

DESIGNSAFE.CI

A NATURAL HAZARDS
ENGINEERING COMMUNITY



ADCIRC 101

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 code. Uses unstructured triangular meshes on 2D Cartesian or spherical domains.
- Typical applications require several large input files, usually generated using SMS or OpenMesh2D.
- 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 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 two years or so. The latest release version is Version 55. To request access to the ADCIRC Github repository contact Zach Cobell at zcobell@thewaterinstitute.com

Input files for PADCIRC

- fort.14—mesh file (x, y coordinates of each vertex or node and bathymetry at that node which is positive downward)
- fort.15---control parameter file
- fort.13---nodal attributes file (e.g. Manning's N)
- fort.22---wind parameter file
- fort.221, fort.222---wind and atmospheric pressure data

Main output files for PADCIRC

- fort.63—time history of water elevation
- fort.64---time history of water velocity
- maxele.63---snapshot of maximum water elevation over the entire simulation
- maxvel.63---snapshot of maximum water velocity magnitude over the entire simulation
- fort.73, fort.74---time history of atmospheric pressure and wind velocity data
- maxwvel.63---maximum wind velocity magnitude over the entire simulation
- minpr.63---minimum atmospheric pressure over the entire simulation

Running ADCIRC in DesignSafe

Log into the DesignSafe website

Go to “Tools and Applications” in the Workspace



Click on “Simulation”

Click on ADCIRC

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. ADCIRC-V55
4. PADCIRC-V55
5. PADCSWAN-V55

DesignSafe Sample job, submission form: **PADCIRC**

Input Directory that contains all necessary input files.

Maximum job runtime.

Number of requested nodes.

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.

[PADCIRC \(Frontera\) - V55 Documentation](#)

Inputs

Input Directory

Select Click to select input data

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.community/app_examples/adcirc/EC2001' above.

Job details

Maximum job runtime

02:00:00

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 (hrs:min:sec).

Job name

padcirc-frontera-55.01u4_2023-05-15T14:46:13

A recognizable name for this job.

Job output archive location (optional)

Select clint/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:

`clint/archive/jobs/${YYYY-MM-DD}/${JOB_NAME}-${JOB_ID}`.

Node Count

3

Number of requested process nodes for the job. Default number of nodes is 3.

Processors Per Node

56

Number of processors (cores) per node for the job. e.g. A selection of 16 processors per node along with 4 nodes will result in 4 nodes with 16 processors each, 64 processors total. Default number of processors per node is 56.

Accessing your Output

Once you run a simulation, the output data is stored in the Data Depot. Go to “archives” then go to “Jobs” then select the date the job was submitted.

You can create a Project and move the data into the Project. The Project can be shared with other DesignSafe users.

When you are finished with the Project, you can publish it and create a DOI.

If you ran your simulation through the command line, you can scp or use Globus to transfer your data into DesignSafe.

Running ADCIRC in a Jupyter Terminal

Log into the DesignSafe website

Go to “Tools and Applications” in the Workspace

Click on “Analysis”

Click on Jupyter

Launch a Jupyter Server

Under the “New” pull down menu select “Terminal”

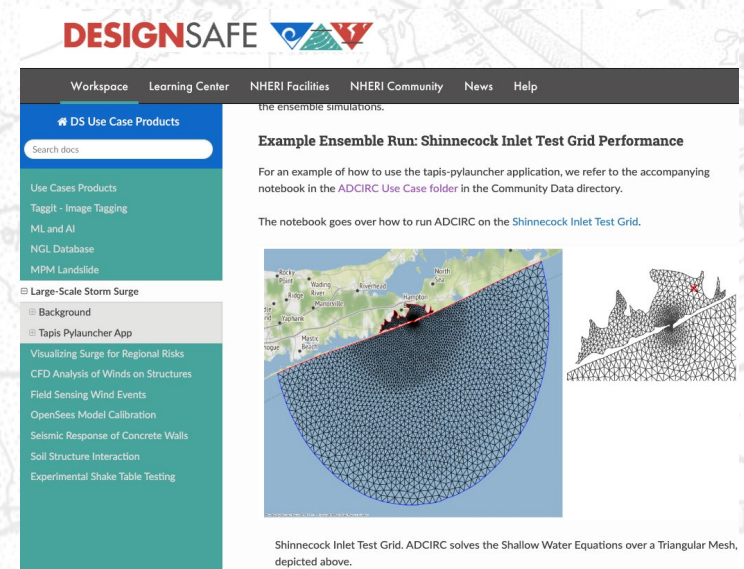
Running ADCIRC in a Jupyter Terminal

Once you're in the Terminal you can ssh to Frontera or Stampede2

To run from the command line you must have an allocation on TACC.

