MODELLING OF THE KINEMATICS AND DYNAMICS OF ASIA

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We have developed methods to quantify the kinematics of active deformation using information from both Quaternary fault slip rates and GPS observations. These kinematic constraints are then used to help define the dynamics (distribution of stresses and effective rheology) of the lithosphere in Asia. Strain rates inferred within areas using the Kostrov summation are interpolated with continuous spline functions in order to recover a self-consistent estimate of the horizontal velocity gradient tensor field. We compare predicted seismic moment rates with those observed in this century in Asia. Our dynamic approach involves the determination of the vertically averaged deviatoric stress field associated with gravitational potential energy differences plus stress boundary conditions associated with the accommodation of India-Eurasia relative motion. Absolute magnitudes of vertically averaged deviatoric stress vary between 50-400 bars. Using the strain rates defined by the Quaternary slip rate and GPS observations and the absolute values of stress, we determine the vertically averaged effective viscosity for Asia. The effective viscosity for Tibet is relatively uniform with average values around 0.5 X 10^22 Pa-s, compared with 1-5 X 10^23 Pa-s in more rigid areas elsewhere in the region. Forward modeling demonstrates our method of directly solving the force-balance equations for the absolute values of stress is valid for cases in which there are spatial variations in the effective viscosity of several orders of magnitude and is also appropriate for non-linear, or power-law rheologies.