AN ANALYSIS OF GPS OCCULTATIONS FROM MT. TSUKUBA AND MT. FUJI

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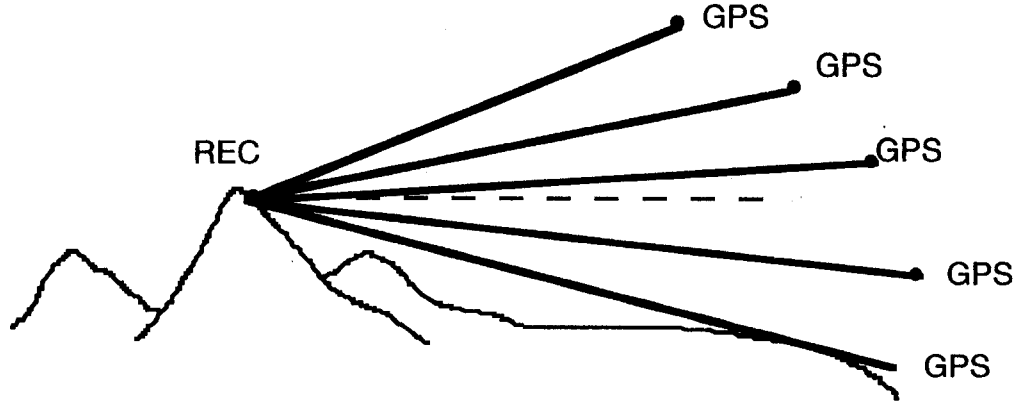
THE CONCEPT

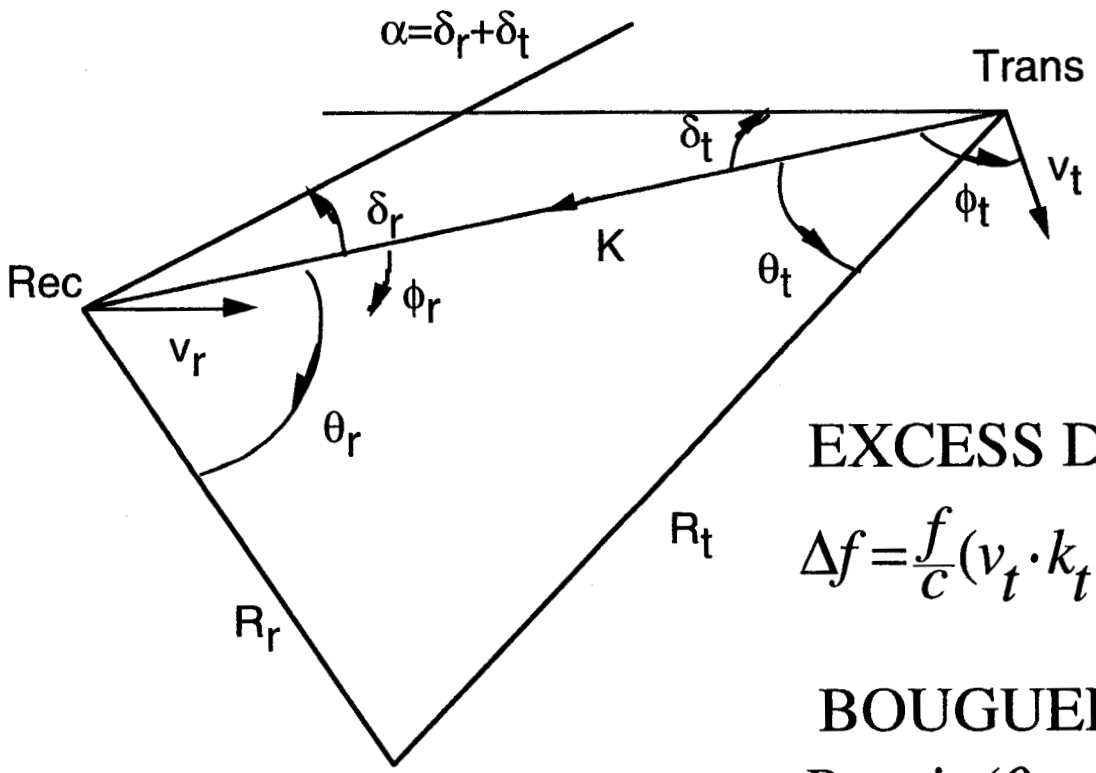
PROBING THE ATMOSPHERE AROUND THE RECEIVER



PROBING POINT IS ~ 100 Km AWAY FROM RECEIVER LOCATION

DEPENDING ON TOPOGRAPHY, LOCAL COVERAGE OF VERTICAL PROFILES CAN BE OBTAINED UP TO RECEIVER HEIGHT

BASIC FORMULATION



EXCESS DOPPLER

$$\Delta f = \frac{f}{c}(v_t \cdot k_t - v_r \cdot k_r - \{v_t - v_r\} \cdot k)$$

