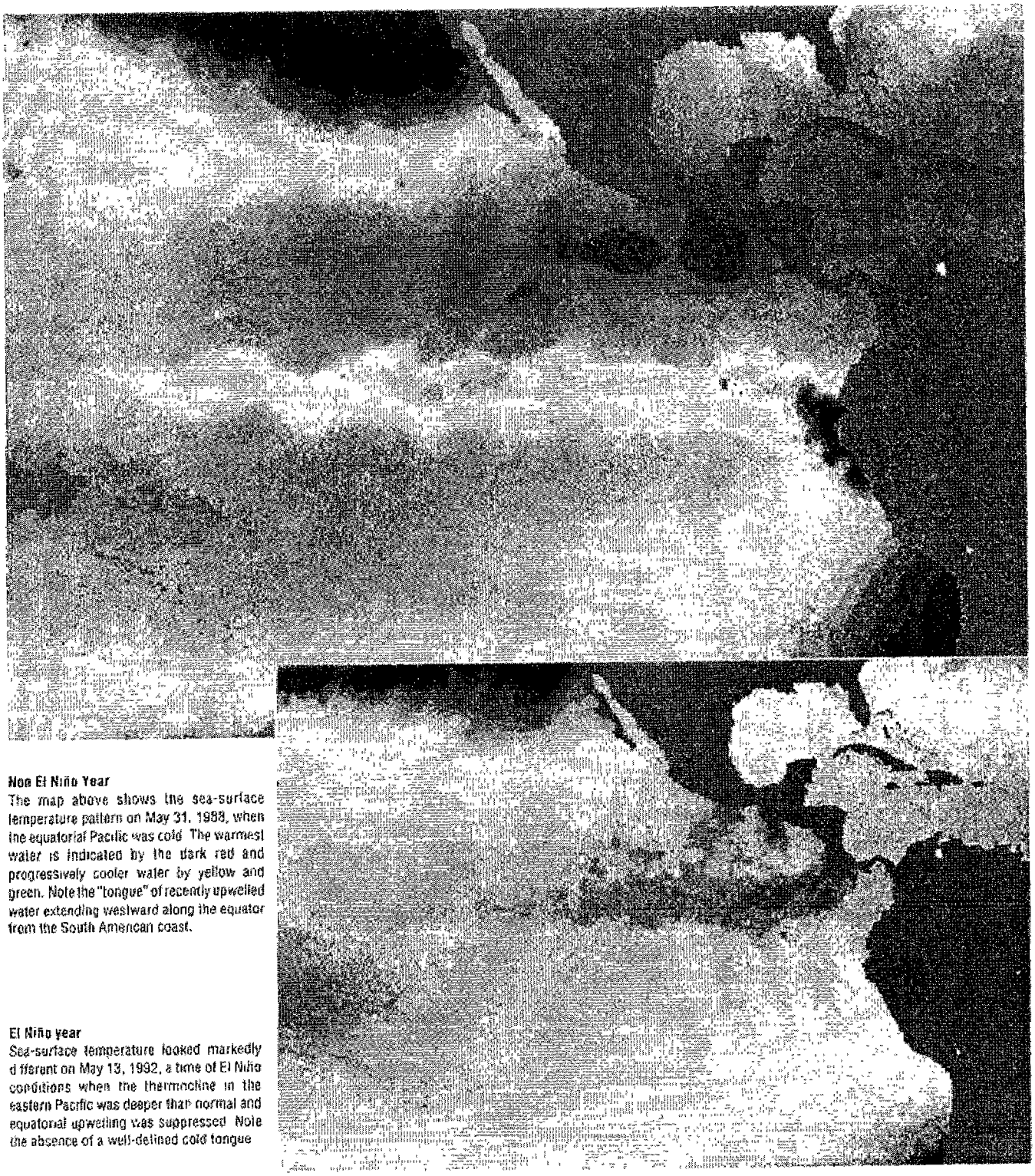
It was not until the advent of satellite imagery that scientists began to comprehend the broad scope of El Niño.



Non El Niño Year
The map above shows the sea-surface temperature pattern on May 31, 1988, when the equatorial Pacific was cold. The warmest water is indicated by the dark red and progressively cooler water by yellow and green. Note the "tongue" of recently upwelled water extending westward along the equator from the South American coast.

El Niño year
Sea-surface temperature looked markedly different on May 13, 1992, a time of El Niño conditions when the thermocline in the eastern Pacific was deeper than normal and equatorial upwelling was suppressed. Note the absence of a well-defined cold tongue.

• the cold tongue in sea-surface temperature weakens or disappears, as in the bottom figure on p. 15.

