UCLA | **Samueli** School of Engineering

The NGL Database: graphical interface and population status

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NGL
NEXT GENERATION LIQUEFACTION

Engineer Change.

Outline

Introduction

The NGL database graphical interface

Current status of the database

Final remarks and path forward

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NGL Database Contributors

- ***PIs****: Jonathan Stewart, Steven Kramer, Yosef Bozorgnia*

- ***Database working group***: Scott Brandenberg (chair), Robb E.S. Moss (Cal Poly), K. Onder Cetin (METU), Kevin Franke (BYU), Paolo Zimmaro (UCLA), and Dong Youp Kwak (Hanyang University)

- ***Southwest Research Institute***: John Stamatakos, Miriam Juckett, Bis Dasgupta, Joey Mukherjee, Zackary Murphy, Steven Ybarra

- ***Nuclear Regulatory Commission***: Thomas Weaver

- ***Caltrans***: Tom Shantz

PEER   Caltrans   SwRI   U.S.NRC   MPC MOUNTAIN-PLAINS CONSORTIUM   UDOT Keeping Utah Moving

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NGL Database Contributors

- *U. of Utah:* Steve Bartlett, Masoud Hosseinali

- *Virginia Tech*: Russell Green, Kristin Ulmer

- *UC Berkeley*: Jonathan Bray, Christine Beyzaei

- *Tonkin & Taylor*: Sjoerd Van Ballegooey, Mike Liu

- *BYU*: Heidi Dacayanan, Lila Lasson

- *METU*: Gizem Can, Makbule Ilgac

- *UCLA*: Omar Issa, Chris Nicas, Trini Inouye, Arielle Sanghvi, Tristan Buckreis, Naoto Inagaki, Wyatt Iwanaga, Michael Winders, Bryan Ong, Siddhant Jain, Allison Lee, Honor Fisher

- *Others*: Mike Greenfield, Teruo Nakai, Hideo Sekiguchi, …

Traditional vs Next-Generation Databases

From *spreadsheet*
(Traditional data analysis)

