Geophysical Research Abstracts,
Vol. 10, EGU2008-A-12055, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-12055
EGU General Assembly 2008

Isostasy, Flexure and Geological Processes

A. B. Watts
University of Oxford, UK (Tony.Watts@earth.ox.ac.uk)

Isostatic considerations suggest that the crust, which comprises the uppermost part of Earth's lithosphere, is buoyant and in a state of flotation on the underlying mantle. Furthermore, flexure studies indicate that the lithosphere responds to long-term (i.e. $>10^5$ a) geological loads not locally, as the Airy and Pratt models of isostasy would predict, but by bending over a wide region. In this paper, we use gravity anomaly and crustal structure data to assess the degree to which the Earth's outermost layers approach the idealised, steady-state, equilibrium that is implied by isostatic models. The short-term (e.g. earthquakes), intermediate (e.g. glaciers and lakes), and long-term (e.g. volcanoes and sediments) loads that might disturb isostasy are considered and their implications examined for *both* the elastic layer thickness of the lithosphere and the viscosity of the asthenosphere. Results suggest a relationship between the elastic layer thickness at the different time-scales. Short-term loads correlate with relatively high elastic layer thickness while long-term loads have a relatively low thickness. The time that it takes for the lithosphere to relax from its short-term to long-term thickness depends on the viscosity, being quite short ($\sim$100 a) in some regions (e.g. Basin and Range) and long ($\sim 5\times10^4$ a) in others (e.g. East Coast, USA). The long-term thickness is the focus of the remainder of this paper since it is this thickness that is most relevant to geological processes. First, we examine the relationship of the long-term thickness to other proxies for the physical properties of the lithosphere such as surface heat flow and shear wave speed. Finally, we explore some of the implications of the elastic thickness structure of the lithosphere for mantle dynamics, terrane structure and structural inheritance, and landscape evolution.