It has recently been recognized that global or near-global magmatic events on Venus, such as those called upon to account for the history of crater preservation and plains emplacement, can have a significant influence on the climate. In particular, the injection into the atmosphere of such magmatic volatile species as H$_2$O and SO$_2$ can lead to substantial variations in both the greenhouse effect and cloud mass (hence albedo) and consequently large excursions of surface temperature over time scales ranging from millions to hundreds of millions of years. There are several important implications of these temperature excursions for the mechanical properties and state of stress of the upper crust. First, changes in surface temperature will diffuse into the interior with time; a decrease (or increase) in surface temperature lasting at least 10 My affects the temperature throughout a 30-km-thick crust. Second, those changes in internal temperature will introduce thermal stress in the lithosphere. In particular, the surface thermal stress following a decrease (increase) in surface temperature is initially extensional (compressional) and becomes more compressional (extensional) as deeper levels of the crust progressively cool and contract (warm and expand). Such thermal stress would be superposed on other sources of lithospheric stress, including those due to topography and lateral variations in lithospheric density and those imparted by mantle dynamics. The magnitude of thermal stress can be a significant factor in deformation; a 100 K change in surface temperature produces a change in stress of order 0.1 GPa. Finally, sufficiently large positive increases in surface temperature can exceed the elastic blocking temperature or brittle-ductile transition temperature for surface materials, at which point the upper crust will undergo ductile deformation in response to topographic and other stresses until the temperature again falls to within the brittle field. It is worth noting that climatically induced changes in the stress field act on a planetary scale, so global synchrony of deformational events is to be expected. These relationships may account for some of the characteristics and timing of deformation in crustal plateaus and tessera blocks, as long as a major magmatic episode predating preserved plains units drove the surface temperature above the elastic blocking temperature and subsequent cooling through the blocking temperature was rapid. The timing of wrinkle ridge formation on the ridged plains may also have been controlled by magmatically-driven climate variations.