

Ad Hoc Expert Meeting on

**Climate Change Impacts and  
Adaptation: A Challenge for Global  
Ports**

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**Ports in Developing Countries: Lessons  
from the World Bank Economics of  
Adaptation to Climate Change Study**

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# Ports in Developing Countries

## Lessons from the WB Economics of Adaptation to Climate Change Study

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## **Economic Development and Adaption to Climate Change**

- Poverty reduction**
- Not business as usual**

### **Estimates of Adaptation Costs for Ports**

### **Mainstreaming Adaptation into Investment Planning**



## Economic Development and Adaption to Climate Change

### Adaptation Costs for Developing Countries

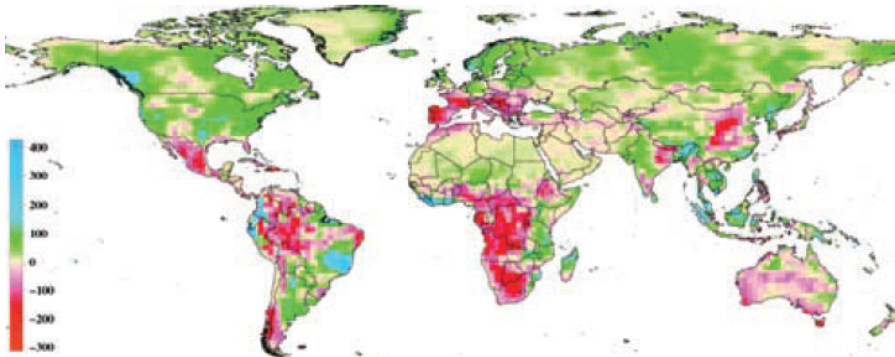
- Estimates of adaptation costs by sector
- Estimates of adaptation costs for ports

### Mainstreaming Adaptation into Investment Planning

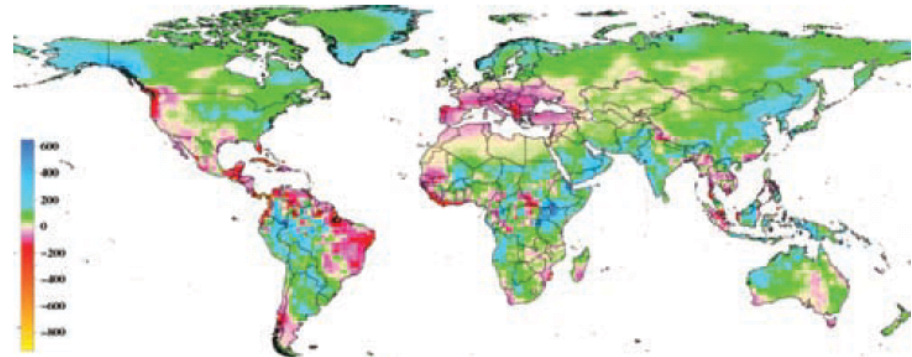
# Adaptation Costs for Developing Countries – Key Assumptions: Adapt to what?

- Time frame – 2010 to 2050
- Development baseline – A2 SRES (population forecasts, emissions and GDP growth projections)
- Focus on planned adaptation (deliberate public decision) rather than autonomous adaptation (households or communities acting on their own)
- *Hard* options (capital intensive) favored over *soft* options (institutions, etc.)
- Choice of climate scenario – Two extreme GCMs to estimate range of costs

Commonwealth Scientific and Industrial Research Organization (CSIRO), driest scenario

