Location Studies Plan

[1]

1. Background

The article 'Global View' was intended to be an evidentially guided introduction to the mechanics of ellipsoidal demand. Ellipsoidal demand is the amount of adjustment of Earth's figure that is required by 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) 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 nucleation and 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.

[3]

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.

[4]

3. Method Outline and Terminology (forecasting/predicting)

An important goal will be to develop the capacity to generate a time series of lunisolar driven, seismic and volcanic triggering potentials for selected locations on the globe. 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 an algorithm 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 event types appear associated with celestial-mechanically forced, dilatational processes of the crust, the two projection algorithms would be quite different. When integrated over time—possibly with adjustable decay parameters of stain/stress—the algorithms should provide time-varying potentials for triggering events, conditionally, within the context of the state of tectonic loading and maturity of nucleation. To emphasize this conditionality, I propose that such astronomically and globally informed projecting be termed "*forecasting*".

[5]
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 borehole strain gauges may be monitored to indicate stress levels 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 understand 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*".

[6]
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.

18 July 2012 rev. / DWZ