

DESIGNSAFE.CI

A NATURAL HAZARDS
ENGINEERING COMMUNITY



A Cyberinfrastructure for Storm Surge Modeling

DesignSafe-ci.org Leadership



Director
Ellen Rathje
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Simulation
Clint Dawson
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Data
Jean-Paul Pinelli
Florida Inst. Tech.



ECO
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Rice Univ.



CI
Dan Stanzone
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Simulation Requirements Team

- Clint Dawson, Lead (UT) - Water
- Pedro Arduino (U. Wash) - EQ
- Ahsan Kareem (Notre Dame) - Wind
- Laura Lowes (U. Wash) - EQ
- Jamie Padgett (Rice) - EQ, Water



TEXAS ADVANCED
COMPUTING CENTER

Management Requirements Team

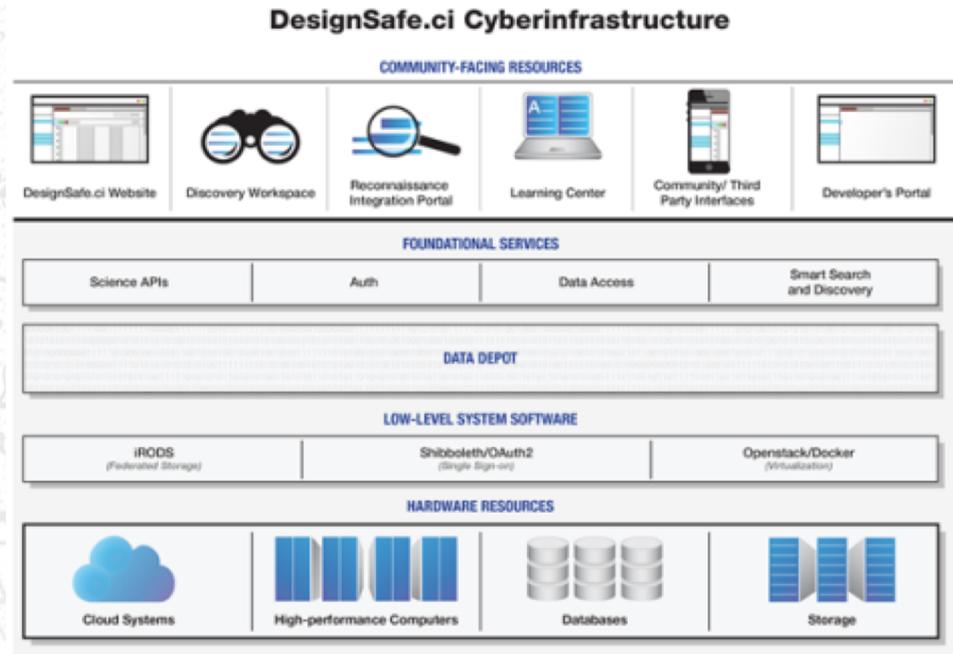
- Jean-Paul Pinelli, Lead (FIT) - Wind
- Brandenberg (UCLA) - EQ
- Frederick Haan (Rose Hulman) - Wind
- Gilberto Mosqueda (UCSD) - EQ
- Lorraine Haricombe (UT) - Library Science

DesignSafe-ci 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
- Enhance, amplify, and link the capabilities of the other NHERI components

DesignSafe Components

- Web Portal
- Data Depot
- Discovery Workspace
- Reconnaissance Integration Portal
- Developer's Portal
- Learning Center



ADCIRC

- Developed from the early 1990's led by Rick Luettich and Joannes Westerink, now led by ADCIRC Users Group
- Simulates free surface circulation and transport in coastal environments.
- Solves the depth-averaged shallow water equations
- Commonly used for hurricane storm surge modeling.
- Finite element based code. Uses unstructured triangular meshes.
- Typical applications require several large input files, usually generated using SMS.
- PADCIRC= parallel ADCIRC. Runs on multicore computers.

ADCIRC+SWAN

- Simulates free surface circulation and transport and spectrally averaged short waves.
- Solves the depth-averaged shallow water equations + wave action balance equation
- Commonly used for hurricane storm surge modeling where waves are an important component.
- Waves are modeled using SWAN-Simulating Waves Nearshore. Developed at TU Delft.
- SWAN runs on the same mesh as ADCIRC.
- PADCSWAN= parallel ADCIRC+SWAN

ADCIRC+SWAN Documentation

[Available at www.adcirc.org](http://www.adcirc.org)

There are also ADCIRC Boot Camps every spring held at different locations. Contact Jason Fleming at jason.fleming@seahorsecoastal.com

There are different versions of ADCIRC, released every year or so. As stable versions are released, we will continue to update them in DesignSafe.

