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The quality of focal mechanism solutions and its impact on the statistical correlation between tidally-induced stresses and earthquake timing.

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The effect of Earth tides on earthquake timings has been widely investigated for many years. However, the evidence of tidally triggered seismicity is often variable and inconclusive. Tidal modulation of earthquake timings is based on the assumption that a critically-stressed seismic fault can be tidally activated only if tidal stresses are oriented along the faults natural slipping direction and therefore, enhance an existing tectonic stress. In this situation, the accuracy of tidal calculations is essential and depends greatly on the quality of earthquake focal mechanism solutions. The focal parameters provide necessary information about the geometry and kinematics of the fault. At the same time, they can be sensitive to numerous factors (e.g. the accuracy of the earthquake location, distribution of seismic stations, assumed velocity model) and thus, the fault-plane orientation and slip direction will always carry some degree of uncertainty. In this project, we conduct a sensitivity test to see how the orientation variability of the fault planes can affect the statistical significance of results on tidally-induced seismicity. We use a Monte Carlo simulation to generate a number of synthetic catalogues with the same properties as the original catalog. However, fault plane parameters of the synthetic catalogs are randomly drawn from the bounded range of uncertainties associated with an earthquake focal mechanism solution. The significance of correlation between Earth tides and earthquake occurrence is then evaluated separately for each catalog using the Shuster test. Firstly, we assign the tidal phase angle at the earthquake occurrence time. The phase angle is measured from the time series of the tidal stress calculated at the location of each event. The value is assigned by linearly dividing the time interval from 0° to 180° or from 180° to 0°, where 0° and ±180° corresponds to the maximum and the minimum of the tidal stress immediately before or after each earthquake respectively. After determining the phase angles for all the earthquakes in a data set, we statistically test whether they concentrate near some particular angle. A comparison of the original and synthetic catalogs is conducted for different qualities of focal mechanisms to identify any significant variation.