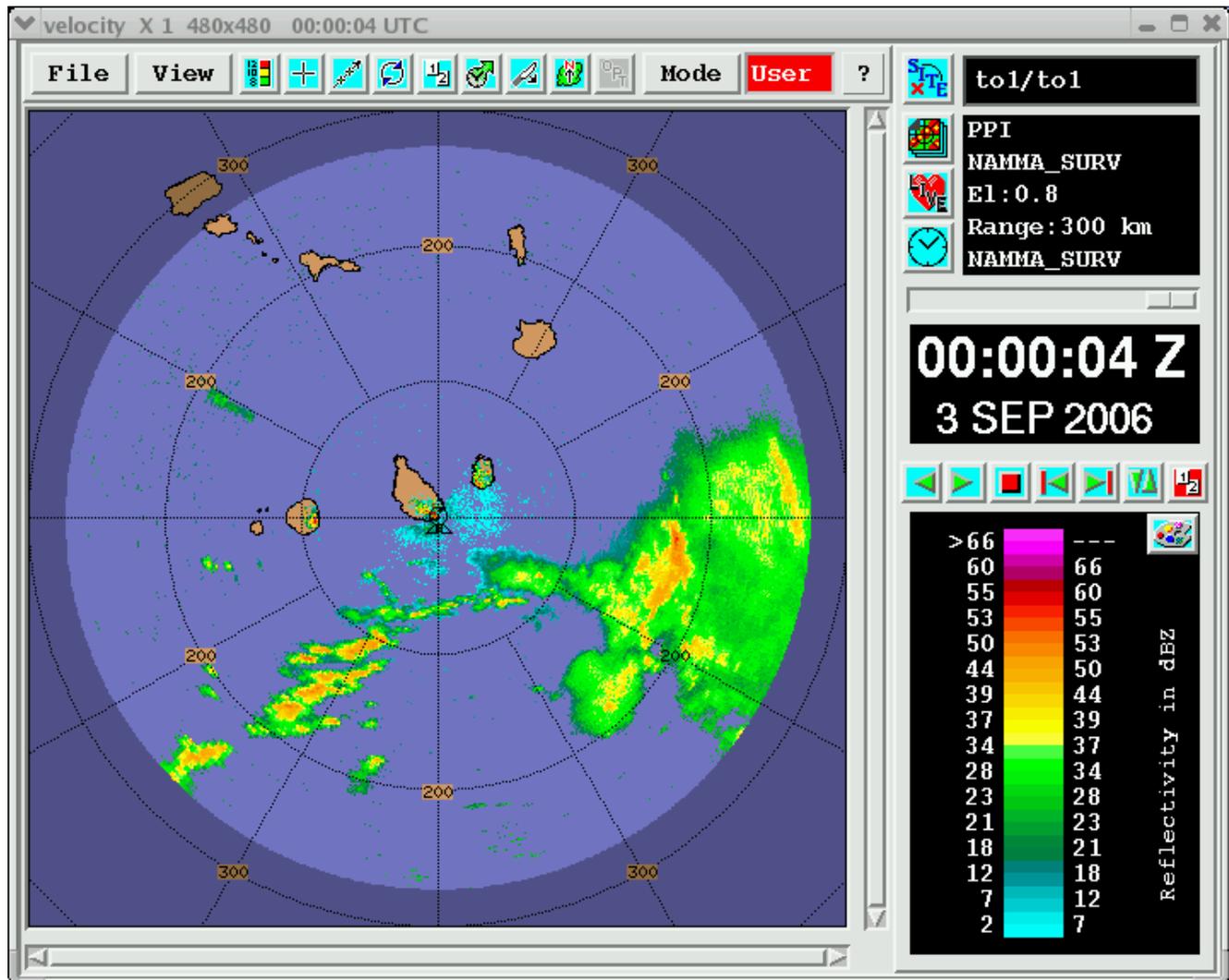


NAMMA – TOGA Radar Scientist Log – Part 2 of 2

3 September 2006

0000Z – Closest portion of SW line appears to be weakening. Little change in overall echo structure from last image.



0020Z – Some apparent attenuation in the eastern stratiform region, behind the main convective echo. Also, some transient small cells within 75 km of the radar.

0050Z – Small cell within 50 km of radar, to east. Still being topped by FAR scan, however.

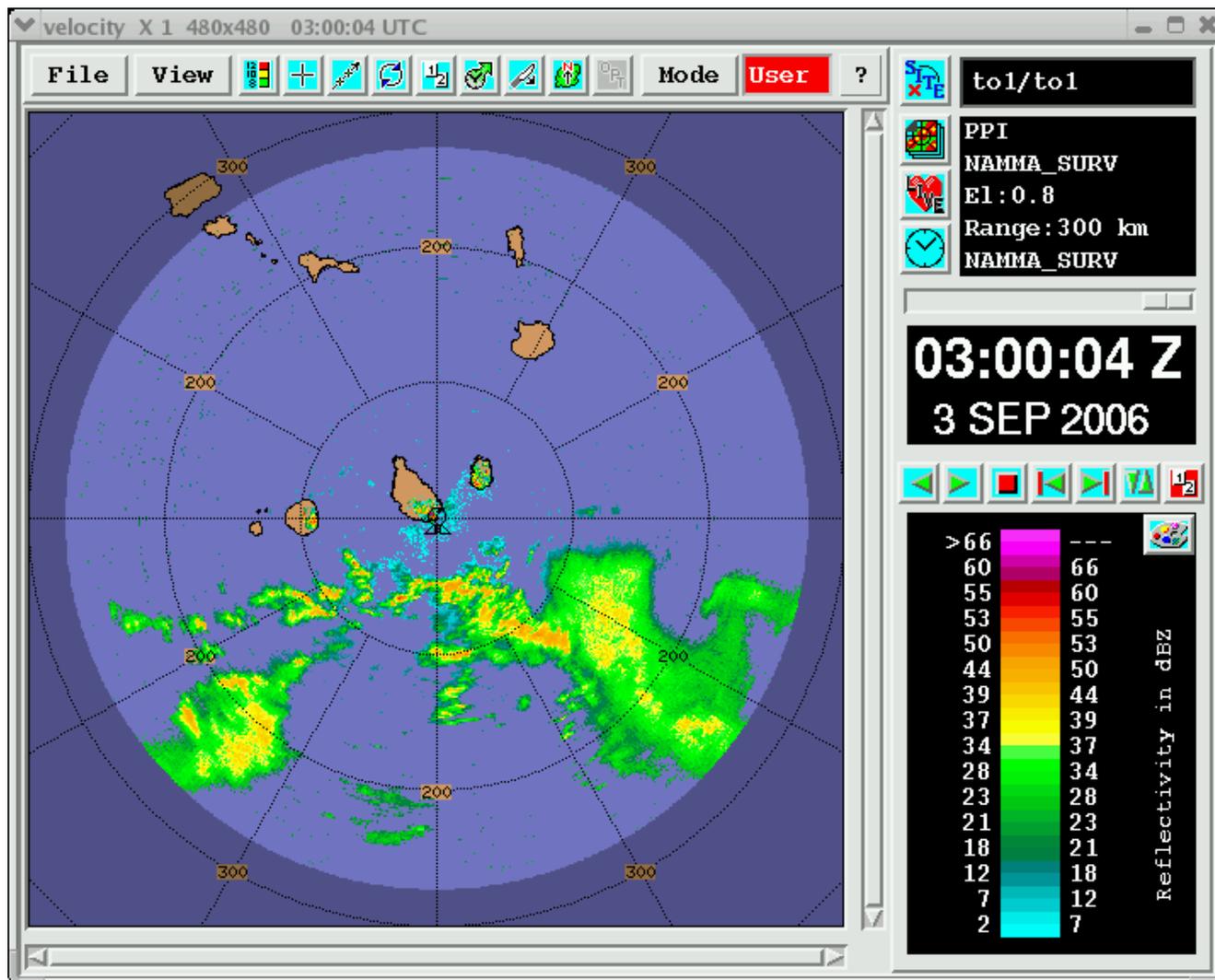
0120Z – Same basic storm structure remains, though a small but significant line of convection has developed to our south, around 50 km out.

0150Z – Near southern line continues to keep overall strength and form new cells. Overall the system maintains quasi-stationarity. Eastern stratiform region seems a bit smaller.

0240Z – There is definitely a circulation feature in the eastern stratiform region, where

dry/precip-free air is being drawn in from the northern side.

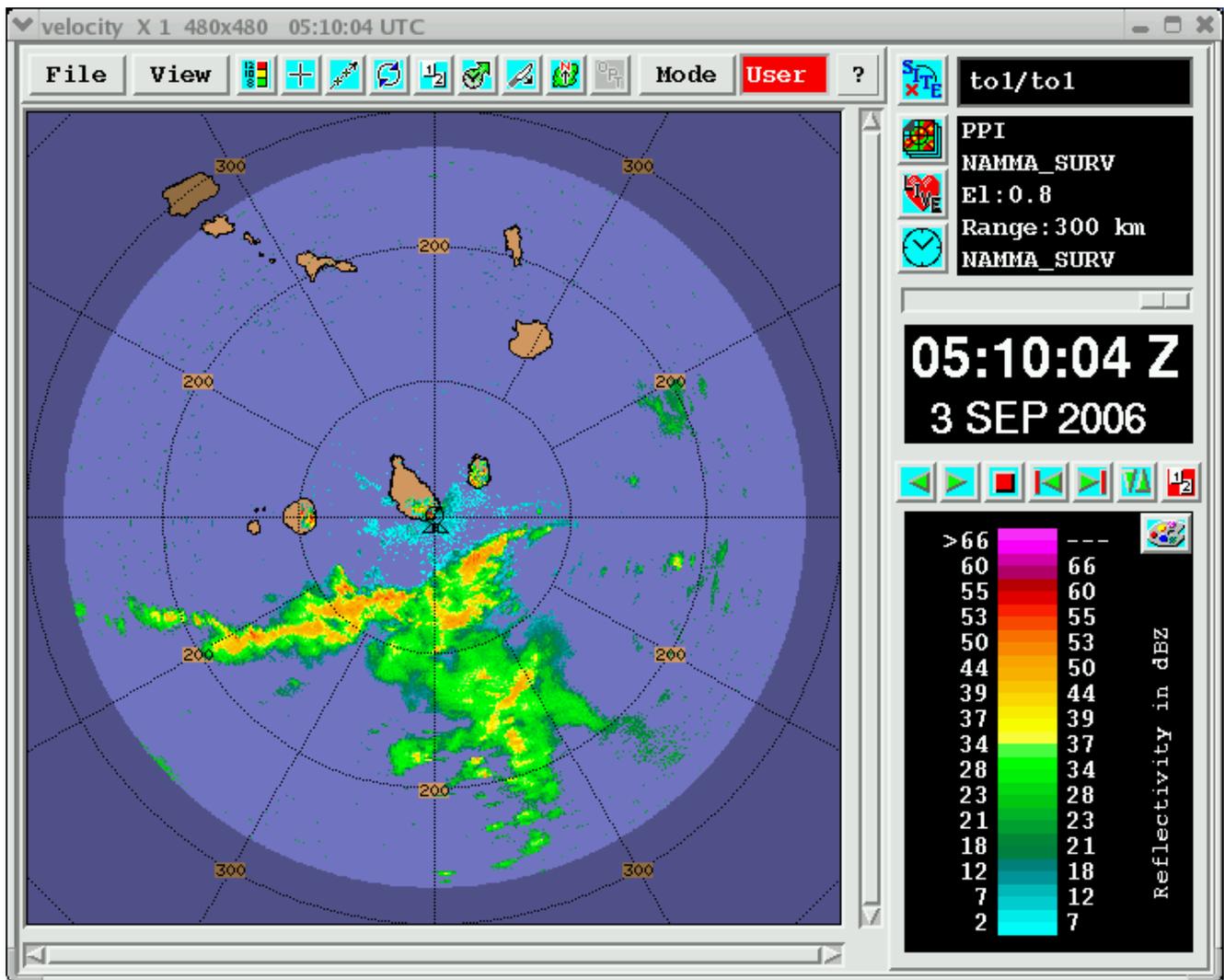
0300Z – Here is an image of the MCV in the stratiform region.



0400Z – Southern line near 50-100 km distance, oriented roughly E-W, continues to develop and grow in strength. Now the most significant portion of the storm system.

0430Z – Some retrograde motion in the southern line toward the radar, though quasi-stationarity being maintained for the most part.

0510Z – View of the current scene, including the E-W line to the south. The stratiform region that moved in from the east is much reduced in strength, and no longer shows much rotation.



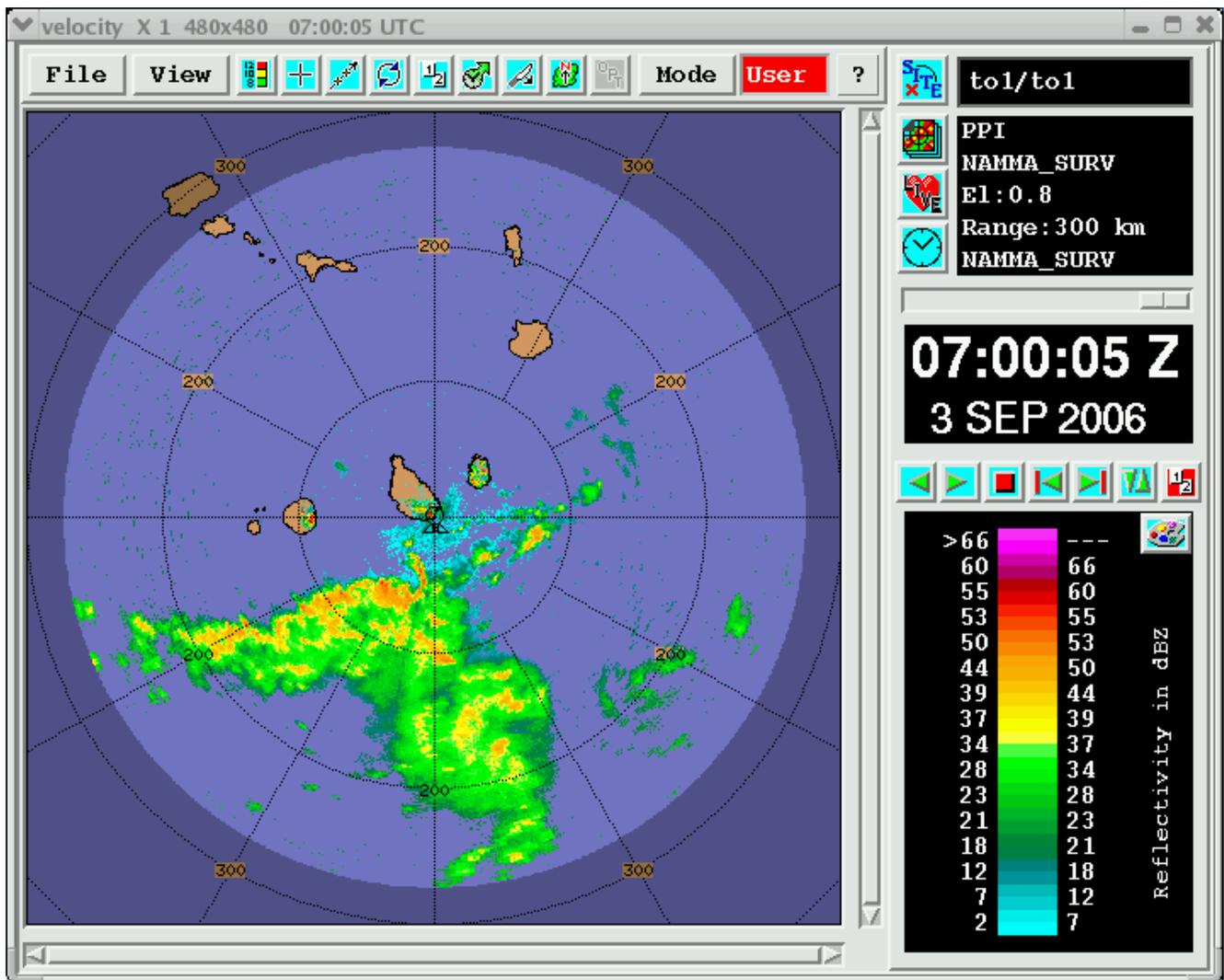
0540Z – Some lightning associated with this storm system, perhaps a few flashes per minute.

0610Z – Closest cell to radar starting to collapse. Other portions holding together.

0640Z – New convection within 50 km of radar.

0700Z – Still quasi-stationary, with slow evolution. Overall strength of the entire system is about the same as previous image ~2 hours ago.

Postmortem comment by BFS: Note suggested cyclonic curvature in remaining very weak bands centered around 130 deg/200 km—possibly an advecting remnant of MCV previously noted in 0300Z image.



0710Z – Some small cells have popped up very close to the radar. NAMMA_NEAR scan sequence will run starting at 0720Z.

0730Z – It's raining at the radar! Pretty heavily too.

0732Z – Well, that was quick. Much lighter now. In other news, the Near scan can't top the closest convection. There also is significant convection over the interior of Sao Tiago.

0800Z – Overall evolution of this system is very slow. Picture at 0800Z looks very similar to the 0700Z one above.

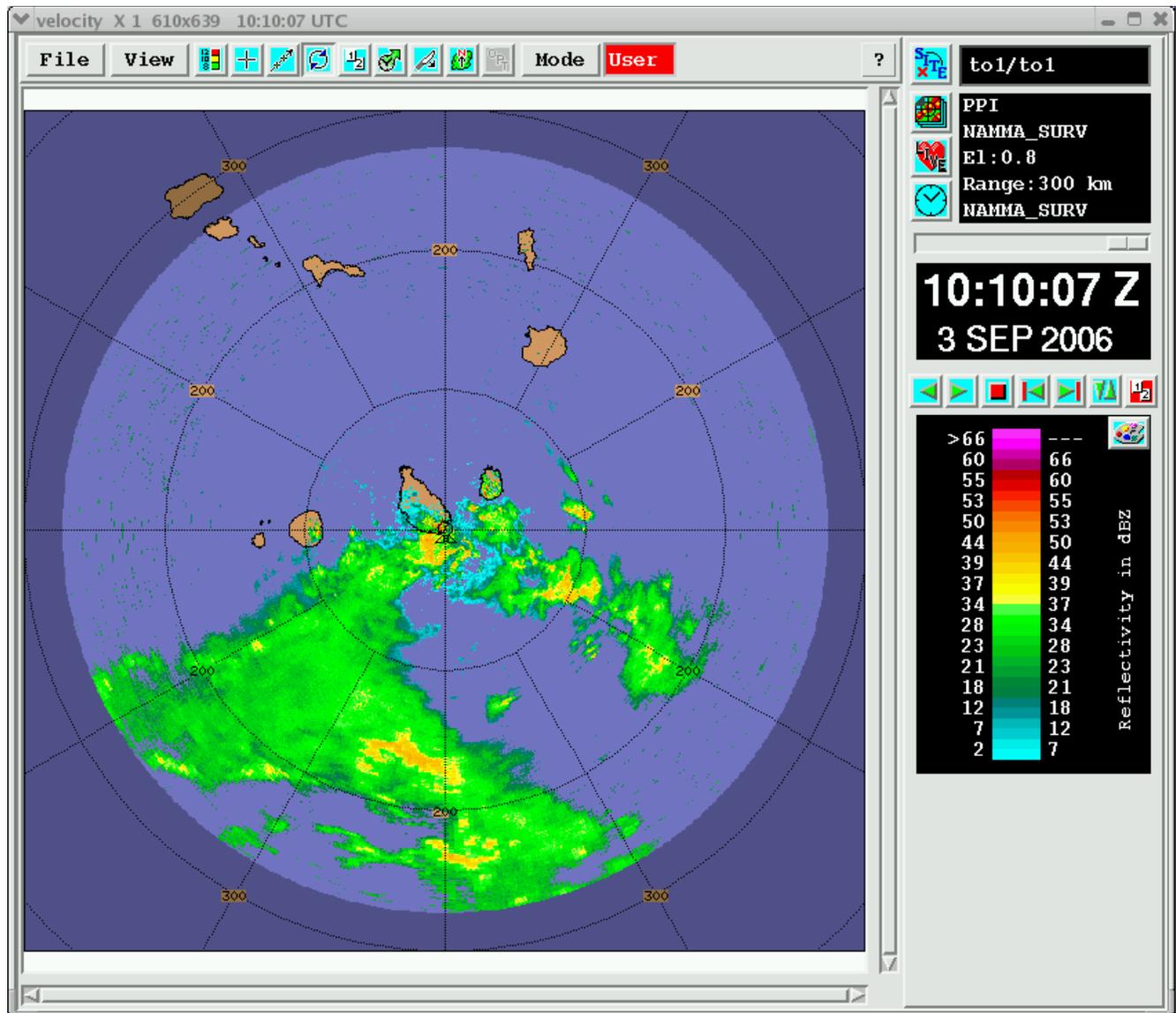
0820Z – Stratiform areal coverage appears to be increasing. Significant amount of convection within 50 km now.

0850Z – Nice multicellular system immediately south and west of the radar now, much of it within 20 km range. Near scan has been topping most of it pretty well.

0930Z – Lang off shift. NOTE: Toga1 system time was updated this shift (reportedly resulting in loss of one surveillance scan, evidently around 2210Z). Radar data timestamps vs. GPS time now appear to be within 10 sec.

0945Z: George and Smull on site. Arrived late because of flat tire. Some sprinkling as we left the hotel with very overcast skies and some low clouds.

Report from Mike Douglas/Ed Zipser @ NAMMA Ops: Planned DC8 takeoff today 1100CVT/1200Z; Sequence of lat/lon points arriving Praia late in mission: 18N/26W, 14.5N/28W, 11N/25W, 14N/23W. All acknowledge we may have MCV to our SW, but feeling is broader scale cyclone (aka "tropical cyclogenesis") is likely to our N. Smull notes this is consistent with very notable *west* component of our surface wind this morning. Upon getting TOGA scientists' phone working (Nathan found cellphone PIN!), advised Zipser it might be wise to adjust plan to arrive vicinity TOGA earlier vs. later in mission. He agreed.

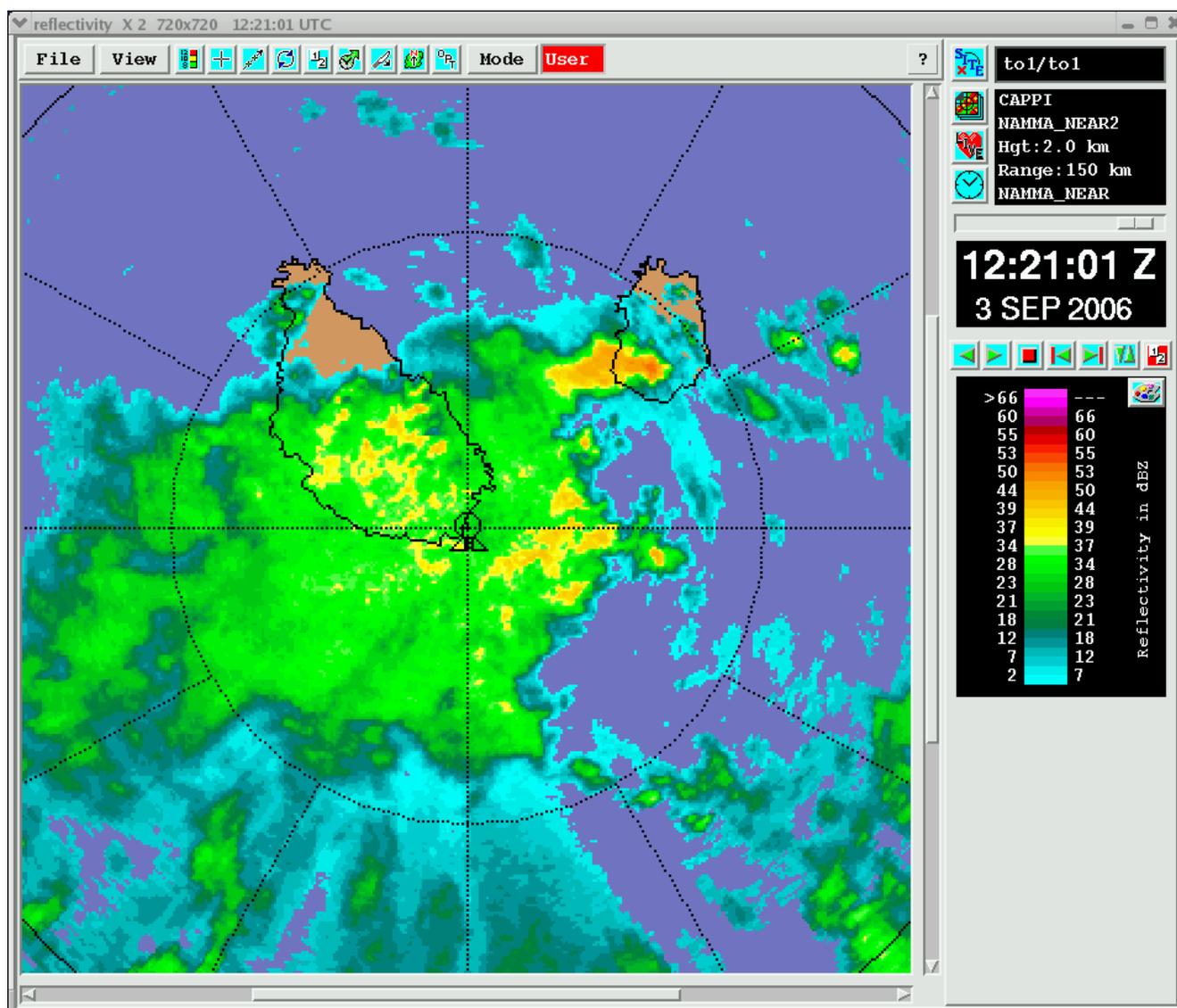


1012Z: Heavy showers occurring over TOGA. Some of the embedded convection within the stratiform region to the SSW of TOGA has diminished and the stratiform region seems to have spread out. Running NAMMA_NEAR scans, however having trouble looking at them on the display but the RAW files seem to be recording in the trmm_linux1 and trmm_linux2 system; confirmed by looking at the Archive menu. New convective areas forming to the

SE of TOGA in a line oriented NW to SE. Possibly a dry slot between the two areas.
1110Z: System mostly moving to the E with some embedded cells moving to the West. Most of the heavy convection is over Praia with some the E. Highest tops being reported to the W of Praia about 6-8km, these may be only possible. Possible MCV's in the embedded stratiform region to the south of TOGA; lat. 13.5N long. 24W. Back building of cells seems too be occurring over Praia, leading to "train-echo" effect as individual cells continue drifting WSW'ward (i.e. apparently advected by upper-level flow).

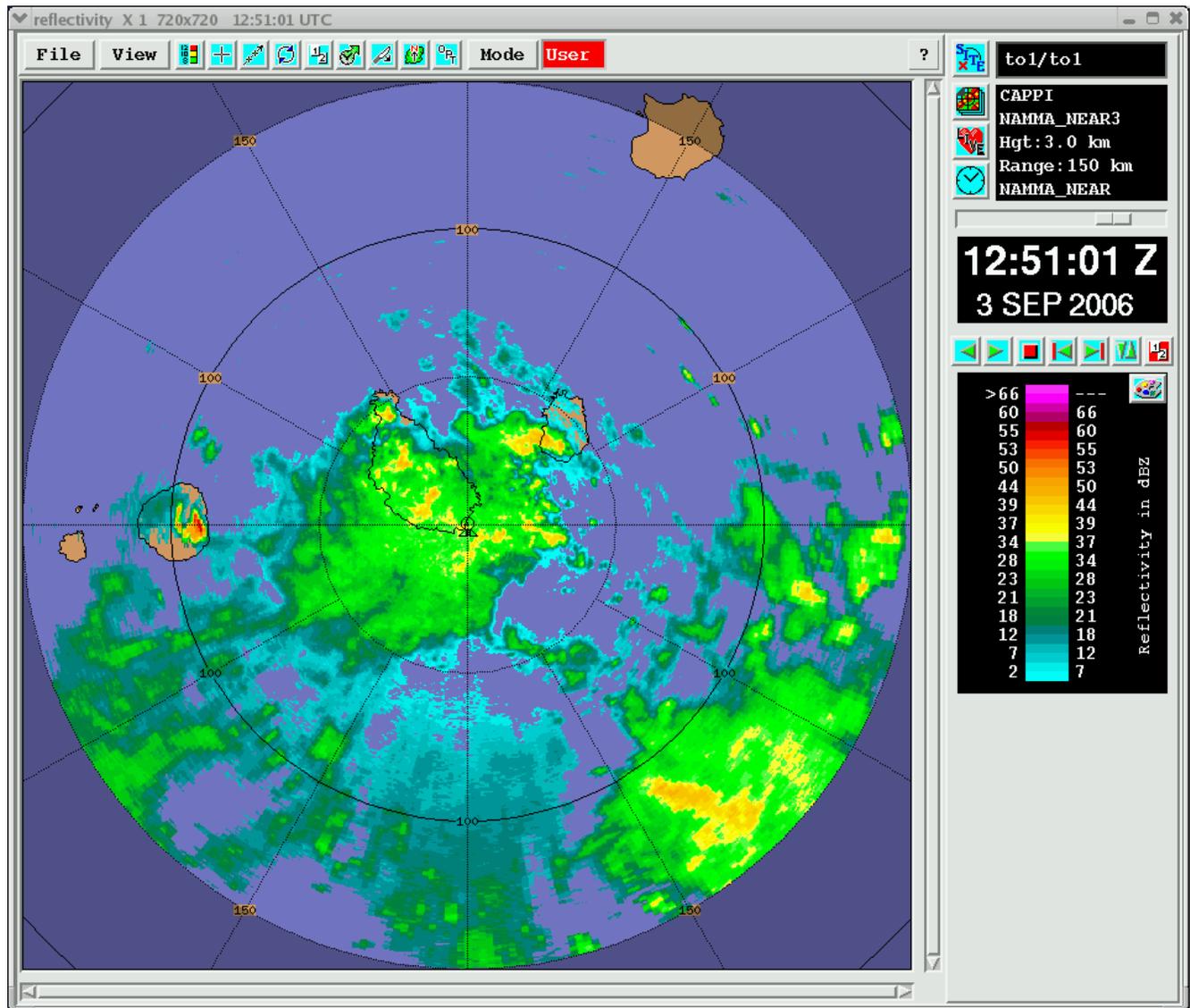
1200Z: Hint of bright band enhancement near 5km MSL in stratiform echo to our SW; nothing too intense though—peaks of perhaps 37 dBZ within surrounding 30-35 dBZ echo.

1220Z: Called VHF 123.45 and established coms w/ DC8 (Call sign: NASA-436) flight deck. Passed IP=Point1 of 15.3/23.1 (just NE of Maio), then SW'ward track over moderate convection toward vicinity (just S) of Praia, viz. Point2 at 14.8N/23.5W. From there, track WSW toward Point3 at 14.0N/25.0W. Anticipate solid stratiform echo will end upon crossing ~14.5N; advised DC8 that when out of good cloud/echo on track toward Point3, should consider executing reciprocal track.



1240Z: NASA-436 requested melting band module location. We see broad stratiform echo to our SW, with some hints of bright-band enhancement in IRIS-derived cross sections. Gave them Point4 (for center of melting-band module) of 14.8N/23.8W (abeam/SW of but sufficiently far offshore from SW coast of Sao Tiago for safety—confirmed w/ DC8 nav).

1250Z: We estimate southern MCV center at 13.3N/24.5W. If DC8 wishes to work echo associated with possible MCV long-axis of stratiform echo in which WNW-ESE NW Point 14.0N/25.6W. SE point: 12.8N/22.7W.



1255Z: DC8 called to reconfirm center point of melting band module. Advised them this area still looks good.

1330Z: Possible circulation/cyclonic shear center near 14.6N/23.6W appears to be developing along S edge of stratiform echo to our SW; interpretation difficult. Attempted coms w/ DC8 at 1338Z, but heard no reply. Guessing that they completed their melting band module and moved on. At 1340Z, DC8 called to report they are completing MB module. Informed them that echoes remain though slowly decreasing in coverage and intensity. Presume all of our radio coms have been with DC8 flight deck as information flow has been one-way. Called Mike Douglas @ NAMMA-Ops via cell to clarify DC8's further

plans. After MB module, will resume planned large-scale dropsonde track (points logged previously, but broadly within bounds of 11-19N and 23-28W) in reverse order. Advised Mike that on DC8's initial SSW-bound track from vicinity Praia to 11N/25W that they will cross band of considerable stratiform precip w/ embedded convection (currently centered ~along our 200 km range ring in SW quadrant). Thanks to good satellite coverage/interpretation, Mike seemed well aware of that.

In dissipating stage of this stratiform region, a small "twist" within decaying echo was suggested and appeared to be moving rapidly W'ward; for example, the apparent center of this rotation (if any) was near 245deg/44km (14.75N/23.85W) at 1341Z. Compared to other more characteristic ~slow-moving MCV features we have seen at long range, this feature doesn't look like much, but might be worth examining further in post-analysis to be sure.

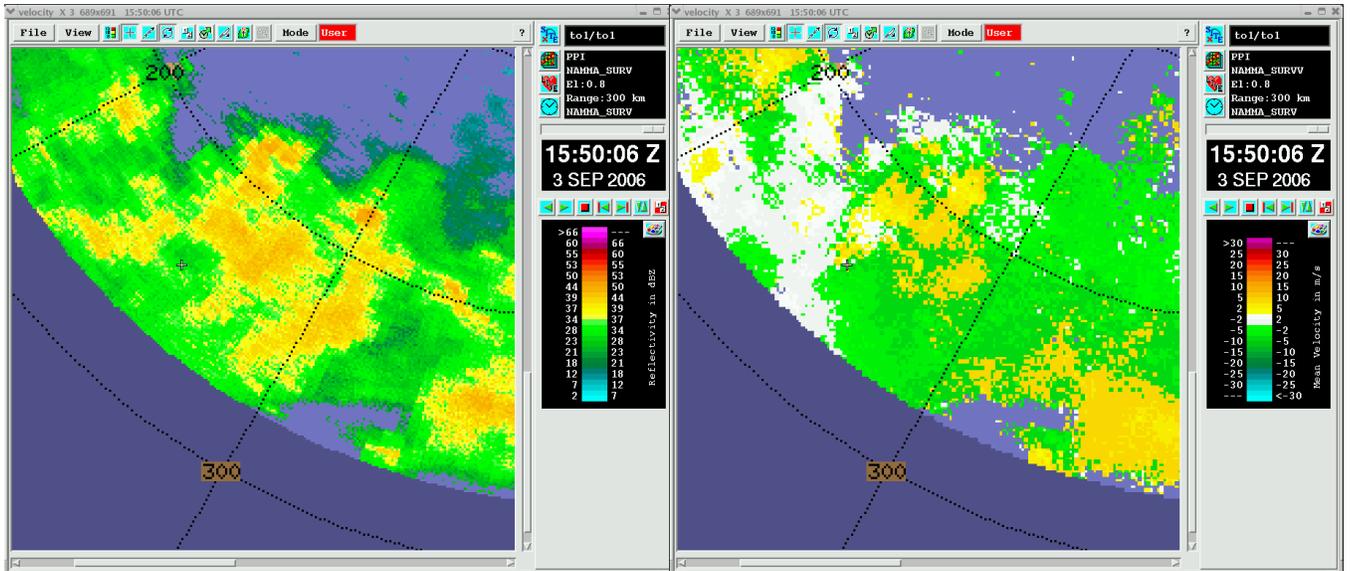
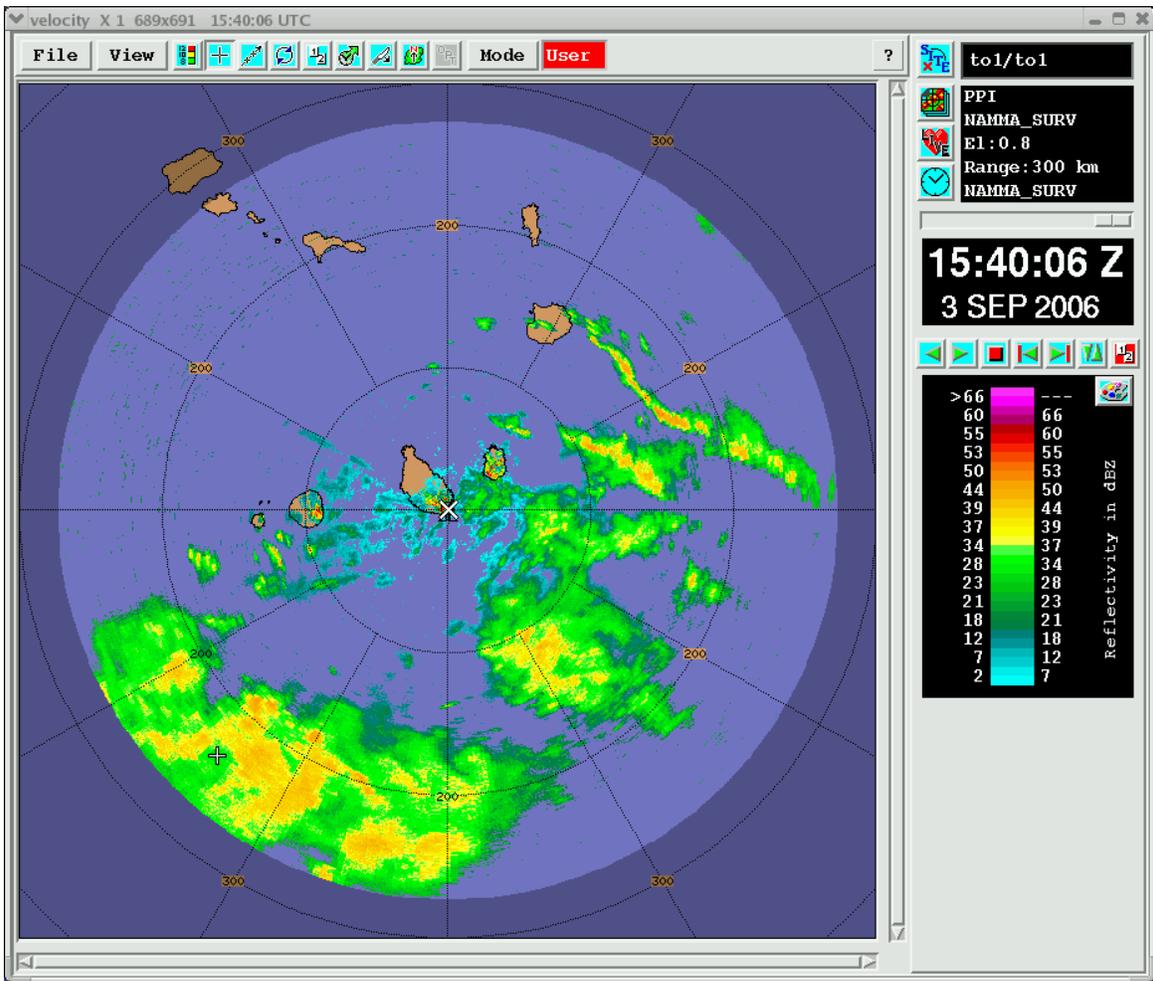
Summary comment: In spite of spotty communications early in day, this turned out to be a well-coordinated flight with great data from TOGA point of view. Weather cooperated tremendously by putting a combination of very healthy convection (to ENE of Praia) and stratiform echo (to WSW of Praia) close to TOGA during period of DC8 investigation. Initial increase of stratiform precip W of Praia (10-11 Z) appeared to issue from convection in immediate vicinity or even W of Sao Tiago. Thereafter, major increase in convection to E of Praia/TOGA fed huge amounts of convective debris into mid/upper-level E'ly flow. Deepest stratiform echo (e.g., as indicated by 6km CAPPI's) developed surrounding 245deg/60km at 1140Z. Tops were thus coming down during DC8 Melting Band module, but that maneuver appears to have been well placed in one of the better defined stratiform regions I have seen so close to TOGA during the entire project.

1345Z: During last hour, George & Smull independently noticed tendency for very broad cyclonic rotation on ~100 km scale, seemingly centered at a point (or at least along a latitude) to S of TOGA. Trying to reconcile this with fact that low-level flow at radar site (and clearly visible in displays of low-level Vr) over Praia is westerly, i.e. suggestive of a broad circulation centered *north* of our location.

1400Z: We note that DVD's filled up at ~1230Z. Will request Nathan perform this switch, at shift change; until then, as insurance, we have copied RAW files up through ca. 1410 UTC to temporary directory on CSU laptop and will do so periodically during this shift.

1430Z: Examination of raw PPI Vr displays makes it clear we have a backing wind profile, i.e. W'ly --> S'ly --> E'ly from low-->mid-->upper troposphere. Upper tilts display clear annulus of maximum reflectivity corresponding to bright-band at near ranges. Main echo areas appear to be (1) large and extremely persistent stratiform area (w/ embedded convection) extending off SW edge of our SURV scans, whose closest edge is oriented NW-SE just inside the 200-km range circle; (2) ~100-km diameter mainly stratiform echo centered near 135deg/120km, which has remnant convective band extending NW from its northern end toward Praia; and (3) newly formed/forming and very narrow NW-SE oriented convective bands in our NE sector, mainly between 100-200 km.

1530Z: Not much change except that narrow (yet locally quite intense!) bands of convection in NE sector increasing. Probably the strongest evidence yet today (at least during day-shift) of MCV-related rotation within far-SW stratiform area, presently centered near 223deg/235km (13.35N/25.0W)--even with suggestion of weak-dBZ "eye". Overall, most echo features display a slow W'ward drift, but center apparent MCV appears to be slipping South with time. Other smaller-scale cyclonic roll-ups are suggested along N edge of this large stratiform area—one of them nearing 180deg azm just inside 200 km.



1630Z: Echo intensities and spatial coverage are finally dropping (esp. over our SE & SW sectors). Sun is coming out in Praia for the first time today! Narrow echo lines in NE sector are generally shifting W'ward (albeit with mixed motions resembling some sort of interference pattern) and remain quite intense, however—peaks >50 dBZ.

1730Z: Shifted back to NAMMA_FAR scans. Banded echoes in NE sector are colliding, though in the net precip area is shifting SW'ward, with collision resulting in “Forward-Fed Leading-Stratiform (FFLS)” type organization, in the vernacular of Parker and Johnson (2000).

1830Z: MCV remains apparent near 220deg/210km (13.45N, 24.72W). Small E-W broken line of cells extends ESE from Fogo (approaching 50 km range ring) and, strangely, is moving NE'ward—as if it were being flung-off previously large area of activity to S that spawned the MCV.

1930Z: There is still remnants of echoes to the NE and to the SW of TOGA. However, most echoes seem to be diminishing except for a few small areas.

Summary Comment: Smull & George are wondering if there is any possibility that the MCV that was originally identified ESE of TOGA around 0300Z last night and observed to drift slowly SW'ward before losing identity might have somehow been linked to the strong MCV that was identified far SW of the radar much later (cf. images at 1540Z)? We're not necessarily thinking that the same feature (variously illuminated/not-illuminated by precip scatterers over time) necessarily translated as an immutable feature, since multiple pulses of convection/stratiform precip (and associated latent heating) occurred along its approximate track during the intervening 12h. Perhaps these are mesoscale spin-ups within a broader gyre? In reading the 3 September NAMMA Forecast (appended below), we wonder if this “mesoscale” vortex was in any sense related to the center of rotation (which NAMMA forecasters insist on terming a “wave”) indicated by larger-scale models?

NAMMA Forecast Summary for 9/3/06
Issued September 3rd, 2006

The wave over the coast yesterday has now moved to a location just south of the Cape Verde islands. Infrared satellite imagery and 925mb analysis indicates a wave center near 15N/23W. The wave is moving to the west at 10-15 knots. Intense convection has been forming with this wave over night, continuing into this morning, and is showing a fairly extensive cloud shield from 26W to 22W. A second convective burst is also located to the southwest of the wave, as well as a third convection burst to the east around at 14N/20W. The GFS 18-hour forecast indicates a westward movement to approximately 24W by the middle of today's flight. The 36 hour forecast, valid at 12Z tomorrow shows a more east/west closed vorticity center at low-levels, centered around 15N/26W. The GFS resolves a slower translation speed for the wave, however keeping a similar speed as current, tomorrows position may be farther to the west than indicated by GFS forecasts. Only slight intensification is indicated over the next 48-hours in the GFS, however the 54-hour forecast shows the beginning of an intensification stage, with the center of the wave located at 14N/29W. By 72-hours, valid 00Z on Tues., Sept. 5th the circulation center is between 35 and 40W, and remaining at 14-15N. Arpege and ECMWF confirm a broad circulation forming within the next 48-hours to the west of the islands. Precipitable water forecasts show a strong moisture convergence into the system, while dry dusty air remains to the north/northwestern regions of this wave. After the current wave, no significant wave is forecast to exit the coast until Thursday/Friday.

2030Z: Convective echoes to the NE of TOGA are among the last to begin showing signs of marked weakening. Upon animating surveillance scans, we also *still* see signs of cyclonic rotation in stratiform echo remnants far to SW of TOGA—centered beyond 200 km along our 215deg radial, with the true center of circulation (if any?) possibly being off our scope.

2130Z: Leaving tech (Gears) with urgent request to get new/blank DVD's installed and mounted to allow additional backups of today's dataset over/above the raw files being recorded to archive Ida2 on trmm-linux1. Smull & George signing off.

2130Z – Lang on shift. DVDs replaced and recording restarted with the 1240Z-onward data from today. DVD replacement instructions:

1. Determine ending times for DVD and total number of files by connecting to appropriate archive on trmm-linux2. Write this on post-it in appropriate case on DVD drive. Also log summary info for full DVD's in file titled "NAMMA_DVD_Log" on trmm-linux2.
2. Unmount the DVD using the archive window commands. Eject and replace with new DVD (DVD box near monitor), and get a new jewel case from box on floor.
3. Initialize in trmm-linux2 terminal window with command "init_iris_dvd -u #" where # refers to 1 (white DVD) or 2 (silver DVD).
4. Once initialization is complete (prompt returns in terminal window), mount the DVD using the archive window commands, then write down the Archive ID # on a new post-it.
5. Now select record in the archive window commands, and write down the starting time for the DVD on the post-it, and put post-it in jewel case. Place case on appropriate DVD drive. Type appropriate info re: newly started DVD's into log-file on trmm-linux2.

2220Z – Not topping some weak echo within 10 km, but staying in NAMMA Far for better vertical resolution given all the weak echo throughout the scope. Definite weakening trend in all echo. Drying up out there. Could be very quiet in an hour or so. Appears the backside of the wave is hitting us now, drying us up.

2250Z – This week convection ~30km to the south appears to be sticking around longer than most. Peak sfc Zs only in the 30s, though. Bright band in the low 40s at higher angles.

2300Z – Some 40dBZ bright band over Sao Tiago not being topped. Hesitate to do this, but switching to NAMMA Near to better top this close but weak echo. Checked angles and one doesn't really lose much vertical resolution going to NAMMA Near. Only one extra angle in the low-mid elevation range for NAMMA Far (1.3 & 1.8 vs. 1.5 only).

2310Z – FYI, GPS time about 20s faster than toga1 right now.

2330Z – Everything dissipating now.

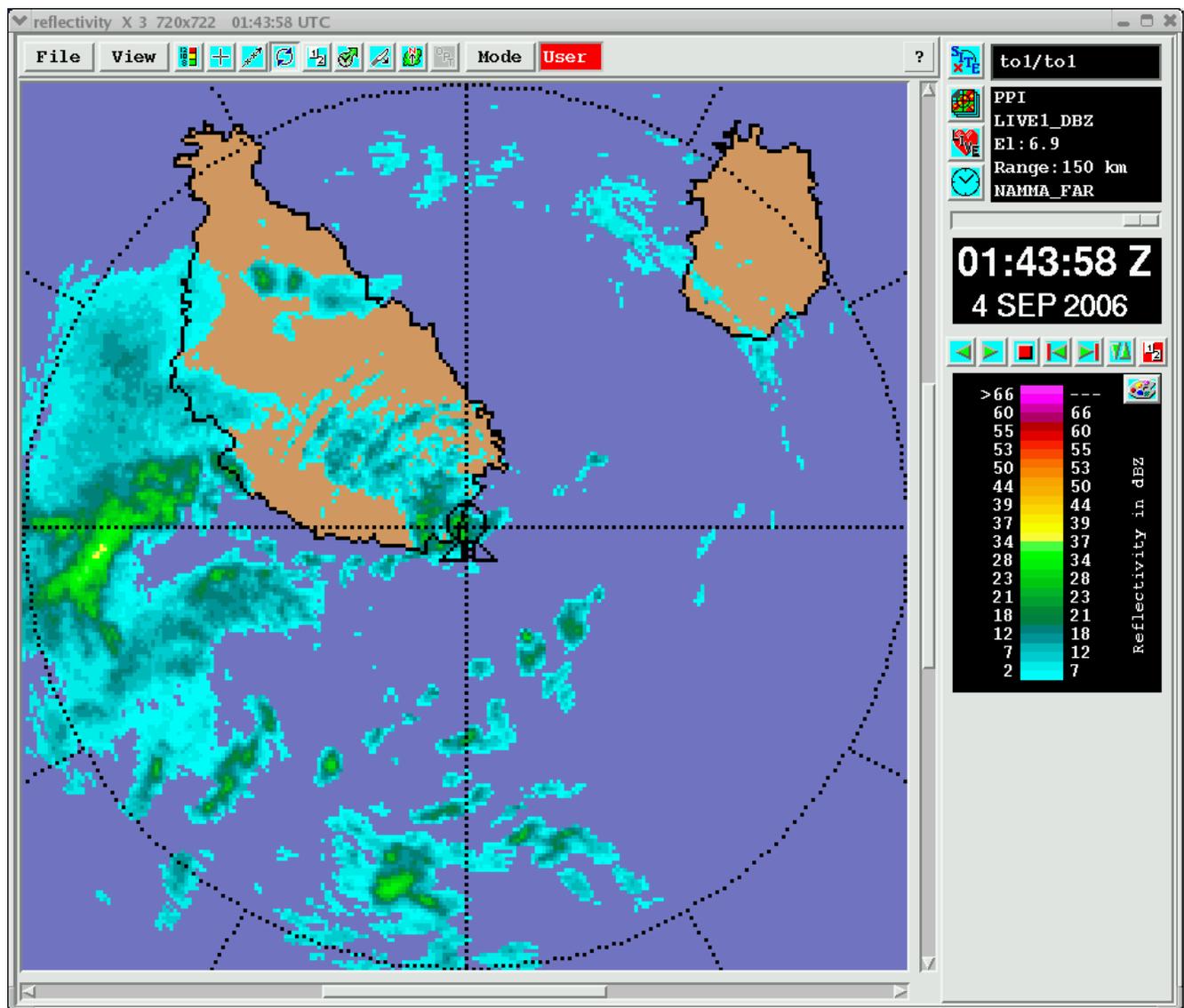
2340Z – Back to NAMMA Far.

4 Sep 2006

0000Z – Gradual dissipation of echoes continues, particularly within 100 km of the radar.

0140Z – Dissipation has been a very slow process, but echo coverage continues to steadily decrease. There is a small line of light precip about 10 km from TOGA, which is only being topped at the 10-20 dBZ level. This line does not show up well at low angles because of clutter/bugs, but is moving onshore from the south. Light precip at radar. Switching to NAMMA Near at 0150Z.

0200Z - Think this short line of precip is orographically forced, as loops show it pops up as a weak system moves north off the west coast of the radar. Note how the line curves around the south end of the island. The weak cores all formed simultaneously.



0205Z – Nice little 40+ dBZ core about 15km NE of the radar now, associated with the passage of this orographically forced line. Line is well inland now. Overall, I have been impressed with the longevity of the precip situation. It is clearly still a bit more disturbed than I thought, though we are nowhere near where we were last night. However, overall scope-wide echo coverage continues to decrease, and most remaining echoes are very weak. Think this is sort of a “last gasp” situation brought on by the impact of moist southerly flow on the islands. Near the radar is really the only area where one could argue echo coverage might be increasing, at least a bit.

0220Z – Now some small 40+ dBZ cores off the west coast of the island.

0230Z – Western echoes have increased in size and intensity a bit, and now cover a small portion of SW Sao Tiago. They reside behind the line that passed thru previously, and may constitute a second wave of orographically convection.

0340Z – Still some small echo over Sao Tiago and surrounding waters.

0410Z – Switching to NAMMA Far due to lack of interesting nearby convection.

0510Z – Some 10 dBZ echo not being topped over Sao Tiago, within 10 km. Not going to switch scanning just yet due to weakness of the echo and lack of interesting characteristics. Otherwise, scattered cells off to the east, about 100 km away is the only interesting feature on the scope.

0520Z – Switching to NAMMA Near, as Sao Tiago storm seems to be growing in size slightly.

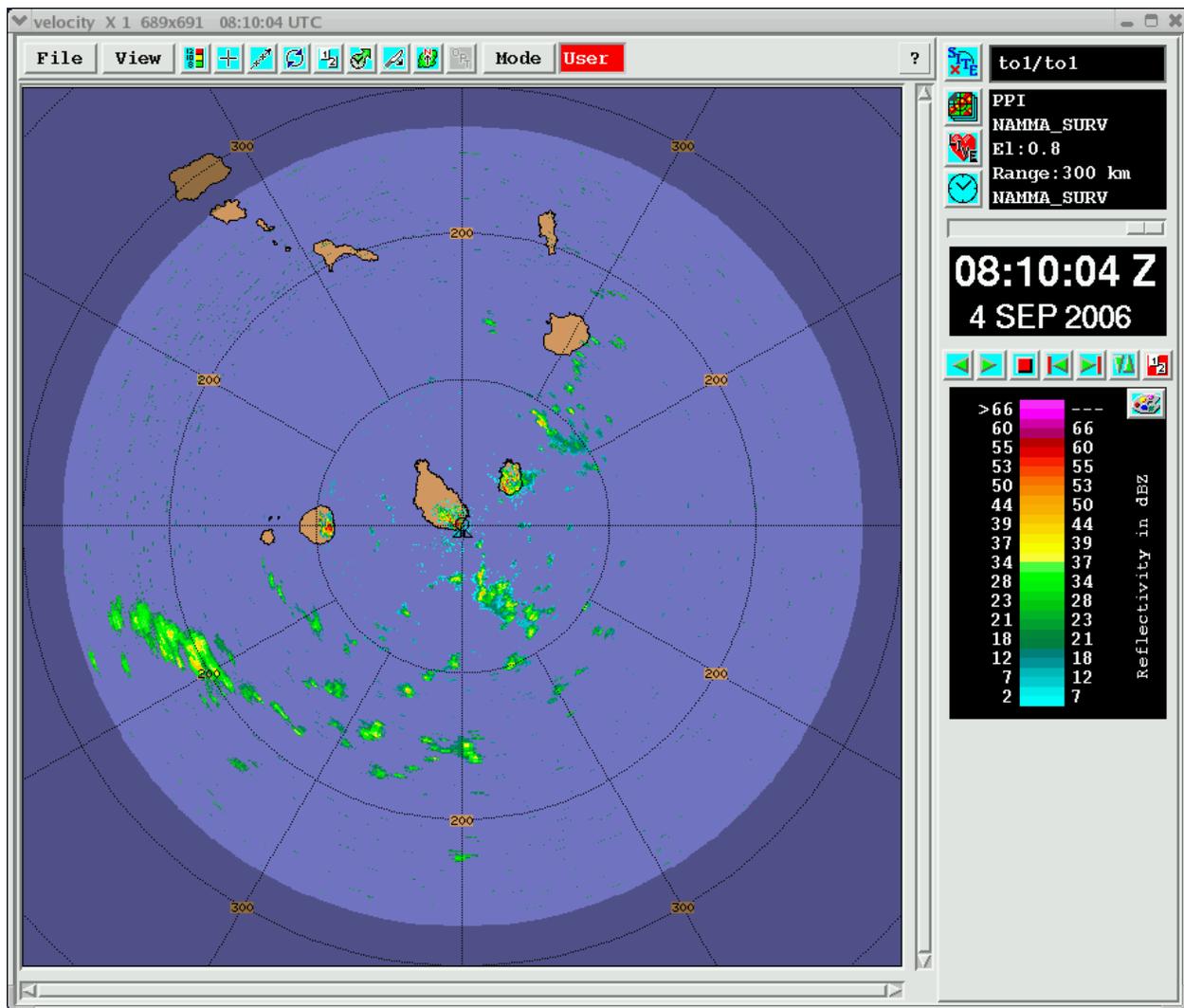
0610Z – Back to NAMMA Far. Distant, scattered, and small echoes to S and E appear to be growing in number.

0720Z – Scattered convection continues, and grows in strength. Over 200km to the SW, a NE-ward moving line has formed.

0750Z – Sunrise peeking in on the mid-level scans.

0800Z – Some nice, yet small, 40+ dBZ cells within 50 km due south of the radar. Most convection on the scope appears to be pretty shallow, much of it topped before 10 deg elevation (even the nearby convection).

0810Z – Here is an image of the convection. The nearby cells to the south could be said to be loosely organized. Some cells are hitting Maio, and the overall precipitation trend continues to be toward increasing strength and coverage. This morning's convection appears to have gotten started around dawn, so one wonders if solar input had anything to do with triggering it.



0900Z – Southern cells have organized themselves into a quasi-linear structure, and portions are headed directly for Sao Tiago. Still quite shallow in terms of vertical structure. Toga1 clock now about 30s slower than GPS.

0920Z – Echo tops product shows the southern convection to be 5-7 km tall at most. Rain shafts are visible from TOGA, as portions of the system are within 20 km.

0930Z – Lang off shift.

0930Z: Smull arrived. Tim Parks is today's tech. Cells approaching from the south are focused along curved band which suggests some tendency for cyclonic circulation and comma tail/head structure. Other somewhat larger (though still sub-MCS) WNW-ESE echo cluster near 245deg/200 km (14.2N/25.1W). Nearby echoes moving NNE @ ~15kt, while those far SW are drifting NNE @ 10kt. 2nd trip confined mainly to W sector.

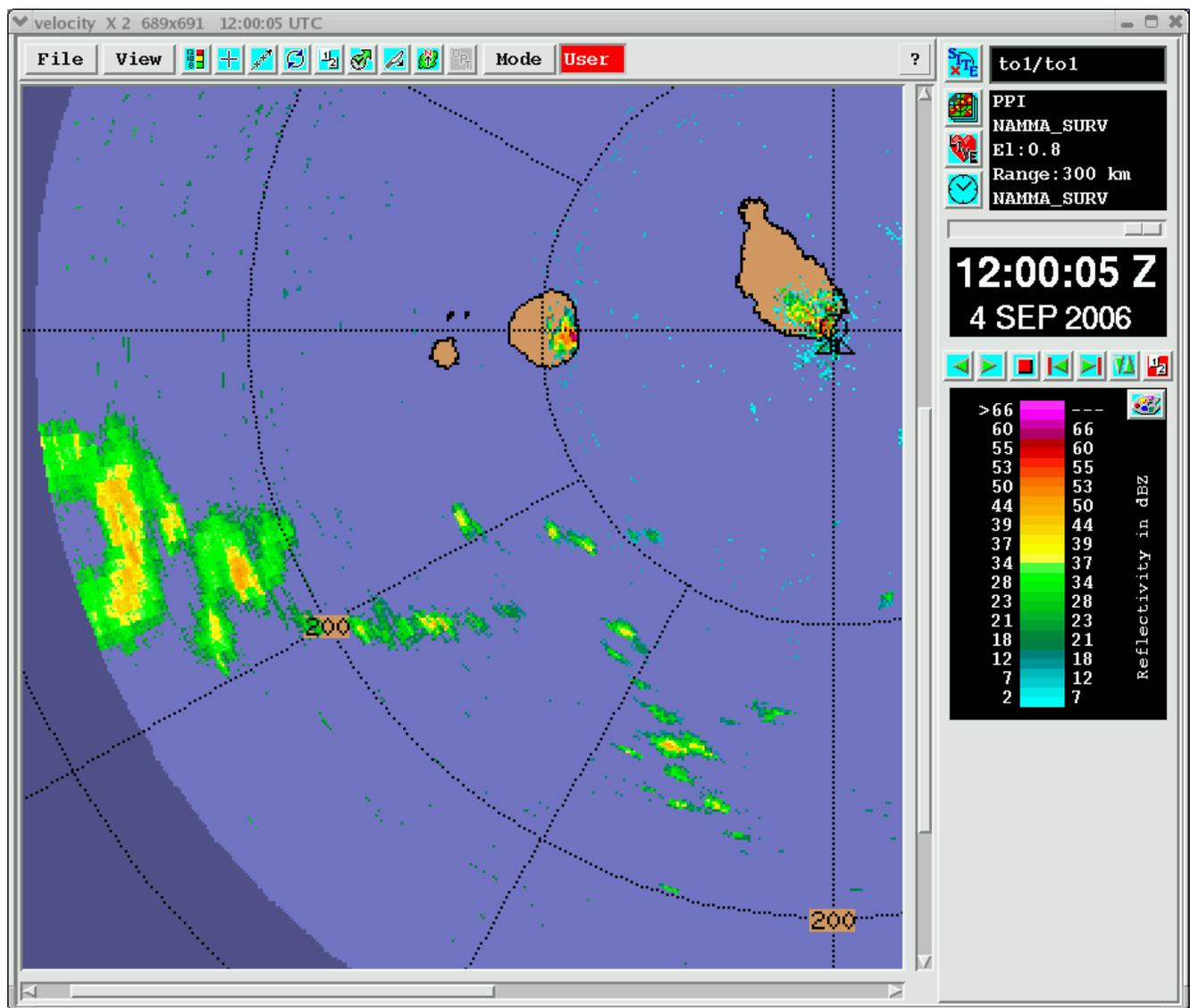
Check-in w/ Zipser @ NAMMA Ops in Sal. Debriefed yesterday's coordinated TOGA-DC8 mission, judged highly successful from both airborne & ground-based perspective. Today's DC8 plan: Follow system now centered 15N 30W. Planned 3rd mission tomorrow will require Wed-Thu (6-7 September) to be down/no-fly. Confirmed that DC8 radio coms on our science frequency are all handled by Mission Manager (non-meteorologist).

