Coastal Impacts of an El Niño Season

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EL NIÑO AND THE COAST

The last major El Niño event to affect the West Coast (1982/83) was accompanied by several different forms of coastal impacts. One of the more spectacular impacts were huge waves spawned by enormous Pacific storms. There also was a local elevation in sea level (caused by the thermal expansion of warm water associated with the passage of El Niño events) of up to 0.5 meter which lasted for several months. The combination of elevated sea level and storm waves can result in extensive coastal erosion. The third form of coastal impact, high rainfall events, caused landslides and coastal flooding.

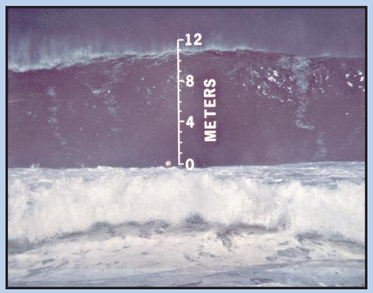
All indications for the coming winter suggest a very strong El Niño event is in the making. However, it is very difficult to predict exactly where the greatest storm impact will occur. Storm tracks are guided by the position of atmospheric high and low pressure cells, which in turn are related to complex phenomena such as the jet stream. Scientists have recognized the strong signals of the present El Niño, but at present they cannot accurately predict the area of maximum impact.

The present El Niño is already having a major impact on other parts of the world. In areas of the equatorial Pacific, normally strong tradewinds have been unusually weak and many island nations are facing severe drought. For example, over 300,000 tribespeople in Papua New Guinea are threatened by extended food shortages caused by 5 months of little or no rain. On the other side of the Pacific, in central Chile, recent rainfall in a four day period was more than 10 times the amount normally received in an entire year.

SEA LEVEL

Storm overwash at Rio Del Mar Beach in Monterey Bay as a result of elevated sea level from the 1982 El Niño and large storm waves.

STORMS



Photograph with superimposed scale of an exceptional 11+m wave on the beach at Fort Ord in Monterey Bay. The orange buoy in the wave trough is 0.5 m in diameter. This was the first of a number of big wave events in the winter of 1982.

FLOODING

Aerial photograph of the mouth of Soquel Creek at Capitola Village in Monterey Bay showing sediment-laden floodwater (brown water) and an eroded beach. January, 1982

LARGE WAVES

View of the cement ship and pier at Seacliff Beach in Monterey Bay during typical non-storm (summer) conditions.

Ocean waves are created by wind blowing over the surface of the ocean. Wave size increases with increasing wind speed and fetch, the distance over which the wind blows.

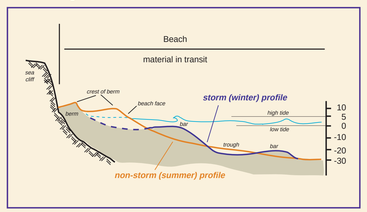
Every winter, storms in the Pacific Ocean create large waves that attack the west coast. During El Niño winters, Pacific Ocean storms are often more intense and frequent, thereby increasing the amount of wave attack along our shores.

The El Niño winter of 1982 was particularly devastating along the California coast with a number of intense storms wreaking havoc on beaches and coastal properties.

View of the cement ship during an El Niño winter storm (1982).

BEACH LOSS AND COASTAL EROSION

Sand beaches are natural accumulations of sediment primarily derived from the breakdown of rocks and carried to the coast by rivers.



Beaches respond to changes in the wave climate. During the summer when wave energy is usually low, the beach is broad with a gentle slope. When wave energy is high, such as during winter storms, sand is eroded from the beach often resulting in a narrow and steep beach. Sand removed from the beach is deposited offshore as part of a natural process to dissipate incoming wave energy. Therefore, the beach acts as a natural buffer to protect the coast from erosion.

During severe storms when the beach is eroded, the bordering coastal cliffs and property are subject to direct wave attack often leading to coastal erosion (the loss of coastal land).

El Niño storm waves crashing near the base of sea cliffs after the protecting beach has been eroded. The houses are built over beach-sand deposits which are periodically inundated during intense storms. South of New Brighton State Beach in Monterey Bay.

Emergency rip-rap being emplaced to protect houses threatened by coastal erosion during an El Niño storm. North of the mouth of the Pajaro River, Monterey Bay.

LANDSLIDES AND FLOODING

El Niño winter storms along the west coast are often accompanied by extreme rainfall events. For example, in January 1982 the San Francisco Bay region was struck by a severe rainstorm that generated widespread disaster. Up to 25 inches of rain fell in 32 hours, creating numerous landslides and widespread flooding resulting in nearly $300 million in property damage and the loss of 33 lives. When high rainfall events are accompanied by large waves, coastal flooding is common—especially at high tide. One benefit the coast derives from landslides and flooding is the introduction of sediment to the littoral zone for later beach building episodes.

During the January 1982 storm landslides were common features in the Santa Cruz Mountains.

Sediment-choked stream during the January 1982 flood. Stream channels deepen and widen during floods resulting in erosion of the stream banks. (Aptos Creek, Monterey Bay).

Sediment deposited at stream mouths provides material for later episodes of natural beach construction.