Hurricanes: Now and in the future

Rebecca Evans
Kurt Hansen
James Hlywiak
Jimmy Ge

FMSEA

MAY 5TH 2018

Outline

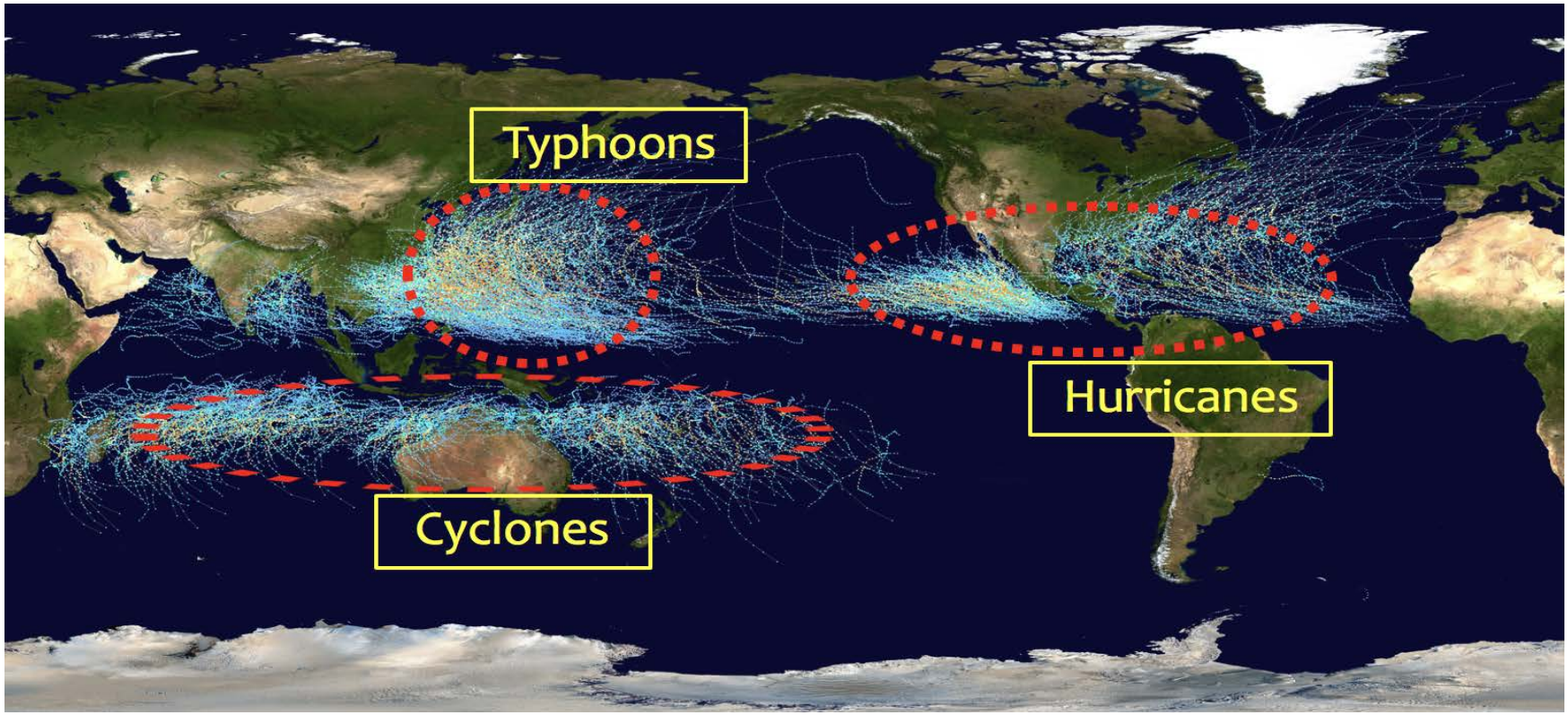
