

Camille "901" dropsonde

On August 17th at 2125Z a dropsonde recorded a 901 mb pressure, and for a short time, this was documented to be Camille's lowest sea level pressure. Some months later in the MWR article on the 1969 hurricane season, a 905 mb from an earlier drop was identified as the lowest sea level pressure.

A footnote said only, "Preliminary reports and other publications indicated a lowest pressure of 901 mb. Recently, a check of the raw data indicates this should be corrected to the 905-mb value given here." This footnote was ambiguous and could have meant two things: either than an earlier drop yielding a 905 mb pressure became the lowest pressure when the 901 mb reading was thrown out, or that the 901 mb reading was recalibrated to achieve a 905 mb reading. It appears that the decision was the former one, to use the 905 mb pressure from the recon flight 20 hr earlier. The storm wallet does not document why the 901 mb sea level pressure was rejected, nor was the decision clarified after contacting the surviving NHC hurricane forecasters from the 1969 hurricane season.

Upon review of the sonde data (attached), the first thing that was noted right away that the 850 mb height of 692 m was not consistent with a 901 mb sea level pressure.

Note first for comparison that the flight into 2005's Hurricane Wilma had a dropsonde with data at 850 mb giving an extrapolated sea level pressure pressure of 901 mb and the 850 mb height was 516 m.

Two other sondes from Camille at 905 and 908 mb had 850 mb pressure heights of 551 m and 586 m, respectively.

These 850 mb heights are listed below:

Camille	"901"	692 m
Camille	908	586 m
Camille	905	551 m
Wilma	901	516 m

It can be seen that the Camille 905 and 908 mb heights are consistent and that the "901" mb height is inconsistent.

Method 1.

Starting with the 905 and 908 mb 850 mb heights and adding a mb for every 10 m height for the "901" dropsonde above the two former drops yields about 918-919 mb as a first rough estimate.

Method 2.

Using the tables at NHC for sea level pressure based on the observed 700 mb flight-level height and temperature data and the standard environmental lapse rate yields (see attached) an estimated MSLP of 920 mb for 2390 m and 16.6 C. That provides a second estimate for the MSLP.

Method 3.

The sonde data was also used to determine sea level pressure, as follows, although this should be using essentially the same calculation.

The sonde data was decoded (the TD was given as a subtraction from the T). There was data from five levels of the "901" sonde. The decoded data from the sonde is as follows. Added is the water vapor mixing ratio and equivalent temperature (using a skew-T, also attached).

Pressure (mb)	T (C)	TD (C)	P height (m)	W (C)	Tv (C)
700	16.6	16.6	2390	14.3	19.0
732	19.4	18.4	-	17.5	22.3
850	28.0	26.7	692	27.0	32.5
874	29.4	27.8	-	27.0	33.9
901	30.8	28.3	-	28.0	35.9

The mean temperature of the layer was taken from the skew-T to be about 27.0 C, or 300.2 K.

The data was plugged into the hydrostatic equation:

$$p(\text{sea level}) = 700 \times \exp \left\{ \frac{(g \times 700\text{mb height})}{(\text{gas constant for dry air} \times K)} \right\}$$

$$p(\text{sea level}) = 700 \times \exp \left\{ \frac{(9.8 \times 2390)}{287 \times 300.16} \right\}$$

$$p(\text{sea level}) = 918.7 \text{ mb}$$

The sonde may not have transmitted all the way to the ocean's surface, with the 901 mb only being the last value transmitted, not the sea level pressure. This could have been caused by some defect, or perhaps the sonde encountered a mesovortex in the eye wall.

Notes:

The satellite and radar imagery and personal observations from a member of the flight crew indicate that Camille was in the process of an eyewall replacement cycle (ERC) and at this time had two eyewalls with a moat in between. Because the plane had radar and their observations focused on the inner eye, this suggests that radar reflectivity of the outer eye was weaker compared to the inner eye (also "double" eyes were not too well known at this date), and that the inner eye was still the prominent feature.

Using a comparison to Wilma, when Wilma was 901 mb and its satellite appearance matched well with Camille's, Camille had a 905 mb pressure. The similarities between the satellite images of the two hurricanes (scaled to same size in the attachment) include a very well defined pinhole eye and smooth central dense overcast (CDO) with subsidence around the CDO, and similar CDO size.

