

EPIC IOP 1 (ITCZ) SCIENCE LOG

All times are in UTC

Beginning 12 Sept, 00 UTC:

Shifts:

RC 0800-1800 (1400-0000 UTC)

WP 0400-1400 (1000-2000 UTC)

BB 2000-0600 (0200-1200 UTC)

DB 1600 -0200 (2200-0800 UTC)

010910

We left the Mexican economic zone as of about 08 UTC (02L) this morning. Initialized DLT's and began writing raw data to tape as of about 1330 UTC. Current position is ~ 13.4N, 101.4W. Expected time to 12N,95W buoy is 22UTC tomorrow. Raw files have been written to the linux box and Sun workstation since about 2150 UTC yesterday. Raw data on the linux box is being dumped into /data/epic/raw. On the Sun it's in /home/epic/ops/radar. Some of this data will have to be deleted since it was collected in the MEZ.

Objectives for today:

1. Get accurate power measurement for the 1.2 us pulse (used for all tasks except rain scan). This value (in watts) will be input into iris using the "setup" utility in order to get reflectivity. The accuracy of the current value that's in setup is unknown.
2. Write script using RSL routines to: convert raw file names to something more intelligible (using radarcp utility); convert raw files to uf (radar2uf), peel off a gif of the low level sweep (radar2anygif), and calculate echo statistics (radarmeta). On the linux box, these files will be stored in /data/epic/raw, /data/epic/uf, /data/epic/gifs, data/epic/meta and sorted into subdirectories by day.
3. Configure graphics products that will be sent from HP to linux box. Plan is to have gifs of low level ppi's, cappi's, tops, vil, vvp, rain, and rhi's for each volume.
4. Evaluate current noise/clutter thresholds and decide whether to implement "rphase" processing to remove 2nd trip echo.

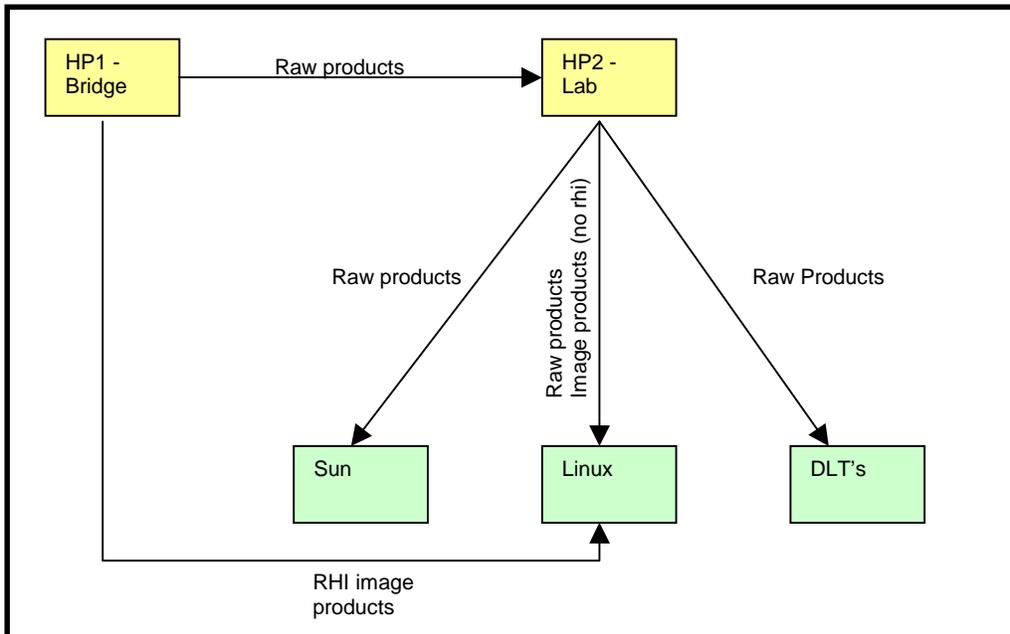
Currently, we have the following tasks configured and in the schedule (task configurations will be printed out and kept in the log book):

EPIC_FAR, EPIC_NEAR, EPIC_EVAD, EPIC_RAIN, and EPIC_RHI. All tasks except EPIC_RAIN use PRF=910 and pw=1.2 us (can't use PRF=1000 with either the 1.2 or 1.0 us pulse since it exceeds duty cycle of transmitter). EPIC_RAIN uses a PRF=500 and a pw of 2 us.

Average power EPIC_RAIN: 50.8 coupler + 5.0 meter = 55.8 dbm

Average power EPIC_FAR, EPIC_NEAR, EPIC_EVAD, and EPIC_RHI: 50.8 coupler + 5.2 meter=56.0 dbm.

Diagram of data flow:



Weather:

1600 UTC: We are apparently transiting directly into a developing tropical disturbance (13 N 111 W). Lots of stratiform rain with embedded convection. Few 30 dBZ tops exceeding 7 km and a little bit of lightning (visual). Made a printout of the AVHRR image at 1200 UTC which shows the cloud system with our posit at approximately 1500 UTC. We will try some EVAD scans since we have such great coverage.

1750 UTC: Antenna locked up at 87 Deg. during RHI's. Stopped scans and Bob Bowie reset (go into antenna menu and have the antenna point at the sun then push "RESET" button. After this, start the low level scan again). Winds are sustained at 35 knots and gusting to 40 or so. Fairly heavy seas.

Note- run RHI's in even numbers to make sure antenna is sitting at lowest tilt for RAIN,FAR,EVAD or NEAR scans.

2100 UTC – another antenna lockup. Got 10 minute cycle back at 2130 UTC. Switched from EPIC_EVAD to EPIC_FAR as echo coverage is decreasing.

2220 UTC- antenna lockup again.

2235 UTC- back on schedule.

Quit the RHI's this evening due to antenna lock ups. We will have to figure something out here.

010911

Several messages on IRIS. On RB2, "error writing files across network" has shown up several times in message list. Looking on DLT's, linux box, and sun it looks like all files are there but it's something to keep an eye on. Noticed last time the IRIS message popped up (1440 UTC) that at unix prompt on RBHP2 a message came over saying that it couldn't rcp a raw file from /usr/iris_data/temp/.

Work shifts: Bob (02-12 UTC), Rob (14-00 UTC), Dennis (22-08 UTC), and Walt (10-20 UTC).

We will start ops today at 00Z. This is about the time we expect to arrive at the 12N buoy. Sounding schedule will start at 4x/day until we get on station to 10N (tomorrow?).

Current position at 15UTC: 12.6N, 96W

Weather at 15 UTC: Radar loop shows us moving east, out of out band of the tropical wave that formed over us yesterday. Most of the significant echo is now ~ 50 km to our west. In satellite IR, the circulation of this disturbance shows up nicely to our NW. It's bigger (in terms of high cloud coverage) than either of the 2 tropical disturbances in the Atlantic basin right now. Skies are broken with cu, congestus, and cirrus in the vicinity of the ship.

We have a script on both the linux box (/data/epic/raw/rsl_script) and the sun (/home/echo/epic/ops/radar/rsl_script_sun) which moves all the raw files for a specified day into a subdirectory (the script creates the subdirectory). These scripts should be run on each day of data collection after 00Z (to get all the files for the previous day). On the linux box, rsl_script also renames the raw files (still gzipped eventhough the extension is ".raw"), converts to uf, and creates a meta file (data for each volume file is appeneded to the meta file). This script also moves image products (as well as the meta and uf) to appropriate subdirectories.

Entering power measurements into IRIS SETUP/RVP upstairs: 1.2 microsec pulse width (FAR, NEAR, EVAD, RHI) yields 56 dBm, entering 398000 (previous value was 336000); 2.0 microsec pulse width (RAIN) yields 55.8 dBm, entering 380189 (previous value was 324000).

010911

02:25 Still under the influence of wide-spread convection associated with our budding tropical depression. Still looks pretty impressive on satellite. Convection is really very oceanic in character. A few deep cells, but 30 dBZ basically confined to less than 30 km. Nice jet structure above the marine layer. Seas still a little bumpy. We will leave the radar to run tonight (and record data/products) in the RAIN and FAR scans without RHI's. If we reach the 12 N buoy at 4 PM Local tomorrow, we'll start our 6/day sonde launch schedule and shifts. Adieu.....and buenos noches.....(or however that goes)

First official sonde released near 23Z. Will run every 6 hrs til we get on station, then every 4.

Another BITE fault/shutdown after RHIs were rescheduled (after power update in SETUP); lost a RAIN scan near 23Z. Problem was the JUNK 'antenna reset' scan wasn't rescheduled fast enough after (or overlapping with) the RHIs. Updated task schedule has now been saved and should be OK.

Little bit of noise in the sonde temps, nothing severe.

010912

0038Z – almost all activity now west and moving west, eastern half clear

0224Z – convection continues to taper off and move west, little in domain at the moment. Walt reported seeing some lightning to the east around sunset.

0412Z – brief moments of 35+ dbz @ 6 km in the stuff moving west. A small isolated cell now NE w/ 50+ dBZ at low levels, and a small bowed line feature with brief turrets of 30 dBZ @>=6 km moving towards us, perhaps will pass to N

0510Z – Sonde #2 released, lock & data look good. Psych. gives 27.1 C / 26.0 C (night on fantail; sonde sfc RH was ~ 85%)

0536Z – another loose antenna/BITE fault; 0520 scan cycle missed, 0530 cycle will complete but be late

note – 0535 RAIN scan (first scan back up) looks like power is too low, 0540 scan looks ok

0655Z – sonde terminated with loss of PTU signal at 14.8 km / 135 mb, looks like before hitting trop

10:03Z- 22 UTC sounding skewt looks funny off the surface. Mixed layer is NOT well mixed in moisture at all. Still getting the spike off the surface in mixing ratio (even though the sonde was never brought into the lab). One system to the south of us. Short line with a bit of stratiform off to the west side. Not much coverage to it though.

11:00Z- Sonde launch. Bob saw lightning ahead of us. Must be out of the system to our south.

11:25 Z- Sporadic winds with this launch. Had 5 satellites, but for some reason, screwy winds. Will do a few RHI's (205, 206, 207°). Xsect shows 30 dB to > 8km. Nice outflow signature at cell top too (15 km).

11:43 Z- RHI shows 37.5 dBZ to 7.6 km in cell at 205° and 70 km. TOPS product suggests 30 dBZ to well above 7 km in many cells in this short line. Be interesting to see what the thermo reveals in the sounding.

12:13 Z – Picture of warm rainer off our port stern. Moving RHI's to 200° or so to keep up with buster to our south.

12:21 Z- Antenna lockup after/during RHI. Will be back on schedule at 12:30:00.

13:51 Z- 00 and 12 Z sounding files put on Bonegi (data/epic/snd).

14:00 Z – echo coverage to south and west decreasing a bit. Still a few small, isolated cells to SE with 35 dBZ to 7 km.

14:50 Z – sonde release. Winds look good this time around. Starting 6/day launches. Launch times are set to coincide with UTC at middle of flight or so.

Target	Launch
UTC	LOCAL
0400	2300
0800	0100
1200	0500
1600	0900
2000	1300
2400	1700

0700

15:41 Z - sonde still goin.....good data so far. Scattered cells in a short line in southeast quadrant. Not too impressive over all.

16:40 Z Moderate cu outside by not much on scope. R/V New Horizon is off our starboard side.

Error message on RB1 about “problem starting scan at EL ** (az velocity out of range)” has come up several times for one or more sweeps in a volume. Checked a volume corresponding to the error message time (1501 UTC –EPIC_FAR) in RDSS after converting to uf. No obvious problems in data – 360 beams in each sweep.

18:45 Z Sonde away! Good winds.

19:15 Z Pronounced dry layer at/near 700 mb (2.5-3 km or so). It will be hard for all but the strongest of cells to punch through. Somewhat of a jet at 700 also (easterly).

19:30 Z Sea clutter in NE quad out to almost 50 km in 10-15 knot NE flow.

20:50 Z – few scattered echos to the SW, otherwise suppressed

21:50 Z – took the radar down for a solar cal. El angle within 0.4 degrees – az within 0.1.

22:00 Z – back on schedule with EPIC_RAIN, EPIC_FAR

22:29 Z Power check, EPIC_RAIN = + 56.0, EPIC_FAR = + 55.8

22:50 - sonde 6 away. Lost satellites right away but then they came back and now getting wind data.

23:39 – sonde was a wash; Vaisala unit never started recording data, so a reasonably good ascent was lost.

23:58 – a replacement for sonde 6 is up and away; took a couple of minute to get GPS, but this time it's receiving and recording data.

