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Probing the upper mantle transition zone under Africa with P520s conversions: Implications for temperature and composition.

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We have investigated the nature of the 520 km discontinuity under Africa by migrating P-wave receiver functions at twenty-four permanent broadband stations in the continent. Worldwide investigations with S520S underside reflections have revealed that this discontinuity is intermittent and that it may split into two separate discontinuities, ∼60 km apart, in some regions. Several explanations have been proposed to explain both the intermittency and splitting of the 520-km discontinuity, ranging from local temperature variations in the upper mantle to compositional variations due to changes in minor phases containing Fe and Ca and/or other trace elements such as water. Our results reveal that the 520 km discontinuity is intermittent under Africa and that - when observed - it does not split. Moreover, local estimates of transition zone temperature inferred from transition zone thicknesses reveal that intermittency of the 520 km discontinuity does not correlate with temperature. The lack of splitting is consistent with low Ca concentrations in the African transition zone due to a general absence of subduction zones around the continent. The intermittency is harder to explain, but the lack of correlation with lateral temperature variations suggests it is mainly driven by lateral variations in trace element contents.