"On the need of Developing Multi-Band Differential (Multiple Pass) POLinSAR Theory and Algorithms for Remote Sensing and Monitoring of Natural Environments and Severe Environmental Stress Changes (Disasters) – such as Severe Storms, Typhoons and Floods, Earthquakes and Tsunamis "

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Abstract

Worldwide, medium- to short-term earthquake prediction is becoming ever more essential for safeguarding man due to an un-abating population increase, but hitherto there have been no verifiable methods of reliable earthquake prediction developed - except for a few isolated examples of earthquake prediction in China and in Greece. This dilemma is a result of previous and still current approaches to earthquake prediction which are squarely based on the measurement of crustal movements, observable only after a tectonic stress-change discharge (earthquake) has occurred. The prediction models were derived from past histories of measurements, mainly carried out during the past 30 – 40 years, although initiated soon after the San Francisco Earthquake of 1906. During the past decade it was proved and shown that it is not possible to derive reliable models for earthquake predictions from crustal movement measurements alone, and that an entirely new approach must be sought and rigorously pursued over years and decades to come.

In support of this conclusion, there have been reported throughout the history of man anecdotal historical up to scientifically verifiable earthquake precursor or *"seismo-genic"* signatures of various kind – biological, geological, geo-chemical and especially a rather large plethora of diverse electromagnetic ones on ground, in air and space, denoted as *"seismo-electromagnetic"* signatures. The existence of all of these signatures can no longer be denied even by the fiercest seismological expert opponents; and it is absolutely high noon that those signatures be more rigorously assessed in order to develop a strategy for designing and carrying out controlled *"seismo-genic"* and *"seismo-electromagnetic"* studies on how to set up world-wide a network of measurement sites for conducting a holistic set of measurements for providing an improved understanding on why and how such precursor signatures are generated, and how and where those may best be observed subject to the rather poor signal-to-noise ratio (SNR), requiring much improved digital instrumentation as time goes on due to the ever increasing man-made electromagnetic noise generation. Another viable novel method of detecting pre-seismic, co-seismic and post-seismic surface deformations is made available by the compatible rapidly advancing air- & space-borne Repeat-Pass Polarimetric Differential SAR Interferometry technology, now gaining increased applicability with the advent of the first fully polarimetric satellite SAR sensors such as the Japanese ALOS-PALSAR, the German Tandem TERRASAT-X 1 & 2 and the Canadian RADARSAT-2.

Similarly, the question on whether there do exist reliable prediction methods was answered long ago by the fauna living within the coastal littoral zone that are affected by tsunamis. Especially during the last devastating *"Boxing Day – 041226 Tsunami"* there were many verifiable episodes on how fish escaped the affected coastal region in time, elephants and other non-domesticated animals rushed for higher ground locations well in time before the tsunami crest approached. Indirectly, these observations provide proof that some electromagnetic or more likely infrasonic local warning signatures are received by these creatures relatively long before the approaching tsunami strikes. We presume that the signatures could be infra-sonic waves traveling at high speeds as under-water surface waves that could be detected by marine fauna as well as coastal animals and birds observing such precursors and acting instinctively without delay. Tsunamis have existed for eons and fauna of the affected coastal region has developed instinctive warning mechanisms – to be explored.

We require a more far-reaching ocean mapping technique which covers the affected wider region of for example the entire Indian Ocean – for now excluding satellite observations - from Sumatra around India to the African Coast from Somali down to the Cap. Next to implementation of GPS indirect telemetry due to ionospheric interaction of the transverse tsunami waves, such a device exists in principle, and it is based on the high-energy transmission and reception capabilities of the HF-OTHR (High Frequency – Over-The-Horizon-Radar) which makes use of the Ionosphere as a reflector. The HF-OTHR can detect minute disturbances in the atmosphere via troposphere to lower mesosphere but also minute changes of the relative ocean surface height at the order of several centimeters. Although major ionospheric disturbances may impact high resolution ocean surface imaging, it is however possible to detect instantaneously the initiation, the rapid spreading of ocean-height and density changes generated by tsunamis and its impact on close to distant coastal shores indirectly again due to transverse tsunami ocean wave interaction with the ionosphere.

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