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Recent Developments of Radar Remote Sensing

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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 taken 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. A number of pilot studies had been initiated, had been supported for a few years, and then aborted because of the high operating costs involved, the poor SNR making signal detection tedious if not impossible with the current state of the art in instrumentation, and because earthquakes don't appear upon demand. For example such major studies as the USGS/NSF NEHER Program of the early 1990's after the Loma Prieta M 7 earthquake of 1987; in Japan the ERSFP after the Kobe Earthquake of 1995; in Greece the ongoing electro-potential methods of Varatsov; in China, and in various regions as well as independent states of the former Soviet Union. There exists a rather large number of fiercely competing groups in Russia coming up with their own diversified yet highly incomplete modeling approaches seeking support from the West for unfortunately all too low-cost scientific mercenary services. No clear picture has evolved and should not be expected; and a much wider

internationally coordinated investigation is required, which may well last for several decades before a unified approach and with it a solution to this vital problem may be found – if ever. In this overview a systematic analysis of main historical records, a summary of pertinent "seimogenic" as well as observed "seismo-electromagnetic" effects and modern ground-based to air- and space-borne metrological signature investigations are presented. Specifically, remote sensing techniques not yet conceived but in urgent need - such as the remote sensing of the groundwater table - for advancing our understanding of this highly interdisciplinary complicated geophysical problem are being identified, and input is sought from participants for possible active future involvement. Whereas the electromagnetic precursor are observed for earthquakes and volcanic eruptions those seem to be less applicable to the detection of approaching tsunamis, instead HF OTHR radar imaging as well as infrasonic surface pressure imaging seem to provide the most promising method of approach and will be discussed.