Side-note: Visibility last night/today is by far best of project I've seen. On drive out last evening, lights of Maio (40-km distant to ENE) were clearly visible, as was the island landmass this morning. Likewise, peaks in central Sao Tiago stood out sharply this morning as rain have evidently scavenged most aerosol.

1030Z: Confirmed all archives up-to-date; logged DVD switch-out in NAMMA_DVD_Log document on trmm-linux2. No significant change in echo pattern. S'ly flow (N'ward echo advection) generally consistent with being on back side of wave and/or E of developing cyclone center. Curved echo line has now moved N of TOGA.

1130Z: Lots of 2nd trip to W in NAMMA_FAR scans (e.g. Echo's painted as moving N toward Fogo). Only legitimate echo of significance is beyond 200 km in 240-270deg sector, which to my eye (upon animation) gives appearance of rotating cyclonically around circulation center off our scope to the W.

1200Z: Nice little "echo donut" on W fringe of surv scans suggests some tendency for rotation, though note depicted N limit of echo is result of blockage by Fogo:



1330Z: Scope is virtually empty, with conditions being more suppressed than I've seen in many days. Visibilities remain high (e.g., Maio remains clearly evident).

1430Z: Borderline PPINE. Interesting sky conditions though, including a ~N-S oriented band of altostratus (almost lenticular in appearance) just to W of us—apparently issued by convection well to our N (along ~18N, 100-km or so N of the northernmost CV's). Strangely, sfc winds once again appear to have significant W'ly component. This would imply some sort of an elongated NE-SW axis of cyclonic vorticity extending to our N from the main center that DC8 is flying out to our W today.

1600Z: Absolutely positively PPINE. Even sea clutter is muted.

1900Z: No echoes last three hours. Tiny bit of 2nd trip at distant (surveillance) ranges in SE quadrant.

2000Z: Only a few very weak (20-ish dBZ) echoes zipping NW'ward in our 150-160deg azm sector beyond 200 km.

2130Z: No change. Apparently this is the calm *after* the storm. Spotty line of echoes beyond 200 km is approaching 165deg azm; estimated motion out of 100deg @ 20 kt, so must be based at upper-levels. Small off-shift.

2130Z – Lang on shift. Looks like a quiet night. GPS ~40s faster than toga1 clock.

2320Z – Only stuff on the scope is weak echoes ~200km to our S and NE.

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0005Z – Distant echoes are trucking along toward the west, definitely influenced by upper-level flow.

0110Z – Some weak upper-level echoes near the radar, nothing special and mostly topped

0130Z – Switching to NAMMA Near to top this nearby echo. Doesn't appear at low-levels, so must be weak, non-precipitating, mid-level echo.

0230Z – Switching back to NAMMA Far as nearby echoes have faded.

0310Z – Continues to be only weak echoes advecting at a fast clip from east to west across the scope. The strongest ones are 100-200 km away and only peak in the 20s dBZ. All the weak echoes near the radar are being easily topped by NAMMA Far.

0500Z – Weak echoes now well into the western half of our domain, and there is nothing of interest within ~100 km of the radar.

0700Z – Scope pretty clear now as the weak echoes have faded.

0810Z – Small 30 dBZ cell about 15 km due east of the radar. Very shallow, though; topped by 4.5 deg.

0930Z – Lang off shift. Weak echo to east has survived, but is still very marginal and topped easily. Some similar cores in its vicinity as well. GPS ~45s faster than toga1 clock.

0930Z: George on shift. Still two small weak echoes to the E and ESE, seem to be very shallow. Visibility is very good around the Island, this is the first time I have seen some of the peaks on the Island. Sea clutter is greatly reduced.

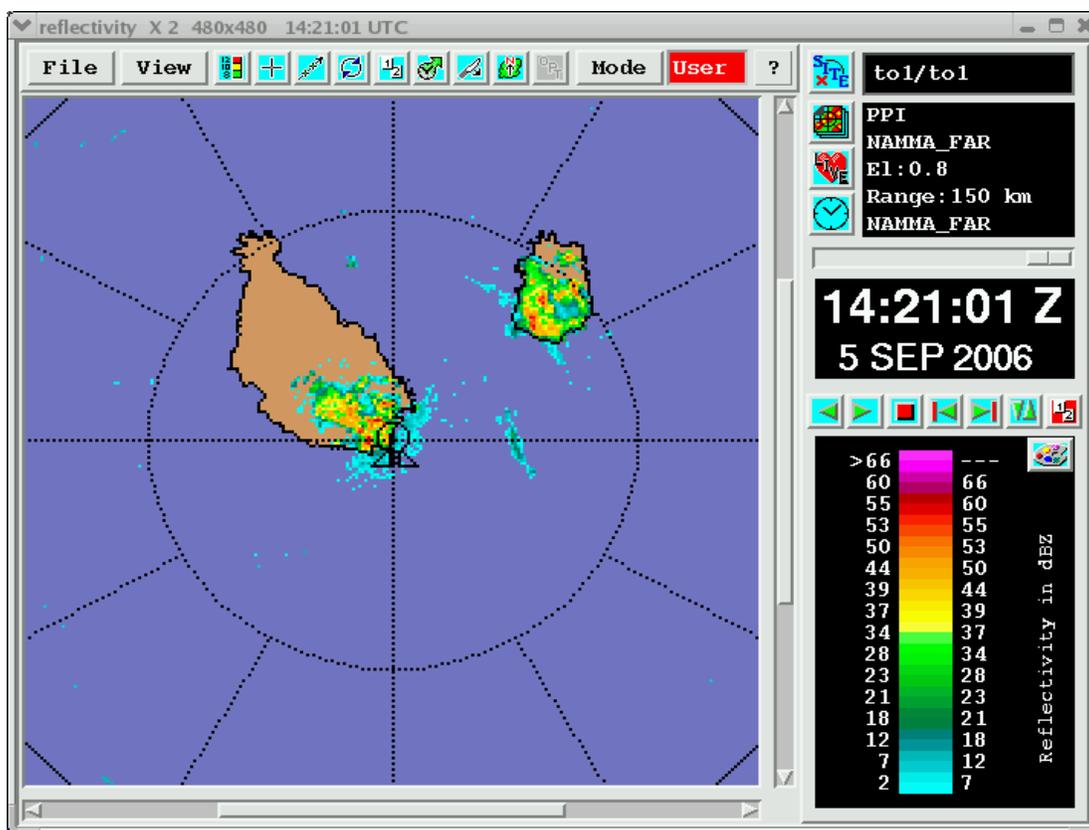
1030Z: Some small weak echoes to the south of TOGA.

1130Z: Well, I suppose some sea clutter. Tim Parks is shutting down the radar for awhile soon for a solar cal. Missed one surv scan and two far scans.

1230Z: Still nothing of real interest. Small weak echo again to the E. And some beautiful side lobes!

1330Z: Small echoes still persisting, moving S.

1430Z: Again, small weak echoes off to the E moving SE.



1530Z: Nothing....

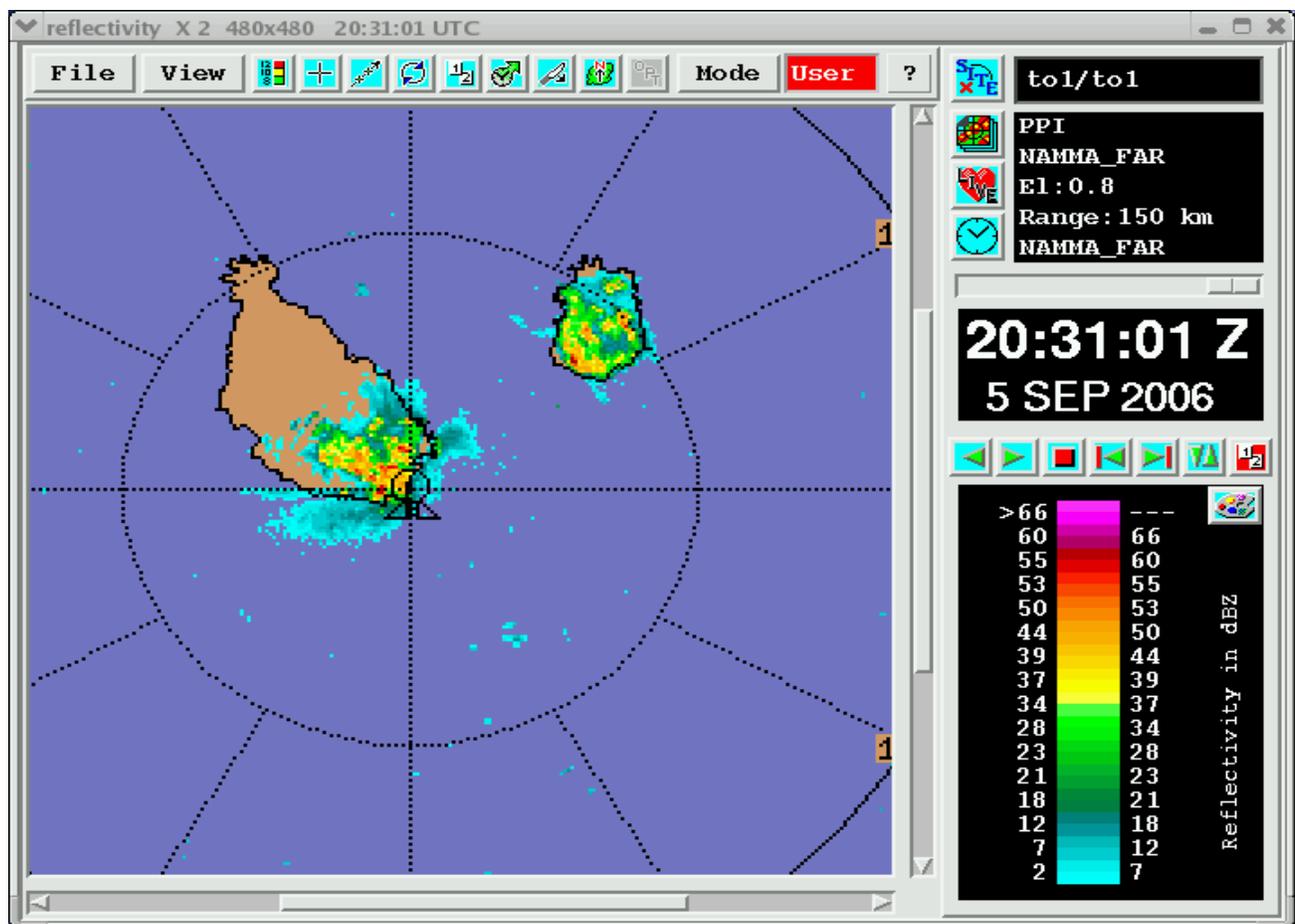
1630Z: Booooring...although there are some clouds over TOGA. Can see a hint of them on the radar.

1730Z: Same conditions.

1830Z: Same

1930Z: A little more sea clutter.

2030Z: A few more echoes around TOGA.



2130Z – Lang on shift. Looks like another quiet night, perhaps quieter than last if that is possible. There is a small 30 dBZ core 200 km to the south, that plus a handful of extremely light echoes within 50 km of TOGA is about it. GPS ~50s faster than toga1 clock.

2320Z – Scope very empty now.

6 September 2006

0000Z – Some 20-30 dBZ echo over 200 km to our SE, traveling to the west. There is what appears to be an island breeze front moving offshore, now well away from Sao Tiago. Very barren in terms of echo.

0200Z – Still pretty empty except for the echoes well to the south, and those are fading.

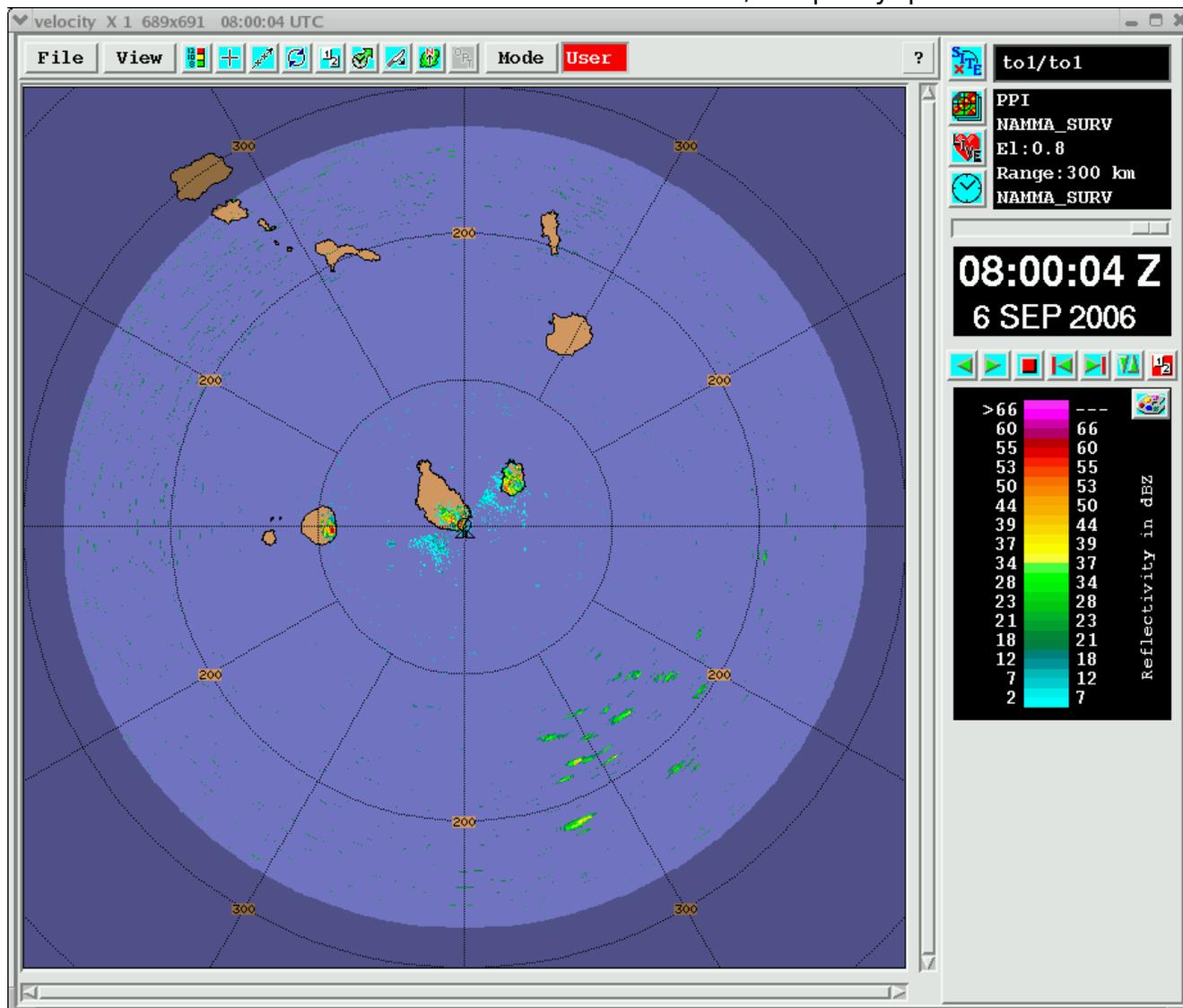
0400Z – Some scattered very weak cells have popped up within 100 km to our south. Far southern echoes have regenerated somewhat now that they've reached our SW quadrant.

0500Z – Weak cells > 100 km SW are about all there is.

0700Z – Cells have reformed in the SE quadrant ~200 km away. Some very weak cells within 50 km of the radar, and some second-trip echo too. Overall very quiet still, however.

0800Z – Distant SE cells have multiplied in number and propagated closer to the radar.

Now around 150 km out. Max Zs in the mid 30s. Overall, still pretty quiet.



0840Z – Given the propagation, shape, and lifetime of these SE cells, I would not be surprised if they were artifacts; perhaps sea clutter or something else. They do have Doppler velocity signatures, however.

0910Z – The southern echoes seemed to have become something more believable as precip about 150 km due south of the radar. They are showing up at higher angles too, strengthening the precip interpretation.

0930Z – Lang off shift. FYI, the toga1 clock got readjusted to better match GPS early on in my shift. Forget the exact time, however.

Smull on-shift. Agreed to have techs shut system down for short period to do routine generator maintenance. Local conditions are among the most humid I've felt in awhile; surface wind component is S'ly. Markedly disturbed seas of yesterday (apparently swells propagating in from afar?) which were pounding the coast near the hotel have abated a fair bit today. Review of overnight pattern suggests sea clutter dropped off rapidly after 04Z.

Yesterday's (5 Sept) NAMMA forecast called for inactive (tho perhaps dusty) conditions until the next wave exits the African coast, which is forecast to occur on 8 Sept (i.e. two long days from now). Meanwhile, grateful for laptop archive of .pdf journal articles & .mp3's...

1030Z: System back up & operational. Missed scans (though no meteorology...) during interval 0920-1020Z, but back online & recording as of 1030Z Surveillance scan. Confirmed all archives are functioning and up-to-date with no unexplained gaps.

Isolated weak echoes Tim previously noted are dying in place near 185deg/150 km.

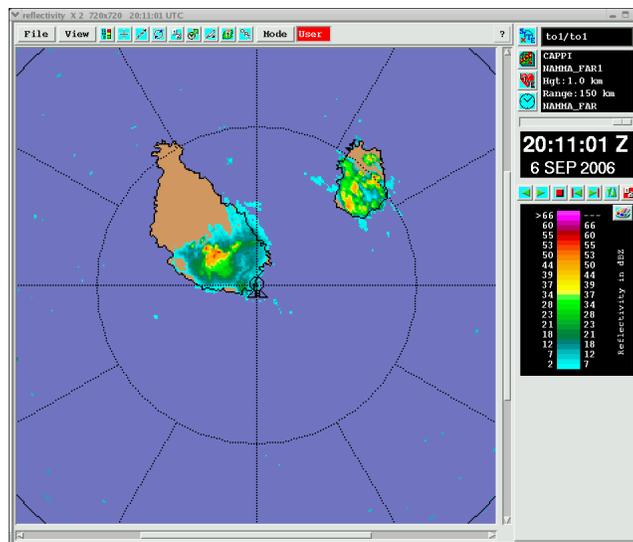
1300Z: Bit of 2nd trip in FAR scans, resulting from renewed bubbling of very weak/isolated echoes seen near 160deg/175km in surveillance mode. Perhaps this is a "hot spot" in SST? Tendency for weak but recurrent small cells there is curious.

1500Z: No change. Sfc wind speed has dropped a bit. Plenty of low clouds, probably orographic. Tides are definitely more extreme as we near full moon. Sediment-laden effluent from local river is very apparent in wake of rains on 3 Sep.

1700Z: PPINE. Iris reports "Message #10 Archive media max product count reached on Unit #1." Appears DVD's have stopped archiving, but RAID appear to be updating normally. NO significant echoes, so will await running this by Nathan Gears when he arrives at shift-change.

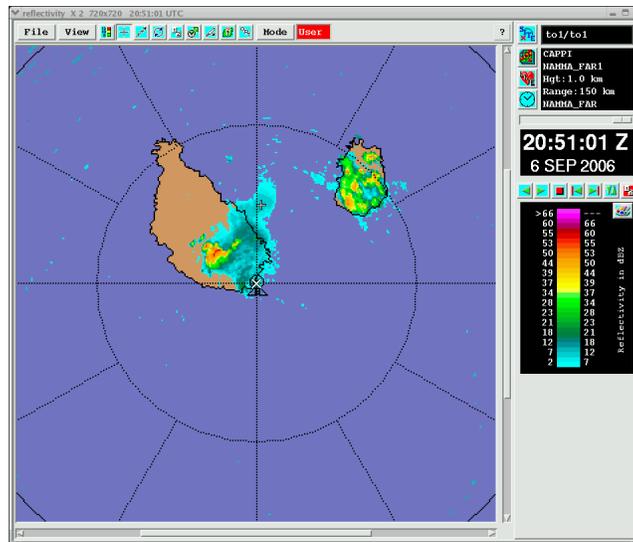
1900Z: No change.

2030Z: On return from old airport, noted darker low cloudbases immed. S of TOGA, accompanying (in a causal sense?) development of N'y component of low-level flow—perhaps in some sort of weak drainage fashion. Subsequently, widespread light echo returns developed surrounding higher terrain, though not necessarily accompanied by widespread cloud. Not sure what this is all about...



2130Z: Weak echo over terrain is advecting E'ward, including a plume of ~10 dBZ echo extending perhaps 20 km out over channel toward Maio. Advection is consistent w/ prevailing Vr pattern. Perhaps there is a non-meteorological explanation (e.g. Insects? As suggested by the huge number of insects hitting our brightly-lit window tonight...). All of

this discussion is a way of saying—there's not much interesting meteorology tonight.



Smull off shift.

2130Z – Lang on shift. DVDs full by around 1630Z today. Will replace now. Note that error message about “max product count reached” is the same thing as the DVDs filling. GPS 20s faster than toga1.

2330Z – Remains fairly quiet.

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0030Z – Some weak cells have popped up about 100 km to the south. These are moving toward the east – much different from yesterday.

0200Z – Some weak echoes to the WSW now, within 100 km. 20-30 dBZ max.

0300Z – Scattered weak cells persist, but show no signs of strengthening or organizing. It remains very quiet out there.

0500Z – Echo pattern remains similar to last entry.

0700Z – Precip echoes have largely faded.

0800Z – Continues to be only scattered light precip echoes at best.

0930Z – Lang off shift. Only thing interesting on the scope is a short line of weak convection a bit of 100 km to the SW .

1030Z: Smull on shift. Only interesting thing is aforementioned echoes moving *E*. Will try to check sounding later, but doubtful there's any W'y flow. We've seen this before—odd. A few super-weak ESE'ward moving shower (drizzle?) cells have also been skirting the S fringe of our sea clutter since (i.e. In what seems to be zone of diurnally favored convergence aided by shift of Praia's winds toward N'y most evenings), but these mostly dissipated by 0930Z. Lastly, we're definitely back in the Saharan dust this morning... Checked-in w/ Gerry Heymsfield at Sal-NAMMA Ops. They're rather non-plussed by the

approaching wave, but in any case see no opportunity to work near us for the next 48h.
1200Z: Short WNW-ESE cell segment 180-190deg just beyond 100 km.

1300Z: Two short segments now exist in S/SW quadrant inside of 150km; cells are up & down, but still present, exhibiting a slow E'ward drift. Notable only because so little else has been going on.

1400Z: Little change.

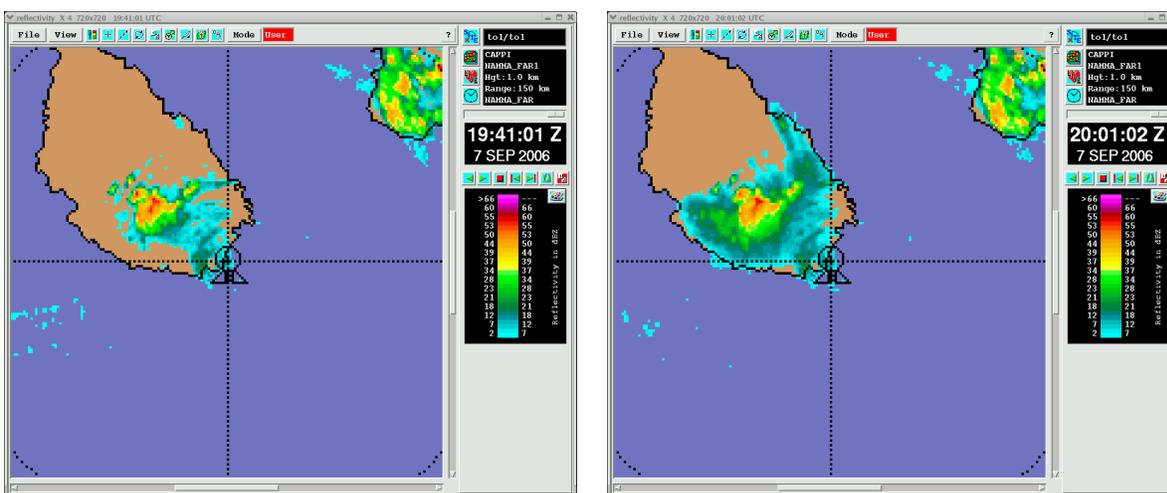
1540Z: Basically PPINE again. Bob Bowie arrived & radar going down for full calibration aka Z-Auto.

1630Z: Scanning was resumed w/ 1611Z NAMMA_FAR sequence. Bob reports all angles/calibrations still look good, i.e. Apparently no major settling of the containers/pedestal owing to the recent heavy rains.

In terms of the scope, it's PPINE. Stopped by old airport earlier to file reports, glance at soundings, read NAMMA website updates etc. With reference to observed eastward echo motions to our south earlier today: Praia soundings show weak (ca. 10 kt) W'lies only in one very shallow layer, as I recall up above 700mb. However NAMMA forecasters make reference to "anomalous westerly winds" near the African coast, so perhaps conditions are different to our east (and south). Unfortunately the forecast for the next (Saturday's) approaching wave is not particularly positive vis a vis prospects for precip.

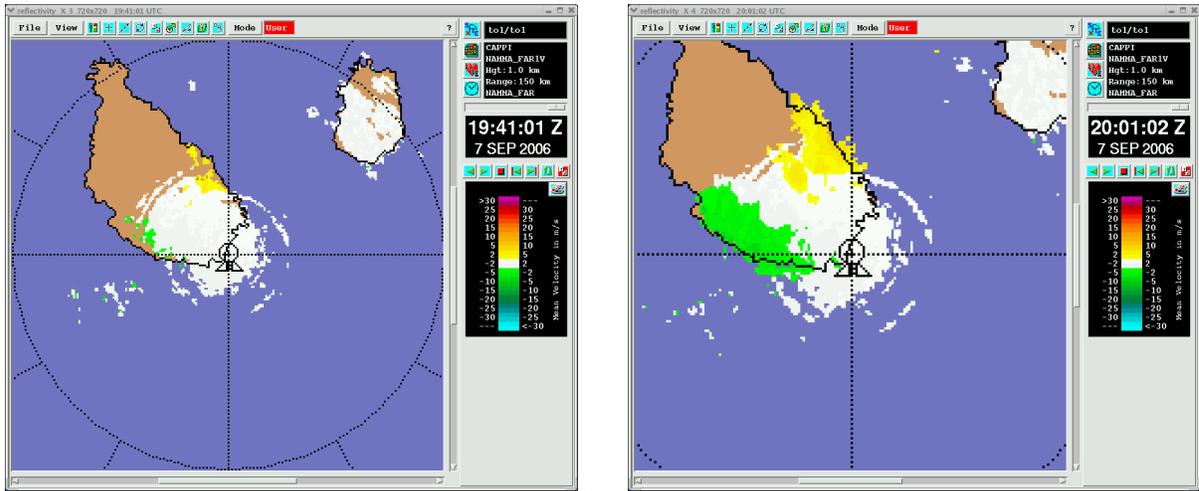
1830Z: PPINE. Helped Tim Parks in turning away unneeded fuel delivery; word from Bob Bowie today is that we most likely have sufficient fuel for the duration. Shipping fuel-laden tanks is a problem. Final decision on additional fuel (if any) will need to be next week.

2000Z: The sun has set, and once again it's time for Cape Verde entomology 101, as illustrated by a pair of 1-km MSL CAPPI's 20 min apart:

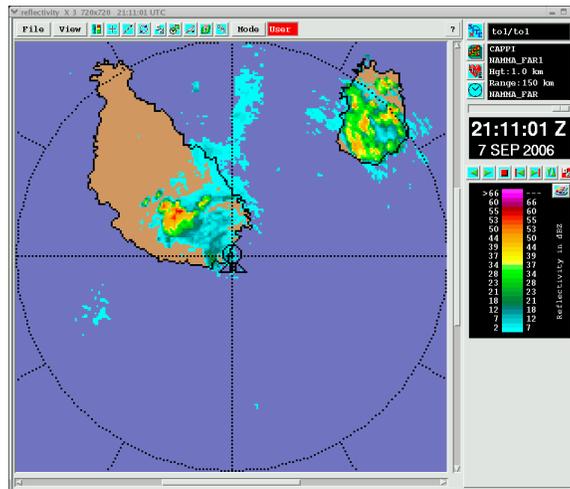


There's of course a chance that this is really ornithology 101, but hypothesis that bugs are the responsible agent is in large part based on the simple observations that (1) the diurnal cycle of this echo matches the density of bugs we observe, and (2) that on the whole we've seen a lot more bugs than birds on this quasi-desolate rock of an island.

Will the plume once again extend NE'ward over the water? Now that scatterers have been injected to illuminate it, velocity pattern looks favorable. Last night they made it well offshore by 2051--stay tuned...



2130Z: And there they go, on their holiday to Maio. (Will work on a stanza later.)
Smull signing off.



2130Z: George on shift with the buggies, and dying for some chipotle...

2330Z: Bugs and sea clutter

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0130Z: Some second trip echoes appearing to the S - ESE of the radar.

0330Z: Nothing

0530Z: Same

0730Z: Same

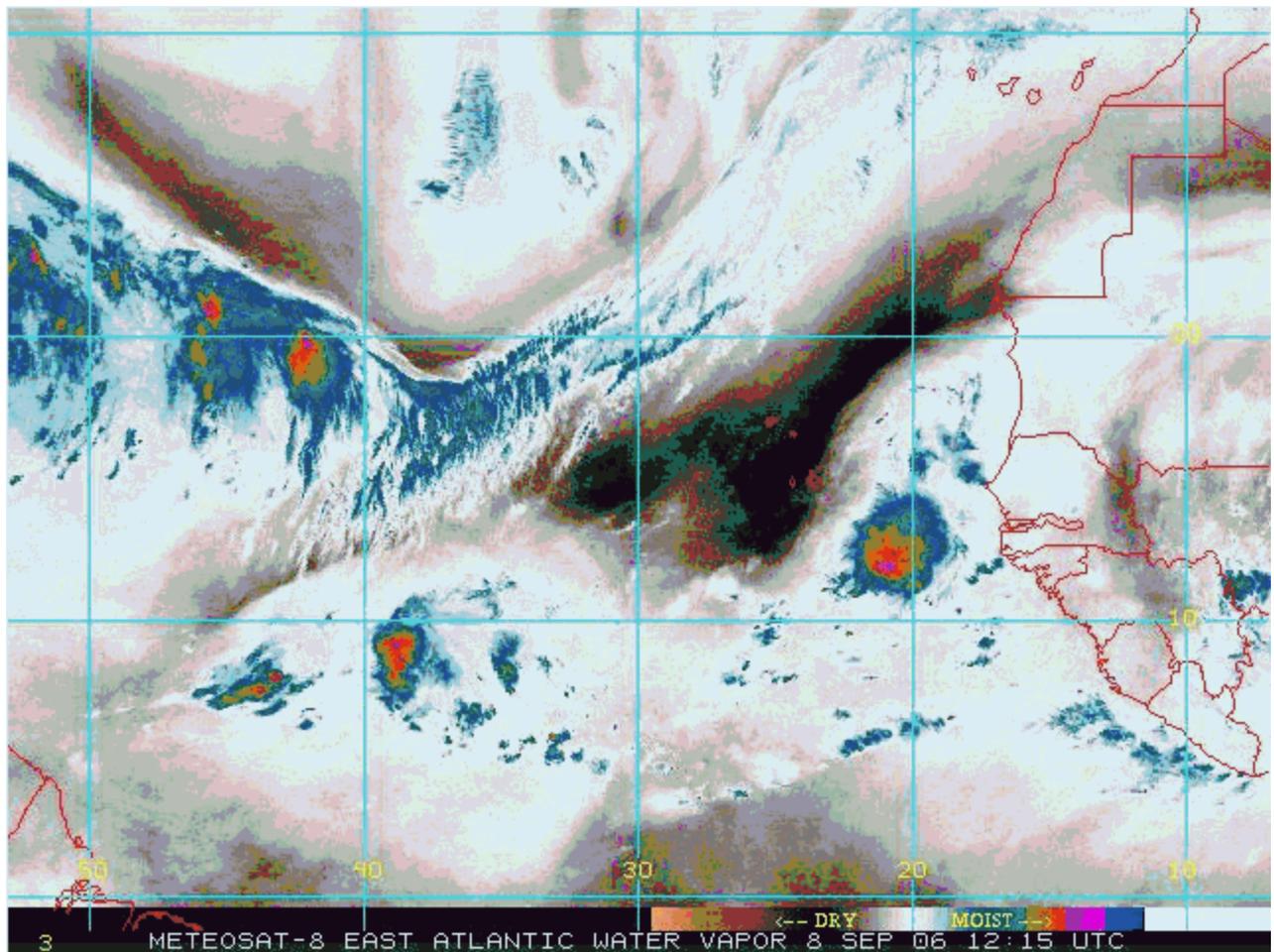
0930Z: Some more second trip echoes to SE. George off.

Smull on-shift. All archives functioning normally. Noted convection blew up last night around sunset over NPOL (pleasant surprise based on more pessimistic forecast). Check-in w/ Heymsfield @ Sal reveals DC8 plans to fly vicinity NPOL today, where stratiform rain remains, and seek-out center of circulation (if any). Reported 2nd trip to our SE, which he says is consistent with "small offshore band." Hopeful for more active conditions within view of TOGA tonight or more likely tomorrow—will check forecast later. Confirmed with Gerry that the last possible flight day for DC8 is indeed Wednesday 13 September. Late in the game (i.e. As of this week), Kakar has deeded an additional 12h of flight time, but not clear that the weather will justify its use.

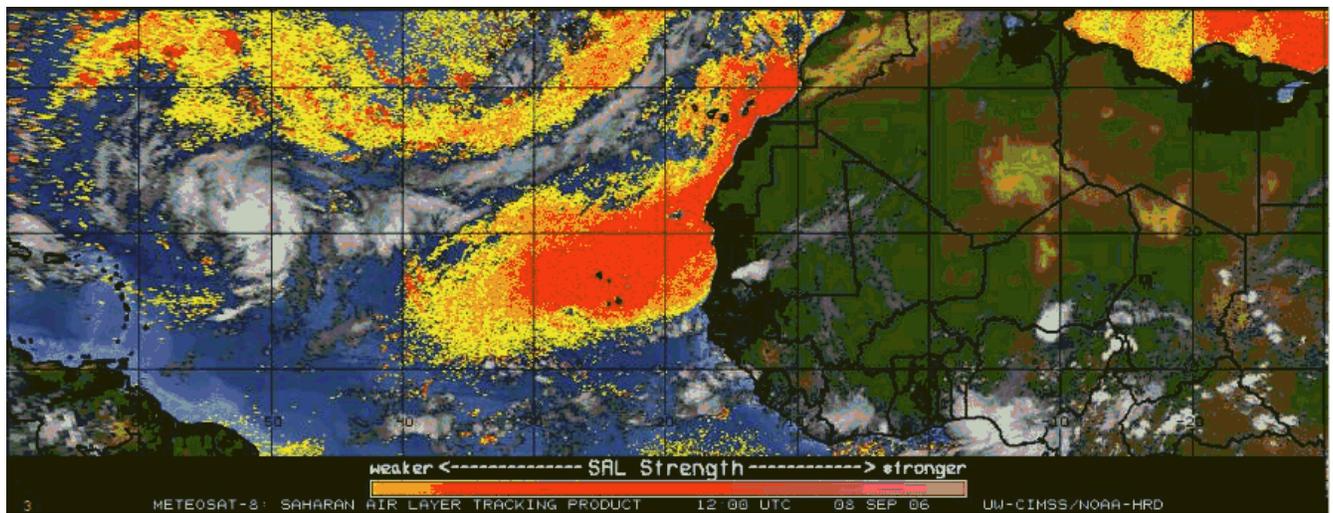
1030Z: Approaching 2nd trip appears to be anvil-like stratiform, perhaps with a bit of convection behind (SE of) it.

1140Z: First genuine 1st trip meteorological echo allegedly linked to the approaching wave (just a single blip) has appeared near 107deg/260 km. It's not much but it's a start. Main body of 2nd trip appears to have slowed it's inbound progress, however.

1400Z: Above-mentioned echo was short lived. 2nd trip is swinging around through our SE sector, suggesting activity passing us by to the S, and apparently weakening with time. Returns presumably associated w/ N fringe of ~circular MCS depicted in Meteosat imagery:



A bit difficult to resolve above image w/ SAL analysis, however:



Note that, esp. since mid-morning, it's been a relatively dark day in Praia—lots of low (and perhaps upper?) cloud. As always, difficult to ascertain role of dust in reduced insolation.

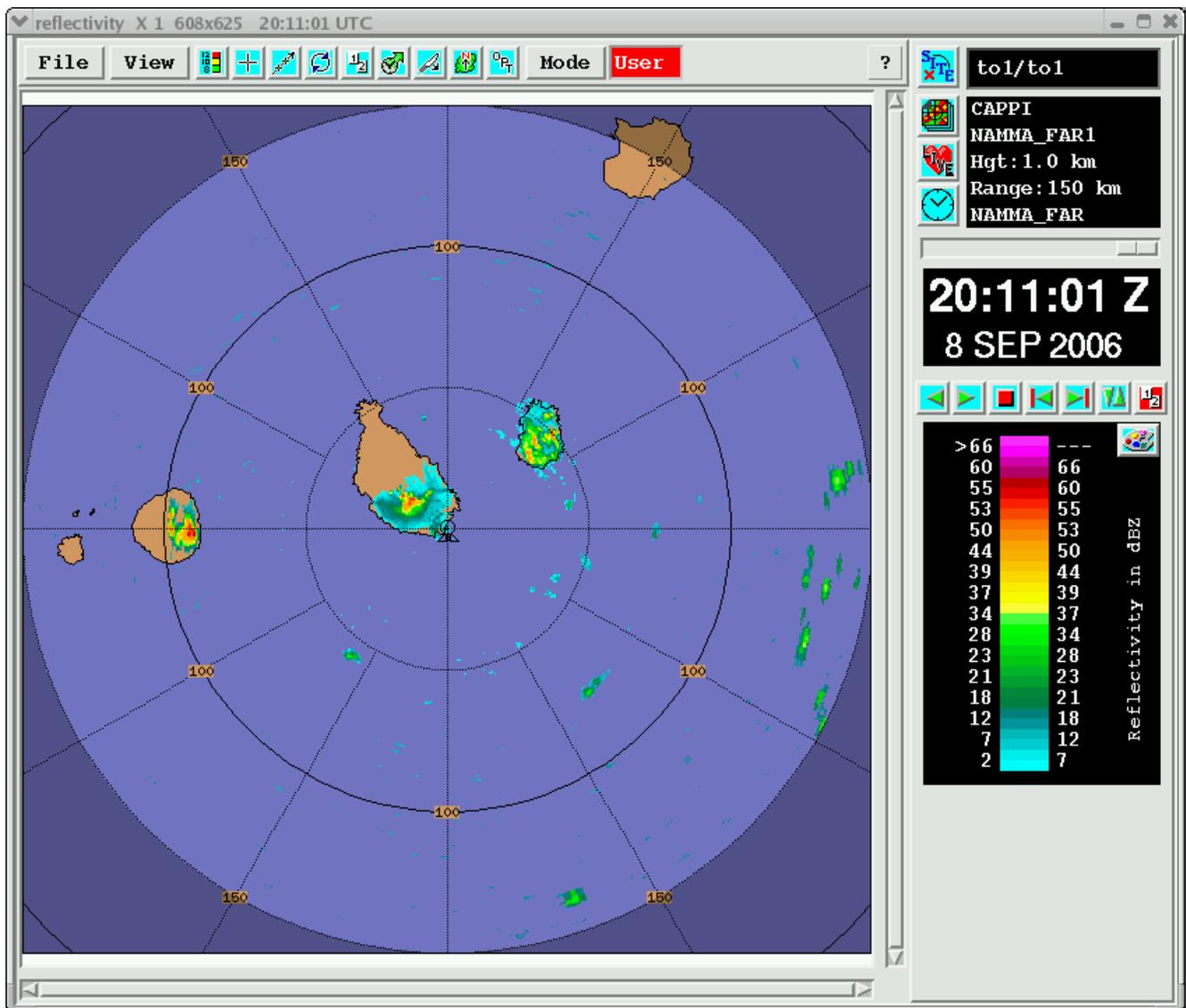
1600Z: Virtually PPINE apart from smallest blip at edge of scope along 153deg.

1620Z: Bowie arrived; agreed to take radar down at 1630Z for calibration. Came back online for 1700Z surveillance scan. Bob reports that calibrations look quite stable on day-to-day basis. Scope PPINE.

1800Z: Side-notes for a quiet afternoon: Numbers of grasshoppers are greatly reduced, with no evidence of any new "hatches" in the wake of last Sunday's rains. Perhaps the one crop is all nature needed for this cycle. Also, a note on previously cited wind directions in this log. Distinct from the issue of wind processing at for the Praia soundings (which as documented in this log back on 29 August has been a matter of much discussion), it's my observation that surface winds here on the E side of the city are subject to large and strange variations, particularly in direction. I have easily seen >90 deg variation in the "sensed" wind at the old-airport sounding release site, a windsock near the S end of the active runway at the new airport, and as noted here at TOGA's hilltop location. My advice is to take any/all wind observations cited in this log with a HUGE grain of salt. It may well be that the appreciable topography (hills, chasms, coastal cliffs) are engendering local variations that are far more significant than one might think at first-glance.

1930Z: Finally, something—a broken, arc-shaped line of weak cells approaching from the E and just beginning to come inside 150km. To repeat an earlier (ill-advised) line, it's not much, but it's a start. More realistically, it's a tenuous feature that's just formed as sunset is rapidly approaching, so its odds don't look great. In any case, I won't be commenting further on insects tonight, no matter what transpires on the scope.

2000Z: One fairly decent 25-30 dBZ cell just inside 150km near N end of arc; tops (sans sidelobe extension) are approaching 6 km. Easily the best echo seen today. Estimated motion through 2030Z is W'ward at 3.5-4 m/s. Other very isolated echoes are also popping up—perhaps some sort of broader forcing is active?



2130Z: Density of cells along arc has decreased, but those remaining are relatively intense (peaking in the 40-45 dBZ range, with tops gen'ly below 5km MSL. Small signing off.

2130Z – Lang on shift. One of the eastern cells appears to be getting larger and stronger, but still topped within 5 deg elevation.

2230Z – Eastern convection approaching 100 km out, and the number of “intense” cells has increased. They peak in the 30-40 dBZ, and are still pretty shallow.

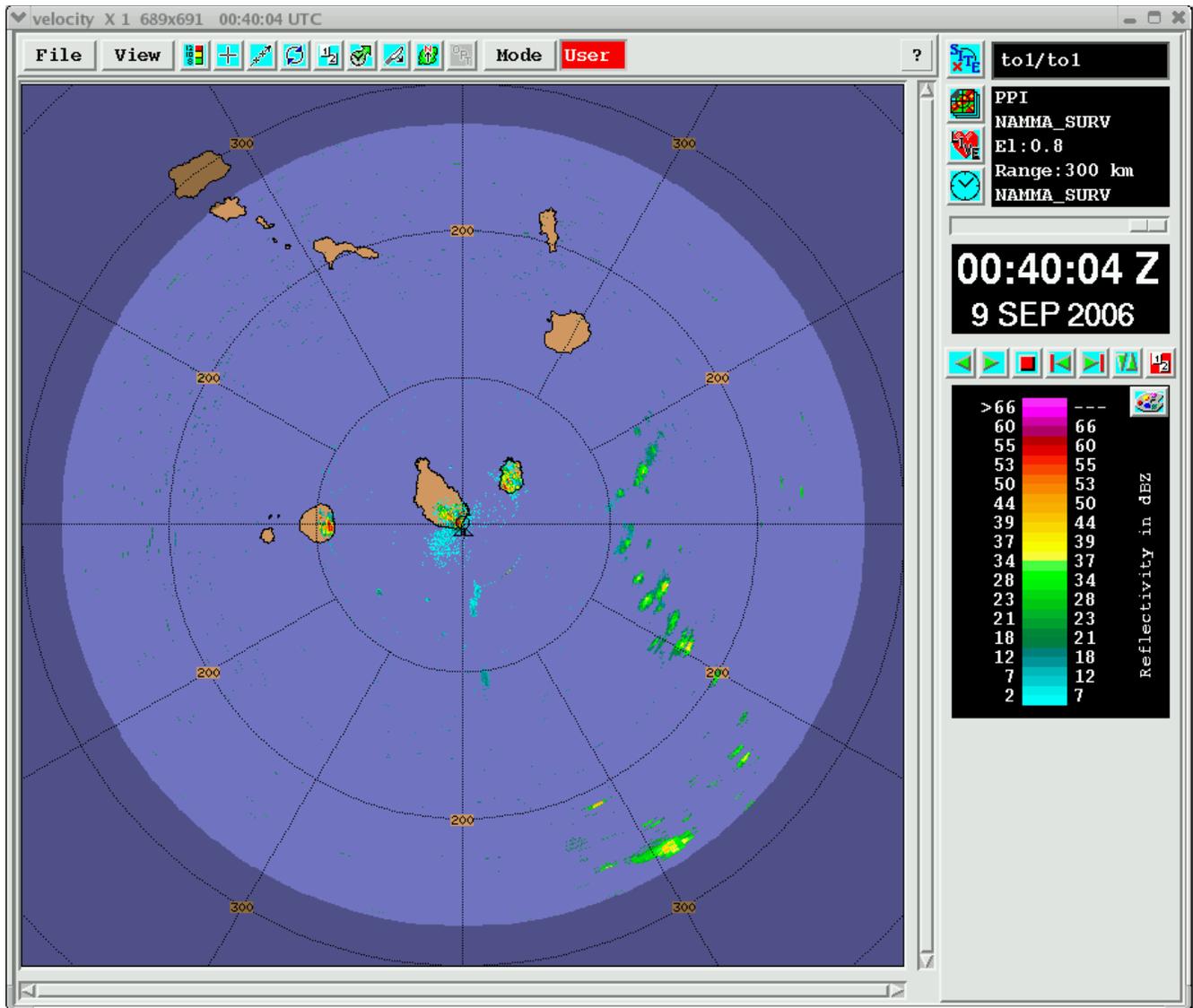
2300Z – Some weak echoes have popped up within 50 km to the east of the radar.

2330Z – Eastern convection has reached ~50 dBZ.

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0000Z – The closest eastern echoes have faded a bit, while there is development of new cells to their SE.

0050Z – Eastern cells are still moving westward, but stall out before reaching 100 km distance and redevelop on their eastern flank. The effective result is that the system is quasi-stationary. Still much more interesting to look at than the last few nights of next to nothing. Also, some cells have formed over 200 km to the SE.

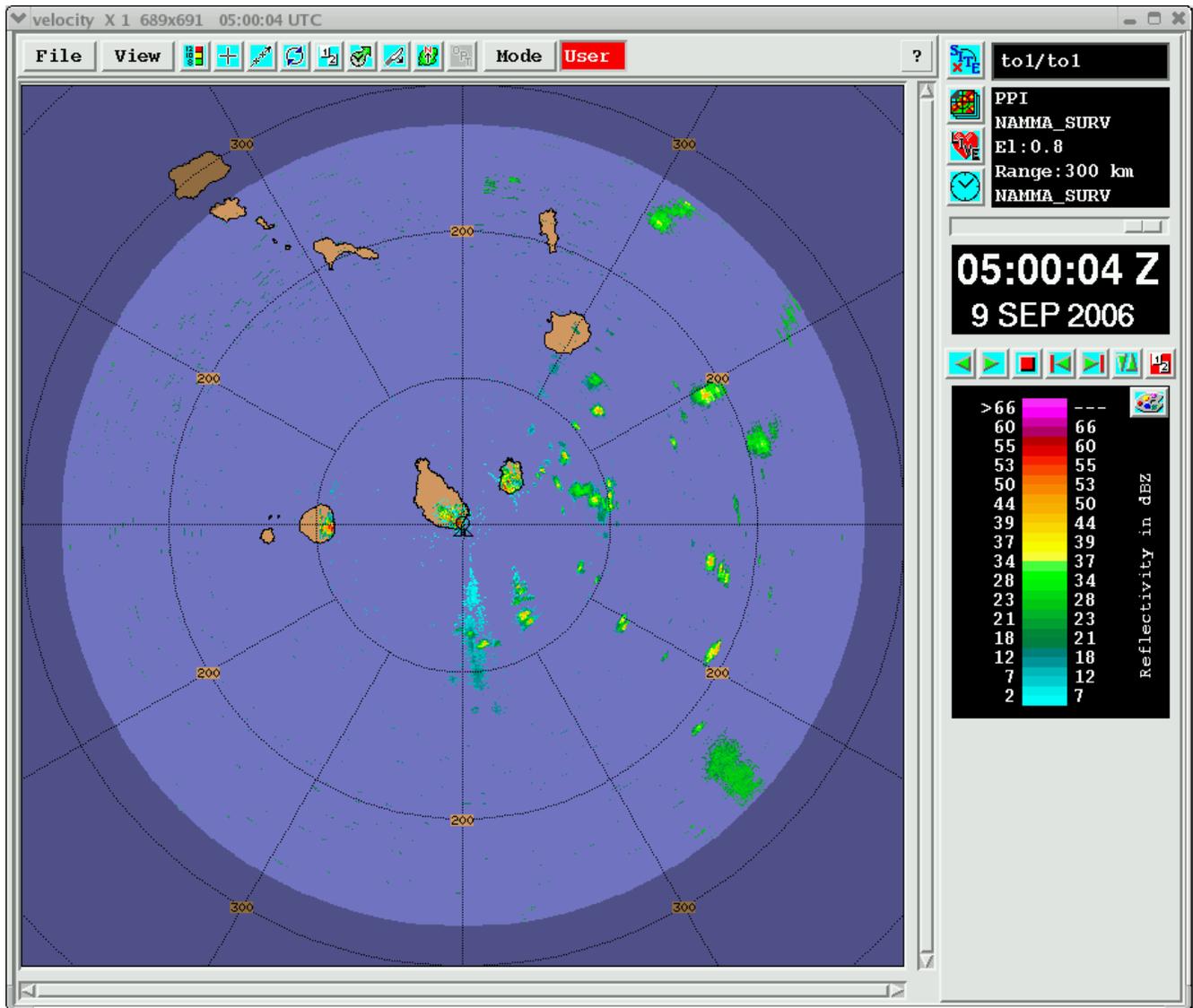


0150Z – Nice second trip to south, even on the long-range scan.

0250Z – Eastern cells seem a bit stronger and more numerous now. Still stuck around 100 km out.

0400Z – Overall pattern maintaining strength. Some 30-40 dBZ cells have popped up about 75 km to the SE. Leading edge of eastern cells have crept to within 100 km.

0500Z – Echo coverage continues to steadily increase, with many echoes now well within 100 km of TOGA. Radar continues to top everything pretty easily, and cells appear to be relatively shallow. There is also significant second trip to our south.

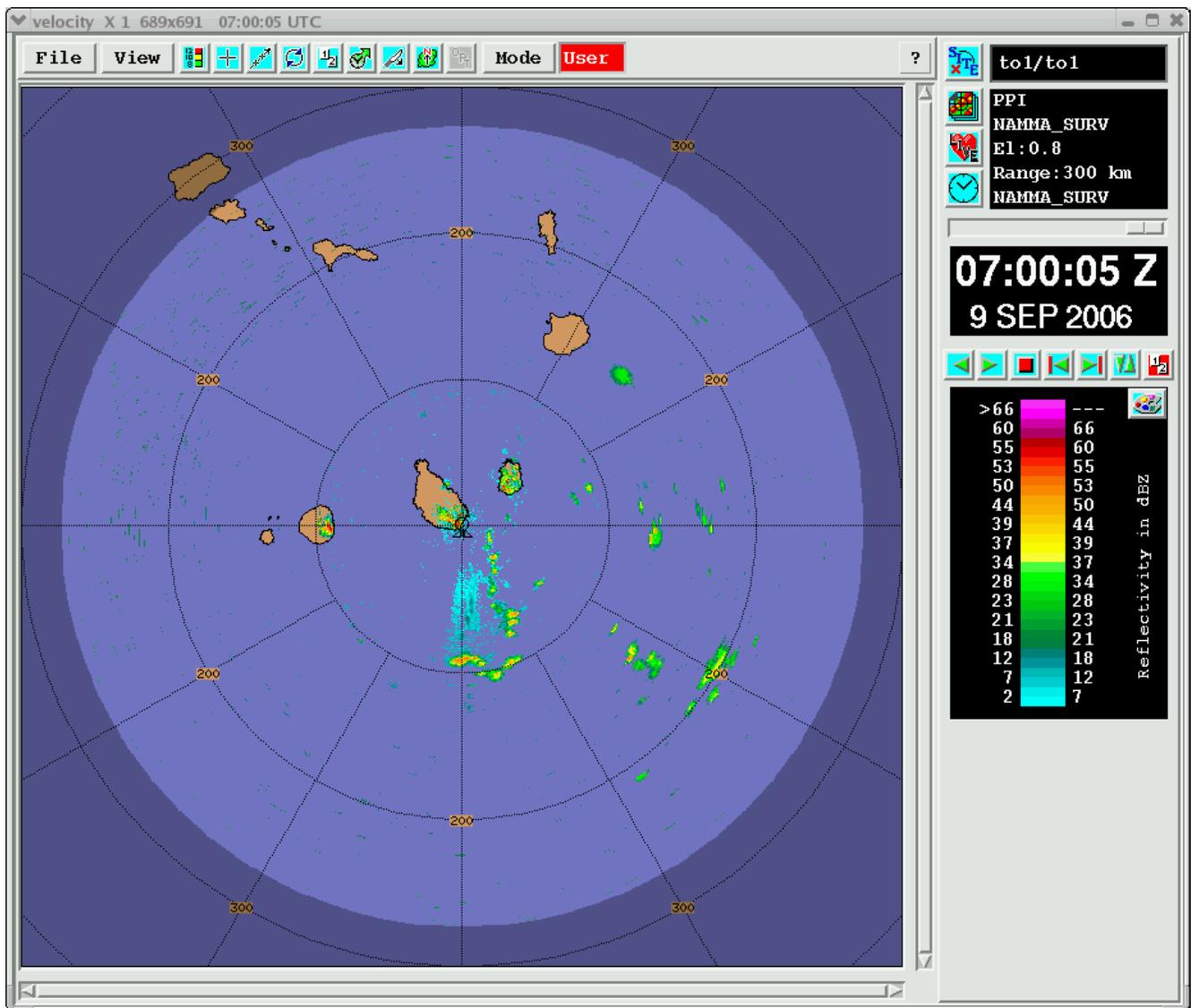


0600Z – Small line of substantial convection has developed to the SE, near the second trip, within 100 km. Two other decent cells (50+ dBZ) have popped up in a more southern position near the second trip. Eastern cells have fizzled a bit, with limited redevelopment, but are being replaced by new convection well behind the old cells. Most convection is still topped by about 10 deg.

0630Z – Cell ~35 km to the SE has substantial sidelobe. Peak Zs in the cell are in the 50s. A cell has popped up about 20 km to ESE. It is topped by 20 deg.

0650Z – Cell has popped up to the NW, along the NE coast of Sao Tiago.

0700Z – GPS about 1 min ahead of toga1. The SE line of convection is maintaining strength, and scattered cells continue to pop up over 100 km away in the eastern sector. There is a hint of cyclonic mesoscale circulation throughout the collection of echoes, from perusing the loops. The island convection has decayed.

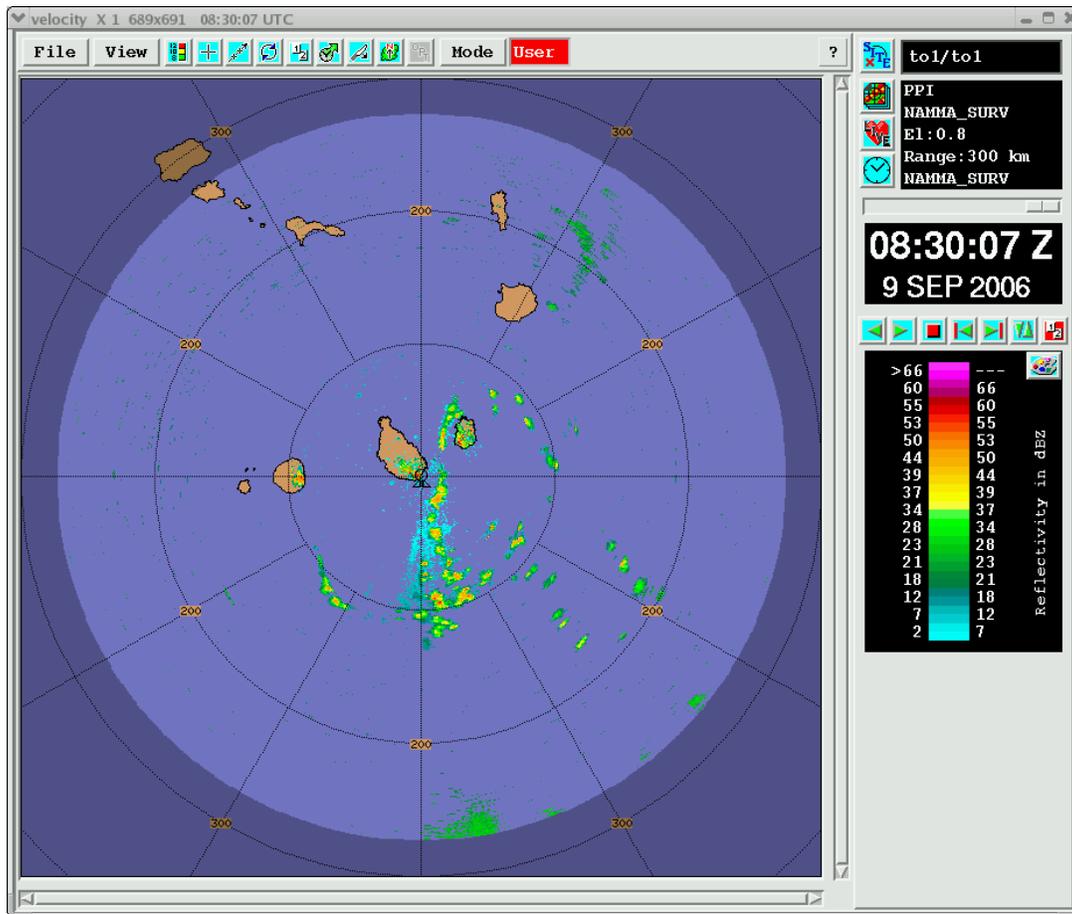


0720Z – Some of these echoes have up to 60 dBZ. Particularly one immediately to the east (~35 km to ENE), and another at the southern end of the southern line.

0740Z – There is some convection over the northern part of Maio, mixed in with the ground clutter at low angles. It is part of the convection to the east, that has formed itself into a N-S line. This convection includes the intense eastern cell described in the last entry. This eastern line is linking up with the southern line, and has the inklings of forming up a possible MCS.

0820Z – Not topping one of the cells, due to its intensity and proximity, so switching to NAMMA Near.

0830Z – The convective line continues to move toward Sao Tiago and the radar. Several minutes earlier it looked like the line was congealing, but some cells decayed and the broken line appearance has returned. There are scattered cells behind the line, and to our SW. Visually, from the view outside the seatainer, the system doesn't look that impressive.



0850Z – Cells re-triggering over the northern half of Sao Tiago.

0910Z – NAMMA Near not topping eastern cell within 10 km of radar. The broken feature of the line also manifests itself visually outside, with clearly separate rain shafts for each portion of the line.