To **relational database**
(big-data analytics)
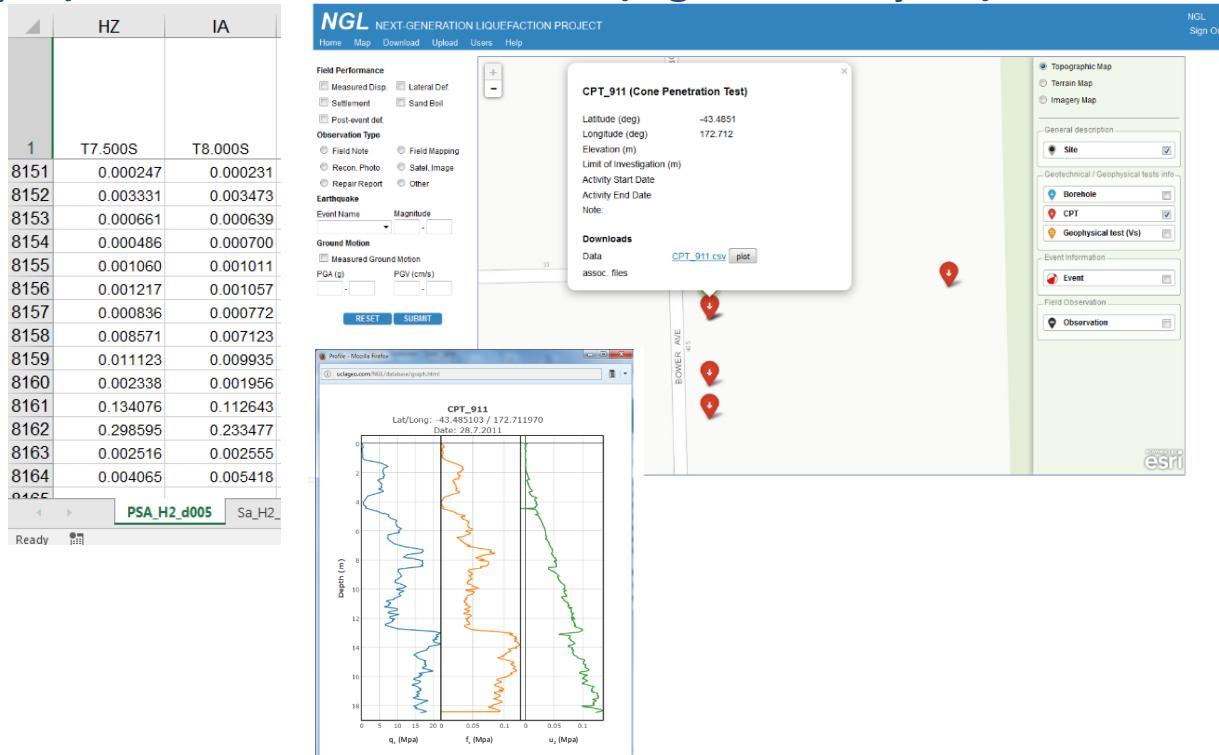
Next-Generation Liquefaction Database, Zimmaro et al. (2018a, SSA),
Brandenberg et al. (2018b, GEESD)   UCLA Samueli
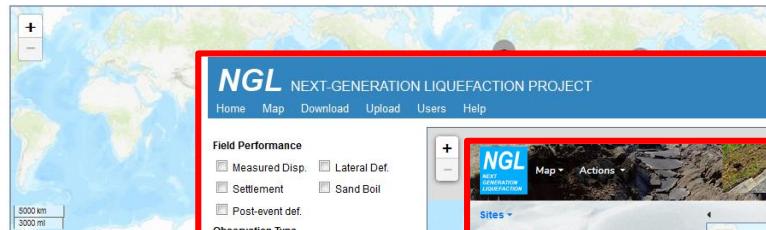
NGL Database GUI development
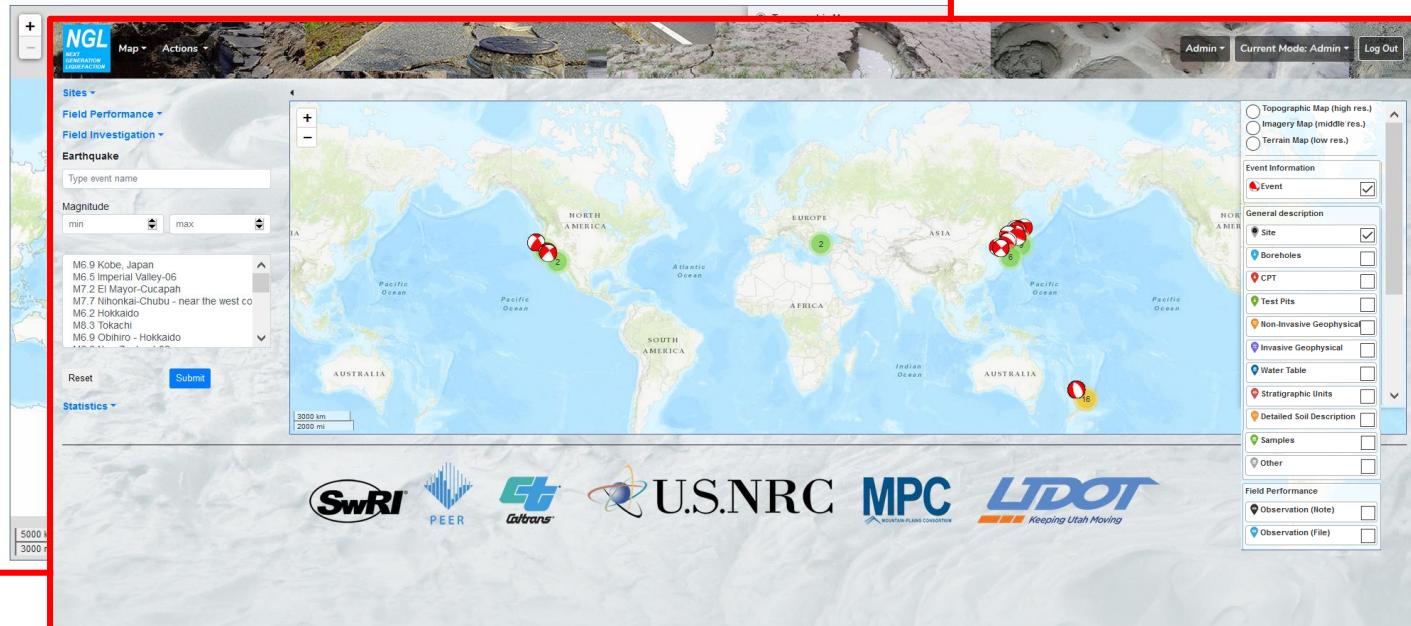
***Ver. Beta_1
(csv + SQL)*** → ***Ver. Beta_2
(full SQL)*** → ***Official release (ver. 2.04)
(full SQL + Review)***