ADCIRC suite of simulators

WORKSPACE

[Learn About the Workspace.](#)

Simulation [10]	Visualization [8]	Data Processing [2]	Partner Data Apps [5]
ADCIRC <i>ADCIRC</i>	clawpack C	CWE Parallel C	CWE Serial C
OpenFOAM 	OpenSees 	rWHALE R	Simcenter Dakota S

Available Simulators:

1. ADCIRC-V51
2. ADCIRC-V52
3. PADCIRC (LS5)
4. PADCIRC (SP2)
5. PADCSWAN (LS5)
6. PADCSWAN (SP2)

Simulates free surface circulation and transport.

Commonly used for hurricane storm surge modeling.

DesignSafe Sample job submission form: PADCIRC

Input Directory that contains all necessary input files.

Type in "Fort.14" for mesh file.

Maximum job runtime.

Number of requested nodes.
64 cores per node (Stampede 2)
20 cores per node (LoneStar 5)

Select a version of **ADCIRC** from the dropdown:
PADCIRC (Lonestar5) ↓

RUN PADCIRC (LONESTAR5) ver. 52.00

PADCIRC is the parallel version of the ADCIRC which is optimized for enhanced performance on multiple computer nodes to run very large models. It includes MPI library calls to allow it to operate at high efficiency on parallel machines. This version of PADCIRC runs on lonestar5.

[PADCIRC \(Lonestar5\) Documentation](#)

Inputs

Input Directory
Select agave://designsafe.storage.default/sharifim/PAD_ST_36 ✓
The directory containing your ADCIRC input files. You can drag the link for the directory from the Data Browser on the left, or click the 'Select Input' button and then select the directory. To try this out with example data, copy and paste 'agave://designsafe.storage.default/mock/examples/adcirc/EC2001' above.

Mesh File
fort.14 ✓
Select your mesh file. This is usually your fort.14 file. This file should reside in the Input Directory specified above.

Job details

Maximum job runtime
06:00:00 ✓
In HH:MM:SS format. The maximum time you expect this job to run for. After this amount of time your job will be killed by the job scheduler. Shorter run times result in shorter queue wait times. Maximum possible time is 48:00:00 (48 hours).

Job name
STORM36_PADCIRC_LS5 ✓
A recognizable name for this job.

Job output archive location (optional)
Select <username>/archive/jobs/\${YYYY-MM-DD}/\${JOB_NAME}-\${JOB_ID}
Specify a location where the job output should be archived. By default, job output will be archived at: <username>/archive/jobs/\${YYYY-MM-DD}/\${JOB_NAME}-\${JOB_ID}.

Node Count
12 ↓
Number of requested process nodes for the job. Default number of nodes is 1.

Run Close

DesignSafe Sample job submission form: PADCSWAN

Input Directory that contains all necessary input files.

Type in "Fort.14" for mesh file.

Maximum job runtime.

Number of requested nodes.
64 cores per node (Stampede 2)
20 cores per node (LoneStar 5)

Select a version of **ADCIRC** from the dropdown:
PADCIRC SWAN (Lonestar5) ▾

RUN PADCIRC SWAN (LONESTAR5) ver. 52.01

Parallel SWAN ADCIRC is the fully-coupled model, the Simulating WAVes Nearshore (SWAN) model with unstructured grids and the ADvanced CIRCulation (ADCIRC) model that runs on Lonestar5, with 20 cores per Node

[PADCIRC SWAN \(Lonestar5\) Documentation](#)

Inputs

Input Directory

Select ✓

The directory containing your ADCIRC input files. You can drag the link for the directory from the Data Browser on the left, or click the 'Select Input' button and then select the directory. To try this out with example data, copy and paste 'agave://designsafe.storage.default/mock/examples/adcirc/EC2001' above.

Mesh File

Select your mesh file. This is usually your fort.14 file. This file should reside in the Input Directory specified above.

Job details

Maximum job runtime

In HH:MM:SS format. The maximum time you expect this job to run for. After this amount of time your job will be killed by the job scheduler. Shorter run times result in shorter queue wait times. Maximum possible time is 48:00:00 (48 hours).

Job name

A recognizable name for this job.

Job output archive location (optional)

Select

Specify a location where the job output should be archived. By default, job output will be archived at: `<username>/archive/jobs/${YYYY-MM-DD}/${JOB_NAME}-${JOB_ID}`.

Node Count

Number of requested process nodes for the job. Default number of nodes is 1.