010913

00:47 – convection picking up since 2200 in the southern quads again, 50+ km distant. Looks scattered and healthy, though vertical development not as pronounced as this morning's.

01:22 – the replacement 0Z sonde died at 750 mb; archived what we got

01:25 – scattered cells distant south have healthy (13+) 15 dBz tops, healthy (> 6 km) 30 dBz tops – should be lightning-capable

02:50 – sonde #7 released, data look good, recording. Psych readings were 28.9/25.6

03:09 – random nighttime lightning observation: 4 flashes / 5 min and 10 flashes / 5 min from two complexes off our starboard and starboard/aft, respectively, presumably scattered (but now denser) cells distant (50 km +) SW and SE. Ships heading (though stationary) is 13 deg, so these may be cells near 90 deg and 120 deg @ 75 km. Trying a couple of RHIs. From the 30 dbz tops product, the latter may have 30 tops to 12 km, as well as a cell at 135.

03:15 – from XSECT, the 135 deg cell has tops to 15, plenty of 40's up to 10-11 km (this may have been the 2 fl/min cell above) Taking RHIs at 107, 131, 135

03:35 – a number of these healthy cells rapidly growing and dying to the SE. RHIs are hopeless; they move too quickly, but XSECT does a reasonable job at getting vertical structure. They're travelling E-W, are small and isolate and grow and die in place, so this isn't residual continental convection

04:09 – sonde 7 is now at 10 km, perhaps a little slow. NOTE – when checked, the AFC had drifted to a very low frequency and wasn't finding the signal, and things were idle for a while. Manually nudging up the frequency helped it find the sonde again and data started catching up. We may have to babysit these closer than we have been. Also, RH crapped out at ~ 8.5 km.

04:34 – sonde temp data has some warts aloft, not the best sonde. More obs on the AFC: the best sonde frequency for this one seems to be 403.31, but the AFC keeps drifting down to what appears to be a secondary signal at 402.97, and hovering there, even though that signal is lower quality. Wonder if there's a way to alter the 'center frequency' of the Vaisala unit scan range, given that most of these sondes are up at 403.3-403.5 anyway...

Also, heard that the phased array profiler data is available on the ship's web. This would be very easy to do given IRIS' GIF network output device capability. We'd have to send a prod to echo (which is on both the ship network and the radar network), then send it from there to a ship web page, but it would be doable. Could then be accessed by the bridge, etc.

05:20 – entire SE quadrant now filled with a large bowed line, bridge reports a lot of lightning in system

05:30 – very nice cell 43 km range, 119 bearing, high reflectivities very deep

05:40 – 14 fl/2 min then 27 fl/4 min from entire SE complex – appears steady @ ~7 fl/min

05:52 – 14 fl / 3 min (~ 4 fl/min). Again, these seemed to be all freely/locally evolving and organizing cells, not coastal residue.

06:22 – sonde 8 released, a little early to get it into the feeder air for this advancing arc/line (and off before the gust front hits and/or the weather sets in). Sonde signal is strong but could only get 1 or 2 GPS sats on the ground, hardly any aloft, so no winds. MAX shows some detrained stuff aloft, so sonde will likely punch through it (XSECT suggests this is currently at 8-11 km). Release was in prestorm air, though. Flash rate still healthy through sonde launch. Psych 28.6/25.5.

06:44 – 10 fl/3 min from the complex (~3 fl/min). Still no GPS on sonde, though T/RH looks OK. Nearly saturated from BL top for a couple of km, then very dry (25%) slot above that.

06:50 – line seems to be less organized, almost breaking back into individual cells

06:52 – dry slot is topped by a much moister layer. Still no GPS/winds

06:53 – many visual confirmed CGs (but not disproportionately so). Remarkable feature is the extremely/unusually visible IC channel structure in these. Also very long fingering extent. Wouldn't call them spiders, but they're definitely not confined to individual cells in this complex.

06:56 15 dbz echo tops are very uniform at 9-11 km, with occasional risers. Bridge reports winds shifting now. It wouldn't be a stretch to say that in the RAIN/PPI animation loop, we seem to have overlapping concentric circles of outflow boundaries firing cells, but perhaps that's wishful thinking

07:10 – gust front on us fully about 5 min ago. 9 fl / 4 min ~ 2 fl/min. One IC could see half of the I-beam structure clear as day, including trunk. Band is splitting and very close so my FOV may not encompass entire complex. Still no sonde winds.

Nice illustration of attenuation behind a small cell in the 0651 MAX product.

Reflectivity cores aloft are definitely way down from before in the 6 km CAPPI

Areal average reflectivity in VVP overlay confirms steady decline since 0610. Seems to have been a peak at 0510, decline til 0600, brief resurgence then steady decline. VVP thinks flow at all levels is ENEly to ESEly with little shear.

07:01 – large patch of stratiform ('real' strat) now in SW quadrant w/ weak bright band

07:36 – sonde at 140 mb, never got any winds, appears to have hit the detrained stuff @ 6-7 km. Two very clear new arc/outflow cell lines now in SW quadrant (see MAX)

08:00 closest line has split in two, passing us on either side.

10:08 Original split line is broken, but still some healthy convection in it. Nice set of cells on the northern side of the line at about 300°/50 km or so. Stratiform exists on the southern side of the line. Couple of scattered cells 125 km to the southeast, but not really organized. Note on previous comments- it makes sense to me that this stuff could really go gang busters with the dry layer aloft as long as there were adequate surface forcing to push towers through the layer and also to provide an environment that protected/organized some of the cores- e.g., a nice outflow or boundary of some kind. Yesterday afternoon all we had was CBL type of convection and it just got obliterated when it hit the dry layer- plenty of CAPE, but no external forcing. This morning, forcing (e.g., gust fronts) some low theta-e air for downdrafts, and I would guess plenty' o CAPE too!

10:21 Deep cell at 291°/57 km producing 4 fl/min. Saw 1 CG too. Still ocnl lightning out of the southern end of the line too. Will take some RHI's at 290, 292, 294. In the middle of a FAR now, so it will likely move into one of these RHI azimuths by the time the RHI starts.....or maybe it won't, but it's 4:30 in the morning, I just got out of bed, and I need some excitement!

11:07 Sonde launch, but, no GPS lock. Had 3 satellites as we walked out with it, and then nothing. Sonde freq. refuses to lock in at anything but 402.97 MHz. This seems similar in some respects to yesterday morning. May be a few missing levels in the PBL.

11:15 Stopped RHI's. system is weakening a little but also moving off to the west. Some scattered stuff is popping up behind it though.

12:07 Small group of cells w/RW developing right over ship. Sounding is quite moist up to 700mb. Balloon must have penetrated a cloud in the low levels too.

12:31 Visibly, the cells are really weakening. Still show up on radar, but are probably raining out.

12:48 Convection is still hanging on in these cells to our east. Energizer Bunny Syndrome (EBS).....

13:00 Still getting a bit of second trip in the southwest quad. I doubt it will affect any of our rain mapping activity though- it's just too weak from a power standpoint.

13:30 watching the evolution of a NE-SW oriented band about 80 km NW of the ship. This feature (less than 50 km long) has intensified over the last half our. 30 dBZ extending to 8-10 km in a couple of cells. Not clear if this band has resulted from outflow of previous convection farther off to the SW – animation would suggest this. In general, though, convective activity has been decreasing in terms of aerial extent over the last few hours.

15:20 Finally got a sonde away. First attempt died right away. Bad sonde. We tuned up to 404 and some change and this one seems good. Great GPS lock.

15:55 Strong inversion/dry layer at around 2.5 km. Trade inversion? Looks bad for any convection that isn't really pushed from below. Another boring day/afternoon of convection in store. Interesting that boundary layer appears more moist (below 2.5 km) than in previous launches. Maybe previous convection has moistened things up down here?

16:20 Isolated echoes. Most are shallow, but still raining. Deepest cell is to our NW at about 50 km out.

17:40 little increase in activity over the last hour. Small band ~ 100 km east (< 50 km long) moving our way with couple cell tops near 12 km.

18:50 sonde away. Psych rh about 10% lower than SCS (psych T about 2C higher) – sonde was in the middle. Sunny and little wind out on the deck. All data coming in OK. Sergio turned off the 915 profiler for the sonde prep but turned it back on at or shortly after the sonde release.

Several messages on RB1 today about “DSP AZ angle exceeds 30 degree span” and “Problems starting scan at EL=? (Az velocity out of range)”

21:36 Antenna check, Sun at AZ =266.3, EL =39.6. Error = AZ= 0.0, EL= -0.3.

21:40 System back scanning, rain,far,junk.

21:50 activity starting to increase slightly in terms of aerial extent and intensity all quads. Nice band ~ 80 km NW with 30 dBZ exceeding 7 km in one or more cells

'outbreak' of small/isolated cells started ~ 20Z or so (2 pm local) ... perhaps we do have a diurnal/afternoon cycle after all...

22:20 waterspout spotted ~ 10-20 deg off the starboard bow, our bearing is 103 deg. Happened to be running a NEAR scan at the time to config products... little squirrely thing, probably not much more than a single beam/range bin wide

maybe a tiny bit of radial shear in RAIN scan vel, nothing to write home about...

candidate cells appear to be 10 km distant in SE quad

Rob reports 3000+ J/kg CAPE in the last few soundings, including the pre-line sounding at 0800 and the predawn sounding at 1200.

22:55 sonde away – winds coming in OK so far. Both sonde and psych RH are about 10% low compared to SCS due to higher surface temp out on the deck – no wind at launch time.

23:33 sonde still going strong. Still dry in mid-lower trop. Isolated cells continue to perk up, similar to yesterday, perhaps some indication of organizing into small lines. Profiler and VVP both say easterlies most of the way up with little shear. Correction – VVP has had uniform SSE'lies for a few hours, perhaps confirmed by spotty profiler data. Perhaps this had something to do with the waterspout...?

010914

00:47 areal average reflectivity continues to build/deepen

01:33 nighttime now and intermittent lightning spotted aft (current RHB bearing is 60). Areal average Z continuing to build.

02:17 3 fl / 5 min from cells at ~ 220 deg. Areal average Z seems to have peaked at 01:20

03:01 sonde away, good lock, has winds, psych 28.4/25.8

03:29 more linear organization, although the cells are congealing to the south and propagating away

04:45 18 fl / 5 min from cells to SW. WARN prod (30 dbz > 6 km) locates 4 main centroids and a couple of smaller in the SW quadrant. Last areal average Z peak was at about 03:40, slight decline since then. Sonde lost contact at ~ 500 mb.

05:05 very similar “dual arc” organization now (compared w/ last night's)

06:50 sonde away, signal very strong, psych is 27.4/25.2 Bob is babysitting this one. Organized line continues to move SW. Earlier, it appeared to “ingest” several small cells that were advecting *towards* it. WIND product (of which I am very skeptical) actually appears to get this right; puts low level vel as southerly south of the line, but easterly behind it...

06:50 there is an odd ringed cluster of cells coming at us from due east. Low level V had interesting azimuthal shear ... rotation?

06:59 started RHIs to SE

07:02 small 55-60 dBz cores in cells 60-90 deg bearing 20-40 km. Switching RHIs to NE quad

07:08 no longer topping close cells to NE, switching to NEAR

07:24 sonde alive but not w/o difficulties, winds didn't start til above BL; RH dropped out for a while in lower trop

08:11 sonde died at 500 mb

10:10 Line of convection over us and oriented NW-SE (we're still in NEAR). Also something shaped like a ring of cells due north about 60-100 km out. Ring is about 40 km in diameter. Actually, it seems like our line is part of another larger ring of cells south of that. Very little, if any stratiform.

10:22 288° at 84 km- cell with 30 dBZ tops to near 13 km! Seeing about 2 fl/min off fantail. Lights are on though, so it's a little hard to get a good view of stuff. These rings of cells seem to be coherent patterns that advect with the wind. Interesting.....

11:26 Just got a sonde off. First sonde looked great, but, balloon went in a dead spot and sonde dipped in the ocean. So, we tuned down another sonde, had 5 satellites at launch and then 0 satellites after launch. We'll see if they lock on during the sounding. Still plenty of convection. The rings are still somewhat coherent and advecting west. Bob saw some lightning off to the northwest.

11:38 Going out of NEAR and back to FAR. Will run an RHI at 305° or so to capture deep cell to the NW. Probably the lightning producer. Convection has become more wide spread in our near vicinity. Looks globular. Several cells have 30 dBZ tops to 10 km or so.

11:54 Some nice shear zones in the cells in the SW quadrant.

