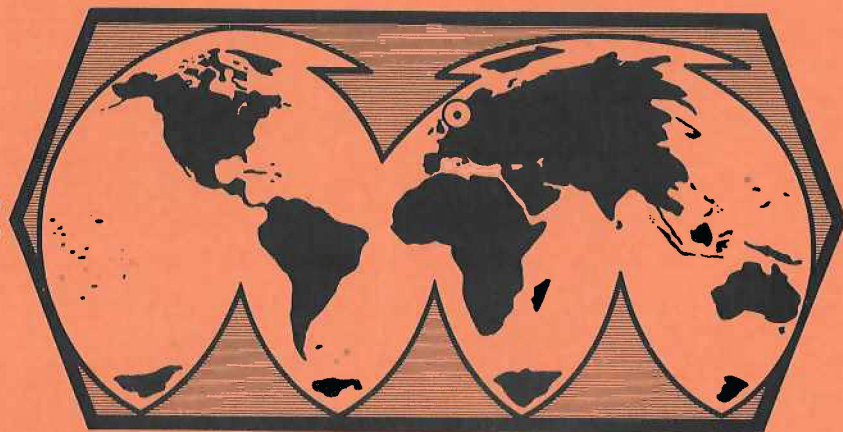# NORSAR

DRm

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SEMIANNUAL TECHNICAL REPORT
NORSAR PHASE 3

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Prepared by
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Kjeller, 1 September 1974

K. MULTIPATHING AND GROUP VELOCITY

It has recently been demonstrated (Bungum and Capon, 1974)
that the Rayleigh waves recorded at NORSAR have for most
regions quite often taken a variety of paths depending on
arrival time and wave period. This multipathing is caused
by lateral variations in phase velocity, and is most serious
for the shorter periods, typically below 30 seconds. An
important implication of the multipathing observations is
the effect on dispersion analysis. Traditionally, this
has been done assuming that the energy has taken a great
circle path. Our results indicate that this is an assump-
tion which can be made only under very ideal circumstances.
To demonstrate this, Fig. 1 shows the results of a dispersion
analysis of an event recorded at NORSAR. The different wave
packets are clearly discernable, and they all have quite
different paths. The first part of the coda is a nicely
dispersed wave train which turns out to have an azimuth
of approach only $+1^{\circ}$ in difference from the true azimuth.
Then at a group velocity between 3.35 and 3.15, the energy
around 40 sec arrives from $+27^{\circ}$. The multipathing analysis
at 20 sec period shows that the energy between 3.1 and 2.9
in group velocity is arriving with -15° in azimuth, between
2.9 and 2.7 the azimuth is $+11^{\circ}$, between 2.7 and 2.5 the
azimuth is $+38^{\circ}$, and between 2.5 and 2.3 the azimuth is
-34° relative to the true azimuth. The immediate effect
of this is that most of the given group velocities are
wrong, since the energy has travelled much longer than the
great circle epicentral distance. This means that the ob-
served dispersion may be more a function of the amount and
type of multipathing than of the actual dispersive
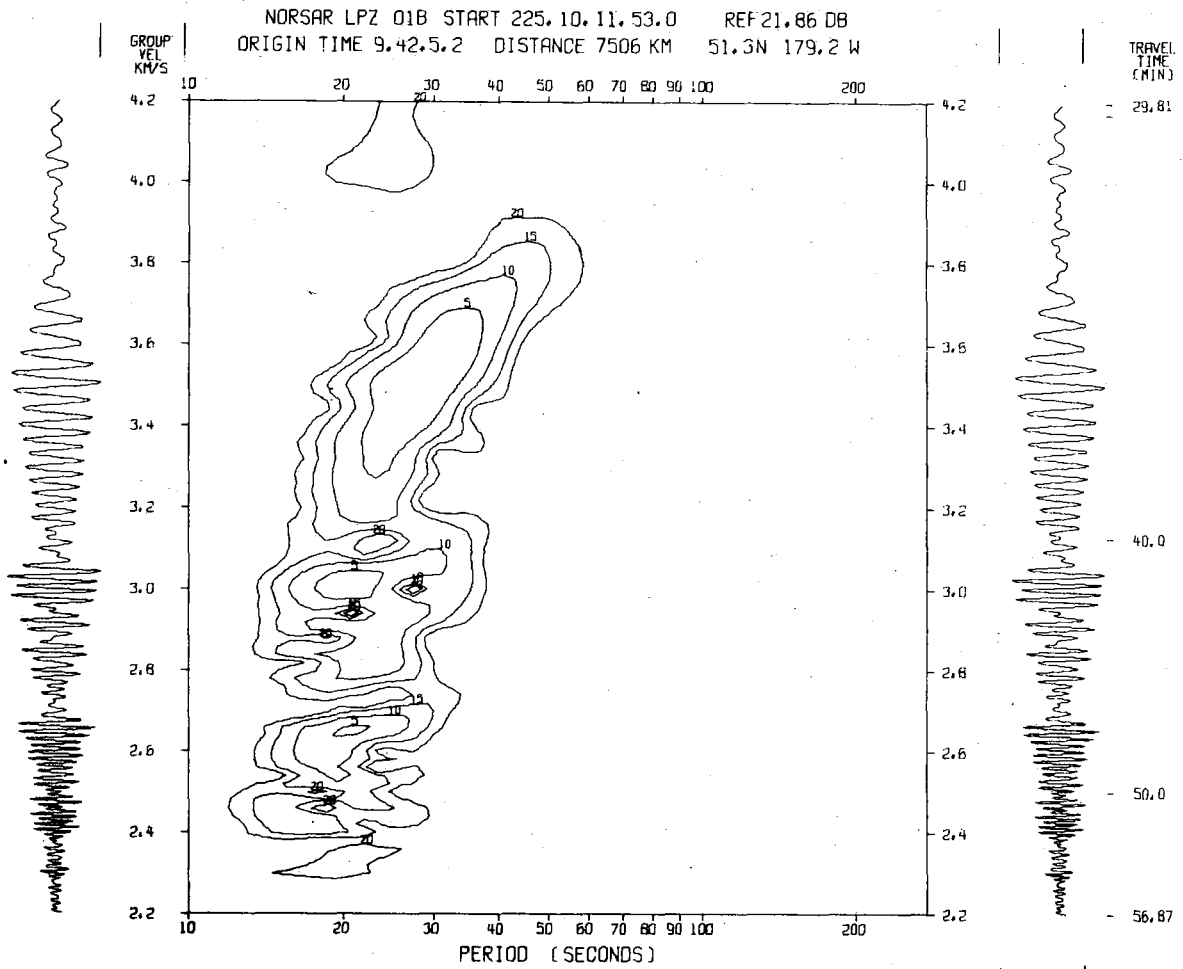characteristics of the medium.

H. Bungum

Fig. K.1 Power of NORSAR-recorded seismic surface waves as function
of travel time and period, using a stack of Gaussian filters
with constant relative bandwidth. The contours are in dB
down from maximum. The event is an earthquake from Andreanof
Islands (51.4N, 179.3W), origin time 12 Aug 1972 at 09.42.05.2
GMT, distance from NORSAR is 68°.

REFERENCES

Bungum, H., J. Capon (1974): Coda pattern and multipath propagation
of Rayleigh waves at NORSAR, Phys. Earth and Planet. Int.,
in press.