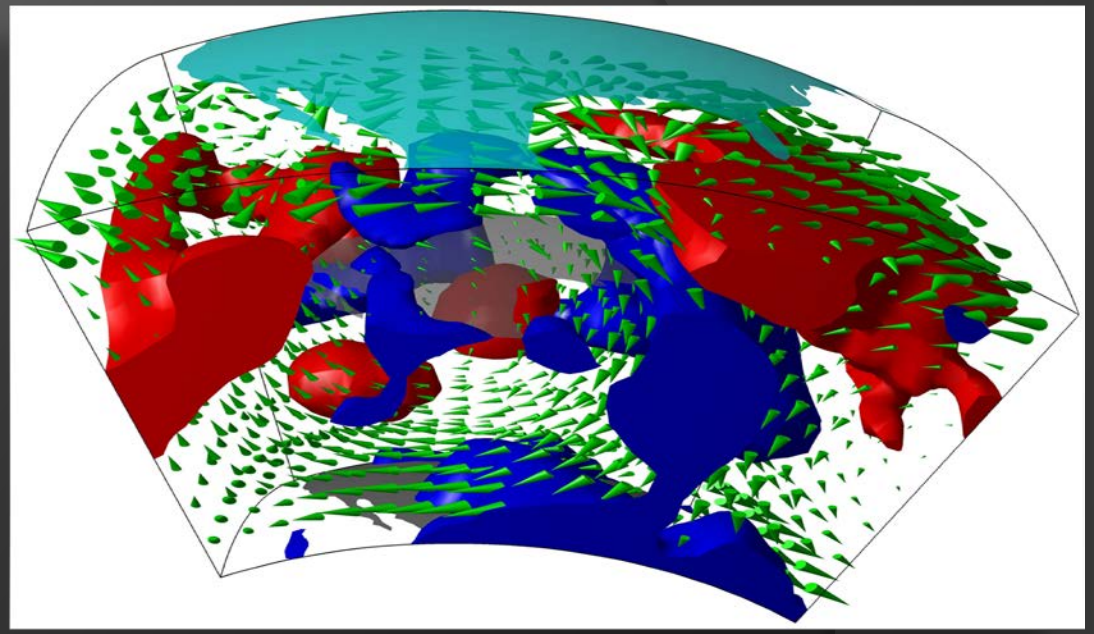
Robert Moucha (Syracuse U.)
David Rowley (U. Chicago)
Alessandro Forte (UQAM)
Jerry Mitrovica (Harvard U.)



