

# Economics of Climate Change Impacts on Small Island Nations

Robert Mendelsohn

Vanuatu, 2011

# Outline

- General Economic Issues
- Specific Island issues

# Grand Policy Questions

- How much mitigation should be done?
- How much adaptation should be done?
- When should mitigation and adaptation be done?
- Who should do mitigation and adaptation?

# What is the objective of mitigation?

- Minimize present value of sum of mitigation costs plus climate damages
- Equate marginal cost of mitigation to present value of the stream of net marginal damages
- Optimal mitigation depends on the severity of impacts and the cost of mitigation

# Free Rider Problem

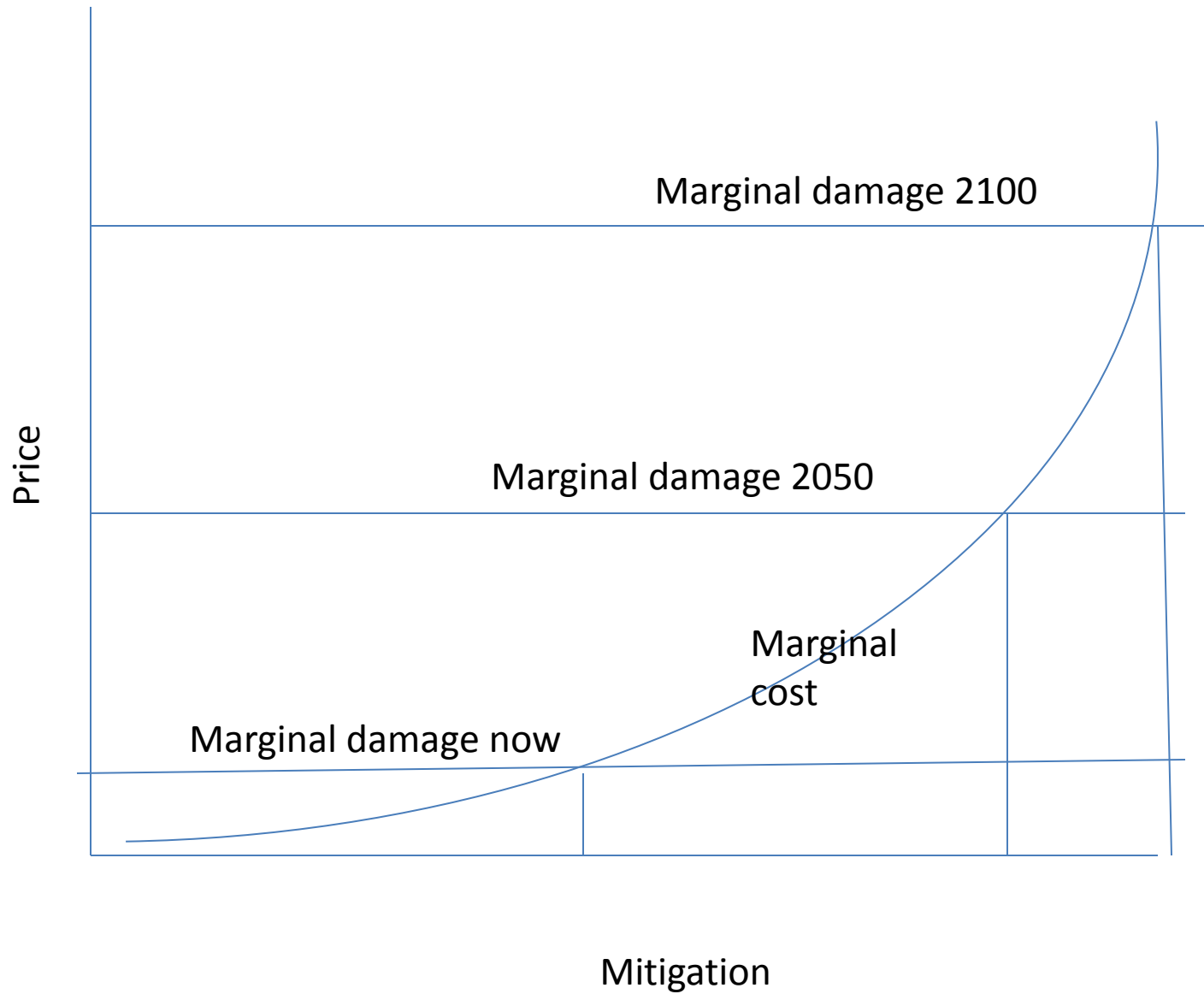
- Impacts are global in nature but mitigation costs are local
- Incentive for every country to “free ride” and let other countries control emissions
- Requires a global cost benefit perspective to justify mitigation

