

In which we encounter  
 a little wildlife, a near eclipse, a seamount, billows, and the foggy foggy dew.  
 May 16-May 22, 2022

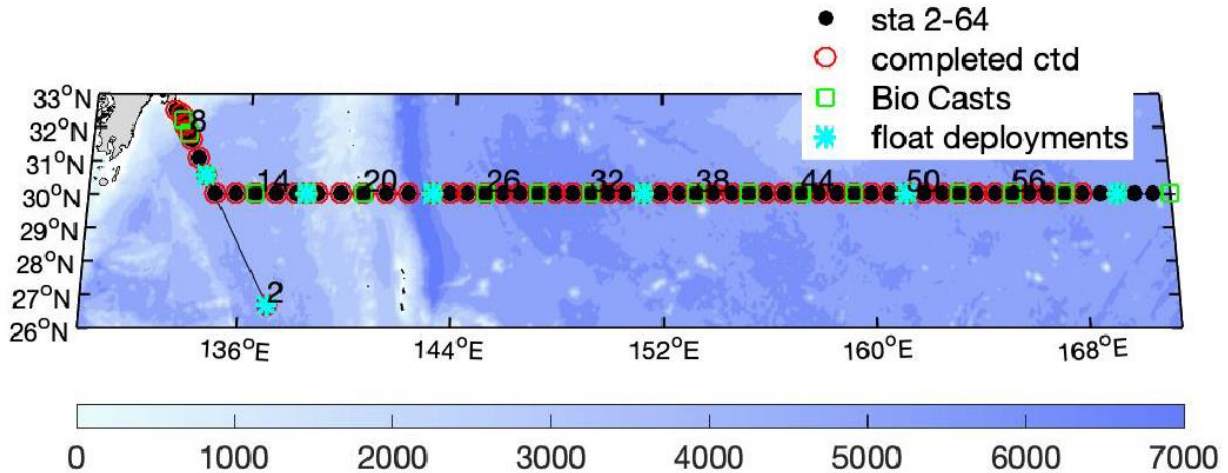


Figure 1: Map of station locations (black dots), completed stations as of the morning of May 22, 2022 (red circles), bio casts or combined core/bio casts (green squares) and float deployments (cyan asterisks). Sta. 1 at 21N, 140E which included core & bio casts and a float deployment is not included.

