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Why we do not see Moonquakes on the Lunar Far Side and how to fix that

S. Hempel (1), M. Knapmeyer (1), J. Oberst (1), and C. Sens-Schönfelder (2)

(1) Institute of Planetary Research, DLR Berlin-Adlershof, Dept. of Planetary Physics, Berlin, Germany (hempel.stefanie@web.de), (2) Institute for Geophysics and Geology, University of Leipzig, Germany

Based on the registration of more than 12000 seismic events on the Moon during the Apollo missions from 1969 to 1977, moonquake classifications and locations of half the deep moonquakes clusters as well as structural models of crust and mantle have been derived.

Most Moonquakes were located on the lunar near side (the hemisphere which is always facing the Earth). This may be due several reasons. The most obvious reason is that there may be a lack of seismic sources on the Lunar far side. Second, the small aperture of the Apollo seismic network located on the near side certainly will introduce a strong bias towards near side events. This bias may increase owing to high attenuation of seismic signals in the deep Lunar interior which may mask farside events. In addition, the previously used location procedures, all of which required starting models for event locations may introduce a bias in the distribution of located sources.

To eliminate the last one of these possibilities, we carried out relocations of supposed far side clusters, using an adaptive grid method (LOCSMITH, Knapmeyer, GJI, 2008), which does not need starting models.

We identified the factors on which location results as well as uncertainties depend (the best achievable certainty of arrival times for primary and secondary waves, the dependency of location solution sets and thereby the errors of location to the patterns of registering stations, the number of available arrivals, and used velocity models) and tested their influence numerically.
We show that for so far unlocated deep moonquake clusters it is indeed in many cases impossible to distinguish Far Side from Near Side events in the view of the poor signal strength and poor readings of seismic arrival times typical for Apollo.

These tests demonstrate that the Moon's seismicity may be symmetrical, but we simply could not detect most of the far side deepquakes via the Apollo seismic network. To overcome the near side/ far side ambiguity of Moonquake locations, we recommend that at least a triangular network with center of figure near the 90° E or W, e.g. including stations on the Lunar farside, is installed.