

# IMPACTS OF SHORT AND LONG TERM WEATHER EVENTS ON COASTAL ENVIRONMENTS

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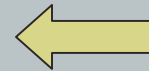
# WEATHER EVENTS

- **Short Term**
  - Summer/Winter – every year
- **Long Term**
  - La Niña/El Niño – every 3 to 7 years
  - Dry/Wet – every 18 to 45 years
  - Global Warming – centuries to millennia



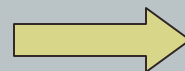
# BEACHES

- Waves are small
- Long period
- No rain
- WIDE BEACHES



SUMMER

- Waves are big
- Short period
- Some rain
- NARROW BEACHES



WINTER

# LAGOONS

- Salinity high
- Oxygen low
- Temperature high
- Algae growth
- HIGH STRESS IF CLOSED



SUMMER

- Salinity low
- Oxygen high
- Temperature low
- Limited algae
- HEALTHY

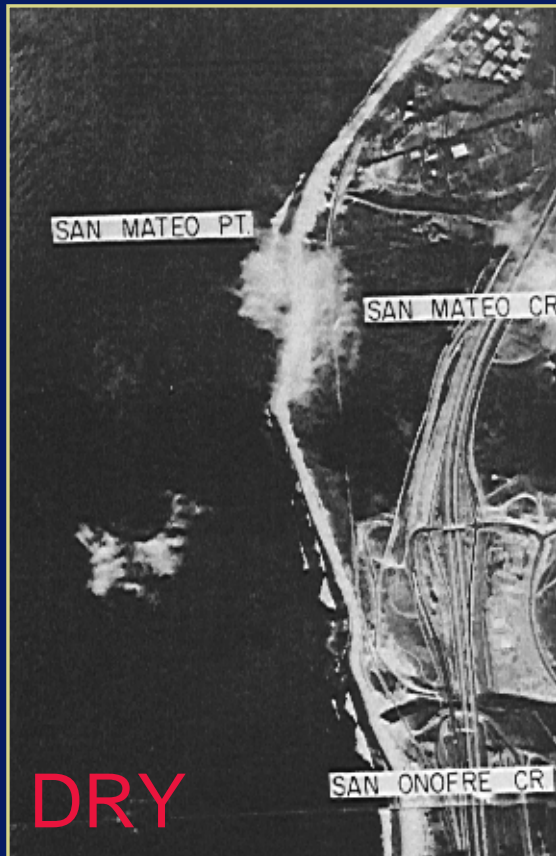


WINTER

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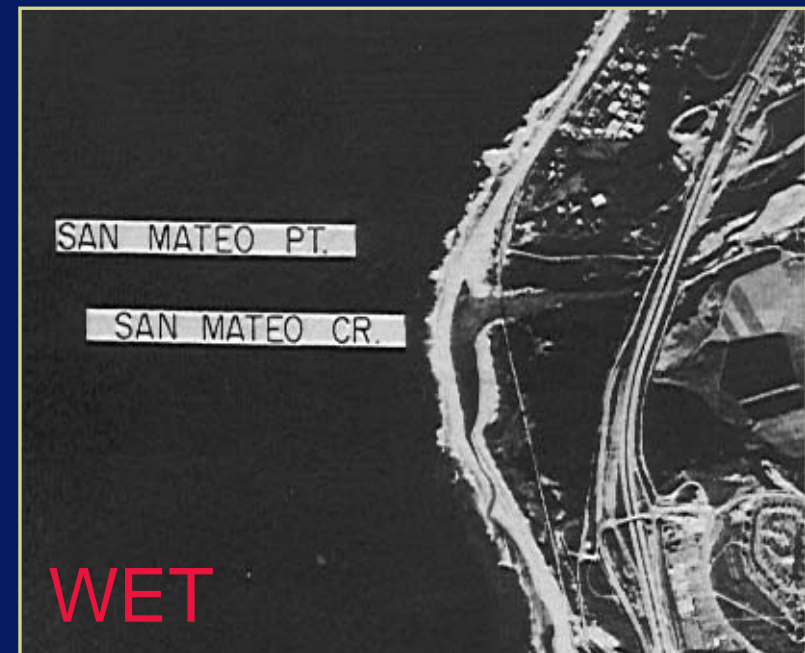
# BEACHES