Hurricanes now

Hurricanes in South Florida

Formation conditions

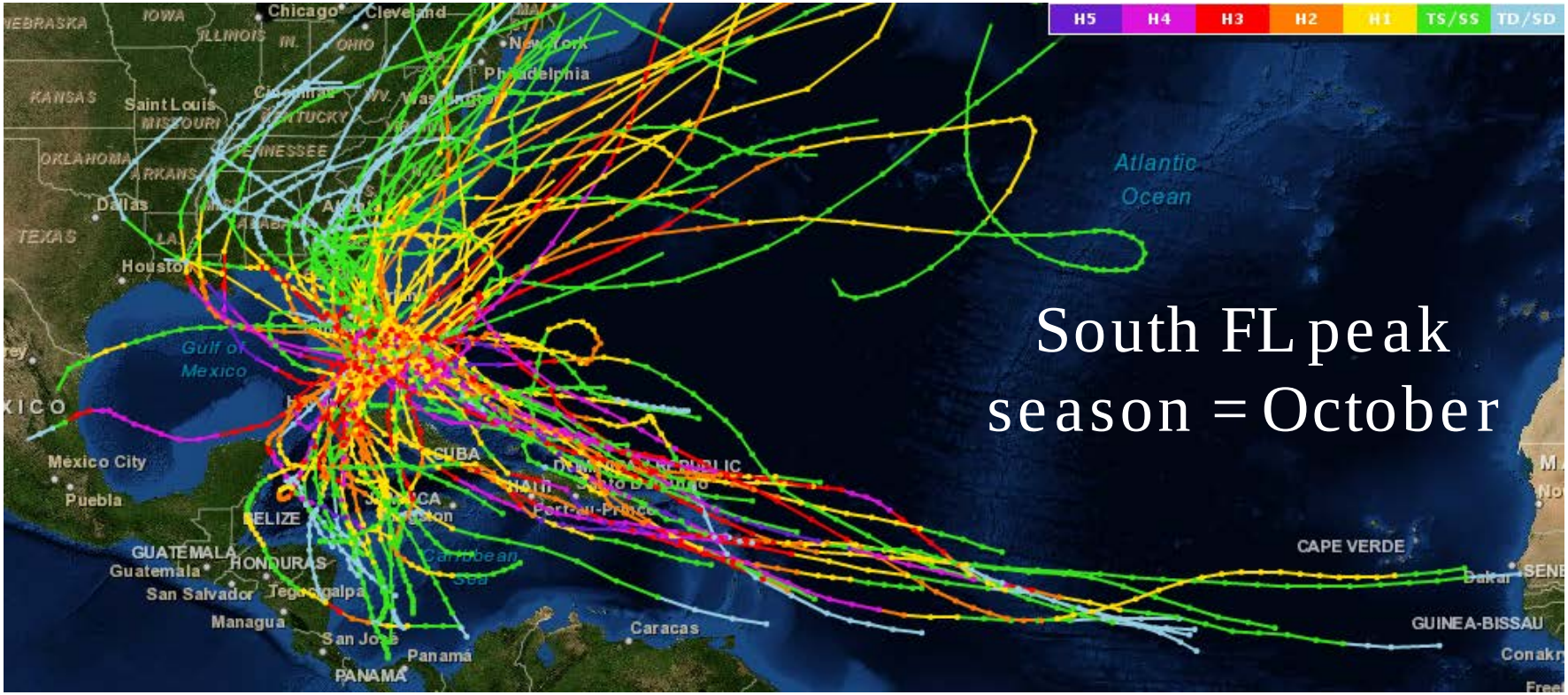
Hurricanes in the future

Climate change