A subsequent visual satellite image of Camille showing a moat and secondary eyewall formation around the inner eyewall is matched with an image of Wilma at a similar stage with an ERC in progress. There is also a radar image of Camille showing a double eyewall at this time (attached). The radar image was within 10 minutes of the drop, at 17/2115Z. Wilma's pressure between the peak and the ongoing ERC had increased 10 mb from 882 to 892 mb. Therefore it is logical for Camille's pressure at this time to be at least 10 mb higher as well (905 to at least 915 mb).

Wilma's intensity had only dropped to 140 kt from its peak at 160 kt. Therefore it is also logical for Camille's inner eye to have only weakened slightly from its peak intensity (which will never be completely known).

These satellite images for this comparison have been provided as well.

In conclusion the three methods yield 918-919 mb, 920 mb, and 919 mb. Therefore the confidence is good that Camille's pressure was about 919 mb at this time.

Attachments:

- Data from the "901" sonde drop
- Table for MSLP using 700 mb height and temp
- Skew-T
- Camille radar image from same time as the drop
- Camille / Wilma visual satellite image comparisons

00 URXX KCHS 171824Z
GULL THREE CAMILLE ONE EYE LOCATED BY PENETRATION AT TWO EIGHT
DEGREES ONE TWO MINUTES NORTH EIGHT EIGHT DEGREES FOUR SIX MINUTES
WEST AT ONE EIGHT ONE FIVE ZULU

NNNN↓ 11A
00 URXX KCHS 171957Z
GULL THREE CAMILLE
A GULL THREE CAMILLE TWO
B 1↑2↑3↑4↑5
C 28 DEGREES /12 MIN N
D 88 DEGREES /46 MIN W
E 1815Z
F 1
G 2
H 901 -
I 28 DEGREES /12 MIN N 88 DEGREES /46 MIN W 1815Z
J 180
K 15 DEGREES /00 MIN
L C↑8
M 700/2390
N 2393 16.7
O 2393 10.4
P 2393 250/95
Q 150/30
R 6
S CLOSED WALL
T W↑1 P↑1 T↑1

NNNN↓MEMUUV
URX KCHS 172125Z
GULL THREE CAMILLE THREE
97779 71717 TI 1742/ 99282 70188 08188 99901 30825 00///
///// 85692 28013 70390 166// 88999 77999
VV 1742/ 99282 70188 08188 00901 30825 11874 29413 22732
19410 33700 16600 51515 10168 07370

