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ARTICLE

Disasters in Japan: LIASE-Funded On-site Experiential Learning Courses Exploring the Science, Social Impact, and Culture of Disaster

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This article describes two interdisciplinary summer experiential learning courses focused on disasters in Japan, both partially funded through LIASE (Luce Initiative on Asian Studies and the Environment). The first course was titled “Seismic Japan” and was centered on earthquakes through Japan’s history culminating in the 2011 disaster. The second, “Meltdowns and Waves,” was a comparative look at the Three-Mile Island meltdown incident, the Fukushima Daiichi nuclear disaster, Hurricane Sandy, and the 2011 tsunami. Both courses provided a unique interdisciplinary learning experience for our students, one that explored the science behind earthquakes, tsunamis, and nuclear accidents as well as the impacts of these disasters on Japanese society and culture.

Keywords: LIASE; earthquakes; disasters; tsunamis; nuclear disasters; Fukushima; experiential learning; pedagogy

In the summers of 2013 and 2016 I led two different summer courses to Japan which focused on disasters; both were partially funded by a LIASE grant. Both of these trips were interdisciplinary and included different colleagues in Earth Sciences each time. I am a specialist in Japanese literature and film with a scholarly interest in representations of the 1923 Kantō earthquake, while my colleagues have interests in earthquakes, disasters, and energy resources. The 2013 course was titled “Seismic Japan” and centered on Japanese earthquakes through history, culminating in the 2011 disaster. The second, in 2016, “Meltdowns and Waves,” was a comparative look at the Three-Mile Island meltdown incident, the Fukushima Daiichi nuclear disaster, Hurricane Sandy, and the 2011 Japanese tsunami. On each occasion, the idea was to bring together our expertise to provide a unique interdisciplinary learning experience for our students, one that explored the science behind earthquakes, tsunamis, and nuclear energy as well as the impact of seismic disasters on Japanese society and culture. Our goals were to have students come away with complex ideas about the role of disasters in Japan, and ideas about sustainable responses to living with earth’s hazards.

For the first program in 2013, “Seismic Japan,” some of our time in Japan was spent in the classroom at our partner institution, Nanzan University. This time was devoted to an overview of Japanese geography, basic geological concepts, and the history of earthquakes in Japan. Lectures and readings explained how the subduction zone adjacent to Japan both helped form the islands and has also led to its volcanoes, hot springs and frequent earthquakes. Interspersed with the class time in Japan were various field trips exploring geological evidence of prehistoric seismic activity and specific sites related to the earthquakes we discussed in class. For the 2016 “Meltdowns and Waves” course, we provided background before departing and concentrated our time in Japan on field trips.

A large portion of the “Seismic Japan” course explored the science of earthquakes. A key part of our study of seismicity was a trip around the Bōsō Peninsula to help understand Japanese earthquakes in terms of geological time. There, we could observe the uplift of coastal rock, tsunami deposits far inland, as well as other dramatic evidence of an earthquake millions of years ago. On the coast we could see

evidence of erosion, followed by sudden uplift associated with both the 1855 Ansei earthquake and the 1923 Kantō earthquake (**Figure 1**).

Students were then able to look up the hillside to see a recurring history of the uplifts that formed the Bōsō Peninsula. Further evidence of seismic activity could be seen in a geological roadside park in the region.¹ The excavated embankment preserves the results of an underwater landslide from millions of years ago (**Figure 2**). Yuzuru Yamamoto, a JAMSTEC (Japan Agency for Marine-Earth Science and Technology) geologist, discovered this unusually chaotic rock strata formation and hypothesized that it was the result of liquefaction following a major seismic event.

