

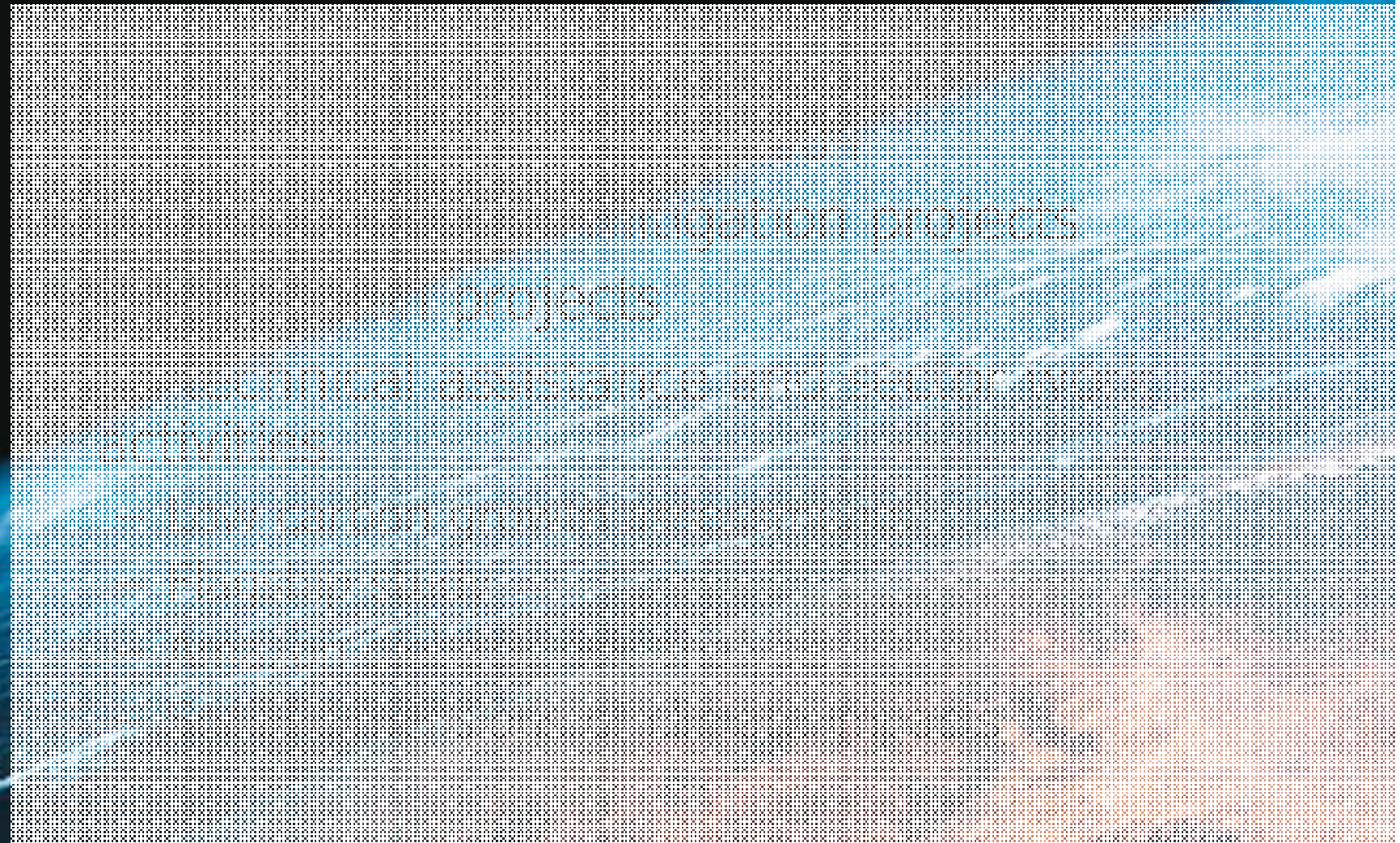
**Adaptation to Climate Change  
in the water sector –  
Experience from World Bank Projects  
in Latin America**

**Laura Tlaiye  
July 23, 2008  
Expo Zaragoza**

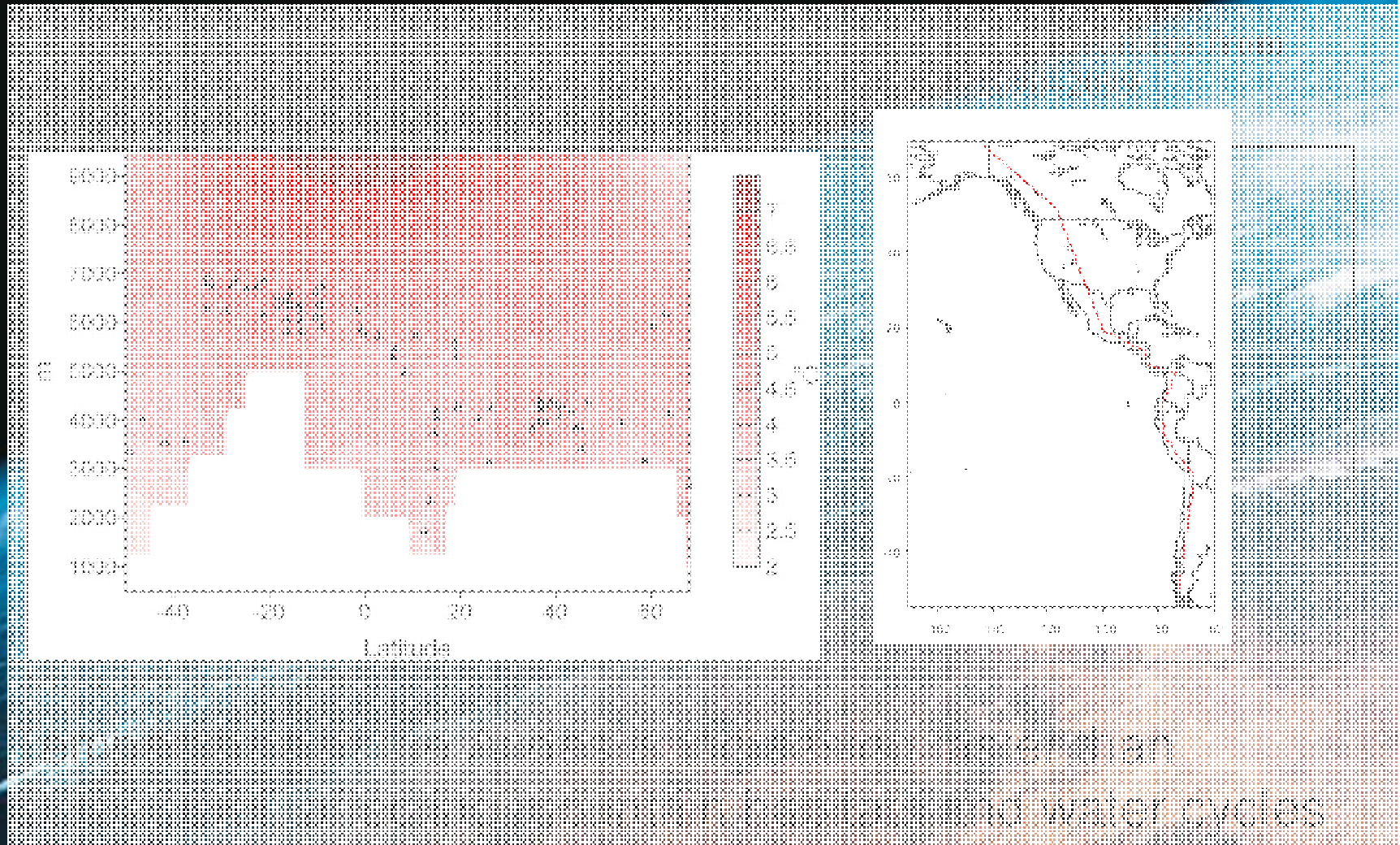
# Adaptation = Good Development

Adaptation = the adjustment of local conditions and projected impacts, to moderate or avoid adverse effects of climate change.