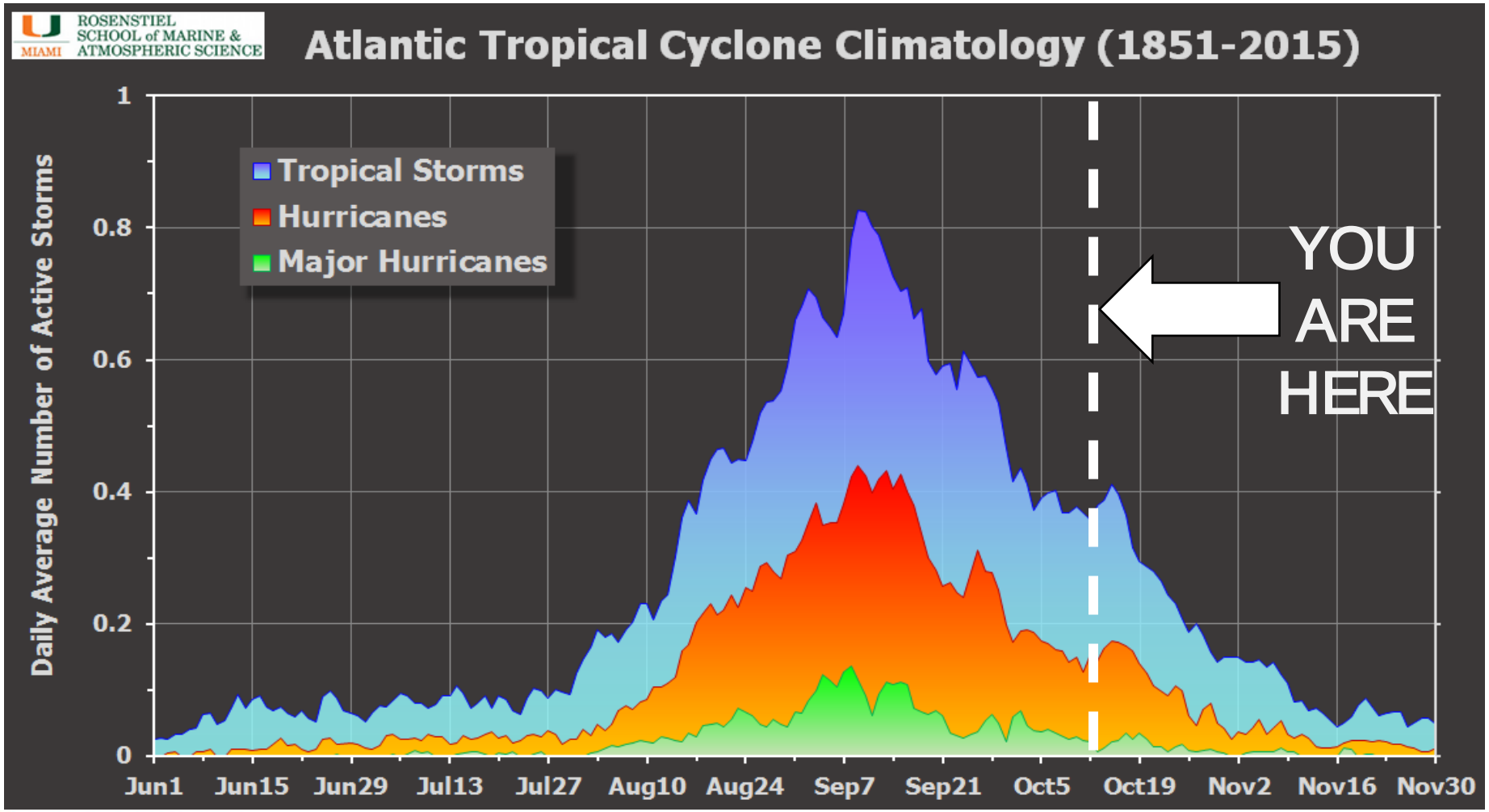


South Florida

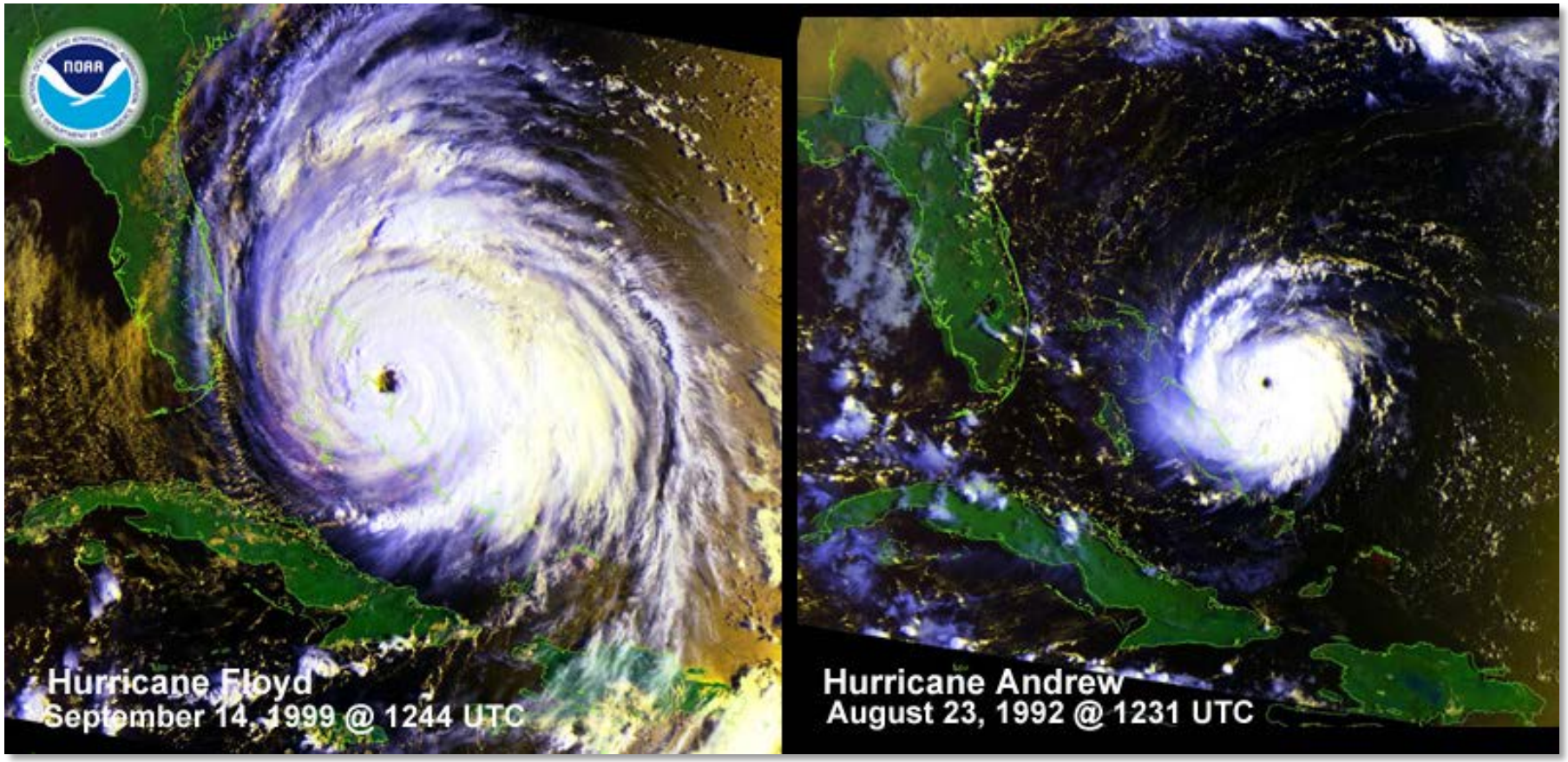
63 (31 major) Hurricanes Passed Through South Florida from 1851-Present



