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Rheology of petrolatum - paraffin oil mixtures: applications to analogue modelling of geological processes

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Paraffins have been widely used in analogue modelling of geological processes. Petrolatum and paraffin oil are commonly used to lubricate model boundaries and to simulate weak layers. We present rheological tests of petrolatum, paraffin oil and several homogeneous mixtures of the two. The results show that petrolatum and all petrolatum-paraffin oil mixtures are strain, strain rate and temperature dependent under typical experimental strain rates (10-3 – 10-1 s-1). For the same conditions, pure paraffin oil is a slightly temperature-dependent, linear, Newtonian fluid. All mixtures have yield stress and flow stress (strain softening) values that decrease with decreasing shear rate, and with increasing relative amounts of paraffin oil. The degree of strain rate dependence (shear thinning) also decreases with increasing paraffin oil content. Because these materials have rheologies that can be characterized and controlled, they are suitable for use in a large number of analogue model settings, either as a lubricant or to simulate weak layers. When used as a lubricant, mixtures with higher paraffin oil content should perform better than pure petrolatum. In addition, we present results of 3D dynamical models of subduction in which these materials were used to lubricate the plate's interface and test different degrees of mechanical coupling.