Eddy-Mixed Layer Modeling

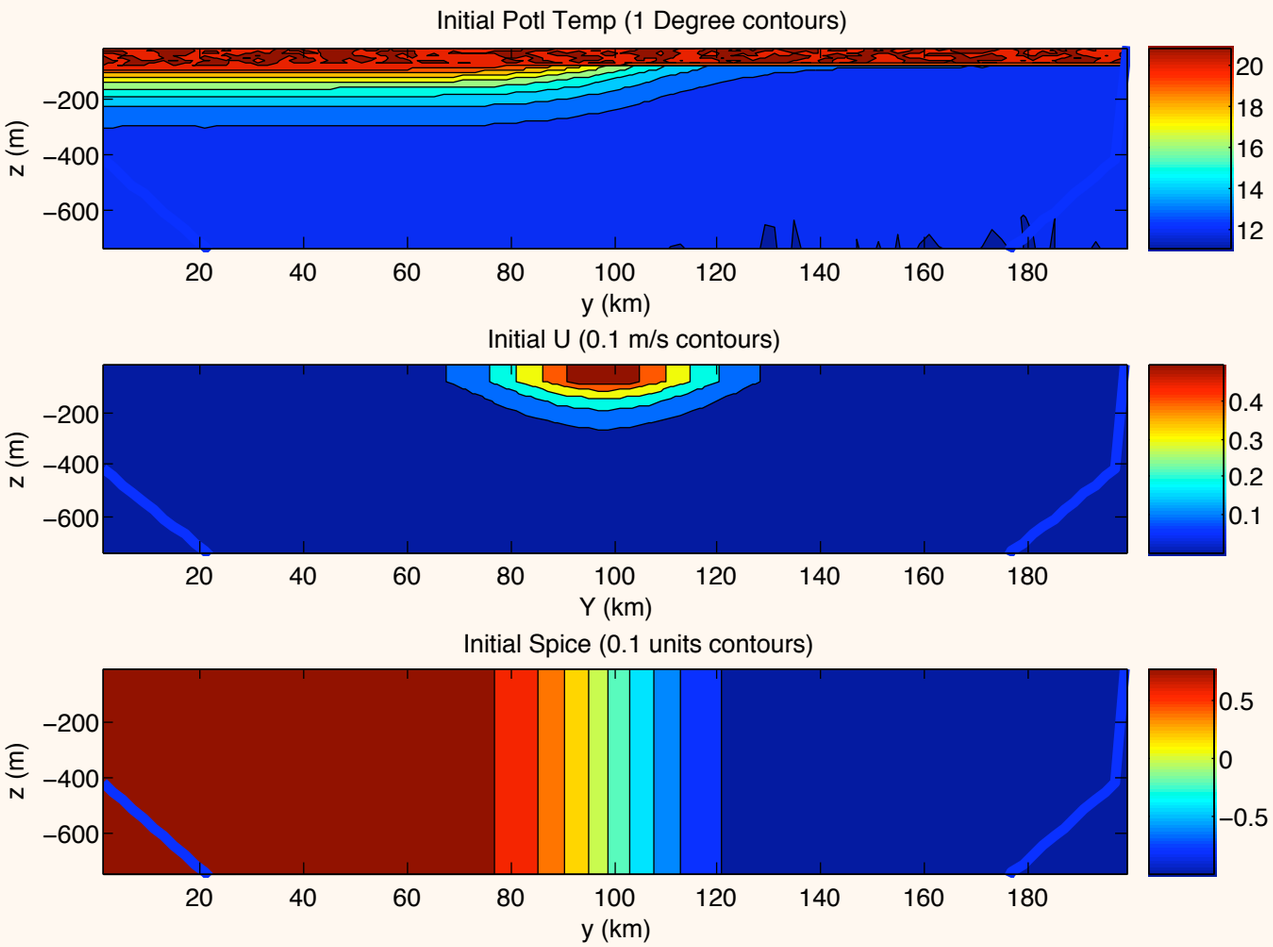
Baylor Fox-Kemper, Raffaele Ferrari et al.