# NGL Database GUI development

UCLA-SwRI Collaboration

www.nextgenerationliquefaction.org

NGL Database GUI Earthquake Events

Liquefaction analysis (at least):

- Magnitude of the earthquake event

- Estimation of intensity measures at the site

- Ground motion characterization

- Analysis of liquefaction sites with ground motion recordings

**Four Tables in the database:**

Event information

Recording stations

Finite fault models

Ground motion intensity measures

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NGL Database GUI Earthquake Events

NGL Event Super-users!

NGA West 2 Database
NGA Subduction (soon...)

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NGL Database GUI Earthquake Events

NGL Event Super-users!

Additional information (and/or missing events) from:

Open literature

Local networks

Global CMT catalogue
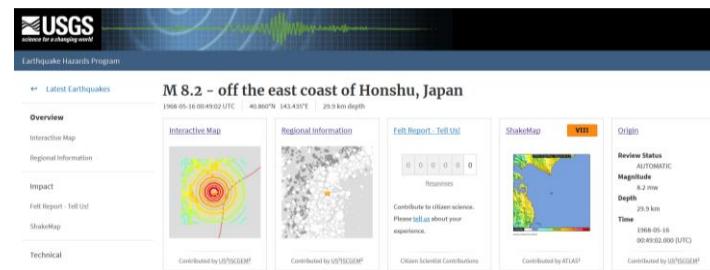
USGS website

Article Citation:
Brendon A. Bradley (*2015*) Systematic Ground Motion Observations in the Canterbury Earthquakes And Region-Specific Non-Ergodic Empirical Ground Motion Modeling. Earthquake Spectra: August 2015, Vol. 31, No. 3, pp. 1735-1761.

https://doi.org/10.1193/053013EQS137M

Manuscripts

Systematic Ground Motion Observations in the Canterbury Earthquakes And Region-Specific Non-Ergodic Empirical Ground Motion Modeling

Brendon A. Bradley, M.EERI[a)]

NGL Database GUI (Map view)

