VLB ARRAY MEMO No. 139

RADIOSONDE DATA FROM PUERTO RICO

D. Hogg 29 October 1982

Puerto Rico is a very attractive VLB site from the standpoint of u-v coverage, but its tropical climate is a concern. To explore the atmospheric conditions in a quantitative way I obtained from the National Climatic Center a tape containing the data from radiosondes launched at the Isla Verde airport of San Juan. The launches were made each day at 0 and 12 hours GMT, and the data cover the four year period 1977-1980. The NOAA tape was read to the IBM 4341 disks using a program written by B. Meredith, and the data was analyzed using a radiosonde program kindly provided me by G. Resch of JPL. The nature of the calculations is described generally in Section 2, Volume 12, Part B of Methods of Experimental Physics.

Figures 1 and 2 summarize four quantities extracted from the radiosonde measurements. In each plot I give for each month the average value, the rms of an individual launch about the average, and the values below which 10 percent and 25 percent of the samples are found.

My conclusions are that the atmospheric conditions change relatively slowly with season, and that San Juan is a wet site. Neither conclusion is surprising. To give a feeling as to how wet San Juan is in comparison with more familiar sites, I compare in the following table the data at San Juan in February and August with data reported by J. Waters in VLA Scientific Memorandum No. 8 (1967). The bracketed quantities are the rms values of individual observations

Station	Precipitable Water Vapor gm/cm^2		Excess Path Length cm	
	February	August	February	August
Albuquerque NM	0.67 (0.19)	2.38 (0.39)	2.3 (0.9)	8.1 (1.7)
El Paso TX	0.75 (0.18)	2.77 (0.55)	2.6 (0.8)	9.4 (2.2)
Huntington WV	0.89 (0.43)	2.99 (0.66)	3.0 (2.1)	10.0 (2.6)
San Juan PR	3.41 (0.58)	4.65 (0.72)	20.4 (3.5)	27.8 (4.4)

On the face of it San Juan is not an attractive site for observations at 22 or 43 GHz. It is possible that the southern half of the island is better; possibly this could be checked using cloud cover statistics. It is also important to note that it is of course the fluctuating component of path delay which is important and the radiosonde data does not tell us much about that. If the atmosphere over San Juan is reasonably stable, then useful VLB work can be done. Again, cloud cover data might shed light on this question. The experience of VLBI observers at Arecibo would also be of great help.

