Technical Note

Global List and Interactive Web Map of University-Based Hazards and Disaster Research Centers

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Abstract: This paper describes a novel data set and an accompanying online listing and interactive web map that displays university-based hazards and disaster research centers globally. To date, this initiative has led to the identification of 360 academic hazards and disaster research centers across the five major United Nations geographic regions, including 23 in Africa, 183 in the Americas, 94 in Asia, 37 in Europe, and 23 in Oceania. This web-based initiative is launched in an effort to allow more systematic identification of hazards and disaster research centers and to increase connections, communication, collaboration, and access to emerging research from a variety of disciplines. **DOI:** [10.1061/(ASCE)NH.1527-6996.0000371.](#) © *2020 American Society of Civil Engineers.*

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Introduction

The world's first academic disaster research center—the Disaster Prevention Research Institute—was established at Kyoto University in Kyoto, Japan, in 1951. In the decades since, the number of university-based hazards and disaster research centers, laboratories, and institutes has grown to at least 360 worldwide. These academic centers, which are led by researchers from a variety of disciplines, are located across all five of the major United Nations geographic regions including in Africa, the Americas, Asia, Europe, and Oceania. This paper details a recent initiative, headquartered at the Natural Hazards Center at the University of Colorado Boulder, to identify and geolocate these academic hazards and disaster research centers and to publish the associated data.

The Natural Hazards Center, which is the National Science Foundation–designated clearinghouse for disaster information, has long maintained an online listing of academic hazards and disaster research centers. In 2017, the Center began updating that list in recognition of the rapidly changing research landscape and with the intent of placing the centers in an online mapping portal. By developing a tool for researchers, practitioners, journalists, and policymakers to systematically identify these centers, the aim was to increase connections, communication, collaboration, and access to emerging research from a variety of disciplines (Peek 2019).

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Background

Scholars in the hazards and disaster field have long emphasized the need to strengthen multi-, inter-, and transdisciplinary collaboration in academia, both within and across institutions (Rodríguez et al. 2004). International collaborations are also crucial to advance a global research agenda, especially given that researchers from higher-income countries such as the United States, Canada, Japan, Australia, and New Zealand, as well as those throughout Europe, for example, have a more robust and well-funded research infrastructure (Hamel 2007; Kontar et al. 2018), while lower-income countries experience disproportionate loss of life in disaster. Richardson and colleagues (2009) argued that it is especially important to develop interdisciplinary as well as international partnerships before disasters strike in order to establish trust, identify common interests, and exchange subject matter expertise, while Gaillard and Gomez (2015) underscored the ethical imperative of such collaborations.

Knowledge exchange and opportunities for collaboration between researchers could be enhanced by implementing evolving GIS technologies—such as web maps—that incorporate the internet, cell phone applications, and other advances in computing. Many people and organizations both within and outside of academia—and especially in the fields of disaster response and emergency management—have developed a variety of GIS and mapping technologies over the years that are useful in investigating natural hazards topics ranging from hurricane and wildfire activity, flood inundation, social vulnerability, and more (Dash 1997; Cutter et al. 2003; Esri 2008; CDC 2015).

While GIS is no longer a new technology, innovative web-based mapping applications are increasingly being used to make geospatial data and analysis available online and in real time, with millions of people in the United States using these novel applications every day (Clement 2018). Although GIS technologies like web maps are frequently used for geospatial analysis and as decision-making tools, the disaster response and emergency management fields have also used web maps to support collaboration through simple visualizations and information dissemination (MacEachren 2000; Harder and Brown 2017; Abdalla and Esmail 2019). For example, emergency managers and first responders use these applications to manage personnel and resources during the response phase of disaster management. Since changes can be made to web map

applications in real time, they enable responders to adapt to the fluid nature of disasters in ways that are not possible with traditional paper-based or otherwise static maps. Web maps can enhance collaboration and the exchange of information within the academic research space as well, which is, in part, what led us to create the tool described in this paper.

Creating the Data Set for the Global List of University-Based Hazards and Disaster Research Centers

The resource described here involves a novel, published data set that includes information about academic hazards and disaster research centers across the world (see Peek et al. 2019). Although the data set is not an official census of all academic centers, our Natural Hazards Center research team—which included the authors of this paper as well as other researchers at the Center—used a variety of approaches to populate the data set.

Our team began with a listing of 53 university-based research centers located in North America that had previously been featured on the Natural Hazards Center's website. This list, however, had not been updated for several years and it only included the names of the centers, their university affiliations, and the URLs for the center websites.