Input Directory files for PADCIRC

sharifim / PAD_ST_36

Name

fort.13

fort.14

fort.15

fort.22

fort.221

fort.222

Input Directory files for PADCSWAN

sharifim / SWAN_TEST

Name

fort.13

fort.14

fort.15

fort.22

fort.221

fort.222

fort.26

Stations.loc

swaninit

Archive output location

+ Add

sharifim / archive / jobs / 2019-02-27 / test_padcswan-2212887546436972055-242ac11c-0001-007 / SWAN_TEST

My Data

My Projects

Shared with Me

Box.com

Dropbox.com

Google Drive

Published

Community Data

- [Curation Tutorials](#)
- [Curation Guidelines](#)

 fort.73.nc	1.4 GB	2/27/19 6:55 PM
 fort.74.nc	2.7 GB	2/27/19 6:57 PM
 fort.80	123.5 MB	2/27/19 6:57 PM
 in.prep1	14.0 bytes	2/27/19 6:57 PM
 in.prep2	6.0 bytes	2/27/19 6:57 PM
 maxele.63.nc	122.7 MB	2/27/19 6:57 PM
 maxrs.63.nc	122.7 MB	2/27/19 6:57 PM
 maxvel.63.nc	122.7 MB	2/27/19 6:57 PM
 maxwvel.63.nc	122.7 MB	2/27/19 6:58 PM
 metis_graph.txt	229.8 MB	2/27/19 6:58 PM
 minpr.63.nc	122.7 MB	2/27/19 6:58 PM
 output.eo.txt	1.3 MB	2/27/19 6:58 PM
 partmesh.txt	22.9 MB	2/27/19 6:58 PM

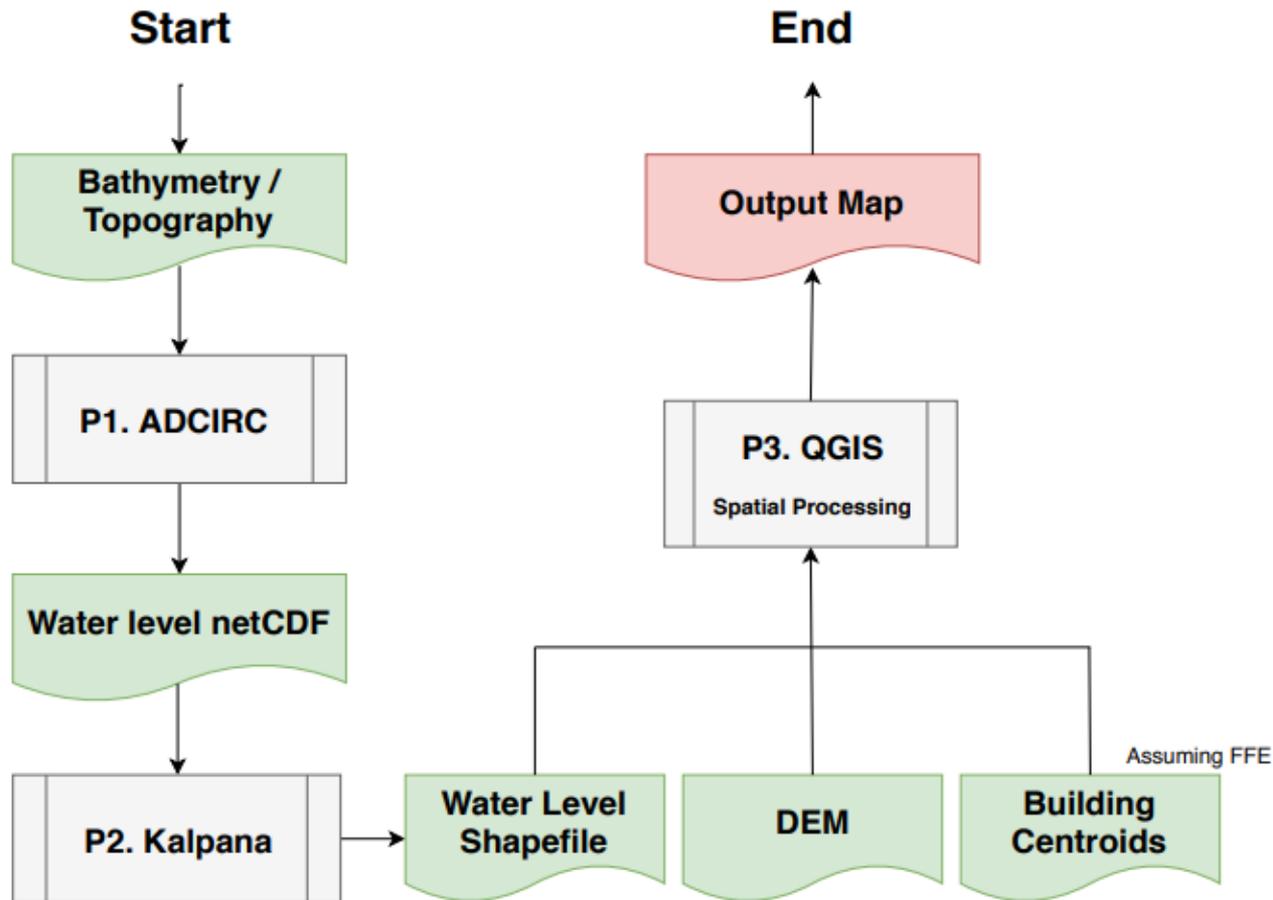
A Practical Problem...

