

DESIGNSAFE-CI

A NATURAL HAZARDS
ENGINEERING COMMUNITY



A Cyberinfrastructure for the Natural Hazards Community



Tim Cockerill

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TACC Director of User Services

DesignSafe-ci.org Leadership



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ECO
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What is DesignSafe?

- A web-based research platform that provides computational tools to manage, analyze, and understand critical data for natural hazards research

DesignSafe Vision

- A CI that is an integral part of research discovery
 - Support end-to-end research workflows and the full research lifecycle, including data sharing/publishing
 - Cloud-based tools that support the analysis, visualization, and integration of diverse data types
- Amplify and link the capabilities of the NHERI partners and natural hazards researchers around the globe



DesignSafe is the web-based research platform of the NHERI Network that provides the computational tools needed to manage, analyze, and understand critical data for natural hazards research.



Learn how to
Start Using DesignSafe



Browse the Data Depot's
Published Data Sets



Join the conversation in
DesignSafe's Slack Channel



Learn more about
NHERI, the NCO & DesignSafe



**NHERI Five-Year
Science Plan**



This NOAA/RAMMB satellite image taken on October 8, 2018 shows Hurricane Michael off the U.S. Gulf Coast. (HO / AFP/Getty Images)

Hurricane Michael Barreling Toward Florida Gulf Coast

Hurricane Michael will make landfall mid-day Wednesday, Oct 10 with life threatening storm surge forecasted up to 12 feet, heavy rainfall up to 12 inches and damaging winds. Researchers from the Florida Coastal Monitoring Program are heading into the field ahead of the storm to set up two 15 meter weather stations.

[READ MORE IN THE NEWSROOM](#)

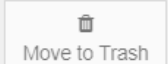


DesignSafe Components

- Research Workbench
 - Data Depot
 - Discovery Workspace
 - Reconnaissance Portal
- Learning Center
 - Training resources and student engagement
- NHERI Facilities
 - Access to information about all NHERI facilities
- NHERI Community
 - News and online Slack community

Data Depot Features

- Different areas:
 - My Data (Private)
 - My Projects (Semi-Private, Collaborative)
 - Published (Publicly accessible, curated)
 - Community Data (Publicly accessible, uncurated)
- Upload files/folders via computer, cloud service providers, or bulk transfer (Globus)
- Manage, preview files within Data Depot
- Data curation and publishing



+ Add

Projects /

My Data

My Projects

Shared with Me

Box.com

Dropbox.com

Google Drive

Published

Community Data

▶ Curation Tutorials

Project title

PI

Last modified

 Hurricane Harvey (Texas) Supplement -- Collaborative Research: Geotechnical Extreme Events Reconnaissance (GEER) Association: Turning Disaster into Knowledge

Tracy Kijewski-Correa (tkijewsk)

5/23/18
4:09 PM

 NGA-East Site Response Simulation Database

Youssef Hashash (hashash)

5/22/18
12:49 PM

 NGA-East Site Response Simulation Database

Youssef Hashash (hashash)

5/18/18
10:11 AM

 NHERI Partner Visits Spring 2018

Tim Cockerill (cockeril)

4/30/18
5:30 PM

 Finite Element Analysis of Drain-Treated Ground

Ellen Rathje (erathje)

4/28/18
8:12 AM

 Community Data

Charlie Dey (charlie)

4/27/18
12:21 PM

My Projects

+ Add

My Data

My Projects

Shared with Me

Box.com

Dropbox.com

Google Drive

Published

Community Data

Curation Tutorials

Projects / Liquefaction Evaluations of Finely Interlayered Sands, Silts and Clays

PRJ-1844: LIQUEFACTION EVALUATIONS OF FINELY INTERLAYERED SANDS, SILTS AND CLAYS

PI	Boulanger, Ross;	Manage Team Members	DOI	(Appears here when published)
Date of Publication	(Appears here when published)		Award	CMMI-1635398
Project Type	Experimental		Keywords	Centrifuge testing, Liquefaction, Thin layer effect, Cone Penetration Test (CPT), Sand, Clayey silt