DesignSafe ADCIRC – Use Cases

- All use cases can be found at <http://www.designsafe-ci.org/ds-use-case/>.
- ADCIRC specific UseCases include:
 - [Large-Scale Ensemble Simulations of Storm Surge \(ADCIRC, pylauncher, Jupyter, HPC\)](#)
 - [Visualizing Surge for Regional Risks - DS Use Case Products \(designsafe-ci.org\)](#)
- Have accompanying Jupyter Notebook walkthroughs.



Archiving your Output

Data that you store on DesignSafe will not go away.
However, there is a limit on how much data you can store.

- **Base Allocation:** 50 GB – Provided to all registered users
- **Startup Allocation:** up to 1 TB – For researchers in need of more than the base allocation. To receive this allocation, send a request and await approval from an internal review.
- **Research Allocation:** 100 TB (negotiable) – For researchers in need of more than the startup allocation. To receive this allocation, send a request and await approval from an internal review.
- **Educational Allocation:** up to 1 TB – For teachers using DesignSafe for educational purposes. To receive this allocation, send a request and await approval from an internal review.
- **Additional Allocation:** Request via [XSEDE](#) or purchase \$100/TB/year

Creating a Project

To create a new project go to the Data Depot under My Projects.

Click on “+Add”

Select “New Project” in the drop-down menu.

Follow the step-by-step instructions.

Organizing your Data

To better organize your data, suggest creating “Input” and “Output” directories for each simulation that you want to archive.

Store input files in “Input” and output files in “Output”.

Input files that are shared across all simulations may be in a separate folder.

Example: see the published project “Texas FEMA Storms Hurricane Winds and Surge”

Publishing ADCIRC Datasets

- Best Practices:
 - Include simulation executables.
 - Group inputs and outputs into separate directories, to facilitate labeling.
 - Group inputs/outputs for different simulations into distinct directories.
 - Put common files used across all simulations, such as mesh files, in a separate directory.
- Example: [Alaska Storm Surge Events | DesignSafe-CI](#)

```
Report.pdf -> Label as Report - PDF summarizing DataSet
execs -> Label as Simulation Model
├─ padcirc - Executable
├─ adcprep- pre-processing Script
mesh -> Label as Simulation Input (ADCIRC Mesh Type)
├─ fort.13 - Nodal Attributes
├─ fort.14 - Grid
├─ fort.15 - Control
inputs -> Label as Simulation Input (ADCIRC Meteorological Type)
├─ event000
│   ├── fort.15 - Control
│   ├── fort.221 - Pressure
│   └── fort.222 - Wind
├─ event001
│   ├── fort.15 - Control
│   ├── fort.221 - Pressure
│   └── fort.222 - Wind
outputs -> Label as Simulation Output (ADCIRC Output)
├─ event000
│   ├── fort.61.nc - Station elevation time series
│   ├── ...
│   └── maxele.63.nc - Max water elevation over grid
├─ event001
│   ├── fort.61.nc - Station elevation time series
│   ├── ...
│   └── maxele.63.nc - Max water elevation over grid
Analysis -> Label as Analysis any notebooks/code/images.
├─ OverviewNotebook.ipynb - Analysis over all events.
├─ event000
│   └─ ExampleNotebook1.ipynb - Event 1 specific analysis.
├─ event001
│   └─ ExampleNotebook2.ipynb - Event 2 specific analysis.
```