# Current status of portfolio



# Expected climate change impacts in the region



Source: Bradley, Vuille and Vergara, 2006

# Are environmental conditions changing in the Andes?

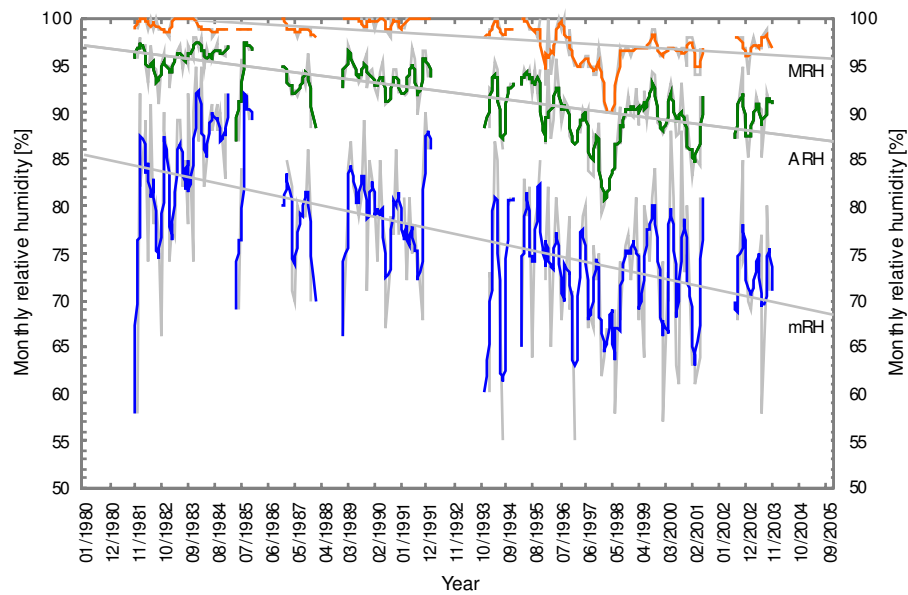
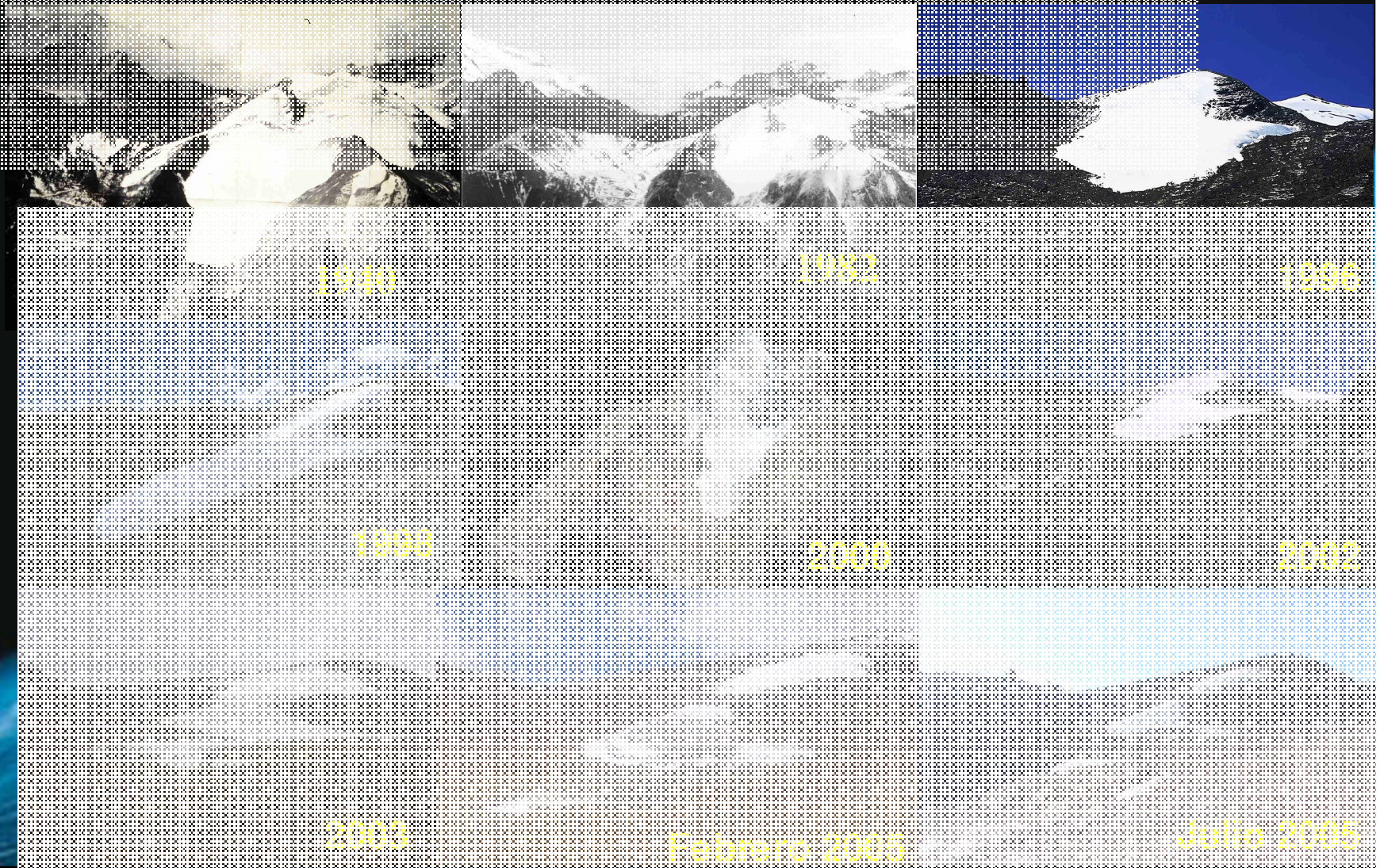


Figure 4. High altitude water body in the headwaters of Santa Barbara and Las Juntas creeks, Claro river, 'Los Nevados' Natural Park, Andean central mountain range, Colombia. Picture on the left was taken in September, 2005; picture on the right, only two years later.

