NOAA Teacher at Sea
Wes Struble
Onboard NOAA Ship *Ka'imimoana*
July 8 – August 10, 2010

NOAA Teacher at Sea: Wes Struble
NOAA Ship *Ka'imimoana*
Mission: Tropical Atmosphere Ocean (TAO) cruise
Geographical area of cruise: Equatorial Pacific from 110 degrees W Longitude to 95 degrees W Longitude
Date: Thursday, 31 July 2010

Weather Data from the Bridge
Current Position: 2.25 degrees South Latitude & 95 degrees West Longitude;
Cloud Cover: 5/8, Cloud types: Nimbostratus, Stratus, & Altostratus; Visibility: 10 nautical miles; Wind Speed: 13 knots; Wind Direction: 130 degrees; Wave Height: 1 – 2 feet; Swell Height: 4 – 5 feet, Atmospheric Pressure: 1014.0 mb; Temperature: 20.0 degrees C (68 degrees F)

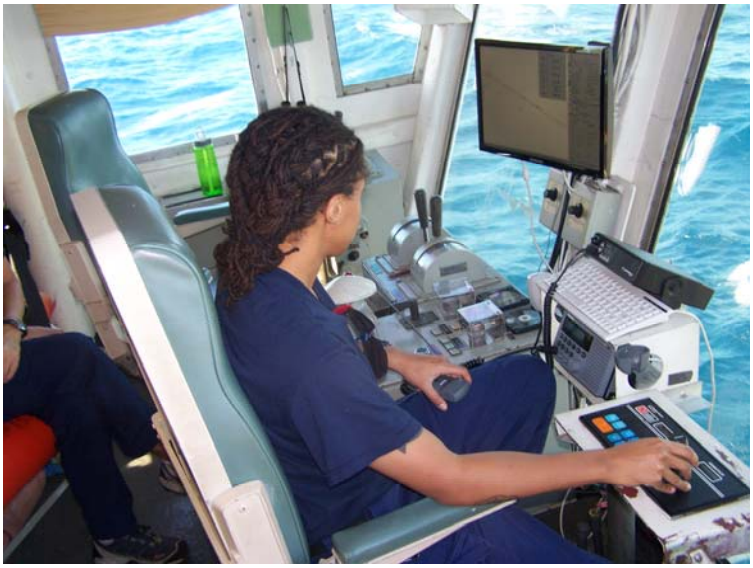
Science and Technology Log
It is easy to get wrapped up in the day- to-day cruise activities that are involved in maintaining the buoy array and the ship. Lest we forget, I wanted to spend a little time in this log discussing the overall purpose that has led to the investment of all this technology, science, and financial resources.

A moment of respite during a buoy deployment operation

This cruise (and many others that follow on a regularly scheduled basis) maintains the TAO buoy array. TAO stands for Tropical Atmosphere and Ocean. The buoy array is located at approximately 15 degree intervals from 95 degrees West Longitude (just west of the Galapagos Islands) across the Pacific to 135 degrees East Longitude (north of the Island of New Guinea). In addition, the buoys are placed north and south of the equator at 8 degrees, 5 degrees, 2 degrees with one buoy positioned on the equator itself.

These buoys measure a variety of ocean and atmosphere conditions: Air temperature, wind speed, wind direction, rainfall, and relative humidity. They also measure water temperature and

conductivity. The buoys generally transmit their data hourly. Besides the huge amount of information that is collected over time that can be used to study atmospheric and oceanographic weather conditions, the TAO array also has a very specific goal – to collect data to increase our understanding the El Niño/La Niña cycle, otherwise known as the Southern Oscillation.



NOAA Corps Ensign Alise Parrish at the controls of Aftcon (Aft control room) during a buoy deployment

Most people have at least heard of the El Niño phenomenon but, other than knowing that it somehow affects weather patterns, many are at a loss when asked to actually explain it. The El Niño is a cyclic weather phenomenon that affects a very large portion of the globe. In its simplest form it is a shifting of warm Pacific Ocean water from the western part of the basin (near New Guinea, Indonesia, and northern Australia) across the equatorial Pacific toward the South American Continent near Peru/Ecuador.

In normal climate years the Trade winds (the Trade winds are easterly winds) and ocean currents (specifically the Equatorial current – a west flowing current) work together to keep the warm equatorial waters in the western Pacific piled up near New Guinea & Indonesia). These warm waters produce huge amounts of evaporation pumping massive amounts of moisture into the atmosphere in this part of the globe. This moisture returns to the earth in the form of the monsoons and rainy seasons so typical for that part of the world.

NOAA Corps Ensign Linh Nguyen catching some sun and reading time during a cool afernoon on near the equator

During an El Niño cycle the Trade Winds and currents weaken allowing the warm western Pacific water to move east across the basin relocating the warm water nearer the South American continent. This rearrangement of ocean water – warm water to the east and colder water to the west – tends to suppress the rainy seasons and monsoons in the western Pacific and brings huge amounts of moisture and storms to the eastern Pacific. Hence,

countries, such as New Guinea, India, Indonesia, and others in the region, which depend on the rain and moisture, are left dry and often experience significant drought conditions. These droughts place many people's livelihoods and even their lives in danger due to starvation and economic loss.

On the other side of the ocean those countries in the eastern Pacific (from Peru north through California) will often have their coasts battered by large storms causing huge amounts of destruction and loss of life. In addition, in the interior they often experience heavy rains in areas that are normally mildly arid. This produces disastrous and lethal flash floods and mud slides. In those areas with little or no sanitation removal, poor or non-existent sewage treatment systems, in combination with compromised drinking water delivery systems can be followed by deadly outbreaks of typhoid and cholera and other life threatening diseases.

With these awful potential consequences, knowing when conditions for an El Niño cycle are in their early stages would be very helpful. The TAO array acts like an early warning system. During the Cold War the United States depended heavily on the DEW (Distant Early Warning) line in northern Canada, Alaska, and Greenland. This was a series of radar stations that looked north over the pole to identify a launch of nuclear missiles soon after they left the ground from the former Soviet Union. The idea being that it would give the U.S. as much time as possible to prepare for the strike and to prepare a response. In a similar way the TAO array is a distant early warning system that registers the changes in ocean temperature and current direction as the warm water of the El Niño moves east across the Pacific. This information gives the countries affected by an El Niño time to prepare for all the possible problems they might experience. The system is expensive to maintain but, much like hurricanes, if you know it is coming well ahead of time preparations can save millions or billions of dollars and thousands of lives.

Crew member Frank Monge with his large Mahi mahi caught from the fantail

Personal Log

Yesterday I spent some time with Tonya Watson (the SST) in the wet lab. She explained the operation of the Autosal and ran a few samples. This machine indirectly measures the salinity of sea water by actually measuring the conductivity of the sample. I hope to explain this in some detail in a future log. Later in the day one of the crew members, Frank Monge, caught a very large and brilliantly colored, *Mahi mahi*. We are hoping to see more marine life as we get closer to the Galapagos Islands. The water will be shallower and warmer and I hope to

be able to spot some whales. The weather conditions have continued to remain cool, mostly in the 70’s, with mixed clouds, wind, and sunshine. I am grateful that the cooler than normal temperatures have been the rule for this cruise.