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Ground effects on sound and vibration from explosions

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Low frequency sound from military activity and explosions do propagate over large distances. The sound pressure may induce substantial vibration in the ground and particularly in buildings. Such vibrations turn out to be a major cause of complaints among neighbouring communities around training fields and blast sites. We will present investigations on long range propagation of low frequency sound and sound-induced vibration, based on a substantial amount of data collected during a series of full scale tests performed in Norway over the last 14 years. All data are assembled in the NORTRIAL database, which is now publicly available. Meteorology and ground interaction largely influence the sound propagation and vibration response. At low frequency meteorological- and ground effects may intricately interact and lead to large, apparently random variability in sound pressure at large distances. Statistically based investigations on the sound propagation and its variability will be presented. Particular focus will be on the ground interaction effects, and a new and more extensive system for ground classification, based on cartographic data, empirical and numerical modelling will be introduced. Findings on building response to outdoor low frequency sound and transfer mechanisms from outdoor pressure to indoor sound and vibration will be presented.