# Efficient Mitigation

- Every source abates to same level of marginal cost (price) in every sector in every country
- Because marginal cost of abatement is very steep, selective abatement in limited countries is very costly (if half of world's polluters abate, program costs twice as much)
- Requires universal participation to be effective

# When should mitigation occur?

- Because there are long lags between emissions and consequences with greenhouse gases, mitigation must anticipate consequences
- Optimal to start slowly but increase intensity over time

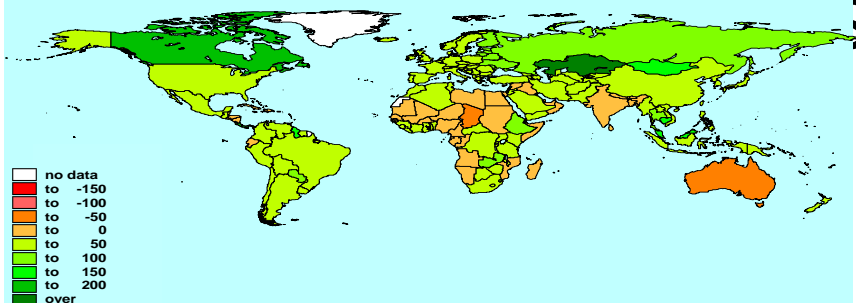




# How to move forward?

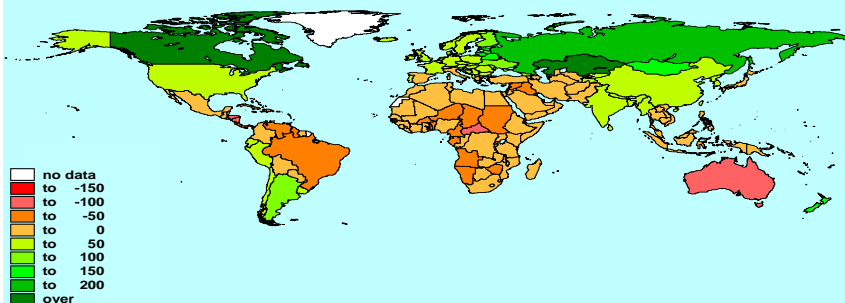
- Start by quantifying damages by sector by location
- Examine adaptation alternatives
- Determine most effective adaptation strategy