One of our first tasks was to update the initial list of centers, while also expanding on the information available for each center. Therefore a data set was created containing the following variables for each center: (1) center name, (2) university name, (3) director name, (4) director official title, (5) director email, (6) center, laboratory, or institute mission statement, (7) website, (8) hazards category (e.g., natural, technological, terrorism/willful violence, all hazards), and (9) primary disciplinary focus (e.g., social science, urban planning, engineering, public health and medicine, natural science, multidisciplinary, interdisciplinary). Next, because a major goal of this initiative was to develop a web-based interactive map, our team also populated a secondary set of variables for each center, including (10) city, (11) administrative area (state, province, region), (12) country, (13) latitude, (14) longitude, (15) UN primary region, and (16) UN subregion.

After the data set was populated with information from the 53 centers that had previously been identified, our team sent the list to colleagues who added information for approximately 30 more centers. We then worked to identify additional centers through several means. The Natural Hazards Center publication subscription list and annual Natural Hazards Research and Applications Workshop registration list were searched for any affiliation that included reference to a university-based laboratory, center, or institute. Upon identification, our team then verified via an internet search that the center was still active. Once we had exhausted the search of the Natural Hazards Center databases, we then conducted a series of internet searches, using terms such as university, research, center, institute, laboratory, hazards, and disaster, paired with individual country names as well as specific disaster types such as hurricane, typhoon, flood, and earthquake. This initial search for research centers was conducted in English and focused on updating the list of centers located in North America and the Caribbean (other regions of the world followed soon thereafter, as described in a subsequent section). By May 2018, our team had identified 128 university-based centers in North America and the Caribbean. At this point, work on the data set was paused to begin development of Version 1.0 of a web map.

Developing and Building the Global Hazards and Disaster Research Centers Web Map

In the spring of 2018, our research team used the aforementioned data set to build a web map that featured the locations of 128 research centers located in North America and the Caribbean (Natural Hazards Center 2018). The release of this map and online listing, coupled with a request that users help our team to identify additional centers yielded two things. First, more than two dozen people from around the world emailed to notify us of centers that were missing from the map. Second, we received several requests to expand the map to encompass all regions of the world.

In response to these calls and in recognition of the need for a global resource, our team continued populating the data set with additional centers through the summer and fall of 2018. In addition to the native-English speakers on our team, support was also garnered from students, postdoctoral researchers, and visiting scholars fluent in Spanish, French, Mandarin Chinese, Norwegian, and Swedish. The vast majority of search returns, however, were in English, which has undoubtedly restricted the number of centers included in the final data set.

As the data set continued to expand, we turned our attention to making the web map interactive. The Esri Web AppBuilder for ArcGIS was used to create an online listing and interactive web map portal, in which users can search for and find university-based hazards and disaster research centers.

The team released Version 2.0 of the global map and online listing in February 2019 (Peek 2019). The website (Natural Hazards Center 2019) includes an online listing and interactive web map of centers around the world focused on various, socially relevant research topics and a range of hazard types (Fig. 1). These centers have unique equipment, computing capabilities, and facilities designed to conduct cutting-edge research that, when translated into action, can help communities and societies mitigate, prepare for, respond to, and recover from hazards and disasters. In addition, many of these centers offer educational and training programs aimed at developing the next generation of hazards and disaster researchers.

How to Use the Web Map

This initiative is designed to serve as an information resource for a worldwide audience that includes anyone seeking information regarding research, outreach, and training. The simplest way to use the web map is by panning and zooming around the map manually. When portal users click on a center's dot on the map, a pop-up box appears with basic information, including name, institutional affiliation, logo, and a website link. The web map also includes a query widget, which allows users to search for centers by their name, institutional affiliation, and by geographic location, including city, administrative area, country, and UN region or subregion (Fig. 2).

