Chaotic activity of Apollo deep moonquakes

Junji Koyama[1]

[1] Earth and Planetary Sci., Hokkaido Univ.

Seismic observation on the Moon during the   Apollo project from 1969 to 1977 discovered   tidally induced moonquakes occurring at
depths about halfway to the center of the
Moon. The identification of these deep
moonquakes and also other events was made   by the visual inspection of long-period
seismograms, resulting in 12,558 catalogued   events. A new computer analysis   of the
Apollo lunar seismic data using a
combination of waveform cross-correlation   and single-link cluster analyses revealed   about 60% of the identified and catalogued   events are deep moonquakes,   and increased
the number of identified deep moonquakes   by   more than a factor of five (Nakamura,   2003, 2005). We have applied a nonlinear   method
of Poincare map to time distribution in the   new catalogue and it reveals previously
undetected features of hidden periodic
components on the deep moonquake activity.   We could classify the deep   moonquake
activities as (1) monthly-periodic, (2)
semi-monthly periodic, (3) successive
multiple events within a few days
accompanied by a monthly event, (4) chaotic   activities, (5) large scatters in
periodicities, and (6) random-like
activities. The activities of (1) and (4) are understood considering various
threshold level to trigger deep moonquakes,   those of (4) and (5) are interrelated and that of (6) would be very   low threshold
level. The threshold trigger levels differ   from one deep moonquake source to another, and such difference among deep moonquakes is relevant to the above various types of
activities. This would be partly due to the   defree of heterogeneity in each source   region, making the fluctuation of periodicities of deep moonquake occurrences.