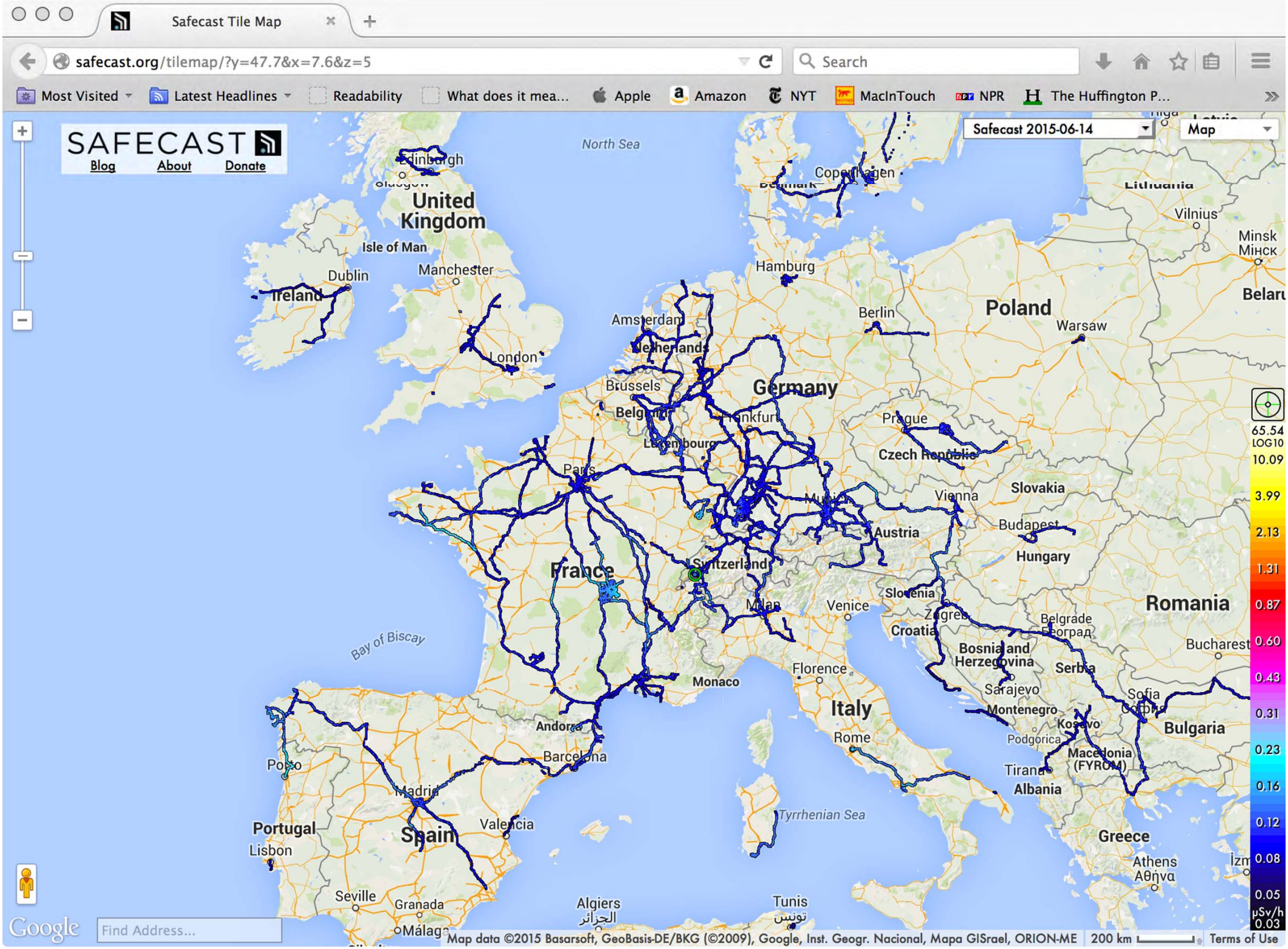

g/tilemap/?lat=35.70669&lon=499.797757&z=11
Safecast 2014-12-09
Map
Chiba Port
千葉港
Map data ©2014 Google, ZENRIN
2 km
Terms of Use

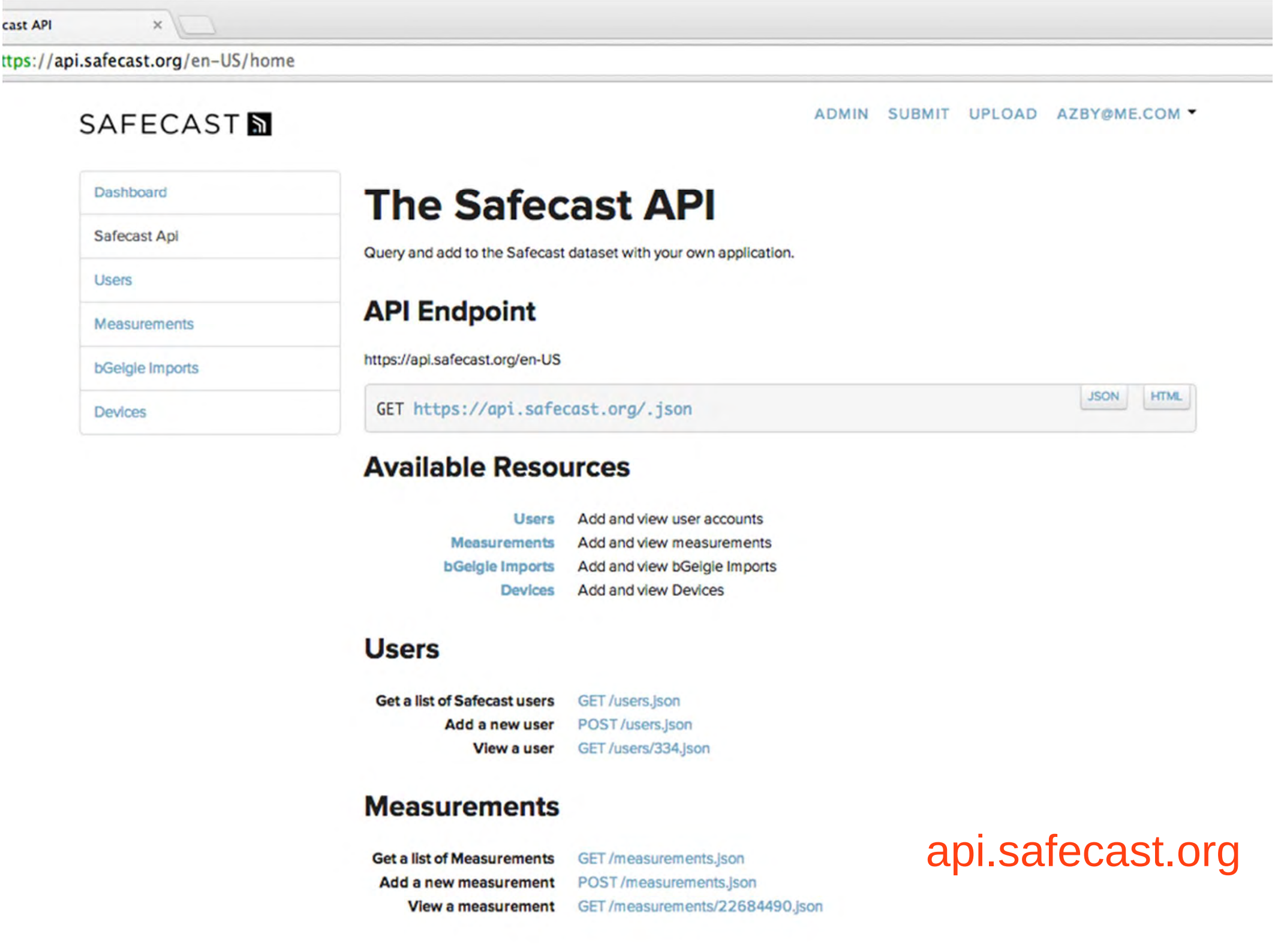

/?lat=37.421469&lon=501.021359&z=15&lidx=1
Safecast (a) 2014-12-09
Map
391
Ottozawa Post Office
夫沢簡易郵便局
Fukushima Daichi
Nuclear Power Station
福島第一原子力発電所
252
夫沢一区集会所
東電展望台
Okura Dam
大蔵ダム
あいパークおおく
65.54
LOG10
10.09
3.99
2.13
1.31
0.86
0.60
0.43
0.31
0.23
0.16
0.12
0.08
0.05
μSv/h
0.03
Map data ©2014 Google, ZENRIN
200 m
Terms of Use


