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One man's noise is the other man's music; using satellite radar interferometry for ground movement estimation

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The application range of geodetic observations for deformation studies is dictated by measurement precision, spatial and temporal sampling, and spatial and temporal coverage. Pushing both technology and processing methodology to a next level enables a new range of applications: signals that were previously hidden below the general noise floor now appear as distinguishable signals. These general characteristics are particularly applicable to satellite radar interferometry (InSAR), a technique that has been in a process of spectacular development since the early 1990's. During this period, particularly developments in processing methodology aimed towards noise reduction have lead to the detection of minute signals. As some of these signals do not have a direct economic effect, other geodetic techniques have not been applied to those signals. Here we present examples of these developments over the Netherlands, in which we show the successful detection of ground movement due to gas withdrawal in rural and forested areas, solution salt mining, ground water withdrawal, peat compaction, subsidence due to coal mining and subsequent uplift of abandoned mine complexes, and deformation of infrastructure such as railroads and water defense systems. Detection and monitoring of these processes is only possible if other components of the interferometric phase signal, such as atmospheric delay, can be uniquely identified. We comment on how well different types of signals due to geometry, (time dependent) deformation, and propagation delay can be separated in order to estimate the signal of

interest. Finally, we discuss the prospects of future missions to make yet another step towards detecting new signals.