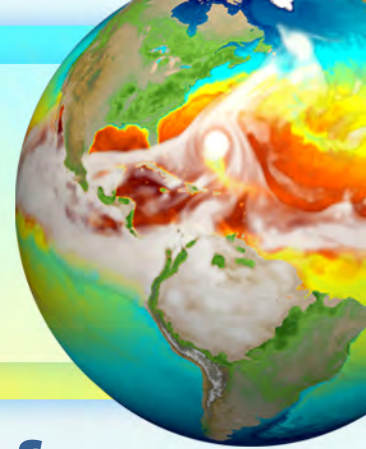


*Mark Petersen, Steven Brus, Darren Engwirda,  
Andrew Roberts, Kevin Rosa, Phillip Wolfram*



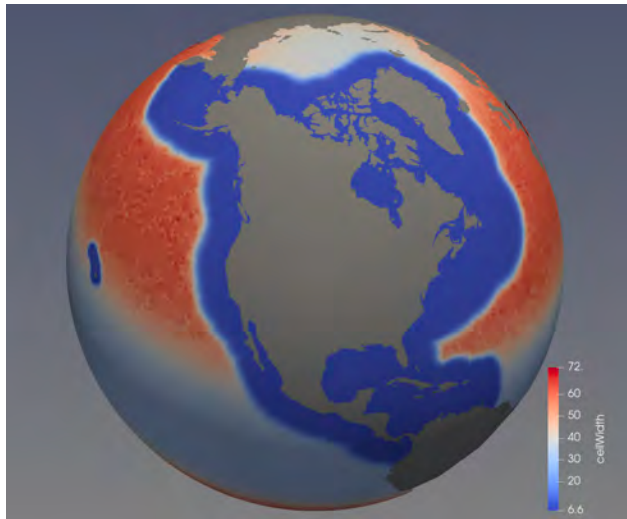
# **MPAS-Ocean Simulation Quality for Variable-Resolution North American Coastal Meshes**

*How does mesh design impact simulation  
quality?*

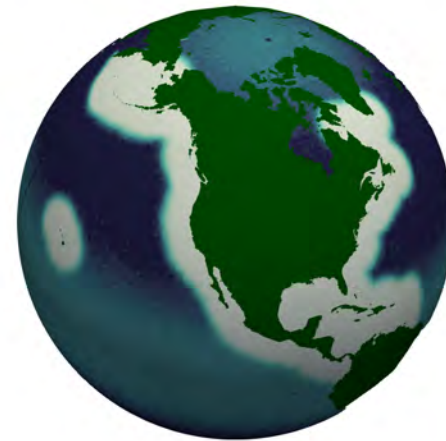
Kristin Hoch

# CUSP Mesh

- Coastal United States 'Plus'
- Build on EC60to30 background mesh
- 8 km coastal resolution
- 400 km wide resolution region
- 600 km transition region



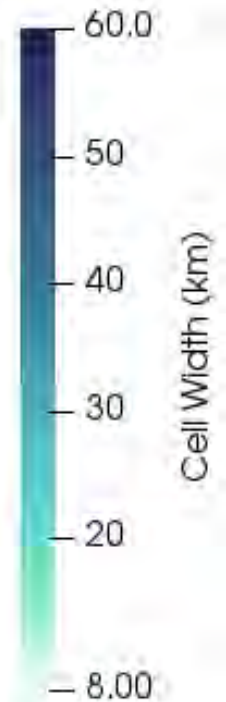
Final CUSP8 Design



CUSP8



North Atlantic (NA8)



