



Standard Guide for Measurement of Atmospheric Wind and Turbulence Profiles by Acoustic Means¹

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1. Scope

1.1 This guide describes the application of acoustic remote sensing for measuring atmospheric wind and turbulence profiles. It includes a summary of the fundamentals of atmospheric sound detection and ranging (sodar), a description of the methodology and equipment used for sodar applications, factors to consider during site selection and equipment installation, and recommended procedures for acquiring valid and relevant data.

1.2 This guide applies principally to pulsed monostatic sodar techniques as applied to wind and turbulence measurement in the open atmosphere, although many of the definitions and principles are also applicable to bistatic configurations. This guide is not directly applicable to radio-acoustic sounding systems (RASS), or tomographic methods.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this guide.

2. Referenced Documents

2.1 *ASTM Standards*:²

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

3. Terminology

3.1 *Definitions*—Refer to Terminology **D1356** for general terms and their definitions.

3.2 *Definitions of Terms Specific to This Standard*:

Note: The definitions below are presented in simplified, common, qualitative terms. Refer to noted references for more detailed information.

3.2.1 *acoustic beam*, n —focused or directed acoustic pulse (compression wave) propagating in a radial direction from its point of origin.

3.2.2 *acoustic power*, n —relative amplitude or intensity (dB) of an atmospheric compression wave.

3.2.3 *acoustic refractive index*, n —ratio of reference (at a standard temperature of 293.15 K and 1013.25 hPa pressure) speed of sound value to its actual value.

3.2.4 *acoustic scatter*, n —the dispersal by reflection, refraction, or diffraction of acoustic energy in the atmosphere.

3.2.5 *acoustic scattering Cross-section Per Unit Volume* (σ , m^{-1}), n —fraction of incident power at the transmit frequency that is backscattered per unit distance into a unit solid angle.

3.2.6 *acoustic attenuation* (ϕ , dB/100m), n —loss of acoustic power (acoustic wave amplitude) by beam spreading, scattering, and absorption as the transmitted wavefront propagates through the atmosphere.

3.2.7 *backscatter*, n —power returned towards a receiving antenna.

3.2.8 *beamwidth (degrees)*, n —one way angular width (half angle at -3 dB) of an acoustic beam from its centerline maximum to the point at the beam periphery where the power level is half (3 decibels below) centerline beam power.

3.2.9 *bistatic*, *adj*—sodar configuration that uses spatially separated antennas for signal transmission and reception.

3.2.10 *clutter*, n —undesirable returns, particularly from sidelobes, that increase background noise and obscure desired signals.

3.2.11 *decibel (dB)*, n —logarithmic (base 10) ratio of power to a reference power, usually one-tenth bell; for power P_1 and reference power P_2 , the ratio is given by $10\log_{10} (P_1/P_2)$.

3.2.12 *directivity*, n —concentration of transmitted power (dB) within a narrow beam by an antenna, measured as a ratio of power in the main beam to power radiated in all directions.

3.2.13 *Doppler frequency* (f_D , Hz), n —shifted frequency measured at the receiver from the scattered acoustic signal.

3.2.14 *effective antenna aperture* (A_e , m^2), n —product of antenna area with antenna efficiency.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.