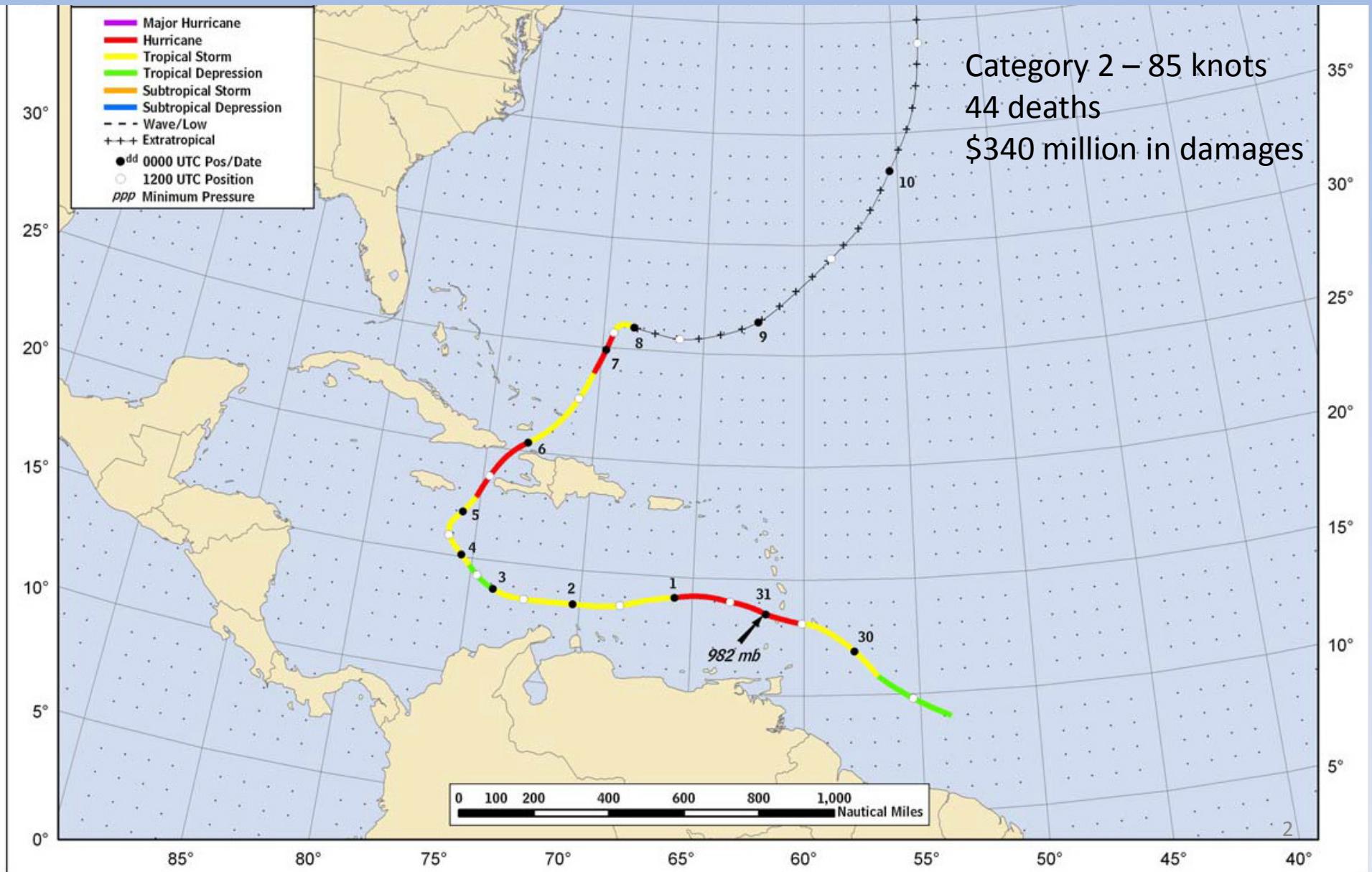


Influence of Topography on the Track and Intensity of Tropical Cyclones

Frank P. Colby Jr.

Univ. of Massachusetts Lowell
Lowell, MA

Hurricane Tomas





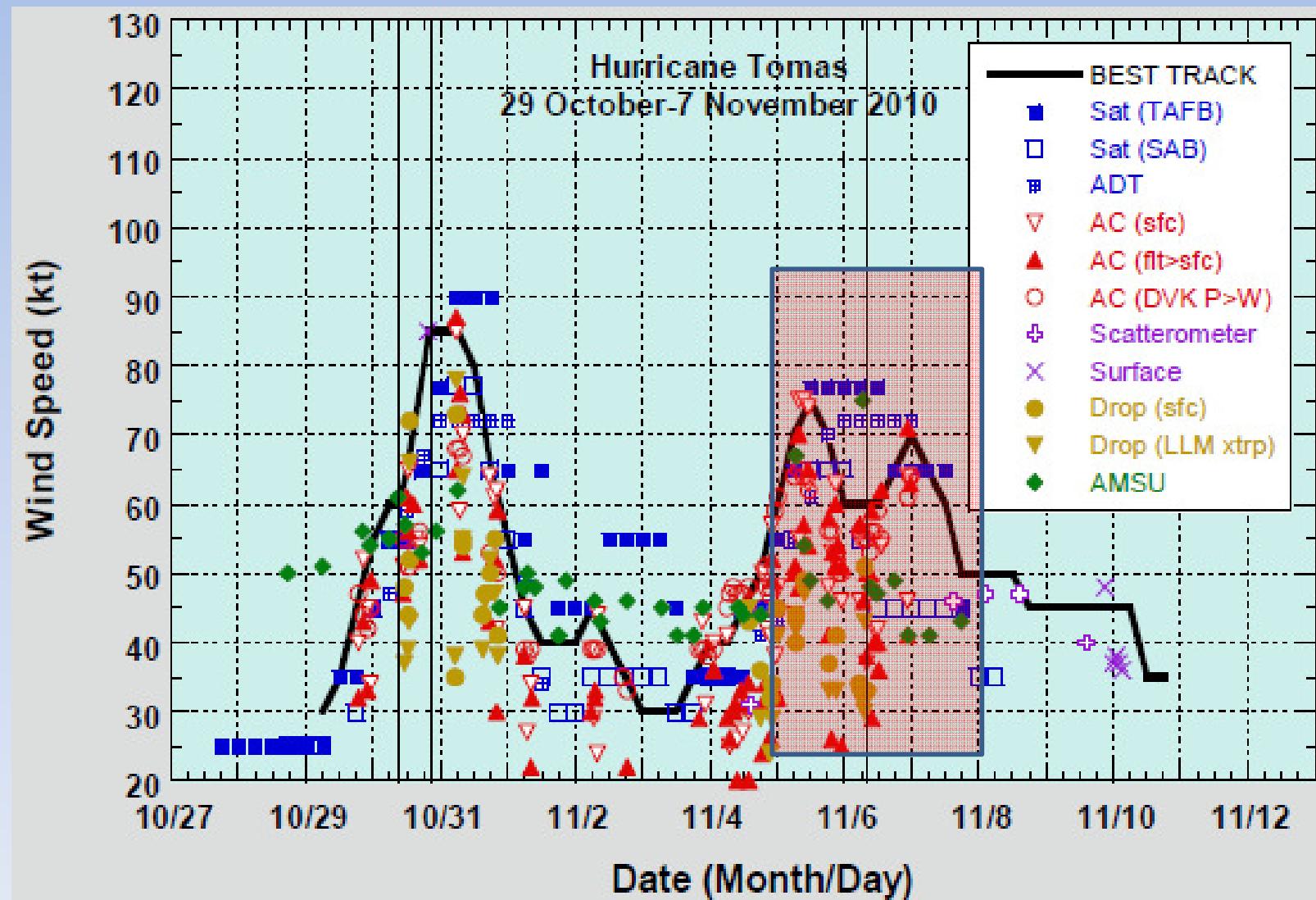
Outline

- Introduction
- AHW Model Specifications
- Model Results
- Summary
- Ongoing Research

