Absolute Gravity Measurements at UK Tide Gauges

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Absolute gravity near 3 of the United Kingdom's (UK) core tide gauges was repeatedly measured using an FG5 gravimeter over a period of 3-4 years to determine vertical land movements at those gauges. The absolute gravity sites were established at Newlyn and Aberdeen in 1995 and in Lerwick in 1996. Assuming a height change of 1 mm causes a change in gravity of 0.2 μgal we see vertical land movements of 1.0±1.4 mm/yr at Newlyn, -3.8±1.6 mm/yr at Lerwick and 0.9±3.1 mm/yr at Aberdeen. These land movements are, within the error estimates, in agreement with land movement predicted by a model of post-glacial rebound/subsidence. To ensure that our absolute gravimeter is giving accurate results it has been regularly inter-compared with other absolute gravimeters and was verified to be in agreement at the 2 μgal level.

The Effect of Coloured Noise on the Uncertainties of Rates Estimated From Geodetic Time Series

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Until recently, it was typically assumed that only white noise was present in geodetic time series. However several data sets have now provided evidence for the presence of power-law noise. The uncertainty of any rates estimated from such data sets are dependent on the error model assumed for the data. Here we introduce a general form for the covariance matrix for any power-law noise model and empirically derive simple equations that relate the rate uncertainty to the noise amplitude, sampling frequency and length of the time series. In addition we provide some equations to analyse data sets and obtain a rate uncertainty when computational speed is at a premium. These equations are tested against previously published geodetic data sets.

The Effects of Offsets on GPS Time Series

Offsets, either artificial or real, are a common occurrence in GPS time series. Artificial offsets may result from changes in the processing strategy of a network, incorrect site information or changes in the instrumentation at the site. Real offsets can occur due to earthquakes, changes in local site conditions, or movement of the equipment (for example, unscrewing/screwing of the antenna). Here we study the effects such offsets have on the estimation of site velocities from two viewpoints. First, the effect an offset/s has on the site velocity when the position in time of the offset is known. If the noise in the time series is white (gaussian) the variance of the velocity is dependent on the position of the offset in the series with the worse case having the offset in the centre. The estimated velocity for a time series with an offset is simply the weighted sum of the two slopes either side of the offset. If the noise in the time series is random walk we find that the variance of the velocity is independent of the position of the offset. Further, If the length of the time series is greater than the sampling frequency, then the variance of the velocity is very close to the variance of the velocity of a series without offsets. The second viewpoint concerns the effect on the time series of undetected offsets. Undetected offsets cause the time series to "behave" as if there is either random walk or first-order gauss markov noise, depending on the nature of the offsets, present. Offsets, small enough to go undetected, can therefore have an effect on the velocity (and its error) estimated from the time series.

Estimation of Coloured Noise from a set of global and regional GPS Time Series.

The presence of two types of power-law noise, random walk and flicker noise, in GPS time series was tested using a maximum likelihood estimation (MLE) algorithm. All of the 268 sites tested from the JPL global time series indicated that flicker noise or random walk was present along with white noise. Over 98% of time series (268 sites by 3 components) had a higher log likelihood value for flicker noise than for random walk noise indicating that flicker noise is the most likely. The amplitudes of the white noise component show a definite latitude dependence. Sites near the equator showed larger white-noise amplitudes than sites further north or south. A latitude dependence for the flicker noise amplitude was also possible but not definite. In addition to the global JPL time series, series from sites in the Southern California Integrated GPS Network (SCIGN) were also tested. A "common mode" element had previously been removed from these series. As for the global series, power-law noise together with white noise was indicated as more likely than white noise only in all of the components of all of the time series. However, around 37% of the series had a higher log likelihood value for random walk noise than for flicker noise. The amplitudes for both the power-law noise and the white noise were lower by up to half an order of magnitude than the equivalent sites in the global series. Monument noise, speculated to be present in GPS time series, is random walk in nature. That 37% of the more precise regional time series show random walk in the series may indicate that the common mode filter for a dense geodetic network is removing sufficient amounts of the spatially correlated flicker noise and white noise for the monument noise to now be detectable.