Though we spent two class sessions on Buddhist concepts of disaster and the Ansei earthquake of 1855, the majority of the experience was focused on earthquakes from the start of the Meiji era in 1868. The first modern earthquake we examined in detail was the 1891 Nobi earthquake. Students read excerpts from Gregory Clancey's *Earthquake Nation*, which covers Japan's role in the development of seismology as well as the cultural role of earthquakes in the Meiji era (Clancey 2006). When the 1891 earthquake struck, Japan was in the midst of questioning its wholesale acceptance of

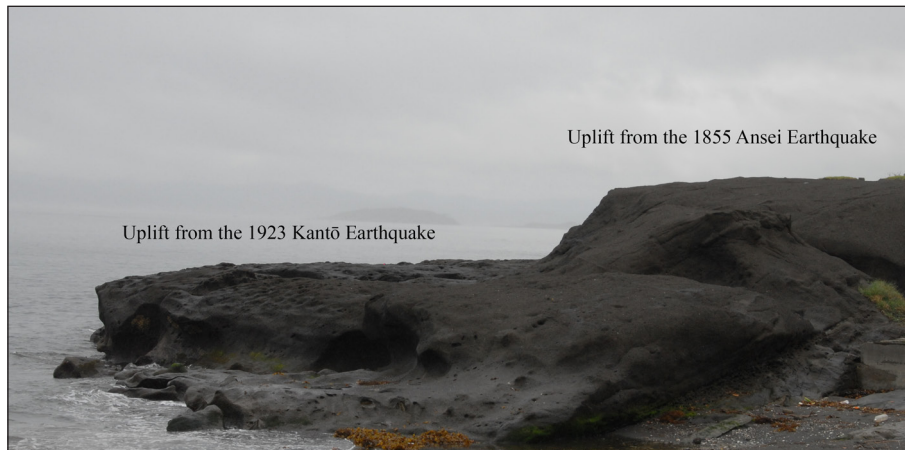


Figure 1: The upper step is from the 1855 quake, whereas the lower step is the more recent uplift from 1923. Photo courtesy of Emily Pawley.

¹ The park is just off the Yasubō Green Line, just before the tunnel. It was through the efforts of Yuzuru Yamamoto that the embankment has been preserved as a geological point of interest.



Figure 2: The chaotic formations visible at the roadside park. Photo courtesy of Emily Pawley.

western technology. The visual culture in the aftermath contrasted the spectacular destruction of modern brick buildings with standing traditional buildings to call attention to the folly of foreign architects and the ingenuity of traditional craftsmen.

The inland fault that ruptured causing the Nobi quake was unusual because most of Japan's earthquakes are caused by slippage along the plate boundary off its coast. Due to its inland location, it is possible to visit the site of the rupture in Motosu, Gifu prefecture, and see how the earthquake shaped the landscape. Such a visit is even more fruitful because the Neodani Fault Museum has preserved an excavated section of the fault, giving us a rare opportunity to examine evidence of underground seismic movement. The six-meter shift in the rock helped students comprehend the intensity of the quake. There, we had students practice their observational skills and draw on their classroom knowledge to describe what they were seeing in the exposed earth (**Figure 3**). The museum collection of contemporary photos, maps, images, and books also helped students see further evidence of Clancey's arguments.

For the Kantō earthquake of 1923 and the Hanshin-Awaji earthquake of 1995, we were able to visit memorial museums dedicated to each disaster. Of the two, the museum in Kobe (Hanshin-Awaji earthquake) was the most accessible to foreign visitors. Many of the interpretive signs were in English and several of the volunteers



Figure 3: The exposed fault in the Neodani Fault Museum. The darker rock shows an uplift of about six meters. Photo courtesy of Emily Pawley.

spoke English as well. There were other school groups in the museum on the day we visited, a regular occurrence, and we were able to discuss the prominent role given to disaster education in Japan in contrast to disaster education in many other countries. Students particularly appreciated the personal stories of survivors and the way the museum recreated a post-disaster street scene. In conjunction with this visit, we read some of Murakami Haruki's stories about this earthquake. As I have argued elsewhere, these stories showed different attitudes toward the powerful natural

forces of the earth (Bates 2018), which helped complicate the idea of a unified Japanese idea of nature and earthquakes.

