

Survey on the Flood in *Iiyama* City Caused by Typhoon No. 19 of 2019 (Typhoon “*Hagibis*”)

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1. Activity

1.1 Introductions

Typhoon No.19 (Typhoon “*Hagibis*”) struck Japan on October 12th, 2019, caused record rainfall, caused a great deal of damage, and was named the “*Reiwa* 1 East Japan Typhoon”. The Emergency Warning of Severe Rainfall was announced in *Nagano* Prefecture, *Tokyo*, and 11 other prefectures in/around the *Kanto-Koshin* region, for breaking the record of precipitation amount per unit time.



Fig. 1 Stage Diagram of Presumed Inundation Depth (Geographical Survey Institute)

Fig. 2 Flood Damages to Iiyama City (1:00PM, Oct. 13th, provided by iNet)

According to the latest information on the *Iiyama* city website (as of November 22nd, 2019),

- Damages to flooded houses
38 largely destroyed, 152 half destroyed, 24 partially destroyed, 416 partially damaged (less than 10% damaged), total 630
- Damages to flooded office buildings
147 (Including houses accompanying stores, and those that only have damaged warehouses and/or vehicles)
- Damages to public facilities related to civil engineering
64 points of road, 6 pieces of equipment related to roads (snow-melting pipes, control panels)

for snow gutters), 3 points near rivers

- Damages to agricultural facilities

16 agricultural facilities aided by the government, 40 agricultural facilities not aided by the government, 2 facilities for agricultural waste water treatment (Government aided), 1 facility for removing rice straw, 4 rice patties needing soil removal

Since the damages to *Iiyama* city were large scale as shown above, we felt the need to record this flood damage, and started to investigate. We started our investigation in December, so we asked the townspeople for their assistance by providing us with photographs and video clips. We also gathered information on the internet from blogs, etc., and interviewed staff from the local cable television station.

1.2 Methods of Investigation

a. We made flyers as shown in Fig. 3, distributed them from house to house in the damaged area, and gathered or asked to provide photographs, video clips, and the time they were taken.

① Using the online storage service Dropbox, we created and set a folder for the photograph or video files to be uploaded.

② We created a QR code for uploading, printed it on the flyers, and distributed them.

b. Gathering Information on the Internet from blogs, etc. “*Hako-mise-ya yokocho oya no miseban nikki* [Diary of the Landlord of Box Shop Lane Doing His Shopkeeping]”, #TyphoonNo.19, #Iiyama, etc.

c. Interviewing Local CCTV Station *iNet Iiyama*

We asked the staff to provide us with photographs and video clips.

1.3 Results

There were 19 pieces of information gathered to this club. There were both photographs and video clips. We asked them to write the time they were taken in the section for the name, but there were pieces with no information of time.



Fig. 4 Photographs of the Iiyama Flood

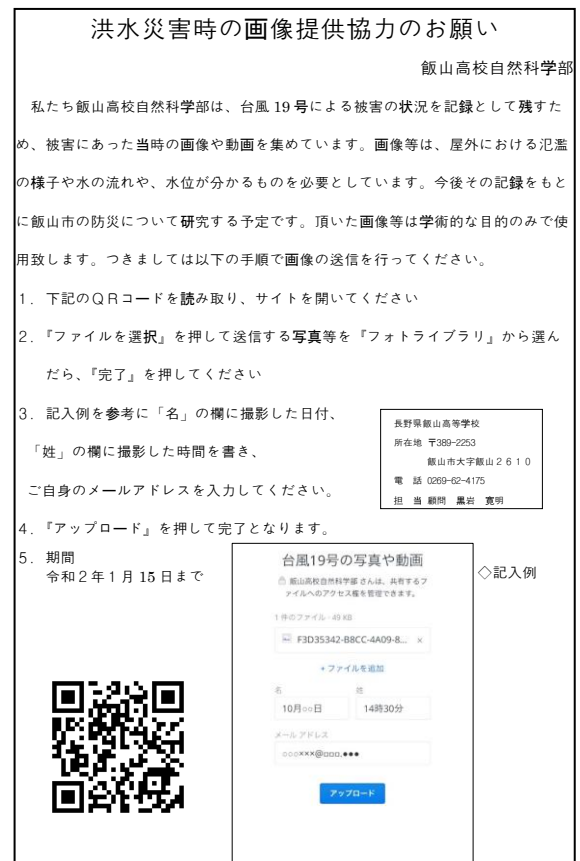


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Fig. 3 Image of Flyer



Fig. 5 Collapse of the Sara-gawa River
(6:00AM, Oct. 13th)

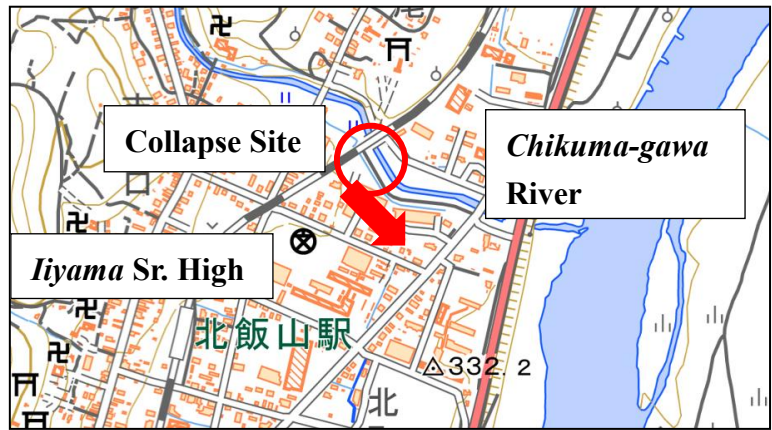


Fig. 6 Site of Sara-gawa River Collapse



Fig. 7 Site of Sara-gawa Collapse (provided by iNet)