# Study Overview

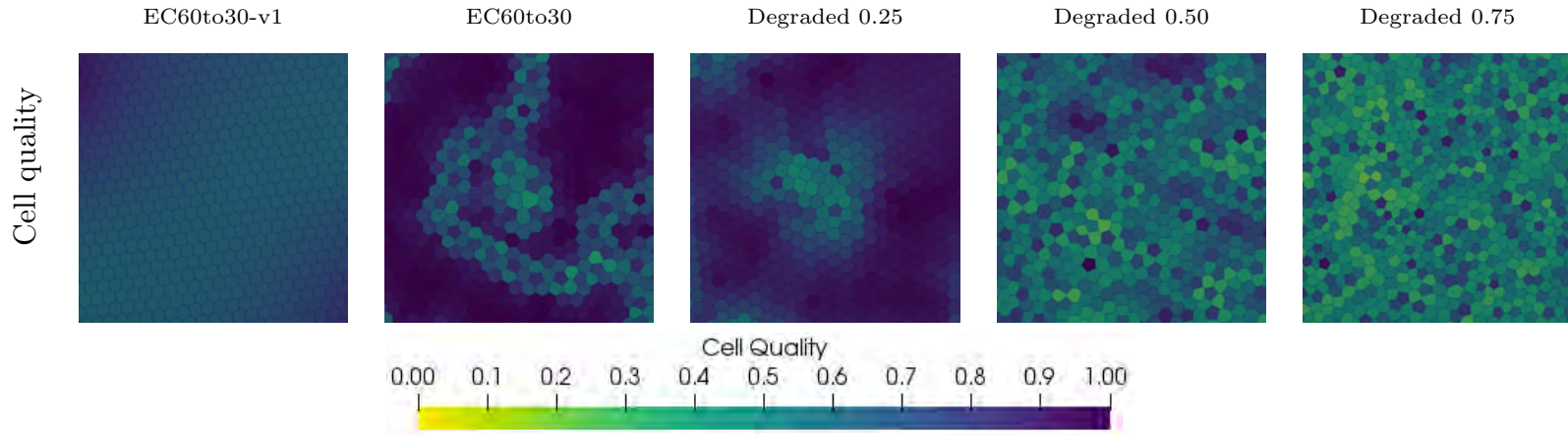
- Study 1: Degraded Mesh
  - *What is the effect of mesh quality on simulations?*
  - Intentionally degraded cells on an EC60to30 mesh
- Study 2: Transition Width
  - *How wide does the transition region between the high resolution region and the low resolution background mesh need to be?*
  - Changed the transition width of the CUSP8 mesh from 10 km to 900 km
- Study 3: Coastal Resolution
  - *Does improving the coastal resolution improve the dynamics of the Gulf Stream?*
  - Changed the coastal resolution of the CUSP mesh from 8 km to 30 km