BOUGUER'S FORMULA

$$R_t n_t \sin(\theta_t + \delta_t) = R_r n_r \sin(\theta_r + \delta_r) = a$$

SYSTEM OF TWO NON-LINEAR EQUATIONS IN TWO UNKNOWNS, δ_r AND δ_t

BASIC FORMULATION

REFRACTIVITY UP TO RECEIVER HEIGHT IS OBTAINED ANALYTICALLY VIA ABEL INTEGRAL

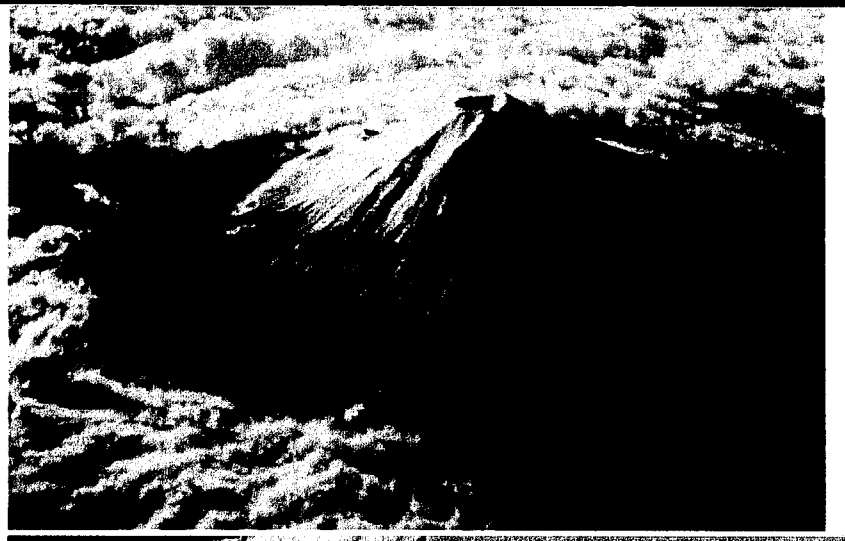
$$\frac{n(a_o)}{n(a_r)} = \exp\{\frac{1}{\pi}\int_{a_o}^{a_r} \frac{\tilde{\alpha}(a)}{\sqrt{a^2 - a_o^2}}\, da\}$$

$$\tilde{\alpha}(a) = \alpha_-(a) - \alpha_+(a)$$

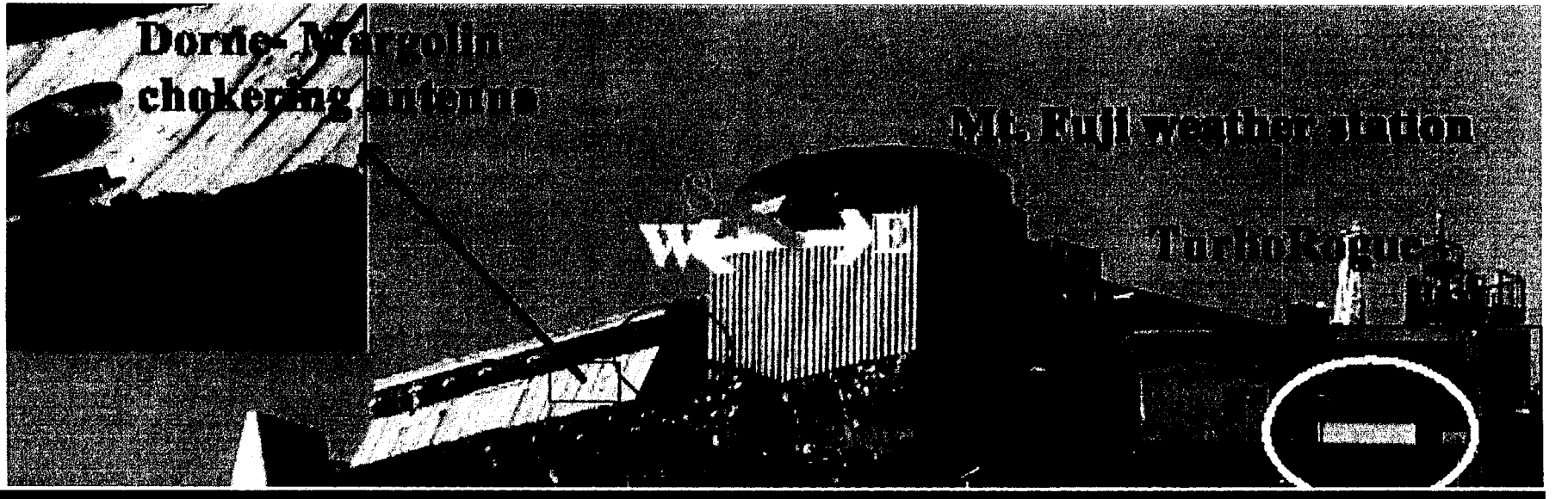
WHERE THE BENDING DIFFERENCE BETWEEN NEGATIVE AND POSITIVE ELEVATION AT ANY GIVEN a IS TAKEN, YIELDING THE CONTRIBUTION FROM THE TANGENT HEIGHT TO THE RECEIVER ONLY