Hurricane Season



Does size matter?



However, Hurricane Andrew was a small storm but was devastating for Miami-Dade

Hurricane Recipe

LOW VERTICAL
WIND SHEAR

MOIST
ATMOSPHERE

DEEP LAYER OF
WARM OCEAN

HURRICANE
MATTHEW
Norfolk
Wilming
105 mph
SAT Early AM
Jackson
" Alright,
Alright,
Alright "
120 mph
FRI Early AM
Miami
125 mph
THU Early AM
Cancún
130 mph
WED Early AM
San Juan
JAMAICA
HAITI
Hurricanes
& climate
change

The future of hurricanes

What does a climate modeler look at?

Observations of the past 150 years of climate

+

Equations for dayyyyyyssss

(The Navier-Stokes equations – similar to those used for weather forecasting)

Projections of future climate

Question: How does this relate to hurricanes?

The future of hurricanes

Hurricanes strongly depend on both the ocean and atmosphere

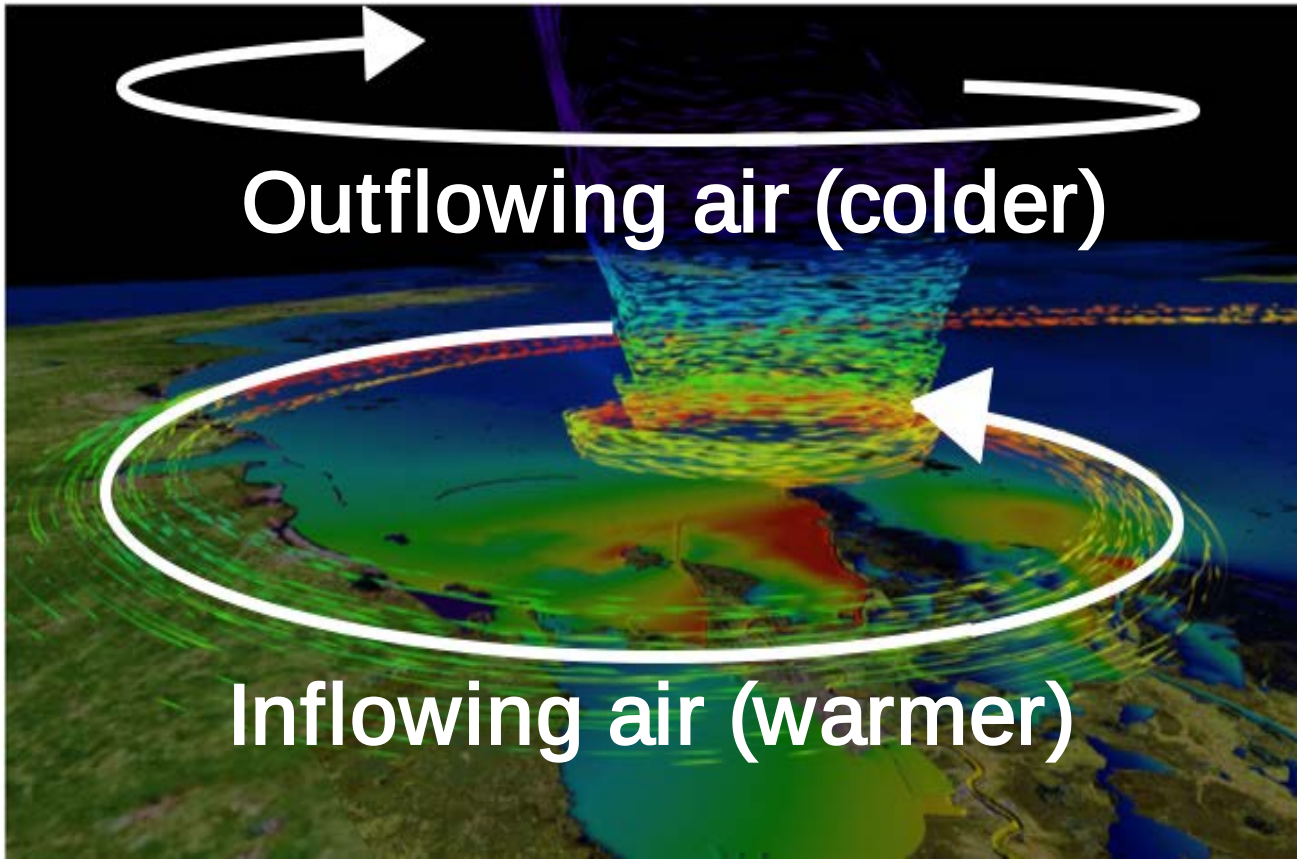
Both the ocean and atmosphere will get warmer, but the spatial differences in temperature may change