www.nextgenerationliquefaction.org

Site – Geotechnical characterization
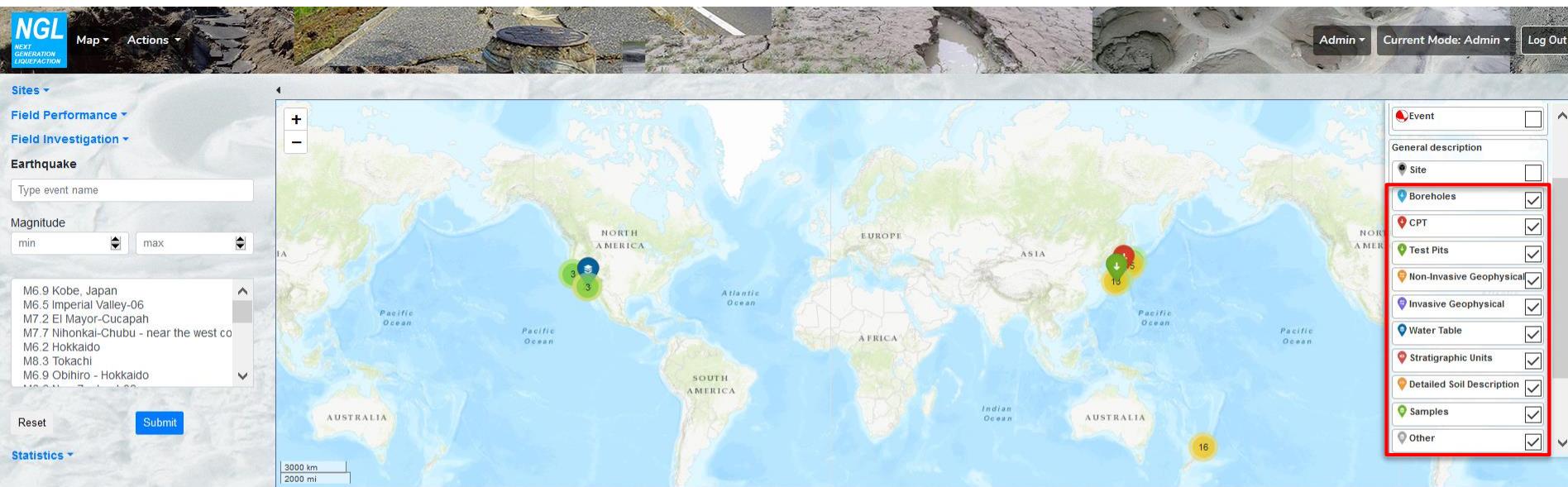
NGL Database GUI (Map view)

www.nextgenerationliquefaction.org

Earthquake events (that produced observations)

NGL Database GUI (Map view)

www.nextgenerationliquefaction.org
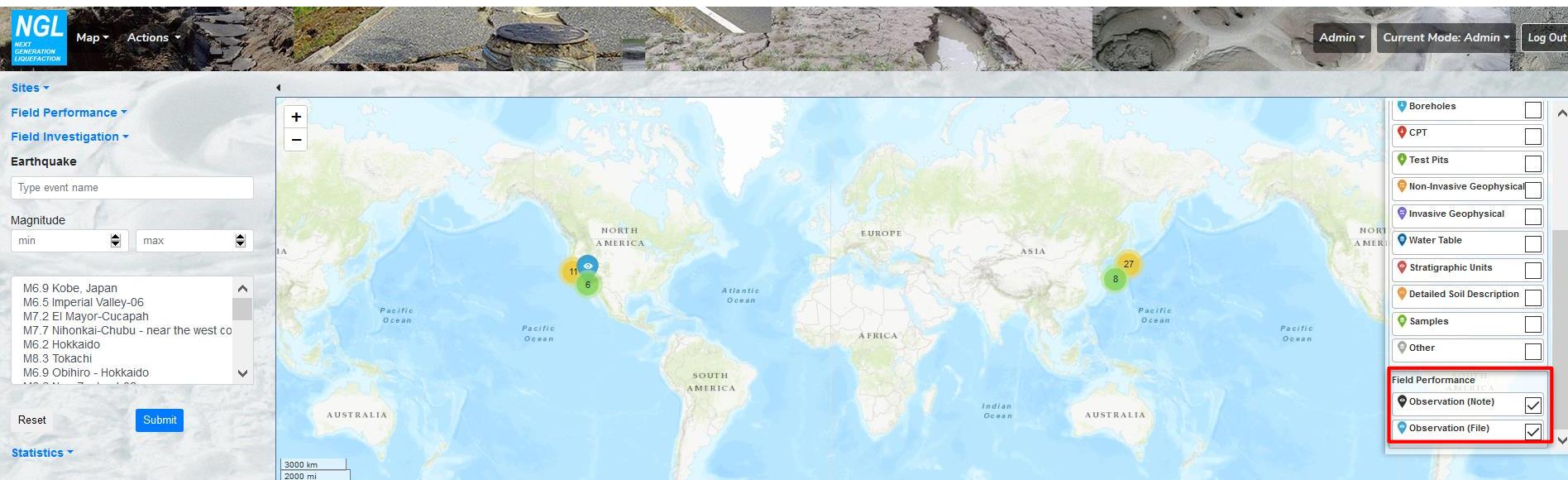
Post-earthquake observations