...with a Cyberinfrastructure Solution

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

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

Workflow Process in DesignSafe



Kalpana

RUN KALPANA ver. 1.0.2

Kalpana is a python script that converts ADCIRC output files to GIS compatible shapefiles. The code accepts NetCDF formatted ADCIRC outputs for maximum water levels and wind speeds and converts these to polyline/polygon shapefiles.

[Kalpana Documentation](#)

Inputs

Working Directory

Select

The directory containing the files that you want to work on. This directory and its files will be copied to where your kalpana session runs. You can drag the link for the directory from the Data Browser on the left, or click the 'Select Input' button and then select the directory.

File type

Please enter maxele.63.nc for maximum water levels, or maxwvel.63.nc for maximum wind speeds.

Contour information

Please enter contour information; for contourrange use format 'min max interval' (e.g. '0 5 0.5') and for contourlevel provide custom set of contourlevels (e.g. '0 1 2 3 4 5 6 7 8 9 10 11 12').

Vector shape

Please enter your choice of vector shape.

Contour type

Please enter your choice of contour type.

Python script that converts NetCDF formatted ADCIRC outputs (e.g. maximum water levels) to polyline/polygon vector formats for GIS

Quantum GIS

QGIS

Free and open source GIS that can be used to create, edit, visualize, analyze, and publish geospatial information.

WORKSPACE

[Learn About the Workspace.](#)

Simulation [10]

Visualization [8]

Data Processing [2]

Partner Data Apps [5]

Utilities [2]

RUN QGIS DESKTOP ver. 2.18.16

Run an interactive QGIS Desktop session on a virtual machine.

[QGIS Desktop Documentation](#)

Inputs

Desktop Resolution

1920x1080

Set the desktop screen size for your QGIS Desktop session.

Job details

Job name

QGIS_Job

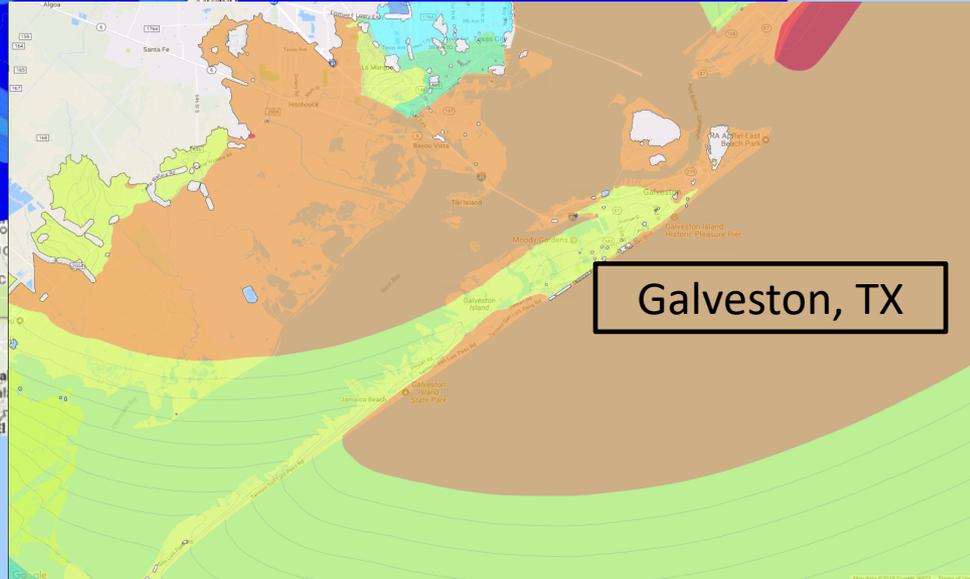
A recognizable name for this job.