ap/?lat=37.483031&lon=140.3878&z=9&lidx=3
NNSA Japan 2011-06-30
Map
Murakami
村上
Arakawa River
荒川
Tainai
胎内
Shibata
新発田
Mt Ninouji
二王子岳
Mount Iide
飯豊山
Nagai
長井
Nanyo
Kaminoyama
上山
Mt Zao
蔵王山
Natori
名取
Shiroishi
白石
Kitakata
喜多方
Mount Adatara
安達太良山
Mt Mikagura
御神楽岳
Lake
Numazawa
沼沢湖
Aizuwakamatsu
会津若松
FUKUSHIMA
Mt Asahi
旭岳
Mt Taishaku
帝釈山
Lake Ozenuma
尾瀬沼
Kuji River
久慈川
Lake Chuzenji
中禅寺湖
Naka River
那珂川
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


Safecast Tile Map
safecast.org/tilemap/?lat=39.172126&lon=262.028425&z=5
SAFECAST
Blog
About
Donate
Safecast 2014-12-09
Map
United States
Winnipeg
Quebec City
Ottawa
Montreal
Toronto
Hamilton
Milwaukee
Chicago
Detroit
Cleveland
Pittsburgh
Columbus
Indianapolis
Kansas City
St Louis
Atlanta
Dallas
Houston
San Antonio
Austin
Jacksonville
Orlando
Miami
Monterrey
Ciudad Juarez
Albuquerque
Phoenix
San Diego
Portland
MONTANA
NORTH DAKOTA
MINNESOTA
WISCONSIN
MICHIGAN
NEW YORK
VERMONT
OREGON
IDAHO
NEBRASKA
IOWA
NEVADA
COLORADO
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
MISSISSIPPI
ALABAMA
GEORGIA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
DELAWARE
BAJA CALIFORNIA
SONORA
CHIHUAHUA
COAHUILA DE ZARAGOZA
NUEVO LEON
Gulf of California
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
Google
Find Address...
Map data ©2014 Google, INEGI
200 km
Terms of Use
Report a map error


Safecast Tile Map
safecast.org/tilemap/?lat=22.306964&lon=474.179914&z=12
SAFECAST
Blog
About
Donate
Safecast 2014-12-09
Map
Tai Mo Shan
大帽山
Tai Mo Shan Country Park
大帽山郊野公園
Tai Lam Country Park
大欖郊野公園
TUEN MUN
Ma on Shan Country Park
馬鞍山郊野公園
Sai Kung East Country Park
西貢東郊野公園
Tai Long Wan
大浪灣
High Island Reservoir
萬宜水庫
Kau Sai Chau
滘西洲
Port Shelter
牛尾海
Tiu Chung Chau
吊鐘洲
Basalt Island
火石洲
Ma Wan
馬灣
Tsing Yi
青衣
DISCOVERY BAY
Peng Chau
坪洲
Hei Ling Chau
喜靈洲
香港
Hong Kong Island
香港島
Shek O Country Park
Tung Lung Chau
東龍洲
Tai Tam Bay
大潭灣
Lamma Island
南丫島
Sheung Sze Mun
雙四門
Cheung Chau
長洲
Shek Kwu Chau
石鼓洲
Google
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 AutoNavi, Google
2 km
Terms of Use
Report a map error


Safecast Tile Map
safecast.org/tilemap/?y=47.7&x=7.6&z=5
Search
Most Visited
Latest Headlines
Readability
What does it mea...
Apple
Amazon
NYT
MacInTouch
NPR
The Huffington P...
SAFECAST
Blog
About
Donate
Safecast 2015-06-14
Map
North Sea
United Kingdom
Isle of Man
Ireland
Dublin
Manchester
London
Edinburgh
Copenhagen
Hamburg
Berlin
Poland
Warsaw
Vilnius
Minsk
Amsterdam
Netherlands
Brussels
Germany
Frankfurt
Prague
Czech Republic
Slovakia
Vienna
Budapest
Hungary
Austria
Paris
France
Switzerland
Milan
Venice
Slovenia
Croatia
Zagreb
Belgrade
Romania
Bucharest
Bosnia and Herzegovina
Serbia
Sarajevo
Montenegro
Kosovo
Podgorica
Macedonia (FYROM)
Bulgaria
Sofia
Albania
Tirana
Greece
Athens
Bay of Biscay
Florence
Monaco
Italy
Rome
Andorra
Barcelona
Madrid
Spain
Portugal
Lisbon
Valencia
Seville
Granada
Málaga
Algiers
Tunis
Tyrrhenian Sea
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
Google
Find Address...
Map data ©2015 Basarsoft, GeoBasis-DE/BKG (©2009), Google, Inst. Geogr. Nacional, Mapa GISrael, ORION-ME
200 km
Terms of Use


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

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<br>Return difficult district |
| **Credits** | Aizu radioactivity information center |
| **Height** | 1.3m |
| **Orientation** | Facing Left |
| **Cities** | Koriyama,Hirata,Ono,Iwaki,Hirono,<br>Naraha,Tomioka,Okuma,Futaba,Namie<br>Minamisoma,Iitate,Kawamata,Fukushimaa,<br>Nihonmatsu,Motomiya,Inawashiro,Aizuwakamatsu |