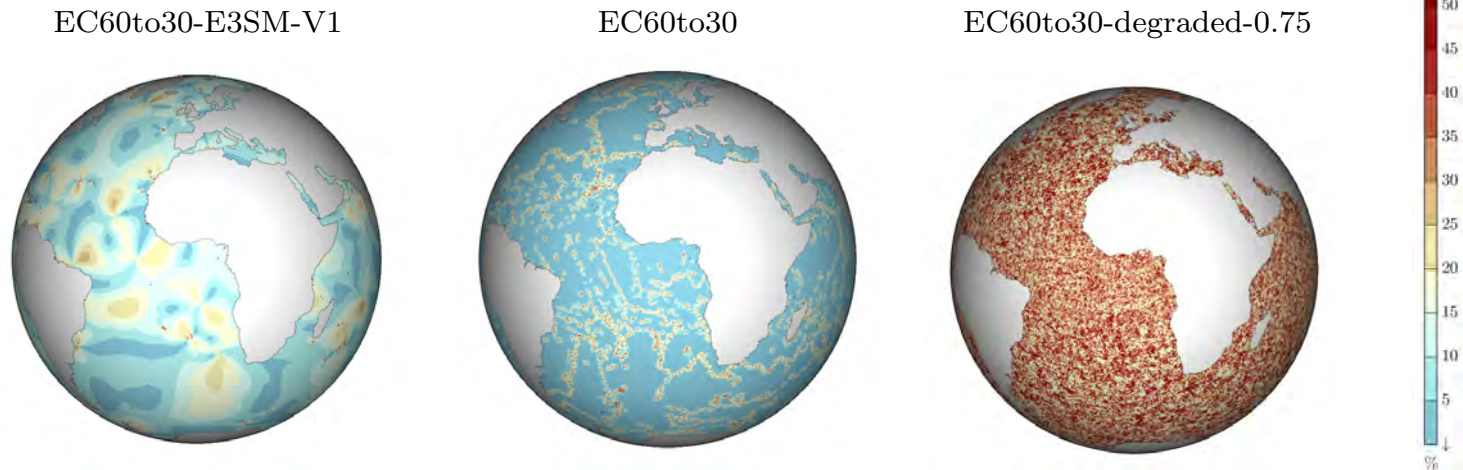
# Study 1: Degraded Mesh

## Two measures of mesh quality

### 1) Ratio of smallest to largest side of cell

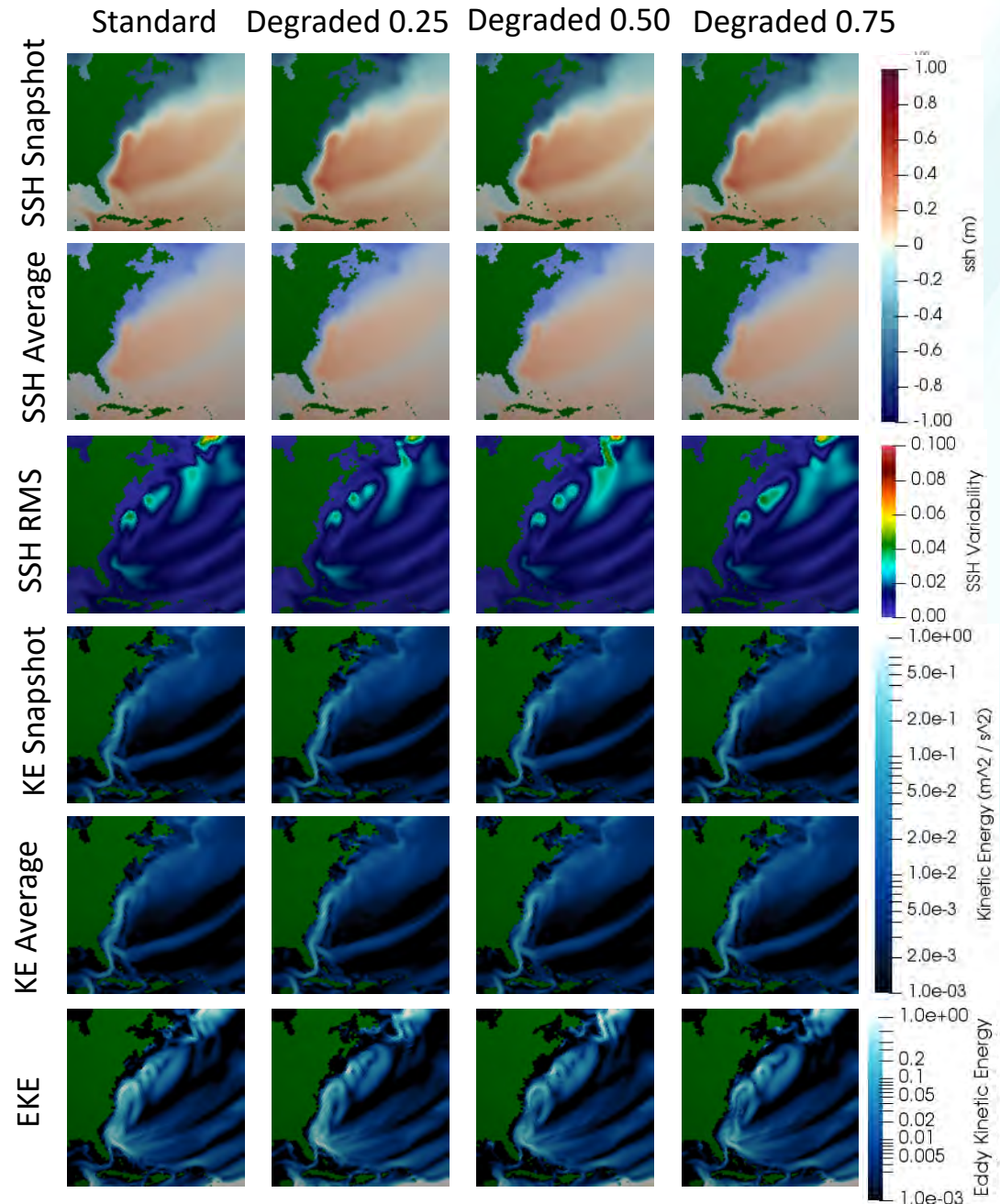


