

Hydrological contributions to seasonal crustal deformation

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Seasonal components seen in GPS station positions are due largely to the snow load in NE Japan (Heki, 2001) while spurious seasonal change in the scale of 5-6 ppb contributes greatly to the seasonal components in a nationwide scale (Hatanaka, 2003). Also in the 'true' seasonal crustal movements obtained by removing the scale contributions, there are significant amount of variations that cannot be explained solely by the snow load. Last year, I estimated the amplitudes of the seasonal changes in non-tidal ocean loads and atmospheric loads, and reported that annual atmospheric pressure changes are the most important in SW Japan. In the present study, I give quantitative estimate of seasonal changes of soil moisture considering monthly potential evapotranspiration (PET) and precipitation values. I also take account of seasonal changes in water levels in water reservoirs throughout the country. Combined contributions of the snow, atmosphere, ocean, soil moisture and artificial water storage can explain the observed seasonal crustal deformation to a large extent but still fall short of the observed amplitudes. This is partly due to the underestimate of the snow load due to the negative biases of the AMeDAS station elevations from the national average. SW Japan extends E-W and spurious N-S crustal movement signals might be seen because atmospheric delay gradients would not be averaged to zero there.