Fig. 8 Site of Sara-gawa River Collapse (Oct. 14th)

Information about measures by/evacuation of *Iiyama* city (According to March 14th, 2020 edition of local newspaper “*Kita-Shin Local*”)

Italic Sentences: Water Level and Damages

Oct. 12th 8:45PM Evacuation Advisories announced on *Kijima* and *Tokiwa* regions

Oct. 13th 2:30AM Evacuation Advisories announced on parts of *Oofuka* ward

2:30AM Message of Sara-gawa River overtopping

2:50AM Evacuation Advisories announced on parts of Goino, Nakayamane, and Kamigumi wards

3:00AM Water level surpasses Evacuation Advisory Criterion (9.4m) at Iiyama Water Level Observation Station (9.58m)

3:20AM Evacuation Advisory announced on Kitamachi ward

4:00AM Water level surpasses Evacuation Order (Emergency) Criterion (10m) at Iiyama Water Level Observation Station (10.20m)

4:00AM Evacuation Advisory announced on Ario ward

4:00AM Evacuation Advisories announced on parts of Okubo ward, Akidzu region (near Japan National Route 117 Bypass)

4:15AM Sara-gawa River collapses, water level drops in left bank dam

4:50AM Evacuation Advisory announced on Tamachi ward, Iiyama region

5:30AM Evacuation Advisories announced on parts of Kuwanagawa ward, Okayama region (Baba)

5:30AM Evacuation Advisories announced on parts of Tomida, Nakagumi, and Sekizawa wards, and all of Tonago ward, Mizuho region

5:40AM Joyama Rainwater Drain Pump Facility starts to flood

6:40AM Evacuation Advisories announced on *Fukujumachi, Honmachi, Sakanamachi, Kanmachi, Shinmachi, Teppoumachi, Narazawa, Sakaemachi, and Agatamachi* wards, *Iiyama* region, and *Kitabata* ward, *Akidzu* region due to high flow exceeding processing capacity of pump

7:00AM Joyama Rainwater Drain Pump Facility stops functioning due to flooding

9:15AM Evacuation Advisories called off on areas not flooded in *Tokiwa* region, *Goino, Kamigumi, Nakayamane, Tonago, Nakagumi, and Tomida* wards and all of *Kijima* region

Oct. 14th 9:00AM All Evacuation Advisories called off on *Iiyama* city



Fig. 9 Fukujumachi Ward (3:00PM, Oct. 13th)
The water level was at its maximum at this time.

2. Discussion and Problems

In this investigation, there were many photographs with no indication of when they were taken, so there was a limit in our investigation. Some of the photographs were arranged in detail in the blog “*Hakomise-ya yokocho oya no miseban nikki [Diary of the Landlord of Box Shop Lane Doing His Shopkeeping]*” about the “Typhoon No. 19 Inland Water Flooding”, so we referred to it.

- **The Inland water flood was due to the bank of the *Sara-gawa* river, a branch of the *Chikuma-gawa* river, collapsing.**

We do not know the main cause of the *Sara-gawa* river overflowing. The *Sara-gawa* river flows into the *Chikuma-gawa* river through the *Himon* gate. However, according to the “*Hakomise-ya yokocho oya no miseban nikki*”, the gate was closed at 1:44AM, October 13th, and the operators have evacuated. The problem is whether the *Sara-gawa* river itself overflowed, or water from the *Chikuma-gawa* river flowed upstream into it. A firefighter from the *Gakuhoku* Fire Department has reported that “there was a reverse flow from the *Himon* gate into the *Sara-gawa* river”, but there is no official opinion about the fact.

Moreover, other branches such as the *Sakae-gawa, Shinshuji-gawa, and Kiyokawa* rivers flow through *Iiyama* city, but there are no reports about them. It is possible that these rivers have flooded as well.

- **Specifying the range of flooding in *Iiyama* city**

We have plotted the area of flooding in *Iiyama* city based on the image reported on *TV Tokyo* (Afternoon of October 13th) (www.youtube.com/watch?v=mQUmaD5mWEc). The area surrounded in red in Fig. 10 has flooded during the disaster.



Fig. 10 Range of flooding in
Iiyama City

- **The Evacuation Advisories were announced too late during this flood.**

The overflowing of the *Sara-gawa* river was noticed (2:30AM), and surrounding communities (the *Kitamachi* and *Ario* wards) were evacuated (3:20AM and 4:00AM, respectively). If they had announced the Evacuation Advisories in the *Fukujumachi*, *Honmachi*, *Sakanamachi*, *Kanmachi*, *Shinmachi*, *Teppoumachi*, *Narazawa*, *Sakaemachi*, and *Agatamachi* wards of *Iiyama* region, vehicles and household belongings on the first (ground) floor could have been evacuated. This topic is also discussed at the *Iiyama* city council.

This flood occurred in the middle of the night, not during the day, when city hall staff and firefighters are on duty. We think that a nighttime disaster prevention manual is needed.

- **Floods in *Iiyama* city occur repeatedly.**

Floods have also occurred in *Iiyama* city, in 1982 and 1983, due to the *Chikuma-gawa* river overflowing. We can ask our parents and grandparents, and perform research on these past disasters, so we can make good use of them, along with what we learned from this one, in preventing future floods.