In addition to the widget described, the following additional widgets are included in the web map: About, Basemap Gallery, Legend, Layer List, Summary, Screening, and Near Me. The web map portal includes a guidance page that details how to use each of these widgets. Users in need of additional help navigating the web map portal can access a video introducing users to the project and several brief instructional videos. These instructional videos explain several of the more advanced widgets included on the map in more detail. As the Natural Hazards Center research team expands the center data set and learns how people are using the map, additional widgets will be added.
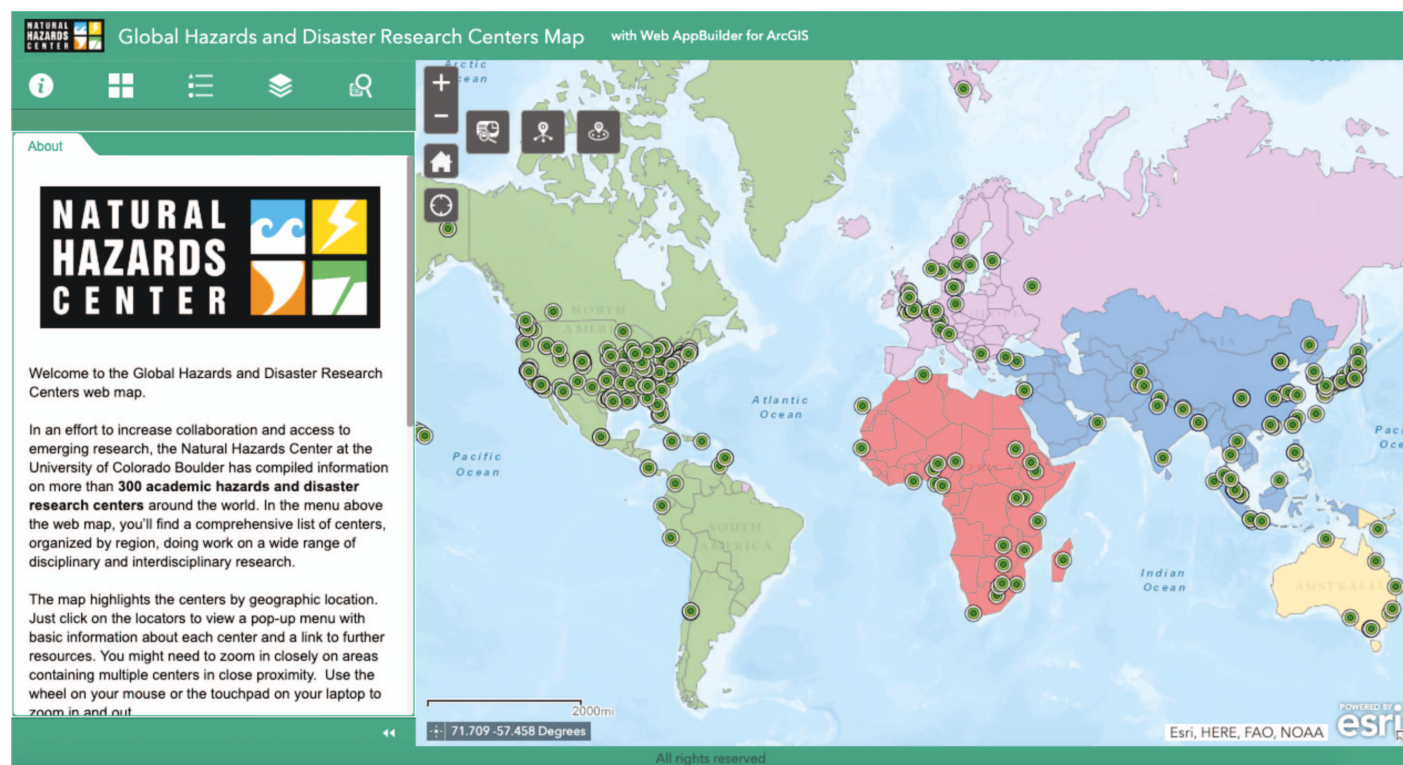
Fig. 1. (Color) Global hazards and Disaster Research Centers Map, Natural Hazards Center. (Reprinted from Peek et al. 2019; Map data from Esri, HERE, FAO, NOAA.)

Research Centers by Region, Subregion, and Nation

A comprehensive list of centers is also available in the menu above the map. Here, users can find lists of centers organized by UN region (Africa, Americas, Asia, Europe, Oceania). These lists—which are further organized alphabetically by UN subregion and country name—include the center name, institutional affiliation, and country, as well as a link to each center's website.

As of August 2019, and with the help of the hazards and disaster research community who have responded to subsequent requests to identify additional centers, our team has verified a total of 360 academic hazards and disaster research centers globally (Table 1). The web map and the associated listings are updated online every other month.

As shown in Table 1, the UN Americas region is home to approximately half of the university-based hazards and disaster research centers identified thus far. The UN Northern American subregion has the highest concentration of academic hazards and disaster research centers. Within that subregion, the United States alone is home to 157 of the 360 centers catalogued in the web map and online listing. Just more than one-quarter (26.1%) of the academic centers are in the UN Asia region, 10.3% are in the UN Europe region, 6.4% are in the UN Africa region, and 6.4% are in the UN Oceania region. As noted previously, however, the Natural Hazards Center recognizes that this effort is incomplete, because the team relied heavily on preexisting connections, English-language internet searches, and the feedback of a select number of colleagues who have been able to review the map carefully. Therefore, these initial results should be viewed with some caution, although they are still instructive regarding regional concentrations of academic centers.