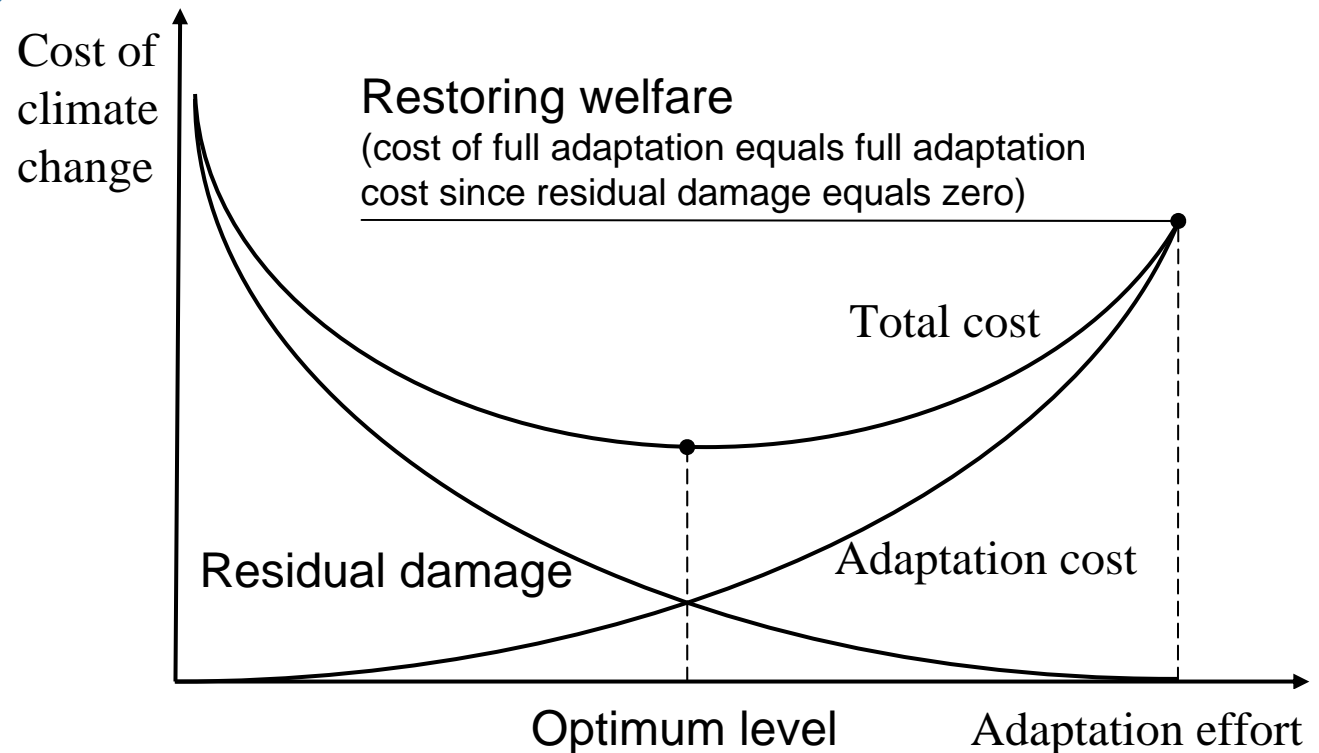


National Centre for Atmospheric Research (NCAR), wettest scenario



# Adaptation Costs for Developing Countries – Key Assumptions: How much to Adapt?

- No adaptation at all – All damage from climate change
- Optimum level of adaptation – Marginal benefits from adaptation equal to their marginal costs
- Full adaptation – Adapt up to the level which would have prevailed without climate change



# Adaptation Costs for Developing Countries – Adaptation is cost effective

- Impact of climate change without adaptation will be much more costly
- Accounting for climate change future adaptation in today development planning (i.e. adoption of more stringent design standards today)

## BETTER DESIGN STANDARDS WOULD ENHANCE SAMOA'S RESILIENCE

*(Impact of climate change with and without adaptation)*

	No adaptation		With adaptation		Benefit of adaptation	
	NCAR	CSIRO	NCAR	CSIRO	NCAR	CSIRO
<b>Design standards for 10-year return period</b>						
Present value @ 5%, \$ million	103.9	212.4	34.8	24.5	69.1	187.9
Annualized equivalent, \$ million per year	5.9	12.1	2.0	1.4	3.9	10.7
Loss/benefit as % of baseline GDP	0.6	1.3	0.2	0.2	0.4	1.2
<b>Design standards for 50-year return period</b>						
Present value @ 5 %, \$ million	19.9	37.0	4.5	5.4	15.4	31.6
Annualized equivalent, \$ million per year	1.1	2.1	0.3	0.3	0.9	1.8
Loss/benefit as % of baseline GDP	0.1	0.2	0.0	0.0	0.1	0.2

Note: NCAR is wettest scenario; CSIRO is driest scenario.

