Geophysical Research Abstracts
Vol. 14, EGU2012-8287, 2012
EGU General Assembly 2012

Automated determination of P-wave polarization at the GRSN

L. Cristiano (1), T. Meier (1), C. Weidle (1), and F. Krüger (2)

(1) Institut für Geowissenschaften der CAU, Kiel , (2) Institut für Erd- und Umweltwissenschaften der Universität Potsdam

Polarization analysis of P-waves has been applied for identification of seismic phases (Earle, 1999), for earthquake location (Dyer et al., 1999), measurements of seismic anisotropy (Schulte–Pelkum, 2001), and determination of velocity models. In isotropic, lateral homogeneous media, P-wave polarization is confined to the vertical-radial plane; deviations of horizontal polarization direction from the great-circle propagation direction can be due to smooth lateral velocity heterogeneities, dipping discontinuities, and seismic anisotropy. In order to distinguish between these different causes, P-wave polarization parameters have to be determined for a large number of events in different source regions.

Here we present the results of the polarization analysis of P-waves recorded at the GRSN for events in the distance range between 5° and 90°. For a consistent and efficient processing of a large data set we developed an automated procedure for the determination of the P-wave incidence angle and backazimuth. Details of the algorithm are described and results are shown as a function of backazimuth and frequency.

We select events with a SNR > 2 at various epicentral distances and avoid the contamination of the P-wave with depth phases. The P-wave polarization parameters are calculated in a moving window using eigenvectors and eigenvalues of the covariance matrix of 3 component records (Jurkevics,1988). The length of the moving window is dependent on epicentral distance and the corner frequency of the band pass filter applied prior the computation of covariance matrix. We also estimate a quality factor and an uncertainty for the polarization parameters in terms of ratio between the intermediate and smallest eigenvalues. An automated picking of the P-wave polarization has been developed based on a characteristic function, defined in terms of amplitude, signal to noise ratios, polarization parameters and their comparison with the predicted ones calculated for the IASP91 model (Kennett, 2005). Especially for lower frequencies results between the stations are comparable. For higher frequencies and local events the spatial variation of the parameters is larger. Interestingly, indications for a dependency on frequency are found in certain distance ranges for incidence angles as well as azimuthal deviations. For comparison we apply the f-k analysis (Capon, 1969) to determine the propagation direction.