PCM exp 2020



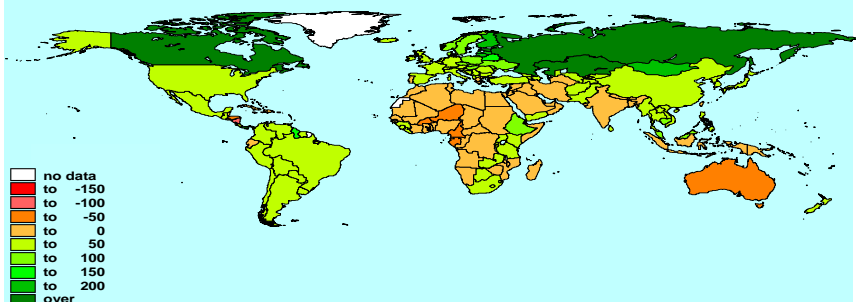
**AGRICULTURE**

HAD3 exp 2020



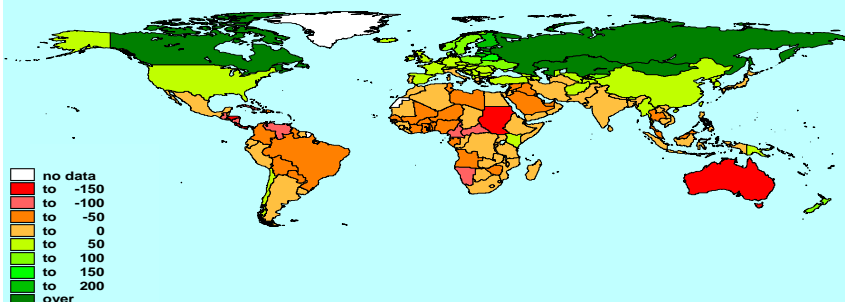
**ECOSYSTEM**

PCM exp 2060



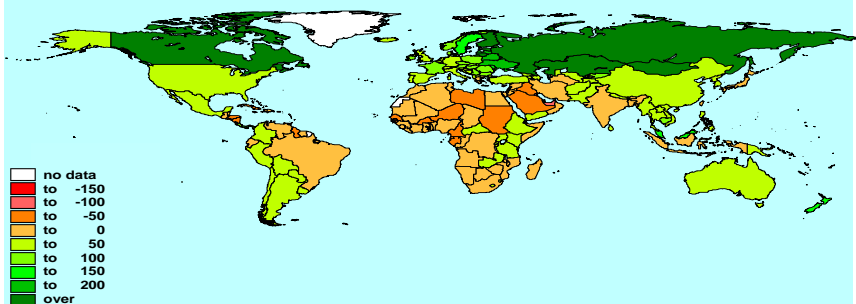
**AGRICULTURE**

HAD3 exp 2060



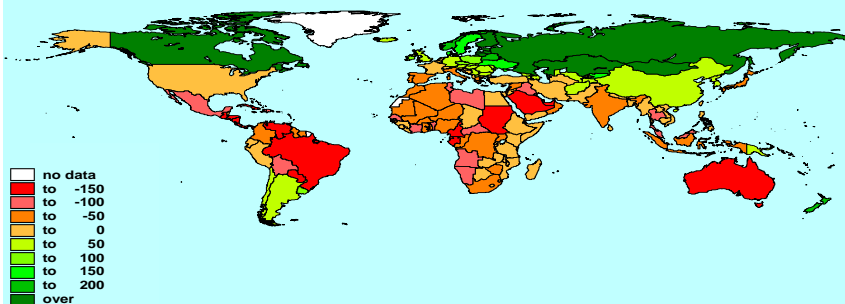
**ECOSYSTEM**

PCM exp 2100



**AGRICULTURE**

HAD3 exp 2100



**ECOSYSTEM**

# *Net Global Market Impacts in 2100 (USD Billions/yr)*

	PCM 2.0°C	CCSR 4°C	CCC 5.5°C
Low	+217 (+.01%)	-23 (-.001%)	-50 (-.002%)
High	+64 (+.002%)	-94 (-0.03%)	-273 (-0.1%)

Stern estimates impacts of 5% of GDP

# What damages are most important to island nations?

- Sea level rise
- Agriculture
- Water
- Tropical cyclones
- Ecosystem-tourism
- ???