↓

Temperature distribution is very important

Let's consider the ocean and atmosphere separately to understand why

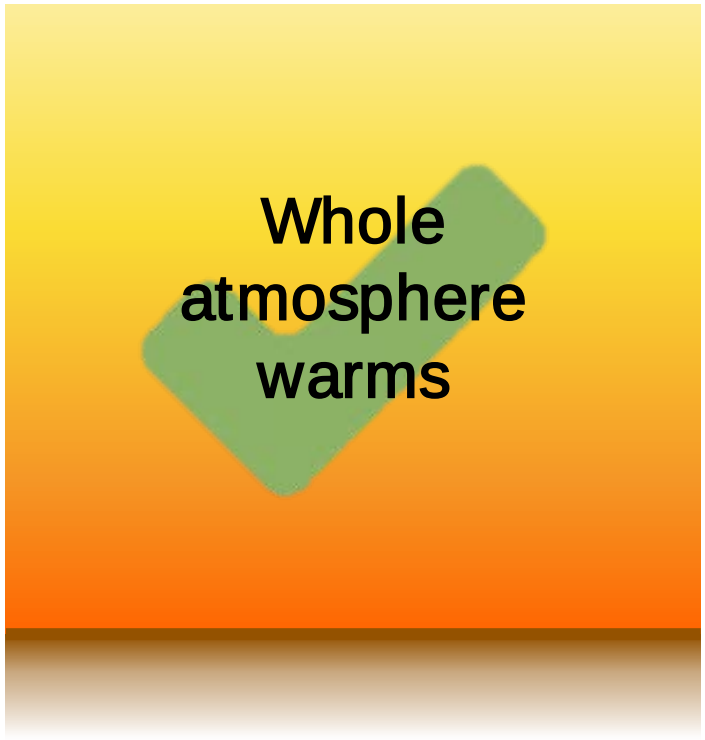
The atmosphere



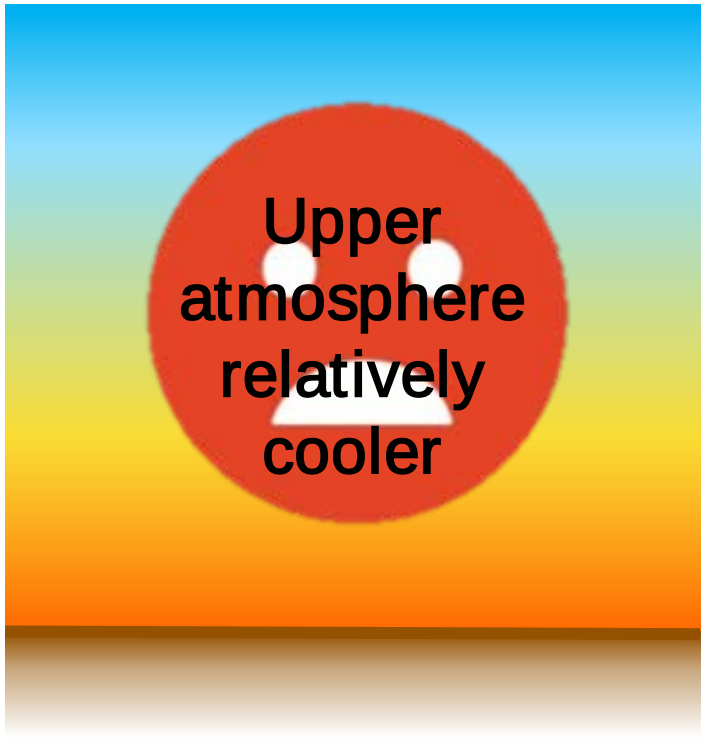
Benger et al. (2006): Hurricane Katrina

The atmosphere

Options



Better – temperature difference between upper and lower atmosphere doesn't change



Bad because it promotes convection/disturbance development

The ocean

Atlantic SSTs will **definitely warm** due to climate change

Question: Does this mean more intense tropical cyclones?

Answer:

Better Answer:

There are two possibilities:

A. Warmer Atlantic = more intense hurricanes

B. Warmer Atlantic but it warms at the same rate as the rest of the tropics

No relative difference = no hurricane activity change (Vecchi et al., 2008)