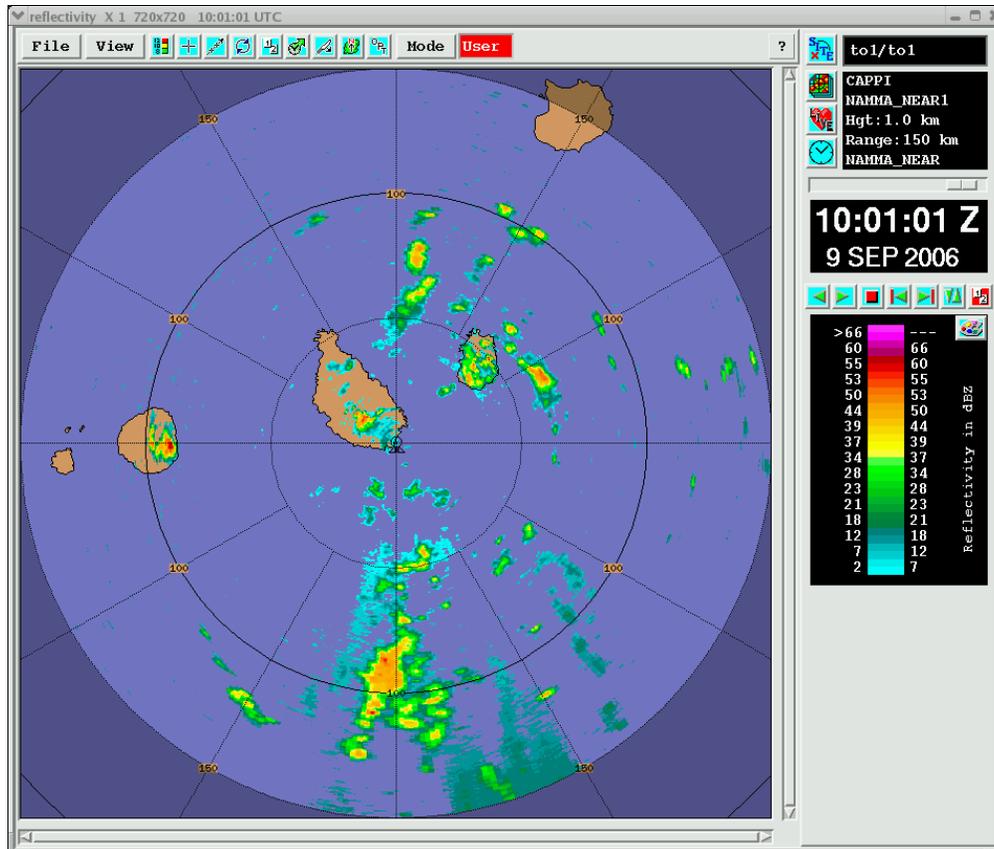
0920Z – Cell on the NE coast of Sao Tiago is looking pretty nice right now. Very light sprinkling precip at the radar site.

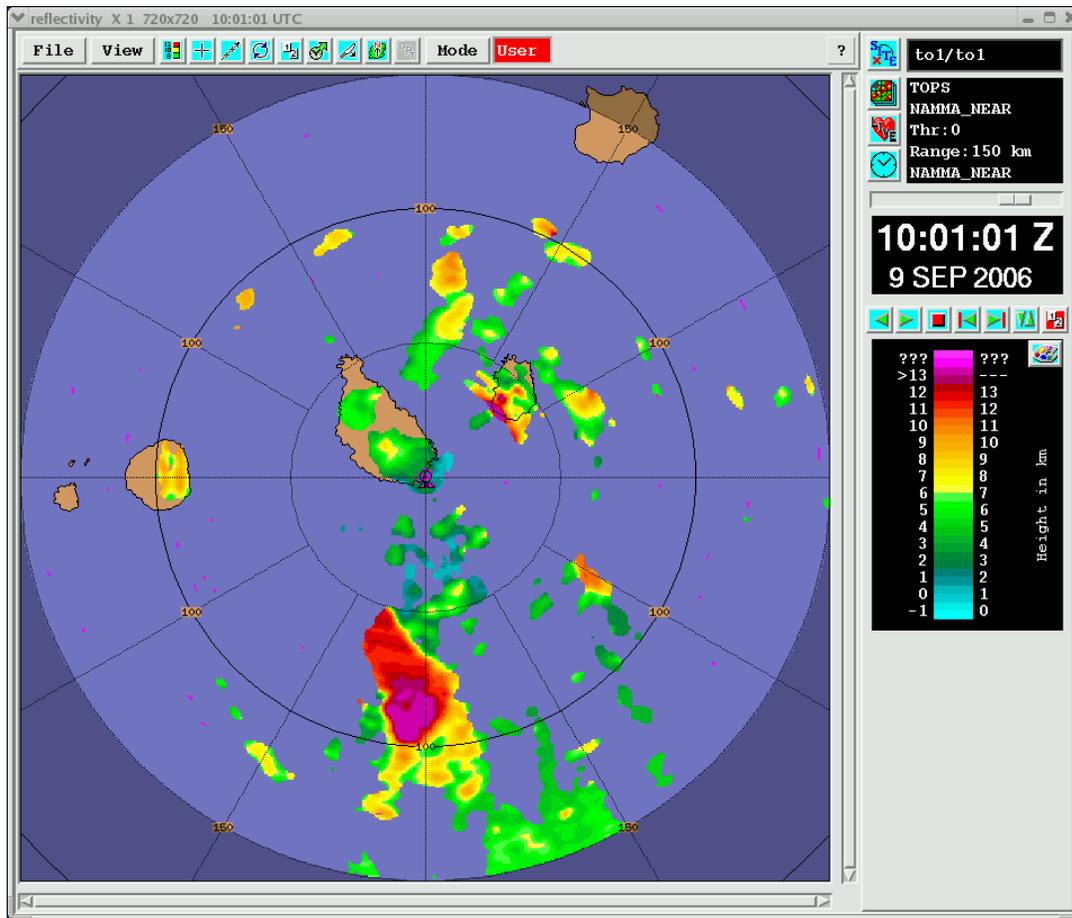
0930Z – Lang off shift. Smull & George on-shift. Having received messages late yesterday re: NAMMA Ops center being without Internet (and hence today's de-facto Ops Center being at their hotel), took a bit of extra time this morning to survey imagery before coming to radar site. Connected w/ Heymsfield at hotel via his cell. He was expecting to hear we had nothing significant on scope, so was surprised to learn about N-S echo line, including tall cells to our SE and farther S (e.g. Area of tops >12 km MSL just inside 180deg/100km). Informed him that this line is shifting slowly/progressively to our west, and that only appreciable 2nd (3rd?) trip echo we see is well to our south, i.e. No immediate prospects for organized activity approaching from E. Thus offered assessment that, barring rapid new convective developments this morning, chances of major echo structures within close range of TOGA that DC8 could work appear less than hoped.

Heymsfield reported DC8 is moving ahead with plans for Noon CVT (1300Z) takeoff to execute large-scale “X-shaped” pattern centered on apparent center of circulation approx. 200 km S of Praia (viz. near 13 deg N). He noted & we confirmed that best convection on

satellite is S of that location. Proposed to attempt radio contact as DC8 passes abeam of TOGA to our W. Also provided DC8 sat phone number (likely need to initially dial '00', followed by 8816 214 49 240) in case we had urgent need to contact them about significant/rapid echo developments. This avenue necessary because at this point all scientists are planning to fly (absent good Internet connectivity on ground).

1000Z – George notes that line appears to be “splitting” to N/S of Sao Tiago, perhaps due to local divergence superposed on convergence line as flow is forced to split in diffluent fashion around island landmass. Echoes ~100 km to our S are most impressive, per following illustrations. Note also superposed 2nd trip immediately W/NW of 1st trip echo:

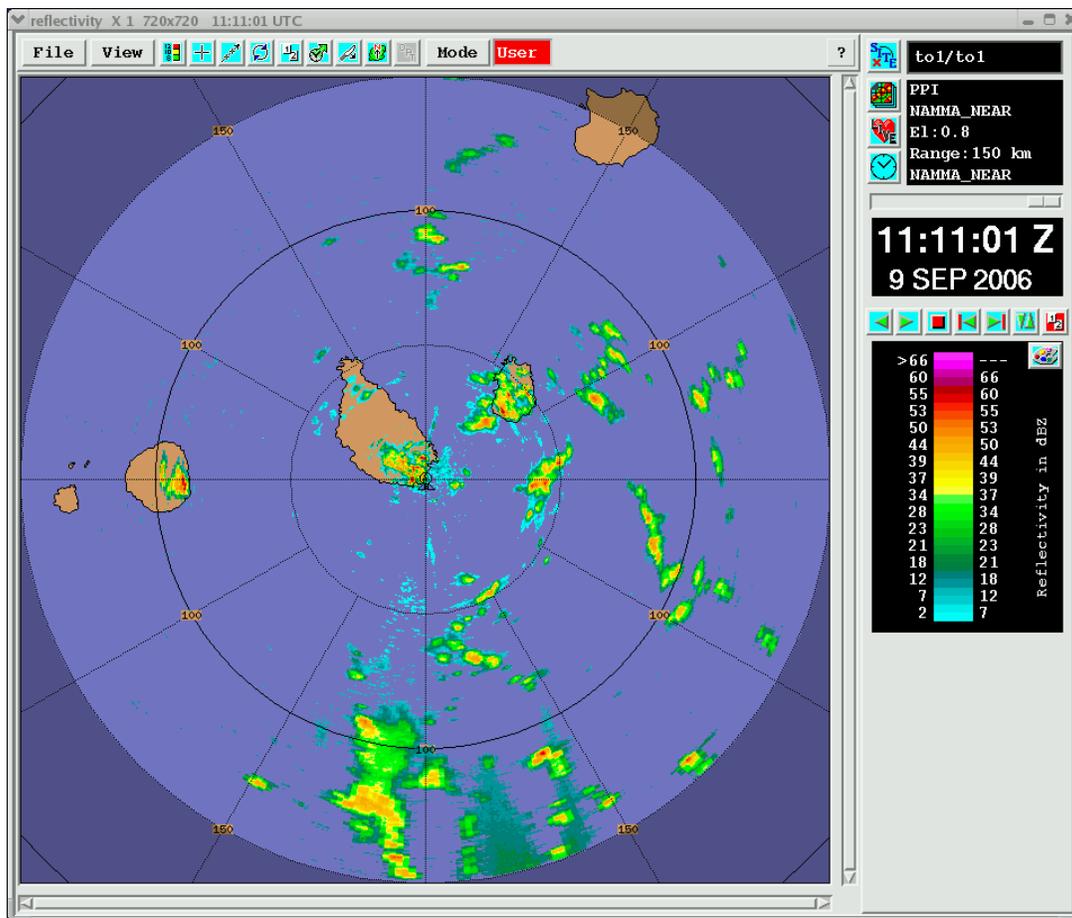




Animation of above TOPS product appears to show high/deep anvil streaming NNW'ward off zone of active convection centered near 182deg/90km (i.e. near 14N/23.5W).

1040Z: Possibly indication of synoptic scale circulation centered around 13W 22.9N. Large area of convection to the south of TOGA is still persisting although the large dBZ values seem to have dropped some. Called in to report this apparent center of circulation and associated cluster of deeper convection to the DC8 crew and they confirmed it corresponds generally to the approximate area of synoptic circulation shown by models. The line of convection seems to be disintegrating even more as is it moves to the W over the islands. Although there are new isolated cells forming further to the E of the islands. Anvil appears to continue to spread (looking at the TOPS product).

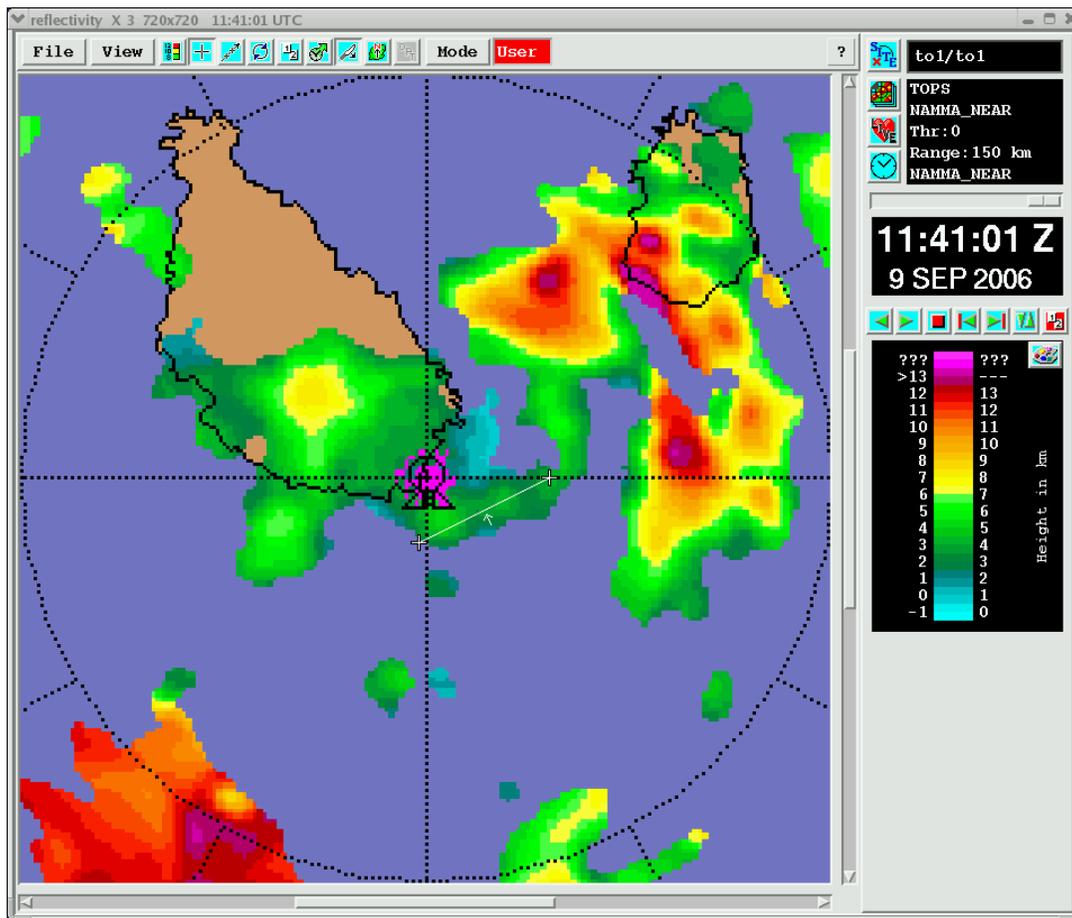
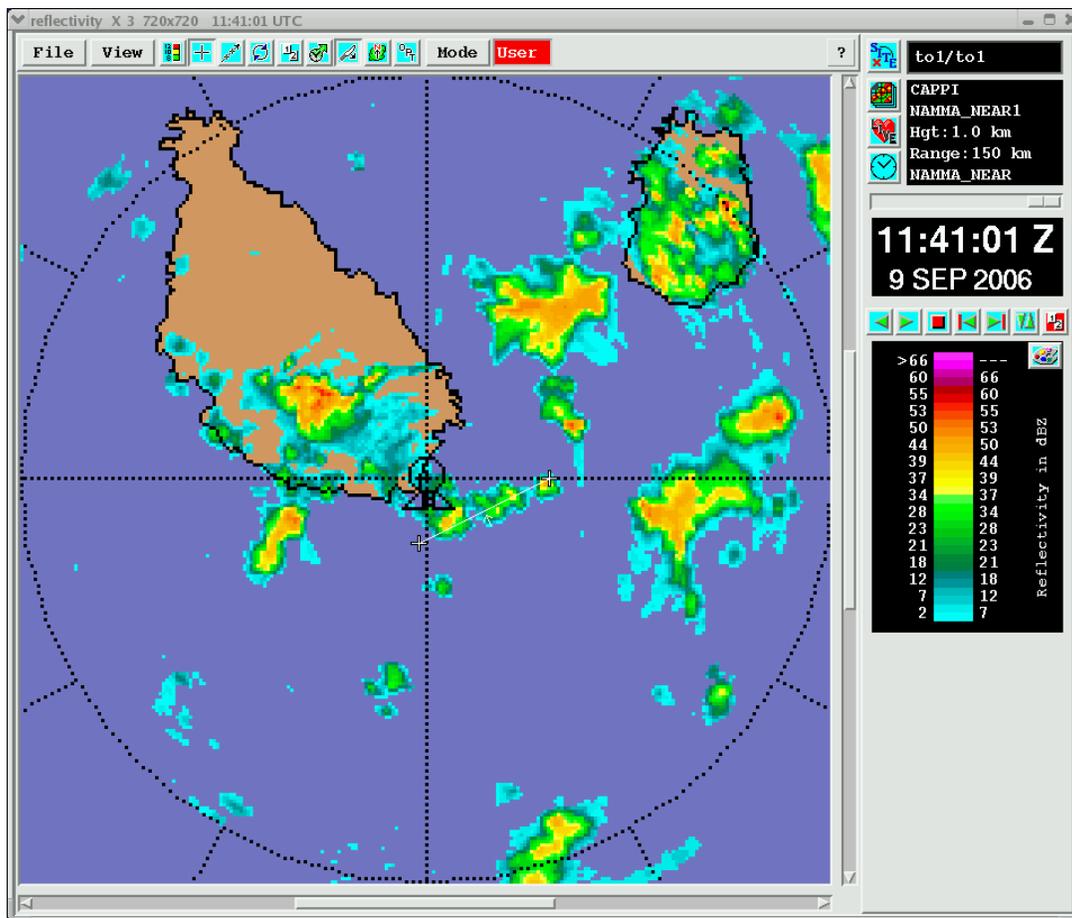
1115Z: Additional short ~N-S convective bands are appearing in our E sector, either via new development or simply moving W'ward into range of TOGA. Pattern includes one short NNE-SSW oriented line just inside 50 km heading straight for us. (Estimated motion toward 285deg @ 5 m/s). Other spotty but locally intense (40+ dBZ) echoes even closer, e.g. cell at 100deg/10 km with estimated top near 5 km). Thus electing to maintain NAMMA_NEAR mode.

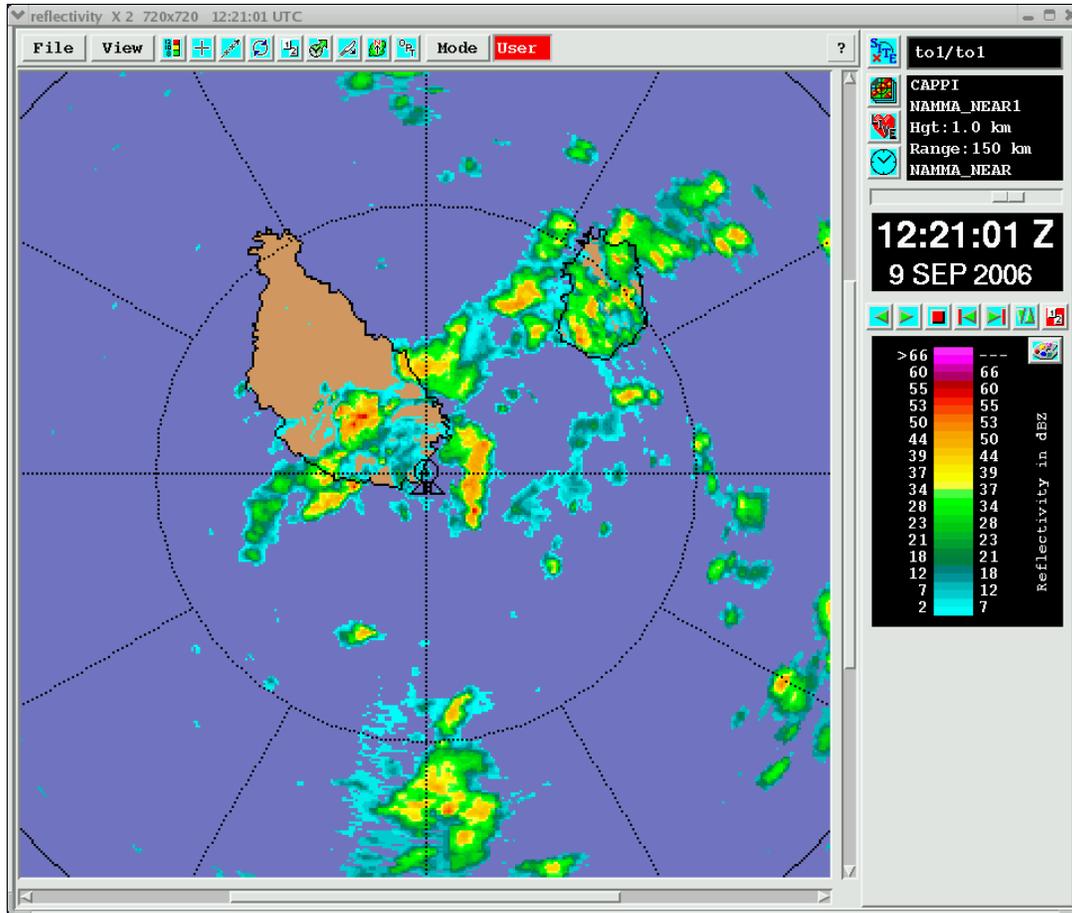


1200Z: Surprisingly active/volatile, with lots of tendency for rapid new echo development in local area over past hour. Basic echo structure and tops are both impressive (see next page). Cross sections depict tendency for WSW'ward (presumably down-shear) tilt of echoes with height. E-W sections across intense southern band (e.g. at 1141Z near 164deg/48km) show signs of discrete new cell development aloft ahead (W) of band in 2-3 km layer, thus showing some aspect of organized-multicellular structure.

1215Z: Called Heymsfield (aboard DC8 on tarmac) to advise convection is becoming more widespread in the region E-SE-S of Praia encompassing apparent center of circulation. Reported to him that none of the tops currently shown (all now at/below 10 km) should present a problem for DC8 at cruise level, but advised that they should be prepared to encounter more dense convection at lower planned flight level (presumably ~700 mb).

1235Z: George & Smull back inside; noted rather gradual (perhaps ~5degF) temp drop over past 5 minutes, with visual suggestion of arcus cloud immediately to our S, and prominent precip shafts beyond it to E-SE-S. Cross sections (photographed) show tops in 8-9 km MSL range with very tight leading-edge dBZ gradient and evidence of overhang & multicellular structure.



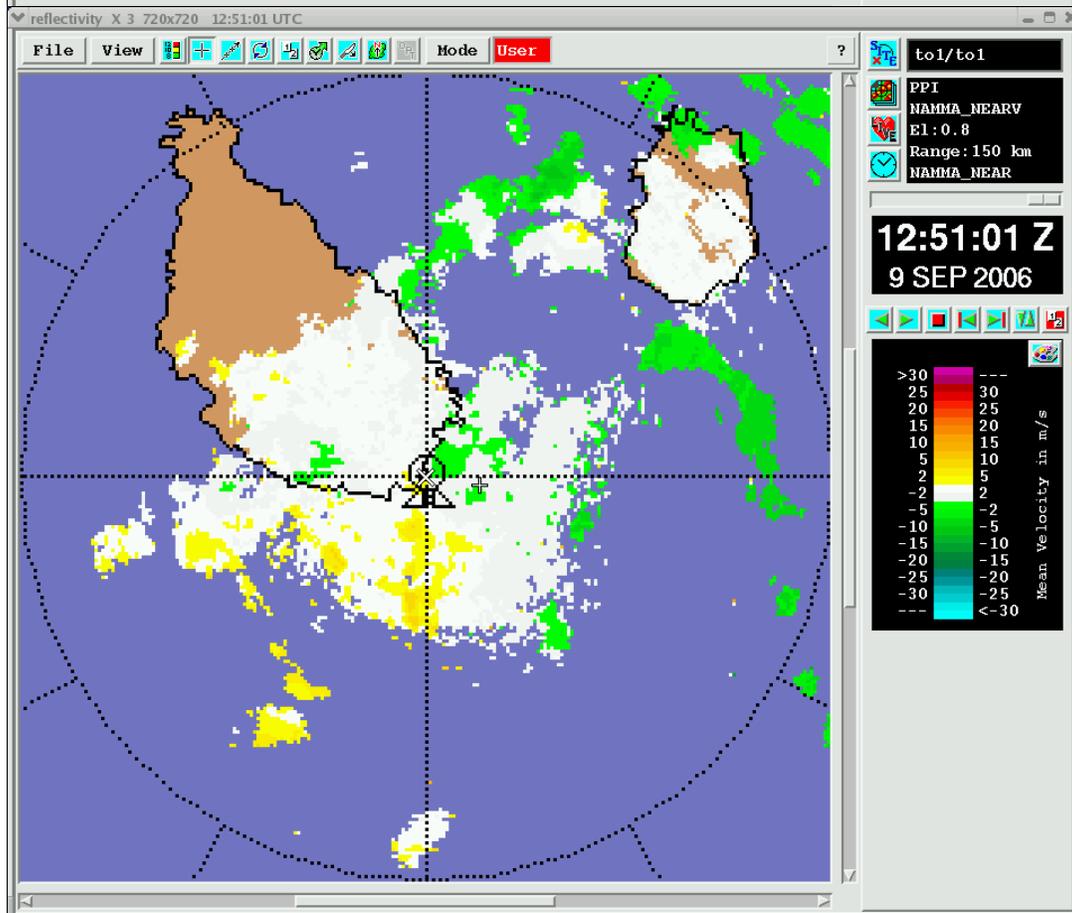
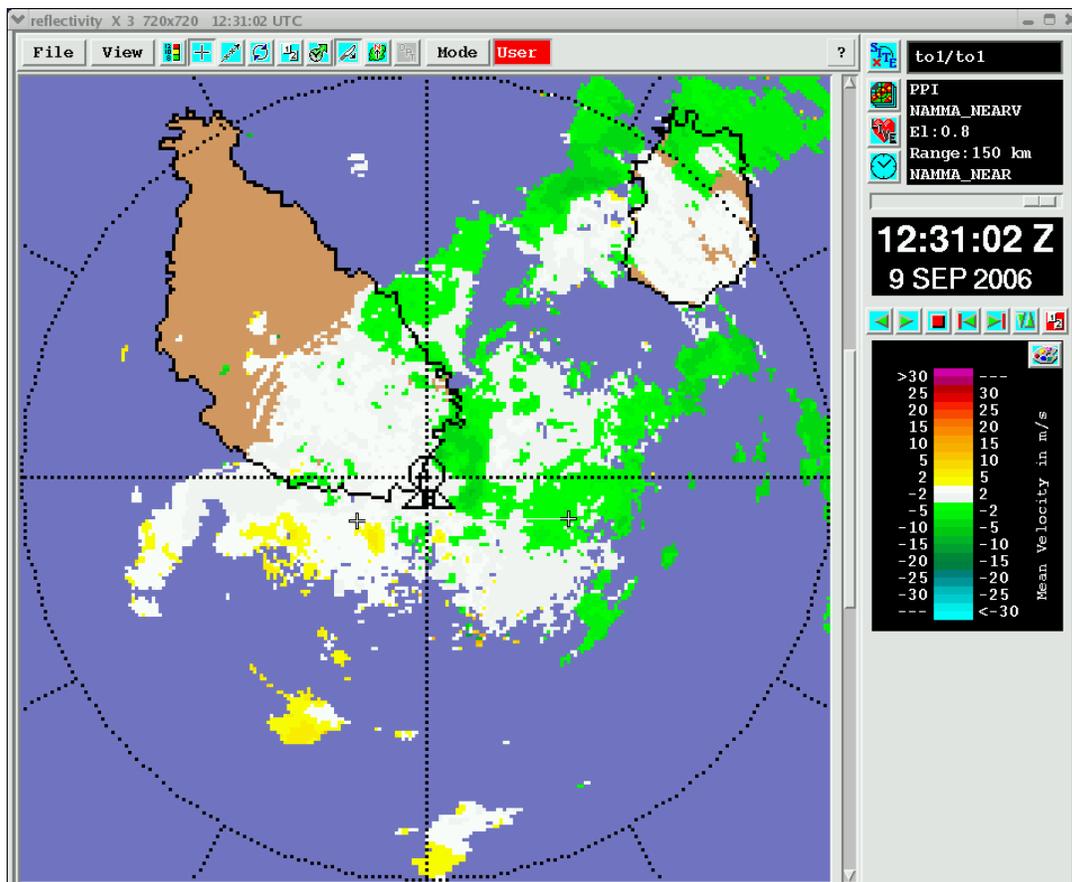


1245Z: ESE-facing window being pelted by rain with occasional gusts. Most intense core near 150deg/5km, with peak intensities of ~45 dBZ. Of course even NAMMA_NEAR scans are failing to top this echo.

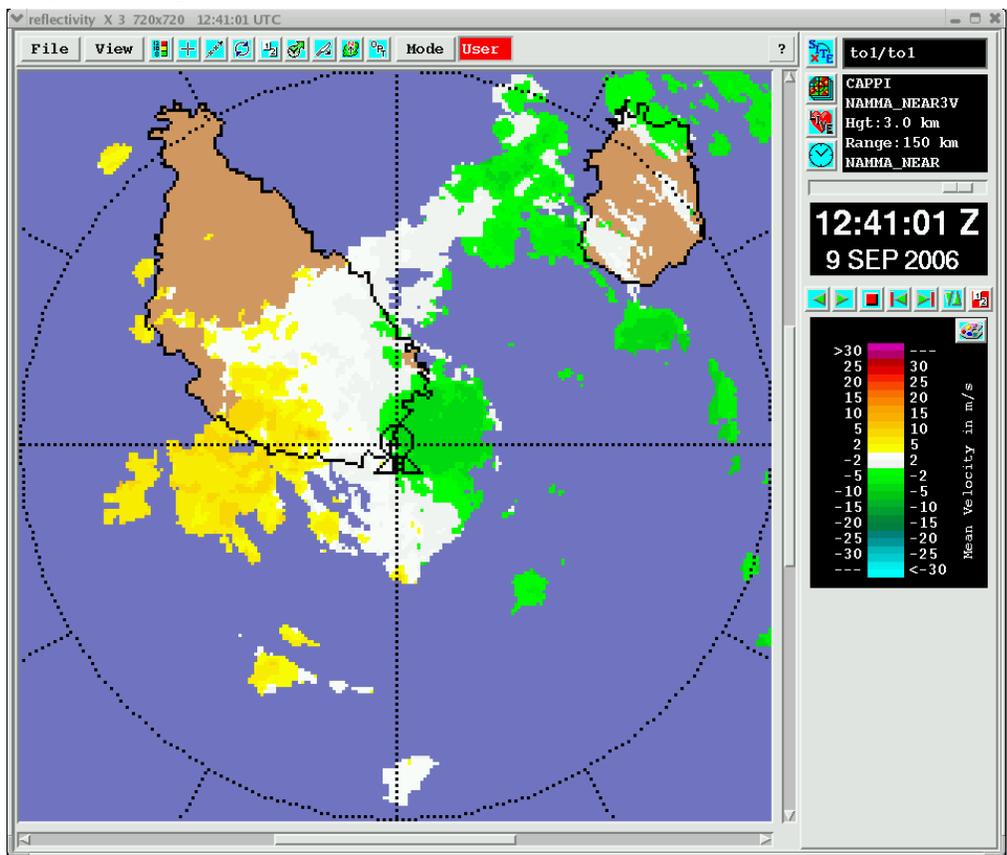
1255Z: Surface rainfall rate at site now decreasing. Shower was sufficient to wet the ground but not puddle. Review of Vr data at lowest available (0.8deg) PPI shows N-S band of inbounds > 6m/s linked to passage of this band.

1300Z: Definitely seems to be some tendency for disruption of ~gust-front inbounds by island of Sao Tiago. This was suspected with breakup of initial convective arc during interval 09-1000Z, but is clearly evident in terms of Vr pattern (cf. Images for 1231 & 1251, which shows failure of inbound signature to penetrate even a bit inland; meanwhile, outbound/retreating-gust front signature nicely defined over waters to SSW of TOGA).

Tops are all below 10 and generally below 8 km with exception of near 14deg/38 km, where indicated tops are above 12km.

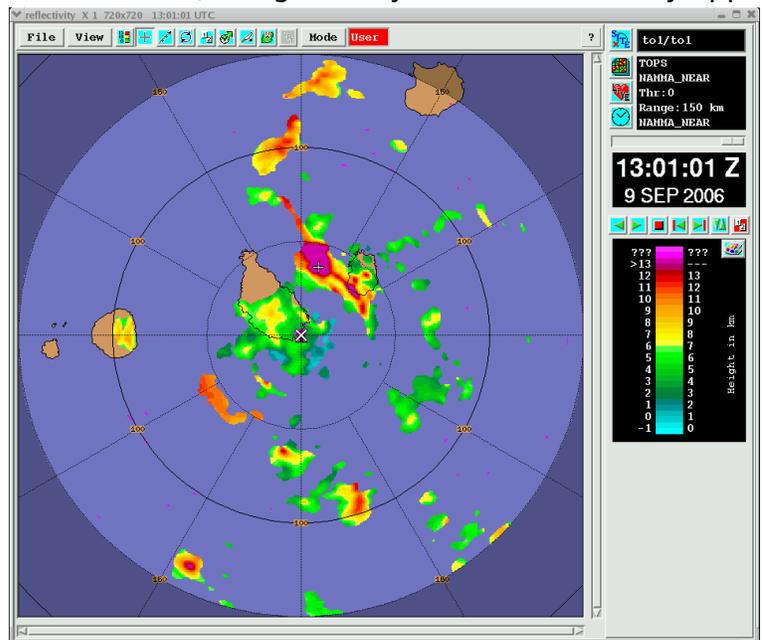


Definite ENE'ly wind signature aloft, as shown in 3-km CAPPI of Vr:

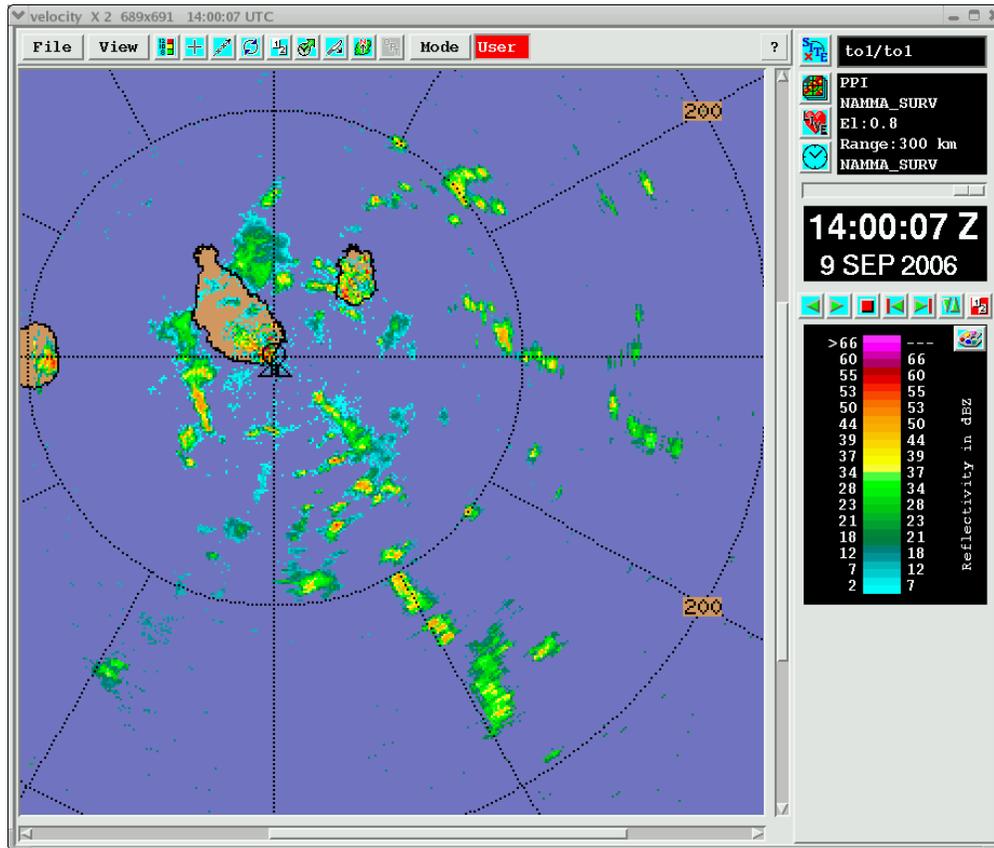


1330Z: Had some light rain over the radar. Main center past somewhere to the south. Center of larger synoptic scale circulation seems to be more near our longitude now. Another line of activity is forming just N of TOGA heading westward with tops being to exceed 8-9km. More isolated cells continue to form off top the E around the 150km circle.

Echoes are mainly concentrated between 13.5-15.5N and 22.5-24W. Tops in activity well to south (nearer to circulation center) are generally 6-7 km, but locally approaching 8km.

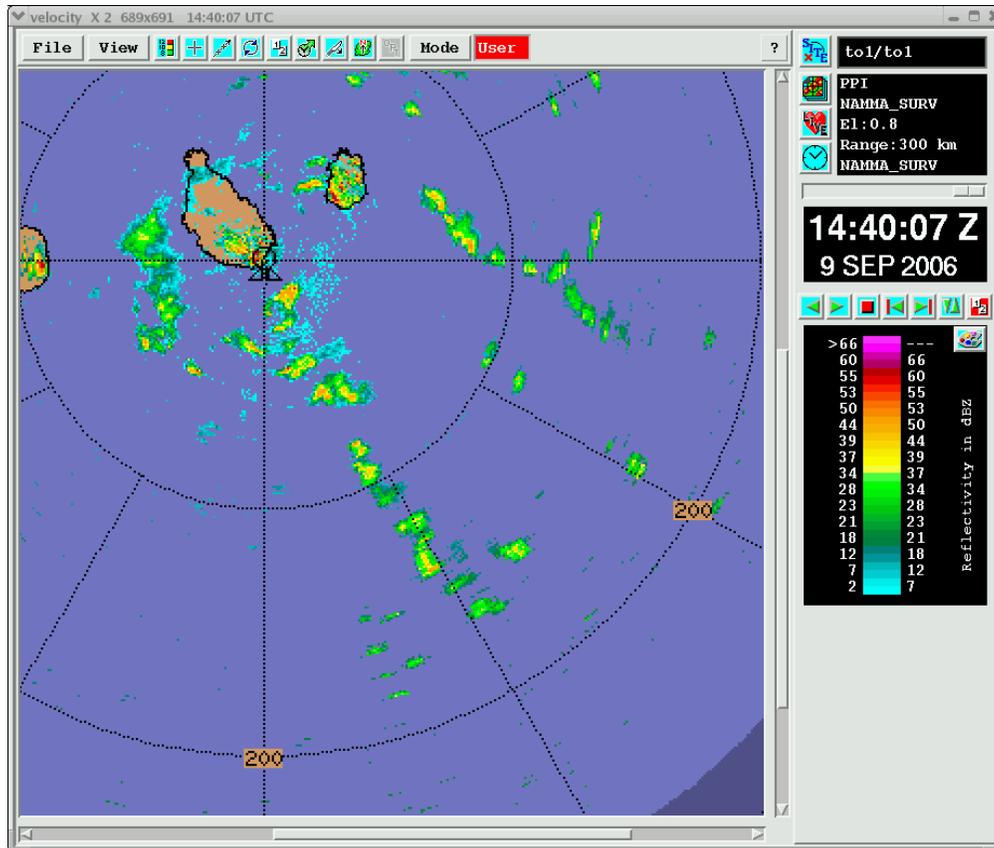


1400Z: More of a line orientation for the cells has appeared with the cells oriented NW – SE. A couple examples of this is seen to the E and SE of the radar. With the cell to the N becoming a nice stratiform echo with bright band seen using the cross-section tool.

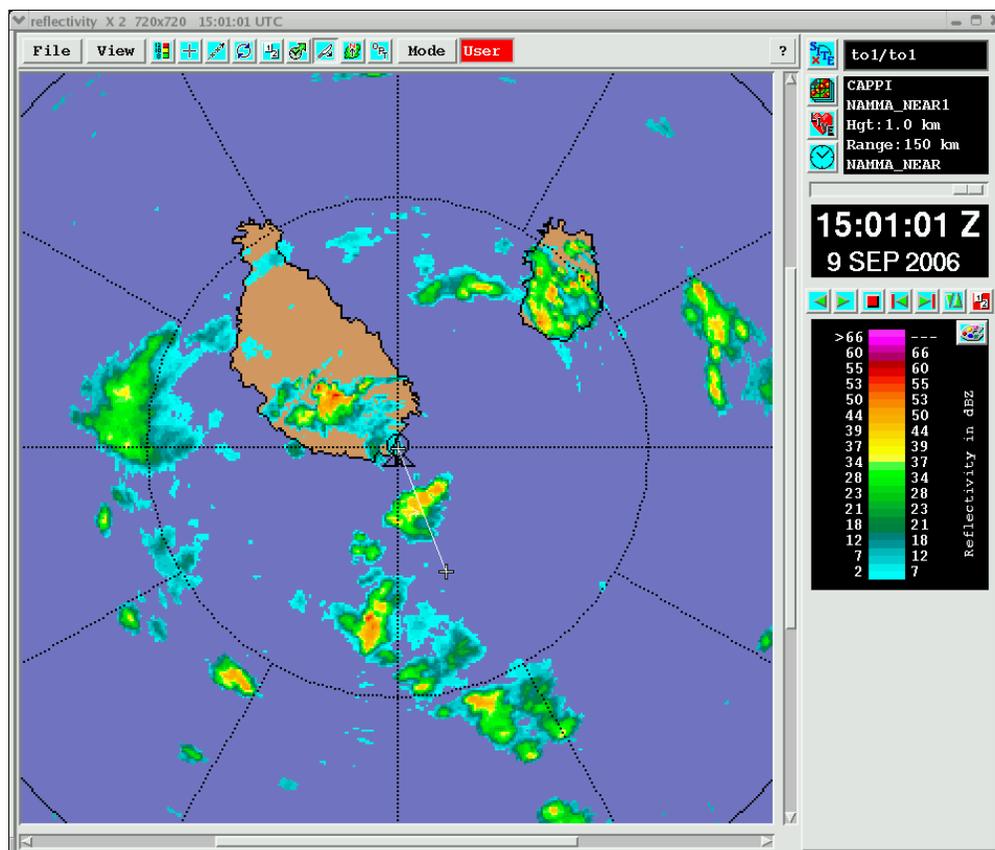


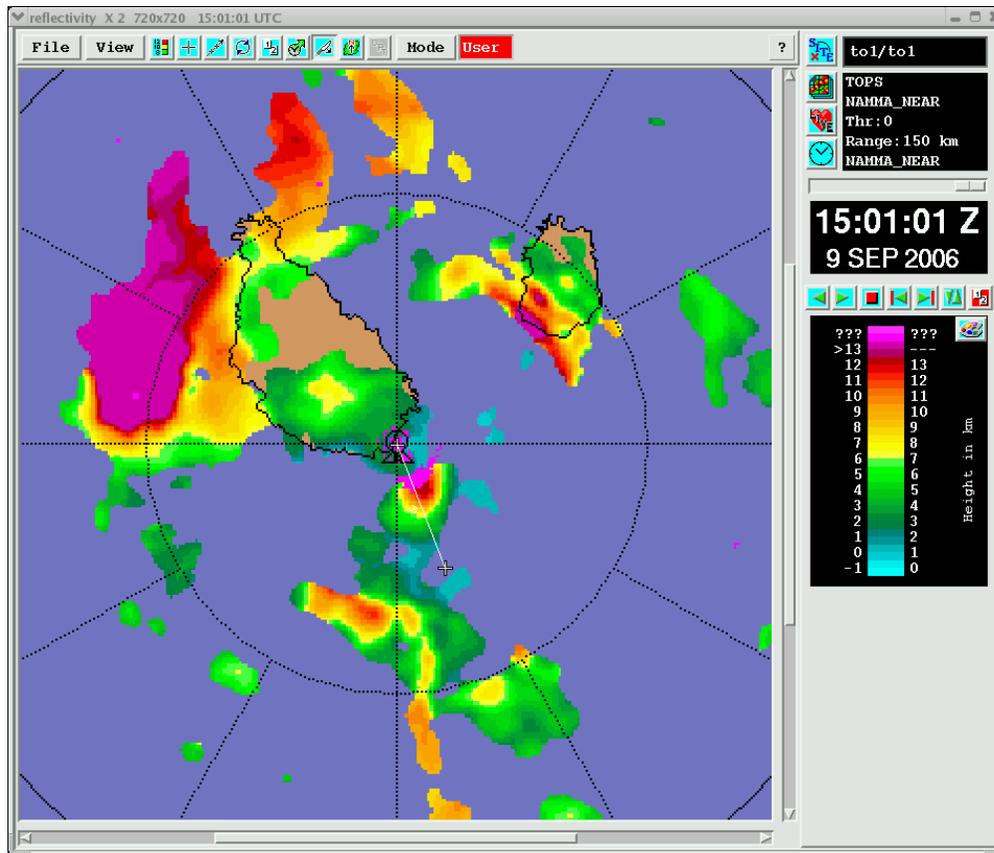
1430Z: Received call from Mike Gaunce (Sal) asking for Praia sfc wind ob to be relayed to DC8 to assist in defining wave. Of many questions we anticipated to come from aircraft, this wasn't among them. Somewhat reluctant to guesstimate based on recent discussions about local wind variability (as logged elsewhere in this document), but did the following: (1) based on Vr/finger-in-the-air observations, estimated sfc wind direction as ENE; (2) referred Mike to rawinsonde crew at old airport (he wasn't aware they are NASA staff), though based on past experience/discussions with them Suspect those guys may also be hard pressed to provide this info. They don't have an anemometer/wind vane either.

On the verge of coming out of NAMMA_NEAR mode; will likely do so as soon as cell to our immediate S passes by. Its current motion (toward WNW at 6-7 m/s) is carrying it closer to TOGA with time. Overall echo coverage has reduced, but with some tendency for convective showers to become even more concentrated along NNW-SSE oriented bands. Best estimate of circulation center based on animations is vicinity 13.7N/23.5W, but difficult to discern given paucity of scatterers.



1520Z: Cell immediately to S of TOGA not too shabby; indicated tops pushing 12km, sharp leading (NW-facing) reflectivity gradient. Not too impressive visually, though.

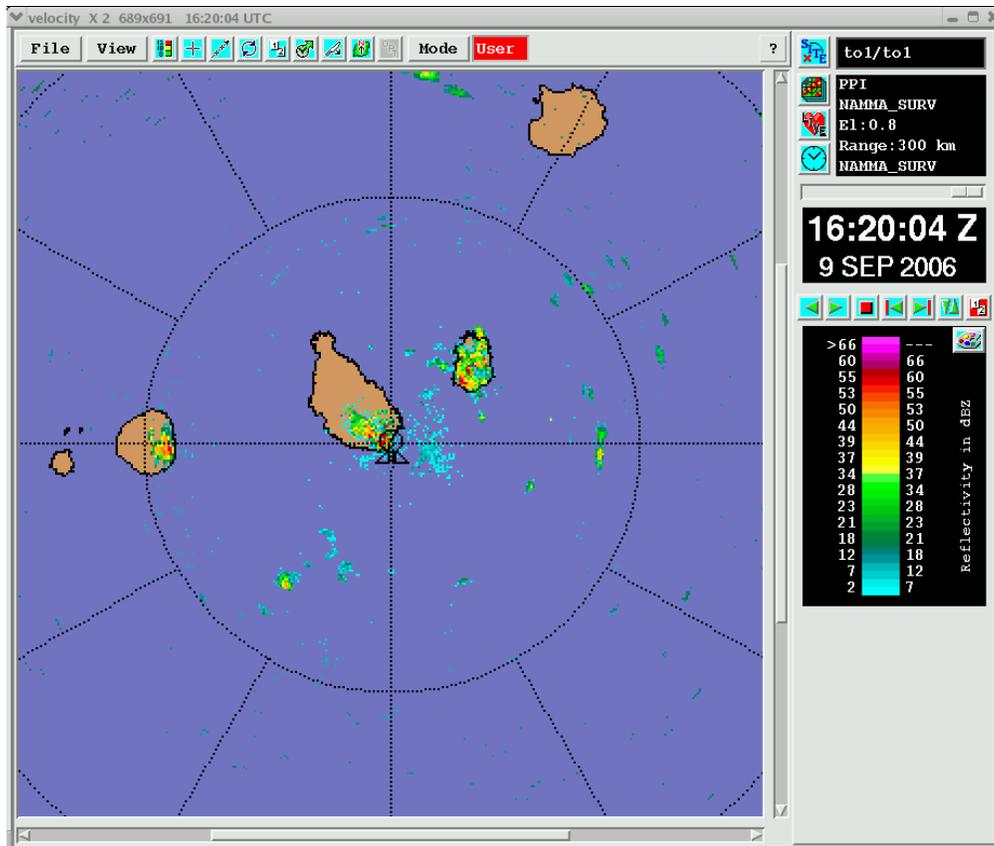
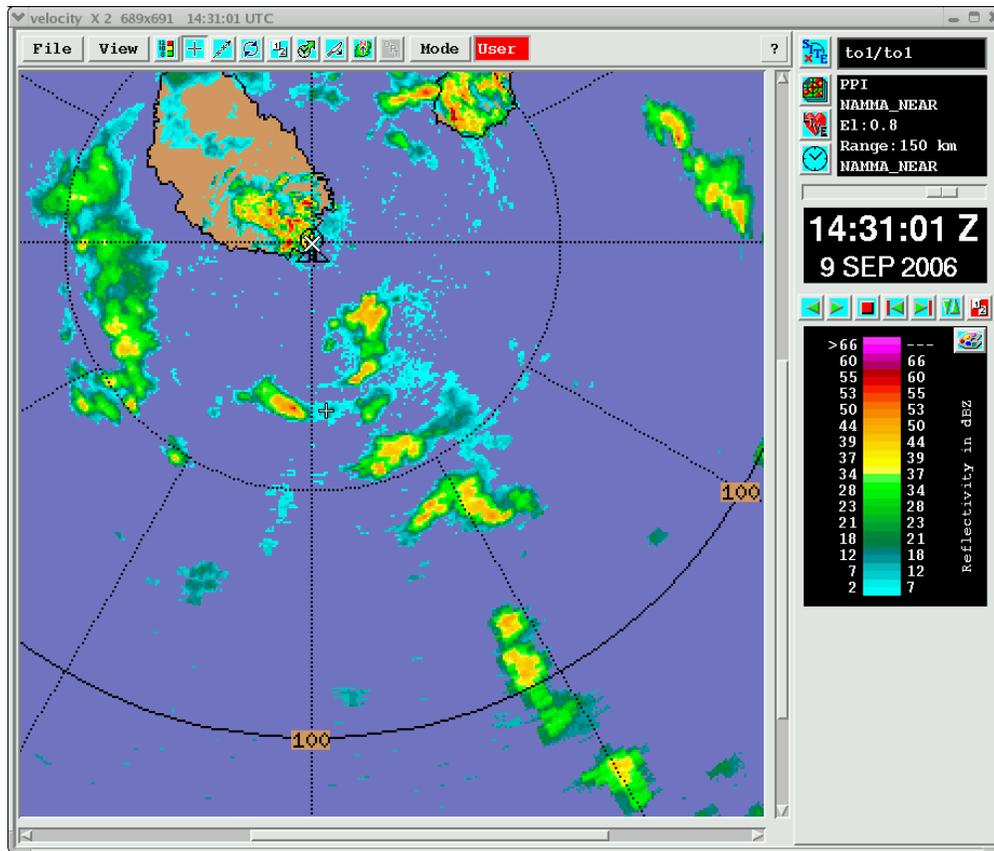




1550Z: Cell immediately to our S has rapidly dissipated. Switching to NAMMA_FAR sequence eff. 1600Z. Overall weakening trend in most all echoes detected in surveillance scans.

1600Z: Review of surveillance scans 1400-1600Z suggests that cell passing over radar site around 1250Z (and to some degree collapsing thereafter) threw out a S'ward propagating (outflow?) boundary that interacted with N end of NNW_SSE band to TOGA's SE. Admittedly, this impression garnered from reflectivity scans is not very well supported by Vr data, which show weak flow overall, but might be worthy of closer examination vis a visa Mapes' "gregarious convection" arguments. Note echo arc passing through 180deg/34km ~orthogonal to approaching NNW-SSE band and newly-triggered cell immediately W of aforementioned (cursor) location. Over time, echo pattern gives impression of "interference" or at least superposition of two distinct organizational modes. (Note: Any individual view, including the one inserted below, may suggest this feature was merely a sidelobe off intense convection along the NNW-SSE feature, but animation clearly shows the distinct and independent propagation of this ~E-W echo feature down the longer band.

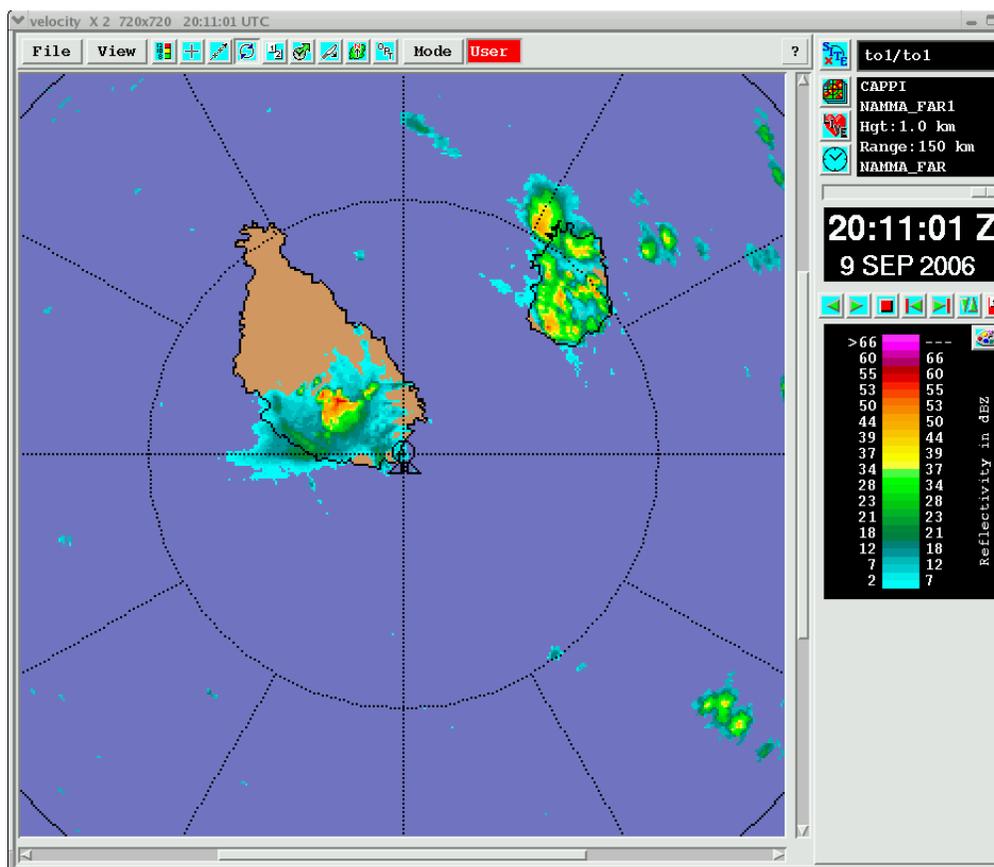
1620Z: Received sat phone call from Heymsfield aboard DC8. Understand they mapped weak circulation center to our south. Informed him that while we have had intense convection near TOGA earlier, echo intensities are dropping rapidly (as illustrated by attached 1620Z surveillance image). Thus concurred with his suggestion that DC8 would proceed directly Sal without any loiter/coordination w/ TOGA.



1900Z: Returned from old airport/Internet access, found trmm-linux1 locked up. Phoned Nathan and got instructions for re-boot. Not sure iris has come up fully, but ingest summary looks complete & DVD's are updating properly so no huge deal—will address further issues w/ Nathan when he/Tim arrive.

2000Z: Only remaining cells primarily extend along/near 165deg radial from 125-175 km. Individual cells are moving northward, again suggesting wave/cyclone axis is W of there. Additionally, a few cells are running into the N end of Maio.

Locally, note our (now typical) diurnal echo enhancement over island. Visually, against fading sunset it's clear there are no clouds over the lower reaches of the island, so this echo is developing in optically clear air. Its advection tonight out to the W of the island rather conclusively suggests a passive tracer, namely insects.

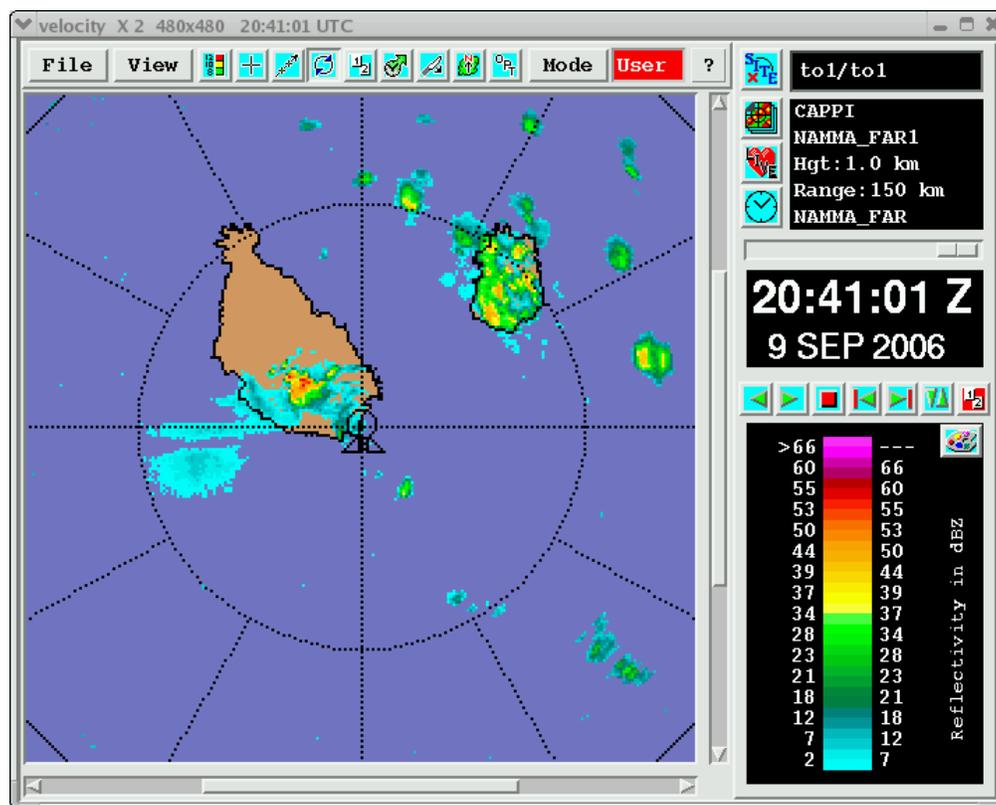


2030Z: Far to S, one cell is now dominating, located near 165deg/165km.

Only remaining apparent problems re: reboot of trmm-linux1 are (1) raw files missing on Ida between 1650-1900Z, and (2) associated missing products (e.g. For animation display).

2040Z: Follow-up CAPPI illustrates narrow zone of blockage along ~264deg azimuth (corresponding to blockage by truncated "volcano cone" to our west). This is a possible consideration in analysis of data from the Melting Band Module executed by DC8 on 3 September, which likely intersected this very narrow zone of blockage.

Yet another round of scattered cells approaching from E. Smull & George off-shift @ 2130.



2130Z – Lang on shift. Scattered convection continues over large portions of the scope. There is a decent cell about 20 km SW of the radar, up to 50+ dBZ max.

2200Z – There is a small 50 dBZ cell 20 km to the NNW, near the NE coast of Sao Tiago.

2230Z – Lots of cells within 75 km, scattered in all directions, but everything is topped before 10 deg. Plus, there is little to no mesoscale organization.

2300Z – I guess this overall precip pattern could be described best as popcorn convection.

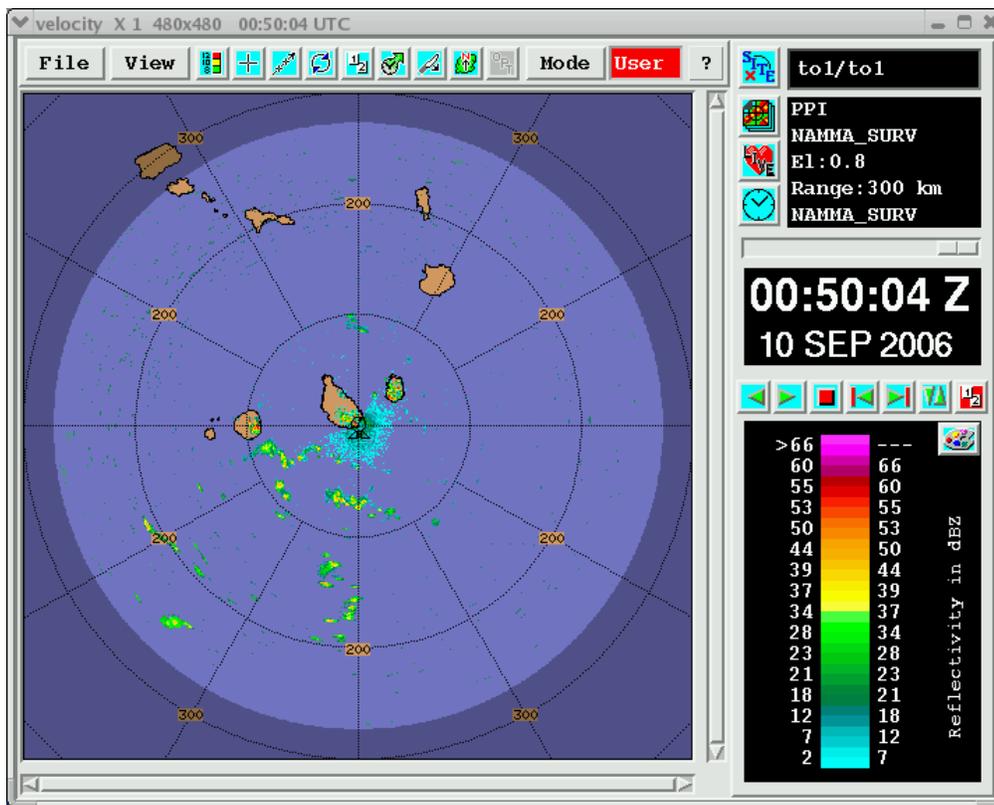
2350Z – Echo coverage is gradually increasing, but echoes remain quite scattered. There is a nice 50 dBZ cell about 15 km NE of the radar, but is still topped by NAMMA Far.

