Ultrasonic in situ measurements of density, adiabatic compressibility, and stability frequency

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Limnol. Oceanogr., 47(4), 2002, 1255-1260 | DOI: 10.4319/lo.2002.47.4.1255

ABSTRACT: An in situ density profile has been measured with an ultrasonic density probe in the mining lake Merseburg-Ost 1b. From the acquired measurements of sound speed and acoustic impedance, the important physical properties of in situ density and adiabatic compressibility could be calculated. It was also shown that these two properties sufficed to determine the stability frequency, which hence becomes a directly observable physical magnitude. Measurements of all magnitudes are presented. Currently the accuracy only suffices to provide new insight in the density structure of natural water bodies in cases of unusual composition of dissolved substances. However, as all required data are acquired in situ and density is measured directly, i.e., without need of empirical formulations (□equations of state□), the ultrasonic approach has the potential to become a reliable reference for density measurements in limnic waters, when chemical conditions are complex or spatial or temporal variation of dissolved substances becomes relevant for the stability of the water column.