### 2) Maximum percent change in cell area between adjacent cells



# Study 1: Degraded Mesh

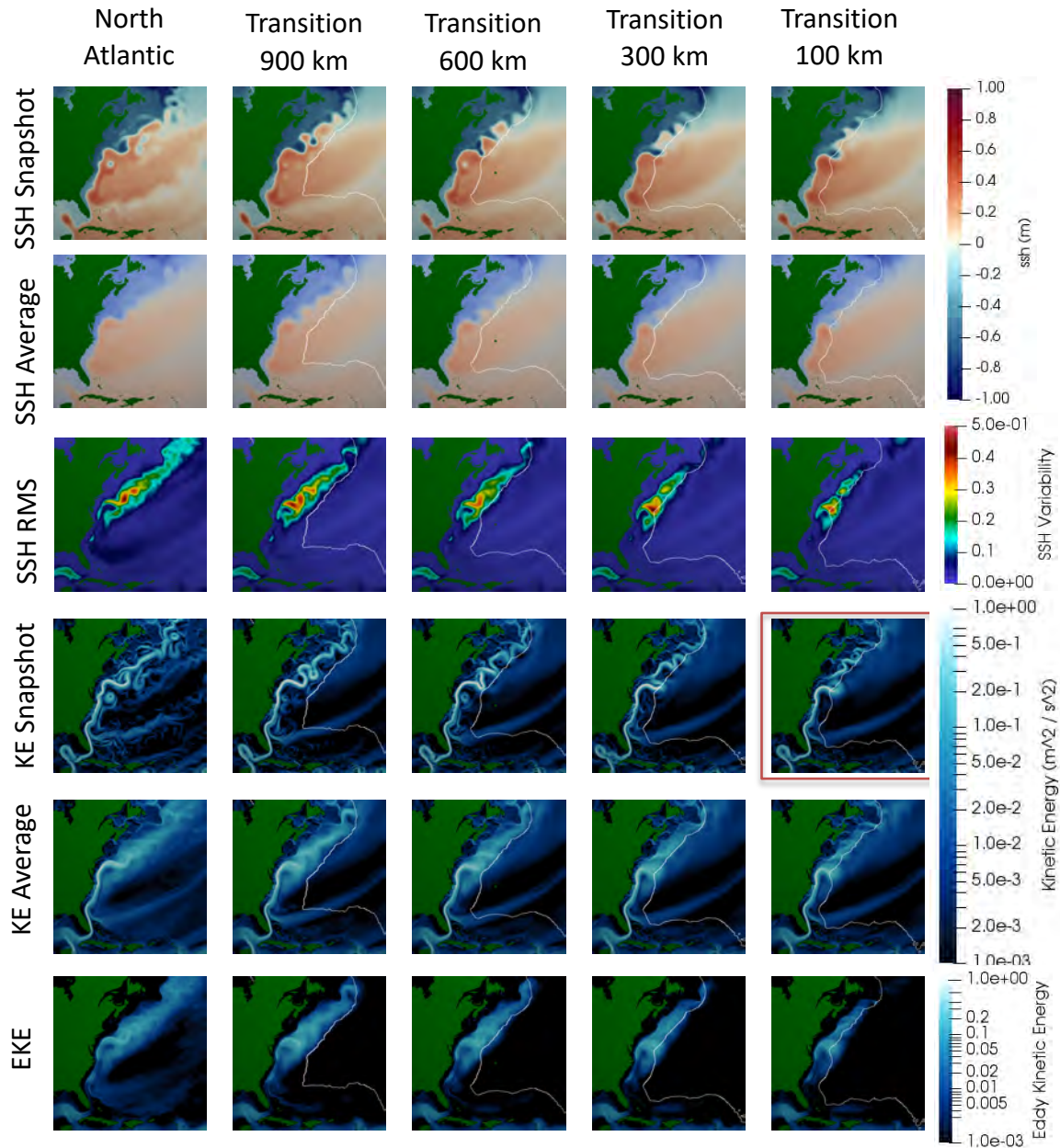
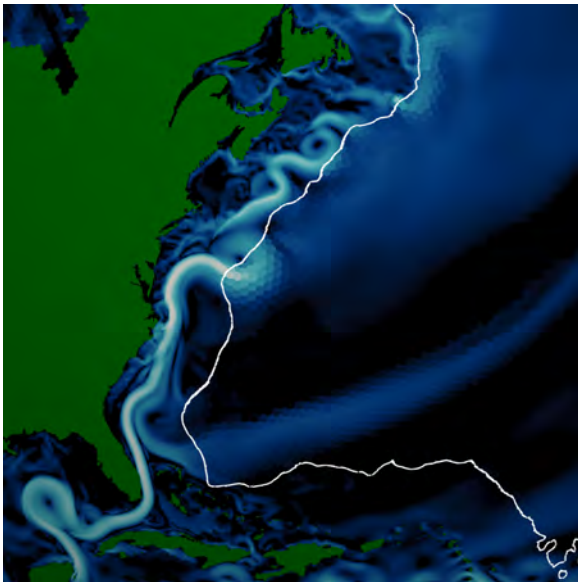
- Degraded meshes perform very similarly to the standard EC60to30 mesh
- Degraded meshes have slightly higher SSH RMS and EKE
- 0.50 and 0.75 degraded meshes had to be run at smaller timesteps





