

Tsunami

Thursday night I happened to end a show at 10 and the TV defaulted to Fox news where there was obviously something going on. It was supposed to be Greta but the scene was of lots of water and floating cars. The girl standing watch on the news desk was commenting on a live feed from Japan but she was very unsure of what she was seeing. She knew there had been a quake, 7.9 she said, and that there had been a tsunami warning, but was surprised that so much had happened so quickly. There were cars and trucks and people on a bridge or overpass, lots of water under the bridge, apparently a dike holding a pool of water with jumbled floating cars, and occasionally cars on the road under the bridge and in front of the dike driving through a puddle of water. There seemed to be nothing happening and her comment about the jumbled cars was that there had probably been people in them and how terrible something had happened. She kept repeating that they were "efforting" to find out more but that all they had was the raw feed. Also she gave the time of the quake in Japanese time, which was the afternoon of the following day, Friday. What would have been useful was if she had simply said it had happened about 20 min. ago.

What she did not yet know was that we were looking at Sendai city and the first wave or surge had come in previous to her live feed and was very shortly to begin washing back out. That so much could have happened within the first 20 min. after the quake is very shocking and indicates the severity of it and how close it was to the shore. Also how fast it had traveled.

Within moments the backwash began. First water began spilling over the dike, then cars. Where cars had been driving through a puddle became the base of a waterfall of cars, debris and eventually a large boat crashed over and into the bridge. The sightseers on the bridge were apparently cut off at the other end and began turning around and leaving. One very large tanker truck had to back all the way.

Soon more info began to come through with maps, an up-grade to 8.9, phone interviews with scientists and helicopter video of the wave as it washed over farmland, houses and roads. Some roads had moving cars. This is fascinating to watch to see how the wave wraps around some obstacles, flattens others and was even blocked by a roadway atop a raised earthen fill. It looks like it is traveling so slowly until you compare it with the speed of vehicles on the road. It is difficult to distinguish people but we know many perished there that day, and some cars seemed to be heading toward the wave as if unaware of it.

Much has been said about tsunamis lately and it seems to still be very misunderstood. They used to be called "tidal waves" and that term was probably more descriptive since the wave acts very similar to the tides except it's larger and quicker. The "tidal wave" first goes out like the tide and then comes back in like the tide. The big difference is, when it comes in it does so with a massive surge of water that inundates any area that lies within its height. It is not typically a surf kind of wave but rather a very large swell.

In my marine science classes I describe it as a shock wave generated by a massive seafloor disturbance. This shockwave travels maybe 500 mph, maybe 10 inches high and has a wavelength of maybe 50 miles as it crosses the ocean basins. It is bounced around, reflected and refracted by all the seafloor features of whatever ocean basin it crosses, and when it reaches landfall lots of forces and circumstances come into play.

Some areas like Crescent City, have a submarine topography that focuses the wave into something big. This, when combined with a low-lying valley such as where the town is, allows for predictable destruction. The mechanism is the same as for waves in general. A wave begins to "feel ground" as it approaches shallower water and it slows and grows. It grows in height as its wavelength decreases, with the water bunching up on top of the water in front. Since it is so large it acts more like a surge, as in what the tide does when it rises and falls. Except that it happens over a period of minutes rather than hours.

Many in news media as well as public don't seem to know what a "tidal wave" is like. They kept looking for "rougher waves" or "bigger surf". We had a better idea after having seen the one from Chile last year. After many years of preparing for waves that never arrived, the one from Chile was a surprise. It seems to be standard for them to arrive later than predicted. I recall standing on the bridge over Dana Harbor and suddenly

realizing the water was moving under me like a huge river. It was churning up mud from the bottom so that it had color and shape. It seemed to flow like that for as much as half an hour before it reversed itself and went the other direction.

The Channel 5 news chopper above Ventura Harbor illustrated it beautifully in the recent one. At 0906 you could begin to see a few muddy swirls. They went totally unnoticed by anyone until maybe 15 min. later when they were almost everywhere and began to plume out the harbor entrance. By 0930 you could see whirlpools forming between the ends of the jetty but after another 15 min., just as the outgoing water was getting up momentum, the incoming wave was trying to enter. This caused branches of outgoing water to swirl out to the sides, outside the jetty, in directions I would never have expected. This accounted for what we felt during the many smaller surges the next day as we anchored outside the short jetty at Dana. Our boat would not line up with the wind but it did line up with the other sailboats anchored nearby. Our anchor rode stayed tight and almost straight out to the side. When we later reentered the harbor we could see a large whirlpool at the end of the short jetty, and it gave the girl at the wheel a thrill as we went through it. All of this was very much like boating on a river, and I would expect that if aerial photo videos of our harbors were studied, these currents might become more predictable for the various locations/ areas of a harbor.

Orange County announced it was closing its beaches and sheriffs would be enforcing the closure. Ventura had no closures and on TV the reporter was commenting on views of people walking down to see and even pick up marine things exposed by the receding water. His comment "There were surfers surfing right there where it now looks like green grass (eelgrass) and people walking around." This happened several minutes before the effects became apparent in the harbor. The phrase of the day for Orange County was "out of an abundance of caution" as Sheriffs encouraged boats to put to sea "3 miles". While 3 miles might be excessive, particularly for our deep water coastline, there were surely many boat owners in places like Santa Cruz that wished they had put to sea. The videos from Santa Cruz harbor made it appear that the incoming tide created a sort of "tidal bore" where the marina narrowed. This wave ripped boats and even entire docks loose and scattered them. One large sailboat was shown swept into the railroad bridge and wedged there by its mast until the surge reversed and sent it back into the congestion of drifting boats and crumpled docks.

The mystery to me is Crescent City. How could such a place, that had to know it was most likely to be wiped out, have left so much in the path of destruction. Including the tourist that went out on the jetty to take pictures. If they recover his camera I'll bet there are some pretty spectacular pictures. While in some places they do things out of an abundance of caution, in others they do not.

The most dramatic moment Thursday night came about an hour after the quake and was an aerial shot of the coast of Japan, presumably off Sendai. For miles, as far as could be seen, was a line of parallel breaking waves, far apart, each in an unbroken white line. A large swath of subtidal debris strewed the beach at the shore. This was the middle of the night for everyone here and the geophysicists on the telephones were mostly tired and guessing like everyone else. But when that view of the coast came up, the scientist on the phone indicated he was now at home and watching on TV. Mary Ann Rafferty asked if he had ever seen anything like that. I was surprised when he answered, a little breathless, "No, I don't think anyone ever has. I have been to conferences all over the world and I don't think there have ever been pictures like this."

Lessons learned:

I found it very interesting to watch the tidal wave completely blocked by the huge earthen berm with the roadway on top. This shows that it is possible to stop a tidal wave. Also that it is possible to channel the wave around things. Some buildings withstood the wave and even had large boats floating around them.