- Reduced sand supply
- Long term erosion



- Increased sand supply
- Long term accretion



# SAN DIEGUITO LAGOON



**(1946-1978) Lagoon  
Closed 70% of the Time**



**(1978-1998) Lagoon  
Open 70% of the Time**



# MAINTENANCE NECESSARY TO OPEN SMALL LAGOON INLETS DURING DRY PERIODS



← BEFORE

AFTER →





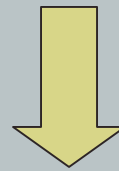
# BEACHES

- **LA NIÑA**

- Smaller waves
- Weak longshore transport
- Decreased rainfall
- BEACH STABLE

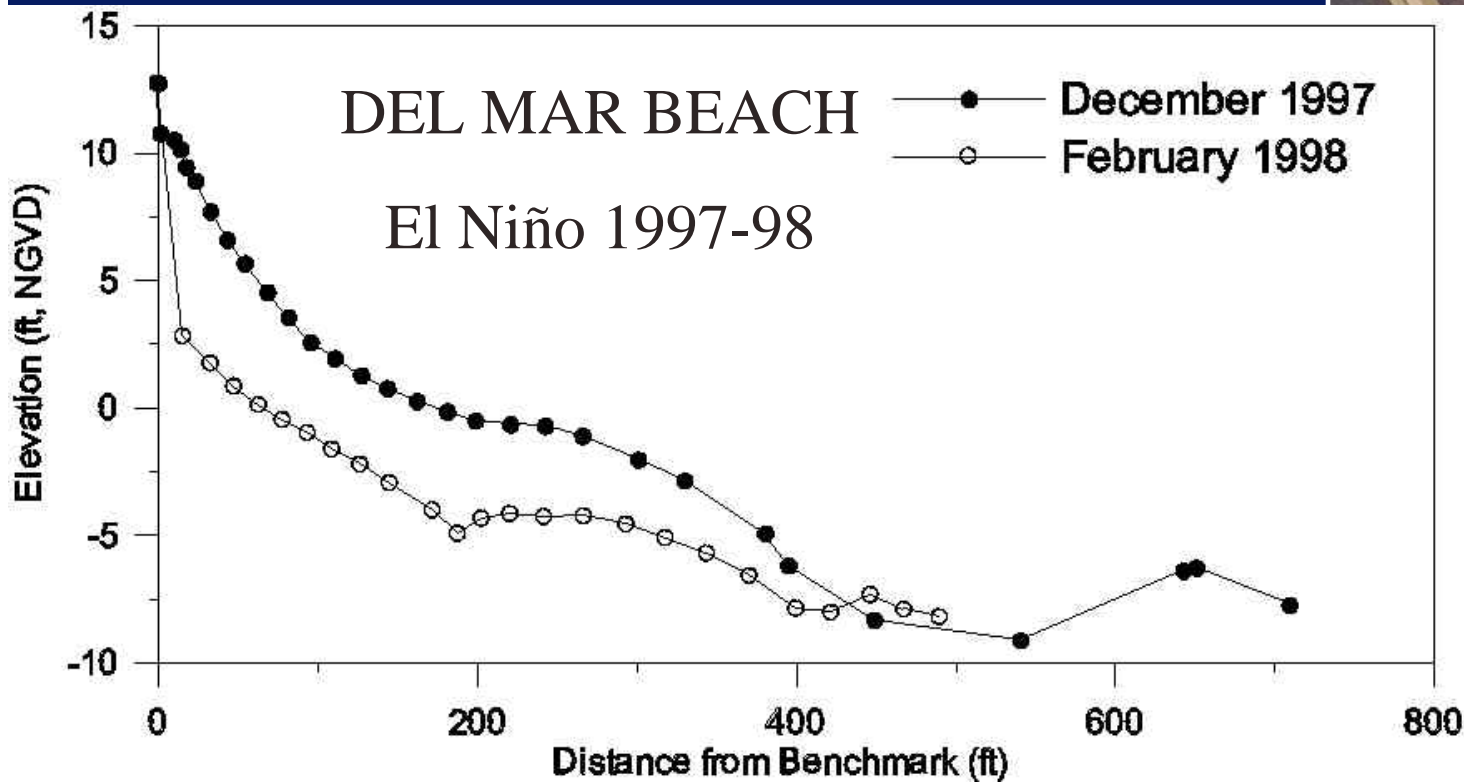
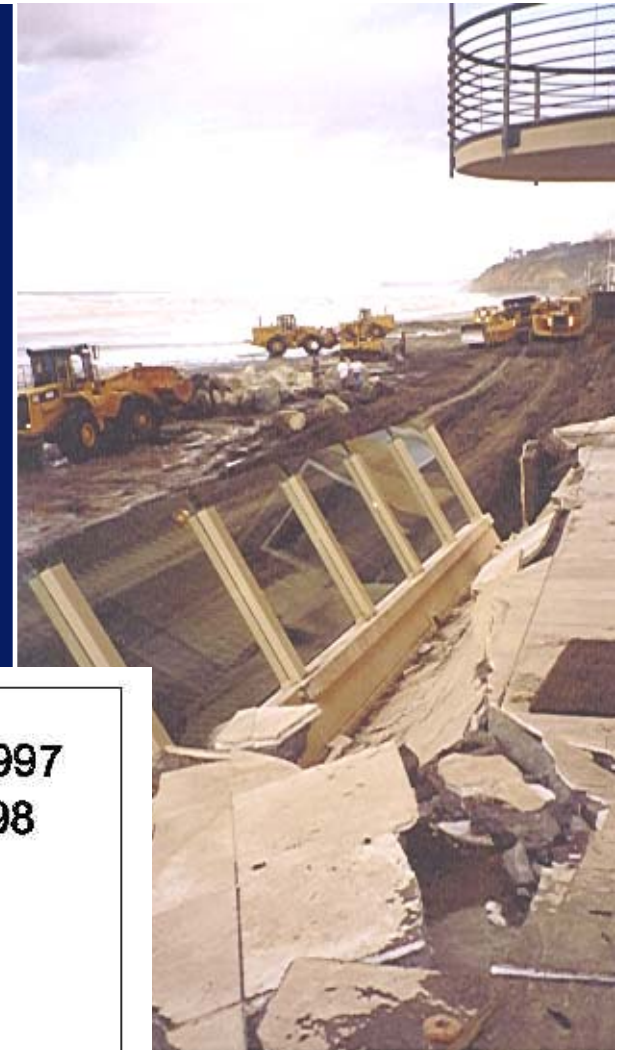
- **EL NIÑO**