Delete this Import

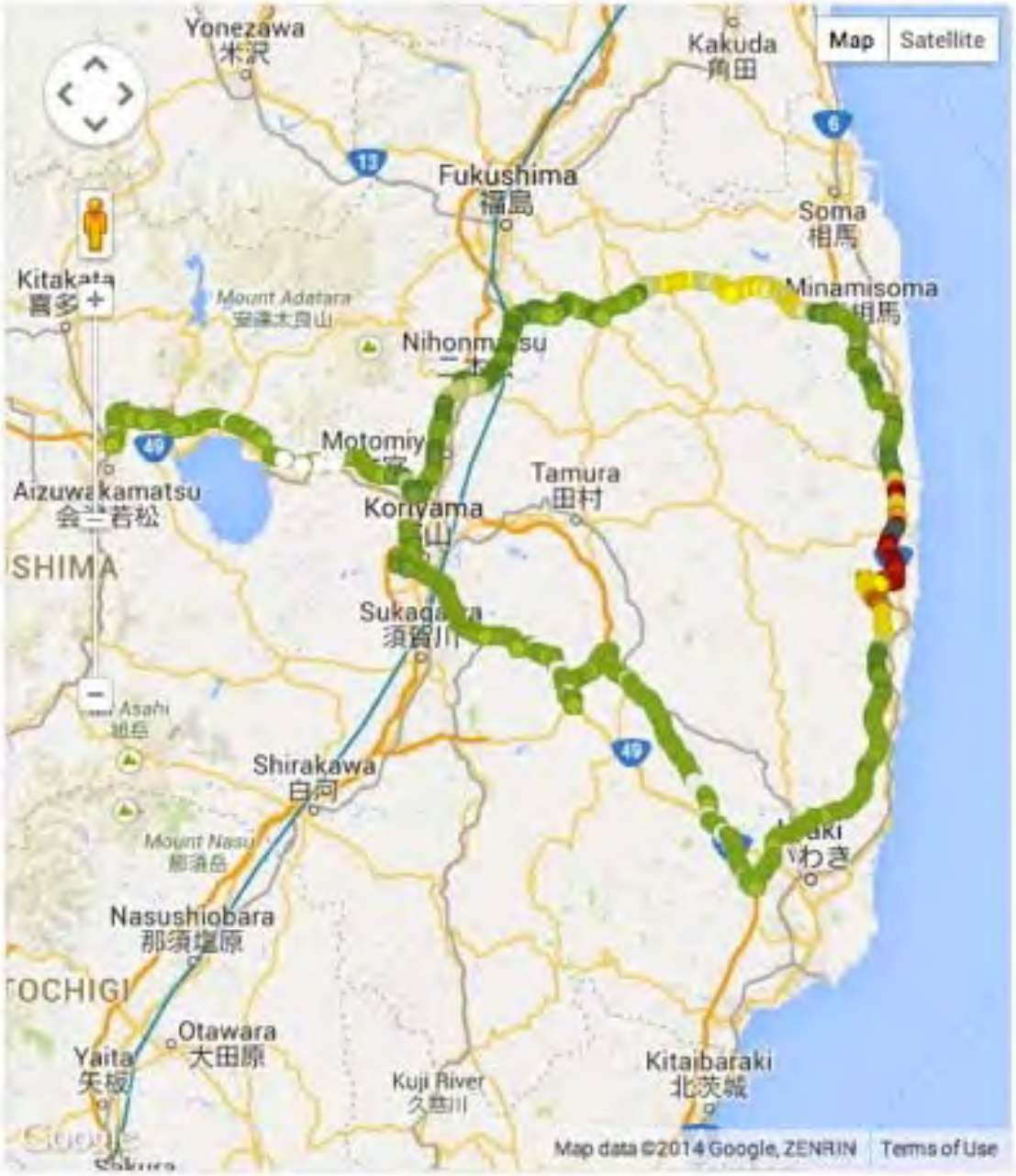
MEASUREMENT

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

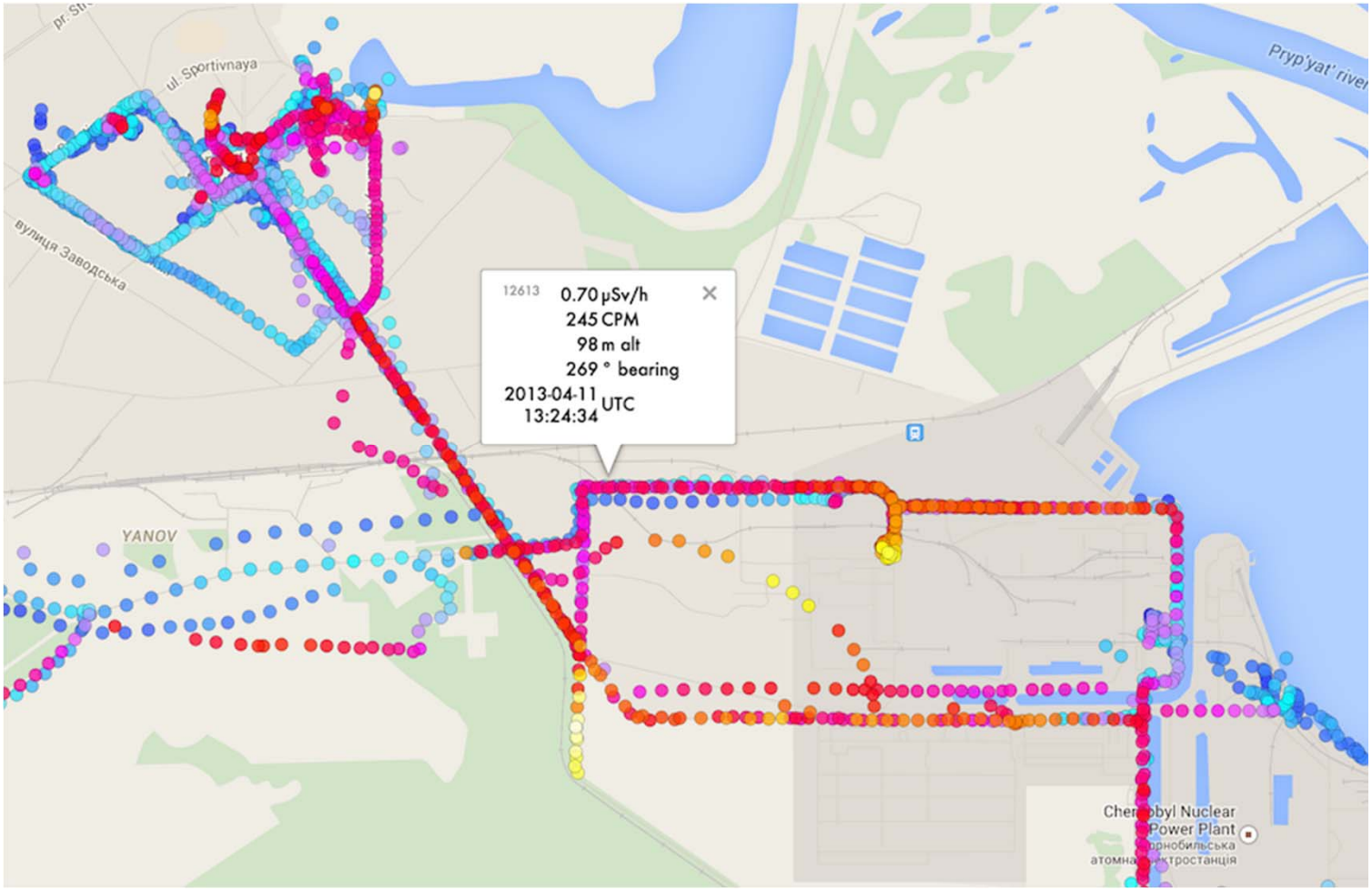
Delete this Import

MEASUREMENT

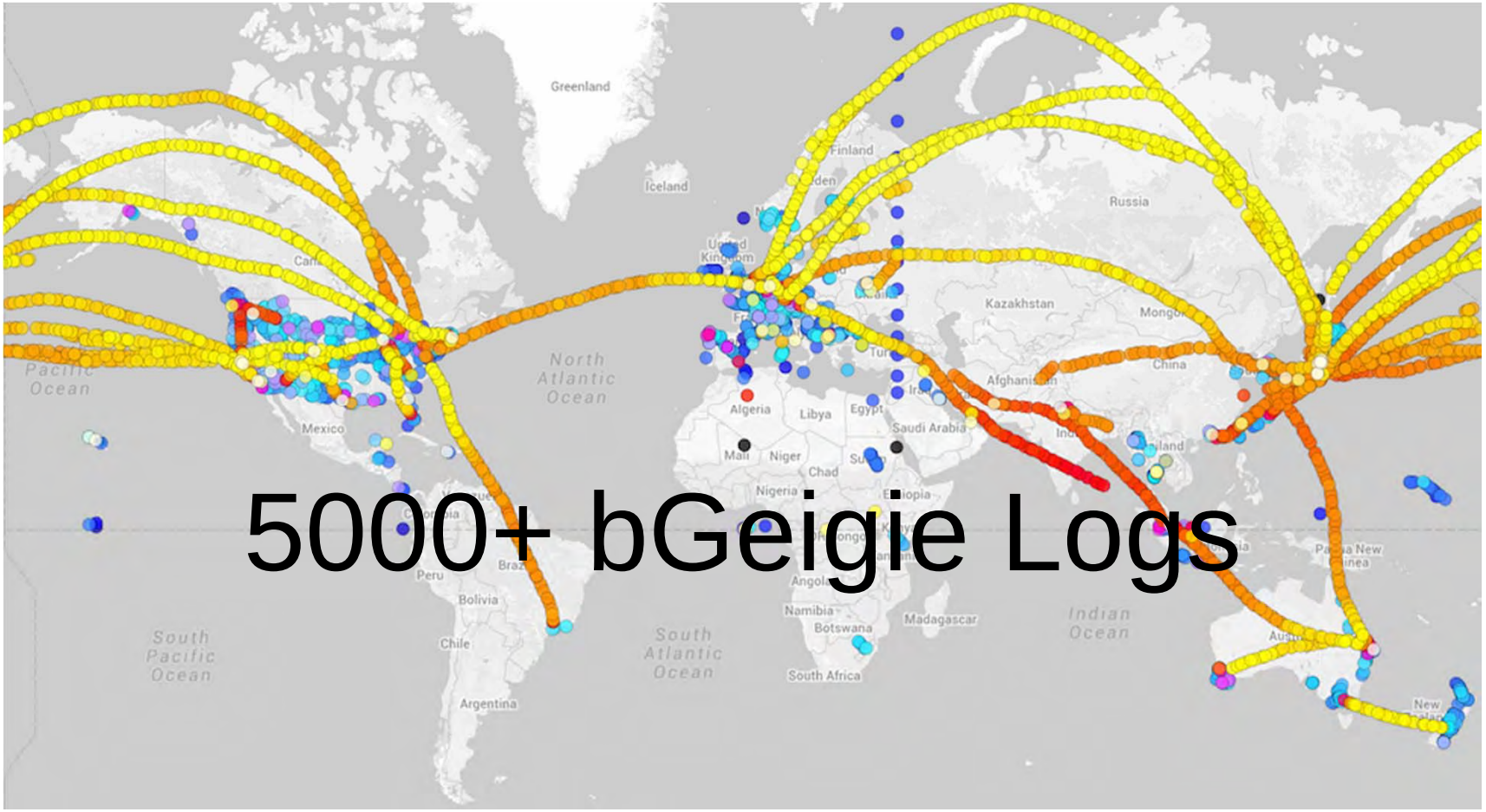
| | |
|---|---|
| Captured At | |
| 2014-11-12T10:27:28Z | |
| Latitude | 37.4701 |
| Longitude | 140.3621 |
| CPM | 72 |
| µsv | 0.22 |