Launch

Close

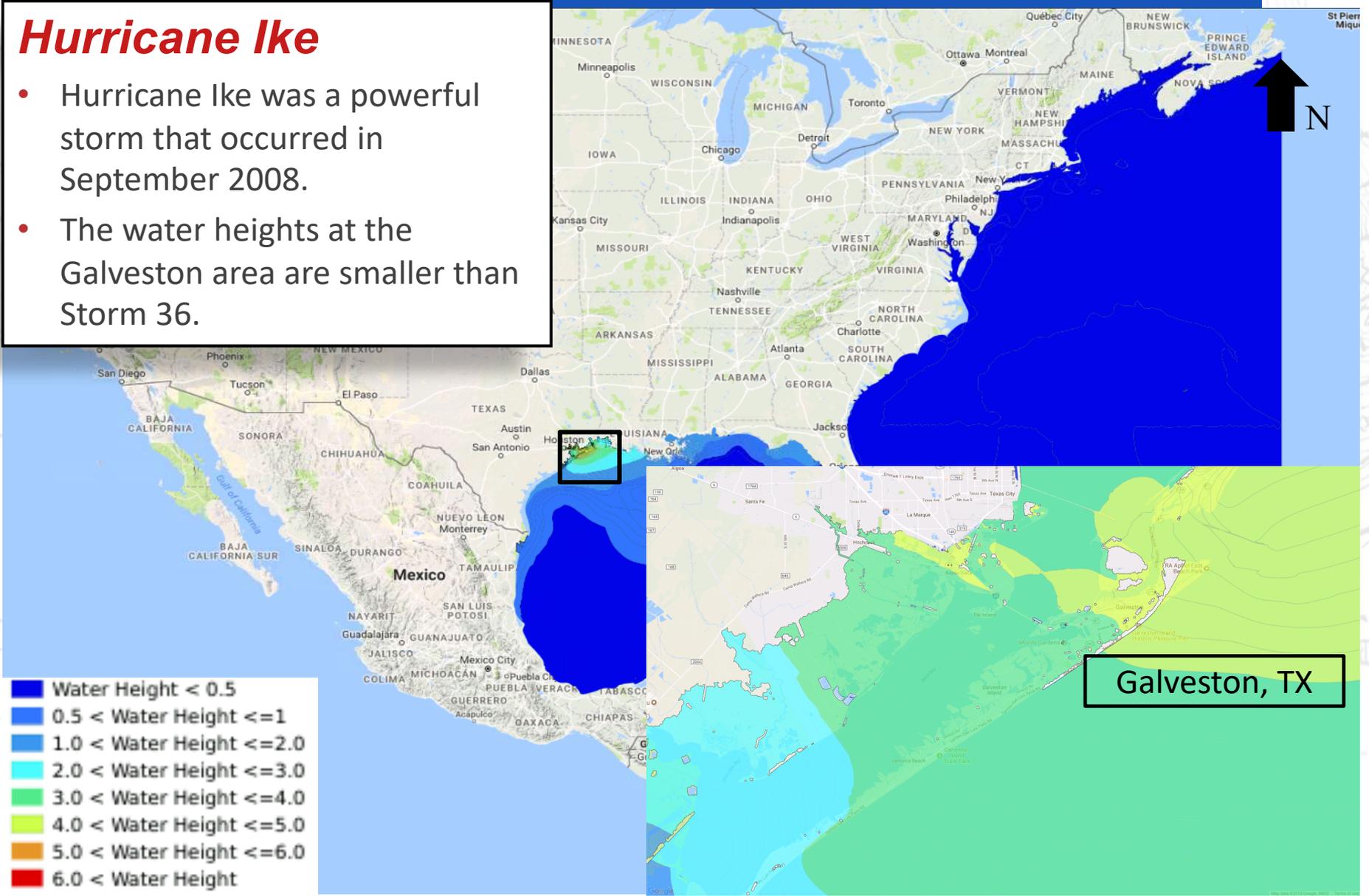
Storm 36

- Storm 36 is a synthetic storm for FEMA flood insurance study.
- Resulting storm surge floods the entire island, with the seawall overtopped and flooding from the backside.