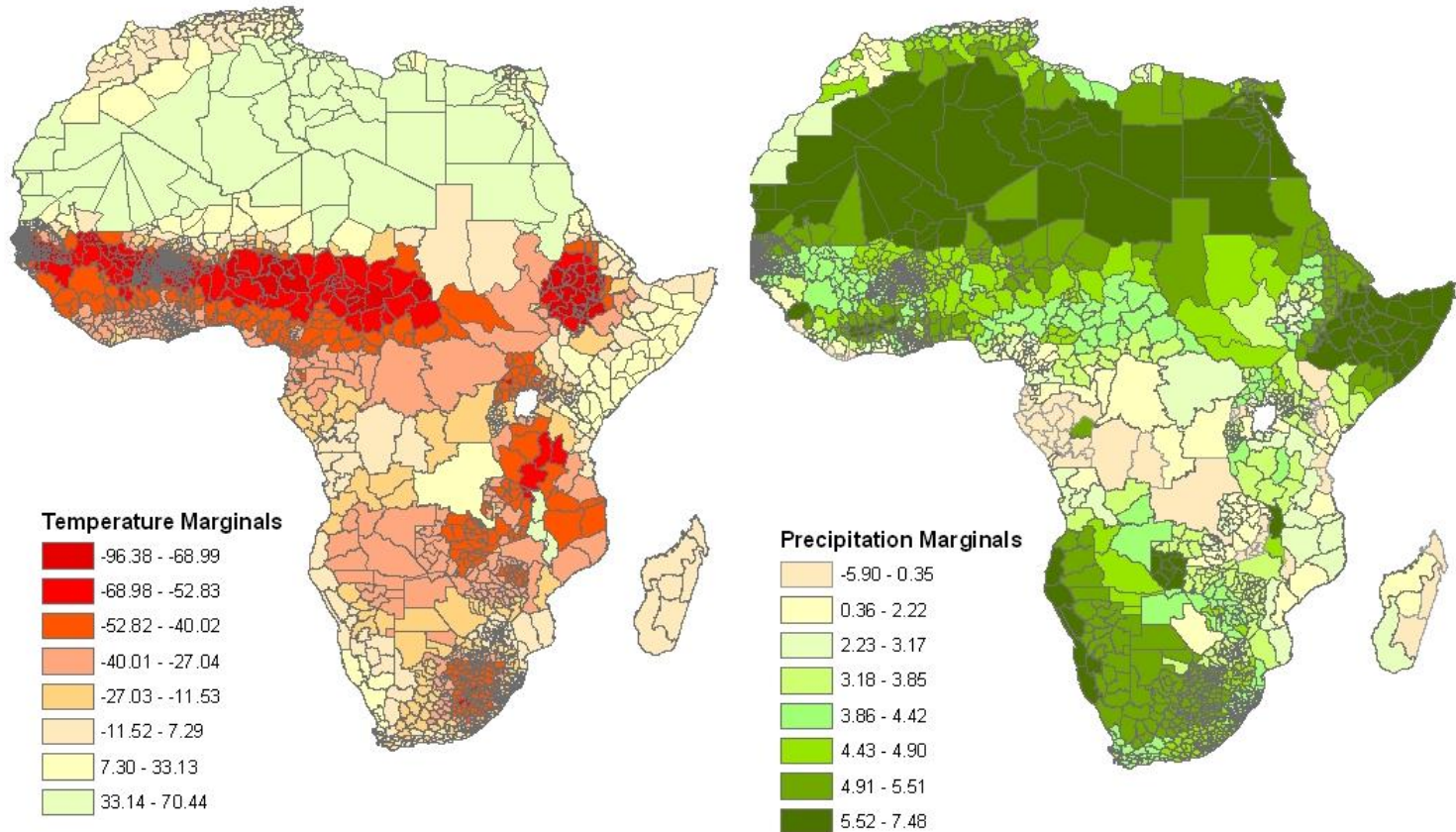
# Sea level rise

- Seas expected to rise from 30cm to 100cm by 2100
- Quantify vulnerable property at each height
- Determine cost of building coastal defenses
- Likely protect high valued urban coastline
- Possibly protect high valued beaches
- Likely retreat elsewhere

# Agriculture

- Damages expected to be highest in low latitudes
- Most crops grown in island nations have not been studied
- Need to study impacts
- Determine yields of crops and net revenue per hectare across islands
- Determine how climate change will affect outcomes

