

RANGE-DEPENDENCE COMPENSATED LASER RADAR ECHO
AND ITS QUANTITATIVE INTERPRETATION IN RHI DISPLAY

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ABSTRACT

Compensation of range dependence of the laser radar echo is indispensable to observe atmospheric scattering profile quickly. The range dependence is induced by divergence of scattered light and attenuation by atmospheric scattering and absorption. This divergence makes the echo inversely proportional to the square of the range ($1/R^2$). Compensation of this $1/R^2$ dependence can provide sufficient signal correction to observe atmospheric mixing layers, even without compensation of the attenuation.

This range dependence has been compensated by varying the voltage of dynodes of a photomultiplier tube.⁽¹⁾⁽²⁾ While this method has a large dynamic range, it requires a critically adjusted circuit and a logarithmic amplifier to compress the signal of a wide range into a proper voltage range for CRT brightness modulation.

We have studied to compensate the $1/R^2$ dependence by adding logarithmically amplified ramp signal of adequate amplitude to the log amplitude of the received signal. This method enables both the range compensation and compression of the signal dynamic range, with rather simple circuits. Range-dependence compensated signal is displayed in range-height indication (RHI).

Then the problem is how to quantitatively interpret the relation between the brightness of the CRT and the signal intensity or between the photograph of the CRT display and signal intensity. We will discuss on the techniques of the range dependence compensation and the quantitative interpretation of the range-compensated RHI display.

(Reference)

- (1) P. M. Hamilton, Phil. Trans. Roy. Soc. Lond. A. 265, 153 (1969)
- (2) R. J. Allen and W. E. Evans, Rev. Sci. Inst. 43, 1422 (1972)