The Great Kantō Earthquake Memorial Hall and the adjacent museum in Tokyo required a bit more explanation. Gennifer Weisenfeld's chapter on "Remembrance" in her book *Imaging Disaster* provided the perfect catalyst for our conversations. Weisenfeld outlined the debates over the memorial and the outcry over the initial Western-influenced design due to its lack of "ethnic characteristics" (Weisenfeld 2012, 274) (**Figure 4**). This discussion connected back to Clancey's argument and



Figure 4: The Earthquake Memorial Hall, designed by Itō Chūta. Photo courtesy of Emily Pawley.

the way East/West dynamics can impact earthquake memories. Weisenfeld's book also helped us think about the objects displayed in the museum. Weisenfeld pointed to the way that "burned and mangled bicycles gesture to absent riders" (Weisenfeld 2012, 288). Students wrote their reactions to individual objects on the class blog. One student explained how an object as simple as a damaged pen took on new meaning when displayed in a memorial museum.

Either of these museums could add a disaster-related dimension to more-general study tours of Japan. To visit requires a mere half-day excursion as part of a trip to these respective cities. If both museums are included, then a comparison of the two could be fruitful. The Tokyo museum and park are centered on memorialization, whereas the Kobe museum is primarily geared toward education. There is a similar facility for education in the Tokyo Rinkai Disaster Prevention Park near Odaiba that we visited during the 2016 trip; this could be included in a Tokyo trip.

Before we traveled to Tōhoku to discuss the March 2011 disaster, we provided context through lectures and brief scientific articles.² We also had students read some recent works of literature available in the collection *March Was Made of Yarn*. We all read "Island of Eternal Life" by Tawada Yōko, and students selected another story to read from the *March...* collection. We discussed Tawada Yōko use of science fiction and history to posit an alternate future that strangely resembled the Edo period. The story suggests that scientific "progress" could, ironically, cause national regression if nuclear power, corporations, and government were to run unchecked. Through this and other stories in the collection, students were able to see the range of literary responses to the disaster and discuss how each author responded in their individual way.

We also studied an artistic response to disaster during a visit to Shibuya station, the site of the giant mural "Myth of Tomorrow" by Okamoto Tarō. This cold war era anti-nuclear bomb mural was modified soon after the 2011 disaster by the guerilla art group Chim↑Pom (**Figure 5**). In a work titled "*Level 7*" (after the most serious level on

² For example, Satake and Atwater (2007), Blandford and Ahn (2012), and Ritsema, et al. (2012).



Figure 5: Okamoto Tarō's "Myth of Tomorrow." Photo courtesy of Emily Pawley.

the nuclear disaster scale), Chim↑Pom added an image of the damaged Fukushima nuclear plant to the corner of the painting, modifying Okamoto's message to speak to the recent catastrophe. Linda Hoaglund provided context and a series of links about the art group and their politics in an article in *Japan Focus* (Chim↑Pom and Hoaglund 2012). The videos of Chim↑Pom's various post-3/11 activities, accessible through Hoaglund's article, encouraged discussion of artistic responses to disaster without a trip to Japan, but it was impressive for us to stand before the mural itself and talk about both Hiroshima and Fukushima.

The trip to the Tōhoku region was the most moving part of each year's visit. Our first stop was the city of Matsushima, whose bay full of pine-covered islands is one of the most famous scenic spots in Japan. There were very few traces of the tsunami or the earthquake in Matsushima. As we walked through the town with our students in 2013, we pointed out remnants of the disaster which could easily be overlooked. There were recently constructed memorial markers, sidewalks warped by liquefaction, and an historic tree at the base of a famous temple whose root system had been damaged by the salt water. The traces were even harder to spot in 2016. There was little evidence of the tsunami on our boat tour of the bay, but the guide showed images of how some rock formations were altered by the shaking and how the waves and salt water had killed trees on one or two of the islands as well, though disease and pests were also causing subsequent harm to these beautiful trees. The lack of tsunami damage in Matsushima allowed discussion of why that was

the case. Students were able to deduce that the shape of Matsushima Bay resulted in a less powerful wave and that many islands helped dissipate the wave's energy (**Figure 6**). The same effect on a larger scale can be seen in a simulation by the National Oceanic and Atmospheric Administration (NOAA) available on YouTube (see References). Their video demonstrates how Papua/New Guinea and the Solomon Islands, for example, protected Australia from the full impact of the waves.

