



NOAA Teacher at Sea
Dave Grant
Onboard NOAA Ship *Ronald H. Brown*
November 6 – December 3, 2008

NOAA Teacher at Sea: Dave Grant

NOAA Ship *Ronald H. Brown*

Mission: VOCALS, an international field experiment designed to better understand the physical and chemical processes of the Southeast Pacific climate system.

Date: November 10-11

Science and Technology Log

*The ship was cheered, the harbor cleared,
Merrily did we drop,
Below the kirk, below the hill,
Below the lighthouse top.*
(Coleridge)

Finally, it is time to cast off. For days the scuttlebutt has kept us guessing about what has been holding up the cruise. It is approaching Midnight and dock workers have suddenly arrived, crew is adjusting lines and has flushed the birds, and new sounds and rumbling from the engine room are emanating through the deck. I am half asleep, lying in my bunk, and starting to hear announcements from the bridge that remind me of HAIKU:

*All stations report.
Testing bow thrusters.
Visitors must leave the ship.
Cast off lines.*

The Ron Brown has come to life!

Leaving port is complicated since even the most experienced captain is usually in strange waters. For this reason, a local ship's pilot is taken onboard to guide us. Thoreau wrote about the pilots off of Cape Cod in the 1800's and describes how after lookouts spotted a vessel, pilots would race their sailboats to claim the fee for guiding the ship safely to port.

Our pilot boarded with great fanfare and salutations from the deck hands. Even though it was calm, it can be dangerous transferring between vessels. Once aboard, he headed to the bridge to take over the wheel.

Hands-on training started immediately. Our first task was to use a *sonde* to take radio soundings of the atmosphere above



Pilot boat alongside the *Brown*

the ship. Radiosondes are lifted by balloons and as they rise, broadcast atmospheric pressure, temperature and humidity data to the ground station. (In this case the lab on the ship.)

This allows atmospheric scientists to record a slice of the air up through the cloud levels through most of the troposphere, where our weather is generated. Radiosondes can also be modified to conduct ozone and radioactivity soundings for pollution studies, but the emphasis of the VOCALS research is the marine layer and its interaction (linkage) between the ocean and atmosphere. Here in the Southeast Pacific, away from continents and major cities, the air should be some of the least polluted on the planet.

Radar reflectors and parachute accessories are available too, but not needed out here since recovery is not an option. Once the balloon reaches low enough air pressure, it expands too much and bursts, and the unit falls into the ocean. (Now, before you start worrying about sea turtles swallowing balloons and meteorologists littering the ocean...this was my first question, and I was told that these materials deteriorate rapidly once they are removed from the hermetically sealed foil containers.)

Many students will state that observing weather and collecting data was the “hook” that got them interested in science; and that certainly applies to me too. As an elementary student helping Mr. Giffin and Mr. “Z” set up mercury column barometers, and seeing 16mm movies of “real scientists” launching weather balloons, really piqued my curiosity. And here I am, so many years later, sending up my own balloons – and for that matter, launching them off a ship in the middle of the ocean!



Closeup of radiosonde

The science of radiosondes has been around since before WWII and is fairly straight forward. First, read the SAFETY INSTRUCTIONS FOR BALLOON OPERATORS:

- **Do not use in an area with power lines or overhead obstructions.** (No problem, we will be hundreds of miles west of the coast of Chile.)
- **Do not use without consultation and cooperation with aviation authorities.** (We will not see any air traffic here, except the scheduled flyovers from VOCALS research aircraft.)
- **Use extreme caution if generating hydrogen gas.** (No problem. We use helium; but I did have a flashback of our grandmother Hinemon’s tale about witnessing the Hindenburg explosion from the family farm near Lakehurst, NJ.)
- **The balloon film is only 0.05 mm thick upon launch [And over a meter in diameter], so ensure that there are no sharp or pointed objects nearby.** (That seems pretty obvious

now, doesn’t it Homer Simpson?)

- (And finally, the *Dennis the Menace* clause) **It is not advisable to deflate the balloon if it is leaking. Instead, release the balloon without a load.**

The units we send aloft are made in Sweden and have a small GPS omni-directional receiving antenna that looks like an eggbeater; a 9-inch wire broadcast antenna; and a thin metal sensor “boom” for temperature and humidity. Power is supplied by a curious little low voltage battery that is activated when soaked in water for a few minutes while the sonde is calibrated by the radio receiver and computer.