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0000Z - A lot of these cells are pretty intense, with cores in the high 40s to low 50s. But size and lifetime are both limited. The NE coast of Sao Tiago is favored for redevelopment, possibly due to orographic forcing.

0030Z – Some convection mixed in with the Sao Tiago ground clutter. The island convection forms a short line that runs parallel to the island's axis. The echoes appear to be shallow, however.

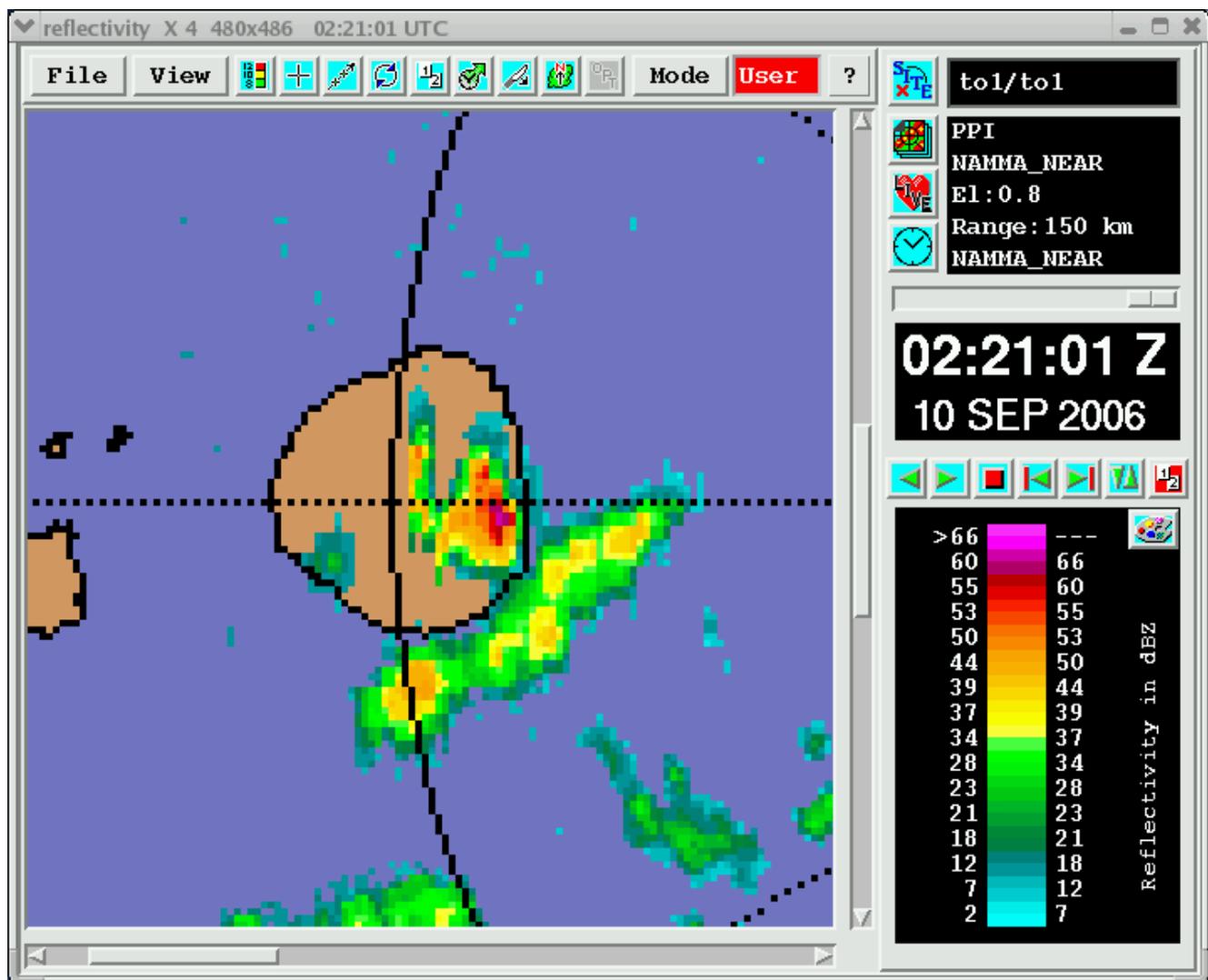
0100Z – There seems to be a trend toward increasing organization in the convection. Most of the remaining storms are centered in the SW quadrant.



0130Z – New cell has formed 10km east of the radar. Not topped by NAMMA far, so switching to NAMMA Near. Lots of redevelopment along the eastern coast of Sao Tiago. The easterly flow definitely is causing a lot of orographic precip.

0210Z – As storms pass to the west, there seems to be limited redevelopment to the east to replace the advecting cells. The one exception might be the eastern coast of Sao Tiago. Fogo is about to be hit by a short line of convection.

0230Z – The Fogo line has impacted the island and is starting to wrap itself around it.



0240Z – Switching to NAMMA Far to get an extra angle on the Fogo storm. The Sao Tiago convection has petered out. In addition, the Fogo impact seems to have weakened that storm considerably as well.

0320Z – Fogo convection is mostly decayed now. There is a new cell over Sao Tiago, NW of the radar, but it is being topped by NAMMA Far for now.

0410Z – Scattered convection continues throughout the scope, but it has really quieted down within 100 km of the radar. The strongest stuff is over 200 km to the SW.

0510Z – Continues to be mostly weak popcorn convection around the radar. The best convection is far to the west and SW.

0630Z – Scope is less active now, but there are still some scattered echoes about.

0730Z – Over situation about the same as last report, a few scattered echoes. Strongest stuff is over 100 km away to SW, and consists of two short lines.

0830Z – New cell off the NE coast of Sao Tiago, ~30 km away. Otherwise, not much of interest within 100 km. GPS 75s faster than toga1.

0930Z – Lang off shift. Definitely a scope-wide fading trend in effect for most echoes. George and Smull on shift. All echoes seem to be diminishing rapidly. Anything that is left, which are very small weak echoes, is on the WSW side of the scope.

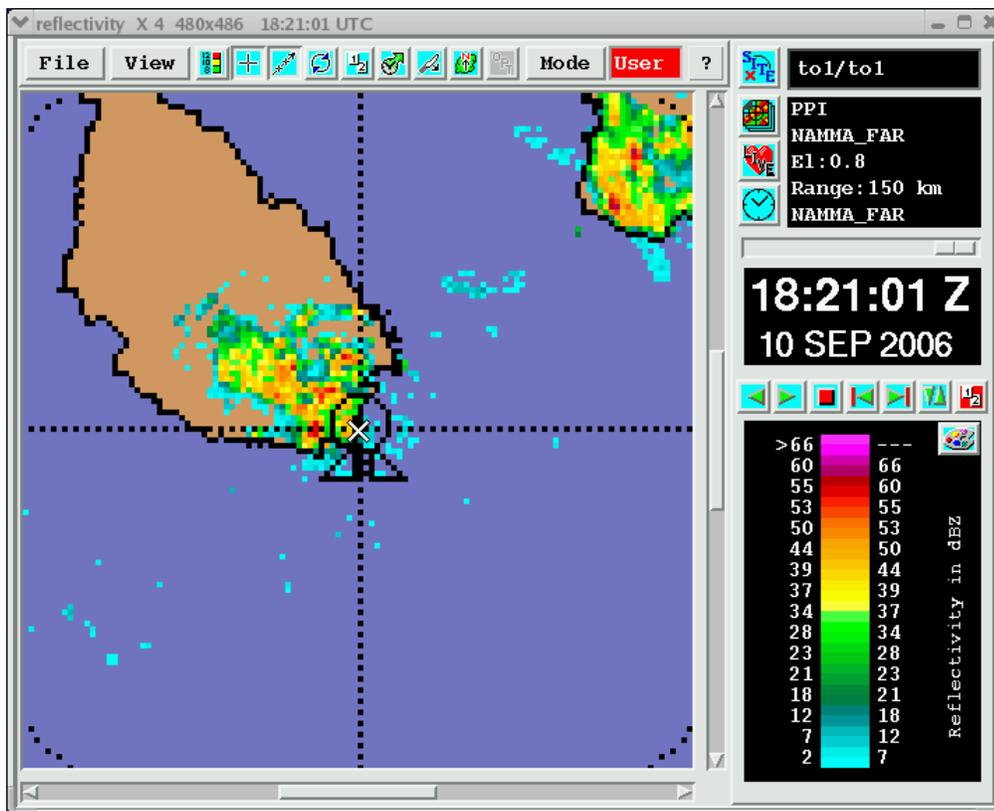
1030Z: Last echoes disappeared shortly after 0930Z. PPINE. Check-in via cellphone w/ Gerry Heymsfield @ Sal: First did a quick debrief of yesterday's DC8 mission, judged successful in terms of locating center of cyclonic circulation (apparently within 50 km or so of where TOGA scientists estimated) though not so successful in terms of subsidiary precip-related goals. Crew saw evidence that the circulation was tilting with height under the influence of vertical shear. Lots of convection early-on, as alerted by TOGA, but no substantial problems encountered in execution of tracks. DC8 explored vertical structure via porpoising and using just a few dropsondes (to conserve that limited resource for final two missions planned during coming week). Executed downward spiral (melting band?) maneuver, but this was not so successful, which was attributed to lack of surveillance radar guidance. Forecasters believe convection (and the westward drifting circulation) are suffering effects of strong shear, accounting for their weakness today. Hence this is a hard-down day for DC8, and tomorrow (Monday) is a no-fly day. Forecasts are calling for an intense wave/associated closed sfc low to come off the coast Tues/Wed. Next call-in to Sal scheduled for Tues am, with next (and last!) possible coordinated DC8/TOGA operation on Wednesday. Both Tues & Wed would be full 8-hr missions for DC8.

1200Z: PPINE. Severe clear here. Only clouds are a few very humble Cu over orography. Haze-wise, we've seen less but we've certainly seem more. What appears to be an E'ly component breeze continues, with sun beating down & relatively humid conditions.

1500Z: (PPINE)**n, where 'n' is bounded but large (and probably set to get larger).

1800Z: All systems functional, including echo suppression system. Recommend buying futures in 'n'.

1930Z: Weak but distinct “fine-line” echo seen in NAMMA_FAR 0.8deg PPI's, marked by 10 dBZ peaks. Echo tracker gives propagation speed of 1.5 m/s toward 180deg. Feature appeared to originate immed. SW of Maio around 1700 (e.g., 035deg/30km) and is now approaching point abeam of E'most point of Sao Tiago. Best definition achieved around 1821 between 030deg/19km and 046deg/24km. Speculation: As nothing at all is visible to the naked eye in in that general direction, perhaps this echo marks leading edge of diurnal wind shift to more N'ly component noted by radiosonde crew many quiescent evenings.



2130Z – Lang on shift. Looks like we are missing 2050-2120 files on the raid due to a trmm-linux1 crash. Will try to obtain these tomorrow night when Gears works again, and update the CSU laptop. DVDs are current, and there was nothing to scan anyway. Otherwise, looks like I'll be able to catch up on some sleep tonight. Very dead out there.

2150Z – GPS about 1.5 min ahead of the toga1 clock now.

2250Z – As dead as I've seen it for a while.

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0100Z – Still dead.

0215Z – Some weak stratiform-like echo has popped up over 200 km to the NE. Some second trip associated with this echo as well. Evidently, there is something more just beyond TOGA's range.

0400Z – Scope has cleared out again.

0600Z – Bereft of convection.

0800Z – Still pretty empty.

0830Z – New 20 dBZ echo to NE, around 200 km out. Just popped out of nowhere.

0930Z – Lang off, Smull & George on. Some low cumuliform clouds in an unusual spot, viz. visible through hazy/dusty skies over water to E, plus the usual bit of cloud over terrain.

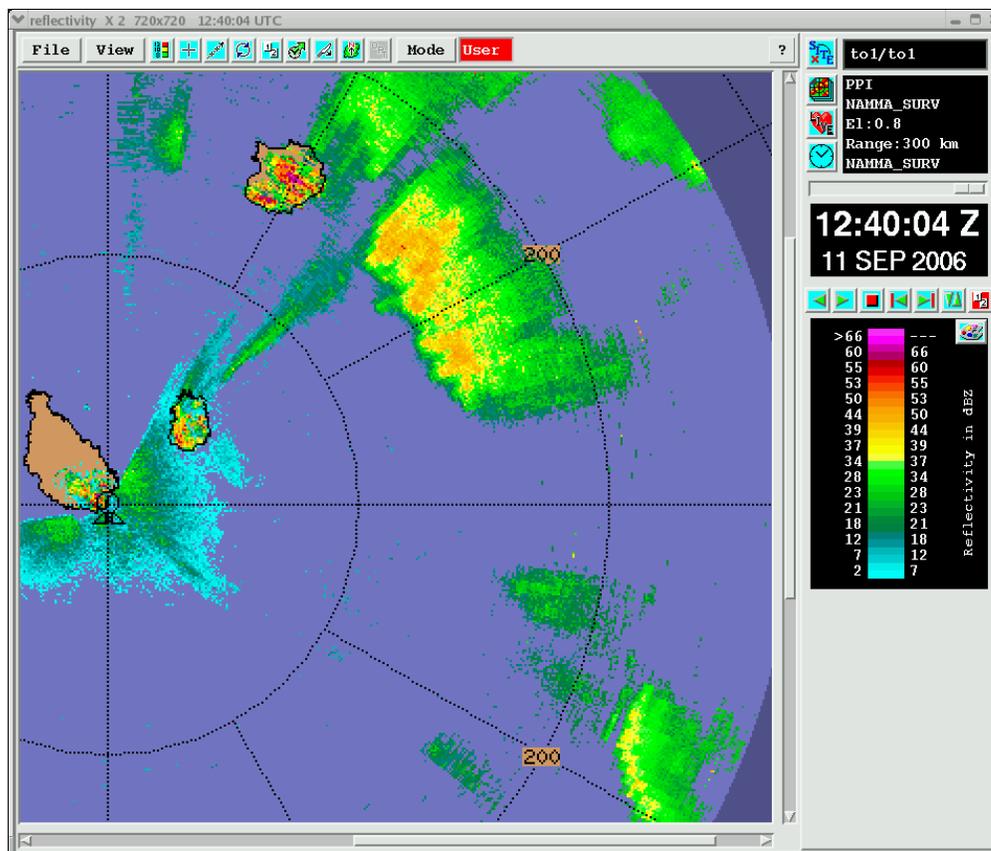
Owing to hard-down for DC8, no NAMMA forecasting support today, but note that last two runs of GFS have both shown similar results pointing to possibility an upcoming busy period for TOGA. Both runs have developed a well defined cyclone (min central pressure 1004mb @72h valid 12Z 13 Sept that passes our longitude late Wed morning, at a distance of only 50-100 km S of TOGA. Precip is forecast by the global model to be on the increase starting during the 12h period ending Noon GMT 13 Sept, with an additional more intense pulse of rainfall progged during the 12h period ending at Noon GMT 14 Sept. In view of coarse model resolution and limitations of model physics, have to take all of this with a big grain of salt -but- the run-to-run consistency suggests 13th-14th is likely to be an interesting period.

1030Z: Quite a lot of 2nd trip centered along the ~33 & 72deg radials. Unusual to see 2nd trip in the NE sector. Echo bracketing 200km range ring in 30-90deg sector looks to be a mix of 1st & 2nd trip, with 1st trip echo being more stratiform in appearance.

1100Z: Unsteady character of echo in NE sector suggests virtually all of it is 2nd trip. Headed to old airport for Internet session, if power supply there permits.

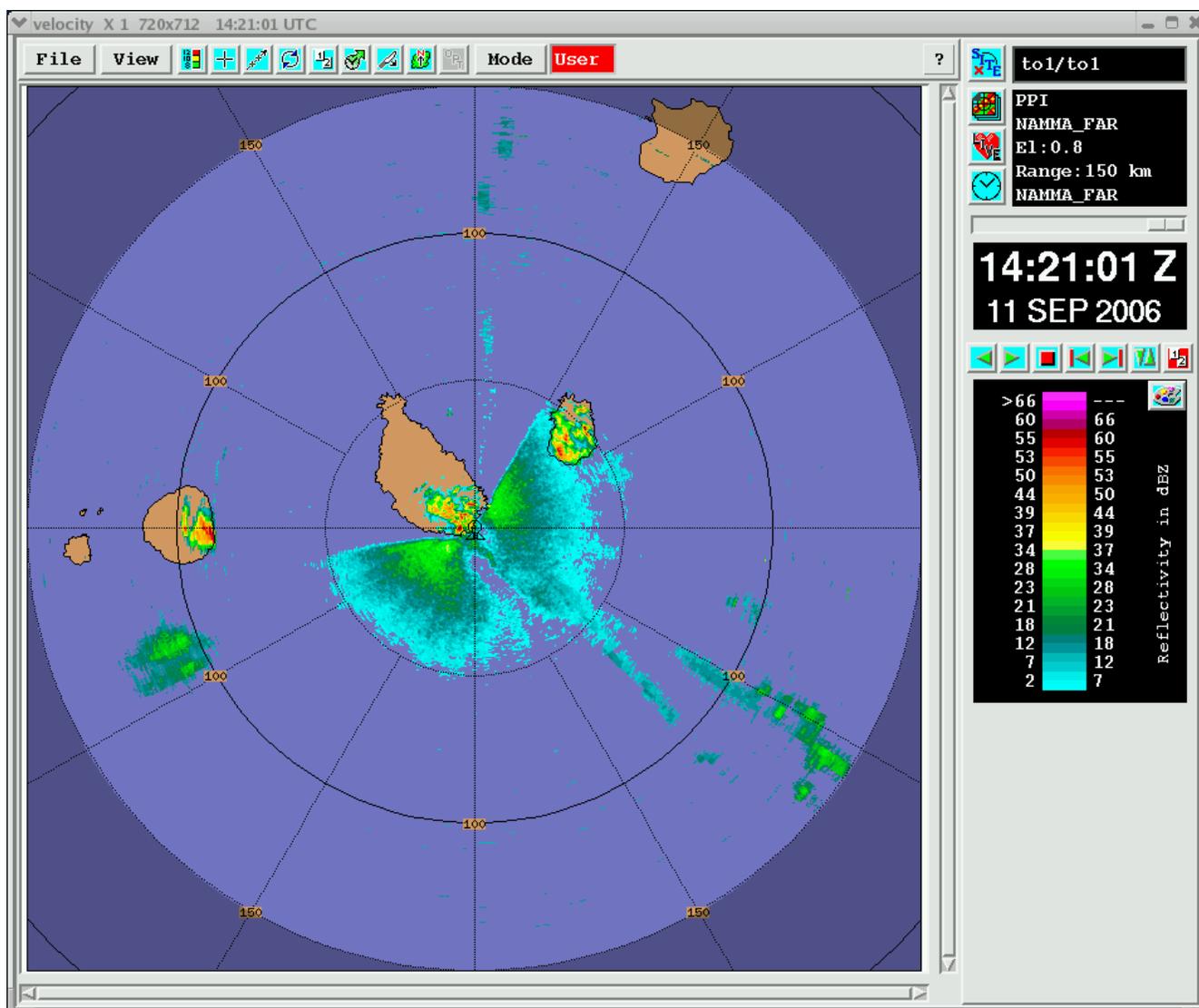
1230Z: Echo coverage increasing in 000-120deg azimuth sector beyond 100 km. Our guess is that this echo is a mix of 1st & 2nd trip. Have to go change a tire; never a dull moment in NAMMA! (Well, yesterday maybe...) Also, winds have really picked-up this morning. Definite W'y component in sfc layer, with radiosondes showing a quick veer to more N'y flow short distance aloft and of course E'y flow well aloft. These low-level winds are wholly consistent with zone of sfc pressure falls centered along African coast just N of Dakar.

1300Z: What appears to be valid echo is just now entering the NAMMA_FAR scan region. Cross sections indicate we're seeing the tops of convective cells (i.e. Portion of echo above 3km, extending up to perhaps 6km) in the 060-090deg azimuth sector.



1330Z: Aforementioned echo near 072deg/160 km is weakening; moreover, its behavior isn't fully consistent with being 1st trip echo. On the other hand, if this echo is in fact 150 km farther distant, it must be -extremely- tall convection. Good (i.e. Recent) satellite data would help sort this out, and unfortunately we don't have access to that at TOGA. These echoes, if they are 1st trip have a southward movement. More linear echo (seen at bottom-right of above image) has also weakened somewhat but remains well defined, with a fairly rapid motion toward 265deg @ ~14-15 m/s. This more southern line seems to have more realistic motion although it has movement toward the W. This different direction in movement between the two areas is curious to say the least.

1420Z: Most of the larger echoes in the E have dissipated. The line mentioned previously SE of the radar has propagated to the west and has continued to weaken and break apart. Another smaller echo has appeared just S of Fogo, although it also appears to be weakening. Also noted is the large amount of sea clutter on the radar out to 50km. This is attributed to the very windy day we are having on Praia.



1500Z: After looking at the time look of the supposed 2nd trip echoes, it would seem that something is passing to our N.

1600Z: Everything has dissipated. There are slight indications of some second trip echoes to the SW of the radar, just S of Fogo.

1700Z: Some second trip to the SE. A few small echoes have started to emerge around 120deg and move westward. A large extension off the southern part of the island is probable second trip although it does have velocity data associated with it and its movement is consistent with some of the bands observed on previous days.

1800Z: Everything has dissipated. But the "tail" off of the island is still persisting.

1900Z: Nothing on the scope but some sea clutter.

1940Z: A small line of convection has developed to the ESE of the radar, moving to the W. It is very weak and does not seem like it will survive long.

2100Z: Various weak isolated echoes in the bottom half of the scope. Most are to the SE of the radar. There is one collection of cells just to the SE of the radar that seems to be in a disconnected line.

2130Z: Strange wave line like structure to the W of the radar moving through the sea clutter...bugs...birds...aliens?...George and Smull off.

2130Z – Lang on shift. Missing files from yesterday's crash have been updated. Also, real-time display clock has been updated to match GPS. Missed scanning window with the time change, so we will restart scanning at 2140Z. There will be no set of 2130Z scans.

2140Z – Restarted NAMMA Far and Surveillance.

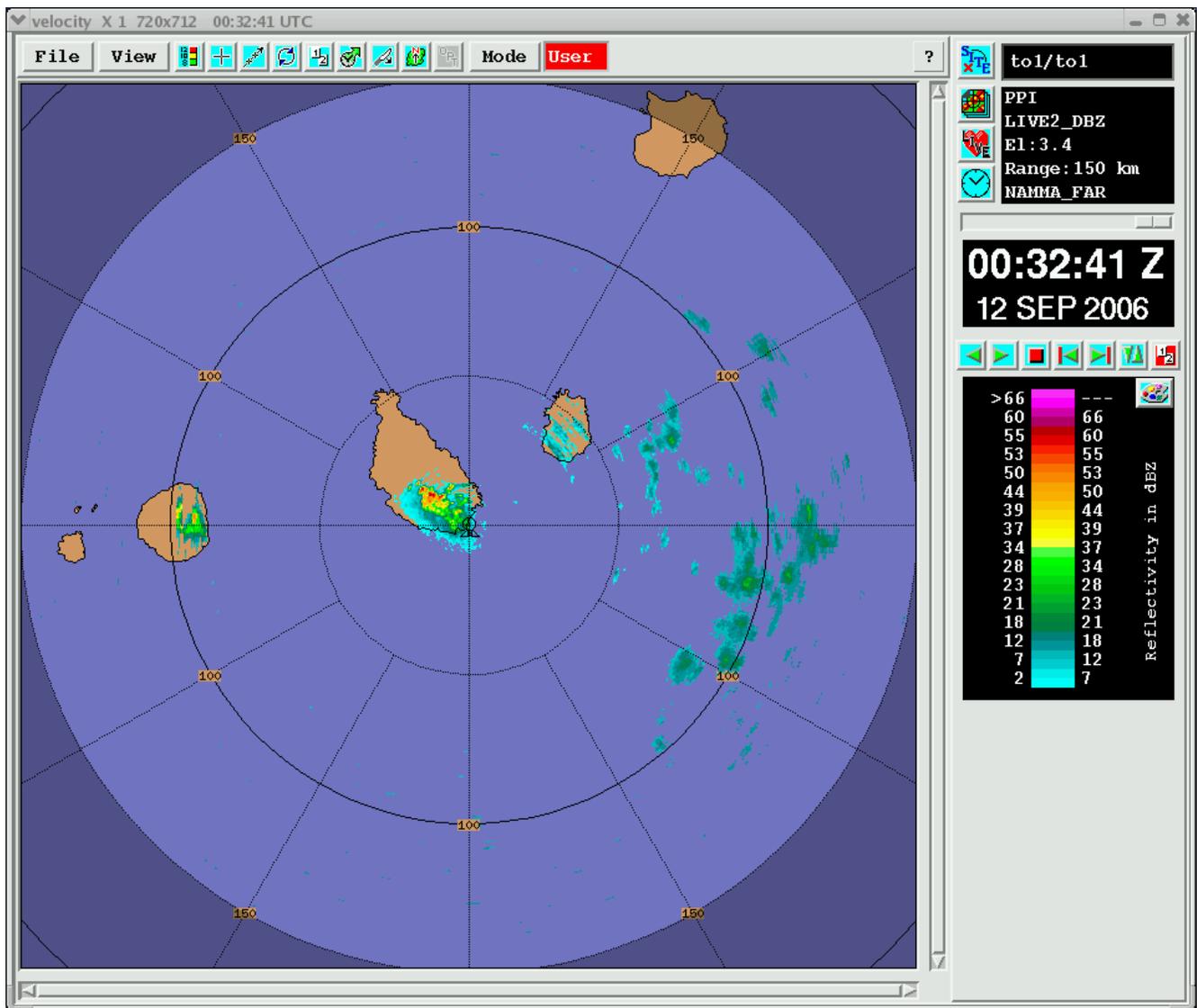
2250Z – Some weak 20 dBZ echoes trucking in from the east at a good clip. Now within 200 km.

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0010Z – Leading edge of weak echo has reached 50 km range. It is based higher in the atmosphere, not showing up well at low elevation angles.

0030Z – This echo is pretty interesting. It must be at very high altitudes, and fairly uniformly spread across the eastern sector, as each successive tilt brings it rapidly closer to the radar, from up to 200 km out at low angles, to within 20 km at high tilts. It is not just simple stratiform echo though (it looks to be close to the radar), as it is fairly cellular. I think it is basically 3 sets of echoes. Stratiform in close. High-based cellular about 50 km out, and another set of high-based cellular 100 km out. The cellular echoes appear to be shallow, as they are topped within a few tilts. All the echoes have Doppler signatures, so they aren't obvious artifacts. Everything is pretty weak, with max Zs in the 20s and 30s. (Smull/George P.S.: Perhaps this type of echo accounted for 2nd trip earlier in day?)

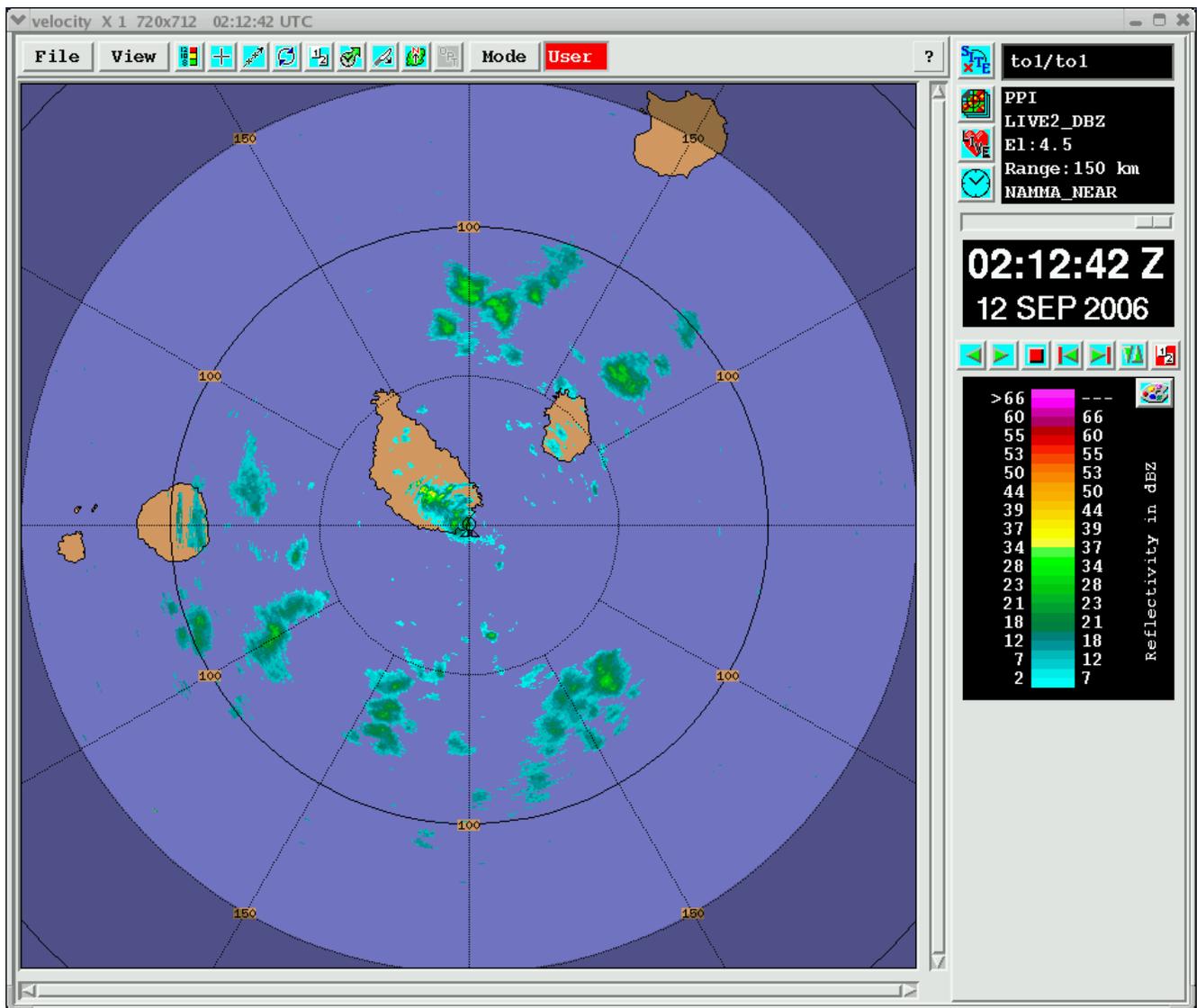
0050Z – Switching to NAMMA Near to top the stratiform echo in closer. The image below from the 0030Z volume shows the two sets of cellular echoes, the first more NE just beyond 50 km, and the second more to the SE at 100 km.



0100Z – Interestingly, the close stratiform echo didn't start showing until the 0030Z volume. It sprung up very quickly, out of seemingly nowhere. Even NAMMA Near doesn't top it completely. The surveillance sweep looks pretty clean, with just a few weak echoes about 200 km to the SE. This is all high-based stuff. The humidity felt a little drier today back at the hotel, so I wonder if that might be playing a role here.

0200Z – Overall pattern is similar to before, except echoes are a bit closer owing to advection, and the tier-like pattern of before is less distinct, with a more gradual variation from 150 km distance to within 20 km as tilt angle increases. Also, echoes seem to surround the radar more, including to the west. I would describe the overall pattern as cellular stratiform, very shallow and at high base. Precip is not reaching the surface for the most part.

0210Z – Here is an image of the overall pattern, at 4.5 deg. At low angles the only precip is 150-200 km to the SE. The echoes shown here don't appear near the surface.



0250Z – Some second trip to the SE.

0350Z – Echo coverage on a decreasing trend as this system of echoes moves toward the west. The SE second trip continues, and may have strengthened a bit.

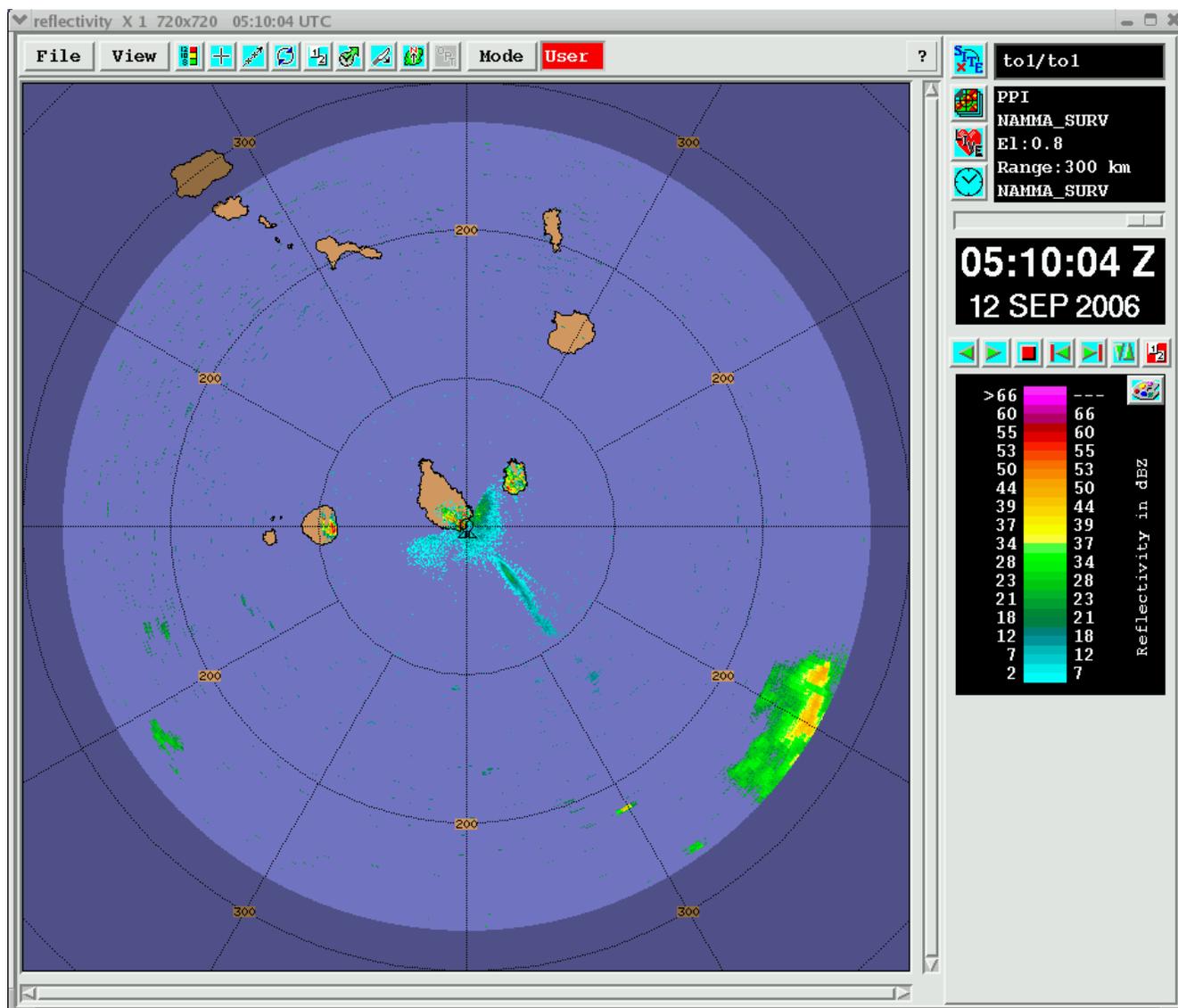
0400Z – Looks like some stronger echo is now entering the scope from the SE. It is a bit off angle from the second trip, so it is a different set of echoes than that.

0410Z – Actually, this new echo is second trip itself. It shows up only on the 150 km scans, not the 270 km ones. It is right at the edge of that range, so it is too far out to see on the longer scan. It must be a fairly impressive storm if it is showing up that far out.

0430Z – Switching back to NAMMA Far as everything is topped not far past 20 deg.

0440Z – Now it appears that the stronger convection is finally entering into range of the long-range surveillance scan. This echo has up to 40 dBZ.

0510Z – Echoes associated with the previous pattern have either advected off or dissipated. The current echo patterns looks like this:



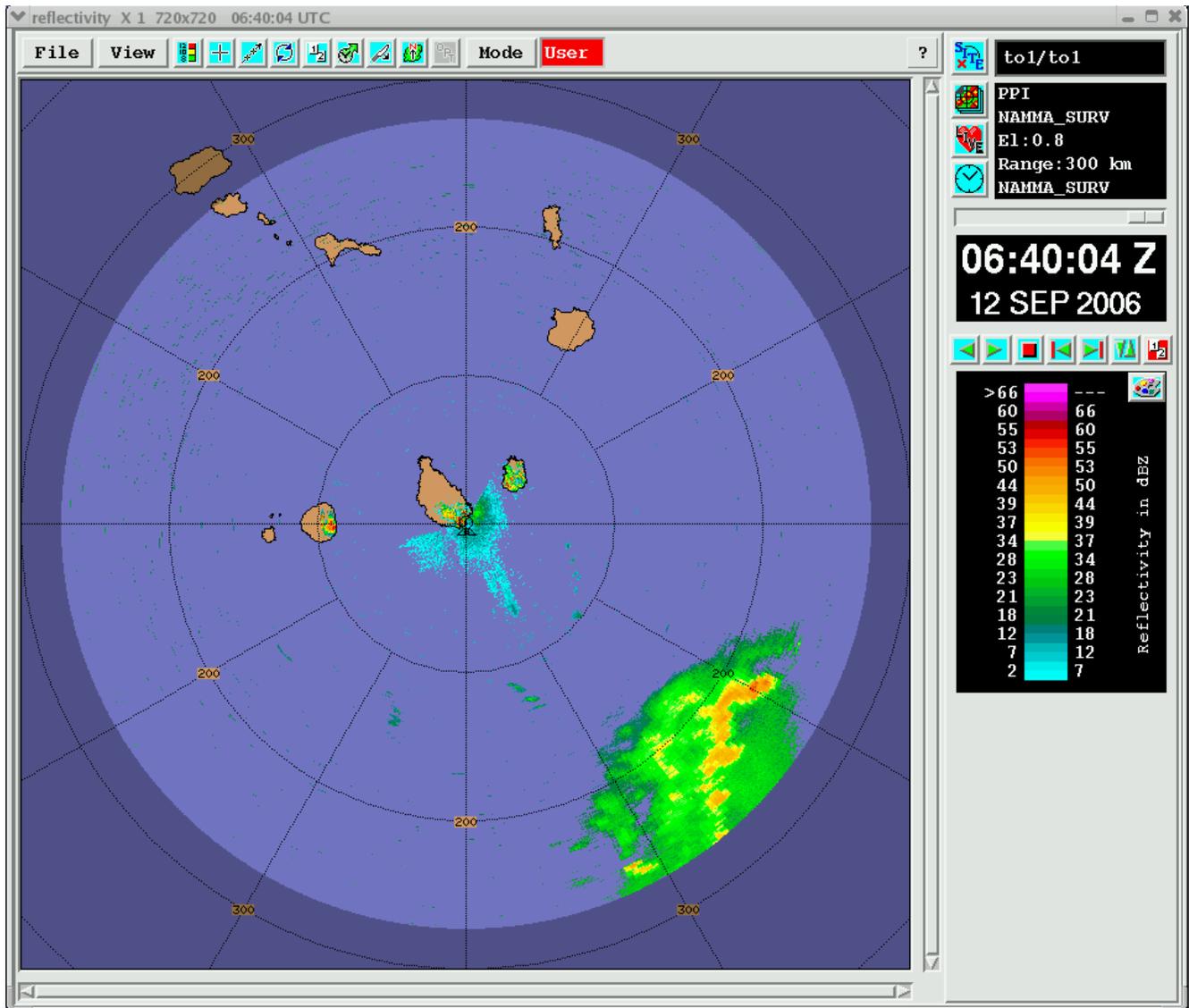
The big story is this echo to the SE, which is slowly entering our scope, which peaks over 50 dBZ. It continues to show up as second trip on the short-range scans, but I believe the long-range has it as first trip. There continues to be additional second trip on the long-range, SE of the radar within 100 km.

0547Z – Transmitter stopped after the 0530Z surveillance but before the 0530Z volume scan started. It remained off until restarted halfway thru the 0540Z sequence. It is transmitting normally now, but the 0530Z volume is completely noise, along with the 0540Z surveillance and half the 0540Z volume.

0600Z – The SE echo is a nice little MCS. Shame it's too far away to do volumes.

0610Z – There is a small line of cells to the SE within 150 km, moving toward the south. There is also new development along a N-S line to our east, within 100 km.

0640Z – Here is a view of the surveillance scan at the current time. The MCS remains out of range of volume scans. Indeed, it is not even entirely within range of the surveillance sweep.

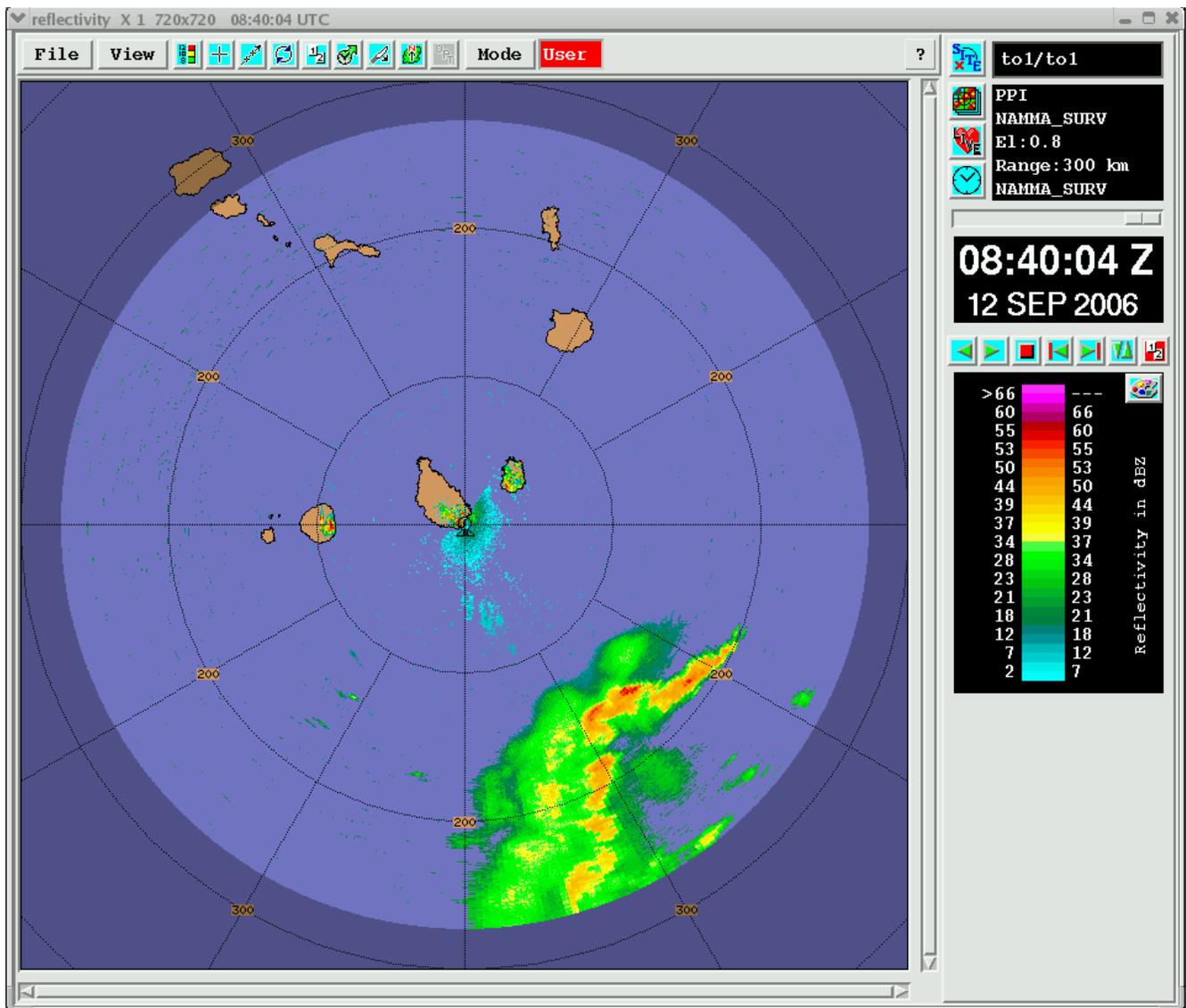


0730Z – Northern tip of the MCS has Zs in the mid- to high 50s. The MCS continues moving westward, leaving most of it outside volume scan range.

0800Z – Northern edge of MCS just passing into range of the volume scans. The northern cells in the MCS are the most intense of all its convection.

0830Z – Leading edge of MCS getting close to crossing the 180-deg azimuth. Storm is still too far away to do volume scans on it, as just the northern tips of the northern cells are within range.

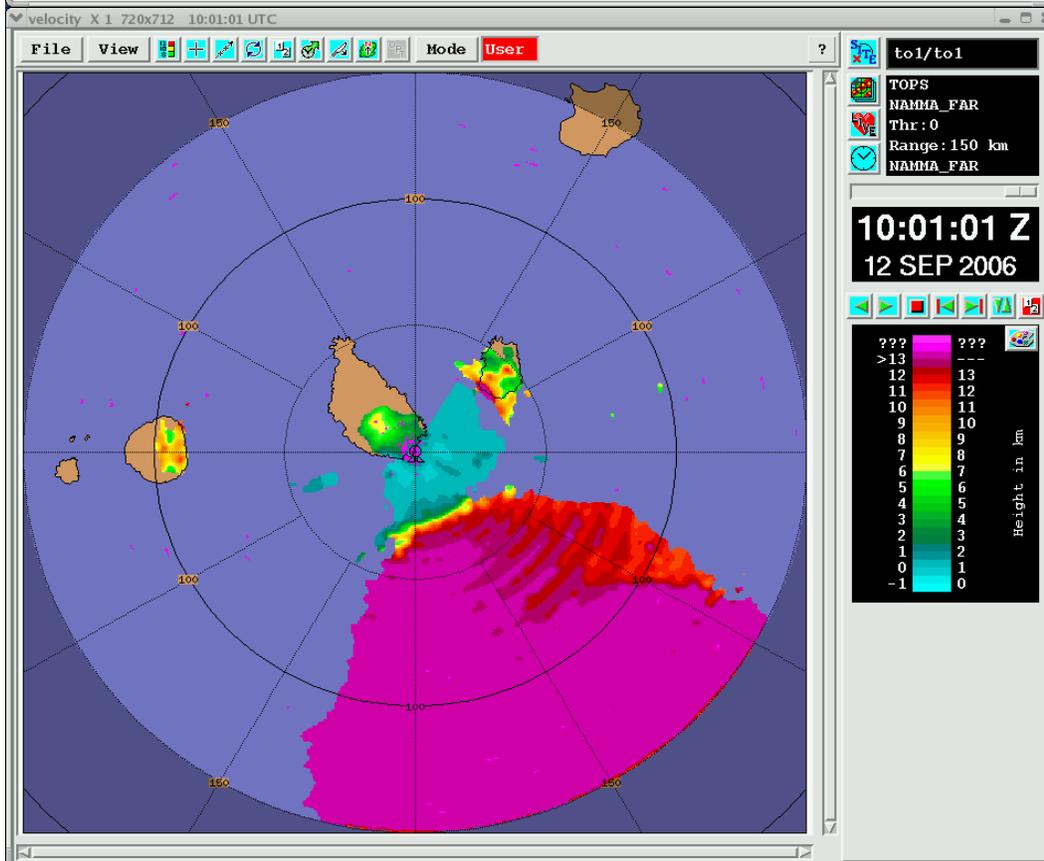
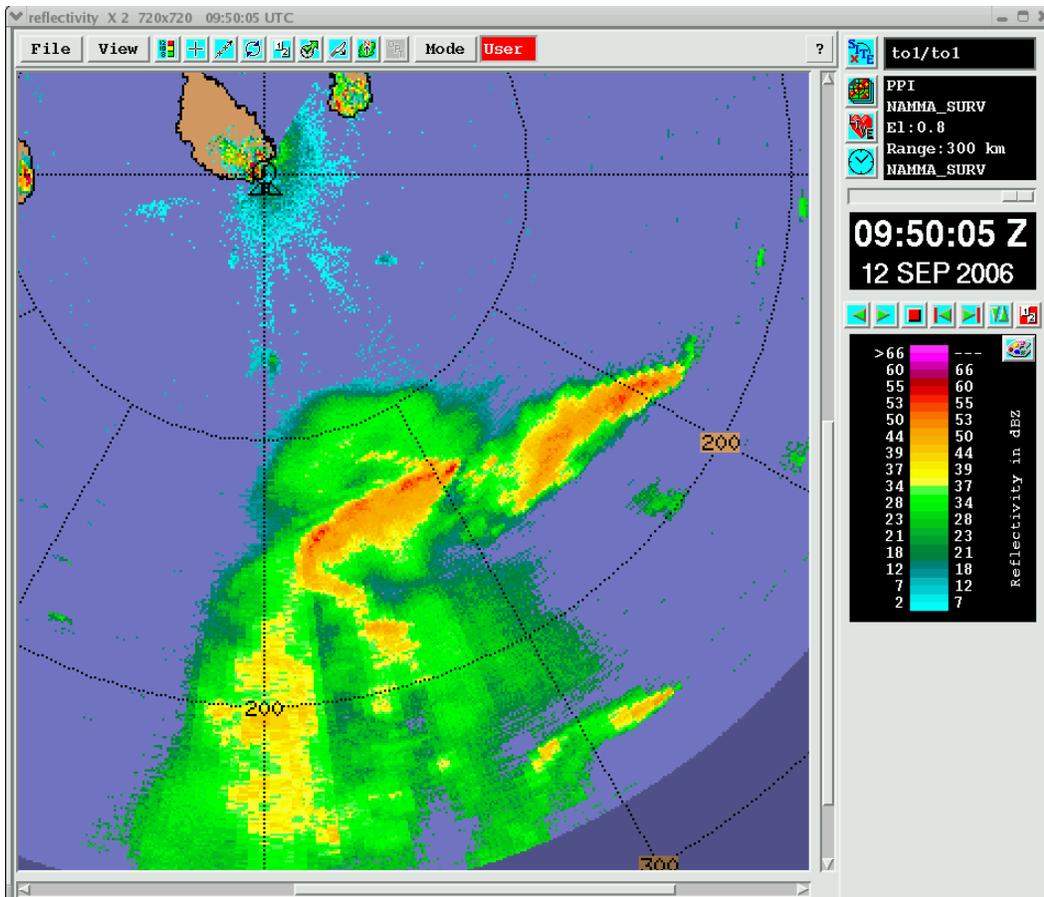
0840Z – There is redevelopment of convection immediately east of the northern cells, behind the main line. Here is an image from the latest surveillance sweep. This appears to be a trailing-line, leading-stratiform MCS.



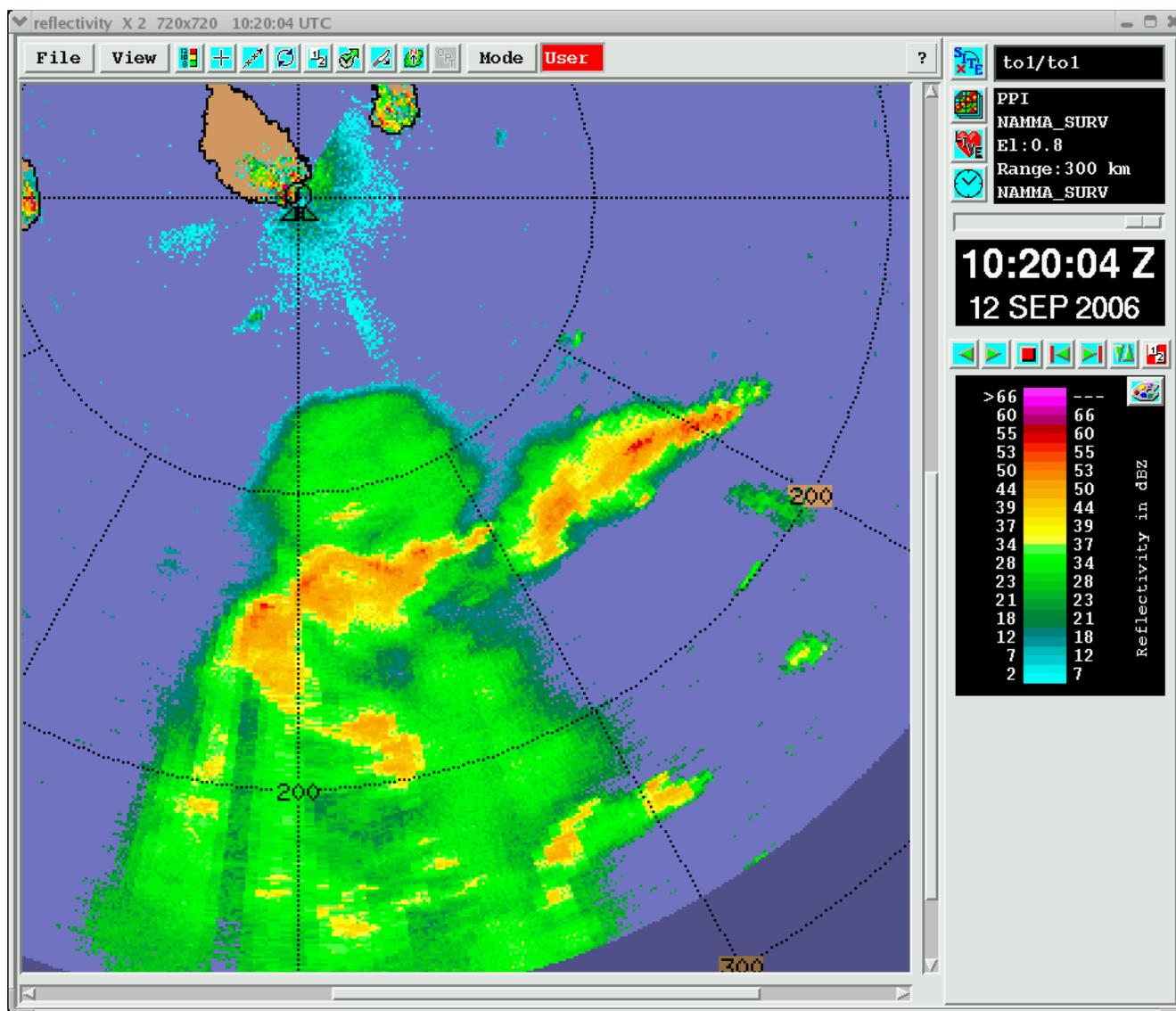
0900Z – Portions of the strongest cores in the northern part of the MCS are now visible on the volume scans. The system continues to move basically due west, though this redevelopment on the north eastern flank does add a bit of a northward component to the convection there.

0930Z – Lang off shift. George and Smull on.

1000Z: The system continues to move mostly to the W at about 17m/s, i.e. Its motion is oblique (rather than orthogonal) to the line's orientation. A very broad area of high tops is being shown using the TOPS product on the FAR scans with it reporting tops in excess of 13km over virtually the entire system. Looking at cross sections across the whole area it is easy to see the overhanging anvil. Tops in the strongest region seem to be in excess of 10km on these cross sections; confirming the TOPS product to some degree. (Cross section displays extend only up to a max height of 8km, making conclusive comparisons difficult). Max dBZ is being reported around 56dBZ in the strongest regions. There is a nice hook on one of the most active regions, and as it moves toward the W it is being exaggerated. The lines/shadows just below the region of high dBZ might be attributed to attenuation by the curved (along-beam) portion of the convective band or perhaps some kind of second trip.



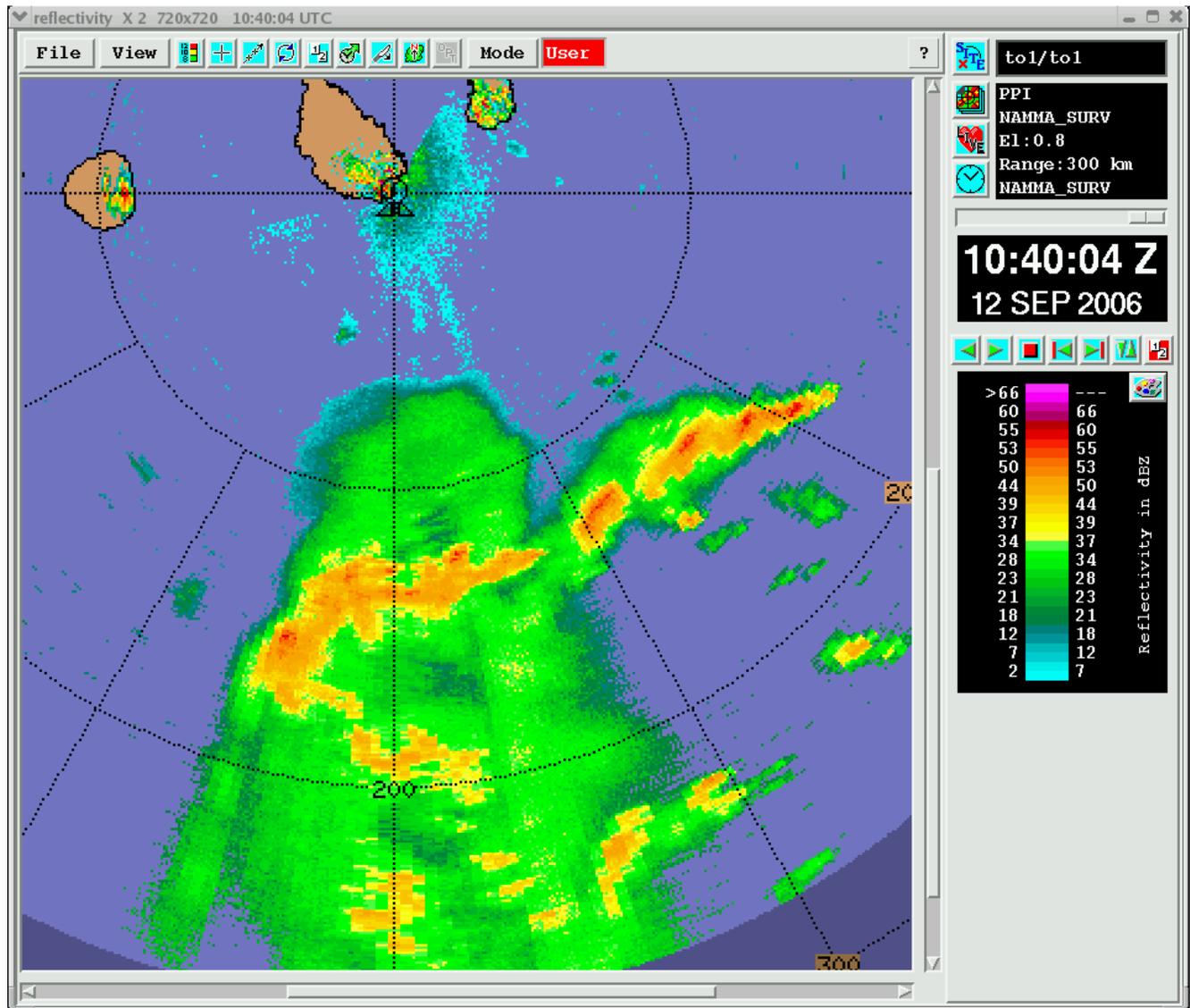
1020Z: The previously most intense segment of the convective region, which previously exhibited a very smooth linear (vs. cellular) structure, is now tending to break-up into individual cell-like structures. Peak dBZ values also seem to be decreasing somewhat. Also, what originally appeared to be one single long linear convective feature has now broken up into two distinct mesoscale segments. The W end of the eastern segment is likewise developing a S'ward hook, again suggestive of downdraft-generated cold pool dynamics at work. A tendency that has persisted for about the last hour is some tendency for "back building", i.e. E NE'ward extension of new convection at the NE end of the convective band, even as the entire system slides to the W.



Belated notes from 0930Z phone chat w/ Robbie Hood & Mike Douglas: Passed along endpoints (14.4N/21.8W to 13.6N/23.1W, with most intense segment centered near 13.8N/22.9W) & apparent motion (toward 265deg @ 15 m/s) of intense convective line to our S, and noted southward extension of broad stratiform region (and some embedded convection) from it's W end, as well as some tendency for pre-line stratiform echo development. Noted this is perhaps the 4th time during the project TOGA has observed a squall-like feature on the N periphery of a developing AEW-type cyclonic circulation (perhaps owing to greater access to midlevel dry air and associated cold-pool generation at

these higher latitudes vs. along the far moister ITCZ region?). Douglas reports wave is moving eastward a good deal faster than progged, with estimated center of circulation near 11.5N/20.0W at 0600 UTC 12 September, with good inflow from the S. Douglas reports that lots of lightning is being detected with this system in a region consistent with (and extending well S, i.e. From 14N to 11.5N) the endpoints we provided. Douglas reports mean (presumably upper-level) flow is from the NE. Their plan is to do an initial W-E dropsonde transect (BFS note: heavy with fuel during initial part of flight, so this would nominally be executed near at 35kft = 10.5 km MSL) along 13N between 26W and 23W, then head diagonally ESE toward estimated circulation center to begin "X" pattern. Agreed we will attempt VHF radio coms on their initial S'bound transit to 13N/26W and as they fly E'bound.