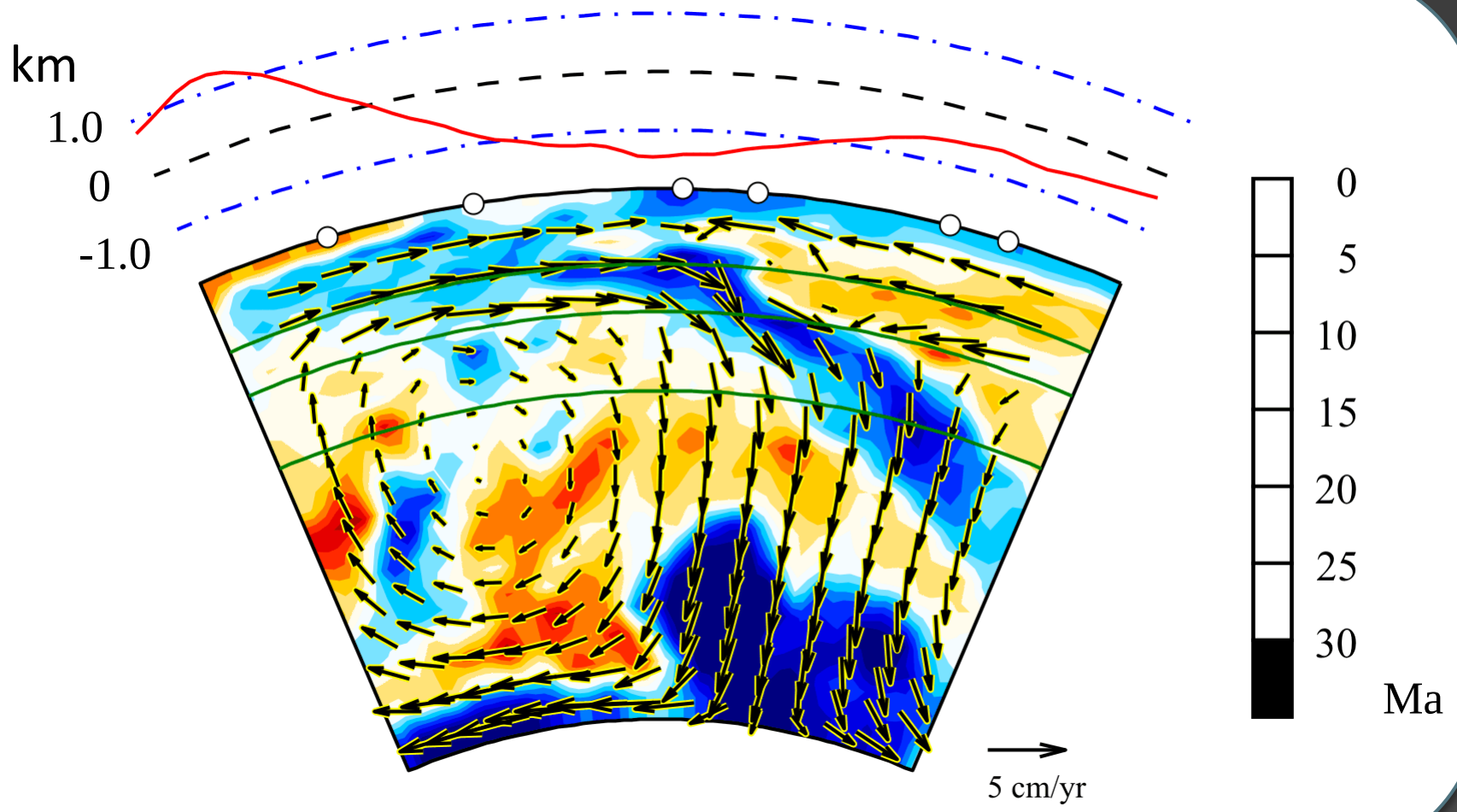
Mantle Dynamics

The recent evolution of the Eastern North American margin

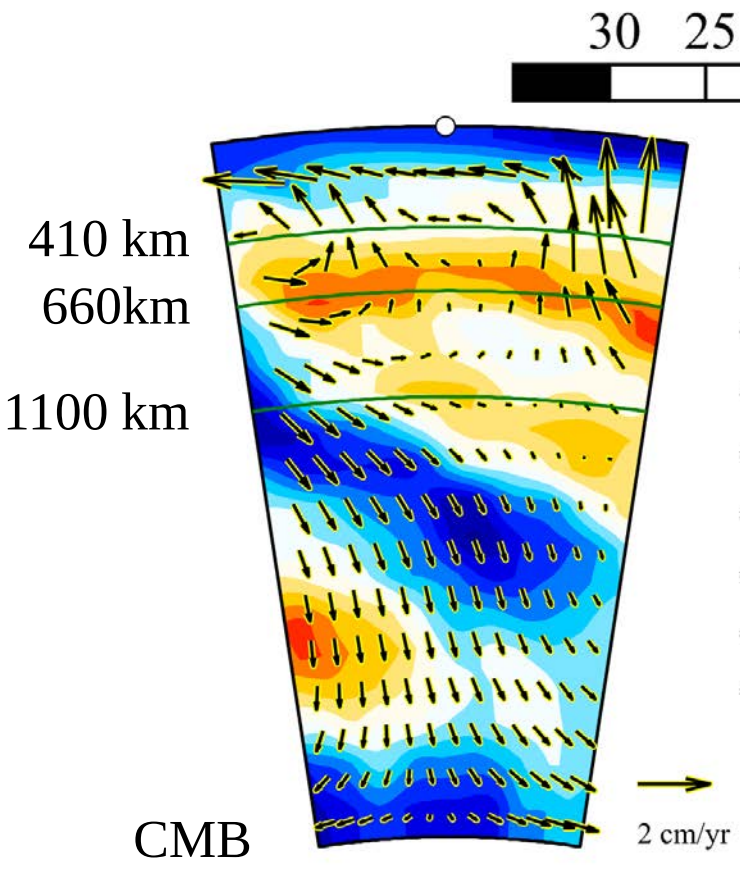
Modeling Dynamic Topography

- *Residual (dynamic) topography is the difference between isostatic crust topography and the surface topography*
- *Dynamic topography is maintained by convective normal stresses due to buoyancy driven mantle flow*
