



DesignSafe-CI



Ellen M. Rathje, Professor
University of Texas
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DESIGNSAFE-CI

A NATURAL HAZARDS
ENGINEERING COMMUNITY



A Cyberinfrastructure for the Natural Hazards Community



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***DesignSafe-ci.org* Vision**

- A CI that is an integral and dynamic part of research discovery
- Cloud-based tools that support the analysis, visualization, and integration of diverse data types
 - Key to unlocking the power of “big data”
- Support end-to-end research workflows and the full research lifecycle, including data sharing/publishing
- Enhance, amplify, and link the capabilities of the all NHERI components

DesignSafe-ci Cyberinfrastructure



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A CLOUD-BASED ENVIRONMENT FOR RESEARCH IN
NATURAL HAZARDS ENGINEERING



NHERI Community ▾

Research Workbench ▾

NHERI Facilities ▾

Learning Center ▾

About

Contact



NHERI COMMUNITY

Relevant news, field-based opportunities, and user-guided discussions aimed at bringing the natural hazards engineering community together.



RESEARCH WORKBENCH

A comprehensive cloud-based research environment for experimental, theoretical, and computational engineering and science.



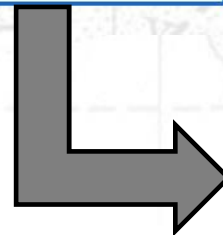
NHERI FACILITIES

Shared-use sites including Experimental Facilities, the Computational Modeling and Simulation Center, and the Network Coordination Office.



LEARNING CENTER

Training resources, site support, outreach, and student engagement opportunities to enhance research and better utilize DesignSafe's toolbox.



- Data Depot
- Discovery Workspace



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Data Depot Features

- Upload files/folders
- Different levels of access
 - My Data (fully private)
 - My Projects (shared space with collaborators)
 - Sharing of individual files with other users
 - Public data (including NEES data)
- Manage files within Data Depot (move, rename, etc)
- Data Depot files accessible for tools in the Discovery Workspace

Data Depot Browser



Welcome, Ellen! [My account](#)

A CLOUD-BASED ENVIRONMENT FOR RESEARCH IN
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Research Workbench Overview **Data Depot** Workspace Support Roadmap

New

Private

My Data

My Projects

Shared with Me

Box.com

Public

Published

Projects

Project title	PI	Created
Jupyter Notebooks are Fun	Scott Brandenburg (sjbrande)	10/31/16 4:03 PM
Projekt Drei	Ellen Rathje (erathje)	10/30/16 3:57 PM
TACC DesignSafe Project	Tim Cockerill (cockeril)	10/20/16 2:42 PM
New Zealand Lateral Spreading	Ellen Rathje (erathje)	10/20/16 2:37 PM
Tim Test Project	Tim Cockerill (cockeril)	11/8/16 7:42 AM

- Working with EFs to upload bulk data to your Data Depot Project for sharing with you



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Discovery Workspace

- Simulation tools: OpenSees, ADCIRC, OpenFOAM,

DISCOVERY WORKSPACE

The screenshot displays the Discovery Workspace interface. At the top, a toolbar contains icons for various tools: ADCIRC 51.33, Compress folder 0.1, Extract tar/zip/gzip File 0.1, JuPyter 4.1.0, MATLAB 0.3, OpenFOAM 2.4.0, OpenSees-EXPRESS 2.5.0.6248, OpenSeesSP 2.5.0.6248, Parallel ADCIRC 51.33, and Paraview 4.3.1. The ADCIRC and OpenSees tools are highlighted with red boxes. Below the toolbar, the 'DATA DEPOT BROWSER' section shows a 'Select data source' dropdown set to 'My Data' and a list of files: .ipynb_checkpoints (32 kB), .Trash (32 kB), archive (32 kB), and Centrifuge_notebook (32 kB). The 'SELECT AN APP' section prompts the user to 'Select an application from the tray above' and provides a description of the workspace's capabilities.