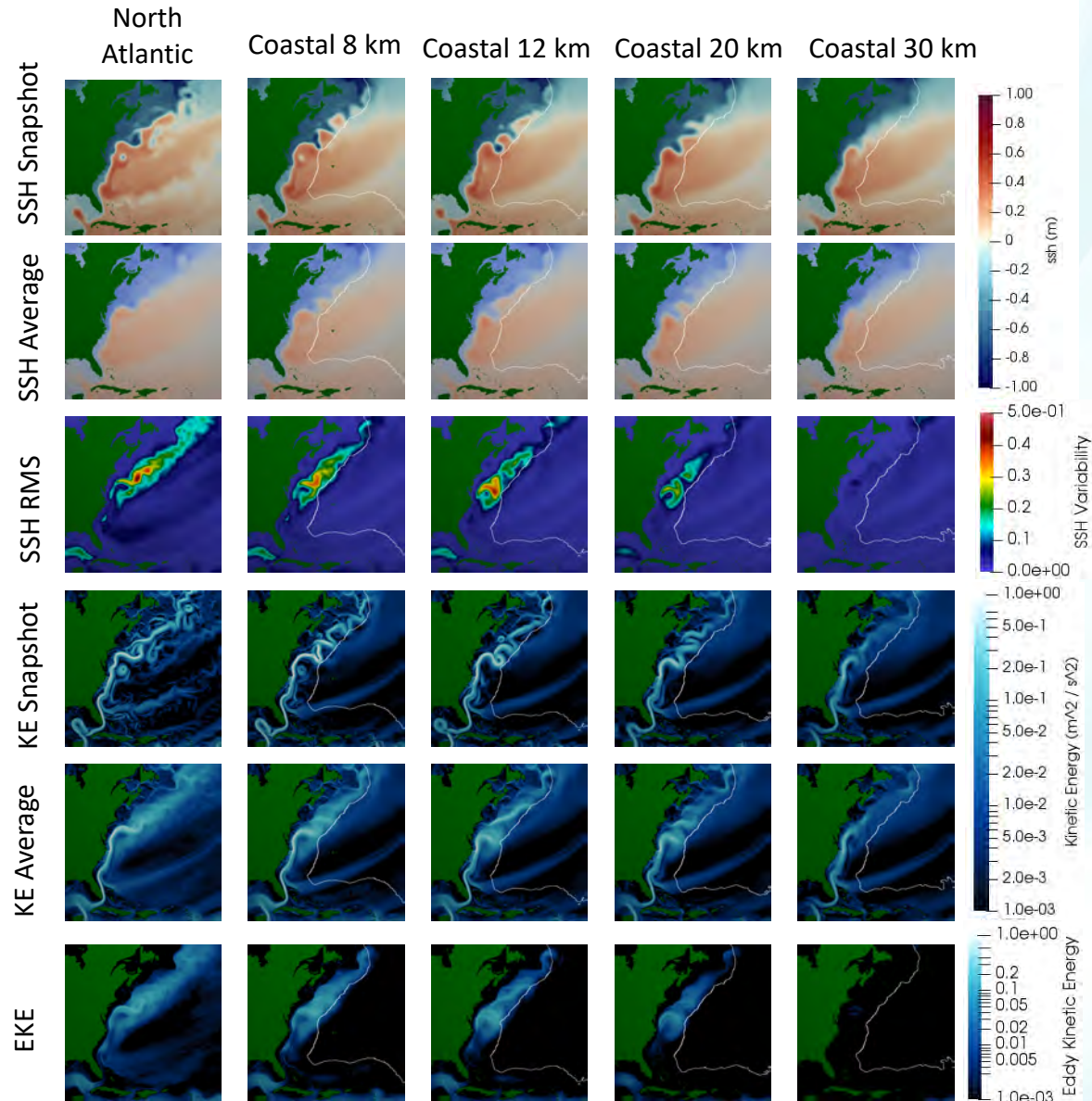
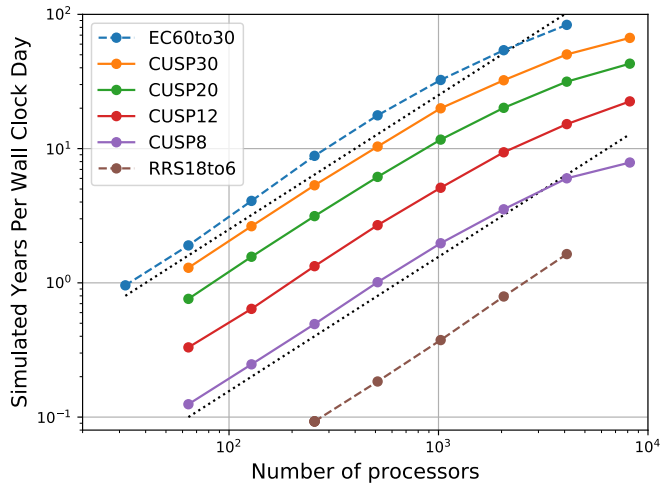
# Study 2: Transition Width

- 10 km transition crashed
- Wider transitions improved dynamics
- Eddies and meanders are affected by narrow transition



# Study 3: Coastal Resolution

- Improved dynamics with higher coastal resolution
- CUSP8 performs similarly to the North Atlantic mesh



# Conclusion

- Variable resolution JIGSAW meshes are robust
- Cell quality does not appear to be a major source of error
- Care should be taken with placement of transition region
  - Can affect eddy formation and propagation
- Can variable resolution fix your problem?