- *Buoyancy variations in the mantle are directly inferred from a joint seismic-geodynamic-mineral physics tomography model (Simmons et al., 2009).*
- *Viscosity in the mantle is estimated from GIA and mantle convection observations (Mitrovica & Forte, 2004)*
- *Backward predictions (retrodictions) of dynamic topography are obtained via backward advection of present-day mantle heterogeneity.*

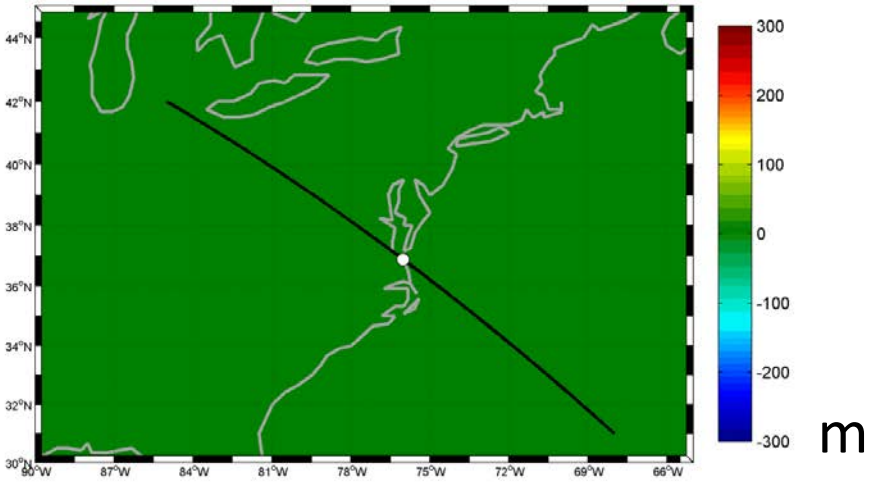
Backward Mantle Convection



A Stable Passive Margin?

