NORSAR

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P. HIGHER MODE SURFACE WAVES

Higher mode surface waves are valuable for probing the structure of the uppermost mantle on account of their selective depth sampling. Attempts to exploit higher modes are generally frustrated by the necessity for long, homogeneous paths and by limitations in the dynamic range of most recording devices. However, NORSAR's siting and digital recording is such that higher modes are commonly well-recorded from sources in Sinkiang, Central Russia, Southern Europe and Novaya Zemlya.

It has been suggested previously (Crampin, 1966) that higher mode propagation over much of Eurasia exhibits mode coupling which apparently finds no satisfactory explanation in isotropic Earth models. Crampin (1967) suggested an interpretation involving a thin layer of aligned crystalline anisotropy in the uppermost mantle, and has subsequently explored theoretically the implications of such an interpretation (Crampin, 1970; Crampin and Taylor, 1971; Crampin, 1975). The principal features include distinctive particle motion, differences in phase (wave) and group direction, and the generation of Love waves by atmospheric explosions.

NORSAR is potentially (and perhaps uniquely) suitable for a detailed examination of higher mode propagation in Eurasia; the spatial sampling of the NORSAR configuration offers the possibility of multiple analyses of particle motion as well as of direct estimation of phase and group direction. A data base of some 14 events with well-recorded higher mode wave trains has been assembled and representative examples from 2 events are plotted in Fig. P.1. These data commonly exhibit mode coupling between vertical and horizontal transverse components over extended sections of the higher mode trains. Phase velocities and directions of higher mode and fundamental mode arrivals are being estimated using high-resolution f-k analysis, and have revealed significant

($\sim 10^{o}$) differences in phase direction between the two wave groups along some paths (e.g., Sinkiang). Attempts to measure group velocity and direction of fundamental mode waves by fitting a least squares wavefront to interpolated peaks of envelopes formed from narrow band Gaussian filtered data have yielded encouraging results and may provide determinations sufficiently reliable for comparison with phase determinations.

Finally, NORSAR recorded Love waves of peak amplitude only slightly less than the Rayleigh waves from a large atmospheric explosion in southern Sinkiang in June, 1974. The possibility of explaining this observation in terms of mode conversion after propagation in an anisotropic region is being explored.

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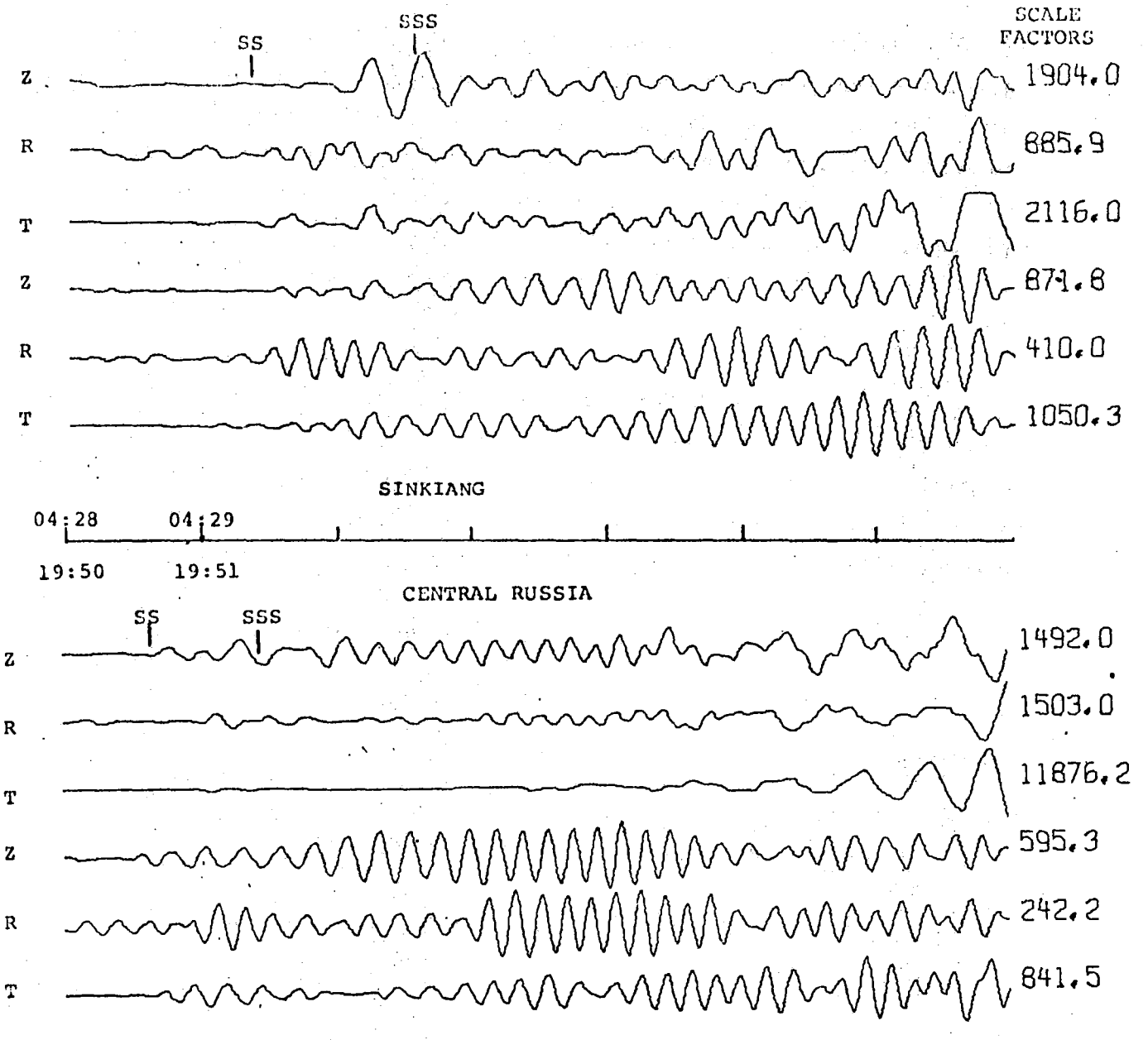

Fig. P.1

Higher mode wavetrains from events in Sinkiang (April 9, 1972, 04:10:50.7) and Central Russia (August 24, 1971, 16:33:22.7). For each event, both unfiltered and 8-17 sec bandpass filtered Z, R, T data from Subarray 01A is plotted. Approx. JB times of body phases SS and SSS are marked.