# Marginal impacts of Temperature and Precipitation



# Water

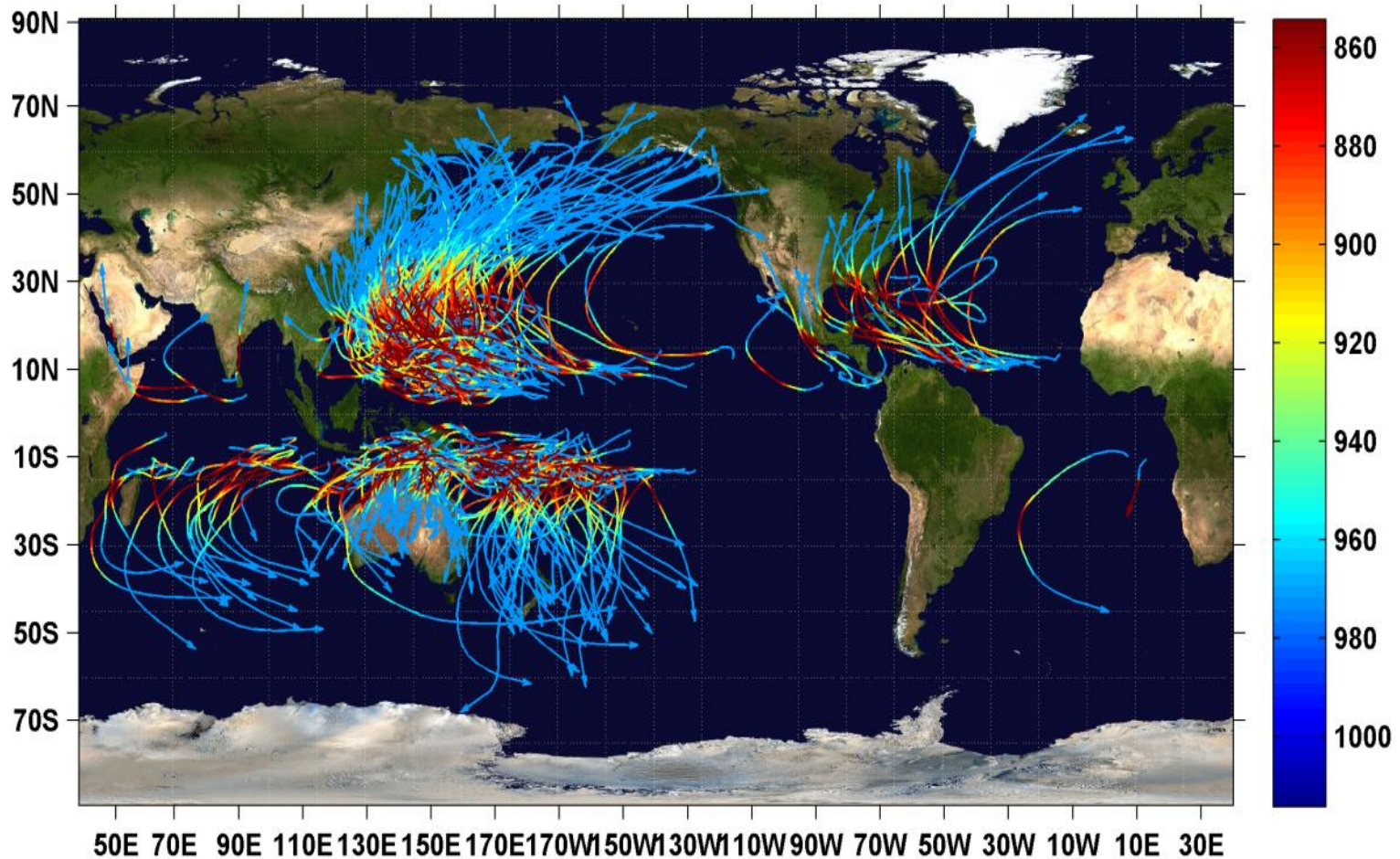
- Likely increase in precipitation but larger increase in evapotranspiration so less runoff
- Increase in demand for water for household use, cooling, and irrigation
- Water likely to become scarcer
- Determine how to manage water now and in the future