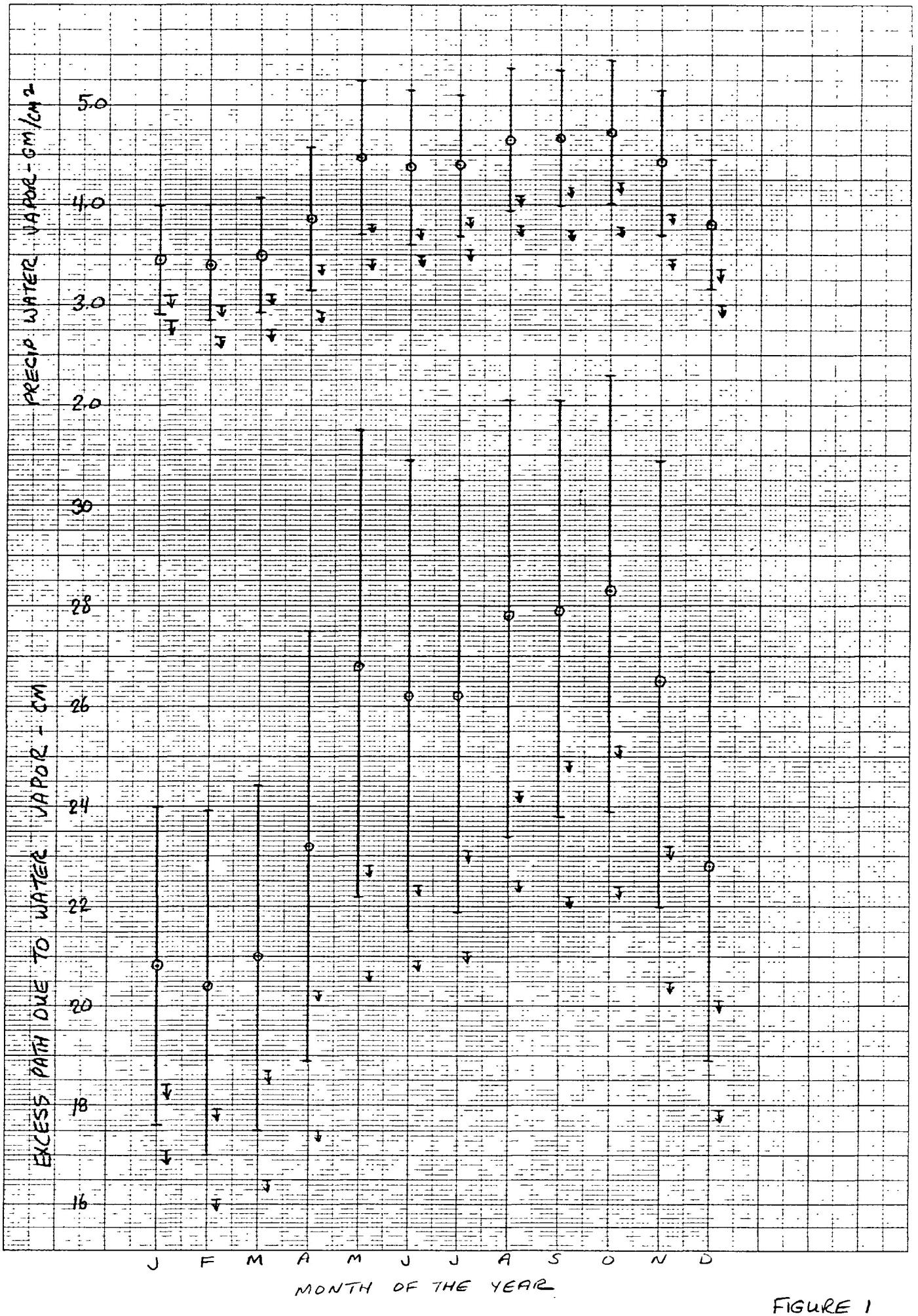

FIGURE 1

INFERRED VALUES FOR 22.2 GHz SAN JUAN P.R. JAN 1977 - DEC 1980

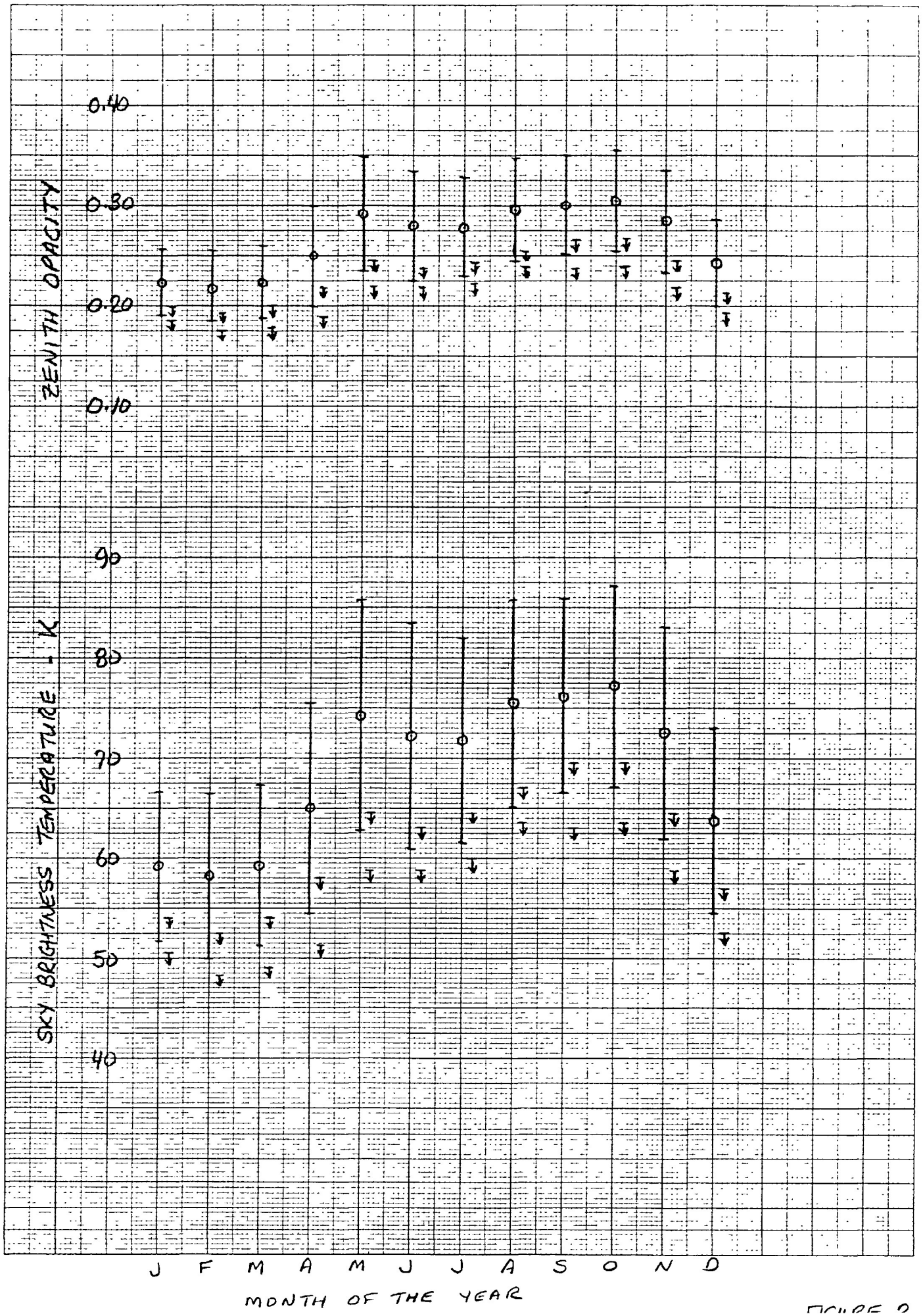

FIGURE 2

VLB ARRAY MEMO No. 139-A

ADDENDUM TO VLBA MEMO NO. 139

D. Hogg November 12, 1982

I made an error in the calculation of path length from Joe Waters' data. The correct values are given in the following table. The correct numbers are now consistent with the San Juan data.

Station		Precipitable Water Vapor gm/cm^2		Excess Path Length cm	
		February	August	February	August
Albuquerque	NM	0.67 (0.19)	2.38 (0.39)	4.0 (1.5)	14.4 (2.9)
El Paso	TX	0.75 (0.18)	2.77 (0.55)	4.5 (1.4)	16.7 (3.8)
Huntington	WV	0.89 (0.43)	2.99 (0.66)	5.4 (3.6)	17.6 (4.4)
San Juan	PR	3.41 (0.58)	4.65 (0.72)	20.4 (3.5)	27.8 (4.4)

The calculations in Memo 139 were for a frequency of 22.235 GHz. It has been suggested that it would be helpful to have opacities at frequencies off the water line, where the continuum work will be done. Attached is a summary of opacities and brightness temperatures at three other frequencies.

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RADIOSONDE DATA – PUERTO RICO 1977–1980