Description

The effect of soil interlayering on the measured cone penetration resistance was examined in a layered soil model tested on a 9-m radius centrifuge. The soil profile consisted of a layer of sand between overlying and underlying layers of low plasticity clayey silt. The sand layer thickness varied from 0 to 240 mm (model scale) along the length of the model. The sand was loose with a relative density of 44% on one side of the model, and dense with a relative density of 88% on the other side. The clayey silt had a plasticity index (PI) of 6 and over-consolidation ratio (OCR) of about 1.5. Multiple cone penetration soundings were performed along the width and length of the model using cone penetrometers with diameters of 4, 6 and 10 mm.

Working Directory

Publication Preview

Edit Project

Manage Experiments

Name	Size	Last modified
Test MKH05	--	12/13/17 6:05 PM

Data Curation Philosophy



- **Vision:** Allow users to easily store, share, document, and publish data throughout the life of a project
- Flexible data models and interactive curation
 - Allows researchers to decide how to represent their research
 - Consider what is needed for data to be understandable by an outside user
 - Example: user-defined categories for experimental data

Model Config, Sensor Info, Event, Analysis, Report

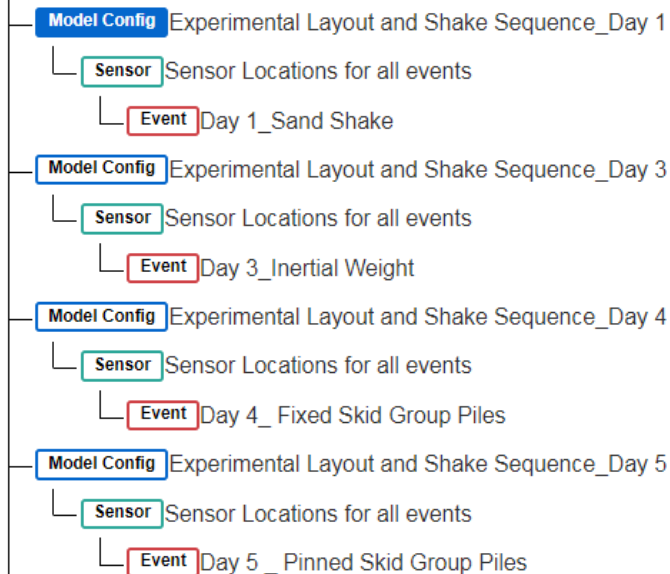
Data Curation and Publication

Define
Category
Tree



Assign
Categories to
Files

— Helical Piles Under Seismic Loading



Working Directory

Publication Preview

Name

10-mm
Event CPT_Dr88%_10mm
4-mm
Event CPT_Dr88%_dc4mm
6-mm
Event CPT_Dr88%_dc6mm

Data Curation and Publication



[Add](#)

[Published / PRJ-1617](#)

PRJ-1617: RAPID: LARGE-SCALE SHAKE TABLE TEST TO QUANTIFY SEISMIC RESPONSE OF HELICAL PILES IN DRY SAND

PI	Cerato, Amy	View Team Members	DOI	doi:10.17603/DS2ND6F	Citation
Date of Publication	Jan/31/2018		Award	1624153	
Project Type	Experimental		Keywords	helical pile, helical pier, single helix, double helix, push pile, group effects, rocking foundations	

Description

This Rapid Response Research (RAPID) project investigated the seismic behavior of helical piles by means of shake table tests on full-scale piles in the UC San Diego laminar soil box. Helical piles are deep foundation elements that look like, and are installed like, a large steel soil screw - they have a slender steel shaft with any number of round plates welded to the central shaft at the tip to provide support to the structure they hold. Helical piles are spun into the ground with a large torque motor and provide support through soil bearing on the plates and along the shaft. They come in many lengths and are often the foundation of choice for retrofitting existing buildings or new, urban construction, due to their small footprint and ability to create minimal disturbance to surrounding structures. Even though it is known from anecdotal studies (e.g., New Zealand and Japan) that piles with comparatively small cross-section and high anchoring capacity, such as helical piles, are beneficial for seismic resistance seemingly due to their slenderness, higher damping ratios, ductility, and resistance to tip uplift, building codes and current state of practice have not been adequately developed for this pile type because no quantitative data exist. Research of seismic behavior of helical pile supported structures is therefore imperative to generate necessary data that will help ensure that helical piles are being correctly applied in seismic areas and establish quantifiable benefits and/or limitations of helical pile use in seismic areas. This project will benefit people living in seismic zones by educating engineers with full-scale helical pile experimental data so that they better understand how to design a building system that is safer, more resilient and sustainable for individuals and the community.

