El Niño’s Economic Costs

• The cost of the 1982-1983 El Niño was about $8 billion.
• The cost of the 1997-1998 El Niño is estimated between $30 billion and $90 billion.

Floods in some parts of Africa

Drought & famine in other parts of Africa

Drought and Fires in Indonesia and Australia
Social Unrest in South America

Flooding in the United States

Floods in the United States

The Southern Oscillation
Oscillation of the Walker Circulation Cell
Atmospheric conditions: Typical vs. “Southern Oscillation”

Changing Wind Patterns in Response to Changes in Walker Circulation

Changing Precipitation Patterns in Response to Changes in Walker Circulation

Ocean Response to Atmospheric Conditions

Typical Conditions

- Easterly trade winds cause surface waters to pile up in the west.
- Thermocline is deep in the west and shallow in the east.
- Proximity of thermocline to the surface in the east enhances coastal upwelling effects and thus biological productivity.
Ocean Response to Atmospheric Conditions
ENSO Conditions

Surface and Subsurface Temperature Distributions: Normal Conditions

Temperature Field in the Pacific Prior to El Nino (Normal Conditions)

Temperature Field in the Pacific During the Initial Progression of El Nino
Temperature Field in the Pacific During the Height of El Nino

Temperature Field in the Pacific During the Recovery from El Nino

Satellite Remote Sensing
Normal Conditions

Satellite Remote Sensing
ENSO Conditions
Global Weather Responses to ENSO

Drought and Fires in Indonesia and Australia

Effect of ENSO on Equatorial Productivity

Variation in Coastal Upwelling and Productivity off Peru
Teleconnections
Long-Distance Environmental Changes
Linked to El Niño

US Weather Responses to ENSO
Long-Term Effects of ENSO