Options A and B

Option A

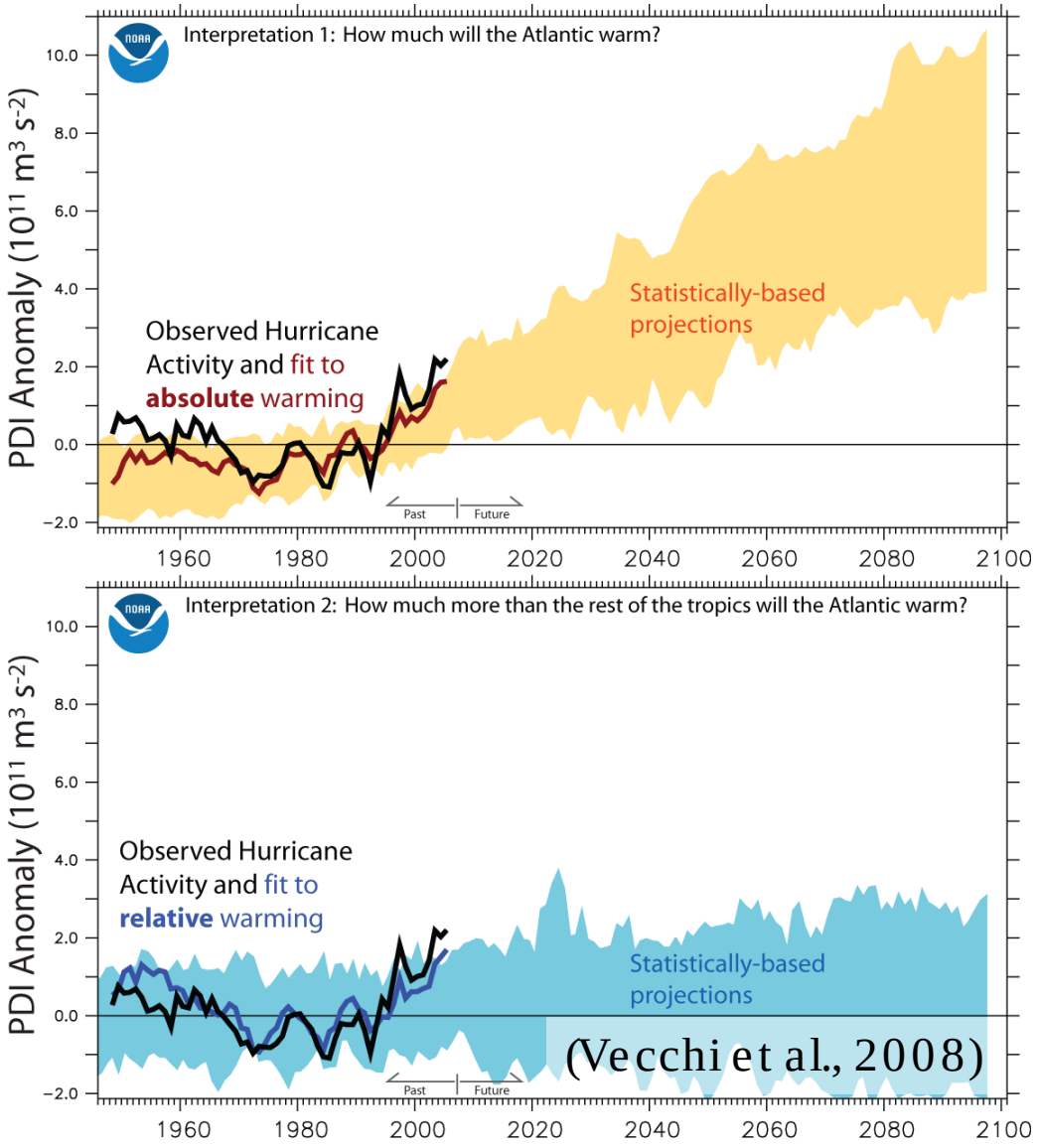
Atlantic is warmer

→hurricanes more intense