Data Curation and Publication

Define
Category
Tree

Assign
Categories to
Files

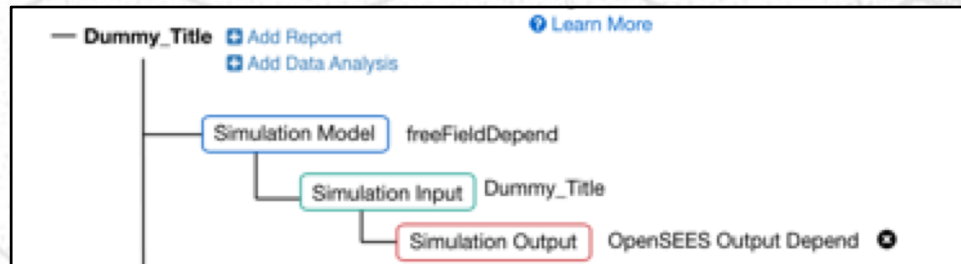
Publish
Project and
Files

The screenshot displays a data curation interface for a project titled "Helical Piles Under Seismic Loading". The interface is divided into several sections:

- Metadata:** Authors (Cerato, Amy; Shahbazi, Maryam;), DOI (doi:10.17603/), Experimental Facility (Large High Performance Outdoor Shake Table, University of California San Diego), Experiment Type (Shake), Equipment Type (Large High Performance Outdoor Shake Table (LHPOST)), and Date of Publication (Jan/31/2018).
- Description:** Tests were conducted on ten piles consisting of nine helical piles and one driven pile which were embedded in the UCSD Large High Performance Outdoor Shake Table (LHPOST). Either an end-on or side-on and helix configuration, were installed along each pile on the east-west faces. These strain gauges were connected as quarter bridge and recorded bending moments and axial forces. These strain gauges were connected as quarter bridge and recorded bending moments and axial forces. These strain gauges were connected as quarter bridge and recorded bending moments and axial forces.
- Relations:** A sidebar on the left lists relations: Experimental Layout and Shake Sequence_Day 1, Sensor Locations, and Sensor Locations.
- Category Tree:** A hierarchical tree structure on the right shows the organization of data:
 - Model Config: Experimental Layout and Shake Sequence_Day 1
 - Sensor: Sensor Locations for all events
 - Event: Day 1_Sand Shake
 - Model Config: Experimental Layout and Shake Sequence_Day 3
 - Sensor: Sensor Locations for all events
 - Event: Day 3_Inertial Weight
 - Model Config: Experimental Layout and Shake Sequence_Day 4
 - Sensor: Sensor Locations for all events
 - Event: Day 4_Fixed Skid Group Piles
 - Model Config: Experimental Layout and Shake Sequence_Day 5
 - Sensor: Sensor Locations for all events
 - Event: Day 5_Pinned Skid Group Piles

Data Curation and Publication

- Data Models
 - Experimental
 - Simulation
 - Other
 - Hybrid Simulation (coming in June)
 - Field Reconnaissance (working with RAPID)
- Virtual Office Hours with Data Curator
 - Tues/Thurs Zoom meetings with Maria Esteva



Make your data count!