- Big waves
- Strong, balanced longshore transport
- Increased rainfall
- BEACH ERODES



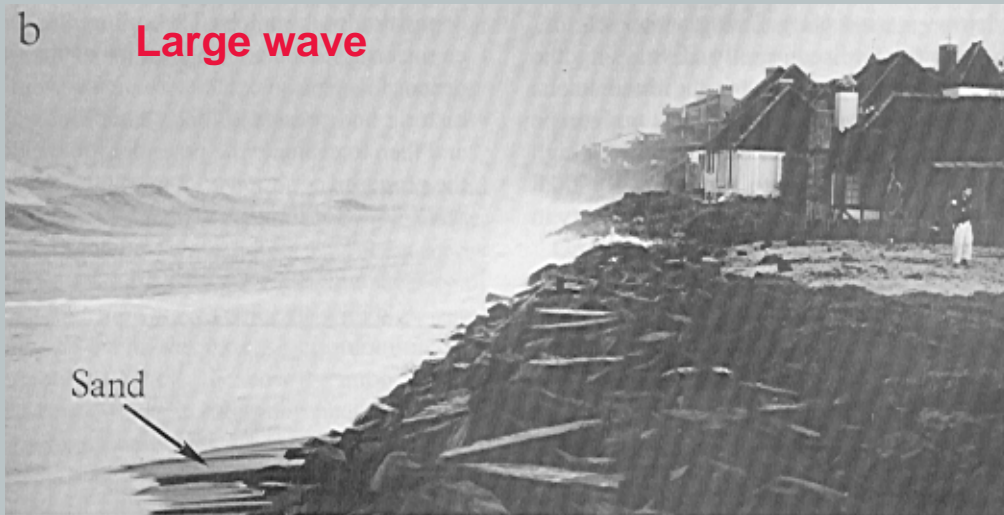
- COASTAL PROPERTY AT RISK





# WAVE POWER

## San Malo Beach (27Jan83)



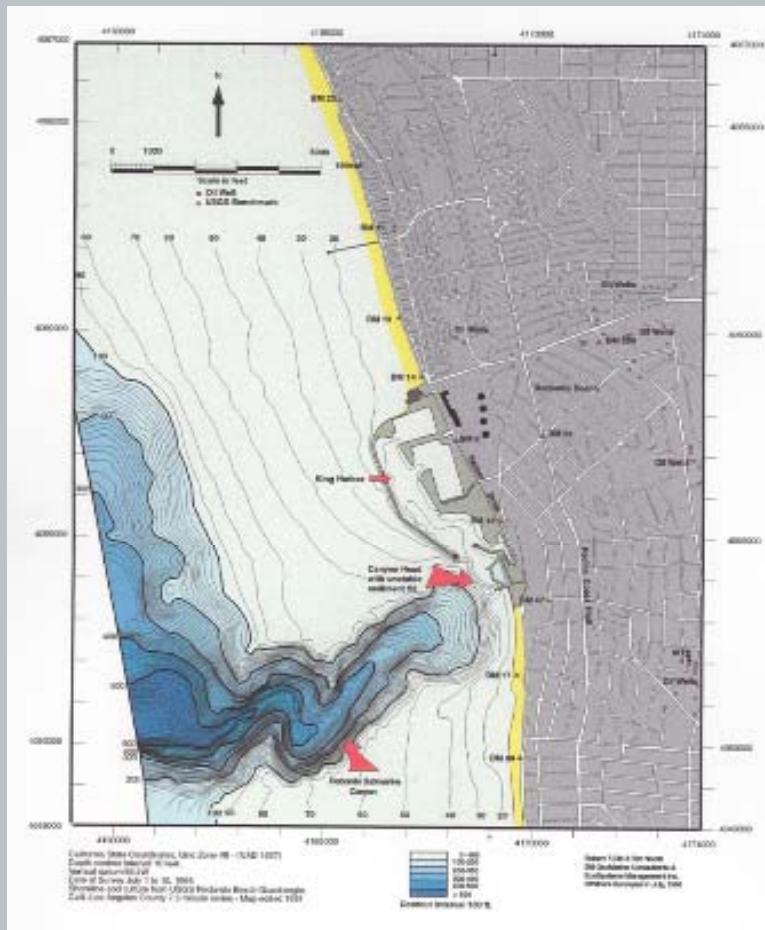
- Underestimated the power of the waves



From Inman & Jenkins (1989)

# WAVE POWER

## King Harbor (17-18 Jan88)



# COMBINED EVENTS

## Higher Risk of Damage

- **CLUSTER OF STORM WAVES (1982-83)**
- **STORM WAVES AT HIGH TIDE ELEVATION**
- **WAVES AND BOTTOM BATHYMETRY (King Harbor 1988)**
- **RAINFALL AND EARTHQUAKE**



# CONCLUSIONS AND RECOMMENDATIONS

- CHANGES IN WAVE CLIMATE DUE TO WEATHER CYCLES ARE EXPECTED
- LONG TERM EVENTS ARE MORE EXTREME THAN SEASONAL CYCLES
- LONG TERM MONITORING IS ESSENTIAL
- THERE ARE NEEDS TO DEVELOP NUMERICAL PREDICTION TECHNIQUES, RISK ANALYSIS MODELS, AND PROBABILISTIC DESIGN METHODS

