DEVELOPMENT OF MESHES FOR COMPOUND FLOOD SIMULATION FOR THE TEXAS COAST

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The Texas coast is subjected to frequent storms leading to floods in the yearly hurricane season. To provide forecasts of hurricane storm surge, a shallow water equation solver, the Advanced CIRCulation model, Luettich (1992) is used. The current state-of-the-art ADCIRC meshes for the Texas coast used in forecasting were developed about a decade ago, see, Hope (2013). ADCIRC uses unstructured meshes that require significant tailoring to ensure accurate and physically relevant solutions. The current mesh used in forecasting has very high resolution on the Texas coast for accuracy and numerical stability, whereas areas far away from Texas are of low resolution for computational efficiency. The applicability and accuracy of these meshes is regularly verified to be used in operational storm surge forecasting.

Recent events have shown that the storm surge from hurricanes is often accompanied by floods from multiple sources, including rainfall and riverine flows, Loveland (2021). The aforementioned ADICRC mesh has high resolution in the Texas coast, however, it lacks the necessary detail of rivers to be used to study compound floods where rivers and storm urge interact. Recently developed ADICRC meshes, Contreras (2022) use the latest available bathymetry databases for nearshore areas and rivers extend far inland into all major rivers on the Gulf and Atlantic US coasts. These meshes have resolutions down to 120 and 30 meters on the entire US coast and in rivers, hence, both accuracy and computational cost are high. See Figure 1 for an illustration of the 30 meter mesh in southern Texas.

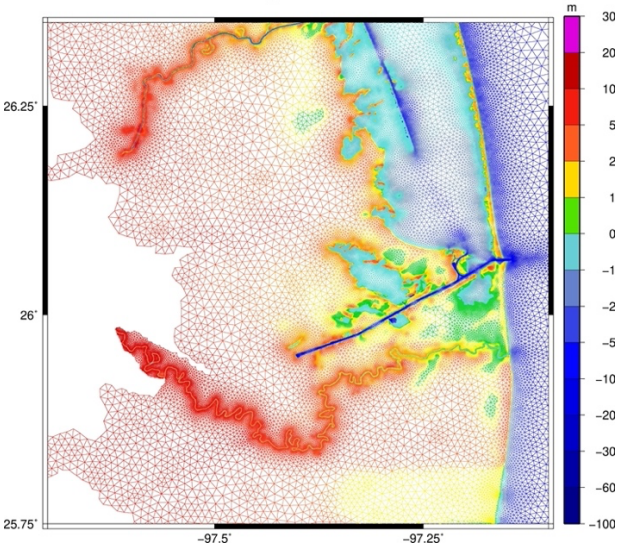

Figure 1 ADCIRC Mesh near the Rio Grande River

In an effort to reduce the computational cost to use in storm surge and compound flood forecasting on the Texas coast, we modify the resolution of the meshes. The modification is done by reducing the resolution of the mesh outside Texas and Louisiana, and potentially increasing the resolution in this region. The modified meshes are subsequently validated for past hurricanes to ensure acceptable accuracy. We subsequently use these modified meshes to study the effects of compound flooding in major Texas watersheds due to storm surge and riverine flows.

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