12:10 Line is trying to solidify to our west-southwest. Almost the appearance of a LEWP in the dBZ but it could just be a coincidence.....or maybe not.....there is some definite azimuthal shear 50 km to the southwest at about 210°. Making a plot.

12:30 No winds in sounding. We lost the satellites off the surface again. Good PTU though. Very moist up to 2.5 km. Then a nice dry inversion layer (trade inversion). Lots of cells- visibly erect and going up fast. It seems that drawing on the dry air in terms of downdrafts must help force these things through the inversion- that, and a fair amount of CAPE. Line is now solid to our west to southwest. Lots of wrinkles in the line that must be associated with the az. shear signatures. Profiler suggests decent directional low level shear. Snapped a bunch of pictures of isolated deep cells.

12:35 Tops product shows 30 dB tops at or above 8 km are now really prominent in the convective line. Looks very good. There is another cell at 284° about 100 km out that has 30 dB tops to 11 km or so. This stuff is pretty robust. Scheduling some RHI's through the stuff in southwest portion of line. (240° or so).

12:41 Ok. Someone needs to fix how this radar does RHI's. The antenna decided it likes 8° for an azimuth even though I picked 240 242 and 244. The antenna goes around to 8° and then tells the task scheduler that 8° is one of the azimuths. When you then look at the saved RHI task, you will find 8° in as one of the angles- somehow, it overwrites your selections.

12:43 I think the line is trying to develop some rear inflow as it organizes now. Quite apparent in the radial velocities. It's turning into a "sucking" line (using the Zipser and LeMone terminology). Geez, some of these cells almost look like they have mesocyclones.....Very strong upper/mid-level easterly flow out ahead of the line- flowing out of the line? Cross section shows nice flow structure. Max tops are only 13 km or so.

13:01 Stratiform to the southwest but, I'm thinking this is decayed junk. Still no solid strat behind line...a few new cells though. Actually there is another arcing line developing 20 km out to our

NW-NE. It's just going gang busters! The PTU data should be good for characterizing this environment. Have to use the profiler data to characterize the winds.

13:06 Scheduling RHI's through convection developing at 330 Deg. Looks like pretty good stuff. Ok- no 8° az. this time.

13:10 In the big picture it looks like our lines are really just part of a larger "ring" of some kind of boundary or something. Very interesting.

13:17 Cell is cranking in the NW quad at 25 km out. Not that tall (10 km or so) but has 30 dB up to 8 km. Will go take a picture. Now a fair amount of stratiform ahead of the line to the southwest.



13:50 feature moving off to the SW has spread out considerably in terms of echo coverage and weakened slightly. Pronounced flow structure evident in V-xsection: midlevel inflow from the southwest on the west portion of the feature (formerly an arc-line). Also, nice downdraft signature at low levels. Animation shows a lot of low level boundaries moving around that appear to be forcing new cell development.

14:05 12 Z Sounding terminated at 99 mb or so. At least we got the trop. No winds though.

14:10 Southwest line has plenty'o stratiform. Running RHI's centered on 240.

14:45 Sonde up and running. No winds again after having a full GPS lock at the surface. **CO Says they want us to tell them we are preparing to launch a balloon prior to launching (in case there is some reason we should not launch- e.g., an aircraft in our vcnty.**

15:40 Pilot whales off the port stern. Convection in SW line now considerably weakening. New batch firing up in NE quad about 60-70 km out.



16:45 Convection has really weakened over the past hour. Still some left in the NE quadrant about 70 km out.

Note error on IRIS in RB2 message list at 0738 UTC – “ENOMEM Not Enough Core </usr/iris_data/product/RB01091407211” – checked the raw file in RDSS and using meta script: didn't see any obvious problems, though echo return at upper levels looks too geometric to be real...

18:45 – sonde away with winds. We win the M&M's....with our luck on the winds though, they'll probably melt in our hands! The trick this time was to wait several minutes after the GPS status menu showed > 4 satellites (5 satellites appeared then disappeared at first). The other trick was to make sure enough sats were on the sonde while the sonde was at the release point- not the middle of the deck.

20:20 few cells > 100 km away – not much to look at.

21:15 – sonde 16 finally quit after reaching above 30 mb (winds all the way up this time).

21:50 linear band feature has formed in the last hour about 100 km north of us. The band is oriented E-W and extends to about 80 km in length. That's about the only significant echo to speak of.

22:11 – Bob taking radar down to do a sun cal

22:18 - Sun check, AZ = 267.6, EL = 28.9. AZ error = 0.0, EL error = -0.3.

22:50 – sonde 18 away – winds coming OK so far...20Z sonde showed a pretty strong low level inversion

23:30 – sonde 18 quit transmitting about 100 mb off the surface. Attempted another release at 23:45, tuning the frequency up but I apparently didn't get it far enough up as the ground station is

having trouble distinguishing. Ground station is monitoring the sonde OK but it won't get out of "release" mode so I think we're hosed.

010915

got rain1 and rain24 hour products configured and scheduled. Key was go to setup in IRIS menu and setup projection and force a reference point for the maps to be centered on (not centered on radar with each scan). Few changes made in setup utility: changed allocation of raw/derived product disk space from 50-50 to 25-75 and increased total allocation space from 300 MB to 400 MB. This was done in order for rain1 products to be preserved on disk for full 24 hours as opposed to being wiped out every 6-8 hours (what happens now).

Serious tape screwup with the DLT's on RB2. When unmounted for IRIS restart, they came back up as non-IRIS. Turns out (by looking at /var/adm/syslog) that there had been a SCSI parity error and tape reset yesterday at ~03Z. The tape thus rewound without IRIS knowing about it, so new IRIS prods were written over the start of the tape. Scanning syslog, there has been at least one other such error since Tuesday. If this is a persistent problem, streaming continuously to the DLTs over a field program is not a viable archival solution.

Fortunately all RAWs have been network copied to echo (Sun) and rain/bonegi (Linux). Best archival approach will likely be to hook the DLT to bonegi and do a massive single dump at the end of the program. Auxiliary backups to exabyte wouldn't hurt.

03:45 – 04Z sonde looks like it may finally be a keeper. Slight dry notch from 2-4 km, then pretty moist above that. Winds increase sharply above 9 km.

Some more fine tuning of RB2 disk allocation to facilitate RAIN prods. Latest allocation is 275 MB ingest, 125 MB raw, 525 MB prods. The % of total vals for kept files aren't relevant; these apparently only apply to files manually flagged as Keep. This allocation leaves several hours' ingest and raw still on disk and hopefully will allow enough CAPPis to be stored to get a full 24 hour map.

Loose band of cells approaching from distant (130-140 km) S/SW, but will take a while to get here. Local cells are all pretty wimpy and isolated.

05:08 – finally a complete sonde; went to 20 km. Radar activity still unimpressive.

06:50 – sonde 20 up and away, solid lock so far. Very moist BL and lower trop. Nearby convection almost all gone; cells distant south holding in place

08:00 – sonde now at 200 mb, looks like we'll have another complete sounding. Still no cells to speak of w/in 100 km.

10:55 – Sonde is up with winds. Looks good. Not much going on in terms of convection. Isolated small cells.....

12:12 - Disk (/vg00/lvol17) filled up on HB2. Too many products or something. Eliminated all of the 14 Sept. products and some of the 15 Sep. RAWs (already archived) to free up some space so the data will keep being archived. No writing of data from 10 Z to 12 Z on RB2 (even raws- on any of the devices). The modification to disk allocation needs to be reconsidered. Will have to keep up with this until Dennis can take a look at what was changed earlier. FTP'ing raw files from RB1 to Linux box from 10 Z –12 Z to fill in the gap. I am rapidly losing confidence in this archive process- wonder if it wouldn't be better to just ftp stuff to the linux box from RB1. Stopped RAINN products and VIL products- don't need them right now and they take up space.

14:00 – back into setup- changed allocation as follows: ingest=200 MB, raw=100 MB, and other=550 MB. Total =850 MB (vs 925 MB previous)

14:50 sonde 22 up and away with winds.

14:49 – final tune to 200/100/425, (total=725 MB) after reviewing /usr disk usage, current product consumption and free space. Resent raws from RB1 during missing time span (10-12 UTC) so that derived products can be made and sent to linux. Copied the RB1 raw files that were ftp'd to linux box to SUN. Guess copies of these will now be sent from RB2 – we can delete the RB1 files later.

15:00 echo activity seems to be increasing over the last hour or so.

Re-running RSL_script on linux box for 010914 files. The script had bombed out around 06Z for some unknown reason. Seems to be working OK so far.

16:23 Still not much going on. Sounding has reached 70 mb or so- looks good. Still waiting for the wave over/off Central America to stir things up. Looks like there's another wave sitting just east of South America (off the coast of Guyana).

17:40 have 2 sets of raw products being written to all output devices (Sun, linux, DLT's). Turned off raw product request in RBHP2 and saved as EPIC_ITCZ. This seems to have eliminated the problem. Should probably eliminate the repeat files before implementing RSL_script at the end of the day (not sure if repeat files will be appended to the output meta file)

18:50 Sonde away. Success again! Few more echoes on the scope on the east and south side. Still nothing all that organized. Cell motion appears to be toward N-NE today.

21:09 Loop of dBZ Max shows shear very nicely. Slow westerly moving cells going with low level winds with tops being blown off toward the west by the upper level easterly flow. Several cells with 30 dBZ tops exceeding 7 km. In the mean, 15 dBZ tops are not higher than about 11 km, but, some exceed 13 km.

22:45 sonde 24 away with winds.

010916

01:30 several small cells in close, but all tiny so not switching to NEARs

01:40 some sort of e/w oriented boundary / line-of-cells advancing at us from the north, visible on the long range scans. All small cells in it though.

03:00 sonde up and away. No winds but signal otherwise OK. Very moist. Line of cells distant (~100 km) north still advances towards us, albeit slowly. Disorganized cluster to E, nothing W, and large contiguous mass still distant S (as it has been for over a day now). Advection pattern of these, if any, is hard to discern.

04:06 line to north has dissipated, but now cells to E are organizing into a N/S line. Activity distant S still 'steady-state'. Sonde going strong but never got any winds. From VVP, the shear is at 7 km (westerlies below, easterlies above)

04:56 sonde finished, hit the tropopause (well, a tropopause), no winds all the way up. Light rain outside. According to VVP, upper level easterlies are relatively strong (2 barbs). Low level winds still WSW. Not topping the cell overhead but from what I can see it looks pretty modest, and is the only one in close, so still keeping with FAR's. WIND inversion has placed low level westerlies

behind the semiorganized line/cluster to the E, but northerlies ahead of it. Would be interesting to know if that is legit.

06:49 sonde away, signal good, getting winds. Cells east have now agglomerated into a large cluster taking up a good bit of the SE quadrant.

06:53 disk free space has been holding steady at 133 Mb for the last couple of hours. Nudging the allocations up to 200/100/460. This shouldn't cause any space overruns. Note, in OUTPUT, the 435 Mb allocated last time for 'other products' seems to be used for both RAWs and others (i.e., we had 100 Mb raw and 335 Mb others – this is confirmed by du'ing /usr/iris_data/product). The SETUP menu is thus misleading.

07:36 sonde just lost RH at 5.7 km; almost certainly going through cloud, so possibly rimed. Bridge reports recurrent lightning; just saw a very close flash w/thunder outside. Cell very close to us NW (< 10 km) likely culprit but it isn't the main action so still not switching to NEAR (wouldn't likely top it anyway). Sonde briefly lost winds but they picked up again; RH still out

08:15 steady moderate rain above us; this cell doesn't seem to want to go anywhere. New cells building close in, but so far 15 dbZ tops still suggest the best action is further off, so still holding off on NEARs.

10:00 Convection still over the ship and extending into a big patch of stratiform to the south and southeast. Wonder if this is the start of the long awaited wave coming off Central America or just a big gravity wave from the land (which satellite also suggests could be the case). Winds are still westerly at low levels and easterly above that- Doppler even suggests a westerly jet off the surface of 10 m/s. We should keep an eye on this to see if they switch around to the east today sometime later today.

10:08 New line forming on edge of stratiform at 180°.

10:30 Bob says the lightning is picking up to the south. 102 Mb free on lv017.

10:55 Sounding went in the drink. Balloon got too wet (it was raining hard) and just dropped like a rock. We are going to try and overfill a balloon and then release as soon as we take it out. We could never get a GPS lock- 10 satellites but not a single one of them locked on (probably the weather). So, we'll go for PTU data and not worry about winds. This way, the balloon will have a fighting chance to get off the deck. Lots of lightning to the north-northeast (right where the WARN product puts a big centroid). Big blob of convection up there. We appear to be filling in with precip.