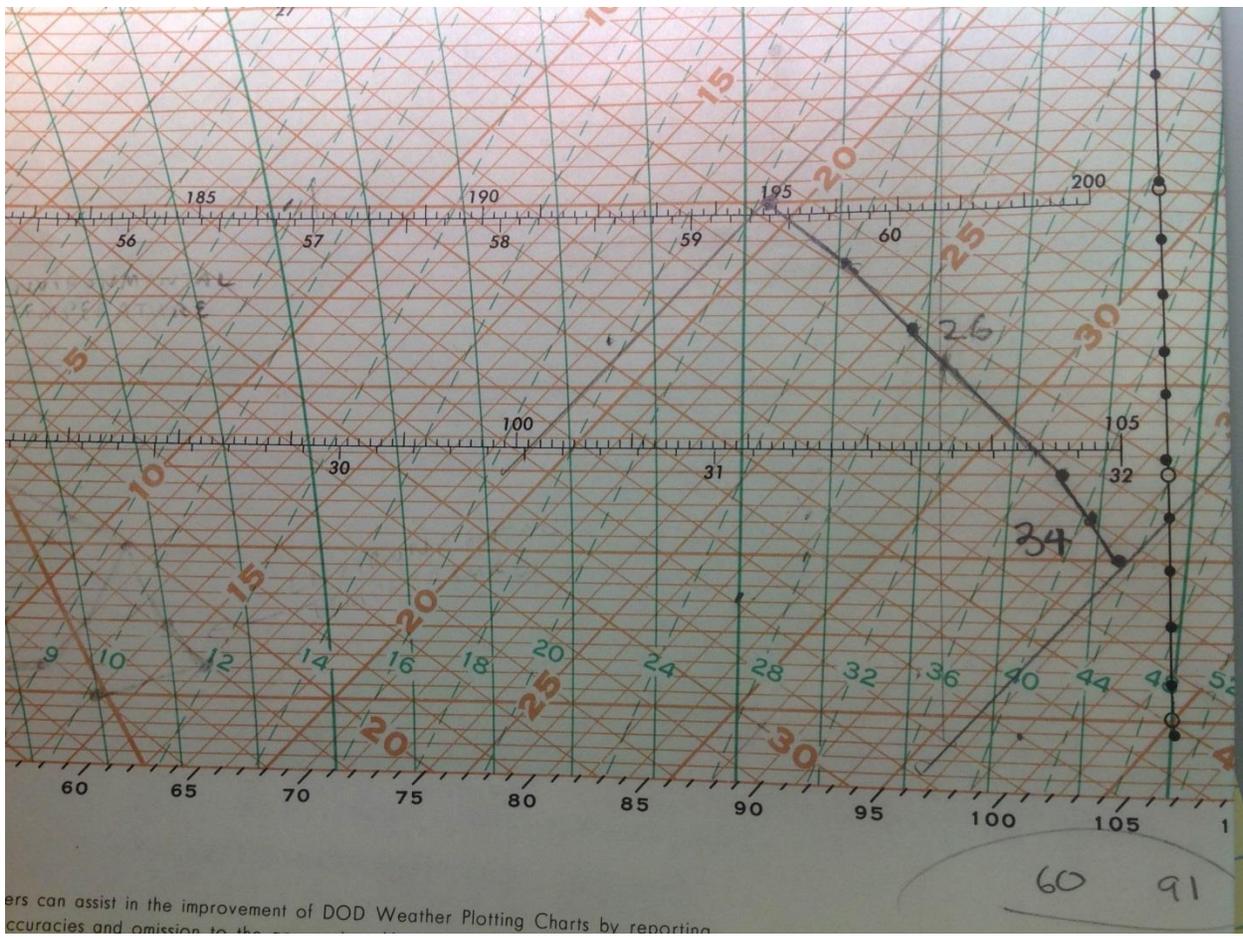
URXX KCHS 172140ZPOST FLIGHT SUMMARY
CAPT ZUBER AND CAPT WADAGNOLO
FIXED EYE 1815Z AT CORDINATES 28 DEGREES 12 MIN N 88 DEGREES 46 MIN W
WELL DEFINED EYE CLOSED WITH FEEDER BAND IN ALL QUADRANTS MAX SFC WNDS
OBSERVED IN SE QUADRANT OF 180 KTS PLUS MAX FL WND OBS SE QUAD AT
95 KTS MISSION ABORT 0000Z FIX DUE TO SHUTDOWN NO. FOUR ENGINE

SURFACE PRESSURE AS A FUNCTION OF 700 hPa HEIGHTS AND TEMPERATURES

Heights	700 hPa Temps.								
	4	6	8	10	12	14	16	18	20
3100	1012	1009	1006	1004	1001	998	996	993	991
3075	1009	1006	1003	1001	998	996	993	991	988
3050	1006	1003	1001	998	995	993	990	988	985
3025	1003	1000	998	995	993	990	988	985	983
3000	1000	997	995	992	990	987	985	982	980
2975	997	995	992	990	987	985	982	980	977
2950	994	992	989	987	984	982	980	977	975
2925	991	989	986	984	982	979	977	974	972
2900	989	986	984	981	979	976	974	972	969
2875	986	983	981	978	976	974	971	969	967
2850	983	980	978	976	973	971	969	966	964
2825	980	978	975	973	971	968	966	964	962
2800	977	975	973	970	968	966	963	961	959
2775	974	972	970	967	965	963	961	959	956
2750	972	969	967	965	963	960	958	956	954
2725	969	967	964	962	960	958	955	953	951
2700	966	964	962	959	957	955	953	951	949
2675	963	961	959	957	954	952	950	948	946
2650	960	958	956	954	952	950	948	945	943
2625	958	955	953	951	949	947	945	943	941
2600	955	953	951	948	946	944	942	940	938
2575	952	950	948	946	944	942	940	938	936
2550	949	947	945	943	941	939	937	935	933
2525	947	945	942	940	938	936	934	932	931
2500	944	942	940	938	936	934	932	930	928
2475	941	939	937	935	933	931	929	927	925
2450	938	936	934	932	931	929	927	925	923
2425	936	934	932	930	928	926	924	922	920
2400	933	931	929	927	925	923	922	920	918
2375	930	928	926	925	923	921	919	917	915
2350	927	926	924	922	920	918	916	915	913
2325	925	923	921	919	917	916	914	912	910
2300	922	920	918	917	915	913	911	910	908
2275	919	918	916	914	912	910	909	907	905
2250	917	915	913	911	910	908	906	904	903
2225	914	912	911	909	907	905	904	902	900
2200	911	910	908	906	904	903	901	899	898