- **Formally publish** data sets in stable data repositories
 - Include data processing scripts, visualizations, etc.
- Data needs a permanent, **digital location (DOI)** not just a URL
 - List curated data sets on your CV
- Formally cite data **in your reference list** of your papers using DOI, citation language as indicated in DesignSafe

Experiment ABP03s - Centrifuge Modelling of Variable Rate Cone Penetration in 80S20K Silt-Clay Mixture (80g) ^			
ABP03s - Centrifuge Modelling of Variable Rate Cone Penetration in 80S20K Silt-Clay Mixture (80g)			
Authors	Price, Adam; Boulanger, Ross; DeJong, Jason;	DOI	doi:10.17603/DS2DD46
Experimental Facility	Center for Geotechnical Modeling, UC Davis		
Experiment Type	Centrifuge		
Equipment Type	1m Radius Dynamic Geotechnical Centrifuge		
Date of Publication	Apr/17/2018		

Citation

Citation

Price, Adam; Boulanger, Ross; DeJong, Jason, (2017), "ABP03s - Centrifuge Modelling of Variable Rate Cone Penetration in 80S20K Silt-Clay Mixture (80g)", DesignSafe-CI [publisher], Dataset, doi:10.17603/DS2DD46

Reconnaissance Portal

Identifying Archived Datasets from Recon Events



Reconnaissance Portal

Identifying Archived Datasets from Recon Events



Recon
Portal

[Back to results](#)