Bruton and Kattawar, 1997

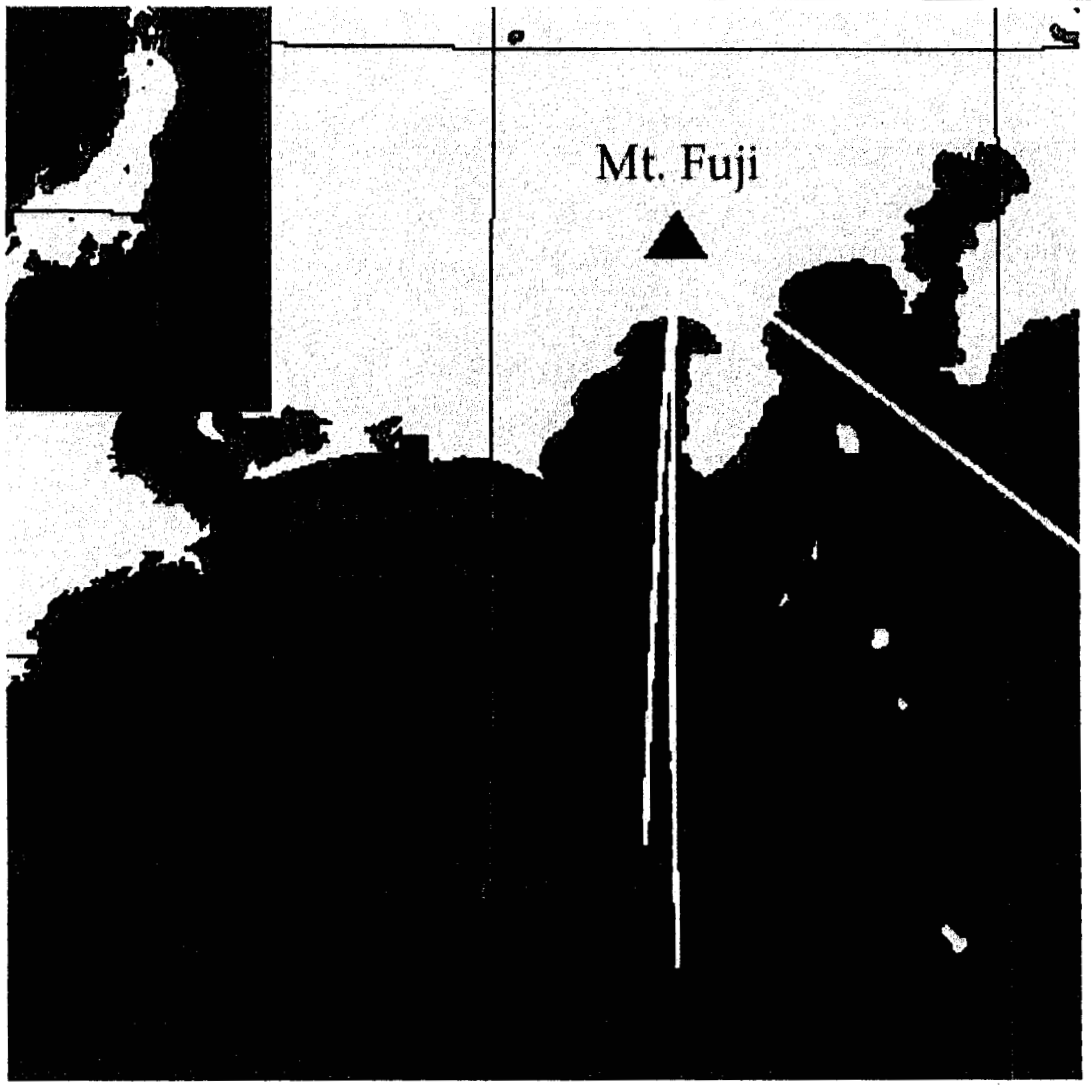
EXPERIMENTAL SETUP



MEASUREMENTS WERE TAKEN FROM THE MOUNTAIN TOP AT 3810 M IN THE SUMMER OF 2001 AND 2002



OBSERVATION DISTRIBUTION

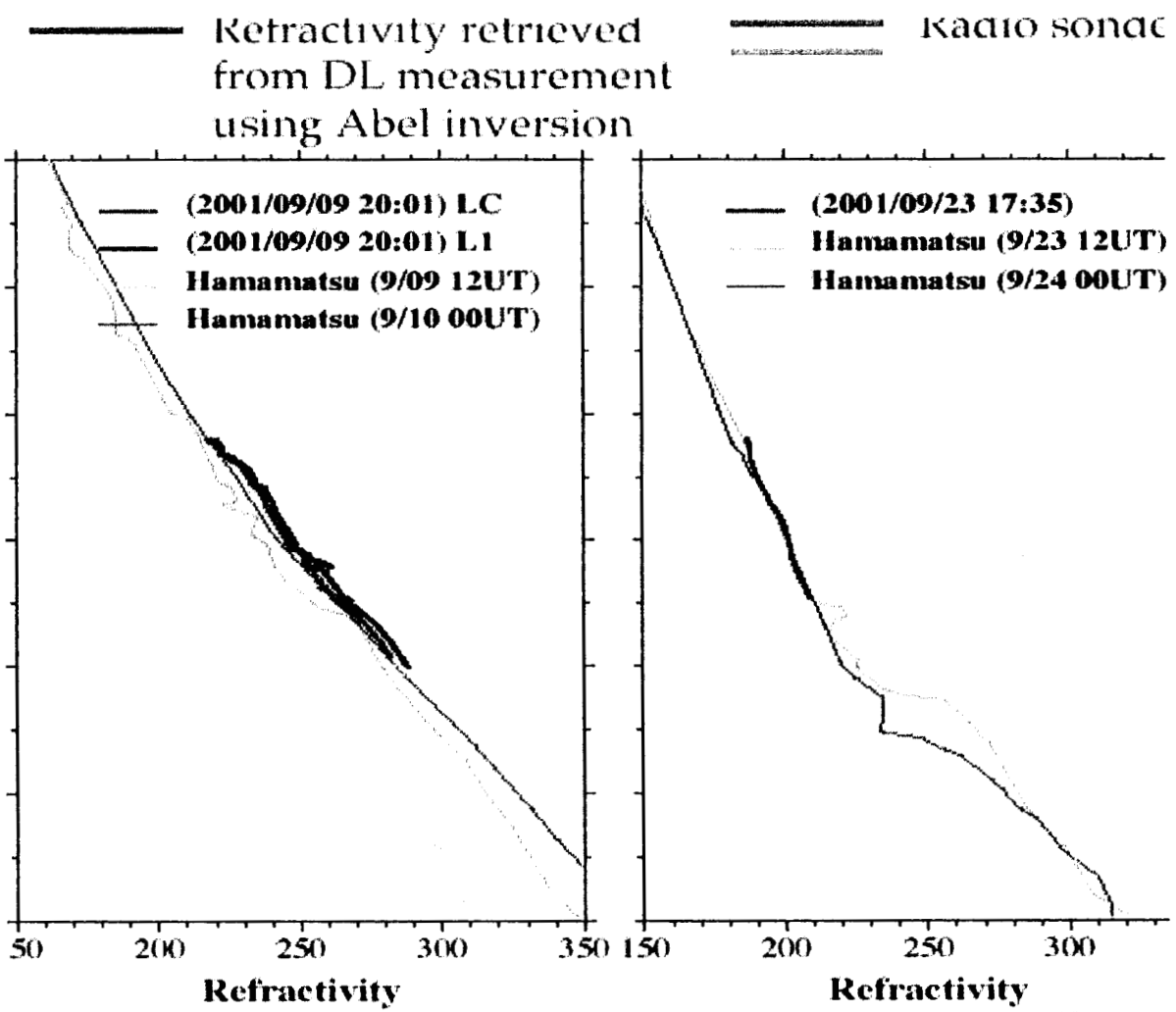


MT FUJI LAT,LON

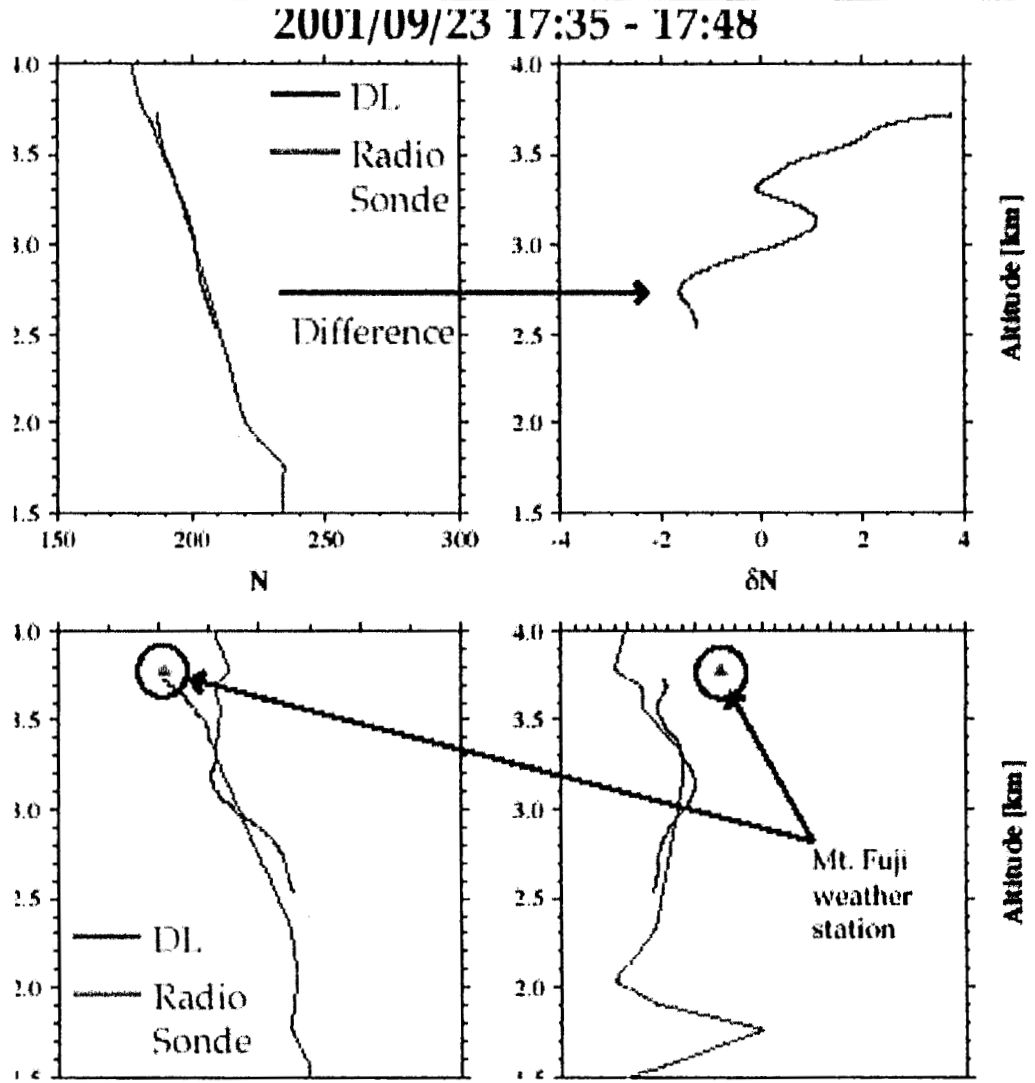