# Adaptation Costs for Developing Countries – Annual Costs by Sector (\$ billion)

Sector	United Nations Framework Convention on Climate Change (2007)	Parry and others (2009)	Economics of Adaptation to Climate Change study (in 2005 prices, no discounting)	
			National Centre for Atmospheric Research (NCAR), wettest scenario	Commonwealth Scientific and Industrial Research Organization (CSIRO), driest scenario
Infrastructure	2–41	18–104	29.5	13.5
Coastal zones	5	15	30.1	29.6
Water supply and flood protection	9	>9	13.7	19.2
Agriculture, <sup>a</sup> forestry, fisheries	7	>7	7.6	7.3
Human health	5	>5	2	1.6
Extreme weather events	—	—	6.7	6.5
Total	28–67	—	89.6	77.7

- **The cost between 2010 and 2050 of adapting to an approximately 2°C warmer world by 2050 is in the range of \$70 billion to \$100 billion a year**
  - ◆ **This cost is the same order of magnitude as the foreign aid that developed countries now give developing countries each year**
  - ◆ **At the same time, this cost is still a very low percentage (0.17%) of the income of countries (measured by their GDP, which was roughly \$60 trillion in 2009)**



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- **Comparison limited by methodological differences – in the EACC study**
  - ◆ Use of a consistent set of climate models to link impacts to adaptation costs
  - ◆ Explicit separation of costs of development from those of adaptation
- **Major difference is the nearly six-fold increase in the cost of coastal zones**
  - ◆ Improved unit capital cost estimates and introduction of maintenance costs
  - ◆ Inclusion of costs of port upgrading and risks from both sea-level rise and storm surges

# Adaptation Costs for Ports – Annual Costs for Developing Countries (\$ billion)

Coastal zone cost component	Low sea-level rise	Medium sea-level rise	High sea-level rise
Beach nourishment	1.7	3.3	4.5
River dikes	0.2	0.4	0.6
Sea dikes	10.7	24.6	36.7
Port upgrades	0.2	0.4	0.5
Residual damages <sup>a</sup>	0.7	1.5	2
<b>Total</b>	<b>13.5</b>	<b>30.2</b>	<b>44.3</b>

## ➤ Climate-induced global mean SLR scenarios (Neumann, 2009)

Year	Low sea-level rise	Medium sea-level rise	High sea-level rise
2050	15.6	28.5	37.8
2100	40.2	87.2	126.3