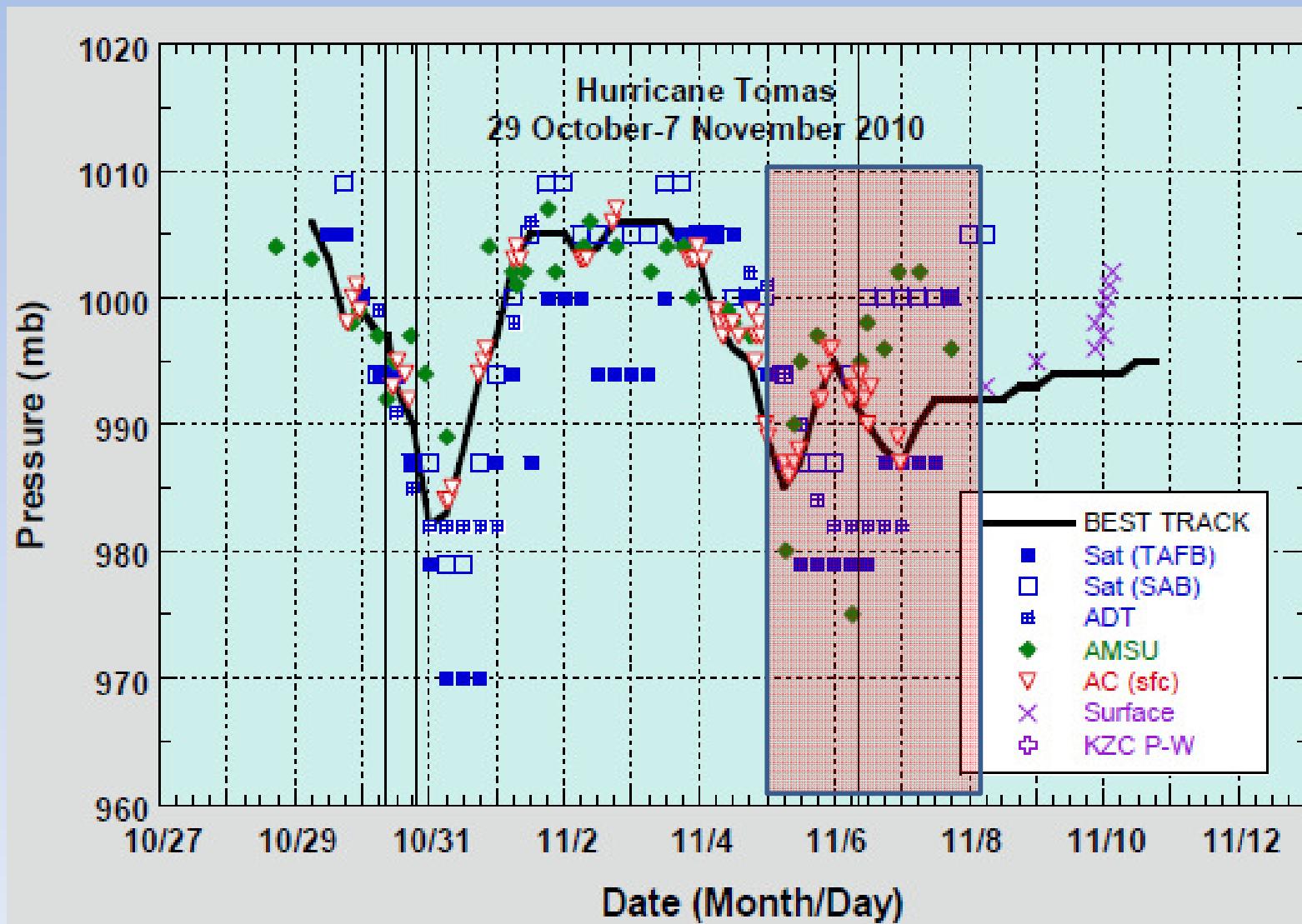
Introduction

- Selected Previous Relevant Research
 - Geerts, et al. (2000) – Hurricane George
 - Convection developed in eye – more rain fell
 - Chan and Liang (2003) – hypothetical vortex
 - Surface LH flux and location of convection
 - Farfan and Cortez (2005) – Hurricane Marty
 - Mountains were a barrier
 - May et al. (2008) – TC Ingrid
 - Wind field changed markedly

Hurricane Tomas



Hurricane Tomas





AHW Model Specifications

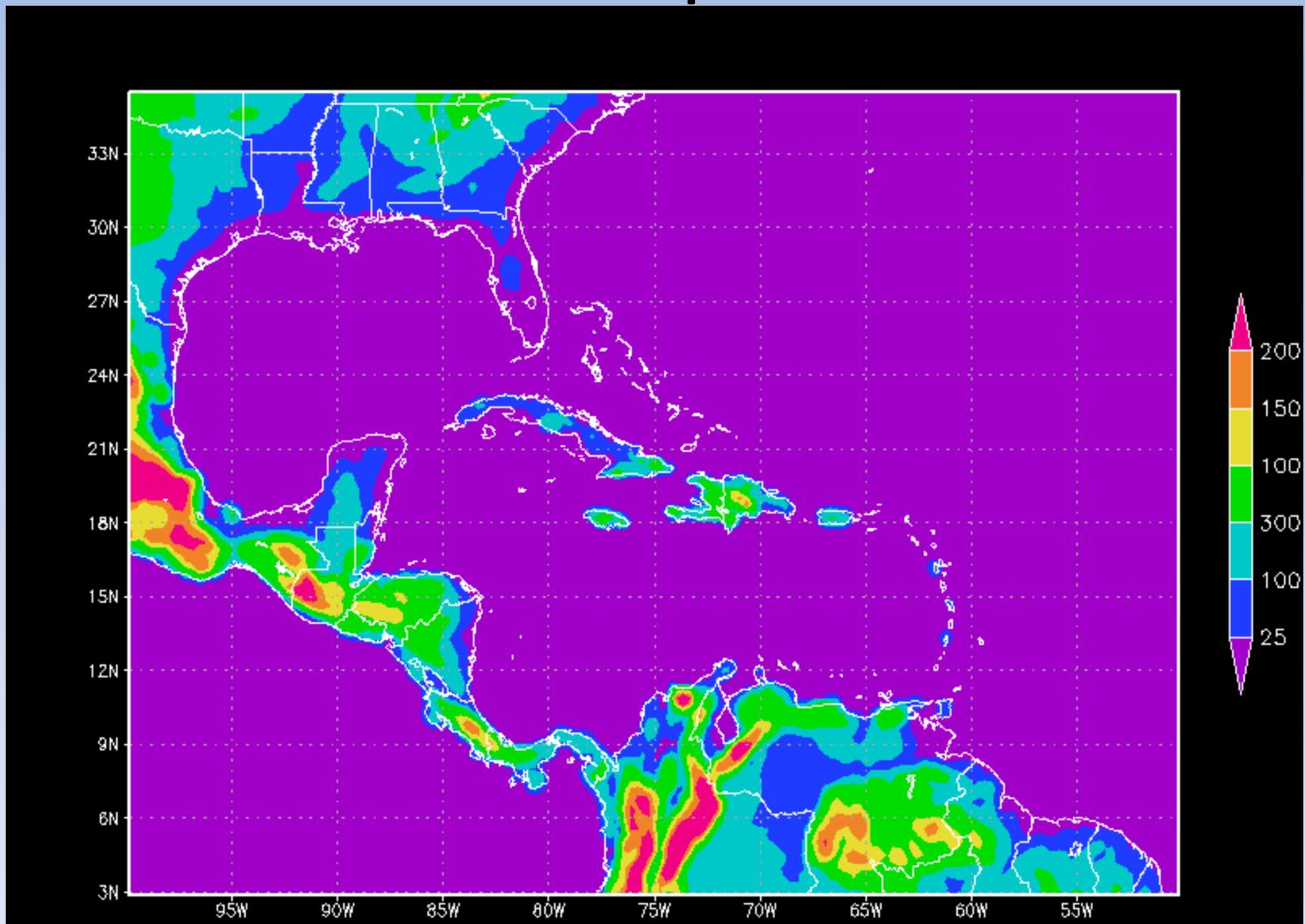
- WRF v3.2 with Hurricane Modifications
 - Special surface fluxes
 - Simple Ocean Mixed Layer
 - WSM 3 microphysics
 - YSU boundary layer
 - Kain-Fritsch cumulus parameterization
 - SST update