35.4 N - 138.7 E

DOTS MARK THE LOCATION OF THE TANGENT HEIGHT, WHERE THE ACTUAL ATMOSPHERIC PROFILING TAKES PLACE

COMPARISONS WITH RADIO SONDES REFRACTIVITIES



COMPARISONS WITH RADIO SONDES T AND RELATIVE HUMIDITY



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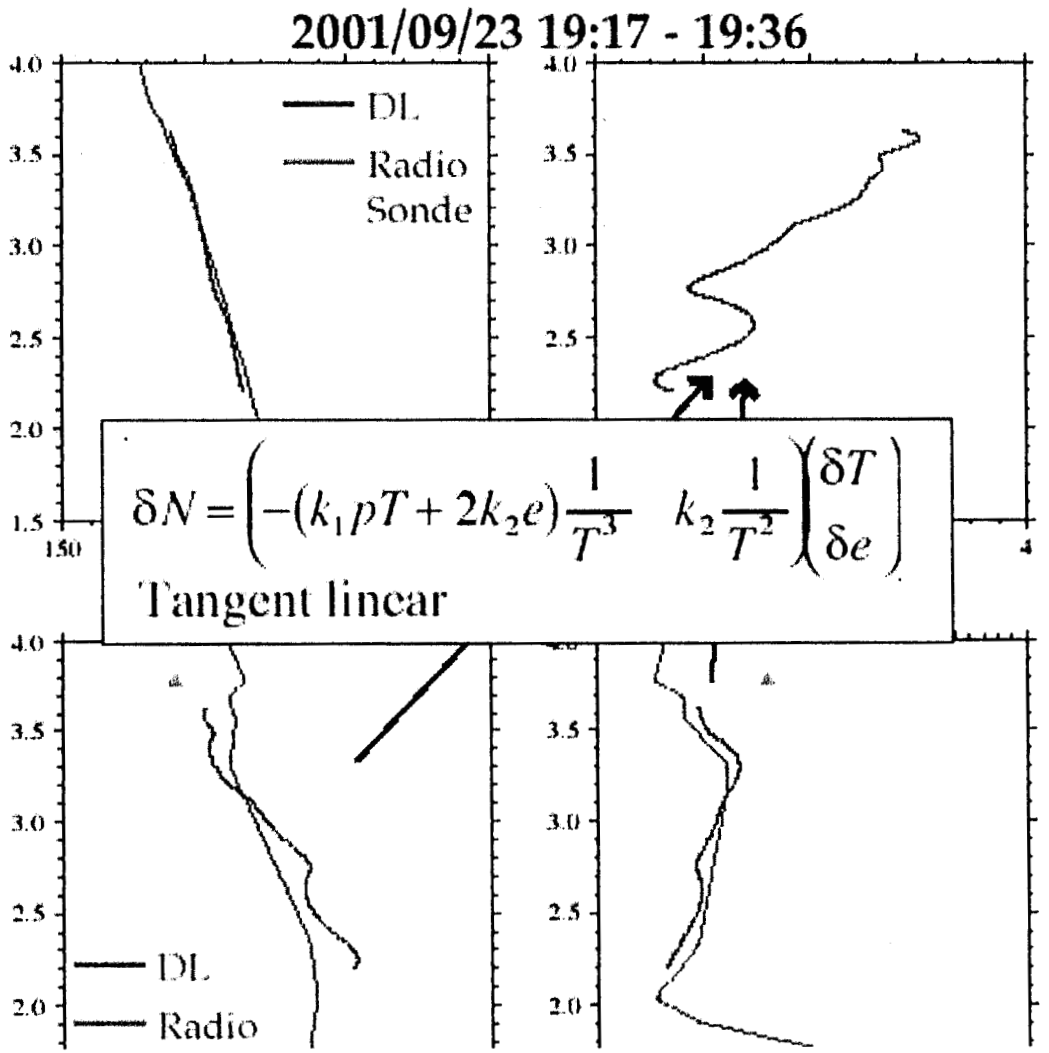

$$\delta N = \begin{pmatrix} -(k_1 pT + 2k_2 e)\frac{1}{T^3} & k_2 \frac{1}{T^2} \end{pmatrix} \begin{pmatrix} \delta T \\ \delta e \end{pmatrix}$$

Tangent linear

CONCLUSIONS

EXPERIMENTS FROM MT. TSUKUBA AND MT. FUJI TO PERFORM OCCULTATIONS FROM MOUNTAIN TOPS HAVE PERFORMED SATISFACTORILY

REFRACTIVITY PROFILES UP THE RECEIVER HEIGHT, AND HENCE TEMPERATURE AND WATER VAPOR HAVE BEEN OBTAINED AND COMPARED WITH THOSE FROM RADIO SONDES, SHOWING GOOD AGREEMENT

THE TECHNIQUE IS ATTRACTIVE FOR PROFILING REGIONS SURROUNDING THE MOUNTAINS, AND PROBING THE BOUNDARY LAYER