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清华大学安全科学学院

# 第004期“安全科学论坛”

题目： 近地表地球物理学与城市公共安全  
Near Surface Geophysics and its Impact on  
City Public Safety

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报告地点： 自强科技楼（吕大龙楼）102会议室

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## 报告摘要 Abstract

地球物理学大约起源于140年前，地震仪的广泛出现，研究地震并应用地震波研究地球内部构造成为一门独立的科学。大约70年前，地球物理学被广泛应用于勘探石油和天然气资源，随后在这个领域全球诞生了约6000家石油勘探企业，于是勘探地球物理学诞生了。地球陆地地下构造的近地表区域（0-1000米内）是最复杂的，没有全球统一的地质模型，所有深部传播的地震波都要经过近地表区域才能被接收到，因此研究地震波的近地表成像技术成为石油勘探的重要课题。随着人类城市活动的繁荣兴旺，为确保城市安全，不仅需要监测城市之下近地表构造及其变化，地震仪采集的城市声音与振动信号也可以帮助重建各种场景的特征，于是采用同一套声音与振动信号采集设备同时监测地下1000米内构造活动，地表人类活动，地上1000米内低空飞行活动 - 新的近地表地球物理学出现了，本报告介绍这门新拓展的科学现状以及对人类生活深远的影响。

Geophysics originated approximately 140 years ago. With the widespread advent of seismometers, the study of earthquakes and the use of seismic waves to investigate the internal structure of the Earth became a branch of science. Around 70 years ago, geophysics was applied in the exploration of oil and gas resources. Subsequently, about 6,000 oil exploration companies emerged globally in this field, marking the birth of Exploration Geophysics. The near-surface region (within 0-1000 meters) of the Earth's subsurface is the most complex, and there is no globally unified geological model. All seismic waves propagating from deep within the Earth must pass through this near-surface region before being received, making the study of near-surface seismic imaging techniques a crucial topic in oil exploration.

With the prosperity of urban activities, ensuring city safety now requires not only monitoring the near-surface structures beneath cities and their changes, but also analyzing urban sounds and vibration signals collected by seismometers, which can help reconstruct the characteristics of various scenarios. As a result, the same set of equipment used to collect sound and vibration signals is now being employed to simultaneously monitor subsurface activity within 1000 meters, human activities on the ground, and low-altitude aerial activities within 1000 meters above the ground. This has led to the emergence of a new definition of Near-Surface Geophysics. This talk introduces the current state of this newly expanded science and its profound impact on human life in future.