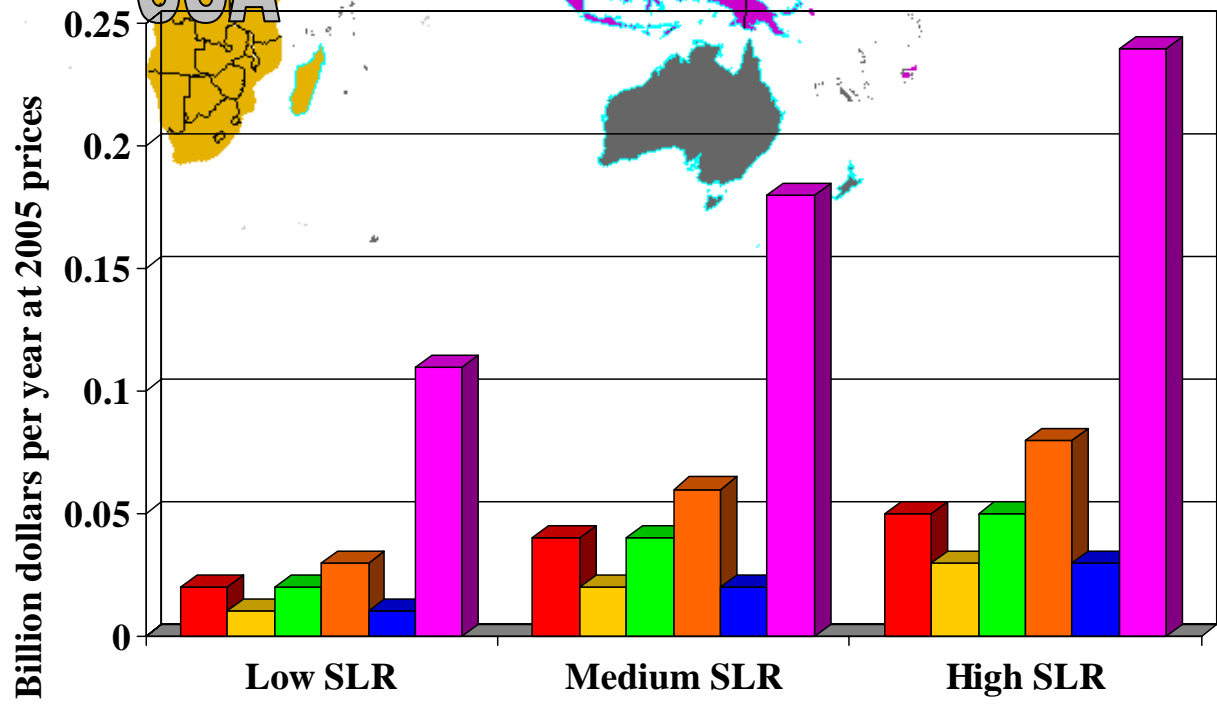
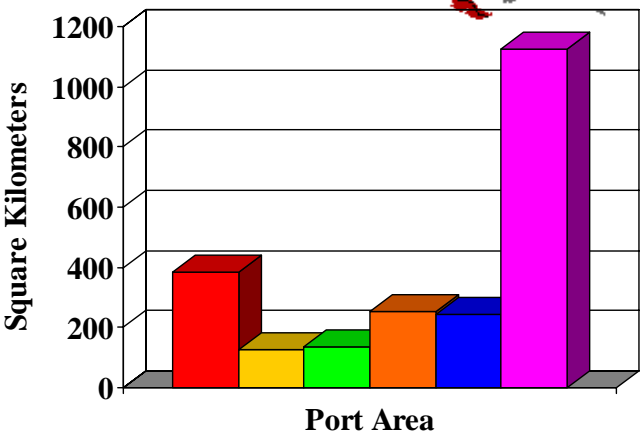
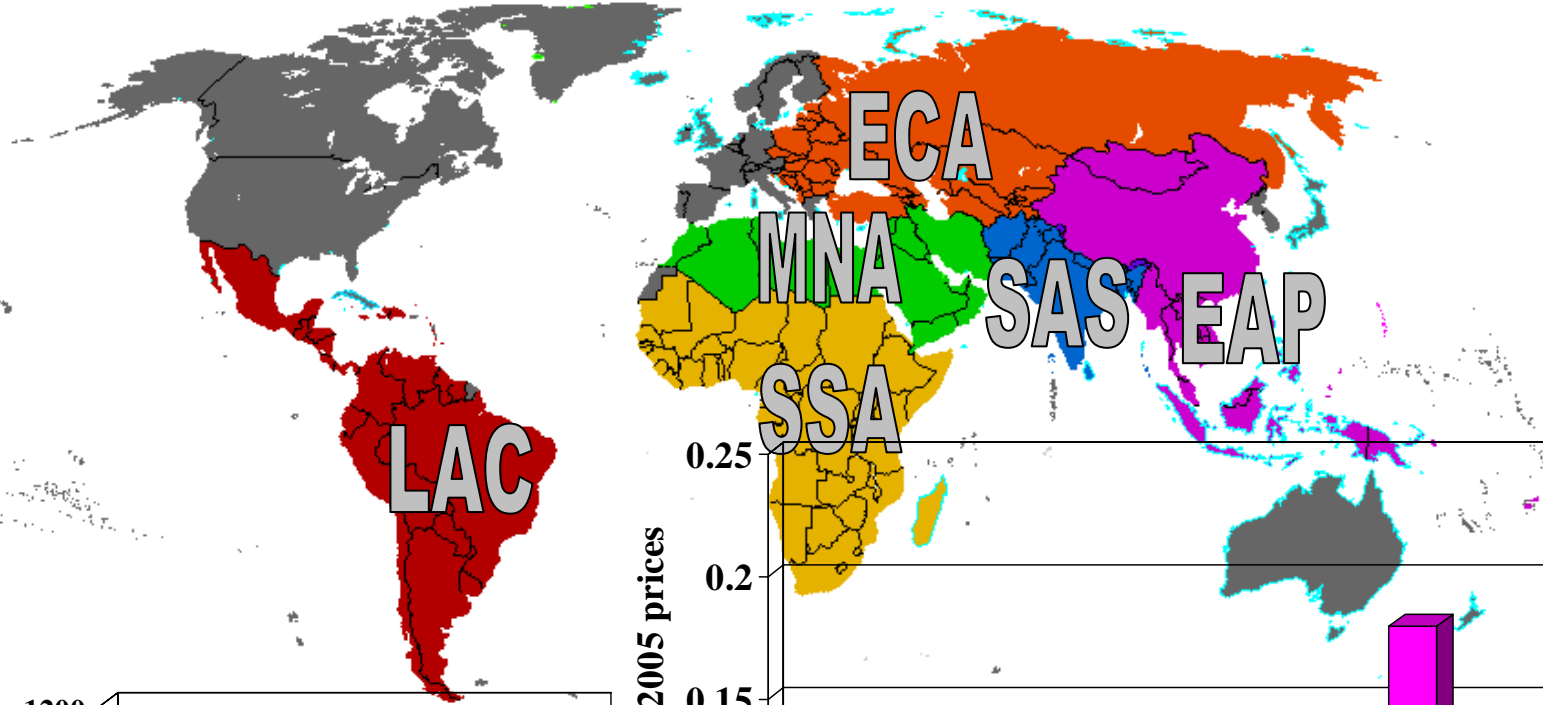
## ➤ Form of adaptation – Raising current port areas to maintain their elevation relative to a total sea-level rise projected to 2050