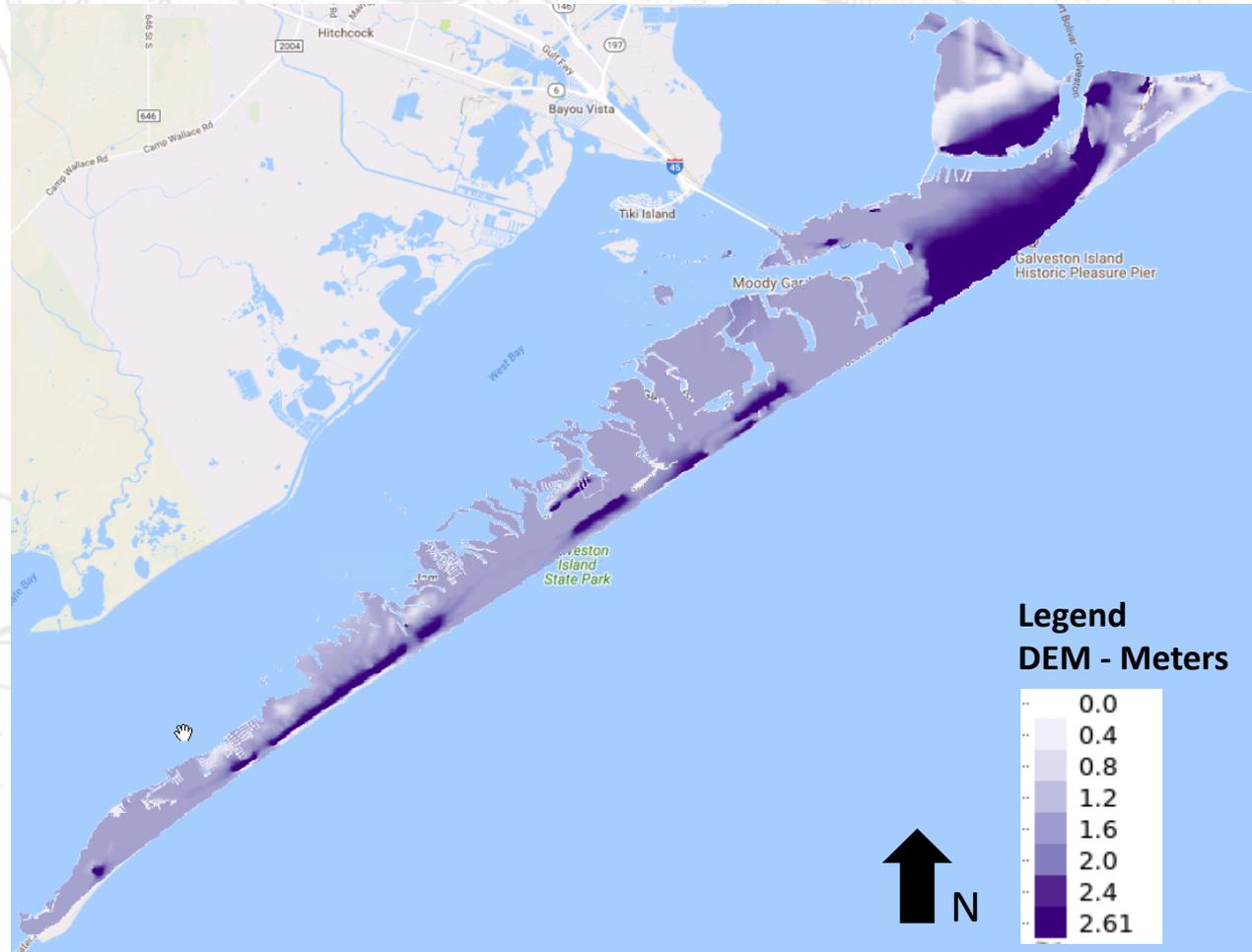
Hurricane Ike

- Hurricane Ike was a powerful storm that occurred in September 2008.
- The water heights at the Galveston area are smaller than Storm 36.

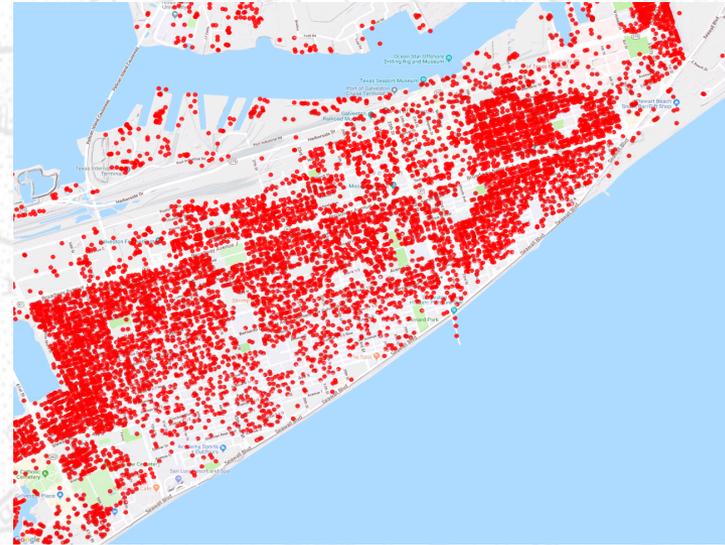
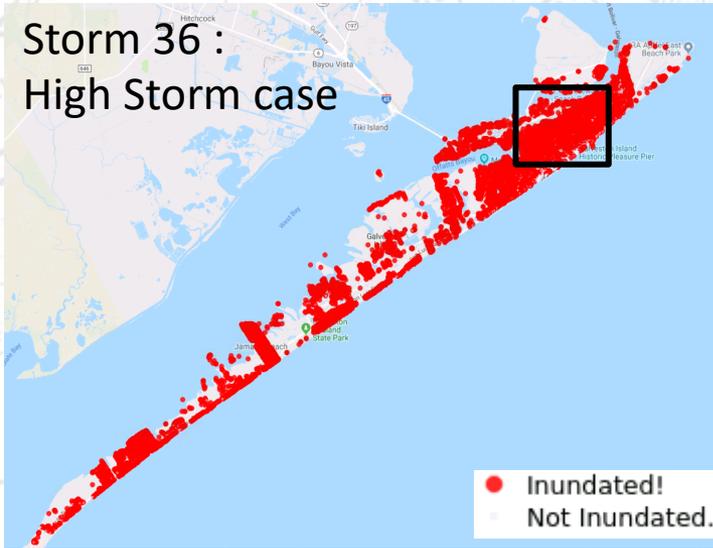