There are a dozen steps to remember for a successful flight. First the unit is unpacked from its shipping container. Then it is checked to confirm it is functioning and calibrated to the local conditions of temperature, pressure and humidity; as well as the current latitude and longitude. Fortunately the ship monitors these conditions continuously, so you just have to punch in the numbers prior to release.

There is a science to filling the balloons. Too much Helium and it rises too fast for the sensors to record good information. Too little Helium and it may hit the water and malfunction. (You don’t get any second chances!)

Once the balloon is filled, and any messages you wish to photograph are attached to it, clearance is requested from the bridge by letting the duty officer know you will be on the “lee side of the stern” to launch it. Just like when you are seasick...this keeps things blowing away from the boat, instead of in your face.

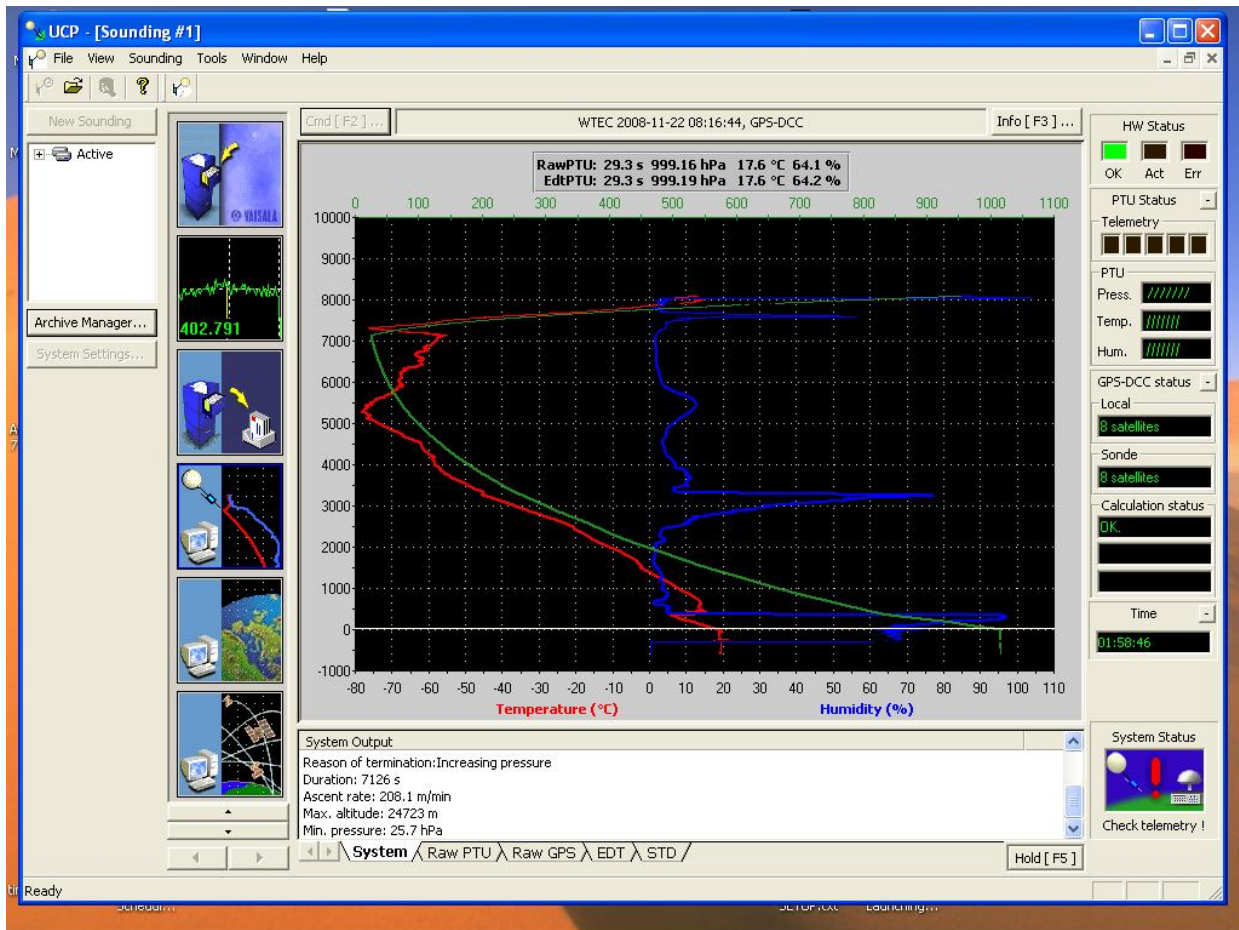
I thought I was clever putting our college logo and president’s name on one, until I saw the Great Pumpkin – a well-decorated balloon that made it to a whopping 23,464 meters on Halloween! (Not to be outdone next time, I am working secretly at night on a Thanksgiving turkey design.)