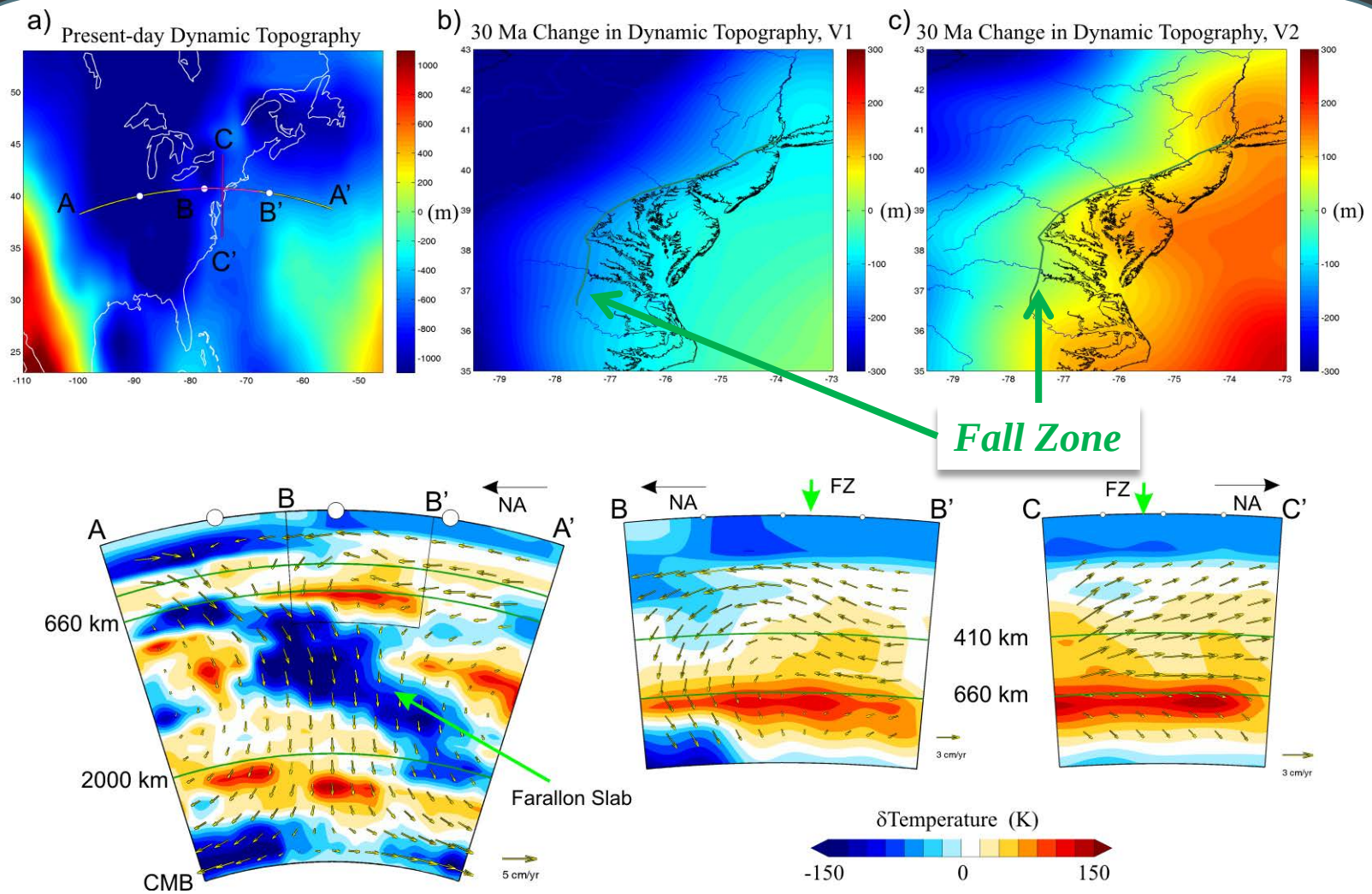


δDynamic Topography since 30 Ma TX2007 V2

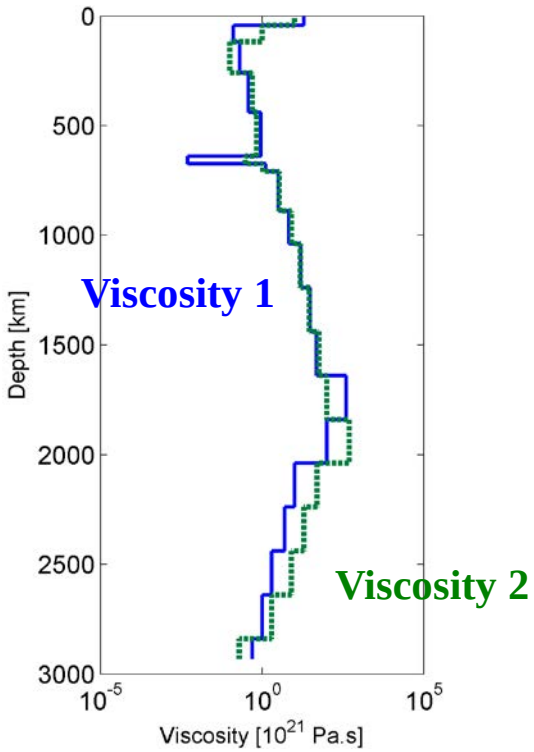


(Moucha et al., EPSL, 2008)