- ◆ Only existing port areas considered and assumed to be flat
- ◆ Any new development assumed to be designed for future changes in SLR to 2050

# Adaptation Costs for Ports – Key Assumptions

- **Indicators used because of lack of comprehensive data**
  - ◆ Information on ports fragmented and inconsistent
  - ◆ Necessary physical parameters not systematically reported
- **Ports in countries classified as middle or low income economies**
- **Traffic to area calculations**
  - ◆ Tonnage-space ratios for mixed cargo (3t/m<sup>2</sup>), bulk/oil (30t/m<sup>2</sup>) and containers (16t/m<sup>2</sup>)
  - ◆ Port-level information when traffic values available either in ton or TEU (Lloyds List, 2009)
  - ◆ Country data otherwise using barrels per day (CIA's World Factbook)
- **Cost of the upgrade to port ground levels – \$15 million per km to raise ground levels by 1m in 1990 (IPCC, 1990)**

# Adaptation Costs for Ports – Annual Costs by World Bank Region (\$ billion)





## Economic Development and Adaption to Climate Change

### Adaptation Costs for Developing Countries

#### **Mainstreaming Adaptation into Investment Planning**

- Hard versus soft measures
- Current climate vulnerabilities
- Climate uncertainty: the need for robust strategies

# Lessons from the World Bank Economics of Adaptation to Climate Change Study

1. Tackle the root causes of *poverty*
2. Persist in economic development but *not business as usual*
3. Cost to developing countries of adapting to 2°C warmer world between 2010-2050 is approx. *\$70-100 billion per year*
4. Look beyond planned and hard adaptation to soft adaptation (e.g. economic/legal incentives) and *enabling private adaptation*
5. Develop hard and soft measures *at the same time*
6. Start with no-regret options
7. *Do not rush* into making long-lived investments in adaptation