Balloon with message that says, “Thanks TAS!”

The wind has been remarkably gentle most days, but with the ship rocking and steaming ahead constantly, handling a large balloon while zigzagging across deck between equipment and storage boxes can be challenging, especially in the dark.

Sounding balloons are sent up every four hours, so the work is shared by everyone. There is a friendly competition to see whose makes it the highest and gets the best data.



2008-11-22-5AM

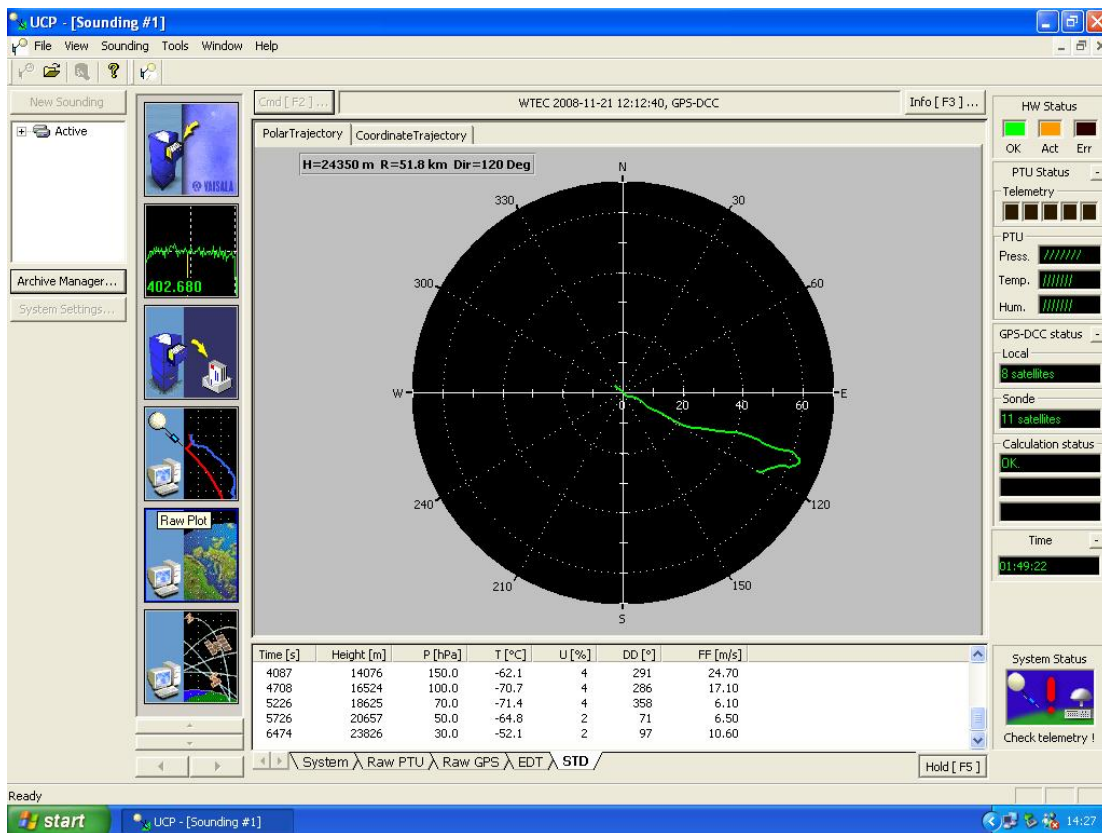
Note the details in the above image of data from a sounding balloon (Sonde). Air PRESSURE (Green line) decreases to 25.7 hPa and the balloon finally bursts. The unit then plunges back to the ocean and pressure increases back to “normal” sea level values.