MONTH	15.0 GHz		20.0 GHz		25.0 GHz	
	OPACITY	BRIGHTNESS TEMP K	OPACITY	BRIGHTNESS TEMP K	OPACITY	BRIGHTNESS TEMP K
JANUARY	0.039 (0.005)	13.6 (1.3)	0.134 (0.019)	38.3 (4.7)	0.140 (0.020)	39.9 (4.9)
FEBRUARY	0.038 (0.005)	13.4 (1.5)	0.131 (0.022)	37.6 (5.3)	0.138 (0.023)	39.3 (5.7)
MARCH	0.039 (0.005)	13.5 (1.4)	0.134 (0.021)	38.4 (5.2)	0.141 (0.022)	40.0 (5.4)
APRIL	0.042 (0.007)	14.4 (1.9)	0.148 (0.027)	41.8 (6.6)	0.156 (0.030)	43.6 (7.0)
MAY	0.046 (0.007)	15.6 (2.0)	0.169 (0.029)	46.8 (6.8)	0.176 (0.031)	48.6 (7.2)
JUNE	0.045 (0.007)	15.4 (1.8)	0.164 (0.028)	46.0 (6.6)	0.172 (0.029)	47.8 (6.9)
JULY	0.046 (0.006)	15.5 (1.6)	0.164 (0.026)	46.0 (6.1)	0.172 (0.027)	47.9 (6.3)
AUGUST	0.047 (0.006)	15.9 (1.7)	0.173 (0.026)	48.2 (6.1)	0.181 (0.028)	50.0 (6.4)
SEPTEMBER	0.047 (0.006)	15.9 (1.6)	0.174 (0.025)	48.2 (5.9)	0.181 (0.026)	50.0 (6.1)
OCTOBER	0.048 (0.006)	16.0 (1.6)	0.176 (0.025)	48.8 (5.9)	0.184 (0.027)	50.6 (6.2)
NOVEMBER	0.046 (0.006)	15.5 (1.7)	0.166 (0.026)	46.2 (6.3)	0.173 (0.028)	48.0 (6.5)
DECEMBER	0.041 (0.006)	14.3 (1.6)	0.145 (0.024)	41.2 (5.8)	0.152 (0.025)	42.8 (6.0)

Quantity in brackets is the rms of a single launch about the mean