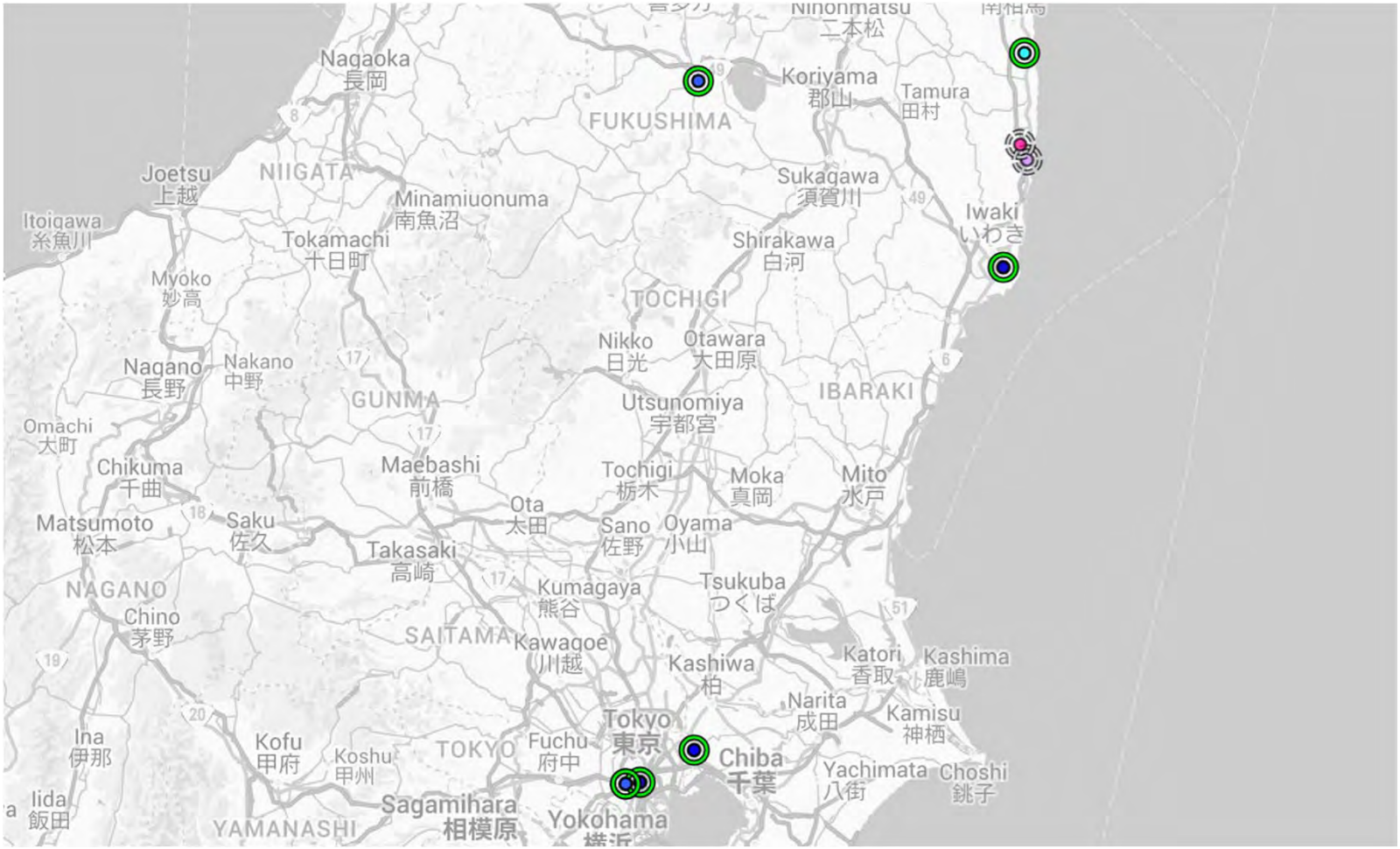
We think it’s very important to keep humans in the loop!




# bGeigie Log Viewer




(In-flight radiation data can be uploaded, but is not included on our main maps)




# Realtime Sensors

Expanding network, new hardware deployment.

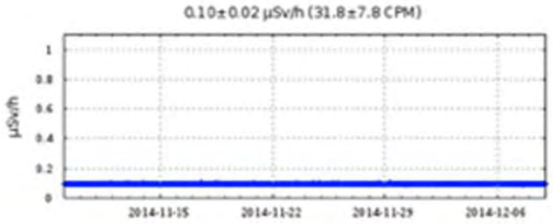
Bgeigie Import #17323 \\ | Safecast Tile Map | Japan, Fukushima, IwakiSA

realtime.safecast.org/sensor/41

# Japan, Fukushima, Iwaki (sensor 41)

Online

| 6 mins ago | 12 months ago |
|---|---|
| 31 cpm | 60 cpm |
| 0.093 µSv/h | µSv/h |




Download the dataset

Share

## Leave a Reply

**Name (required)**

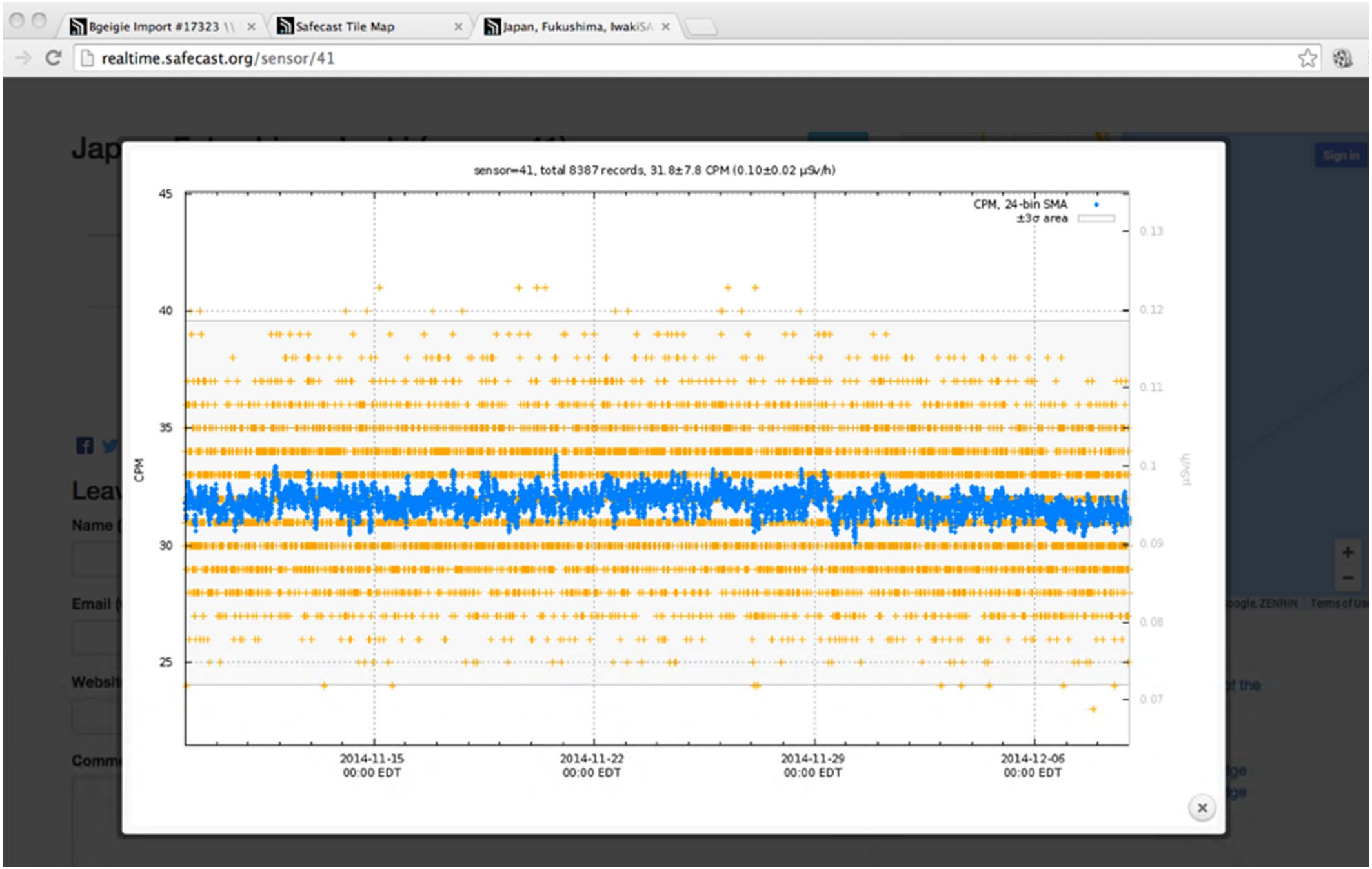
**Email (will not be published) (required)**