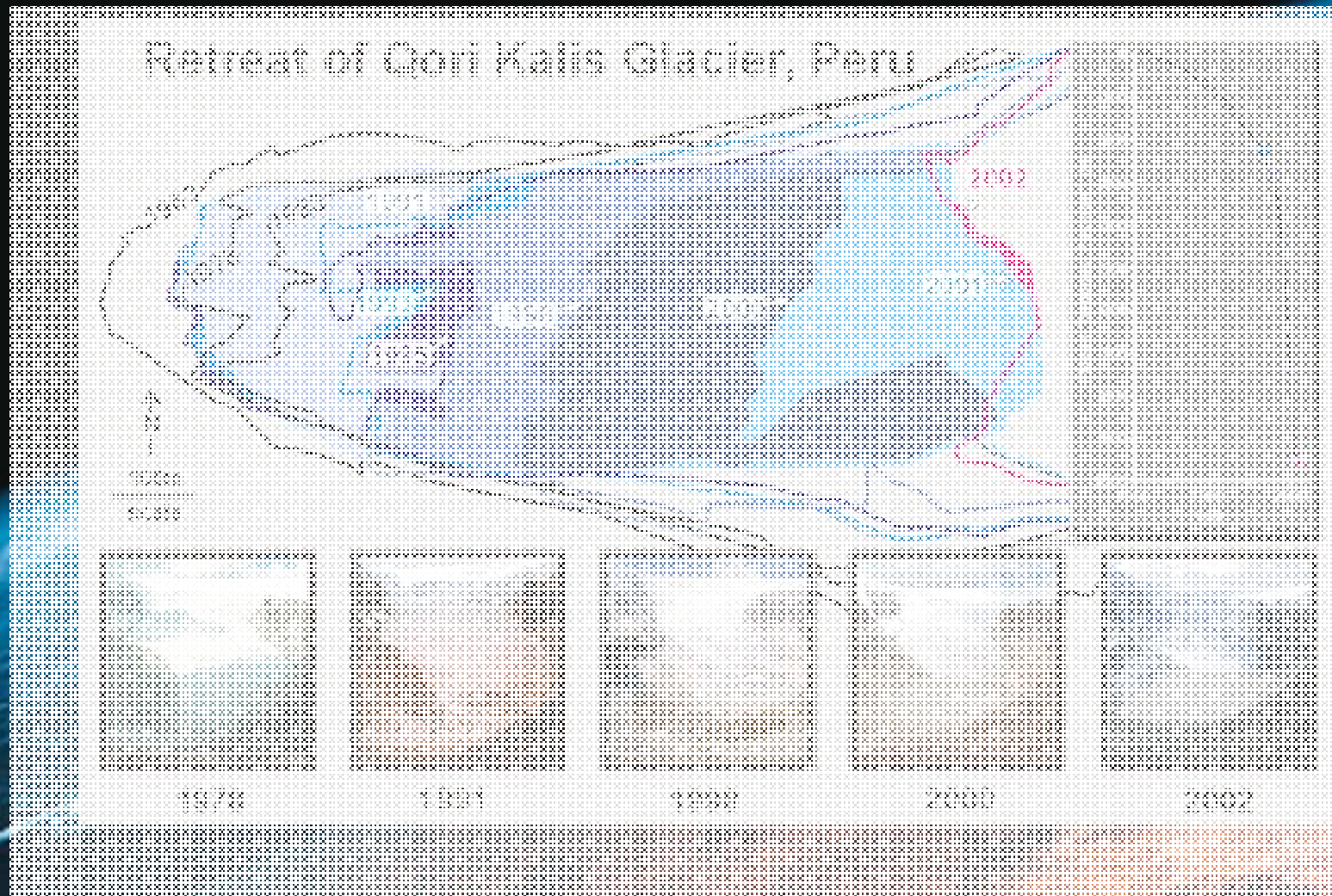


# The fate of the Chacaltaya Glacier, many times repeated in the Andes



As a result, considerable mass loss occurred on the majority of glaciers and ice caps worldwide (Figure 2.6) with increasing rates: from 1960/1961 to 1989/1990 the loss was  $136 \pm 57$  Gt/yr ( $0.37 \pm 0.16$  mm/yr sea level equivalent, SLE), between 1990/1991 and 2003/2004  $280 \pm 79$  Gt/yr ( $0.77 \pm 0.22$  mm/yr SLE). The widespread 20th century shrinkage appears to imply widespread warming as the primary cause although in the tropics changes in atmospheric moisture might be contributing. There is evidence that this melting has *likely* contributed to sea-level rise. [WGI 4.5, 9.5 Table 4.4]

Since 1970, glaciers in the Andes (Colombia, Ecuador, Peru, Bolivia, Chile, Argentina) have lost 20% of volume with serious immediate implications for water and power supply in the region



(Source: Thompson, 2005)

# Glacier retreat trends

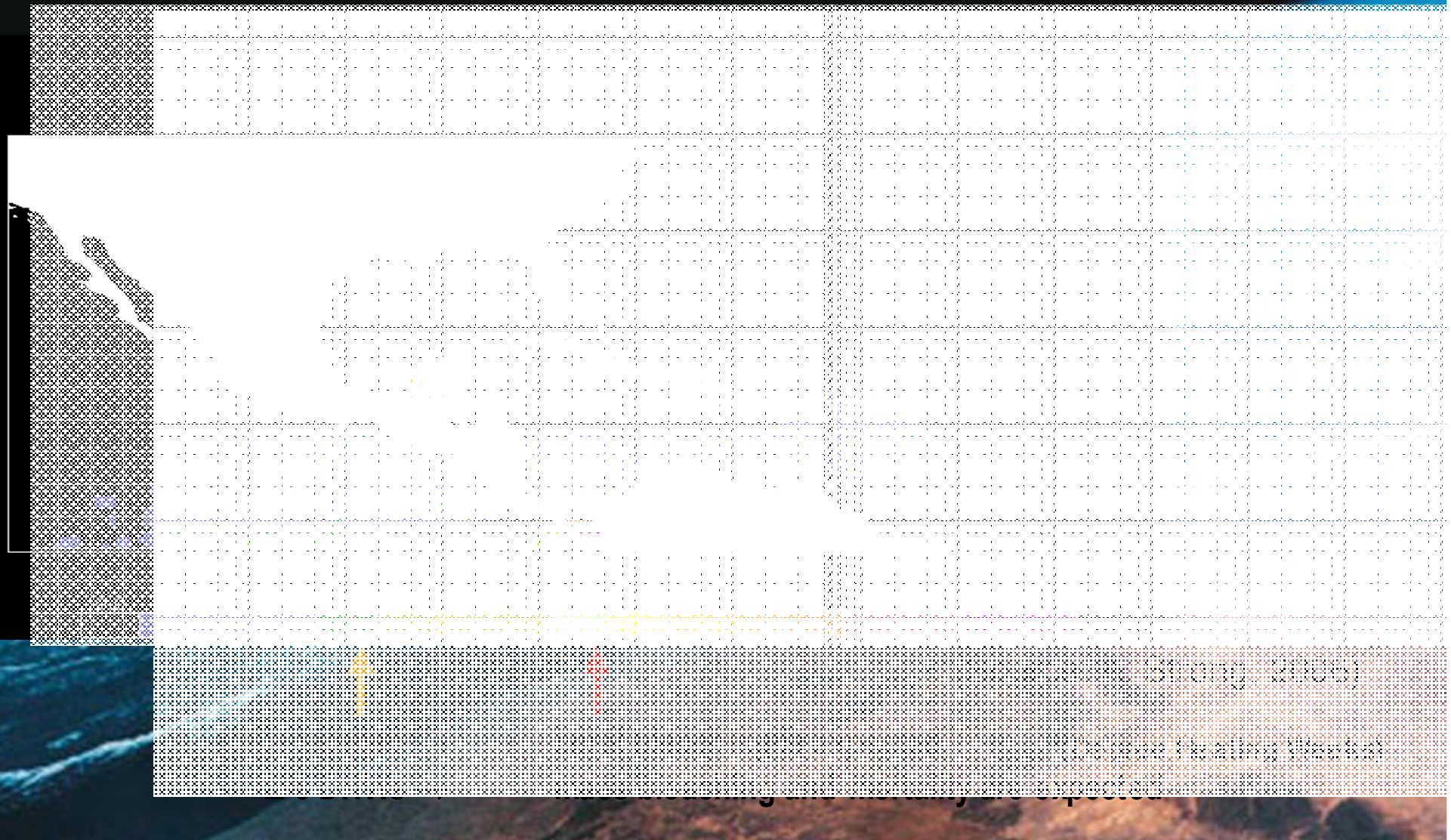
(IPCC, technical paper on climate change and water, 2008)