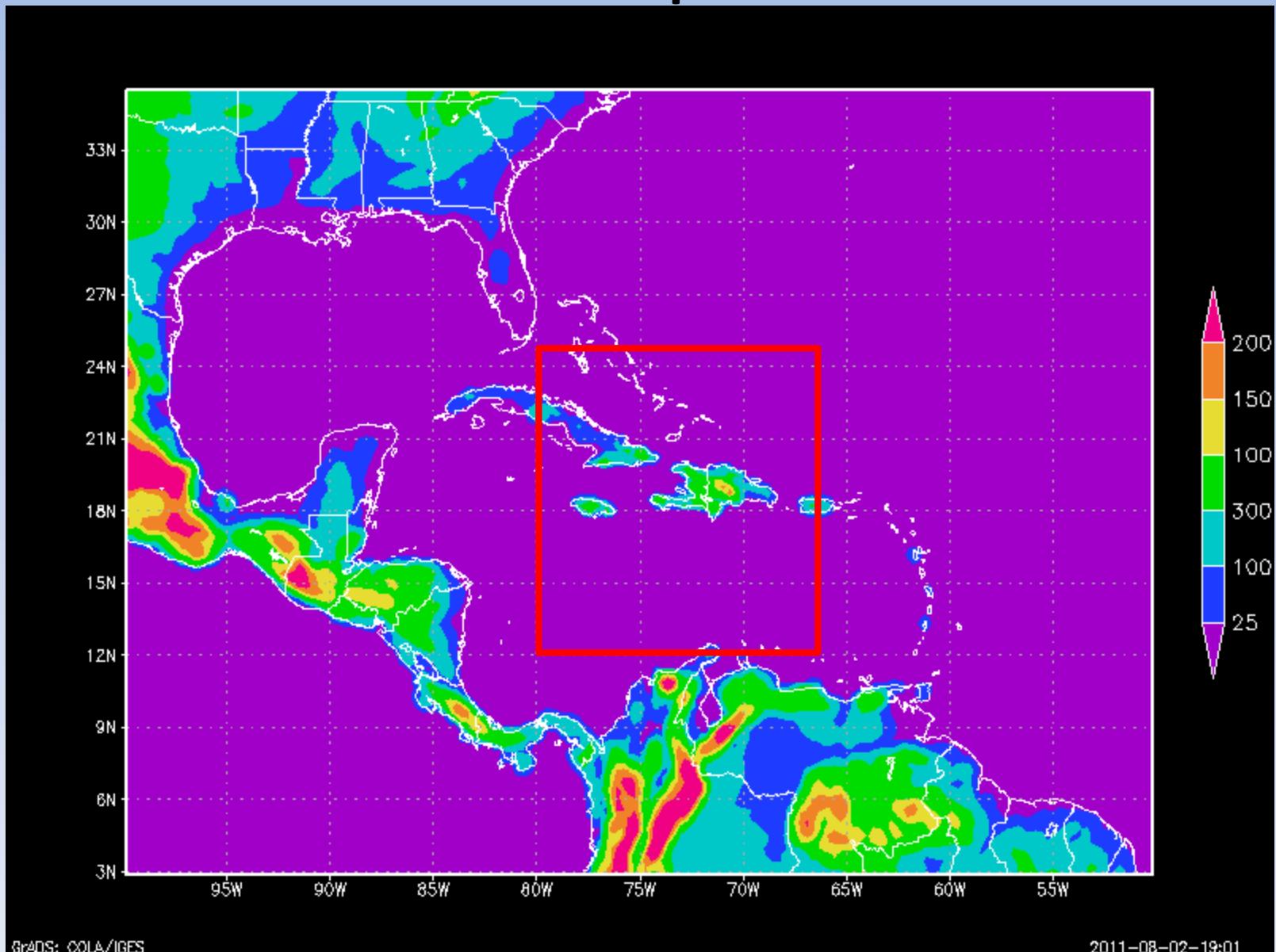
AHW Model Specifications

- 2 Domains – 28 vertical levels
 - 30 km (186 x 132)
 - 10 km (151 x 145)
- GFS analysis initial and boundary conditions
- Real-time, global, SST analysis