11:15 Sonde away. A successful launch. This time we didn't worry about winds or satellite locks but the satellites locked on just off the surface, so, theoretically, there should be winds. We really inflated the balloon- hard to get out the door. This could be a case for comparing bright band height to freezing level height if balloon punches through. Against my better judgement.....I'll take a couple of RHI's in the NE sector.

11:44 VVP suggests stuff is definitely getting deeper with time. Winds are very nice. Westerly winds to 7 km or so. Easterly above that.

11:50 Topping stuff within about 20km, but it's close- will switch to NEAR. Coverage and structure still not really well suited to EVAD, but will keep on eye on it.

11:57 Stratiform right over the top. Some lightning still out of the NE sector- O[1/min]. Winds on VVP match up well to sounding. Balloon punched the bright band nicely.

13:02 Echo is just a huge wad of stratiform. Sounding punched tropopause- so we're good to go there. 112 Mb free on lvol17. Archiving looks good.

13:27 One nice cell right off to the NE (10 km out or so).

13:39 Cell due north is quite deep and intense. Going to run an RHI at around 330 Deg. or so.

14:07 Low levels moving east, upper levels streaming off to the east. Very pronounced boundary forming just SW of the radar. New cells developing along it.

14:10 antenna hung – lost one cycle - should be good to go at 14:20 with EPIC_RAIN and EPIC_NEAR. RHI's discontinued. Probably should just forget about doing them.

14:25 RHI showed 30 dBZ to 10 km or better. Very strong.

1445 sonde 29 away with winds. Launched in light rain with lightning in close vicinity

15:10 Several big cells in our vicinity. 30 dBZ to 10 km in many. Made xsect plots and put in /data/epic/gifs/set1. We seem to be on the eastern edge of system that is wrapped around us with a clear tongue to our east.

15:50 We are in the clear slot. Convection is weakening around us a bit. Lots of stratiform about.

16:10 Back to FAR's. Still an extensive area of > 10-13 km tops just to the south

18:52 Balloon away- great launch by the TAS Jennifer Richards. Winds are good.

19:55 Convection is really on the decrease except 100 km to our south. lvol17 holding at 110 Mb. Archival going fine.

20:52 intensity decrease continues with exception of line/band 50-80 km to west. Animation shows cells in this feature moving east while the whole mass moves S-SW.

23:00 sonde 31 up and away, good signal, getting winds. Local convection dying out. Cookout on the fantail.

23:58 low level Wly/upper level Ely shear layer has definitely descended from last night/this morning's ~7 km to ~4 km, evident in both VVP and sonde

010917

01:30 sounding complete; barely hit tropopause then lost it

01:58 cells still mostly wimpy. Several very thin lines organized along what appear to be outflow boundaries evident.

02:46 OK, here's one for the history books. About 30 seconds after we released sonde 32, a *different* sonde came fluttering down about 5 feet off our starboard. Sonde 32 is still up taking good data. Either we're sending too many up, or we got a batch of homing sondes ☺

02:52 the thin line to our west is quite long and slightly intensifying, although echo tops suggest mostly warm rain cells. Some indication of cells to our E and NE intensifying.

04:30 sonde made it to about 12 km then lost signal

06:47 rain outside is surprisingly intense for what looked like pretty unimpressive cells in both PPI and XSECT. Switching to NEARs. These cells are the northern edge of the western line which has intensified over time. Holding off slightly on sonde launch since this stuff is nearly past us. 07:43 – tried to get a sonde off with no success; heavy rain above us and looks like it will continue for some time. Strong sonde signal on deck was lost almost immediately after launch, presumably it went into the drink. Unless things ease up soon we may abort the 08Z sonde, given how little success we've had with launches during heavy rain (1 for 3).

08:07 – an awful lot of rain out of pretty shallow (7-9 km 15 dbz tops), modest reflectivity (30s-40s dbz) cells (makes me wonder about our Z-R as well; the 0800 RAIN1 didn't have very high accumulation, but visually, it was just dumping on us outside). A second line is also forming near west behind the first one and will also likely be upon us soon.

08:16 – in watching the NEAR scan TOPs loop, it appears the 07:21 volume scan has azimuth off by a few degrees; the whole frame 'rotates' clockwise, then goes back to the 07:11 cell orientations in the 07:31 frame. Might be worth keeping an eye out for similar glitches. With second band continuing to intensify behind us and heavy rain outside, seems little prospect of a successful 8Z launch, so scrubbing that sounding.

10:12- Watched the satellite again on this system (made a plot). Couple of things going on. 1. Easterly wave coming off Central America into our area. 2. Nocturnal boundary/gravity wave from diurnally forced convection over Central America. These two things are interacting with the ITCZ to give us the storm this morning. It seems like in the absence of E. waves, but still copious moisture, that the boundaries simply interact with the ITCZ- causing a big blow up. Since the boundaries take some time to propagate from C. America to here- we don't see the increase in organized convection until night/early morning. This reminiscent of Houze's work near Borneo and Winter MONEX over the M. Continent region (at least with respect to the boundaries and nocturnal convection). Wonder how persistent this cycle is (e.g., how come it isn't more definitive in satellite data over longer time periods?). Radar wise- a large band of sloppy precip fills the lower half of the scope on the 125 km range display. Deepest convection is located along edge to our south and also some to the east. One cell just to the south of the ship. Mucho stratiform (if we can get a balloon up this will another nice bright band case)!

10:22 In the big picture you can see those little "rings" of convection again. The cells just seem to rotate around these rings of "initiation". (about 140 km to our north).

10:57 Sonde launch at about 10:45. Raining, but went up and the winds kicked in just off the surface. So, all in all, a success.

11:35 First balloon hung at about 850 mb. Must have lost its buoyancy. We launched a second sonde since we didn't get the 06 Z sounding. We may want to do an inventory on how many sondes/balloons we actually have. This could help us determine how many second launches we can do.

11:40 Continuing light stratiform rain over the ship. Archiving looks good. Syslog is clear. 114 Mb free space on lvol17. Loop and radial velocities suggests the presence of some sort of small circulation to our south ~80 km out (MCV?).

12:10 Balloon hung just above freezing level. Probably iced up going through the bright band. Still good coverage of stratiform on scope. A few good cells developing along the edge on the 040° radial or so. 30 dBZ to 9 km.

12:31 Beautiful isothermal layer in skew-t at melting/freezing level- quite deep. No wonder the balloon hung.

12:45 Tops product suggests a deepening of system to southeast. Wonder what's going on.

Concentric circles in the NEAR scan are bothersome. Wonder if we have a resolution problem. Might switch to FAR's to see how we top stuff

12:50 Switched back to FAR's. 0845 IR definitely puts us in a mix of the ITCZ and land forced area of convection under influence of wave.

13:50 made a couple of x-sections from EPIC_FAR and EPIC_NEAR which show bright band and it's apparent height variability with range. Can't think how this would be a radar system anomaly. Suspect that some of the max echo below the freezing layer is residual convection – not stratiform.....rings are apparent in both EPIC_FAR and EPIC_NEAR. Hope this is just a resolution problem on the screen. Tops on most echo < 100 km of ship is below 9 km now.

14:15 Note that dlta and dlta archives are out of synch in terms of number of files on each tape. Dlta is currently at file #775 while dlta is at file #815. Suspect this may have happened when we had the double file problem the other day but would need to inspect the tape inventories to find out when this occurred.

14:40 – sonde 36 away with winds. Very light rain at release time.

15:30 lost the sonde at 450 mb or so – these rain clouds are just hammering the sonde data today. Another arc of convection appeared about 100 km north.

18:10 echo coverage generally decreasing; however, small boundary has formed about 20 km to the west over the last hour. This feature will probably overrun us in the next ½ hour or so.

18:55 Sonde away, but winds/satellite lock very sporadic. Took to 750 mb to get the temp/pilot message.

20:20 another ring feature has formed about 50 km to NE. Seems to be a lot of outflow kicking around right now. Few cells have tops poking out to near 12 km but it's shortlived (10 min) and most everything else is below 10 km.

Notice message "Bad Ray Size:612" popping up on RBHP2 prompt. Not sure what this means...are we getting too many bins in EPIC_FAR scan (612 vs 600)?

22:15 activity on the rise again in the NE sector of domain. Fairly extensive area of >45 dB with some tops > 12 km.

23:23 OZ sounding went off without incident, now at 400 mb, looks like it will be a good one. Tiny cells in close, most organized activity now distant NE

010918

02:43 04Z sounding away, signal clear. Cells have been building for last 2-3 hours, mostly eastern quads. General propagation is to the north; sfc winds are southerly.

03:07 cluster of cells to NE has organized into a large high-Z complex during the last couple of scans, far out though. High reflectivity punching through to midlevels, but overall cloud tops are not high at all. Most everything today has been fairly low-topped. Outside air has been discernibly cooler than previous days.

04:30 sounding complete, good data all the way up

06:13 disorganized cells to our eastern quads have continued to align and now form a N/S oriented line through our 150 km range plots. Tops are modest (7-8 km) with brief risers to 11-12 km, although again midlevel reflectivities are fairly healthy. Some are close, but given low tops,

we're still topping them with FAR scans (except for some detrained stuff). Low level flow is basically along the line direction, which is SSE-NNW.

06:41 sonde 40 up and away. Signal good. Line is still just to our east. Sticking with FAR's (I'm using the 30 dBZ TOPs product as the criterion for switching to NEAR; if we significantly don't top a cell in that prod, I'll switch).

07:30 bridge noticed a strong wind shift during last traverse; velocities confirm local near surface winds have shifted to SE'ly despite large scale SW'ly flow; this is presumably outflow from the line which still hovers just E of us.

07:42 areal average reflectivity built steadily from 0100-0540 or so, then has been declining ever since. Near-surface SE'ly wind shift now showing up on VVPs. Given the nature of the detrained outflow from these cells on MAX, and the tilting of the rain shafts evident in XSECT, these appear to be fairly sheared cells; perhaps helps explain modest tops?

08:00 switching to NEARs as this line will be with/over us for a while

08:38 sonde got to 14 km then quit

10:30 Switched scans back to FAR's. Did skewt's. Notice that winds in mid-low levels are starting to come around to the south-southeast. We must be starting to get on the back side of the wave. One thin line of weak cells oriented north south across the radar; widely scattered elsewhere.

10:54 Sonde away at 10:45 or so. Good launch w/winds. Put a piece of paper near the Digicora for marking when second launches are done. Bob says it looks like we've used 58 Sondes up to this point. We've used the about the same number of blue pens apparently.....their scattered all over the place.....

11:00 Archiving looks good. No messages in syslog.log.

11:30 Sonde hung at 800 mb or so. Must have gone in a cloud because the humidities shut up to 102 and then died before it hung.

11:55 We launched another at 11:55. So far, it looks fine.....Some RW just to starboard.

12:05 Sat. image verifies that we are on the backside of the wave. Made a plot for log. Next one is still in the Caribbean approaching C. America.

13:10 A few more cells developing in the southeast quad. Unfortunately, it's close to a "beautiful day in the neighborhood". Sounding nearly saturated up to 2 km, a bit dryer aloft. A couple of inversions.

14:09 Visibly, the clouds look a bit "soft" today, somewhat diffuse.

14:52 Sonde away at 14:45. Good luck etc. Convection still spotty.

15:20 – development of echos in the SE quad continues, though cell tops are < 10 km and max dBZ < 45. Not much activity far down to the south in the ITCZ like we've seen the past few days.

15:58 Visibly unimpressive stuff nearby. However, one cell 100 km to the southeast has 30 km up to 8 or 9 km with 15 dBZ tops to 13 km or so- mass down there is kind of congealing. Short weak line is approaching us from the southwest. We'll see what happens.

16:50 echos to the SW starting to congeal a bit. Several tops near 15 km with 30 dBZ approaching 8 km.

17:29 Nice contrast between warm rainers and some of the deeper ice phase stuff. Tried to capture it in a picture. Outflow boundary from stuff close to us and to the north is really obvious in radial velocities in low level tilt.

18:20 activity really starting to increase in our immediate vicinity. Looks like a line moving toward the ship from the east. Several well developed cores with 30 dBZ . 8 km. Blop to our immediate west has a lot of detrained anvil blowing off to the west.

18:45 sonde 44 away with winds. Launched into a cloud deck.

19:11 switched to EPIC_NEAR – raining at the ship

Note change in clutter pattern between 16:01-16:21 (SW to NW)....not sure if this is meteorological or an INU artifact. Need to keep an eye on this.

19:50 System is just filling in big time right over the top of us. It's pouring outside.

