# Concepts and Solutions to Overcome the Refraction Problem in Terrestrial Precision Measurement

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Refraction, dispersometry, scintillometry, temperature gradient

## ABSTRACT

Refraction is a detrimental problem in terrestrial optical measurements and can be regarded as major source of systematic errors in the precise determination of distances and directions. In general, refraction is a function of the density inhomogeneities of the propagation medium. As the "classical" method of temperature-gradient determination does not meet the requirement of a representative integral determination of the refractive index gradient field, at the Institute of Geodesy and Photogrammetry of the ETH Zürich, two methods to determine and correct the refraction influence have been developed further during the last few years.
One approach focuses on the determination of the refractive index gradient in measuring the turbulence of the air by scintillometry or CDD-based image processing, which is presently the key technology in tracking tacheometers and digital levels. Turbulence is a measure of the energy in the heat exchanging process and can be converted by the Monin-Obukov-Similarity into temperature gradients. The advantage of optical scintillation measurements is to derive line averaged turbulence parameters of the atmospheric surface layer.
Another challenging approach was the successful development of a compact laser-dispersometer at the ETH which could be a component of actual geodetic instruments in the future. A dispersometer theodolite, basing on the dual-wavelength method for dispersive air is capable of refraction-free direction measurements.
The results of both technologies, turbulence determination and dispersometry, will be presented and discussed in this paper.

## CONTACTS

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