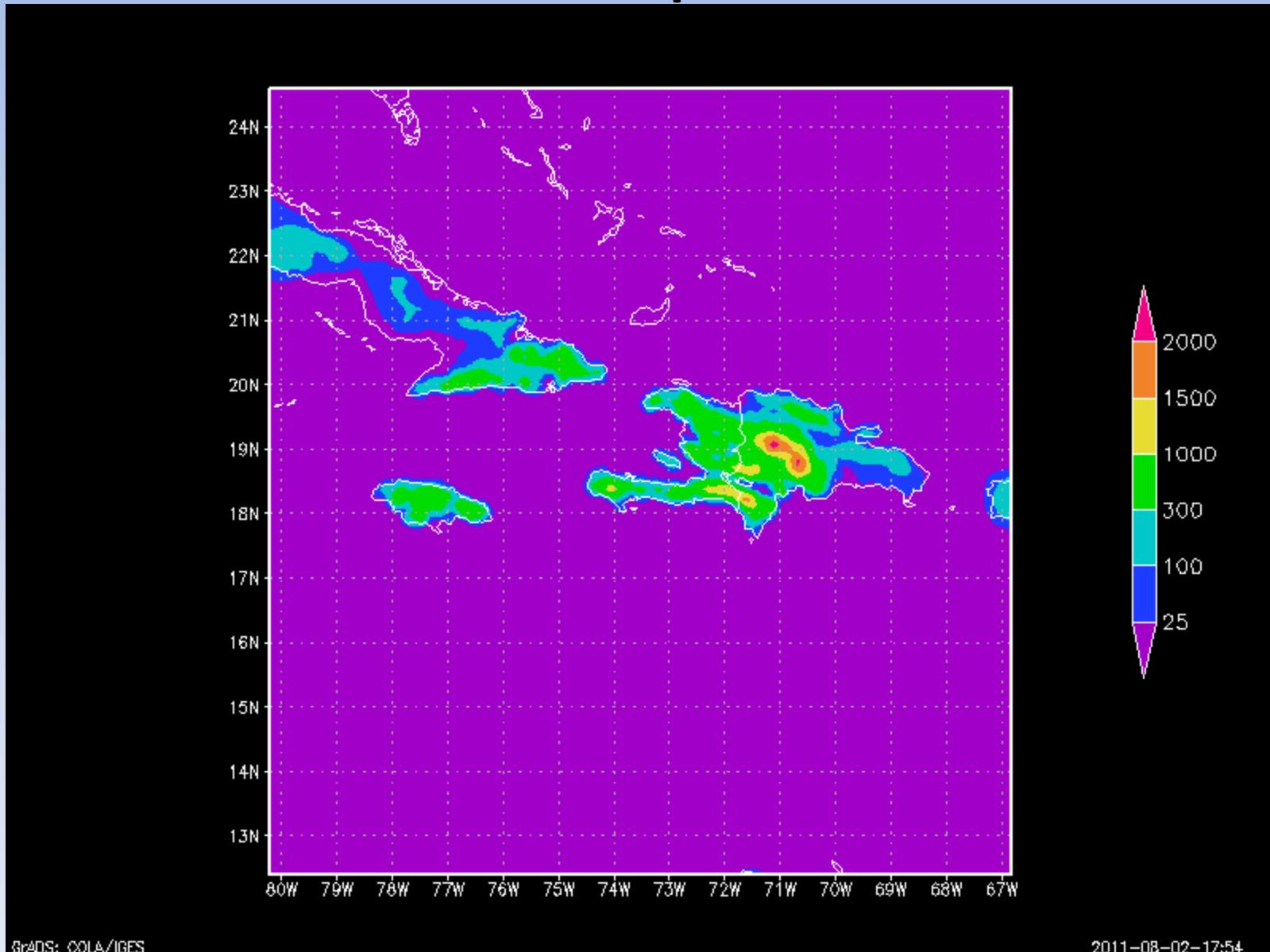
AHW Model Specifications



AHW Model Specifications



AHW Model Specifications





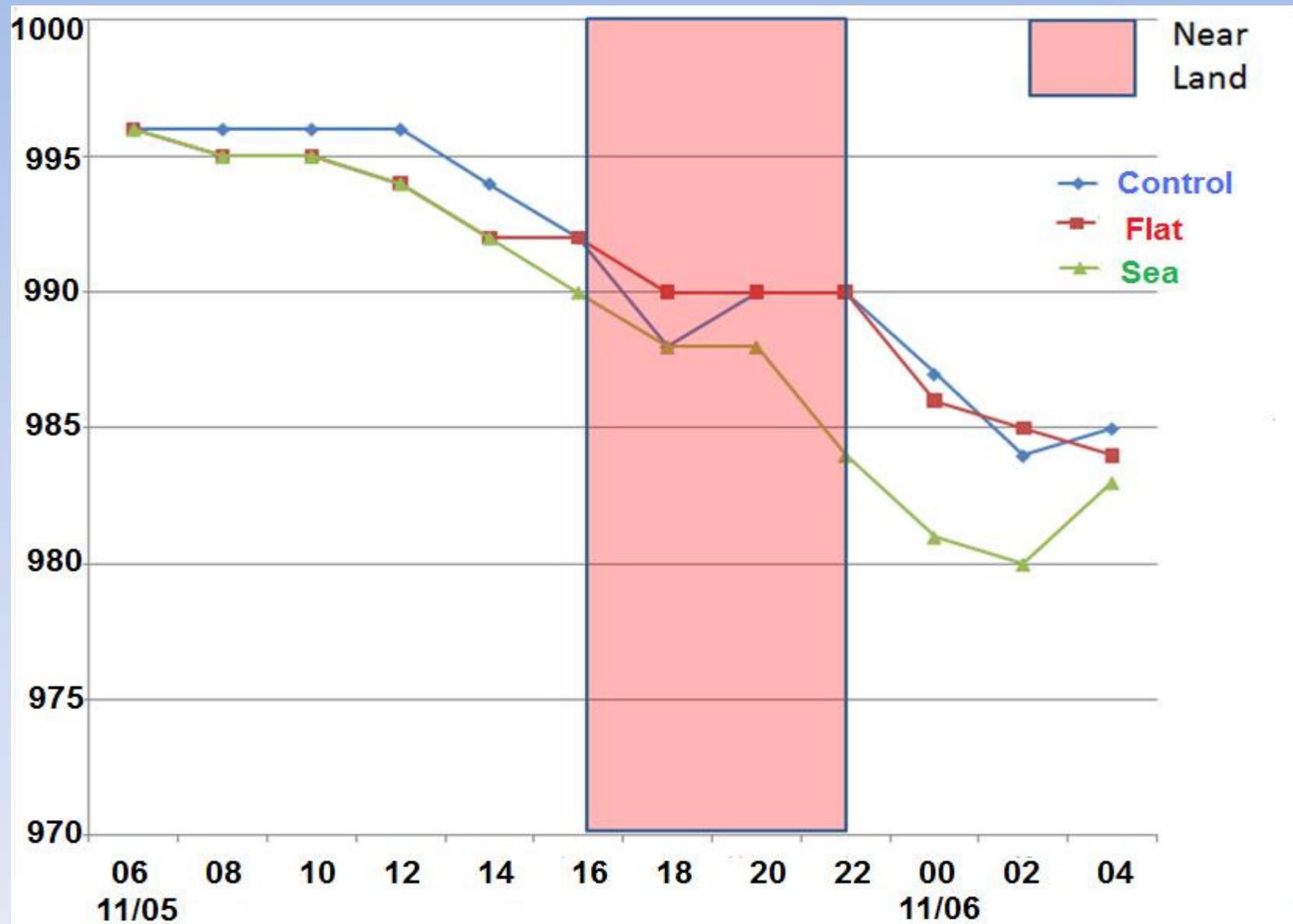
AHW Model Specifications

- 3 Model Runs
- Started 00 UTC 05 November 2010
- Control – Real Terrain
- Flat – Land Elevation Set to 0 in Inner Nest
- Sea – All Land Set to Water in Inner Nest

Model Results

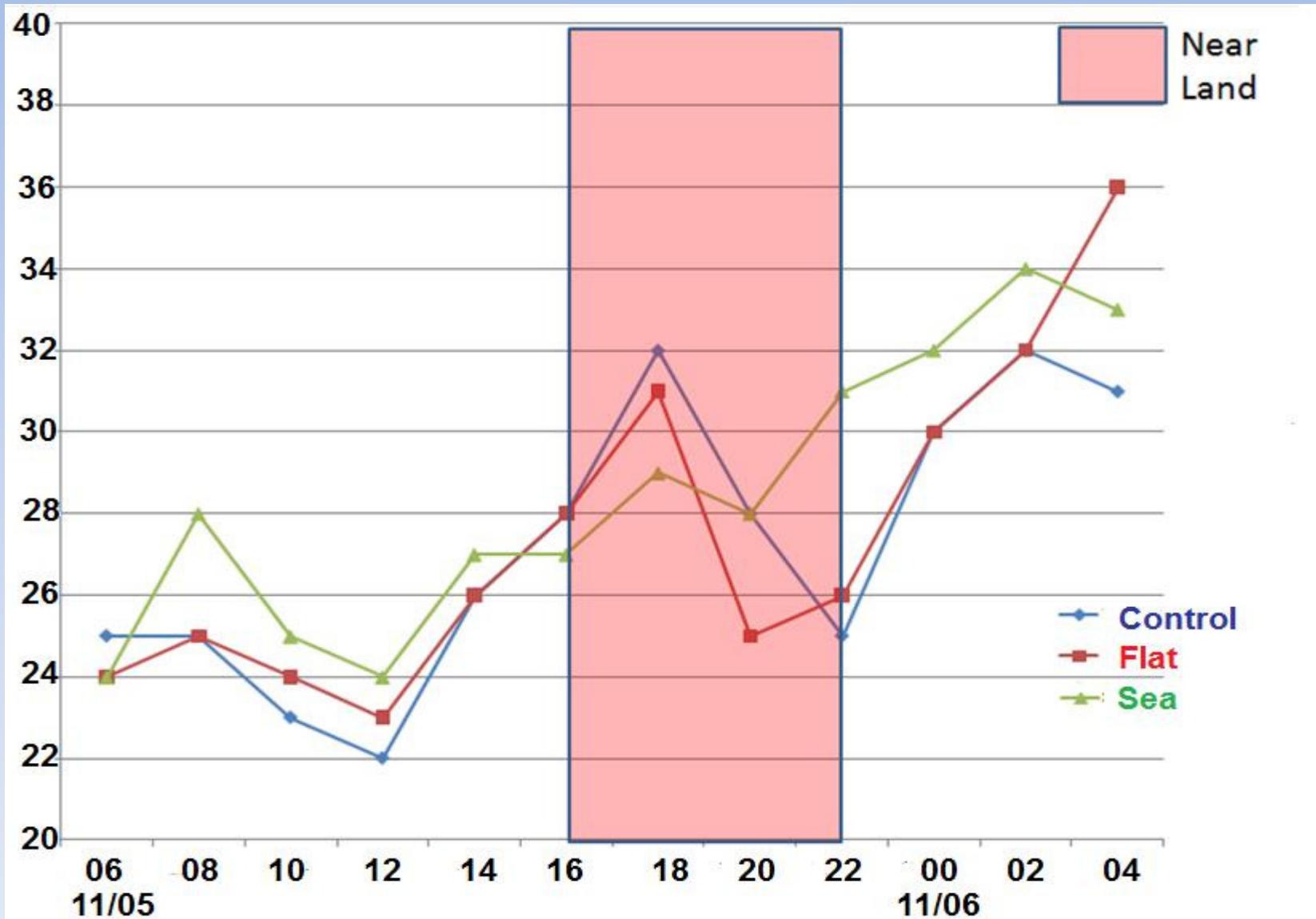
- Land Weakened Storm
- Mountains Deflected Storm
- Mountains and Land:
 - Reduced total precipitation
 - Changed location of precipitation
- Mountains Slightly Reduced Fluxes
- Land Reduced Fluxes