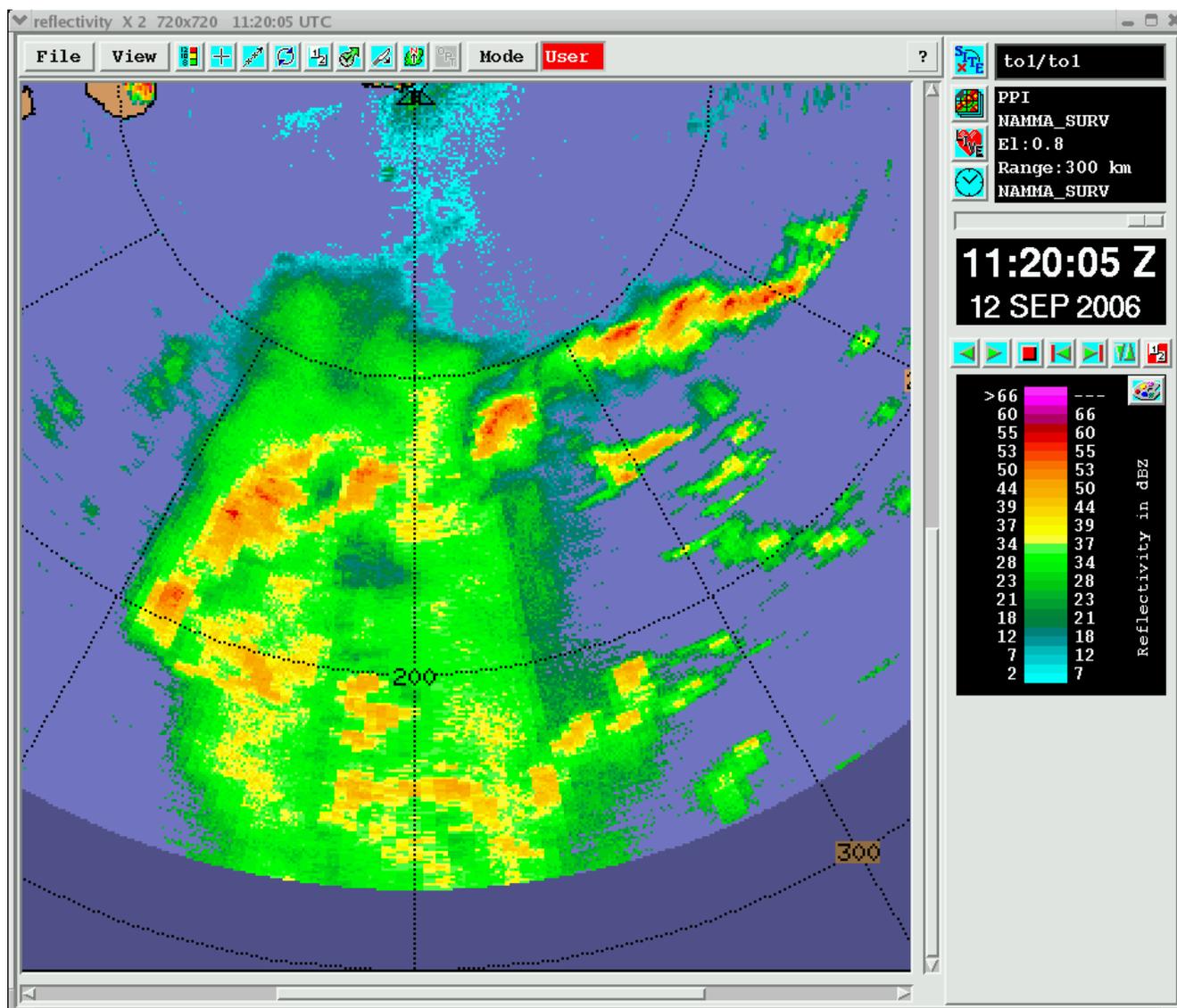
1040Z: More nice examples of attenuation by intense cells/segments along the convective line:



1115Z: Additional telecon w/ NAMMA ops to alert them of (1) exceedingly high echo tops in this system (Iris says widespread >13 km) and (2) relatively fast 13-17 m/s motion of individual cells/echoes, which we estimate will put leading/W edge of convective zone near 24.5W at TO time and nearer 24.75W at the time DC8 begins its initial E-bound transect.

Heysfield speculated and I agreed that DC8 could possibly have difficult time penetrating this feature if intensities hold.

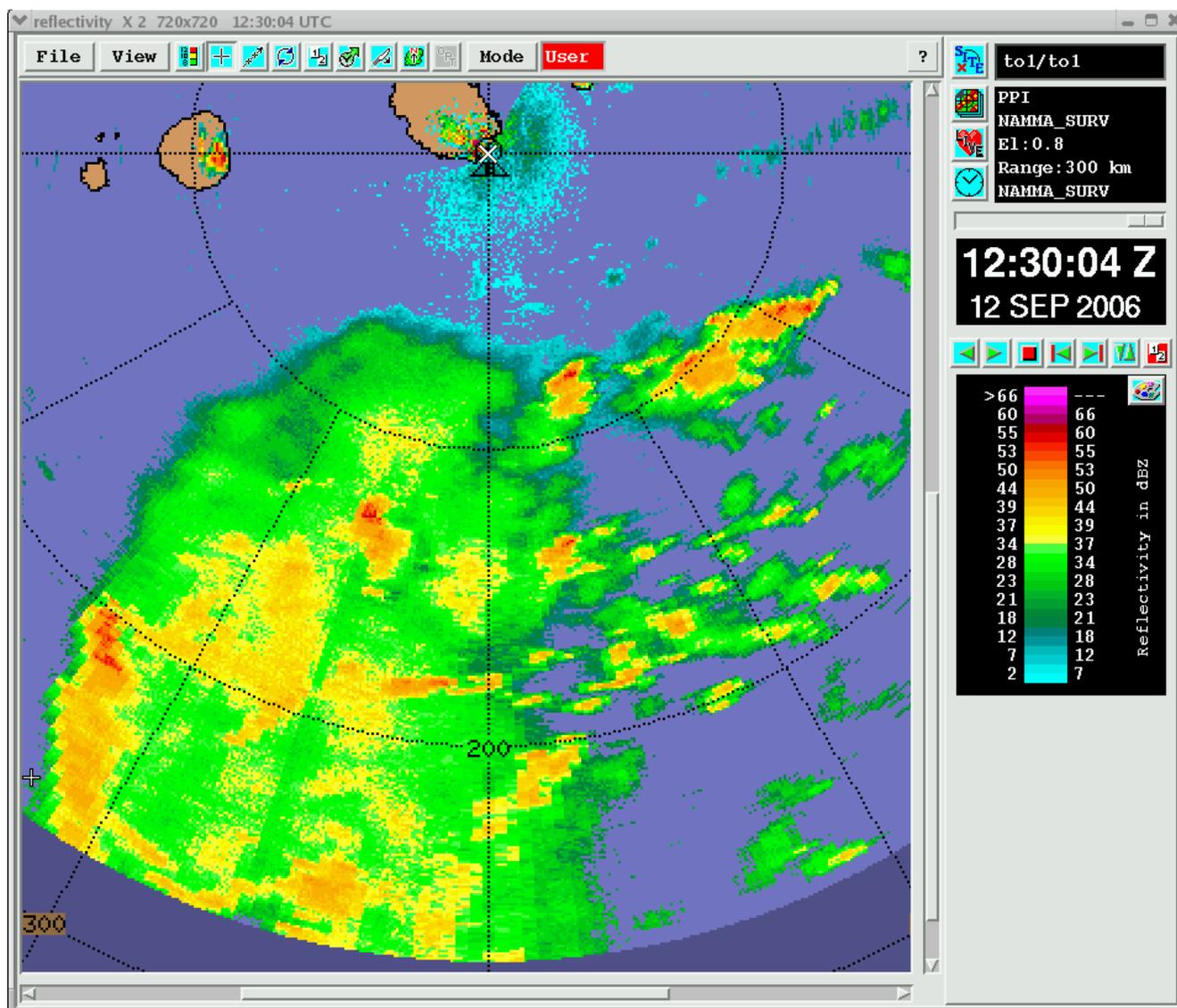
Here at TOGA we note that while N fringe of system retains a focused, quasi-linear convective structure, the echo down nearer 13N (where DC8 will do its transect) is more of a convective-stratiform hodge-podge (i.e. a “dog's breakfast” in Aussie lingo), though admittedly our perspective is more qualitative at these long ranges.



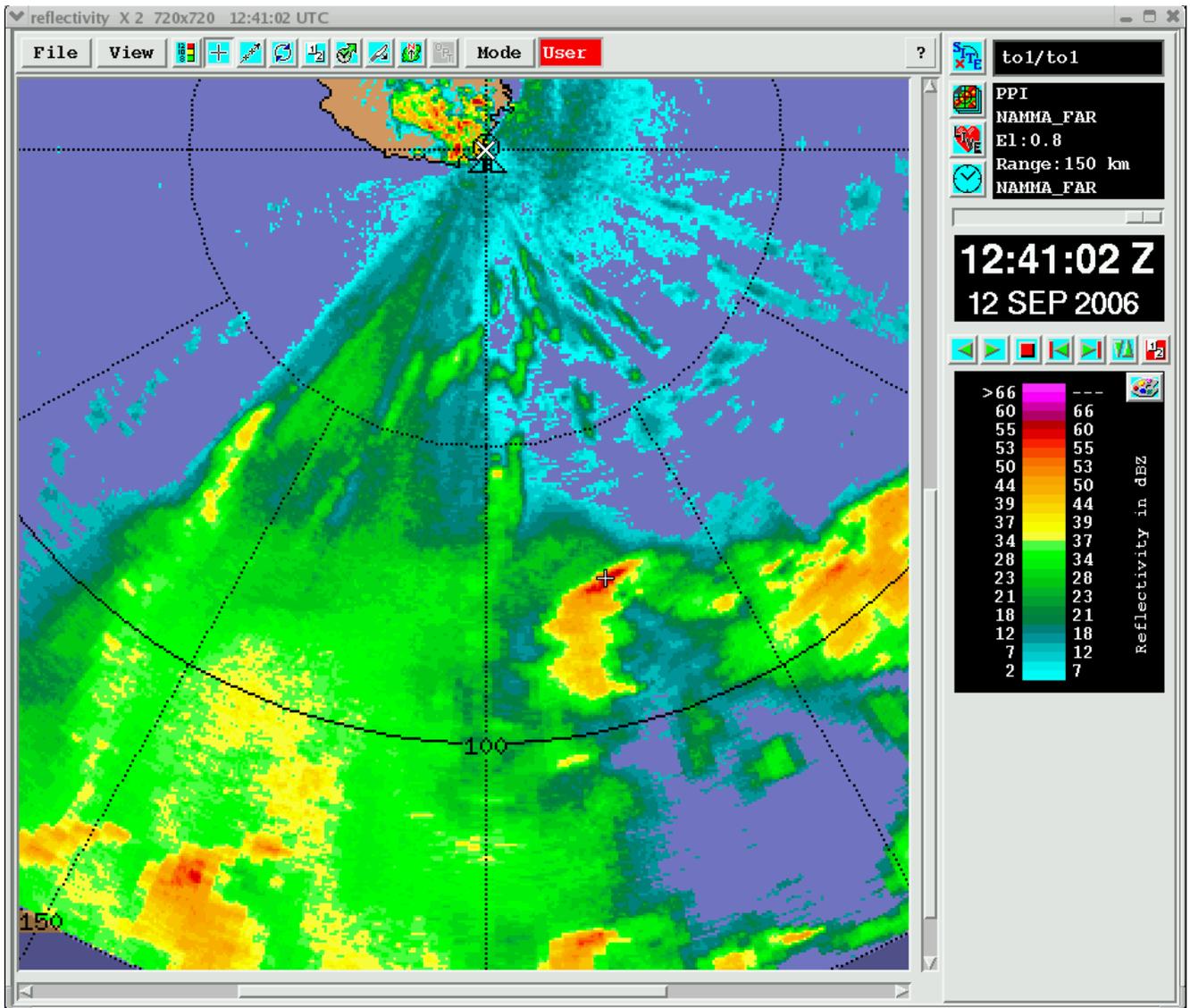
1200Z: What continues to occur is mostly a westward movement of the entire system, however, there is development to the E. There is still a very random arrangement of convective areas within the precipitating area.

Call to Robbie Hood @ NAMMA Ops for X-chat relay to DC8 upon TO: Most intense part of system apparently remains along it's N edge, i.e. Region N of 13.3N. However range effects may be biasing this view. Indicated echo tops remain quite high over broad region (IRIS still says >13 km). Within most intense cells along N edge, locally see 40 dBZ up to 10 km, more typically to 8km. We lack volumetric radar coverage and ability to estimate tops/intensities along DC8's planned E-bound track along 13N. What we do see there is:

Echo currently extends from 24.6W to 22.8W, i.e. Over a 200-km stretch. Appearance is solid stratiform echo w/ embedded convection, not organized in any obvious fashion (i.e. Potentially challenging for pilots). Best estimate is 40 dBZ at beam height of 6km, but urged this value to be taken with huge grain of salt. Feedback from Robbie: As of ~1230, DC8 is steaming S'ward near 14.7N/26W, preparing to begin execution of E-bound leg along 13N. Reiterated to her that they should be prepared to encounter convection near 24.9W. Cursor in attached image is at 13N/24.9W.

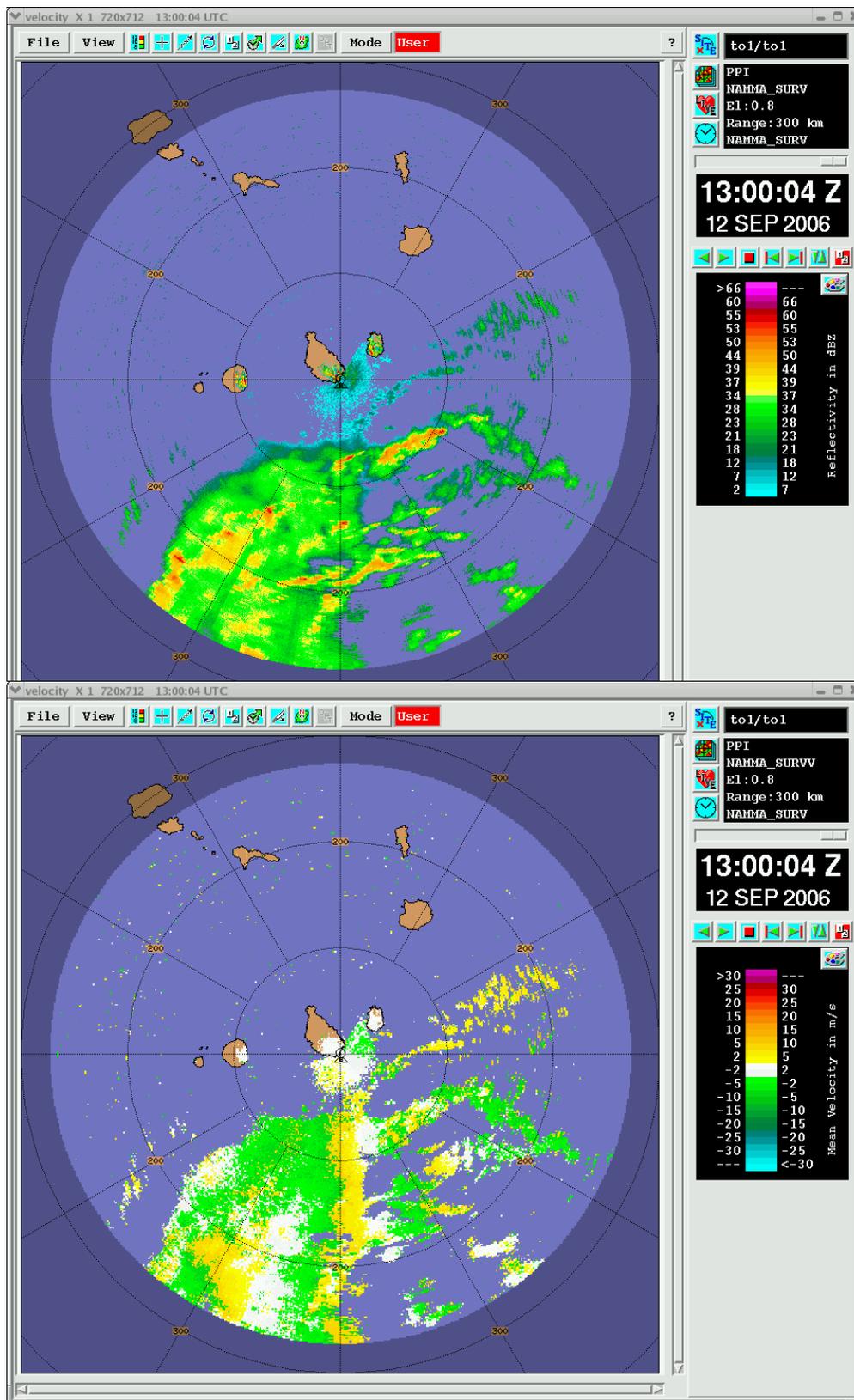


We note that system has evolved from one of a primary WSW-ENE (though fast-moving W'ward) line with extensive stratiform echo to its south to more of a N-S leading convective line with trailing stratiform precipitation, albeit with multiple overlain WSW-ENE convective bands ("shear-parallel" features in LeMone/Asai-lingo). Nice mini-bow echo feature (centered near 165deg/75 km) being sampled by FAR scans (dBZ image attached), albeit without much of an impressive Vr signature (not shown).



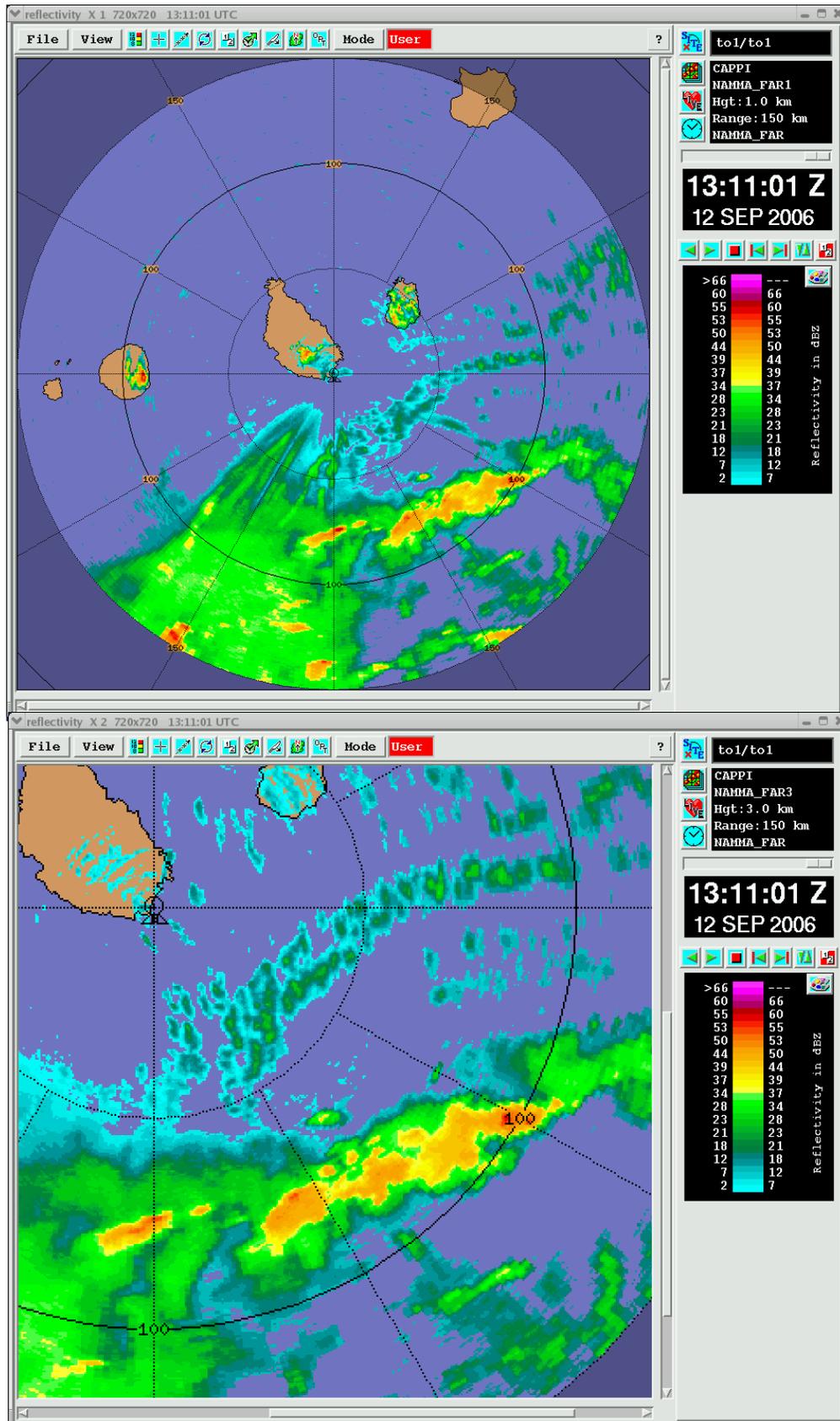
1250Z: Vertical sections across stratiform echo out near/beyond 100 km range ring now showing first hints of bright-band enhancement. (Heretofore echo has been stratiform w/ embedded convection but with no indication of MB.) Quick/dirty analysis of surveillance (i.e. Clearer/non-range folded) echo & velocity pattern (pair of images next page) indicates prevailing low-level ENE'ly flow (viz. Note white real-zero line along ~165deg radial). Tendency for stronger (folded) outbounds with distance westward across stratiform region could simply be linear projection of prevailing flow on variable beam orientation, but may also be partly attributable to cyclonic shear (i.e. Increasing outbound component from E to W in our SW sector). Needs more careful attention.

Aside: Last load of fuel was delivered late this morning.



1320Z: Interesting (though weak) curved WSW-ENE bands of cellular precipitation now coming inside 50-km range ring on NAMMA_FAR scans. Overlain w/ 2nd trip, esp. near their W end, even on 1-km CAPPI (example attached). Will monitor for need to shift to NEAR.

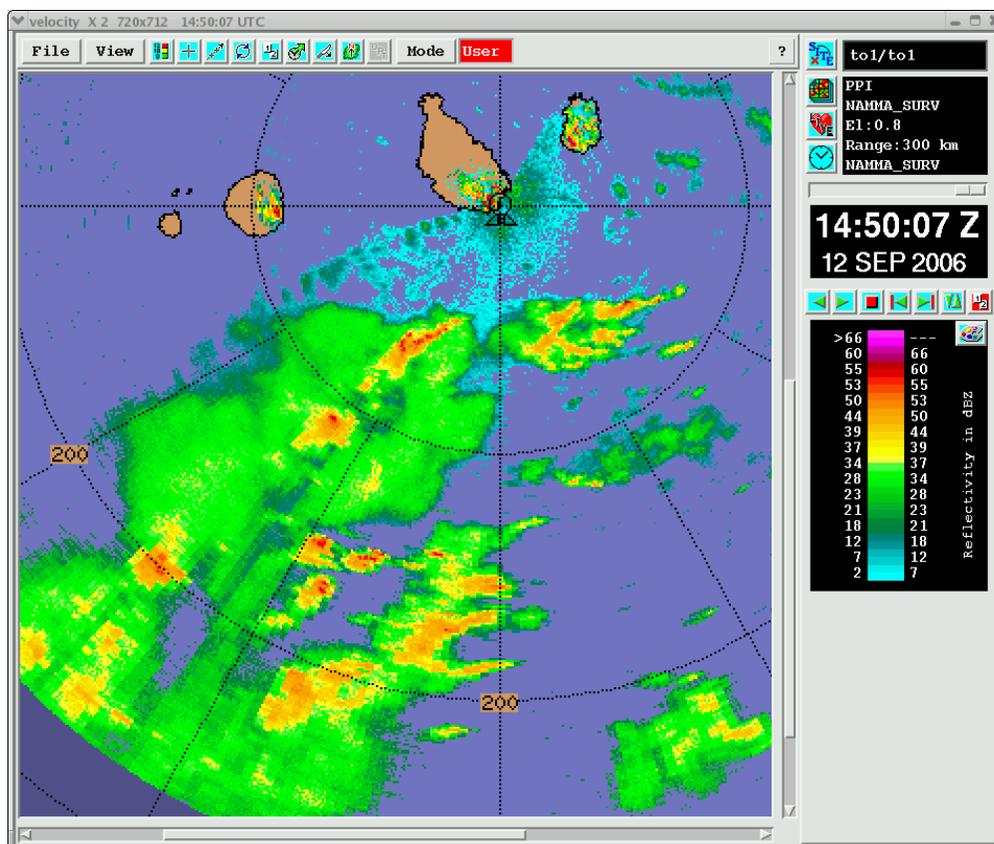
Also appear to be some very odd NNW-SSE oriented multiple bands of echo aloft at very close range—shifting to NAMMA_NEAR eff. 1331 scan to better sample these features (which may be terrain- (or more likely shear-) related? Intriguing.



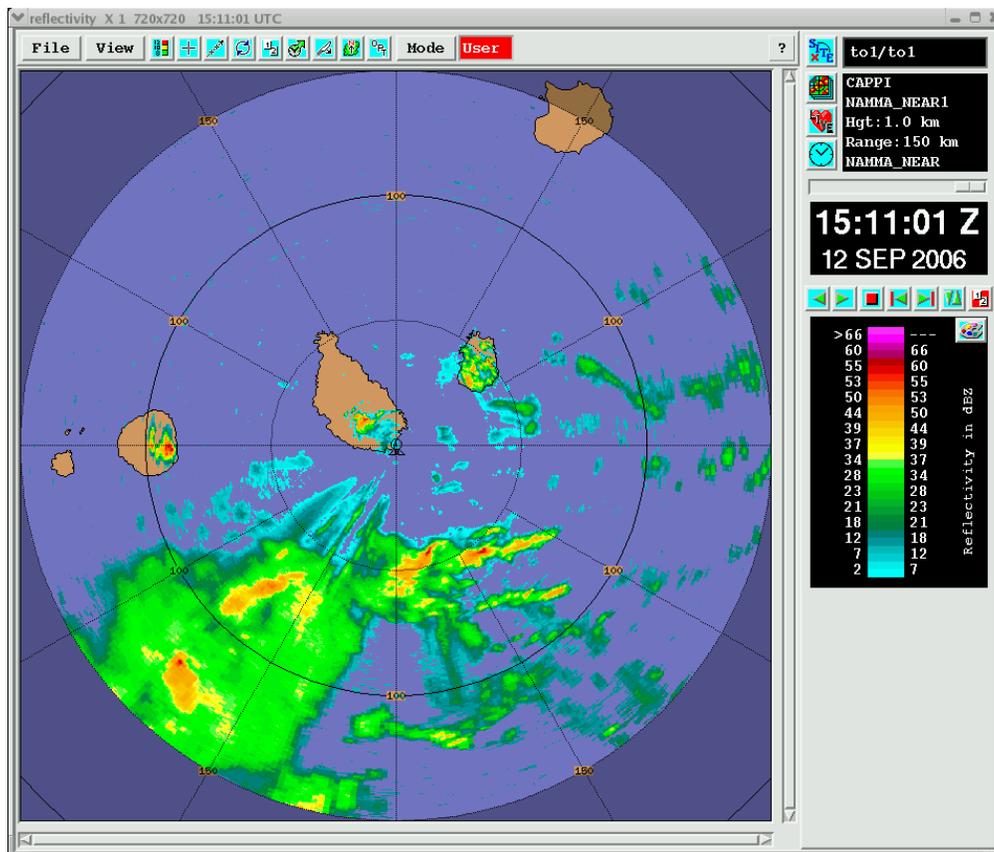
1400Z: Northern band of intense convection continues to persist and exhibit back-building characteristics. The entire precipitation area seems to have developed more of a wedge shape; at least over our viewing area. Another defined band of convection farther to the south is beginning to develop. The small cells (showers) to the E of Praia continue to persist and move to the W; maybe we will see a little rain... These cells seem to be developing into loose lines, with dBZ values around 20-25dBZ max.

1440Z: Just had two interactions with Bill LaPenta @ NAMMA Ops. First concerned Ed Zipser's thesis (via chat) that we may have a mesovortex to our SW. We reported that there is indeed a large area of stratiform precip (presently moving out of surveillance range) and that we've closely examined it (albeit using single-level Vr data) but have seen no strong evidence of a closed circulation. Cyclonic shear [$d(V_r)/d(AZM)$], yes, but dipole in Vr, no. Second call passed along Gerry Heymsfield's request that we keep in mind possibility of DC8 melting-band module for their return. Reported that at present we see no evidence of extensive stratiform regions at close range (only the one large area moving out of range) as pattern is dominated by multiple ENE-WSW bands, however we will gladly keep this in mind for DC8's N-bound transit 2-3 hours from now.

1445Z: Overall pattern is decreasing in intensity, if not coverage. Large stratiform region behind previously noted ~N-S line now exiting scope. In its wake, multiple ENE-WSW convective bands persist, with smaller surrounding regions of stratiform echo. Multiple lines of smaller/shallower (sheared?) cells exist on the N fringe in the vicinity of and E of Praia, but previous tendency toward possibly setting up a new E-W convective band at/N-of Praia's latitude now seem diminished. Will monitor for DC8's possible arrival in ~18Z time frame. Not much 2nd trip to E/SE however (only to SSW where one would expect it), so prospects could be better. Stay tuned...



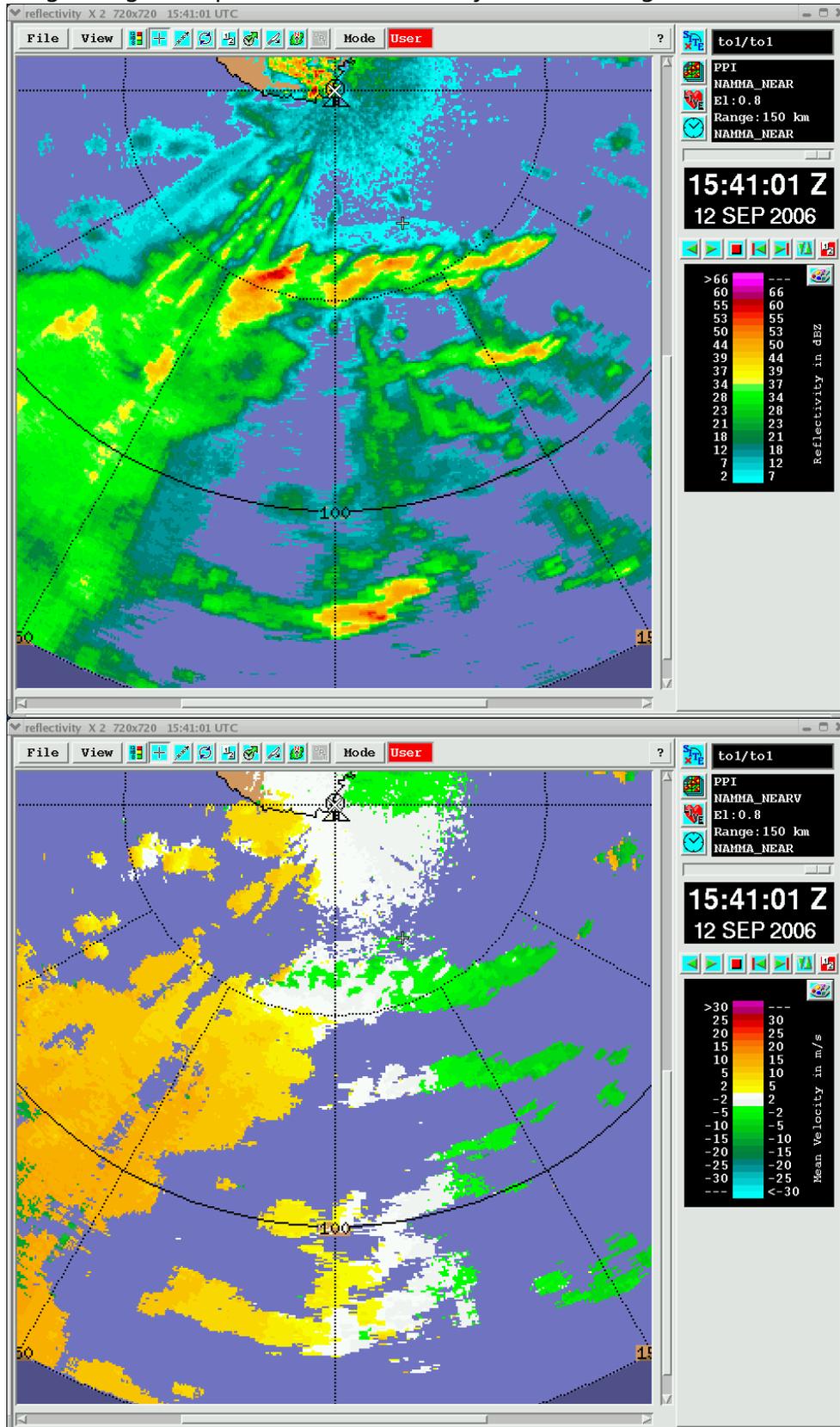
1500Z: Some continued tendency for echo re-development (“back-building”) on E ends of narrow convective lines between 40-80 km range in our SE quadrant. This is also promoting generation additional stratiform echo feeding into our SW quadrant, though overall that echo continues to advect slowly W'ward toward edge of scans. Overall, SF echo has been most persistent around 14.1N/23.9W (i.e. near 205deg/95km). Will monitor for future potential.



Side comment: Radiosonde crew remarked yesterday that they were seeing some of the strongest (E'ly) winds aloft of the entire project, at least since very early on, and the impact of that flow is evident today in continued rapid W'ward propagation of most echo features, viz. W'ward @ 12-15 m/s.

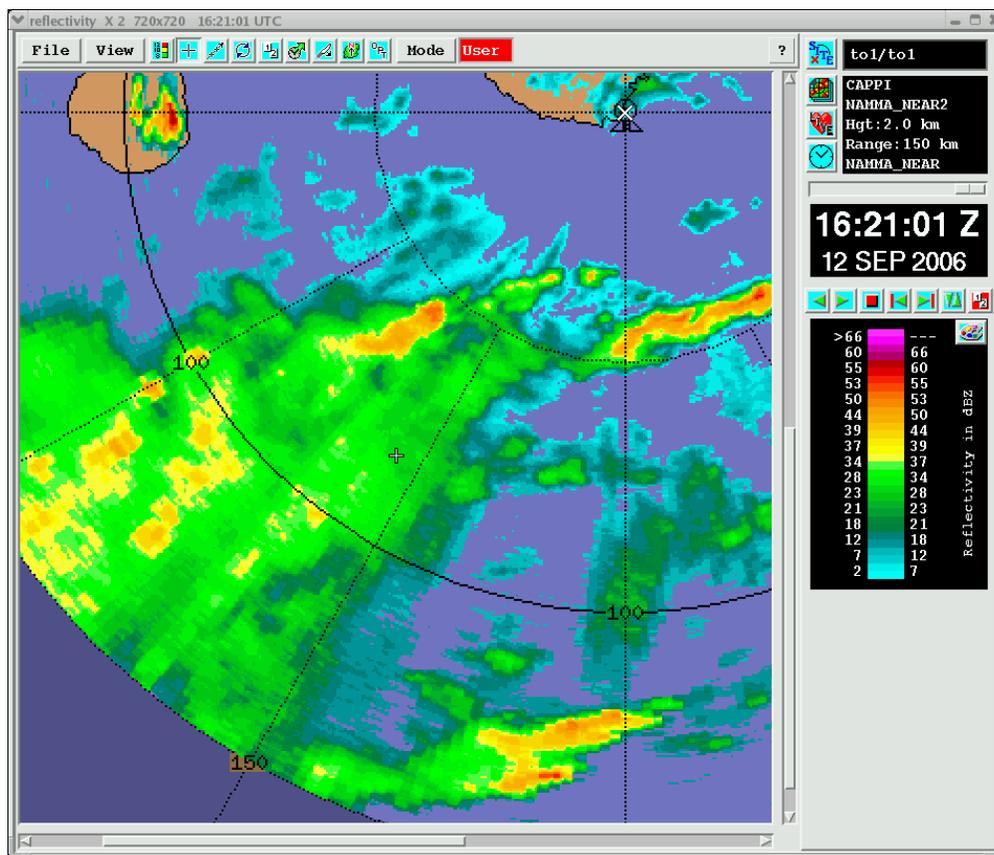
1550Z: Checked-in w/ NAMMA Ops. DC8 currently doing low-level figure-8 patterns across circulation center, which has now been designated as a Tropical Depression (Number 8?) by NHC. I asked Robbie Hood to relay to Gerry Heymsfield that echoes are persisting to SE-SW of TOGA, owing to continued convective re-development in our SE sector. (Robbie commented that this activity is still generating a good bit of lightning.) I also expressed two concerns vis a vis setting up DC8 MB pattern SW of TOGA: (1) stratiform areas are relatively small, almost always with hard convection nearby, and (2) all echoes are moving rapidly W'ward. Thus if a MB module took ~30 minutes to complete, it would be important for DC8 to drift westward with the flow, otherwise they would likely be impacted by deep convection. As such, recommended that if Heymsfield found a large-enough stratiform region that DC8 was comfortable working in, that they pursue that. Expect DC8's ETA at our latitude around 1730-1800 UTC.

E-W convective band has generated a parallel “fine-line” just to its N, i.e. extending E-W through cursor location in attached image. In animations, this feature clearly propagates northward. Corresponding Vr signature is relatively weak, but shows some inbounds—nothing striking though... esp. in view of relatively clear dBZ signature:



This E-W feature seems the best candidate for generation of stratiform echo that could be worked by DC8. At present, most suitable location appears to be near 14.4N/24.0W.

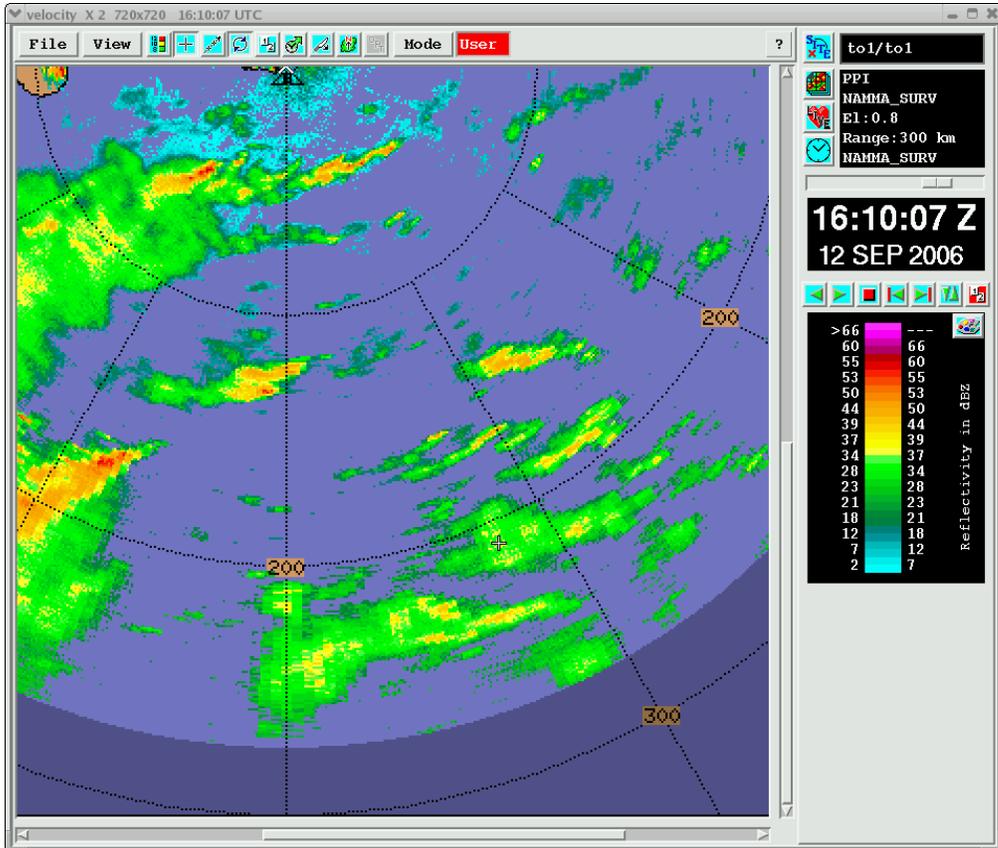
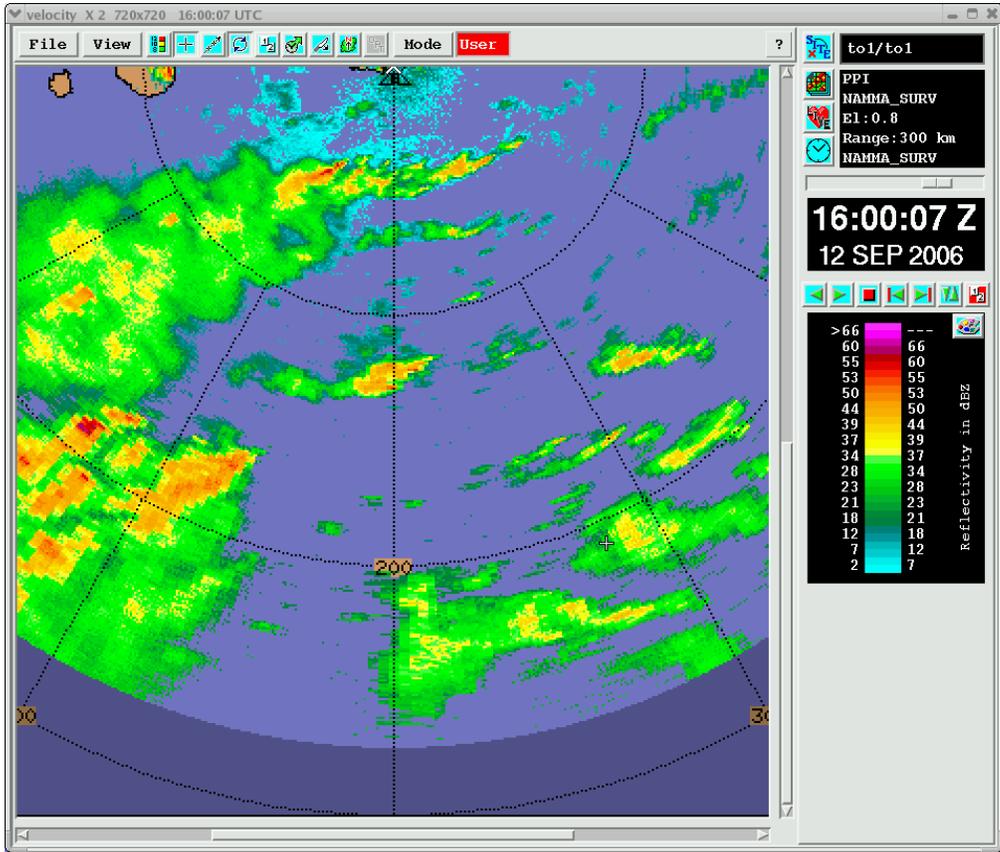
1630Z: Called NAMMA Ops to suggest possibility that DC8 could do MB module in stratiform echo to our SW. Nominal spot (workable at present, and looks as if it has healthy convection upstream) is near 14.3N/23.9W (cursor in attached image). Advised that this would be far more challenging pattern than seen on 3rd, as echoes are moving quickly w/ intense convection (esp. to N/E) that would require careful exit strategy. Bill LaPenta will be back in touch w/ ETA for DC8.

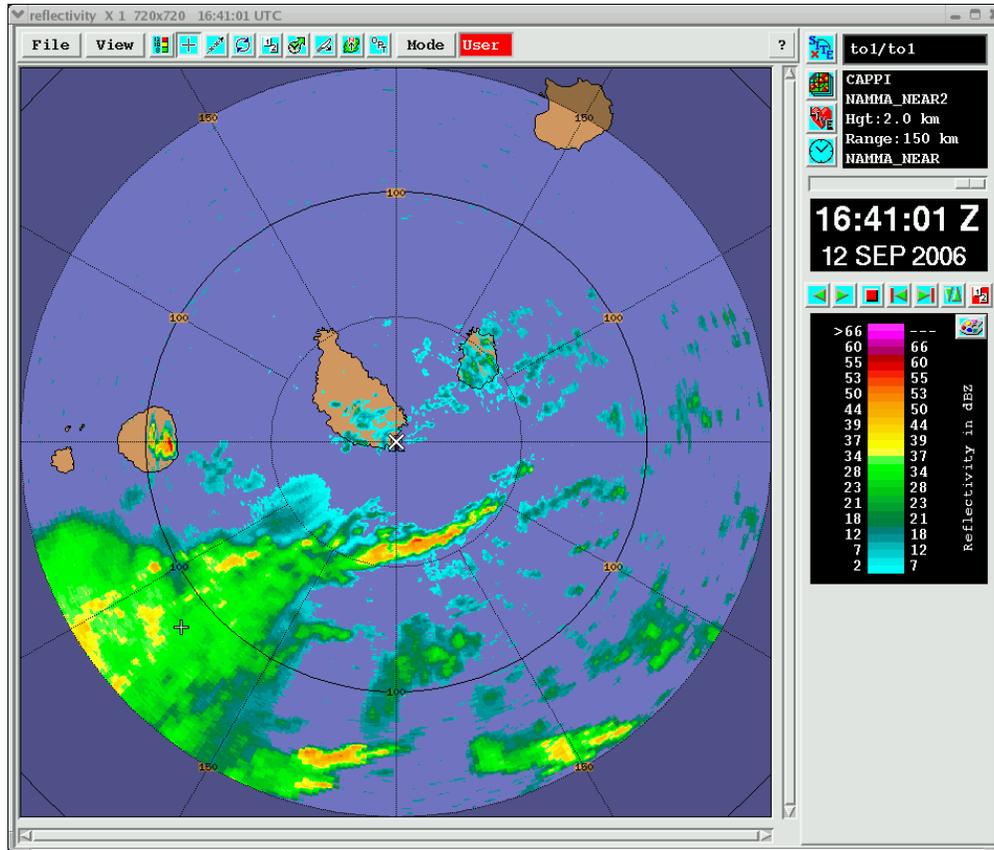


1650Z: Thinking something nearer 14.25N/24.25W. Tradeoff is increased range from TOGA, but better echo properties. Still, if convection along 14.5N detrains sufficient hydrometeors into prevailing NE'ly flow aloft, original point could still work well. Will sit tight for now. Returned to NAMMA_FAR sequence eff. 1651 UTC scan.

Aside: Representative of local US Embassy dropped by to deliver bill for security services (something in the neighborhood of 150,000 CVE, i.e. \$1500-1600 US). Will pass this and his request for further info/confirmation of container shipment dates/addresses back to US along to Nathan Gears when he returns for night shift.

Postmortem comment added upon seeing post-mission depiction of DC8 flight track for 12 September mission: Attached pair of images shows location (cursor) and echo conditions accompanying the DC8's second melting-band module type spiral, which was conducted ~150 km N of the cyclone's center. This image pair (spaced just 10 min apart) illustrates the rapid advection of echo past the nominal spiral point. Presumably this was yet another elongated feature more convective/stratiform near its E/W end, respectively.

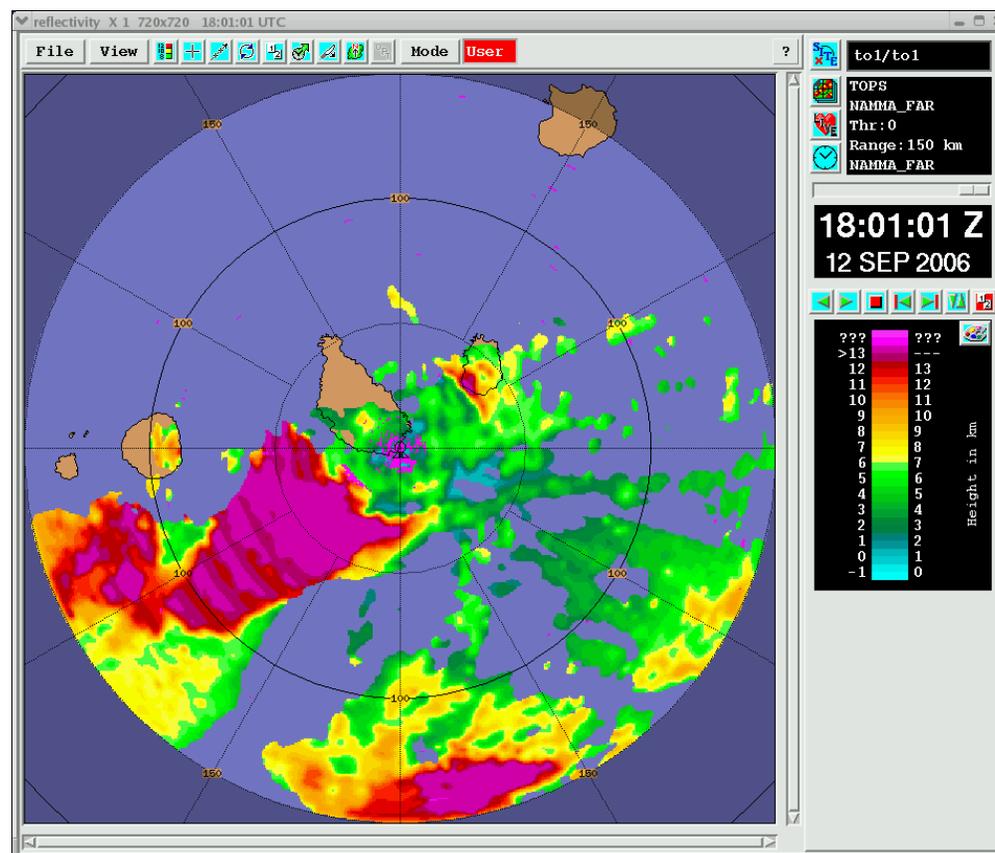
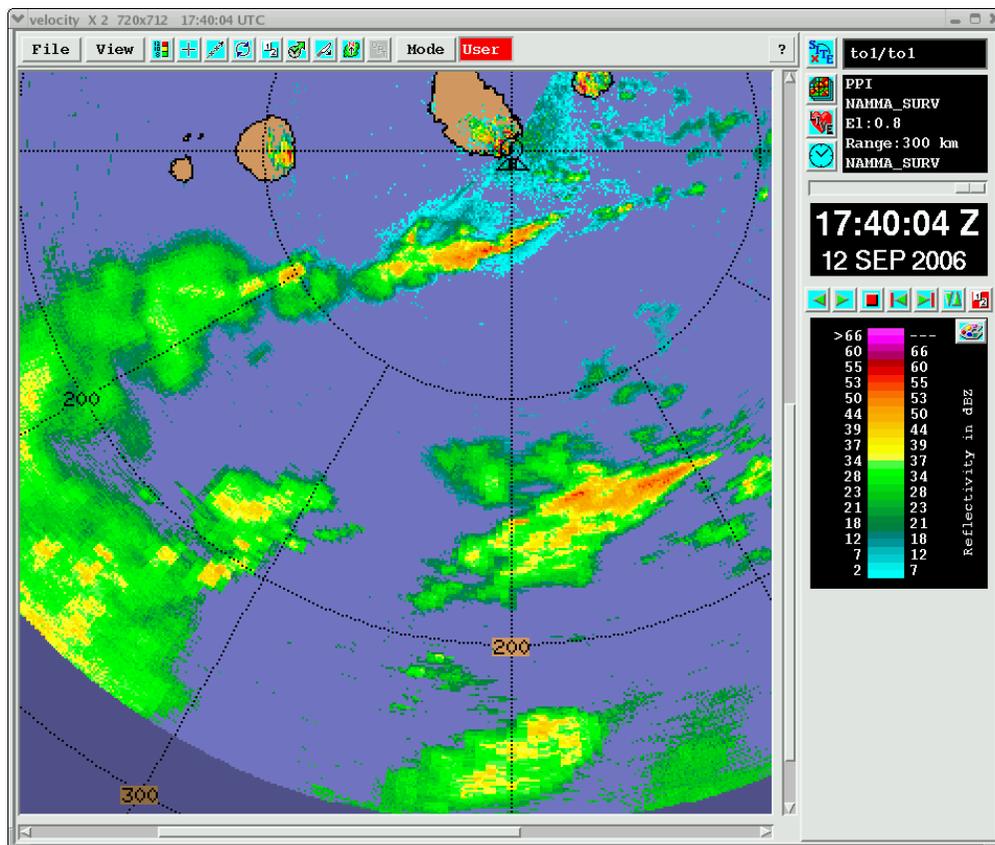




1800 UTC: Surveillance scan now shows two or perhaps even three mini-MCS's all exhibiting the same organizational mode, viz. narrow WSE-ENE convective band coming to a sharp stinger-like tip w/ existing (or merely developing) stratiform echo downwind to W. Tops (to the extent they're trusted) also remain impressive and point to continued intensity of convection. The most northern of these wedged mini-MCS's has remained intact and quasi-stationary for a few hours now, however, most of the stratiform that was assumed associated with it has been diminished appreciably.

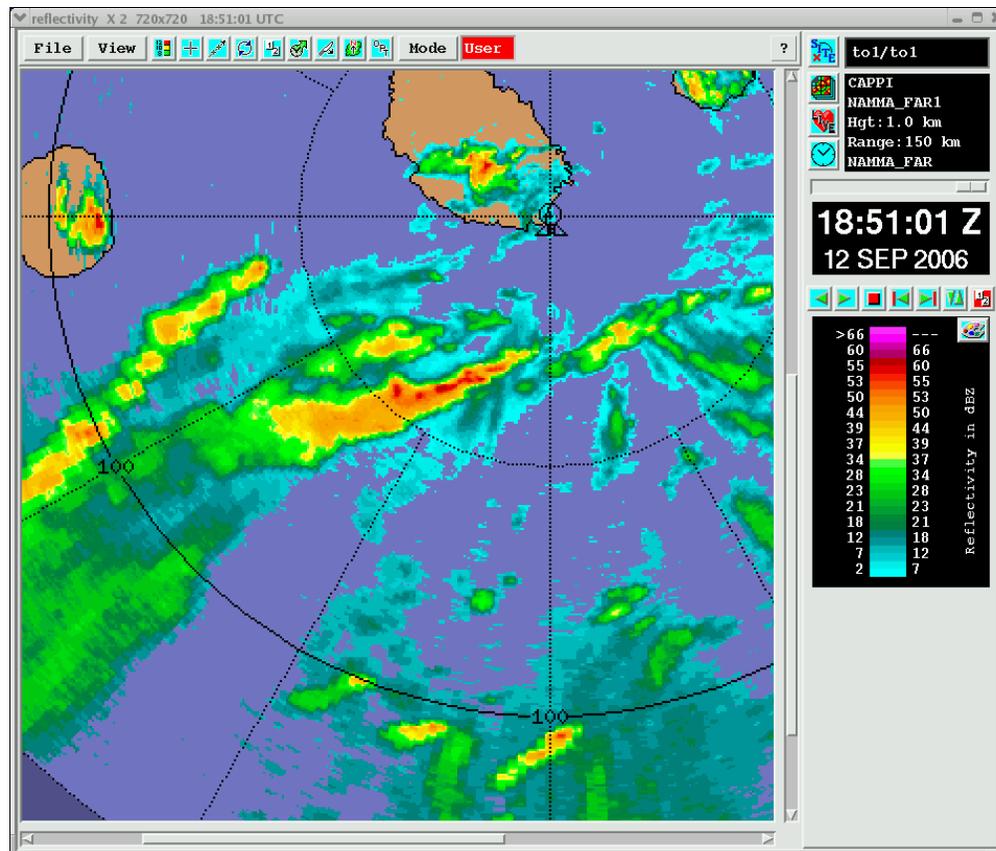
Aside: Bob Bowie returned from water/supply run to report that he had been flagged-down (flashing lights etc.) on airport road. Turns out the "flagger" was Hertz rental car guy, who wanted to give us repaired flat tire of yesterday. (Bob noted that it would have been easy enough for the Hertz guy simply to follow him to the airport rather than stop on highway.) We congratulated Bob for having attained status as an "honorary Cape Verdean", as indicated by his ability to come to a dead stop on a heavily-traffic1ed road.

1815Z: NAMMA Ops called. DC8 has done (successful?) MB maneuver down closer to TD center, and is executing some other maneuvers (porpoising etc.) in that vicinity. Thus not sure how much time they would have for TOGA coordination. Assured Ops that no ideally situated stratiform regions exist near TOGA anyway. Also alerted to need to stay E of 23W on N'bound track to avoid intense convection immediately S of us on descent into Sal.



1820Z: Another stratiform region with embedded convection is just coming into range on the SE portion of the scope. Also, another thin line of weak cells seems to be forming above this new stratiform region. There are some small weak cells around the radar that seem to be hanging around still.

1900Z: Needle like line of convection just to the south of the radar has very intense echoes that extend up to 8km. Looks like many different lines are forming around this intense line with their tips all pointing toward the E. The echo tops over this line are still very high, as reported by the TOPS product as being above 13km. The stratiform region to the SE also continues to creep its way onto the scope.

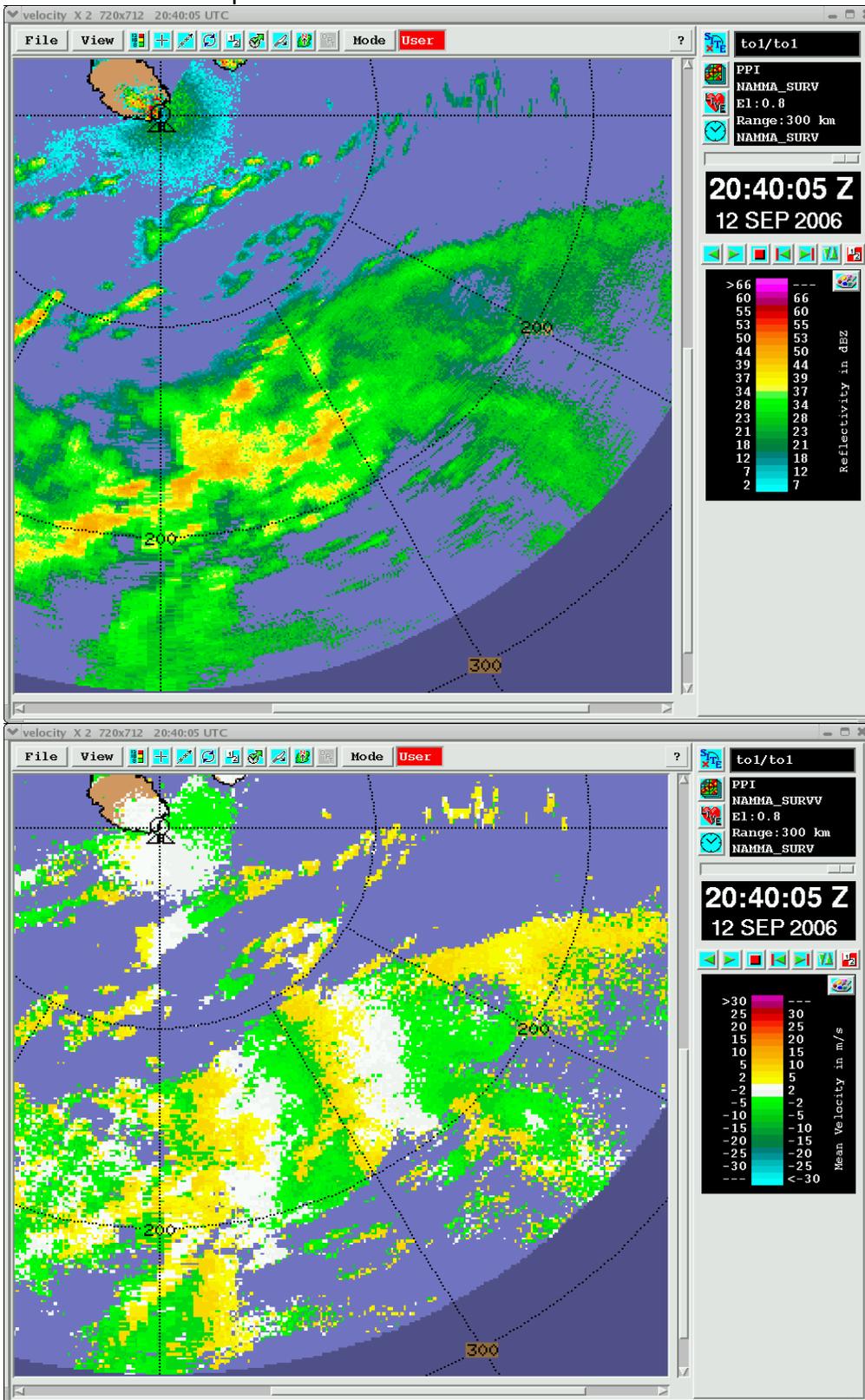


1930Z: Stratiform system to the south seems to be forming into an NE-SW orientation like everything else. There is a definite tendency for the systems to line up this way; seemingly parallel to the prevailing wind. The needle like appearance of the strong convective area to the south has lessened some but the line appearance is still prevalent.

2000Z: More NE-SW lines forming to the SE of the radar. Large stratiform region looks like it is beginning to have more embedded convection in it with stronger dBZ signatures. Suggested northerly flow in the echo to the SE of the radar just beyond 200km at about 140deg. Will keep an eye on this to see if this is the first sign of the flow switching to a northward wind.

2100Z: Feature moving in from SE appears to be organized on MCS scale (dBZ & Vr images attached next page). Survey PPI animation suggests tendency for cyclonic rotation (the first noted today), and corresponding Vr plot depicts fairly packed isodop gradient (around real-zero along 160deg radial?) consistent with marked cyclonic shear. Naturally, this

assessment will require careful evaluation later.