## Glacier retreat trends (Went and Cook)

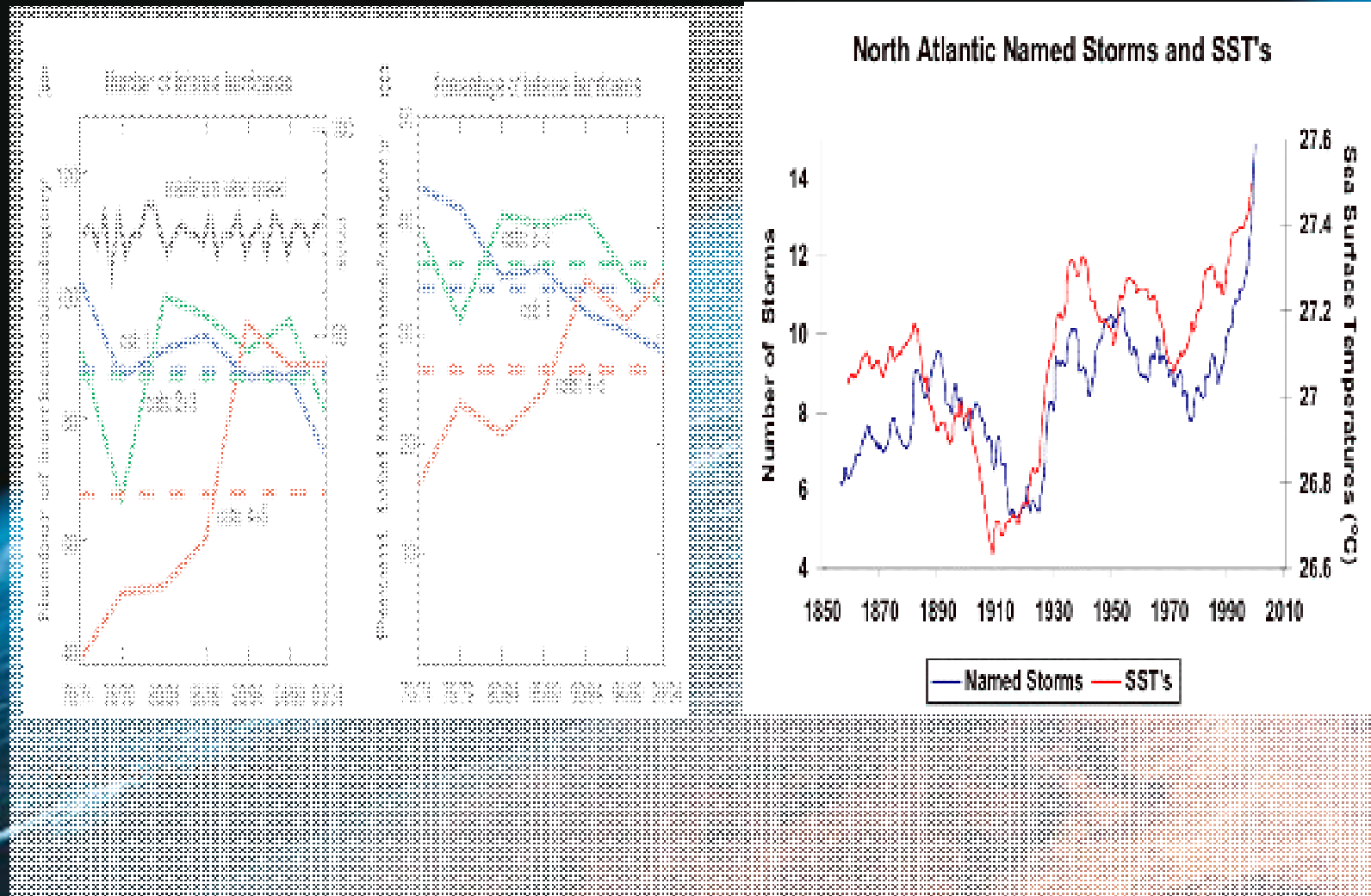
Glaciers/Period	Changes/Impacts
Peru <sup>a,b</sup> last 35 years	22% reduction in glacier total area (cf. Figure 5.9); reduction of 12% in freshwater in the coastal zone (where 80% of the country's population live). Estimated water loss almost $7,000 \times 10^6 \text{ m}^3$
Peru <sup>c</sup> last 30 years	Reduction up to 60% of glacier surface from very small glaciers; loss of $188 \times 10^6 \text{ m}^3$ in water reserves during the last 30 years.
Colombia <sup>d</sup> 1990–2000	82% reduction in glaciers; under the current climate trends, Colombia's glaciers are expected to disappear completely within the next 100 years.
Ecuador <sup>e</sup> 1956–1998	There has been a gradual decline in glacier length, reduction of water supply for irrigation, clean water supply for the city of Cuito.
Bolivia <sup>f</sup> since mid-1990s	Projected glacier shrinkage in Bolivia indicates adverse consequences for water supply and hydropower generation for the city of La Paz. Also see Box 5.5.