Lapse rate used: -6.5 deg C/km
 Assumed dew point depression of 10 deg C.

This table is based on the identical computations used by IWRS to extrapolate SLP from aircraft platform data.



ers can assist in the improvement of DOD Weather Plotting Charts by reporting accuracies and omission to the

#2

HURRICANE CAMILLE

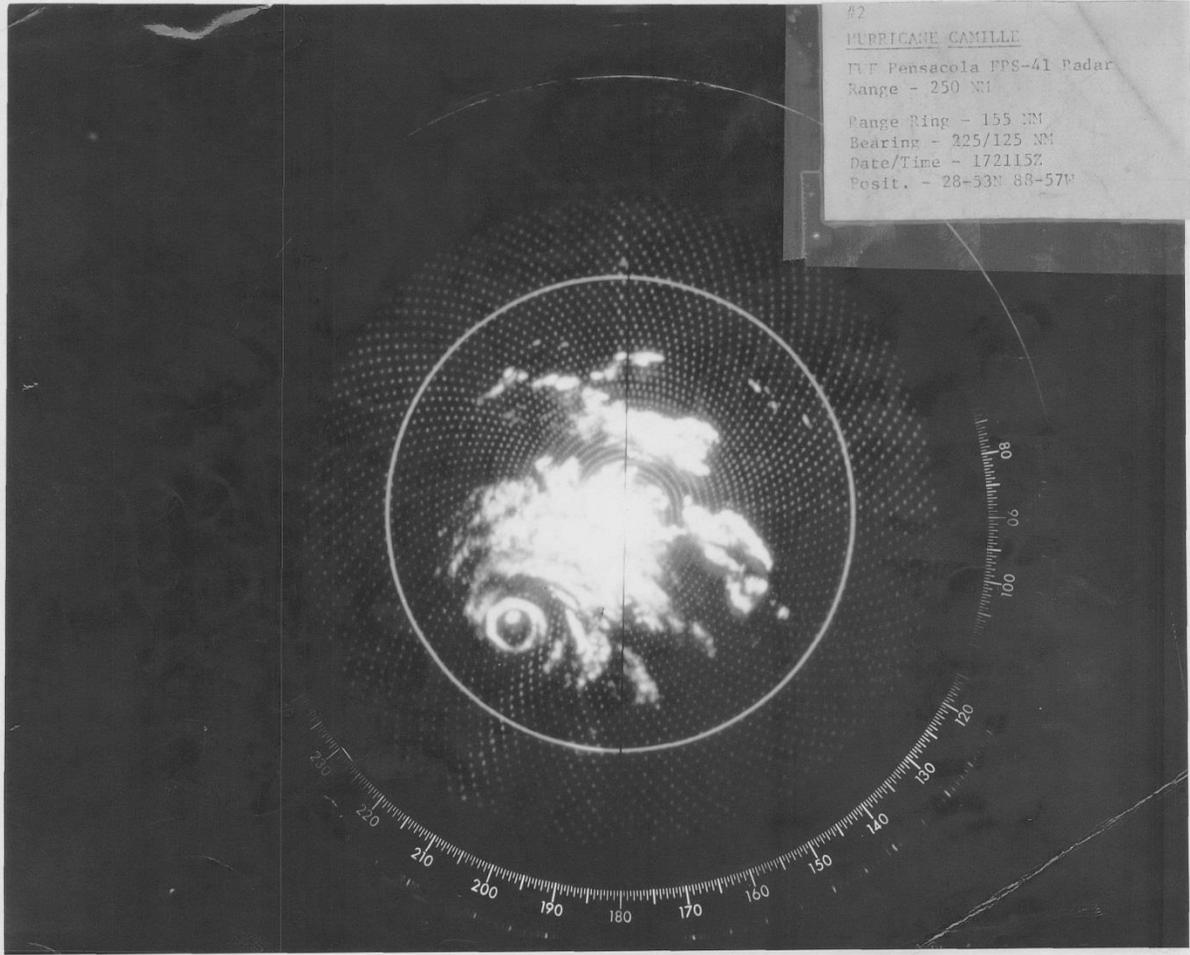
FLT Pensacola PDS-41 Radar
Range - 250 NM