2130Z: Smull & George off-shift.

2130Z – Lang on shift. Nice system we got here. The PPI animation definitely reveals

mesoscale rotation as mentioned in previous log entries.

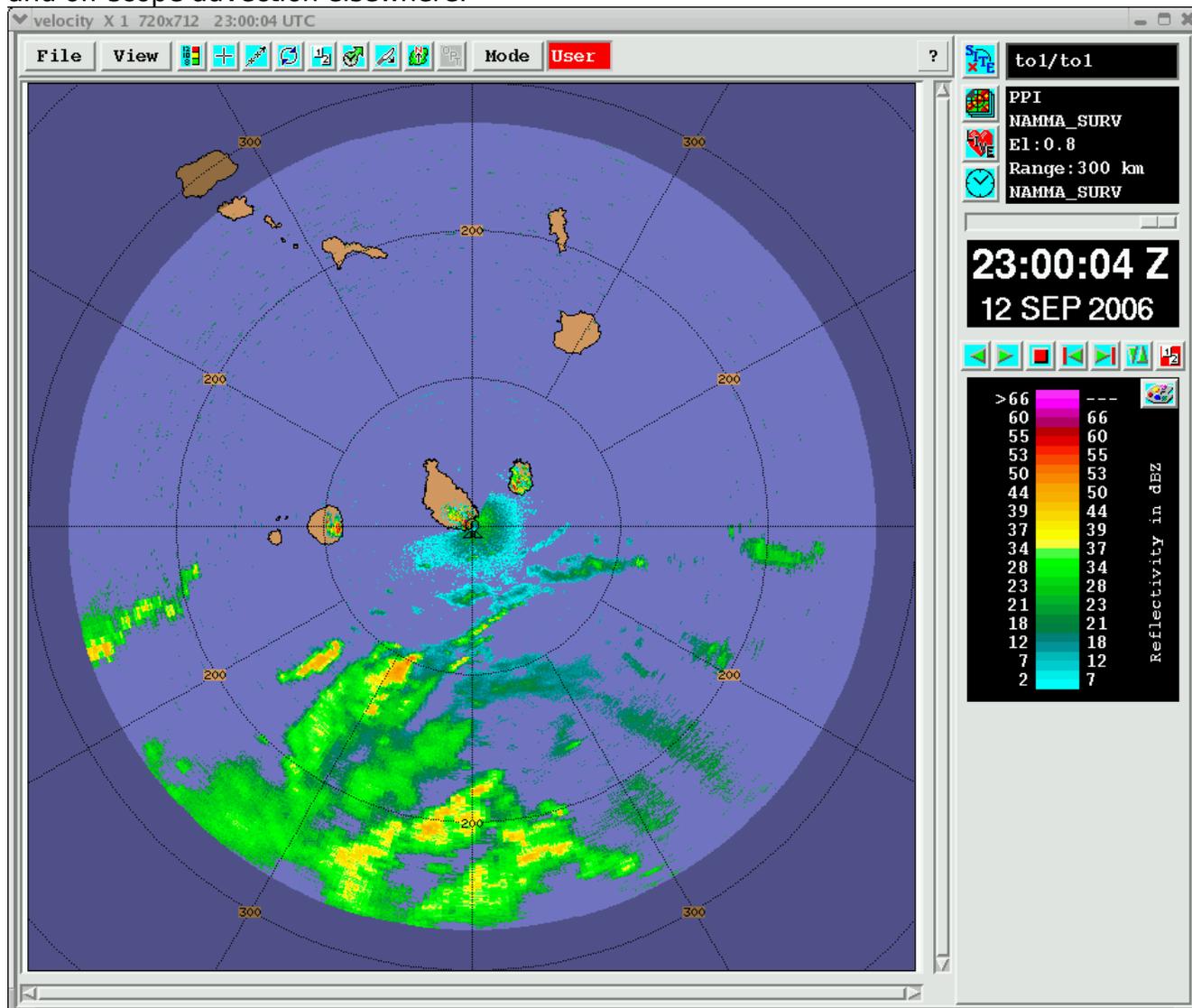
2150Z – Nice little short line of convection within 50 km to our south. Beyond that at 100 km is the most intense set of echoes on the scope. That line almost appears to be part of a spiral rain band given the curvature and rotation, though I doubt that is a correct interpretation. Just what it looks like.

2200Z – Switching to NAMMA Near for a short while to better top the nearest convection. Everything is advecting westward at a fairly good clip, and I don't see much coming out of the east to replace it. If nothing shows up there, it could get quiet here in a couple hours as the system moves off scope.

2220Z – Going back to NAMMA Far. GPS about 15 s faster than toga1.

2240Z – I would say there is a general trend toward weaker echoes and decreasing echo coverage over the past hour or so.

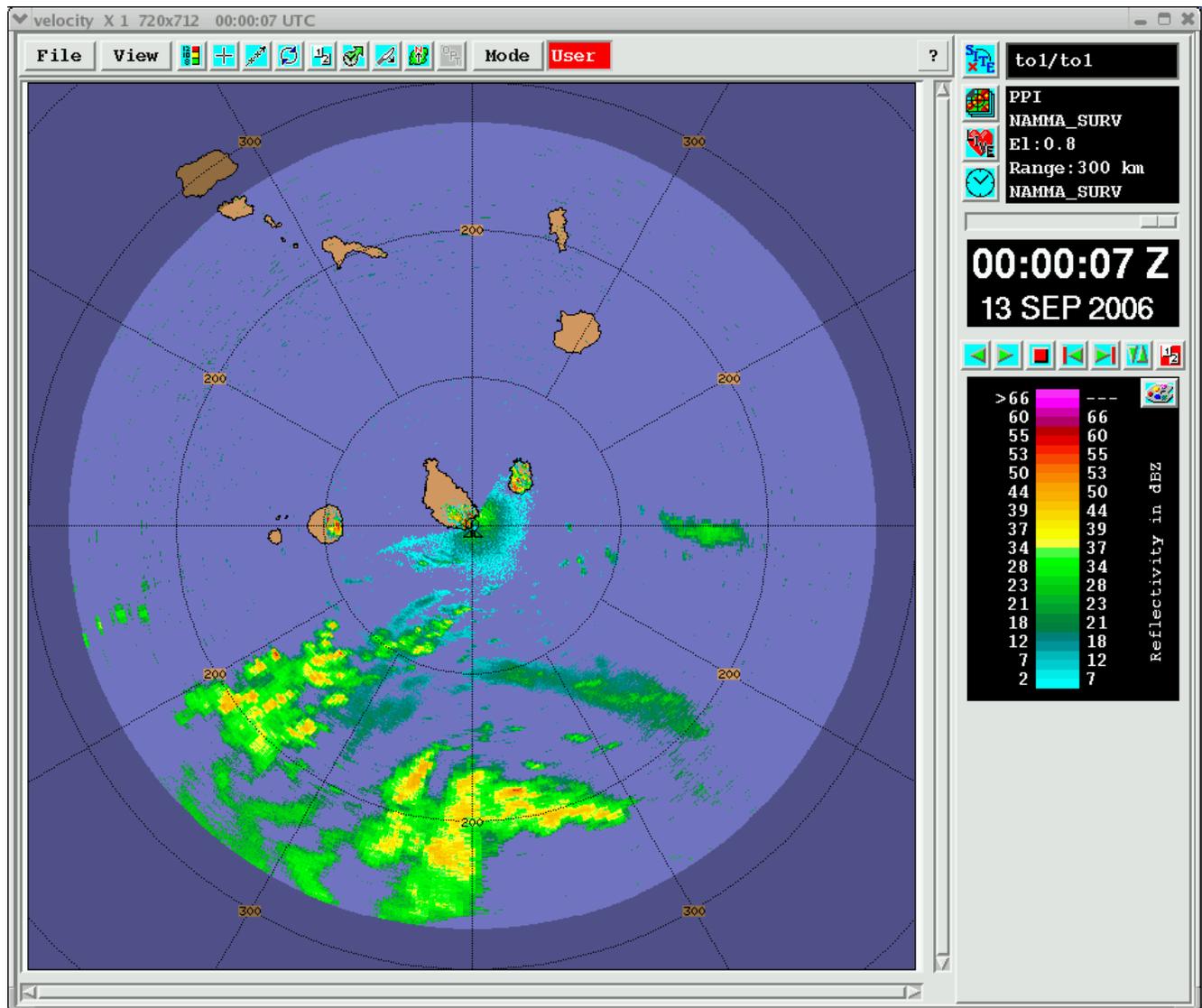
2300Z – There is some redevelopment and rotation about 200 km to the south. Here is an image of the present situation, showing the far southern redevelopment with weakening and off-scope advection elsewhere.



2330Z – Switching to NAMMA Near to better top some new cells 10-20 km east and southeast of the radar.

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0000Z – NAMMA Near not topping the stratiform echo within 10 km of the radar. Some redevelopment in convection 150-200 km to the SW, in addition to the convection 200 km to the S. Convective echo seems to be doing OK, but stratiform echo has definitely reduced in coverage over the last few hours.

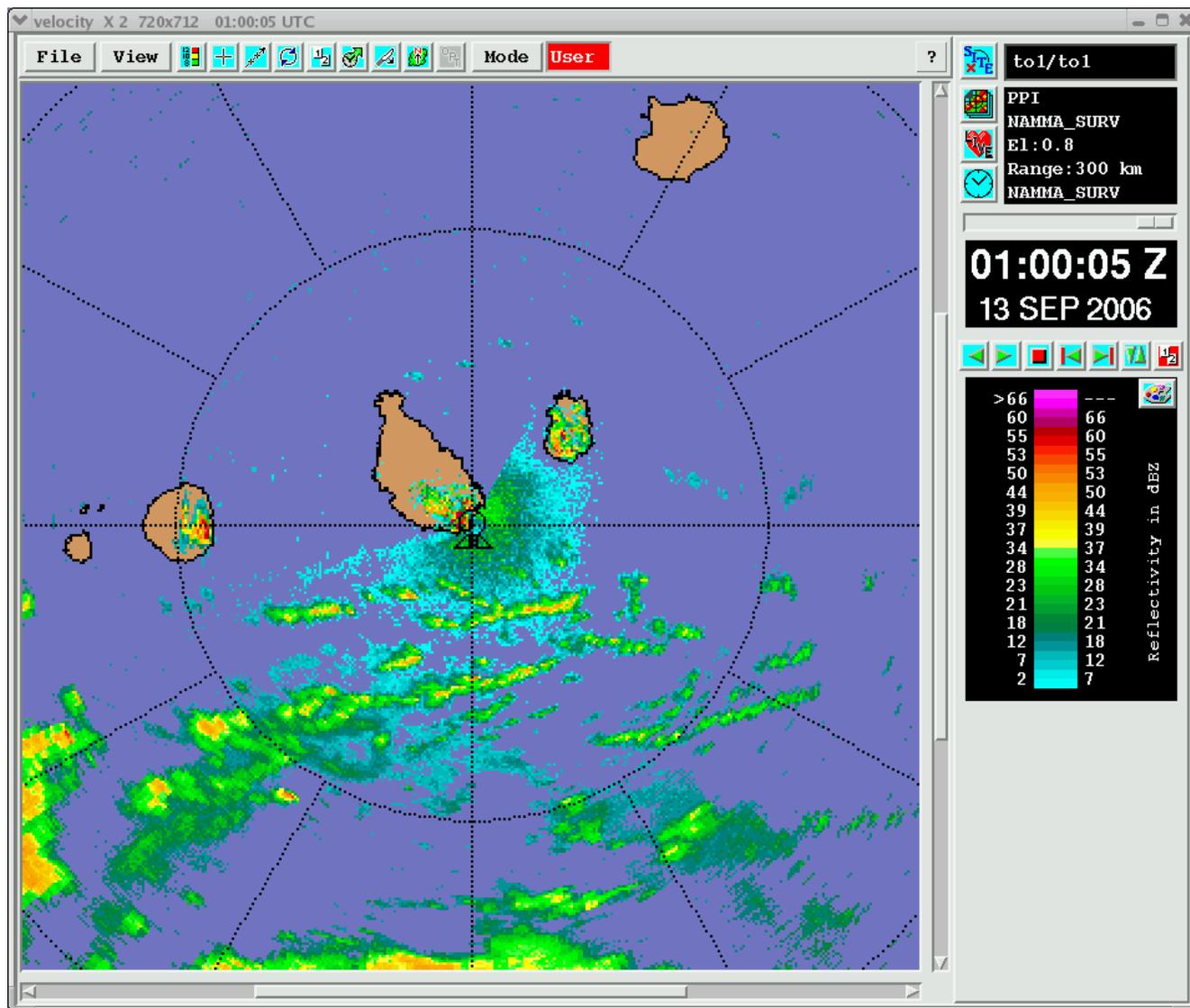


0020Z – New line of 50+ dBZ convection 40 km to the SW.

0030Z – Overall trend toward redevelopment of convection along several lines within 100 km of TOGA.

0040Z – Switching back to NAMMA Far as very nearby echo has faded. However, the overall strengthening trend near TOGA remains in place.

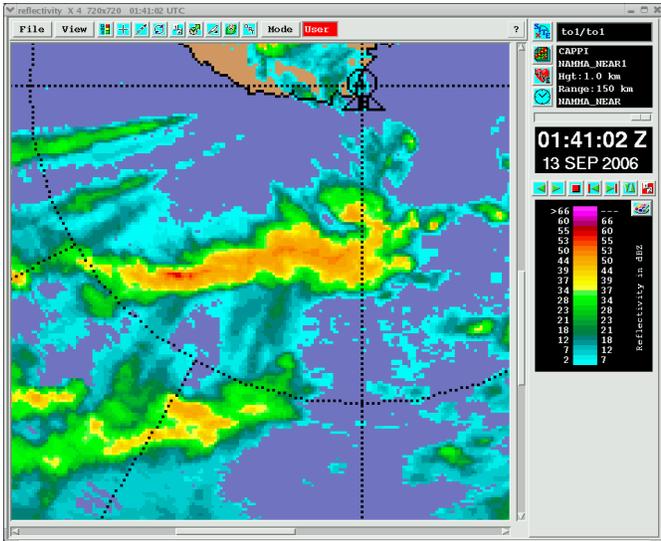
0100Z – A view of the nearby convective lines. Thankfully the weather has cooperated and made up for the lack of redevelopment or on-scope advection in the eastern sector and just redeveloped south of the radar.



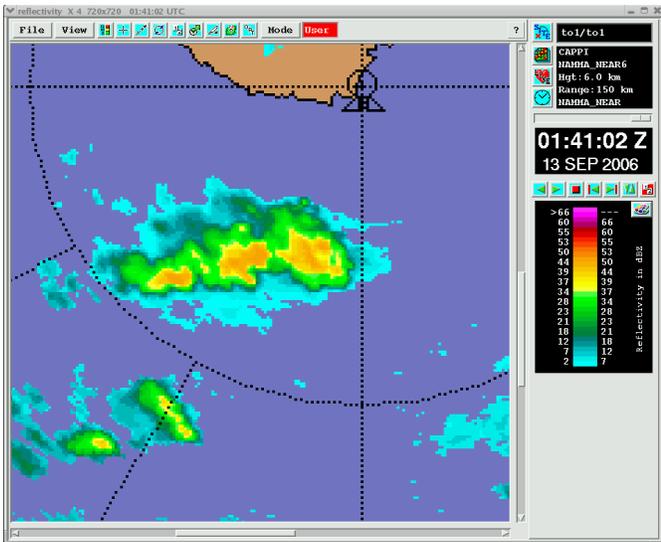
0130Z – Nearby southern convective lines continue to multiply in number and gain in strength. Lots of 50+ dBZ cells. Right now the scans are providing really good coverage of an E-W line due south of the radar, between 20 and 40 km out.

0140Z – Switching to NAMMA Near to better top this southern line, as well as some echo immediately west of the radar. May stay in it a while this time, rather than cycling every half an hour as convection ebbs and wanes. This particular storm to the south is very nice, as of the 0130Z volume it has Zs approaching 60 dBZ, and tops over 13 km. Also have 40+ dBZ at 6 km. Looked outside and don't see any indications of lightning, however. Perhaps it is still too far away and/or too obscured by intervening cloud.

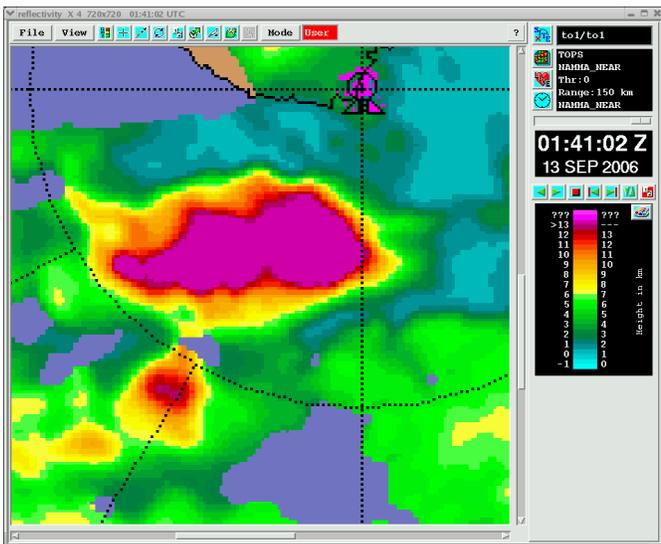
0150Z – Here are some images from the storm. Pretty nice little storm for being over the ocean.



1 km CAPPI – Peak Zs over 50 dBZ



6 km CAPPI – Peak Zs in 40-50 dBZ range

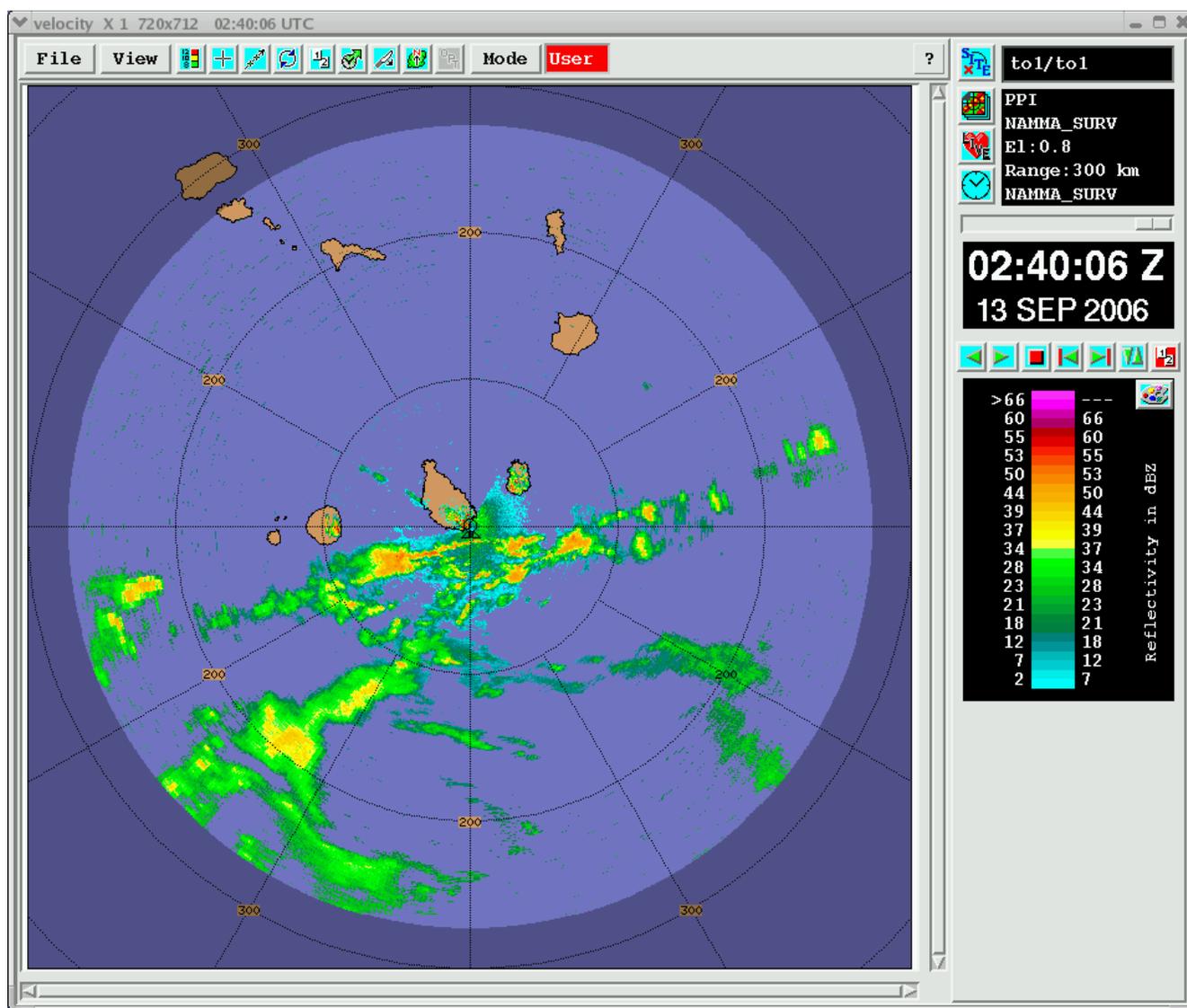


TOPS – Way over 13 km!

0200Z – Playing with the CAPPI tool in the 0150Z volume shows 0 dBZ tops up to 18-19 km now. Finally saw some lightning outside. Think this storm is a bit too obscured to get the full effect. It looks pretty electrified; at least 10 per minute and that's just the flashes I can see. A lot of flashes look to be a bit obscured, as they are on the far end of the storm and I can barely make them out. Caught a nice IC channel that came out of the cloud on the backside of this storm.

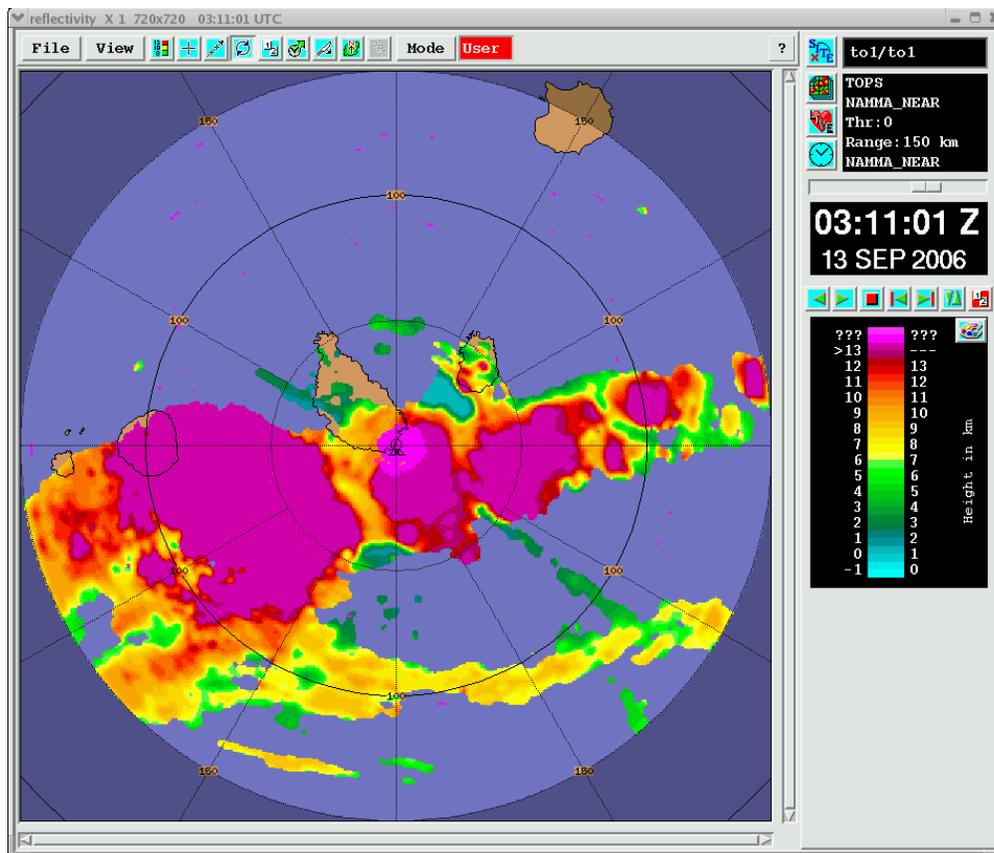
0210Z – At the mesoscale, there is increasing organization among all the short convective lines. They are trying to form some longer and more organized mesoscale lines. For example, some nice developing cores exist along a line stringing east of the main storm. CAPPI tool shows a small core of over 50 dBZ in the 6 km CAPPI at 0200Z on the east flank of the main storm of interest.

0240Z – The line of which the main storm is a part now spans at least half the diameter of the scope. The cells just SW of the radar seems to hold the most promise for continued strengthening. Here is the surveillance of the current situation. Some second trip exists to our northwest.



0300Z – Some stratiform echoes persist at even the highest Near angles. Some of this precip may hit us within the next hour or so. Mean movement is toward the ENE.

0308Z – Light rain at the radar site now. The heavier stuff is coming though. This whole line is going to overrun us.



0317Z – Think I just heard some thunder; hard to tell inside the seatainer. Wouldn't be surprised if it were.

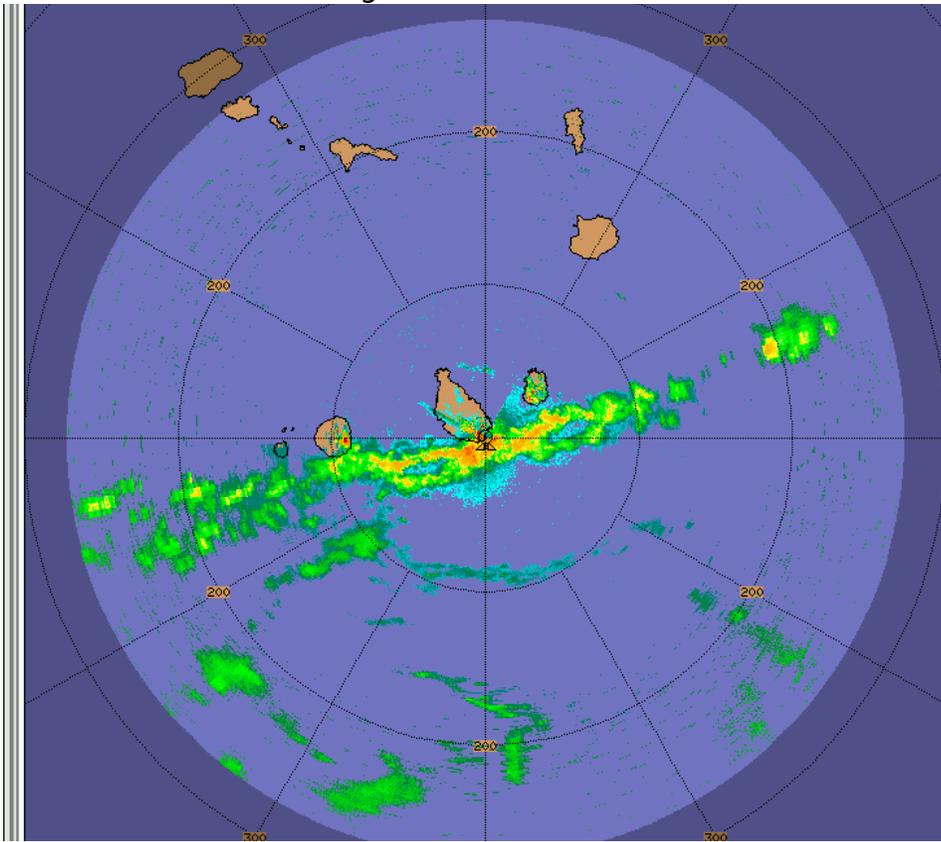
0318Z – Thunder confirmed. A trovada tem chegado.

0327Z – Leading edge of heaviest precip looks to be hitting us very soon. Thunder is close enough to rattle the seatainer. Looks like light to moderate rain out there now. Lightning within a mile.

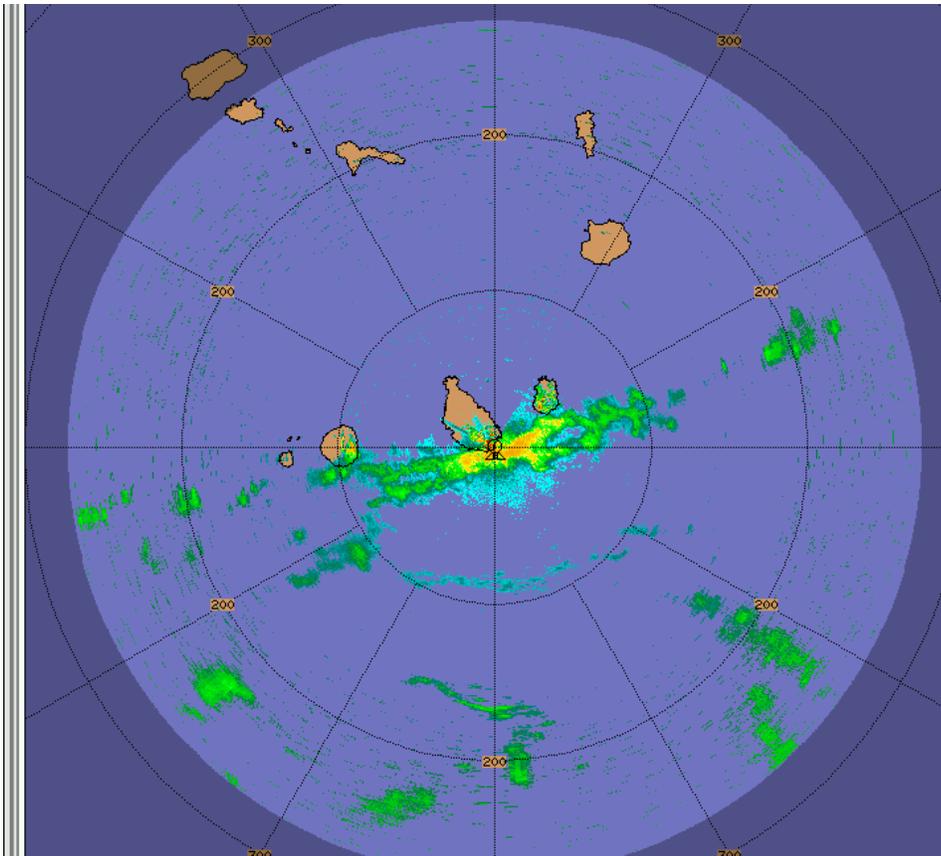
0337Z – The heavy rain has really hit us now.

0340Z – Wow. Attenuation went thru the roof once the heavy rain hit. We lost entire echoes. Check this out:

Before at 0330Z – 0.8 deg Surveillance



After at 0340Z



0350Z – With a line oriented directly along radar beam axes, this case is going to test the limits of any attenuation correction scheme.

0400Z – Tempted to run NAMMA Evad but we'd lose the low-level surveillance since it has 21 angles. Maybe I'll cut off the top angle and try it instead of NAMMA Near for a round or two. I would not describe this as the best evad case given the convective nature.

0410Z – On second thought, sticking with NAMMA Near. The time to do an evad was a couple volumes ago, when the line was more centrally located. We are on the backside of everything now, and really we did not have homogeneity in the echo pattern anyway.

0413Z – Heh ... distant echoes are starting to reappear now that we are on the backside of this line and attenuation is reduced.

0424Z – The radar is now on the back edge of this line. The deluge will soon end. Down to light rain at the radar site.

0430Z – Portions of the line over Sao Tiago have tops up to 18 km, with 40+ dBZ at 6 km.

0500Z – Portion of the line extending west from Sao Tiago is clearly affected by the terrain blocking over the interior of the island. Nice bright band signal at high elevation angles.

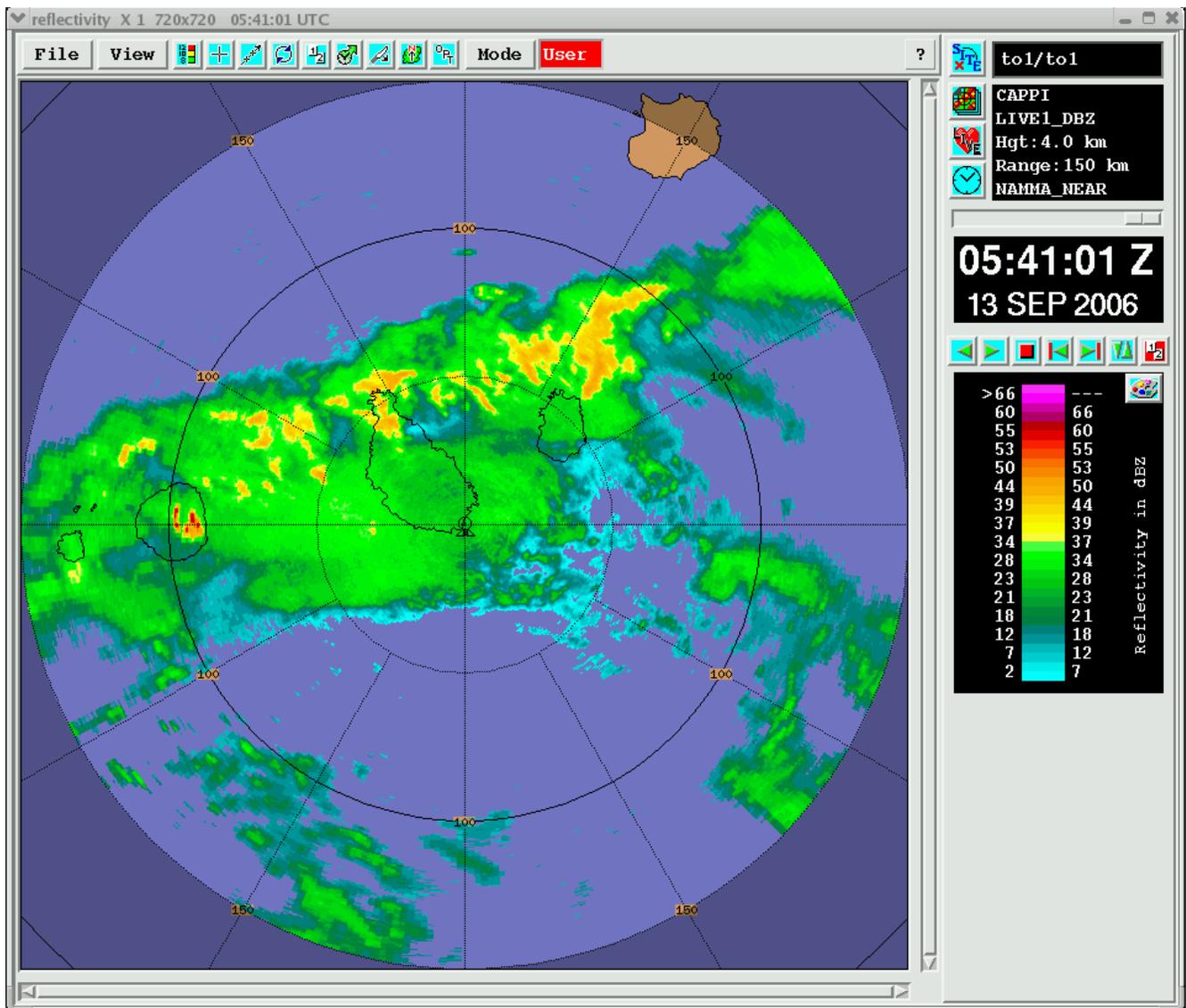
0510Z – Some of the cells in the line show 40+ dBZ up to 10 km. Still light rain at the radar.

0520Z – Trying NAMMA evad for a round this 10-min cycle, covering the stratiform echo behind the convective line that passed thru earlier. Will cut it off early to avoid overrunning on time. Really nice-looking southeasterly jet above the surface, in the Doppler data. Note the folds. [BFS P.S.: Very nice curved rainband and apparent center of cyclonic rotation centered near 205deg/200 km proceeds to spin WSW'ward off TOGA displays over the ensuing 2-3 hours.]

0530Z – Stopped manually after 20th angle (~49 deg) and restarted sequence with NAMMA Evad once more. Will run this one more time and go back to Near scans. We are sort of on the back edge of the strat precip, so I am not sure this is the most ideal evad case. But certainly worth a shot with two dedicated evad scan sequences. Strat echo fills the first 20 km, with the strongest echo in the northern half of that domain. At higher angles, the strat echo is much more uniform, with a very distinct bright band.

0540Z – Regular Near sequence restarted. The convection in the line still remains strong throughout a large portion of it, with plenty of areas of 40+ dBZ near 6 km. However, Healthy chunks of the line are blocked at low levels because it is situated well to our north, behind our terrain blocks. Thus, at first glance it appears to have significantly weakened, which is most certainly not the case yet.

0550Z – Here is a CAPPI at 4 km of the present situation. Classic leading-line/trailing-stratiform MCS. The echoes just north of Maio remain the strongest portion of the line. From loops, the stratiform echo formed after the line started passing over Sao Tiago. Note that due to blockage these mid-level CAPPIs are much better choices for showing the basic structure, as low-level PPIs are too blocked at this point.

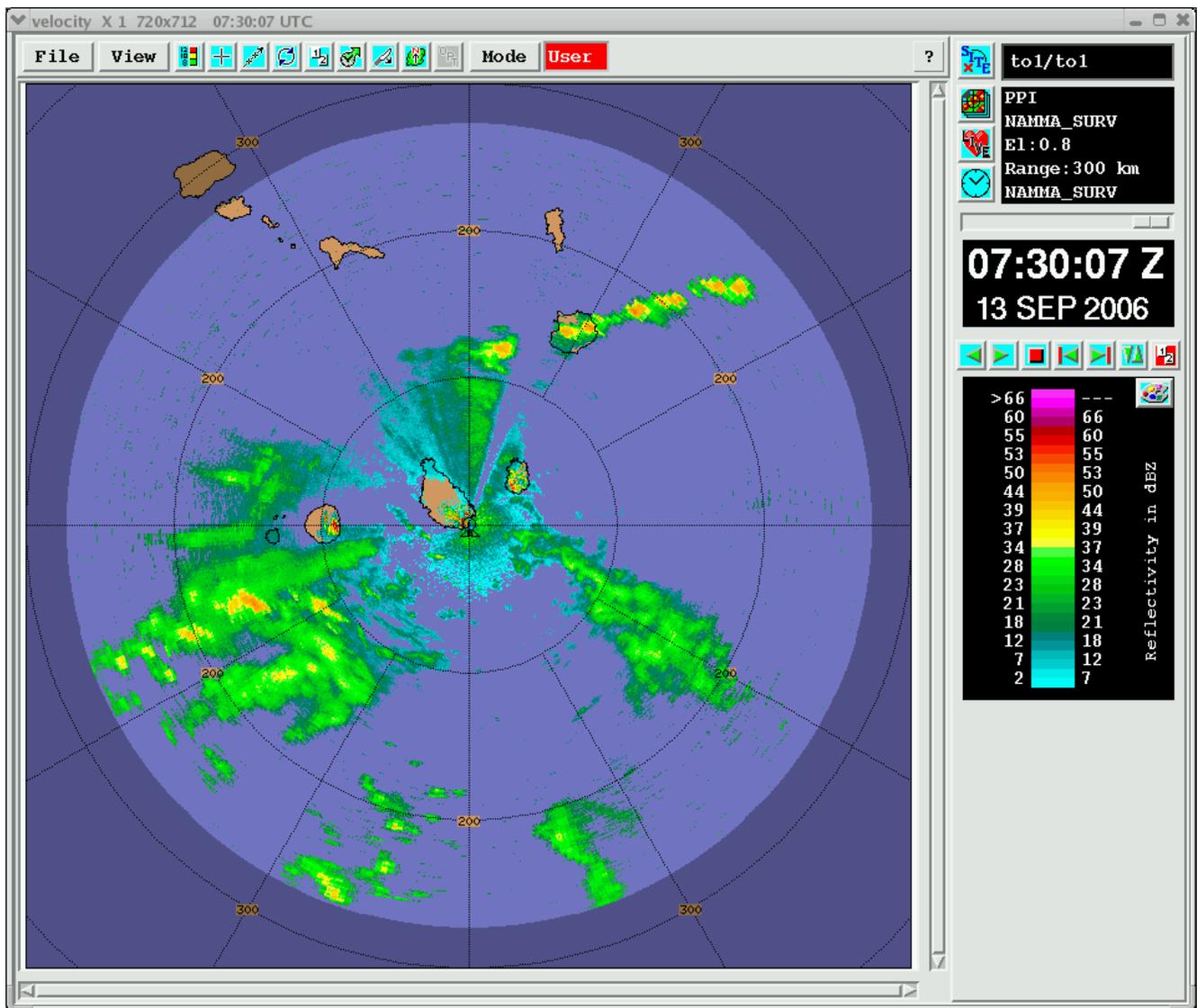


0630Z – New line of convection out in front of the old line, particularly the NE portion which has decayed. This new line extends off the scope.

0640Z – Back edge of strat precip is moving north of radar. Just very light sprinkling at the radar now.

0650Z – New development near/along 240 deg azimuth. Couple with the new NE line, it gives the appearance of a WSW-ENE oriented line that spans the scope, except it is broken and offset near the center. Also, there is a new cell ~20 km SW of TOGA. That cell is fairly isolated.

0730Z – The original MCS appears to have mostly faded into stratiform echo. The NE line still seems to be doing OK, along with portions of the SW line. However, much of the remaining convective echo is out of volume scan range. There are still a few isolated cells immediately to TOGA's SW and W.



0810Z – The SE stratiform echo is decaying as it approaches the radar. A similar fate befalls the SW echo as it brushes past the radar vicinity.0

0820Z – NE line fading. The far SW line not looking too hot either. Overall trend toward stratiform echo continues. Much of the stratiform seems to be able to persist. In addition, scattered cells appear to be able to handle themselves immediately W and SW of the radar.

0900Z – Decaying trend appears to be taking hold scope-wide. However, some scattered convection still is able to develop here and there.

0930Z – Lang off shift. GPS 20s faster than toga1. Smull and George on-shift.

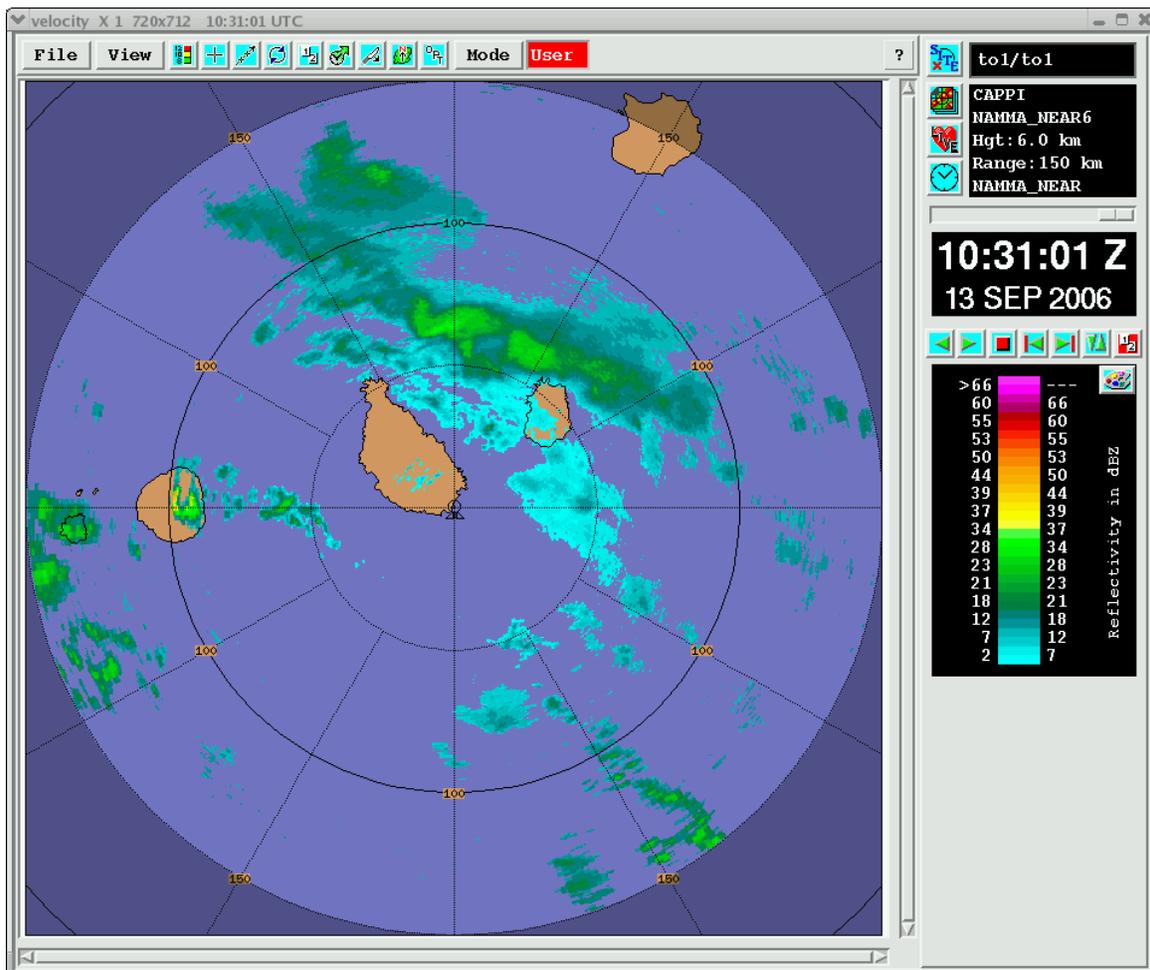
0940Z call to NAMMA Ops: Regrettably, news is that DC8 is grounded today.

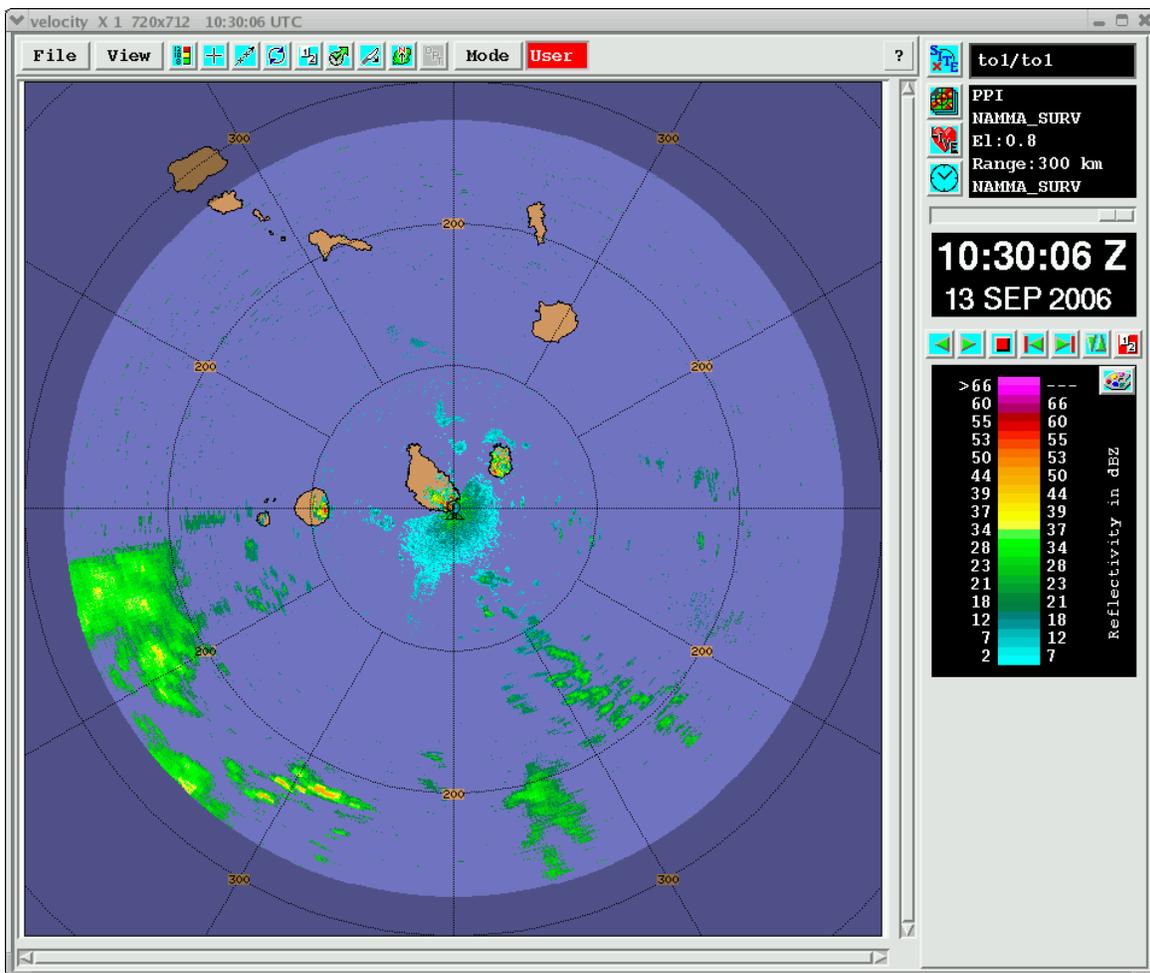
Based upon quick perusal of web-distributed flight tracks/FL from hotel this am, yesterday's DC8 mission appeared to be quite successful. However Heymsfield reports the DC8 sustained a lightning strike (likely triggered) that did damage to the trailing edge of an elevator. Rules state that this is a grounding condition and that the only suitable repair is replacement. Thus DC8 is grounded for the foreseeable future. Those scientists in Sal who

planned to ferry back home on DC8 tomorrow late this week will either have to fight for limited commercial seats or await the C-5 cargo airlift. Gerry sounded seriously bummed, though he appreciated that we at TOGA are still operating. Did a summary de-brief of our great operations over the past 24h.

NAMMA forecast support has also ended (effective yesterday). Brief discussion re: outlook (w/ input from Bill LaPenta) indicates that not much is expected to occur through Friday in the wake of this major developing storm. There is a disturbance in the wave train approaching W Africa, but not expected to arrive our longitude until very late Friday or Saturday. We will thus have to do watch wx independently and carefully evaluate our options. Current thinking is we should be conservative and will operate at least through at least the bulk of the day Friday. Will of course caucus w/ Rob Cifelli on this subject via email.

1030Z: Few straggler cells (including multiple N-S oriented "rice-grain" tiny cellular elements in high-elevation scans immediately above radar) passing overhead, so will maintain NAMMA_NEAR sequence for awhile longer. However larger rotating echo feature with curved band(s) containing convective elements is now beyond 200 km in SW sector. It's northern portion is severely blocked. This is the last major precipitation feature evident in PPI's as the outer fringes of TD#8 (soon-to-be TS Helene?) exits our scanning domain. HOWEVER, RHI's/CAPPI's extending to levels at/above 3 km (cf. 6 km CAPPI attached). This speaks to notably high evaporation rates in the lower troposphere on the outer fringes of this developing TS.





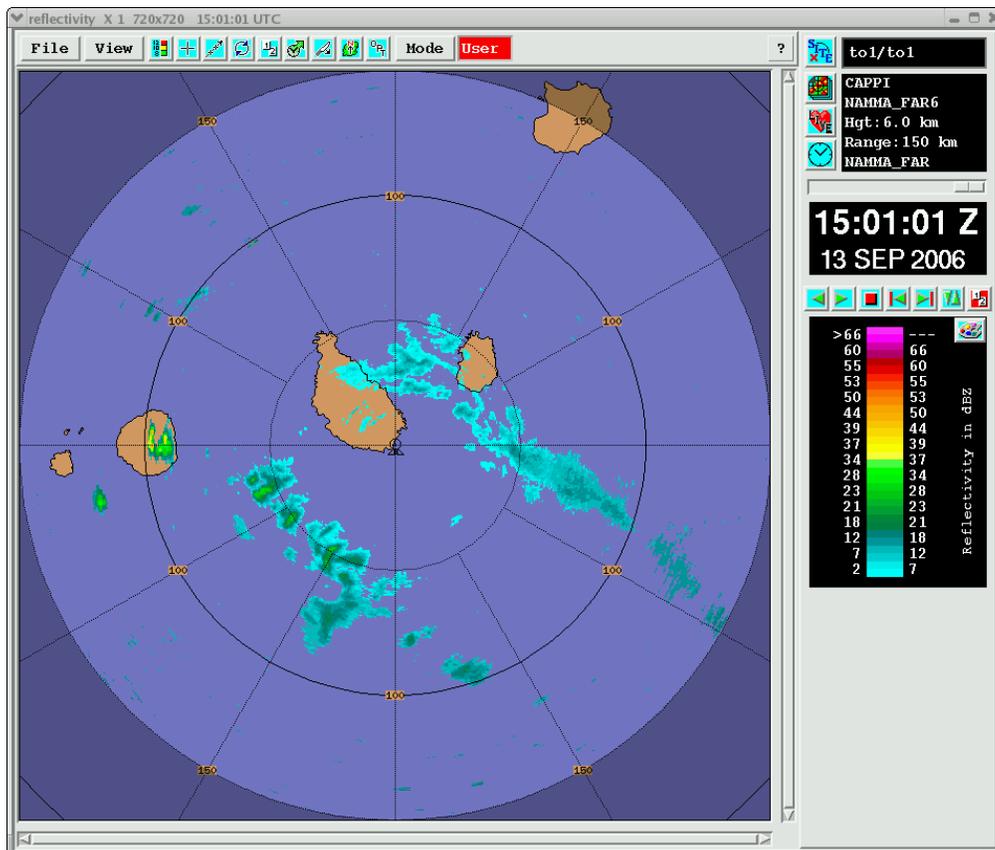
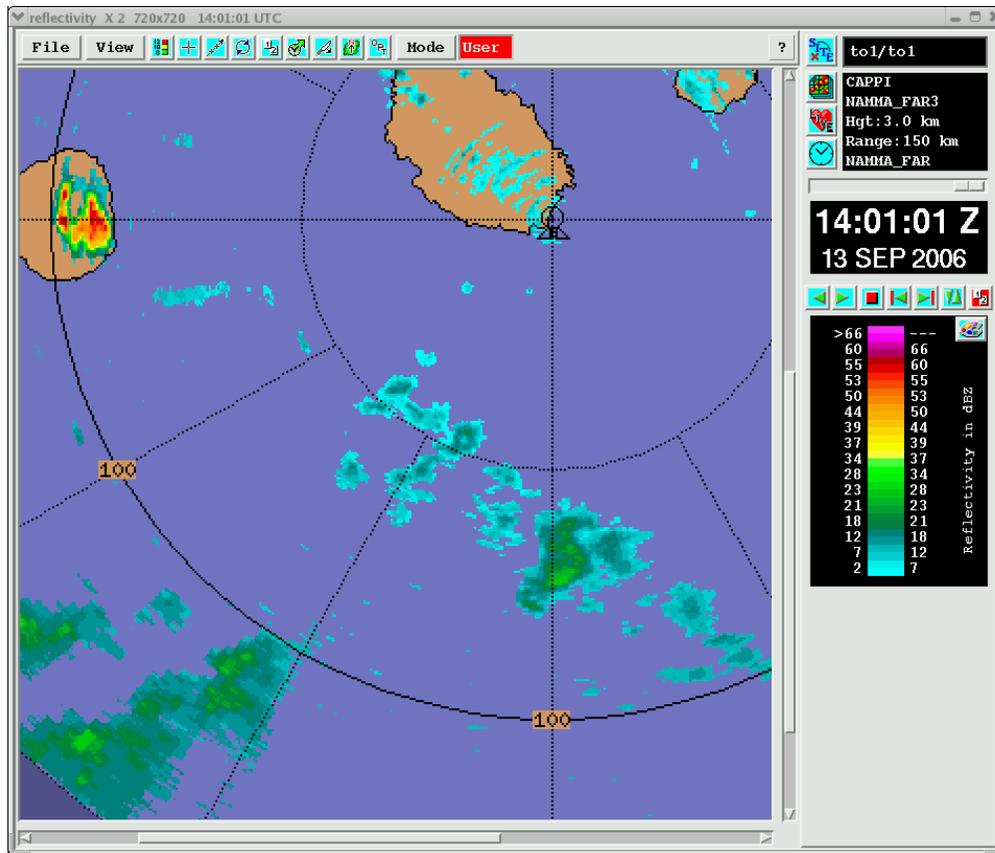
1130Z: A few additional intense convective cells are circulating N-NW'ward into far SW reaches of our surveillance domain, but appears we're on the verge of bidding adieu to TD#8. Small straggler cells concentrated along a ~ill-defined WNW-ESE band are approaching Sao Tiago from E, hence maintaining NAMMA_NEAR sequence for a bit longer.

1230Z: Anvil-like echo overhead in NEAR scans, with relatively intense E-W band of cells sweeping NW'ward out beyond 150 km to our SW. Sun now dimly visible through cirrus anvil (with multiple broken layers below).

1300Z: Switching back to NAMMA_FAR eff. 1311 scan. Only remnants of previous echoes are left. Only portion with some convection is to the SW of TOGA starting at 150km, but only a small area. Otherwise, there are only small weak echoes scatter about the scope. There is still some high stratiform to the NW that can be seen on the 6km CAPPI, but it is much smaller than the previous few scans.

1400Z: The echoes continue to diminish and move with a NW track. Coverage continues to be somewhat more widespread aloft (cf. Attached 3km CAPPI), indicative of continued low-level evaporation here on the NE fringe of the cyclone.

1500Z: Echoes confined to increasingly higher levels, with NW'ward motion still suggestive of at least weak banding about cyclone center now well to our SW; cf. CAPPI at 6km:



1630Z: A distinct band (or perhaps two) of widely scattered small cells is pushing its way N'ward into SW sector. Echo coverage/intensity is extremely limited, however.

1800Z: Remaining few spotty echoes to S of TOGA are rapidly dwindling w/ sunset. A few popcorn-type cells have developed immediately S of Sao Tiago.

1950Z: Cells previously clustered S of Sao Tiago have started moving N'ward, so will shift to NAMMA_NEAR eff. 2001Z (though expect this to be brief). 1955Z: RW at the radar.

2025Z: Shallowness of this activity (<3 km deep!) makes it prone to getting "lost in the clutter" over land (tho not water), but more importantly points to a warm-rain (collision/coalescence) type precip process. Returning to NAMMA_FAR eff. 2031Z.

2100Z: Strangely, the interaction w/ Sao Tiago (and possibly Maio?) appears to have effectively destroyed this broken line. Granted it was shallow and not particularly intense, but unlike the "Fogo hit" of several nights ago, the scale of this band of showers seemingly exceeded that of the island(s).

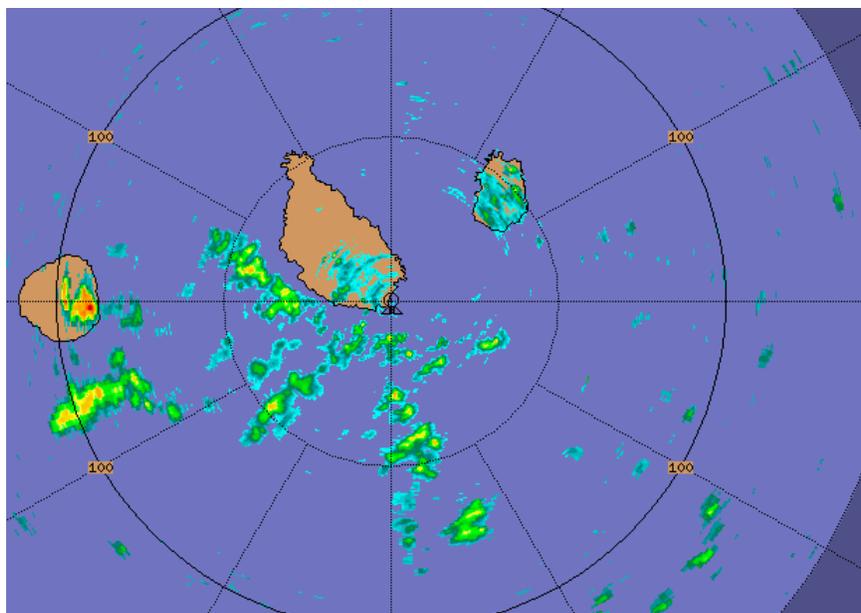
Another little round of these showers is approaching from the S, however locally stars are visible.

2130Z: Smull & George off.

2130Z – Lang on shift.

2220Z – Cells continue to move northward and develop, and become increasingly organized, but have not reached TOGA yet. Switching to NAMMA Near in anticipation of needing a bit more to top the cells soon.

2300Z – Here's a 2 km CAPPI from the last 10 min of data, showing the increasing organization of this shallow, warm convection. Still headed our way, but it's taking its time.