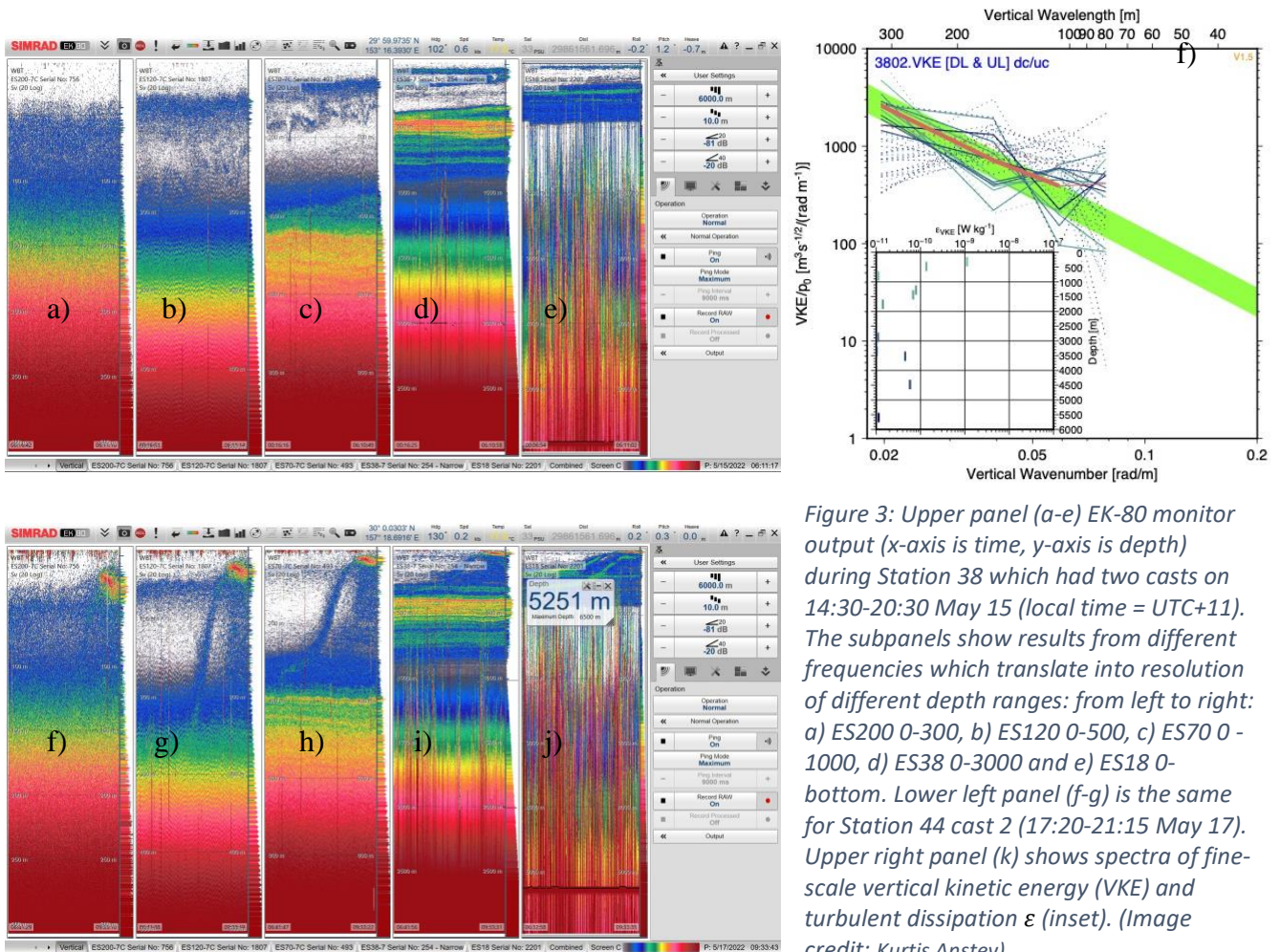
In writing last week’s report, we found we had more figures and plots to show than made sense for a weekly report, so this week we attempt to include some more of these preliminary results.

The moon has been nearly full to full, incandescent in the night sky. Earlier in the week we almost saw the lunar eclipse, but the clouds rolled in on the horizon, so while the moon became an orange rectangular slit in the cloud bank, it is hard to say an eclipse was actually witnessed. These early mornings have been extremely foggy, horn blaring, we have been getting soaked standing in the 100% humidity of the staging bay as we sample. That said, on many days as the winds pick up a little, the skies have turned brilliant. One afternoon, to the chagrin of everyone not in the vicinity at the time of appearance, a pilot whale was spied. Seabirds while not plentiful are around (Fig. 2) and often jellies (and plastics) surround the ship.



Figure 2: Resident bird enthusiasts believe this to be either a masked booby or a masked/brown booby hybrid. Caught in action by Nick Benz.

We continue to encounter small issues: annoying rather than catastrophic: a few bottle issues (damaged o-rings, snapped lanyard, bottle 19 refusing to fire properly), spiking temperature that differences led to a station with multiple short re-casts, the changing out of one sensor, then another. Then on the following station - a pump, followed by the other pump on the next station and re-replacement a few days later. We are back to acceptable differences. We suspect that some of the early change-outs were not necessary, but all is well and not a great deal of time was lost. We've had an off-and-on hiccup with the LADCP software, where a startup error caused by an incorrect command goes away when the command is removed, but then the command and the error reappear on a later cast. This behavior is now recognizable. The UVP has been working well since we stopped using it on bio-casts preceding full casts. On May 21, we lost about 15 nm of pCO<sub>2</sub> data due to a system's glitch, but the problem was quickly dealt with and we are back online. The EK-80, which has been running on every cast, has been finding some interesting features, mainly shallow and mainly later in the day (Fig. 3).



