Development of Automated SKS Splitting Measurement - an Additional Parameter to be Provided by the ISC

Eos Trans. AGU, 84, Fall Meet. Suppl., Abstract S32C-03.
A talk in Wednesday afternoon session S32C, Splitting and Anisotropy II

M S Evans
J M Kendall
R J Willemann

We have implemented an automated system to measure shear wave splitting in SKS and SKKS arrivals for stations and networks where waveform data are freely available and archived. Pending review by the Governing Council, the ISC plans to include these measurements in its On-line Bulletin as an aid to studies of anisotropy in the Earth.

After identifying suitably large events from the ISC Bulletin, (Mw 5.8 or greater), we locate stations at a suitable distance from which three component broadband data have archived, and formulate the appropriate request. We intend to make automated measurements only for strong, clear signals, and at distances where there is no chance of contamination from S, ScS, Sdiff or other phases, as predicted by the IASP91 earth model. Phase onset will be more accurately identified using a simple STA/LTA picker.

When a polarised shear wave passes through an anisotropic medium, it is split into two perpendicular time lagged wavelets. In measuring splitting, we seek a polarisation angle and lag time that best correct these wavelets back into a single polarised wave, minimising either the energy on the transverse component or the smaller of the two eigenvalues calculated from the covariance matrix. We report both methods, as we find differences between the two to appear to be systematic at some stations, so could provide a basis for further work. Error estimates are calculated using both the methods of Silver and Chan (1991) and Sandvol and Hearn (1994).

As well as the above error estimates, we include two other quality control parameters. We calculate the ratio of eigenvalues (min/max) calculated from the covariance matrix of both the uncorrected and corrected waveforms. For the uncorrected waveforms, if this ratio (min/max) is smaller than a set threshold, we conclude that there is insufficiant initial energy on the transverse component for results to be considered reliable. Similarly, for the corrected waveforms, if this ratio is too high, then the corrected particle motion is not sufficiently linear for these results to be included.

We find good correlation between these automated results and manual measurements made on data from stations in the Canadian National Seismic Network, and plan to apply these methods on stations distributed globally in the near future.