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Meshing To Realistic Domains

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Introduction

- We were tasked with developing a user-friendly graphical interface for the meshing of realistic domains
- The method chosen was to create Python plugins for Quantum GIS (QGIS)
- Produced: Rasterise Polygons, RasterCalc and Mesh NetCDF

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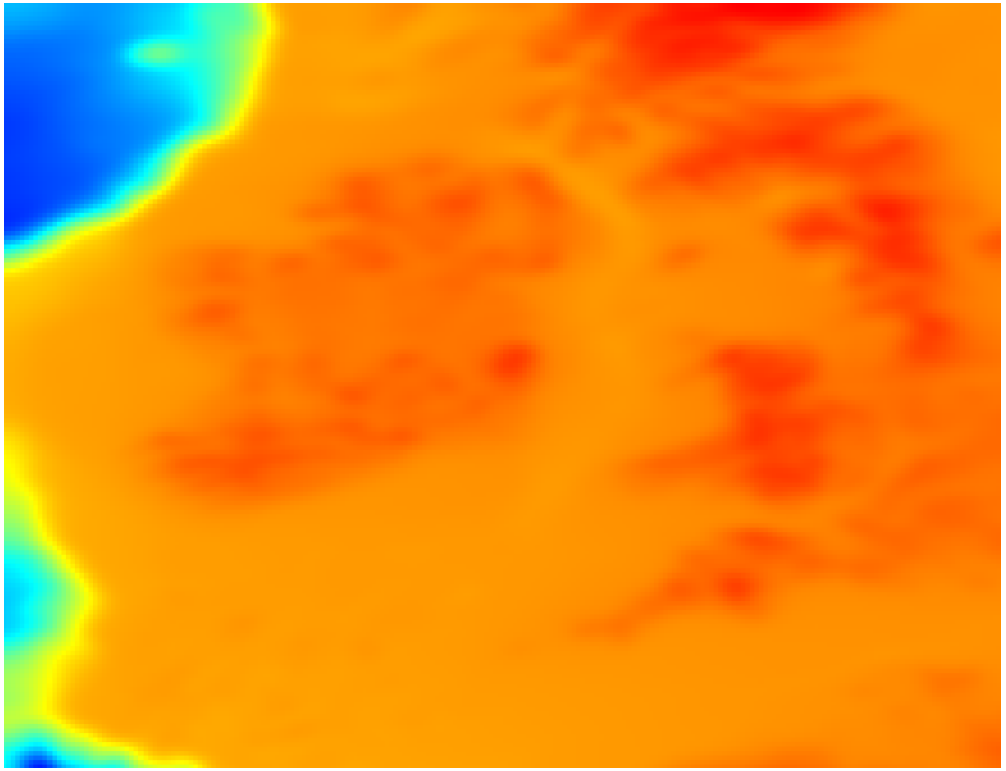
Domains

- Domains to be meshed are stored as Shapefile polygons
- QGIS can extract the domain from either bathymetric data or a Shapefile layer such as GSHHS



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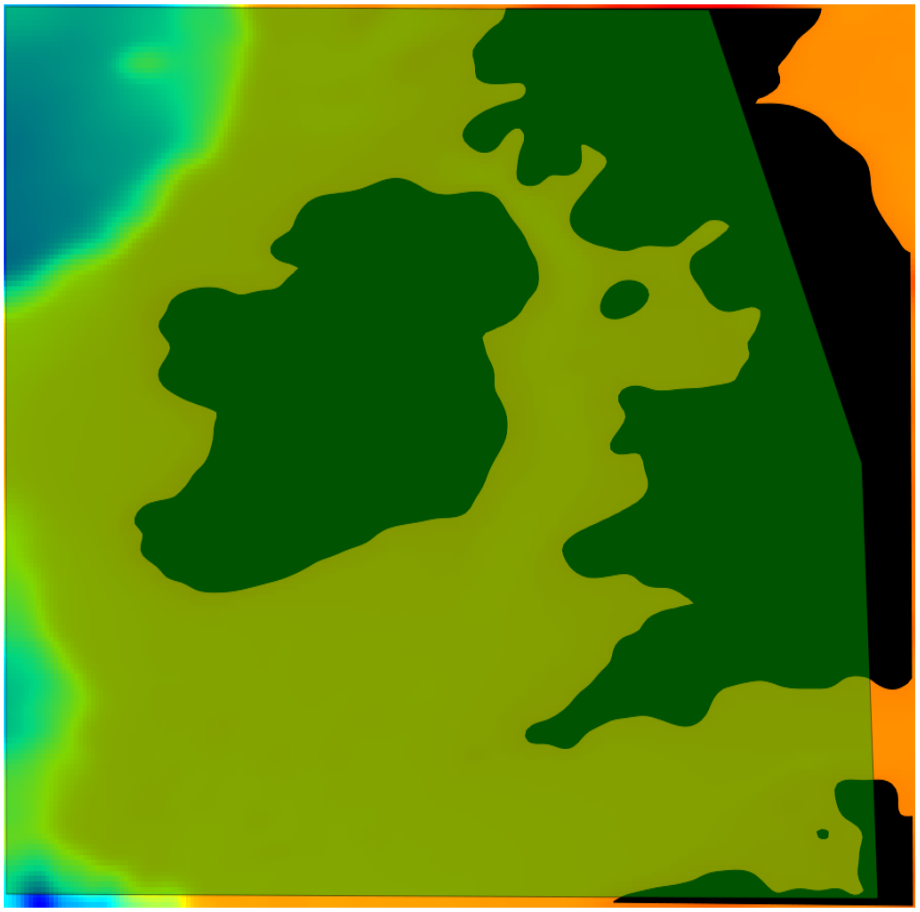
Obtaining Domain