# 2005 Coral bleaching event in the Caribbean

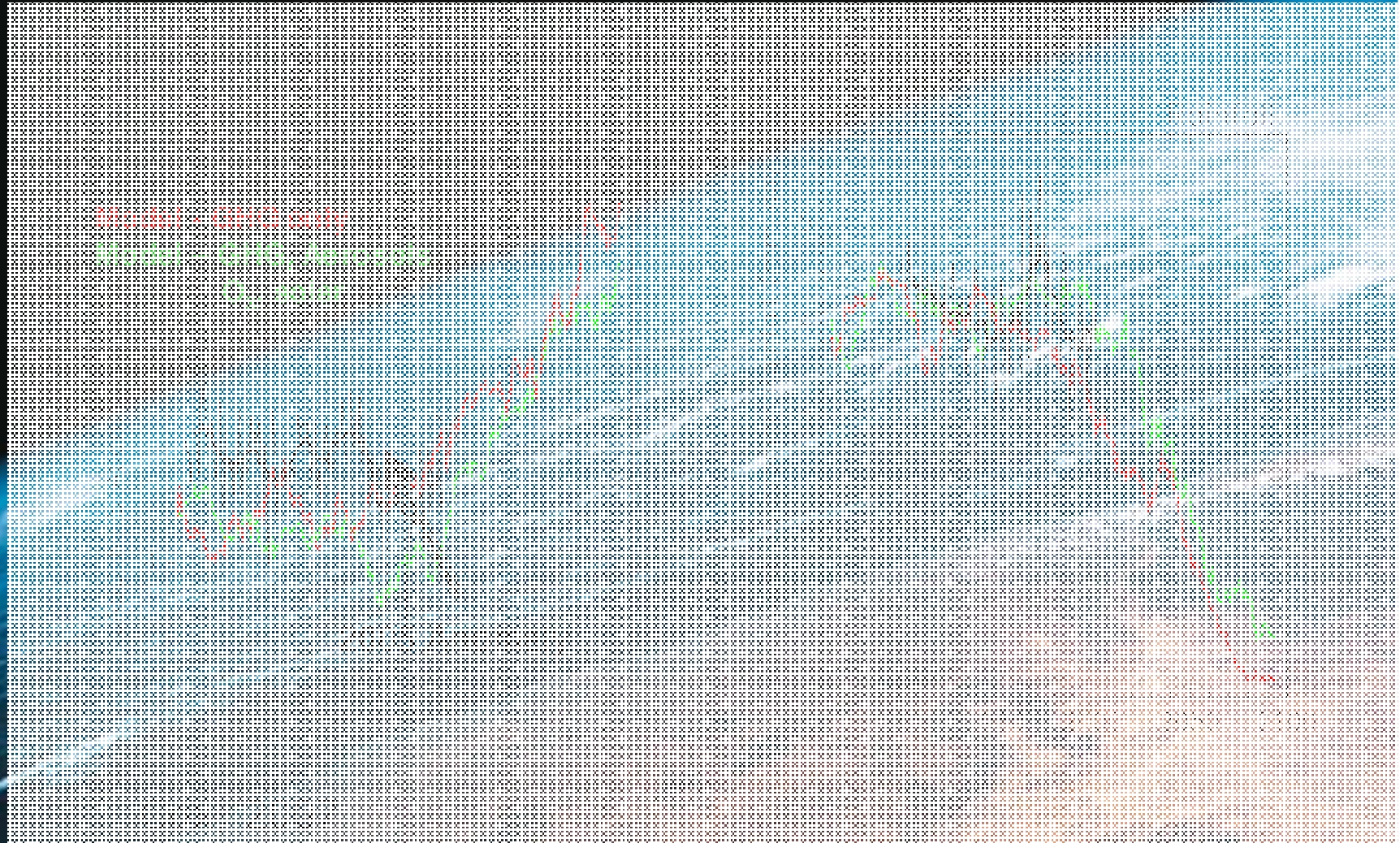
Since the 1980s, corals in the Caribbean have experienced unprecedented mortality with anticipated lasting impacts on fisheries and tourism (2005 event)



# Hurricane intensity has steadily increased since the 1970s in tandem with sea surface temperature



# Projected drop in rainfall over western Amazonia as a result of increase in SST index

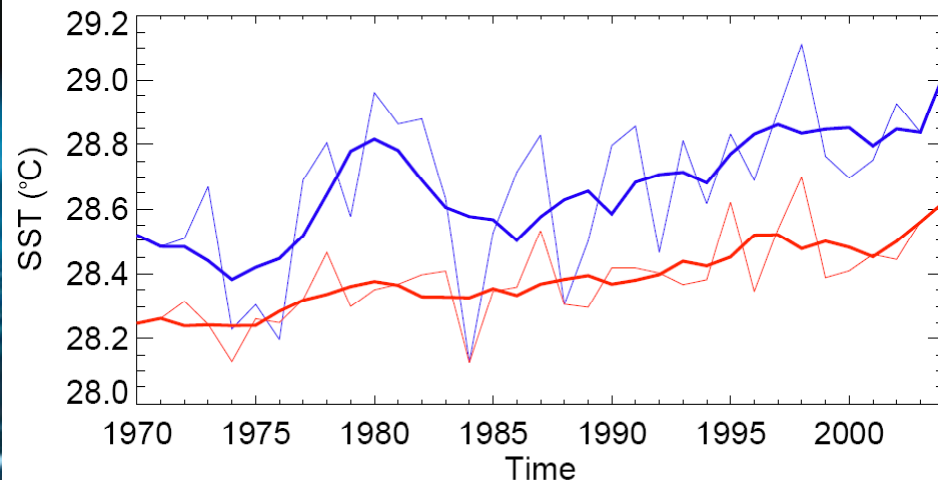
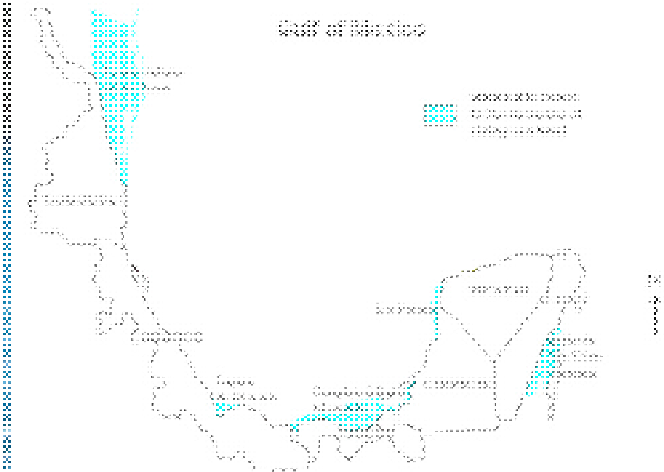


# The Gulf Coast of Mexico is very vulnerable to sea level rise and increased sea surface temperature.

Global mean sea level rising with *high confidence* that the rate of rise has increased between the mid-19th and

the mid-20th centuries. The average rate was  $1.7 \pm 0.5$  mm/yr for the 20th century,  $1.8 \pm 0.5$  mm/yr for 1961–2003, and  $3.1 \pm 0.7$  mm/yr for 1993–2003.

Bates, B.C., Z.W. Kundzewicz, P. Wu and J.P. Palutikof, Eds. 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.