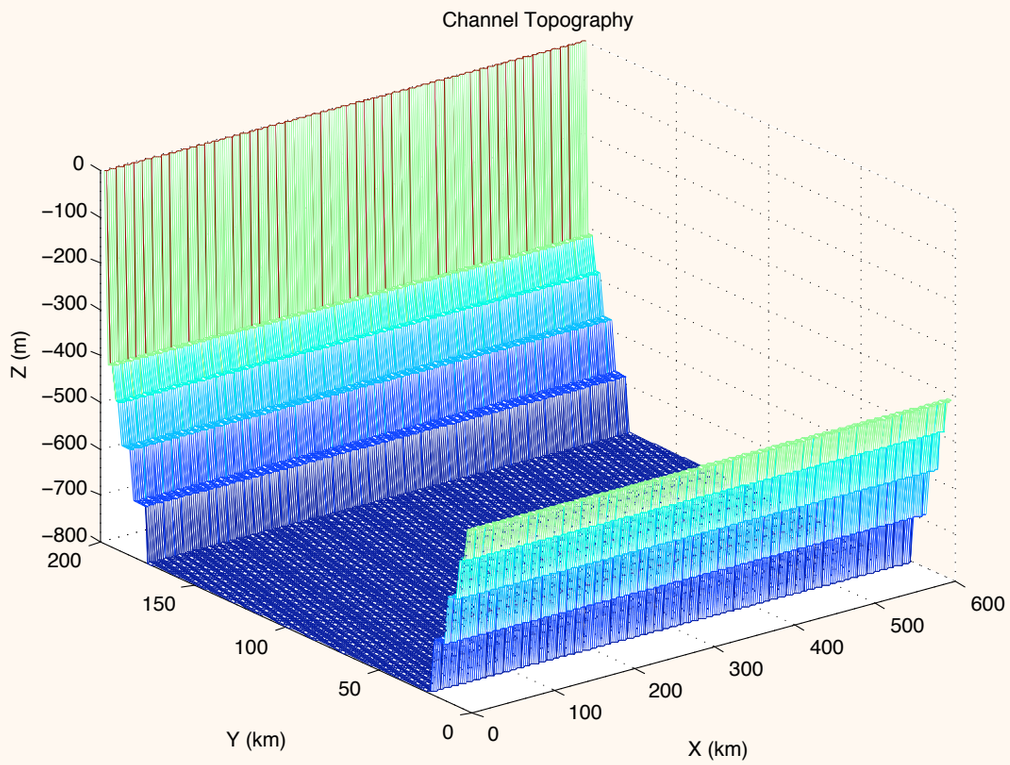
CPT-EMILIE Meeting, Providence, RI 11/11/04

Introduction

- Model Calculations using the MITgcm
- Non-hydrostatic and KPP-Capable
- Idealized Domain and Forcing
- Will attempt to resolve scales 100km->100m
- Will develop suite of diagnostics/metrics