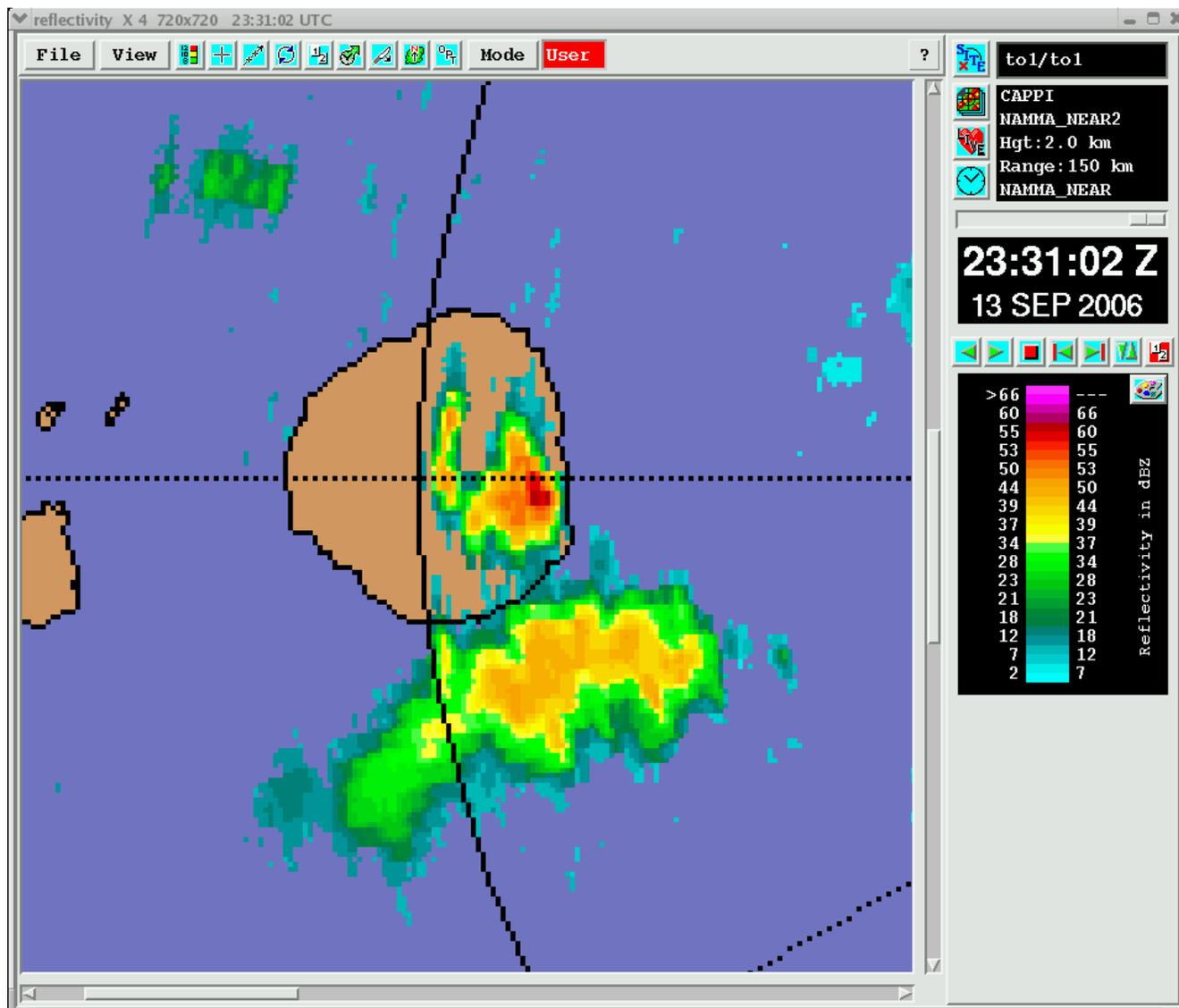
2310Z – Some of the cells now hitting the SW coast of Sao Tiago.

2320Z – Looks like another short line of convection is going to hit Fogo. (Again!)

2330Z – NAMMA Near not topping a cell immediately S of TOGA.

2335Z – Rain at the radar.

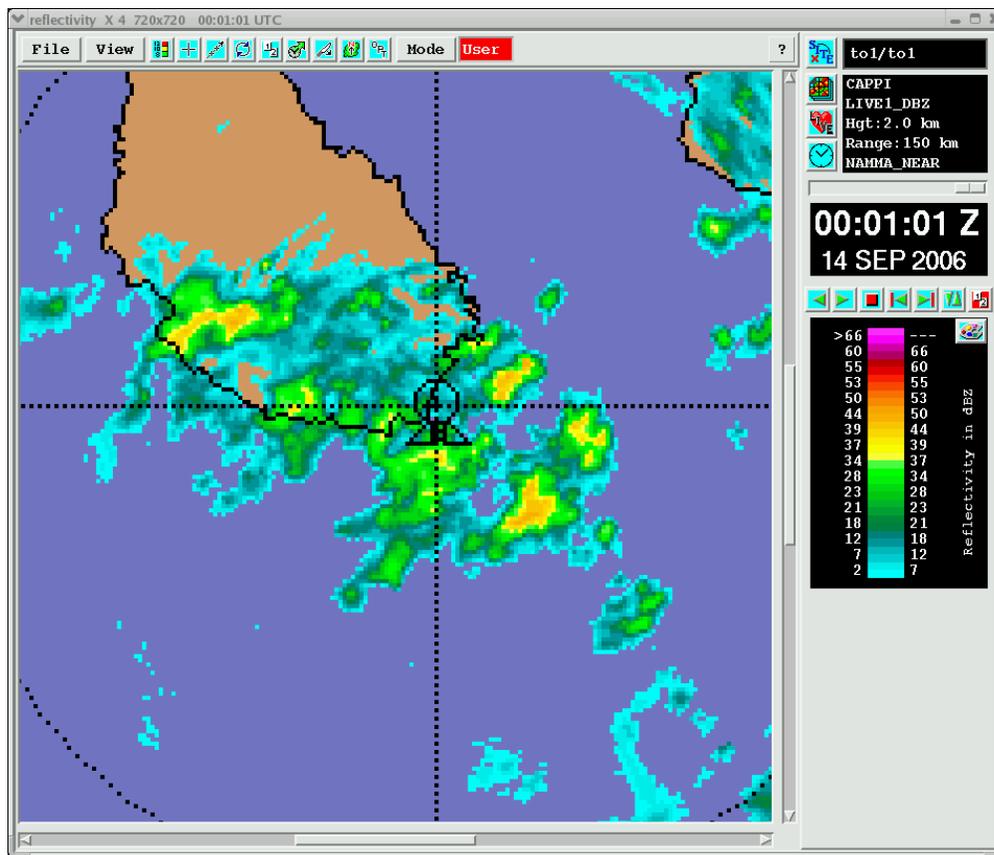
2340Z – Here is a shot of Fogo Hit, Mark II.



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0000Z – Much like before, the line hitting Fogo is decaying after the collision. The GPS is about 30 s ahead of toga1.

0010Z – Here is the convection over Sao Tiago. The widespread scattering has collapsed into a morass of shallow echoes that are busily colliding into Sao Tiago. Still raining at the radar. However, that echo does not survive the hit for very long. There was a minor collision of a small line with Maio too.



0040Z – Some new scattered quasi-stationary echoes have formed 100-200+ km to our south. The Sao Tiago convection going up the channel between ST and Maio seems to be hanging together better than the convection hitting ST itself.

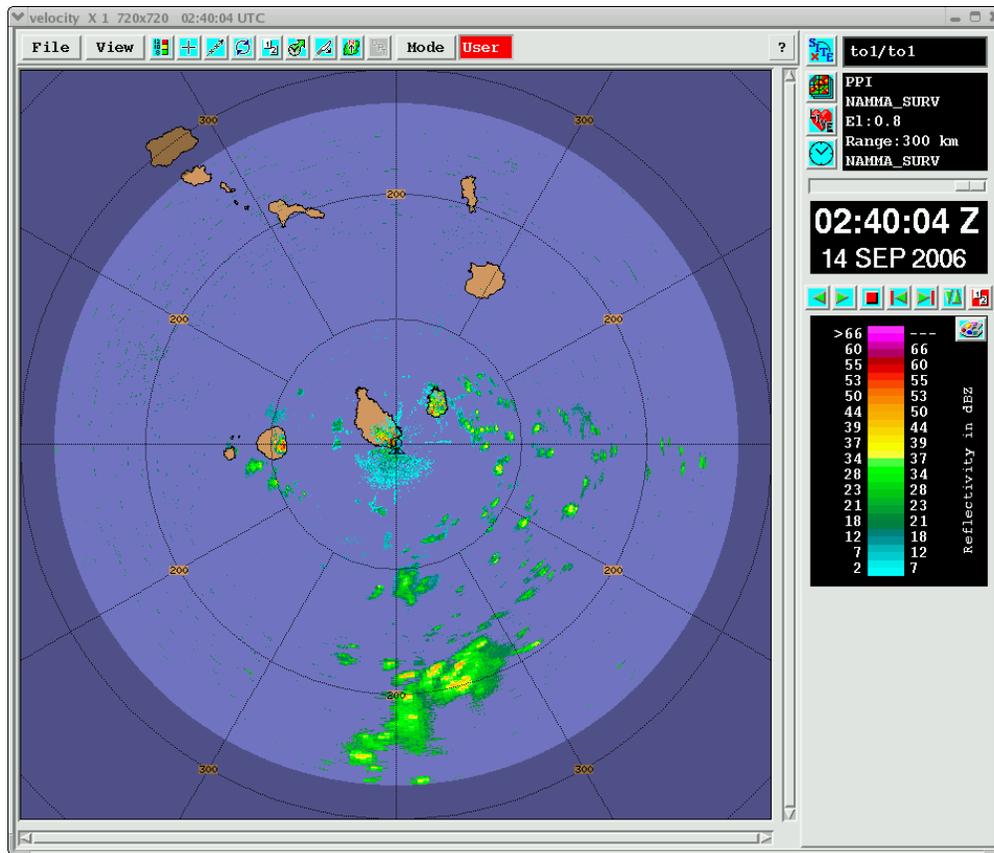
0100Z – Nice storm about 80 km to our west. It formed from the Fogo line – the part that didn't hit the island. Clearly, island collisions are the kiss of death for convection in these parts.

0200Z – Set of new echoes has formed over 100 km to the east. Otherwise, the main echoes of interest are these storms to our south. There are two main cell complexes, the first at about 100 km south and the second at 200 km. There is also some storms remaining along the ST coast as well as the remains of the Fogo convection, both to our WNW. Rain has stopped at TOGA.

0210Z – Going back to NAMMA Far, given the lack of rain near the radar.

0230Z – Nice 40+ dBZ storm 50 km to our WNW. Loops show the convection that passed northward to the east of ST ended up tacking to the NE and striking Maio, with the expected result from such an island collision. The entire SE quadrant from the radar is now full of scattered convection.

0240Z – Here is the current scene.



0320Z – New line of convection forming just south of Fogo. Popular island tonight. Southern convection at 200 km continues to organize. Some of the Maio convection has redeveloped NE of the island, while much of the convection due east beyond 100 km from TOGA has faded. There are some decent eastern cells within 100 km, however, some of that being the Maio stuff. Scattered convection continues to persist in select locations elsewhere.

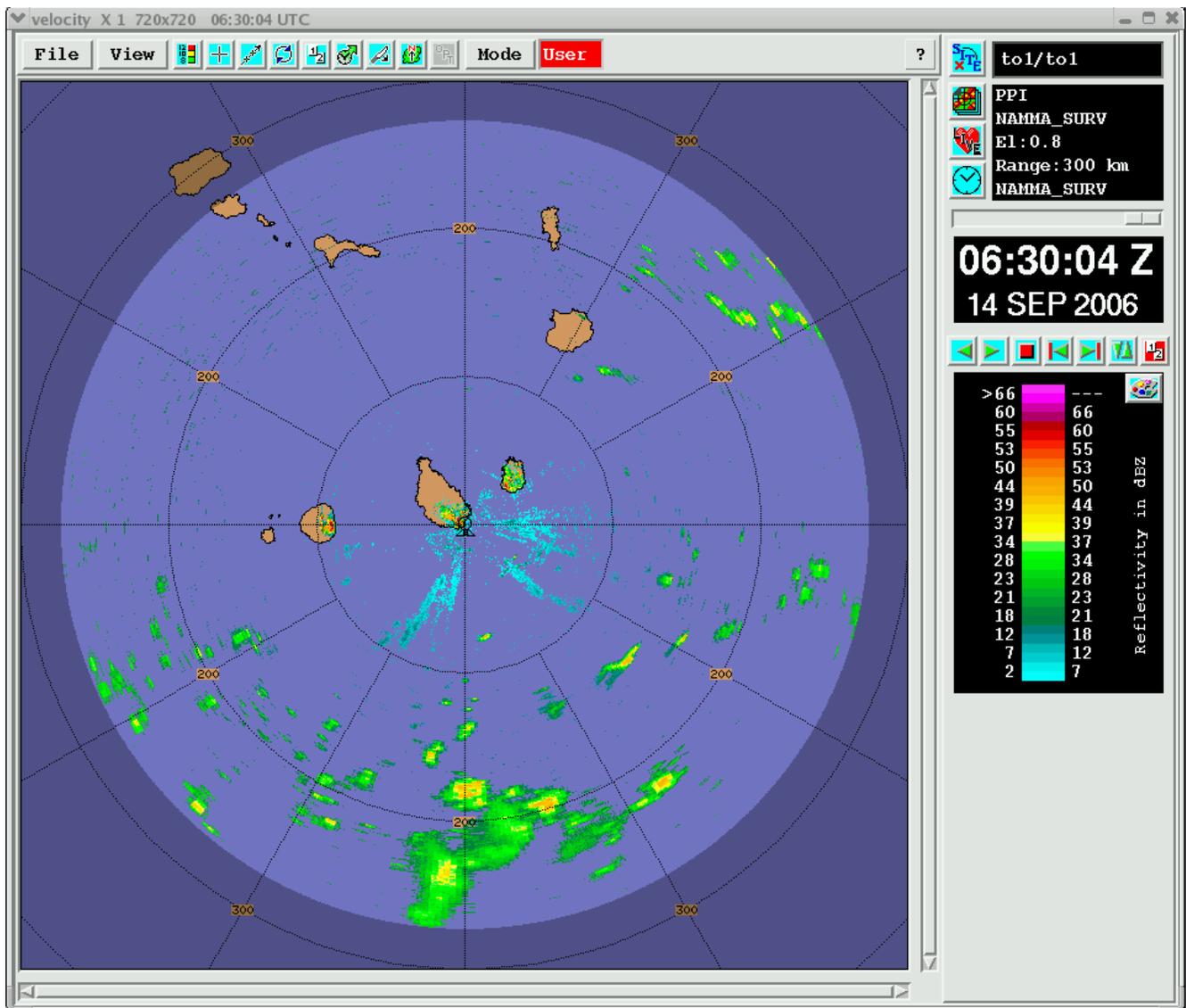
0420Z – Seems to be a decreasing trend for most convection, the main exception being the storm 200 km to the south.

0500Z – A fair amount of second trip, even on the long-range surveillance, especially toward the E and S.

0530Z – Mostly scattered convection continues, with the far southern storm remaining the only really organized thing on the scope. Not much within 100 km of the radar, however.

0600Z – Echo coverage slightly increasing on long-range convection. Still pretty quiet within 100 km.

0630Z – Echo resurgence continues, including some new cells within 50 km of the radar. Here is the current situation.



0730Z – Getting pretty active all across the southern half of the scope. Otherwise, there are some cells ~200 km away to the NE.

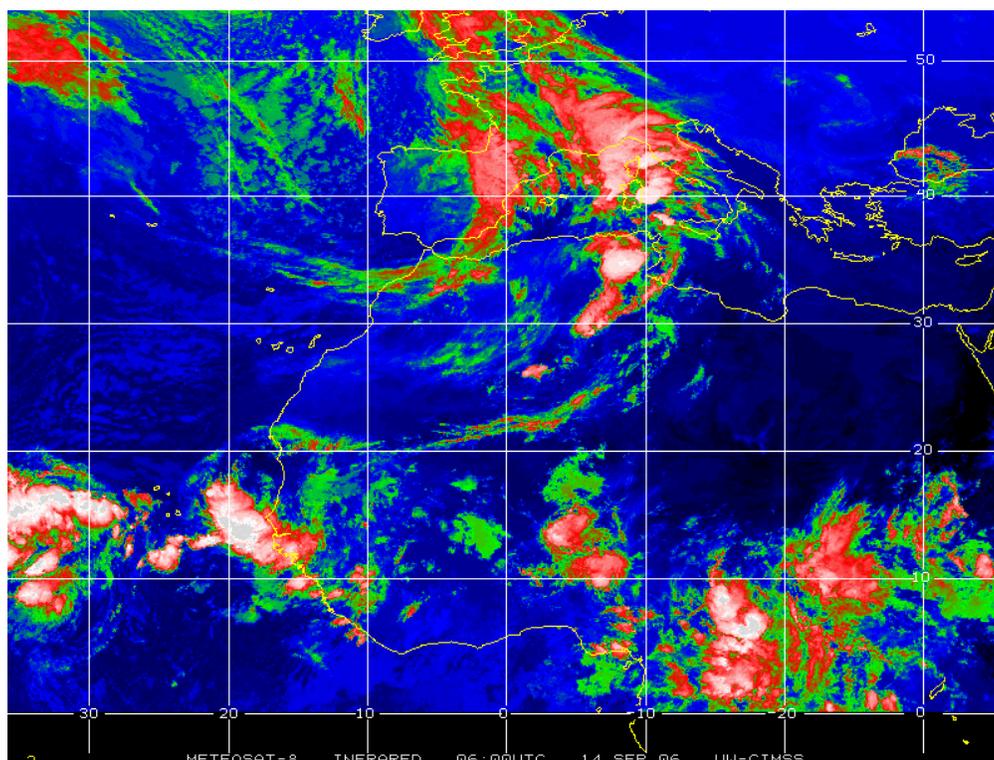
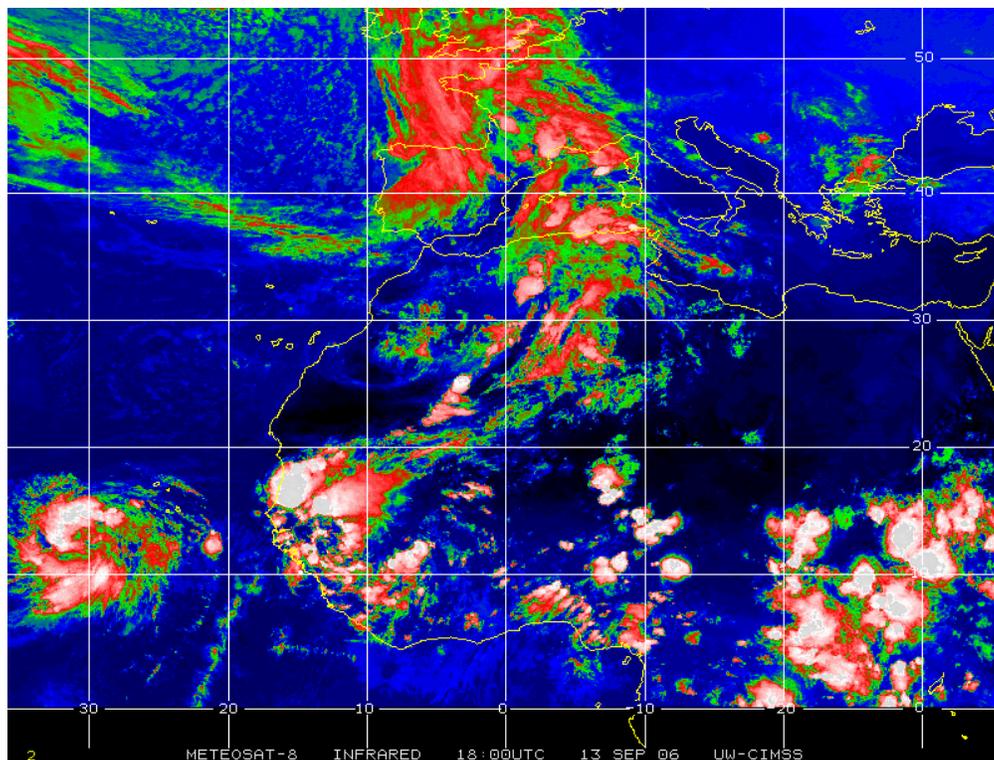
0830Z – Looks like an MCS organizing just off the scope to the ESE. The southern convection is maintaining itself. The northeast stuff is fading, and there are a few scattered cells just beyond 50 km, but only one or two within 50 km.

0900Z – Some 50+ dBZ cells SE at 40 km. Some weaker cells same direction at 20 km. Also, a cell at 40 km along the NE coast of Sao Tiago. Overall, increasing but still scattered cells within 100 km of TOGA.

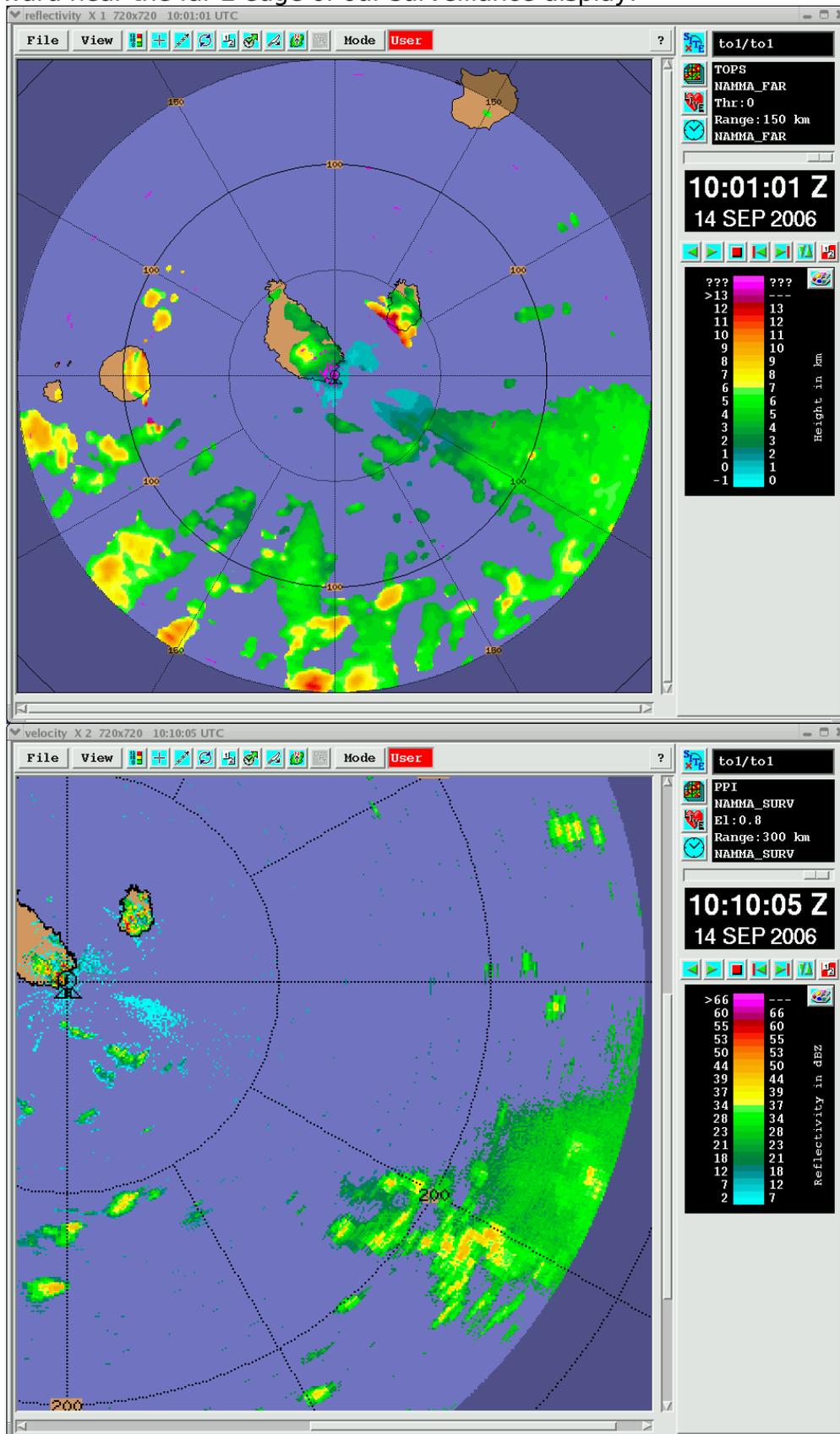
0930Z – Lang off shift. GPS ~40s ahead of toga1. Really doesn't take long for this clock to drift. You know, after all these days with hints of cyclonic rotation, if there is any hint at mesoscale rotation this morning it is anti-cyclonic.

0930Z: George & Smull on-shift. We say “Amen” to the above comment—the overall echo motion pattern (N'ward to our west, S'ward to our east) is trending toward anticyclonic. Goodly bit of 2nd (3rd?) trip in SE sector may relate to large cloud shield shown in Meteosat

Imagery, which evidently came off the coast of Senegal last evening and, as of 05UTC, had a leading/western edge near the Senagalese coast last night but near 21degW this morning. (See following pair of images; also note circulation that was earlier this morning christened "TS Helene" propagating W'ward out of view). Note that IR temp pattern in this morning's (lower) image is suggestive of leading line/trailing stratiform system propagating SW'ward, i.e. not truly toward but generally to aimed more to the S of CV. We'll see...



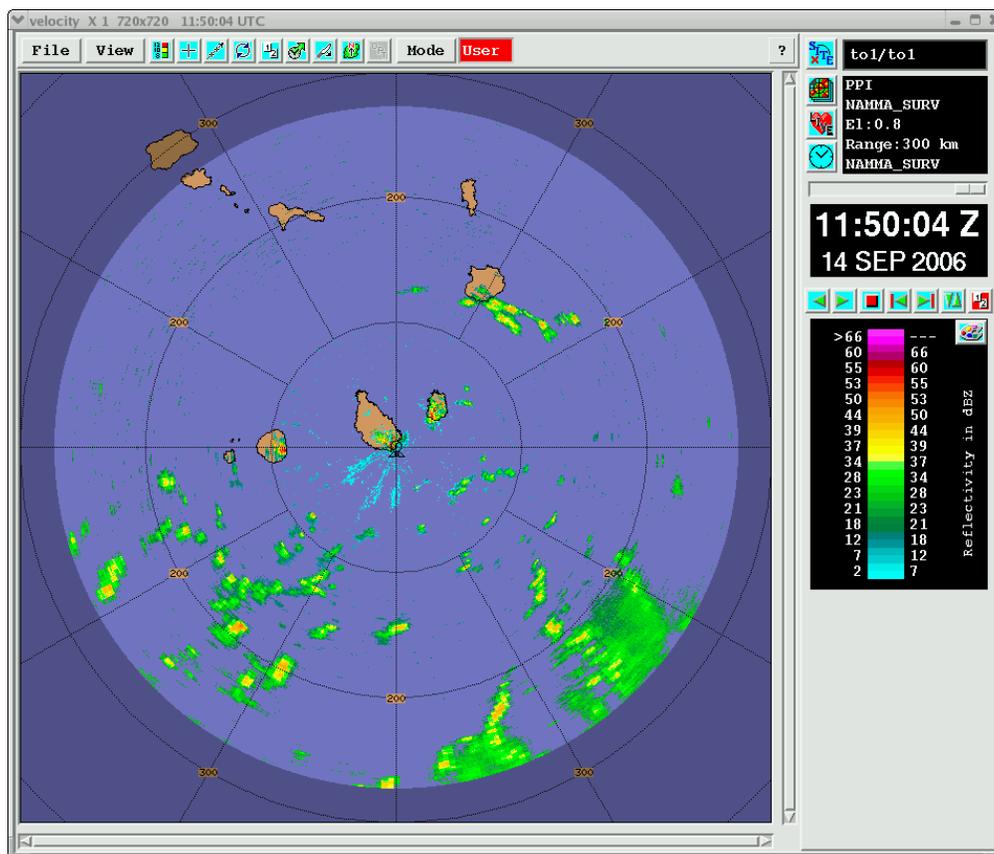
The aforementioned leading-line/trailing stratiform structure is increasingly suggested by a region of higher tops and the general reflectivity patterns associated with an apparent MCS sliding SW'ward near the far E edge of our surveillance display:



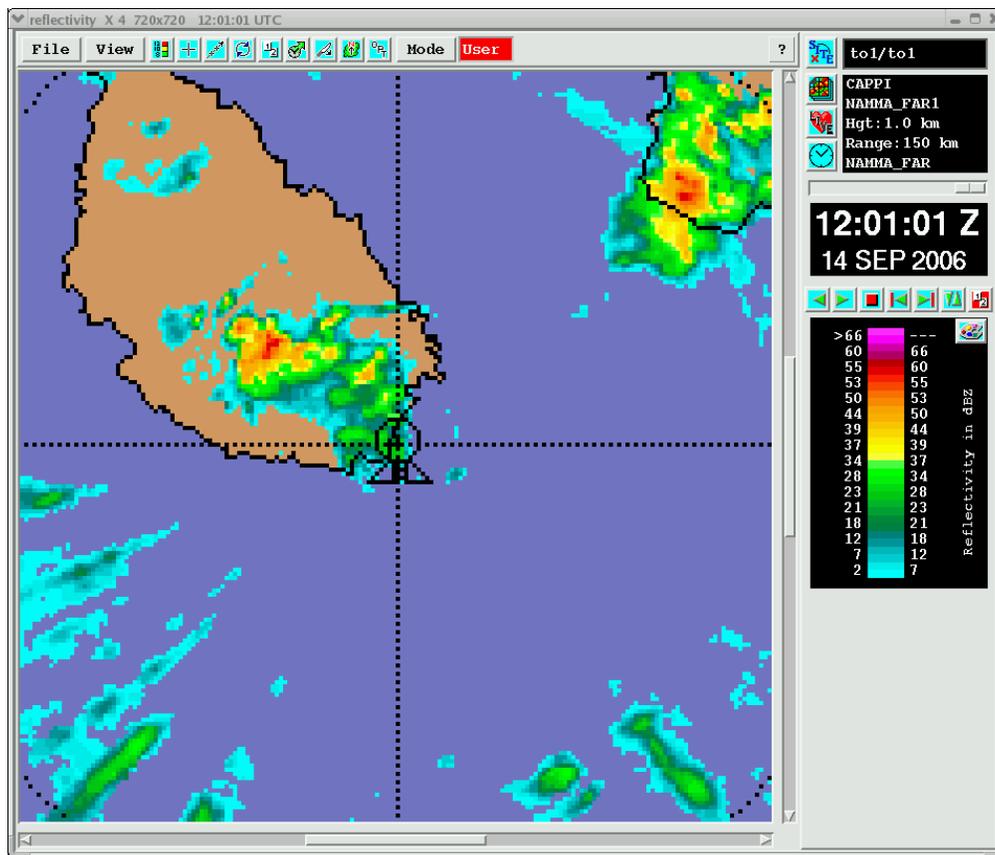
1040Z: Scattered cells are around mostly to the SW and S of the radar. There is a convective and stratiform region that is starting to form to the SE around 200km. This could be the W edge of the larger system seen on the satellite image.

From a synoptic-scale perspective, review of satellite imagery of last two days (esp. in view of current tendency from N'ward to S'ward echo motion across our display from west to east) is suggestive of a relatively short wavelength AEW wavetrain anchored by TS Helene to our W and a trough axis behind (E of) the convection currently advancing onto our E edge of our displays. Yet another wave axis and associated area of active convection is poised to enter the main AMMA observational array in Niger (viz. cloud edge near 5degE in 2nd image of above satellite pair valid 06 UTC 14 Sept). Clearly this far eastern feature cannot reach TOGA prior to shutdown late tomorrow. Thus the wave-induced activity presently between TOGA and the African coast looks to be the "last show" playing on our screens for NAMMA.

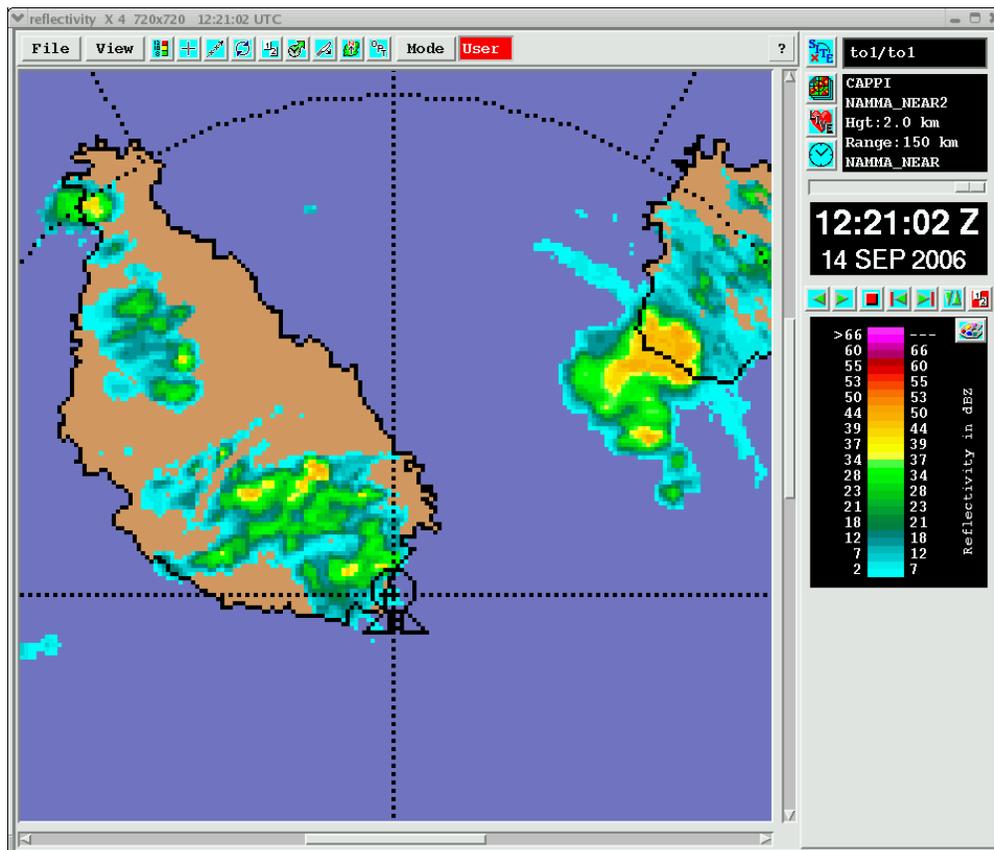
1150Z: It's been drizzling lightly at radar site, but no significant echoes or organization of returns near us so maintaining NAMMA_FAR sequence. Portion of MCS in-range currently entering S/SE sector; most echoes are confined to region S of TOGA with exception of cluster of cells moving SW'ward past Boavista (and generally towards Maio):



1208Z: Some evidence of cellular (evidently orographic) development over S end of Sao Tiago, primarily just NW of radar site, so shifting to NAMMA_NEAR eff. 1211 UTC volume.



1230Z: Top (53.4deg) scan is just barely topping a cell out on our 300deg radial. A nice ~line of cells appears to be forming near long-axis of Sao Tiago, as well as over Maio:

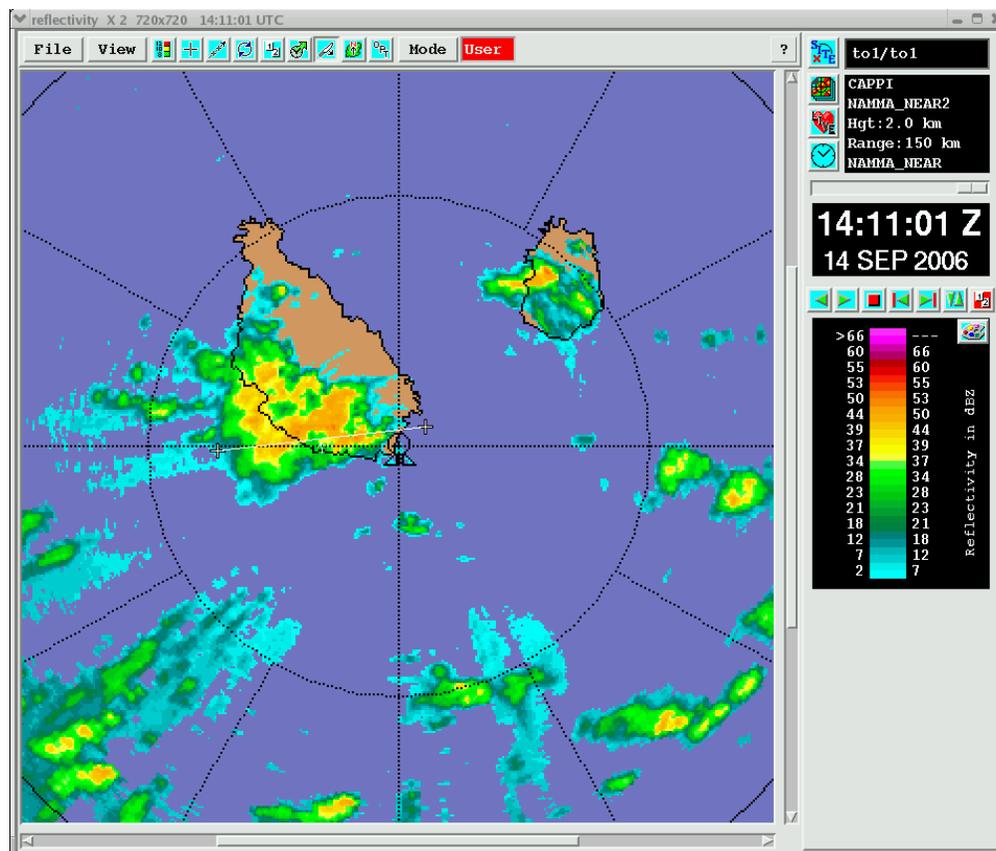


Aside: During drive to the site this morning, we noted a particularly nice line of TCu over the higher terrain to NW. Atmosphere was obviously quite moist overall, with multiple cloud layers (but with sunbreaks). Virtually no evidence of dust, however, and outside vicinity of showers visibilities appear to be quite high.

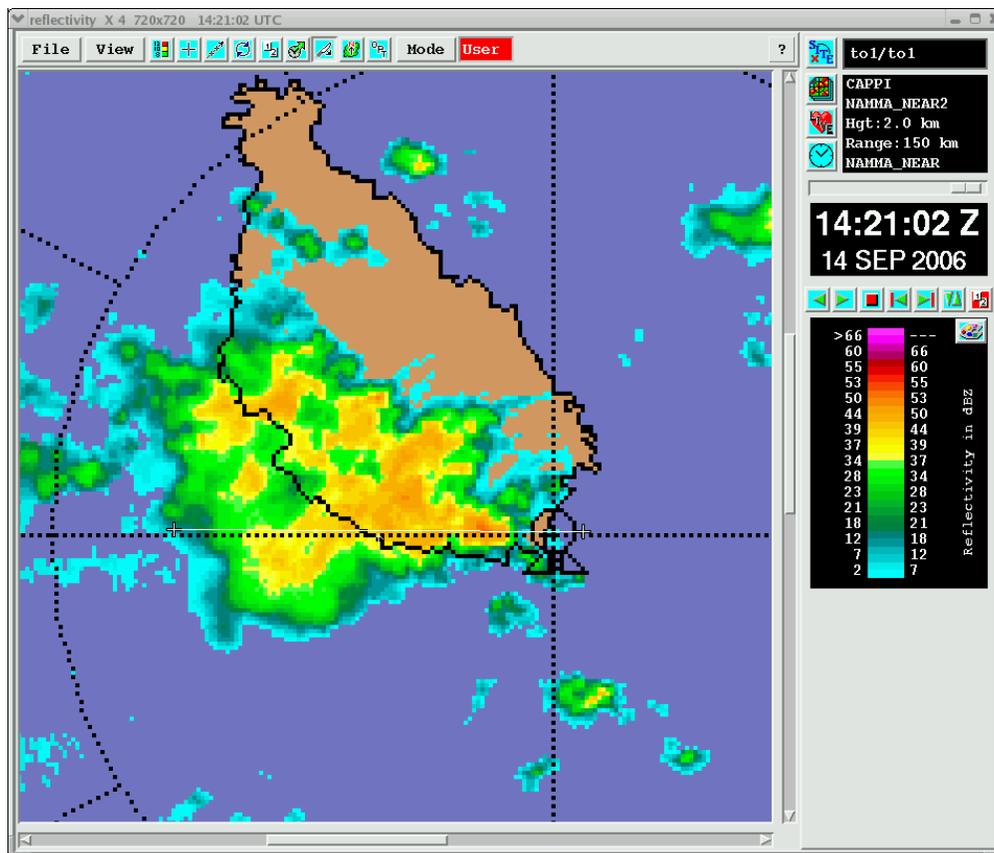
1300Z: Cells just SE of the radar appear to be organizing into a line oriented loosely NE-SW and are somewhat quasi stationary for the moment. There is also a line of convection near Boa Vista that is heading toward the radar. Still very scattered cells over most of the southern part of the scope.

On a broader scale, the MCS skirting our SE boundary is now exiting our surveillance display. Other widely scattered echoes remain mainly in our SE-SW-W sectors.

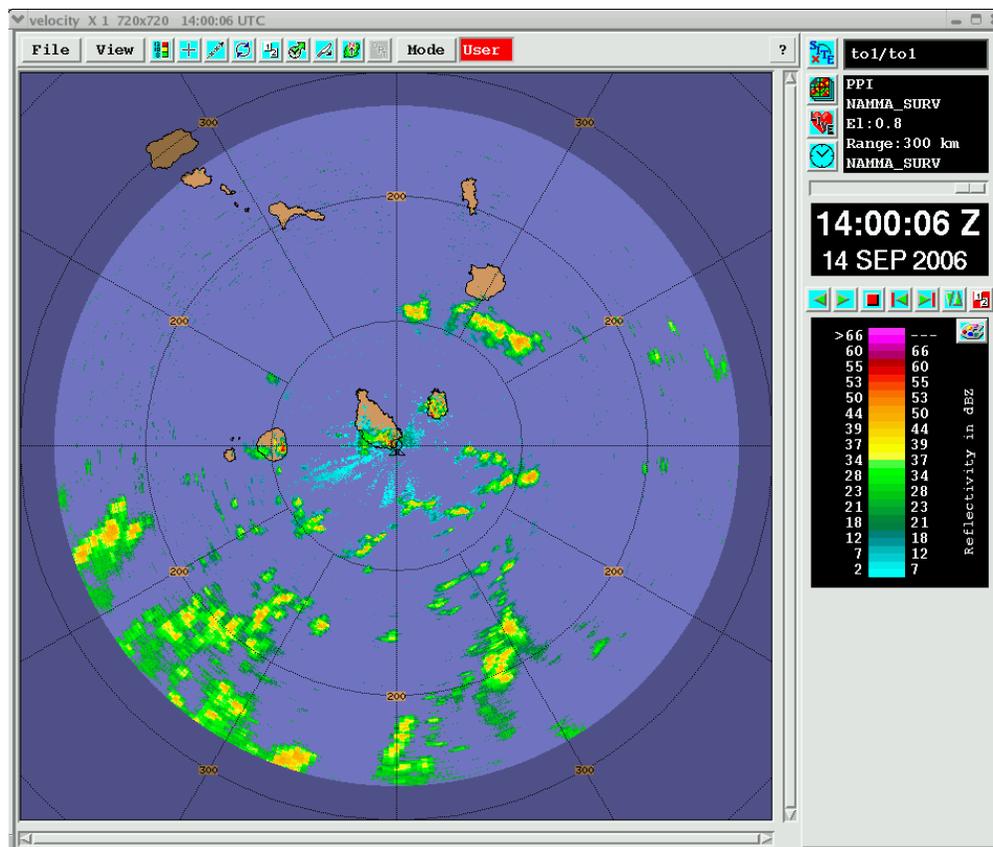
1400Z: Intense convection remains anchored to the high terrain of Sao Tiago. Persistent heavy (30-40 dBZ rains) over the higher mountains above Praia are likely causing flash-flood problems. Naturally NAMMA_NEAR scanning continues. Cross sections (photographed) suggest an E-W transition from convective to more stratiform echo structure. This raises a question as to whether orographic processes may have played some role in helping to establish widespread stratiform precipitation immediately W of Sao Tiago during the 3 September NASA DC8 coordination.



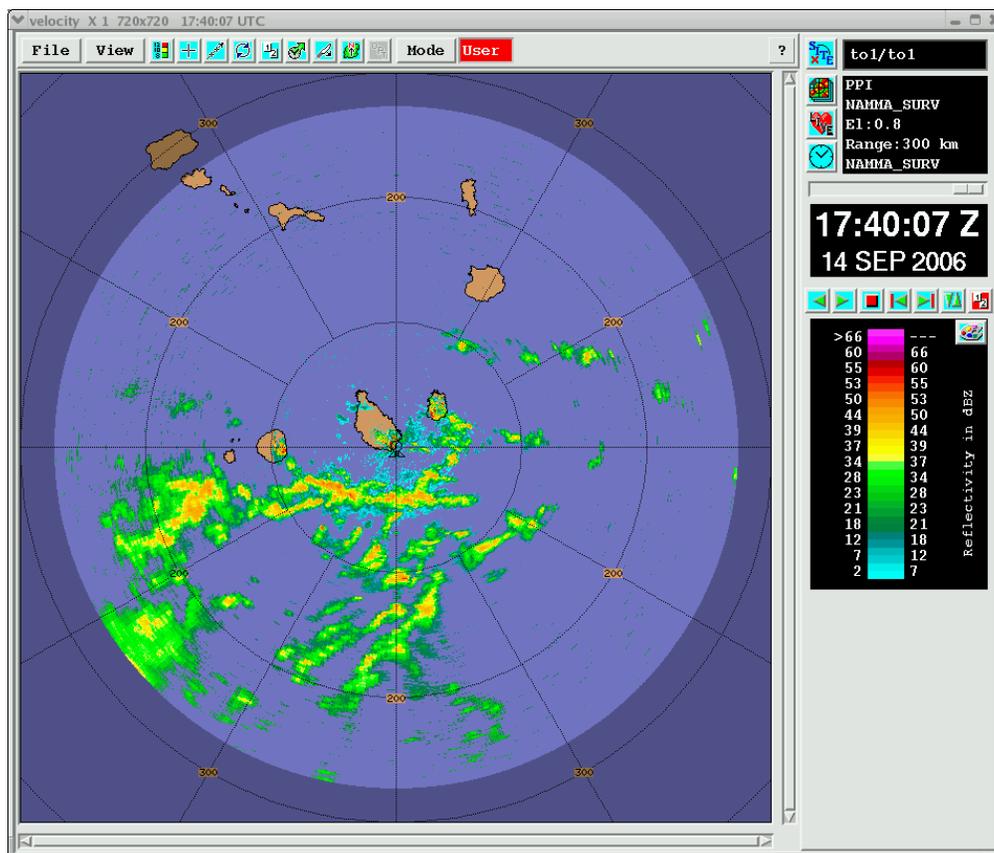
1430Z: Intense convective cores creeping southward toward Praia (or at least immediately W of Praia). Flash flooding through some of the deep canyons feeding toward the S coast seems a strong possibility.



1440Z: Convection seems to be gradually weakening and shifting SW off the higher terrain. Here's a broader view:



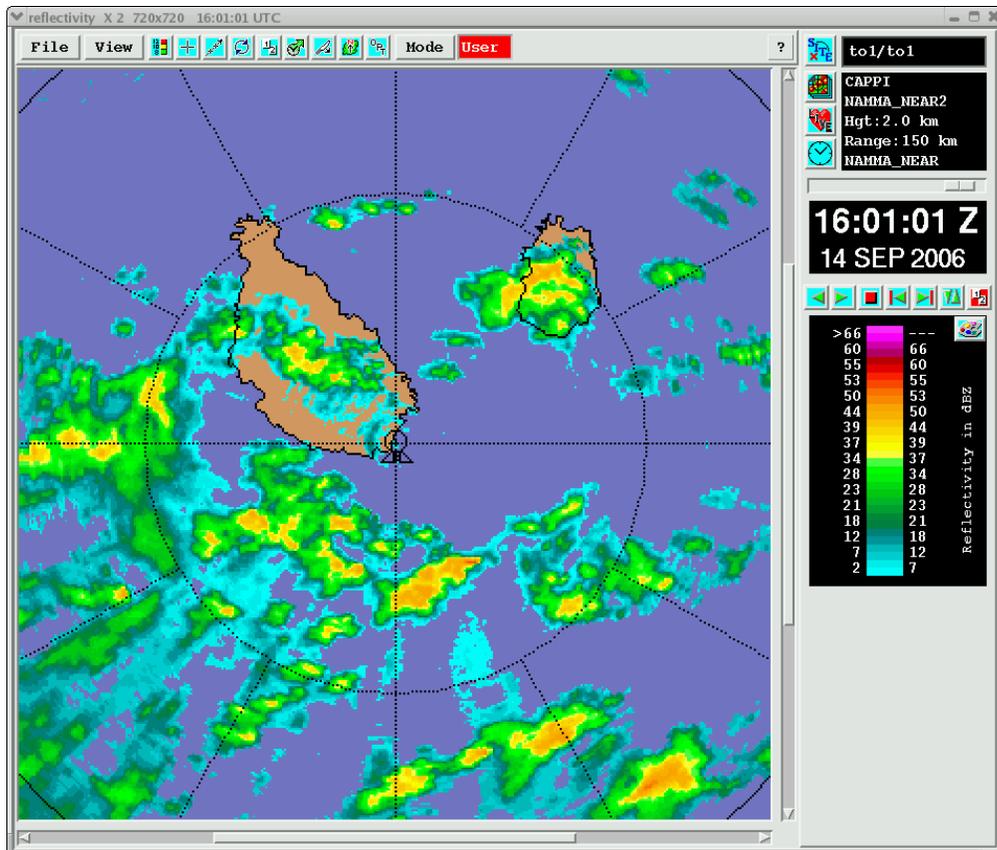
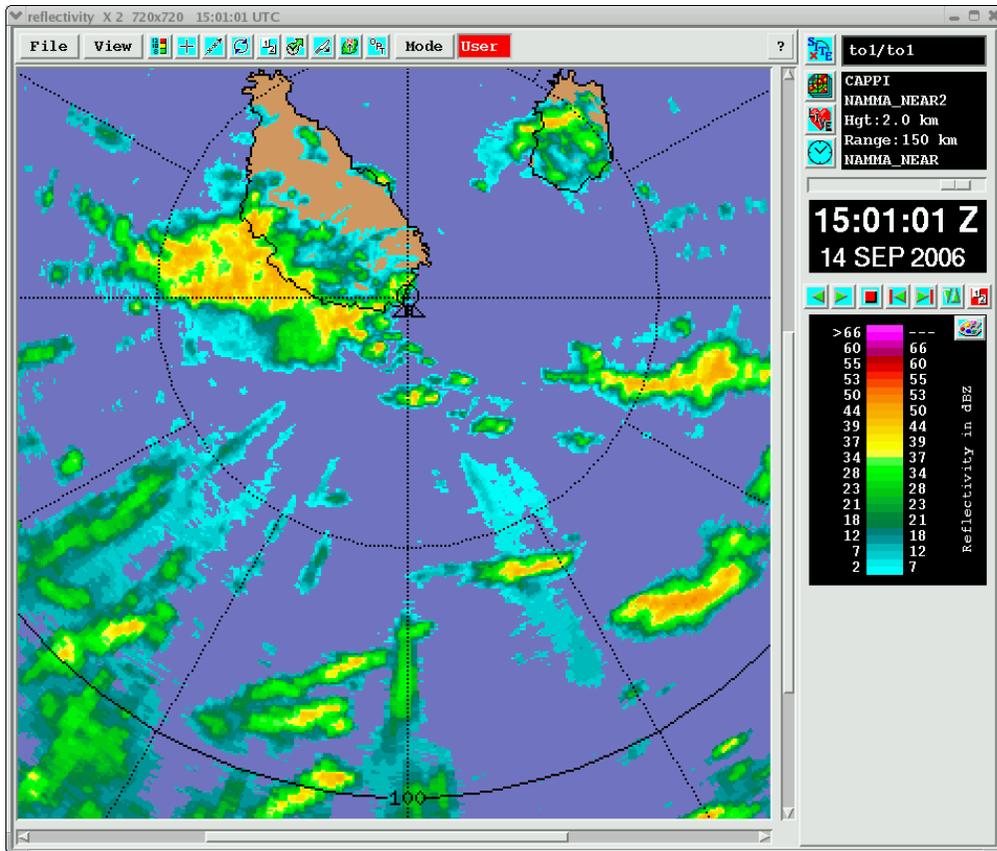
1745Z: Scientists back on-site after (slow...UGH) email session at hotel . Some the streets resembled small rivers. Over ensuing interval, it appears the echoes S of TOGA have considerably morphed/consolidated. Previously noted orographic convection continued its S'ward drift and apparently played role in forming a dominant E-W band. Interestingly, the overall pattern somewhat resembles that seen two nights ago on the northern fringes of TD8, but with an obvious major distinction: The severe convective "spiral band" feature on the N fringe of TD8 propagated *N'ward*, whereas the feature seen here is drifting only slowly *S'ward*. Conditions over the interim have been closely monitored by Bob Bowie, who has kept us in NAMMA_NEAR to ensure these convective echoes are properly topped.

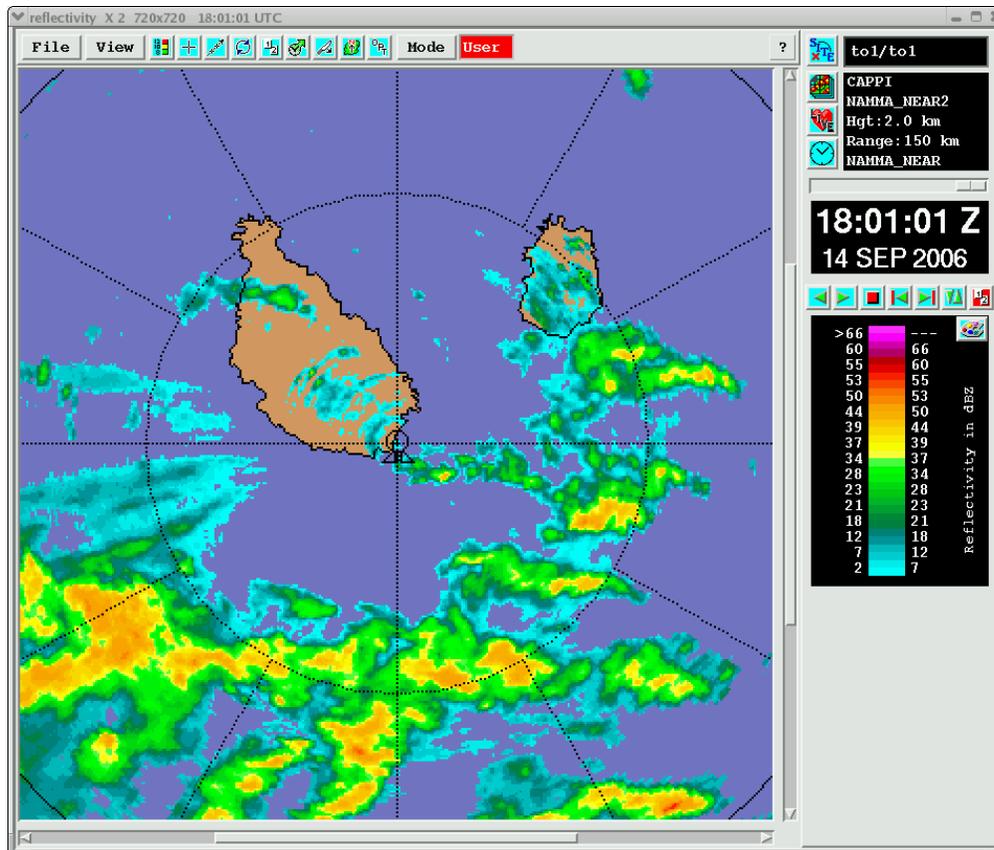
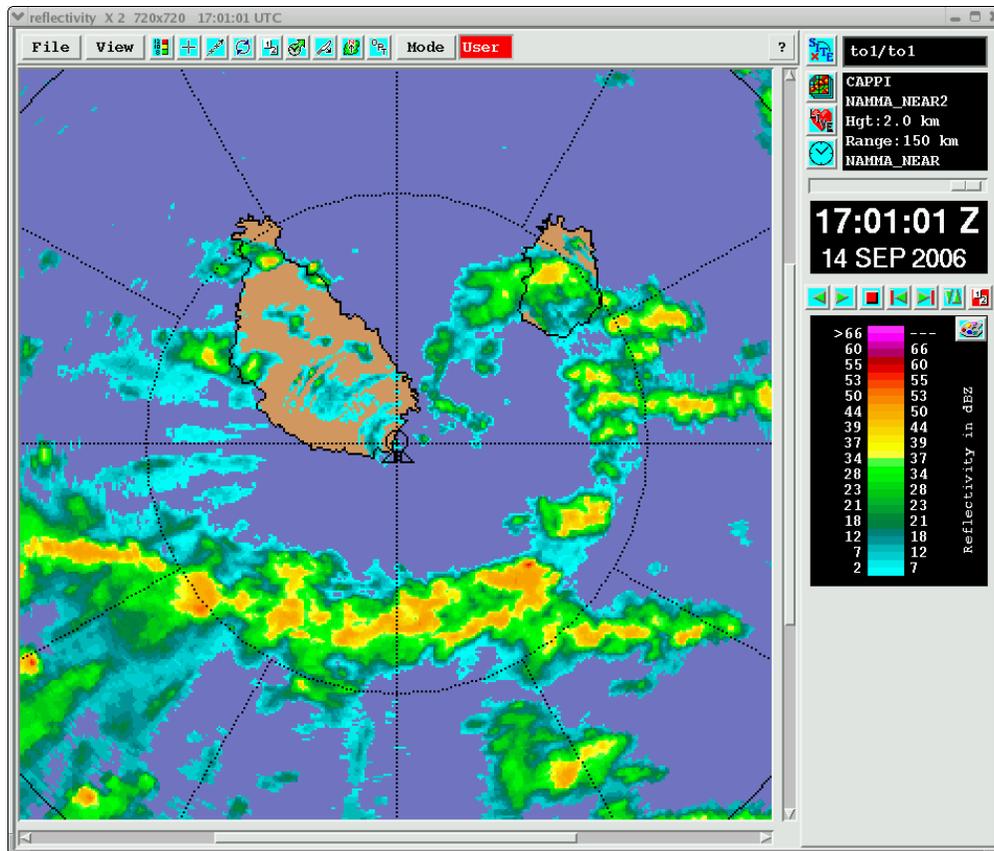


Echo evolution suggests following hypothesis: Persistent, heavy convective precipitation over Sao Tiago island favored development of downdraft, particularly during its later/collapsing phase. Downdraft swept off island forcing an expanding arc of convergence. Through some shear-related mechanism, E-W portion of this expanding arc favored and tended to amalgamate w/ nearby cells thus growing "upscale" to a length far greater than that subtended by the original outflow. (Anybody have a good model handy?)

Aside: Review of satellite imagery suggests that in the wake of Helene ITCZ has essentially relocated to a position very near our latitude. Not certain if broader synoptics (sfc wind pattern etc.) support this, but available radar data are certainly consistent with this notion.