**Website**

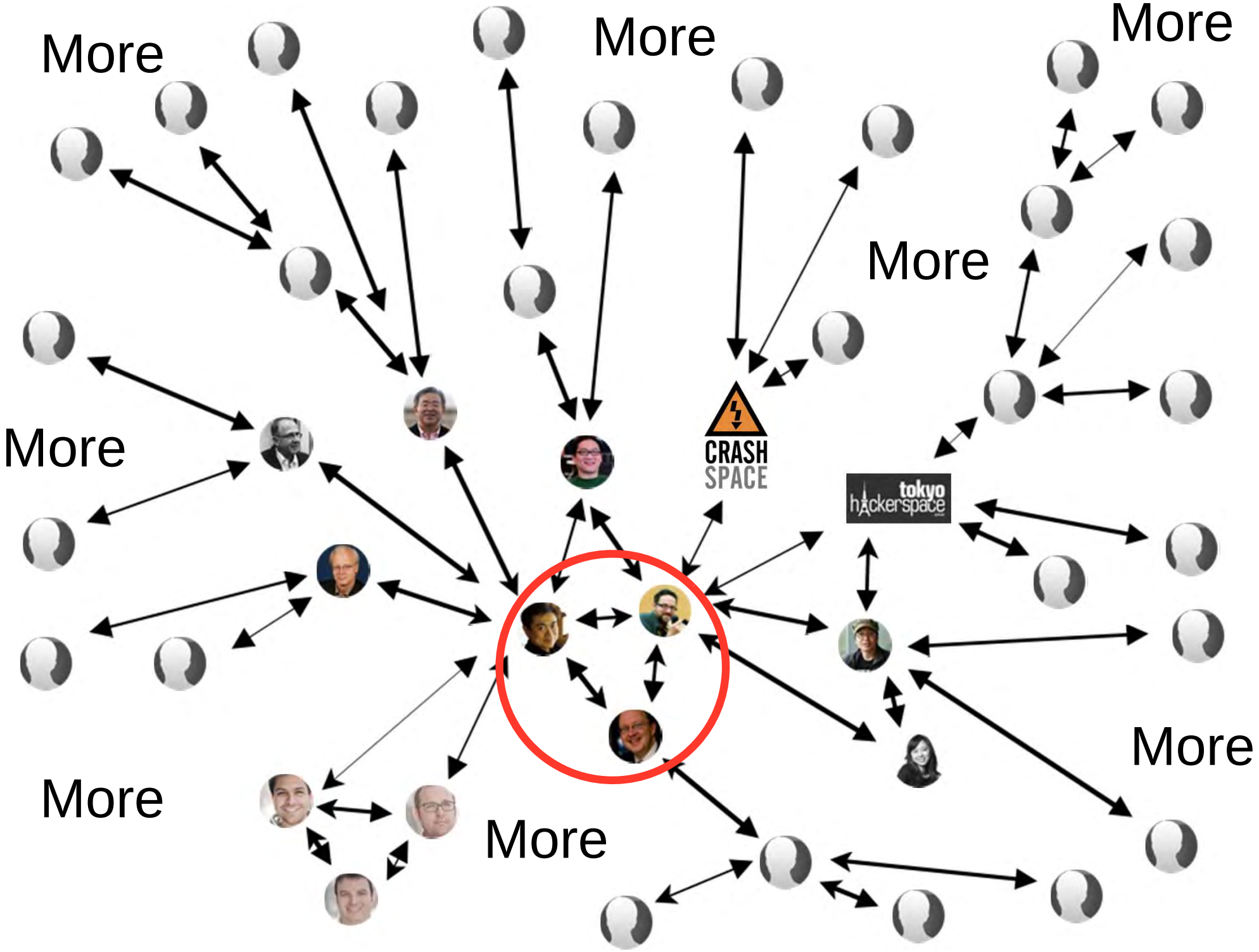
**Comment**

## Comments

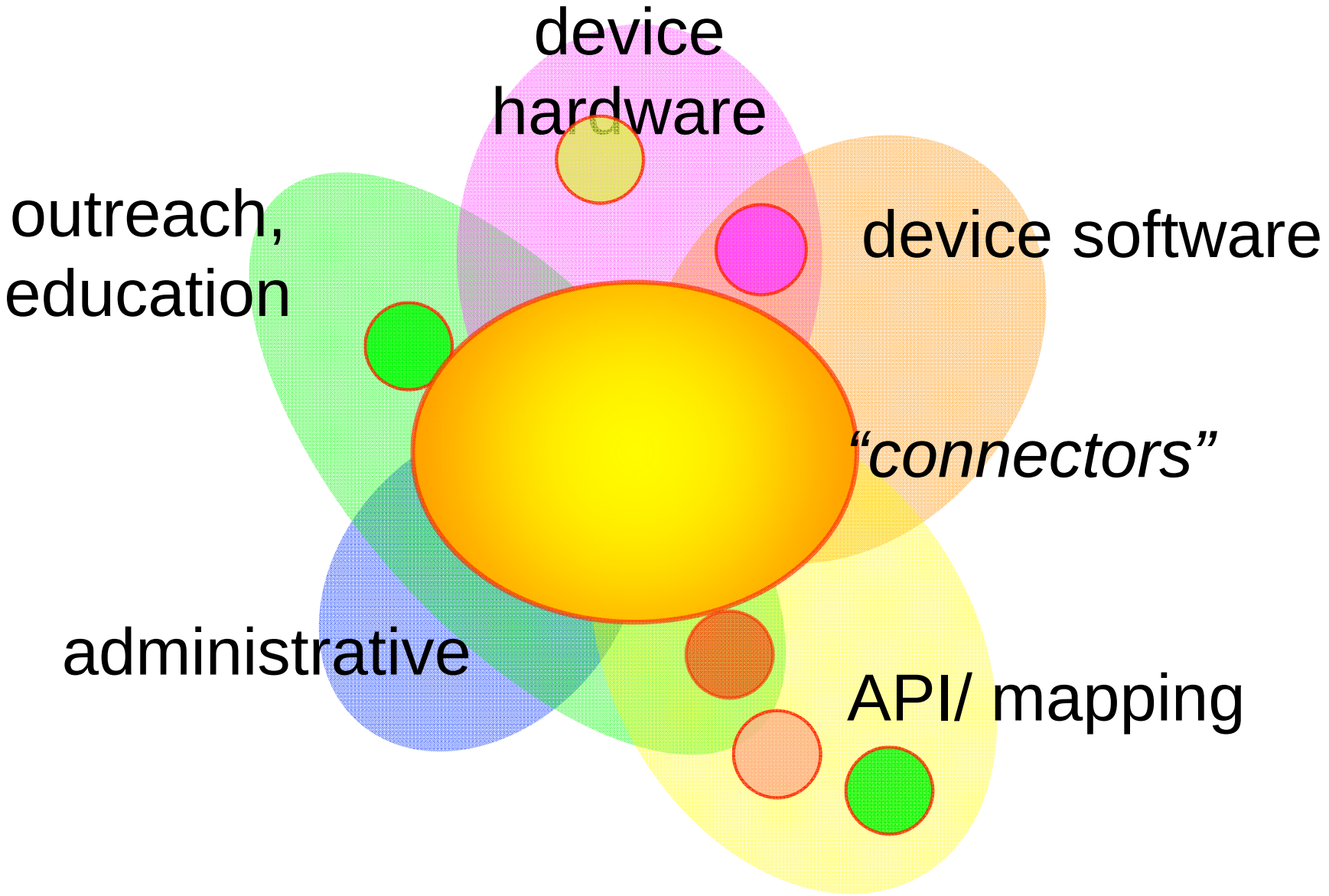
- Rob Oudendijk on Japan, Tokyo, Embasy of the Netherlands
- ray ozzie on USA, MA, Manchester
- ray ozzie on USA, MA, Manchester
- Safecast on USA, Massachusetts, Cambridge
- Safecast on USA, Massachusetts, Cambridge