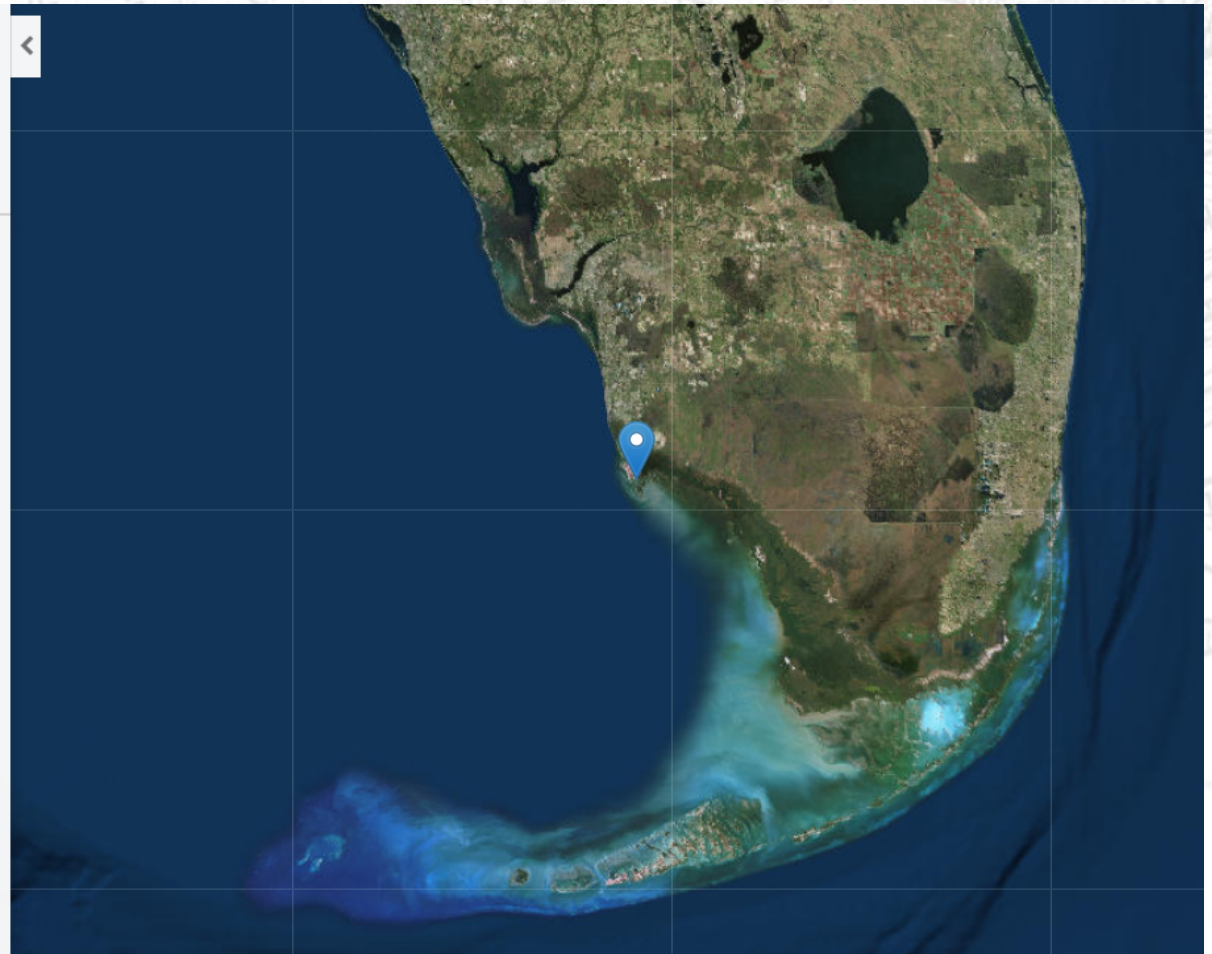


2017 Hurricane Irma
Florida, USA
2017-09-10

hurricane

Available datasets:

- Hurricane Irma Preliminary Reports and Information
- GEER Hurricane Irma - Cape Coral to Key West (Initial Data Collection)



Recon Portal → Data Depot

+ Add

Published / PRJ-1900

My Data

My Projects

Shared with Me

Box.com

Dropbox.com

Google Drive

Published

Community Data

[Learn About 'My Projects'](#)

PRJ-1900: GEER HURRICANE IRMA - CAPE CORAL TO KEY WEST (INITIAL DATA COLLECTION)

PI	Stark, Nina	View Team Members	DOI	doi:10.17603/DS2239D	Citation
Date of Publication	Apr/19/2018		Award	NSF CMMI-1266418 (GEER)	
Project Type	Other		Keywords	reconnaissance, geotechnical, coastal, Hurricane Irma 2017	

Description

Hurricane Irma was a category 5 hurricane on the Saffir-Simpson hurricane wind scale. Irma developed from a tropical wave around the Cape Verde Islands. The National Hurricane Center started monitoring it on August 26, and it was classified as a tropical storm named Irma on August 30. Moving across the Atlantic Ocean, Irma increased in strength. On September 5, Irma was classified as a category 5 hurricane with wind speeds up to 175 mph (280 km/h). Irma made landfall in the U.S. on Cudjoe Key (near Big Pine and Summerland Keys) in the morning of September 10, still being a category 4 hurricane, and made a second landfall on Marco Island, south of Naples, on the same day as a category 3 hurricane. In preparation for Hurricane Irma, more than 6.5 million people were ordered to evacuate (<http://www.pbs.org>), 134 fatalities were associated to the storm, and damages were recorded of more than \$50 billion (<http://www.bbc.com/news/business-41231323>; https://en.wikipedia.org/wiki/Hurricane_Irma). Two teams from the Geotechnical Extreme Events Reconnaissance (GEER) Association, supported by the National Science Foundation, were deployed to investigate geotechnical impacts of flooding, storm surge and wave forcing in Florida in response to Hurricane Irma in September of 2017. The teams worked collaboratively with federal, state, and local organizations in Florida. This initial data collection presents the field observations of the GEER team made during the field reconnaissance from September 24 to 28, 2017. The survey region extended along the coastal zone from Cape Coral to Key West.

Name	Size	Last modified
 floridairma-coord.kml	378.1 kB	4/19/18 3:50 PM
 GEER_report_#56.pdf	22.8 MB	4/19/18 3:48 PM
 Photos	--	4/19/18 12:39 PM
 READ_ME_GEERIrma.pdf	305.8 kB	4/19/18 3:50 PM

Discovery Workspace

- Cloud-based tools for use in research
- Access to files in the Data Depot

WORKSPACE

[Learn About the Workspace.](#)

Simulation [15]

Visualization [7]

Data Processing [3]

Partner Data Apps [4]

Utilities [2]

My Apps [6]

Jupyter

MATLAB R2017b

MATLAB

SELECT AN APP

Browsing:

/ erathje

File name

.ipywb_checkpoints

.Trash

Select an application from the tray above.