20:11 System is just a big mess. Convection is embedded in stratiform that is a result of decaying convection. Bright band showing up on the display over us now. This has turned out to be a nice case.....all on a day when we didn't think much would happen.....

21:30 echo slowly moving toward the west and away from the ship.

22:00 back to EPIC_FAR

22:46 sonde 45 up and away, signal looks good. Widespread cloud cover outside but clear blue skies aloft visible through breaks.

23:14 sounding has moist westerlies up to 6 km switching cleanly over to very dry easterlies aloft. This is corroborated by VVP. Lower trop winds thus show a definite shift from the SW'ly flow of the last day or so (also evident in VVP t-z plots). Systems have healthy 15 dBZ tops but not much ice content aloft. XSECTs still show clear shearing of rainshafts. Areal average Z has been declining since perhaps 18Z or so.

23:50 system weakening for the most part, although region ~ 50 km to S appears to have kicked of a boundary with new cell development in this region. Several of these cells are quite vigorous with 30 dBZ > 10 km.

010919

00:06 areal average reflectivities have grown since ~ 23:20, reflecting in close cell development

00:14 XMTR power check epic_rain = +55.8, epic_far = +56.0

00:21 sonde looks like it's done, hit trop, nearly 17 km / < 100 mb

02:57 sonde away, never got any sats on sfc and none aloft, so no winds

03:11 almost everything has died out, residual low-topped activity is all to our southern quads

05:22 sounding reached nearly 20 km, no winds all the way up. Very dry aloft. A line of very low-topped warm cells close in to our SW.

05:50 outbreak of low-topped warm rain cells in NE quad. Deepest activity is still distant S.

06:58 sonde up and away, good signal, getting winds. Low level westerlies are even shallower than at 0Z; winds shift to SE'ly now at just over 1 km (although wind speed is very low). Deep cells continue distant south, only little junk in close.

08:04 still nothing but small warm rain cells in close, deeper activity all distant S

10:53 Balloon away at 10:45. GPS lock kicked in about 500 m off the surface. Still just scattered stuff around us (shallow). Most of the significant activity is to our south beyond 100 km. Good clutter out to 20 km in NW quad. (winds are 10 kts out of the west). Archival looks good on RB2 (no SCSI errors and plenty of room on disk- 113 Mb).

12:29 Some RW around, but clouds are very shallow- warm rainers for certain. The tops are quite ragged as they hit the dry air aloft. Clutter pattern appears to have shifted into the SW quadrant with sporadic appearances on the east side. We just turned about 15 minutes ago.

13:20 Only thing of interest is the shifting clutter pattern.

14:45 sonde 49 is a happy camper with winds and ptu data....

15:40 looking at archive menu of dlta and b to see if number of files in each is constant or changing. Currently dlta has 1368 files and dlta has 1408 files (difference of 40 files)

16:20 echo coverage is unimpressive

16:57 Echoes are picking up a little in the southern half of the coverage domain- but they are not very organized.

18:45 sonde 50 up and away but winds are very flakey. Cord did not unwind on sonde

19:40 a few more echos to the south – nothing too organized.

21:10 echo coverage continuing to increase slightly through the south and east quads

22:45 sonde 51 away but no winds after it left the deck.

23:42 Sun ck. Sun= AZ 269.6 El 8.96, error = az 0.0, el 0.0

23:40 RAIN scan has low power from restart

23:59 0Z sonde lost signal near 8 km, but with some babysitting picked it up again. RH lost above that, though. No winds all the way up.

010920

00:10 some linear organization of elements off to our east and to our south. Couple of vertically well developed cells with 30 dBZ to 8 km along one of the lines.

00:48 sonde stopped at 28 mb

01:36 some very intense isolated cells distant S with pretty high Z aloft

01:43 19 fl / 5 min out of at least 2 visual areas to S and E (~ 4 fl/min visual domain total)

01:45 smaller cells to E have 50+ dBZ rain cores (and have had for a while)

03:20 04Z sonde up at ~ 400 mb getting good signal. Still plenty of lightning outside (some close), although nearest cells don't have overly impressive 30 dbz tops. Sounding shows easterlies consistently above lowest km or two

03:40 sonde made it to 270 mb then flagged a sounding stop, signal was fine at the time though; presumably it was a burst.

05:09 low level winds have been shifting from northerly to northeasterly/easterly over the last few hours

05:54 some truly monstrous warm rain echoes in small cells 35 km SW; 58+ dBZ seen growing and descending over last few vol scans. Further south, some very high dbz aloft cells. 50+ cores in a lot of the small cells tonight.

06:48 sonde up and away, little trouble getting a lock at first but came through with winds in the end. Easterlies down to 1 km now with thin layer of northerlies below that. Massive midlevel reflectivities persist in some of the SW cells as does the lightning show, although flash counting is complicated by all the intervening junk. Areal average Z has been building since 0400.

07:14 55 + dbz cores present in many of the small cells for some time now

10:55 Sonde away. Launch about 10:45- good lock. Still have westerly winds right at the surface. Larger echo mass that was south of us is moving off to the east out of range. Right now there are a few short lines just to our west and then north. Some 30 dBZ to near 7 km in the cells. Echos are all progressing to the west in the easterly flow that exists just off the surface.

12:28 Looking at the sounding winds. The westerly winds at the surface appear to be confined to the mixed layer, or actually, the nocturnal boundary layer. There is a slight inversion over the top of this layer that must be keeping the westerly momentum confined to this layer (and the WIND product is really not picking up the westerly layer very well (except right at the ship) it thinks winds are all easterly in the 0.5 tilt). Very cool. Strong easterly jet at trop.- 22 m/s. Echo's still pretty scattered. Visibly, quite a few skinny-necked warm rainers around. Getting a fair amount of second trip off the big mass of stuff to our southwest (shows up in long ranges on RAIN scan- edge about 150 km out).

13:56 No significant change in the echo coverage.

14:45 sonde 55 up, up and away with winds

15:51 Short line E-W oriented sitting up 70 km to the northwest. Not especially spectacular, tops around 8 km or so. Stuff behind it (few cells; 120 km at 020°) has more respectable tops- 11-12 km.

17:05 SCSI apparently reset (20th at 00:40 UTC or so). So tapes have likely been re-wound and written over.

17:40 watching long range scans showing a region of mostly sf precip coming our way from the NE. I'm not totally convinced yet that it's real and not 2nd trip.

18:51 Sonde 56 launched at 45. Good winds. Echo mass to our northeast is slowly encroaching into our area. Still 180 km out.

19:30 few cells in line (about 80 km long) approaching us from the east. Guess they are forming along some sort of boundary. Rather small line but cells have some 55-60 dBZ up at 3-4 km. Made a xsect.

20:00 outflow boundaries approaching from the north-northeast and the east. These boundaries are zipping up. At their intersection, convection is forming.

20:15 Cells 20 km to NE are producing pixels > 55 dBZ in 2-4 km layer still. FAR tilts suggest they are northeastward tilting too with some overhang. Substantial clutter in northern quad.

20:50 line of cells to NE continue to approach the ship but are starting to decay

21:30 what's left of the linear feature is moving SE of the ship

Note – several error messages on RB1 today (19:09, 13:17) regarding – “invalid heading” and “byte fault cleared”. Comparing image products at 19:01 vs 19:11 there is a discernable shift in sea clutter pattern in PPI's from EPIC_RAIN but not in echo orientation. Nothing obvious in any of the other products I've looked at. Don't know if this is significant or if I've just been staring at this blasted monitor too long....

22:40 sonde 57 is away and a happy camper

010921

00:10 echo coverage decreasing overall. Lot's of 2nd trip showing up in the low PRF scans

01:49 OZ sonde complete, got well above trop with good data. Not a lot going on w/ radar; new line of small cells to NE; edges of the tropical wave to our east have been lingering distant NE for some time now.

03:11 NE cells not amounting to anything. Sonde OK at 5 km. Lots of second trip NE quad from organized wave stuff distant NE.

06:52 sonde up and away, good signal, getting winds. Small cells distant N and NW growing modestly, few in close are still pretty wimpy. Large organized mass 200+km NE is slowly but steadily intruding into RAIN scans. If relative position persists, we may miss most of the action from that wave...

07:34 line of cells seems to be advancing on us from the north, perhaps a 'band' of the organized activity up there

08:09 latest GOES imagery has core of the wave's convection up near 13N, and the cells we're seeing do look like a weak outer band. Sounding still going; had an odd dry slot from 6.-7.5 km of SW'ly (!) winds, not sure what that means... Low level radar winds are NW'ly, consistent with expected pattern for what's out there. XSECT through the organized echo now at the NE edge of our 150 km scans shows it to be a large, thick, classically sloped 'deep' anvil (5-12 km altitude). Wonder if it's spider-infested...

10:00 Large band of activity is slowly sinking to the south. The weaker outer band is basically over us and moving south. Really nice blow-up of convection in the wave on the satellite- per Dennis' last comment.

10:21 Mixed bag of convection and stratiform forming over the top of us. Cells in this thin band are combining and decaying to produce this mass.

10:45 We launched #60 but it probably won't have winds. It was raining on deck when we launched. Weak bright band over us now. Echo Coverage is picking up all quads. Starting to fill in. Largest band is still 150-200 km north of us, but things are popping all over the northern ½ of the scope. 55-60 dBZ is not uncommon in some of the cores in the 2-4 km level.

11:25 Launched #61. The last one did a descend at about 4 km in a cloud or something. The digicora decided the balloon had burst, but the sonde actually ascended again. This one has winds too. Hopefully it will make it a little further. On the scope there is an apparent circulation at 300° and 160 km out or so.

11:52 small boundary with cells moving south located about 80 km to the northeast. Sounding suggests 0° level is up near 5500 m or so- really increased in height.

12:52 New batch of small cells about 25 km to the NE. Gobs of stuff around us, but just not over us.

13:50 Seems to be 2 different lines or bands: one to N and one to NE – they are orthogonal and are about to intersect in the NE quad. A number of vertically well developed cells here with 30 dBZ > 10 km and tops to +15 km (53-55 dB max cores). Animation suggests at least one of these formed along an outflow boundary.

14:45 sonde #62 is up, up and away and is a happy camper

16:10 Convection to North still out 30 km or so but last few sweeps suggest that another boundary has formed along it's southern margin – this boundary is quasi perpendicular to the previous convection

16:32 CAPPI with wind product suggests the presence of a big line of confluence arcing from E to W. Convection is forming along it. Cells very close by- within 10 km. Looking back, one cell at 14:51 had 30 dB tops that were at almost 14 km!

17:41 Rain at ship. (may have started earlier though) Switching to NEAR's.

18:25 lots of 2nd trip in EPIC_RAIN

18:50 sonde #63 is away but not happy – no winds

19:31 back to EPIC_FAR – linear feature still holding together to N and NW

19:56 Nice cyclonic eddy at about 210 km to the northwest (in rain scan ppi loop).

21:40 echo coverage generally decreasing across domain. Disturbance to our north is just on the edge of the display at ~ 200 km range now. Circulation still evident. Most echos are moving N-NE. Note this a reversal to just several hours ago when everything was moving down from the NW. Assuming this isn't an INU corruption, it makes sense being on the back side of the wave, I guess. Animation shows the band that had been hovering around the ship several hours ago reversing direction....I'm still a little suspicious about this.

22:45 sonde 64 is away and a happy camper

010922

02:09 sonde 64 completed awhile back, well over tropopause. Nothing but tiny cells around; edge of wave organized echo is now distant NW. 18-hr VVP time-height shows low level cyclone / upper level anticyclone passage beautifully.

02:35 hourly CAPPI (EPIC_HOURLY) has been rescheduled to every 3 hrs, to conserve print cartridges.

02:55 sonde 65 up and away, signal good, getting winds.

06:52 sonde 66 up and away, signal good, getting winds. Still dead'r'n'a'doornail on the scope, 'cept for some tiny warm cells

08:25 small cells increasing in frequency but not in depth

10:00 Thin arcing line of cells extending from north to south across scope. Must be along a boundary- but it's a really long one. The cells don't seem particularly impressive.

10:47 Sonde #67 away at 10:42. Good launch w/winds. Scattered clumps of cells along the N-S boundary. Some decent rain in them- 30 dB tops approaching 7 km.

11:23 Some of the convection is trying to solidify into a mass to our east and southeast (20-80 km out). We'll see what happens. I'm not holding out much hope for this stuff, in terms of a long life, if that dry layer still exists at 7 km.

12:09 Convection to our east is just staying in place as movement seems to be along line from the south. Still fairly wide spread in the eastern ½ of the scope. Tops are about 12 km or so.

