Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

#157 May 3, 2014
Finding Yourself at Sea

The international observational buoy, anchored to the bottom in about 12,000 feet of water, at the exact intersection of the Equator (0 degrees) and the Prime Meridian (0 degrees)

Being around college students who have spent virtually their entire lives surrounded by electronic devices with amazing capabilities frequently gives me the overwhelming urge to explain to them that those things permanently attached to their palms weren't always around. This usually produces nothing but dull stares, but doesn't discourage me from seizing on the next opportunity to remind them again.

Knowing exactly where you are today is as simple as pushing a button on your I-phone, but this is a relatively recent convenience. Before setting out on this voyage, a NASA scientist sent me a GPS (Global Positioning System), along with a compact device that measures sunlight intensity as a measure of ozone in the atmosphere. NASA is interested in the changes and condition of the Earth's atmosphere and ocean and they don't get a lot of readings out in the middle of the ocean.

About noon every day I step out onto the deck with the instrument and the GPS to get a series of readings of solar intensity at that particular geographic location. Within seconds after I turn on the GPS I get a screen that shows me the number of

satellites that are within range- usually 4 to 6 of them- orbiting around up there somewhere. And so NASA will know exactly where the solar reading was taken, probably to within a few hundred feet.

Two other satellites have been sending down precise measurements on the elevation of global sea level for the past 20 years. While we have had tide gages or water level recorders attached to piers and bridges around the world measuring sea level and its changes for about 150 years, none of these records provide an overall global picture. Each of them is biased by the stability of land they are anchored on. Some coastlines are rising (northern California or Alaska, for example), and some are sinking (New Orleans or Venice), so they all provide slightly different values for sea-level rise.

Satellites give us a precise global picture, in fact very precise. Based on two decades of measurements from space, we now know that sea level is rising at about 3.2 millimeters yearly, and the rate looks to be increasing. But how do those satellites orbiting the Earth, hundreds of miles up, know sea level with the precision of tenths of millimeters?

I have to admit from my background this seems like an impossible task. Yet to the geodesists of the world, who routinely design instruments that know exactly where they are within millimeters, it's what they do.

One of the few exciting moments in our 6-day, 2700-mile, transit from South Africa to Ghana, was passing the precise location where the Equator and the Prime Meridian cross. To my amazement there was an instrumented buoy right on the spot collecting oceanographic and atmospheric data. Using satellite navigation, the ship found the exact location, circled the buoy, sounded the horn for 20 seconds, and we continued on our course, with few people on board appreciating how amazing that was.