The *Workspace* allows users to perform simulations and analyze data using popular simulation codes including OpenSees, ADCIRC, and OpenFOAM, as well as data analysis and visualization tools including Jupyter, MATLAB, Paraview and VisIt.

Jobs Status

DesignSafe Discovery Workspace

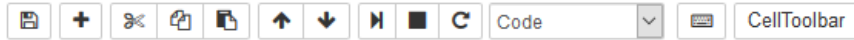
- Data analysis in the cloud
 - Matlab: data analysis and plots
 - Jupyter : electronic notebook that supports Python and R
- Computational simulation codes
 - OpenSees: finite element code for structures and soil
 - ADCIRC: storm surge modeling
 - OpenFOAM: computational fluid dynamics
 - LS-DYNA: available via Bring Your Own License
- Visualization in the cloud
 - Potree: View and analyze point cloud data
 - QGIS: geospatial data analysis

Electronic Data Report

 **jupyter** Data Report v 02 (read only)

 Control Panel Logout

File Edit View Insert Cell Kernel Widgets Help

 Code CellToolbar

Data Report: Centrifuge Testing of a Circular and a Rectangular Embedded Structure During Base Shaking

Elnaz Esmaeilzadeh Seylabi^{*1}, Eva Agapaki^{†2}, Dimitris Pitilakis^{‡3}, Scott J. Brandenburg^{§2}, Jonathan P. Stewart^{¶2}, and Ertugrul Taciroglu^{||2}

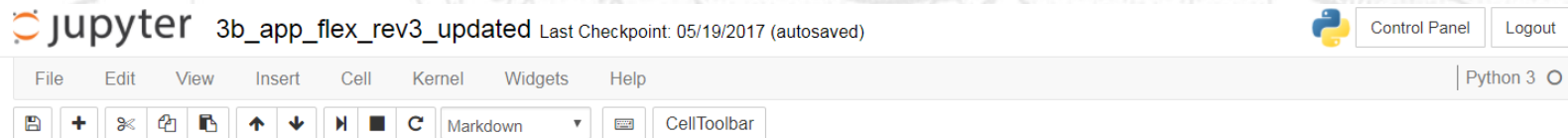
¹Mechanical & Civil Engineering Department, California Institute of Technology, CA 91125
²Civil & Environmental Engineering Department, University of California, Los Angeles, CA 90095
³Department of Civil Engineering, Aristotle University of Thessaloniki, 54124, Thessaloniki, Greece

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[§]Associate Professor, sjbrandenberg@ucla.edu
[¶]Professor, jstewart@seas.ucla.edu
^{||}Professor, etacir@ucla.edu (Principal Investigator)

1 Introduction

Seismic response of underground structures is a complex soil-structure interaction (SSI) problem in which two fundamental mechanisms are at play. Kinematic SSI is concerned with the motion of the structure in the presence of spatially variable ground motions and the interface pressures that develop as a result of different structural and free-field motions. Inertial SSI captures the soil reactions that develop to resist inertial forces associated with the acceleration of the structure. The kinematic component is generally considered to be more significant for buried structures, due to their modest mass and their confinement with the surrounding soil.

Published Analysis Scripts



Application of Probabilistic Framework for Flexible Sliding Displacements

Vector (PGA, PGV) Approximation

Site Location: W -121.99 and N 37.18, Santa Clara County, California

Deaggregation Source: (<https://earthquake.usgs.gov/hazards/interactive/>) - Vs30 = 760 m/s

Mean and standard deviations of ground motions (ie. PGA and PGV) Source: NGA_Models_Version2.4.xls

MRE for PGA obtained from deaggregation Correlation coefficient between PGA and PGV, $\rho_{pgapg} = 0.6$ Correlation coefficient between k_{maxz} and k_{vmaxz} , $\rho_{k_{maxz}k_{vmaxz}} = 0.6$ Logic tree consists of 27 branches: 9 for Ts and ky (correlated) and 3 for Tm

Reference: Rathje, E.M., Wang, Y., Stafford, P.J., Antonakos, G. and Saygili, G., 2014. Probabilistic assessment of the seismic performance of earth slopes. Bulletin of Earthquake Engineering, 12(3), pp.1071-1090.