12:40 Looking at the satellite loop, it seems apparent where the dry air above 5 km is coming from. If you look down around 5 N it is clear that there is a low level cloud deck to our southwest. The absence of deep cloudiness in that region (i.e., a squashed low level cloud deck) likely suggests mid-level subsidence and a dry mid-troposphere- since it is located to our southwest and our dry layer is associated with strong southwest winds.....the advective connection seems sort of obvious. Apparently we were just a little too far south on the development/progression of this particular wave. Once the wave moves just a bit further west, perhaps the dry layer will erode somewhat if the winds turn a bit.

12:47 Two new cells 10 km east.

14:45 Sonde #68 away. Good winds. One cell due south and scattered elsewhere. Switched to a NEAR just for fun (actually, group leader Cifelli forced me to).....

15:20 Petersen's insubordination has been noted in my personal log... Cell passing to our W-NW. Not particularly impressive in terms of echo tops or max reflectivities (~53 dB in one pixel). Lot's thin-necked congestus outside and sounding shows another pretty hefty dry layer above 5.5 km or so.

16:19 Raining at the ship.

16:45 Still raining at the ship. Most of the scattered cells have tops of 10 km or less. No extended 30 db cores apparent.

18:20 back to EPIC_FAR

18:45 sonde 69 away with winds – not much on the display to look at

20:55 still just scattered small echos

22:45 sonde 70 away and no winds – echo coverage starting to pickup a bit

22:50 clear 180 deg shift in the clutter pattern right after we did our turn-about maneuver to reposition. This definitely suggests slight elevation misalignment, although with a 0.5 deg surface tilt and 1 deg half-power beamwidth, it wouldn't take much for a noticeable effect...

23:38 humidity came back after first couple hundred mb, looks plausible; never got any winds. Close cells still isolated and mostly low-topped.

010923

00:52 cell advection speed has been pretty zippy (SW-NE) today; in RAIN-24, can see gaps in the rain streaks caused by small cells advecting (in the 10 min between updates) by > their diameter. Areal coverage has increased significantly last couple of hours, with most organized action to the SE. 15 dbz cell tops still very bimodal overall (very low or very high)

02:41 sonde up, signal good, getting winds. Activity to the SE is now a large contiguous mass in MAX, just about that in PPI.

03:15 small cells in very close, but still very low topped. Action distant SE now has very healthy mixed phase Z

04:50 mass to the SE has been sort of 'backbuilding' towards us; individual cells migrate to the NE, but new convection seems to be forming as isolated cells to the west of it 'mash into it', or as new cells form along its western boundary. Odd mode of westward propagation overall.

06:18 echoes are now fairly close, but XSECT reveals most of echo over us to be simply anvil, so holding off on NEAR's for a little while

06:47 sonde 72 up and away, pretty gusty out there (17 knot sfc) but made it up OK. Main cell cores continue to hang out east of us and seem to be migrating NE without further backbuilding, so still keeping in FARs (just anvil over us at the moment).

06:57 17 fl / 5 min out of 2-3 main centers to the E and NE ~ 3 fl/min ~ 1 fl/min/center. MAX now shows a very large contiguous 40+ core to east, cells have all agglomerated. Areal average Z has risen steadily since ~ 02:30.

07:56 sounding burst at 12 km – what a *weird* sounding, though it looks legit. Lapse rate looked moist adiabatic up to the midlevel dry slot, then looked like it increased, perhaps dry adiabatic, through the dry slot, then was topped by a fairly deep (several hundred meter) *isothermal* layer at 7.5 km, then resumed moist adiabatic above that (along with increased humidity). Definitely not your typical well-adjusted tropical sounding.

08:04 XSECTs still suggest only anvil above us not being topped; so leaving it in FAR mode for now.

10:00 System to the east had/has some nice cores in it. Fair amount of stratiform. Winds are pretty strong right out of the west. Looks like convection oriented N-W and moving north collided with something moving into our area from the east.

10:25 Group of cells now growing directly south-southeast and over our location. Switching to NEARs. Large mass of stratiform with embedded cells in NE quadrant. Very nice looking system. On satellite appears to be forming under the influence of a band associated with exiting E. wave and something that moved off shore.

10:55 Sonde #73 away in very light rain. Got winds. Archival looks ok- 113 Mb free on vol17.

11:25 #73 bit the dust early. Launched #74 with winds. Echo mass seems to be fed by a westerly stream of cells.

12:08 Echo coverage just gets better and better. Convective lines extend radially outward from the ship in a gross sense. 30 db tops look very oceanic for the most part.

13:10 Sounding time-ht series indicates the development of deep westerly winds (up to 8 km) as of today. This must be providing the steering flow for the streaming of cells into the echo mass

located due west of the radar. Some echo tops are approaching 18 km! 30 dB cores to a maximum of 12 km! Deep stuff! Made an xsect.

13:25 Tops product suggests stuff in SE quad is now the more intense/developing. Stuff in NW is falling off a bit. Still in NEAR's to top stuff close in- but within 10 km it's not really getting to the top (even at 60°).

13:30 Boy, one thing the low Nyquist on the rain scan is good for is detecting the boundaries that are floating around out there. They are all over the place. Upper level easterlies are just blowing anvil way out to the west.

13:35 Satellite imagery (AVHRR and GOES-8) show a very large blow up over us. Very cool. Wonder if this will develop into a depression so close on the heels of the larger disturbance to our NW. Made plots of sat. picts.

14:10 Eddy apparent in dBZ loop just to our NW.

14:45 sonde 75 is away with winds. Launched into a fairly ominous sky with 1-2 flash/minute cells just to the east.

15:07 Cross sections of radial velocity suggest a very sloped updraft structure.

16:24 Feeder bands from the west seem to be diminishing a bit, but the echo mass is still well developed and raining hard over the top of us. Surface winds have shifted to the southeast and are blowing at 17-20 kts. Looks like some kind of boundary went by us on the radar display. There is some convection embedded in all the junk that is developing along this line. This system just keeps going and going.....Very evident easterly current up to 1.5 km in cross section overlaid by westerlies.

16:44 Enough coverage to switch to EVADs- will do this on next go around.

17:00 started EVAD's – surface winds are now out of the NW at 25 knts- heavy rain at ship. Fairly broad region of > 12 km echo tops.. Quick visual suggests 1-2 flash/minute

18:10 System is evolving into a squall line. Leading line of convection is oriented NW-SE with stratiform behind. Though the leading line appears to come from the west, and bumped into the stratiform.....not your typical squall line development.....Given that the air the line of convection is running into is located in a vast region of stratiform precipitation- you would think the convective line should die a quick death as it ingests lower theta-e air. That doesn't seem to be the case yet.

18:56 Sonde 76 away at 18:40 or so. We didn't worry about winds since it is pouring rain and there was lightning overhead. Basically, the convective situation continues. Feeder bands from the west merge with the large stratiform area to our east. The bands die, or at least exhibit a significant decreased intensity, and become part of the regeneration process of the stratiform region

19:06 The max loop shows a very obvious N-S boundary moving through the cloud mass from east to west. Where are these boundaries coming from?

19:56: The system seems to be weakening. There is an area ~40 km to the east that is starting to open up (like a transition zone). The core tops are not as pronounced, looking very oceanic. The convection may finally be tapping into air that is spent. Still raining outside, though not as heavily.

20:15 line of convergence continues to surge out ahead of the convective blob – this feature is close to 200 km in length (stretching N-S) from the radar. Although overall coverage is decreasing, EVAD scans still look pretty good (more sf than convective within 40 km of the ship).

21:30 bright band showing up nicely in EVAD's now. Coverage a little spotty in northern sector but should be able to make something of it.

22:00 boundary is still visible moving W-SW but appears to be decreasing in intensity

22:40 #77 away with winds. Launched in light rain – not holding out hope for a long flight

23:05 – EVAD coverage getting pretty degraded – switching to NEAR starting at 22:11. Interesting bright bands structure. Very ragged with cellular features below the BB in many places, presumably a result of decaying convection.

010924

00:01 bright band dominates areal average Z now, has done since 21:00. Sonde 77 crapped out near melt level.

02:01 switched back to FAR's. Strat mass over us has rained out; large mass now NW; front edge of line seems to have petered out as well

05:53 we have had some new cells crop up behind this afternoon's mass (now distant NW) and intensify in the usual nightly ritual

06:45 sonde 79 up and away, good signal, getting winds (sonde 78 got nearly to trop but lost sats just after launch and never got winds)

07:32 the local stuff is blossoming into the usual midnight-3 am outbreak, although not many deep 30 dbz tops in it yet. Amazing that it can occur after that day-long sogging we got.

07:41 fairly heavy rain over us but from all indications it is fairly low-topped, so sticking with FARs for now

08:32 several small deep cores aloft in the mass to the SE now, two to N. The SE activity has again merged into a large contiguous blob

08:53 SE mass is now dominant although development aloft is not intense (5-6 km 30 dbz tops over most of it). Areal average Z has built steadily since 0500 or so. Wind profile is now back to low level westerlies (< 4 km), upper level easterlies (> 5 km)

10:15 N-S band of rain directly over us. Still gravity wave trains of stuff coming in from the west colliding with this mass. Doesn't seem especially well vertically developed.

11:15 Balloon launch was a bust. We waited until rain let up a little (it was still pouring though), got a good release- with winds even, but the balloon went up about 50 mb and then down 50 mb. We're bagging a second launch as it doesn't look favorable for a break on the radar. Large sloppy system over the RHB this morning.

11:55 Situation unchanged.

12:10 Satellite loop suggests that the system of yesterday and this morning, including the eastward propagating bands are associated with Juliette. We are simply getting collisions between her outer bands and gravity waves or buoyancy waves propagating westward off the

coast. We seem to be in a magic location with regard to where things blow up during the night. The system of yesterday basically got absorbed into Juliette (or the wave associated with her).

12:15 A new discovery- The sun appears to rise at an azimuth of 090°. Give me my Nobel now.....

13:17 Stratiform with embedded convection is starting to shift ever so slightly to the north. There actually appears to be a small circulation present with a notch located 20 km to our southwest. Still raining moderately at the ship.

13:41 switched to NEAR scans – nice bright band on the display

14:45 sonde 81 away with winds. Launched under light rain – 15-20 knts of wind. Echo area continues slow northward movement. The ship is at the southern extreme of this. A non-uniform band of convective echos has appeared within the stratiform rain shield, extending N-NW from the ship for over 100 km. Echo tops are still generally below 10 km.

Sun disk is at 95%. Wrote 10 days worth of raw files (010910-010919) to 2 exabyte tapes (5 tar files/tape) and deleted corresponding files on the Sun.

15:14 Bands of little puny conjestus keep coming from the west- you can just make them out. They collide with the mass and reinvigorate the whole precipitation area.

16:04 Sounding 81 died at the bright band. The max product shows a very strong (40 dBZ) bright band, so, I guess it's no wonder.

16:40 echo area continues slow migration northward and is slowly decaying. Low level echo coverage within 50 km of ship is pretty ragged. Echo tops generally less than 9 km.

16:46 Switching to FAR's at 16:50.

1845 sonde 82 away with winds. Launch in spitting rain.

20:26 Echo mass shrinking in size to the north. We are basically precip free here. Just cloudy now.

21:00 echo mass continuing to slowly drift north and decay – most of it is now 100 km north of our location.

22:45 – sonde 83 up and away with winds. Cloudy. A few drops of rain.

22:40 transmitter down temporarily – power return in 22:40 rain scan is weak

010925

re-started IRIS on both rb1 and rb2 since could not connect to menus on rb1 upstairs. DLT's came up non-iris so we turned off those devices in the product output scheduler (rb2). Back on line at 00:10.

Sonde made it to tropopause above 15 km before quitting.

02:44 sonde 84 up and away, good signal, getting winds. No local cell blooming yet but there is a large anvil or mass distant (250+ km) to the east.

05:07 slight eruption of low-topped cells in the NE quad the last couple of scans. Activity distant east slowly approaching (edge now ~ 200 km off)

06:48 sonde 85 up and away, good signal, getting winds. Fairly dry in lower trop. Local cells never amounted to anything in close, but did agglomerate just past 150 km, merging with the approaching eastern mass of echo. Feels like we're between bands.

07:48 eastern mass now in our volume scan range, far edge.

10:00 Line/blob from the east is about 100-140 km out. Cells moving from the west into the edge seem to feed it.....seems like I've said this before.....

10:55 Sonde #86 away with winds. Stuff to the east is decreasing in intensity.

11:50 Still just a small area of cells to the distant east. Lot of mid-level cloud coverage outside. Winds stopped working in sounding at about 2.5 km (not sure why).