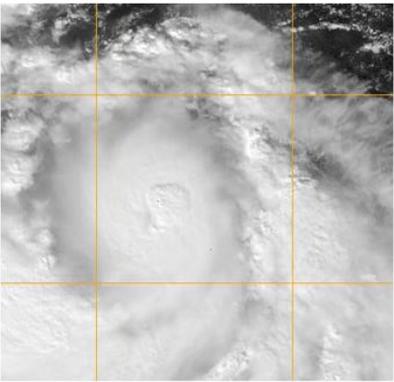
Range Ring - 155 NM

Bearing - 225/125 NM

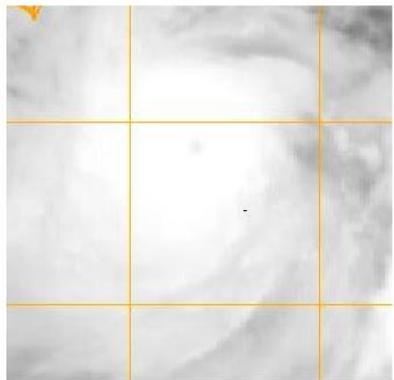
Date/Time - 172115Z

Posit. - 28-53N 88-57W

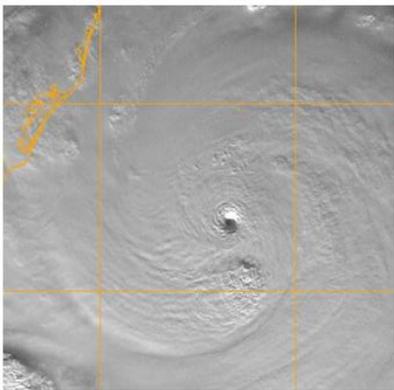




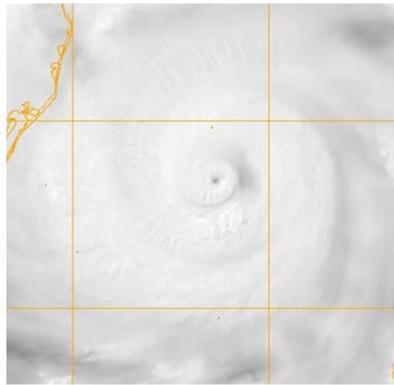
18 / 1445Z 979 mbar, 65 Kt



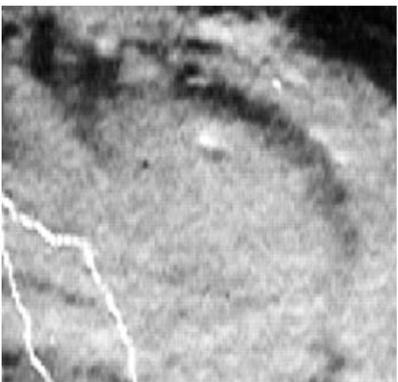
18 / 2345Z (IR) 970 mbar, 75 Kt



19 / 1215Z 882 mbar, 160 Kt



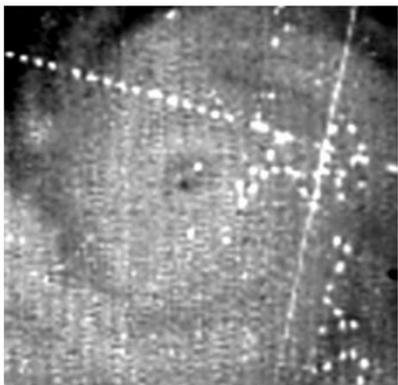
19 / 1815Z 892 mbar, 140 Kt



16 / 1311Z



16 / 2340Z 905 mbar



17 / 1953Z