DATA DEPOT BROWSER

Select data source

My Data

Browsing: erathje

File name	Size
.ipynb_checkpoints	32 kB
.Trash	32 kB
archive	32 kB
Centrifuge_notebook	32 kB

SELECT AN APP

Select an application from the tray above.

This initial version of the *Discovery Workspace* allows users to perform simulations and analyze data using popular open source simulation codes OpenSees, ADCIRC, and OpenFOAM, as well as commercial tools such as MATLAB (software license verification required). The selection of codes and tools will continue to be expanded as seen at the [Workbench Roadmap](#).

Discovery Workspace

- Data analysis tools: MATLAB, Jupyter notebooks

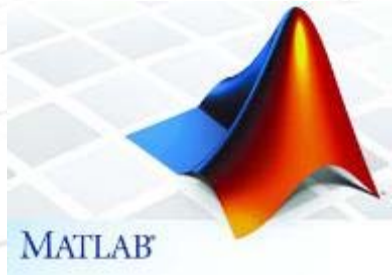
DISCOVERY WORKSPACE

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File name	Size
.ipynb_checkpoints	32 kB
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The 'SELECT AN APP' section prompts the user to 'Select an application from the tray above.' and provides a description: 'This initial version of the *Discovery Workspace* allows users to perform simulations and analyze data using popular open source simulation codes OpenSees, ADCIRC, and OpenFOAM, as well as commercial tools such as MATLAB (software license verification required). The selection of codes and tools will continue to be expanded as seen at the [Workbench Roadmap](#).' A 'Jobs Status' sidebar is visible on the right.

Data Processing in the Cloud



- MATLAB
 - Run processing scripts on data in the Data Depot
 - Access to HPC to process large data sets
- Jupyter Notebooks
 - Rich text, live code (Python, R), plots
 - Mechanism to share experimental data, processing scripts, etc.





Access to Experimental Data

Project Name:
Development of validated methods for soil-structure interaction analysis of buried structures

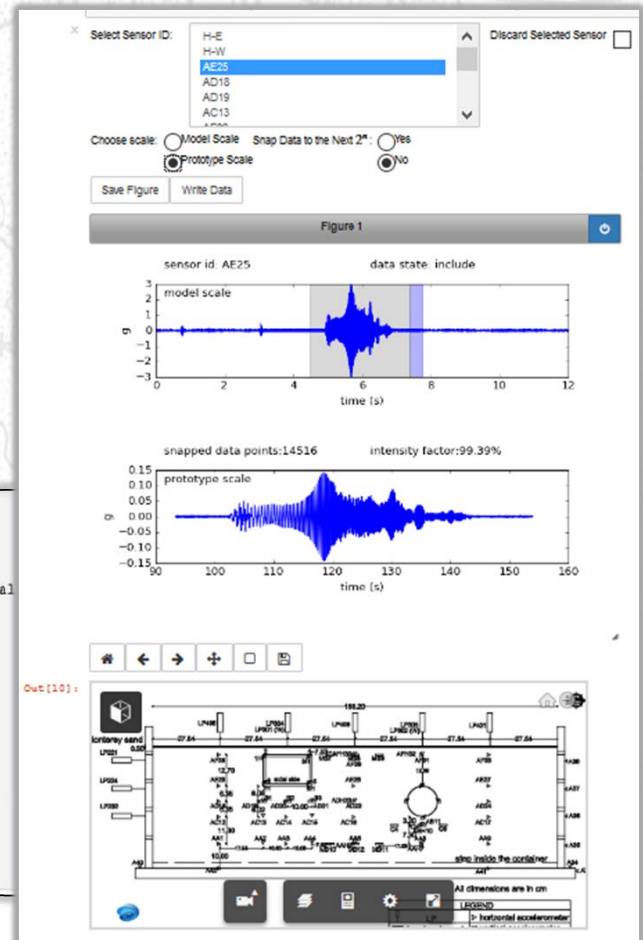
Project Team:
Elnaz Esmaeilzadeh Seylali, Eva Agapaki, Dimitris Pitilakis, Scott J. Brandenburg, Jonathan P. Stewart, Ertugrul Taciroglu (UCLA)

