

Seismic wavefield visualizations with AlpArray and AdriaArray

Johannes Stampa¹, Thomas Meier¹

1. Institut für Geowissenschaften, Christian-Albrechts-Universität Kiel, Germany

DOI: <http://dx.doi.org/10.17169/refubium-41086>

The dense network of broadband seismometers in the alpine region is making it possible to resolve the seismic waves moving across the array in fine detail. These animations allow for an insight into the wave field dynamics, but processing the data poses several challenges, especially in bringing the amplitudes across the array into a range where they can be usefully shown alongside each other, and filtering the data to bring out the seismic phases visually from the shorter period noise.

Here, we use a normalisation method based on the envelopes of the long-period lowpass filtered waveforms. The waveforms are then also band-pass filtered. The amplitudes are represented in color, with red being positive and blue being negative, as well as marker sizes in the animations for vertical component data. An estimate for the wave propagation of the most important seismic phases is performed via TauPy, and this estimate is drawn into the animation as coloured lines of theoretical wavefronts to facilitate the association of the visible wavefronts with them.

The horizontal component is shown as well, but here the color is used to represent horizontal direction, while the marker size still corresponds to amplitude. The colour wheel encoding the directional information is shown in the top right, with white and black corresponding to radial polarisation and red and blue to transversal polarisation of the seismic waves.

These animations can provide an intuitive, visual way to gain an understanding of seismic waves. They can also showcase the data quality, and might represent an early step in identifying specific problems at a glance over the whole array, like polarity errors or strong station noise level.

