Focal depth of the magnitude Mw5.9 Woods Point earthquake on 22 September 2021, from seismograms recorded on the other side of the Earth

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Abstract

Moment tensor-modelled focal depths range from 12.0 to 21.5km yet the prolific aftershock sequence hints at a very shallow depth. We examined seismograms from two 3-component stations of the Macedonian seismic network at a distance of approximately 140 degrees. At this distance various PKP phases converge and reinforce each other.

Phases PKIKP and PKP were identified along with their reflected phases pPKIKP and pPKP on the vertical channels of stations Valandovo (VAY) and Ohrid (OHR) operated by the Skopje Seismological Observatory. The time difference between these core phases and their reflections from the Earth's surface above the focus was 1.42±0.3s, slightly longer at OHR than VAY.

We adopted an average crustal velocity of 6.5km/s in the vicinity of the earthquake and our averaged measured time differences indicate a focal depth of 4.6 ±1.4km, much shallower than initially reported.

If there was no surface faulting then we conclude the rupture propagated downward rather than up towards the surface.