Publishing the Data

This web map portal will be used as a living repository in which information about hazards and disaster research centers will be stored, updated, and disseminated to the broader communities concerned with ameliorating the causes and reducing the harmful consequences of disasters. Version 1.0 of the research center data set used in the web map portal was published via the Natural Hazards Engineering Research Infrastructure (NHERI) DesignSafe Cyberinfrastructure in May 2019 (Peek et al. 2019). This data set will be updated annually to ensure open access to the content and to encourage further analyses of the available data.

Next Steps

Moving forward, evaluation will be a crucial component to ensure that this initiative has succeeded at fostering more multidisciplinary, interdisciplinary, and international collaboration and knowledge sharing. We have already implemented simple evaluation measures, such as tracking site and page views, as well as their source geographies. Since the launch of the Global Hazards and Disaster Research Centers web map portal in 2018, the map and associated webpages have received more than 4,770 views from nearly 80 countries. In the future, we also plan to implement more sophisticated measures, such as surveys or interviews with hazards and disaster researchers and informal polls at scientific meetings to learn how users are engaging with the web map. This information will help inform future map updates and increase usability. We also have considered a social network analysis survey, so that we can better understand how these centers are collaborating and how this varies by region, disciplinary focus, and other related variables.
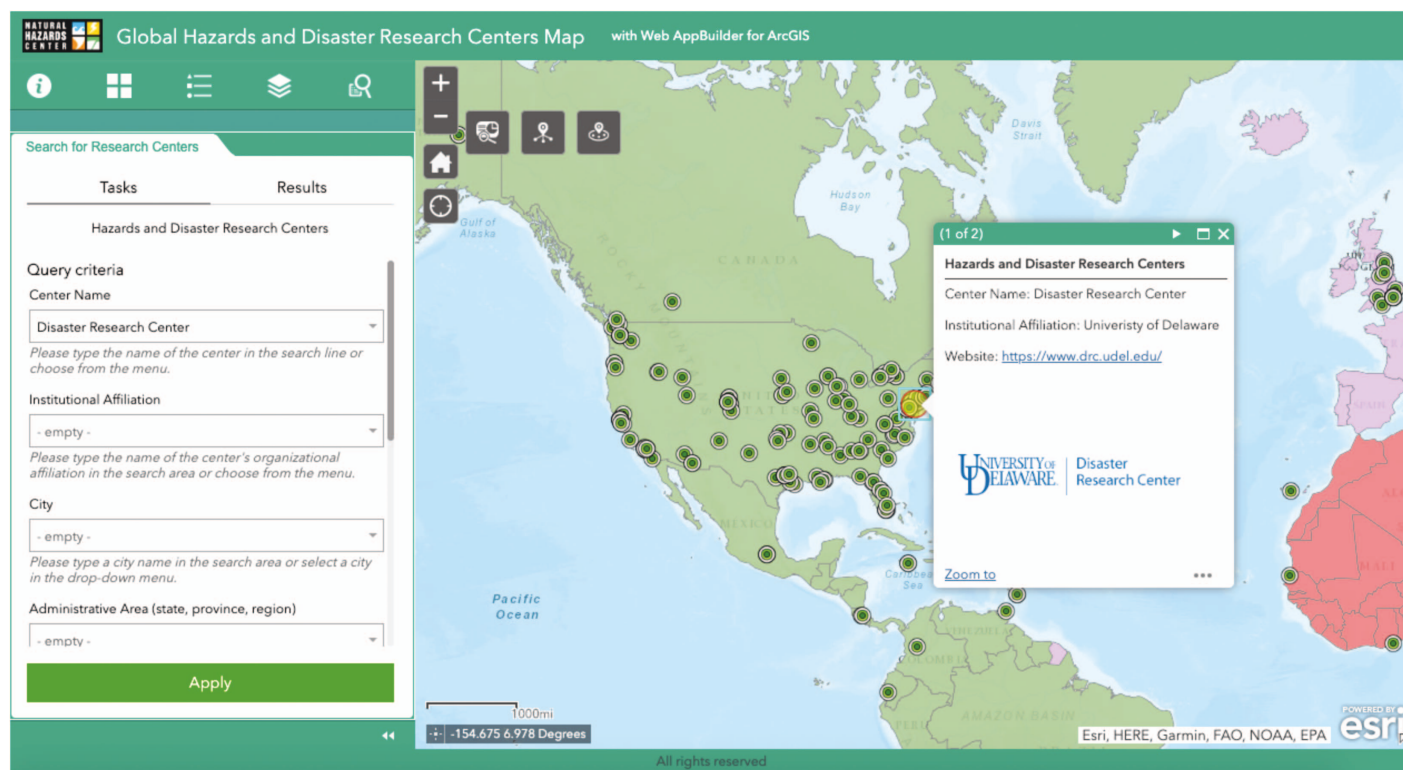
Fig. 2. (Color) Interactive web map enables users to search for academic hazards and disaster research centers by various criteria. (Reprinted from Peek et al. 2019; Map data from Esri, HERE, Garmin, FAO, NOAA, EPA.)