Bgeigie Import #17323
Safecast Tile Map
Japan, Fukushima, IwakiSA
realtime.safecast.org/sensor/41
sensor=41, total 8387 records, 31.8±7.8 CPM (0.10±0.02 µSv/h)
CPM, 24-bin SMA
±3σ area
CPM
µSv/h
45
40
35
30
25
0.13
0.12
0.11
0.1
0.09
0.08
0.07
2014-11-15
00:00 EDT
2014-11-22
00:00 EDT
2014-11-29
00:00 EDT
2014-12-06
00:00 EDT

# People


More
More
More
More
More
More
More
More
CRASH
SPACE
tokyo
hackerspace

# Our Teams




*Lots of multitasking, multi-competence*

SAFECAST

# Building Community

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

- Safecast blog, discussion, Facebook, Twitter, etc
- Geiger-counter 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

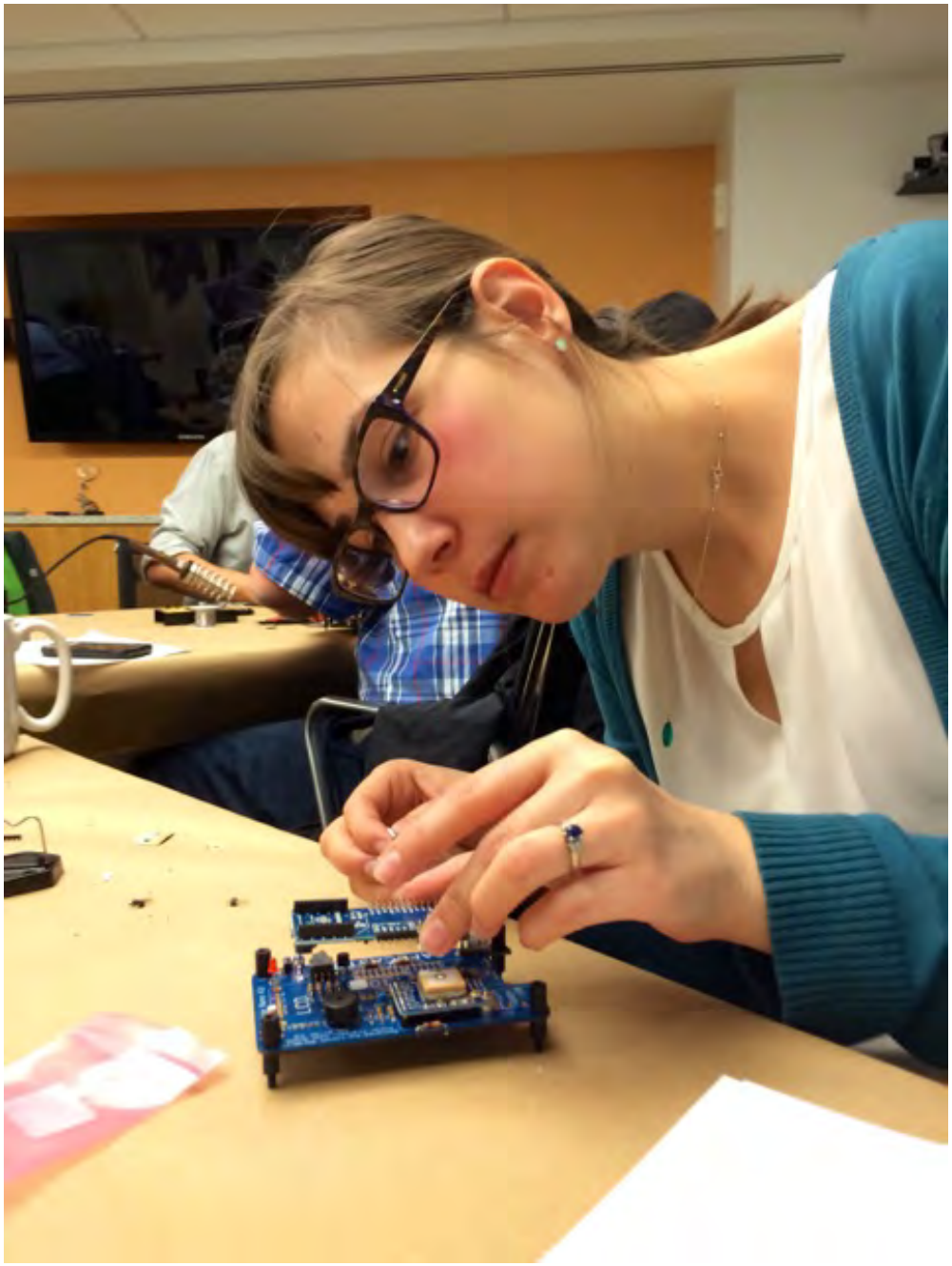
Sorry, this entry is only available in 日本語.

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 the Woods Hole Oceanographic Institution (WHOI). Dr.