NGL Database GUI
(List view and functionalities)

www.nextgenerationliquefaction.org

NGL Database GUI
(How to upload a case history?)

www.nextgenerationliquefaction.org

1. Using the online guided step-by-step procedure

2. Using a pre-populated csv template (empty template + example provided)

NGL Database GUI
(How to upload a case history?) - manually

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NGL Database GUI
(How to upload a case history?) csv template

www.nextgenerationliquefaction.org

NGL Database GUI
(How to upload a case history?) csv template

www.nextgenerationliquefaction.org

NGL Database GUI User Experience

Just something that works(?)

Something better

A well-designed product

Wrong design

redundant

NGL Database GUI
User Experience Design

Estensive Beta-testing from various user types

Senior researchers

Practitioners

Junior researchers

Graduate Students

Undergraduate students, …

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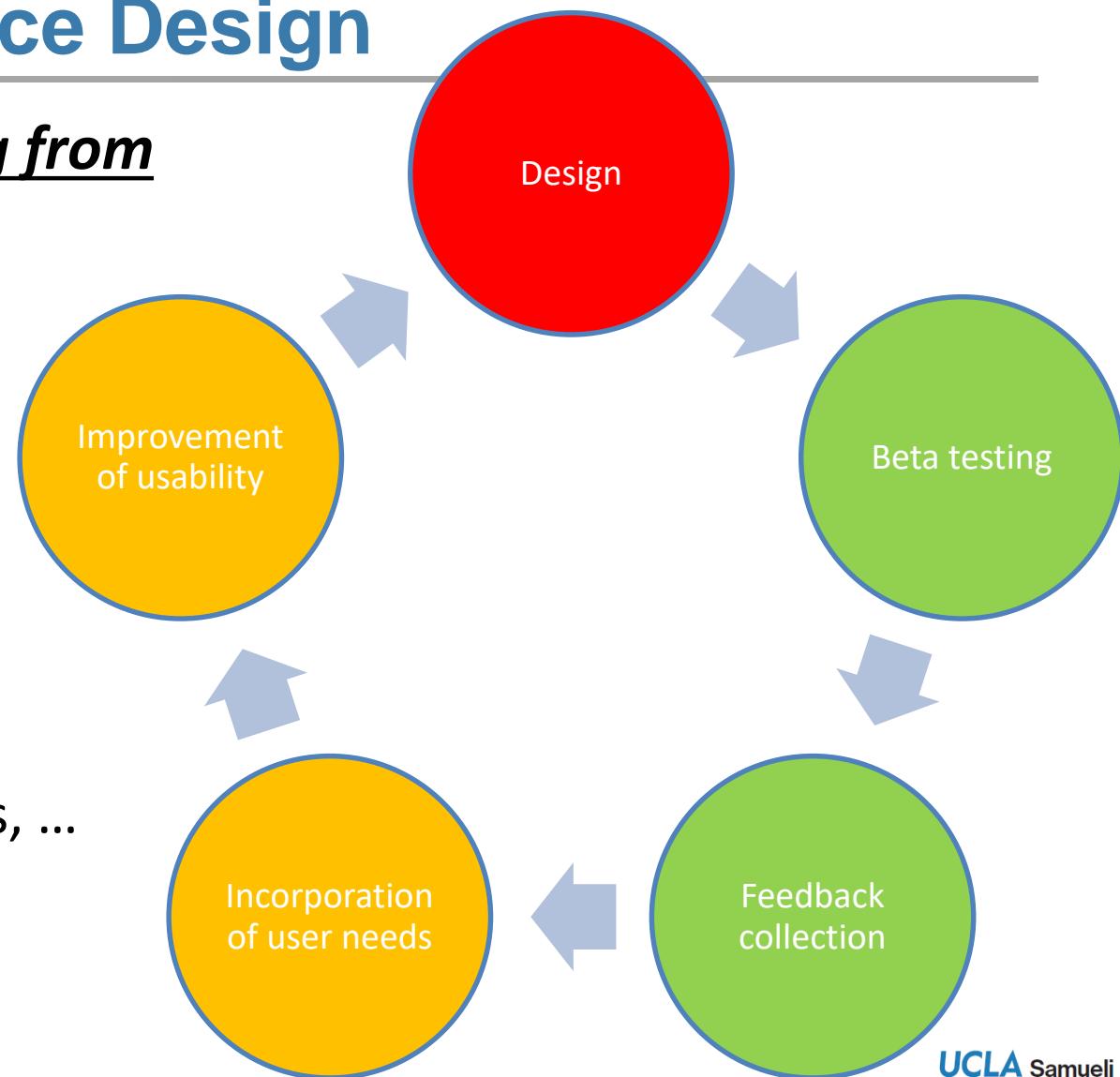
Database Current Status