- Extract the 0 m contour and create polygon(s) from the contour
- Add a boundary layer defining the extent of the domain



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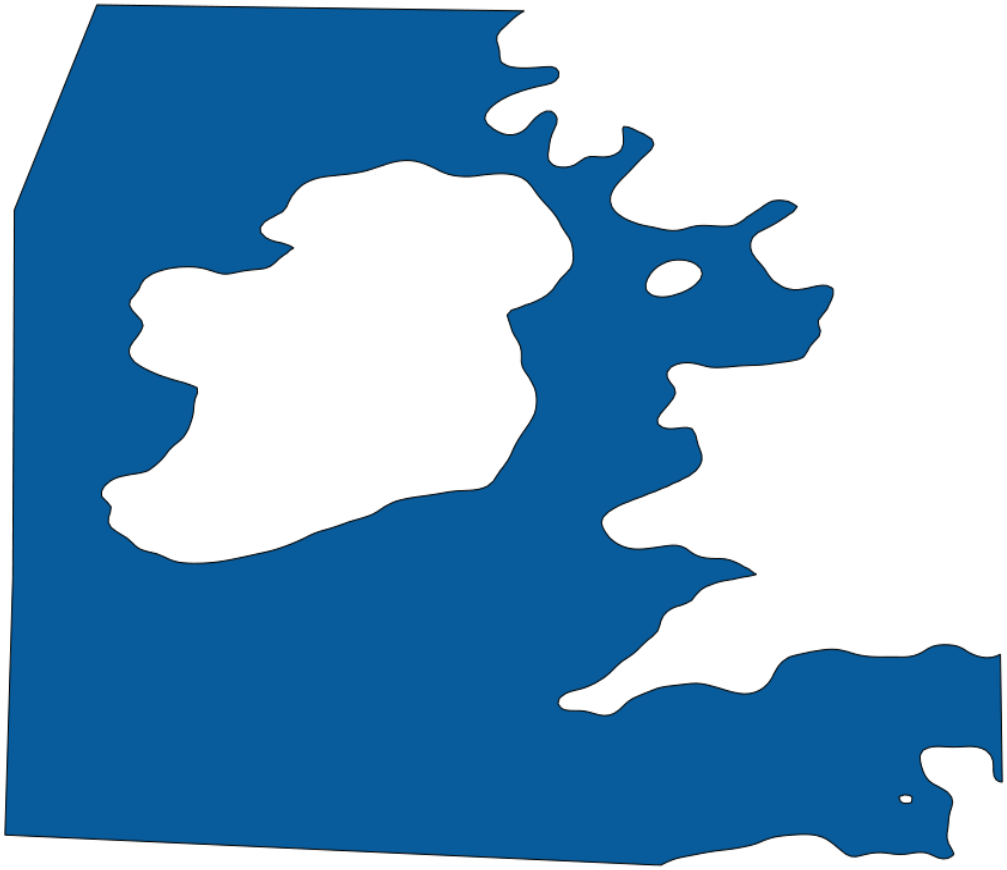
Obtaining Domain