Search Here  Go



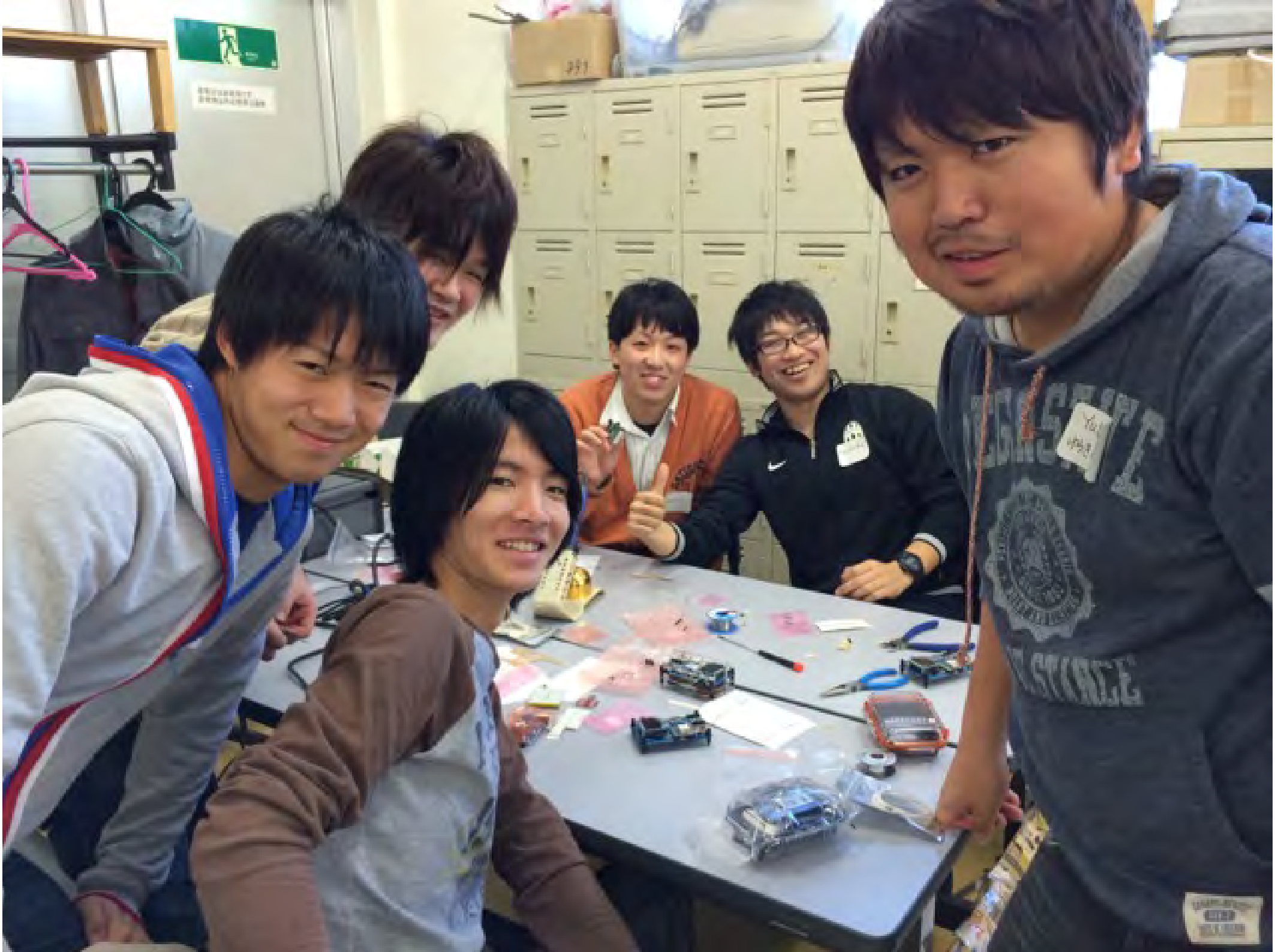
**Recent workshops in:**

Tokyo
Fukushima
Kobe
Washington, DC
Strasbourg
Taipei

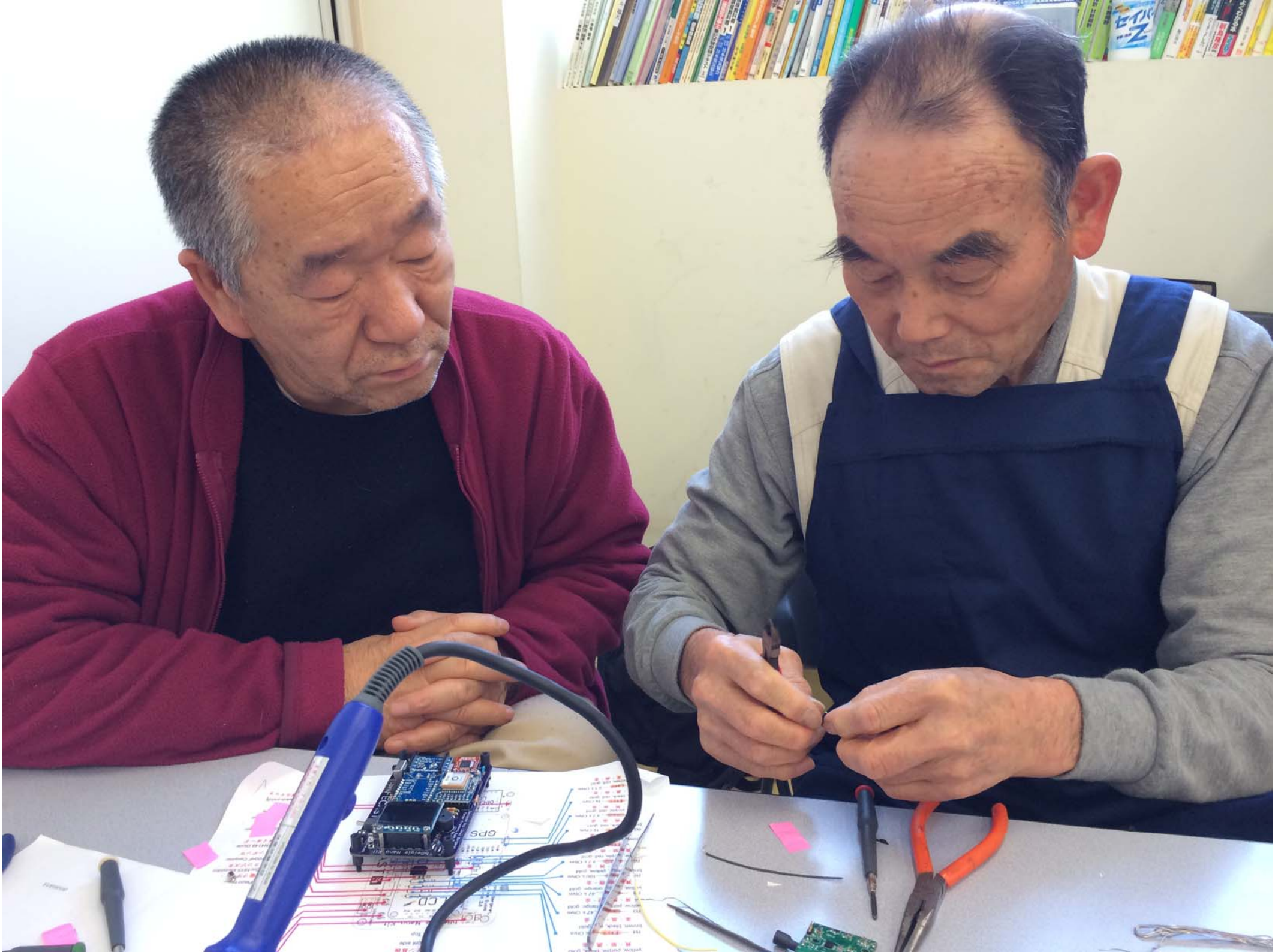
**Upcoming workshops:**

Los Angeles
Berlin

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



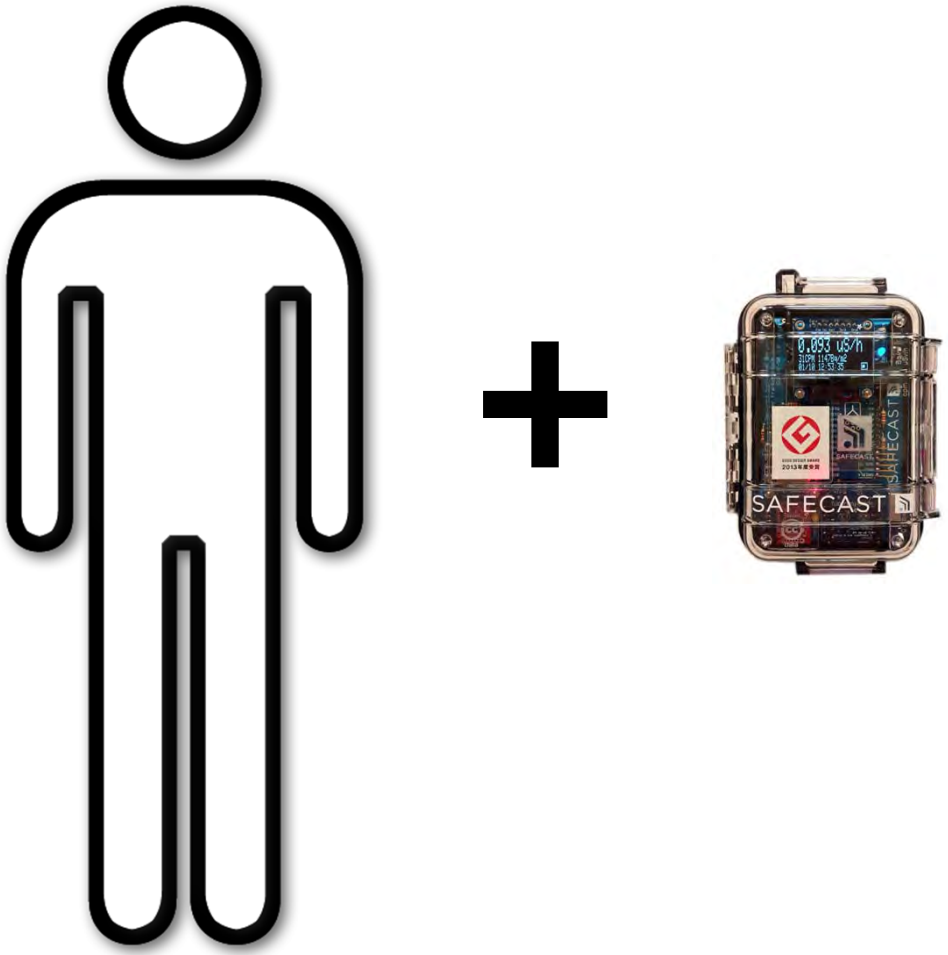
Testing 12 newly-built bGeigie Nanos in a nearby park.