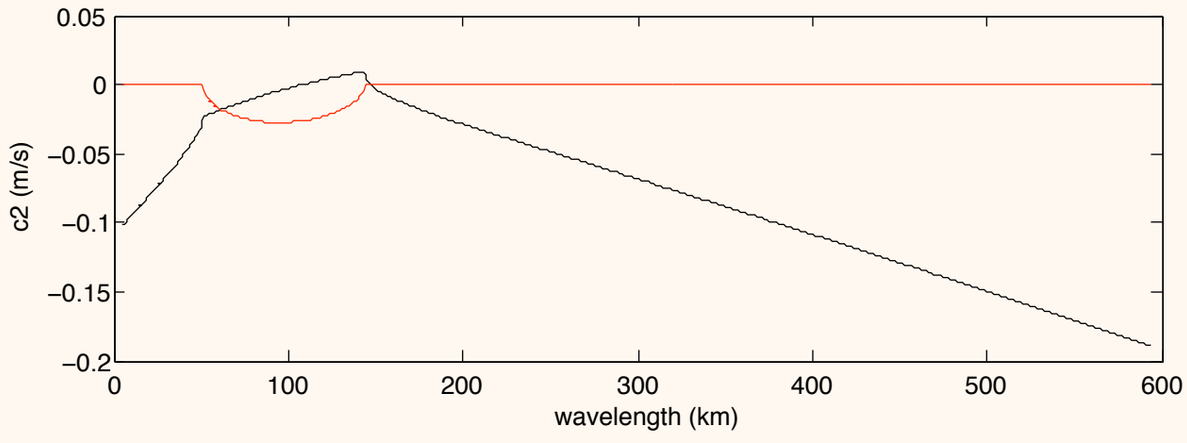
The Basin and Basics

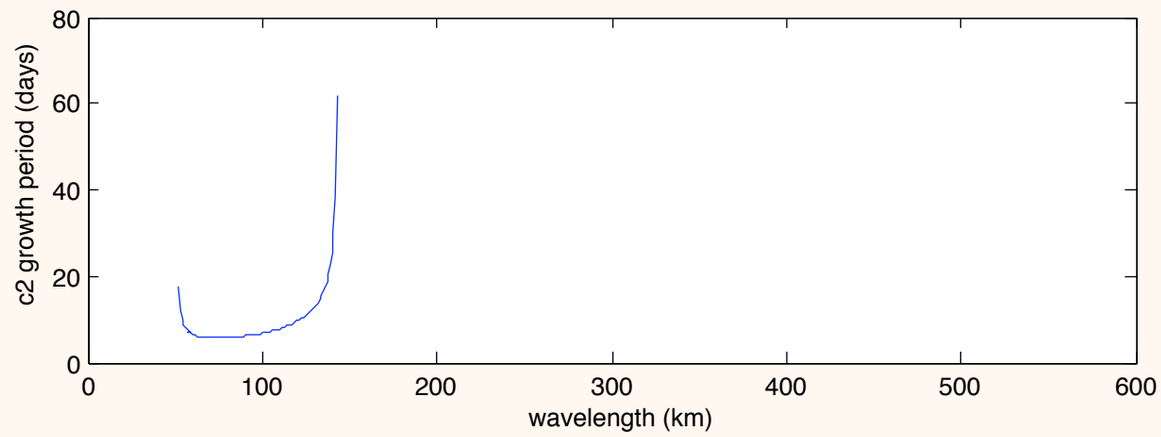




Forcing of the basic flow is accomplished by restoring Temp and Spice to initial conditions on sides above topography

