

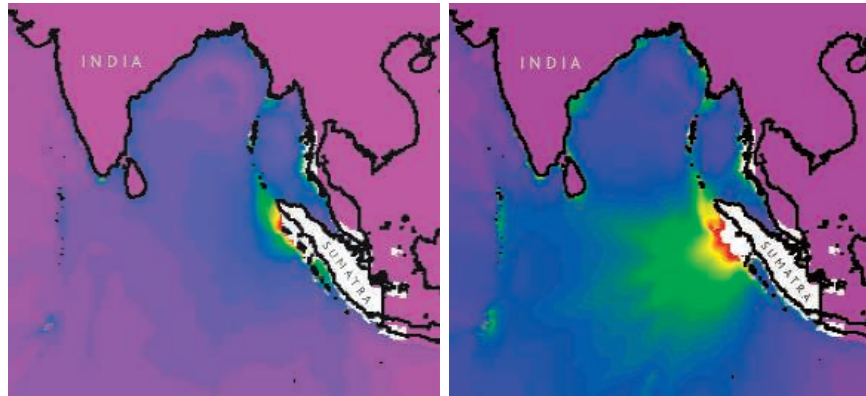
ASIAN TSUNAMIS

Model Shows Islands Muted Tsunami After Latest Indonesian Quake

In the first days after a magnitude 8.7 earthquake leveled buildings on the Sumatran islands of Nias and Simeulue on 28 March, experts wondered why it failed to generate a significant tsunami. After all, the monster quake that struck just to the north in December spawned a tsunami that killed more than a quarter-million people. Now that they've had a chance to locate the fault rupture more precisely and to run some simulations, they believe that the islands that bore the brunt of the March quake largely stifled its tsunami.

Quakes generate tsunamis by moving the sea floor, along with a lot of overlying water. The March quake was not only about a third as large as its December predecessor, but it apparently had another disadvantage: It didn't reach as far, vertically. The December quake appears to have ruptured the fault—the inclined, deep-diving boundary between two tectonic plates—from tens of kilometers deep all the way up to the sea floor in the deep-sea trench off northern Sumatra, says seismologist Seth

Stein of Northwestern University in Evanston, Illinois. The vertical displacement of the sea floor along the rupture would have transferred more of the quake's energy into heaving up the tsunami, he says. In contrast, the rupture caused by the March quake didn't breach the sea floor, which means that it would have transferred less energy to the water column.



With and without. Simulations driven by the March quake off Sumatra fail to generate a far-ranging tsunami (green) until islands overlying the quake (included at left) were removed (*right*).

Further weakening any tsunami, the March quake occurred under relatively shallow water. (The deeper the water over a quake, the more water it will displace and the larger the tsunami

will be.) The movements of the overlying islands, in fact, displaced no water at all—and that turned out to be a critical factor.

When hydrodynamicists Costas Synolakis of the University of Southern California in Los Angeles and Diego Arcas of the National Oceanic and Atmospheric Administration's Pacific Marine Environmental Laboratory in Seattle, Washington, simulated the March quake's tsunami with the islands removed from their model, the resulting tsunami was much larger. Significant waves reached the distant islands of the Maldives south of India in the islandless simulation. "Had the two

islands not been there" off Sumatra, says Synolakis, "we would have had another damaging trans-oceanic tsunami, although smaller in impact than the December one."

Such vagaries of tsunami generation are reinforcing the tsunami community's conviction that it won't be able to predict tsunamis reliably

anytime soon from seismic observations alone; only a dense network of tsunami detectors on the ocean floor will do.

—RICHARD A. KERR