Effects of the oceanic currents on variations of the vertical,the tilt and the strain

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Variations of the vertical in the east-west component between Mizusawa and the US Naval Observatory,Washington,D.C., and the east-west component of the strain at the Esashi Earth Tides Station show positive correlations with the MSOI (Modified Southern Oscillation Index). We assume that the Tohoku district, Japan consists of a thin elastic lithosphere. The Kuroshio intrudes northward during El Nino events and changes mean pathway eastward. Changes of the Kuroshio direction push the east coast of the Tohoku district. We derive displacements of the lithosphere bending upwards at the centre of the Tohoku district. We obtain the tilt, the strain and variations of the vertical for the east-west component as the same order of the magnitude as the observed values.

Variations of the vertical derived from the astronomical time observation between Mizusawa and US Naval Observatory,Washington ,D.C.,d(UT1-TAI) (ILOM) -d(UT1-TAI) (USNO) and the east-west component of the strain ,which is observed at the Esashi Earth Tides Station , are used to study correlations with the MSOI (Modified Southern Oscillation Index). The MSOI is defined as (the Darwin surface pressure) -(the Tahiti surface pressure) in unit of hPa by taking the negative sign of the Southern Oscillation Index and shows more than 2 hPa during El Nino events.We apply a 4-year low-pass filter and obtain correlation with the annual mean value of the MSOI. The east-west component of the strain is obtained by using a 12 -month low-pass filter. We obtain the slope of the regression line relative to the MSOI as follows, (vertical ms) /(MSOI hPa) = 3.71 (2.68),(strain n rad)/(MSOI hPa)=5.72(5.59), where brackets after each slope indicate the 99 percent significance level according to the test .

For the period of El Nino events the Kuroshio intrudes northward and changes mean pathway eastward. Changes of the Kuroshio direction push the east coast of the Tohoku district , Japan .The magnitude of the compressive stress is about 20 hPa at the sea surface and decreases rapidly downwards. We derive bending displacements of a thin

rectangular plate upward at the centre of the Tohoku district ,Japan by using a model of an elastic lithosphere .We take the thickness of the lithosphere to be 30 km ,and the half wavelengths of the lithosphere in the east-west and the north- south components to be 100 km and 200 km respectively. We obtain the tilt and the strain to be 61n radian and 11 n radian respectively. These values are large enough to explain the observed values. We can estimate variations the vertical in the case that a square elastic plate ,having the half wavelength to be 100 km ,supports the atmospheric pressure load of 2 hPa varying periodically ,and we obtain variations of the vertical to be 50 n radian.This gives the comparable order of the magnitude with the observed values.