Land Weakened Storm Model Results – SLP



Land Weakened Storm

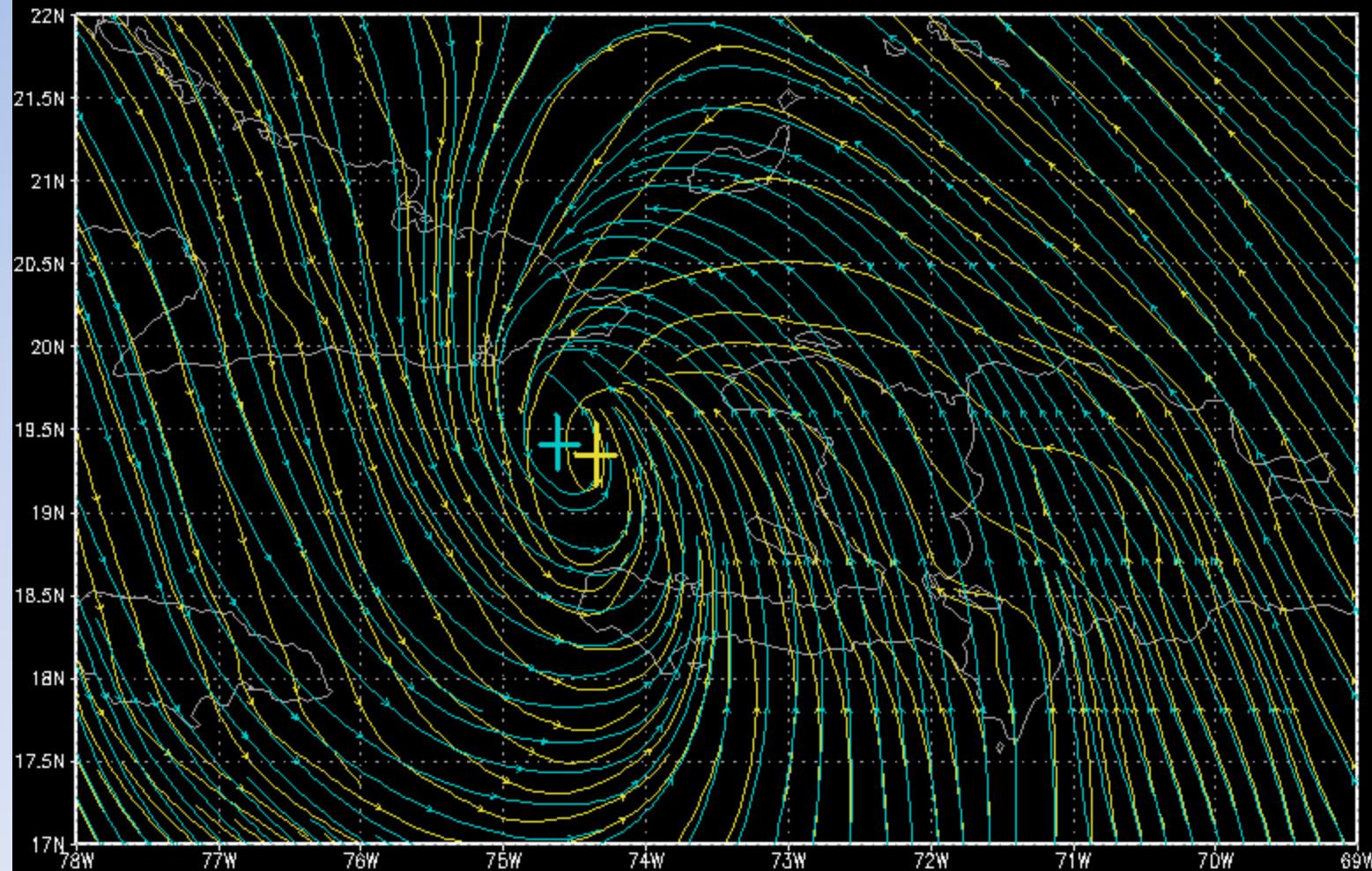
Model Results- 10m Max Windspeed



Mountains Deflected Storm

SLP – Control (yellow) and Sea (cyan)