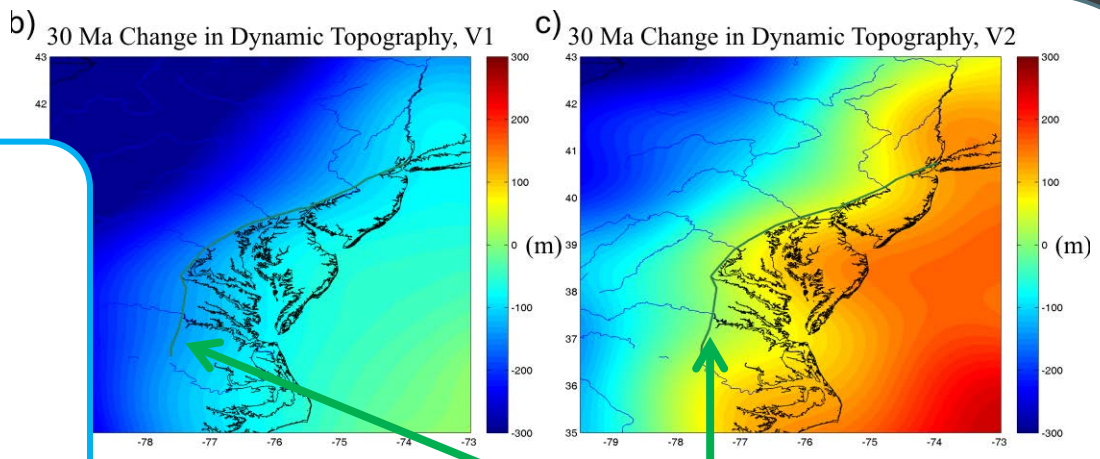
Late Cenozoic East Coast Geodynamic Evolution



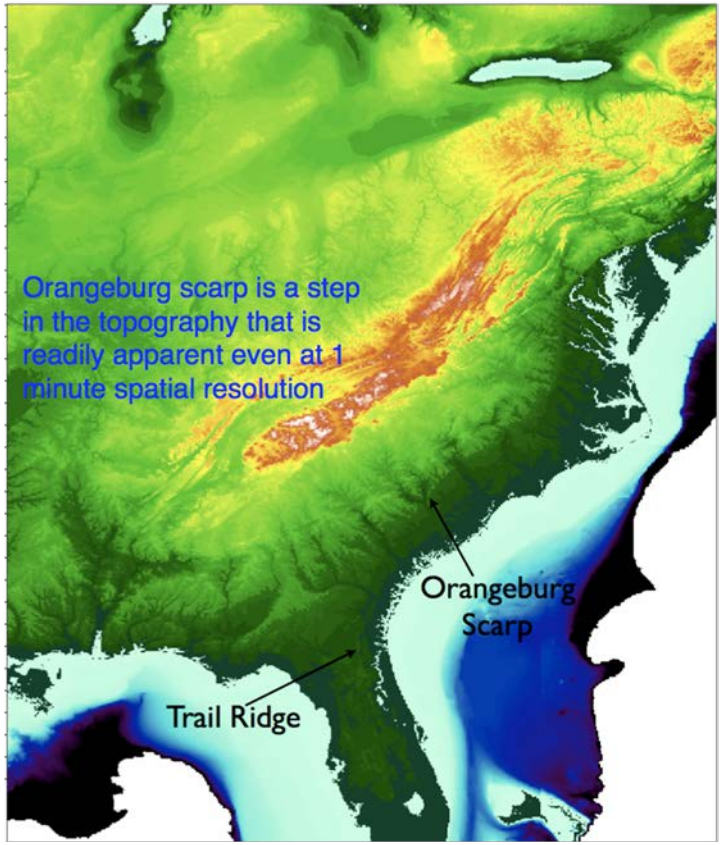
Late Cenozoic East Coast Geodynamic Evolution