- Perform a 'difference' vector operation to obtain the domain



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Define Physical ID's

- We are able to define unique ID's for domain boundaries
- Distinct ID's allow separate boundary conditions to be used in Fluidity
- A layer is added with polygons defining the ID
- The part of the boundary lying underneath a polygon obtains that ID when the Geo file is created

Mesh-Size Metric

- The Mesh NetCDF plugin uses a NetCDF file as a mesh-size metric
- The value contained by the pixels define how fine the mesh element size shall be
- One example is mesh size related to depth – fine where shallow and coarse in deeper areas

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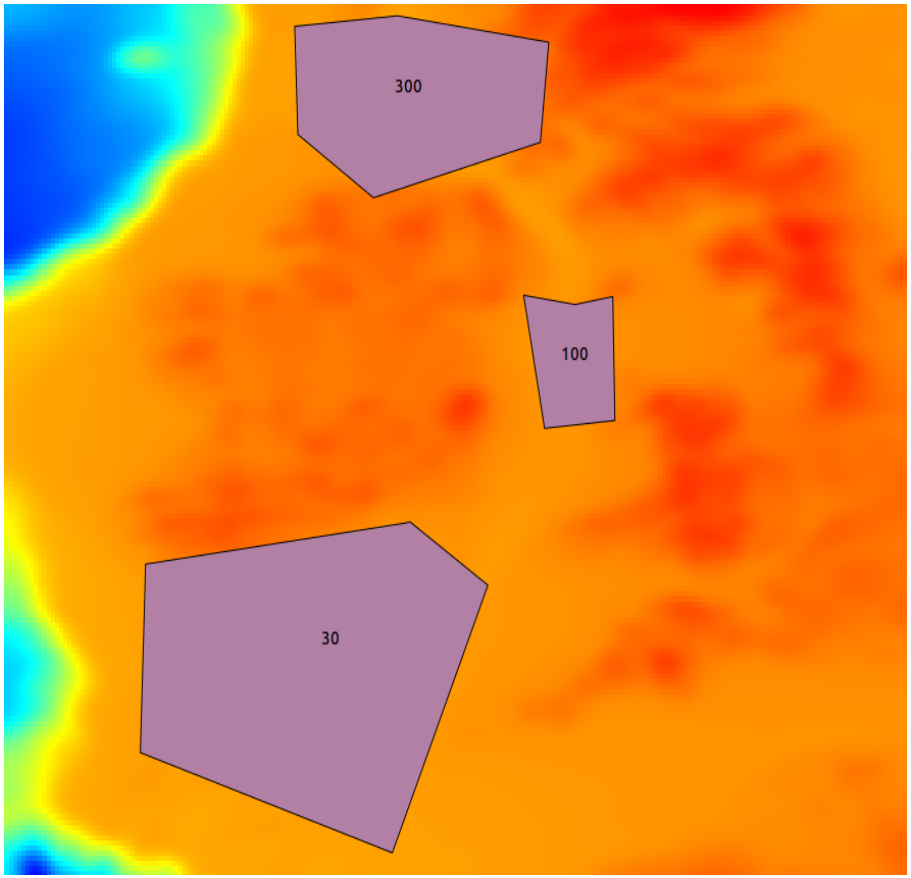
Defining Mesh Metric

- Regions can be defined for specific mesh size
- Add a new layer above the bathymetry
- Each ID of the polygon represents depth in that area