Site Location

Out[4]:



DesignSafe Workflow Example

What addresses will be inundated on Galveston Island by storm surge from the impending hurricane?

- Compute storm surge water levels with ADCIRC
- Convert output to shapefile format
- Import results into a GIS along with elevation and property data
- Identify addresses that are inundated by simulated water levels

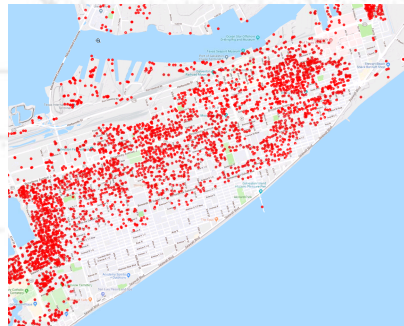
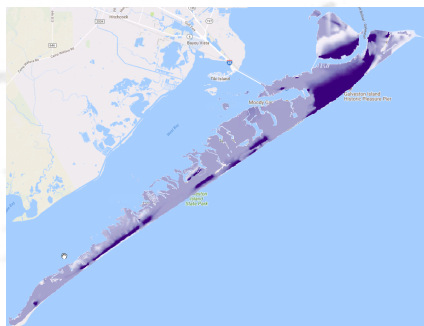
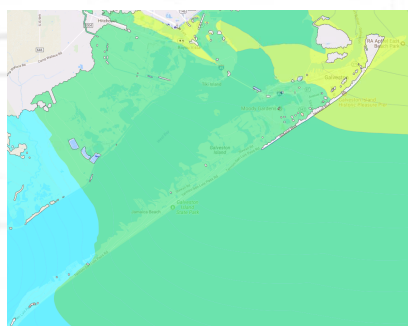
WORKSPACE

[Learn About the Workspace.](#)

Simulation [14]	Visualization [7]	Data Processing [3]	Partner Data Apps [3]	Utilities [2]	My Apps [7]
Parallel SWAN+ADCIRC 160 cores ADCIRC	Parallel ADCIRC ADCIRC	ADCIRC ADCIRC	Parallel SWAN+ADCIRC 240 cores (Lonestar5) ADCIRC	Parallel ADCIRC (Lonestar5) ADCIRC	clawpack C
Dakota D	Hurricane Data Analysis H	LS-DYNA LSTC	LS-Pre/Post LSTC	OpenFOAM ▽	OpenSeesSP OpenSees



Kalpana python script used to convert ADCIRC output files to shapefiles. Executed within a Jupyter notebook in DesignSafe



WORKSPACE

[Learn About the Workspace.](#)

Simulation [14]
Visualization [7]
Data Processing [3]
Partner Data Apps [3]

RUN QGIS DESKTOP ver. 2.18.20
Run an interactive QGIS Desktop session on a virtual machine.
[QGIS Desktop Documentation](#)

HPC Allocation Policy

- **Base allocation:** 8000 SUs and 50GB of storage. Automatically given to each user.
- **Startup allocation:** 50,000 SUs and 1TB of storage. Requires fast track internal review.
- **Research allocation:** up to 2,000,000 SUs and 100TB of storage. Requires a proposal.
- Allocations last for one year, then you can request a renewal or extension.
- www.designsafe-ci.org/rw/support/allocations-policy