Table 1. Geographic distribution of academic research centers currently included in the web map

UN regions and subregions	Number (%) of centers	Countries represented and counts by country
Africa	23 (6.4%)	
Eastern Africa	10	Ethiopia (2), Kenya (1), Madagascar (1), Malawi (1), Mozambique (1), Tanzania (1), Uganda (1), Zambia (1), and Zimbabwe (1)
Middle Africa	1	Cameroon (1)
Northern Africa	2	Algeria (1), and Sudan (1)
Southern Africa	4	South Africa (4)
Western Africa	6	Ghana (1), Nigeria (4), and Senegal (1)
Americas	183 (50.8%)	
Caribbean	5	Barbados (2), Jamaica (2), and Trinidad and Tobago (1)
Central America	5	Costa Rica (2), and Mexico (3)
Northern America	167	Canada (10), and USA (157)
South America	6	Chile (3), Colombia (1), Ecuador (1), and Peru (1)
Asia	94 (26.1%)	
Central Asia	1	Tajikistan (1)
Eastern Asia	53	China (24), Japan (26), and South Korea (3)
South-Eastern Asia	24	Indonesia (6), Laos (1), Malaysia (8), Philippines (4), Singapore (3), and Thailand (2)
Southern Asia	11	Bangladesh (3), India (4), Nepal (2), and Pakistan (2)
Western Asia	5	Israel (2), Oman (1), and Turkey (2)
Europe	37 (10.3%)	
Eastern Europe	1	Russia (1)
Northern Europe	27	Denmark (2), Finland (2), Norway (2), Sweden (6), Svalbard (1), and United Kingdom (14)
Southern Europe	3	Italy (1), Macedonia (1), and Spain (1)
Western Europe	6	Belgium (1), Germany (4), and Switzerland (1)
Oceania	23 (6.4%)	
Australia and New Zealand	21	Australia (10), and New Zealand (11)
Melanesia	2	Fiji (1), and Papua New Guinea (1)
Micronesia	0	
Polynesia	0	
Global Total	360	

Additionally, as the list of research centers grows, the Natural Hazards Center intends to collect additional data from the centers represented on the map to enable portal users to search for centers based on even more criteria, such as (1) year the center was founded, (2) size of the center, (3) specific area(s) of disciplinary expertise, (4) hazards and disasters studied by event type, and other categories based on feedback and community-driven input. The Natural Hazards Center also hopes to eventually expand this mapping effort to include non-academic research centers run by government agencies, nonprofits, and other hazards and disaster groups.

To date, the map and associated information has only been disseminated in English. While we have partnered with researchers who speak other languages and live and work in countries outside the United States, we recognize there is a need to translate these materials and to further engage researchers in all of the major UN regions.

Finally, additional data layers could be added to the Esri Web AppBuilder for ArcGIS mapping portal and used for analysis in conjunction with the aforementioned research center data set. For example, many data layers are available via Esri's Living Atlas of the World database (Esri 2019), as well as through an increasing number of websites made available by governmental, nongovernmental, and public organizations that participate in the growing open data movement.

Conclusions

This paper has described a new interactive web map and global listing of academic hazards and disaster research centers. This Natural Hazards Center initiative uses new technologies to respond to calls to promote convergence-oriented activities between researchers and those in impacted communities, as well as between individuals and organizations involved in decision-making and policy work across the government, nonprofit, and private sectors (McNutt 2015).

Although the global list we have presented here is not yet considered comprehensive, the interactive web map reveals stark differences in the identified concentrations of academic research centers around the world. The United States, for example, is both home to the highest number of identified centers, and also where the largest share of all economic losses from disasters occurs (Wallemacq and House 2018). Other regions, such as Africa and Asia, which are disproportionately burdened by disaster deaths (Wallemacq and House 2018), appear to have fewer research centers. As we continue to develop this data set and foster new partnerships, we plan to expand this initiative and evaluate its overall impact. We hope, however, that this is a step toward identifying and recognizing the important research occurring the world over.

Data Availability Statement

Some or all data, models, or code generated or used during the study are available in a repository or online in accordance with funder data retention policies (Peek et al. 2019).

Acknowledgments

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