IBIS: an Innovative Technology Based on Ground-based Radar Interferometry for the Measurement of Deformations

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ABSTRACT:

In this last decade several papers appeared in literature reporting Ground Based InSAR experiments for landslide and subsidence monitoring. Capabilities of these systems in terms of imaging, DEM generation and displacement measurement have been investigated for different configurations and wavelengths. The systems here presented are the first ground based interferometric systems available for research and commercial uses, named IBIS, designed and developed by IDS company. IBIS, based on radar interferometry, allows the remote monitoring of movements of large portions of territory (landslides, slopes, volcanoes, glaciers etc.) and of structures (dams, bridges, towers, buildings etc.) with sub-millimetre accuracy. IBIS technology revolutionizes the traditional approach to measuring the movements and deformations of territories and structures, both in static (slow displacements) and dynamic vibration measurements).

The particular characteristics of this new instrument are that it can operate remotely, with no contact required whatsoever with the target to be monitored and that it can supply practically continuous deformation maps (not just punctual information as provided by current contact sensors), all with an unprecedented measurement speed and accuracy compared to current technology. The radar beam of the apparatus illuminates the entire scenario to be investigated; the radar receiver then measures the signal reflected. The high resolution capacity over distance provided by the radar produces a displacement map showing the displacement of many points across the entire target; in fact, the radar samples the target about every 0.5 metres. In principle this is as if a vast number of sensors was applied to the target, one every 50 centimetres (virtual sensors).

Thanks to the microwave technology used, the radar can detect displacements of each point on the target up to an oscillation frequency of 100 Hz. with a detection limit of less than 1/10 mm. This great sensitivity in detecting displacements is due to the use of interferometry, measuring the phase differences of the radar waves reflected from each point. Each sub-millimeter displacement gives rise to a phase difference of the reflected wave, detectable by the radar.