

Date: October 25, 1989
 To : EISCAT data representatives
 From : Peter Collis
 Subject : Calibration of EISCAT electron densities

The enclosed figure and table indicate the relationship between peak F-region electron densities derived from standard analysis of EISCAT common program data over the years 1988/89, with those determined from F-region critical frequency measurements by the University of Tromso ionosonde at Ramfjordmoen.

The table also includes an indication of the range and mean value of the system temperature during each experiment, and for those using the CP-1-I type pulse scheme (GEN-2F algorithm) the relative electron densities from the two power profiles are compared.

In the following it is assumed that the foF2 values are a good indicator of the true F-region peak density. Hence if there is a discrepancy between these and those derived from EISCAT data the implication is the existence of some system-induced effects. Detailed information concerning 1988 experiments has already been distributed (Nov 1988).

The ratio of densities from foF2 and from EISCAT has not been constant over these two years and can be broken down into a number of intervals separated by step-like changes, each of which requires an explanation (see figure). The experiments are divided into the two groups CP-1, 2, 5 frequency groups for long-pulse measurements.

<u>Period</u>	<u>EISCAT densities</u>	<u>Explanation</u>
before May 1988	Correct	OK
May 88 - Oct 88	CP-1 20% too high CP-3 10% too high	Frequency dependence of noise injection (Installed 22 April 88)
Oct - Dec 88	Correct	Noise injection modified
Jan - Mar 89	All 15% too low ?	
Mar - May 89	(no ionosonde data)	
Jun - 16 Oct 89	All 20% too high (except CD-1 Aug 1/3)	Directional coupler changed
Oct 16	to be determined	Noise injection modified

Although there are no ionograms for March to May 1989, the abrupt change in calibration appears to have occurred before 4 April according to astronomical measurements on that day, and most likely was introduced when the directional coupler (which couples the noise injection into the waveguide) was changed on 16 March. No obvious explanation has been found for the 15% change between Dec 88 and Jan 89. Further information will be distributed concerning calibration after Oct 16 when tests have been completed.

UPDATED TABLE OF SYSTEM TEMPERATURE DURING COMMON PROGRAMS,
 COMPARISON OF PEAK ELECTRON DENSITIES WITH FOF2 FROM RAMFJORDMOEN
 IONOSONDE AND INTER-COMPARISON OF POWER PROFILES.

<u>Date</u>	<u>Expt</u>	<u>Tsys(*)</u>		<u>Ne calibration(**)</u>	
		<u>Range</u>	<u>Mean</u>	<u>LP</u>	<u>PP</u>
1988					
Mar 8/9	CP-3	111-129	120	--	--
Mar 16/20	CP-1	111-117	113	--	0
Apr 5/7	CP-1	112-117	114	--	0
Apr 11/13	CP-2	110-117	112	-10	0
Apr 25/27	CP-3	77-107	95	0	--
May 3/4	CP-1	95-110	104	20	30
May 10/11	CP-3	88-108	98	10	--
Jun 13/15	CP-2	85-109	100	--	30
Jul 12/14	CP-3	90-117	103	10	30
Jul 26/27	CP-1	85-145	125	-10t o+20	30
Aug 9/10	CP-2	120-138	130	20	30
Aug 16/18	CP-2	101-127	118	20	30
Aug 30/01	CP-1	87-113	105	--	30
Sep 6/7	CP-1	88-117	103	--	30
Sep 12/14	CP-3	88-115	98	--	--
Oct 25/27	CP-3	87-130	96	0	--
Nov 9/10	CP-3	87-103	95	--	--
Nov 15/17	CP-2	88-112	92	--	10 to 20
Dec 5/10	CP-5	88-101	94	0	10 to 15
1989					
Jan 10/11	CP-1	90-94	91	-22	10 to 20
Jan 31/01	CP-3	88-125	96	-10 to-20	--
Feb 7/8	CP-1	88-93	90	-15	20
Feb 14/15	CP-2	89-93	91	-15	10 to 20
Feb 21/22	CP-3	89-110	97	B	--
Mar 7/8	CP-3	90-110	101	-10t o-20	--
Mar 28/29	CP-1	110-120	112	--	0 to 20
Apr 10/13	CP-3	92-110	101	--	--
Apr 25/26	CP-2	93-101	97	--	15
May 2/3	CP-1	94-98	96	--	20
May 9/11	CP-3	92-112	101	--	--
May 30/04	CP-5	95-115	104	15	15
Aug 1/3	CP-1	100-105	103	38	20
Aug 28/01	CP-2	100-105	103	22	20
Sep 5/6	CP-1	100-104	102	23	20
Sep 19/21	CP-3	100-120	110	22	--

(*) Excludes eg. Known sky noise maxima and abnormal values on April 6. Also excludes spikes but includes slower variations. 'Mean' values are judged by eye and are not very accurate.

(**) Ne calibration indicates :

- (i) LP, the percentage overestimate of long pulse electron densities above those predicated by ionosonde, -- means no ionosonde data available. Note that differences of a few percent could arise from different scaling techniques. Negative numbers indicate that foF2 exceed EISCAT. Exact 'agreement' occurs when this value is about -5% to -10% due to range smearing effects.
- (ii) PP, excess (in %) of 14 us power profile densities over 29 us power profile densities. This value is zero when the two are equal. CP-3 has only one set of power profiles (indicated by --. If the PP's are different, it is not clear which, if any, is correct.