# Adaptation measures in coastal zones of the West Indies (SPA US\$ 2.1 m, total US\$7 m)



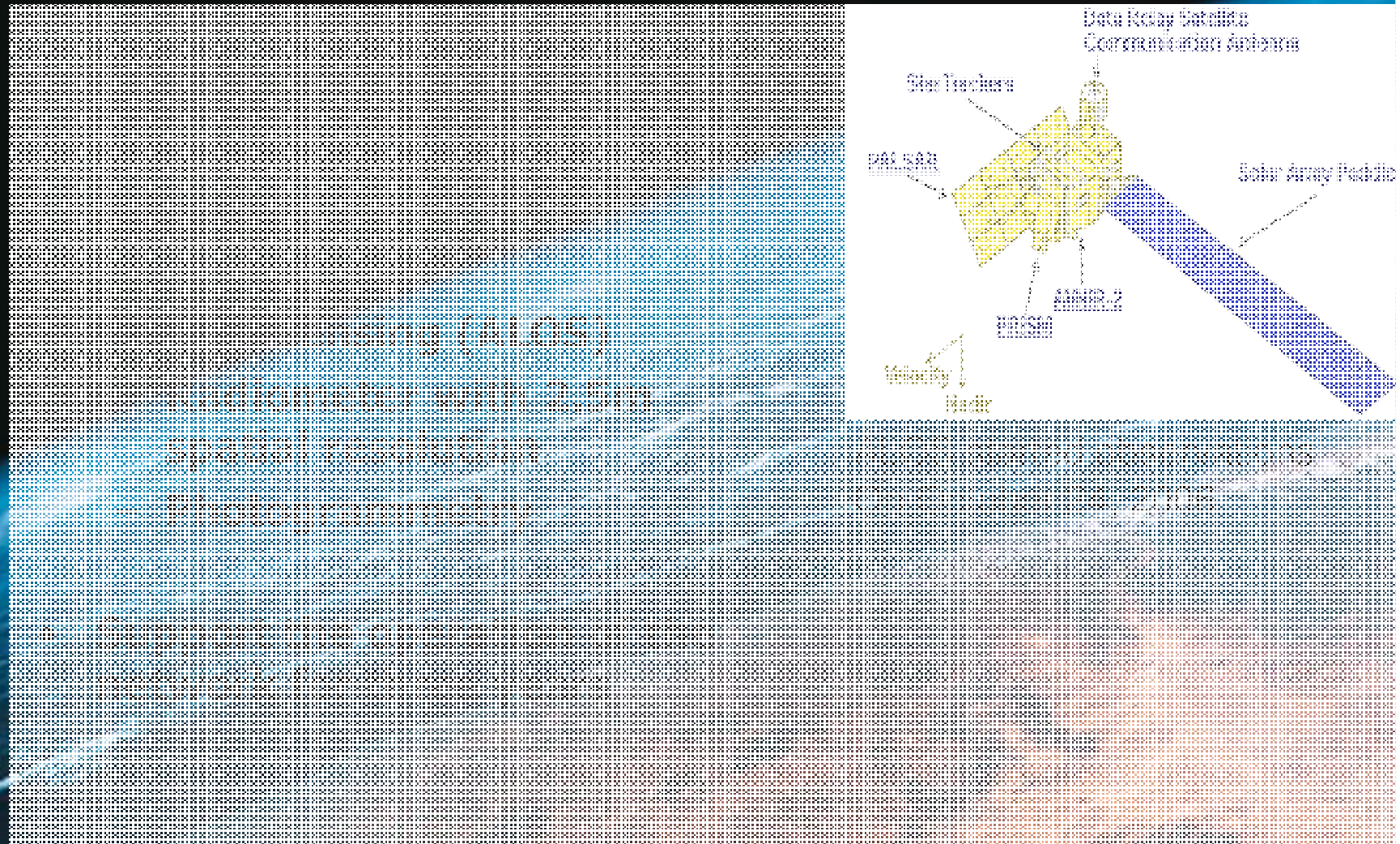
# Colombia: Integrated National Adaptation Plan (SPA US\$ 5.4 m; total US\$15 m)



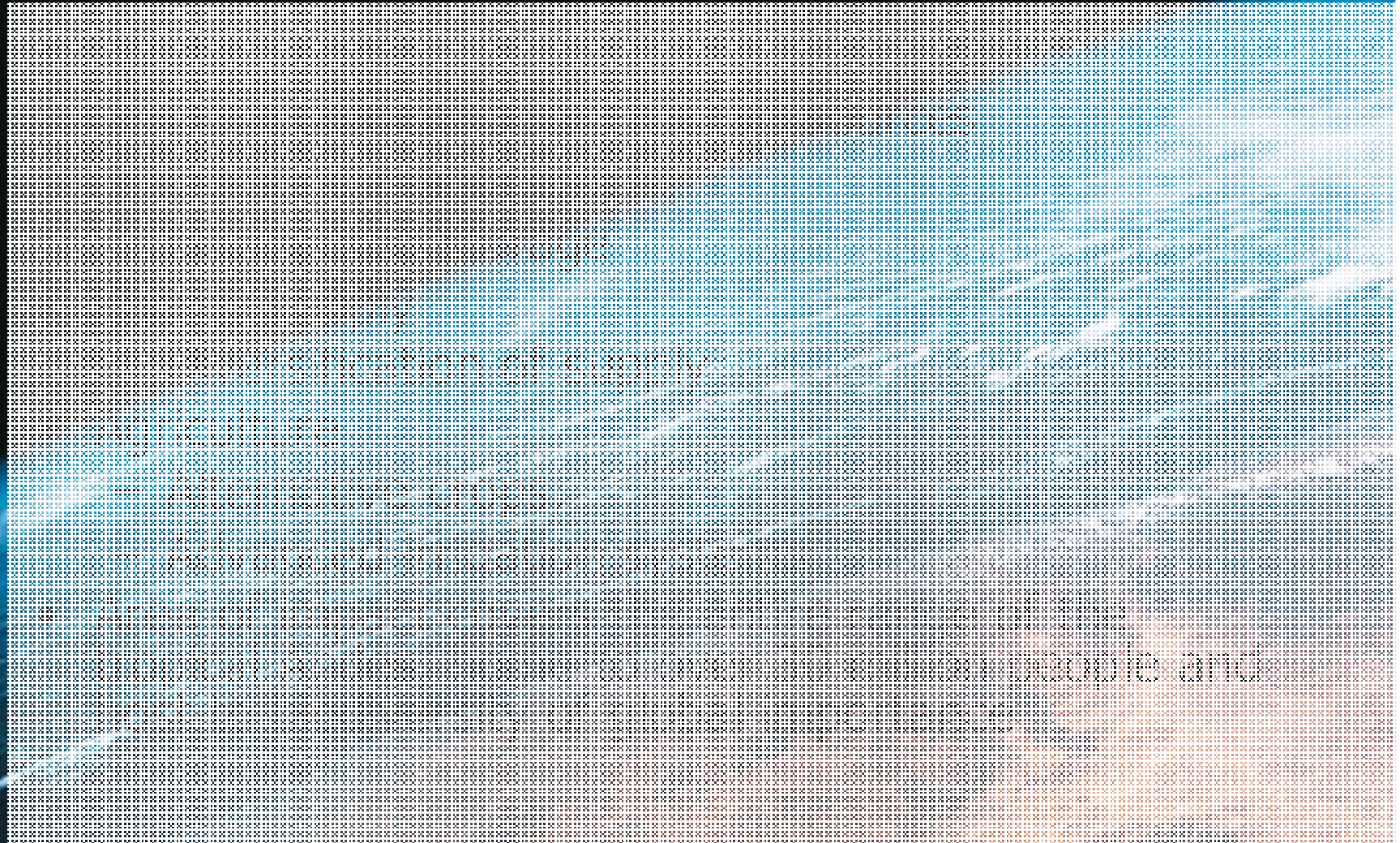
# Characterize climate impacts in moorlands (US\$0.4 m CCIG)