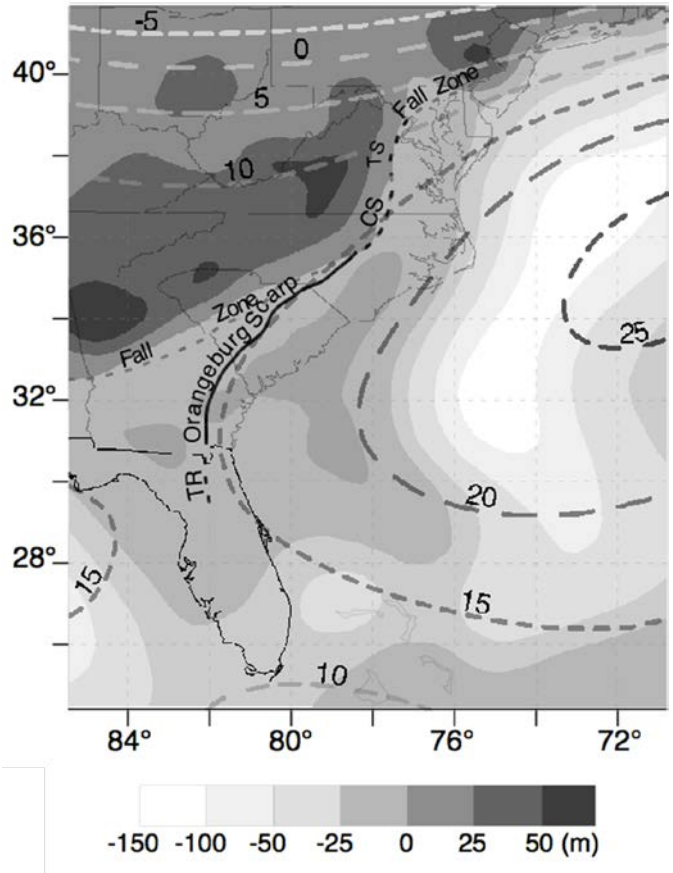
Mitrovica & Forte (2004)