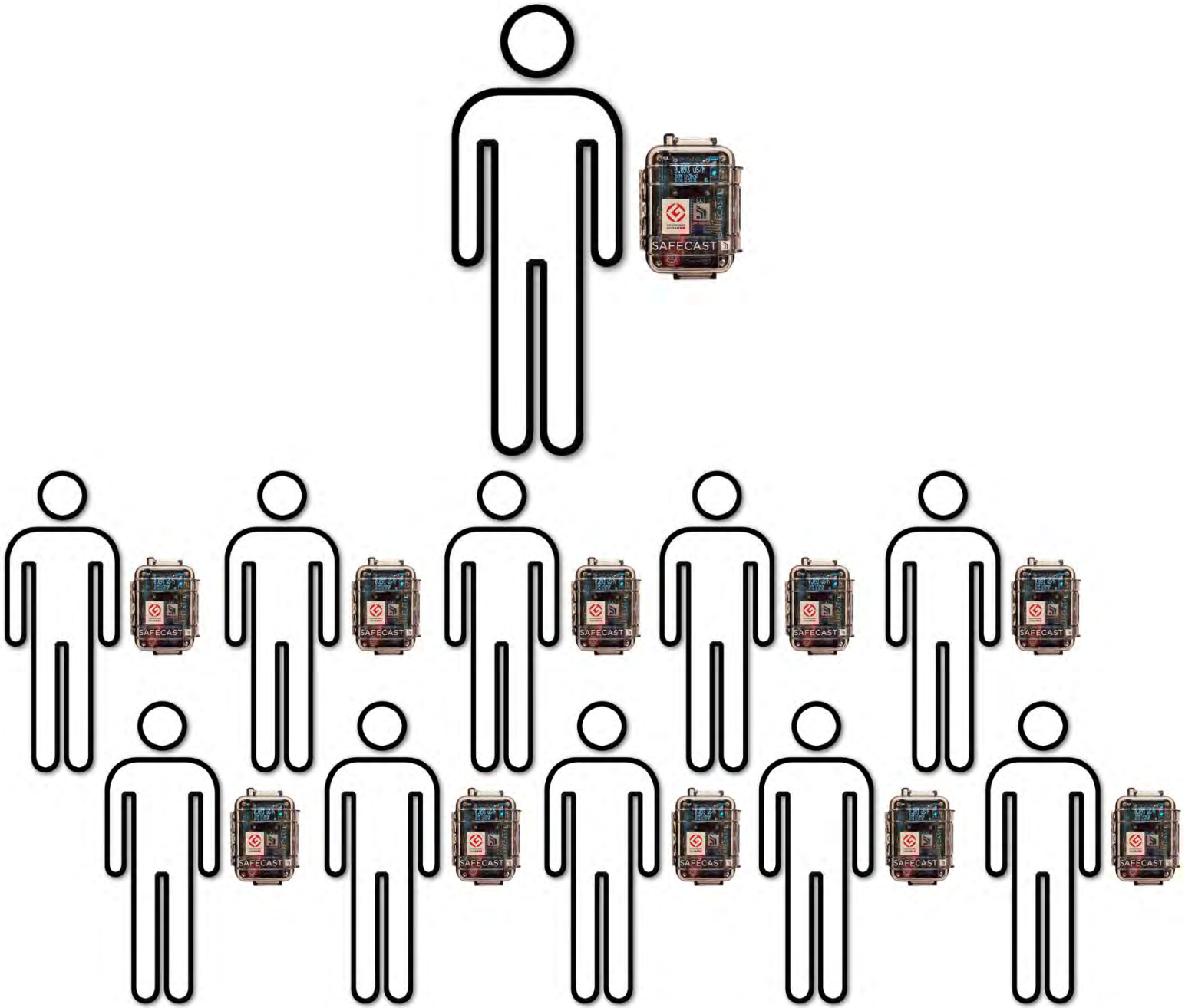
Safecast volunteers and Koriyama City officials

Ten bGeigies were delivered to Koriyama City

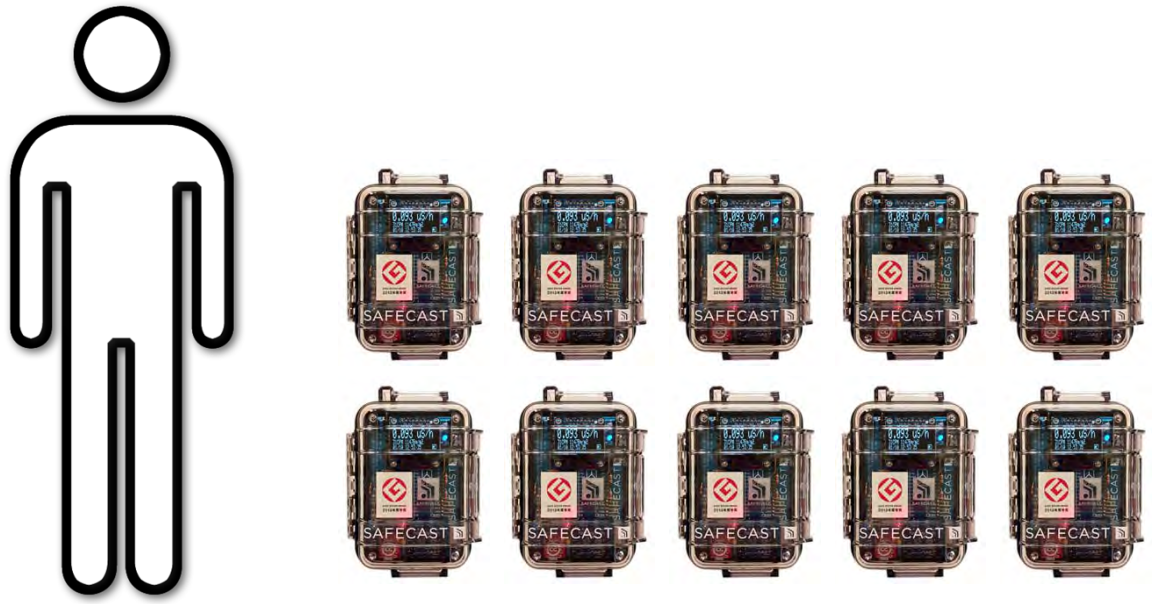
They were mounted on postal delivery vehicles, which cover every street in town over the course of normal daily activity.




Our experience after Fukushima suggests that in the event of another large radiation emergency additional manpower will be needed.




One person can quickly teach ten others.




We have prepared “airlift crates” of devices that can be quickly sent emergency areas anywhere in the world.

We’ve found it’s necessary to educate media as well.

# THE SAFECAST REPORT

VOLUME 1 - MARCH, 2015

www.safecast.org

# **SUMMARY**:

Everything we do has been enabled by open hardware and software, new DIY fab tools, and social media.

It required putting into practice agile development and iterative design - “Deploy or Die”

Managing human networks is harder than managing technical systems.

Our credibility depends on our openness.

Govt agencies are accountable for people’s lives and well-being.  We aren’t, and that makes our work easier than theirs.

SAFECAST
SAFECAST

GOOD DESIGN
SAFECAST
www.safecast.org