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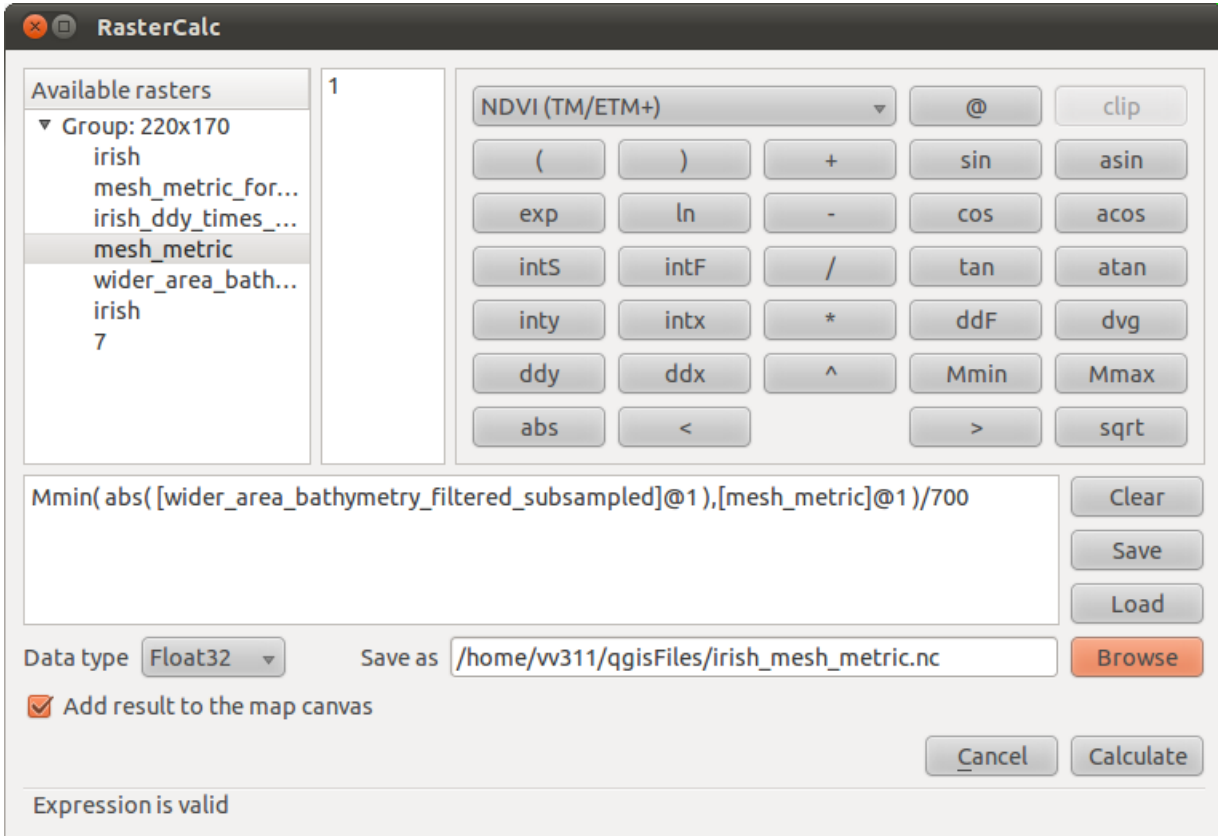
Calculations with Rasters

- To combine the bathymetry and the specific mesh size raster we can use RasterCalc



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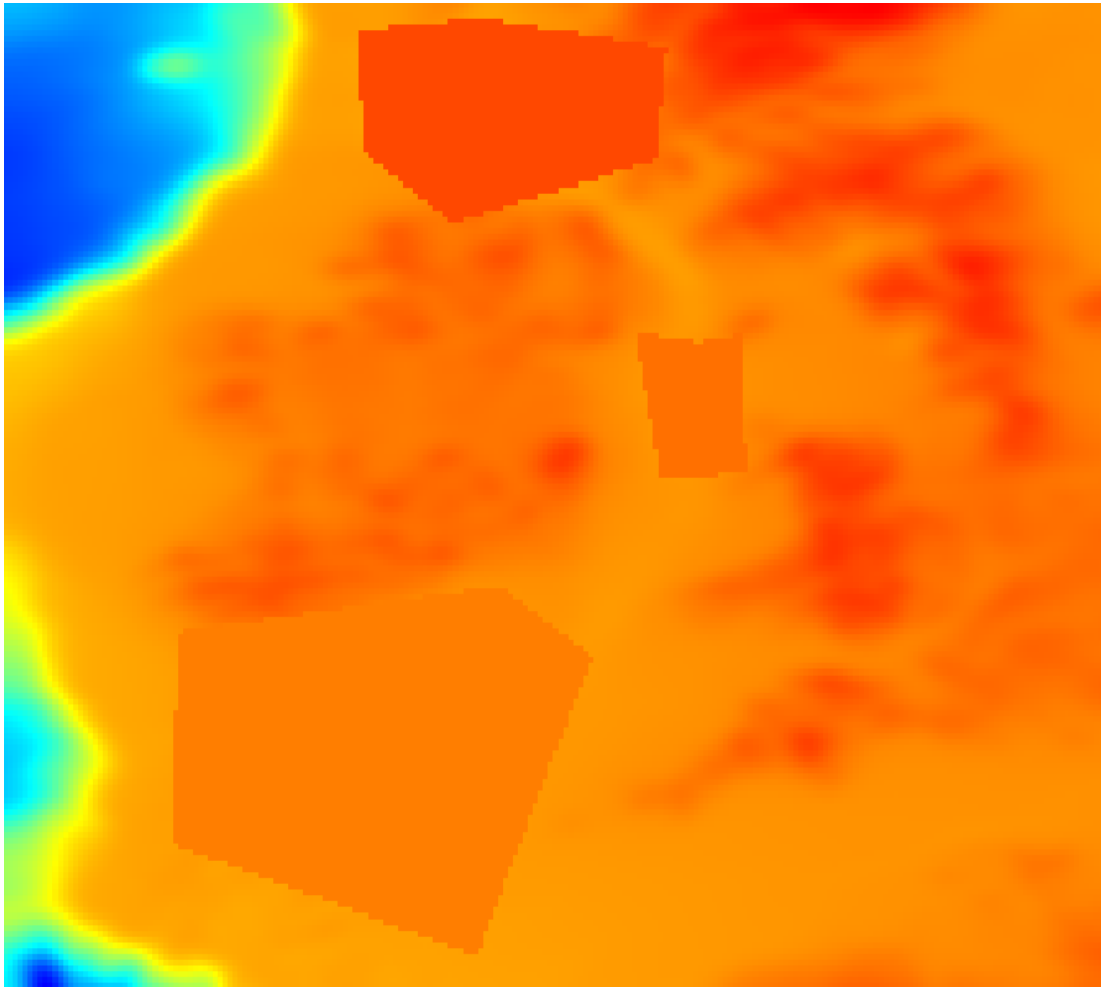
Mesh Metric



