Resilient cities: 3D geoscience for sustainable subsurface management

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It is estimated that global population reached 7 billion in 2011. Almost half of that population live in towns or cities. Rapid urbanisation driven by population change, socio-economic and technological development has placed increased pressure on the natural capital provided by the natural environment to society. Land use change and increased competition for space above and below ground places ever growing demands on the ability of urban ecosystems to deliver the goods and services on which society depends. A 3D geoscience framework provides a means to assess the impacts of predicted future demographic and environmental change on the subsurface and the demands placed upon it.

The shallow earth system in and around towns and cities has been affected by human activity as people have made use of the natural capital around them. Human interventions that use the subsurface have, at different times, included mineral exploitation, ground water abstraction, waste disposal, utility platforms and foundations for the design of engineered infrastructure. In support of sustainable urban design, the subsurface is increasingly utilised for the underground sequestration of carbon, geothermal energy, sustainable drainage systems (SuDS) and novel exploitation of coal gas resources.

Many of these regulating, provisioning, supporting, cultural and platform-based services are provided on the basis of the interaction of humans and the shallow earth system. Good management and governance of underground space will result in resilient and adaptable urban systems where conflicts in subsurface demands can be avoided, negative interactions between natural and engineered systems minimised and their benefits maximised.