13:19 Ditto.

14:11 Same.

14:40 sonde 87 away with winds

16:50 Line of weak cells still holding 100 km out from RHB.

18:50 Sonde 88 away with winds. Still a N-S oriented patch of cells 100 km to the east of us.

21:10 persistent echo mass 60-100 km east of us....not much else to look at

22:40 sonde 89 away – no wind

010926

00:39 sounding complete. Pronounced subsidence evident, even in the linear T-z display. A line of low (1-2 km) topped cells evident at 00:20. Visually (at sunset) some of these were precipitating, with barely more vertical development than one or two mixed-layer depths...

02:45 sonde 90 up and away, getting signal good winds. Will be up to triple digits soon; we should plan something wild and crazy for the 100th, I dunno, maybe an extra RAIN scan one cycle or something

looks like RBHP2 locked up at 02:41:40; will have to reboot (screen had frozen, could not remotely login from RBHP1 either, so had to hard-reboot)

02:59 IRIS back up on RBHP2; resyncing 02:21, 02:30, 02:31, 02:40, 02:41, 02:50 and 02:51 scans from RBHP1

03:19 scans resynced; had to restart IRIS on RBHP1 as well because of hung network connection to RBHP2 from before. 03:10 RAIN scan was low power on restart. Products from 02:21 FAR scan (the one being processed during hang) are also messed up.

03:20 very low topped cells are lined up in NW-SE propagating "streets" (low level flow looks NW'ly)

06:14 large clump has been loosely aggregating distant E/SE the last couple of hours, nothing in close

06:44 sonde 91 up and away, signal good, getting winds

10:00 Mass of stratiform with embedded convection 40-100 km to our east-southeast. Small cell within 20 km to the north. Another smaller mass of stuff about 120 km to the northwest. The blob to the east just sort of slowly oozed its way west. There appears to be one little short band of cells ahead of it (can't tell if this is the edge of an outflow). This is all low top stuff.

11:07 Lost the first sonde in rain (it hit the ocean and then went up). So, #93 was launched successfully following the first attempt. Echo mass is sliding toward the southwest. Still quite a number of cells embedded in the stratiform.

11:55 Edge of echo mass is sliding closer and closer as it moves southwest. Still some active convection in it with 30 dB tops through 7 km!

12:32 Echo mass is trying to become more linear. Perhaps because some of the stratiform fill-in is decaying. Appear to be a few decent cells out there.

12:40 Starting to see parallel bands on the NW side of the mass (NE of us). They are somewhat regularly spaced ~ 20 km wavelength.

13:15 Archiving ok.

14:47 Balloon #94 away at 14:40. Fairly dark toward the east. Convection to east has tops that are now in excess of 13 km, some above 15 km. 30dB tops are up to 8 km or so in several cells to the south-southeast.

15:51 Line is slowly progressing toward the ship. The edge of the precip. Is about 30 km out. There appear to be several cores with 30 dB above 6 km.

17:01 Seems to be a notch in the southern part of the convective line- wonder if it is finally developing some rear inflow to push it along. Still not over us bet getting close.

17:40 cross sections show some fairly healthy tops in a few cores (> 15 km) and a broad area of 12+ tops. The deep cores are vertically well developed with 30 dBZ above 8 km – the reflectivities in the broad area suggest small ice only above the melt level – very weak returns aloft. In terms of horizontal structure, the precipitation mass has solidified over the past hour: typical oceanic stratiform blob with embedded cells and small bands of convection.

18:45 Sonde #95 away with winds. Precipitation blob continues to slide W-SW – we are just catching the corner of it here at the ship. Overall, intensity appears to be diminishing somewhat. Yes, I must concur with Dr. Cifelli's insightful comments.....Dr. Watson.

19:48 System still decreasing in intensity. Shooting out a fine line on its SW edge.

22:00 echo coverage decreasing

22:19 maybe, maybe just a hint of rotation in the dissipating mass to our S/SE

22:40 sonde #96 away with winds – radios work well. We should have appropriate code name identifiers for this to be a legit operation....

010927

00:19 sonde #96 made it up to 17.5 km, hit a tropopause or three, then burst. Winds all the way up.

01:14 echo still declining all round

02:45 sonde 97 up but lost winds a few mb off the surface. Some cell regrowth to the SE after ~ 02Z. The new cells are SE of where the center of possible rotation from a couple hours back would be now.

04:47 sonde 97 got up to a tropopause before losing signal. Not much to say; cells are doing their usual nightly bloom. Main activity is to the south although isolated ones are starting to approach from the north now.

06:55 bird #98 has flown the coop, signal good, getting winds. Line of cells from the north has picked up in speed towards us in the last hour or so and is nearly atop us. While widespread, 30 dbz vertical development has been pretty modest in most cells tonight. Areal average Z has deepened and intensified more or less steadily since 0200.

07:10 cells are streaking past us but they're all very low-topped; keeping with FAR's

07:18 sonde seems to have hit a strong downdraft or rain shaft around 750 mb; it started descending rapidly and the base unit terminated data recording, although the signal kept coming in afterwards, suggesting that the sonde recovered. Opted not to send up a replacement since we're still surrounded by intense-but-shallow cells (some cores 50+ dbz)

07:26 will be interesting to see what happens when the rapidly advecting northern cells plough into the nearly-stationary southern agglomeration... should happen within an hour or two...

08:13 cells to the east have formed an extended N/S line, cells to the south bunched into a semicircle-arc, cells to the north keep streaming in, the whole area's just a mess of quasi-organized features

09:40 Went to NEARs.

10:52 Successful launch of #99 w/winds and in rain. System is just a big mass of stratiform now with only weak embedded convection. I am going to switch to EVAD's since we have pretty decent coverage (may have been able to do this earlier, but the NEAR's will still be useful for doing EVAD's too). Satellite imagery suggests that this convection is associated in some sense with a weak (at least in our neck of the woods; it looks much stronger toward the Yucatan) E. wave that is making it's way over our area.

11:08 Just scheduled EVAD's, so they should start at 11:10 or so. Some new convection regenerating on the eastern edge.

12:00 Convection on NE side of mass has some healthy tops, but 30 dB is just poking up to 6 or 7 km.

12:58 System seems to be reorganizing itself into an E-W band/blob now. Convection has weakened again. My eye wants to put a circulation center just to our west (watching the loop of the 6 km CAPPI).\

13:42 Some new convection appearing on the northern side again. Some of the newer cells are now looking quite vertically developed.....well, at least one is. Just to the northeast of the radar about 50 km out.

13:50 Long range shows more convection breaking out to the east- Yippee!

14:00 This band now stretches 300 km in the E-W direction. We are located on the eastern end. Eddies embedded in the band are clearly visible.

14:50 Sonde 100 away! Winds and all. Still raining when we launched. Line has backbuilt to the east a ways (collided with another boundary). Still in EVAD's and plenty'o coverage.

15:00 linear band along northern perimeter of echo mass is becoming vertically well developed with 30 dBZ to 8+ km and tops to near 15 km. Made a cross section. Cross sections in all other directions show pretty healthy stratiform precip.

15:15 the century bird hit the freezing level and decided to head back to the hen house. Ground station considered the target lost and wrote it off to collateral damage, despite the strong signal still coming in.

16:06 After reading the last comment, I think Red Leader may have lost it. We may have to relieve him of command (or at least relieve him of the radio). Little skinny lines of convection keep forming along long boundaries to the northeast. It seems that we are on the edge of a very long plume of light stratiform rain.

18:53 #101 away. Light rain.

19:10 Small fine line actually propagating through the middle of the stratiform precip and stirring things up to boot! This fine line maintained its identity as it slid in from the NE and underneath the stratiform shield- amazing!

19:42 FARs will start at 19:51.

20:52 skinny line of convection forming along old location of stratiform, nearly over the top of us.

21:50 – skinny line has dissipated but scattered cells continue to pop up along preexisting boundaries. Remnants of stratiform deck continues to dissipate off to the NW. One of the scattered cell clusters (NW ~ 50 km distant) is fairly robust with tops above 13 km and 30 dBZ to near 10 km – everything else is below 10 km tops and weak vertical structure.

22:45 #102 away with winds

23:16 – MAX loop from 19-23Z shows another suggestion of mesoscale rotation in the decaying stratiform mass distant W

010928

00:10 Previous strong echo to NW has developed into a N-S band 25-75 km from radar. Animation shows that several of these bands have developed in parallel in the N quad. Amazing that this can happen so quickly in the wake of 9+ hours of stratiform rain... Cross section shows pretty healthy vertical development in this cell-band (30 dBZ to 9 km and tops to 13 km). Feature is tilted with strong outflow evident in velocity field and anvil spreading off to the west.

00:30 sonde got up to 9 km then died. Little mini-N/S lines in our northern quads now.

01:35 two main N/S oriented lines just W and further E of us now

02:54 sonde 103 – first balloon hit a-frame and burst; second went off ok, good signal, getting winds. Radar situation largely unchanged from last entry.

03:14 another RBHP2 lockup, at 02:50:10

03:22 RBHP2 rebooted; IRIS restarted on RBHP1 at 03:22; no scans lost; re-sending scans from 02:40 forward to RBHP2 for product generation.

03:49 no adverse entries in /var/adm/syslog/OLDSyslog.log at time of crash (although did note several SCSI hangs on the 26th; interesting, was this before or after we stopped using the DLTs?)

06:47 sonde 104 up, getting winds, good signal. 103 made it all the way up to ~ 60 mb/20 km. Just not much to say about the scope tonight; the thin, modest-topped N/S lines W and E of us have persisted all night.

07:55 some intensification, particularly in cluster to the east has a couple of small lines have piled into each other.. On a larger scale, the activity to the west almost makes a long (albeit broken) line N/S across our 300 km RAIN scan domain

10:00 Somewhat randomly oriented series of convective lines around us. Closest, and somewhat impressive, is 50 km to our SE. Tops are > 13 km.

10:55 Sonde #106 up at 10:45. Good winds. Convection has basically merged into a NE-SW oriented line, broken in some areas, about 60-80 km to our east (at its closest point). The line itself appears to be over 200 km long. Bob reported lightning to starboard, which is in the general direction of that line. Makes sense, it has fairly deep cores in it- 30 dB up to 12 km in one cell (made a cross section).

12:15 Convective line/complex is slowly shifting to the southwest. Development of a few small cells within 50 km of the ship toward the west. Cell 70 km due east has 30 dB to ~12 km or so. These are not wimpy cells! Now, I'd love to know what kind of aerosol concentrations are being seen.....

13:00 Convective band has solidified to the east (due east on north side of line). Doppler velocities show a moderate southeasterly wind (8 m/s or so) into the back side of the line, but, it just doesn't seem to push this direction. It seems to be more aligned with the low level northerly flow. There is a definite wind shift axis/confluent zone located along this long line of convection.

14:00 Another band has developed to our west. This one is oriented NW-SE and appears to have formed along some line of confluence or other boundary. Animation suggests that feature is working it's way over to the other activity to our E-SE. Very difficult to discern over all motion of these features. They seem to form in place and show little evidence of continuous propagation. Tops of the activity to the east is very healthy: broad area above 11 km with some tops approaching 15 km – several well developed echos with 30 dBZ still over 10 km. Line to the west has one high topped cell but everything else is still developing.

15:04 Got #107 away, but it was raining and it's not doing well. May have to launch another. Cells building over us and west-east. Winds shifted to the east and there is a big convergence zone over us.

15:32 Sonde is just hanging in cloud. The Digicora still says "Release".....may be a missing flight on this one. Still raining over us and convection all around the ship in close. Two boundaries moving opposite directions basically collided over us.

16:16 Launched another sonde at around 16:00. Rain still over and around us.

16:30 Echo mass is rapidly expanding into the mesoscale. Hard to pin any real obvious organization to it- some lines, some stratiform, many intersections. Cells in the system have 30 dB confined to 7 km or less. Some 15 dBZ tops to 10-11 km- looks kind of messy.

17:22 Echo mass has filled in and extends 200 km long from NW to South.

17:50 another line has developed about 100 km north (E-W orientation) – sort of on the northern perimeter of this mess. Animation suggests it formed as cells advecting from NW collided with a

boundary of some kind. Coverage in our immediate surroundings is ragged and echo tops are pretty low so staying with FAR's for now.

18:45 sonde 102 away with winds. C-130 called. They are flying a line to the north of us now. Originally, they were to fly the line directly to our north (about 70 km out).

20:05 – most of the echo mass has congealed into stratiform precip to our north. One cell 80-100 km south with tops to 16 km and 30 dBZ to 10 km. Made a cross section (19:41). Believe we are now headed over to the buoy to recover instruments...

