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Detection and characterisation of anthropogenic pieces by magnetic method

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Human activities have let many anthropogenic objects buried under our feet. Some of these like explosive devices left after the World Wars turn out to be a threat to safety or environment. Others must be perfectly localised in case of construction work, for example gas pipe. Geophysics and more specifically magnetic cartography (many of these items are magnetic) can obviously help to locate them. We already use this method on daily basis to detect UXO (unexploded ordnance) but less than 10% of the unearthed objects are actually bombs or shells. Detection and mostly characterisation methods must be improved in order to reduce this proportion.
On the field there are a few things we can do to increase data qualities. Characterisation may be improved by multiple scale prospections. We search a large area with our usual and rather fast method then we achieve high definition cartographies of small interesting areas (upon the object to characterise). In the case of measurements in an urban environment for example, data are distorted. The traffic (train, tramway, cars…) produces temporal variations of the magnetic field. This effect can be lessened, sometimes even removed by the use of a fixed scalar magnetic sensor.
Data treatment is another key as regards the characterisation. Tools such as analytic signal or derivative are frequently used at the first degree. We will see that in a synthetic case the second and third degree bring even more information. A new issue appeared recently about pipes. Can we localise very precisely (less than 10 cm uncertainty) a gas pipe? Horizontally we can but due to our inversion method we still have troubles with the depth accuracy.
Our final concern is about the amplitude of some anomalies. Potential methods equations are based on the fact that the anomaly norm must be minor to magnetic field norm. Sometimes this is not the case but vector magnetometry is a lead to solve this problem.