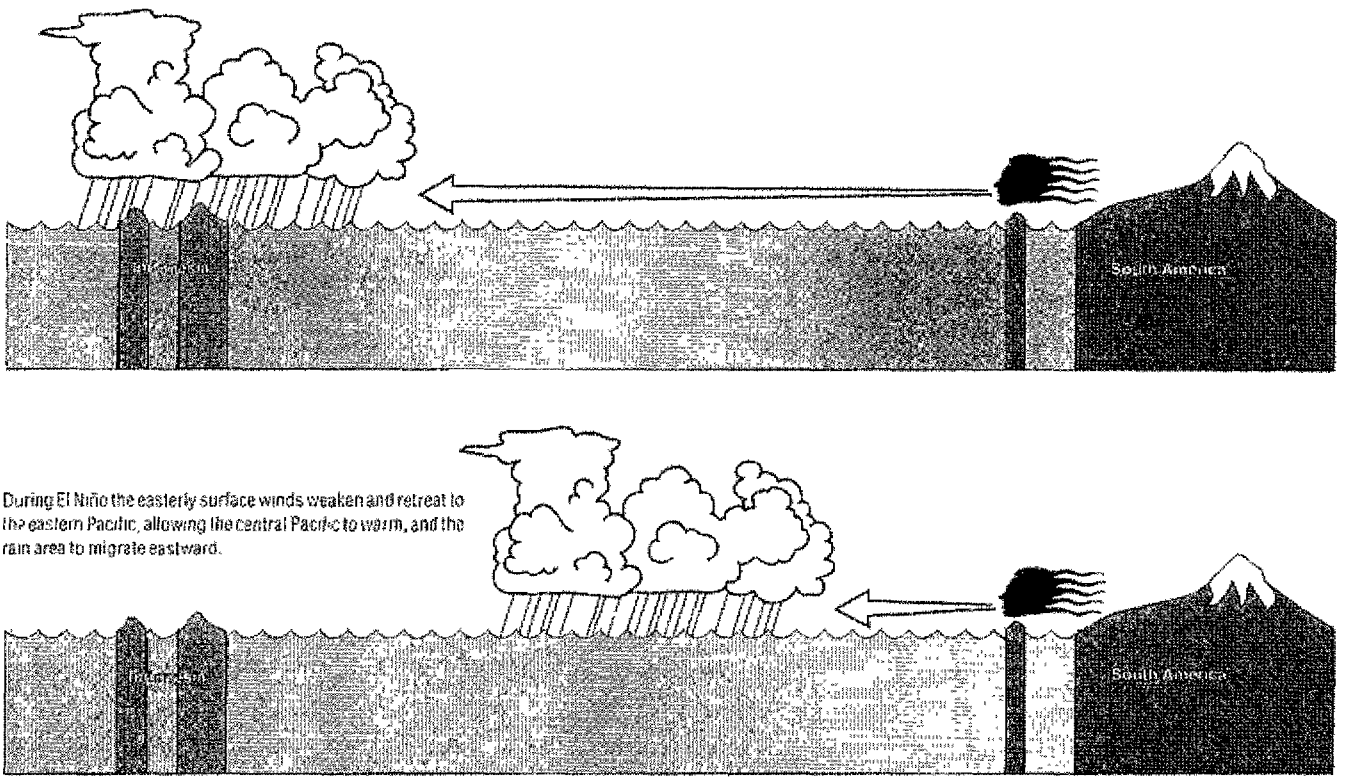
• sea level flattens out, dropping in the west and rising in the east. Surface water surges eastward along the equator.

When this impulse of relatively warm water reaches the eastern end of the basin, typically a few months later, it is forced to turn northward and southward along the coast, causing sardines and other species of fish to move and raising sea level as it goes. These effects have been felt as far north as Canada and as far south as central Chile.

How the Sea Affects the Winds

The oceans and the atmosphere carry on a continuous dialogue. Each listens to what the other is saying and responds. Up to now we have eavesdropped on one side of that conversation: how the winds along the equator influence the slope of the thermocline and the intensity of the upwelling. But the resulting changes in sea-surface temperature will, in turn, have an effect on the winds.

When the easterlies are blowing at full strength, the upwelling of cold water along the equatorial Pacific chills the air above it, making it too dense to rise high enough for water vapor to condense to form clouds and raindrops. As a result, this strip of the ocean stays conspicuously free of clouds



El Niño rearranges the distribution of rainfall in the equatorial Pacific. During normal years (top figure) upwelling induced by the easterly surface winds along the equator (arrow) keeps the surface waters of the central Pacific cool (blue). Heavy rainfall is confined to the warm (red) waters surrounding Indonesia at the western end of the Pacific.

During El Niño the easterly surface winds weaken and retreat to the eastern Pacific, allowing the central Pacific to warm, and the rain area to migrate eastward.