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Probing the rheology of the lithosphere using earthquake seismology

Tim Craig

University of Leeds, Institute of Geophysics and Tectonics, School of Earth and Environment, Leeds, United Kingdom of Great Britain – England, Scotland, Wales (t.j.craig@leeds.ac.uk)

Earthquakes provide a crucial way of probing the deformation style, strength, and stress state of the lithosphere. In this talk, I will outline ways in which we can use careful analysis and precise seismological observations of earthquakes, particularly those at moderate magnitudes ($M \sim 5-6$), to map out how stress is supported in the lithosphere, and how the rheology of the lithosphere can vary in both space and time, summarising our current understanding of the controls on the distribution of earthquakes. I will draw on examples from a range of regional studies, and outline what conclusions we can draw about the geological and geodynamic controls on the distribution of earthquakes in each region, and the variation on the style of deformation within the lithosphere. I will also discuss areas in which our current understanding of the distribution of earthquakes remains unable to explain some observations, and challenges for the future.