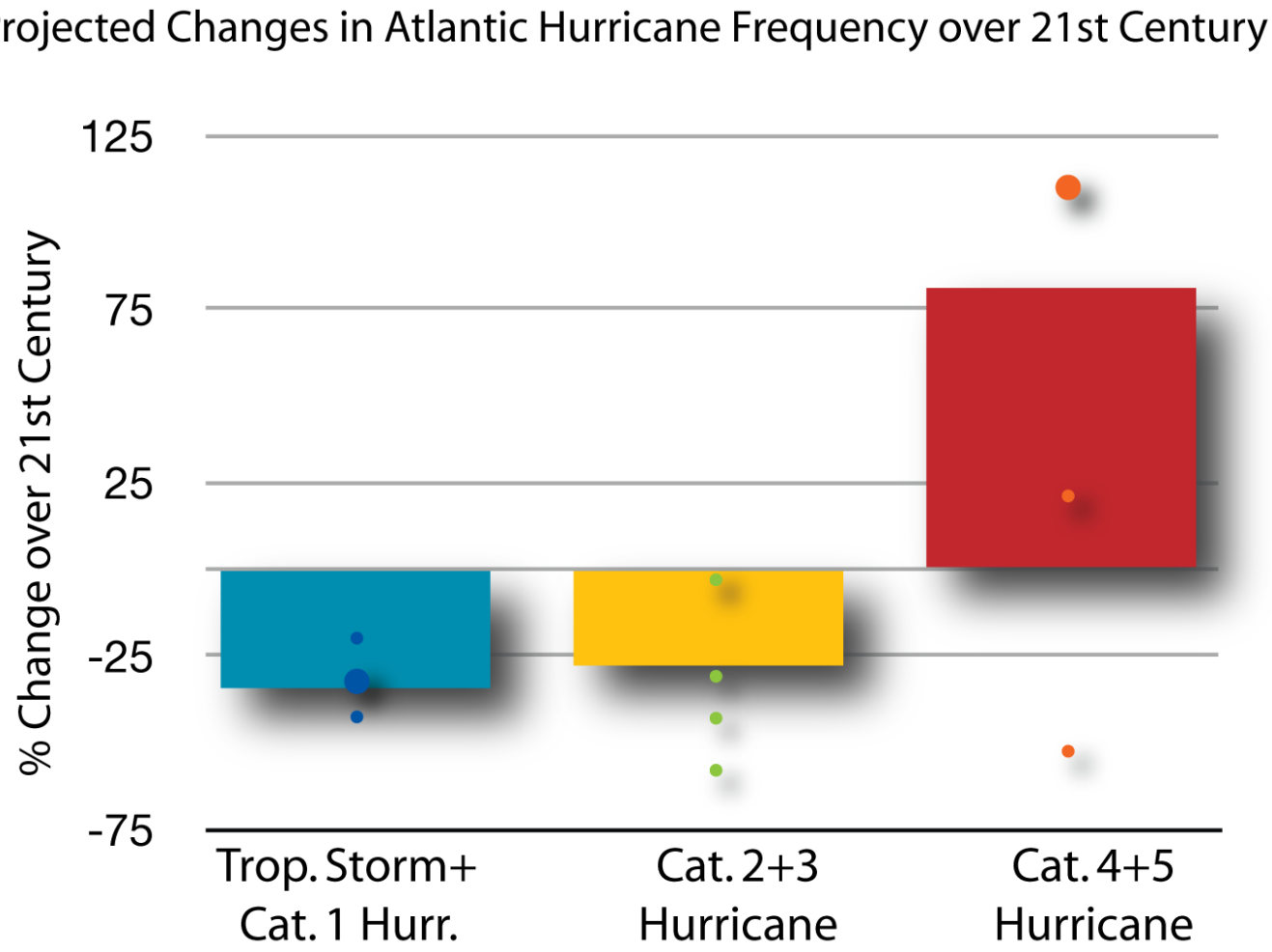
Option B

Atlantic is warmer but temperature relative to the rest of the tropics same as today