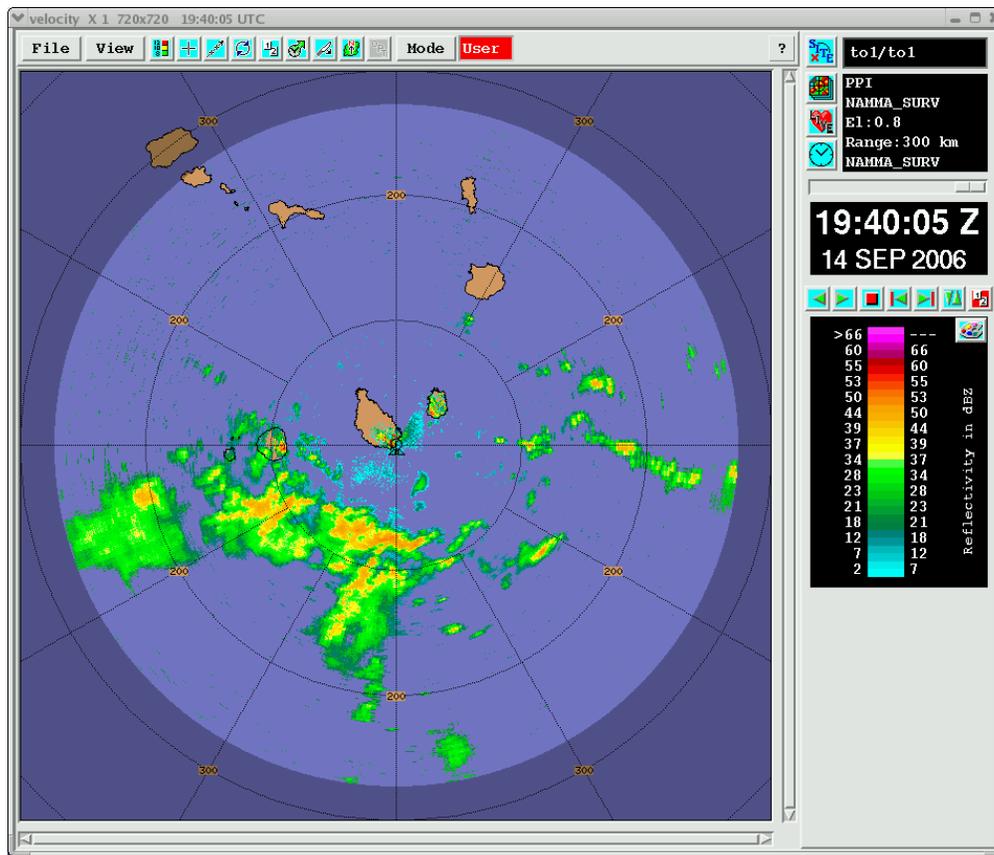
1800Z: Still have some moderately intense cells close-in to the SE, so definitely staying in NAMMA_NEAR. These appear in some sense to have originated over/near Maio. Zoomed-in CAPPI's over the past several hours make for a nice illustration of orographic/shear interactions in organizing convection ("band genesis"). Also, toward the end of this set of images, notice the tendency for other convection in the area to form E-W lines (some of them relatively short). Some larger scale influence is seemingly at work:



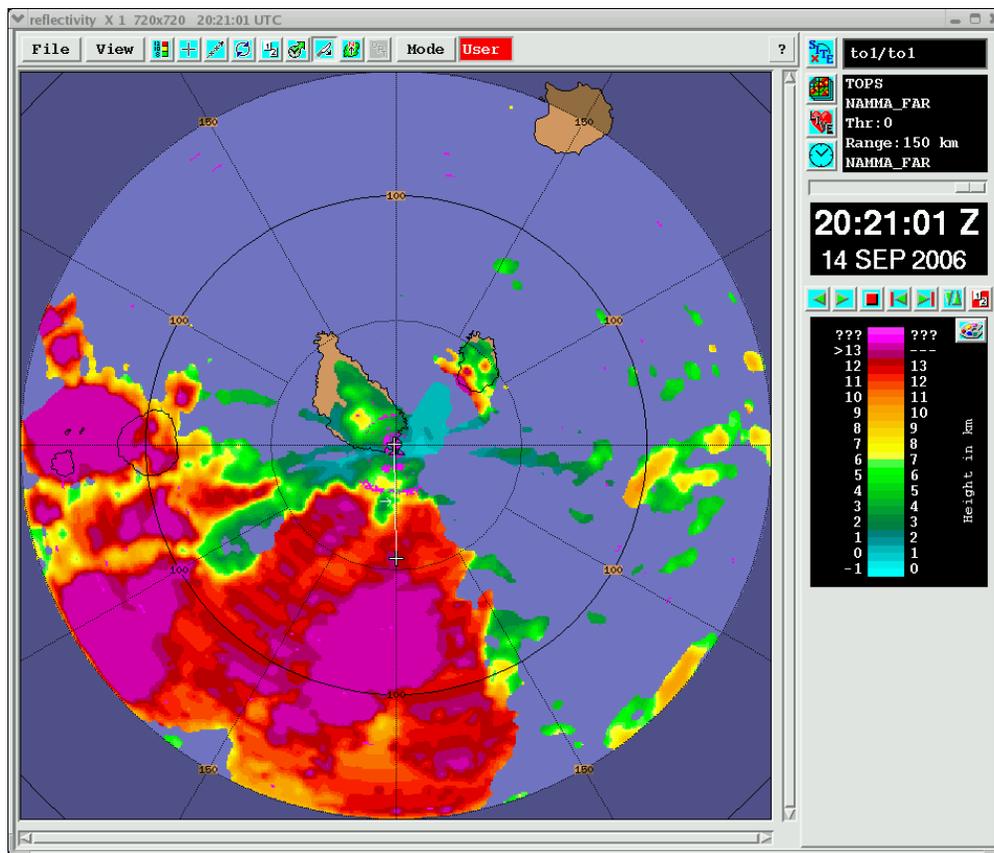


1830Z: Returning to NAMMA_FAR sequence.

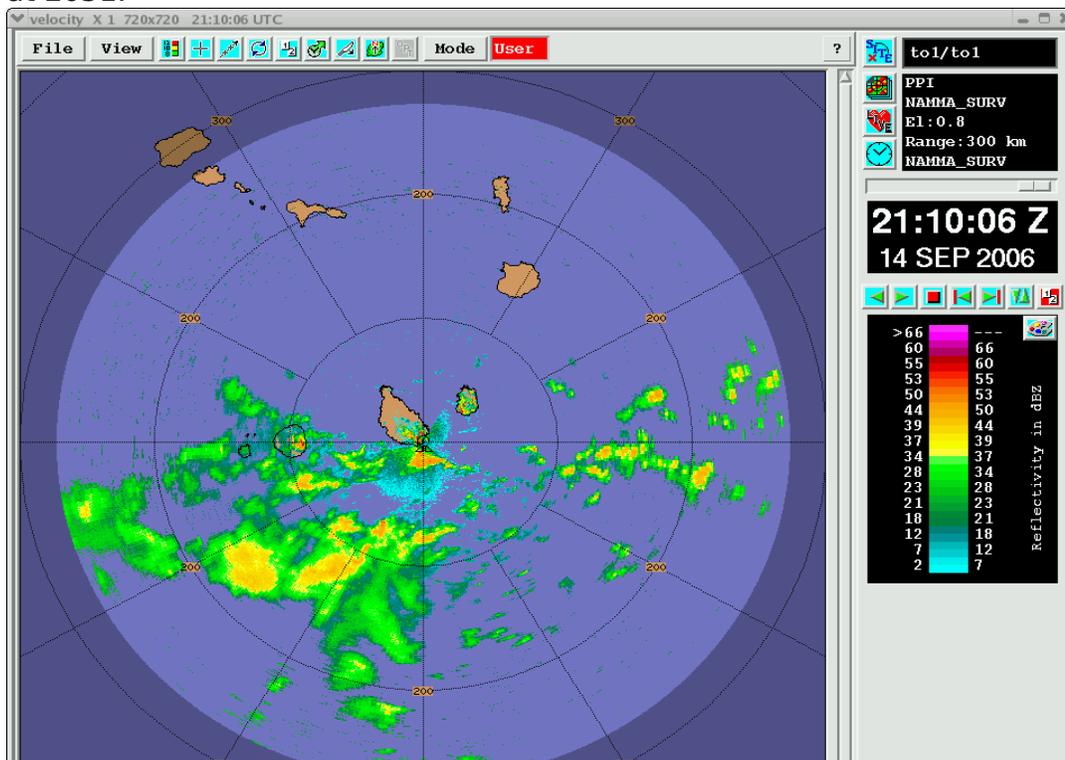
1930Z: Seems to be some overriding tendency to focus what had previously been more scattered convection into just a few relatively intense E-W lines. The most prominent is that sagging to S of TOGA, but yet another narrow band is congealing out near 090deg radial in surveillance scan:



2030Z: What essentially appears to be a small MCS, complete w/ convective & stratiform regions, has congealed in our SW quadrant. Map of tops (attached) suggests a relatively large, common upper cloud canopy over this convection.



2045Z: New convection suddenly blew up just S of Sao Tiago -will commence NAMMA_NEAR at 2051.



2110Z: New convection forming off the southern end of the island. It looks roughly like this is part of another large line of convection that may form in time. George and Smull off.

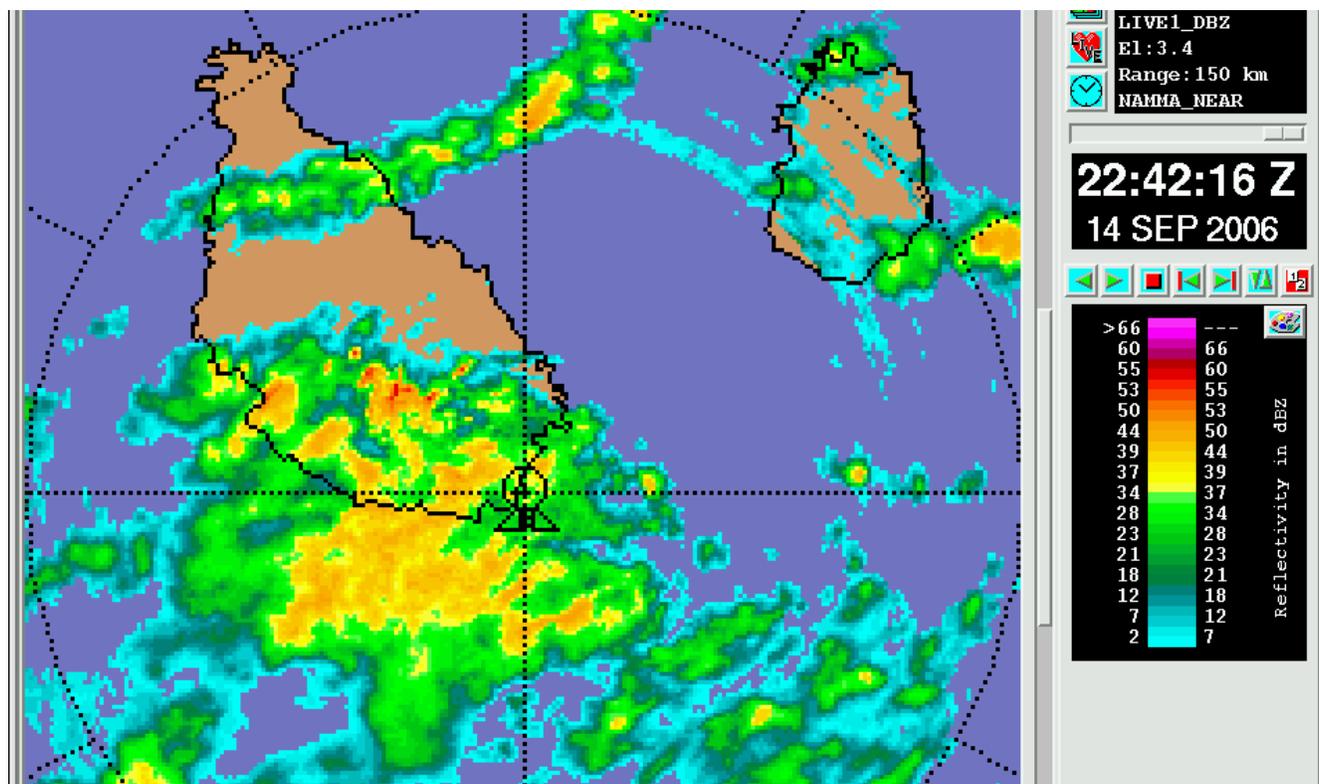
2130Z – Lang on shift. Damn ... third straight night of really active weather. Impressive. Looks like we are running Near, and there is light rain at the radar. Check that – rain is picking up in intensity. Precip is covering most of SE Sao Tiago. Saw some lightning on the drive to the radar this evening.

2140Z – Looks like significant attenuation is hitting this next volume, due to nearby precip.

2200Z – Loops show some complicated cell motions near Sao Tiago. Some cells were headed toward the island, but then get caught by outflow or island breeze and reverse course. Also, cell immediately to our south (causing rain at TOGA) split in two and the southern portion moved south, but it almost appears as though its outflow is keeping the northern portion jammed against the island. In other news, it is tough to gage the relative convective trends due to the attenuation, which continues to be a major factor. Moderate wind and rain at the radar. Near fails to top all the nearby convection within 10 km.

2210Z – System over southern Sao Tiago is quasi-stationary, possibly due to outflow forcing from convection further to the south. Classic flash flood situation, if it can maintain itself. Damn, it's pourin' out there!

2220Z – A new line of convection moving down from the north. This line is intensifying. It is over northern ST now – will be interesting to see what happens when it hits this south coast stuff.



BFS P.S.: Re-constructed RHI estimated tops on this activity are in 4-6 km range, i.e. On ragged edge of containing mixed-phase processes (hence early lightning). However, suspect warm-phase processes dominate (ala Ft. Collins flood). No lightning noted at later times from hotel, even during most torrential (and persitent!) stage of the rains.

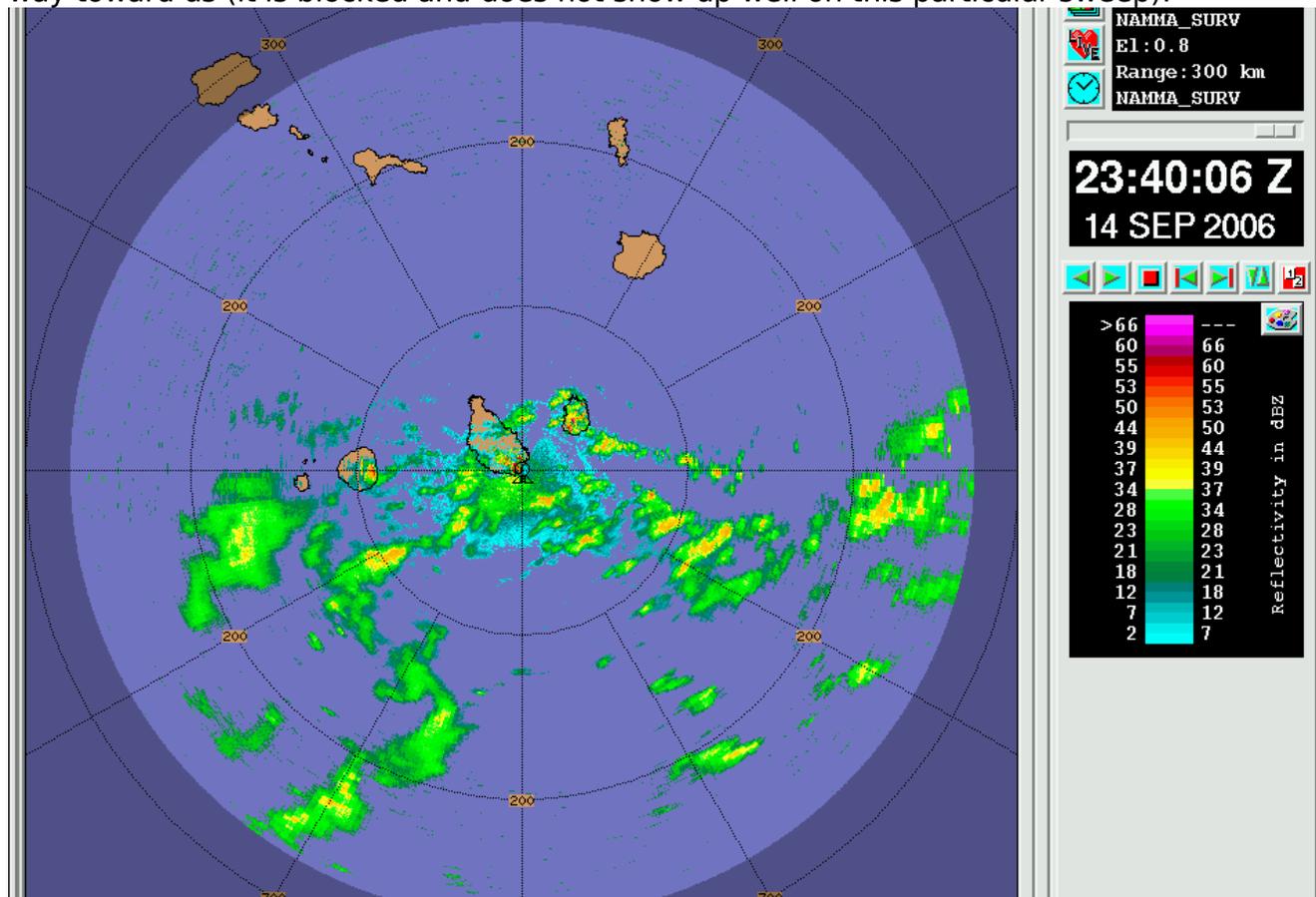
2250Z – Above is a PPI of the current situation near the radar. Clearly visible is the south coast convection, which finally looks like it might be moving, perhaps because the farther south convection whose outflow was holding it in place has moved off. Also, the northern line continues to head toward the south. There is also a line of convection extending east from Maio. Portions of this line are visible in the above image.

2310Z – Portions of the south coast convection are connecting with a SW-NE line that extends from ST out beyond 100 km.

2320Z – NAMMA Near pretty much topping everything now. Light rain at TOGA, with much less wind. GPS 50 s ahead of toga1 clock.

2330Z – General southward trend in all convection, with the northernmost significant echo level with Maio and northern ST. If this pattern holds up, the bulk of the precip should shift south of us. But we got a long way to go to get there.

2340Z – Here is an image of the current situation, which remains very active. Next best chance for significant precip at the radar is the northern ST line, which is slowly making its way toward us (it is blocked and does not show up well on this particular sweep).

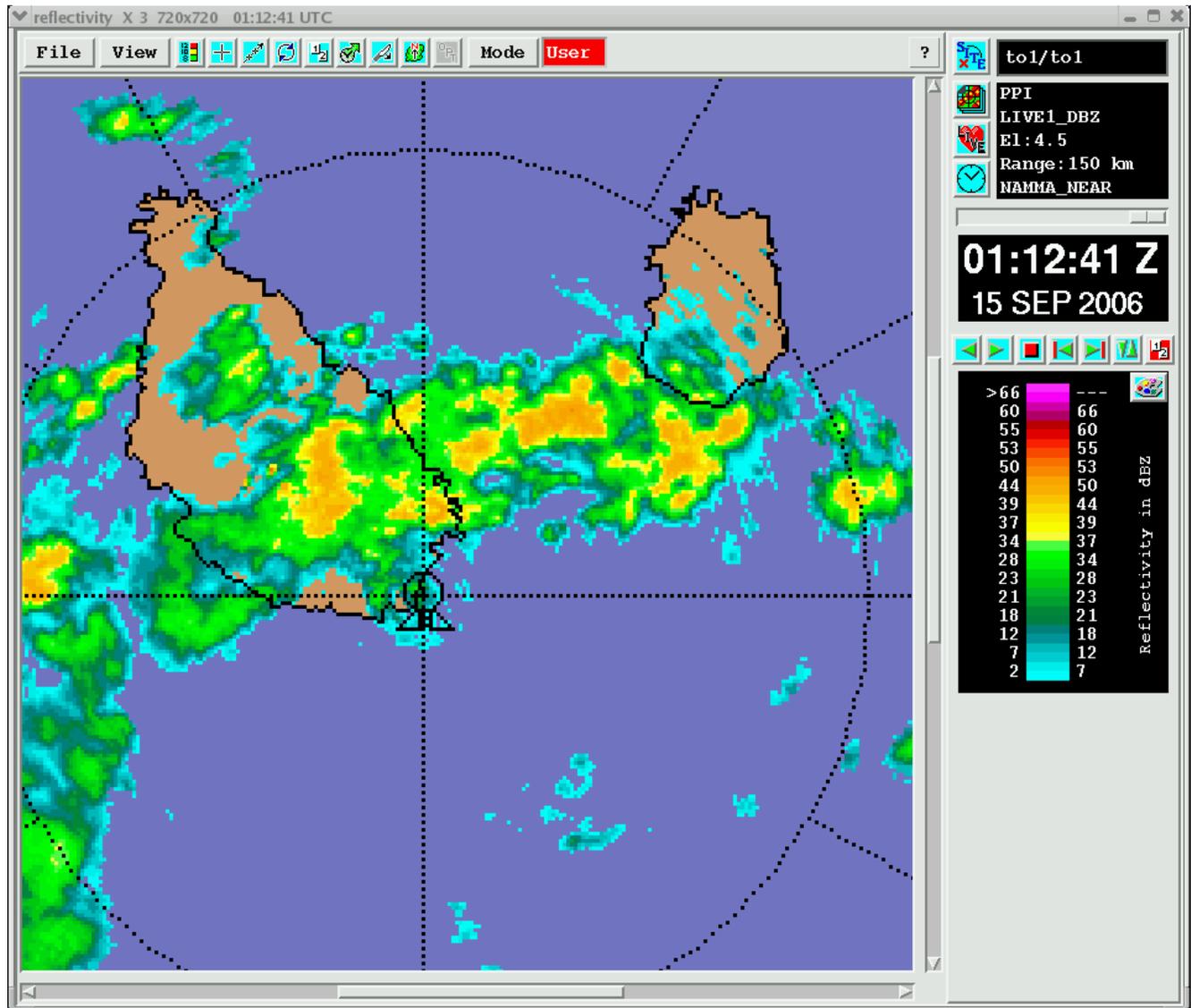


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0020Z – Last day! The SW-NE line extending from ST has broken up. There is now a partial ring of convection curving around 20-40 km from the radar, from the SW to the NE. Southward movement continues.

0050Z – A gust front collision might have helped strengthen the NE convection near Maio. Looks like we're going to have something like the reverse of a couple nights ago – an MCS passage from the north instead of the south.

0120Z – Here comes trouble ...



0147Z – Rain at the radar.

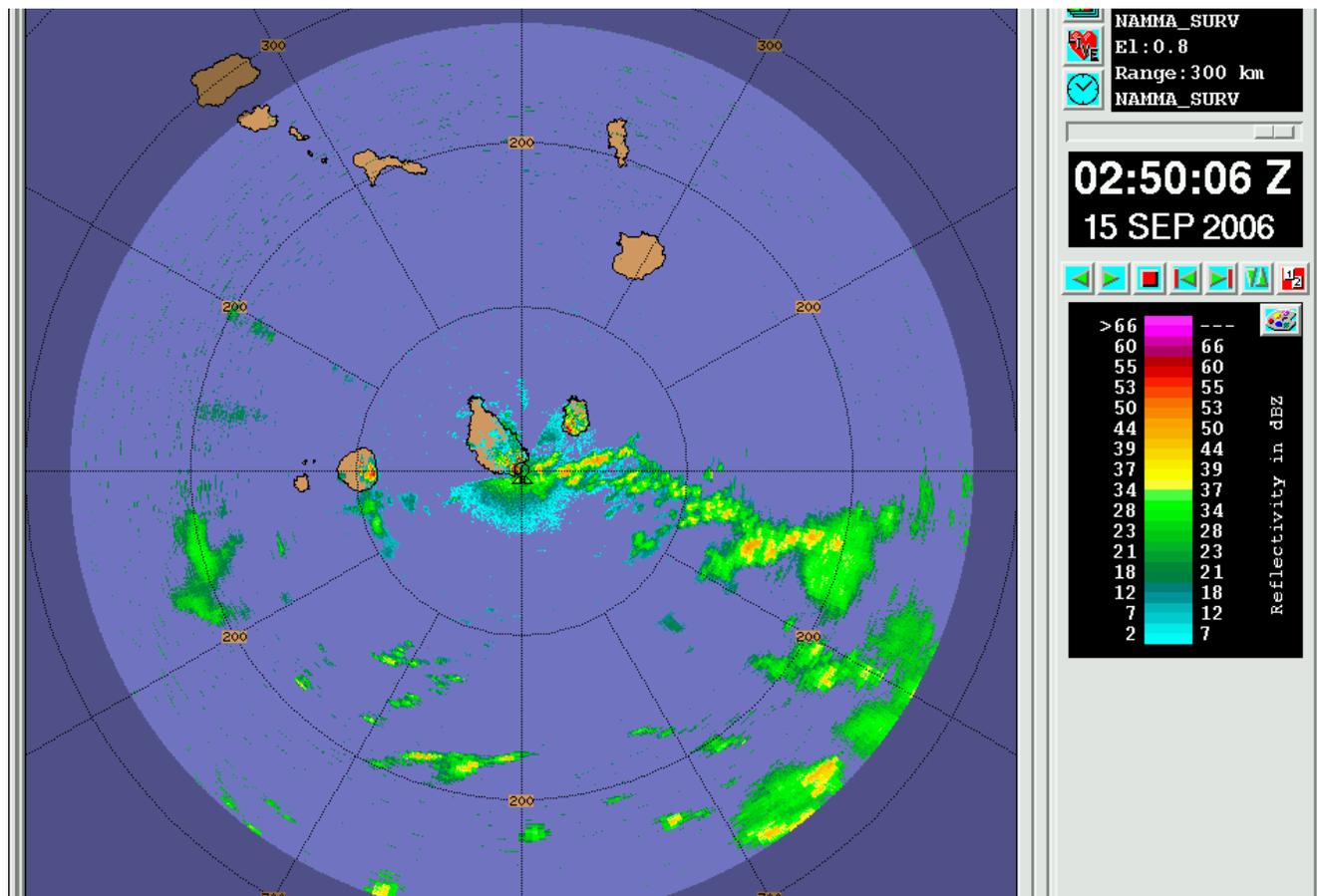
0150Z – This is just a portion of a long MCS that extends from ST up to Maio then kinks southeastward and stretches out to 150 km from the radar.

0200Z – Hmmm ... convection over ST has really collapsed. However, it still looks good over the ocean. But this means we won't be getting as much rain at the radar from this system.

0240Z – The strongest convection in our immediate vicinity is now just due east of the radar, over the ocean. Still only light rain at the radar. This eastern MCS now appears to

be breaking up into smaller components, with the nearby eastern convection being the western component, stretching out to about 50 km range or so.

0250Z – Loops show this original eastern MCS to probably have been a transient one, made up of the superposition of two colliding convective lines. As the lines continue to move past one another, the “MCS” is breaking up as described above. Here is a view of the current situation. Note the dissipation of convection to the west.



0300Z – There is some developing convection north of the radar, near the NE coast of Sao Tiago. This formed after the line passage, in the wake of the convection from the line portion which decayed over the island.

0340Z – New development ~200 km to the SW. Closer in, the eastern MCS has broken into a few smaller complexes. This convection has moved well away from the radar toward the SE. The NE coast Sao Tiago convection continues to encroach upon the radar.

0410Z – New E-W convective line immediately W of ST.

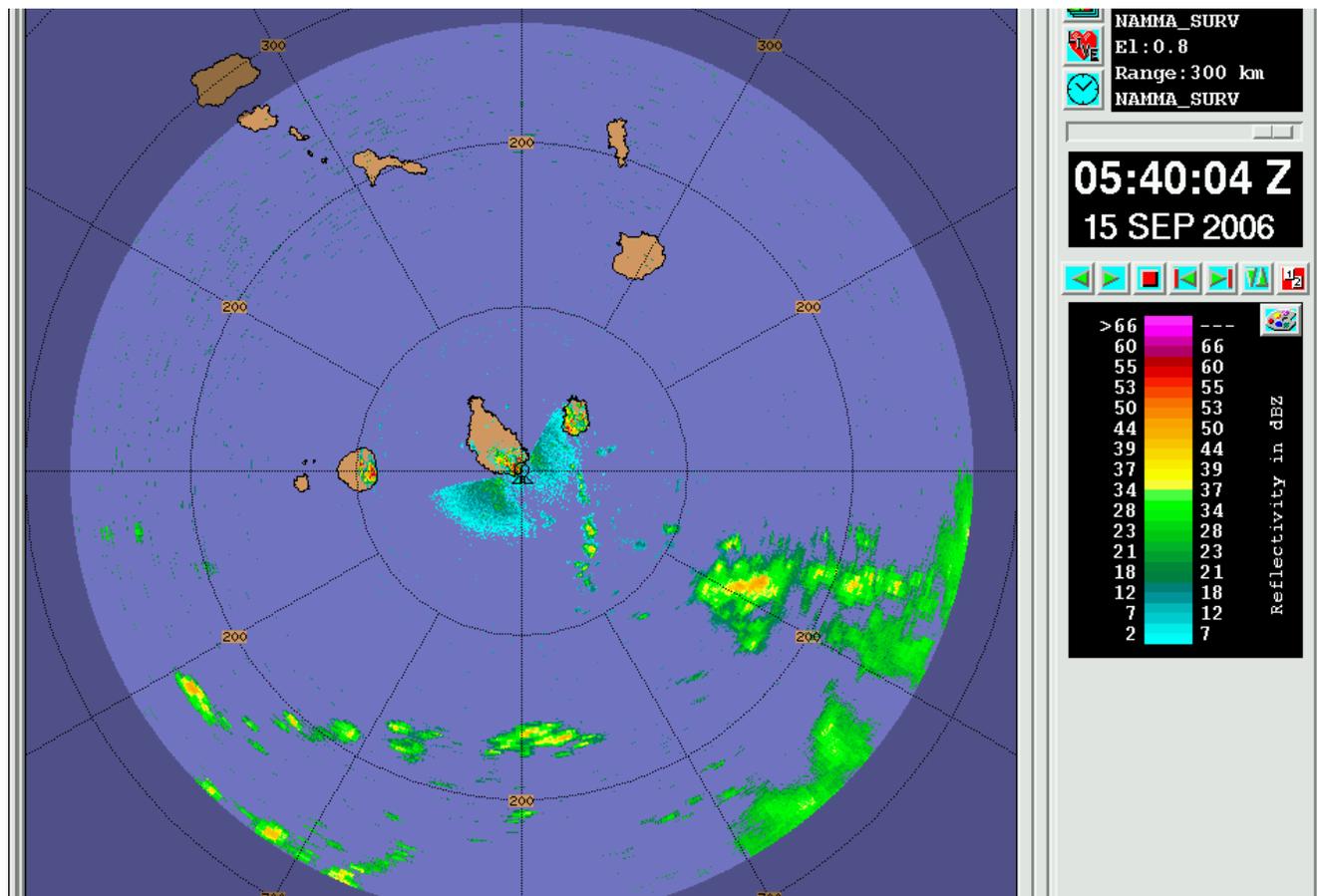
0430Z – That new line already shows signs of fading.

0450Z – Some resurgence in that line as it moves south of the radar. Also, some redevelopment over the interior of Sao Tiago.

0510Z – Switching to NAMMA Far as there is nothing with altitude close to the radar.

0520Z – Most of the convection over ST is not much taller than 6-7 km. Really starting to quiet down within 100 km of the radar. There is, however, a new N-S line 40-60 km east of the radar.

0540Z – The situation at 0540Z. The new convection to our east and SE is visible within 100 km of TOGA. There is also the long-range convection, which shows some organization. The stuff 150 km to the ESE is the remnant of the eastern MCS, from earlier in the night.



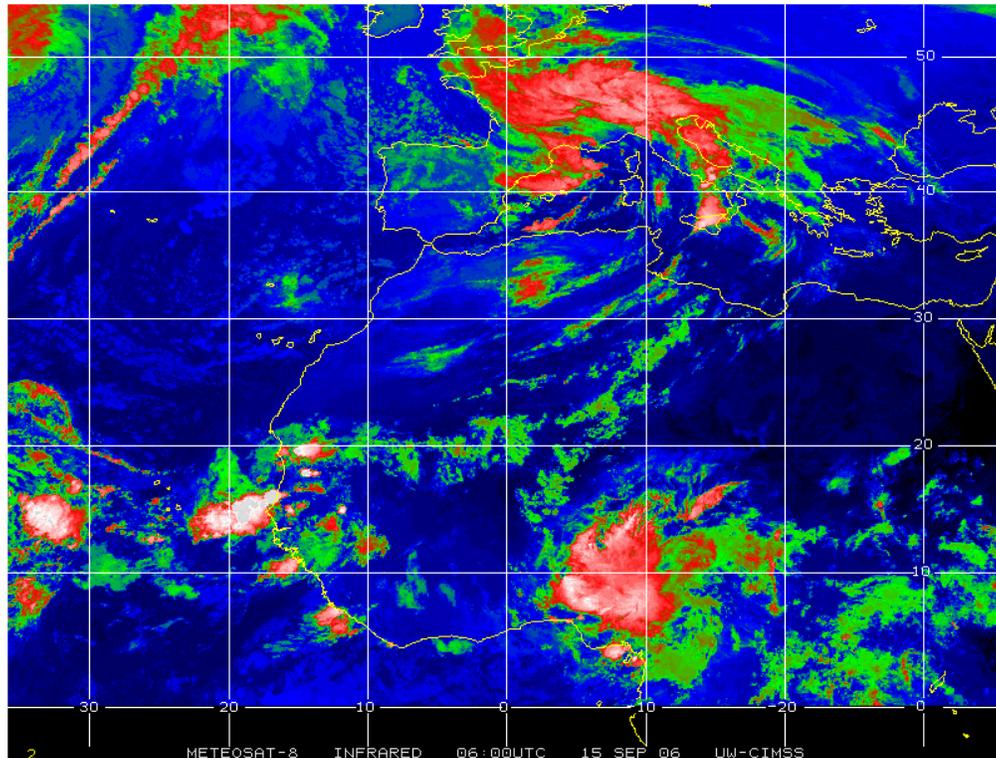
0600Z – Northern portion of near eastern line is curved around to our north, over the island.

0730Z – Once again quieting down near the radar, as the rest of the convection continues heading to the south. Weak orographic convection continues over the interior of Sao Tiago, however.

0900Z – Small cell about 80 km to the SSW is the main thing of interest within 100 km. This is part of a partial ring of weak convection stretching from due south up to Fogo. Also, there might be an MCS off scope to the SE.

0930Z – Lang off shift. GPS ~1 min ahead of toga1. Smull & George on-shift. Implications of progs (00Z GFS run) and bandwidth-limited recent satellite imagery not terribly clear-cut. NHC confirms our impression (or we confirm theirs?) that the ITCZ is now positioned at or just south of our latitude, i.e. displaced well northward of climatological position in wake of Helene. Morning IR image (attached) shows multiple ~E-W bands of cool cloud just to our S, in agreement w/activity shown retreating southward in surveillance scans.

More organized ENE-WSW large-meso/small-synoptic scale cold cloud-cluster extends from just N of Dakar to position near 14N/21W; slightly warmer/lower W'ward extension of this shield appears to correspond to MCS like convective/stratiform echo combination now located beyond 150km in our SE sector. GPS does not show any significant incursion of precip into CV's (of course, neither did it do so 24h ago!!) nor any organized sfc cyclone moving off the coast until well beyond our project period, when it brings another strong TS-like cyclone along a path very similar to that of Helene (viz. Passing immediately S of CV on /about Wed Sept 20th). Bottom line: Current local trend suggests marked down-tick in activity. We will monitor carefully through day, probably doing a late-afternoon check of imagery, and plan to make go/no-go decision for nighttime ops at 8:30 pm shift-change.



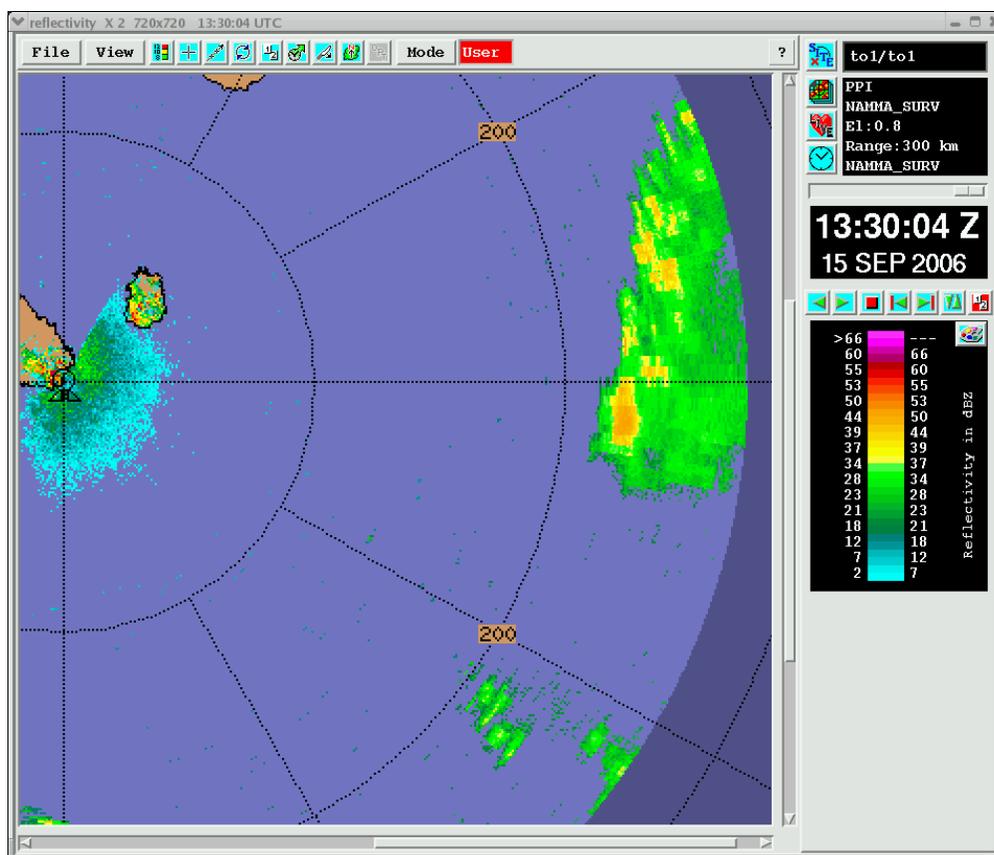
Lastly, locally things look far more suppressed this am—e.g. No TCu over mountains, and only relatively humble (and strongly sheared/S'ward tilting) Cu over waters.

1030Z: Most echoes now beyond 200 km in SE-SW sectors, with exception of single short*, moderately intense NW-SE line centered near 200deg/125km. (*Is this my tired brain's way of saying "I need a latte"??)

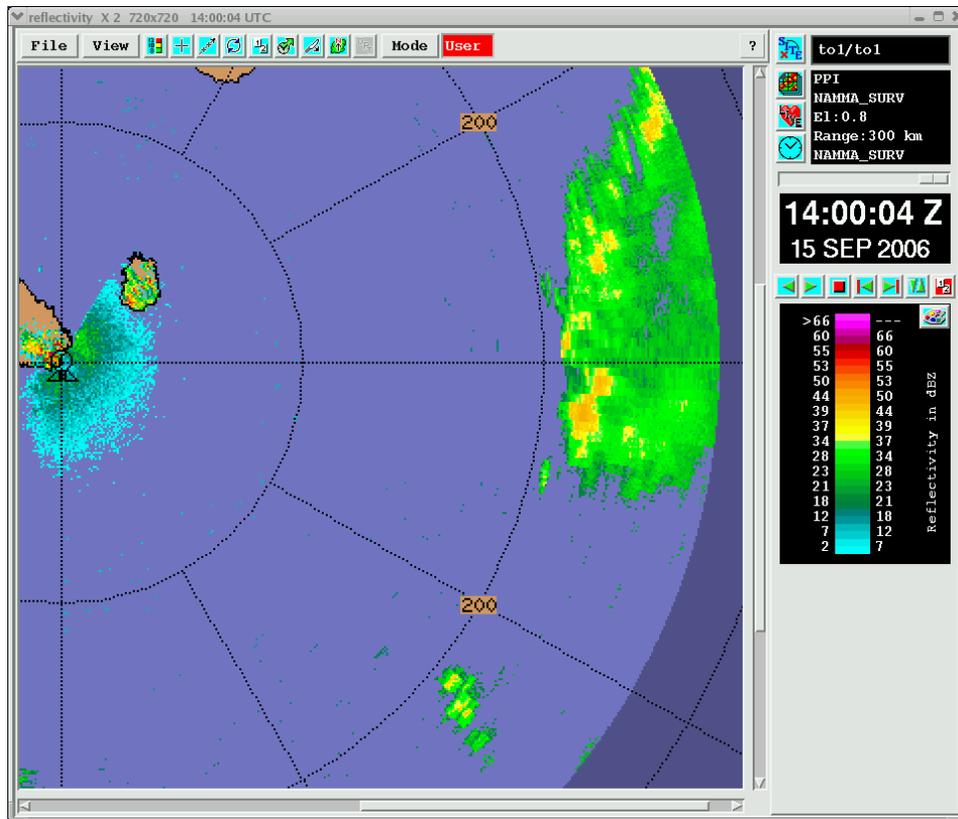
1200Z: Little change, except that a somewhat more intense/organized looking echo is just barely edging into far-E portion of our surveillance scans. Locally, clouds appear to be somewhat more widespread but even more suppressed than earlier this am—mainly just flat SCu now.

1300Z: Trend continues, w/ eastern convection now just creeping inside 225 km. Locally, cloudcover is rapidly decreasing, and N-NE'ly (with standard caveats) sfc wind seems to be on the increase.

1330Z: Squall-like structure emerging in far E reaches of surveillance display. Cells give appearance of being strongly sheared, i.e. Elongated NNW-->SSE.

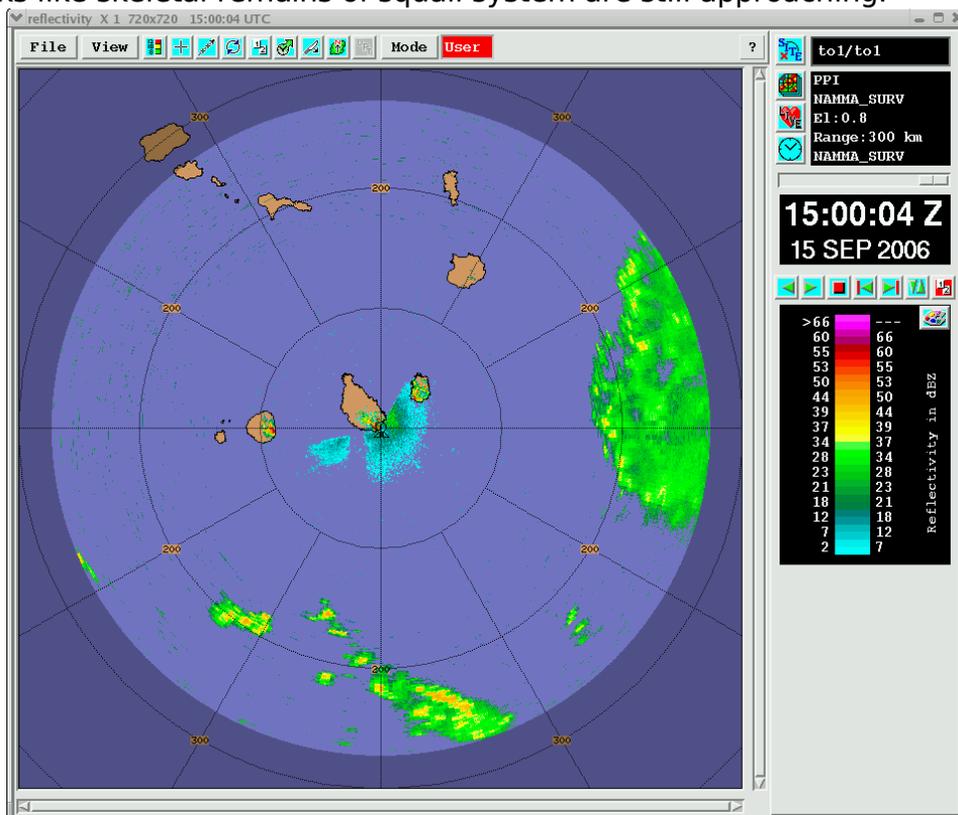


1400Z: System continues to approach, estimated motion toward 235deg @ 7-8 m/s. Echo pattern shows a N-->S gradient of cell intensity, and at least a hint of transition-zone reflectivity minimum separating leading convective line from trailing stratiform region.

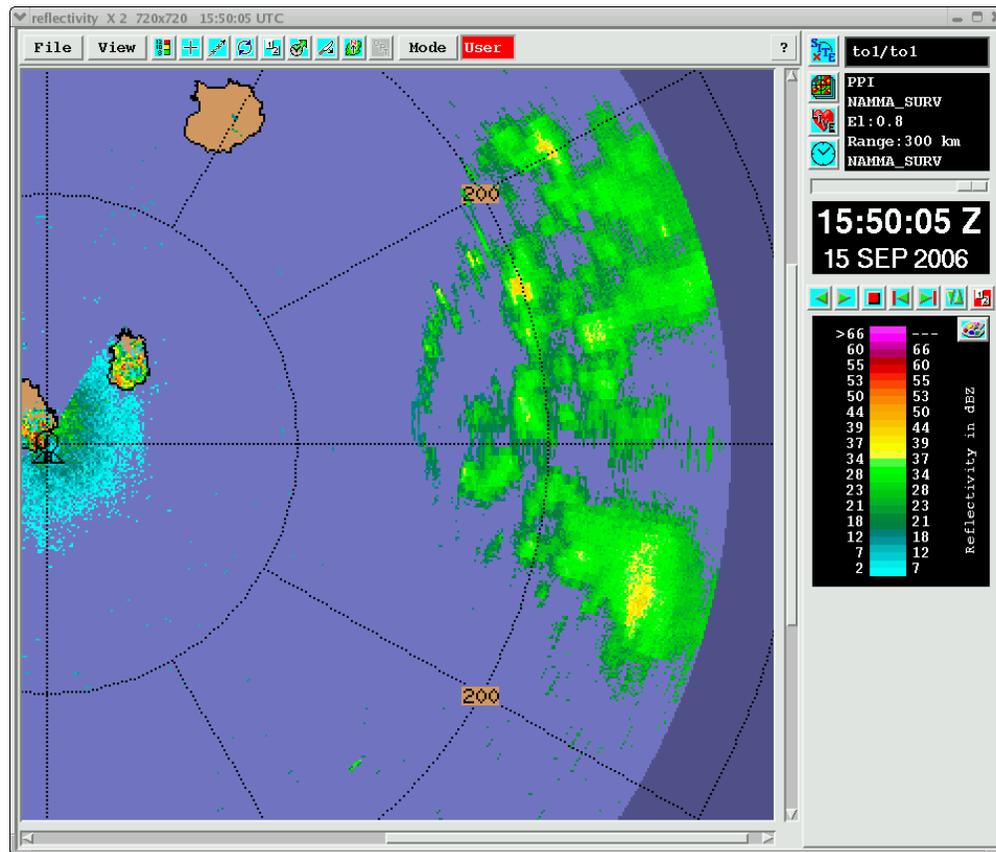


1438Z: Server toga1 going down for UPS switchout; will probably result in missing 1440-1449Z surveillance and "far" scan (no huge deal). Back online/archiving @1550Z.

1500Z: Looks like skeletal remains of squall system are still approaching:



1600Z: Gust front is outrunning system, with precious little convection remaining along it. Appears squall has come to our doorstep to die—perhaps a fitting end for close of a field program? We'll see...

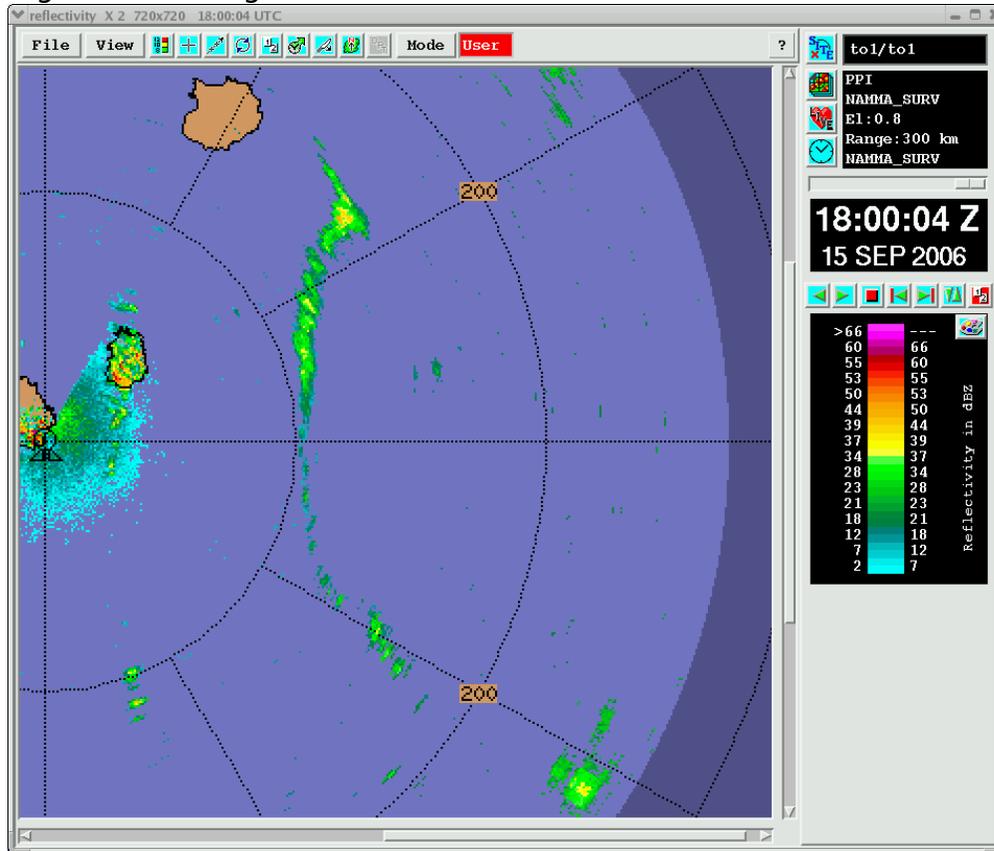


1800Z: Would you believe... a rope cloud? W'ward propagation speed is 4-5 m/s. Of the formerly skeletal squall line, only the spine remains. But a further detail emerges: Ahead the "rope" is another (perhaps more intense!) band of newly-formed echo that is enhanced in the lee (to the S) of Maio. Not sure what to make of this... some combination of a gravity wave disturbance and previously noted lee-banner effect? See image pair next page.

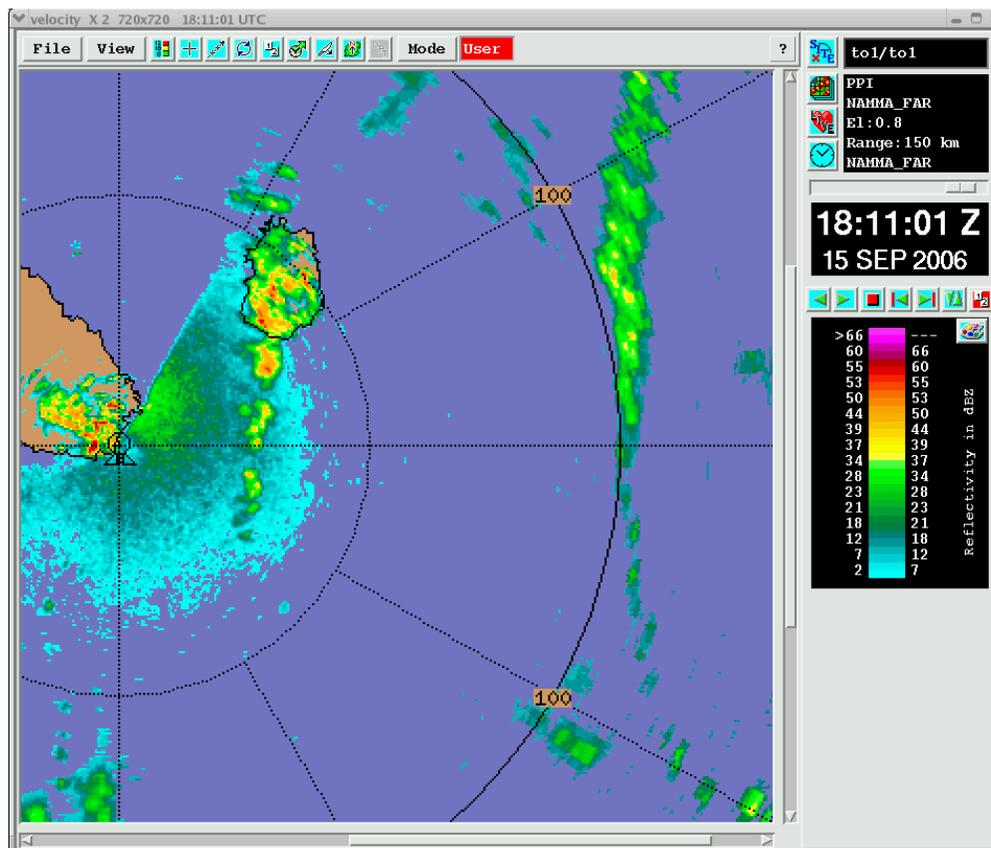
Discussion re: shut-down schedule in space available. George & Smull just completed fairly thorough review of output from various global (+FSU-MM5) models as well as sat imagery (stills & loops), made possible as Nathan resurrected old-airport DSL. (Yay Nathan!) We see little evidence of pronounced W'ward ejection/propagation of a sfc cyclone toward CV within the next 24 h. However several models (e.g. CMC) do tend to inch today's precip max (located ~midway between NPOL & TOGA) W'ward during the day tomorrow. We are presently leaning toward the following scenario: (1) operate through 8pm, then shut down for overnight; (2) do early-morning review of Meteosat imagery and presumably come to radar post-breakfast to do either (a) daytime operation for what would be LAST DAY of TOGA Ops in NAMMA, and/or (b) end-of-project calcs.

We see intense echo within 150 km overnight as a very low-probability event. Somewhat higher probability of this during the day tomorrow. This tentative decision was reached jointly w/ input from Rob Cifelli (via email back-and-forth earlier this afternoon) and will be finalized once we have the benefit of seeing two more hours of PPI's and last-minute input

from Tim Lang at shift-change.



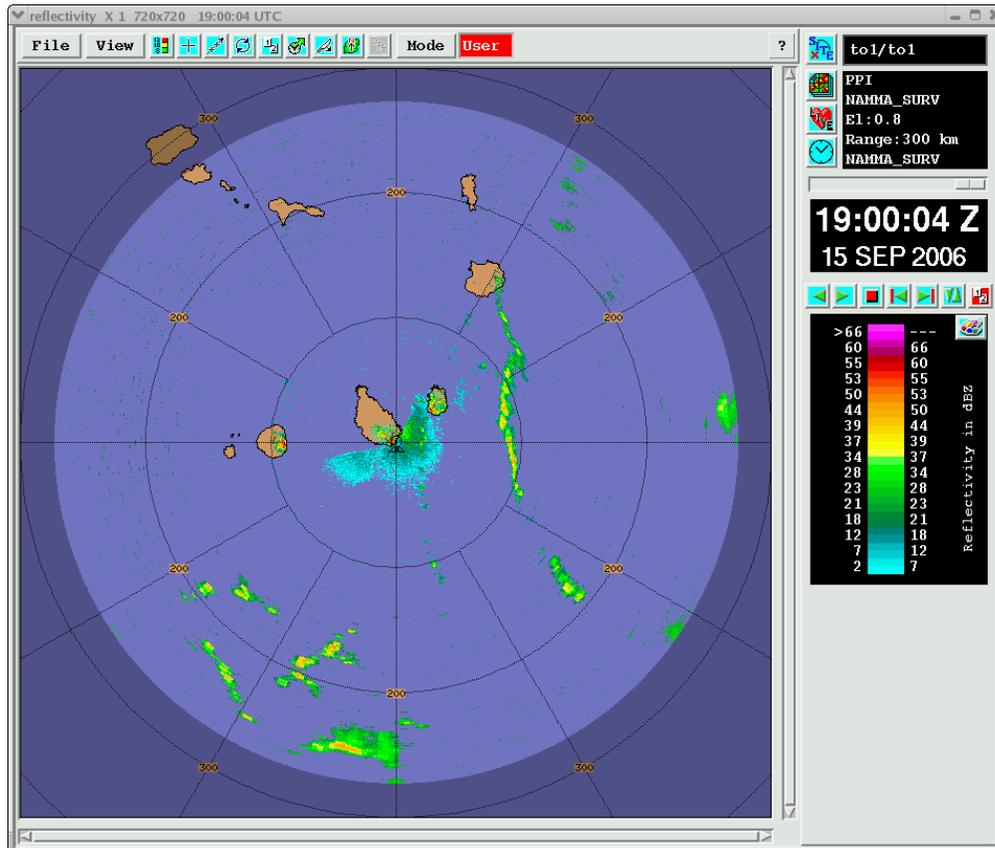
And a higher PRF view:



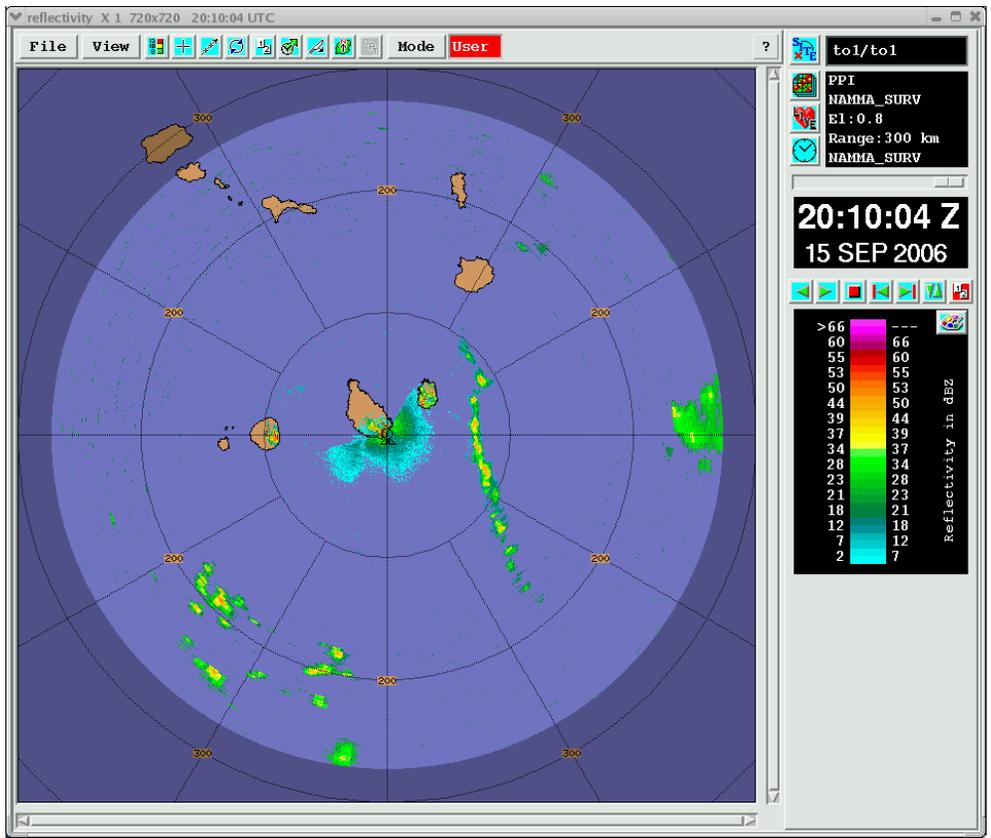
1830Z: Visibly, just some soft cumuliform clouds sitting on top of the ca. 45 dBZ echo in the lee of Maio. Elsewhere (even over our nearby terrain) things appear extremely suppressed. Would seem to be the atmosphere's last-gasp effort to make us stay...

1840Z: Close-in echo noticeably weakening, but breaking free of Maio.

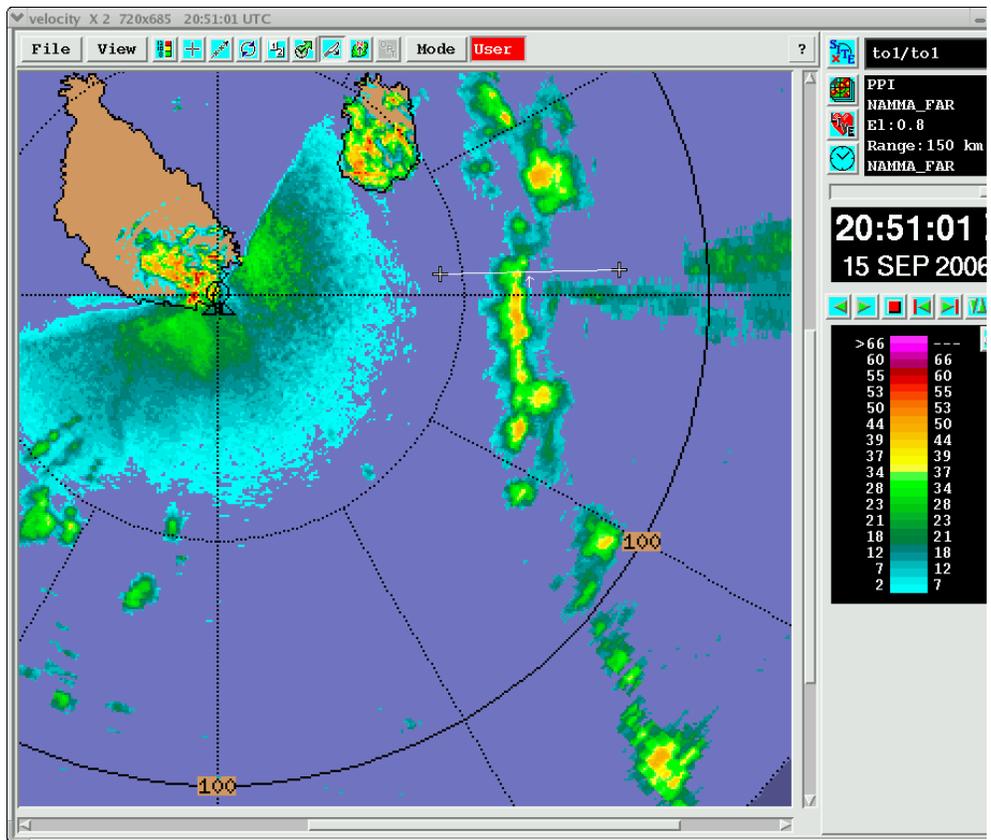
1900Z: An emptying but not quite empty scope (ignoring echo peeking in at E edge in hopes it will just go away):



2015Z: It's not going away, and on some level it's intriguing. Cross sections show these echoes to be as it's been relatively well documented over a number of hours already and it isn't likely even remotely connected with tropical cyclogenesis.



2100Z: Rope echo finally appears to be losing its battle with shear and some of its coherence; tops are down mainly below 4 km (from 6km previously); band has effectively halted W'ward propagation and is now simply being advected southward w/ mean flow:



2130Z – Lang on shift. Guess we'll see what happens with this N-S line to the east.

2150Z – Portions of the line are hanging together, but progressively smaller and smaller portions. This system really started heading toward the south as it approaches CV – must be fairly northerly flow near the islands, like last night.

2220Z – Line appears to be heading almost due south now, and is decaying. Rest of the scope is drying out too.

2310Z – You know, the SAL satellite product had a lobe of Saharan air over the northern portions of this archipelago. With the dominant flow near the radar from the north, one wonders if the dry air is killing off any convection in the area.

2330Z – Decaying pattern continues.

2359Z – Stick a fork in it. Scanning stopped.