HUMIDITY (Blue line) shows three (3) peaks (About 95%, 75%, and 15%. The highest humidity is at sea level and when the sensor reaches cloud level. The next sharp peak is moisture moving south from the ITCZ (Meteorological Equator). The small, wide peak is probably Cirrus clouds that were seen earlier before the lower Stratus clouds moved in to block our view.

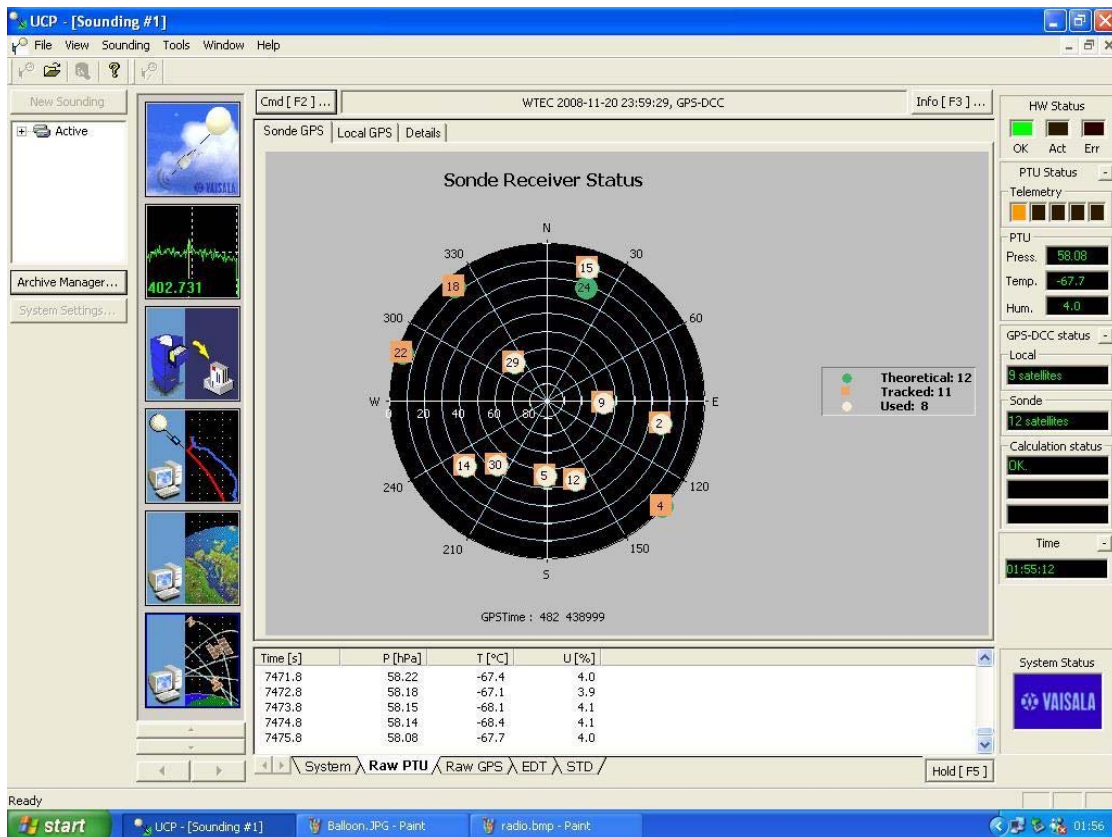
TEMPERATURE (Red line) decreases with height and humidity until the sonde reaches the Tropopause, then begins to rise where higher intensity UV light adds heat.

At the top of the image, all three lines merge as the sonde plunges back to sea level.

From the flow of data while this remarkable little instrument is aloft, we can study the decreases in temperature and pressure, and the changes in humidity from sea level to the moment the balloon reaches the bottom of the clouds. An hour or two later, the computer screen even shows the poignant moment (For the launch person, at least), and the decent rate when the balloon bursts and falls back to Earth.



Directional data of balloon winds: Tracking of the sonde shows the direction is drifting in relation to the ship.



GPS tracking of the sonde is accomplished with at least four (\$) satellites

*I've looked at clouds from both sides now,
From up and down and still somehow,
It's cloud's illusions I recall,
I really don't know clouds at all.*
Joni Mitchell

Personal Log

I have the best cabin on the ship! Below us is the freshwater tank - the Brown produces over 4,000 gallons of freshwater every day (About 30% more than is needed) and the sloshing of all that water each time we rock not only drowns out the noise of the ship, but it sounds to me like I'm right on the surface of the water. Falling asleep, I dream that I'm Thor Heyerdahl on Kon-Tiki!

