MPAS-O mesh characteristics, generation, and regional refinement

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Global and regionally refined resolution example
MPAS-O meshes

MPAS-O flow discretization (T. Ringler et al)

Grid generation via JIGSAW (D. Engwirda) in COMPASS (S. Brus)
(Coastline-following meshes coming)

3km mesh

Current meshing approach (v1/v2)
Variable and mesh properties

Variable definition
• Scalars (water surface, temperature, salinity) at hex cell centers (black dots)
• Velocity face-normals at cell edge mid-points (red arrows)
• Vorticity at hex cell edges (blue dots)

Triangular mesh
• Delanay triangulation
• Dual to Hexagon mesh (orthogonal)
• Connectivity between MPAS-O scalars on triangle vertices

D. Engwirda
High-level COMPASS coastal mesh resolution workflow (S. Brus)

1. Extract coastlines
2. Calculate coast distance
3. Apply transition functions and composite

Input provided to JIGSAW produces MPAS-O compatible mesh and initial conditions can be provided in COMPASS.
CONUS coastal North America regionally refined mesh

• Built off RRS60to30 mesh
• US Coastal water resolution 8km
• Resolves mid-latitude Rossby Radius of Deformation to resolve mixing (Wolfram et al, 2015)
• Additional mesh resolution:
  – Compatibility with MPAS-Seaice
  – Ensures straits open (e.g., Nares)
  – Ensures under-resolved cells that are land aren’t removed
D. Engwirda’s new unified land-river-ocean hexagonal meshes via prototype JIGSAW (v3/v4)
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Note: Coarse mesh used to illustrate downscaling cleanly on single mesh.