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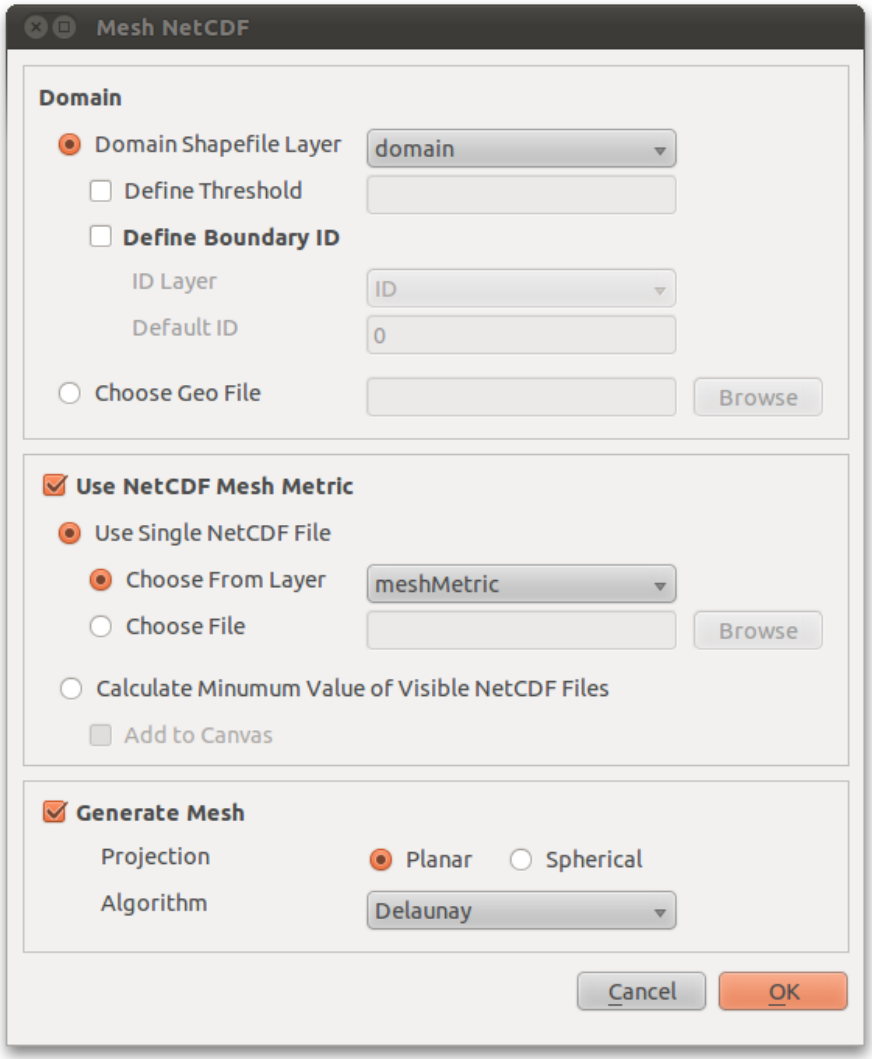
Meshing