- Legacy case-histories (used in the past for model development) are in the process of being added (~300 case histories)

- Case histories with co-located recording stations

- Recent case histories
  - Christchurch 2010-2011 sequence (New Zealand)
  - Tohoku 2011 **M**9.0 earthquake (Japan)
  - Emilia 2012 **M**5.9 (Italy)

- Total case histories available (and work in progress): ~530

- Stable database GUI officially released on 09/24/2018: **TODAY!**

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Database Current Status

Legacy case-histories (used in the past for model development) include:

- 1964 Niigata (Japan)
- 1979 Imperial Valley
- 1987 Superstition Hills
- 1989 Loma Prieta
- 1995 Kobe (Japan)
- 1999 Chi Chi (Taiwan)
- 1999 Kocaeli (Turkey)
- U. Utah + BYU lateral spread sites
- Etc…

Total ~300 case histories (work in progress…)

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Database Current Status

- Christchurch (New Zealand) 2010-2011 sequence:

Green et al. (2014) case histories (VTech Green and Ulmer)
25 sites, 50 case histories (Complete - under review)

Tonkin + Taylor case histories (Van Ballegooy and Liu)
37 sites, 135 case histories (Complete – will be under review soon)

UC Berkeley sites (Bray and Beyzaei)
10+ sites/case histories (work in progress…)

Database Current Status

- Tohoku (Japan) 2011 **M**9.0 event – Unpublished

Tohoku + Mihama - UCLA
2 sites/case histories (Complete – will be under review soon)

Instrumented levee arrays - UCLA
3 sites/case histories (Complete – will be under review soon)

Additional lateral spread sites – UCLA-BYU
3 sites/case histories (work in progress)

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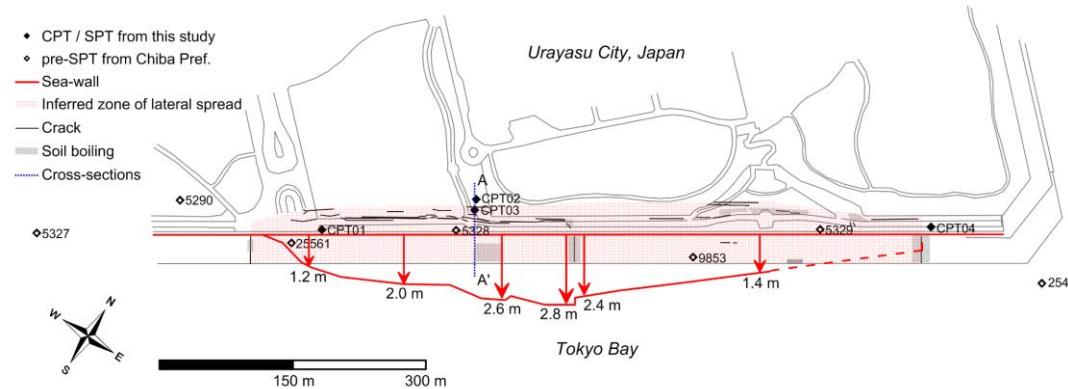
Database Current Status