Mid-Pliocene East Coast Geodynamic Evolution

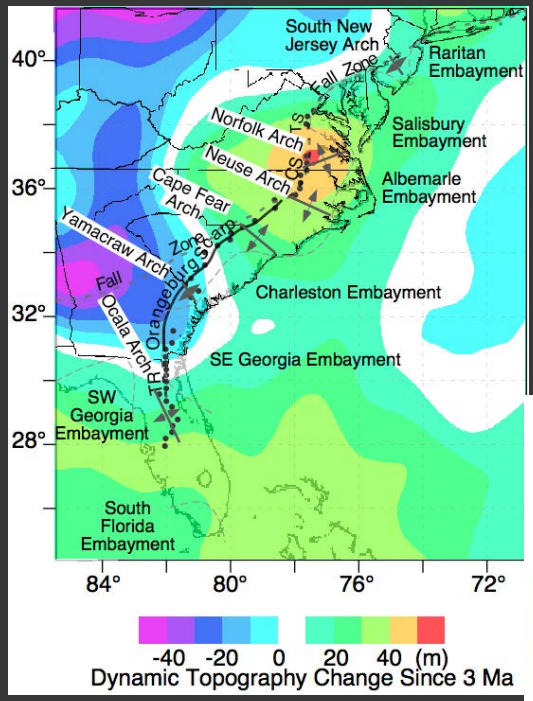


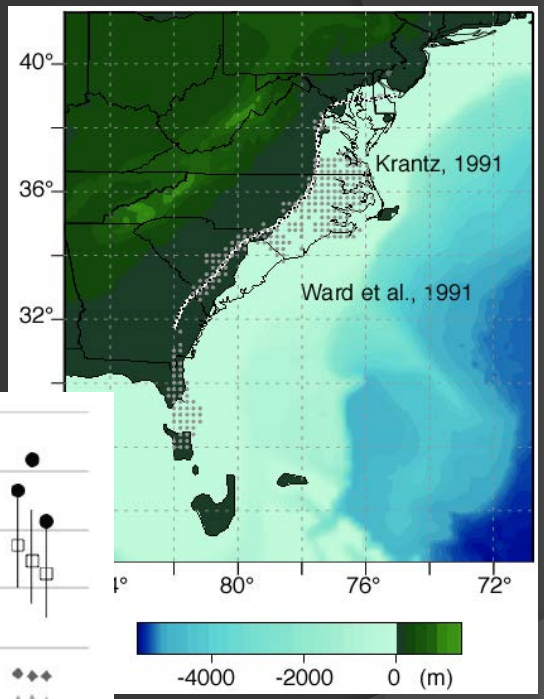
ETOPO1

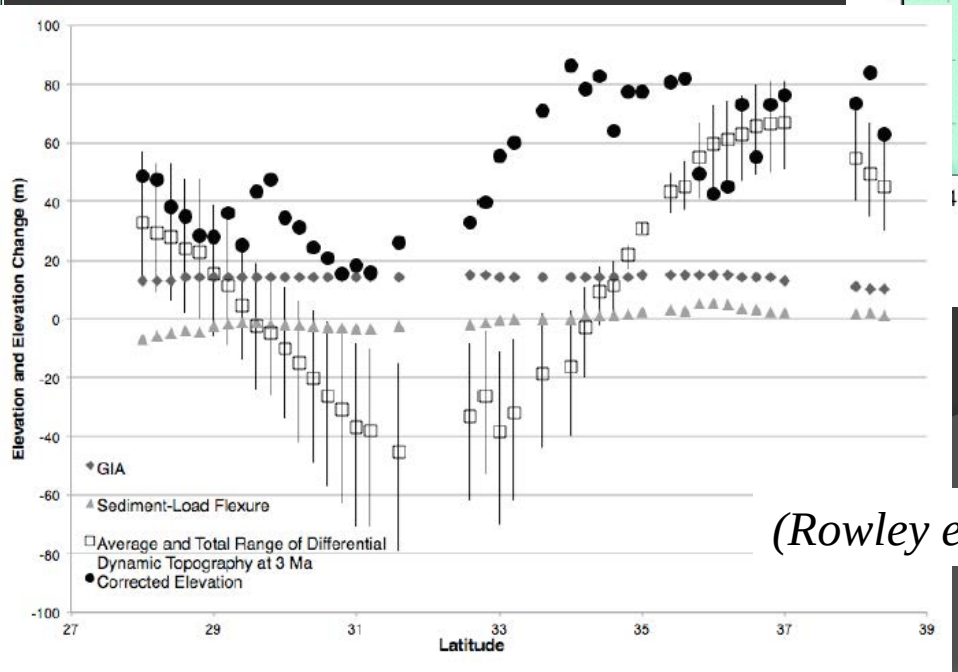


(Rowley et al., in prep;
GIA corrections from Raymo et al., 2011)

Mid-Pliocene East Coast Geodynamic Evolution







(Rowley et al., in prep)