From Matsushima we went to Ishinomaki, the largest city to be directly impacted by the tsunami, and then to Minamisanriku, one of the most devastated communities. The contrast between Matsushima and Minamisanriku was striking. One difference was accessibility; we were unable to make it all the way Minamisanriku by train, as the route serving much of the coast in the area remained impassable. The most conspicuous difference was in the visible remnants of the disaster. No matter how many times students had seen photos, video, or satellite imagery, those could not prepare them for the shock of seeing a city literally wiped away. The fact that the

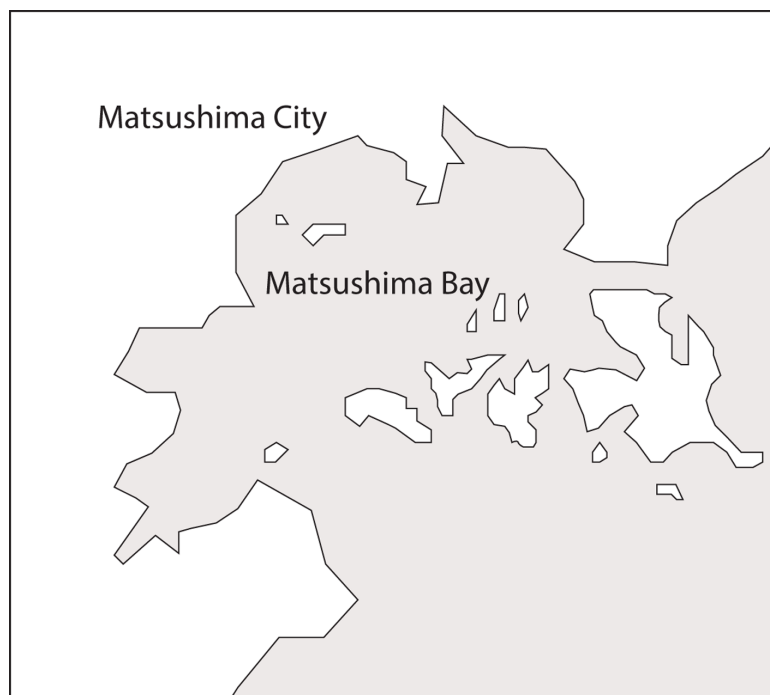


Figure 6: Map of Matsushima Bay.

pre-tsunami population in Minamisanriku was similar to that of our college town (approximately 18,000) helped put the devastation in context. In contrast to Matsushima, the shape of the bay in Minamisanriku concentrated the waves making them higher here than in other areas.

Hotel Kanyō, our accommodations in the area, arranged for a bus tour of the devastation the morning after our arrival (only available in Japanese). Our guide had lost his home and everything in it, but his young family was saved. We saw makeshift memorials, heard stories of people who sacrificed themselves to warn others, and saw signs of revitalization in a temporary shopping area (**Figure 7**). While I felt the tour was valuable for our students, I was conflicted about the “disaster tourism” aspect. Nevertheless, we held a fascinating discussion following the tour that touched on the



Figure 7: The Minamisanriku Disaster Management Building makeshift memorial in 2013. Photo courtesy of Emily Pawley.

complicated ethics of “disaster tourism.” Students noted that while profiting from a disaster was troubling, the educational merit to us and others, and the employment opportunities provided for the dispersed community were not easily dismissed. It was one of the best discussions we had in the class.