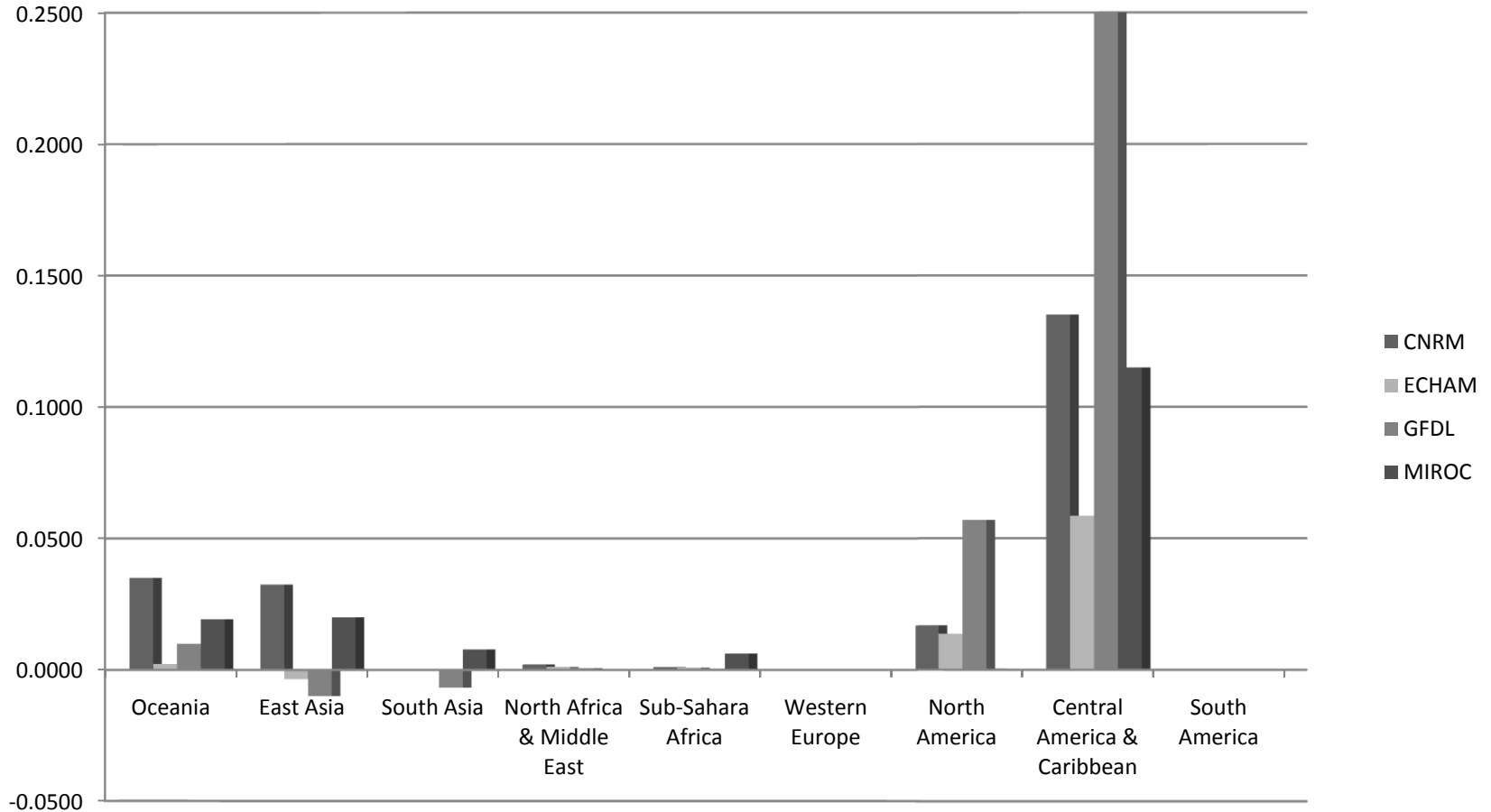
# Tropical Cyclones

- Expected to become more intense
- Damages likely rise sharply with intensity
- Could become much larger problem in the future
- Detailed study needed of PACC

# Generated hurricane paths



# Climate Change Impacts From Tropical Cyclones \$/GDP



# Ecosystem Change- tourism

- Predict changes in terrestrial systems
- Predict changes in marine systems
- Measure impact of biological changes on attractiveness of islands for tourism