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```

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├── Report.pdf -> Label as Report - PDF summarizing DataSet
├── execs -> Label as Simulation Model
│   ├── padcirc - Executable
│   ├── adcprep- pre-processing Script
├── mesh -> Label as Simulation Input (ADCIRC Mesh Type)
│   ├── fort.13 - Nodal Attributes
│   ├── fort.14 - Grid
│   └── fort.15 - Control
├── inputs -> Label as Simulation Input (ADCIRC Meteorological Type)
│   ├── event000
│   │   ├── fort.15 - Control
│   │   ├── fort.221 - Pressure
│   │   └── fort.222 - Wind
│   └── event001
│       ├── fort.15 - Control
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│       └── fort.222. - Wind
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│   ├── event000
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│   │   ├── ...
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│       ├── fort.61.nc - Station elevation time series
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│   ├── event000
│   │   ├── ExampleNotebook1.ipynb - Event 1 specific analysis.
│   ├── event001
│   │   └── ExampleNotebook2.ipynb - Event 2 specific analysis.
└──

```

where identified by looking at the difference between the predicted tide and the observed water levels at NOAA tide gauge stations. Events across all three strait input forcing for the identified events were pulled from NCAR's CFSv1/2 data set, including barometric pressure, winds, and ice concentration. A lightweight elements was used with the meteorological forcing to generate hindcasts for all 115 identified events. These hindcasts are meant to be used in future studies, machine learning models.

Working Directory Curation Directory Publication Preview 1 | Add Simulations 2 | Add Categories 3 | Relate Data

PRJ-3887

☒ Name☐ **adcirc_v55**

adcirc_v55

ADCCIRC v55 [Remove](#)

events

Alaska Storm Surge Analysis

Alaska Storm Surge Analysis Remove

-- Select a Category --

☐ inputs

ADCIRC Meteorological Forcing

ADCIRC Meteorological Forcing Remove

-- Select a Category --

ADCIRC Me

Results were



☐
☒



outputs

outputs

ADDITIONAL

-- Select a Category --

-- Select a Category -- Save

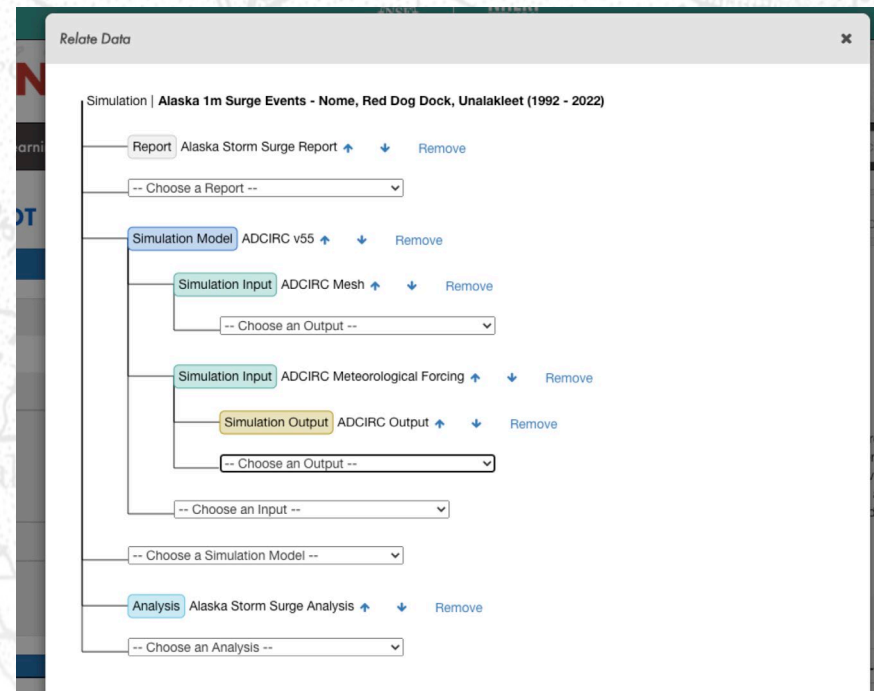
☐ report

Alaska Storm Surge Report

Alaska Storm Surge Report Remove

Curating Data – Relating Data Types

- Make sure to nest simulation files appropriately.
- Simulation events using the different ADCIRC executable should be related as separate simulation models.
- Analysis can be included per model, or across all models.
- At minimum create a report at the base level explaining what data is included.



Published Dataset: Alaska Storm Surge Events

Simulation | Alaska 1m Surge Events - Nome, Red Dog Dock, Unalakleet (1992 - 2022)

Cite this Data:
Del-Castillo-Negrete, C., B. Pachev, P. Arora, E. Valseth, C. Dawson. (2023) "Alaska 1m Surge Events - Nome, Red Dog Dock, Unalakleet (1992 - 2022)", in *Alaska Storm Surge Events*. DesignSafe-CI. <https://doi.org/10.17603/ds2-4rnb-j321> v1

Download Citation: [DataCite XML](#) | [RIS](#) | [BibTeX](#)
2 Downloads 8 Views Details

Hide Data

Simulation Type

Storm Surge

Author(s)

Del-Castillo-Negrete, Carlos; Pachev, Benjamin; Arora, Prateek; Valseth, Eirik; Dawson, Clinton N.


Date of Publication

03-30-2023

DOI

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License(s)

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Storm surge events where surge exceeded 1m at one of the three following NOAA tide stations: (1) Nome (2) Red Dog Dock (3) Unalakleet from the years 1992 - 2022 where identified and hindcasted using ADCIRC. Events where identified by looking at the difference between the predicted tide and the observed water levels at NOAA tide gauge stations. Events across all three stations were merged into a set of 115 non-overlapping events. Input forcing for the identified events where pulled from NCAR's CFSv1/v2 data set, including barometric pressure, winds, and ice concentration. A lightweight Alaska mesh with with ~440k nodes and ~850k triangular elements was used with the meteorological forcing to generate hindcasts for all 115 identified events. This base data-set of storms comprises of one of the more comprehensive and complete sets of all storm surge events along the coast of western Alaska. The data is presented in a clean and re-usable format to for future studies, in particular as a base data-set to generate features for training machine learning models.

Report | Alaska Storm Surge Report

Simulation Model | ADCIRC v55


Simulation Input | ADCIRC Mesh

Simulation Input | ADCIRC Meteorological Forcing

Simulation Output | ADCIRC Output

Analysis | Alaska Storm Surge Analysis

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 **TEXAS**
The University of Texas at Austin

TACC

RICE

Florida Tech