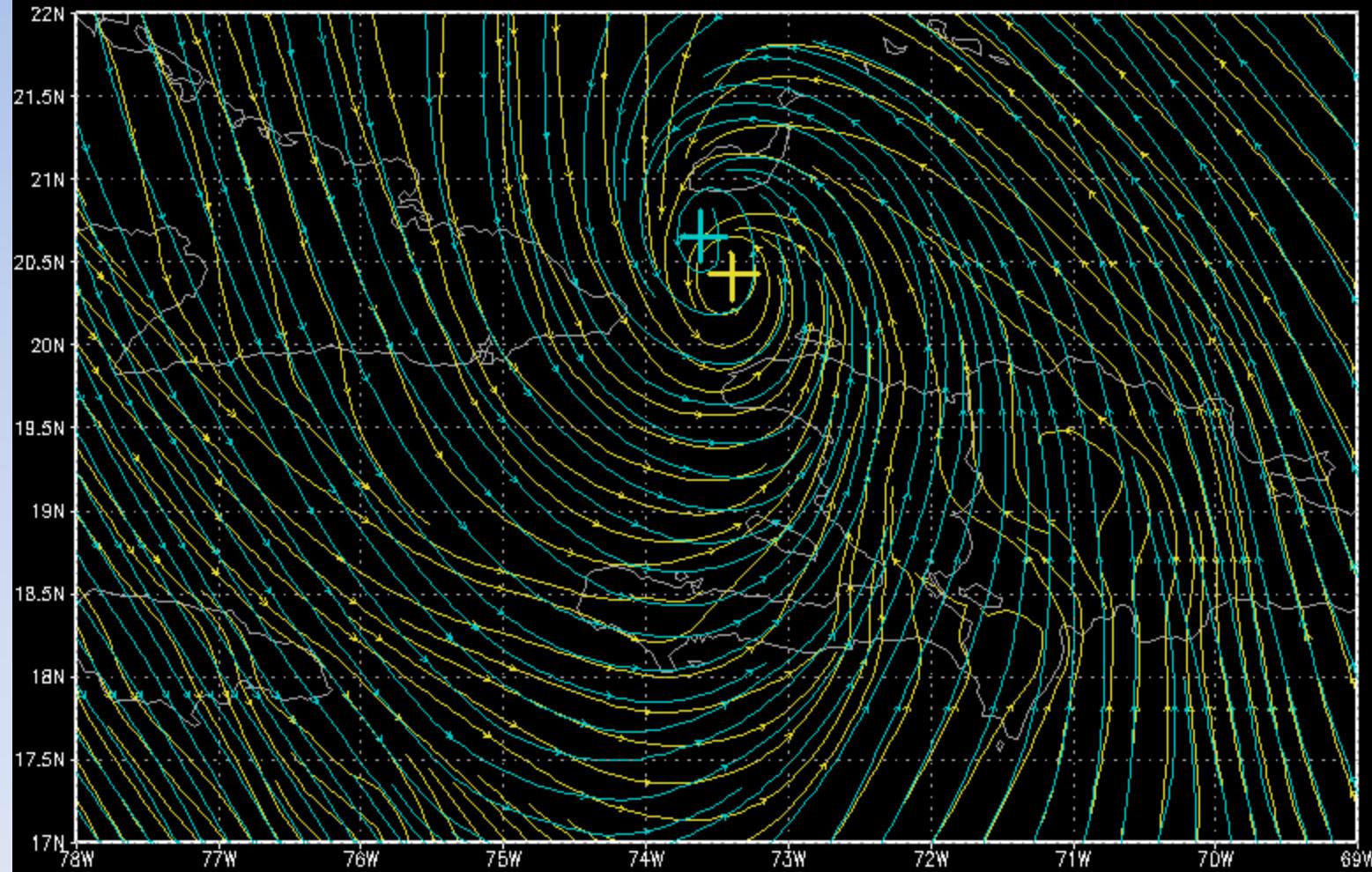
16 UTC November 5, 2010



Mountains Deflected Storm

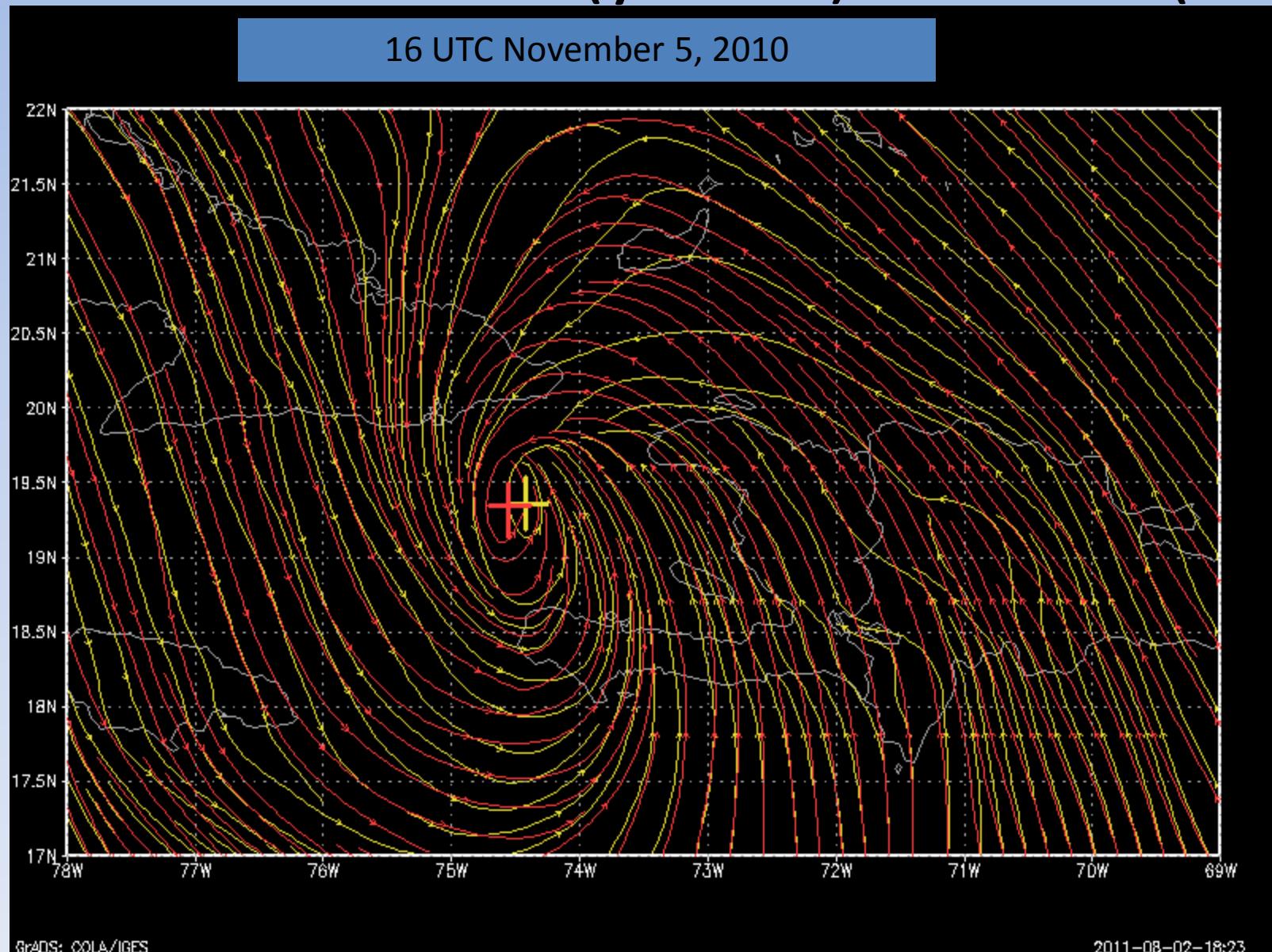
SLP – Control (yellow) and Sea (cyan)

22 UTC November 5, 2010



Mountains Deflected Storm

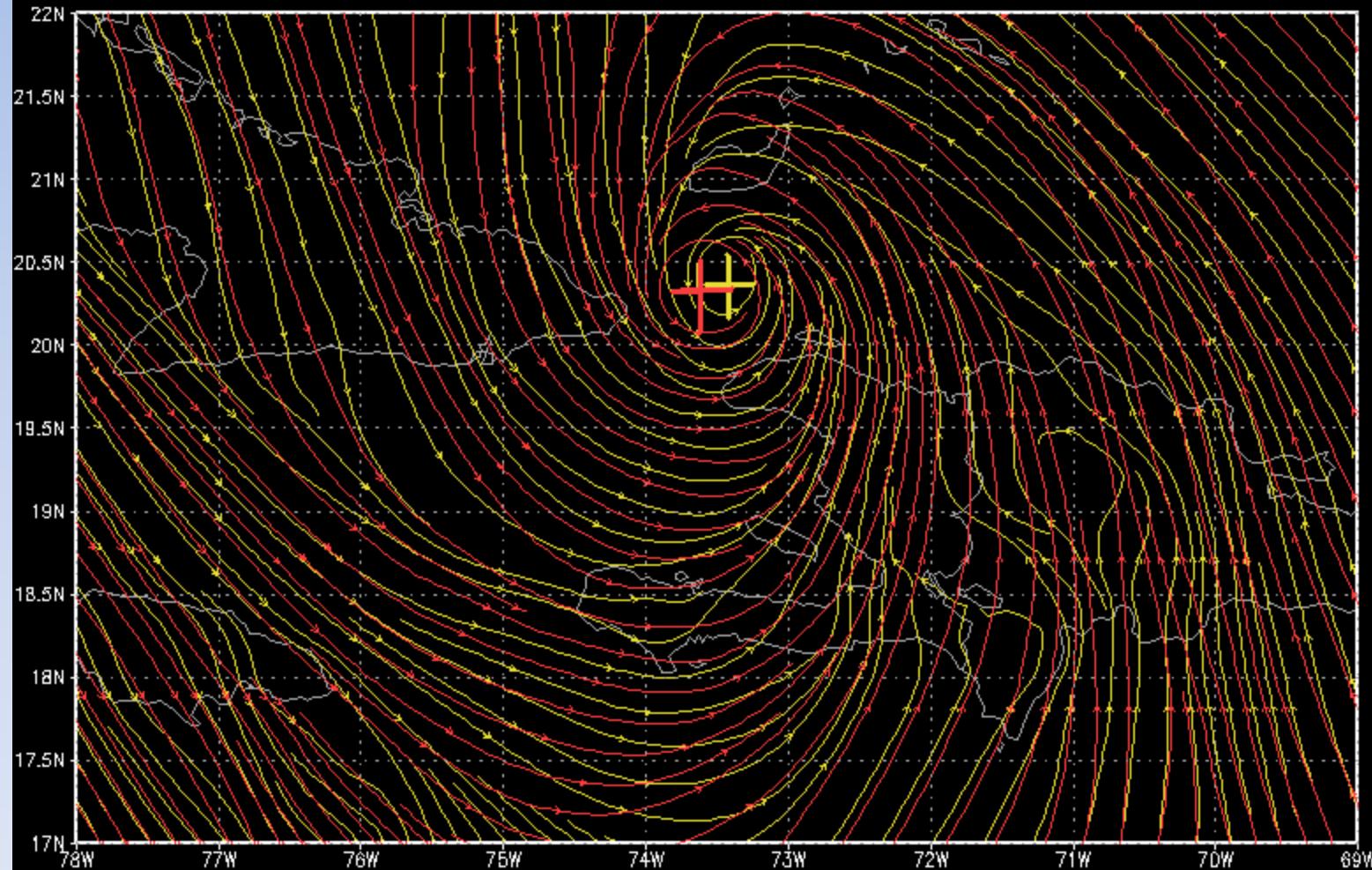
SLP – Control (yellow) and Flat (red)



