1. Motivation

- The ADVanced CIRCulation model (ADCIRC) is used to predict coastal flooding during extreme storm events.
- High resolution is computationally costly
- Hinders the speed of ADCIRC runs
- Delays the forecast predictions
- This study aims to increase the accuracy and efficiency of ADCIRC by:
  - Adding sub-mesh correction factors to the governing equations
  - Running on coarsened meshes

2. Wetting and Drying

REALITY

• In traditional ADCIRC, elements are either treated as fully wet or fully dry.
• At the wetting and drying front, this methodology leaves a vertical wall of water between a wet and dry element.
• In reality the ground surface is either fully wet or dry.
• In a model, the wet/dry interface can be represented more realistically by using a partially wet element.

TRADITIONAL ADCIRC

3. Sub-mesh calculations

- Sub-mesh calculations are performed using a high resolution digital elevation model (DEM) underlying a ADCIRC mesh of coarser resolution.
- Sub-mesh correction factors such as $\phi$ and $(H)_c$ are found by integrating the space surrounding each vertex
- Sub-mesh quantities are pre-computed and read into ADCIRC.

4. Governing Equations

- Governing equation for mass in 1D with averaged variables.
  \[
  \phi \frac{\partial^2 (\xi)_w}{\partial t^2} + \phi \tau_o \frac{\partial (\xi)_w}{\partial t} + \frac{\partial \phi (J_x)_w}{\partial x} + \frac{\partial \phi (J_y)_w}{\partial y} - \langle u \rangle_w (H)_o \frac{\partial \tau_o}{\partial x} - \langle v \rangle_w (H)_o \frac{\partial \tau_o}{\partial y} = 0
  \]

5. Results

- Sub-mesh features:
  - Hydraulic features that influence flow
  - Exist below the resolution of the mesh.
  - Include: small scale channels and ponds, marsh grasses, roadways

- ADCIRC meshes are created by interpolating to elevations specified by a DEM.
- Through the interpolation process, bathymetric details contained within the mesh can be left out.

6. Summary/future work

- Testing of the new wetting and drying algorithm and sub-mesh averaging is on-going.
- Testing on more realistic domains is soon to come.
- The end goal of this section of the project will be to:
  - Cut the run time of ADCIRC at least by half
  - Maintain the accuracy a high resolution mesh
- Incorporation of additional correction factors will be involved in future work.