Conclusions

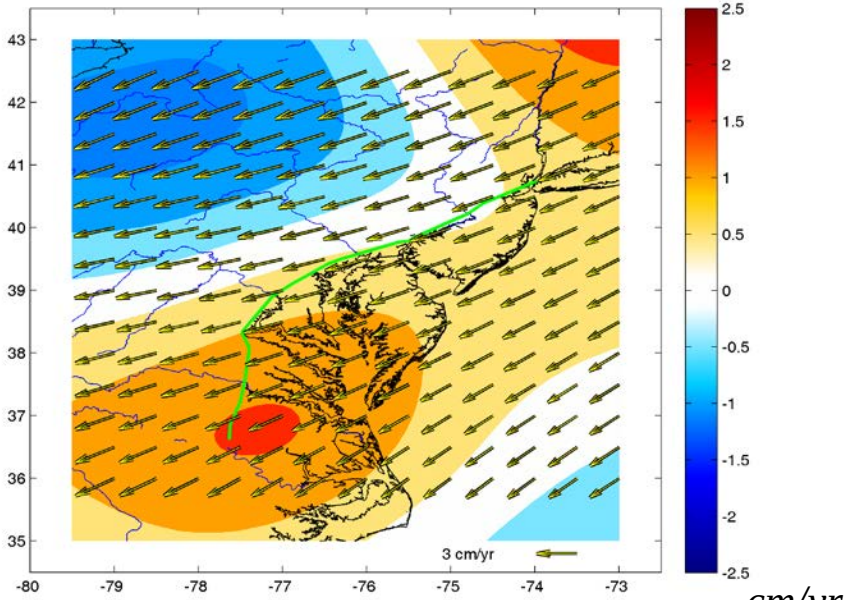
- *Significant changes in dynamic topography of the North American East Coast coincide with major topographical and geological features*
- *Along strike variation in uplift and subsidence of the North American East coast demonstrates that purely thermal subsidence is incompatible with these observations.*
- *Rates of change of dynamic topography are of the same order as third order sea level variations and thus likely confounds attempts to derive sea level reconstructions from local analyses without incorporating dynamic topography contributions.*
- *Further constraints from surface observations and regional seismic data are needed.*

CIFAR
CANADIAN INSTITUTE for ADVANCED RESEARCH

Thank You !

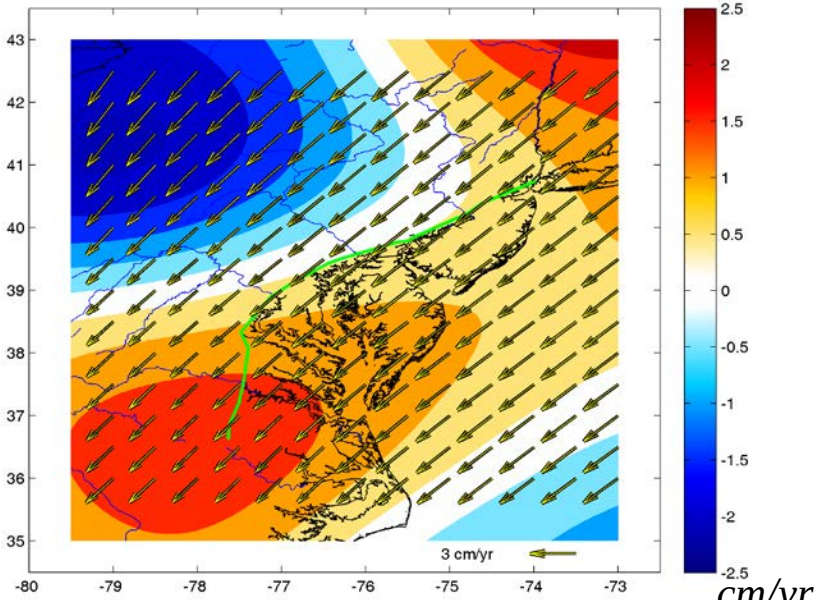
Mantle Flow at Depth

Depth 250 km



cm/yr

Depth 350 km



cm/yr