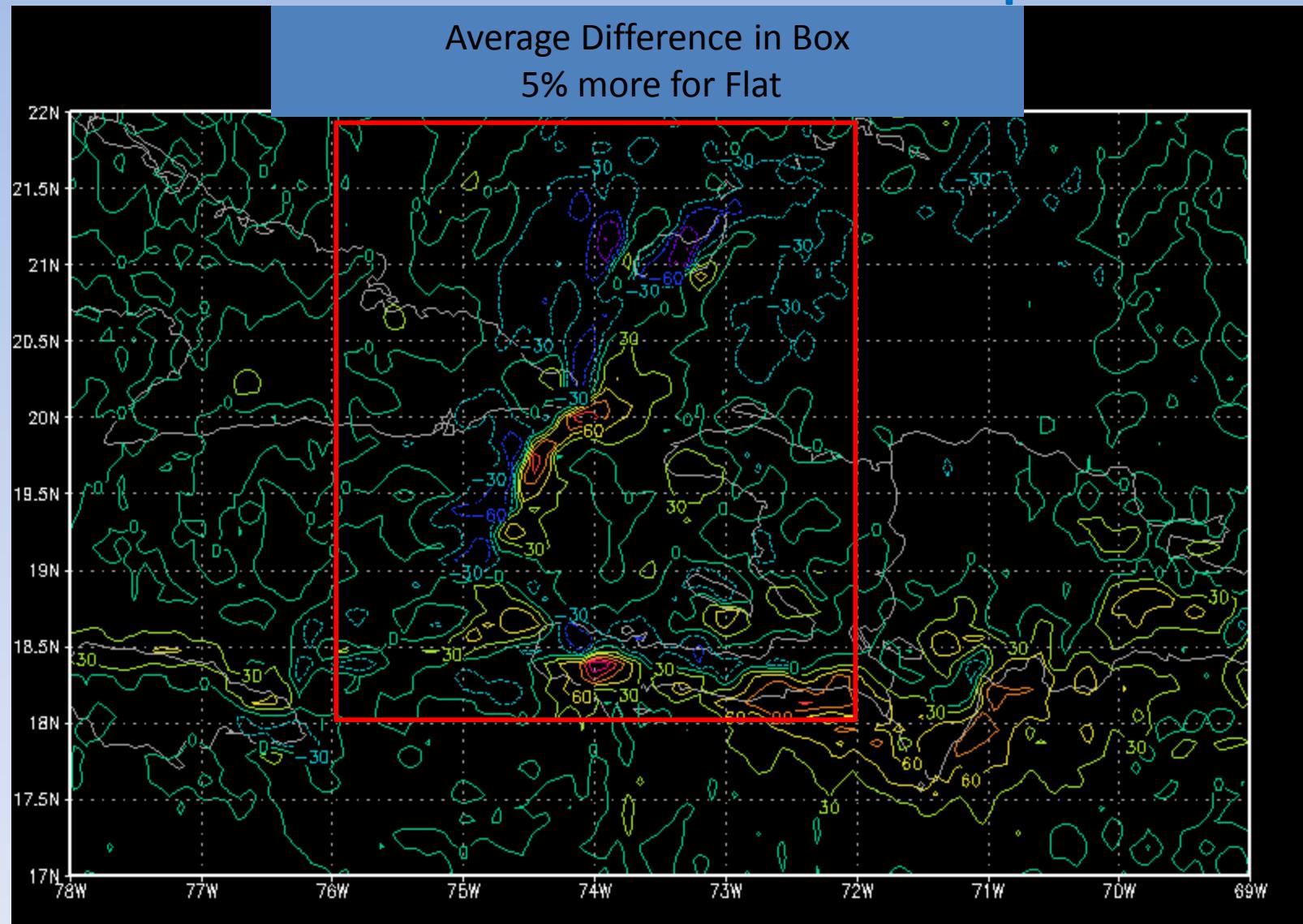
Mountains Deflected Storm

SLP – Control (yellow) and Flat (red)