As soon as we hit the open sea you could see some people getting uncomfortable, but as always, "Doc" was on top of it dispensing sea-sickness tablets and in a very few cases, injections. Within a day everyone was moving about and within two days even the dizziest landlubber was up for duty and at every meal.

There are few things worse than *mal de mer*. In part because, as the fishermen like to say, *you can't buy the boat from the captain* once you are out there.

Years ago on a long and stormy cruise to Madiera, I was issued an experimental device that was part of a NASA trial to treat motion sickness. It was a CD player with headphones that were flat plates fitted behind your ears, which sent out random vibrations to "reset" your middle ear. It reminded me of one of those hearing tests you got in grade school, and seemed to help. However, when I quizzed the ship's surgeon Dr. Bob (Ex-marine, Vietnam-era Army helicopter pilot, emergency room specialist; trainee in NASA's early space program, humanitarian and great storyteller) about how his gadget works, he only shrugged his shoulders and replied, "We haven't a clue."

As it turns out, even NASA doesn't understand why 80% of us get motion sickness at some point in our lives; but current research is pointing away from the traditional disoriented "middle ear" hypothesis.

Over the years I have had success with my own remedies, including: acupressure, ginger cubes, Coca-Cola (Not a commercial endorsement) and as a last resort, over-the-counter remedies with Meclizine. They seem to do the trick, but this night as we sail west to Point Alpha, all I needed to put myself to sleep was Richard Rodger's soothing tango from the US Navy's classic WWII Victory At Sea documentary – Beneath the Southern Cross.



A sunset launch



An unbelievable sunset

“The sea language is not soon learned, much less understood, being only proper to him that has served his apprenticeship.” (Sir William Monson’s “Naval Tracts”)

Words to check today:

Nautical term	Meaning	Origins
Alpha	Beginning, Start	First letter of the Greek alphabet.
Bridge	Wheelhouse, Topmost part of the ship where the steering wheel is in place.	Like a bridge over a river, it is high above the water.
Bow	Front of the ship	From <i>curve</i> or <i>bend</i>.
Fantail	Flat working deck at the back of the ship	The broad or wide open deck.
Galley	Kitchen	Inside the ship. Said to date back to before Roman times.
Head	Bathroom on a ship. Ship’s toilet. Under the base of the bowsprit where splashing waves cleaned the spot.	Said to come from the days of sailing when you went to the front or <i>head</i> of the boat for the bathroom. First used 1708

Port	Left side of a ship	Where cargo was loaded from the wharf or <i>port</i>.
Starboard	Right side of a ship. From the word <i>steering-board</i>.	Where the <i>steering-board</i> was placed. May come from the Vikings.
Stern	Back of the ship	Back edge or corner. Said to be from the German.

Sources include: www.history.navy.mil/trivia

From Dave Grant's collection of stories:

The world's worst tale of seasickness?

As told by Ulysses S. Grant in his Memoirs

One amusing circumstance occurred while we were lying at anchor in Panama Bay.

In the regiment there was a Lieutenant Slaughter who was very liable to seasickness. It almost made him sick to see the wave of a table-cloth when the servants were spreading it.

Soon after his graduation [from West Point] Slaughter was ordered to California and took passage by a sailing vessel going around Cape Horn. The vessel was seven months making the voyage, and Slaughter was sick every moment of the time, never more so than while lying at anchor after reaching his place of destination.

On landing in California he found orders that had come by way of the Isthmus [Panama], notifying him of a mistake in his assignment; he should have been ordered to the northern lakes.

He started back by the Isthmus route and was sick all the way.

But when he arrived back East he was again ordered to California, this time definitely, and at this date was making his third trip. He was sick as ever, and had been so for more than a month while lying at anchor in the bay.

I remember him well, seated with his elbows on the table in front of him, his chin between his hands, and looking the picture of despair.

At last he broke out, "I wish I had taken my father's advice; he wanted me to go into the navy; if I had done so, I should not have had to go to sea so much."

Poor Slaughter! It was his last sea voyage. He was killed by Indians in Oregon.