Minamisanriku had changed considerably between 2013 and 2016, though we were unable to get there by train even five years after the tsunami. There were two lines of thinking about rebuilding in post-tsunami Tōhoku. One suggested that the best preparation was to create wide paths for escape and leave coastal areas as parks; the other was to engineer higher walls. It was clear which path Minamisanriku (and much of the northeastern coast of Japan) chose. The Tōhoku coast in general was undergoing massive public works construction, with significant environmental cost in terms of leveling mountains for landfill and resultant runoff into the ocean. Many remnants of the devastation had been removed, though the Minamisanriku Disaster Management Building still stood as a memorial. It remained, but had been dwarfed by a massive landfill project that, more than being a mere tsunami wall, aimed to raise the town 11 meters (**Figure 8**). The entire town no longer looked like the site of a massive disaster, but was, rather, a busy construction site. Students noted that construction workers seemed to outnumber town residents. Nevertheless, we walked through the construction and saw the reborn fishing district providing employment for locals who had been displaced. The temporary shopping district was still operating in the same temporary structures. It was clear that reconstruction had favored the fishing industry and big landfill project, and the town had a long way to go before it could be considered reconstructed.

Though the time spent in Japan was only one aspect of the 2016 program, the “Meltdowns and Waves” trip focused more on the social impact of the 2011 disaster and we spent more time exploring the impact of the Fukushima nuclear accident. In Tokyo we toured the Tokyo Rinkai Disaster Prevention Park, visited an NGO (non-governmental organization) working on disaster relief, and attended one of the regular anti-nuclear power protests held near the Diet building. After a few short days in Tokyo, our main focus was on the affected areas of Tōhoku. For the Fukushima portion of our trip, we were centered in Kōriyama. From there we visited activists, government workers, NGOs, and displaced residents. We heard

about their fears and hopes, and the actions being taken to improve people's quality of life.

One particularly impressive NGO was the Mother's Radiation Lab Fukushima, also known as Tarachine, an early word for 'mother' from a *Man'yōshū* poem. This volunteer-based lab in Iwaki has sophisticated scientific devices designed to measure radiation in vacuum cleaner dust (usually high in radiation in areas stricken with nuclear disasters because it concentrates airborne particles that settle on the



Figure 8: The former Minamisanriku Disaster Management Building surrounded by landfill aiming to raise the level of the town. Photo courtesy of Hayat Rasul.

ground), toys, and food. It has been highlighted in several news outlets including the *Japan Times*, BBC, and Reuters. Tarachine provides a crucial service for locals who have trouble trusting government safety reports. At Tarachine, we observed workers testing cabbage in a radiometer detecting sodium iodine. The devices were surrounded by cases of water to eliminate background radiation (**Figure 9**). These workers were trained only after the disaster, and often not in universities but within the organization itself. In an article about the group, the director is quoted as saying humbly, “If a university professor saw [the self-taught lab workers] I think they would be completely shocked by what they see” (Shibata 2017). Nevertheless, one of my colleagues was impressed by the quality of citizen science being practiced and even had the radiation in his body measured by one of the devices. Students were inspired to see what science could do to help people and what citizens could do through collective non-governmental work.

In 2016, our tour of Tomioka, a town once inside the exclusion zone, was especially powerful, mostly thanks to our guide, a former resident. Unlike in Minamisanriku, Matsushima, and Ishinomaki, this region still displayed considerable damage and debris from the tsunami and the earthquake even five years post disaster. The town was



Figure 9: Radiometer measuring the radiation levels in local cabbage at Tarachine in Iwaki, Fukushima. Photo courtesy of Hayat Rasul.

mostly deserted. Shops had broken facades and a few buildings remained collapsed. We stopped by our guide's home. It had weathered the disaster relatively well, but was looted after the mandatory evacuation. The door to the house remained damaged from the break-in and our guide remarked that there was no point to repairing it. She and others from the neighborhood were considering what to do once they were permitted to move back. Many knew they would never return, but others were thinking about returning despite lingering radiation; some had few other options.

Reconstruction efforts visible elsewhere were lacking in Tomioka, though we did spot a few workers still performing decontamination. In Tomioka there were measurable differences in radiation levels, especially in gutters. Though we could not see or feel the radiation, our instruments told us it was there. We went to the barrier marking the border of the exclusion zone, beyond which we could travel no further. On one side, people would soon start returning to their homes. On the other, it was unknown when that might be possible. Of course, radiation was a concern to us and our students, but radiation levels published by both the government and NGOs showed we would be exposed to more harmful radiation on our flights to and from Japan than in the half day spent in Tomioka. Nevertheless, we offered students the option to excuse themselves from this portion of the trip. No one took us up on the offer.