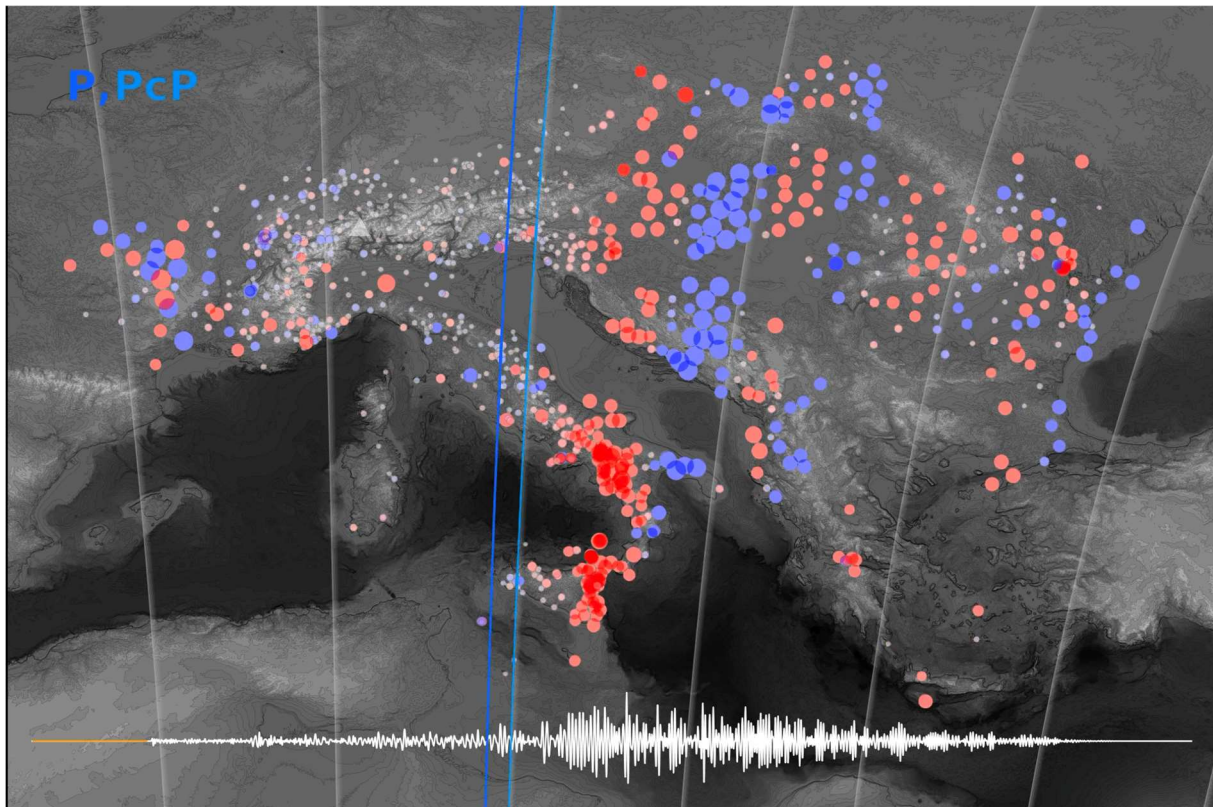


Figure 1: Screenshot of the vertical component wave field animation at the time of the arrival of the teleseismic P- and PcP-phase from a strong event that originated 171 km South-South East of Teluk Dalam, Indonesia, on the 24th of April 2023. The reference trace shown on the bottom was recorded at station FUSIO in the western alps.

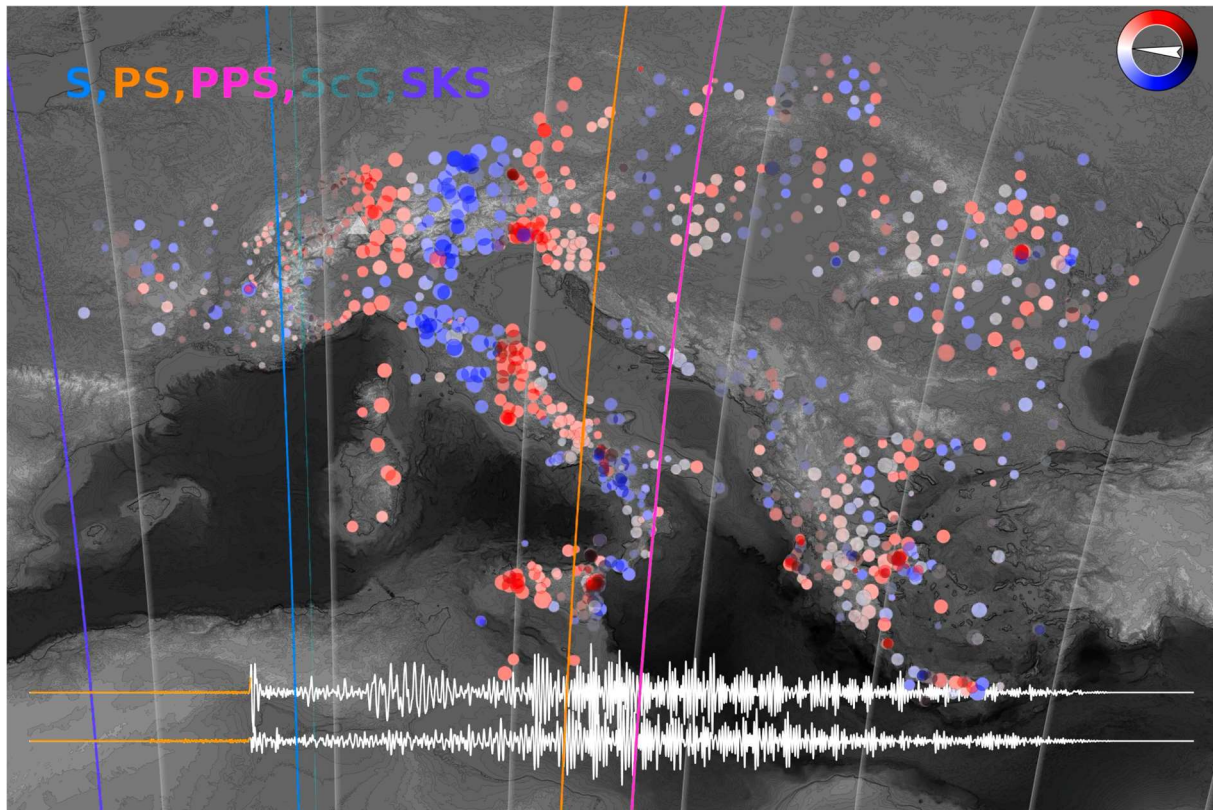


Figure 2: Screenshot of the horizontal component wave field animation at the time of the arrival of the teleseismic S-phase and some related phases.