→No change in intensity



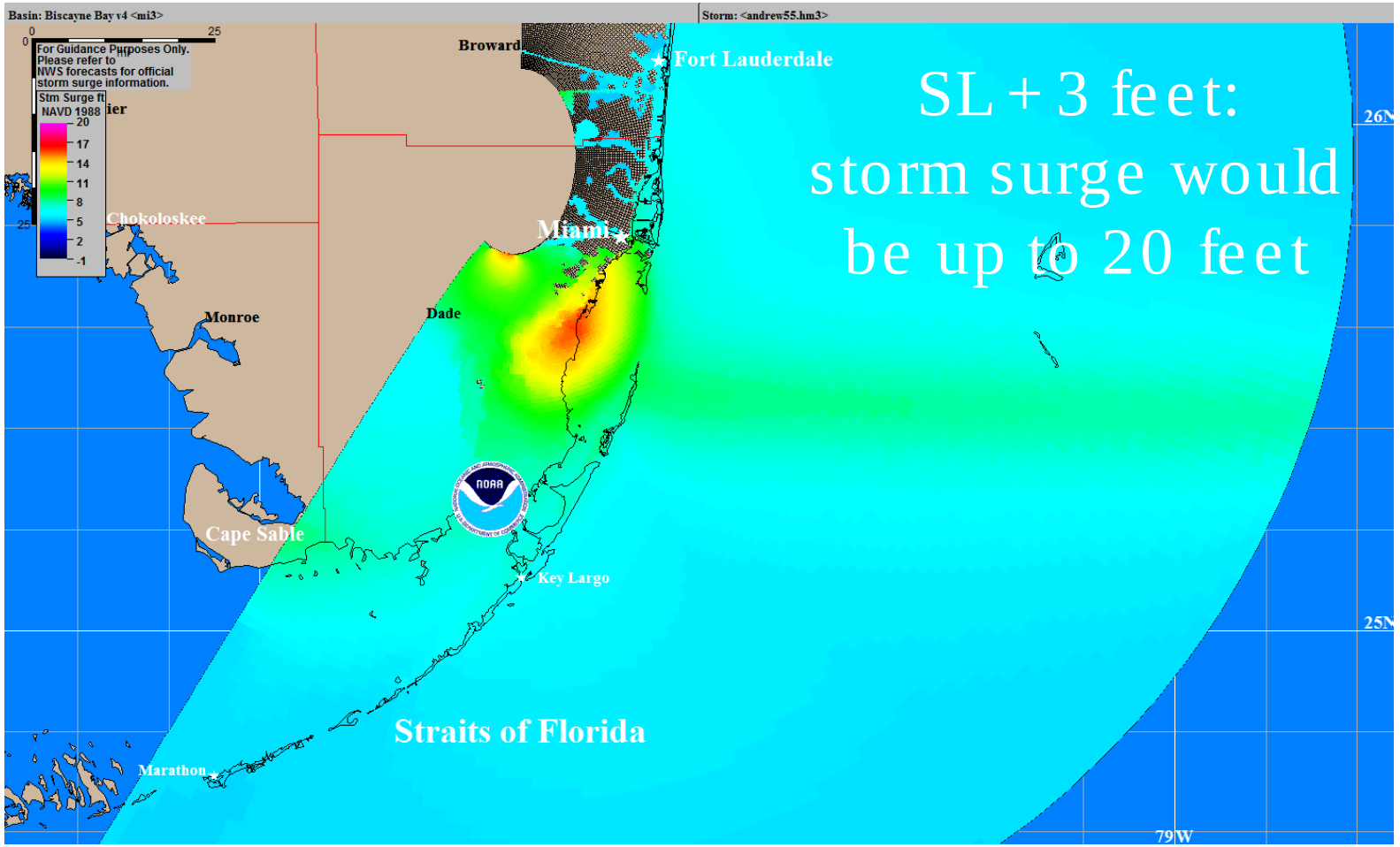
Could it be both?



ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE
MIAMI

Bender et al. (2010)

SLOSH storm surge prediction



ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE
MIAMI

Courtesy of Brian Soden

Conclusions