22:40 – sonde 109 away with winds. Action is moving away to the NW and scattered cells to SE

23:56 sonde 109 got a stop-detected at ~ -7C, data pretty freaky above the melt level

23:41 our usual fleet of near-sunset 2-3 km topped rain cells are marching in, this time from the west

010929

01:50 this is the clearest I've seen the scope in a long time... MAX is fairly amusing, many small < 15 dbz cells with apparent rainshafts, but 15 dbz tops are almost nonexistent. Large patches of organized activity persist distant NW and SE on the RAIN scans.

02:55 04Z sonde aborted after 2, count em, 2, sondes lost all contact immediately after launch. Balloon went off straight horizontal from the ship (15 knot winds); sondes either got doused or fell off or something. (Very similar to 0Z launch, although that one made it up, albeit briefly). Since we're scrubbing this one without any data, the 08Z sonde will be 111 (on advice of XO). Note this doesn't jibe with the 109 0Z entry above, but the list in the hydro lab indicates that should have been 110 anyway.

04:20 there is now a field of more-or-less evenly spaced, sub-15-dbz cells in the PPI base scans, mostly in our eastern quadrants. They have been increasing in density over time.

06:58 sonde 111 up and away, good signal, getting winds. Slightly overfilled it after the 04Z debacle. Tiny cells to east are starting to bunch up and have collective 15 dbz tops to ~6-7 km. A large contiguous mass dominates the distant SE (150 km+) on the RAIN scan, with a smaller arced/line feature approaching from distant W (just beyond 150 km range now)

08:22 little cells are again starting to string together into mini-lines. Large mass to the SE has been slowly drifting northward, unclear if it will get close to us or not, but it has been very persistent. Stuff to the west mentioned at 06:58 died out, but a second cluster is approaching from behind it.

09:01 small cells are systematically deepening distant (100+ km) east, but we're still growing a new crop of tiny 1-2 km cells in close. Bob reports a significant inversion at 2-2.5 km in the 08Z sonde.

10:56 Unlike the previous launch-challenged crew who should receive numerous demerits from the esteemed group leader for their failure, we were able to launch our sonde successfully (#111 by order of the XO and in concurrence with the CO, Secretary of the Navy and President of the United States). ☺ Cells are moving rapidly west to east and are generally isolated (popcorn like) and low topped. A bit of a mass to the east about 120 km out (all the cells seem to be piling up there).

11:13 Most tops < 7 km.

12:13 Cells are kind of in a “ring” around the radar at about 120 km out.

14:50 Sonde #113 away with winds. Weak echos all quads. Sea clutter out to 40-50 km in moderate to strong west winds.

16:30 little cells of little consequence – sonde still going but lost RH above 500 mb – digicora must have cut it off due to noise....

17:50 little cell activity has picked up in our vicinity (diurnal SST warming?) – still wimpy little things that are moving quickly eastward

18:40 sonde 114 away with winds. Scope looks the same as last log entry

19:44 Today could best be described as a “popcorn” convection day. Though there is a big difference between this convection and that which occurred during COARE- during COARE the wind didn’t blow as hard when we had the pure “popcorn” days, today the winds are quite strong out of the west over the EPIC area.

21:50 rain at ship – activity has picked up somewhat in intensity and aerial coverage Still relatively low-topped cells (<10 km) streaming in fast SW current but cell aggregates are larger and more numerous. Also, many of the cells are in small linear fragments parallel to the low level flow. Can see effect of shear with anvils detraining westward to the rear of cell movement.

23:10 sonde 115 away with winds after a couple aborted attempts

23:53 pretty gusty (20 knots sustained) and good-sized waves all around. Cells are moving rapidly SW-NE, lots of areal coverage but not getting terribly deep.

010930

01:10 there are definitely low-level “sub lines” oriented perpendicular to the general SW-NE stream of cells with very low tops, which seem to race ahead of the main march. Sea clutter extends all the way to ~ 60 km range in these heavy seas. Areal average Z is still in deepening/intensifying mode (since ~ 21Z). 30 dbz tops continue to be very modest (< 7 km), apparently capped at the strong shear layer there?

01:30 sonde 115 got up to 104 mb then quit

01:59 sea clutter in close up to ~ 40 dbz

02:50 sonde 116 up and away, good signal, getting winds. Widespread, SW->NE streaming echo coverage persists, but mostly confined now to our 45-225 deg azimuths.

03:10-03:50 interesting brief and widespread deepening of 30 dbz tops to just over 7 km, for 3-4 scans, if this is to be trusted and not just an artefact of advection through upper elev tilts

04:44 general cell pattern has persisted since last entry, but areal average Z has declined since 01:30. Bright band apparent in areal average for the last couple of volume scans. VILs also declining. Lower trop winds have also weakened. Fairly early for things to be quitting out...?

04:53 reviewing the 03:10-03:50 awkwardness – it appears this is indeed an artefact; printed out a XSECT to the SE at 03:41 showing the bright band severely inclined along a tilt. Perhaps not surprising given the rough seas, but not good news either.

04:55 XO reports @ 03:16 – 04:08 we were in transit back to the center of the circle – wind wave 8 ft, swell 8 ft swell 280, during transit it was behind us (we were heading downwind) heavy yaw and roll then, more pitch now.

06:51 sonde 117 up and away, good signal, getting winds. (btw, sonde 116 quit out about halfway up after very noisy data appeared; we appeared to lose much of the signal when the ship turned around for the transit and no amount of tuning could get a strong signal back). Echo w/in 150 km range continues to fall apart, hardly any 30 dbz echo now, mostly dissipating stratiform.

07:00 With the launch of sonde 117, I show that we have used up 126 sondes so far.

10:30 Yawn.....

10:52 Sonde 118 away with winds.

12:21 Isolated and very weak convection scattered about.

12:31 Note- SST's have fallen quite a bit. They are down to 28.5 or so this morning. They were relatively stable at ~30 °C prior to this wave passage and strong SW winds. Outside there is a fair amount of cloudiness. Low level Cu-topped PBL and plenty of mid-level Alto-Cu. Believe we are still in the trough of the wave, though probably on the backside of the trough axis itself.

14:55 sonde 119 away but no winds. Few cells to south.

16:14 Couple of isolated echos to the southeast (60 km) that appear to have tops around 7 km or so. Sonde lost humidity data around 8km. Substantial dry layer between 2.5-5 km.

18:51 Sonde 120 away with winds. Large patch of decent convection has developed about 100 km to our southeast. No specific organization- just a large blob. Tops are respectable with a few deep cores.

21:20 not much change – area still active about 100 km to the E-SE. Also some echos about 200 km N-NW. Not much but sea clutter in our immediate vicinity

22:45 sonde 121 away with winds

011001

00:38 sonde 121 complete well above trop. Activity is now our distant ENE and NW.

01:09 few isolated 1-2 km 15 dbz tops cells, moving SW-NE, similar to last night. All other activity is now past our 150 km range.

02:50 sonde 122 is Up Up and Away in its Beautiful Balloon. Scattered cells have picked up in density and deepened, on average, by ~ 1 km (still all warm though)

06:00 official end of station-keeping (midnight local 10/1); heading in for first CTD

06:43 sonde 123 is Up Up and Away in ... yeah, whatever. 122 made it well past the trop

07:20 small cell cluster from earlier still in our southern quads, tops now around 6-7 km.

10:00 Nice short line of cells- somewhat organized even.....coming up from the south. Clear turn in the winds behind it. Tops are respectable.....not excessive, but respectable (12-13 km or so).

10:53 Sonde 124 up and away w/winds. Raining over ship. The once "close to being organized" line is now just a blob (10-12 km 15 dBZ tops) that is moving over our position (not to mention we are heading south directly into it). Winds at the surface have come back around to the northeast but it looks like this in response to some type of boundary. There appears to be a confluence line developing just ahead of our linear blob that arcs back to the southeast.

11:15 Magnetron went down at 10:58. Tried to reset at antenna control but that didn't work. Bob reset on the RCP but there was some arcing as the Maggie kicked back on. Bob will check the power supply when the sun comes up. For now, the radar is working.....Meanwhile the sonde bit the dust at 846 mb.

11:47 Sonde# 125 up and away w/winds. Still raining fairly hard. Radar still running.....that's a good sign.

12:02 Convective system is now a mess of stratiform with a few embedded cells. Anvil is sheared to the southwest- very clear in radar data. Winds really suggest we are in an area of robust low level convergence. Satellite shows the last wave that went by us very clearly now- starting to wrap up into a low. Amazing how diffuse it was when it passed over the land mass to the east. We appear to be in a relatively small, localized area of convection on the satellite, though, we are probably in the southern part of the ITCZ.

13:13 Precip area seems to be enlarging on the south side and merging with some smaller stuff in a N-S line to the NE. There is absolutely nothing to the south of this small cluster. Still very stratiform looking. In FAR's at the moment, but, if the coverage keeps increasing I'll switch to EVADs.

14:31 switching to NEAR scan. The blob appears to be turning into the typical stratiform with embedded convection. Tops are up near 13 km on the east side.

15:40 bagged sonde launch due to heavy rain at ship. We are now at the very southern margin of this precipitation blob but not quite out of it. Now stopping for a CTD cast.

16:12 Edge of this large mass is just 10 km to our south.....hurry up with the CTD so we can get some sun!

17:21 Mass of precip. Is breaking up a bit. Two east-west primary bands are located to our north. There is a new boundary over us now- probably new convection developing on the edge of what was stratiform precip. Looks clear to the south of us (within say 10 km or so).

18:45 sonde 126 away with winds – light rain – most of the precip is to our north and appears to be dissipating

23:30 sonde 127 is a bust: 2 attempts and the balloon got no higher than 850 mb...activity has really decreased. We are shutting down operations at 00:00Z

011002

00:20 back up scanning. Raw and GIF dumps to echo/bonegi ceased, archiving now to DAT tape on RBHP2

02:45 sonde 128 up and away but lost winds

06:45 sonde 129 up and away with winds

10:49 sonde 130 up and away with winds. Full moon is really nice out there. Quite cloudy though. Isolated bands of echoes on the screen. One slightly more intense group about 100 km to the SE. Orientation of bands is SW-NE. Reflectivities are generally < 35 dBZ.

12:00 Sun is up. Lots of little rain shafts around but these things are ALL warm rainers. 15 dBZ tops are all below 5 km. Orientation of the bands is the same as before.....SW to NE. The sea is starting to really calm down.....starting to almost look like it could go glassy on us.

13:00 We are driving into some showers- light according to the radar. There is one more organized line about 20-30 km to the south of us.

14:05 Sonde 131 away with winds. Some light rain about. Still shallow tops- but some reasonably heavy rain prior to launch.

18:53 Sonde 132 away with winds in light drizzle. Bands of drizzle/light rain are all about.

22:45 Sonde 133 away with winds amidst barbecue mahi smoke. Beware data contamination.

23:59:40 group leader is setting a terrible precedent by leaving shift 20 seconds early. I'll do the best I can, I guess.

011003

00:00 surprisingly we are not echo-free, there are long streets of very shallow clouds & rain. Street orientation is roughly SSW-NNE, low level flow is southerly. Sounding has very dry (down to nearly 0% RH) subsidence region in lower trop. Up til 21Z the street cells had 15 dbz echo tops of 2-3 km; now they're still present but mostly have echo < 15 dbz. Still managing to get drizzle on the ship from time to time.

01:05 sounding complete well above tropopause

02:46 sonde 134 up and away, saturated almost immediately, getting winds. Cloud streets persist with very few having > 15 dbz. Again super-dry above 2.5 km.

06:48 sonde 135 up and away, again saturated almost immediately. Sonde released at ~ 3.5N. Getting winds. Message from JS on Digicore-1: "You're just blowin' wind". N/S cloud streets persist although reflectivity and vertical development, if possible, appears even lower than before.

10:37 Radar taken down. Transmitter arcing again. Bob will bring it back up after daybreak when he can check the power supply (suspected problem). He will try cleaning things first. Cloud streets prevalent in display. Some drizzle. We have crossed the SST front and are in much cooler water (26.5° C or so). Air temps are also quite a bit cooler- feels more like the California coast (I wish.....).

11:21 Sonde 136 was up and away at about 10:50 or so. We are definitely in a stratus/strato-cu topped PBL region.

17:30 Radar back up. Found a loose wire to the input of the modulator assembly (RC6000), it appears as it was not completely on the pin.

18:45 sonde 139 away with winds – last launch

20:40 sonde 139 terminated well above the trop. Archiving data. Leg 1 operations are now complete.