Funded by:

```
bwrite = widgets.Button(description='Write Data')
bdiscard = widgets.Checkbox(description='Discard Selected Sensor', value = False)
bsave = widgets.Button(description='Save Figure')
bmodpro = widgets.RadioButtons(description='Choose scale: ', options=['Model Scale', 'Prototype Scale'])
bsnap = widgets.RadioButtons(description='Snap Data to the Next ' + '$2^n$' + ': ', options=['Yes', 'No'], value='No')

ccontainer = widgets.HBox(children=[sensor_select, bdiscard])
rcontainer = widgets.HBox(children=[bmodpro, bsnap])
bcontainer = widgets.HBox(children=[bsave, bwrite])
display(ccontainer)
display(rcontainer)
display(bcontainer)

bdiscard.observe(callback.discard)
bmodpro.observe(callback.scaledata)
bsnap.observe(callback.snap)
bwrite.on_click(callback.writedata)
bsave.on_click(callback.savefigure)
callback.truncate()
```



From Prof. S. Brandenburg, UCLA



Sharing Analysis Scripts

jupyter 1GM_Sufficieny Last Checkpoint: 08/11/2016 (unsaved changes)

File Edit View Insert Cell Kernel Widgets Help

Markdown CellToolbar

Displacement hazard curves using scalar (PGA,

Summary:

This script demonstrates the displacement hazard calculation procedure using the Scalar (PG

Input

- GM hazard curve (MRE and PGA)
- Deaggregation (deag)
- Yield strength (ky)

Output

- Sliding diplacement hazard curve
- Sliding displacements with 10% and 2 probability of exceedance in the next 50 yrs (lam

Reference: Rathje EM, Saygili G (2009) Probabilistic assessment of earthquake-induced slidin
42:18–27

Import GM hazard curve (MRE and PGA) and Deaggregation (P[M|PGA)

```
In [38]: import numpy as np
MRE = np.genfromtxt("MRE.csv",delimiter=None)
PGA = np.genfromtxt("PGA.csv",delimiter=None)
deag = np.genfromtxt("deag.csv",delimiter=",")
```

PGA hazard curve

```
In [39]: #To enable plotting in the current notebook using Matplotlib
%matplotlib inline

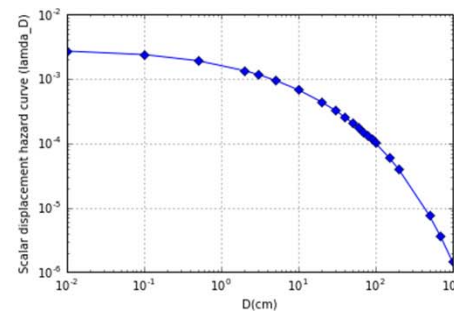
import matplotlib.pyplot as plt
plt.semilogy(PGA, MRE, marker='D')
plt.title('Ground motion hazard curve')
```

```
In [47]: lambda_D_plot = sum(sum(hazard))

#To enable plotting in the current notebook using Matplotlib
%matplotlib inline

import matplotlib.pyplot as plt
import pylab as p

plt.loglog(D_cm, lambda_D_plot, marker='D')
plt.grid(True)
plt.xlabel('D(cm)');
plt.ylabel('Scalar displacement hazard curve (lamda_D)');
```



```
In [48]: T475 = lambda_D_plot > 0.0021;
lambda_D_475 = D_cm[sum(T475)-1]
#-1 b/c first element ranking is zero

print ("Displacement level with 10% probability of exceedance in 50 years is", lambda_D_475, "cm")

T2475 = lambda_D_plot > 0.0004;
lambda_D_2475 = D_cm[sum(T2475)-1]
#-1 b/c first element ranking is zero

print ("Displacement level with 2% probability of exceedance in 50 years is", lambda_D_2475, "cm")

Displacement level with 10% probability of exceedance in 50 years is 0.1 cm
Displacement level with 2% probability of exceedance in 50 years is 20 cm
```

From Prof. G. Saygili, UT-Tyler