A Tunable Instability

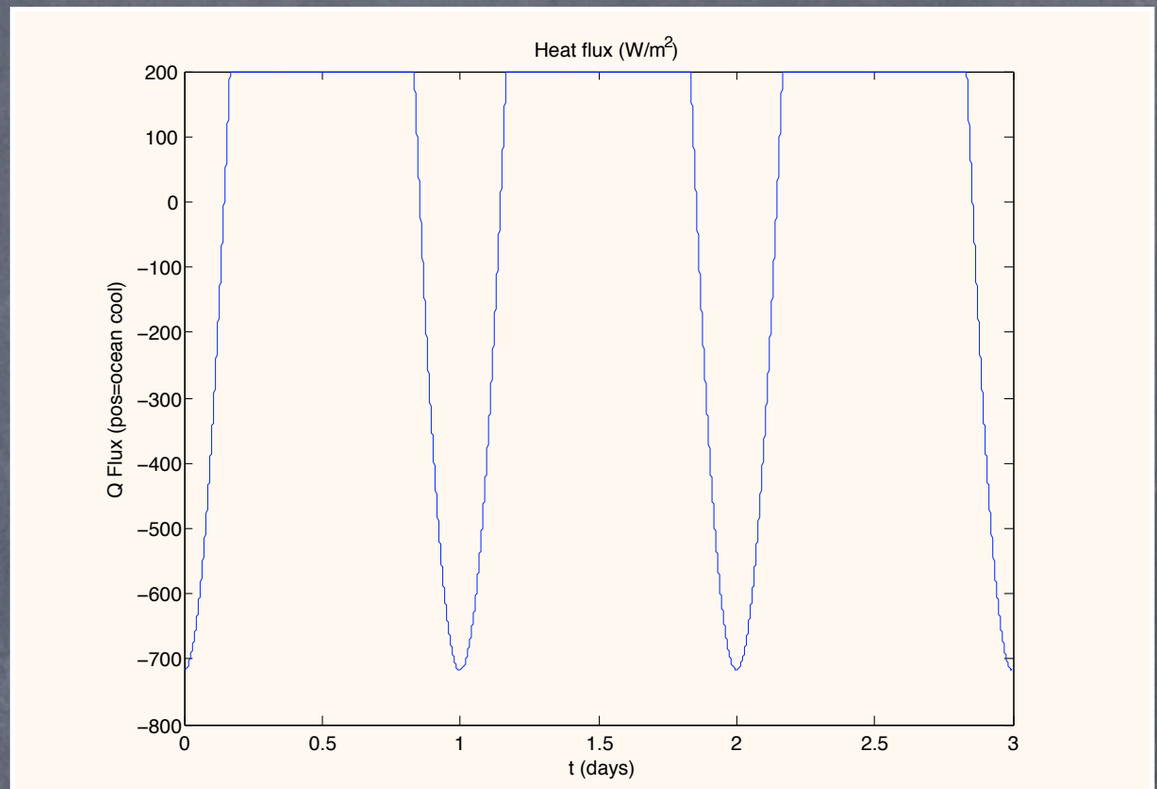




Forcing of Mixed Layer

Convection is used to add mixing in ML

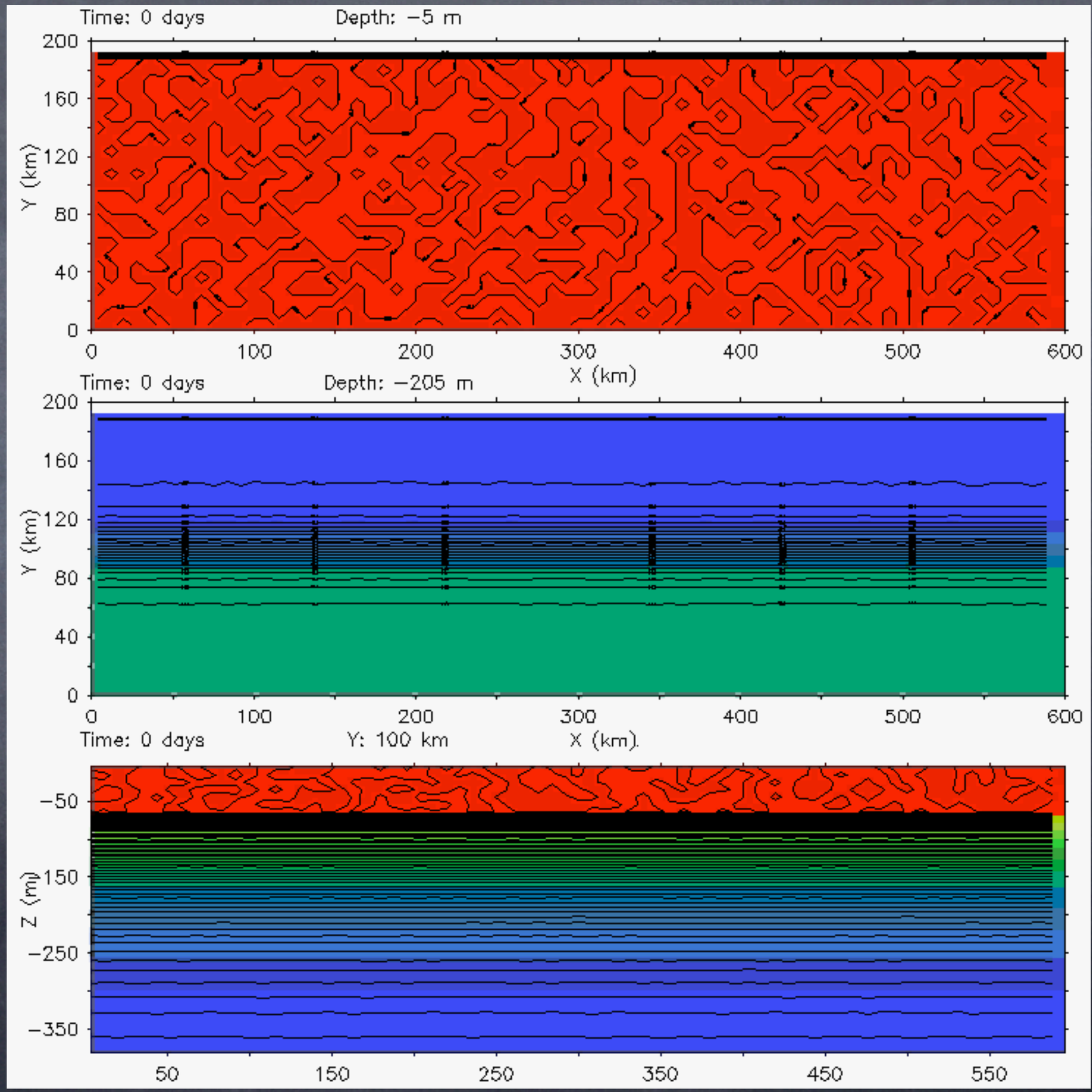
Diurnal Cycle with no net flux is added to surface, heating penetrates