- Case histories with co-located recording stations
  (Kramer and Greenfield (U. Washington)
  16 sites, 22 case histories (Complete - under review)

Ibaraki, Japan (2011 – Tohoku):
from Kramer et al. (2016) and
M. Greenfield pers. comm.
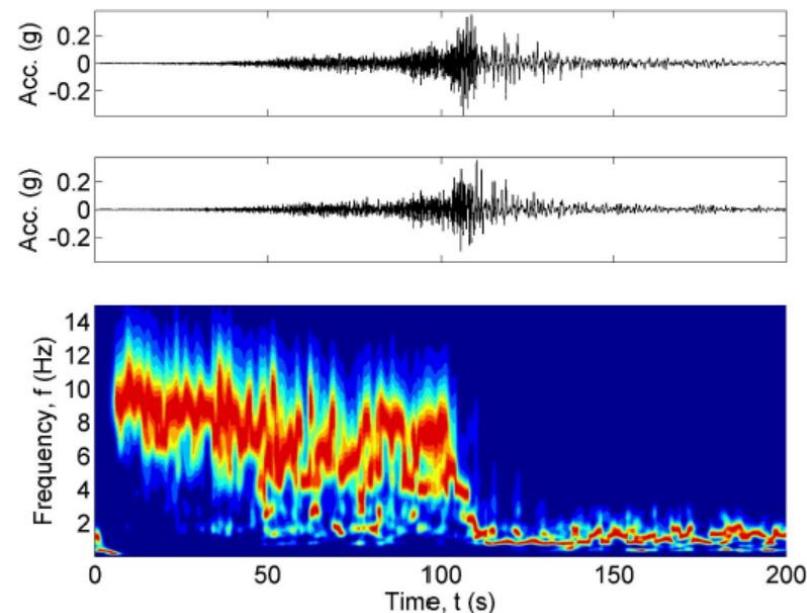
- Emilia (Italy) 2012 **M**5.8 earthquake – UCLA
4 sites/4 case histories (Complete - will be under review soon)

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# Review/Vetting Process

Database working group. After review, data is marked as reviewed.

Purpose: to verify that required fields are present and the inputs match source materials.

Vision for Community Access
(*to cloud or not to cloud?*)

- Due to **large amount of data**, downloading data and processing them on a laptop is inefficient and undesirable (though still possible).

- The database is mirrored onto **DesignSafe** (www.designsafe-ci.org). Users will be able to process data on the cloud using SQL queries in Jupyter notebook Python scripts (*off-the-shelf* libraries).

Final Remarks

- Today's milestone: Release of Stable database GUI: *nextgenerationliquefaction.org*

- The NGL relational database (being populated): capabilities for big data analytics

- Vetted database (NGL working group)

- NGL-NGA interaction – earthquake events

- The NGL database is mirrored onto DesignSafe – Cloud-based analytics

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Thank you!

Questions?

Relevant References

Brandenberg S.J., Kwak D.Y., Zimmaro P., Bozorgnia Y., Kramer S.L., Stewart J.P. (2018). Next-Generation Liquefaction (NGL) Case History Database Structure. Fifth decennial Geotechnical Earthquake Engineering and Soil Dynamics Conference, Earthquake Engineering and Soil Dynamics Committee of the Geo-Institute. Austin, TX (USA), June 10-13.

Zimmaro P., Kwak D.Y., Brandenberg S.J., Stewart J.P. (2018). NGL: An Open Source Global Database for Next-Generation of Liquefaction Assessment. SSA-LACSC scientific conference - Seismology of the Americas. Miami, FL (USA), May 14-17.

Stewart J.P., Kramer S.L., Kwak D.Y., Greenfield M.W., Kayen R.E., Tokimatsu K., Bray J.D., Beyzaei C.Z., Cubrinovski M., Sekiguchi T., Nakai S., Bozorgnia Y. (2016). PEER-NGL project: Open source global database and model development for the next-generation of liquefaction assessment procedures. Soil Dyn. Earthquake Eng., 91, 317–328.

Project homepage:

https://uclageo.com/NGL/

Database:

http://nextgenerationliquefaction.org

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