The lunar perigee and the occurrence of historical large earthquake along the Japan Trench

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It is known that diurnal and semi-diurnal tidal stresses can affect the statistical probability of earthquake occurrence. However, decadal-scale periodicity has been studied by relatively few researchers. In a previous study (Tanaka, 2013, GJI), I reported that the probability of the occurrence of historical earthquakes in eastern Japan with M>7.5 during the past 1000 yr has increased approximately every 8.85 yr, which is the period associated with the motion of the lunar perigee. Approximately half the recorded events intensively occurred within two successive years on a cycle of 8.85 yr and the probability that this concentration occurs randomly is smaller than 0.1%. The past strain and tilt observations conducted in Japan during the 1950s through the 1970s indicate that, nationwide, gradual compression repeated every 8-10 yr in the direction of relative plate motion. These compression periods are also in accordance with the periods of the higher seismic activity. Decadal changes in tidal stress calculated from an ordinary theory of solid Earth tides are too small to cause periodic variations in seismicity. However, if one assumes that a tidal force acts on a spherically asymmetric block-like upper mantle beneath the Pacific Plate, the computed phase and amplitude could explain the observations. Apart from understanding the origin, the important fact is that in some areas, the occurrence of large earthquakes, if considered as a group, appears to be strongly governed by a periodic stress disturbance rather than by completely random processes. Elucidating the wide-range approximately 9-yr mode helps us narrow a range in occurrence time in a probabilistic mid-term prediction of large interplate earthquakes. Next peaks are around 2020, 2029, ... Katsumata (2011, EPS) reported a seismic quiescence in an off-Boso area. This area might be a candidate of a next event (red circle).