- Now there is a domain, boundary ID and mesh-size metric layer we are able to mesh
- Mesh NetCDF will create a Geo file and use the mesh-size metric as the background field



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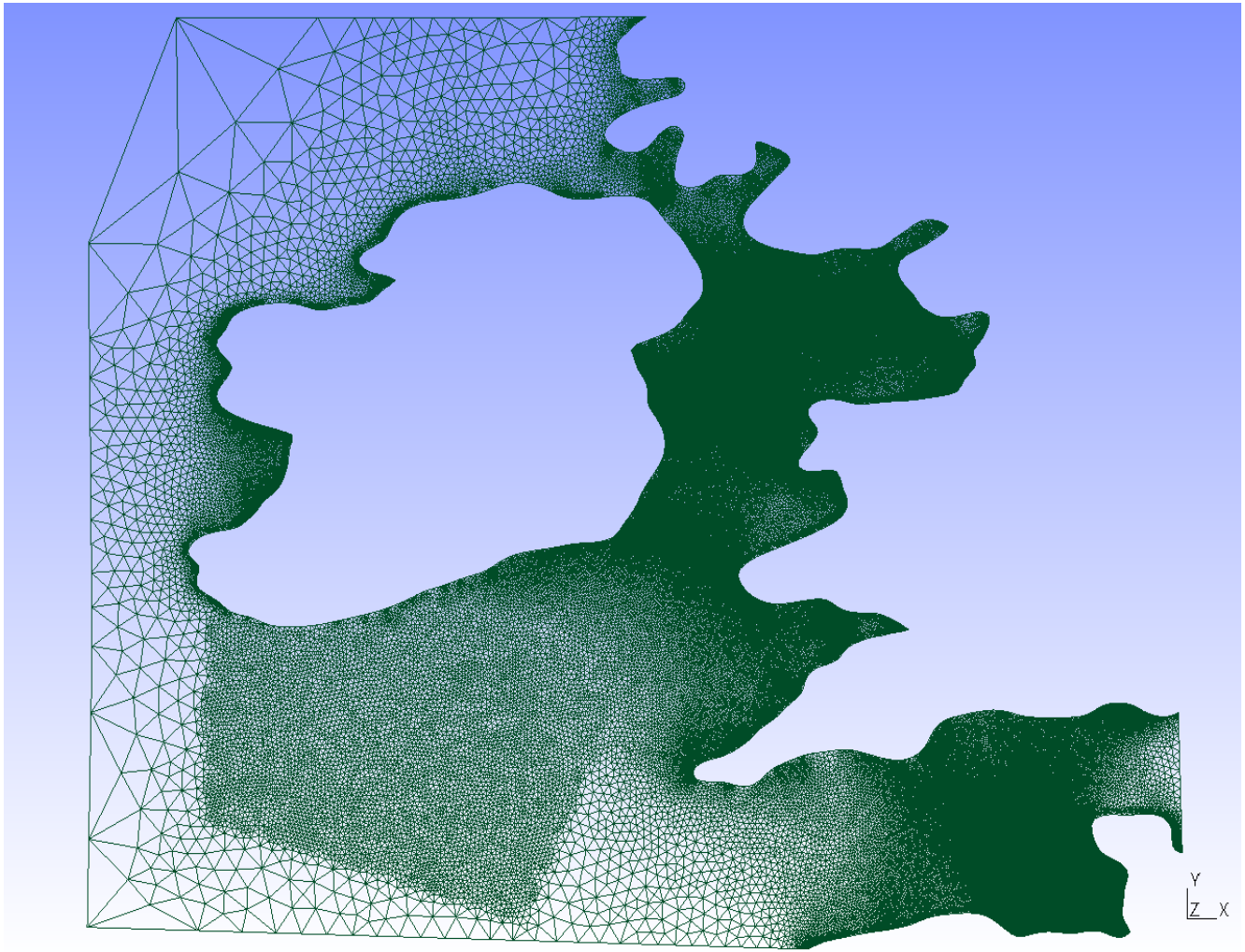
Mesh



Multiple Domains

- The plugin allows the meshing of multiple domains
- For example, meshing the ocean and ice shelf of Antarctica as separate domains

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Antarctica Ocean and Ice Shelf Domains