Location Studies Plan

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[1]
1. Background
The article 'Global View' provides an evidentially guided introduction to the mechanics of ellipsoidal demand. Ellipsoidal demand is the amount of equipotential adjustment of Earth's figure that is required at a given location to maintain the equilibrium ellipsoid during secular drift of the rotational pole. While the motion of tectonic plates, probably driven primarily by convective processes, seems to be a principal mechanism loading the crust throughout the seismic cycle, the fluctuating dynamics of ellipsoidal demand (hypothetically, astronomically forced) also seem important to the triggering of earthquakes and volcanic eruptions, because ellipsoidal demand often appears to determine the timing of events, presumably, by filling the strain/stress deficit to advanced nucleation and criticality.
[2]
After two location studies were begun (Iceland and Los Angeles), we suspected that although the dynamics of ellipsoidal demand seemed to be principal influences to the triggering of quakes and eruptions, their effect did not always work unaided. It now appears that the (generally) smaller dilatational pulsations of lunisolar earth tides and ocean tides may combine constructively with ellipsoidal demand strain/stress to fulfill the nucleation process to criticality. Although this combination of mechanisms makes the projection of quakes and eruptions far more complex, it also provides much greater temporal resolution for an event near a given location. Orbital behavior of the Earth, Moon, and Sun and lunisolar-tidal effects on Earth are precisely modeled and so it seems likely that triggering potentials resulting from celestial-mechanical forcing can be forecast accurately over time.

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2. Plan
The general plan is to investigate and seek to understand celestial-mechanical driven, lunisolar influences on nucleation processes and subsequent triggering of earthquakes and volcanic eruptions.

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3. Method Outline and Terminology (forecasting/predicting)
An important goal will be to develop the capacity to generate a time series of lunisolar-driven potentials for selected locations around the globe to aid in the successful projection of events. Algorithms to estimate seismic and volcanic eruption triggering probabilities may then be developed that utilize lunisolar forcing. Three components of this forcing are: ellipsoidal demand (indirect), earth tides (direct), and ocean tides (indirect, often significant near coastlines). Combining with the crustal loading resulting from any active tectonic deformation, abrupt changes or maximum/minimum extremes in the dynamics of ellipsoidal demand frequently appear to determine the triggering of quakes and eruptions. Ellipsoidal demand dynamics, presently, seem difficult to translate into crustal strain/stress and may have to be utilized as cofactors in units of dynamics, when designing algorithms for projecting events. Crustal deformations resulting from earth tides and ocean tides are convertible to strain/stress units at depth and may be used in that form. Lunisolar-tidal forcing frequently appears influential to event triggering when a relatively small, subcritical strain/stress deficit is probable. Complex, repetitive forcing from all three components should cumulatively advance the nucleation processes of quakes and eruptions. Although both quakes and eruptions appear associated with celestial-mechanically forced, dilatational processes of the crust, the two respective projection algorithms would be quite different. When the driving potentials are appropriately integrated and factored over time—possibly with

adjustable decay parameters of stain/stress—resulting algorithms should provide time-varying probabilities for event triggering, conditionally, within the context of the contemporary state of tectonic loading and maturity of nucleation. To emphasize this conditionality, I propose that such astronomically and globally informed projecting be termed "*forecasting*".

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Each location that is analyzed must be considered individually—by reason of its unique combination of crustal conditions (e.g. tectonic regime, thermal regime, fault systems, seismic history, lateral heterogeneities, and vertical structure). Thus, the forecasting described above will inform seismological authorities when and where to deploy instrumentation to closely monitor stress conditions and the nucleation progress of phenomena. For example, appropriately located volumetric borehole strainmeters may be monitored to indicate strain/stress fluctuations at depth. Microseismicity may be utilized by computerized networks of seismographs to image the activation or development of fracture zones. Experienced practitioners, familiar with the locale, may interpret the monitored data to help estimate relative stress levels and the extent and maturity of nucleation. After considering the forecast, such local information should be helpful for projecting the timing and size of a quake or eruption. I propose that the resulting, forecast-consistent, instrumentally informed, and currently subjective projecting be termed "*predicting*".

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4. Evolution of Understanding

Collaboration between forecasting teams and location analysis groups will, over time, produce detailed case histories from initial nucleations to energetic releases. Thereby, valuable location-specific process characteristics and input/output (I/O) function coefficients might be determinable from analyses that relate the forcing time series in effect (ellipsoidal demand and lunisolar-tidal) to the resulting developmental patterns of events. Of course, more rudimentary analyses of locations, that relate past forcing to historic events—without modern instrumental data—may provide preliminary approximations of general I/O relationships of the phenomena.

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