

## **Probing the Ultimate Capabilities of Radar Interferometry for Deformation with Low Gradient**

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Abstract :

The use of radar interferometry for measuring ground deformation of geophysical origin has been first demonstrated in the context of the large displacement field generated by a major earthquake [Nature 364 138-142, 1993]. This first study has been quickly followed by others where the amplitude of the phenomena, was lower, whether caused by smaller earthquakes [GRL 22 1541-1544, 1995; Science 268 1333-1336, 1995; GRL 23 969-972, 1996; GRL 23 2677-2680, 1996] or by volcanic activity [Nature 375 567-570, 1995].

At the same time two quests were initiated in parallel: the first aimed at using properly this new signal [GRL 22 1037-1048, 1995], the second, more technology oriented, aimed at pushing the limit of the method down to the artefact level [GRL 22 1537-1540, 1995; IEEE/TGARS 33 401-408, 1995] while trying to observe phenomena characterized by low gradients of deformation, such as post-seismic evolution [Nature 369 227-230, 1994; Nature 382 612-616, 1996; Science 273 1202-1204, 1996].

Here we discuss the prospects of extending the use of radar interferometry to a whole class of phenomena it did not explore so far. Such phenomena include post-glacial rebound, interseismic deformation, tidal loading over large areas as well as large and deep earthquakes. Some of these have their amplitudes maximized with time, which raises the question of long term coherence and the parallel issue of the proper satellite mission required to seize this opportunity. Tidal loading, a cyclic phenomenon, may be maximized by stacking adequate image pairs. The deformation field of deep earthquakes can be discriminated against noise by the consistency in the signal of adjacent radar tracks. In any case, the competing artifactual phenomena: orbit adjustment, radar clock drift, meteorological fronts... must be fully understood by the end users of radar interferometry before any attempt is made toward these new fields. We hope to contribute such an understanding with this paper.