We were especially excited to visualize billow-like structures using the EK-80, which may be a result of shear instability. EK-80 display from the period covered by casts 01 (bio) and 02 (core) of station 038 (Fig 3a-e). The ES70 (Fig 3c) clearly illustrates the development of billow-like structures at depths between 100 m and 200 m. Note, the start time of 00:16:25 misleadingly

shows the stop time of the previous cast in UTC. According to S. Tan’s timer, the billows start to develop at around 15:00 (local) and die out at around 17:00 (local). Consistent with the instabilities, spectra of fine-scale vertical kinetic energy (VKE) and turbulent dissipation  $\epsilon$  (Fig. 3k) show large  $\epsilon$  ( $\sim 10^{-9} Wkg^{-1}$ ) above 500 m. On cast 02 of Station 044, we encountered internal waves during the CTD downcast and advection of cold and low-chlorophyll surface waters during the CTD upcast (lower panel). Then on the morning of May 21, while we sat on Station 54, the EK80 caught “something” passing in and out of view at about 400 m over the course of about 20 minutes (Fig. 4). If you really want to know - Yes. We all thought “Whale!...with babies!” But one must consider that the x-axis is time, so we will wait for those who better understand to tell us what might actually have been caught on our EK80 view finder. We look forward to seeing more exciting flow structures in the future.

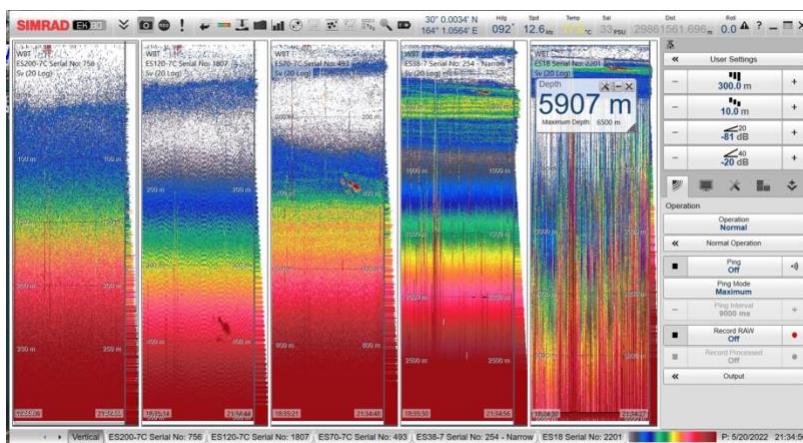


Figure 4: Same as left hand panels of Fig. 3. EK-80 monitor output (x-axis is time, y-axis is depth) during Station 54 May 21 06:35 to 09:30 (local time = UTC+12).

Between May 15 and 16, we crossed over a seamount where the SADCPC picked up rotating velocity vectors (Fig. 5) and we have seen as we would have hoped the well-mixed subsurface North Pacific Subtropical Mode Water (Fig. 6).