Everywhere we went were large black bags of contaminated soil and debris (**Figure 10**). The then-current solution for this waste, according to our sources, was to use these bags of contaminated debris as landfill, dulling the radioactivity by covering it in layers of more landfill. The problem was that there was too much refuse and the radiation was a continuing problem. Thinking about this radioactive debris along with the regular waste from nuclear power plants helped our students consider the challenges of nuclear power. While it did not contribute greenhouse gasses to our atmosphere, there were other costs made tangible to our students through what we saw and how the people were affected when something went wrong. Tokyo and Kyoto are the usual foci of study-abroad tours, and the distance to Tōhoku makes it difficult to include on many trips, but doing so would be well worth the effort.



Figure 10: Black bags of contaminated soil and debris outside Tomioka, Fukushima. Photo courtesy of Hayat Rasul.

These programs allow for experiential learning that is otherwise not possible. Through carefully orchestrated interviews and site visits, we helped students see the movement of the earth and the impact of the resulting disaster on the lives of real people. At the same time, there were countless serendipitous moments when an artifact in a museum, a geological formation, or a chance encounter with an earthquake survivor or volunteer led to deep discussions. In the final evaluations, students remarked that these trips and the individuals we encountered helped them “think more deeply about earthquakes and their impact on people,” in the words of one student. Another commented that the trip to Tōhoku would have a “life-long influence” on them. These comments suggest the importance of understanding disaster by standing face to face with its effects and with people affected, rather than through the abstraction of news reports or history books.

Museums and Facilities

Tokyo Rinkai Disaster Prevention Park

<http://www.ktr.mlit.go.jp/showa/tokyorinkai/english/>

This would be the headquarters of disaster management should a major disaster hit Tokyo (the park includes a helipad). At the same time, it serves as an educational facility that includes earthquake simulation and information on preparing for and surviving a major disaster.

Edo-Tokyo Museum

<http://www.edo-tokyo-museum.or.jp/english/>

This museum, close to the Kantō Earthquake Memorial, provides information on disasters in the Tokyo area along with other useful information about the city. It gives context to the smaller earthquake museum next to the Earthquake Memorial Hall.

Kantō Earthquake Memorial Hall and Museum

<http://www.kensetsu.metro.tokyo.jp/kouen/kouenannai/park/english/yokoamicho.pdf>

Most of the signs are in Japanese, but there is much to discuss in this museum, especially in conjunction with Gennifer Weisenfeld's book.

The Great Hanshin-Awaji Earthquake Memorial Museum

<http://www.dri.ne.jp/english/>

This Kobe museum has information in a variety of different languages, and is very accessible to English speakers. It is particularly useful in describing the role disaster education plays in Japan.

The Neodani Fault Museum

Motosu, Gifu

This museum has very little in English, but provides a unique opportunity to see a major fault exposed.

Useful websites

Japan Meteorological Agency

<http://www.jma.go.jp/jma/en/Activities/earthquake.html>

This site includes detailed information on earthquakes, Japan's particular seismic intensity scale and the early warning system. It is useful for explaining the array of networks and institutions that help Japan deal with its frequent earthquakes.

Mother's Radiation Lab Fukushima

<https://tarachineiwaki.org/>

This amazing NGO provides a range of services for local residents interested in knowing more about radiation and its impact on their health. In addition to testing, it provides medical care, field trips, and more.

Nagoya City Information on Disasters

<http://www.nic-nagoya.or.jp/en/e/daily-living-guide/earthquakes-typhoons-and-other-natural-disasters>

Most local governments have information on local disaster preparedness in English. For one assignment, students explored the information available online to determine a disaster plan for our group. While this site is for Nagoya, any reasonably sized city should have similar information and maps outlining the evacuation centers. An earthquake disaster plan is important for any trip to Japan, but making one was a fascinating learning activity.

Competing Interests

The author has no competing interests to declare.

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