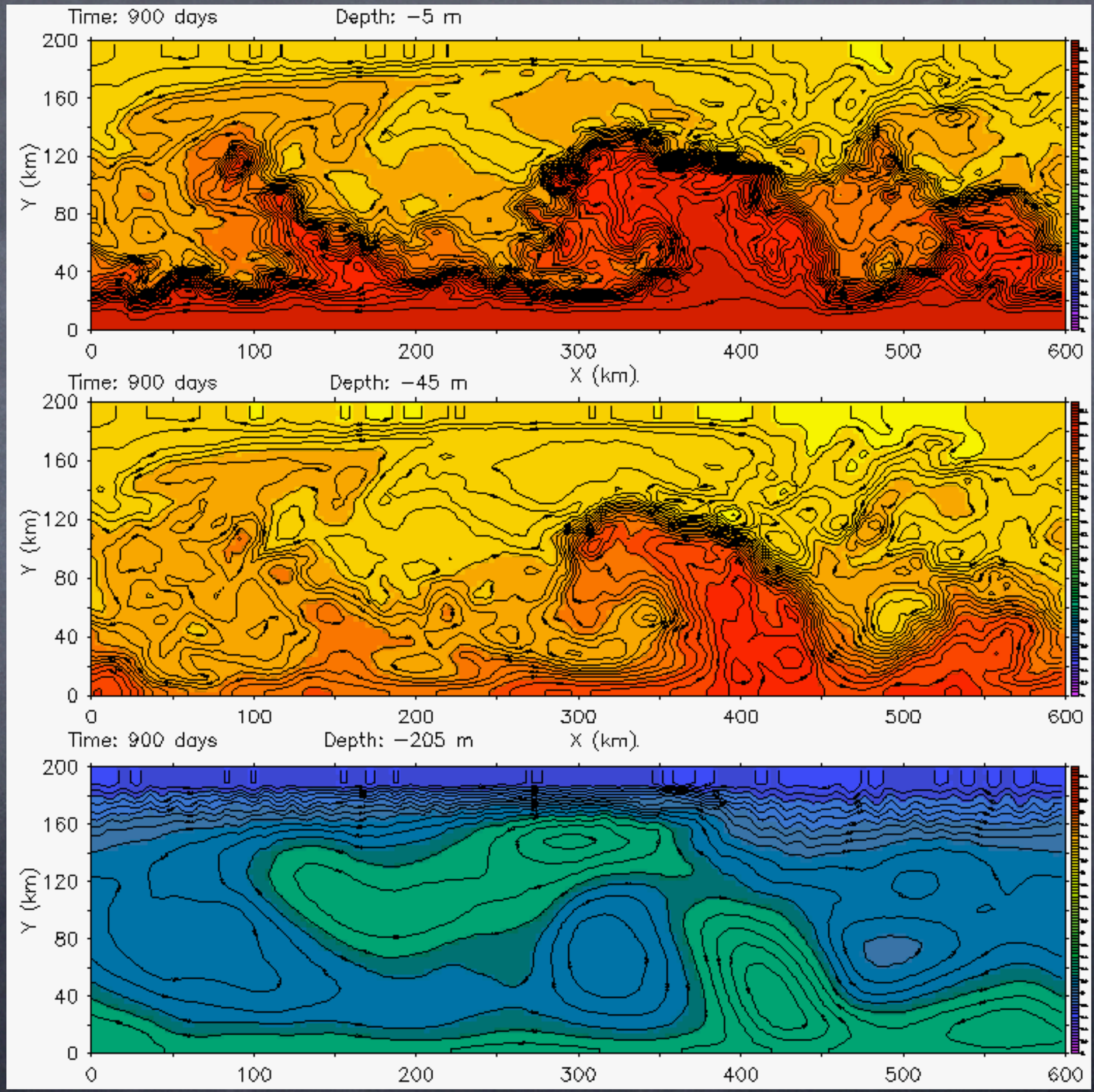
Near equilibrium in 1000 days; Without Heat Flux, vertical diffusivity quickly erodes ML O(25 days)

