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## First observational results of Underwater Muon Detection System to Measure Coastal Mixed Layer Depth for Ocean and Climate Studies

After atmospheric muons enter the sea, a decreased muon count is observed at the bottom of water. Muon count is inversely proportional to the density of water which can be measured by counting muons at the bottom. Mixed Layer (ML) in Oceans is defined as the less dense upper region of the water column where turbulent mixing occurs. Mixed Layer Depth (MLD) is the depth of this region and shows diurnal, seasonal fluctuations, and spatial variations. MLD can be estimated by combining bottom muon count measurement with the sea surface temperature, salinity, and altimetry data from earth observing satellites. We constructed a scintillator based underwater muon detection system which can measure average water column density by counting surviving muons at the bottom. The detector system deployed in the North-Eastern Mediterranean at METU-IMS harbour in Mersin/Turkey while a similar detector system deployed on land in Ankara/Turkey for control sampling. Initial observations with both detector systems show consistent muon flux measurements with previous studies. Diurnal muon flux shows around 0.1 % variations between noon and midnight. Forbush decrease events with increasing KP-index were also captured with both systems. After validation of muon detection, Mixed Layer Depth measurements were performed. In order to calibrate the MLD estimation via muon count, water density measurements with CTD (Conductivity, Temperature, Depth) were done simultaneously. In this work we will present our first measurements of Mixed Layer Depth using atmospheric muon flux. This work is actualization of a previous study which was presented at ICHEP-2024 in Prague and the article "Mixed Layer Depth Measurement in Coastal Waters Utilizing Atmospheric Muons" (10.1175/JTECH-D-24-0044.1) published in Journal of Atmospheric and Oceanic Technology.

## Collaboration(s)

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