Digital Elevation Model (DEM)

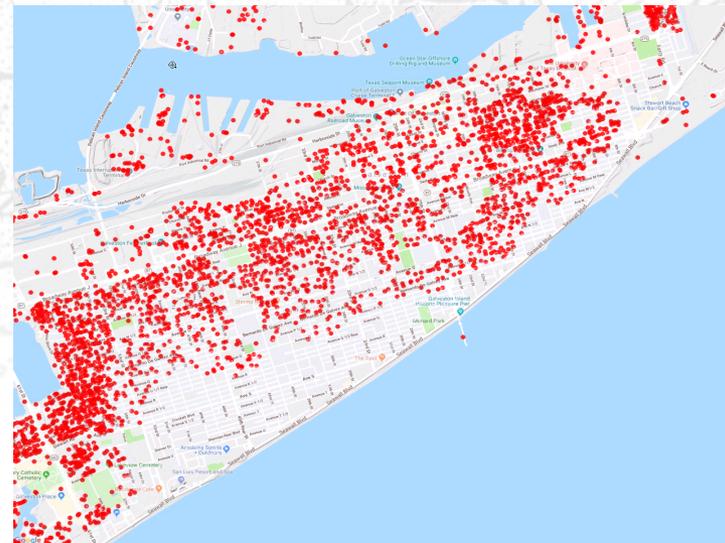
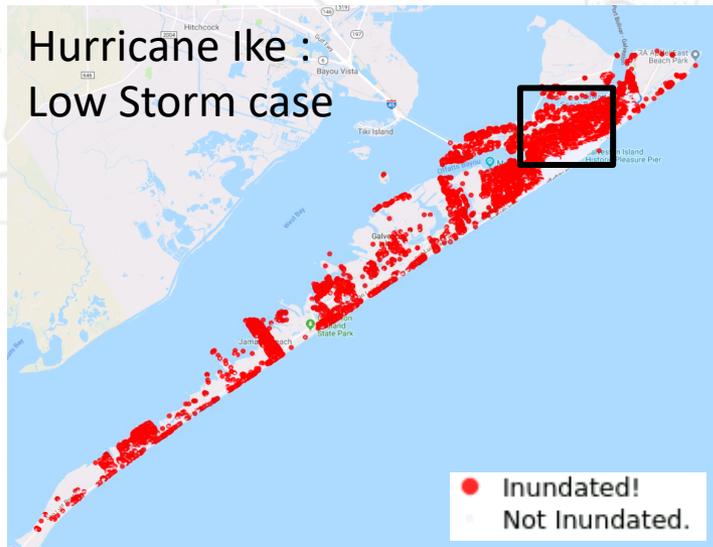
10-m resolution DEM
from USGS National
Elevation Dataset
(NED) program