Mixed-Layer Spinup

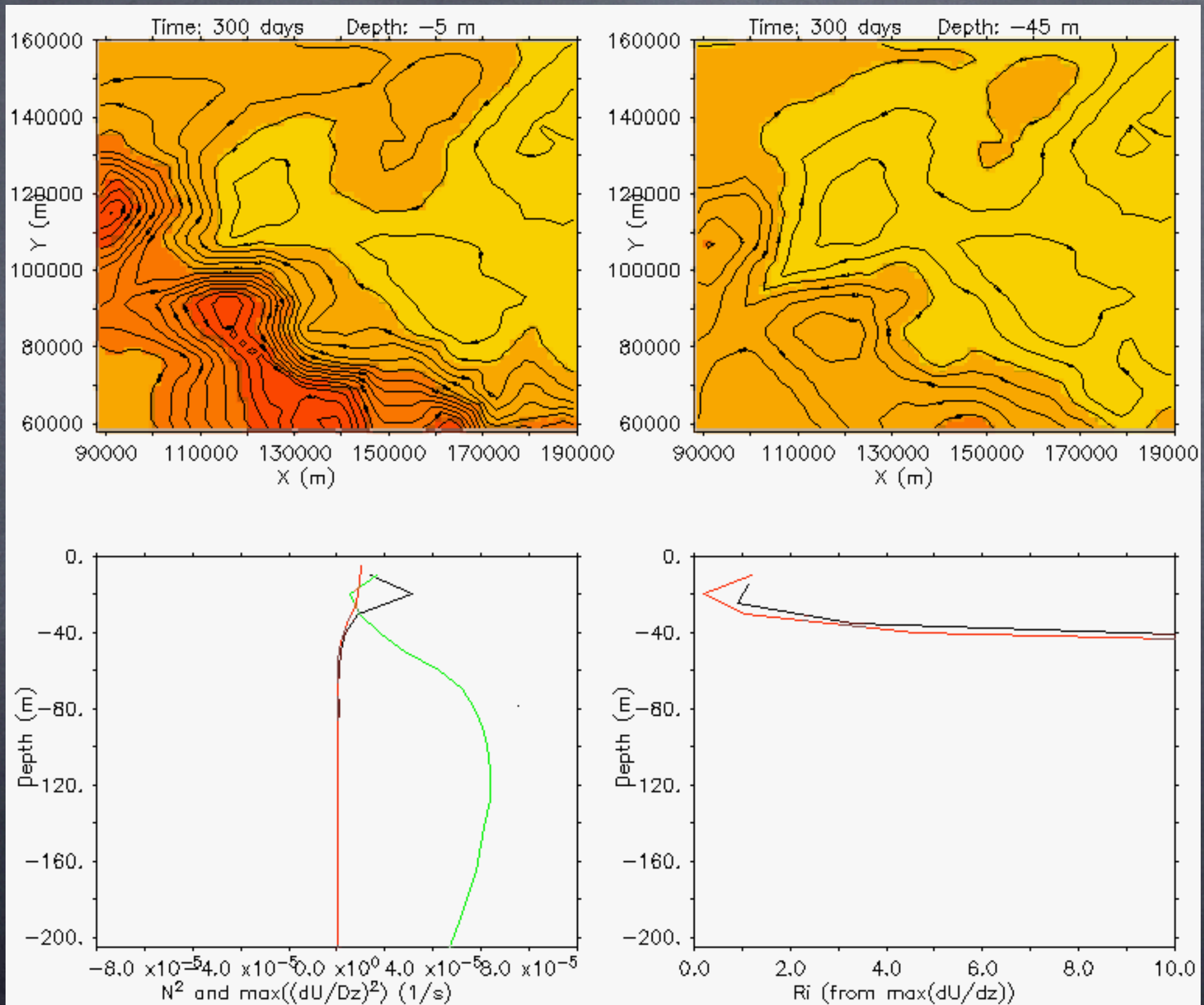
8 km-Res



Mixed-Layer Proj. to 2 km-Res



Zoom to an Instability



Instability Scales versus Stone (1971)

$$|\lambda| \approx 2\pi\sqrt{\frac{1+Ri}{5/2}}\frac{u_0}{f} \approx 10\mathrm{km}\sqrt{1+Ri}$$

From Model: O(30km)

$$\tau \approx \sqrt{\frac{1+Ri}{5/54}}f^{-1} \approx \frac{\sqrt{1+Ri}}{2}\mathrm{days}$$

From Model: O(5days)

Conclude and Discuss

- Model still subject to change--Suggestions?
- We have problems with doing a residual mean, since eddies wipe out mean stratification gradients--wind forcing?
- These calculations demonstrate the plausibility of the proposed calculations. We have not yet used much computer time...