Other Components



NHERI: A NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE



Welcome, Ellen! ▾

Research Workbench ▾

Learning Center ▾

NHERI Facilities ▾

NHERI Community ▾

About

Help ▾

Search DesignSafe

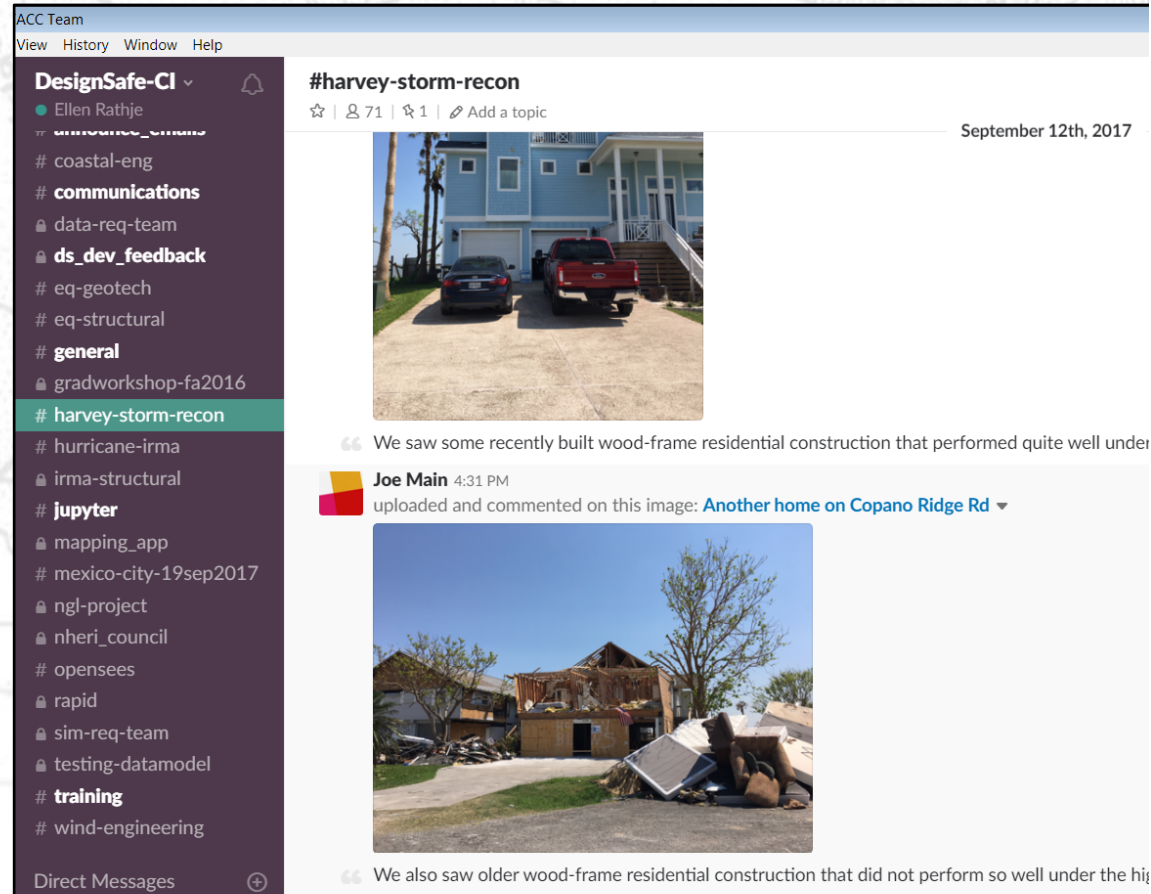


- **Learning Center:** Access to webinars, information on REU, CODE@TACC DesignSafe for high school students, Summer Institute, FAQ
- **NHERI Facilities:** Web pages for NCO, EFs, SimCenter, and Facility Scheduler
- **NHERI Community:** News, access to Slack online collaboration



Slack Online Collaboration

- Online collaborative communication tool
- DesignSafe Slack Team (<https://designsafe-ci.slack.com/>) accessible via web browser or downloadable Slack app
 - 43+ topical channels
 - Active use with 27k+ posts



DesignSafe: Open for Business

www.designsafe-ci.org

- Capabilities available to the global natural hazards research community—account registration is free
- Training webinars
 - Overview webinars, as well as detailed training on Jupyter, etc.
 - Archived training webinars available at <https://www.designsafe-ci.org/learning-center>

***Please share your feedback,
ideas, experiences!***

Ellen Rathje e.rathje@mail.utexas.edu