Storm 36 : High Storm case



Hurricane Ike : Low Storm case

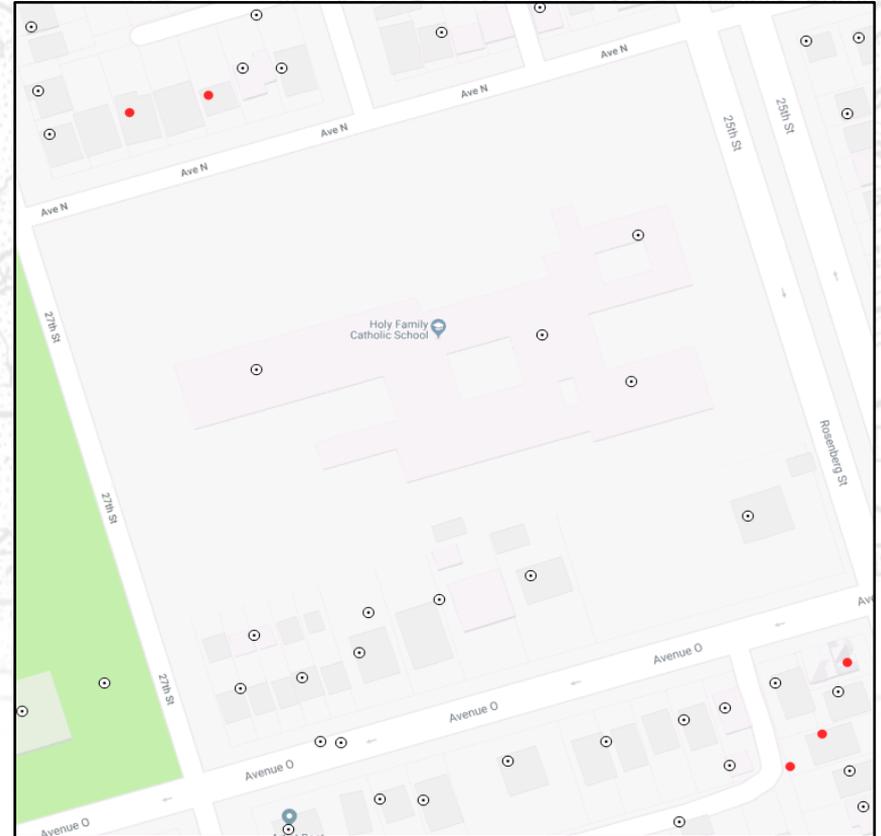
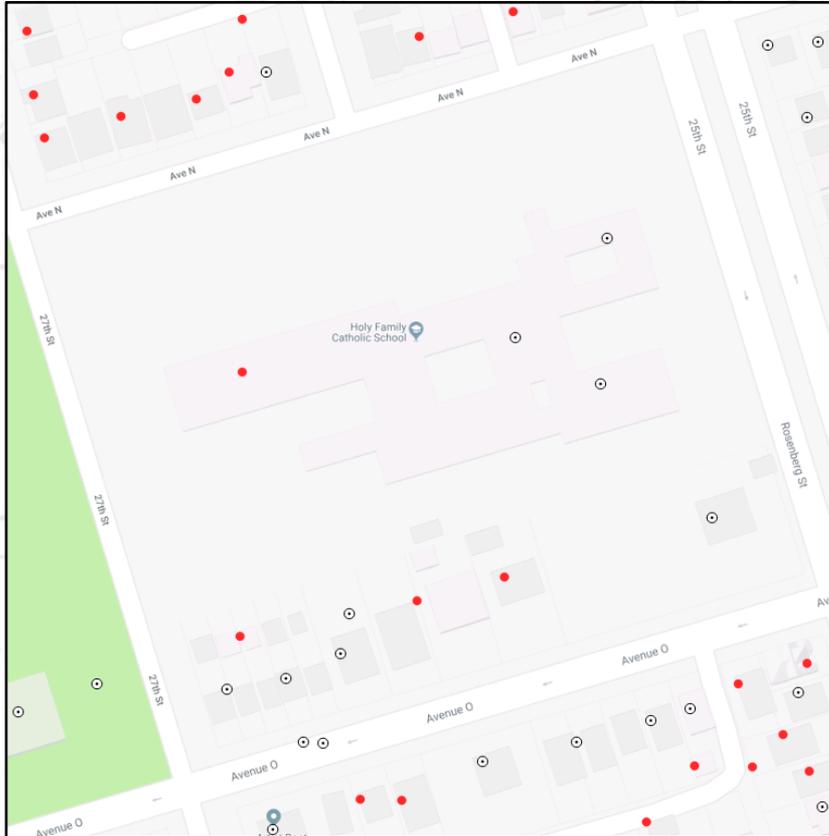


Did my house flood?

● Inundated!
○ Not Inundated.

Storm 36

Hurricane Ike



Address List Output

- The address of flooded houses are reported in a CSV file for later response and recovery.
- Here is a part of the list for addresses for homes that are flooded under **Storm 36** and not flooded under **Hurricane Ike**.

address	flooded_low	flooded_high	count	fids	
1 BLUE HERON CIR JAMAICA BEACH TX 77554	FALSE	TRUE	1	7802	
1 CADENA DR GALVESTON TX 77554	FALSE	TRUE	1	5002	
1 CAMPECHE ESTATES DR GALVESTON TX 77554	FALSE	TRUE	1	4959	
1 CEDAR LAWN DR N GALVESTON TX 77551	FALSE	TRUE	1	17345	
1 CLARA BARTON LN GALVESTON TX 77551	FALSE	TRUE	1	21648	
1 COLONY PARK CIR GALVESTON TX 77551	FALSE	TRUE	1	23494	
1 QUINTANA CT GALVESTON TX 77554	FALSE	TRUE	1	5048	
1 SAN JACINTO DR UNIT 7 GALVESTON TX 77550	FALSE	TRUE	1	8229	

CLI Job submission

- If the resources through DesignSafe Workspace is not sufficient:
 - Request an allocation on Stampede2
 - Login directly to Stampede2 to run simulations
 - Documentation for requesting such an allocation:
 - <https://www.designsafe-ci.org/rw/user-guides/allocations-policy/>