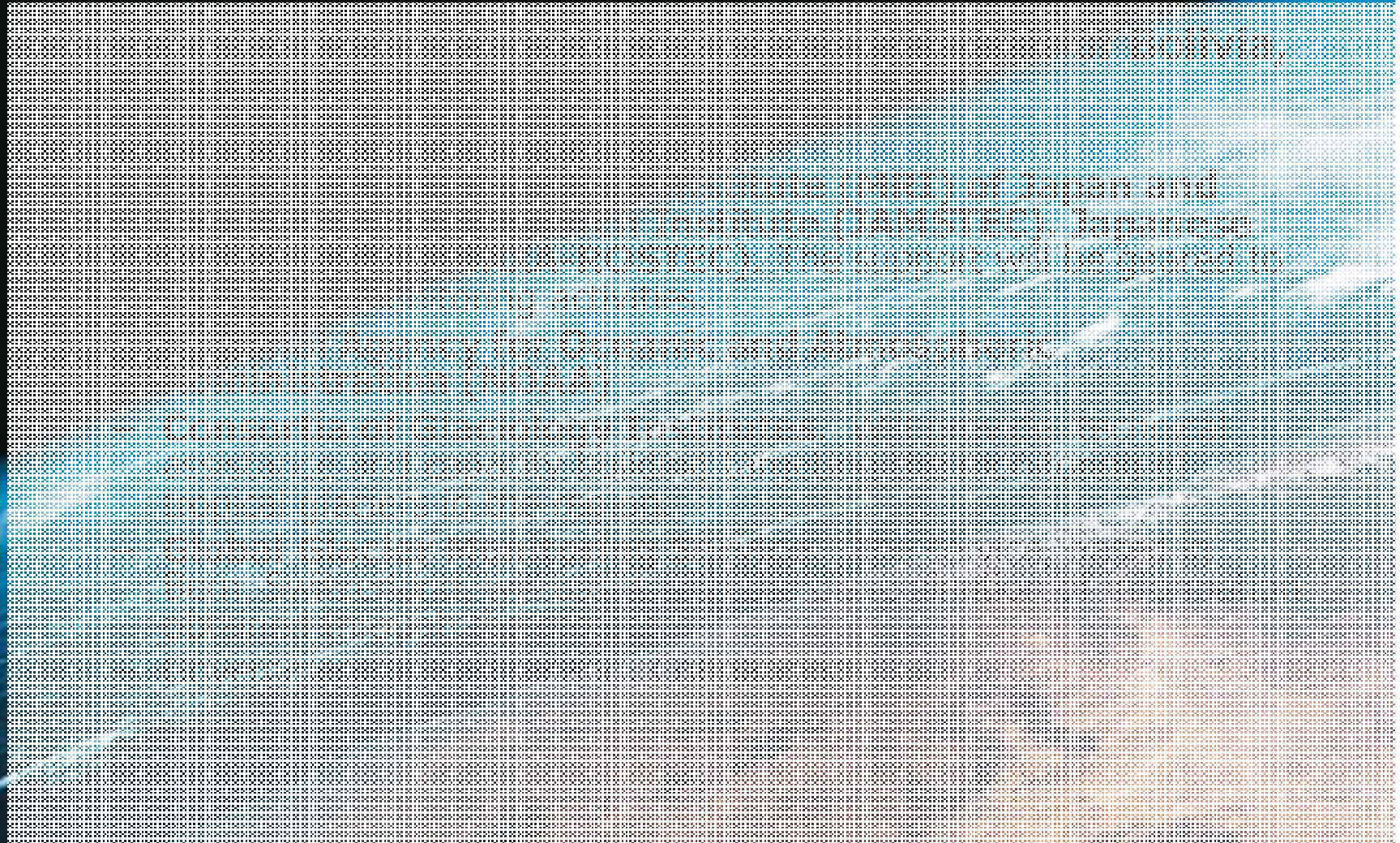
# Monitoring of glaciers and associated moorlands (US\$0.8 m, CCIG)



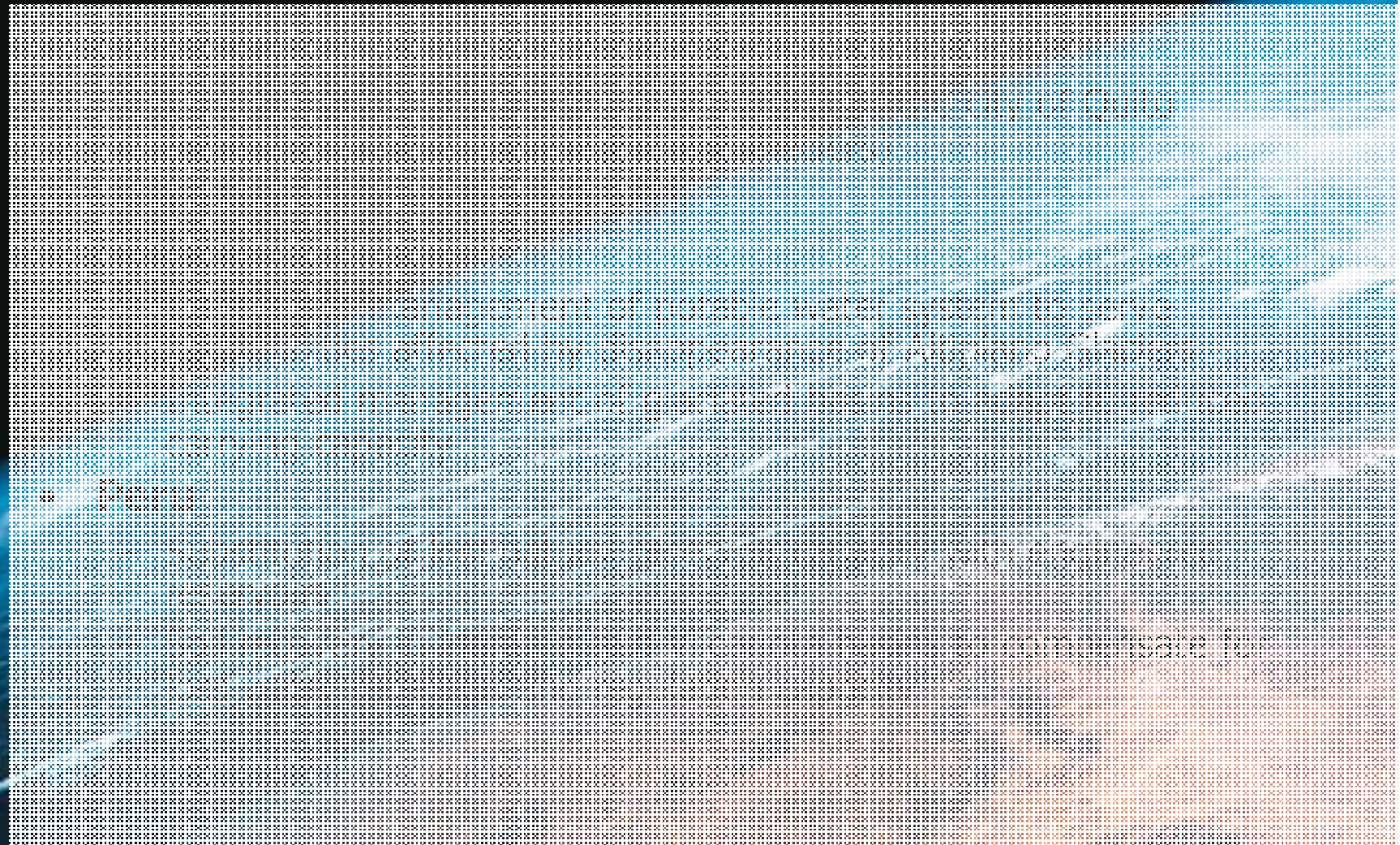
**Adaptation to climate impacts in glacierized  
basins (Bolivia, Ecuador Peru)**  
– SCCF US\$ 7.49m, US\$33 m



