Methodology

1. Convert kur_slab2_dep_02.24.18.grd to .contour file using GMT at different contour lines.

   gmt grdcontour kur_slab2_dep_02.24.18.grd -C-1,-2,-3,-4,-5,-6,-7,-8,-9,-10,-11,-12,-15,-20,-25,-30,-35,-40,-45,-50,-55,-60,-65,-70,-75,-80 -D > japan_trench.contours

2. Update and run `make_slab2.py` to create a Japan.gmsh file compatible with GMSH.

   #Gmsh output file name
   gmsh_out='/Users/oluwaseunfadugba/Documents/Projects/TsE_ValerieDiego/TsE_1D_vs_3D/Japan_Trench_Mesh_GMSH/Japan.gmsh'

   #Depth filter maxdepth=50 #Line filters #north line L1x1 = 148.03 ; L1y1 = 40.95 L1x2 = 141.97 ; L1y2 = 45.54 #south line L2x1 = 144.86 ; L2y1 = 33.04 L2x2 = 137.49 ; L2y2 = 35.88

   #Contours files contour_files= ['/Users/oluwaseunfadugba/Documents/Projects/TsE_ValerieDiego/TsE_1D_vs_3D/Japan_Trench_Mesh_GMSH/japan_trench.contours']

3. Open GMSH

- Load Japan.gmsh
- Make surface
  - Create different segments along strike (5 divisions) and dip (say 20, 35, 50, 65 and 80 depth contours) because of the curvature of the trench.
    - Geometry > Elementary entities > Add > B-Spline
    - Left click (it will show red)
    - The spline points have to connect and in order.
    - "e" - proceed as is.
    - It will add spline points in Japan.gmsh
    - Press "e" and "q" when done.
  - Turn B-Splines to Ruled Surfaces becuase we can not mesh splines.
    - Add > Ruled Surface. Click on the splines that you want to convert.
    - Press "e" after selection. Repeat as needed.
  - Turn each Ruled Surface to Physical Groups.
    - Physical Group > Add Surface
    - Select the surface and press "e"
    - You can edit the Japan.gmsh file directly to add all the physical groups using the Ruled surface number and creating a new Physical Group number.
- Make mesh
  - Adjust the element size
    - Tools > Options > Mesh > General.
    - Chane the element size factor from 1.0 to about 150. Meshes with an element size factor of 1.0 will be too small thereby increases the computation time.
    - Change the meshing 2D algorithm from Automatic to Delaunay. Tools > Options >Mesh > General > 2D Algorithm to Delaunay
  - Meshing
    - Mesh > 1D
    - Mesh > 2D
  - Save using Mesh > Save. The mesh will be saved as Japan.msh in the working directory.

4. Turn .msh file to .fault and .mshout that MudPy can use.
   - Open `fix_strikes_make_mudpy.py` code.
   - Edit it accordingly and run.

- It will generate two files (.fault and .mshout).
- Note that the depth is negative downwards in the .mshout file and positive downward in the .fault file. Also, confirm if the strike and dip values make sense. Also, check the length and width if they are okay. You may need to adjust the element size factor in GMSH to increase or decrease the length and width of the triangles.
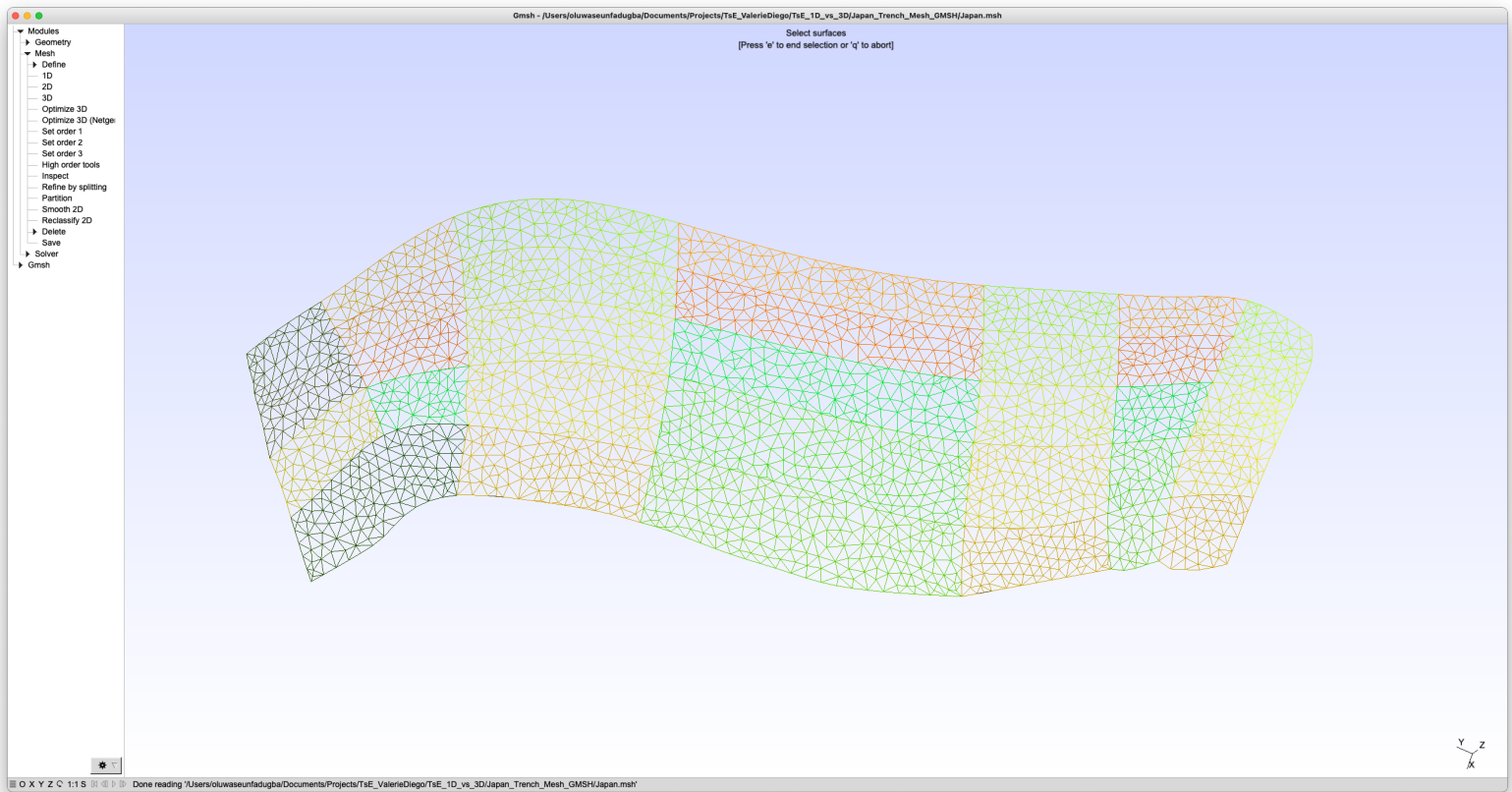

Fig.: Mesh of the Japan Trench using GMSH.

5. Because of the large nunber of subfaults compared to a relatively small finite fault model, we removed the subfaults that are outside the outline of the .rupt file using the same [code] [mapping_slips_on_faults] used for mapping the slips on .rupt file on the .fault geometry.

[mapping_slips_on_faults]: