Interdecadal variations of latitude at Ukiah

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The latitude variation at Ukiah, International Latitude Service (ILS) station (-123.2 E, 39.1 N) shows rapid increases more than 200 mas after 1960 (Vondrak, 1999). The purpose of this report is to study variations of the vertical (latitude variations) at Ukiah caused from (1) the normal stresses on the boundary between the North America plate and the Pacific plate, and (2) the upwelling mass associated with the plume flux of the North America hotspots. The caldera of Yellowstone (-110.4 E, 44.6 N) shows the average caldera uplift of 22 mm/yr for the period from 1973 to 1985 and subsidence of -19 mm/yr for the period from 1985 to 1996. A Long Valley caldera (-118.9 E, 37.7 N) shows uplift of 4 mm/yr for the period from 1980 to 1985. Latitude increases for the period from 1975 to 1980 at Ukiah. Increases of latitude at Ukiah suggest mass accumulation beneath the geothermal field centered at Mt. Hannah (-122.7 E, 38.9 N) about 50 km south-eastward from Ukiah. To estimate effects of the normal stresses and the thermal heat flow on variations of the vertical, we construct a model of an elastic mantle having a cylindrical form of which axis is parallel to the vertical. The radius of the cylinder is taken to be small compared with the axial length. The excess temperature of the mantle plume is assumed to be expressed by a form of a progressive wave with the interdecadal variation along the axis upwards. We assume the normal stress on the side wall of the cylinder to be the same as the normal stress due to compression between the Coast Ranges and the Great Valley. We take variations of the strain to be 3.8 mm/yr (Prescott et al.,2001). We assume the magnitude of the yearly variation to be 1/10,000 of the average excess temperature of 300 K for the Hawaiian swell (Sleep,1990) .We obtain that the yearly variations of the vertical are 0.6 mas/yr (effect of the pressure), and 0.2 mas/yr (effect of the temperature).