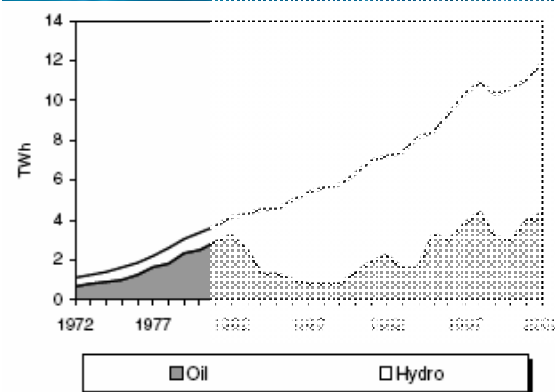
# Institutional framework



## Cont.. main interventions



# Economic and social costs of the destruction of tropical glaciers



# Mexico: Gulf Coast Wetlands

- **Wetlands provide environmental goods and services and perform very important environmental functions** that are critical for economic activity and civil protection in a wide region of the country.
- **The wetlands of the Gulf of Mexico identified** by the National Institute of Ecology (INE) **as the most critical and threatened ecosystem by the effects of climate change** (vulnerable to sea level rise, intensifying hurricanes, fluctuations in water regimes and storm surges).



# Mexico: Gulf Coast Wetlands

SCCF US\$4.5 m, total \$25 m

## Objective:

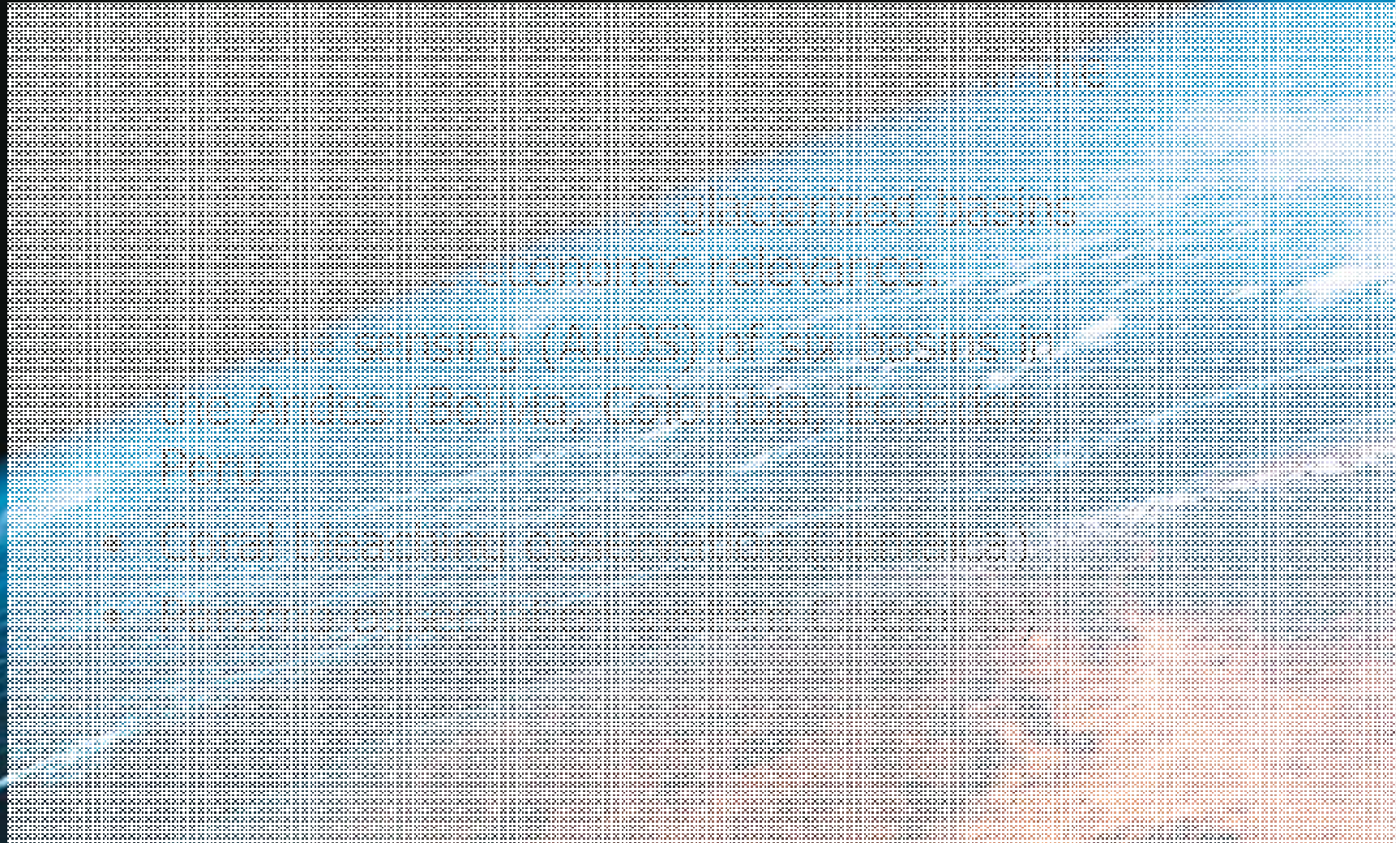
- Reducing the vulnerability with a focus on inland basins and wetlands.
- Improve national policies to address the impacts
- Assess climate impact on national water budget assessment
- Address impacts from subsidence and salination on the Gulf Coast of Mexico:
  - Restoration of natural surface drainage
  - Rationalization of water use
  - Regeneration of soil cover
  - New set asides



# Convey information on climate into the development process



# Support of long-term climate observation systems.



# Concluding remarks

• The  
• 1990s

• The 1990s were characterized by a general trend of  
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