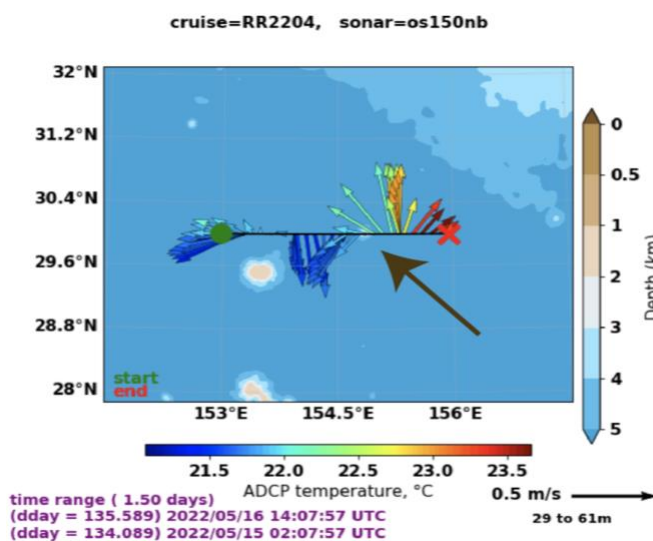


Figure 5: SADCPC measured near surface velocity vectors measured as we crossed a seamount (see brown arrow pointing to the small light shaded region at about 30°N, 155°E.) Here we see evidence of the anticyclonic rotation associated with conservation of potential vorticity as flow passes over the seamount (i.e., a Taylor Column). Recent observations in the western tropical Pacific suggest increased productivity in the region of a seamount due to the lifting of isolines (Ma et al., 2021, <https://doi.org/10.1016/j.ecolind.2021.107777>). While we did not stop at this location, we do have a station near a seamount coming up – an exciting opportunity for our bio-physicochemical collaboration. (Image credit: University of Hawaii UHDAS system) [https://currents.soest.hawaii.edu/uhdas\\_fromships.html](https://currents.soest.hawaii.edu/uhdas_fromships.html))

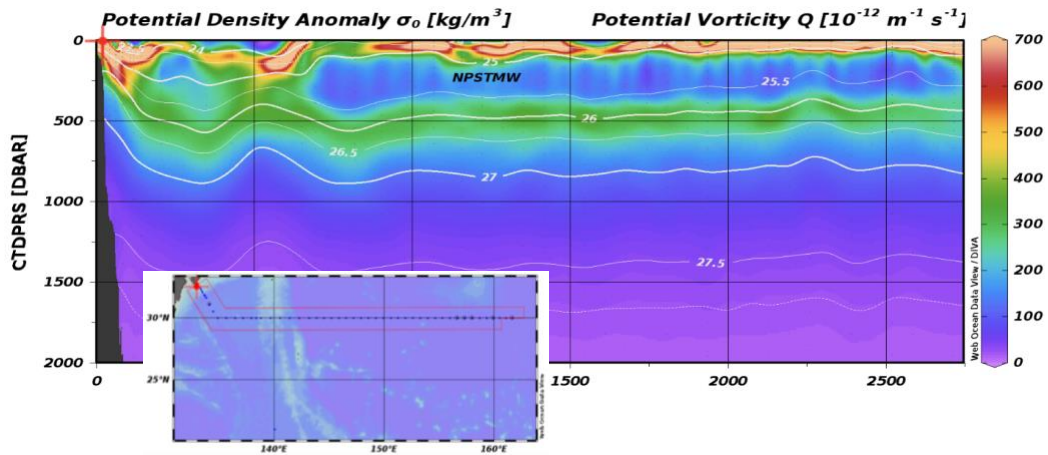


Figure 5: (Image created using Web Ocean Data View 5.4.5, web server 28). North Pacific Subtropical Mode Water (NPSTMW) is formed to the east/south of Kuroshio/Kuroshio Extension in the late winter and early spring. Subducted, it tends eastward, and like all mode waters is well mixed and is therefore recognizable by its low potential vorticity. In the North Pacific, there is an Eastern Subtropical Mode Water as well. With overlapping characteristics, the two are distinguished as existing to the east and west of the date line. NPSTMW is only one of several mode waters formed in the northwestern Pacific which is an area rich frontal zones and meteorology conducive to mode water formation.

All in all, both the standard full-depth core casts and the 1000 m, bio casts have been going smoothly. We are turning around the bio-casts in 60-70 minutes and are maintaining a rate on one every three stations. We deployed two more GO-BGC floats – a task the day shift has been enjoying, but we are hoping that #8 will fall to the night shift. Not to jinx ourselves, much wood has been knocked upon, as of station 47, we have returned to 30 nm spacing.

Our CTD student Mari celebrated a 23-hour birthday as we moved our clocks forward a second time. We told her she could have the other hour back when crossed the dateline. The weather remains good (calm and humid in the mornings, gentle breezes and sunshine in the afternoons). Even Saturday's rain, while most definitely wet for those on deck, went away as the sun came up. At today's drills we were warned about complacency, but for now we are happy to take what we are getting.

Back with more news and science next week,

Alison Macdonald and Shuwen Tan  
 Chief and co-Chief Scientists for  
 2022 P02/Leg 1 (33RR20220430)