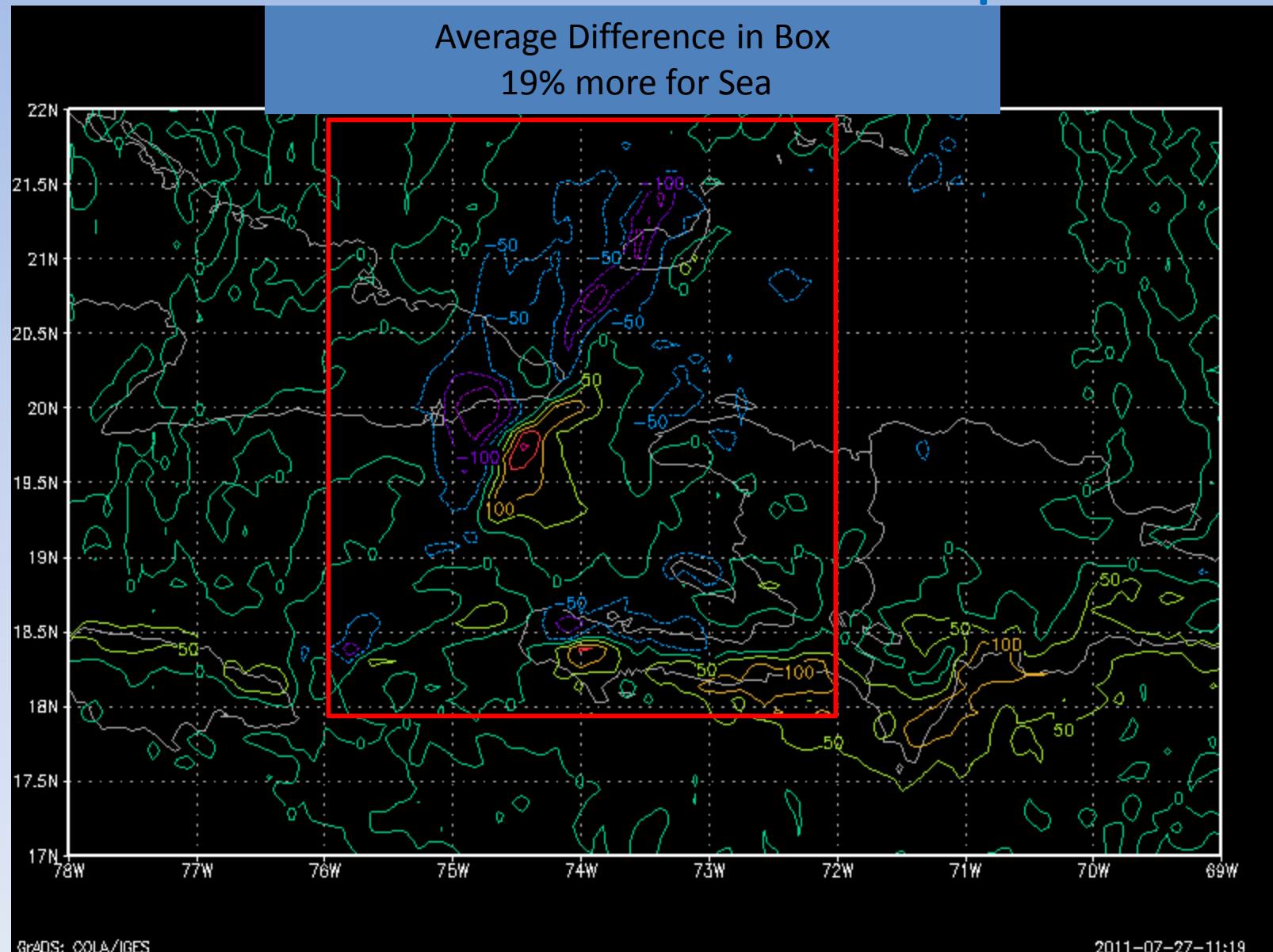
22 UTC November 5, 2010



Precipitation Reduced and Moved Control-Flat Total Precipitation

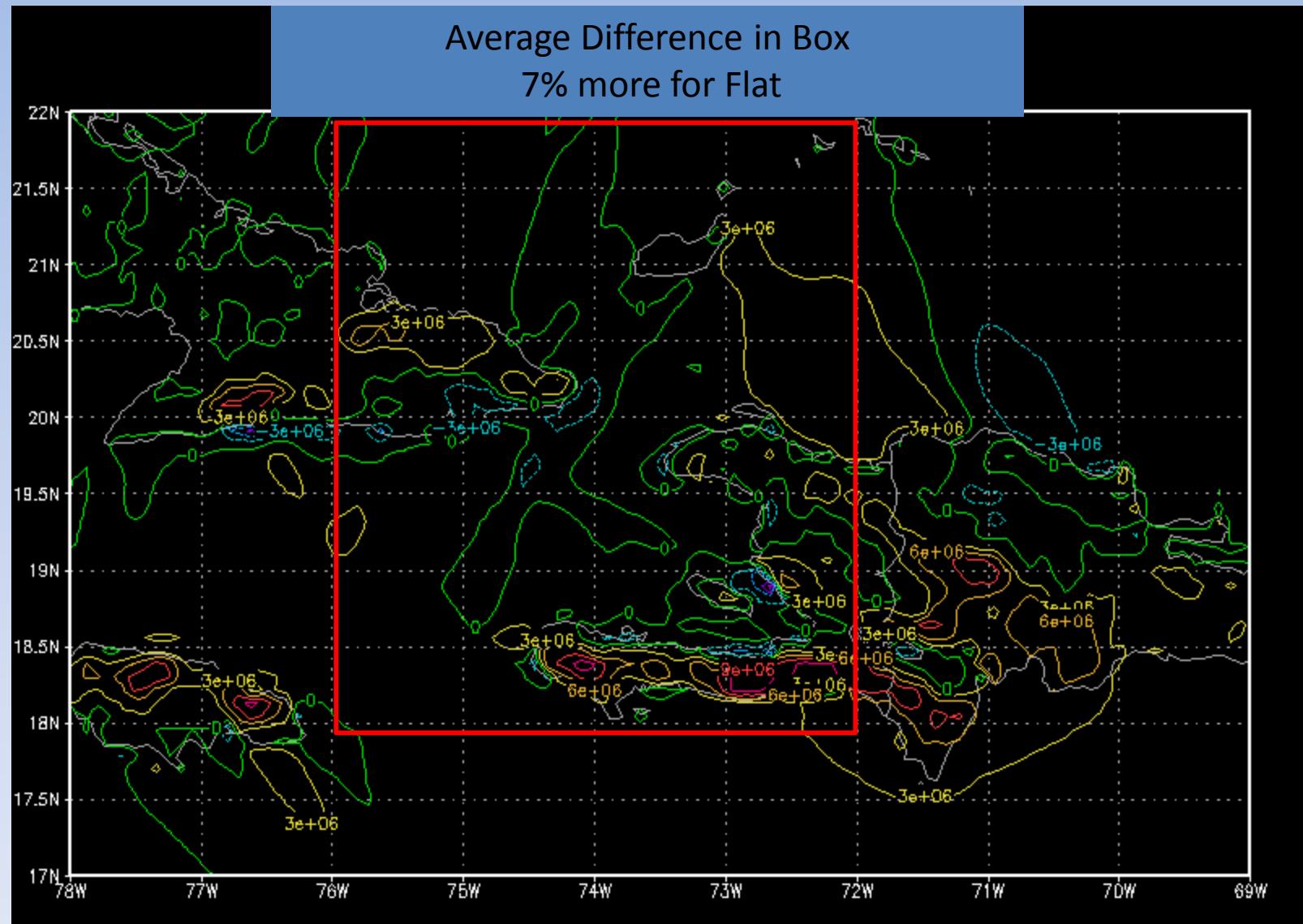


Precipitation Reduced and Moved Control-Sea Total Precipitation



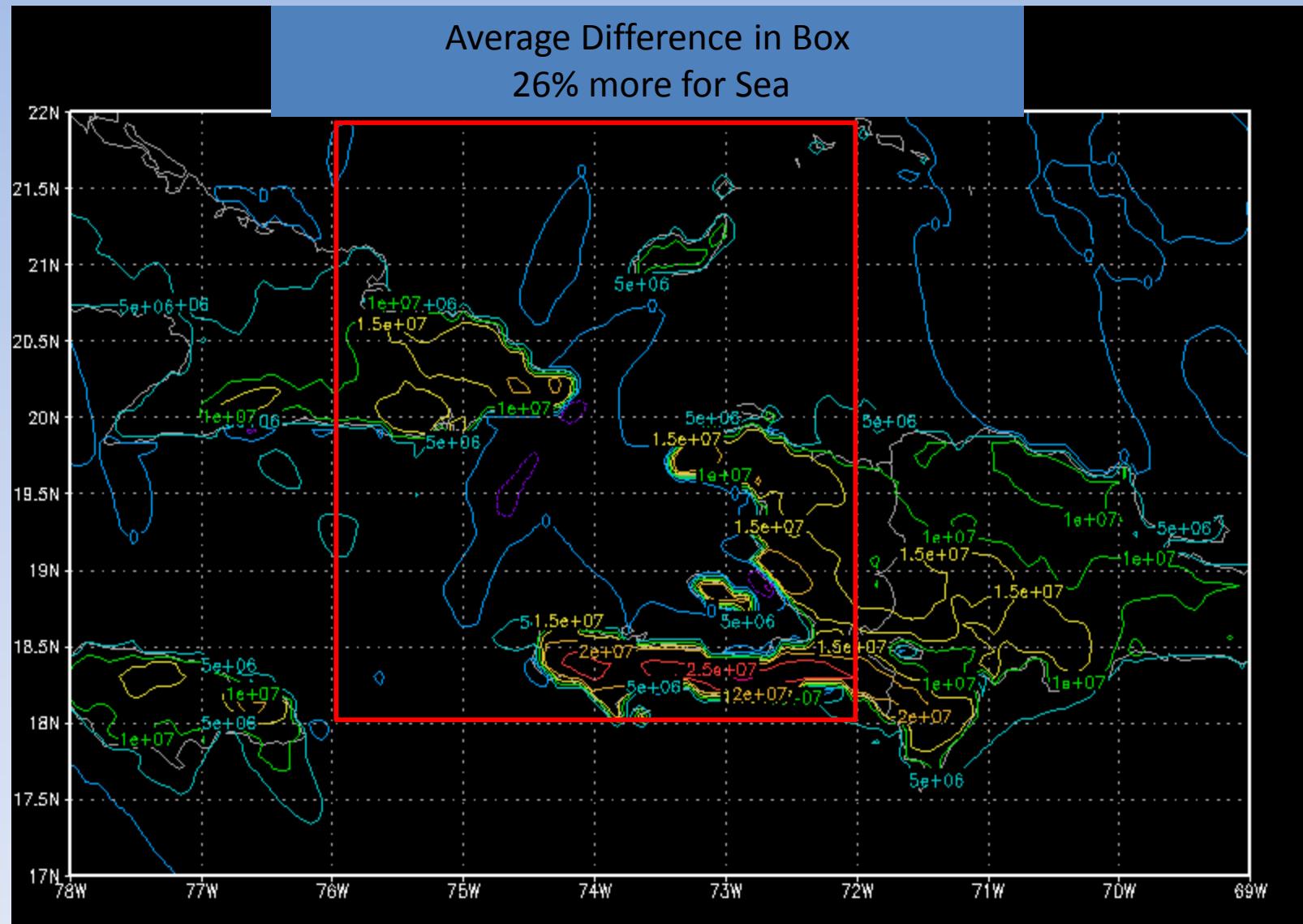
Mountains Reduced Fluxes

Flat-Control Accumulated Latent Heat Fluxes



Land Reduced Fluxes

Sea-Control Accumulated Latent Heat Fluxes



Summary

- Presence of Land Reduced Surface Fluxes
 - Weakened storm
 - Reduced total precipitation
- Mountains
 - Deflected storm eastward
 - Changed the location of precipitation
 - Slightly less total precipitation

Ongoing Research

- Examine More Storms to Measure Sensitivity of:
 - deflection to terrain height
 - precipitation to terrain height
 - storm intensity to terrain height
- How Universal are these Results?